English Heritage

WILSFORD SHAFT: EXCAVATIONS 1960–62

P Ashbee, M Bell, and E Proudfoot

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Paul Ashbee, Martin Bell, and Edwina Proudfoot

with contributions by
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Foreword

The Wilsford Shaft can fairly be called a famous prehistoric site. From the moment of its discovery in 1960 it has been much discussed in general works on prehistory, but these accounts have been based on interim statements and are thus, of necessity, incomplete. A site of this importance requires full publication, not only of its structure and the artefacts found in it, but also of the environmental material from the shaft bottom which offers an unrivalled insight into the Wessex environment of the period.

The importance of the site was appreciated at a very early stage, but the excavation presented great difficulties demanding technical resources rarely employed at the time. It is greatly to the credit of the officials of the then Ministry of Works, and to their excavators, that every effort was made to facilitate the site work and to bring the excavation to a satisfactory conclusion. The bottom of the shaft was reached in August 1962 and the fieldwork was completed shortly thereafter.

The second stage of the programme – the preparation of the site data for publication – has presented problems. Progress has been faltering over the last 25 years, and it will be clear from the arrangement of this volume that some areas of disagreement remain unresolved. Why the work has taken so long and why problems remain require a few words of explanation.

The project originated as part of a programme of barrow excavations initiated by the then Ancient Monuments Board and conducted on behalf of the Ministry of Works, in response to plough damage which was rapidly destroying this class of monument. Three round barrows west of Normanton Gorse were identified as in need of recording, one of which was thought to be a pond barrow. In February 1960, Miss Edwina Field (Mrs Proudfoot) was asked to carry out the work. The excavation took place in July and August with volunteers and, as usual at the time, a team of workmen under a foreman, from the direct labour force.

From the outset the so-called pond barrow presented problems. Instead of being a comparatively simple structure with a shallow depth of stratigraphy, a rubble infill was encountered which proved to be the upper level of a large pit. This unexpected development prolonged the work and required an extension of facilities and time which was eventually granted. At this stage Edwina Field had to leave the site to return to her other work and teaching commitments. The project, however, could not be left and therefore work was allowed to continue with Mr Peter Gray overseeing the digging. Edwina Field returned at weekends to confer with him and with Mr Paul Ashbee from whose team Mr Gray had been seconded. Although at this stage it was still hoped that work would be completed during 1960, it eventually became clear that the pit was in fact the top of a shaft of unknown depth and for work of this kind certain engineering provisions would have to be made. Excavation was brought to a halt while preparations were put in hand.

For the 1961 season, the excavation continued with Paul Ashbee as supervisor. The excavation was now developing into an extremely complex technical and engineering problem and progress was, of necessity, slow. The Ministry was now continually under pressure to provide greater resources. Part of the problem was the need for a more sophisticated pump and electricity for lighting. By the end of the season the shaft had reached a considerable depth, but there was no sign of the bottom.

In 1962 things ran a lot more smoothly with the technical facilities now in place and working well. However, the organic materials from the base of the shaft began to pose problems. Conservation of such material on site required a range of decision-making and technical skills which had not at this stage been perfected. Relations between the excavator and the Ancient Monuments Laboratory deteriorated and, in the end, no proper arrangements for the subsequent selection of material for conservation were made. It was with relief that the bottom of the shaft was reached in 1962.

Edwina Proudfoot, who retained responsibility for what she had done in 1960, returned to work on her material in 1978, but laboratory work was delayed and, understandably, she declined to continue until proof of progress could be provided. Paul Ashbee, who was also waiting for action from the laboratory, put aside his post-excavation work on the shaft, concentrating his efforts on other projects.

The situation remained at an impasse until the Backlog Working Party, set up by English Heritage to oversee the publication of rescue projects completed before 1973, took a positive hand. Having considered the situation in 1985, the Working Party recommended the appointment of Dr Martin Bell to review the environmental material. He was subsequently asked to arrange a programme of specialist reports, the results of which are presented here. Progress on these reports depended to some extent on the progress of the archaeological accounts separately prepared by Paul Ashbee and Edwina Proudfoot. The combination of these two contributions and the environmental report into an integrated volume has fallen to Dr Robin Taylor.

Given the somewhat disjointed history of the project, it is not surprising that some questions remain unresolved. It is only proper to record that it has not been possible to produce a report with which all the main contributors are entirely content. For this reason, the archaeological and environmental accounts have been presented here with no attempt to gloss over differences of approach and interpretation.

Yet, despite all this, what emerges is a full and scholarly account of a remarkable site, adding considerably to our understanding of the second millennium BC. That this report has been published at all, owes much to the integrity and tenacity of the principal participants. It also reflects the determined belief of English Heritage, who have funded the work leading to publication, that major sites of this kind should be fully presented in published form. Only then can the project be regarded as complete.

Professor Barry Cunliffe
Oxford, January 1989

Acknowledgements

The main authors (in alphabetical order) make their acknowledgements as follows.

Excavation of the destroyed pond barrow was begun in 1960 by Mrs Edwina Proudfoot (née Field). Her determination in persevering with such a difficult site led to the clearing of the great inverted conical cavity and the discovery of the top of the shaft. Some 60ft (18m) of the shaft's infill were cleared by Mr Peter Gray, mainly working alone, although aided for a period by Mrs Peggy Wilson. In 1961 Peter Gray returned and assisted for part of the time, as did a number of volunteers including undergraduates and senior schoolboys. Their work and enthusiasm were dogged by incessant mechanical breakdowns, which stopped work, and damped by persistent wet weather. The 1962 season, as a result of the goodwill and common sense of Messrs W Fryer and W J Knapp, Superintendents of Works at the then Ministry of Works depot at Bristol, saw the conclusion of the excavation. The site had been equipped with reliable apparatus, watched over by George Symcox, Clerk of the Works, and Thomas Hargreaves, Resident Electrical Engineer. Richmal Ashbee ordered the finds register and recorded the many pieces of wooden artefacts, wood, organic matter, and other objects that were recovered from the waterlogged conditions at the bottom of the shaft. Her meticulous record allowed an assessment to be made after the alteration of much of the material during the conservation processes. A great deal of environmental and other material was recovered as a result of the wet-sieving station that she devised, organised, and led. The 1962 work was aided in various ways by the unstinting work, at various times, of Peter Harradine, David E Johnston, Robin Kenward, Patricia McClure, Diane Simpson, and Raymond Wilton. Dr Cyril Everard, of Queen Mary College, University of London, investigated the water-table problems and most kindly located wells in the vicinity. Professor G W Dimbleby discussed the problems inherent in the wood and the environmental materials, besides undertaking pioneer investigations.

The excavation was visited, and the shaft descended, during the course of 1961, by R J C Atkinson, Desmond Bonney, J B Calkin, P and D Christie, G C Dunning, R L S Newall, and Dr I F Smith. During the 1962 season, there were visits from R J C Atkinson (and family), A Badcock, Graham Connah, G W Dimbleby (with Philip Porter, his assistant), G C Dunning, C Everard, Paul Johnstone, R L S Newall, Dr I F Smith, and Stanley Thomas. R Robertson-Mackay was the conduit for the Ministry of Works' facilities and he visited the site in 1961 and 1962. Dr Leo Biek (Ancient Monuments Laboratory) visited the site during 1961, and Edward Cripps (Ancient Monuments Laboratory) was able to make latex impressions of axe-dressing and antler-pick work in 1961 and 1962, from which positive plaster casts could be made. In 1962 E Blomfield (Ancient Monuments Inspectorate Photographer) made studies of the shaft's interior and records of various wooden artefacts. Elizabeth Fry-Stone (née Meikle), the Ancient Monuments Inspectorate's Illustrator, drew a number of wooden artefacts before they were packed for transit to the Ancient Monuments Laboratory, and Derek Henderson (Ministry of Works Land Survey) produced measured profiles of the emptied shaft and a contour plan of the weathering cone.

An apposite assessment was for long impossible because effective arrangements for the examination and conservation of the organic remains, in the charge of the Ancient Monuments Laboratory, were not immediately carried out. In 1984, however, Professor B W Cunliffe, as Chairman of the Backlog Working Party of English Heritage, was able to enjoin befitting action. The enterprise is indebted to him for this and for his sustained and sympathetic encouragement in the face of the various impediments. Work began with Dr M G Bell (St David's University College, Lampeter) directing and coordinating the environmental investigations and the present writer matters archaeological. A happy and fruitful relationship ensued and, because of Martin Bell's exertions, much has been extracted from a near-moribund situation.

Richmal Ashbee check-read each section and her exact memory of circumstances and objects has made a comprehensive account of an undertaking, now a quarter of a century in the past, more cogent and complete than was, initially, ever considered possible. Sarah Jennings (York Archaeological Trust) and Graham Reed (Passmore Edwards Museum) drew the line illustrations of the pottery, bone pins, beads, etc, and details of some of the wooden artefacts. Philip Judge (School of Environmental Sciences, the University of East Anglia) redrew various plans and graphs. Clifford Middleton photographed the pins, beads, and pottery. Dr Robin J Taylor, Academic and Specialist Publications Branch, English Heritage, was the channel for the facilities of that body. He was able to make its support effective, rational, human, and congenial. Clifford Price, Head of the Ancient Monuments Laboratory, and John Saunders, Chief Inspector's Division, were similarly supportive.

Desmond Bonney (Royal Commission on the Historical Monuments of England, Salisbury Office) kindly supplied an enlargement of the map of monuments in the vicinity of Stonehenge. Clare Coneybeare (Salisbury and South Wiltshire Museum) arranged access to the casts of the shaft's interior, preserved in her museum, which were photographed by Lynn Rivers. Ann Ellison generously pointed to the compeers of the urn. Mary Harman (Passmore Edwards Museum) identified the bones from which the pins were fashioned. Veryan Heal (then at the National Maritime Museum) examined and commented upon the pieces of wooden artefacts that had retained some form after conservation. Hilary Howard and Mike Pitts examined and commented upon the fragment of metamorphosed sandstone. Paul H Robinson searched the Wiltshire Archaeological and Natural History Society's library for mention or record of the pond barrow.

The Committee for Aerial Photography, the University of Cambridge, allowed access to its archives and has generously permitted the publication of one of its unrivalled photographs of the Lake group of pond barrows. Oswin E Craster amplified the details and circumstances of his scrutiny of the newly-bulldozed pond barrow in 1954. R E M Hedges and R A Housley, of the Oxford Radiocarbon Accelerator Unit were good enough to contribute an explanation of the qualities of the samples and the properties of the dates obtained therefrom.

P A

Clifford Price created the conditions whereby the long-overdue environmental report could be prepared. Nigel Thew helped to locate samples and documentation at Fortress House. I have also enjoyed the friendly cooperation of Paul Ashbee and Edwina Proudfoot. In coordinating this report I have been particularly helped by Mike Allen, who prepared a large cross-referenced index of all the biota and also sorted samples out at Fortress House. Sue Pegg was also a great help: she sieved and sorted the samples and despatched material to specialists. Particular thanks are due to all the numerous specialists who responded so cheerfully to very tight deadlines and difficult material. As will be obvious to the reader, Peter Osborne, Professor Geoffrey Dimbleby, Caroline Grigson, and Mark Robinson have played a particularly important part in bringing the site to publication, and I am especially grateful to them for their help.

M B

Thanks are due to my husband for support and encouragement in the endeavour to see that this excavation was reported in spite of all difficulties. Further thanks are due to Martin Bell for smoothing an extremely difficult path and for his patience. Robin Taylor has had an unenviable task as editor. Geoffrey Dimbleby provided encouragement when the project seemed unlikely to make progress, and Clifford Price was also encouraging. Reay Robertson-Mackay was the Ministry of Works (now English Heritage) Inspector for the excavation and was most helpful. Cynthia Gaskell Brown (Warhurst) and Isobel Smith were enormously helpful during the excavation, as were Paul Ashbee and the late Peter Gray. Professor Christopher Hawkes and Sonia Hawkes initially examined the pottery from the site and commented on it; Frances Raymond, through the Trust for Wessex Archaeology, provided a report on the pottery. Andrew David of the Ancient Monuments Laboratory commented on the flints. The pottery drawing was provided by the Trust for Wessex Archaeology; other drawings were reworked or done by Chris Boddington of the Academic and Specialist Publications Drawing Office of English Heritage. Lance Vatcher and the late Faith Vatcher were among a number of colleagues who lent their support and encouragement to this improbable excavation at a time when some thought it should not continue. Thanks should also be expressed to Mr Noble on whose land all this work took place. The small band of workmen and volunteers performed a remarkable feat under difficult conditions, and finally there are colleagues and friends who have encouraged me to seek recognition for my work and without whom this report would not have been written.

E V W P

Some of the specialist contributors acknowledge assistance as follows.

I am very grateful to Paul Ashbee for inviting me to work on the bones from Wilsford Shaft many years ago when I was still a mere beginner in faunal analysis; to him, Edwina Proudfoot, and Martin Bell for much interesting discussion; to Miranda Armour-Chelu for examining gnawing and cut marks with me; to Juliet Clutton-Brock for making space for me to carry out the identifications in the Mammal Section of the British Museum (Natural History); to Simon Davis for allowing me to make use of his as yet unpublished work on equid phalanges; to Martin Bell for his patient compilation of the environmental data. The osteological material from the cone was originally sorted and listed by Dr A S Clarke.

C G

I am grateful to the following for their assistance: Dr R A Wilson, for confirming the identification of the oocysts, and Professor D L Lee, for examining the material.

A K G J

This work was undertaken in the University Museum, Oxford and funded by English Heritage. I am grateful to Miss Serena Marner for access to specimens in the Fielding-Druce Herbarium, Department of Plant Sciences, Oxford. Thanks are due to Miss Vanessa Straker for help with the cereal remains, Mrs Camilla Dixon for looking at the opium poppy seeds, and Miss Philippa Tomlinson for recognising the fern leaf stem scales.

M R

I am grateful to Professor U Körber-Grohne, Dr Allan Hall, and Penelope Walton for advice, and to the Conservation Laboratory of the York Archaeological Trust for the use of their phase contrast microscope.

P T

1 General introduction

by Paul Ashbee, Martin Bell, and Edwina Proudfoot

The circumstances of the excavation and the discovery of the shaft

During the later summer of 1960, Edwina Proudfoot undertook the excavation, on behalf of the Ancient Monuments Inspectorate of the Ministry of Works (now English Heritage), of three barrows on Normanton Down in the parish of Wilsford (South). Two of these, Nos 1 and 33, were bowl barrows (Proudfoot forthcoming), the third, 33a, the subject of this monograph, a pond barrow (Annable 1961, 30; 1963, 468; Longworth 1961, 346). Although upon the land surrounding Stonehenge, purchased after a national appeal in 1927–8 and in the care of the National Trust, the bowl barrows had been severely damaged by deep ploughing and the pond barrow all but obliterated. The sustained destruction of much of this relict landscape began in 1954 when a large part of the celebrated Normanton group of barrows was destroyed (Underwood 1954), and the three barrows, just to the west (Fig 1), were early casualties. Edwina Proudfoot's excavations were designed to salvage as much as possible and were carried out as part of the then Ministry of Works' barrow excavation programme.

Wilsford 33a (NGR SU 10864148) had been listed by L V Grinsell (1957, 225), who gave its locality as Normanton Gorse. He recorded it as a bank, about 12ft (3.6m) in width and 1ft (0.3m) in height, surrounding an area 42ft (12.6m) in diameter and 2ft (0.6m) in depth. Thus the overall diameter would have been of the order of 70ft (21m). His scrutiny suggested that it was a normal pond barrow, comparable with others in the vicinity. An unsolicited description was provided by C W Noble, the agent of A M Hosier, the National Trust's tenant. In his words, 'It was a hollow with a bank about it in which were a cow to lie on its back it would be trapped and die.' This was his justification for the use of a bulldozer to level the monument.

The razed pond barrow was seen by Oswin Craster, at that time Inspector of Ancient Monuments, on 11 August 1954. He took photographs (Figs 2 and 3) which clearly show the naked chalk on the site of the bank and the mixed material, chalk and topsoil, infilling the 'pond'. He noted that 'No 33a, which was a pond barrow, has had its bank bulldozed into its hollow, and the area is now a flat chalky expanse. No 33 [one of the bowl barrows close by] has evidently also been bulldozed. There is now no sign of a ditch. The work has evidently been done this summer as a forerunner of ploughing, which has started on the north side of the down.'

In 1960 the conventional view was that a pond barrow was 'a slight depression well and regularly formed, the material from which has been placed around the circumference to form an embanked rim' (Grinsell 1941, 89; 1953, 23; Ashbee 1960, 25–6, fig 3). This definition, long attended by doubts regarding their function, seemed to have been substantiated by the excavation of examples on the Dorset Ridgeway (Atkinson *et al* 1951; Farrar 1954, 89). Here the ring-banks appeared to enclose pits, some containing burials, covered by 'pavements' of flint nodules.

With such notions unavoidably in mind, Edwina Proudfoot set out baulk-divided quadrants and began her excavation. A destruction layer infilled the central depression. This depression, however, proved to be no more than compact chalky debris, comparable with the infill of a deep ditch (Gray 1934, pl XXXIX, fig 2), and its removal disclosed a great inverted conical cavity. Its layered character showed that weathering and silting were responsible for the accumulation. Deeper digging demanded that the baulks be removed. Thus, after the upper silts had been recorded, removal of the chalk rubble and flint nodules showed that the huge pit gave way to the vertical sides of a cylindrical shaft.

Edwina Proudfoot was unable to continue the direction of the shaft's excavation owing to her work commitments. Work was kept going by Peter Gray, who had that summer (1960) assisted with the excavation of Amesbury Barrow 51 (Ashbee 1978a). He was visited at intervals by Edwina Proudfoot and Paul Ashbee, and his efforts resulted in the removal of almost sterile, sometimes soil-stained, chalk rubble and flints to a depth of more than 60ft (18m).

Deep digging during 1960 was aided only by ladders and a mechanical hoist, and it was obvious that further work would entail a better-equipped approach. Edwina Proudfoot was thereafter not involved in the planning or carrying out of the excavation and did not have an opportunity to visit in subsequent seasons. Paul Ashbee continued the work in 1961 and 1962 at the request of the Ministry of Works. During 1961, despite persistent administrative, technical, and mechanical difficulties, infill was removed to beyond a depth of 80ft (24m). In August 1962 the excavation was concluded with augmented plant, supervised by a Clerk of the Works and maintained by a resident engineer.

Notices and details of the excavation and its plant appeared in the local and national press during and shortly after its completion (local press: *South Wiltshire Gazette*, 9 Sept 1960; *Southern Evening Echo*, 7 Aug 1962; *Salisbury Times & South Wiltshire Gazette*, 10 Aug 1962; *Southern Evening Echo*, 13 Aug 1962; *Salisbury Journal*, 31 Aug 1962; *Salisbury Times & South Wiltshire Gazette*, 31 Aug 1962; *Wiltshire News*, 31 Aug 1962; national press: *Daily Telegraph and Morning Post*, 1 Jan 1962; London *Times*, 6 Aug 1962; *Daily Mail*, 7 Aug 1962; *Evening News*, 10 Aug 1962; *Daily Telegraph and Morning Post*, 14 Aug 1962; *Birmingham Post*, 25 Aug 1962; *Daily Mail*, 25 Aug 1962; *Daily Telegraph and Morning Post*, 25 Aug 1962; *Manchester Guardian*, 25 Aug 1962; London *Times*, 25 Aug 1962; *Sunday Times*, 9 Sept 1962; *Daily Telegraph and Morning Post*, 27 Dec 1962). One of a programme series entitled 'The Archaeologist', broadcast by the BBC on 31 December 1962, was an account of the site. In addition, an article describing the use of the closed-circuit television system, entitled 'Mit der Kamera in die Vergangenheit, das Fernsehen hilft der Altertums-

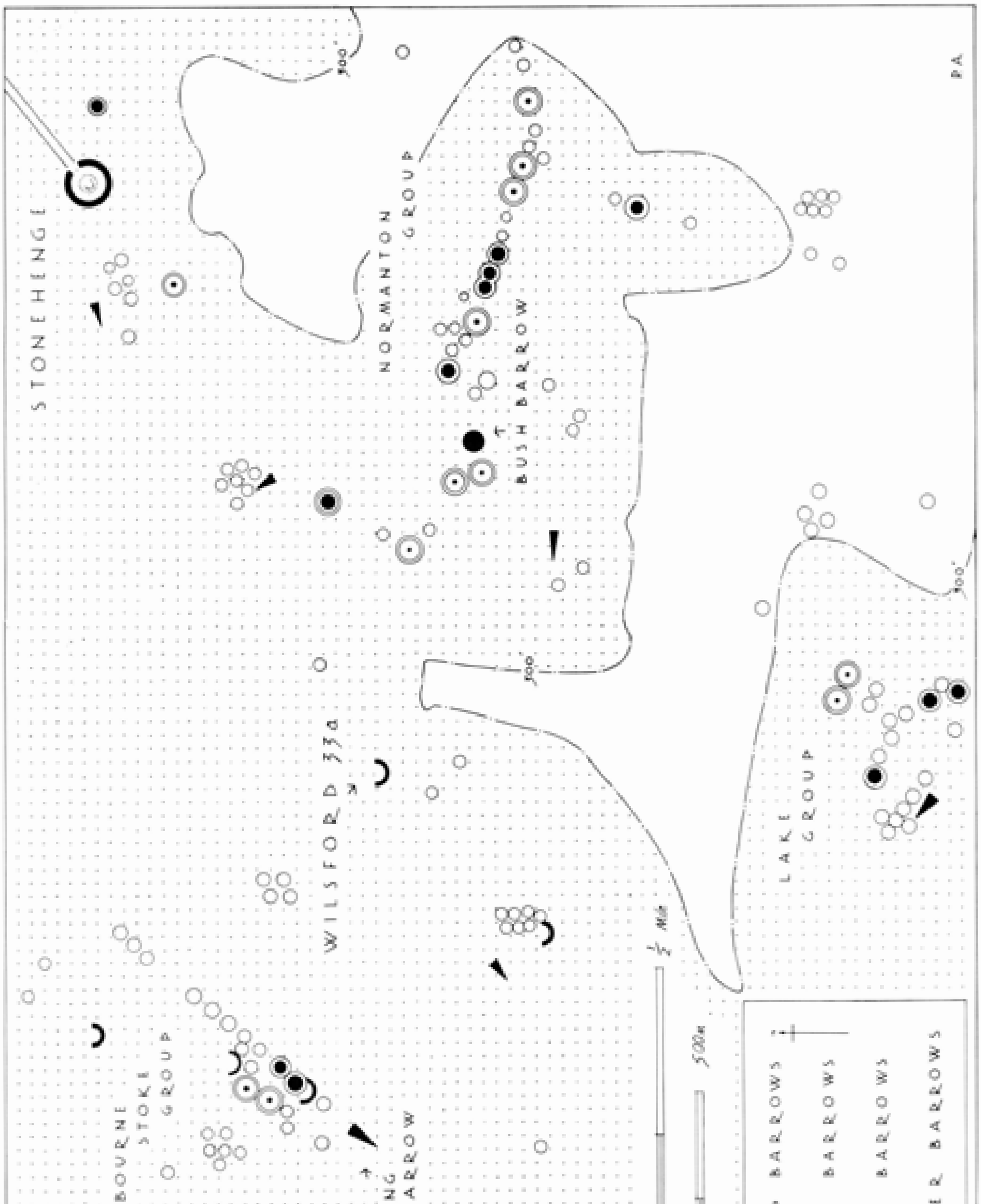


Fig 1 The Wilsford Shaft (33a pond barrow) and its immediate surround

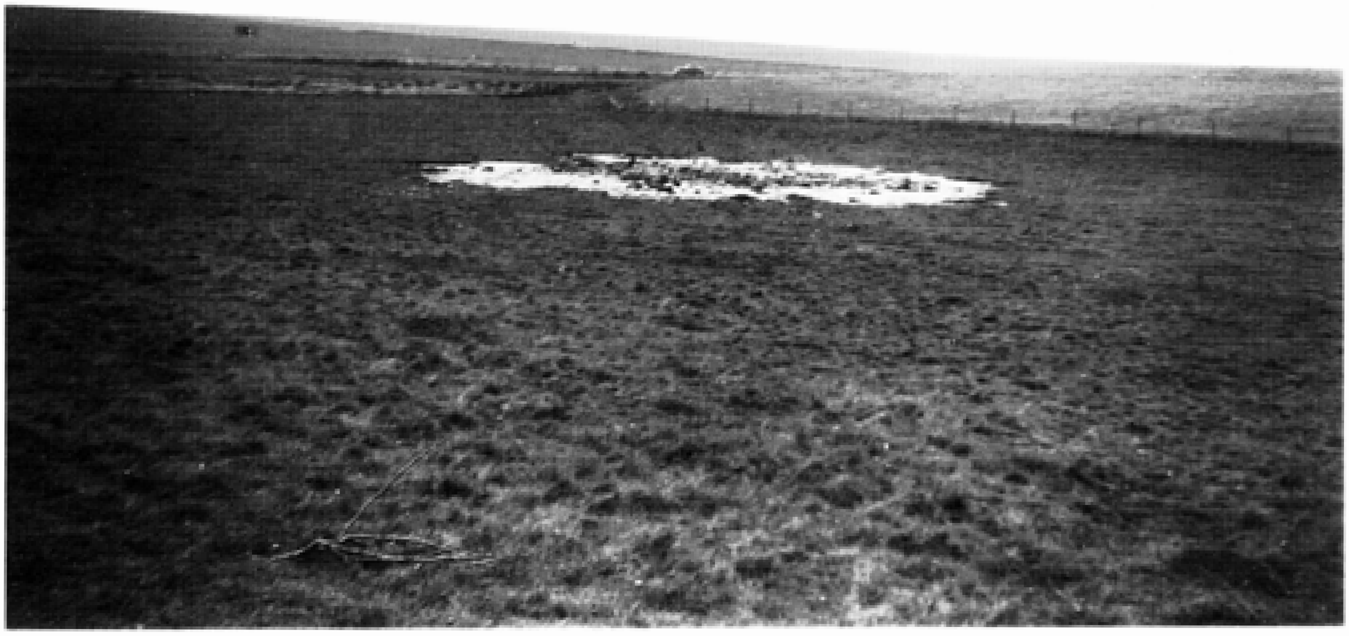


Fig 2 The bulldozed pond barrow from the south, 11 August 1954 (O E Craster, English Heritage)

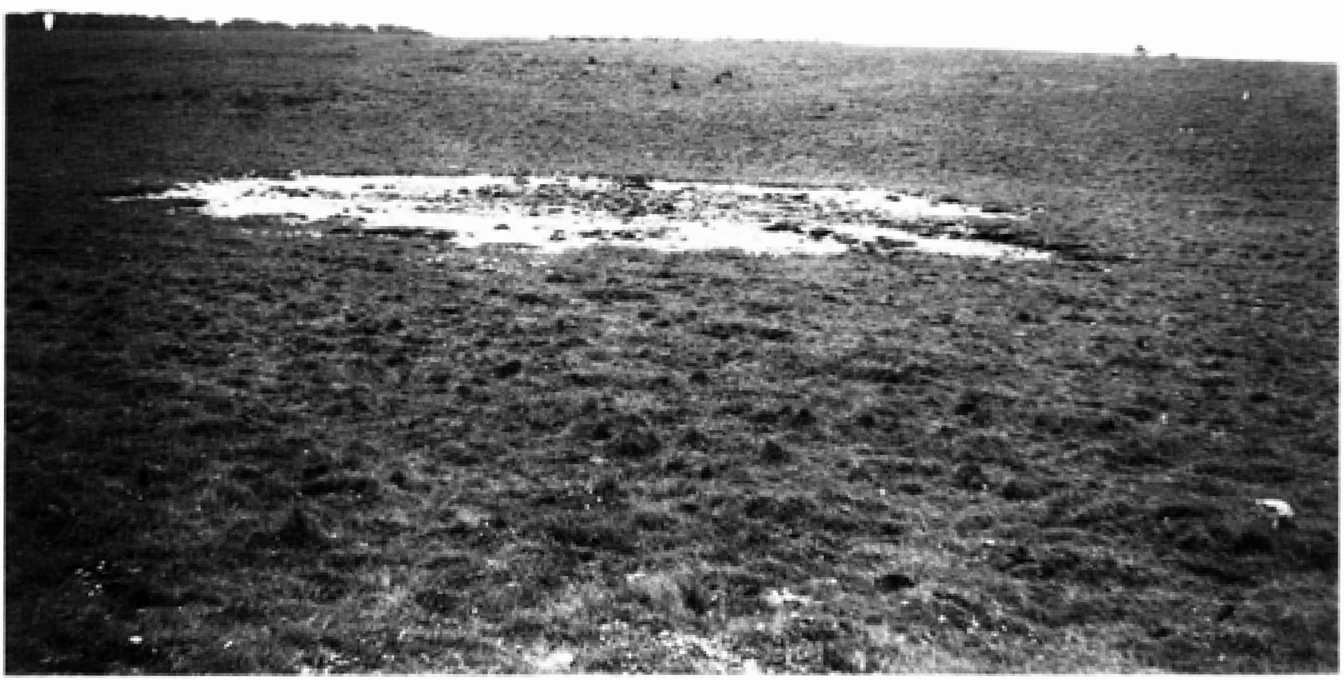


Fig 3 The bulldozed pond barrow from the west, 11 August 1954; the dark central area is assumed to be the remains of the former bank, while the surrounding white chalk may indicate its previous position (O E Craster, English Heritage)

forschung' was published in the German television magazine *Hören und Sehen* (*Heft* 39, 1962).

An interim account of the pond barrow and shaft was published in 1963 (Ashbee 1963) and, later, a note regarding a radiocarbon date (Ashbee 1966a) from wood found at the bottom. Reference to the shaft and its date has been made in various general works (S Piggott 1965, 232; Ross 1967, 25; 1968, 257; S Piggott 1973, 383, fig 24; Bradley 1978, 50; Ashbee 1978b, 225, fig 67; RCHME 1979, 19). Lectures describing the site and its significance were given to the Wiltshire Archaeological and Natural History Society at Devizes on 16 October 1965 and to the Prehistoric Society, in London, on 1 December 1965.

Siting, topography, geology, and aerial photographs

The pond barrow's location (NGR SU 10864148) at Normanton Gorse, given by L V Grinsell (1957, 225), derives from the small rectilinear wood just to the east, in which lies a disc barrow (Wilsford (S) 2) and a bowl barrow (Wilsford (S) 2a), the western outliers of the Normanton Group (Fig 1). The pond barrow is in the head of the dry valley (Figs 2 and 3), indicated by the 300ft (91m) contour, that runs to the south to join the yet larger dry valley which debouches into the Avon valley at Great Durnford. This dry valley is markedly flat-bottomed, perhaps as the result of a vanished hydrological system.

This low, almost isolated, siting, unlike that of other pond barrows which are mostly associated with groups and lines of barrows, might denote a specific use of the dry valley. Since it lies in the head of this valley, it is overlooked upon almost every side, and activities at the head of the shaft, within the encircling bank, could have been clearly seen, albeit from a distance.

The pond barrow lies upon the low chalk plain (Gifford 1957, 6), and the shaft was dug through a cryoturbated mantle into the undisturbed, flint-seamed chalk below. This, the Upper Chalk, has been cloaked by a shallow soil, sometimes almost black and with rendzina characteristics. It contains few flints but much weathered and broken chalk.

Sadly, there were no photographs taken of the area south-west of Stonehenge during the heroic age of aerial photography (Crawford 1928; 1929; Crawford and Keiller 1928; Allen 1984). However, it emerged that the survey of the British Isles undertaken by the Royal Air Force during the immediate post-war period (Daniel 1948) had photographed the area prior to (Fig 4), and after, the ubiquitous destructive deep-ploughing that took place in 1954. The details of these photographs are listed in Table 1.

The first four photographs show the pond barrow, its surrounding bank, and the internal depression as worn but, like the other barrows on the bush-clad, unbroken expanse of Wilsford Down, intact. A track led south-eastwards to the dry valley where it bifurcated and joined another. The bank, burrowed into by rabbits, had been bared. Its outline showed it as more substantial on its north-western flank. Destruction, shown by the fifth photograph, had involved the complete removal of the bank. Only a circle of lacerated chalk surrounding darker soil, with the bank's debris infilling the internal concavity, indicated the erstwhile emplacement.

Table 1 Aerial photographs

Before plough-destruction		
Date	*Sortie no*	*Print no*
25 Sept 1945	106G/UK/839	RP 3065
11 Oct 1945	106G/UK/915	RP 3206
7 Oct 1946	CPE/UK/1769	RP 3332
29 Oct 1946	CPE/UK/1811	RS 4358
After plough-destruction		
18 July 1956	58/RAF/2513	F21 0159

Pond barrows, their nature and incidence

William Stukeley (1740, 45) was the first to excavate a pond barrow and record the results. Of his work he recounted:

> Going from hence [the Normanton Group] more southerly, there is a circular dish-like cavity dug in the chalk, 60 cubits in diameter, like a barrow revers'd. 'Tis near a great barrow, the least of the south-western group. 'Tis between it, and what I call the bushbarrow set with thorn-trees, Tab XXXII.
>
> This cavity is seven feet deep in the middle, extremely well turn'd, and out of it, no doubt, the adjacent barrow is dug. The use of it seems to have been a place for sacrificing and feasting in memory of the dead, as was the ancient custom. 'Tis all overgrown with that pretty shrub *erica vulgaris*, now in flower and smelling like honey. We made a large cross section in its center upon the cardinal points; we found nothing but a bit of red earthen pot.

The reference to Tab XXXII is an error for Tab XXXI, 'A Prospect of the barrows in Lake field, called the Eleven barrows & lately the prophets barrows. 2[d] Sep.[r] 1723'. Although bell, disc, and other barrows are clearly depicted, he did not, sadly, show the pond barrow nor the piece of pottery. He observed, however, near the Rollright Stones in Oxfordshire, 'many circular dish-like cavities, as near Stonehenge, we may call them barrows inverted.' Was this, perhaps, a group, as on Lake Downs (Grinsell 1953, 170), destroyed when the heathland was reclaimed and improved?

Colt Hoare (1810, 22) coined the term 'pond barrow' saying:

> I can form no conjecture about these *tumuli* that carries with it the least plausibility; they differ totally from all the others, and resemble an excavation made for a pond; they are circular, and formed with the

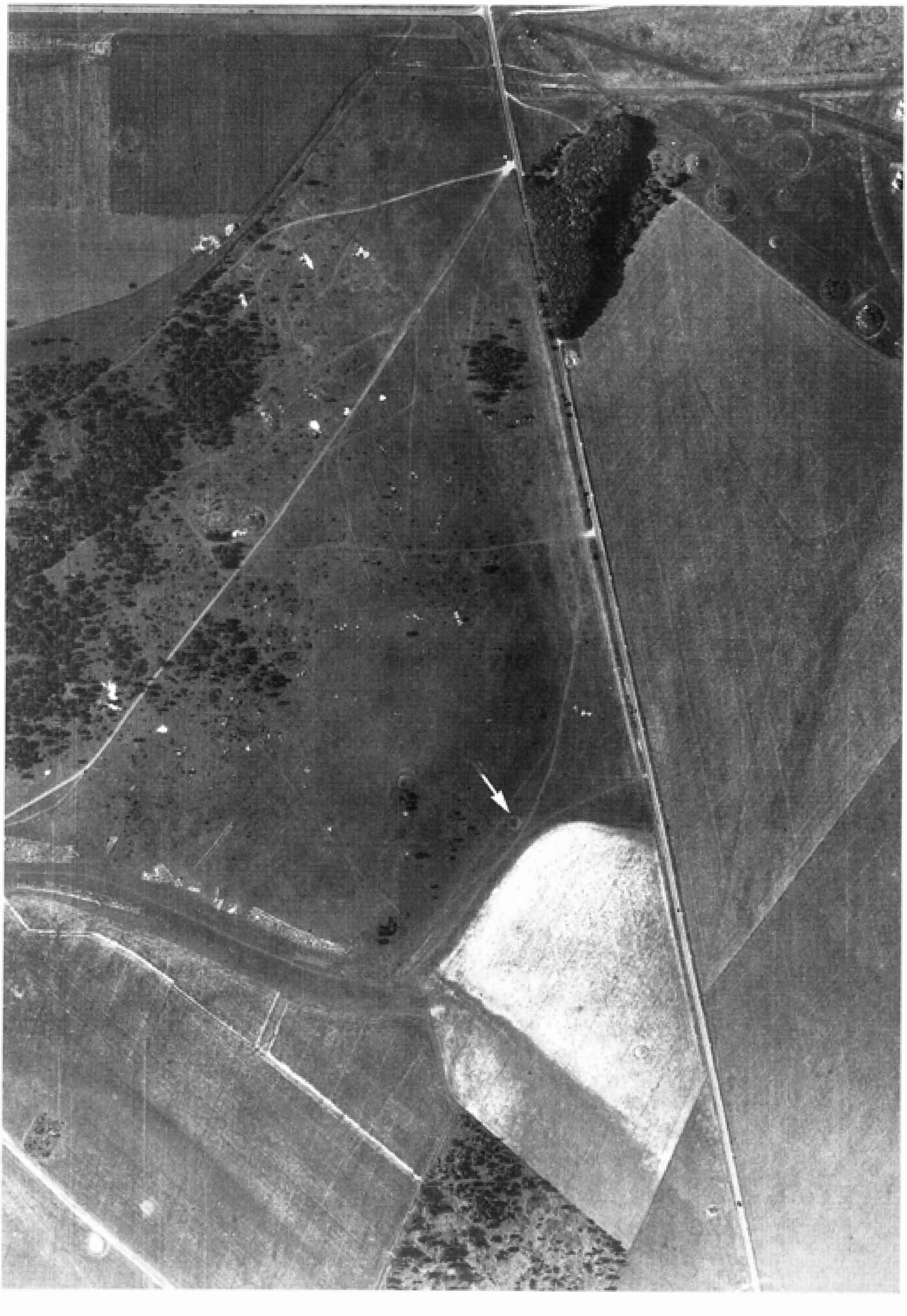


Fig 4   An aerial photograph of the pond barrow and its surround in 1945 (Royal Air Force)

> greatest exactitude; having no protuberance within the area, which is perfectly level. We have dug into several, but have never discovered any pottery or sepulchral remains: though I have heard that an interment of burnt bones was found within the area of one of them on Lake Downs. We generally find one or more of these barrows in the detached groups, and on Lake Downs there is a cluster of four or five of them all together. I once thought that the Britons might have adopted this method of preparing their barrows for interment, by thus marking out the circle, and throwing out the earth on the sides, but the very great regularity of the vallum militates against this idea.

He records (1810, 121) the southernmost pond barrow of the Winterbourne Stoke group of barrows (Grinsell 1953, pl II), which impinges upon the ditch of the adjacent bell barrow, and thus appears to be later, saying only that 'No 14 is a pond barrow' and, with the same certitude, he referred to No 167 (Wilsford 33a) as a pond barrow, but made no further comment.

Half a century later, John Thurnam was clear-minded and informative although inconclusive (1868, 166, fn b). In his masterly introduction to *Ancient British barrows* he wrote of Colt Hoare's classification:

> I do not include No VI or 'Pond-barrow', a misnomer introduced by Sir R C Hoare, it not being a barrow at all, but a circular excavation in the surface, similar to what might be made for a pond. The name 'barrow' (Anglo-Saxon *beorh*, a hill) necessarily involves the idea of a mound or heap, and, as applied to sepulchral monuments, implies a grave-mound: it is entirely inapplicable to such hollows as are here referred to. These circular excavations are often found among or adjacent to the barrows of Wiltshire but the area within has scarcely ever yielded traces of interment. Sir Richard (*Ancient Wilts*, i, 22), and, as I find from the MS notes kindly lent to me by his son, the late Rev E Duke of Lake House, Wilts, excavated the centre of three without finding sepulchral or other remains; in a fourth, however, in a hole in the chalk, there was a deposit of burnt bones. Dean Merewether opened others in North Wilts, and the Rev J H Austen one in Purbeck, Dorset (*Salisbury vol of the Arch Institute*, p 85; *Papers of Purbeck Society for 1858*), and found nothing. I have also dug into two or three, including that marked No 14 on Winterbourn Stoke Down (*Ancient Wilts*, i, 121), with the same negative result; save that in one (No 94 or 97, *Ancient Wilts*, i, 168), a mile to the north of Stonehenge, I found the skull and bones of the right arm of a woman *in situ*. The absence of the left arm and of the lower part of the skeleton was remarkable, and showed that the body had been dismembered before burial, which was probably long subsequent to the formation of the cavity. Stukeley opened one near Stonehenge (*Stonehenge*, p 45), and found nothing but a bit of red pottery. He speaks of them as 'circular dish-like cavities dug into the chalk, like a barrow reversed'; and elsewhere calls them 'barrows inverted' (*Abury*, p 12). His view of their use as 'places for sacrificing and feasting in memory of the dead' is not unlikely. The earth and chalk excavated from them would be employed, we may suppose, in the completion of one or more of the adjacent barrows, whilst the hollow itself was perhaps temporarily roofed in, so as to form a place of shelter during the time occupied by the funeral ceremonies and in the formation of the barrows.

In this century pond barrows (Fig 5) attracted the attention of Gerard Mackworth Young, then Director of the British School at Athens, who suggested that they could have been *bothroi*: pits which gave access to the underworld and facilitated appropriate libations (Young 1934). This interpretation explained the absence of remains emphasised by Thurnam, and Young included a list extracted from Canon Goddard's pioneer compilation published in 1913. L V Grinsell defined and discussed the characteristics of pond barrows in his initial review (1936, 25), but in his analysis of the Bronze Age round barrows of Wessex, his definition had greater precision and the sparse details of the excavated examples were indicated. He stressed their association with other barrows, mapped their Wessex incidence, and on balance considered them sepulchral (Grinsell 1941, 89–90, map IV).

The excavation of an ostensible pond barrow at Winterbourne Steepleton in Dorset during 1947 (Atkinson *et al* 1951) facilitated a further scrutiny of the problem. An outer bank appeared to enclose pits, some containing burials, covered by a pavement of flint nodules. As this is the only modern published account of the excavation of a pond barrow, the details of the central depression are of particular interest. It was said that:

> The central depression was circular in plan, 35ft [10.5m] in diameter. The middle, some 15ft [4.5m] across, was almost flat and lay at a depth of 2ft [0.6m] below the surrounding undisturbed chalk. The sloping sides were regularly cut, and the chalk surface, where not disturbed by the pits, was smooth. It was noticeable, however, that towards the centre the chalk became more friable, perhaps because surface water tended to drain in that direction so that the underlying subsoil was affected to a greater extent by the disruptive action of frosts.

Fig 5 Undamaged pond barrows: the Lake Group from the air in 1954 (J K St Joseph, University of Cambridge Committee for Aerial Photography)

This pond barrow on Sheep Down yielded, from the pits and burials, two food-vessels and a group of distinctive collared urns. These were named Sheep Down and were thought of as early. They have now been seen as belonging to both the primary and the secondary series (Longworth 1984). Such an assemblage was unique and contrasted markedly with the meagre material produced by the nineteenth-century investigations. No significant difference was seen between the Wiltshire and Dorset groups of pond barrows, and their intimate association with Wessex barrows (bell, disc, etc) was emphasised. Their embanked nature invited comparison with henge monuments, then thought of as sanctuaries, and a native Neolithic tradition was invoked.

In 1957 the pond barrow, half-surrounded by the great barrow cluster, on Snail Down, between Everleigh and Tidworth, was excavated. It was about 40ft (12m) in diameter and the central depression was 1ft (0.3m) in depth. This and other barrows had been much damaged by the passage of military vehicles. Three pits, surrounded by a circle of stakeholes on the lip of the depression, suggesting a fence, contained fragments of human bone (Longworth 1958, 214; Thomas 1960, 225, fig 54).

Some 60 pond barrows have been identified in Wessex; about 25 line the Dorset Ridgeway (Grinsell 1959, 19, 172–3; RCHME 1970, 428) and, in Wiltshire, there are about the same number in the vicinity of Stonehenge (Grinsell 1957, 225; Fig 6; Appendix A). Other examples are at no great distance from Avebury. Possible pond barrows may exist on Butser Hill in Hampshire and Bow Hill in Sussex (Grinsell 1958, 104). With some exceptions they are intimately associated with groups and lines of barrows. One (Winterbourne Stoke 3a), as mentioned above, overlaps the ditch of one of the bell barrows (WS 4) of this well-known group. Wilsford 33a, the subject of the present monograph, stood in near-isolation, while the Lake Down pond barrows, about two miles (3km) to the south of Stonehenge, where 5 of the 16 barrows in the group are of this kind, are a unique concentration.

At the cost of logic, one of the major conclusions must be anticipated; the possibility should be envisaged that other pond barrows, some of which have large diameters (Grinsell 1957, 225), are the culmination of bank-surrounded, silted-up shafts. This would account for the circular, dished depressions, which are in every way comparable, except in overall form, with the regular infills of deep ditches (Gray 1934, pl XXXIX, fig 2). Excavation, even during recent decades, may have done no more than expose pits and graves, which have been assumed to

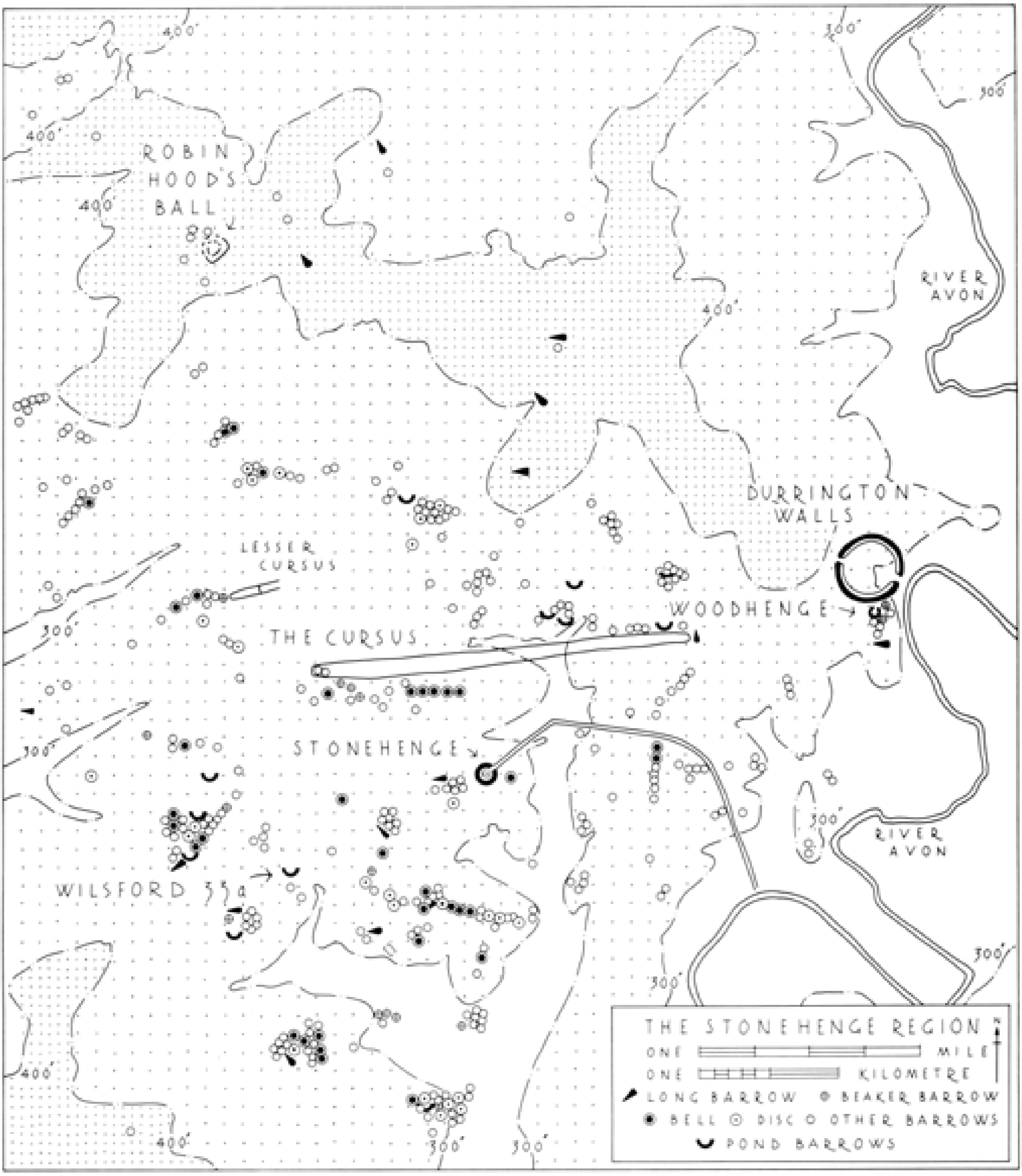


Fig 6 Pond barrows in the Stonehenge area

be the *raison d'être* for the monument, dug into the weathered lips and tops of compacted shaft infills. At Winterbourne Steepleton, for example, it was observed, regarding the central depression, that 'towards the centre the chalk became more friable': a condition that was explained by the action of frost upon percolating ground-water (Atkinson *et al* 1951, 5, pl 1, A). At Wilsford, the loose character of such chalk led to its removal, the emptying of the weathering cone, and the discovery of the top of the shaft. In lieu of excavation, the careful measurement of the bank volumes of undamaged examples, and comparison with central depression capacities, could perhaps provide indications which geophysical methodology might test.

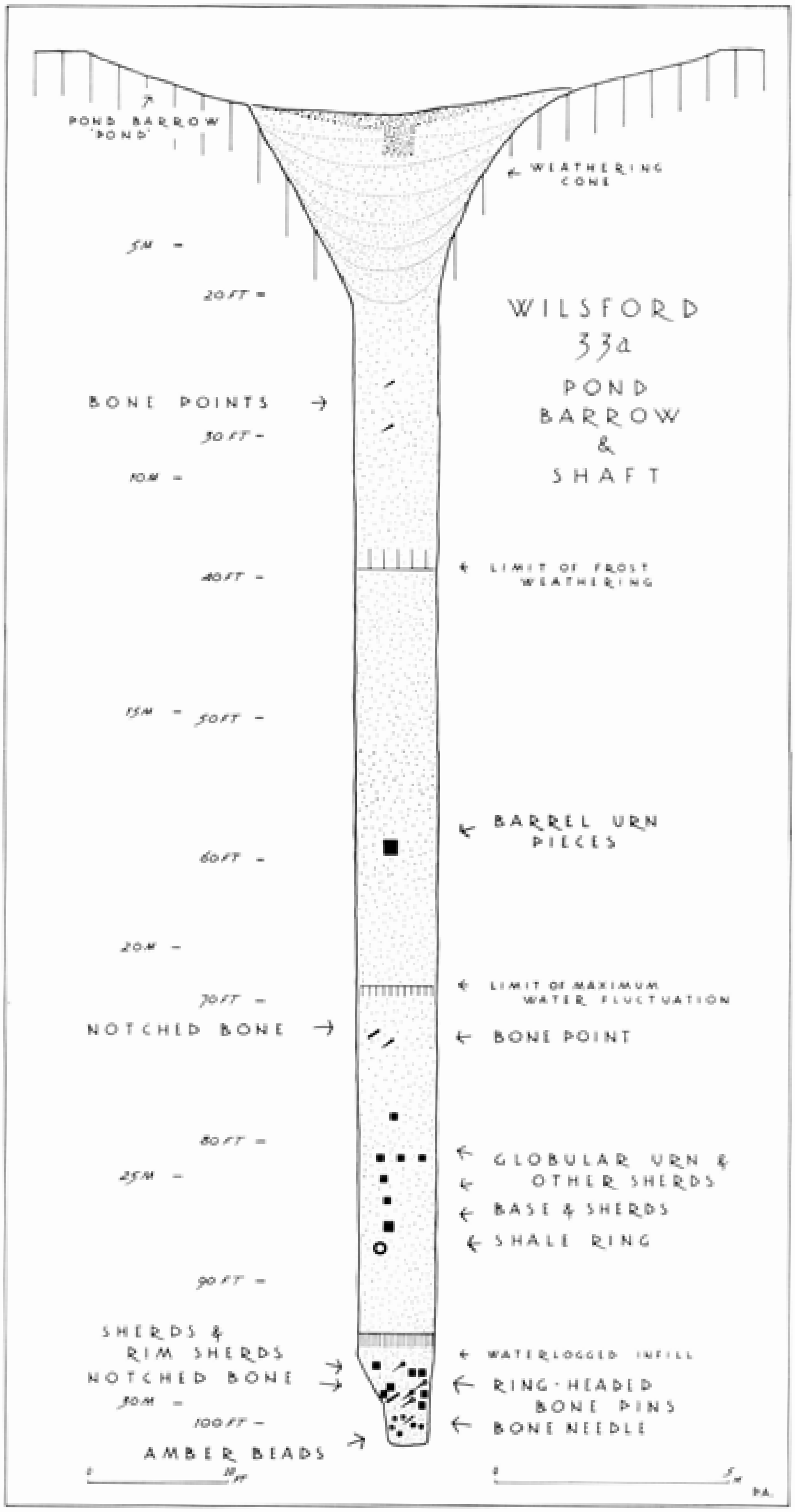


Fig 7 The pond barrow and shaft: the principal pottery and other non-wooden objects

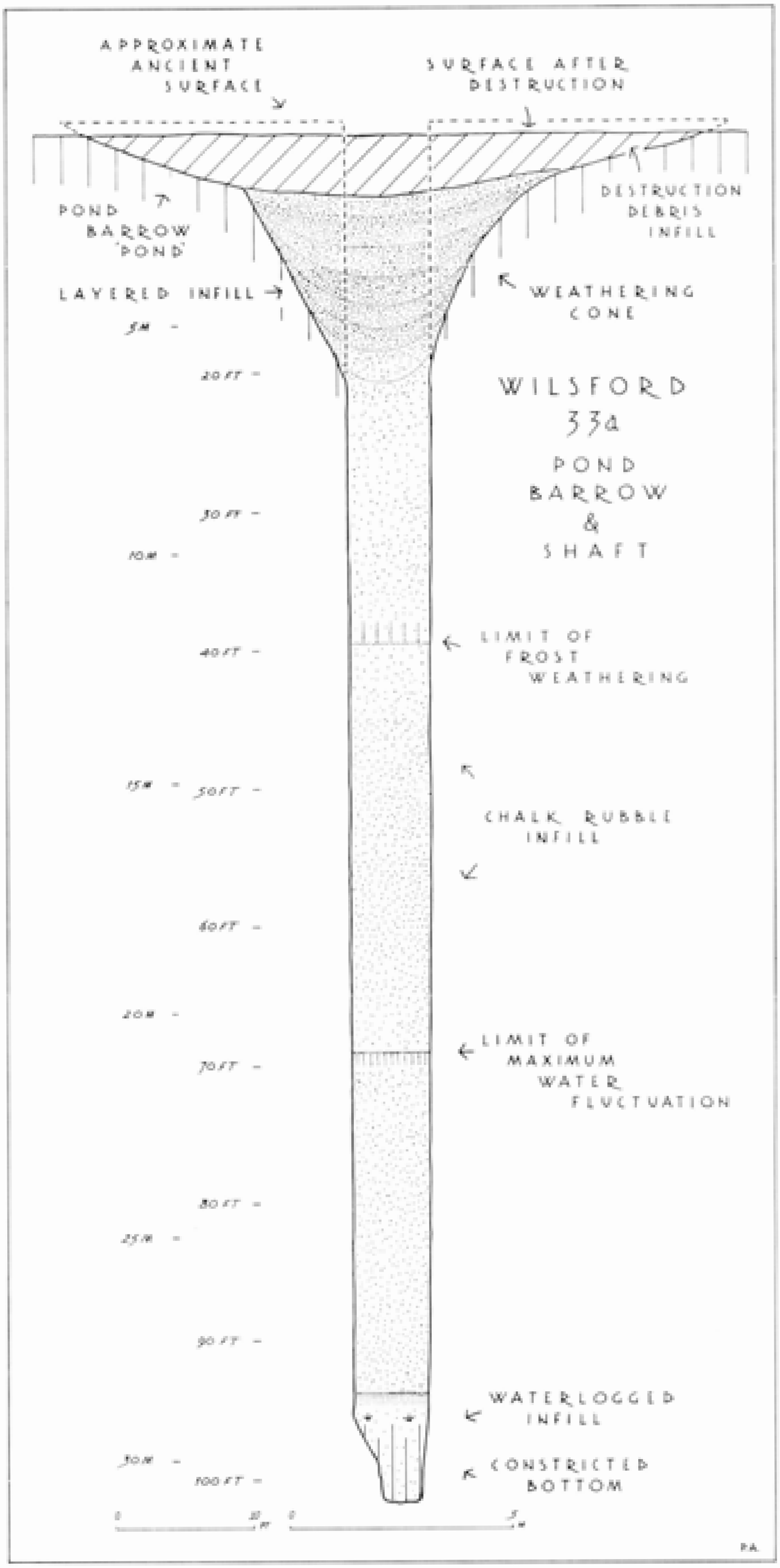


Fig 8 The pond barrow and shaft: its character, weathering, and infill

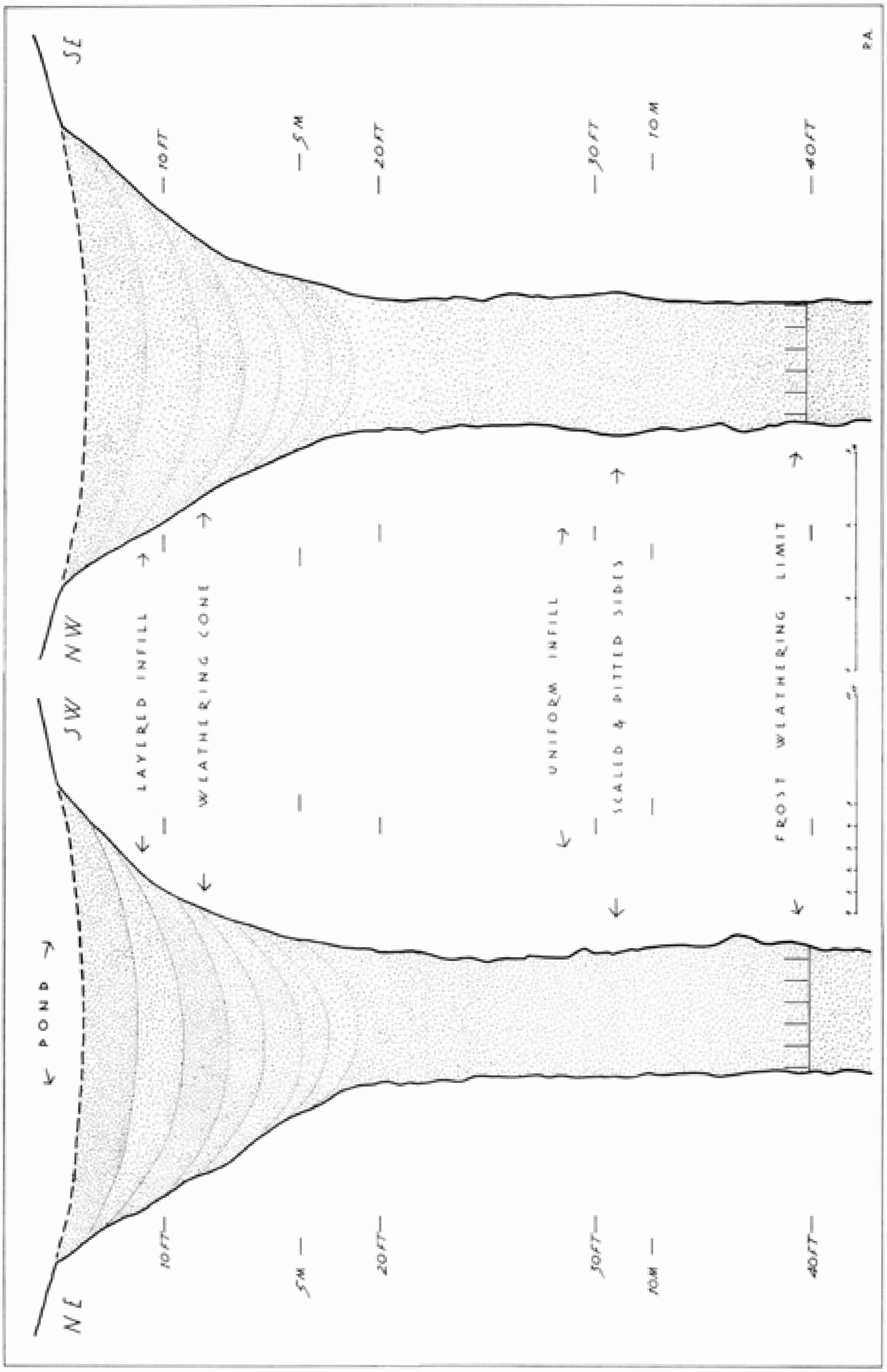


Fig 9 Detailed profiles of the shaft: the weathering cone and frost-weathered upper portion

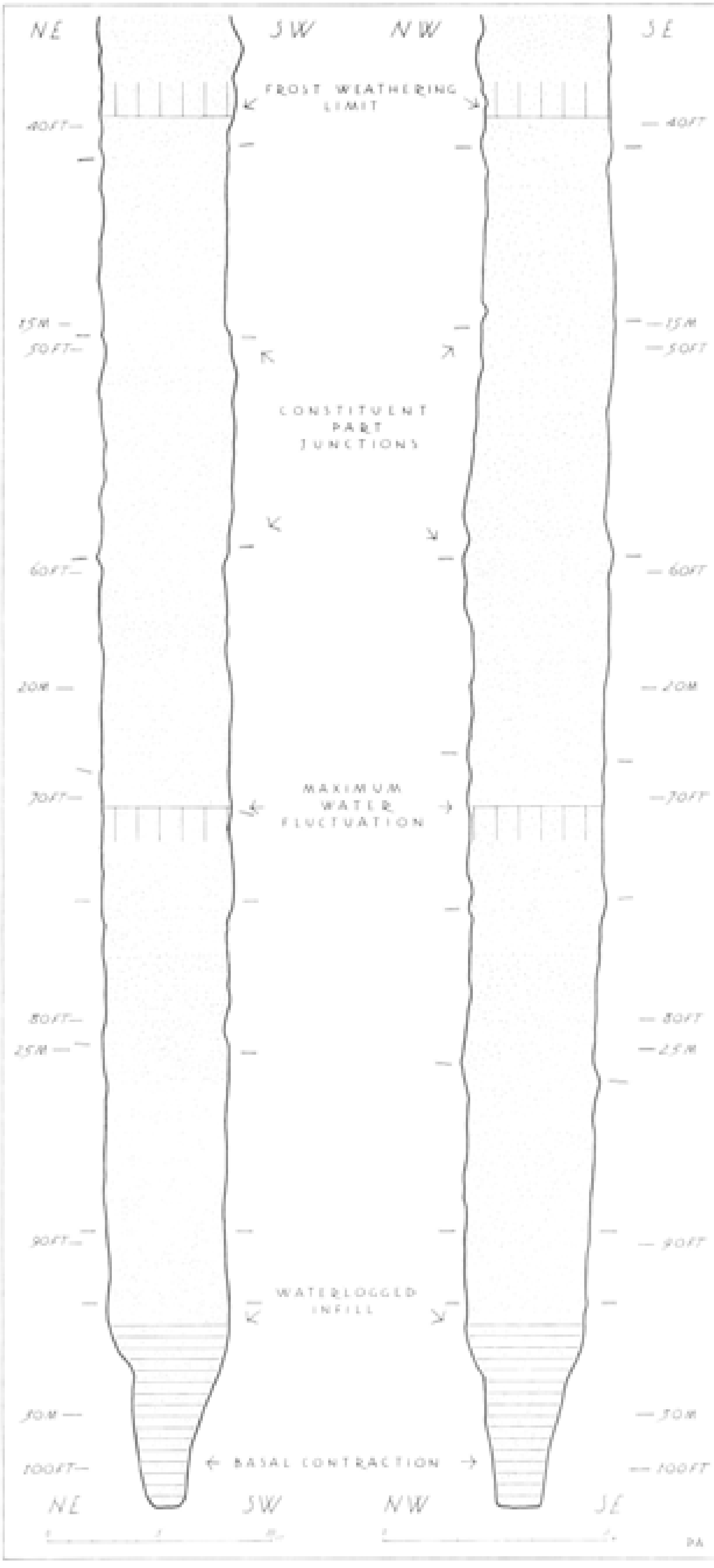


Fig 10 Detailed profiles of the shaft: the lower portion showing the component parts and constricted bottom

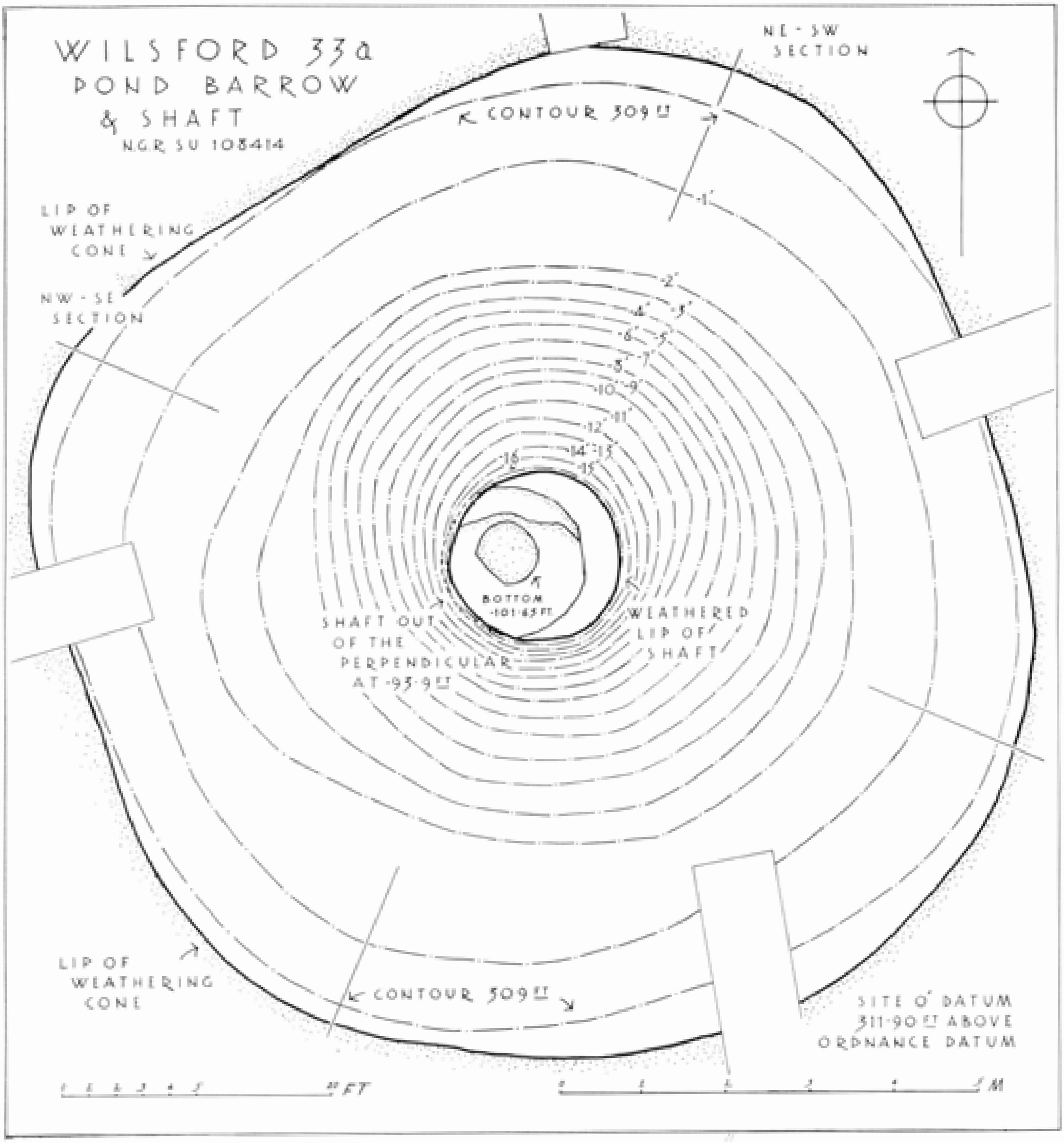


Fig 11 Plan, with contours, of the weathering cone and shaft

Recording and recovery

Objects found in the shaft's infill, or samples removed from it, were recorded by depth. A weighted tape was suspended from a reinforced horizontal scaffold member set at approximately the level of the grassed surface surround. This was 311.9ft (93.6m) above Ordnance Datum, a height which reflects the pond barrow's siting at the head of the dry valley delineated by the 300ft (91m) contour (Figs 1 and 6). This level was related to the Ordnance Survey's Bench Mark, value 357ft (107m), on the milestone near Longbarrow Cross Road, on the Salisbury–Devizes road. Objects in the infill were mostly more or less in the middle; where they were patently against the side of the shaft, this was observed and a direction (north, east, etc) noted. Large pieces of wood were sometimes lying vertically or at an angle, so two measurements, a top and a bottom, were made.

The waterlogged infill at the bottom of the shaft (Figs 7 and 8) contained a considerable amount of organic material, besides shreds and small pieces of wood which had palaeobotanical significance, and their excavation in the normal sense was impossible.

Such fill was brought to the surface, after its position had been recorded, and minutely examined by careful washing and sieving. By this method smaller objects, such as amber beads, and quantities of palaeobotanical material were recovered. Certain readily recognisable, and to some extent reconstructable, parts of composite wooden containers and the like were drawn on site by Elizabeth Meikle, the Inspectorate of Ancient Monuments illustrator. Appropriate photographs were also taken. Thereafter all wooden objects, pieces of wood, and other organic remains were listed and categorised, before being wet-wrapped in suitable containers, prior to their being taken to the Ancient Monuments Laboratory in London.

Once the shaft had been emptied of its infill, it was possible to scrutinise its unweathered lower part, as a whole and in detail, and to record the evidence of the work of those who dug it in prehistoric times (Fig 8). It had been sunk in short sections and, besides abundant antler-pick marks, there were extensive zones of metal axe-dressing and chasing.

The fundamental characteristics of the shaft and its weathering cone were recorded in detail by Derek Henderson, of the Land Survey Section of the then Ministry of Works, and by Paul Ashbee. Profiles of the shaft (Figs 9 and 10) at north-east–south-west and north-west–south-east were made. Measurements were made at 6in (150mm) vertical intervals, with extra notation where necessary, and the lineaments were drawn at a scale of 1 inch to 1 foot. In addition, contoured plans (Fig 11) at the same scale were made of the pond barrow's weathering cone, while the opening of the shaft was indicated.

In addition to the photographs taken by Paul Ashbee, a pictorial record of the shaft's interior was made by John Blomfield, the Ancient Monuments Inspectorate photographer, using a half-plate camera, with, when necessary, a wide-angled lens and photo-flood lighting (English Heritage: A5971/9 to A5971/18; for details *see* Appendix C). In addition a small number of colour photographs were taken of the iron oxide staining of the shaft's sides brought about by the fluctuations of the water-table.

A further and more permanent record was also made of the antler-pick marks and zones of axing visible upon the lower, unweathered sides of the shaft. Following experiments made in October 1961, rubber latex impressions (Fig 34) were made of selected areas (Appendix D). Positive plaster casts were made from the negative impressions, constituting a dimensional depiction to supplement the pictorial and descriptive details. These latex impressions (Appendix D), and the casts therefrom, are stored in the Salisbury and South Wiltshire Museum along with the other finds and archive from the excavation.

The sequel to the shaft's excavation

After excavation there remained the great inverted conical cavity, the weathering cone, and the shaft descending 100ft (30m) into the chalk. Clearly it was desirable that such a phenomenon, unique in the vicinity, should not be precipitately backfilled, for many of its aspects warranted investigation and further scrutiny; yet it could not be merely fenced and left to the weather. Thus in order that others, in the fullness of time, might study it, thought was given to preservation. Similar currents of thought flowed among those primarily concerned with the environmental aspects of archaeology. Potential was seen in its proximity to Stonehenge, as well as its position in an area vital to British prehistory.

Preservation was discussed with A M Hosier, the tenant, when he visited the site before the close of the excavation. It was suggested that the shaft should be capped with a raft of reinforced concrete, with a hatch, below cultivation levels. Viewers, with lighting and precaution against carbon dioxide, could descend in a bosuns chair.

This idea was put to the Ministry of Works, supported by Professor G W Dimbleby, then at the Imperial Forestry Institute, Oxford, and by Dr I W Cornwall of the University of London's Institute of Archaeology, as well as Dr T Margerison, then Science Correspondent of the *Sunday Times*. It was turned down, because the tenant farmer wanted the land back in cultivation, and because it would have been too expensive to carry out. Backfilling began on 17 September 1962.

2 The pond barrow and weathering cone

by Edwina Proudfoot

Introduction

Before excavation the site appeared as a barely discernible hollow, approximately 1ft (0.3m) deep at the centre and some 30ft (9m) in diameter, surrounded by what were assumed to be traces of a bank, the overall diameter being about 54ft (16.2m).

Earlier descriptions had indicated that these were the remains of a pond barrow. Excavation evidence from other sites was limited and, with the exception of Winterbourne Steepleton on Sheep Down, Dorset (Atkinson *et al* 1951), largely non-sepulchral. Accordingly, preparations were made to excavate the site as for any other barrow excavation. There was no reason to anticipate that specialist equipment, such as winching gear, safety helmets, shoring, ladders, pumping equipment, or oxygen, might be required.

In fact the site proved unusual from the start. The slope of the chalk, at first assumed to be the residual bank, soon gave way to a steeply-angled slope. Work was extremely difficult with neither skilled staff nor specialist equipment. Nevertheless the small workforce of labourers and volunteers coped admirably, in spite of the dangerous conditions. Even simple equipment such as planks and ladders were at a premium, but eventually a pulley system was devised by the foreman, until mechanical equipment became available late in the year.

It rapidly became clear that, instead of a shallow hollow surrounded by traces of a bank, the site comprised a deep hole in the chalk, 20ft (6m) wide at the top, with steeply-angled sides. By the end of the first month, excavation had proceeded to a depth of 12ft (3.6m), reaching 20ft (6m) by the end of the sixth week. At this point the sides, which had been converging and were expected to bottom out between 20ft (6m) and 34ft (10.2m), became vertical with a diameter of 6ft (1.8m). A 6ft (1.8m) probe could be pushed easily into the filling, so that no estimate of depth was feasible.

At this stage the writer had to hand over to Peter Gray, and excavation continued until October, when work had proceeded to a depth of nearly 70ft (21m). Still the only means of entering and leaving the site was by ladder, eventually a set of four 25ft (7.5m) ladders roped together. From the depth of 20ft (6m) the shaft, as it proved to be, remained a fairly constant 6ft (1.8m) in diameter.

Above 20ft (6m) the steeply-sloping sides were recognised as a cone or funnel, with a mouth 20ft (6m) in diameter at some 3ft (0.9m) below the modern surface. The top 3ft (0.9m) comprised disturbed material, which was assumed to be the bulldozed filling of the hole described by the farmer, although it did not conform to the dimensions given by him. There was no evidence of an original bank surrounding the site, but it may be assumed that this would be the source of the filling of the central area.

When the excavation reached this stage, ie a depth of nearly 70ft (21m), the second phase of the first season of 1960 was completed and the site was closed for the winter. Finds from the upper part of the site to 20ft (6m) depth were retained by the writer for study and are reported on in Chapter 4, while the items recovered by Peter Gray are discussed by Paul Ashbee.

The excavation

The main details relating to the first season's work are shown on the plan (Fig 12), the sections (Fig 13), and the photograph (Fig 14).

A grid was laid out with the main section perpendicular to the A303 road; thus the site grid was oriented north-west–south-east. Starting with four initial trenches, one in each quadrant, but concentrating on the north-east one at first, it soon became evident that all four quadrants had to be opened up together, in order to allow access to the central area, which was restricted in all but the south-west quadrant.

Before excavation the site had been spread by deliberate infilling of the central area and by ploughing, so that it seemed to have a diameter of some 54ft (16.2m). Therefore the main trenches were extended well beyond the grid boundary, to 60ft (18m) overall, to ensure that the outer limits of the presumed bank would be detected.

Excavation revealed a central area, filled with loose chalk and soil mixture, approximately 40ft (12m) in diameter. Around this, immediately below a thin ploughsoil layer, was a rim of relatively unweathered chalk, some 5ft (1.5m) across, ie *c* 50ft (15m) in diameter. Beyond the chalk ring the ploughsoil was deeper; it had a normal soil profile with weathered chalk at its base.

No trace of a bank could be identified, but the narrow rim of fresh, unweathered chalk delimiting the central soil-filled area was assumed to reflect the position of the destroyed bank, while the central area was identified as the interior of the so-called pond.

No secondary features were recovered from the excavated area, nor were there any casual finds from the ploughsoil. Although there were minor differences between one trench or quadrant and the others, this resulted from the layout of the excavation and not the contained archaeology. The site is therefore described as a whole.

Features

The features revealed by the excavation did not conform in any way to those anticipated as pertaining to a pond barrow. The remains proved to be unitary, though not relating to a single period. In the first season a circular area, some 40ft (12m) in diameter, was uncovered and excavated to a depth of 20ft (6m). The sides sloped gradually at first and then more steeply, until, at a depth of 20ft (6m), they became vertical around a hole of 6ft (1.8m) diameter (Figs 12 and 13). These were eventually recognised as the features of a weathering cone.

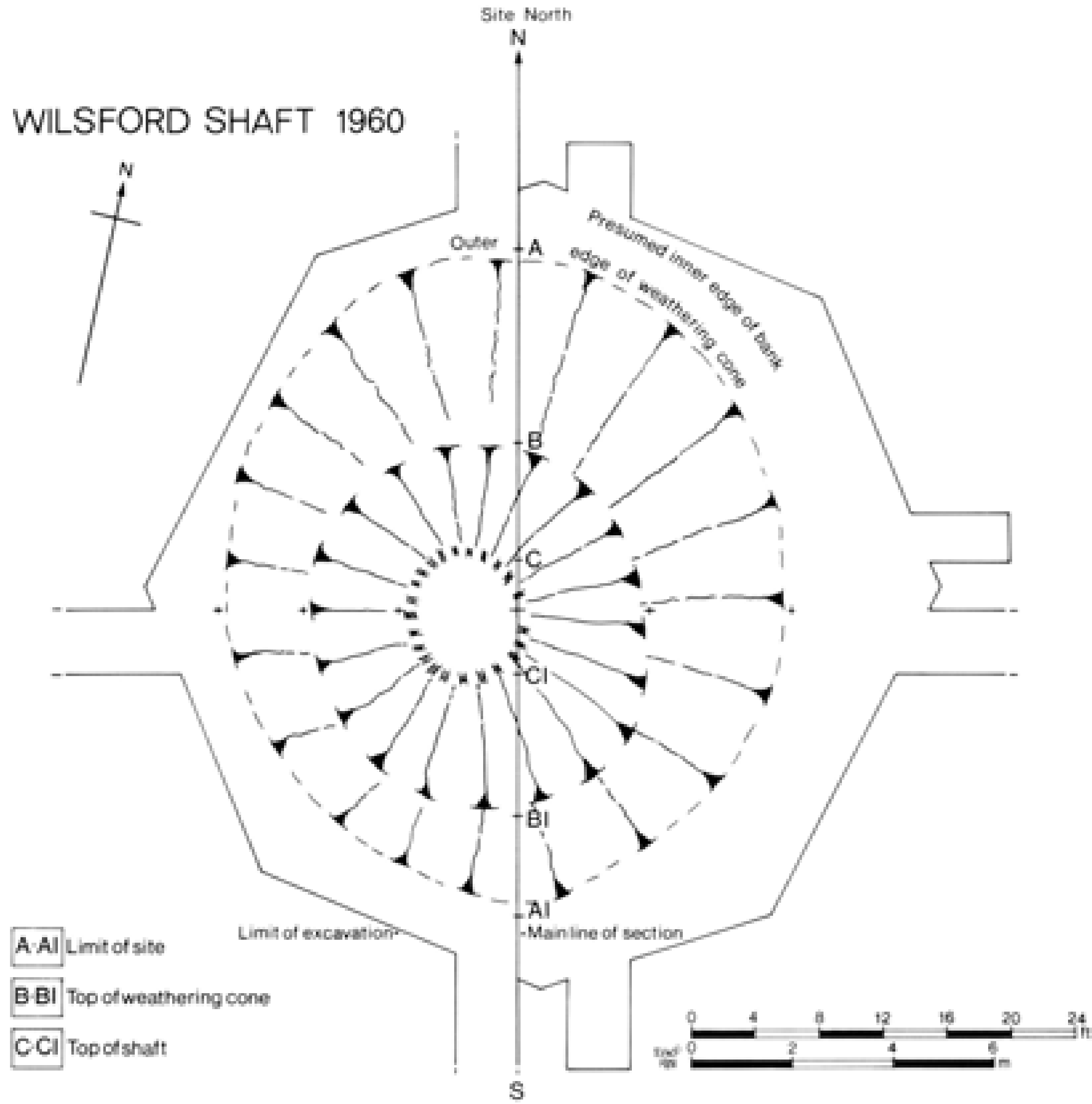


Fig 12 Plan of the weathering cone; C–C1 indicates the base of the cone, just above the junction with the surviving top of the shaft; B–B1 indicates the top of the weathering cone to the buried soil layer, to which height the shaft had filled naturally; A–A1 indicates the limit of the site and may represent the position of the former bank

Excavation revealed no features other than the shaft and its filling. At the time of the excavation a number of misinterpretations were put on the evidence, largely as a result of the identification as a pond barrow and the lack of comparative material available in the early stages of the excavation. Aspects of this problem will be referred to in the discussion.

On the plan (Fig 12) the site could be seen as a circular ring of fresh chalk encircling an area of disturbed material. The overall diameter of the central area was some 40ft (12m). As the loose fill was removed from the central area, a buried soil was located, 2ft 6in (0.75m) below Datum 1 (*see* the description of the sections) at the centre, tapering towards the outer circumference. This was initially assessed as the pond of the pond barrow.

Below the buried soil the character of the remains was more readily recognised, although not understood at first. At a depth of 3ft (0.9m) below Datum 1, the area of soil was still loose and dark at the centre with a diameter of 6ft (1.8m), as shown in Figure 14. Surrounding this was brown chalky soil and rainwash, progressively finer and more compacted towards the undisturbed chalk at the side. At a depth of 2ft 6in (0.75m) below Datum 1, the overall diameter was reduced to 20ft (6m); the chalk sides sloped at an angle of approximately 20°.

By 8ft 6in (2.55m) below Datum 1 the diameter had narrowed to 13ft (3.9m), and the angle of slope of the side of the hole was steeper at 65°.

By 15ft (4.5m) below Datum 1 the diameter had narrowed to 8ft (2.4m) and the angle was 75°. The angle was not constant, being somewhat steeper on the west, generally becoming shallower on the east, as may be seen on the plan (Fig 12) and sections (Fig 13).

Finally, as already noted, at a depth of 20ft (6m) the sides became vertical and the diameter narrowed further to 6ft (1.8m) – a width maintained almost to the bottom of the shaft.

The filling of the upper part of the site, to a depth

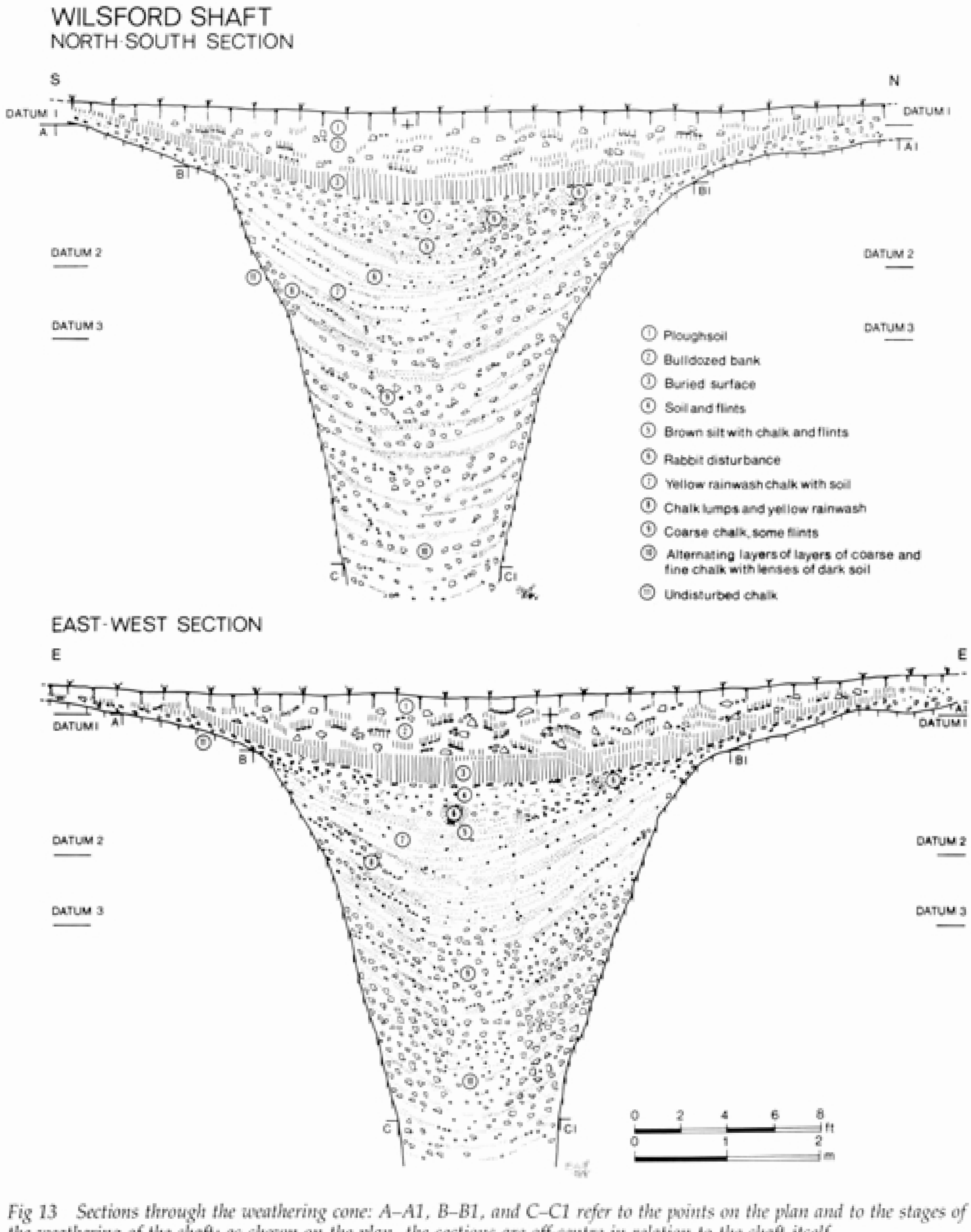


Fig 13 Sections through the weathering cone: A–A1, B–B1, and C–C1 refer to the points on the plan and to the stages of the weathering of the shaft; as shown on the plan, the sections are off-centre in relation to the shaft itself

of some 10ft (3m) below Datum 1, was relatively uniform with a central area of dark soil, surrounded by brown, chalky soil and yellow rainwash with large blocks of chalk and fine rainwash against the sides (Figs 14 and 15). Below 10ft (3m) the central part of the filling contained much less soil. There was an increase in the quantity of large, loose chalk blocks and lenses of soil with what appeared to be broken turf fragments. Surrounding this was finer, loose material, washed down the sides of the site (Figs 16 and 17).

Below the buried soil as the angle of the sides became steeper, so the angle of the layers became steeper (Figs 13 and 14). However, by a depth of about 10ft (3m), as the sides approached vertical, the angle of the deposits became shallower. Despite the fact that work had to be carried out on arbitrary horizontal layers, rather than following the 'natural' lines of the deposits, it could be seen that there was a broken edge between softer central material and the surrounding deposits, although there was no significant change of texture (Figs 14 and 15). This was clear even at 20ft (6m) and can be seen on the drawn sections and in Figure 18, although it was not understood at the time of excavation.

Excavation was by the quadrant method, which caused certain difficulties in view of the eventual nature of the site (Fig 16). As may be seen from the plan (Fig 12), the main part of the weathering cone lay within the south-west quadrant. For this reason the majority of finds were from this area, in particular from the dark soil at the centre of the site. Once the four quadrants had been excavated to a depth of 8ft (2.4m) below Datum 1, the east half and then the west half of the main east–west baulk were removed, leaving the main north–south baulk as a control. At this stage the central area, 13ft (3.9m) in diameter, was still considered to be the 'pond' of the original pond barrow, and it was anticipated that the steeply-converging sides would give way to the base of the site.

After a period of heavy rain the central dark soil core collapsed away from the main north–south section when the excavation was at a depth of 9ft (2.7m), with the result that a considerable number of finds from the collapsed baulk were no longer stratified. However, all other finds were *in situ* when recorded (Fig 19).

Sections

Figure 13 illustrates the main features of the upper part of the site, from the modern surface to the top of the shaft at a depth of 20ft (6m), excavated in the first part of the 1960 season. All measurements refer to the 1960 site Datum, indicated on the section drawings. Datum 1 was 6in (0.15m) below the modern surface at the centre of the site, and is approximately 1ft 6in (0.45m) below the datum later used for the excavation of the shaft. Datum 2 was placed 6ft (1.8m) below Datum 1, and Datum 3 was 2ft 6in (0.75m) below Datum 2, ie 8ft 6in (2.55m) below Datum 1. All measurements have been converted to refer to Datum 1.

The layers can be described as follows:

1 Modern ploughsoil.
2 Turf, soil, and loose chalk; modern filling resulting from the bulldozing of the site.
3 Buried land surface: this was the level to which the site had filled naturally.
4 Weathered chalk and rainwash, lightish brown in colour, with some blocky chalk; located on the upper slopes of the cone, with more soil towards the centre.
5 Weathered soil with some chalk at the centre, giving way to compacted rainwash; *compare with* layer 4 towards the edge of the cone.
6 Rabbit disturbance in the softer soil of layers 4 and 5.
7 Fine compacted grey/yellow rainwash, some chalk and soil lenses, softer towards the centre; the angle is very steep, reflecting the angle of the weathering cone.
8 Large chalk lumps and rainwash towards the edge of the cone.
9 Loose chalk, occasional flint fragments; clay patch; derived from the weathering of the upper levels; *compare with* Layer 10.
10 Loose chalk, with lenses of soil and broken turf, derived from the weathering of the surface of the site.

The filling of the upper part of the site resembled the filling of a deep steep-sided ditch as at Avebury (Gray 1934, pl XXXIX, fig 2).

At the centre the deposit contained more soil and was softer, while towards the edge it was harder and contained both rainwash and broken blocky material. The layers spread down the sides and across the central area.

From the surface to a depth of *c* 10ft (3m) there was a core of soil, some 5–6ft (1.5–1.8m) in diameter (Fig 14). Below this there were lenses of soil and broken turf throughout, but the central core was predominantly of loose, coarse, blocky chalk, interspersed with the soil lenses (Fig 18). This filling continued down into the shaft itself with alternating chalk and occasional soil lenses. There were only minor variations in the texture of the fill from the top of the shaft down to 70ft (21m).

Although the filling at the centre of the cone was of a slightly different colour and texture, it could not readily be distinguished from the rest of the filling. As can be seen in Figure 14, the layers show no hard lines, cuts, or breaks at the centre but are chiefly distinguished by colour and moisture content. After the collapse of the core material of the north–south section (Fig 19), the remainder of the fill of the cone could be seen to be entirely homogeneous (Fig 14). During the excavation, the central core material, to a depth of 8ft 6in (2.55m), was thought to be an intrusive pit. However, as discussed below, the evidence does not support this interpretation, and it can be seen from Figure 20 that the horizontal fill shows no change of colour or texture.

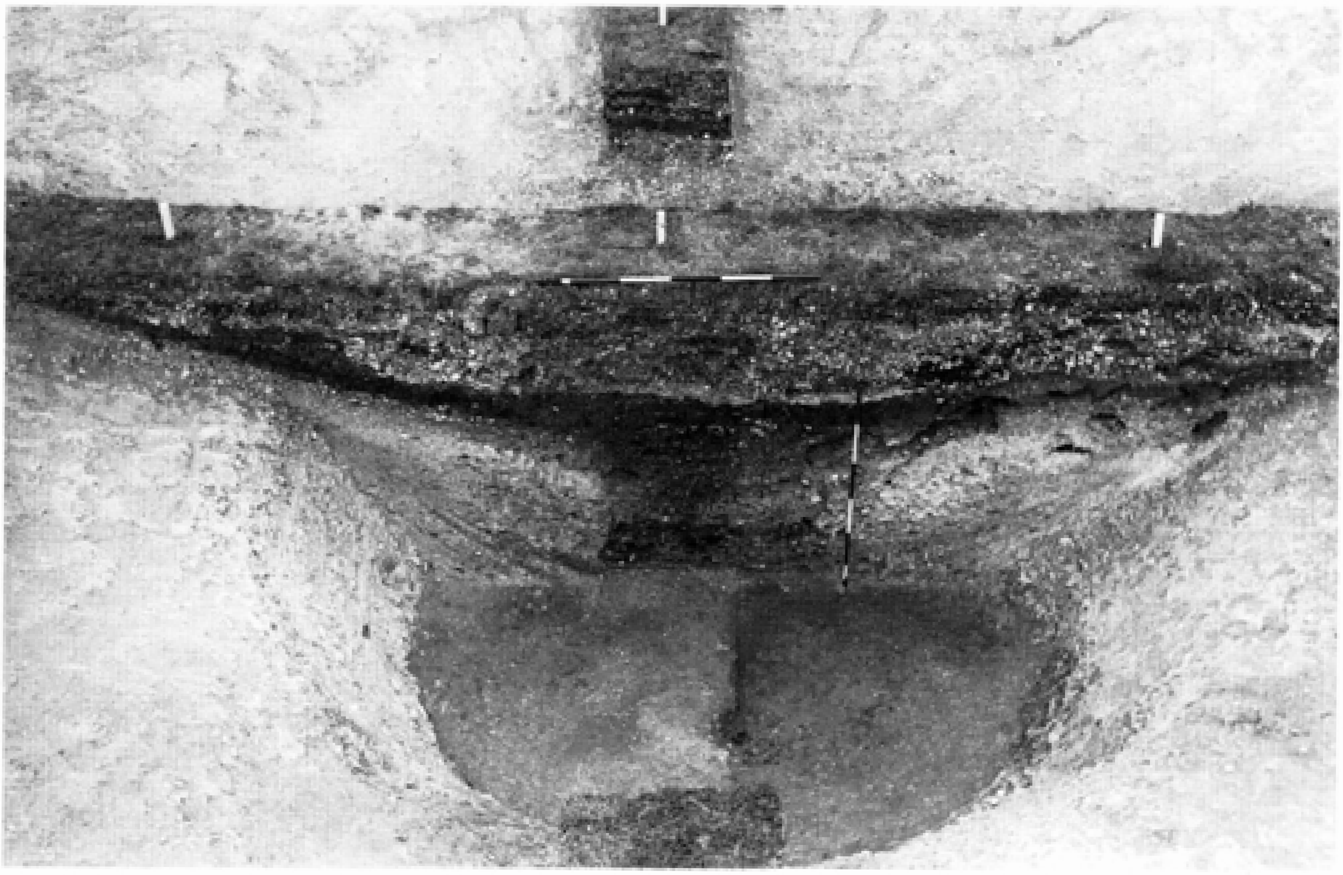


Fig 14 View of the west face of the north–south section, showing the weathering cone at the top of the shaft; the Iron Age jar found at c 9ft (2.7m) can be seen in the bottom of the trench (E V W Proudfoot)

Fig 15 West face of main north–south section: central core visible; the layers of weathered chalk in section are also discernible as darker bands in plan at the base of the trench (E V W Proudfoot)

Fig 16 Showing the emerging weathering cone, then described as a chalk wall: the central darker core is visible with dark areas resulting from percolation of moisture (E V W Proudfoot)

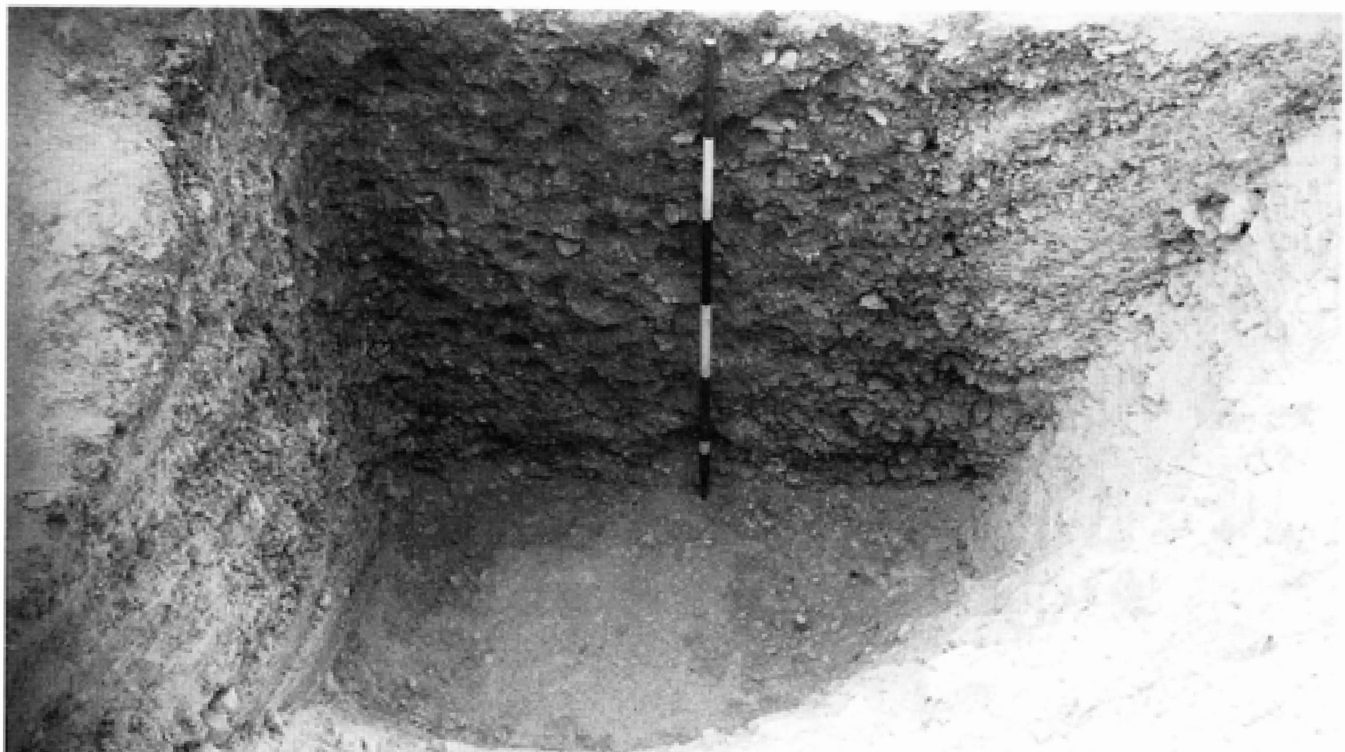


Fig 17 The lowest part of the weathering cone at the point at which the top of the shaft became visible, at a depth of 20ft (6m) (E V W Proudfoot)

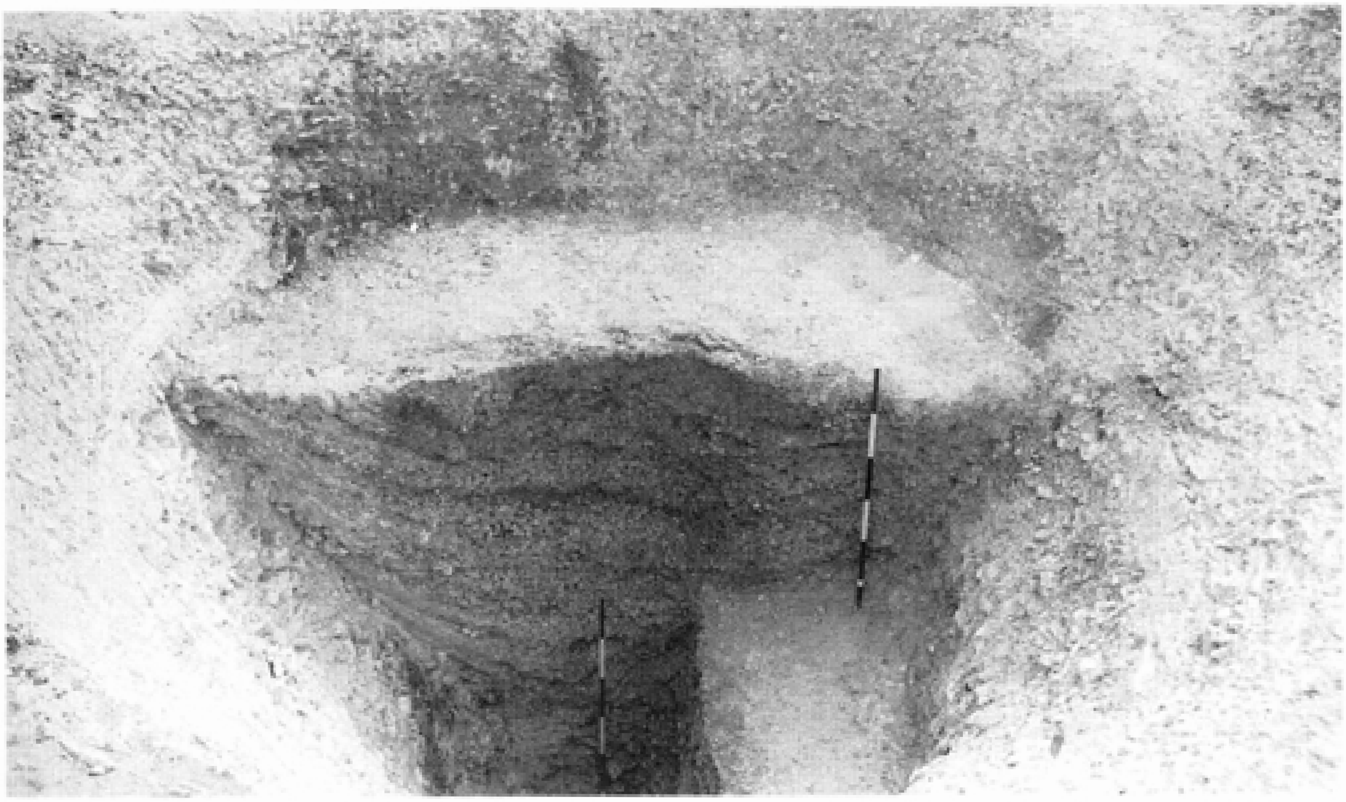


Fig 18 Weathering cone from a depth of 10ft (3m) to 20ft (6m) after collapse and subsequent removal of main north–south baulk; the alternating layers of weathered chalk with soil lenses are clearly visible (E V W Proudfoot)

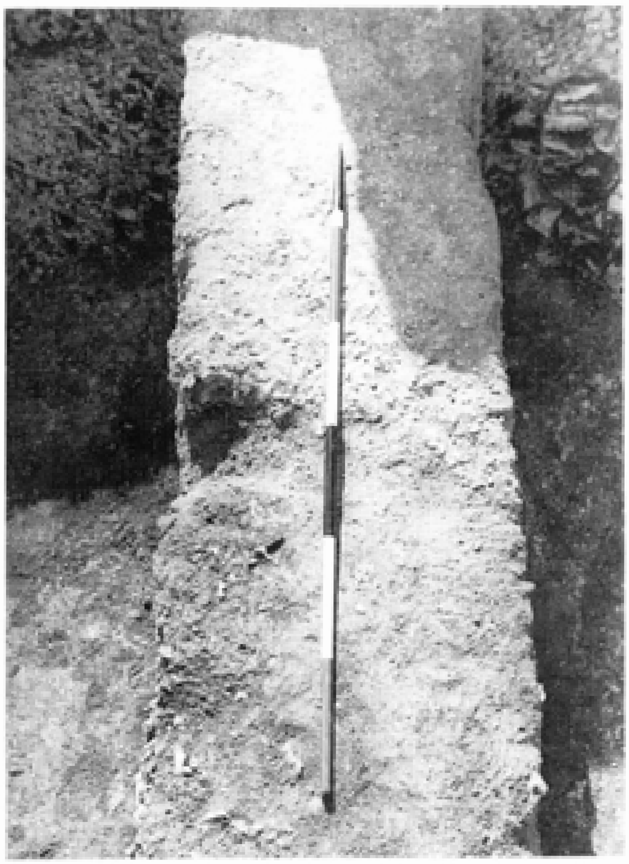


Fig 19 Main north–south section, showing core of shaft at rim of weathering cone; it was this core material that collapsed at a late stage in the excavation, when the work had reached a depth of some 9ft (2.7m) (E V W Proudfoot)

The shaft, the weathering process, and the pond barrow

(Appendix G; Figs 21 and 99)
The appearance of the site before excavation in 1960 and prior to its levelling was considered above in Chapter 1.

Excavation revealed a cone-shaped hole, some 40ft (12m) in maximum diameter at the surface and 6ft (1.8m) in diameter at a depth of 20ft (6m). The 6ft diameter was maintained from the depth of 20ft (6m) almost to the base of a cylindrical shaft, at a further depth of 80ft (24m), ie to a total depth of *c* 100ft (30m) from the present-day surface. The cone has been interpreted as the result of weathering (Appendix G; Chapter 3); the material from the weathered top of the shaft would have been sufficient to refill the shaft after it ceased to be used.

Figures 21 and 99 show the reconstruction of the sequence in which the cone would have developed. It is the only theory that takes into account the main features and dimensions of the site.

Even after the weathered nature of the filling of the cone was recognised as being similar to that of a major ditch as at Avebury (Gray 1934, pl XXXIX, fig 2), there was nothing about the site or its appearance to indicate how deep it might be, when, or if, the sides would converge, and whether or not it might have a flat base. It came as a considerable surprise to all concerned, therefore, when the angle of slope changed and the vertical sides of the shaft became visible. This posed many questions that could only be answered after the bottom of the shaft had been

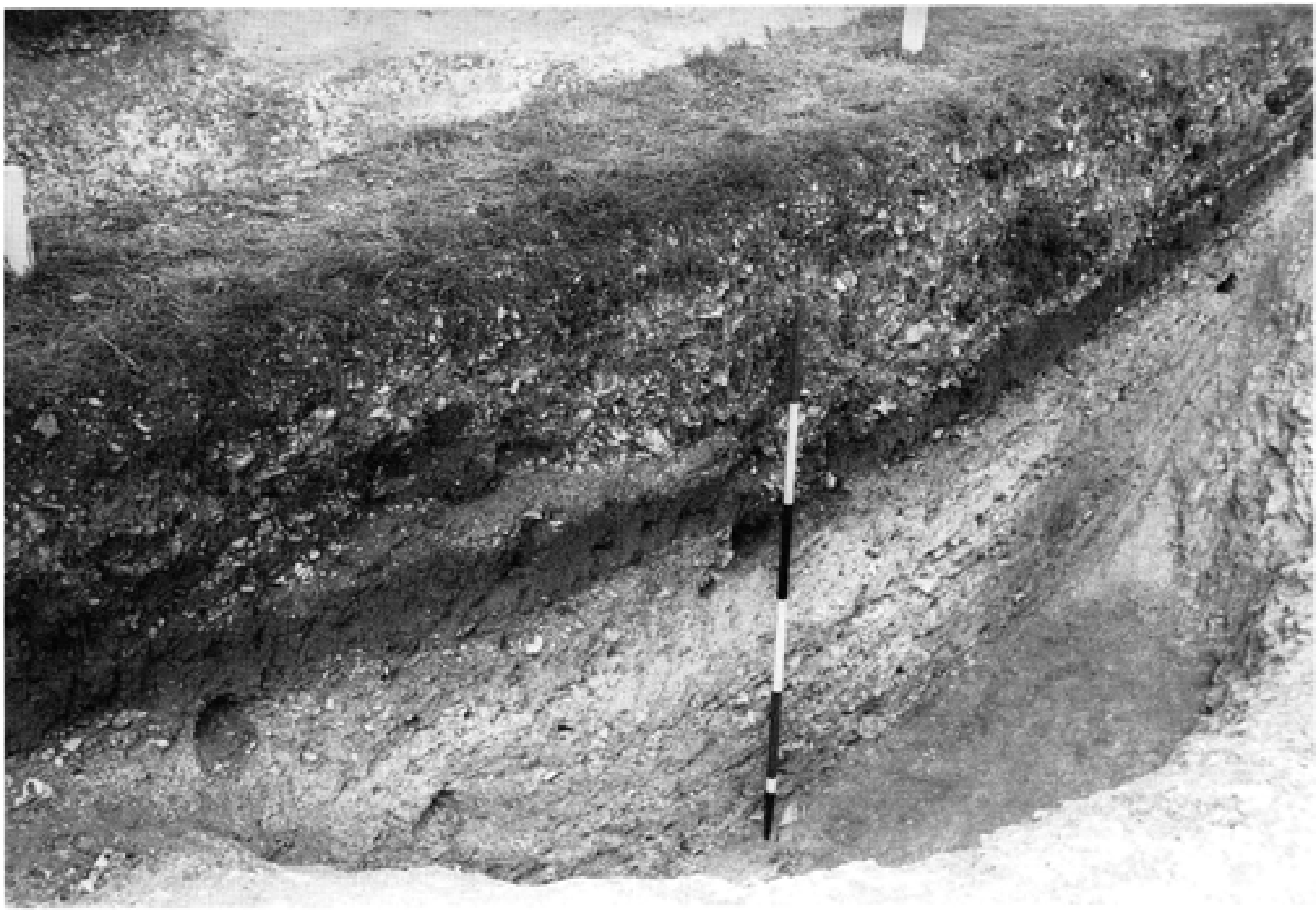


Fig 20 Detail of north–south section, east face, showing the unbroken weathering layers in relation to the chalk edge of the funnel (E V W Proudfoot)

reached. Again, it was only at that stage that the weathering cone interpretation could be recognised as the reason for the form of the upper 20ft (6m) of the shaft.

It has been shown by calculation (Appendix G) that the material derived from the cone, which represented one-fifth of the total depth of the shaft, could have provided an adequate volume of chalk (with an expansion factor of 1.2) to fill the shaft after it ceased to be used.

The shaft has a marked asymmetrical position in relation to the weathering cone. On the south-west the sides of the cone are steeper than on the north-east, where the upper part of the shaft itself is not vertical; this is also true of the layers of silt and rainwash filling the cone. This lack of symmetry is interpreted simply as the result of the prevailing weather conditions, particularly frost action. If the winds blew from a generally south-westerly direction, that side of the site would be slightly more protected and would weather back more slowly than the more exposed north-east.

The weathering cone theory provides a valid explanation for how the shaft filled, in addition to explaining the formation and gradual filling up of the cone. However, the original material from the excavation of the shaft had to be dumped or stored. It is probable that the spoil would have been disposed of nearby, either as an amorphous pile, for which there is no evidence, or, for greater convenience and safety, placed at a short distance from the shaft as an encircling bank. If the material derived from a shaft 6ft (1.8m) in diameter by 100ft (30m) deep was placed concentric to, but at a distance from, the shaft, it would have been sufficient to create a bank of modest proportions. It should be remembered that a bank was recognised as the main feature of the site prior to its modern infilling and gave rise to the pond barrow designation. This can be compared with the chalk dump from the flint mine at Grimes Graves, where the dump was linear and simply placed for easy access (Mercer 1981, 13). The precision of the bank layout at pond barrows, their defining characteristic, clearly sets this aspect of the site in context as important to the builders in every case, including Wilsford.

As the site was recognised at least from the early nineteenth century as a pond barrow, by definition surrounded by a low circular bank, this bank must have been far enough away not to have weathered back into the shaft or the weathering cone. Therefore, as the weathering cone reached a maximum of 40ft (12m) in diameter, the bank must have lain beyond that. Presumably its site was indicated at the time of the 1960 excavation by the chalk rim referred to previously. No trace of the bank itself survived, although its former position may be identified from the angle of the buried soil, layer 3, extending out over the edge of the cone as indicated on the section (Fig 13). On the available evidence the bank would have had an internal diameter of approximately 40ft (12m). Grinsell (1957, 225) gave the dimensions of the bank as 42ft (12.6m) by 1ft (0.3m) high, figures commensurate with those given above, since the measurement was probably from crest to crest of the bank which would have been spread by weathering independent of the weathering of the central area. The volume of chalk derived from the shaft would have been sufficient to build a low bank in the position described at Wilsford. Any other method of disposing of the chalk spoil would have resulted in a large mound in the near vicinity, for which there was no evidence.

Discussion

The problems posed by the weathering cone and its contents differ to some extent from those of the remainder of the shaft. They are unrelated to the deposits at the base of the shaft. One important question is that of relative dates. Another is whether or not there had been a pond barrow, and if so how could it be dated relative to the shaft and the cone.

When excavation began in 1960 the site had been levelled and was difficult to locate on the ground. At that time it was considered to be a pond barrow, a class of monument about which relatively little was then or is now known.

In 1960 it was anticipated that a shallow hollow would be uncovered, and within this various features, mainly of a funerary nature, would be revealed. As all earlier writers had referred specifically to an encircling bank, and as material resembling a bank had recently been bulldozed into the central area, it was expected that traces of the bank would also be located.

However, the remains uncovered bore no resemblance to those anticipated. Indeed, it took a great deal of tenacity to pursue the excavation, since nothing was as expected and there was much doubt as to the authenticity of the site chosen for the excavation. During the first weeks of excavation every effort was made by the excavator and all visitors to the site to interpret the features within the small body of pond barrow data, but finally it was decided that there had to be an alternative solution. It was agreed that the interpretation of the site as a weathering cone, put forward by V B Proudfoot, best fitted the evidence.

It is of relevance in the 1980s, when excavation and publication strategies are prepared and planned well in advance of the excavation, to bear in mind that the slender body of evidence for pond barrows did not provide a suitable model for devising an excavation strategy at Wilsford 33a. In practice the comparative material proved a hindrance, since none of the features revealed could have been predicted. It took some time to be assured that the remains were man-made and that the site most obviously resembled an enormous ditch. Perhaps the greatest difficulty was the uncertainty about when the base of the site would be reached. Moreover, time was short and equipment inappropriate for the site as it was developing.

In addition, the farmer's recollection of a squarish hole, some 5ft (1.5m) deep, was a diversion. This suggested that there might have been a central pit below the general level of redeposited material. For this reason the darker soil at the centre was initially interpreted as a pit and so published (Proudfoot 1961, 30). Indeed, it did compare with Iron Age silos, such as were common on Iron Age settlement sites, eg Little Woodbury (Bersu 1940, fig 11), although the location in a damp hollow was hardly suitable, and it was not obviously related to a settlement. Later, it was recognised that the stratigraphy was continuous across the site with no indication of any formal disturbance.

The circumstances of the change of excavation director and the delays in finally studying the site and its finds have meant the loss of a considerable body of information, as referred to by numerous contributors to this volume. Nevertheless, possible benefits have accrued, in that progress in research methods has enabled stronger inferences to be drawn from some of the material.

Much has already been published about the Wilsford Shaft since 1960, as the bibliography attests. Much of this was written without reference to the original data or the present writer. Attention concentrated on the remarkable phenomenon of the shaft and its waterlogged deposits, the importance of which for the understanding of the landscape, the environment, and Bronze Age skills has long been recognised, as the specialist reports testify. Interpretation has focused, therefore, on those lower deposits. However, the upper levels of the site are significant for other reasons and should not be overlooked because of the richness of the lower deposits.

Discussion of the upper part of the site has always been difficult, because of the early pond barrow identification. Although it is possible that there could have been a pond barrow on the site, into the centre of which the shaft was dug, there was no evidence for two phases or periods of activity to support this. However, the interpretation of the site as a weathering cone around a shaft takes account of all the major physical features recorded and allows the present writer's thesis that there was no pond barrow at any stage.

It would appear more probable that the shaft was dug as the first major feature on the site, and that the chalk excavated from the shaft was deposited at a distance from the centre in the form of a low encircling bank – hence the earlier definition of the site as a pond barrow. There is no evidence for the chalk derived from the digging of the shaft having been deposited elsewhere, since there are no irregular chalk mounds in the area. Artefacts or deposits such as burials or settlement debris, contemporary with the shaft or of other date, whether buried or left on the surface, could have fallen into the shaft and the weathered cone at the top in random order as part of the normal weathering process, once the site had ceased to be maintained during normal use. Such a process is the standard interpretation for the majority of archaeological sites and requires no special pleading. Comparison with the evidence from the Experimental Earthwork at Overton Down (Jewell and Dimbleby 1966, 318) suggests that initially weathering would have been rapid and that the shaft could have filled up within decades, although the cone would have taken very much longer to fill as the sides became less steep and more stable, shown diagrammatically in Figure 99. There is no reason to suggest that the alternate chalk and soil layers need represent annual deposition, but another view is presented by Martin Bell in Chapter 6 (*see* pp 74–5). There is no method by which a sensible estimate of the time taken for infilling can be achieved solely on the basis of the stratigraphic or sedimentation evidence. However, if the radiocarbon dates at the base of the shaft and the consistent dates from the upper fill of the cone are used to bracket the infilling of the shaft and cone, then a timespan of some 800 years is implied (Fig 64). The casual disposition of the artefacts and other remains found in the shaft and weathering cone confirms the suggestion that they reached their positions in this way. Moreover, this would explain the incomplete skeletons, for example, and the scrappy nature of the finds as a whole.

Material from the cone at the top of the shaft comprised sherds, two flints, animal bone, and human bone. Other environmental evidence was limited, because the soil samples had to be disposed of without examination. Nevertheless, two of the small number of charcoal samples from the site came from the cone. *Quercus*, *Corylus*, and *Alnus* were represented, though not from substantial timbers. It may be inferred from this that the charcoal weathering into the site came from the locality and reflected conditions in the area similar to those found at the base of the shaft. However, it must be borne in mind that material from the cone was not all of the same date or context.

By the time the shaft had filled and the weathering cone had opened up, the weathering process would have slowed down. Since there was a lack of evidence for deliberate deposition, it may be assumed that the majority of finds in the cone derive from casual events, such as weathering or possible animal activity, which would have disturbed material from the surface. The origin of the surface material cannot be accurately assessed, but it could have come from contemporary or earlier deposits or from accidental losses in the area. Some fragments of bone or pottery could have been disturbed and rolled into the weathering cone, while other elements remained *in situ* for a further period. By the time further disturbance resulted in more material reaching the sides or base of the cone, an amount of silt, soil, and general rainwash could have built up, so that two fragments from the same item might not have lain adjacent, but could have been widely separated from one another vertically and horizontally. A piece of pottery or bone encased in a lump of turf that broke away would roll further into the cone than a small fragment that weathered out and washed only a short distance, yet they could be from the same pot or animal. The same sequence of deposition could result in one fragment being fresh and unweathered and the other being badly abraded, a situation recorded in the ditch fill at Avebury (Gray 1934). Caroline Grigson identified animal bone fragments belonging to the same animal from different locations, as just described (Chapter 6), and it was noted during the excavation, as well as by Frances Raymond (Chapter 4), that some of the sherds were particularly fresh, which suggests that they did not remain exposed on the surface for long. The Deverel-Rimbury ware could not have been exposed for long, since it is fragile and would have deteriorated quickly: a piece of evidence which appears to support the suggestions above.

The question remains: where did all this casual material come from? There must have been both Bronze Age and Iron Age activity in the vicinity of the shaft, since pottery of both periods has been identified, and the dated animal and human bones also support this suggestion, although no Iron Age sites have been located near to the site. Many Bronze Age barrows are known from the wider area, but there is no specific reason for Bronze Age pottery to have been exposed and to have found its way into the shaft and cone. Nevertheless, there must have been some human activity, leaving behind either surface scatters of debris or even pits with domestic rubbish in them. An additional possibility is that some material could have been thrown into the cone.

From excavation records, drawings, and photographs it can be seen that there appeared to be a vertical feature at the centre of the cone, extending into the top of the shaft. At first thought to be a pit, this was subsequently recognised as a result of the weathering process, interpreted as the result of occasional differential slumping within the shaft. This would have accentuated the tendency for a hollow to form at the base of the cone during the weathering process, but the hollow would have filled with the same material as the rest of the cone. Therefore, there would have been no change in the texture or nature of the filling, as would have happened if a hole were dug into the area. The centre of the filling of the cone was certainly somewhat damper than the rest of the material. Such a damp area would no doubt attract damp-loving plants and animals, such as snails. It is unfortunate that the soil samples from the cone were not available for study, as there are several environmental questions that must now remain unanswered in relation to it.

By the time the site had filled naturally, the cone was no longer an obvious aspect of the site, since there was a thick layer of soil across it. This would have been the flat layer at the centre of the monument described by Colt Hoare and subsequent writers. Following the deliberate infilling of the site, this became a substantial buried soil.

No secondary use of the site is implied by the above interpretation. It is suggested that the so-called pond barrow was no more than the final stage of the weathering back of the shaft. Chance dictated that it was the encircling bank, ie the spoil heap from the digging of the shaft, that survived, while the functional part of the site became buried.

Discussions on the problem of pond barrows in 1960 and subsequently have largely been concerned with whether or not they all might resemble the shaft at Wilsford. Clearly there is little likelihood that any others will be excavated, for reasons of cost as well as health and safety. However, there are various ways in which the subject could be taken further. Even in 1960 there were several methods of resistivity surveying; today there are numerous methods of geophysical testing. An inexpensive survey programme would be helpful in determining the possibility of further shafts, or pavements of flint as at Winterbourne Steepleton (Atkinson *et al* 1951), or the presence of other relevant features. Other anomalies could be identified by this method, and therefore a small but relevant body of data would become available.

Grinsell and others have classified pond barrows according to location, size, proximity to other pond barrows, and location within or adjacent to barrow cemeteries. There do appear to be differences of these kinds, and, a fact of considerable importance, many cemeteries appear not to have had a pond barrow in association. Grinsell, for example, commented on their being found in three main geographical areas (1941, 90).

As already noted, complete excavation of additional sites is not a reasonable proposal because of the possibility that they could cover shafts, but a programme of limited excavation, following geophysical testing, would rapidly and simply indicate the nature of individual sites. This would then enable a further refinement of the classification. It would also show clearly whether Wilsford is one of many such shafts or whether it is unique. This last point is significant for interpreting Wilsford itself and Bronze Age technology and ritual in general.

As progress is made in understanding prehistoric landscapes, society, and social change, there will be further speculation about the place of Wilsford in prehistory that may only be addressed by setting up a research programme of this kind. Pond barrows have always had a 'poor image', in part because they have produced neither burials nor artefacts; Grinsell refers to them as 'so-called' (1941, 89–90). The few excavated examples have produced widely divergent information, with the result that they are still not understood. Indeed, when RCHME published *Stonehenge and its environs*, pond barrows as landscape features were not discussed and Wilsford Shaft was thereby given a unique prominence (1979, 19).

3 The shaft, its infill and character

by Paul Ashbee

Introduction

The excavation of the shaft, that is the progressive removal of the accumulated infill, revealed its physical characteristics. This infill varied in character and contained artefacts as well as various materials with environmental implications (Fig 7). It was not until excavation had reached a depth of about 60ft (18m), where it was possible to see a clear contrast between the frost-weathered upper part of the shaft and the unaffected lower part, that its full character was appreciated (Fig 8). Thus, the detailed account of the infill and its contents precedes an evaluation of the physical characteristics.

The infill of the shaft

The observations of Pitt Rivers (1898, 24), Curwen (1930), and Cornwall (1958, 58–9), coupled with the records of the processes at the Overton Down Experimental Earthwork (Jewell 1963; Jewell and Dimbleby 1966), have led to a greater awareness of the mechanics and anomalies of the silting of ditches cut into chalk, as is shown, for example, by the details of sections published in the Mount Pleasant monograph (Wainwright 1979a). Such principles must also apply to pits and shafts, when they have not been deliberately infilled; but because of differing form and dimensional constraints this has not always been sufficiently appreciated. In the circumstances, therefore, it is perhaps useful to anticipate and show how, by the processes of natural weathering and denudation, a bank-surrounded vertical shaft could become a pond barrow (Fig 21).

When initially dug, the shaft ran vertically from the ancient surface. The spoil was used to construct the surrounding bank, which was presumably flat-topped and with battered sides (Fig 21, I). Weathering and the resultant infill may, at the outset, have been arrested by a shaft-top installation which was removed or allowed to decay. Thereafter the sequence would have been substantially as follows:

a The lip of the shaft, below the ancient soil or turf, weathered and crumbled. Chalk rubble, with a considerable admixture of soil, fell to the bottom. At the time, or during the early stages, the shaft contained water on which certain pieces of wood and various objects would have floated clear of the accumulating rubble until they were finally overwhelmed (Fig 21, II).

b The infilling continued, fed by the steeper part of the retreating lip, so that some two-thirds of the shaft was infilled and protected from further degradation (Fig 21, III).

c As the lip had by then retreated, the infill accumulated to the vicinity of the base of the great inverted conical cavity.

d The final stage was much more gradual and continued at a steadily decreasing rate, in layers, until the inverted conical cavity (the weathering cone) was infilled. There was also adjustment between the ancient soil sealed beneath the surrounding bank, which had been denuded and had spread, and the cone, resulting in a less abrupt, encircling, slope. When an angle of rest, which allowed the growth of vegetation, had been reached, the 'pond' of the pond barrow had been formed (Figs 21, IV; and 13).

Excavation showed that the shaft's infill comprised three distinct elements:

a the layered deposits, below the 'pond' of the pond barrow, infilling the great inverted conical cavity (weathering cone)

b the homogeneous infill of the weathered and unweathered parts of the shaft proper

c the waterlogged deposit in the bottom of the shaft and its constricted extremity.

The layered infills at the top of the shaft have been described in detail by Edwina Proudfoot (Chapter 2).

There are, however, certain observations to be made. First, it is uncertain whether the denudation of the surrounding bank contributed to the final infill of the shaft, as the end stages of the weathering process could have impinged upon it. In general terms the infills, particularly of the upper weathered part and the weathering cone (Fig 13), are comparable to those of the end of a large chalk-cut ditch. The ditch at Avebury (Gray 1934, pl XXXIX, figs 1 and 2) shows clearly a weathering ramp and layered infills, while the proximal end of the ditch on the southern side of the Fussell's Lodge long barrow (Ashbee 1966b, pl 16a) shows how the weathering cone would have come about. A graphic illustration of frost weathering, and concomitant shaft infill, can be seen in the 5ft (1.5m) of coarse chalk rubble from the exposed weathering cone that accumulated at Wilsford during the winter of 1961–2. The degree of coarseness or fineness of such chalk silting is in proportion to the rapidity with which it accumulates.

No trace of layering could be detected in what has been termed the homogeneous infill of the shaft proper. Nonetheless, changes of character and texture were observed, although they were not distinct layers.

At about 20ft (6m) the fill was clean, apparently unstained and unworn, and the larger pieces were of even size. Below this at 25ft (7.5m) the fill was much more rubbly and loose with a considerable admixture of black soil. The clean, even, close-knit chalk rubble at 35ft (10.5m), at about which depth an ox vertebra was found, was massively flecked with fine shreds of charcoal, while downwards from this were considerable numbers of flint nodules, many of which were flaked and smashed by falling upon others of their kind. At 40ft (12m) the fill was clean, but for a few charcoal flecks, but from then on down there were progressively greater amounts of soil, culminating in a considerable pocket at approximately 45ft (13.5m). Below this marked concentration of dark

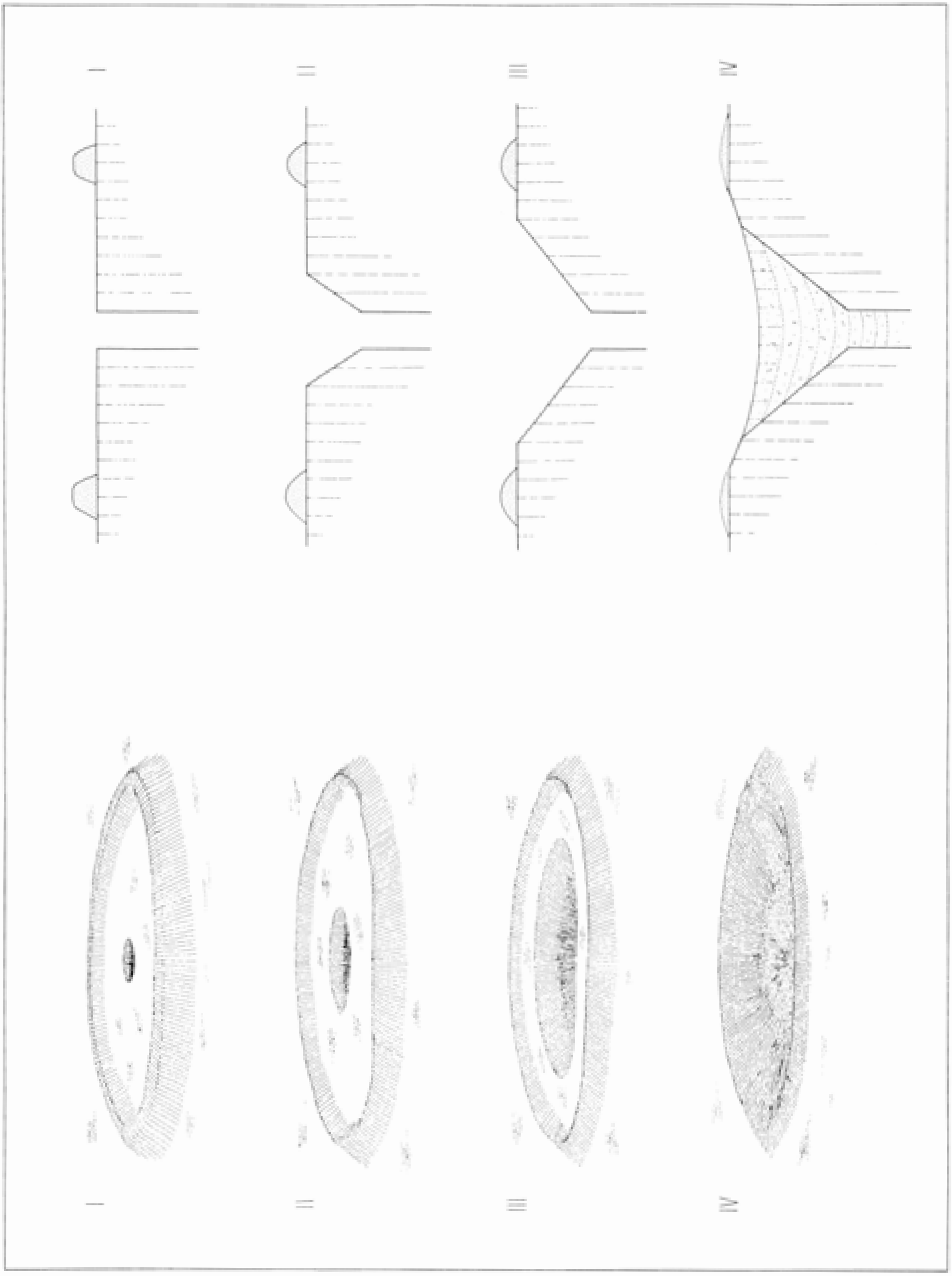


Fig 21 Progressive isometric views, with sections, showing the weathering and infill of the shaft and the formation of a 'pond barrow'

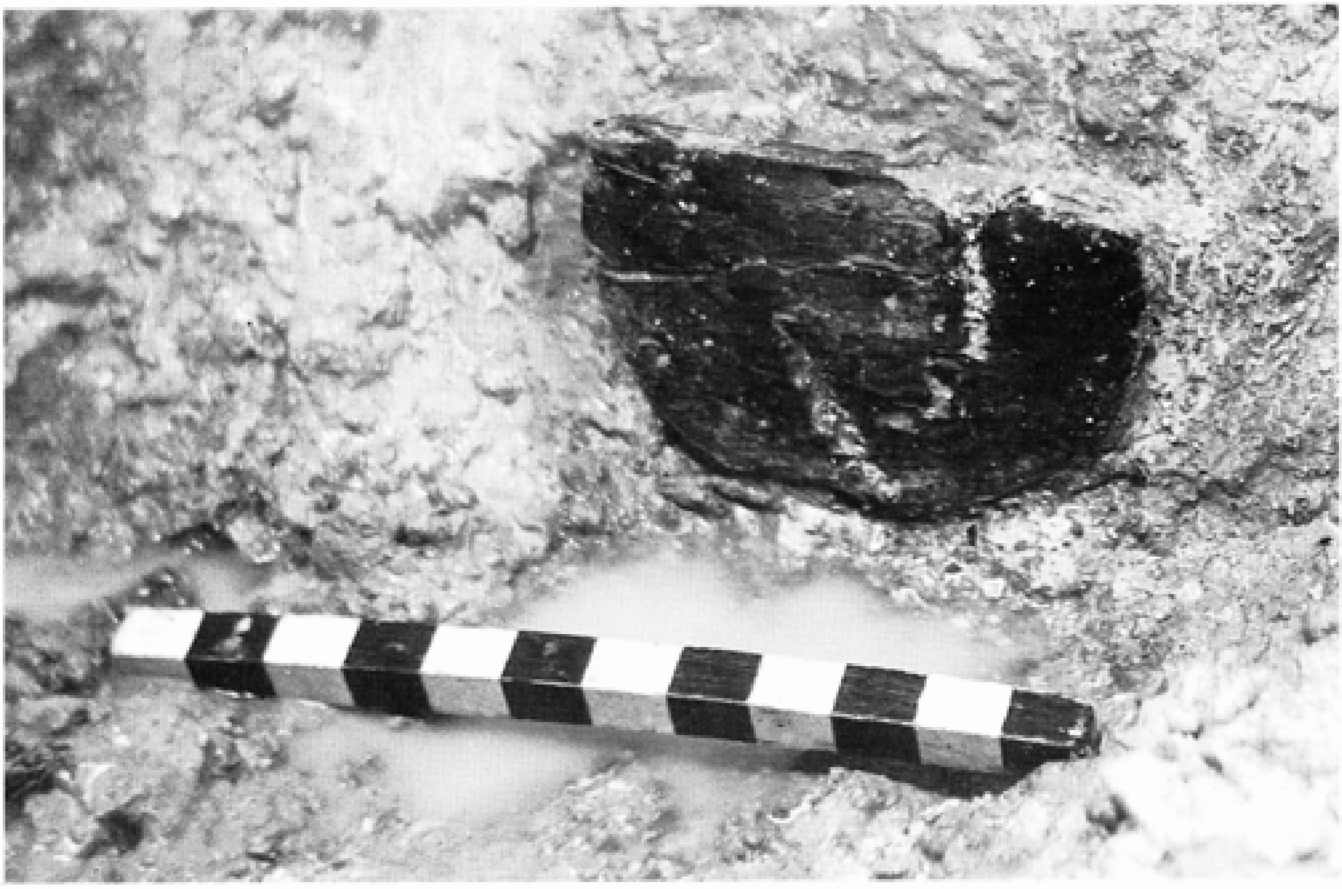


Fig 22 A broken bucket bottom in situ *against the east side of the shaft, c 95ft (28.5m); scale in inches (P Ashbee)*

Fig 23 A complete bucket bottom in situ *in the waterlogged infill at c 95ft (28.5m), close by the south side of the shaft; scale in inches (P Ashbee)*

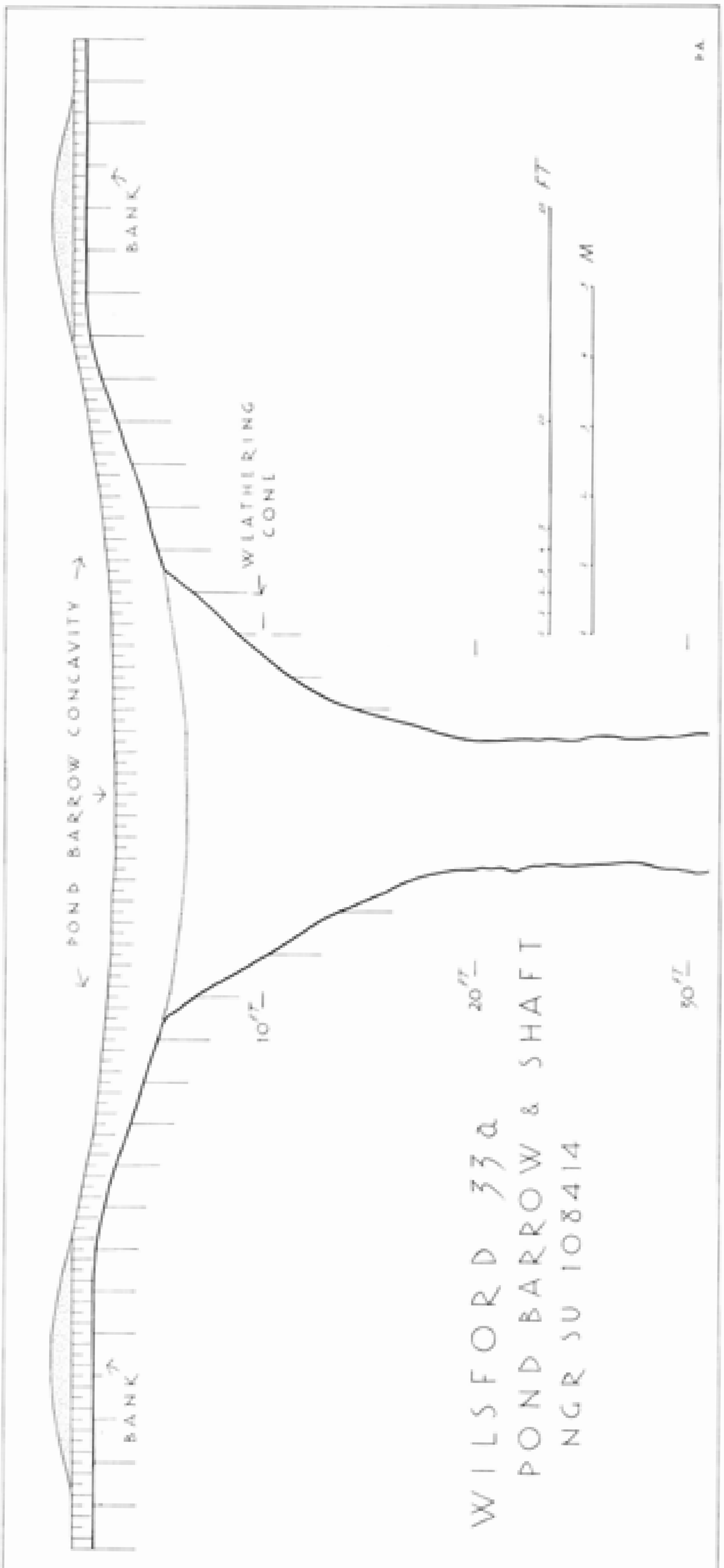


Fig 24 A reconstructed profile (after L V Grinsell's dimensions) of the pond barrow and the shaft beneath it

soil, continuously larger pieces of chalk rubble were encountered until at around 70ft (21m), the maximum limit of water fluctuation, blocks, some as large as 6in by 6in (150 × 150mm), were found.

A general characteristic of the infill, from the bottom of the weathering cone to a depth of about 70ft (21m), where there was a change of character because of periodic water-table fluctuation, was its compaction. This meant that, for the most part, it had to be loosened with a fork or even a pick. It would appear that the infill, from the area of the surface of the developing weathering cone before that was covered, restricted by the constraint of the shaft, was inevitably consolidated by its own direct weight.

From about 70ft (21m) downwards, the fill, although compressed, had been subjected to the rise and fall of the water-table, as was shown by the iron oxide staining of the shaft's sides (*see below*). Not only was much of the chalk rubble also stained with iron oxide, but water had washed the finer material from it, leaving it compact but loose, or had cemented quantities of rubble together. This cementation, however, only affected the artefacts found in this particular kind of infill in a minor way: they were quite unlike the large barrel urn pieces, found at about 60ft (18m), which were massively coated.

At a depth of about 94–5ft (28.2–28.5m), small pieces of wood (*see below*) were encountered, trapped vertically in the coarse chalk rubble at the sides of the shaft, together with what was thought of at the time as a mass of humus, with amorphous organic matter, grass, and seeds. This was followed by further small pieces of wood, twigs, and the readily identifiable remains of beetles (Chapter 6). Thereafter, wood and organic materials, as well as amber beads, bone pins, and pottery, were encountered to the bottom of the shaft. In general, as the coarse chalk rubble was removed, it was found to be increasingly impregnated, indeed blackened, by its organic material content. The varied nature of the organic and other materials is discussed in Chapter 6.

Various considerations emerge regarding this largely fragmentary material, organic and otherwise, concentrated in the fill at the bottom of the shaft. The not inconsiderable amount of humus at the bottom of the shaft was, presumably, derived from the initial collapse of the lip at the top which had subsequently been compressed by the chalk rubble. Whether there was water in the shaft at this time is uncertain; there may not have been a continuous inflow if the water-table had retreated to a lower level. Thus, were the various wooden containers (Figs 22 and 23) broken by falling rubble, or did the pieces ultimately disintegrate as they rose and fell with the water fluctuation?

By analogy with the details of the progress of chalk weathering and ditch accumulations now available, the infill of the shaft may have been considerable after about three decades and almost complete in a century. At the end of such time the weathering cone, surrounded by the weed-grown, denuded bank, would have assumed some of the lineaments of a pond barrow (Appendix B). It is argued below on the basis of sedimentation rates in the cone (*see* pp 74–5), and independently on the grounds of the sequence of radiocarbon dates, that the entire shaft, up to about 9ft (2.7m), could have infilled in 100–150 years.

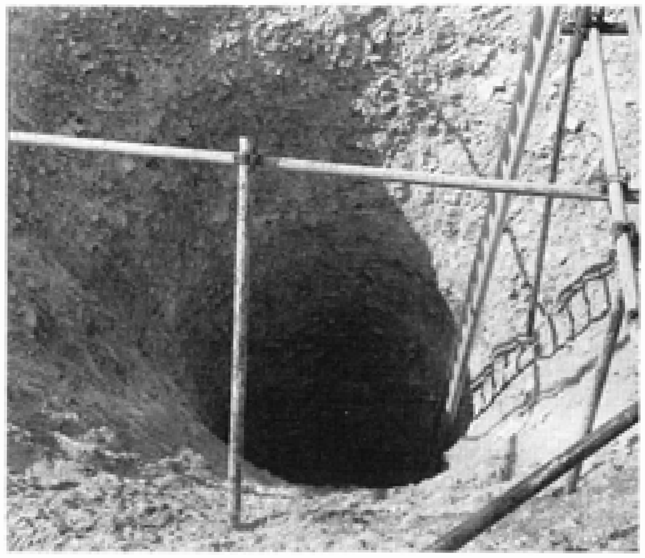


Fig 25 The base of the weathering cone and the top of the shaft: looking down from the east side, October 1960 (P Ashbee)

The form and characteristics of the shaft

Removal of the infill disclosed the shaft and, when that had been completed, it was possible to scrutinise it as an entity. Essentially it had four parts:

a at and immediately below the surface, the pond barrow concavity and the weathering cone
b the upper, frost-weathered, debris-scarred part of the shaft
c the unweathered, lower part which bore manifest traces of how it had been sunk and partially finished
d the constricted cavity at the bottom.

Scrutiny and survey located clear indications of how the shaft had been sunk. This was in short, straight components, aided by a template to maintain the cylindrical form. Many of these components were out of the perpendicular and the descent had been successively replumbed. Irregularities at their junctures had been adjusted often by deep cutting with antler-picks, supplemented by dressing with broad-bladed metal axes, presumably palstaves.

The lower part of the shaft bore clear traces of the fluctuations of the water-table. There had been an inflow of water from the start, which accounts for the survival of the pieces of wooden buckets, wood, and other organic materials, discussed in detail in Chapters 4 and 6.

The pond barrow concavity and the weathering cone

(Figs 24, 11, and 9)
The final stages of the shaft's weathering and infill have been detailed above. It suffices to state that the

Fig 26 A side of the shaft just below the weathered zone showing the striations caused by falling debris during the weathering process (English Heritage)

concavity of the pond barrow and the weathering cone are, in terms of the constraints of a crumbling shaft-top, comparable with the characteristic 'trumpet-mouthed' ditch profile (Jewell and Dimbleby 1966, 339–40), so distinct when chalk is the geological solid (Fig 25). Such a development, from erstwhile steep, straight sides, has been amply demonstrated, and thus it is inescapable that the upper part of a vertical, circular shaft would have been broken down in a similar manner. In a ditch the lowest part of an excavated profile is preserved by the initial accumulations, and here at Wilsford the bottom of the shaft was similarly covered and protected. It is thus an indication of the original form. Irregularities are a feature of the weathering cone (Figs 11 and 9) and would result from such factors as resistance to periodic freezing, thawing, and crumbling.

The upper, frost-weathered, debris-scarred shaft

(Fig 9)
Below the weathering cone the circular – about 6ft (1.8m) diameter – shaft's surface had been subjected to frost weathering down to a depth of about 40ft (12m), where it gradually ceased. It was irregular: indeed, during the removal of infill, a near-recess was encountered at about 30ft (9m). Such cavities had been caused in many instances by sometimes large blocks of flint weathering out and falling. When seams of flint were met with and dug through, the remaining projecting nodules had been broken off neatly by percussion and sometimes dressed. Particularly at the lower level of this component part, such falling debris caused considerable close-knit areas of vertical striations (Fig 26). These sometimes scored deeply into the smooth, worn, dirty chalk. Here and there, particularly at the lower level between 30ft (9m) and 40ft (12m), these striations cut across the worn traces of antler-picks.

Although these striations seem likely to have been caused by continual falling debris, which would have included many large, angular, broken flint nodules, there is the possibility that the patterns may in part have been caused by the prehistoric engineers hauling up spoil from the depths during digging. However, it may be significant that they are confined to the upper part and are absent at lower levels.

Fig 27 Antler-pick grooving forming a lozengiform

The unweathered lower part of the shaft

(Fig 10)
Weathering had not affected the shaft below about 40ft (12m), and from here to the bottom its interior bore manifest traces of the methods of the ancient engineers. A notion of how the shaft had been sunk was obtained when its infill was removed to a depth of about 60ft (18m). An irregular zone, scored by antler-pick marks supplemented by deep axe-dressing (Figs 27 and 28), extended right around the cylindrical surface. Beneath this the shaft was more or less smooth and well finished, but not exactly vertical. Some 10ft (3m) below the first clear-cut irregular zone was another of the same kind. Beneath this the shaft was again smooth but not vertical, and this zone was curtailed by another, much more pronounced and irregular. It was thought that the shaft's sinking had involved the use of a template, and that the irregular zones betoken correction for verticality. These two stages had strayed from the perpendicular and the deep pick-marks, supplemented by axe-dressing, were the traces of correction before a fresh descent was embarked upon.

Below the first two clearly discernible descents, terminated by a pick-marked, axe-dressed (Figs 29, 30, and 31), correction zone, was another. This descent was markedly perpendicular and presumably illustrates the endeavours of the shaft-sinkers to make the shaft, as a whole, plumb. Another lesser descent, only some 7ft (2.1m) in depth, was also a perpendicular drop. The next descent, about 10ft (3m), was markedly askew and the corrections were deeply cut at top and bottom, by which time the general shaft depth was in excess of 80ft (24m). There followed a further lowering, again pronouncedly vertical, of some 10ft (3m), followed by one of only 5ft (1.5m), also vertical. The conjoining zone, although discernible, hardly involved any incutting and the finish was of high quality.

The initial work below this last short descent, at about 93ft (27.9m), involved a considerable amount of incutting, although the departure from verticality was at a depth of about 91ft (27.3m). Here the sophisticated circular shaft ceased and gave way to the constricted bottom.

Fig 28 Antler-pick grooving and axe-dressing (right) at c 80ft (24m) (P Ashbee)

The constricted cavity at the bottom of the shaft

(Fig 10)

This roughly funnel-shaped, and thus constricted, cavity was some 8ft (2.4m) in depth, and its bottom brought the depth of the lowest point of the shaft to more than 100ft (30m) (Figs 32 and 33). Unlike the finished circular shaft, where pick-marks were mostly to be seen at the junctures of the descents, the cavity was honeycombed and scored with them. Indeed this may point to unfinished work, for this bottom section impinged directly upon a water-bearing fault in the chalk.

The ancient shaft-sinkers may well have employed, at each stage of descent, a funnel-shaped pit such as was found at the bottom of the otherwise markedly circular, well-finished shaft. Such an antler-pick-hewn pit, progressively enlarged as it was dug and finally finished to the requisite diameter, would have been an eminently practical digging procedure.

Antler-pick usage and axe-dressing

Neither antler-picks nor pieces of antler were found in the shaft's infill. The positive evidence of antler-pick use in the shaft was the incidence of grooves (Figs 27 and 28), such as are known to be produced by them, at intervals in the lower unweathered part, while the constricted pit at the bottom was scarred by the patent signs of their intensive use (Fig 33).

Experiment has shown that antler-picks can be swung so that the chalk to be removed is struck by the brow tine (Jewell 1963, 51–2). Even within the confines of the shaft – 6ft (1.8m) in diameter with a circumference of almost 19ft (5.7m) – they could have been effectively used in this manner, as is attested by the many marks in the unfinished pit at the bottom. However, the numerous vertical and oblique grooves, often with ridges in them, and scorings, mostly in zones around the shaft at descent junctions, suggest that, once a pit had been dug to an approximate descent depth, substantial picks driven into the chalk at the circumference could have been used to lever out material to the desired dimension. The grooves, sometimes 1ft (0.3m) in depth and as much as 1.5in (38mm) wide, and usually about 1in (25mm) deep, could have resulted from a substantial pick having been struck behind the burr by a weighty fine-grained rock hammer.

The vertical and diagonal grooves comprising the zones, mostly at the descent junctions, were usually single or in intersecting pairs or groups, rarely of more than three, at roughly 2ft (0.6m) intervals and sometimes rather less. The zones were more or less horizontal but sometimes, especially at a junction where corrections had been made, they were diagonal. Such grooves also showed that antler-picks had been used for the extraction of flint nodules (Fig 35), for here and there, when beds had been dug through, the groove ran directly down to individual flints or the cavities left by their extraction.

These grooves in the shaft point to the collection of antlers of mature and massive red deer (shed antlers, a renewable resource, are normal), which were perhaps stored for a period to harden them and then used as picks until the brow tines were worn, smoothed, and rounded. Antler-picks of this character have been found at Woodhenge (Cunnington 1929, 76–7), Durrington Walls (Wainwright and Longworth 1971, 185–6), and Mount Pleasant (Wainwright 1979a, 171–6). Their tines are worn and many display traces of battering behind the burr. The obdurate, compact, flint-seamed chalk into which the shaft is sunk would have been demanding even of the more robust examples.

Although the larger areas of axe-dressing (Figs 29, 30, and 31) were next to the antler-pick-seamed conjunctions of the descents, it is possible that axe-dressing was to have been the general finish for the shaft and that its development was incomplete. This would explain the areas of axe-dressing between descent junctions which were adjacent to clear, seemingly scraped, spaces. That this obtained from the top to the bottom is shown by substantial pieces of chalk bearing axe marks recovered from the waterlogged deposit at the bottom.

The axe-dressing had for the greater part been carried out with broad-bladed axes or palstaves (examples in Moore and Rowlands 1972, pl VI, 6–10; pl VII, 16, 17, 21, and 22; pl VIII, 31) (Fig 34). There were, however, traces of treatment by an apparently square-ended palstave or even, perhaps, a socketed axe (for example, Moore and Rowlands 1972, pl VII, 29 and 30; pl X, 47). All the cuts that were seen so clearly in the chalk, within the shaft, were of a sharp, flat character. Stone axes, with the exception of certain exotic jadeite examples, would have left a more bulbous, less precise impression.

Fig 29 A view from above of an axe-dressed zone (P Ashbee)

Fig 30 Broad-bladed axe-dressing: north side of shaft at c 90ft (27m) (P Ashbee)

Fig 31 Detail of broad-bladed axe-dressing at c 40ft (12m) (P Ashbee)

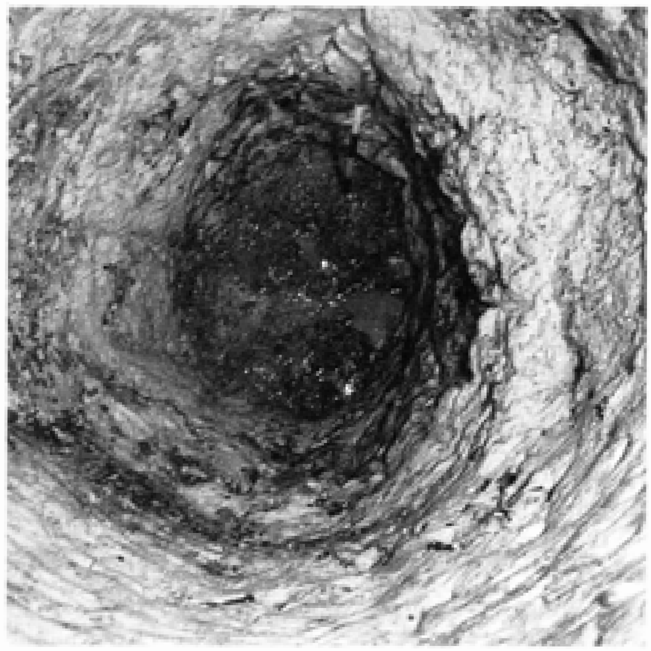


Fig 32 The constricted bottom of the shaft with 2ft (0.6m) of waterlogged infill in situ*; axe-dressing can be seen in the foreground; scale in feet (P Ashbee)*

There were various forms of axe-dressing:

a A close pattern of shallow, lunate impressions, the result of oblique blows. Often there was a cut immediately above the junction of two lower cuts, which imparted regularity to an otherwise ragged, although far from random, pattern.

b Pronounced lunate cuts which followed much the same patterning as (a), but which were not so close together either horizontally or vertically. They were in horizontal or oblique lines.

c Areas where blows with an axe or broad-bladed palstave had been struck at right-angles to the shaft's surface and irregular lines of cuts, often deep, had resulted.

d Small groups of oblique, lunate cuts which were single, double, or vertical series of oblique lines resulting from about 12 to 20 blows, occurring deep in the shaft, at about 90ft (27m).

e Triangular impressions, with the point of the triangle downwards, which could have resulted

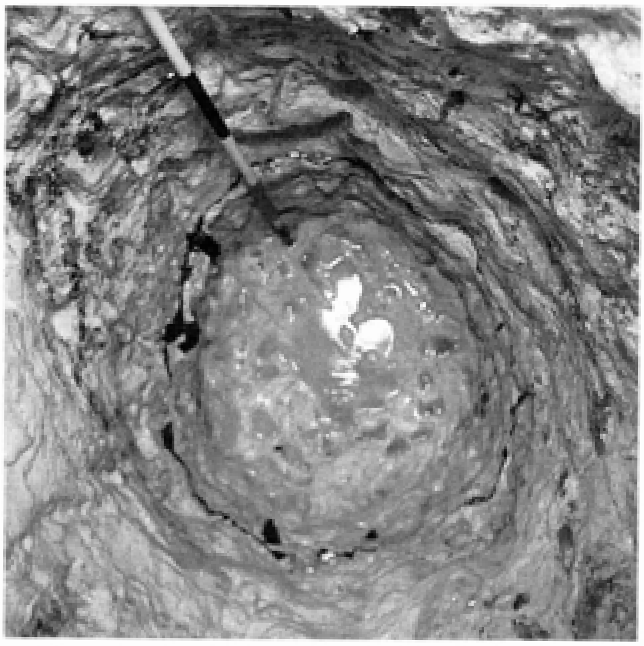


Fig 33 The constricted unfinished bottom of the shaft, all infill removed, showing the flint layers and the worn smooth character of the chalk; scale in feet (P Ashbee)

from a series of blows struck so that only one end of the edge impacted, employing a palstave or even a socketed-axe with a square cutting edge in a small area at about 90ft (27m), on the west side.

f Some small groups, at about 90ft (27m), of oblique, square impressions, spaced one from another, from blows struck using a square-edged palstave or socketed-axe.

g Anomalous marks possibly from an axe or palstave blow or blows. They were shallow, rectangular, sometimes large and even elongatedly crescentic.

This axe-dressing was for the most part remarkably well preserved in the lower part of the shaft and, as has been observed above, it was possible to make latex impressions (Appendix D) of particular concentrations. Down towards the bottom, where there had been water inflow and periodic fluctuations, the dressing, coated with brown ferric staining from this water, was sometimes worn and blurred. Higher up, where the shaft was weathered and striated by falling debris, traces of axe-dressing sometimes remained, albeit so worn as to be almost obliterated.

The water and its sources

At one stage it was thought that the shaft had been sunk in the drier conditions of the second millennium BC when a lower general water-table prevailed in the Wessex chalk country (Ashbee 1966a, 228). However, it was seen that the inflow of water – in 1962 some 14.5 gallons (66l) per hour – was from a fault upon which the bottom section had impinged. The pronounced patina of oxidised iron compounds staining the lower part of the shaft and much of its fill indicated its seasonal fluctuations. The narrow bottom pit, honeycombed and scored with antler-pick marks, pointed to unfinished work, as did the lack of finish on the cylindrical interior. The water inflow may well have curtailed further digging.

In general terms, the water-table in the chalk is often at a considerable depth, sometimes as much as 200ft (60m). However, despite the great quantities extracted by the present-day Water Authorities, some of the dry valleys carry intermittent streams, bournes, or lavants, after sustained heavy rainfall or melting snow. This pattern would have obtained in early times and those who sunk the shaft may have been aware of it. Nonetheless, a fissure which allowed an appreciable inflow was encountered. Further descent was impossible and, even after weathering and infill, waterlogging and fluctuations occurred.

A number of narrow fissures, particularly below the various rafts of flint, had been encountered. As far as could be seen they were, although diagonal to the shaft's descent, also roughly at right-angles to it. None of them appeared as waterbearing or to have in any way carried water. The waterbearing fissure, which as far as could be ascertained was diagonal to the constricted bottom breaking into it, was wider, as much as 2in (50mm) in places, and contained dense yellow granular material through which the water flowed. An attempt was made to probe the fissure, but its infill was obdurate and the inflow of water remained constant. As far as could be seen, the fissure carried an inflow from the water-table, for it was thought unlikely that it was a subterranean downward flow.

From time to time the lower 30ft (9m) of the shaft had been waterlogged to various levels. The diffuse zones of intense staining by oxidised iron compounds, all with boundaries difficult to define precisely, denoted those levels which came about from drying out after the water had retreated from a given height. The bottom in the vicinity of the fissure, from which the water derived, was also stained but not as massively as higher in the shaft. Presumably the lowest 10ft (3m) was more or less permanently flooded, which would account for the exceptional preservation of the wooden artefacts, pieces of wood, and other organic material.

Dr C E Everard of the University of London, who kindly advised the present writer on the hydrological problems, procured a number of well records (Appendix E) from the vicinity. One of these, close by the New King Barrows (NGR SU 135420), was at a height of 363ft (108.9m) above Ordnance Datum and the water-table was encountered at 263ft (78.9m) above Ordnance Datum, 100ft (30m) below the surface. This record, from the beginning of the century, is comparable with the bottom of the shaft, almost two miles (3km) to the west, where the ground level was about 312ft (93.6m) above Ordnance Datum. All the wells on Dr Everard's list were visited in 1962 with a view to measuring water-levels and, if possible, checking their given depths. All, with the exception of this well close by the New King Barrows, were inaccessible. However in 1962 (31

Fig 34 Cast of an axe-dressed surface with a broad-bladed palstave for comparison (Lynn Rivers, Salisbury and South Wiltshire Museum)

Fig 35 A massive flint nodule smashed back to the general surface of the shaft (P Ashbee)

August), water was encountered here at a depth of 166ft (49.8m) or 197ft (59.1m) above Ordnance Datum.

In general terms, the shaft need not have reached the water-table, which is considered to be at about 220ft (66m) above Ordnance Datum but is undulating and roughly conforms to the land surface. Moreover, we do not know exactly when the well records were made and, if a well did not strike a fissure, it may not have had much water in it, regardless of where the water-table lay. Nonetheless, the higher the well, the greater the seasonal fluctuation.

4 The artefacts from the shaft's infill

The artefacts from the 'pond barrow' and weathering cone

by Edwina Proudfoot

Introduction

At the outset of the excavation it was decided to retain all small finds until the site and its contexts could be interpreted. As sieving was not a normal procedure at the time of the Wilsford excavation, except in specific contexts for limited periods, the location of finds was by observation and retention of everything disturbed during digging. This method undoubtedly biased the sample, but it did so in a consistent manner.

All finds were recorded by horizontal distances along the site grid and by depth from the site datum. Contexts, soil colour, and texture were noted. At a late stage this method of measurement became difficult because of the restricted nature of the site, the poor access, lack of equipment, pressure of time, and shortage of personnel. Finds then had to be triangulated in from the north and south ends of the main north–south baulk at its junction with the edge of the shaft (referred to as the edge of the pond in the notebooks). Depth was measured below datum as before.

The original site datum was at approximately 6in (0.15m) below the surface at the centre of the site (ie at the base of the ploughsoil). Later, a second and then a third datum were required, as described in Chapter 2. All measurements have been converted to refer to the original site datum – Datum 1. The positions of all datum lines are shown on the section (Fig 13).

No finds came from the material bulldozed into the centre of the site. The majority of fragments derived from the darker, damper central area, between 3ft 6in (1.05m) and about 12ft (3.6m) below Datum 1 at the centre. There were relatively few pieces from the weathered chalk and rainwash near the sides of the shaft.

From 16ft (4.8m) to over 20ft (6m), only a small part of the filling was removed in 1960, and there were few finds from this material then or when Peter Gray was in charge.

Various attempts were made to group finds and to plot them on to a section, because of the difficulties of interpreting the upper part of the site. However, it is not now considered that these were particularly useful or helpful, and so they have been omitted. Instead, particular comment has been made on the context and location of specific finds referred to by specialists in their reports in order to show how the horizontal and vertical distribution of finds relates to their interpretation.

The pottery

At the time of the excavation, a range of possibilities (other than those actually found) was anticipated. There was much confusion over the pottery, which was mainly small and fragmentary, much with relatively fresh breaks. When first found, it looked not unlike Neolithic pottery in texture, but when dry it was hard and appeared more like Iron Age pottery, which seemed improbable in the context.

In an attempt to resolve this difficulty, but with some reluctance to accept the implications of the Iron Age interpretation for the bulk of the pottery at a stage when the shaft had progressed further, the pottery was sent to Christopher and Sonia Hawkes. For this it was grouped broadly according to location, which seemed sensible in relation to the problems of interpreting the site; few sherds were found near one another, and none was from a context other than the now recognisable weathering cone, despite the initial identification of the darker central area as a pit.

The Hawkes' identifications confirmed the general Iron Age nature of the majority of the sherds; their notes were made available with the pottery for further study by Frances Raymond.

Raymond has indicated a minimum number of vessels attributable to the various categories of sherds. She has also attempted to interpret the material, observing that the Iron Age wares could have lain around on the surface for some time before incorporation into the filling of the cone, while the Deverel-Rimbury sherds must have been incorporated rapidly, since they remained fresh. This is in general agreement with the interpretation of the process by which the shaft and cone filled and material became incorporated.

Report on the pottery
by Frances Raymond

A total of 134 sherds of pottery and an almost complete Iron Age jar were recovered from the pond barrow and weathering cone's infill. A catalogue has been made on the basis of period and fabric. Fabrics were distinguished by inclusion type, frequency, and size. They are referred to in the text in abbreviated form (Table 2). The initial letter of each inclusion, ordered alphabetically, precedes a chronological

Table 2 Key to abbreviations used in the pottery report

Fabric descriptions	
F	Flint
fe	Iron ore; due to difficulties of distinguishing between ores at a macroscopic level, this is used in a generic sense
G	Grog
S	Quartz sand
Sa	Sarsen
sh	Shell
Chronological abbreviations	
RB	First-century Romano-British
IA	Iron Age
DR	Deverel-Rimbury
Indet	Indeterminate

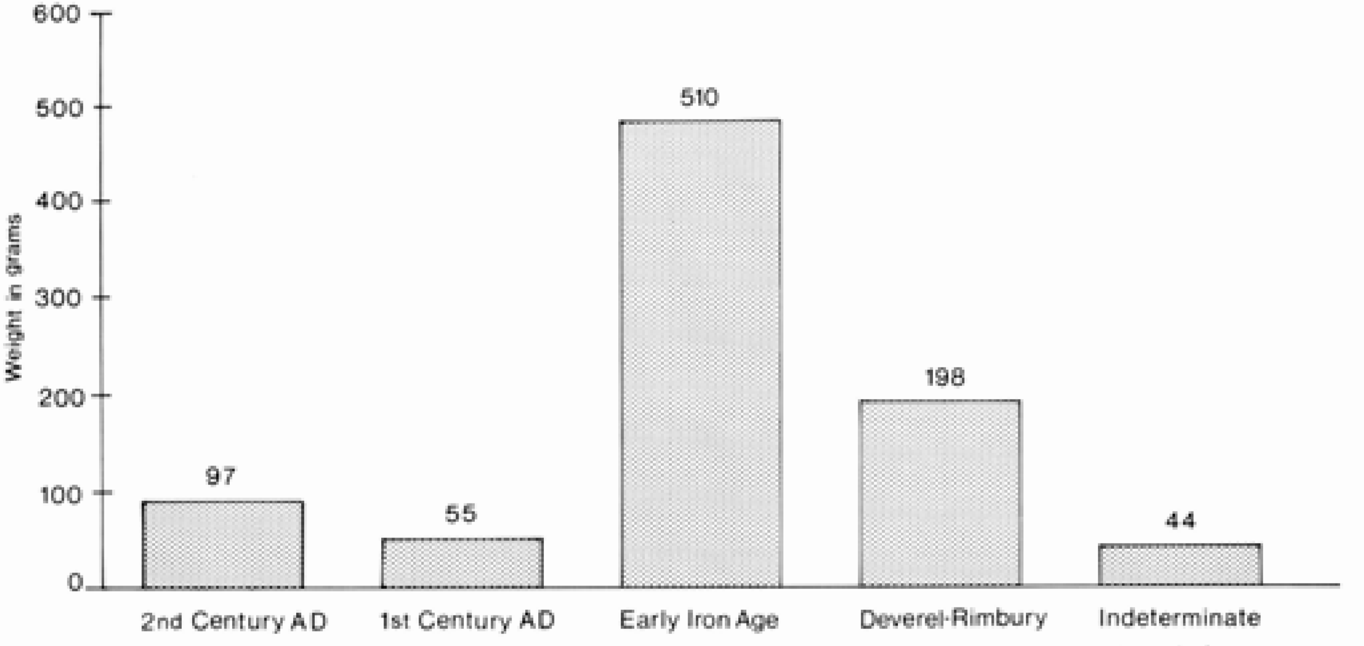


Fig 36 Total weight of pottery from the pond barrow and weathering cone attributed to each chronological phase

Fig 37 Total number of sherds from the pond barrow and weathering cone attributed to each chronological phase

reference and a number which refers to variations in fabrics with the same inclusions and of the same period (*see* the detailed descriptions). The number of sherds belonging to each ceramic phase have been quantified by weight (Figs 36 and 37) and illustrated (Fig 38), while a description of the general characteristics of each group is given.

Deverel-Rimbury

A minimum of three vessels is represented.

10 FfeSsh:DR/1 Two body sherds (1960:17 and 18) with slightly raised cordons decorated with fingertip impressions; rimsherd with an expanded, flattened top. These probably represent a barrel urn, but the sherds are too small for certainty (Fig 38/10).

11 FfeSsh:DR/1 Two body sherds which may be from a globular urn.

The fabric group FfeSsh:DR/1 includes 20 body sherds which could belong to either vessel.

12 F:DR/1 Body sherd with a slightly raised cordon which may belong to a barrel urn.

Indeterminate: One vessel is represented (1960:6). The fabric is consistent with the Deverel-Rimbury series, although its surface may suggest Early Iron Age workmanship. The only featured

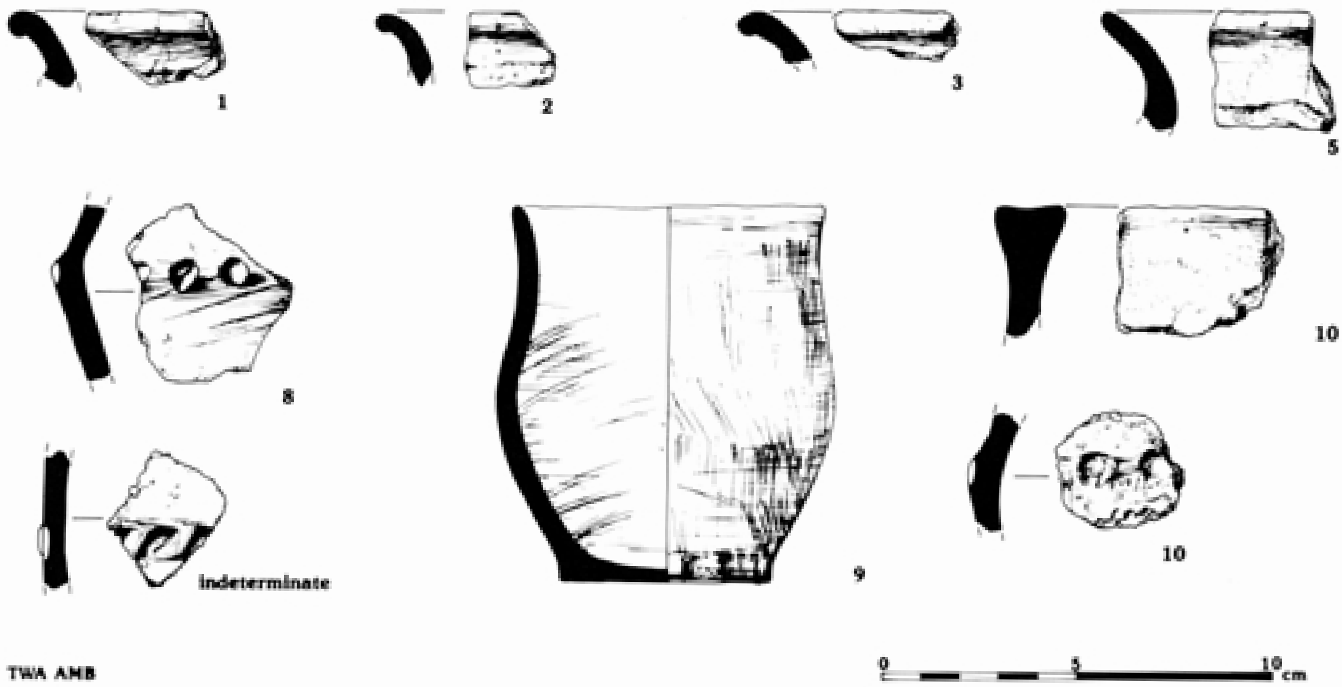


Fig 38 Pottery from the pond barrow and weathering cone infills

sherd shows traces of three fingertip impressions divided by a pronounced ridging effect which could belong to either period (Fig 38/indet).

Early Iron Age

A minimum of four vessels is represented.

6 feS:IA/1 Two base sherds from a coarse vessel which had a rather badly combined paste. There are 27 undecorated body sherds of the same fabric and probably from the same vessel.

7 feSSa:IA/1 Twenty-one body sherds distinguished from *6* by the presence of crushed sarsen stone.

8 Ssh:IA/1 Shoulder of a sharply carinated bowl with fingertip decoration along the carination (Fig 38/8; 1960:117). Also one plain body sherd.

9 S:IA/1 Iron Age jar with a rounded rim with a slightly convex outer surface set at an upright angle and a globular body curving inwards to a narrow base (Fig 38/9; 1960:58).

Romano-British
First century

All this pottery is abraded and has a comparatively low average weight of 1.9g, which is emphasised by comparison between pottery weight (Fig 36) and the number of sherds (Fig 37). The degree of abrasion is directly comparable with the second-century pottery which, being more robust, has the higher average weight of 6.0g, but which represents a minimum of ten vessels out of a possible sixteen sherds. The pottery had been incorporated in the upper infills after exposure to a series of complex post-depositional processes. The sherds can be compared with the unabraded condition of the prehistoric assemblage, where the fabric of the Deverel-Rimbury vessels has an average weight of 7.3g.

Four, perhaps five, vessels can be attributed to the first century AD.

1 Black-burnished ware bowl with a rounded, everted rim (Fig 38/1; 1960:20).

2 S:RB/1 Rim sherd, rounded and everted (Fig 38/2; 1960:37).

3 S:RB/1 Rim sherd, rounded and everted with a well-defined neck, possibly from the same vessel as *2* (Fig 38/3; 1960:36).

4 S:RB/1 Rim sherd; the form is partially obscured by abrasion, but the wall thickness is greater than *2* or *3*.

5 GS:RB/1 Rim sherd, rounded and upright. The angle of the body suggests a near globular form (Fig 38/5; 1960:57).

The remaining 23 sherds all belong to fabric S:RB/1 and on the basis of wall thickness can be attributed to *2* or *3*.

Second century

Two grey-ware rims, one colour-coated rim, and two sherds of samian ware were of second-century date.

The remainder of the Romano-British pottery consisted of abraded body sherds, none of which contradict the proposed dating.

Fabric descriptions
Deverel-Rimbury

FfeSsh:DR/1 Soft and friable with an average wall thickness of 8mm. Flint was moderate (15%), even in distribution, and finely crushed with a size range of 0.5 to 3.0mm. Iron ore was sparse (3%) and less than 0.1mm. Quartz sand was sparse (3%), sub-rounded, and varied in size from <0.1 to 0.1mm. Shell was common (20%), even in distribution, and finely crushed with a size range of 0.1 to 3.0mm. This fabric was used for globular and barrel urns.

F:DR/1 Hard and closely textured with an average wall thickness of 11mm. Flint was common (25%), even in distribution, and finely crushed with a size range of 0.1 to 2.0mm. Probable barrel urn.

F:indet/1 Hard and closely textured with a varied wall thickness from 0.5 to 0.9mm. Flint was moderate (10%), even in distribution, and finely crushed with a size range of 0.1 to 3.0mm.

Iron Age

feS:IA/1 Hard with a badly-combined, lumpy paste and an average wall thickness of 8mm. Iron ore was sparse (3%) and varied in size from 0.1 to 1.0mm. Quartz sand was common (20%), sub-rounded, and varied in size from 0.1 to 0.9mm. There were rare examples of flint, quartzite, and shell.

feSSa:IA/1 Hard and closely textured with an average wall thickness of 8.0mm. Iron ore was common (20%) and varied in size from <0.1 to 1.5mm. Quartz sand was common (20%), sub-rounded, and varied in size from 0.1 to 0.3mm. Sandstone, probably crushed sarsen stone, was sparse (3%), angular, and varied in size from 1.0 to 15.0mm.

Ssh:IA/1 Hard and closely textured with an average wall thickness of 5mm. Quartz sand was common (20%), sub-rounded, and varied in size from 0.1 to 0.8mm. Shell was sparse (3%), plate-like, and varied in size from 0.5 to 5.0mm (the sharply carinated bowl).

S:IA/1 Hard and closely textured with an average wall thickness of 5mm. Quartz sand was common (20%), sub-rounded, and varied in size from <0.1 to 0.3mm. There were rare examples of iron ore and sandstone, probably sarsen stone (Iron Age jar).

Romano-British

GS:RB/1 Hard and closely textured. The grog was sparse (5%), sub-square, and varied in size from 1.0 to 3.0mm. The quartz sand was very common (30%), sub-rounded, and varied in size from 0.1 to 3.0mm (first century AD).

S:RB/1 Hard and closely textured with an average wall thickness of 7.0mm. The quartz sand was common (20%), sub-rounded, and varied in size from 0.1 to 1.0mm (first century AD).

The pottery was sorted into fabric groups using a binocular microscope with a magnification of ×30. The frequency of inclusions was assessed using density diagrams based upon soil description charts (Terry and Chilingar 1955, 229–34), while inclusion size was measured with a graticule. Although rare inclusions have been listed in the detailed descriptions, they do not appear in the abbreviated codes.

Flint artefacts

When the pond barrow was first examined, two other barrows in the same field were also being excavated. One of these, 33 on the downs above 33a, was on a clay-with-flints site, and incorporated in the mound were many pieces of unworked flint, as was to be expected; in addition, there was a substantial assemblage of worked and struck flakes of flint.

In contrast, although a certain amount of broken unworked flint was noted in the upper filling of the pond barrow (ie the material bulldozed into the central area by the farmer), surprisingly there seemed not to be a great deal of flint in the area. None of the flint from the disturbed material above the buried soil was retained, because it was apparently naturally fractured and probably broken when the site was levelled.

However, in view of the amount of struck flint at 33 all flint from the pond barrow was kept and examined. A few fragments of broken flint were found in parts of the filling of the upper part of the site. None showed signs of ever being struck and were therefore not retained.

Only two worked pieces of flint (Fig 39) were found in the entire top 20ft (6m) of the weathering cone. Both were from the rainwash, that is they were found nearer the edge than the centre of the shaft filling. The secondary flake (1960:26) was found in chalky soil below a rabbit layer, at a depth of 6ft (1.8m), and the end-scraper (1960:97) was found in rainwash towards the north side of the upper part of the shaft, at a depth of 8ft (2.4m).

Neither of the flints was deposited in the cone, but must have fallen, probably from the topsoil, as the result of normal weathering. They could derive from casual material located on the surface before the shaft was dug or they could be from a deliberate deposit of unknown date. However they came to be in the topsoil, they are most probably of earlier date than the shaft and indicate unspecified activity in the general vicinity.

Report on the flints
by Andrew David

Although the two flints are relatively fresh-looking, they are heavily patinated which precludes the clear identification of microscopic use-wear traces, and a

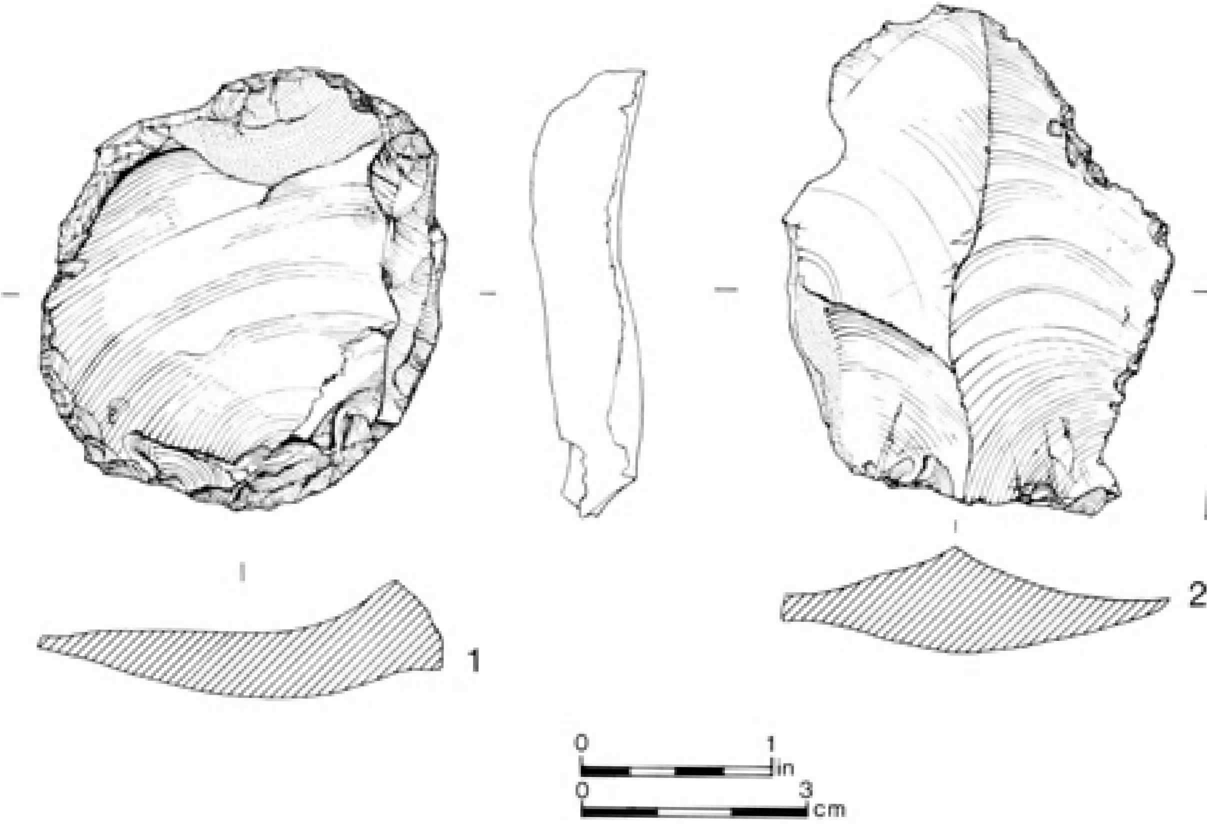


Fig 39 1 Short end-scraper; 2 secondary flake struck from a core: the only worked flints from the weathering cone

description can therefore only rely on simple observations of typology and technology (Fig 39).

1 **1960:97 A short end-scraper (Clark 1960, 217, Aii) developed upon a hard hammer-struck secondary flake with a plain butt. Steep and generally uninvasive retouch is confined to the distal end and parts of the left lateral edge, accounting for a total of about 50% of the tool's perimeter. Cultural attribution on the evidence of a single scraper can only be extremely tentative, yet this example is typical of scrapers commonly encountered amongst later prehistoric assemblages on the English chalkland.**

2 **1960:26 A substantial secondary flake, hard hammer-struck, with a plain butt. There is macroscopic damage to the right lateral edge which may be incidental or from use. Such flakes can result from the preliminary stages of axe manufacture or, more simply, from core reduction: in either case, no specific cultural attribution is possible.**

Animal and human bone

The bone from the upper part of the site was collected uniformly, ie all bone was collected and retained, however small; however, no attempt was made to divide into human/animal, nor was the animal bone identified as to species at the time of the excavation. As there were no specific features or contexts, the bone finds were separated on the basis of the soil layers in which they were recorded.

Initially, all the bone fragments were forwarded to Dr A S Clarke, then at the Royal Scottish Museum; he kindly prepared a species identification, but no further study of size, weight, butchery, erosion, etc was carried out at this stage (1965). Dr Clarke drew attention to and identified the human bone in the assemblage, making various observations on this and the rest of the material.

Caroline Grigson and Janet Henderson have written respectively on the animal and human bone (Chapter 6), with various observations about the material. Therefore only additional comments by the present writer are included here.

In her discussion of the animal bone from the cone (Unit 4), Grigson comments on a well-preserved, but gnawed, ox or equid bone (1960:115) and suggests that it may have been lying in very wet conditions. This is supported by observations made during the excavation, since the sample was found near the centre of the cone fill, at 11ft 5in (3.4m), the dampest, lowest part of the cone when it had weathered back to some 16ft (4.8m) wide at the surface.

Numerous possibilities may be inferred from the location of the gnawed bone and its state of preservation, including the possibility that a dog actually took the bone into the cone to gnaw it. Other ox bones (1960:114) were found in the same general context. These bones could have come from a rubbish deposit in a pit or on the surface and are of unknown

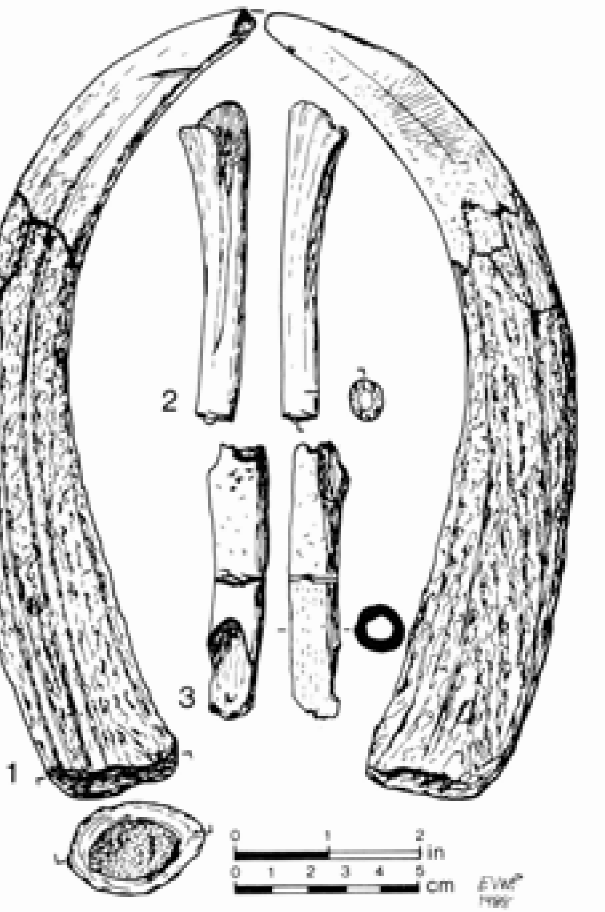


Fig 40 Worked bone from the weathering cone: 1 *red deer antler with polished tip, the striations on the right indicate the direction of working, on the left near the tip is a cut mark, cut and grooved at the base;* 2 *sheep/goat tibia shaft, showing circumferential cuts;* 3 *antler with cuts and gnaw marks, the upper surface is partly polished, the lower part is completely smoothed*

date, although they are interpreted as unrelated to the main use of the shaft. These and other suggestions reinforce the interpretation of the cone filling as a natural rather than a deliberate process.

The nine fragments of ox cranium, identified by Grigson as from a single animal (1960:92, 94, 102, 103, 119, 125) and found in the streaky rainwash silt and in the central dark soil, were distributed vertically through more than 2ft (0.6m). This supports the suggestion made in Appendix G that items lying around on the surface could have weathered out, and fragments could have both rolled into the central low part of the site and washed gradually down the sides, perhaps caught by plants growing on the sides of the filling.

Similar inferences may be made from the suite of associated equid bones (1960:122, 120, 121, 44, 119, 25, 125). Of these, 1960:44 was found in light brown silt fairly high in the cone and relatively close to the side, while 1960:25 was found in chalky rainwash at a lower depth. The other bones in the sample were all from the dark brown soil at various depths from 7ft 9in (2.3m) to 9ft 6in (2.8m). Since the calcaneum (1960:25) and the cuboid (1960:125) belong to the same ankle, it is valuable to have similar radiocarbon dates for these: 2450±60 and 2480±60 BP (OxA-1210, 1213). These and other associated bone fragments are difficult to interpret as deriving from other than surface rubbish deposits accidentally weathered into the shaft. This would explain the many missing fragments, even where substantial parts of a particular animal were otherwise present. Grigson's interpretation of the generality of animal bone remains, including those showing butchery or traces of gnawing, confirms the view that the remains were largely domestic rubbish. There were no bone artefacts from the uppper part of the cone, and few of the fragments showed signs of working.

Figure 40 illustrates the three worked bone fragments from the cone, all residual and not artefacts in themselves.

1 is an antler point (1960:120) with slight cuts and fine striations near the tip, indicating that the antler was used, perhaps for polishing or rubbing, and with several cut marks where it was originally severed.

2 is a fragment of shaft (1960:59), with slight cut marks at the end, where it was cut from the rest of the bone. Another groove was incomplete. Such marks can be the result of making tubular beads, for example. In the present example the unfinished groove, 6mm from the cut end, could indicate a bead of approximately 6mm across.

3 is again a fragment (1960:80), from near the tip of an antler, but broken at both ends. There are some slight indentations at the wider end of the fragment, perhaps gnaw marks, but they could be from use, such as hammering. Like *2* it shows several central cuts, but clumsily executed. This was probably intended as the first step in manufacturing a bead or handle, but was not completed. It is unclear whether the antler broke before or after this work, but the break could have been the reason for not continuing with the manufacturing process.

Such residual fragments could date to any phase in the period of use of the shaft and do not provide any indications of date for the shaft or of manufacture.

While weathering-out from the surface is a possible source of the material, it is equally possible that the remains could have derived from an unrelated pit or pits, of unknown date and size, exposed at the surface by the normal weathering process. Alternatively, they could have been thrown into the cone, a conveniently available hole. In any of the above circumstances, bones would be found in different soils, positions, and depths, even though they could have been contemporary with one another.

Within the limitations of the recording system and the problems of the passage of time, it seems probable, as suggested by Grigson, that some of the material may have been deliberately introduced into the cone, but that the greater part of it represents casual or accidental finds resulting from surface scatter or possibly from a pit exposed at the surface of the site. In all cases there would have been human activity to produce the debris in the vicinity of the partially-filled shaft.

Janet Henderson studied the human bone from the cone; no human material derived from the shaft itself. She identified at least two adults, one juvenile, and two infants. Additional human bone fragments could represent parts of the same or additional individuals, but the remains were too fragmentary for further identification.

It is important to note that none of the human remains were found in association or as articulated skeletons or parts of skeletons. They were found scattered among the animal bone at various levels in the upper part of the cone and thus were not separated out at the time of the excavation.

Two human bone samples have been dated to the Iron Age: 2320±80 and 2360±60 BP (OxA-1211, 1212), not statistically different from the dated animal remains already referred to. It is probable therefore that the human material is in fact of Iron Age date, since the pottery sherds found in the same general deposits were also of Iron Age origin. These remains could have been extremely important, had they been recognised as such and if specific contexts could have been noted at the time of the excavation, but the finds were located generally all through the site and none came from a specific deposit. The presence of human bone among scattered sherds and animal bone is, nevertheless, significant and supports the interpretation for the site as a whole: that the material found in the cone derives from casual, rather than intentional, deposition.

Charcoal

Maisie Taylor reported of the charcoal (Chapter 6) that 1960:21 (6ft 2in, 1.8m) is *Quercus* sp and 1960:111 (10ft 10in, 3.2m) includes *Corylus* or *Alnus* and *Quercus*. Both were found in rainwash towards the edge of the shaft, and both samples consisted of small pieces of twig and not substantial wood remains. The trees identified conform to the environmental identifications and interpretations put forward for the site as a whole, but do not appear to have any relevance for the interpretation of the shaft.

Their find positions, relatively high in the cone, and the small size of the charcoal samples indicate that they were washed or weathered into the cone from the surface. As with the majority of finds from the cone, they seem to relate to a scatter or deposit in the vicinity of the shaft, introduced into the cone by natural causes as the edges weathered back.

Soils

Soil samples were gathered from all the major contexts/layers within the upper part of the shaft, in particular from the dark central area and from the filling of the Iron Age jar. Although chalk sites are by no means ideal for pollen analysis, the present writer was concerned to take samples for this and other analyses, so that they would be available for examination in the future. Another reason for keeping the samples was the inadequate understanding of the class of monument known as pond barrows: this again suggested to the present writer, prior to starting the excavation, that an environmental study should be attempted and that samples should be kept.

Samples were taken, but in the event none was available for further study. They were damaged during the long storage period following the excavation. On examination in 1973–4 the present writer concluded, after consultation, that the samples had been damaged by damp and were then of little scientific value. Accordingly, they were disposed of without being studied.

The artefacts from the shaft's lower infill

by Paul Ashbee

Introduction

Apart from the objects associated with the infill removed from the pond barrow and weathering cone, there were seven groups of artefacts recovered during the excavation of the shaft. These were pottery, bone pins etc, a shale ring, a group of amber beads, pieces of stave-built containers and other woodwork, flints, and some fragments of cord. Some of the pottery, the bone pins and needle, the amber beads, and specifically the container bases and stave fragments, some portions of timber, and the rope were in the waterlogged conditions at the bottom (Fig 7). Indeed, certain artefacts comprised discrete groups: there were the Deverel-Rimbury urn at about 60ft (18m), sherds and the shale ring at about 85ft (25.5m), and further sherds, the ring-headed bone pin, perforated-headed pins, and amber beads in the constricted bottom with the wooden container pieces and other organic materials (Fig 7).

As was detailed in Chapter 1, objects found in the shaft's infill were recorded by depth. They were more or less in the middle of the circle described by the sides of the shaft, a reflection of weathering and accumulation. However, when something was resting against the sides, this was noted.

The pottery

Apart from two small body sherds found in 1960 between 40ft (12m) and 50ft (15m), the substantial and uppermost close-grouped cluster of sherds, all heavily coated with calcium carbonate, were from a Deverel-Rimbury barrel urn. A second group, scattered between 78ft (23.4m) and 88ft (26.4m), comprised (excluding a base) body sherds, some mere crumbs and one lacking an interior surface. The third group, from the constricted, waterlogged base of the shaft, was again, for the most part, body sherds which included one from a Deverel-Rimbury globular urn, recognisable because of its incised line ornament, as well as two pieces from plain rims. When found almost all of them were chalk-coated, and only after careful washing was it possible to see their character. Mostly they were dark-faced, presumably from use, and one carried massive carbonised residues. A rimsherd was, however, buff coloured.

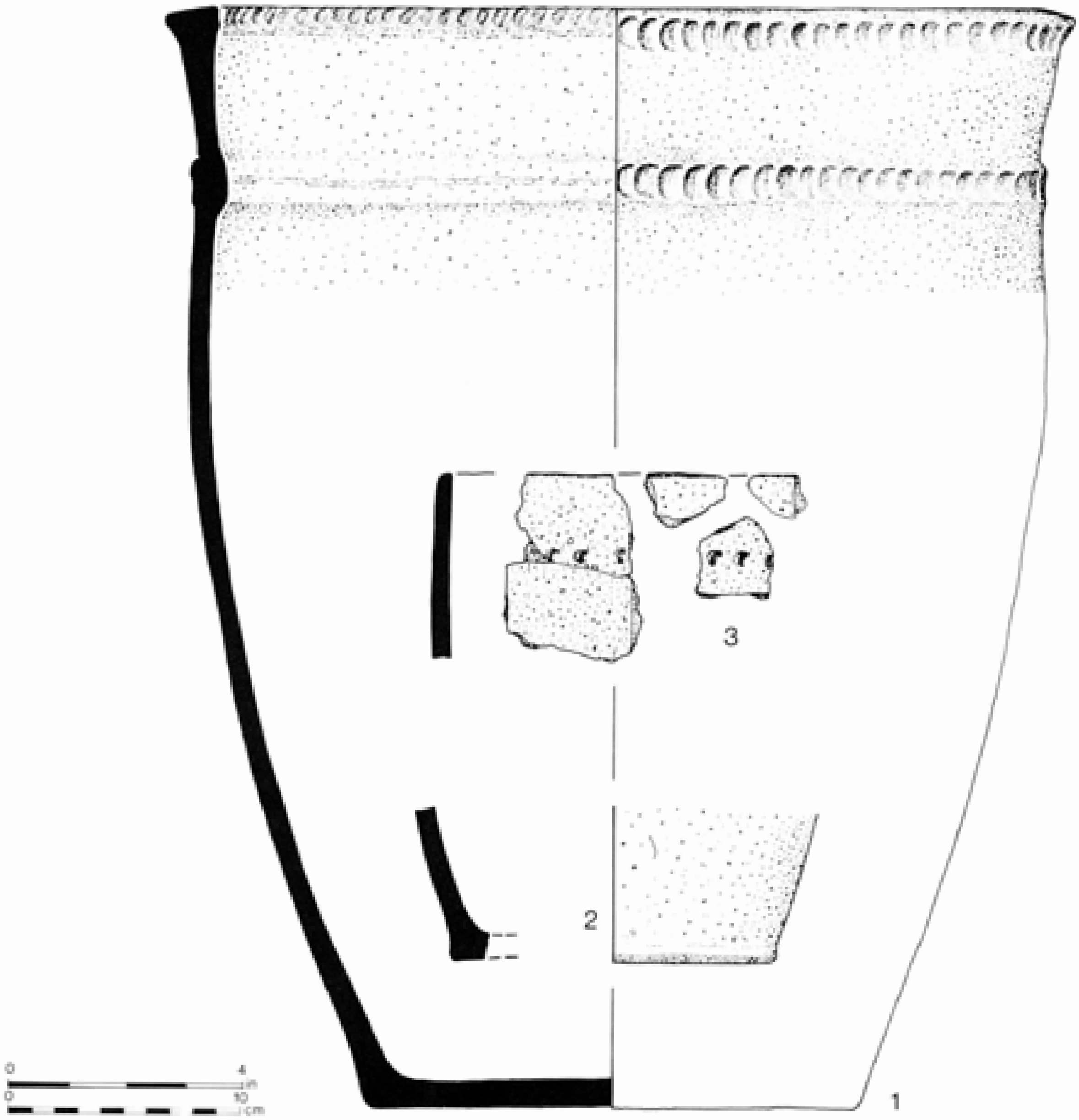


Fig 41 Deverel-Rimbury barrel urn pottery from the shaft's infill

This and a blackened rimsherd could well be from small, well-finished vessels.

The quantity of pottery is not great; excluding the pieces of the barrel urn and including some found on tips, only 20 sherds were found. They are remarkable in that they are, despite their incorporation and coating, unabraded. For example, fragments found close by the base could be attached to it.

An indication of grades and kinds of gritting is given in terms of the practical system devised for Middle Bronze Age pottery in southern England (Dacre and Ellison 1981, 173).

Distinctive pottery

(Fig 41)

1 Pieces comprising the greater part of a Deverel-Rimbury barrel urn of fine, hard, red-buff to dark grey ware, with a profuse inclusion of fine, graded, flint grits (3MF). It was 16in (406mm) in diameter at the mouth and about 20in (508mm) in height, with a base some 7.75in (197mm) in diameter. Decoration: distinct finger-impressions inside the T-shaped, expanded rim which oversailed deep, evenly-spaced, vertical thumbnail impressions outside and immediately below it. Further identical vertical thumbnail impressions were upon an incorporated cordon 3.25in (80mm) below the rim (Fig 41/1). Found at a depth of 57ft 6in (17.25m). Large and small pieces were together in a restricted area and depth.

2 Pieces comprising part of a blackened base of hard, vesicular, fine, flint-gritted (2MF) ware, some 4.5in (114mm) in diameter. They could have been from a globular urn of about 8–9in (20–23mm) in height. Found at a depth of 84ft 3in (25.3m) (Fig 41/2).

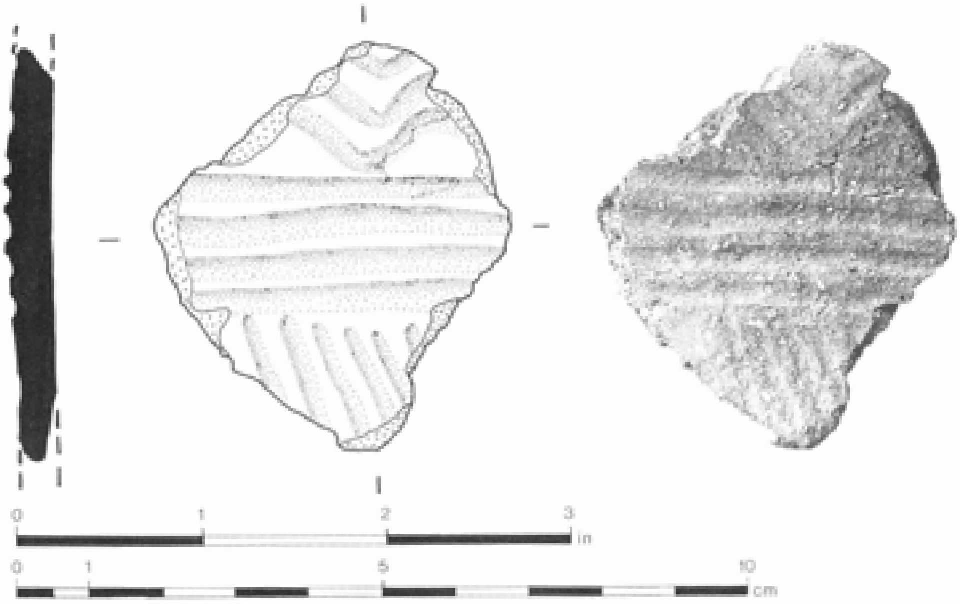


Fig 42 A sherd of a Deverel-Rimbury globular urn from the shaft's infill

3 A blackened sherd of hard, finely-gritted (2SF) ware, with opposing shallow, round-bottomed, grooved line decoration, which could have been part of the infilled triangle pattern upon a globular urn. Found at a depth of 96ft 6in–97ft 6in (29–29.2m) (Fig 42).

4 A flat-rimmed sherd of fine, thin (0.25in, 6mm), hard, grey ware with a smoothed, blackened surface, interior and exterior. The exterior bears shallow horizontal and oblique tooling which, continued and covering a vessel, would have been decorative. The grits are fine flint (2SF) that had been carefully graded. Its characteristics suggest that it is from a globular urn. Found at a depth of 96ft (28.8m).

5 A sherd, with a slightly expanded flat rim, of thin (0.25in, 6mm), hard ware. It has a smoothed, buff exterior and a grey interior. The buff exterior bears signs of short smoothing strokes. The grits are fine, of flint, some larger than others (3SF). It may be from a small vessel of the barrel urn series. Found at a depth of *c* 98ft 6in (29.5m).

6 A small rim fragment from the same vessel as *5*.

7 A weathered sherd with a slightly expanded, rounded, rim, of medium (0.375in, 9mm) ware. It has a blackened exterior, a buff interior, and bears a row of vertical fingernail impressions 0.25in (6mm) below the lined exterior turn of the rim. Some of the flint grits are large and dense (3LF). It is from a medium-sized vessel of the barrel urn series, comparable with *1*. Found on the dump and probably from a depth of between 75ft (22.5m) and 85ft (25.5m) (Fig 41/3).

Body sherds

All about 0.25in (6mm) in thickness.

1960 Sherd, described in register as 'Neolithic' and thus presumably dark-faced; lost; *c* 40ft (12m). Sherd, 46ft 6in (16.9m), lost.

1961 Dark interior and exterior surfaces, 1.75 × 1in (44 × 25mm), 2LF, 77ft 9in (23.3m); piece 0.25 × 0.375in (6 × 9mm), surfaces missing, 2MF, 79ft (23.7m); two fragments with one dark surface, 0.75 × 0.5in (44 × 12mm), 2LF, 81ft (24.3m); buff ware, one surface missing, 0.25 × 0.25in (6 × 6mm), 2MF, 81ft (24.3m); buff exterior, dark interior, two sherds fitting together, 1.25 × 1in (31 × 25mm), 2LF; dark exterior and interior surfaces, exterior bearing three small fingernail impressions, 2 × 1.5in (50 × 37mm), 2MF, found on dump but from *c* 80ft (24m); buff exterior, dark interior, 1.5 × 0.75in (37 × 44mm), 2MF, found on dump but from *c* 80ft (24m); dark exterior, dark buff interior, 1 × 1in (25 × 25mm), 2MF, found on dump but from *c* 80ft (24m); darkened reddish exterior, dark interior, 1.25 × 1in (31 × 25mm), 2MF, found on dump but from *c* 80ft (24m); dark exterior and interior surfaces, 0.75 × 0.5in (44 × 12mm), 2SF, found on dump but from *c* 80ft (24m); dark exterior and interior surfaces, 0.75 × 0.5in (44 × 12mm), 2SF, found on dump but from *c* 80ft (24m).

1962 Buff exterior and dark interior deeply stained by waterlogged conditions, 2.25 × 2in (56 × 50mm), 2LF, exterior has a massive carbonised residue adhering to it, 96ft 6in (28.9m); dark exterior, with residue, grey-buff interior, 2 ×

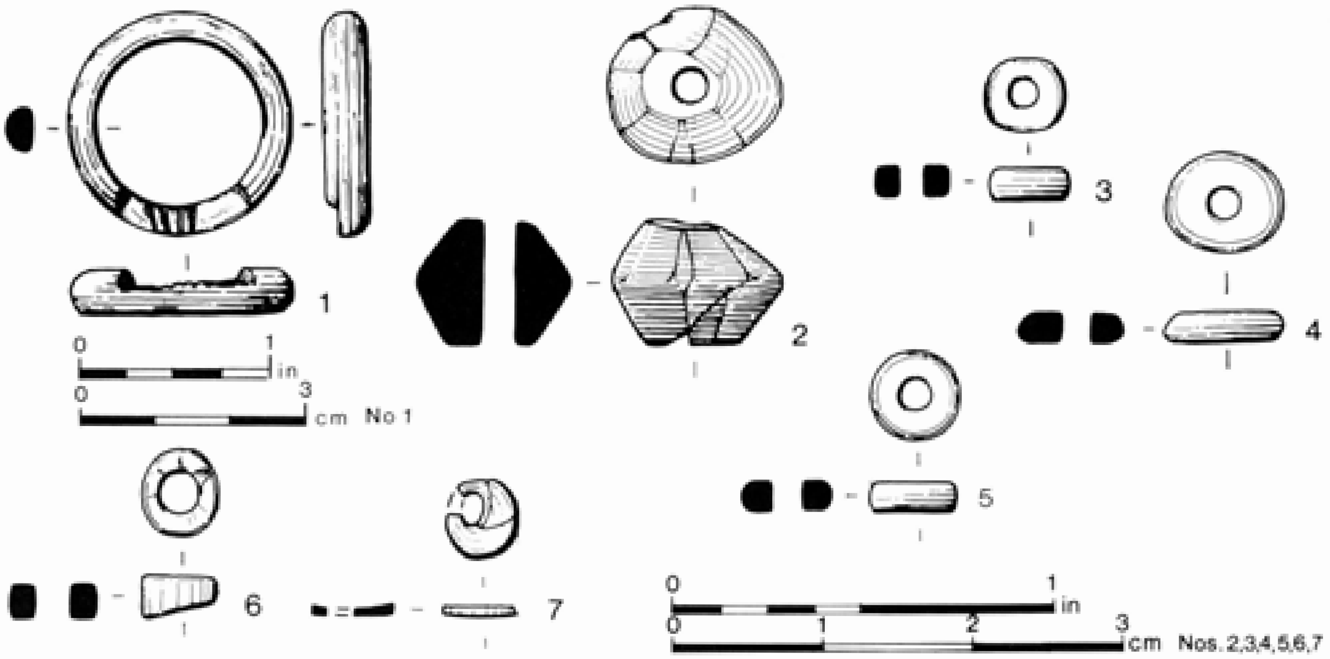


Fig 43 1 Shale ring; 2–6 amber beads; and 7 ?perforated fossil piscine vertebral plate from the shaft's lower waterlogged infill

1.75in (50 × 44mm), 2LF, 98ft 3in (29.5m); buff exterior, dark interior, 0.625 × 0.5in (15 × 12mm), 1MF, 98ft 3in–98ft 9in (29.5–29.7m); dark exterior and dark interior surfaces, thin hard ware, perhaps reburned, bears a single ?grass impression, 2LF, 96ft 6in–97ft 6in (28.9–29.2m).

The shale ring

(Figs 7, 43/1, and 44/1)

1 Shale ring: 1.188in (30mm) diameter, of D-section 0.188in (5mm) thick. The internal diameter is 0.813in (20mm). One side is unmarked, the other has had a piece 0.625in (16mm) long cut out of it. The resultant flat surface has been transversely notched four times. Found at a depth of 88ft 9in (26.6m) in the chalk rubble infill.

The amber beads

(Figs 7, 43/2–6, and 44/2–6)
A double-conical, or fusiform, amber bead and four discoid amber beads were found, almost at the bottom of the shaft, in the waterlogged deposit. Although met with at different depths, association seems likely and thus they can be considered as a group. Waterlogging has preserved them, and their pristine condition is in marked contrast with that of some of the amber beads and other objects from Wessex graves (S Piggott 1973, 363–5). Their colour, a translucent brown, could suggest a Baltic region origin. Such amber need not have been imported into England, for substantial pieces are, from time to time, washed up on to East Anglia's shores.

2 Truncated biconical bead: maximum diameter 0.469in (10mm), length 0.5in (12mm), diameter of perforation 0.094in (2mm); the flattened ends are not parallel to one another. The conjunction of the bases of the two truncated cones is worn and rounded and a flake has been detached, the bead having presumably sustained a blow. One of the flattened ends which truncate the conjoined cones of the bead is circular, the other hexagonal. The perforation, which has within it clear drill marks, is not from the centre, nor is it aligned upon the centre, of either end. Found at a depth of 99ft 3in (29.8m) in the waterlogged deposit at the bottom of the shaft.

3 Discoid bead: diameter 0.188in (5mm), thickness 0.094in (2mm), diameter of perforation 0.063in (1.5mm). It is slightly ovoid in shape, the edge is matt, and the cut face smooth. The perforation, having been drilled from both sides, is of 'hour-glass' profile, and has angular, unworn edges. Found at a depth of 99ft 3in (29.8m) in the waterlogged deposit at the bottom of the shaft.

4 Discoid bead: diameter 0.25in (6mm), thickness 0.063in (1.5mm), diameter of perforation 0.063in (1.5mm). It is an eccentric ovoid in shape, rather than circular; the edge is matt and worn and the perforation is cylindrical, drilled from one side only. Found in the waterlogged deposit at the bottom of the shaft between 94ft 3in (28.3m) and 100ft (30m).

5 Discoid bead: diameter 0.188in (5mm), thickness 0.063in (1.5mm), diameter of perforation 0.063in (1.5mm). It is precisely circular in form, while both sides and its rounded edge are smooth and highly polished. The perforation is cylindrical, drilled from one side only. Found in

Fig 44 The shale ring and the amber beads from the lower and waterlogged infills (C Middleton)

the waterlogged deposit at the bottom of the shaft between 96ft 6in (28.9m) and 97ft 6in (29.2m).

6 Discoid bead: diameter 0.188in (5mm), thickness of one edge 0.125in (3mm), thickness of opposing edge 0.063in (1.5mm), diameter of perforation 0.094in (2mm). The planes of the two sides are not parallel to one another. In form the bead is circular, and the relatively large perforation is not at the centre but eccentric. Its opposing surfaces are worn and have scratches upon them, while its edge is also worn and irregular. These factors accentuate the bead's eccentric character. The perforation is cylindrical, drilled from one side only, but also worn and has an 'hour-glass' appearance.

The bone pins and other bone artefacts

Ring-headed pin

(Figs 7, 45/1, and 46/1)

1 This pin, manufactured from a strip of a long bone of an animal of bovine or equine magnitude, is 2.875in (73mm) in length; the breadth of the spatulate ring-head is 0.625in (14mm), and the diameter of the perforation is 0.375in (9mm). There is a remnant of cancellous internal structure on one side of the head, adjacent to the 'hour-glass' profiled, ground-out perforation. Abrasion marks from the manufacturing process are visible inside the perforation. Its head and almost winding shaft have a glossy, near glassy finish, although the point is worn and abraded. Found at a depth of 98ft 3in (29.5m) in the waterlogged deposit at the bottom of the shaft.

Perforated-headed pins

(Figs 7, 45/2–4, and 46/2–4)

2 Length 4in (100mm), breadth of head 0.438in (10mm), diameter of perforation 0.25in (8mm). It has been made from a split half of a gracile long bone, possibly a sheep or deer metatarsal, so one side is convex and the other concave. A part of the proximal articular facet remains at the perforated head which has been fashioned to an approximately rectangular form. The perforation has been effected from each side of the head, while the shaft has been ground to its tapering form. Scrape and abrasion marks can be seen upon it, although the distal end (1.25in; 30mm) is polished. Found at a depth of 96ft 3in (28.9m) in the waterlogged deposit at the bottom of the shaft (Fig 45/2).

3 Length 3in (75mm), breadth of head 0.5in (12mm), diameter of perforation 0.188in (4mm). It has been made from a split half of a sheep or roe deer tibia or metapodial, so one side is convex and the other concave. The head has been bevelled upon each side, and there is a remnant of the cancellous internal structure of the bone on the convex side. The shaft tapers from the head, is partially parallel sided, and has a positive point. The perforation has been effected from the convex side only. There are scrape and abrasion marks on the shaft, and the pronounced point is highly polished for a distance of 1in (25mm) from the rounded point.

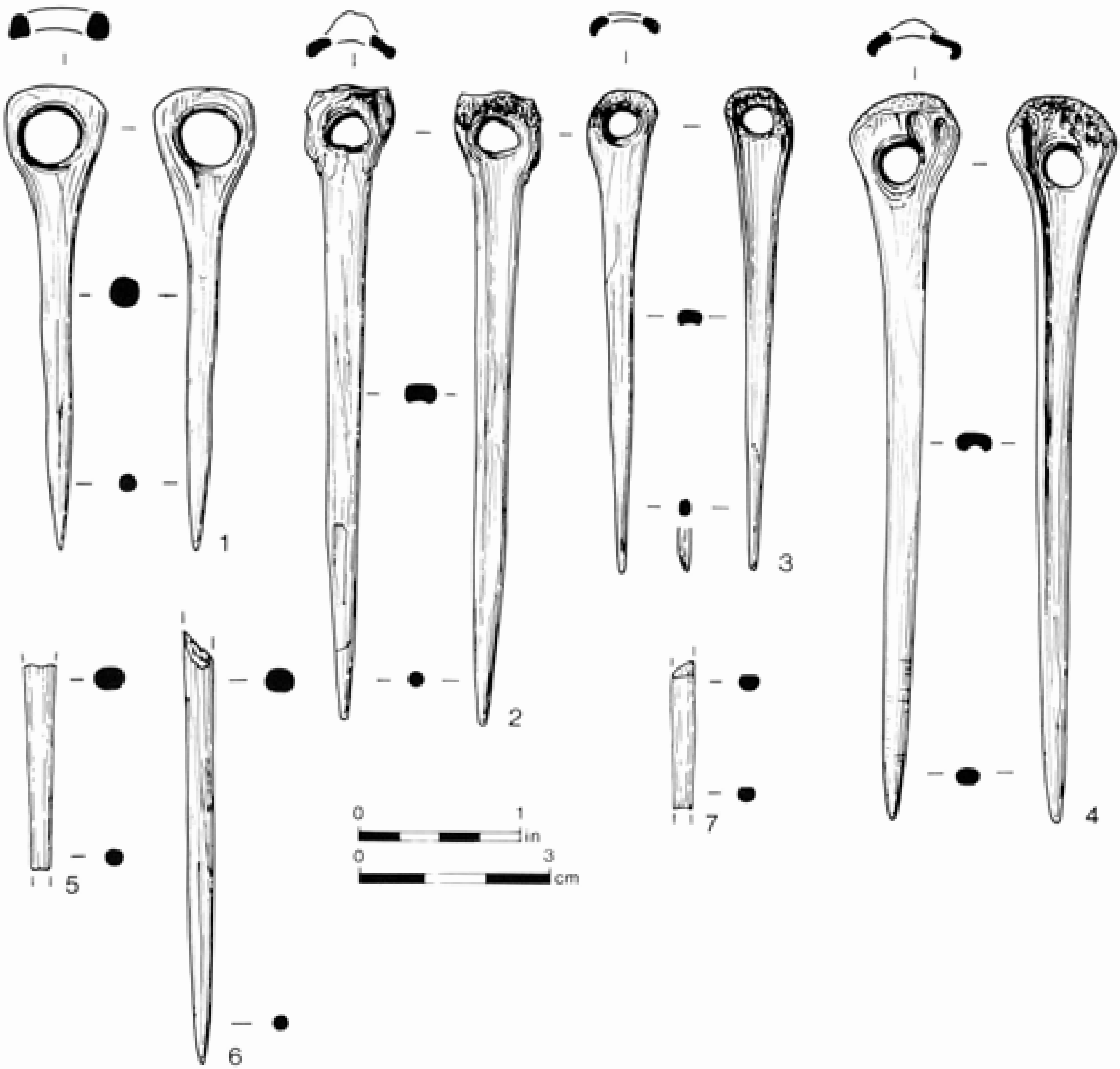


Fig 45 1 Ring-headed bone pin; 2–4 perforated-headed bone pins; 5–7 pieces of bone pins from the shaft's lower infill

Found at a depth of 97ft 4in (29.2m) in the waterlogged deposit at the bottom of the shaft (Fig 45/3).

4 Length 4.5in (113mm), breadth of head 0.75in (18mm), diameter of perforation 0.25in (8mm). It has been made from the split half of a sheep or roe deer metatarsal, so one side is convex and the other concave. The proximal end has been bevelled and bears traces of the structure of the bone's articular surface. There are also traces of its interior cancellous tissue. The shaft tapers from the expanded head; the perforation has been made only from the convex exterior of the bone, and has signs of scraping and abrasion to the required dimensions, while there is about 1in (25mm) of diffuse polish at the brown, perhaps burned, distal end. The point is well finished and circular in section. Found at a depth of 97ft 9in (29.3m) in the waterlogged deposit at the bottom of the shaft (Fig 45/4).

Pieces of shafts of bone pins

(Figs 7 and 45/5–7)

1 Length 1.313in (32mm), oval in section, the proximal end 0.188 × 0.125in (4 × 3mm). Flattened oval section, the flattened sides bearing the marks of manufacture by abrasion. The break at the distal end is recent, that at the proximal end an old one. Found at a depth of 29ft 6in (8.8m) in the chalk rubble infill of the upper part of the shaft (Fig 45/5).

2 Length 2.625in (67mm), the proximal end 0.188in (4mm) in diameter. The fragment has a

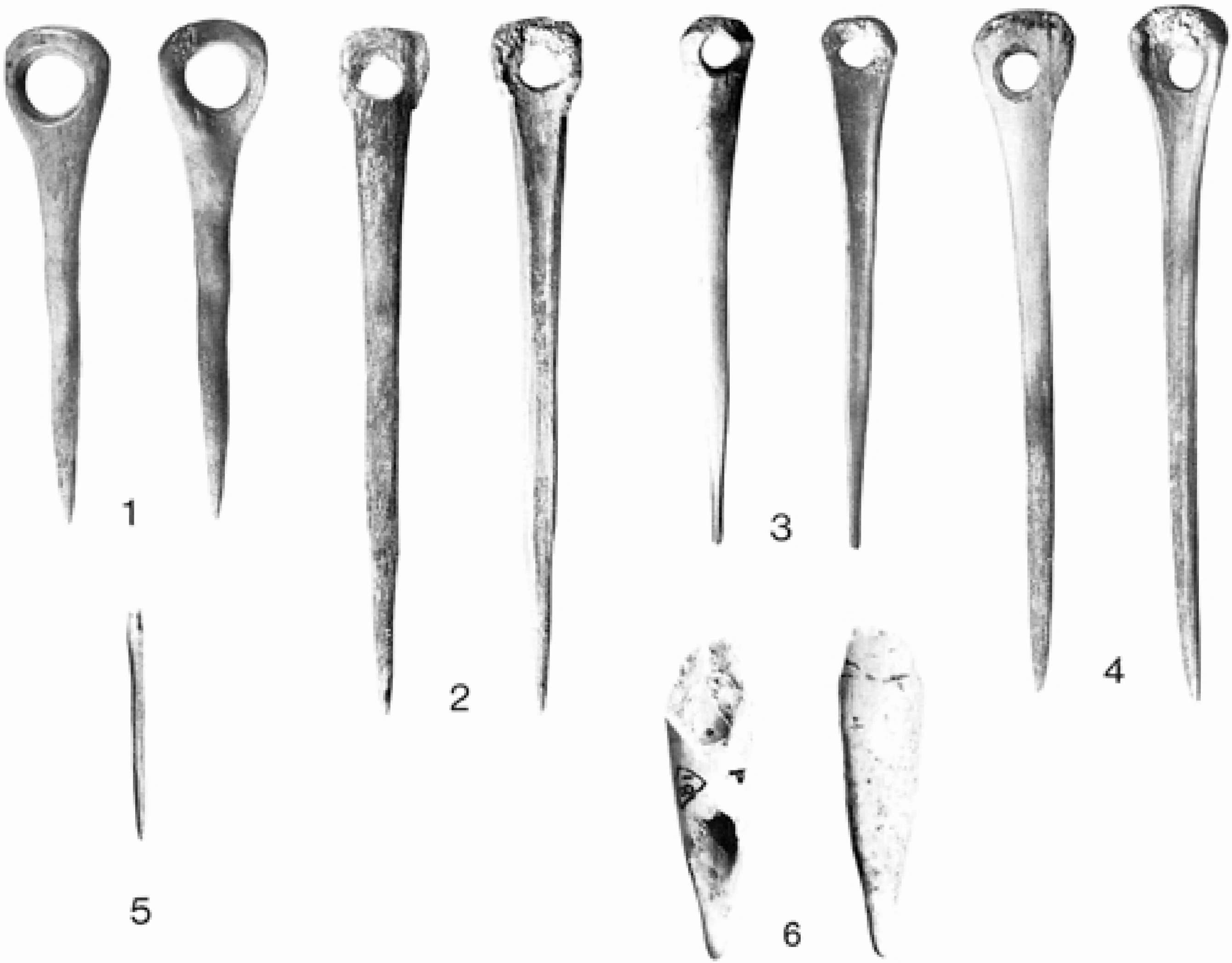


Fig 46 The ring-headed and perforated-headed bone pins, the bone needle, and broken bone point from the lower and waterlogged infills (C Middleton)

flattened oval section and bears the marks of manufacture by abrasion. Its point is matt and unpolished. The break at the proximal end is recent. Found at a depth of 73ft (21.9m) in the chalk rubble infill of the shaft (Fig 45/6).

3 Length 0.875in (22mm), approximate diameter 0.25in (6mm). Convex on one side and concave on the other. The breaks at each end are old and the surface is etched. Found at a depth of 99ft 8in (29.9m) in the waterlogged deposit at the bottom of the shaft (Fig 45/7).

These pieces of shafts are from pins that have been fashioned from long bone shafts of bovine and equine magnitude.

Point of bone awl

(Figs 7, 47/2, and 46/6)
Length of broken fragment 1.875in (48mm); length of point from shoulders 0.75in (18mm). This point has been fashioned upon the distal end of the shaft of a sheep's tibia from which it was broken in antiquity. The shaft would have served as a handle for the awl. It has striations, presumably from its fashioning, and bears a polish which may result from prolonged use. There are also some small cut marks. Found at a depth of 26ft 6in (7.9m) in the chalk rubble infill of the upper part of the shaft.

Bone needle

(Figs 7, 47/1, and 46/5)
Length 1.313in (33mm), 0.094in (2.5mm) in breadth below the elongated eye, with a median diameter of 0.063in (1.5mm). It has been fashioned by abrasion from a fragment of a long bone shaft; one side is flat, and the elongated eye has been pierced from both sides. The top is broken and the eye opened. Its entire length is polished, presumably by use, the polish at the point being considerable. Found at a depth of 98ft 3in (29.5m), on the north side, in the waterlogged deposit at the bottom of the shaft.

Piece of split, notched bone

(Fig 47/3)
Length 4.25in (106mm), breadth of split area 0.5in (12mm). Part of a long bone shaft of bovine or equine

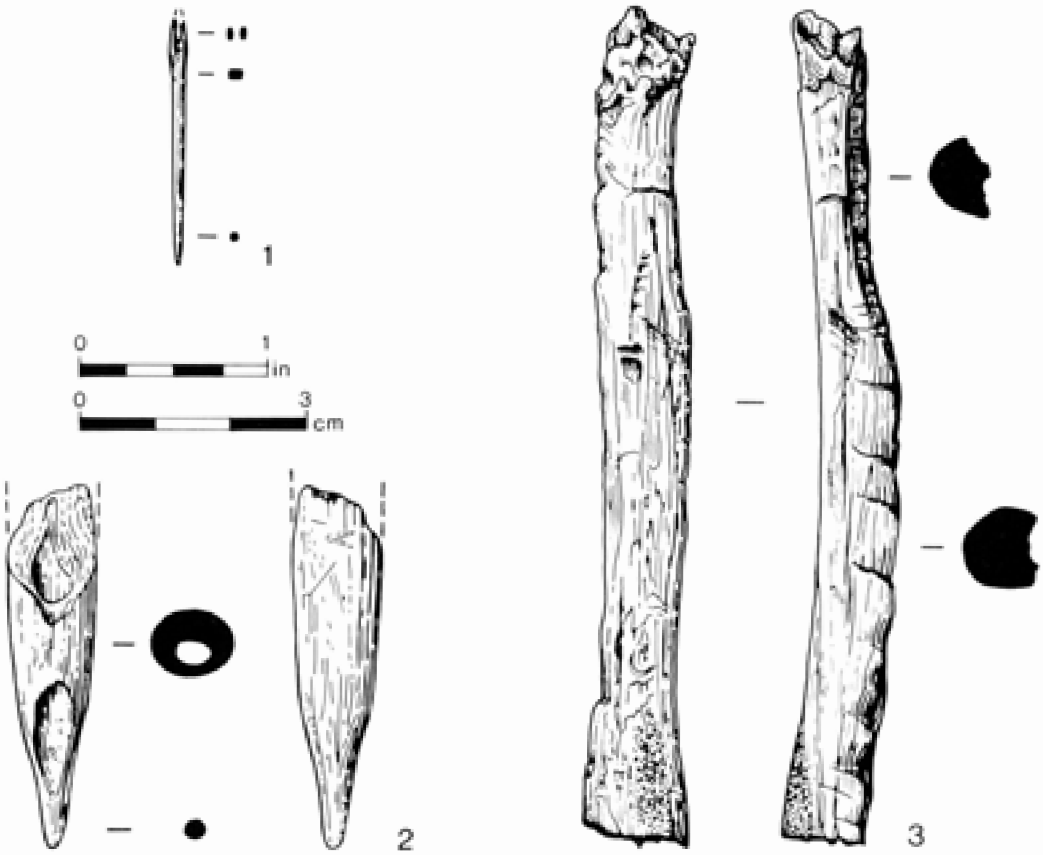


Fig 47 1 *Bone needle;* 2 *broken bone point;* 3 *piece of split notched bone from the shaft's lower infill*

magnitude. The piece and its edges have been fashioned by abrasion and notched at right-angles. The notching appears to be random and thus could relate to a manufacturing process. It could be considered as discarded waste. Found at a depth of 98ft 3in (29.5m) in the waterlogged deposit at the bottom of the shaft.

Notched bone

Length 5in (127mm). The shaft of an ovine metatarsal with the articular ends broken off, the proximal end recently, the distal end in antiquity. Its outer surface has flaked off after drying. It bears traces of cutting, presumably when green, around and at about 1.25in (31mm) from the proximal end. This cutting is, for the most part, about 0.094in (2.5mm) in depth. Found at a depth of 73ft (21.9m) in the chalk rubble infill of the shaft.

Flint artefacts and knapping debris

(not illustrated)
During the excavation of the shaft's infill, 11 struck flints were found and recorded. Of this total, 1 was an artefact, 3 were utilised flakes, and the remaining 7 waste products. The artefact is a long double-ended scraper (Clark 1960, 217); the utilised flakes have had squills removed from parts of their edges (I Smith 1965, 239). The waste includes two cores: one heavily patinated and battered with platforms at right-angles, and the other fresh and sharp-edged with but one platform, the flakes having been removed only part of the way round (Clark 1960, 216). There is also a blade, as well as a fire-fractured flake, and 15 lumps of burned flint.

A division of the scanty assemblage upon a basis of patination or the absence thereof is possible. Five flakes, which include four with traces of retouch and a core, are deeply white-patinated, while the remainder – the long double-ended scraper, three flakes, a blade, and a core – are fresh and sharp-edged. At the most there is not more than a blueish translucence on one or two of the flakes. Those of the deeply-patinated group are presumably in that condition because before they fell into the shaft as a result of the weathering process, they had been in or upon the alkaline soils in the immediate vicinity of its mouth. On the other hand, the fresh, sharp-edged struck flints, although incorporated into the chalk infill possibly as a result of human action rather than by incidental natural process, had been to some extent protected from the highly alkaline ground waters (Schmalz 1960). The condition of the patinated, weathered, struck flints is indistinguishable from that of the quantities of weathered pieces in the topsoil of the surround, many of which became incorporated into the shaft's infill as the weathering cone progressively enlarged.

A group of fresh, struck and smashed, flints found in the shaft's infill stands apart from those detailed above. Four categories can be seen: flakes (14), lumps

(4), fragments (11), and spalls (14). Five of the flakes appear to have been deliberately struck, in that they have clear platforms and more than one point of percussion. Thus it is feasible that a proportion or even the whole of this material may be of human origin, rather than resulting from weathered-out nodules falling from the top and striking others already in or upon the accumulating infill. Nodules taken from the shaft could have been incorporated into the bank or stacked close by pending use.

Besides struck flints, a small number of fire-crackled flints were found. Apart from a fire-fractured flake found in the upper fill, the pieces were concentrated in the waterlogged shaft bottom.

Details and depths of struck and other flints
Artefacts

Possible long double-ended scraper rough-out, 101ft 4in (30.3m).

Waste materials

Patinated flakes: *c* 30ft (9m); 35ft (10.5m); 98ft 9in (29.6m); 100ft 7in (30.2m). Core: *c* 96ft (28.8m). Unpatinated flakes: 29ft 6in (8.8m); 96ft 3in (28.8m); 96ft 6in (28.9m). Unpatinated blade: 99ft 8in (29.9m). Unpatinated prismatic core: 96ft 6in (28.9m).

Fresh struck and fractured flint

Flakes: 48ft 6in (14.5m); 55ft (16.5m); 73ft 6in (22m); seven pieces from 96ft–96ft 6in (28.8–28.9m); two pieces from 97ft 4in (29.2m); 98ft 3in (29.5m). Lumps: two pieces from 96ft 6in (28.9m); two pieces from 98ft 3in (29.5m). Fragments: 11 from 96ft 6in (28.9m). Spalls: 75ft (22.5m); 80ft (24m); two pieces from 96ft (28.8m); nine pieces from 99ft (29.7m); 100ft 7in (30.2m).

Fire-crackled, burned flints

Flake: 30ft (9m). Lumps: two from 98ft 6in (29.5m); seven from 99ft (29.7m); six from 100ft 7in (30.2m).

Miscellaneous pieces

Apart from struck flints and the weathered pieces brought into the accumulating infill from the topsoil, there were some natural fossil remnants, two stone chips that could have come from Stonehenge or its immediate vicinity, and a battered flint beach pebble. The fossil fragments were four pieces of casing from *Echinodermata*, a form common in the chalk, plus a small, soft, limonite nodule. All were found almost at the bottom of the shaft (*c* 100ft–101ft; 30–30.3m) and were in the waterlogged deposit.

The larger chip is of sarsen stone, and 3.25oz (81g) in weight, patently a flake deriving from a larger block. It is about 3.5in (88mm) in length, 2in (50mm) in breadth at one end, and 1.25in (31mm) at the other. One side is convex and the other concave, one edge thick and the other thin, while it is of the dense, uniform, sarsen variety and bears indications of incorporated vegetation. Its surfaces are in great measure reddened, which has for long been taken as evidence of exposure to fire, if not burning. It was found in the infill of the shaft at a depth of 46ft 8in (14m).

The smaller chip, 0.125oz (6.25g) in weight, 0.75in (18mm) in length, and 0.5in (13mm) in breadth, although weathered, is thought to be of a metamorphosed sandstone. It was found in the bottom of the shaft, at a depth of about 96ft (28.8m).

Beach pebbles are normally rounded to a degree that river transport cannot effect and are covered with chatter-marks because of beach hammering. The flint example, found in the chalk rubble infill of the shaft at a depth of about 37ft (11.1m), is a uniform, flattened ovate, weighing 3.25oz (81g) and covered with chatter-marks. Bruising at one end, which has damaged the outer surface and revealed the brown interior, points to its having been used as a hammerstone. The possibility that this pebble was brought into the area as a slingstone (Wheeler 1943, 49) should not be overlooked.

The wooden containers and other pieces of wood

Introduction

The first pieces of wood, together with twigs and seeds, were met with at a depth of about 94–95ft (28.2–28.5m). At the same time, the presence of water, which had to be pumped out, indicated that organic remains might be encountered. These had no parallel, for on the chalklands such things normally leave little trace, but they can at times be detected by sympathetic and skilled excavation (Ashbee 1960, 96). In the event, about 3880 pieces of wood were recovered from the bottom six feet (1.8m) of infill, which had been waterlogged since ancient times. Some 70% were amorphous scraps and pieces, roundwood, and twig remains. The remaining 30% were clearly parts of wooden containers, mostly stave-built with inserted circular bases reminiscent of the tub holding a bronze hoard found near Stuntney, Isle of Ely, in 1939 (Clark and Godwin 1940). Careful excavation of the deposit made possible the recovery of the wood piece by piece; indeed some circular bases and larger pieces were all but complete (Figs 22 and 23). Shreds, scraps, and broken twigs were the only components of the assemblage that were recovered by sieving (Figs 48 and 49). After cleaning, all wood and other organic materials were immersed in water, covered, and handled as little as possible.

At the time of discovery the wood was saturated and soft but, nonetheless, the toolmarks upon the various pieces, particularly of the containers, were clearly to be seen (Fig 50). It was recalled that a decade before, when excavations had been undertaken at the early Mesolithic site of Star Carr at Seamer near Scarborough, Yorkshire, wood, bone, and antler, all in much the same saturated condition as the wood, had been impregnated under vacuum conditions while the work was in progress (Clark 1954, pl III, A). Similarly, this could have been done at Wilsford, because the apparatus would have been made available by the then University Museum of Archaeology and Ethnology at Cambridge. However,

Fig 48 The sieving of the waterlogged infill, 1962: first station in the open air (P Ashbee)

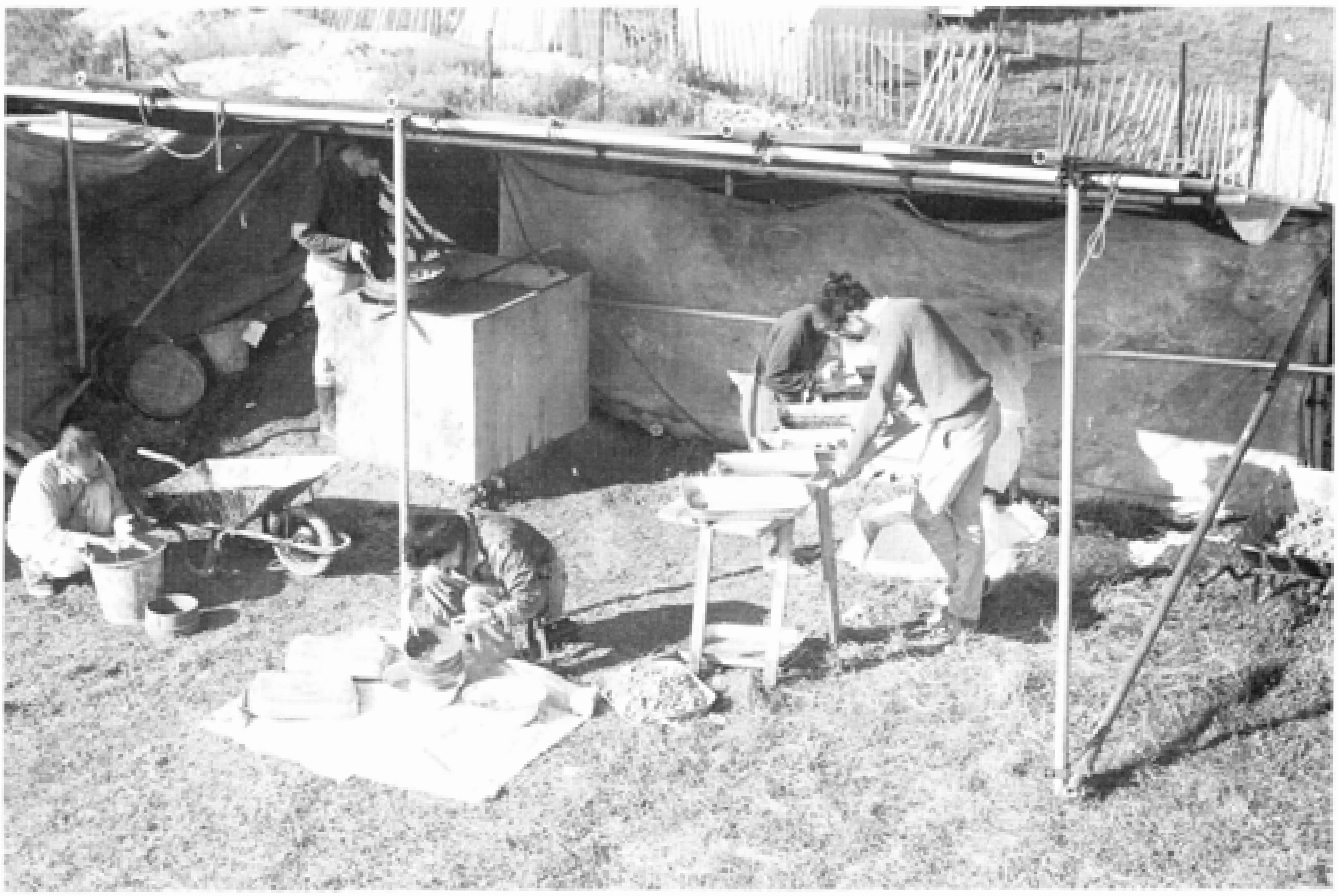


Fig 49 The sieving of the waterlogged infill, 1962: developed covered station (P Ashbee)

it proved impossible to make such arrangements for the immediate treatment of the wood, and the wooden artefact remains, other wood, and organic materials were transported to the Ancient Monuments Laboratory in London.

At the time of the excavation, the Inspectorate of Ancient Monuments and the Ancient Monuments Laboratory had agreed that the examination of the wood and other organic materials was beyond their normal capacities. Thus a suitable environmental scientist should have worked in close association with the archaeologists, but this did not happen at the time. Eventually, by the early 1970s, the wood was conserved in the Ancient Monuments Laboratory using the polyethylene glycol impregnation process. This should stabilise the wet wood by replacing the water with a waxy substance. Some worked wood was also subjected to freeze-drying, but this rendered it light and fragile. Notionally, the application of these techniques should have resulted in the worked wood and other pieces retaining their form and attributes in a hardened state capable of being handled. Apart from two circular bases, and some fragments of others, only six or seven recognisable pieces survived the Ancient Monuments Laboratory treatment. For example, only 1 of the 78 notched stave-ends, or fragments thereof, remained and that was shrunken and misshapen, while the pieces of a finely-turned bowl had ceased to exist. The assemblage recovered in 1962 was now no more than small, amorphous pieces, reminiscent of hardened garden compost.

This virtual destruction has meant that the material could not be scrutinised anew nor could a fresh descriptive narrative be prepared. Back in 1962, however, before all was handed over, drawings (Fig 51), photographs (Appendix C), sketches, and highly-detailed notes were made. The present descriptions are based entirely upon such sources, although the few surviving but much altered pieces have also been examined and described by Veryan Heal (*see below*).

While the wood was in the Ancient Monuments Laboratory, some identifications were undertaken, mainly of the parts of the containers. Further identifications of samples of the treated wood have been carried out and the earlier details incorporated by Jane Squirrell (Chapter 6). It has emerged that out of the total number of worked pieces 55.55% were of alder (*Alnus* sp.), 38.75% of oak (*Quercus* sp.), and 6.25% of ash (*Fraxinus* sp.). Of the unworked pieces 53.33% were of oak (*Quercus* sp.), 38.66% of alder (*Alnus* sp.), 5.33% of ash (*Fraxinus* sp.), and 1.33% of lime (*Tilia* sp.) and Scots pine (*Pinus sylvestris*) respectively. Of the total, some 52% were worked pieces and 48% unworked pieces. The species of samples of the twigs and roundwood scraps, part of the assemblage designated 'palaeobotanical pieces' in the interim report (Ashbee 1963, 119), were also determined. Oak (*Quercus* sp.) accounted for 33.33%, hazel (*Corylus avellana*) 30.03%, birch (*Betula* sp.) 26.66%, alder (*Alnus* sp.) 6.66%, and common dogwood (*Cornus sanguinea*) 3.33%.

At the outset the round number of pieces of wood found in the shaft was given as about 3880. This total, based on site records and Ancient Monuments Laboratory observations, does not take into account disintegration and fragmentation while in the laboratory, and it also includes the more substantial twigs, plus the pieces of roundwood, to be taken from this total, leaving 2874 fragments. Some 57.47% were featureless, often eroded, pieces of wood, 37.05% the pieces of composite containers, and 8.70% the remains of twisted withes and the like, which had bound the containers. Besides the remains of the wooden containers, a substantial piece of timber was found, set vertically in the shaft's infill against the east side at a depth of 94ft 3in (28.3m).

The readily recognisable parts and pieces of composite containers comprised the following elements: staves, notched stave-ends for discoid base retention, pierced ends for stitching, portions of scoops or, perhaps, cylindrical container bodies, and discoid bases or the fragments thereof. Withe remains are apposite to such containers for their nature demands suitable bindings. Apart from the composite container fragments, the only other receptacle was represented by the pieces of a finely-turned, omphalos-bottomed bowl, little more than 0.2in (5mm) in thickness. There was also the substantial piece of fashioned timber. The container elements and other things are, as far as possible, described below.

Staves

(Figs 50, 52, and 51/1)

Some 786 pieces, 29.39% of the wood remains and 64.10% of the composite container parts and fragments, were considered to be of staves, as distinct from their fashioned ends. Most of these pieces were straight or slightly convex in section and were approximately 3in (75mm) in length and 2in (50mm) in breadth. Some 20 or more pieces were larger, about 7in (175mm) in length. Very many were much smaller. Most were about 0.5in (13mm) in thickness, a few less, and some almost twice the average. Where edges remained, these were squared. It was thought possible that many of the thicker pieces might have been discoid base pieces, but they were included here because of their squared edges. Even when wet, many fragments could be joined. Where ends – presumably upper ends – had survived, they were rounded and worn. All in all, the fragments were thought to be from straight-sided, flat, or convex if broad, staves of about 3in (75mm) to 4in (100mm) in width. Outer surfaces were mostly smooth, some inner surfaces (convex pieces were scrutinised) were striated. Some smooth outer surfaces displayed apparent traces of skilled adzing, the facets or marks that can result from the removal of unevennesses and the ultimate squaring of timbers with this tool. Other surfaces had axe cuts upon them comparable with the dressing of the chalk sides of the shaft. It should not be overlooked that axing can also square up timber, and it may be difficult, if not impossible, to distinguish this work from that of an adze. Presumably after timbers were squared and cut to required lengths, the staves were axe-hewn. One or two of the more massive staves had circular or oval

Fig 50 Pieces of bucket staves, some displaying toolmarks (English Heritage)

worn holes through them. Presumably, if the containers were used as buckets, these would have been for rope or withe handles. The high degree of gloss on some of the larger pieces could have come about from handling.

The collapse and fragmentation of such substantial staves represented by the recovered pieces were presumably due to the pressures exerted by the accumulation of chalk rubble in the shaft upon the water-saturated wood. Relatively long staves would have been particularly vulnerable.

Stave-ends notched to house discoid bases

(Figs 53, 54, and 51/1)
The notched stave-ends, or fragments thereof, comprised 6.35% of the composite container remains. Some 78 pieces were in this category: only about a dozen pieces retained their two flanges, designed to house and retain the discoid bases, and the remainder were fragments, some only chips from flanges. This fragmentation occurred because the bottoms of the staves had been left thicker, presumably by crosscutting and controlled cleaving, to allow for the incut grooving to house the base, and thus the flanges were cut across the grain. In concert they would undoubtedly have functioned satisfactorily but, when a container became dissembled, they must have been even more prone to fracture than the upper stave portions.

Certain of these channelled stave-ends were more massive than others and had correspondingly more substantial flanges. This probably represents the diversity of containers as shown by the relative substance of the plain pieces of stave. Such differences should also be apparent in the thicknesses of the discoid bases and their various fragments, as the makers of these sophisticated composite containers would have been fully conversant with the practical necessities for harmony and precision as they assembled their products.

Although a detailed examination of the mode of preparation of the surviving incut stave-ends has been undertaken by Veryan Heal (*see below*), certain pieces were also scrutinised at the time of excavation. One particular piece showed that there had been downcutting, possibly finishing, above the upper flange and that the upper, bevelled surface of that flange had been crosscut at an obtuse angle to the run of the stave. The same pattern was observed on a piece where only the lower flange had survived. There was downcutting on the stave and crosscutting at an angle of the flange's upper edge. The equalities of one particular group of pieces, 17 in all, suggested that there could have been a certain amount of evening-up of the lower interiors and exteriors of the containers after they had been assembled. In one or two instances the bottoms of certain cross-channelled staves, which would have formed an effective footring when assembled, displayed signs of wear.

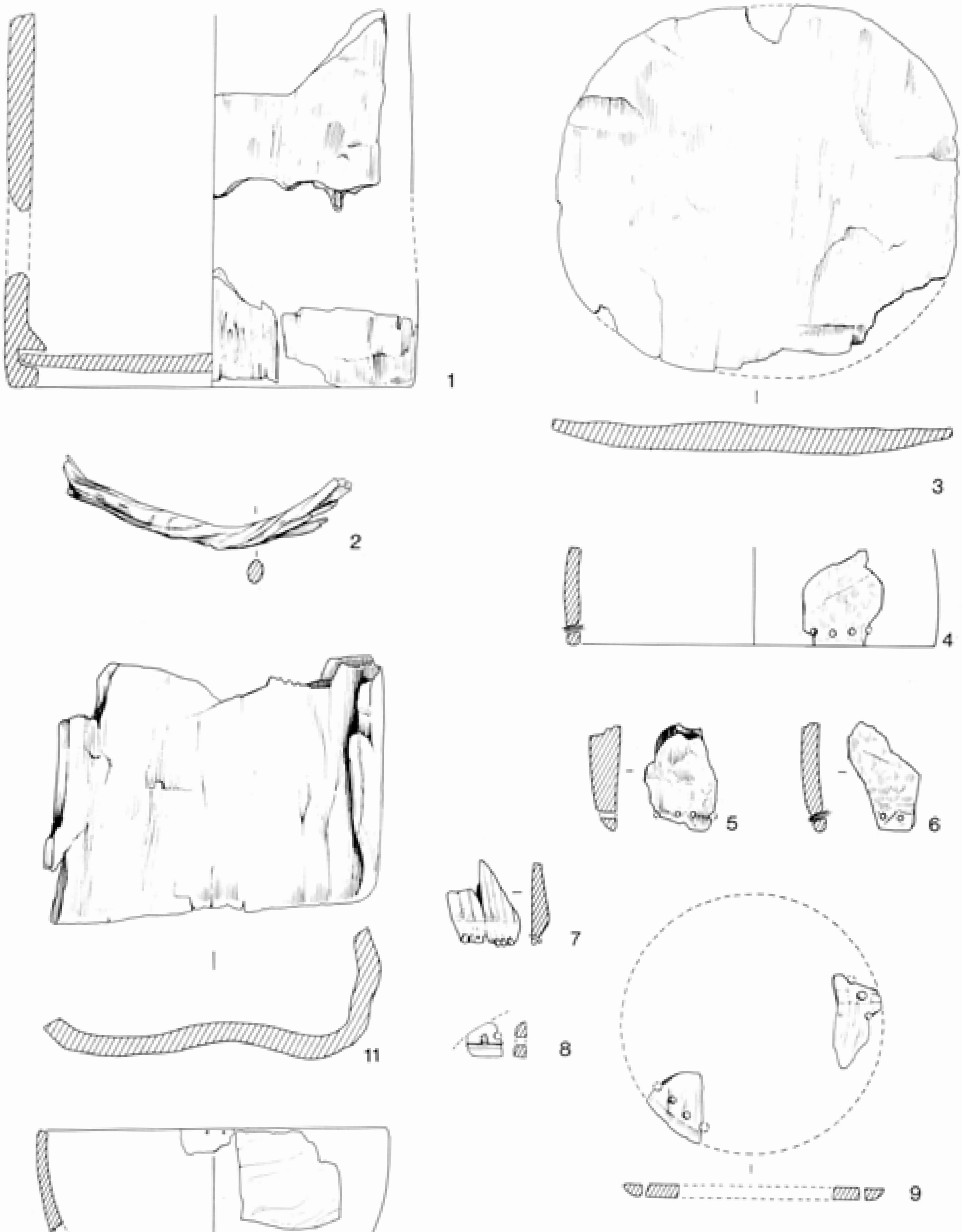


Fig 51 Wooden artefacts from the waterlogged deposit at the bottom of the shaft

Fig 52 Bucket stave pieces, some with worn upper ends (English Heritage)

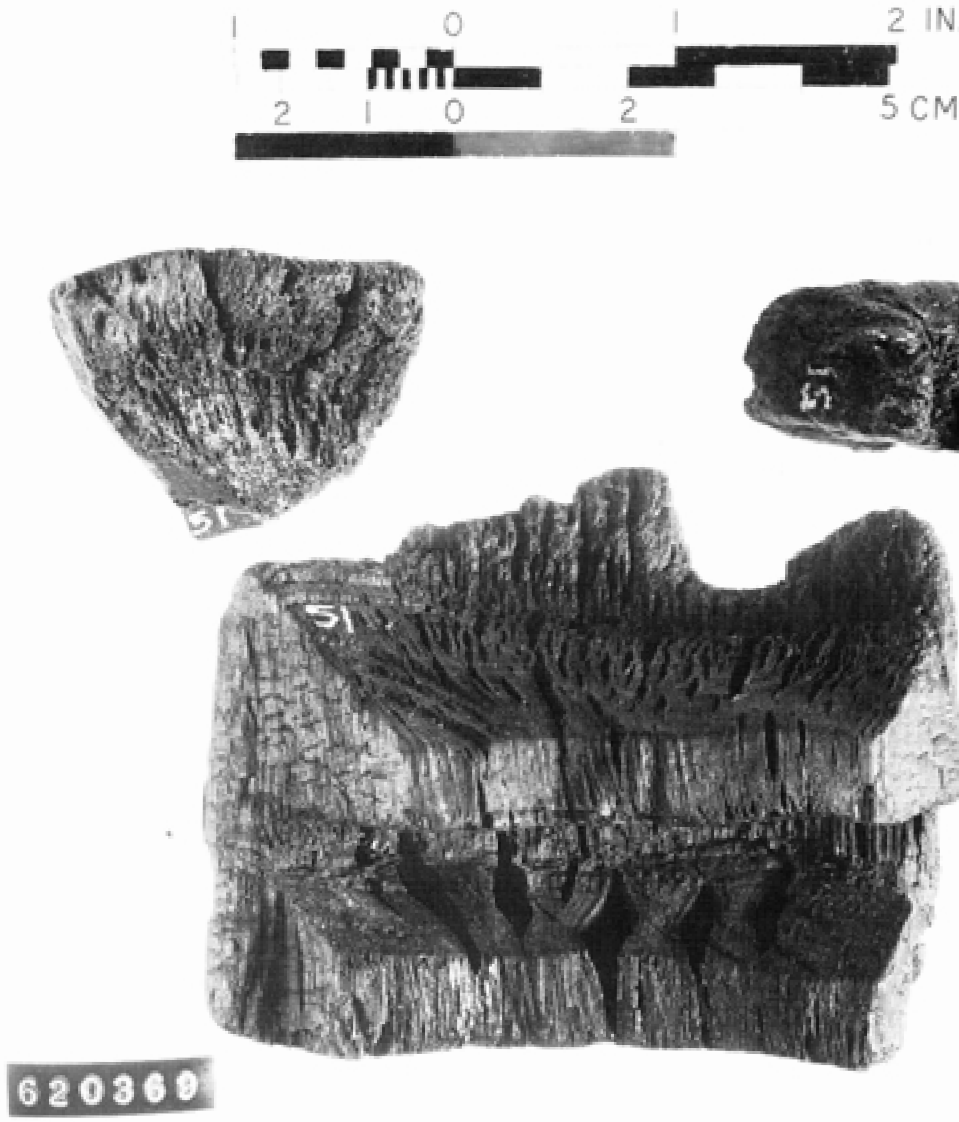


Fig 53 Detail of thickened, rebated lower stave-end (English Heritage)

Dual container bodies (or scoops)

(Figs 55 and 51/11)
One large piece, described in the interim report as from 'a hod-like monoxylous container', had a near-right-angled profile and a worn, fashioned, as distinct from broken, edge. Eight other pieces could have belonged to a similar object, for their edges and traces of close curvature set them apart from the stave fragments. They comprised only 0.73% of the composite container element. Two such components, with an appropriate base, could have been assembled into a more-or-less rectangular container. Used apart, with stops, they could have served as scoops, ideal tools for collecting even chalk rubble within a confined space.

Large components of this kind could not have readily been given incut channels for the retention of a base, or, had they been scoops, a stop. When such a monoxylous container body was given a base, it would usually be stitched on to the bottom with appropriate material (Battaglia 1943, 44, fig 8). Thus the pieces displaying perforations at their edges, and, in one instance some fibrous strands, may belong to this category.

If the components were scoops, in appearance not unlike those used until recently by millers and corn-chandlers, they would have had handles. There was a possible handle 5.5in (138mm) in length, with a rounded end, about 1.5in (38mm) in diameter, tapering to a diameter of less than 0.75in (18mm), besides the fragment of another of the same kind.

Pierced edges and ends

(Figs 56 and 51/4–10, 12)
The pieces and scraps that were seen to have been from containers that had been stitched together, presumably base to body, numbered 51 – 4.14% of the composite container remains. All the pieces had broken edges, and none of them could be seen as from the ends of staves. In one or two pieces there remained fibrous material from the thong system that had held the containers together. There were body pieces, with varying degrees of curvature, of two kinds. A number were substantial; indeed one piece was almost 0.75in (18mm) thick, while the remainder

Fig 54 Rebated bottoms of bucket staves (English Heritage)

were about 0.375in (9mm) in diameter, set close (0.25in; 6mm) to a rounded or tapered edge. Two pieces, and probably others, were from a circular base, thought to have been about 6in (150mm) in diameter, but possibly larger. The edges of these pieces had been bevelled and had worn to a slightly rounded profile, while the substantial perforations, 0.188in (5mm) in diameter, were at about 0.625in (15mm) centres and 0.5in (13mm) from the periphery. Insubstantial adze or axe facets were clearly visible on some pieces which in one or two instances had a worn appearance. Other perforated pieces frequently had a considerable curvature – indeed it was hazarded that they might have been from a monoxylous bowl – and were distinguished by either a flat or steeply-bevelled edge and fine, spaced, or closely-set perforations at their finished edges. The perforations were 0.063in (1.5mm) at 0.625in (15mm) centres on one flat-rimmed piece and close-set, only 0.188in (5mm) apart and about the same distance from the acute edge, on the steeply-bevelled fragments. In these, remains of the stitching had survived. These pieces which displayed the fine perforations were distinctive because of their fine, facet-free surface which was thought to have been polished, although perhaps through use.

Discoid bases

(Figs 22, 23, 57, 58, and 51/3)

Two of these bases were found, almost intact, in the lower infill of the shaft, and it was possible to recover them in a near unbroken condition. In the event the readily-recognisable pieces of seven other bases were found, in addition to more than 40 pieces that could well be from similar bases. The bases and some of their pieces were conserved in the Ancient Monuments Laboratory, and their specific details, such as remain, are discussed separately by Veryan Heal.

Those bases, found more or less complete (Figs 22 and 23), were about 9in (230mm) in diameter and 0.625in (15mm) thick, with a sloped, tapered, bull-nosed periphery about 0.25in (6mm) deep. They readily fitted the channelled stave-ends, for their peripheries were slighter, and, when the containers were assembled, there was presumably wedging and caulking. In profile these bases were plano-convex. Such a convexity, when uppermost, would have taken the weight of the contents which would have compacted the joint. While one convex surface appears to have been a standard pattern for these discoid bases, convexity was much more marked when alder was used instead of oak, because,

Fig 55 Reconstructed part of scoop (or monoxylous container) body and stave ends, three, assembled (English Heritage)

although it is durable in water, it splits more readily under stress than the harder wood.

Preservation unfortunately obliterated all traces of preparation and fashioning. A suitably selected, and appropriately split, plank could have provided a number of blanks. The scrutiny of the bases, and certain other pieces, at the time of discovery showed split surfaces, with the irregularities removed by incidental adzing, and thereafter the circularity attained by axing and possibly abrasion. Such circularity could have been effected by the use of compasses; the absence of any trace could point to the employment of a pattern.

Apart from a piece of pointed timber, the bases were the only things that had survived in a more or less intact condition in the waterlogged deposit at the base of the shaft. It could be that their circularity and grain-pattern made them more resistant to the pressures and stresses exerted by the weight of overlying infill: forces that snapped and fragmented the more gracile staves and other slighter artefacts. In one instance, pieces of chalk were embedded into the softened surface, yet the base had neither broken nor disintegrated.

Withes

(Figs 58 and 51/2)
Although some 250 twisted pieces were designated at the time of discovery as withes, only one has survived. One piece was some 6in (150mm) long and displayed about eight or nine twists within its length. Withes would have effectively bound the stave-built containers (eg E Evans 1949, figs 68 and 69). On the other hand, they could have been integral to basketry, for traces of apparent 'wickerwork' were encountered. It may well be significant that a considerable component of the sampled roundwood and twig material proved to be hazel (*Corylus avellana*), which is traditionally used to strengthen the softer willows. Indeed, withes that had been included with the pieces of cordage (discussed below) consisted of two pieces twisted together which have been considered to be hazel (*Corylus avellana*).

Monoxylous containers

Certain finely-finished pieces, with traces of turning, attracted attention and were patently from a turned bowl which had had an omphalos bottom. It could have been as much as 8in (200mm) in diameter, about 3in (75mm) deep, and no more than 0.2in (5mm) in thickness. The curvature of a number of more substantial pieces could have come from a larger and deeper bowl. Insufficient pieces were gathered to allow any indication of its character.

The pointed piece of timber

(Figs 59 and 60)
This substantial piece of timber, pointed at one end and bevelled at the other, was about 1ft 8in (0.5m) in length and 8in (200mm) in breadth. Axe marks were seen upon its ends and a few upon its body, but the general appearance was one of wear and abrasion. It was found in the shaft's infill, point uppermost, against the east side at a depth of 94ft 3in (28.3m) and was of oak (*Quercus* sp.).

The featureless fragments of wood

These indeterminate pieces, mainly of oak and alder, numbered 1645, including scraps from sieving. All were angular and abraded. A few were almost 3in (75mm) in length and 1.5in (37mm) in breadth, but in the main they were 1in (25mm) in length and about 0.5in (12mm) in breadth.

Twigs and roundwood

Some 963 pieces were classified as twigs, and 41 were unmistakeably roundwood. It is possible that pieces of withes, especially if worn and disintegrated, were included within this category. Sampling has shown that alder (*Alnus* sp.), birch (*Betula* sp.), hazel (*Corylus avellana*), and oak (*Quercus* sp.) were present. During the course of the investigation of the waterlogged deposit about a dozen interwoven pieces, thought at the time to have been wickerwork, were encountered. There is therefore the possibility that this category may largely represent decayed and disintegrated baskets.

The wooden containers and other artefacts: summary

In general terms, the composite containers were about 10in (250mm) in diameter and could have been some 12 or 14in (300 to 350mm) in height. Besides having been bound with withes, their handles could have been of the same material. The remains of the larger monoxylous container were too sparse for comment. The substantial piece of pointed timber could have been from some shaft-head installation. Roundwood and twigs could have been all that remained from a number of sturdy baskets, although other possible origins are considered in the environmental report (Chapter 6).

Fig 56 Perforated stave ends from stitched containers (English Heritage)

Although the conservation processes had been detrimental to the wooden artefacts and other remains, they were nonetheless examined by Veryan Heal, then of the National Maritime Museum. She commented upon the nature and workmanship of the various surviving, although much altered, pieces. Her account supplements the fundamental description based upon the records made at the time of the excavation.

Some conserved wooden artefacts
by Veryan Heal

Photographs of the wood fresh from the shaft show excellent condition and good working details discernible. Twenty-five years later the artefacts are fragmentary. This and the blurring effects of conservation have resulted in the almost total obliteration of evidence for working. Examination cannot therefore be as detailed as would have been possible immediately after excavation and before conservation. Nonetheless, the material is an important group for evidence of prehistoric wood technology.

The bulk of the wood is small diameter roundwood twigs and fragments bearing no trace of working. Among these, however, are pieces characteristic of secondary shoot growth from severed trunks with curving heels and straight cylindrical stems, some of which have had the leading shoot removed leaving a scar and subsequently growing on (Fig 61/1). With such a sample, no case can be made for coppicing, lopping, or topping. It is possible that secondary growth from felled treestumps was being used.

Among the artefacts, the parts of stave-built containers with inserted bases are the most striking group. Photographs taken before conservation show examples of the lower end of staves with an incut slot to house the base. Only one has survived. Shaped from a tangentially cut blank of alder (*Alnus* sp.), this survives to a height of 40mm and width of 20mm, its thickness ranging from 15mm at the foot and 11mm at the base of the slot, to 18mm above the slot. It has broken radially and the surfaces are eroded, but scars remain in the slot from its shaping: fine blade-edge incuts directed in and slightly upwards at the top and bottom of the slot. No other toolmarks remain (Fig 61/2).

Other examples fashioned in the same way can be seen (Figs 53 and 54). The blade incuts show that the

Fig 57 *Reconstructed container (a bucket) base (English Heritage)*

slots were cut by strokes directed straight into the wood, followed by the prising out of the parts between. The working is only visible in the over-deep incisions of the swung blade, and there is no trace of a pushed blade, such as a chisel, having been used to shape the slot. The Stuntney Fen bucket (Clark and Godwin 1940) displays similar workmanship.

Other pieces of alder, which retain tangentially-worked, curving cross-sections and in some cases still have worked edges, appear to be parts of staves, but only fragments. The largest piece is less than 150mm long, they range in thickness from 4mm to 20mm, most being approximately 10mm, and are gently curved. Where traces of edges remain, they are squared. One piece gives an indication of the shaping of the upper ends, having a 10mm thick rim, straight outside surface, and slightly concave inner surface beneath the lip. The rim surface bears two parallel facets running around the circumference (Fig 61/3). This is the only piece which still retains specific shaping of the end. Another has a squared end and remnants of one side. It represents a simpler form of stave, 15mm thick and remaining to a width of 120mm.

All the stave fragments show similar characteristics, the tangential grain in section, and uniform thickness with expansion at the base. The smooth surfaces show little trace of external working, although two pieces (Figs 61/4 and 5) show residual evidence of longitudinal facets, 10–12mm wide. This suggests a fairly standard method of manufacture: tangential alder blanks shaped to a curve in cross-section and straight in profile, thicker at the base where the slot was cut, these thicker parts forming a 'footring' when the container was assembled. Above the bevel translating from the thicker base to the sides, the staves rose straight, their upper and lower edges being squared, though the sides would probably be slightly bevelled to create a tight fit when assembled in a circle. No trace of binding or joining remains.

Examples of the bases of these containers have survived: they were single pieces of oak (*Quercus* sp.) or alder (*Alnus* sp.). None are complete, but they appear to conform to a standard pattern: roughly circular, although now distorted from shrinkage, with a cross-section thicker in the middle than at the edges. The most complete is of oak, 200mm in diameter, 10mm thick in the middle, tapering to the circumference asymmetrically (Fig 61/6). Apart from a few chips from the edges, it is intact and was radially split from a very slow-grown oak (13 annual rings per 10mm).

Of the nine bases, seven were of oak, all worked from radially-split blanks. In some cases (Fig 61/8) one face was the simple split ray surface, the other worked to flatten it, although no discernible tool-marks remain. The use of the ray face conforms to the more recent practice in cooperage of using this split surface as the internal face of the heads of barrels, because it is naturally impervious due to the cells in the ray being evolved for the carriage of fluids in the radial plane and not tangentially through it. Both alder bases (Fig 61/9) were made from tangential blanks and were slightly domed in cross-section. Alder does not have strong rays and it splits more easily in the tangential plane than oak.

Only one example of bored wood with thonging had survived. The freeze-dried and fragmentary piece was made up of fragments that do not belong together. The maximum post-conservation thickness is 15mm, although most fragments are 5–8mm thick, tapering to 4mm at the edge. It is not possible to determine the original dimensions in plan. Where adjacent holes remain, they are approximately round, usually wider at one end than at the other, suggesting the use of a hand-held boring tool bi-directionally rotated. They slant through the wood and are up to 5mm in diameter, but more commonly 2mm. The stitch material appears to be vegetable, possibly two-stranded or a single twisted piece. There is no clear indication of function, but the wood would appear to be part of a round base or lid, bound by stitching to the sides or rim.

There are two pieces which were described as scoops. They are both of ash (*Fraxinus* sp.), tangentially split, and joining to form a piece 125mm long and 150mm wide with an average thickness of 13mm. This is not apparently scoop-shaped now, but has smooth surfaces. Two pieces of alder and oak, both tangentially split, give no clue as to function. A tangentially-split piece of oak does have a double-

Fig 58 Bucket base and pieces of withe (English Heritage)

bevelled edge which might be the rim of a vessel (Fig 61/10). This is 14mm to 20mm wide and was made by successive cuts around the circumference with a 40mm wide blade.

An 8mm thick tangentially-split piece of alder retains part of a hole of incomplete diameter (at least 10mm), which was purposely cut (Fig 61/7). This might have been for a rope handle, knotted at the ends, which would have been a possible form of handle for the stave-built buckets. A piece has also been considered a bucket handle, although it is only a small fragment of alder. It remains to a length of 95mm, a width of 35mm, and is 22mm thick at maximum. It could be the side and arch of a wooden handle.

There are parts of a radially-split oak timber. The pieces remain to a length of 53mm and were cut to a slanted point (Fig 60). There are also some twisted withes (Fig 61/11). Such pliable and supple strands would have a wide range of uses in tying or binding and in wickerwork. There were also a large number of indeterminate fragments, mainly of oak and alder. A large proportion of these are radially-split oak up to 100mm in thickness.

The pieces of cord

(Fig 62)
The waterlogged deposit at the base of the shaft yielded seven pieces of well-preserved, well-finished cord, one of plait, and a hair. One piece of cord was about 3in (75mm) in length, others were 2.625in (65mm), 1.5in (37mm), and 1in (25mm) respectively. Their quality was such as would have been produced by the employment of a cross-bar, or even a cranked brace, in a rope walk (Hodges 1964, 129).

At the time of discovery it was thought that the fibres were of White Bryony (*Bryonia dioca*). However, a sample was sent in 1965 by the Ancient Monuments Laboratory to the Tropical Products Institute, and they commented as follows:

> 'The rope is of three-strand (plain or hawser-laid) construction. Each strand has been formed with an S-twist. These 3 strands have twisted together ("laid") in the reverse direction ie with a Z-twist.
>
> The approximate diameter is $\frac{3}{8}$in [9mm] (rope is more than 1in [25mm] in diameter; this material is cord, ie less than 1in [25mm] in diameter) but since immersion in water causes swelling the original dry diameter would have been less – probably around $\frac{5}{16}$in [7mm]. If we assume this diameter then the breaking load would probably be in the region of 5cwt [252kg].
>
> The fibre from which the rope has been made has not been identified but a preliminary examination suggests that it is a bast fibre (ie from a dicotyledonous plant).'

Fig 59 *Double-pointed piece of timber found set vertically in the infill against the east side of the shaft at a depth of 94ft 3in (28.3m) (P Ashbee)*

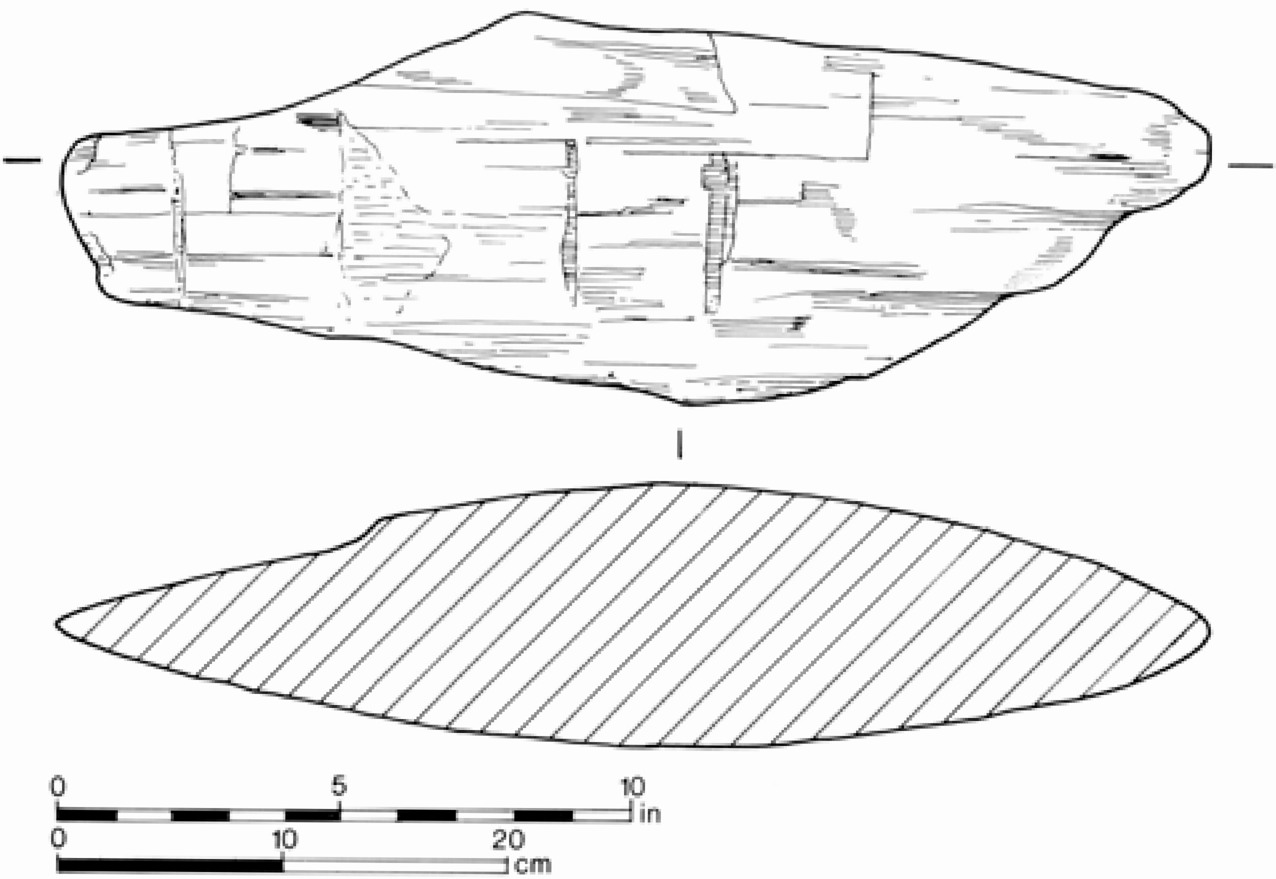


Fig 60 *A substantial double-pointed piece of timber found set vertically in the chalk rubble infill against the east side of the shaft*

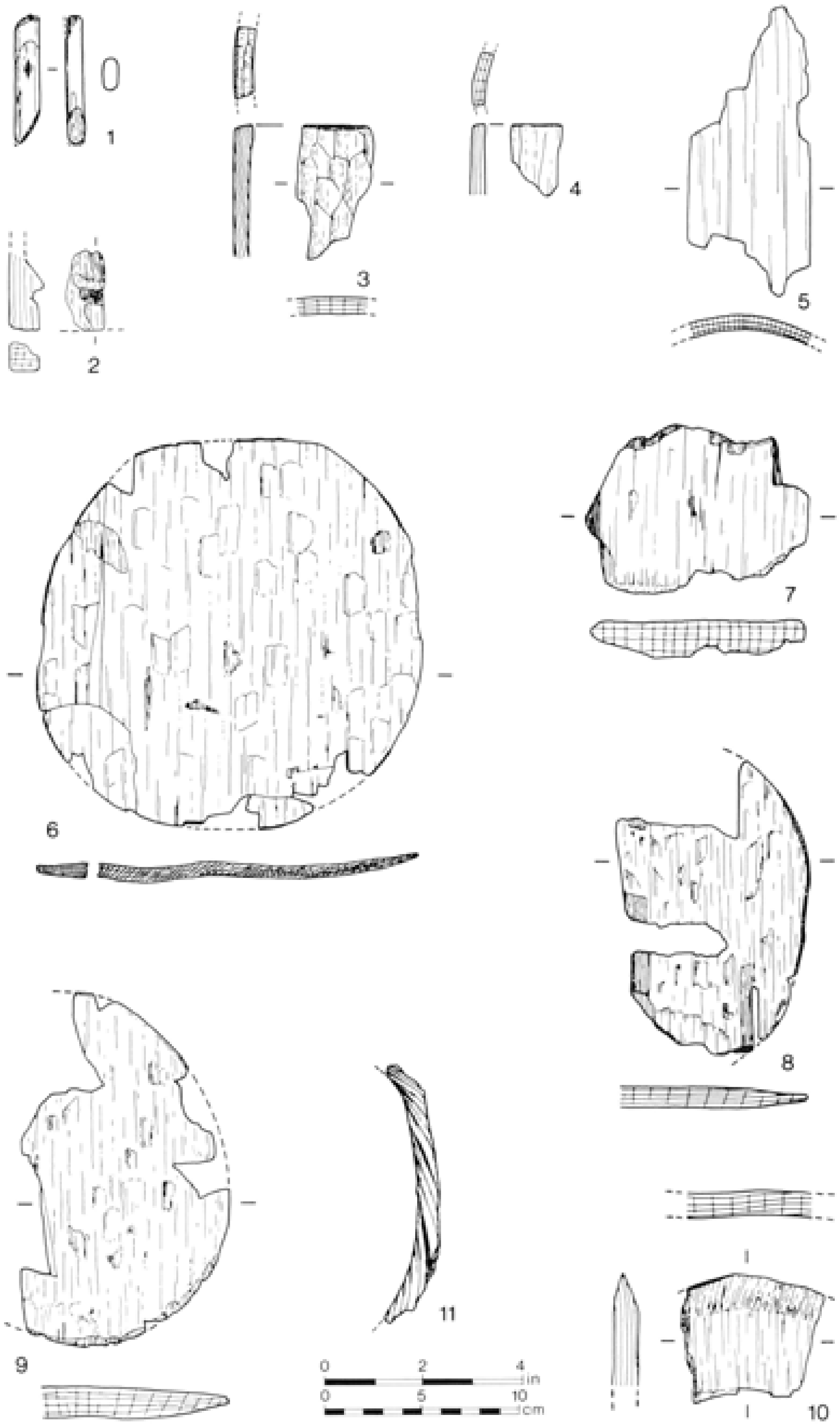


Fig 61 Details of workmanship on some wooden artefacts: 1 cut roundwood fragment; 2 stave-end slotted for base insertion; 3 stave rim-end with facetted edge; 4 stave fragment with worn rim-end; 5 stave fragment; 6 cylindrical container base; 7 thick stave fragment retaining part of a purposely-cut hole; 8 part of a cylindrical container base; 9 part of a cylindrical container base; 10 possible double-bevelled rim; 11 twisted withe fragment

Fig 62 Piece of cord c 3.5in (90mm) long from the waterlogged infill at the bottom of the shaft (English Heritage)

Nothing more was done until 1986, by which time the pieces of cord and plait had unfortunately largely disintegrated. Penelope Walton has been unable to state more than that the pieces were of vegetable fibre (Chapter 6).

The single hair was thought to have been from a bovine tail, but this has subsequently been lost.

The artefacts from the shaft's infill: comparanda and comment

The Deverel-Rimbury barrel urn (Fig 41) belongs to the recently defined central Wessex series (Type 2a: Dacre and Ellison 1981, 173). Indeed, Ann Ellison has kindly listed those urns which are its counterparts (*in litt*, 2 October 1986). Two of these, from Amesbury 77 (C M Piggott 1938, 187; Grinsell 1957, 152), closely resemble our urn, and the possibility of potting within at least a close-knit circle of individuals could be envisaged. They were both found beneath barrows. That from Bishopstone had been inverted over burned bones in a grave. The present example, although not from a domestic context, is in accord with the broad incidence of Deverel-Rimbury pottery, as is the sherd from a typical Type 1 globular vessel (Dacre and Ellison 1981, 173).

Shale rings (Lawson 1975, 241–2) comparable with the example found in the shaft are scarce in Wiltshire. One, of almost exactly the same size but with segmental ornamentation, came from the Upton Lovell 2 barrow; two smaller ones, accompanied by a segmented faience bead, furnished a cremation beneath the Durrington 47 bowl barrow; and two more, with a miniature vessel and four segmented faience beads, furnished a cremation from the Winterbourne Stoke 68 disc barrow. The same grave had in it a cinerary urn, a large amber bead, and three shale beads since lost. Two further, similar shale rings without provenance are preserved in the museum at Devizes (Annable and Simpson 1964, nos 243; 334–5; 460–1; 477–8). In north-eastern Wiltshire a shale ring was among the trinkets which accompanied the famous cups beneath the Aldbourne 6 bowl barrow (Grinsell 1957, 147; Kinnes and Longworth 1985, no 280). In Wiltshire, the *Wessex* context of these shale rings seems unambiguous. However, at Cassington, in Oxfordshire, an early stage beaker was accompanied by a shale ring of the same diameter as the Wilsford example (Leeds 1934, 269; pls XXXI, 1; XXXIV, 2; Clarke 1970, 311: 240). A fragment was found at Flag Fen (Pryor *et al* 1986, pl 11a), and a similar ring was in a small collared urn at Salmonby in Lincolnshire (May 1976, 77, fig 44, 2; Longworth 1984, no 903), while others have been dug from barrows in Derbyshire and Yorkshire (Bateman 1861, 229; Vine 1982, 405, nos 947–8). Substantial rings after the fashion of these were in the remarkable assemblage from the Heathery Burn Cave, in Co Durham (R Smith 1920, 47, fig 33; Britton 1971, 25).

Amber beads are, for the most part, also a *Wessex* phenomenon, allegedly furnishing female burials (Ashbee 1960, 111; S Piggott 1973, 363–5; Gerloff 1975, 202). Small discoid amber beads are integral to the thousand-bead necklace with spacer plates from the Upton Lovell 2e barrow, besides other comparable assemblages (Annable and Simpson 1964, 48, 227; 54, 342). They were also an ingredient of the later Irish necklaces, two of which contained 421 and 500 beads respectively (Prendergast 1960; Flanagan 1964). There are numerous shale counterparts which continue a style of considerable antiquity (Ashbee 1967, 10, 12–13). Precise equivalents to the biconical amber bead are few, although the forms of certain seemingly similar examples recovered from graves cannot be precisely ascertained because of their condition. One such bead, however, was found with the primary cremation beneath the eastern mound of the double bell barrow Wilsford 16, in the Normanton Group, with other amber and shale beads besides a miniature vessel now lost (Grinsell 1957, 214; Annable and Simpson 1964, 52, 308–12; 107, 310). Indeed, as Thurnam (1871, 509) so presciently implied, this is a form more common to shale and jet. Moreover, this variety may have had an especial significance, illustrated by the gold-bound examples (Annable and Simpson 1964, 44, 157; 47, 196) and their various associations (Fox and Stone 1951). A rendering in amber (Clark 1986, 28) might point to this.

A ring-headed bone pin, comparable with that from the shaft's lower infill, was in an urn, now lost, which contained a secondary cremation burial in the Wilsford 40 bowl barrow, one of the Lake Group close to the shaft (Grinsell 1957, 198; Annable and Simpson 1964, 110, 359). Another was with a cremation burial beneath the Collingbourne Ducis 21(c) bowl barrow some ten miles (16km) distant (Grinsell 1957, 168;

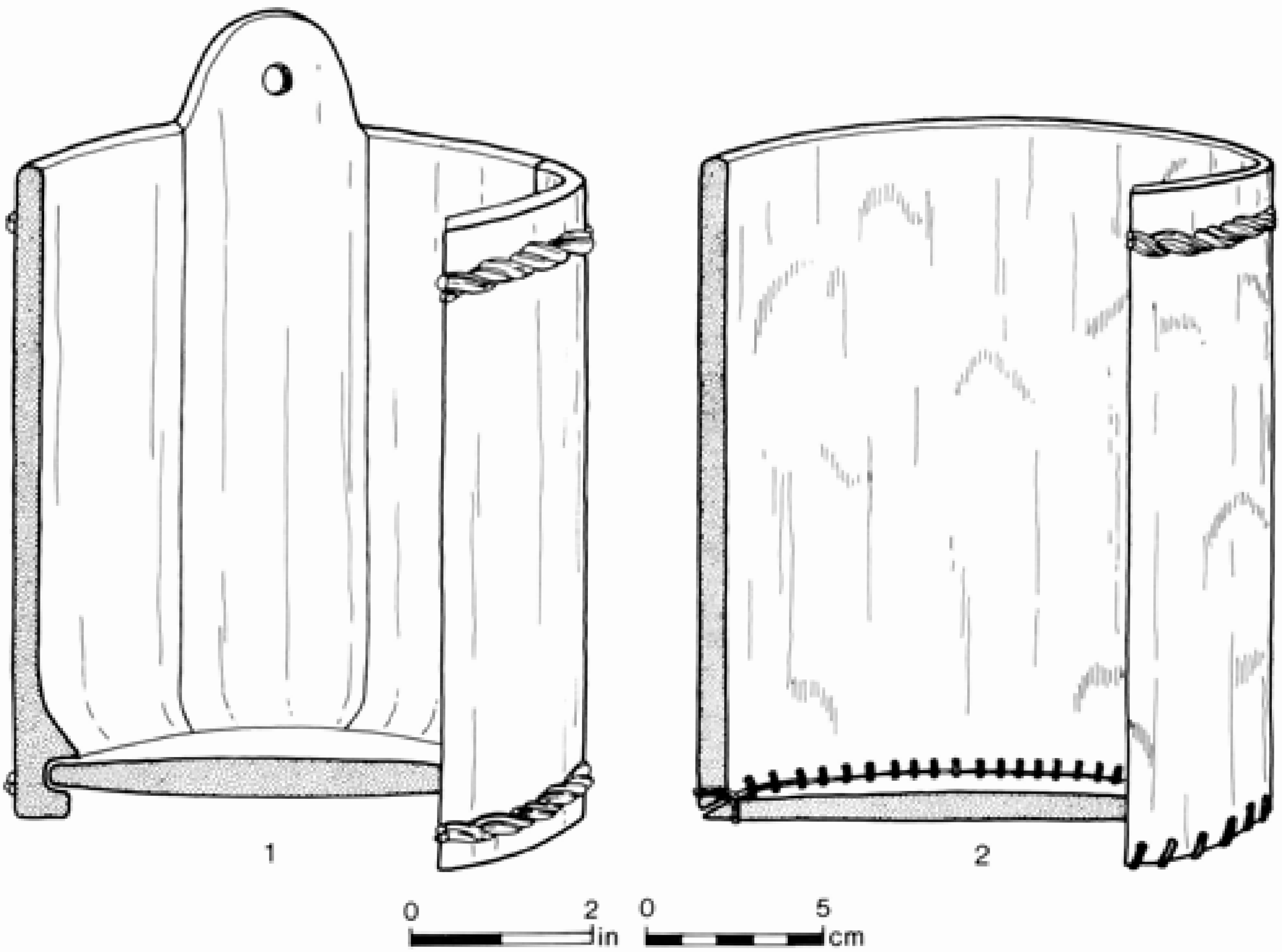


Fig 63 Reconstructions of inset and stitched wooden containers

Annable and Simpson 1964, 110, 358). Such pins, which may copy metal prototypes (Ashbee 1960, 114), have been thought of as furnishing *poor* graves (Annable and Simpson 1964, 27). Gerloff (1975, 251) has listed 13 examples, 8 from *Wessex,* 1 from Derbyshire, and 4 from Yorkshire. Vine (1982, 184, 406, 954) also illustrates such a pin recovered from Galley Low by Thomas Bateman in 1843.

The differing sizes of the three perforated-headed bone points invites comparison with the graduated series from Upton Lovell 2a (S Piggott 1962; Annable and Simpson 1964, 104, 244–9). Colt Hoare (1810, 75–6) found 'more than three dozen instruments of bones pointed and perforated', most of which have survived. A shale ring and three biconical shale beads were in that unusual assemblage. Single examples have come to light in Wiltshire (Cunnington 1938, 107, 19a, 4; Annable and Simpson 1964, nos 314, 350, 378, 379, 389, 452) and beyond (Mortimer 1905, pl V, fig 34; pl X, fig 78; pl XXII, fig 181; pl XL, fig 329; pl XLI, fig 344; pl LXXX, fig 604; pl CXXII, fig 902; Kinnes and Longworth 1985, nos 205, 241, 276, 278, Un 25). Their simplicity means that little more than general significance can be attached to them.

Small bone needles, comparable with that from Wilsford, are rare in the region. A large needle with an awl and knife-dagger, presumably from a barrow, was found in Amesbury Park (Annable and Simpson 1964, 53, 523). On the European mainland bone sewing needles have been encountered in a variety of Bronze Age contexts (Coles and Harding 1979, 91, 148, 232). However, well-made bone needles, two with elongated eyes, were found at Maiden Castle, where they had bronze counterparts (Wheeler 1943, fig 88, 10, 11; 107; fig 105, 2–8). Such needles have also been found upon Scottish sites, where the conditions of preservation were favourable (A Young 1955–6, 321, fig 14, 39; Ritchie 1966–7, 109, fig 2, 21).

An imperfect shouldered bone awl, not unlike the broken Wilsford point, was found at Woodhenge (Cunnington 1929, 107, pl 19a, 3), while one partially worked, but broken, from the Wilsford 58 bell barrow is not dissimilar (Grinsell 1957, 211; Annable and Simpson 1964, 47, 212). The complete form of these tools, before breakage, is illustrated by that from Greenwell's Rudston barrow 64 (Kinnes and Longworth 1985, 64, no 33).

Apart from the unfinished double-ended scraper, there was nothing among the struck flints of a specific nature. Only the 'smashed' material calls for comment. Like the flint industries in barrows, the precise relationship in terms of deposition and function (Saville 1977–8, 22) to the shaft is difficult to decide. The pieces in the upper fill need not have been more than incidental depositions like the animal bones. Some may have been upon the surface and have fallen during the formation of the weathering cone. However, the fresh, struck, and smashed flints, mostly from nodules of good quality, which are quite different from the poor flakes, one or two of which have been struck from thermally affected lumps, may have resulted from activity close by during the early stages of the shaft's weathering and infill.

Pieces of containers (Fig 63) comprised the most numerous recognisable wooden artefacts. The thickened, notched ends of staves, fragments thereof, the patent stave pieces, and the discoid bases are all the components of a kind of wooden container that was used in various forms from prehistory (Coles *et al* 1978, 16) until recent times (Henshall and Maxwell 1951–2, 39, pl VIII, 1). The pieces with perforations may be from a similar, more or less cylindrical, class of vessel. These wooden containers, with inserted discoid bases which were found almost intact in two cases, were of two kinds. There were those which had been built up from a number of staves, and those fashioned from a single piece, hollowed from a suitable trunk. The depth and strength of the flanges formed by the grooving of the thickened stave-ends, or the piece of hollowed trunk, were presumably related to the essential size and the volume of liquid that was to be contained. It has been suggested that the hollowed sections of trunk for single-piece cylindrical vessels were expanded by prolonged soaking to allow the insertion of a dry discoidal base (Clark 1952, 214). Such single-piece containers made from a particular portion of trunk, could, however, have been portioned for base insertion and thereafter exactly reassembled. These tubs and buckets were enclosed with withes and, in later times, metal bands.

Such wooden tubs were widely used. What are perhaps the earliest examples have been recovered from Stuntney Fen, in Cambridgeshire (Clark and Godwin 1940, 54, fig 2) and Zürich-Alpenquai, in Switzerland (Clark 1952, 215, fig 116), both later Bronze Age contexts. Some of the bog-butter, of uncertain age, found in the Irish bogs may have been in stave-built tubs, although the early, mostly inadequate accounts relate that they were mostly single-piece containers (Wood-Martin 1895, 408; Macalister 1949, 320–21). Stave-built tubs, some of them large, were used in the Glastonbury lake-village (Bulleid and Gray 1911, 315, fig 65). It is also apposite to observe that the metal-cased, metal-bound, and handled Iron Age tankards were all constructed from staves and had inserted bases (Corcoran 1952), as were the spectacular embellished buckets from Aylesford and Marlborough (Megaw 1970, 119–20).

Another means of securing the sides of wooden composite cylindrical containers to circular bases was sewing or dowelling. It is thought that these modes may have already been used in Neolithic times (Clark 1952, 210, fig 111; 212, fig 114). Some 50 pieces, fragments and scraps, from Wilsford could reflect this employment. The fine, closely-spaced perforations point to sewn, rather than pegged, bases, as is best illustrated by the cylindrical vessel with its circular base sewn to it found in the Lago de Ledro, in Italy (Battaglia 1943, 44, fig 8).

Scoop-like shovels, often short-handled to facilitate use in confined spaces, were regularly used in the prehistoric copper and salt mines of the Austrian Alps (Andree 1922; Naturhistorisches Museums Wien 1970, Taf 12, 3). Thus the possibility that a similar tool was used within the confines of the shaft should not occasion surprise. Fragments of thin, finely-finished, monoxylous bowls were seen and listed in 1962, when the material was recovered from the shaft's bottom, but these did not survive the conservation process. Bowls, carved from single pieces of wood, were current from Neolithic times onwards (Darbishire 1874). In later times they were turned (Gray and Bulleid 1953, 278, fig 75). Carved bowls can be thin, and a fine finish is achieved by abrasion. The pole lathe (Hodges 1964, 117) may have been used in Wessex times to produce, for example, the famous Hove amber cup (Curwen and Curwen 1924), although it should not be forgotten that the Farway Down shale cups were carved (A Fox 1948, 7, fn 2).

It is tempting to regard the substantial piece of timber, pointed at each end and found set vertically in the shaft's infill against its side, as the equivalent of the sometimes substantial posts found in shaft bottoms both in Britain (C Fox 1930) and upon the European mainland (Schwarz 1962; S Piggott 1975, 72–6). However, it could have been a remnant from a timber installation at the shaft's head which fell, together with chalk rubble, and thus lodged fortuitously in the position in which it was found.

As was observed above, withes would have been a necessity for staved tubs and buckets and, moreover, for receptacles made from pieces of trunks. Never before have so many withe pieces been encountered, and it is a matter for regret that so few survived the conservation process. The principles employed are best illustrated by the twisted withes of juniper and willow which encircled the stave-built wooden tub found with the body of a seventeenth century man in a Shetland peat-bog; the lower, broken band must have encircled the tub some two and a half times (Henshall and Maxwell 1951–2, 39, pl VIII, 1).

Certain pieces of interwoven fine roundwood, difficult to distinguish from withes, were thought of as the remains of wickerwork. At Glastonbury (Bulleid and Gray 1911, 340, pl LVII) and Meare (Gray and Bulleid 1953, 275–7) the remains of substantial basketry containers were encountered, and fragments have been noted elsewhere (Coles *et al* 1978, 17). Baskets would have been ideal for the removal of chalk rubble from the shaft by means of a hoist, rather than staved wooden containers, which would have been of modest capacity. Indeed, baskets were widely used by the civil engineers of the Middle Ages for similar purposes (Harvey 1975, 156, figs 18 and 19).

Cord ornament is common to a range of Bronze Age pottery (Clarke 1970, 52; Simpson 1968; Longworth 1984, 8). These impressions, plus the pieces that have survived (Mortimer 1905, 234, fig 595; Cunnington 1938, 111; Coles *et al* 1973, 288–9, pl XXIX upper), illustrate the traditions to which the Wilsford pieces belong. The use of a brace, the operator moving backwards down a rope-walk, would have been an indispensable condition in the manufacture of such sophisticated cordage (Hodges 1964, 129).

5 Radiocarbon dating

Radiocarbon accelerator dates

by R A Housley and R E M Hedges

Introduction

A series of ten samples was radiocarbon dated by accelerator mass spectrometry. Five samples consisted of animal bone, two were of human bone, whilst the remaining three were from wooden bucket staves preserved in the waterlogged base of the shaft. The radiocarbon dates obtained are presented in Table 3. One further bone sample (a *Bos* skull, Wils 66, 73ft 6in, 22.5m) was prepared, but was found to contain insufficient collagen for an age determination to be obtained.

All bone dates were obtained by isolating amino-acids from the insoluble collagen, the samples being prepared using the method outlined in Gillespie *et al* (1984). Wood samples were prepared in the same way as charcoal (Batten *et al* 1986). The purified samples were oxidised to CO_2, which was then converted to graphite before being dated by the accelerator.

The dates were measured as $^{14}C/^{13}C$ ratios, in comparison with the new NBS oxalic acid standard (Stuiver 1983), and expressed as years BP (present taken as AD 1950) in accordance with the international standard (Stuiver and Kra 1986). No independent measure has been made of the $\delta^{13}C$, and the dates have been calculated as if wood has $\delta^{13}C$ of -25 per mil and bone a $\delta^{13}C$ of -20. (The effect of fractionation is small with regard to the quoted errors in view of the fact that $^{14}C/^{13}C$ ratios are measured). A correction has been made for the known addition of ½% modern ^{14}C contamination during the target preparation process: this also affects the quoted error.

The errors are quoted as one standard deviation and are our estimate of the total error in the system including the sample chemistry. This error includes the statistical precision from the number of ^{14}C nuclei detected, the ability to reproduce the mass-spectrometric measurements between different targets, and the uncertainty in our estimate of the contamination background. This background level is taken to be $0.5 \pm 0.3\%$ of the oxalic standard (from measurements of the ^{14}C free material). Measurements of known-age material (tree-ring series) carried out at the same time as these dates gave results consistent with our estimates of error.

Results and discussion

The earliest AMS date (OxA-1089) on the lowest bucket stave is anomalous in being approximately two millennia (in calendar years) older than the other dated material from near the base of the shaft. Since it was known that much of the wood from the base of the shaft had been conserved by resin polyethylene glycol (PEG), the dated samples were deliberately selected from those items which had not been impregnated, but which had been conserved by freeze-drying instead. Subsequent microscopic examination of unprepared wood from this particular sample detected no resin, whilst the overall state of preservation was consistent with the sample having been freeze-dried. A second confirmatory dating run was undertaken, and a compatible result was achieved. Although it is possible that conservation work, for which there is no record, could be responsible for the older date obtained, this is thought to be an unlikely explanation. The alternative, that the date is a true measurement of the age of the bucket, does cause archaeological difficulties, since it is hard to explain the two millennia hiatus.

The remaining dates broadly fall into two groups. The five dates from the lower part of the shaft (OxA-1214 to OxA-1217 and OxA-1229) can be combined, using the Ward and Wilson (1978) procedures for combining radiocarbon dates, to give a mean age estimate of 3151 ± 29 BP. This implies that the lower part of the shaft filled quite rapidly (probably in less time than indicated by the *c* 115 calendar year upper limit of the 2σ age range), there being no significant difference, in radiocarbon terms, between the date of material at *c* 30ft (9m) and that at *c* 95ft (28.5m). The conventional radiocarbon date, 3330 ± 90 BP (NPL-74), reported by Ashbee (1966a) on seven small amorphous pieces of wood collected between 96ft 6in (28.9m) and 97ft 6in (29.3m) in depth, is in good agreement with the AMS dates reported here.

The uppermost four dates (OxA-1210 to OxA-1213) form a second group which is significantly later than the lower shaft group of dates. The mean age estimate for this group of four is 2413 ± 32 BP. The difference is interesting, since it demonstrates that

Table 3 AMS dates from the Wilsford Shaft

Sample no	*Description and depth*	*Date BP*	*Date bc*
OxA-1210	*Equus* calcaneum, Wils 60 25, 7ft 8in (2.3m)	2450±60	500±60
OxA-1211	Human left femur, Wils 127 (1), 8ft 6in (2.6m)	2320±80	370±80
OxA-1212	Human left femur, Wils 127 (2), 8ft 6in (2.6m)	2360±60	410±60
OxA-1213	*Equus* cuboid/tibia, Wils 125, 9–9ft 6in (2.7–2.9m)	2480±60	530±60
OxA-1214	*Bos* skull, Wils G25, 29ft 6in (8.9m)	3130±70	1180±70
OxA-1215	*Ovis* skull, Wils G35, 44ft (13.2m)	3130±60	1180±60
OxA-1216	Wood from bucket, Wils 11c, 94–95ft (28.2–28.5)	3160±60	1210±60
OxA-1217	Wood from bucket, Wils 94, 95ft (28.5m)	3150±60	1200±60
OxA-1229	*Bos* horncore, Wils 21, 95ft 2in (28.5m)	3200±80	1250±80
OxA-1089	Wood from bucket, Wils 329, 97ft 6in (30.3m)	4640±70	2690±70

the top 10ft (3m) filled about a millennia later than the lower regions (below 30ft; 9m) of the shaft. In the upper group the two dated horse bones are believed to be from the same animal (C Grigson, pers comm) and produce a combined age estimate of 2465±42 BP. The two human bones are from separate individuals and represent the deepest pieces of human bone in the shaft, all the remainder being above 2ft (0.6m). Their dates are not sufficiently different to be distinguished from the horse bones which bracket them stratigraphically. The human femur dates demonstrate that most of the shaft had already infilled before the human remains were deposited, an important point when considering the question of the shaft's function.

The dates have been calibrated using the calibration program (rev 2.0) of Stuiver and Reimer (1986): the resultant date ranges are shown in Table 4. Two methods have been used: one generates calibrated age ranges based on intercepts at ±1 or 2 times the standard deviation (σ) of the radiocarbon age, whilst the second calculates the probability distribution around the radiocarbon age – the age ranges representing 68.3% (1σ) and 95.4% (2σ) of the area under the distribution curve. The relative area provides an estimate of the importance of each age range. The calibration indicates that the lower part of the shaft filled during the late sixteenth or fifteenth century BC with the final 10ft (3m) being deposited in the latter part of the sixth or in the fifth century BC.

Comments upon the radiocarbon dates

by Paul Ashbee

The dates (Fig 64) are in two groups, four from the first ten feet (3m) of fill, namely that below the 'pond' of the pond barrow and in the upper part of the weathering cone, and six from the chalk rubble and lower, waterlogged accumulations. In general terms, the first four dates amalgamate and average around 450 bc, the Iron Age, the second five around 1200 bc, the later Bronze Age. One date is anomalous and would be considered appropriate to the later Neolithic.

These clusters can be separated significantly and their implications for the weathering, denudation, and silting of the shaft are considerable. They show that, presumably after the removal or disintegration of a timber shaft-head structure, silting was rapid, and that, during the currency of the Deverel-Rimbury pottery pieces from the accumulation, it was all but infilled. However, as in a ditch, the process dramatically decelerated and thus by Iron Age times the pond barrow would have been a circular, embanked, trumpet-mouth profiled cavity, some 10ft (3m) in depth. The pond-like declivity, which gave rise to Colt Hoare's coinage (1810, 22), is clearly the creation of little more than the last two millennia.

Iron Age pottery, besides abraded Romano-British sherds and some Deverel-Rimbury urn fragments, was found scattered in all layers between depths of 3ft (0.9m) and 12ft (3.6m). The Iron Age dates are appropriate to such an assemblage. Their closest compeers, in terms of age and affinity, are those obtained from the settlement at Longbridge Deverill, Cow Down (Chadwick 1961): NPL-105 630±155 bc, NPL-104 530±90 bc, NPL-106 500±90 bc, NPL-109 490±90 bc, NPL-108 460±140 bc, NPL-107 420±95 bc; and from Phase I of the farmstead at Gussage All Saints (Wainwright 1979b): Q-1203 418±90 bc, Q-1209 452±75 bc, Q-1204 514±80 bc. In general terms they accord well with the pattern of radiocarbon dates for the Iron Age in southern England (Cunliffe 1978, 258).

Although not indicative of the shaft's prime function, the pottery from its depths (Figs 41 and 42) was of the Deverel-Rimbury series. Because of this and the radiocarbon date obtained in 1966 (NPL-74 1380±90 bc), the shaft has been considered as an integral component of that complex (S Piggott 1973, 383). Indeed, like the Deverel-Rimbury barrows (S Piggott 1973, 393; Ellison 1980, 117), pond barrows, which could be other shafts, in the Stonehenge area (Fig 6; Appendix A) are rarely in a developed sequence or cluster but are at a distance from such groups or in near isolation. Despite the assemblage of attributes (S Piggott 1973, 382–403; Barrett and Bradley 1980), Deverel-Rimbury origins and nature are elusive, although the pottery owes much to Grooved Ware (Ashbee 1960, 156). The wane of the Wessex Culture, and its supersession by a developed

Table 4 Calibrated dates from the shaft

		Calibrated date (cal BC)			
OxA	*Uncalibrated*	*Intercepts*		*Probabilities*	
nos	*date (BP)*	*1σ*	*2σ*	*1σ*	*2σ*
1210–13	2413±32	750–405	760–400	750–730 11% 525–405 89%	760–680 24% 660–635 2% 550–400 74%
1214–17 & 1229	3151±29	1445–1415	1515–1400	1500–1485 17% 1455–1410 83%	1515–1400 100%
1089	4640±70	3510–3345	3625–3110	3600–3585 4% 3515–3340 96%	3630–3565 9% 3540–3300 76% 3240–3105 15%

NB The calibrated dates have been rounded to the nearest 5 years.

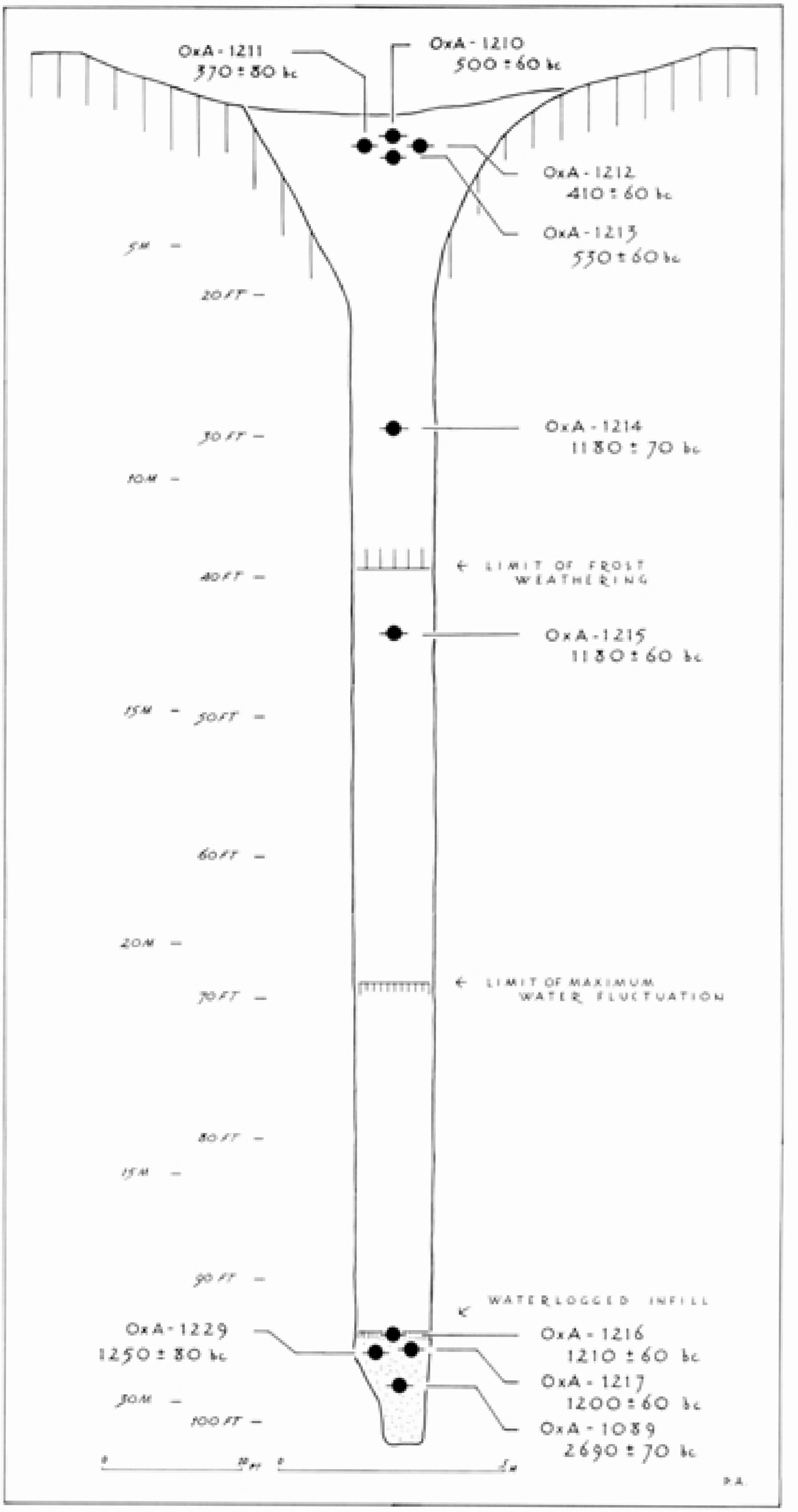


Fig 64 The pond barrow and shaft: the radiocarbon samples, their depths and dates

form of this component, with a substantive development south from the Stonehenge area, seems a likely explanation. This is intimated, albeit indirectly, by such radiocarbon dates as have been assembled for the southern English Deverel-Rimbury series. The earliest, a single date (NPL-199 1740±90 bc) obtained from charcoal associated with a bucket urn beneath the Worgret Barrow, at Arne in Dorset (Wainwright 1966), and that from wood deep in the shaft (NPL-74 1380±90 bc) are, as has been shown (Barrett and Bradley 1980, 185), significantly older than, for example, the dates from the human bone associated with the Edmondsham Wessex II ogival dagger (Proudfoot 1963; BM-708 1119±45 bc) or the antler in Stonehenge Hole Y30 (I-2445 1240±105 bc). The dates from the lower part of the shaft substantiate this developing pattern for southern England in that their span reinforces the inclination to dates of the order of 1150–1250 bc. The wood samples could, however, be appreciably older than the Deverel-Rimbury pottery. This has been balanced by the dates obtained from bones in similar contexts, although they could have been elsewhere for a considerable time before their incorporation into the shaft's infill.

One date (OxA-1089 2690±70 bc) is inconsistent, in that it is appropriate to a Neolithic context. Indeed, it would not be out of place in the series obtained from the Giants Hills 2, Skendleby, long barrow (Evans and Simpson 1986). The sample, assayed a second time with the same result, was selected from fragments recovered from the dump at the end of the shaft's excavation. These are described in the site records as 'bound wood' (perhaps pieces with shreds of disintegrating wood adhering to them), from a depth of 97ft 6in (29.2m) onwards, and the notes, together with a sketch of two pieces, point to some ten small pieces. The two pieces displayed bevelled, perforated edges and were from a finely-finished container of the stitched variety. Unless the piece assayed was from an intrusive piece of timber, perhaps from a shaft-top structure, already ancient when incorporated into the shaft-bottom deposit, we are confronted with the inherent possibility that a composite container may have been more than a millennium (in radiocarbon years) older than others of its kind. Were this errant date to be calibrated, we would be faced with a sample of the order of two millennia older.

Oak (*Quercus* sp.) and alder (*Alnus* sp.) were among the pieces, although the fragment submitted for radiocarbon assay is thought to have been of ash (*Fraxinus excelsior*). Wood samples can be of some antiquity at the time of deposition, and thus the use for the construction of a composite container of very old timber could be an explanation. Indeed, had the sample been of oak, which has a long lifespan, is durable, and subject to reuse, this possibility could have been sustained. Ash is, however, less long-lived, although coppicing and pollarding will considerably extend its span. Indeed, a giant coppice-stool in Suffolk may be at least a thousand years old (Rackham 1976, 29). In the circumstances, the inconsistency cannot be explained by these considerations alone.

If submitted to continual use, composite wooden containers could have had a use-life of perhaps only decades. However, when such containers were used, possibly only periodically, in situations directed to non-material ends, they might have been of considerable antiquity. Indeed, there is evidence from various prehistoric and later sites of conscious archaism which might accommodate such a premise. For example, the use of an exceptionally broad-bladed bronze axe was observed upon the timbers of the later Bronze Age sanctuary at Bargeroosterveld in Holland (GrN-1552 1290±65 bc; Waterbolk and Van Zeist 1961, 18; Butler 1961). Broad-bladed axe-dressing was a feature of the shaft's sides and, similarly, this could have been an obeisance to times past. Miniature vessels resembling earlier Bronze Age urns were found in a Roman cult-site context on the Isles of Scilly (Dudley 1967, 5; Ashbee 1974, 221, 261), while a Roman pit within the Frilford, Oxfordshire, circular temple yielded a votive model sword and shield in the La Tène styles (Harding 1972, 62). Such model votive shields are not unknown in Roman Britain (Klein 1928, 79–81), and they clearly copy the functional shields of an earlier age. Such principles also obtained in earlier Bronze Age burials. Out-of-date stone and flint axe blades, with graduated bone points, accompanied a Wessex battle-axe in a burial beneath the Upton Lovell 2a barrow (S Piggott 1962). Similarly, a necklace of wolf and dog teeth from the South Newton 1 barrow burial may echo earlier modes (N Thomas 1954, 316). The rectangular roofed shrines of Iron Age Britain may hark back to the rectangular structures encountered beneath certain earthen long barrows (Ashbee 1970), while it could be thought that the lintelled sarsen structure of Stonehenge copies a timber building's framework, and that the final incorporation of the renowned bluestones (IIIc; S Piggott 1973, 328) was a backward-looking gesture. In instances there is evidence for the continued use of cult sites that could be measured in millennia (Stevens 1940; S Piggott 1941, 312; 1975, 88; 1978). Where non-material ends were concerned, conscious archaism survived Roman times and can be seen during the earlier Middle Ages (Higgitt 1973; Hunter 1974).

Although the possibility of a wooden vessel in currency for more than a millennium (RCY) is singular, such an occurrence might not be out of place in the general context of pond barrows and shafts, if they are allied to all the other manifestations of the non-material that are encountered in early times.

Besides reflecting the shaft's infilling, the two groups of radiocarbon dates indicate the later, post-Wessex, stages of prehistoric activity in the vicinity of Stonehenge – hitherto, with the exception of Vespasian's Camp, something of a void. Nonetheless they substantiate, as does the pottery from the shaft, the Deverel-Rimbury sherds found at Stonehenge in 1954 and the Iron Age pottery allegedly found in the Y and Z holes (Grinsell 1957, 29). They also show, if the pond barrows *are*, indeed, all shafts, a concerted attention to cthonic considerations that lingered into Roman times.

6 The environmental material from the shaft's infill

Introduction

by Martin Bell

Background

The discovery of waterlogged biological material at the bottom of the Wilsford Shaft represents a find of unique archaeological importance. The range of material is remarkable, eg fungi, moss, pollen, seeds, wood, bud scales, rope, plant fibres, insects, molluscs, domestic animals, small vertebrates, animal fibres, dung, etc. Such a range offers considerable opportunities for comparing and contrasting the evidence from a variety of sources. Increasingly, studies of this kind are being undertaken on waterlogged urban sites of Roman and later date, as at York for example, yet here such an opportunity arises in a much earlier, Middle Bronze Age context. Furthermore, the Wilsford evidence derives from an area of permeable chalk geology, where all forms of non-carbonised floral evidence and organic faunal material are rarely found. Finally, the shaft is in an area of special archaeological importance within a mile (1.6km) of Stonehenge (Fig 6).

The water-table seems to have fluctuated up to a height of *c* 70ft (21m) below the top of the shaft. However, well-preserved organic material was largely confined to the bottom 7ft (2.1m), which would seem to have been virtually permanently waterlogged since the Bronze Age. This would have created anaerobic conditions under which the microorganisms of decay could not operate. Preservation might also have been aided by the fact that the organic deposits were sealed by *c* 100ft (30m) of chalk infill. This would have greatly reduced, or prevented, air penetration (as seems also to have been the case at Silbury Hill: Dimbleby 1984). Under these circumstances the basal organic deposits might have survived brief episodes of partial drying due to falls in the water-table.

It is important to appreciate that the excavation of the Wilsford Shaft was very much a pioneering operation: it took place between 1960 and 1962 when environmental archaeology was still in its early formative stages. Furthermore, the environmental potential of the site was not apparent until the waterlogged deposits were reached. At this point, advice had to be hastily assembled from specialists and appropriate excavation and sampling methods devised under difficult conditions, without the benefit of earlier work on strictly comparable deposits. Post-excavation laboratory work progressed very intermittently after the excavation, and it is only now, 25 years later, that a final report has been prepared. Consequently, we must begin with an historical survey, gleaned largely from the notebooks and letters in the site archive, which helps to establish how the biological evidence was obtained.

Sampling and sieving on site

Samples and artefacts were numbered in single series which began at 1 with each phase of excavation. The original site lists and subsequent lists and indices prepared from them are available for reference in the site archive. In this report the samples from the various phases of the excavation are designated in the following way:

1960:1 etc – Edwina Proudfoot's 1960 excavation
1960G:1 etc – Peter Gray's work in 1960
1961:1 etc – Paul Ashbee's 1961 excavation
1962:1 etc – Paul Ashbee's 1962 excavation.

The 1960 excavation season of the top 25ft (7.5m) of the shaft and surrounds was directed by Edwina Proudfoot. Charcoals and human and animal bones were recorded by numbered finds spots and are included in this report. A number of soil samples were also taken, but these were subsequently destroyed as a result of a flood while in store at Edinburgh. After the main 1960 excavation, the shaft was taken down from 25ft (7.5m) to more than 60ft (18m) by the late Peter Gray, who had regular supervisory visits from Edwina Proudfoot and Paul Ashbee. Gray took 17 samples which have proved invaluable, particularly for mollusc analysis. He described some of his samples as 'representative' of the shaft fill, and these show that he was digging through light grey (7.5YR 8/2 – all Munsell designations are dry) medium and small angular chalk rubble *c* 80% (terminology follows Hodgson 1976). This sediment can almost certainly be identified as the product of physical weathering of the shaft cone, and it was cemented hard in places by calcium carbonate deposited by percolating water. Gray also seems to have taken samples when he came across darker patches which he described on his labels as 'dirty soil'. These were generally light brownish grey (7.5YR 7/2) soil with 30% medium and small chalk pieces, some angular, some rounded. The appearance of these darker patches, together with the results of mollusc analysis, suggest that they were turves or topsoil material which fell in as the cone weathered back. The patches contained a few flint flakes, bone fragments, tiny scraps of pottery, and small charcoal fragments attesting to the incorporation of some, but not much, artefactual material in the soil surrounding the mouth of the shaft.

In 1961 Paul Ashbee took over the excavation and the shaft was cleared down to *c* 94ft (28.2m), by which time the chalky fill was beginning to contain wood fragments and organic material. During the 1961 season eight surviving samples were collected. Most were tiny samples containing charcoal, but two (1961:91 and 94) represent the beginning of organic preservation at *c* 95ft (28.5m). These consisted of brownish-grey (7.5YR 6/1) humic sediment containing large, medium, and small angular chalk pieces and some flint fragments. When originally excavated the samples must have been waterlogged, because they contain vegetable material and beetles, but they are now completely dry.

The final 1962 season took the shaft from *c* 94ft

(28.2m) to the bottom at *c* 100ft (30m). This bottom 6ft (1.8m) contained waterlogged, organic-rich sediment, which produced the bulk of the biological evidence reviewed here. Most of the shaft was *c* 6ft (1.8m) in diameter, but it narrowed at the base where cramped and restricted conditions, together with much water and mud, meant that only particularly large and easily distinguished artefacts and biota could be identified. The remainder of the sediment was sent to the surface in buckets, the depth for each bucket load being recorded. On the surface all material from the bottom of the shaft was sieved, using sieving arrangements set up by Richmal Ashbee and illustrated in Figures 48 and 49. These show material being examined on sieves and washed in bowls and tanks of water. During this process recognisable objects, eg wood, snails, bones, artefacts, and other obvious biota, were removed and individually numbered. The much smaller sediment retained on the sieves was saved wet in *c* 16 plastic bags which were numbered and marked with depths. These samples are listed in microfiche; those that survive consist of tiny wood fragments and other plant material, with a small proportion of very small rounded chalk pieces and a wide range of other biological inclusions, most obviously insects, molluscs, bones, leaf fragments, and fibres. A major problem is that we have no information about the sieve sizes used on site. We know that at the beginning of the 1962 season a large-meshed garden sieve was used, but it was soon realised that material was being lost and smaller-meshed sieves were obtained (two such can be seen in use in Figure 49); these were baker's flour sieves, but the mesh size is not known (P Ashbee, pers comm). At this stage some of the earlier dumps were resieved: at least two of the wet samples (1962:269 and 275) derive from this operation. Eight further samples represent sludge from the base of the water tank used in sieving and shown in Figures 48 and 49.

It might be considered that such uncertainties regarding sieve size greatly reduce the value of work on these samples. However, it is evident that very small biota were recovered. Peter Hawkes (1973) suggested, on the basis of the size of seeds examined by him, that a sieve of *c* 1mm was used. Mark Robinson regards the seeds, which he has examined more recently, as a complete assemblage of seeds down to a diameter of 0.5mm or less. Measurements made on the mollusc shells (pp 99–101) indicate that the sieve used on site may have been *c* 1/24–1/20 of an inch (1–1.25mm), but *only* if separation was inefficient and a significant proportion of finer material was retained. In view of this, we must constantly bear in mind the possibility that small biota may be underrepresented. However, the specialists whose data are particularly affected by this problem (the seeds, beetles, and molluscs) are agreed that it does not seem to have had a major distorting effect on the assemblage.

Post-excavation work on the samples

Following the excavation, 23 bags of wet sediment were transferred by Professor G W Dimbleby to glass jars containing a preserving mixture of water, glycerol, and alcohol. Fifteen of these were sent to Peter Osborne at the Geology Department, Birmingham University, for insect analysis. He sieved the first four samples and from these also recorded small mammal bones, Mollusca, and seeds. Subsequent samples were processed by flotation, and this method only produced insects and seeds. The results of Osborne's insect work were published in a seminal paper (Osborne 1969) and are summarised here with additions (pp 96–9).

At the Institute of Archaeology, London, Professor Dimbleby examined the pollen (pp 75–8) and made arrangements for work on the mosses (pp 95–6) and the seeds on which P G Hawkes prepared an undergraduate dissertation (1973). Hawkes identified the seeds recovered by Osborne during beetle analysis and also sieved samples of five of the eight jars of sieving tank sludge. The result was a total of 2793 seeds of 38 species and a dissertation of a high standard which, had it been published promptly, would undoubtedly have represented a significant milestone in seed work on archaeological sites.

Some botanical material from the shaft, including virtually all the wood, was sent after the excavation to the Ancient Monuments Laboratory. Here arrangements for identification of the worked wood and some specialist comments on rope, ?leather, and ?fungus were put in hand by Leo Biek in the 1960s. Nearly all the wood was resin impregnated in 1968, and a few pieces were freeze dried.

After *c* 1973 progress towards publication of the Wilsford biological evidence seems to have ceased. However, in 1984 the Backlog Working Party of English Heritage instigated a long overdue review of progress towards publication. The present writer was asked to prepare a survey (Bell 1985), which summarised the progress to date and identified what needed to be done to finish the report; he was subsequently asked to take responsibility for preparing the environmental evidence for publication. The decision was made not to do further work on the aspects for which publishable reports were already available, but to concentrate on the less well studied aspects, so that at least some specialist contribution on the whole range of biological evidence in the shaft could be presented. The seeds represent one exception to this approach because at about this time Mark Robinson expressed an interest in doing further work on these to complement his research in the Thames Valley to the north. His offer to look at further seeds and incorporate the earlier work of Peter Hawkes was gratefully accepted, because Peter Hawkes was no longer in a position to prepare his dissertation for publication.

In order to obtain further biological material for analysis (particularly seeds, molluscs, and small mammals), four of the wet samples were sieved totally or partly at St David's University College, Lampeter. They were divided into a series of particle size fractions by washing on a nest of sieves down to 125µm, after which they were sorted wet and dispatched to specialists. Mark Robinson has also checked the residue from which the seeds were extracted. In addition to sieving of the four very productive wet samples, 14 dry samples from above 95ft (28.5m) were sieved; biological evidence from these was largely restricted to molluscs.

As the biota have been studied over a period of *c* 25 years, some of the scientific names have changed; they have, however, been left as in the original reports and, in one or two instances, do not correspond to the names used by other specialists whose contributions were prepared more recently.

Problems caused by loss and deterioration of samples

Twenty-five years after the excavation it is clear that an environmental report cannot be prepared as if the site had just been excavated. Ideas about sampling, sieving, analysis, and interpretation have changed drastically over the 25 years that this material has been studied. Some samples have sadly been temporarily or permanently lost, including some soil samples from the bottom of the shaft, grass samples, and leaves. It has also not been possible to locate any of the material which was in store at the Institute of Archaeology up to the retirement of Professor G W Dimbleby. This included all the seeds worked on by Peter Hawkes (including 20 unidentified species and some cereal grains), seven of the eight jars of tank sludge residue, some ?cereal straw, and ?fungus or latex.

Among the material which has survived at Fortress House, some has deteriorated to the point where its potential for research is very limited. The interim report (Ashbee 1963, 119) mentions well-preserved rope, but only one short length (1962:175 – Fig 62) has been kept damp and in reasonable condition in a test tube; the remainder has dried out and disintegrated. Some of the material described during the excavation as leather and fungus has also dried out and deteriorated quite badly, and the samples described at the time as basketry/wickerwork now consist of little more than desiccated wood fragments.

Problems of contamination

The excavators had no way of predicting the range of biological evidence which would be found at the bottom of the shaft, nor at the time were there any established procedures for minimising contamination. It was noted during the excavation that material blew into the shaft between seasons, although in the later stages the shaft was covered. From the writer's experience, it is also likely that material blew in during sieving. Certainly Peter Osborne notes the presence of some modern beetles which were quite easily separated, and Mark Robinson records contamination by some modern and reasonably easily recognised seeds. Among the molluscs, two samples produced a few shells of a species introduced to Britain during the medieval period: these were much fresher and clearly recent. Sieve analysis revealed some contamination in the form of a ?cigarette paper, ?chewing gum, paper, cardboard, and string, and Philippa Tomlinson also notes the presence of cottonwool in samples examined by her, while Michael Ryder records the presence of modern wool. The problem is certainly serious in relation to some of the plant and animal fibres, where it is uncertain whether some interesting material is Middle Bronze Age or modern. This underlines the need for very vigorous measures to reduce contamination during any similar excavations in the future.

Origins and date of shaft fill

Shafts and wells present special problems for the interpretation of the biological evidence which they contain. Virtually none of the biota in the Wilsford Shaft can have lived *in situ*. Some of the problems of the mode of formation of well fills have been discussed by Hall *et al* (1980). At Wilsford the main problem concerns the biologically very rich material below *c* 94ft (28.2m). In the light of the specialist reports which follow, we will need to consider the relative importance of the following factors:

- i deliberate dumping or deposition by man
- ii accidental accumulation as a by-product of man's activity
- iii accidental accumulation of biota, including animals which fell in and plant material which was washed or blown in
- iv any combination of the above.

It seems likely from the preservation of organic material that there were a few feet of water at the bottom of the shaft during its functional life in the Middle Bronze Age and virtually continuously since. When water was exposed at the bottom, material falling into the shaft would have been divided into floating and sinking fractions. Mixing is also likely to have occurred as a result of human activity and a fluctuating water-table. In view of these factors, it is hardly surprising that no clear stratigraphy was observed in the basal organic sediments during the excavation, nor have any clear indications of spatial variation emerged as a result of subsequent laboratory work. Consequently, it appears that the basal waterlogged deposits below *c* 94ft (28.2m) can be considered as a single unitary context. Above this, the shaft fill consisted largely of sterile chalk with some wood and organic material near the base. The chalk appears to have largely weathered from the cone at the top of the shaft. We cannot rule out the possibility that part of the fill consisted of freshly-dug chalk dumped by man, but equally there is no environmental evidence to support that interpretation. Within the chalk were occasional topsoil patches (?turves) and occasional artefacts and bones.

Photographs of the weathering cone section (eg Figs 14 and 18) show an alternating sequence of bands of angular chalk rubble, separated by fine chalky wash which includes an increasing proportion of soil towards the top. It is difficult from photographs to be absolutely precise about the number of bands, but there appear to be a maximum of *c* 36 between *c* 6ft (1.8m) and 18ft (5.4m). A possible interpretation of this banding is suggested by the basal sediments in the Overton Down Experimental Earthwork, where there was evidence of annual banding in the primary fill (Crabtree 1971; Jewell and Dimbleby 1966). Similar banding was observed in the primary fill of the Coneybury Henge ditch (Bell and Shackleton 1982) 1.5 miles (2.4km) to the east of the Shaft. If this interpretation is correct, then the angular rubble represents frost shattering in winter and the finer wash deposition in summer. Storm events might, however, have created 'false bands' by depositing extra layers of wash, just as winters with little frost might have led to 'missing bands' of angular rubble. If in general a pair of bands does represent annual deposition, then *this part* of the fill was laid down over *c* 18 years. Extrapolating from the average sedimentation rate of *c* 8in (200mm) per year, and assuming that sedimentation was entirely natural, the entire chalk fill of the shaft could have accumulated in *c* 150 years, probably less if sedimentation was more rapid in the early stages.

Although these calculations involve many assumptions and at best provide no more than an approximate order of magnitude, the conclusions they suggest are in line with the radiocarbon evidence. A radiocarbon sample from 29ft 6in (8.8m) had a date of 3130±70 BP (OxA-1214), whilst another sample from 44ft (13.2m) gave an almost identical result of 3130±60 BP (OxA-1215). Furthermore, these dates are not significantly different from most of those from the basal sediments: 3160±60 BP (OxA-1216); 3150±60 BP (OxA-1217); 3200±80 BP (OxA-1229); 3330±90 BP (NPL-74); and 4640±70 BP (OxA-1089).

Housley and Hedges (Chapter 5) conclude that the sediments between 29ft 6in (8.8m) and the base probably accumulated in less than *c* 115 years.

The final shaft fill, down to *c* 9ft (2.7m) in the centre, contained a much higher proportion of soil. This must represent sedimentation under more stable vegetated conditions. Photographs (Fig 14) suggested the possibility of a later pit-like feature cut into the top of the shaft with its base at *c* 9ft (2.7m), but there was no archaeological evidence for this. Dates which relate to these secondary contexts are from 9ft 6in (2.8m): 2360±60 BP (OxA-1212) and 2480±60 BP (OxA-1213). They show that the bones in these secondary deposits are almost a millennium later than the primary fill.

Pollen

by G W Dimbleby

However a narrow shaft such as that at Wilsford comes to fill up, it is apparent that it is not by regular silting producing a neatly stratified deposit. This being so, there was no point in applying the usual sequential pattern of sampling for pollen. In fact three discrete samples, from near the bottom of the shaft, were analysed in the hope of getting some indication of the environment contemporary with the construction of the shaft. The three samples were:

1962:9 at 94ft 4in (28.3m)
1962:230 from the 'bottom of the shaft'
1962:231 from the 'bottom of the shaft'.

The samples were subjected to the normal acetolysis treatment, with HF, and examined at high power on a binocular microscope. The counts and percentages (of total pollen plus fern spores) are presented in Table 5.

Discussion

Before turning to the percentages, it should be noticed that the three samples varied greatly in their richness in pollen. On a scan of four complete slides, 1962:9 yielded 992 grains, 1962: 230 had 222 grains, and although five slides were scanned for 1962:231 a total of only 31 grains was recorded. For any acceptable level of reliability, a total of at least 150 grains should usually be counted. On this basis, therefore, any numerical consideration of 1962:231 is quite pointless.

When we come to take a broad look at the relative abundance of the various taxa in the three samples, it is clear that in all three the grasses (Gramineae) are by far the most abundant group, whilst the proportion of pollen of woody species is very low. All three give this same broad spectrum, but, as we shall see, there may be grounds for suggesting that 1962:9 and 1962:230 differ in certain details. In view of this, and the fact that no useful interpretation can be made on 1962:231, it would be unjustifiable to lump the counts from 231 with either of the others. This sample will therefore be ignored in the discussion which follows.

It is apparent that 1962:9 has produced a much longer list of taxa than 1962:230, but this is to be seen as primarily a reflection of the much higher total count. For those taxa that are recorded in 1962:230, the percentages can be regarded as fairly reliable in view of the fact that a count of over 150 grains was achieved.

A first test which can be applied to these two samples is the calculation of the ratio non-arboreal pollen (NAP)/arboreal pollen (AP). For 1962:9 this works out at 2300% and for 1962: 230 2288%. Neither of these figures can be made to carry too much weight, for even in the richer sample the count for arboreal pollen, the denominator in the ratio, is low, and for 1962:230 lower still. The closeness of the percentages obtained therefore may be largely fortuitous. It is clear that both spectra reflect open country with few trees, probably no more than in the area today. Even if one were to include hazel (*Corylus*) in the arboreal pollen, which is not the usual practice by British pollen analysts, the conclusion would be the same.

The virtual absence of tree or shrub pollen means that there is no possibility of dating these spectra on the basis of pollen. It also means that any ecological interpretation that might be attempted can only refer to the non-arboreal pollen.

Interpretation

Interpretation is limited by the degree of specificity of pollen identification. Sometimes identification can be made to species (eg *Plantago lanceolata*), occasionally to genus (eg *Quercus*), but more commonly only to family. For a useful interpretation one needs to be able to identify some plants which are indicators of certain habitats. It is true that there are families whose members are nearly all characteristic of a certain habitat; for instance, the Polygonaceae family contains many plants that are weeds of farmland. On the other hand, a family such as the Labiatae contains species which are found in a range of habitats; indeed, some are very catholic species, having no close association (Fidelity) with just one habitat. Clearly only families or, better still, species which have close ties with certain habitats have value as indicators.

In this particular case it is apparent that we are dealing with an open environment. Some of the families and species are recognisable as characteristic of farmland, which may be arable or pastoral (though other habitats may be present, eg hedgerows). The dominant pollen taxon is the Gramineae, the grasses, but such dominance is characteristic of virtually all open environments, at least on fertile soil such as this. So the dominant taxon does not tell us much. Some of the subsidiary taxa are not much help either, for, as pointed out above, the species within them may favour a range of habitats (eg Ranunculaceae). However, the seeds extracted (*see* pp 78–90) prove that farming was locally active; seeds can be identified with much more precision than most pollen. The mosses, too, had some indicator value, and some of them suggested the local presence of chalk grassland (pp 95–6). Ecologically it would be interesting to know whether the grassland was short

Table 5 Pollen analysis; the counts and percentages (of total pollen plus fern spores)

Samples (1962:)			*9*					*230*	*231*
Count	*1*	*2*	*3*	*4*	*Total*	*%*	*Σ4*	*%*	*1*
Alnus	1	1	–	2	4	0.4	1	0.5	–
Betula	–	–	2	–	2	0.2	–	–	1
Fagus	–	1	–	–	1	0.1	1	0.5	–
Fraxinus	–	–	2	1	3	0.3	–	–	–
Pinus	–	–	–	1	1	0.1	–	–	–
Quercus	2	6	3	9	20	2.0	5	2.3	–
Ulmus	1	–	–	–	1	0.1	1	0.5	–
Corylus	4	1	4	6	15	1.5	–	–	–
Hedera	1	–	2	–	3	0.3	1	0.5	–
Prunus	–	–	–	1	1	0.1	–	–	–
Salix	–	–	1	–	1	0.1	1	0.5	–
Calluna	–	–	–	1	1	0.1	–	–	–
Gramineae	**85**	**74**	67	87	313	31.6	107	48.2	20
Cerealia	9	7	6	12	34	3.4	9	4.1	1
Boraginaceae	–	–	1	1	2	0.2	–	–	–
Caryophyllaceae	–	1	3	2	6	0.6	1	0.5	–
Chenopodiaceae	4	5	8	6	23	2.3	6	2.7	–
Circaea	–	–	–	1	1	0.1	–	–	–
Compositae									
Artemisia	–	1	3	3	7	0.7	8	3.6	–
Centaurea nigra	–	1	1	1	3	0.3	2	0.9	1
Liguliflorae	17	11	15	13	56	5.6	10	4.5	1
Tubuliflorae	–	2	8	10	20	2.0	6	2.7	–
Cruciferae	–	–	2	2	4	0.4	–	–	–
Cuscuta	–	–	–	1	1	0.1	1	0.5	–
Cyperaceae	–	–	5	2	7	0.7	–	–	–
Helianthemum	1	1	–	3	5	0.5	1	0.5	–
Papilionaceae	–	2	–	–	2	0.2	–	–	–
Plantago lanceolata	32	26	24	29	111	11.2	15	6.8	1
P. major	2	5	2	3	12	1.2	3	1.4	–
Ranunculaceae	7	3	7	8	25	2.5	–	–	–
Rosaceae	–	–	4	1	5	0.5	–	–	–
Potentilla	–	–	–	–	–	–	1	0.5	–
Poterium	6	4	5	7	22	2.2	3	1.4	–
Rubiaceae	2	2	7	2	13	1.3	–	–	–
Rumex	2	1	–	–	3	0.3	1	0.5	–
Succisa	–	–	1	–	1	0.1	–	–	–
Umbelliferae	6	4	3	3	16	1.6	3	1.4	–
Urticaceae	1	–	1	–	2	0.2	–	–	–
Varia	6	10	9	11	36	3.6	4	1.8	–
Dryopteris type	23	12	32	44	111	11.2	11	5.0	1
Pteridium	16	27	27	28	98	9.9	20	9.0	5
Polypodium	–	–	–	–	–	–	+	+	–
NAP/AP %						2300		2288	
Total	228	208	255	301	992		222		31

turf or was dominated by tall grasses. The species-richness of short turf grassland, which until AD 1954 (myxomatosis) was the common plant community of chalk pasture, depends very much on the absence of tall-growing species. Probably this is a matter of competition for light, though tall grass communities can produce a thick cover of dead grass leaves which is also inimical to the dwarf plants of short turf. In the Bronze Age, of course, the rabbit, which was the main agent in determining the modern short-turf community, had not yet been introduced into Britain. However, the sheep was here and intensive grazing might have produced similar communities.

As stated above, pollen identification is generally not specific enough to allow the type of grassland community to be identified. For the present purpose, therefore, the question has been approached in reverse. Taking the species characteristic of chalk grassland, what evidence is there in the pollen that they were present in the neighbourhood of Wilsford? In his monumental work *The British Islands and their vegetation*, Tansley (1939) lists certain species which he regards as closely linked to the chalk grassland community. At that date, long before myxomatosis, the typical chalk grassland was short turf because it was so heavily rabbit-grazed. Tansley did try to put some precise definition on what he regarded as a characteristic species. Before turning to the plants in question, some consideration must be given to the properties by which a species can be labelled as characteristic.

Over the years plant sociologists have tried to describe the habitat preferences of plants by various quasi-quantitative criteria. For our present purpose a detailed treatment is neither possible nor necessary. However, there are three useful concepts which need to be understood.

Constancy It is found that, where species lists are prepared on different samples of a certain plant community, some species are present in nearly all the lists: these are said to have a high 'Constancy'. But it should be noted that they are not necessarily abundant species; even one specimen per sample area is enough to put that species on the list.

Fidelity If one concentrates on one species at a time and studies the range of habitats in which it occurs, it is found that, whilst some species are very catholic and occur in a wide range of habitats, others are almost confined to one habitat (ie high 'Fidelity'). There are a considerable number of species which occur almost exclusively in chalk grassland (at least in Britain).

Frequency This is perhaps better described as the abundance of a species – the 'commonness' of the species in samples of vegetation. Frequency may be quite unrelated to Constancy or Fidelity, but some plants reach their greatest Frequency in certain habitats. For our present purpose, this is relevant in affecting the probability that pollen production will be low or high. Of course, other factors also affect this: some species are wind-pollinated and therefore high pollen producers, whilst others are insect-pollinated and only contribute a small fraction of the airborne pollen at any one time. For instance, two common plants of pasture are the common daisy (*Bellis perennis*) and the ribwort plantain (*Plantago lanceolata*). The latter is wind-pollinated and is nearly always an important component of open-country pollen spectra, but the daisy is insect-pollinated and much more poorly represented (it would usually be recorded under Tubuliflorae). Species of low Frequency may nevertheless have a high Fidelity. For example, the Pasque Flower (*Pulsatilla vulgaris = Anemone pulsatilla*) is rare or very local, but in Britain it is only found on chalk and limestone soils so is a very good indicator when it does occur.

Tansley treats the characteristic species of chalk grassland (to which the writer would add other grasslands on calcareous soils) primarily in terms of Constancy, but adds assessments of Fidelity – or Exclusiveness, to use his term. Table 6 has been

Table 6 The ecological characteristics of selected species in calcareous grassland, based on the work of Tansley

Species	*Constancy*	*Fidelity*	*Potential frequency*	*Pollen taxon*	*Pollination*	*1962: 9*	*1962: 230*	*Stature*
Carex diversicolor	high	high	high	Cyperaceae	wind	+	–	short
Poterium sanguisorba	high	high	high	*Poterium*	wind	+	+	short
Plantago lanceolata	high	mod	high	*P. lanceolata*	wind	+	+	short
Thymus serpyllum	high	mod	mod	Labiatae	insect	–	–	short
Linum catharticum	high	mod	mod	*L. catharticum*	insect	–	–	short
Lotus corniculatus	high	mod	mod	Papilionaceae	insect	+	–	short
Leontodon hispidus	high	mod	mod	Liguliflorae	insect	+	+	short
Scabiosa columbaria	high	v high	mod	Dipsacaceae	insect	–	–	short/taller
Pimpinella saxifraga	high	mod	mod	Umbelliferae	insect	+	+	short/taller
Asperula cynanchica	mod/high	v high	mod	Rubiaceae	insect	+	–	short
Hieracium pilosella	mod/high	mod	high	Liguliflorae	insect	+	+	short
Phyteuma orbiculare	mod/high	v high	local	Campanulaceae	insect	–	–	tall
Anthyllis vulneraria	low	v high	high	Papilionaceae	insect	+	–	short/taller
Campanula glomerata	low	v high	mod	Campanulaceae	insect	–	–	taller
Filipendula hexapetala	low	v high	locally high	Rosaceae	insect	+	–	taller
Helianthemum nummularium	low	v high	mod	*Helianthemum*	insect	+	+	short
Hippocrepis comosa	low	v high	mod/high	Papilionaceae	insect	+	–	short
Senecio integrifolius	low	v high	v local	Tubuliflorae	insect	+	+	short
Anemone pulsatilla	low	v high	v local	Ranunculaceae	insect	+	–	short

NB The species names given here follow Tansley (1939) and a number have now been superseded. Generally, pollen is only recognisable to family level; in column 5 are listed the taxa by which these indicator species would be recognised: only two can be identified to species, two to genus, and the rest to family. Columns 7 and 8 show the occurrence of these taxa in the Wilsford samples.

prepared to show selected species and their characteristics. Some of Tansley's characteristic species have been omitted, notably the orchids, because it is doubtful that their pollen is recognisable and even more doubtful that it is identifiable. In this table there can be no conclusive interpretation for many taxa. For instance, *Hippocrepis* and *Anthyllis* both have high Fidelity to chalk grassland, but their pollen would be recorded under the family Papilionaceae, which may also include other species of lower Fidelity, eg *Lotus corniculatus* which is a less good indicator. The fact that this family is recorded in sample 1962: 9 and not in 1962:230 cannot therefore be used to argue the greater presence of chalk grassland. On the other hand, there are a few more positive indications which it is appropriate to consider under the particular pollen taxa.

Cyperaceae

The sedges (*Carex* spp.) are mostly plants of wet habitats. This taxon is not represented in 1962:230. However, there are a few species which are not associated with damp habitats, and one of these is *Carex flacca* (Tansley's *C. diversicolor*). In 1962:9 there is a presence of Cyperaceae, but there is no indication of any other taxa associated with wet habitats. *C. flacca* has a high Fidelity to chalk grassland, a high Constancy, and it can be abundant. It is also wind-pollinated. It is a low-growing plant, so short-turf chalk grassland would seem to be a likely source of this pollen.

Poterium

There is only one species of this genus which is native in Britain, and it is one of the few taxa in this table whose pollen is recognisable to genus, and therefore in effect to species. Ecologically *P. sanguisorba* is closely associated with chalk grassland in both Constancy and Fidelity. However, being wind-pollinated and often abundant, its pollen may be rather widely dispersed. In 1962:230 there is 1.4% of *Poterium* pollen, but in 1962:9 the percentage is 2.2, possibly indicating a greater element of the chalk grassland component. *Poterium* will not be found in association with tall grasses.

Helianthemum

In effect only one species comes into the reckoning here; the few other members of this genus are very local in Britain and do not occur in this region. *H. chamaecistus* (Tansley's *H. nummularium*) is a low-growing plant with a very high Fidelity towards chalk grassland. It has a very recognisable pollen grain which in the present writer's experience is very seldom met with in postglacial pollen analyses, even from southern Britain. In this analysis a single grain was found in 1962:230, but a total of five in 1962:9.

Plantago lanceolata

Whilst *P. lanceolata* has a very high Constancy in chalk grassland, its Fidelity is only moderate and it can be found in a variety of other open habitats, such as grazed pasture and waysides. It cannot be taken as an indicator of chalk grassland, but, if there are other indications of this community in the vicinity, the markedly higher percentage in 1962:9 would support such an interpretation.

Liguliflorae

In the table there are two species, *Leontodon hispidus* and *Hieracium pilosella*, which are characteristic of, though not exclusive to, chalk grassland and which can reach quite high Frequencies. These are both low-growing plants and would be recorded under the sub-family Liguliflorae. Pollen of Liguliflorae is a general component of agricultural spectra, but again we find that whilst it is represented in 1962:230, it forms an even greater component in 1962:9.

Conclusion

Both pollen spectra strongly indicate open country with an agricultural landscape, but in both there may be a component from chalk grassland. However, on the basis of the representation of several indicator species it appears that there is a greater representation of this element in 1962:9, to a degree which is not explicable simply on the grounds of a richer count. Though clearly closely related, the two spectra are probably distinct; they were not adjacent in the deposit.

Were it possible to identify the pollen of grass species, this conclusion could be tested, but at present, and certainly when this count was made (1968), the identification of grass pollen cannot be reliably taken below the level of family (Gramineae), with one or two exceptions which are not relevant here.

Seeds and other plant macrofossils

by Mark Robinson

The original intention of the present work was to prepare a synopsis of Peter Hawkes' (1973) dissertation, incorporating work on the unidentified seeds and cereal grains; unfortunately, it was not possible to locate any of the material worked on by Hawkes at the Institute of Archaeology, London. Consequently, it was decided to examine material from four of the extant wet samples. It soon became clear that much additional information could be gained by a full analysis of these samples. Three samples (1962:225, 248, and 291) were accordingly investigated in detail for seeds and certain categories of macroscopic plant remains; other categories (eg mosses, fungi, bud scales, plant fibres, and wood) form the subject of separate reports in this chapter. The results of Peter Hawkes' work have with his kind permission been incorporated in this account for comparative purposes. All the samples discussed in this report are from the 1962 series unless otherwise stated.

Methods and results

Uncertainties about the site sieving and sampling procedures have been discussed by Martin Bell in his introduction. However, the size of the seeds recovered in the present investigation and the relative abundance of taxa suggest complete assemblages of seeds down to a diameter of 0.5mm or less.

For the present study, all of sample 225 and sub-samples of samples 248 and 291 were analysed for waterlogged macroscopic plant remains. Summary details are given in Table 7. The samples comprised much comminuted wood, twigs, other plant material, some silt, and small fragments of chalk. Some small charcoal fragments, including *Quercus* sp., were present. Sample 225 had a higher content of silt and chalk fragments than the other two. Each sample was gently washed through a stack of sieves down to an aperture size of 0.125mm. With the aid of a binocular microscope, the residues were carefully sorted under water for potentially identifiable plant remains. The waterlogged botanical remains extracted were stored in a mixture of formaldehyde, ethanol, and glycerol. Charred plant remains were washed and dried. The samples were rich in waterlogged seeds, but because insufficient charred seeds were recovered, the remainder of samples 248 and 291, and the fourth waterlogged sample, 202, were analysed just for charred material. A non-waterlogged sample from further up the shaft, sample 1001, was also investigated for charred plant remains. It comprised small concreted chalk fragments and was possibly the base of a turf.

Preservation of the waterlogged plant remains was good, and a wide range of taxa was present. However, preservation was not of the very highest quality, perhaps due to abrasion caused by the churning action of a bucket in the shaft. Waterlogged seeds of *Plantago lanceolata* were absent, grass caryopses were in a poor condition, and it is possible that cereal chaff and straw were underrepresented due to differential preservation. Some of the carbonised remains had not been fully charred, but instead were a dark brown colour.

Samples 202, 248, and 291 had experienced contamination with a few modern seeds, presumably during excavation or processing on site. These were reasonably easy to recognise. The modern seeds often had an inflated appearance, were of a brighter colour, and were in a better state of preservation. Sometimes they were enmeshed with fine black fungal hyphae. Appendages and thin parts were more rigid than in archaeological examples. The starchy endosperm or cotyledons were often revealed when the modern seeds were cut open. Modern seeds have been excluded from the results. However, sample 225 did not contain any contaminants, and fortunately most of the taxa present in the other samples were also present in sample 225, including the taxa for which the site provides the earliest British records.

Identification was achieved by comparing specimens with appropriate reference material under a binocular microscope at magnifications of up to ×100, the waterlogged plant remains being washed in 70% ethanol prior to identification but not allowed to dry out. Specimens were referred to the seed collection in the Environmental Archaeology Laboratory of the University Museum, Oxford, and herbarium specimens from the Fielding-Druce Herbarium in the Department of Plant Sciences, University of Oxford.

Results are given in Tables 8–11, nomenclature following Clapham *et al* (1981). The term 'seed' is used in a wide sense to cover the normal germinable unit, so includes achenes, stones, nutlets, etc. Where an unqualified identification has been made, all other native British taxa have been excluded, but less likely non-British taxa have not been considered.

Some of the most interesting taxa identified have been illustrated in Figure 65. The *Ranunculus* achenes tentatively suggested as *R. bulbosus* were separated from the other British members of *Ranunculus* section *Ranunculus* as follows: the pits on the centre of the achenes tend to be larger than those shown by *R. acris* and smaller than those shown by *R. repens*. The periphery of the achenes is unlike *R. acris* in being expanded in the manner of *R. repens*. The achenes have retained a brown surface colouration, as sometimes sub-fossil *R. acris* achenes do. *R. repens* achenes are usually yellow. The achenes tend not to be as thick as those of *R. repens*.

The capsule lids of *Papaver hybridum* and *Papaver argemone* were separated from other members of the genus by their convex shape, the number of stigmatic rays, and the absence of deep marginal lobes. The rays of *P. hybridum* just reach the margin of the stigmatic disc, whereas the rays of *P. argemone* turn downwards at the margin.

The identity of the seeds of *Papaver somniferum* was confirmed by the very coarse pattern of the surface network of cell walls, as well as by the overall size of the seeds.

All the seeds listed under the *Stellaria media* gp. can probably be attributed to *S. media* (L.) Vill. itself. They average about 1.2mm in diameter, are very dark

Table 7 Details of the samples analysed for seeds and other plant macrofossils

Samples (1962:)	*225*	*202*	*248*	*291*	*Hawkes*	*1001*
Depth (ft)	100.6–102	98.75–101.9	98.25–98.75	96.5–97.5	94–*c* 100	*c* 60
Depth (m)	30.2–30.6	29.6–30.6	29.5–29.6	29–29.3	28.2–*c* 30	*c* 18
Weight analysed for waterlogged plant remains (kg)	0.68	–	0.26	0.17	>5	–
Sieve aperture for waterlogged plant remains (mm)	0.125	–	0.125	0.125	various	–
Weight analysed for carbonised plant remains (kg)	0.68	0.79	2.04	1.36	>5	0.15
Sieve aperture for carbonised plant remains (mm)	0.125	0.5	0.5	0.5	various	0.5
Presence of modern contamination	–	+	+	+	+	–

Table 8 Waterlogged seeds

Samples (1962:)		*Number of seeds* 225	248	291	*Hawkes*
Ranunculus cf. *bulbosus* L.	Buttercup	3	6	1	)
					) 42
Ranunculus sect. *Ranunculus* sp.	Buttercup	8	9	6	)
Papaver rhoeas L., *dubium* L., *lecoqii* Lamotte, or *hybridum* L.	Poppy	3	5	6	13
P. argemone L.	Poppy	8	20	15	17
P. somniferum L.	Opium poppy	3	1	–	–
Papaver sp.	Poppy	–	5	–	–
Fumaria sp.	Fumitory	5	2	1	16
Brassica or *Sinapis* sp.	Charlock, mustard, etc	–	–	1	–
Capsella bursa-pastoris (L.) Medic.	Shepherd's purse	2	–	1	–
Sisymbrium officinale (L.) Scop.	Hedge mustard	37	16	43	–
Cruciferae gen. et sp. indet.		–	2	–	–
***Viola* S. *Melanium* sp.**	Pansy	–	–	2	–
Viola sp.	Violet, pansy	–	–	–	4
Cerastium cf. *fontanum* Bau.	Mouse-ear chickweed	3	1	1	–
Stellaria media gp.	Chickweed	161	46	61	252
Arenaria cf. *serpyllifolia* L.	Sandwort	1	4	6	+
Chenopodium album L.	Fat hen	335	120	116	+
Atriplex sp.	Orache	136	73	37	+
Chenopodiaceae gen. et sp. indet.		25	37	38	1179
***Malva sylvestris* L.**	Common mallow	–	1	–	4
Linum usitatissimum L.	Flax	2	1	2	9
L. catharticum L.		5	6	5	3
Potentilla cf. *reptans* L.	Cinquefoil	–	–	–	1
Agrimonia eupatoria L.	Common agrimony	–	–	–	1
Aphanes arvensis L.	Parsley piert	10	5	8	11
Sanguisorba minor Scop.	Salad burnet	12	9	9	153
Prunus spinosa L.	Sloe	1	–	–	6
Crataegus cf. *monogyna* Jacq.	Hawthorn	–	–	1	–
Cornus sanguinea L.	Dogwood	–	–	–	1
Aethusa cynapium L.	Fool's parsley	43	34	16	334
Torilis cf. *japonica* (Ht.) DC	Hedge parsley	1	–	–	–
Polygonum aviculare agg.	Knotgrass	36	19	4	142
P. lapathifolium L.		–	–	–	2
Fallopia convolvulus (L.) Löv.	Black bindweed	9	9	8	246
(*Rumex crispus* L.	Dock	–	–	–	26)
Rumex sp.	Dock	3	3	2	–
Urtica urens L.	Small nettle	2	–	1	–
U. dioica L.	Stinging nettle	5	3	6	6
Corylus avellana L.	Hazel	–	1	–	3
cf *Gentianella* sp.	Felwort	–	1	–	–
Anchusa arvensis (L.) Bieb.	Bugloss	–	–	2	–
(*Myosotis* sp.	Forget-me-not	–	–	–	+)
Hyoscyamus niger L.	Henbane	1	–	–	–
Linaria vulgaris Mill.	Toadflax	–	–	–	1
Veronica sp.	Speedwell	1	–	–	–
Euphrasia or *Odontites* sp.		–	1	1	–
Galeopsis tetrahit agg.	Hemp-nettle	1	3	1	53
Glechoma hederacea L.	Ground ivy	1	–	–	–
Plantago major L.	Rat-tailed plantain	9	–	1	–
Galium aparine L.	Goosegrass	20	3	7	2
Galium sp.		8	5	3	15
Sambucus nigra L.	Elder	14	2	2	45
Scabiosa columbaria L.	Scabious	3	1	–	12
Tripleurospermum inodorum Sch. Bp.	Scentless mayweed	1	–	–	–
Arctium sp.	Burdock	–	1	2	+
Carduus sp.	Thistle	2	–	–	4
Carduus or *Cirsium* sp.	Thistle	1	–	–	–
Lapsana communis L.	Nipplewort	3	3	15	7
Leontodon sp.	Hawkbit	2	1	11	9
Picris hieracioides L.	Ox-tongue	1	1	–	–
Sonchus oleraceus L.	Sow-thistle	3	–	–	2
S. asper (L.) Hill.	Sow-thistle	7	1	3	3
Taraxacum sp.	Dandelion	1	–	3	2
Compositae gen. et sp. indet.		–	–	1	–
Juncus cf. *effusus* gp.	Rush	–	–	–	1
Carex sp.	Sedge	1	–	–	–
Bromus S. *Eubromus* sp.	Brome, chess	2	1	–	–
cf. *Triticum*		–	1	–	–
Gramineae gen. et sp. indet.		7	8	4	–
Ignota		4	2	1	48
Total		952	473	454	2775

NB + = present in Hawkes' samples but unquantified; taxa in brackets identified by Hawkes were only represented by modern examples in samples 248 and 291.

brown, and have distinct rounded tubercles. There are no large seeds with long acute tubercles on the periphery characteristic of *Stellaria neglecta*, or small pale reddish seeds characteristic of *Stellaria pallida*.

The seeds of *Linum usitatissimum*, averaging 3.85mm in length, are too large to fall within the size range of *Linum bienne*. They differ from *Linum perenne* ssp. *anglicum* in their general outline, the absence of a slight woody 'wing' around the margin, and in the surface cell pattern. Cells at the centre of the seeds are smaller in *L. usitatissimum* than *L. perenne*, whereas on the surface of the periphery they are equally large.

The *Tripleurospermum inodorum* achenes have the elongate shape and circular oil glands that serve to separate them from *Tripleurospermum maritimum*.

Peter Hawkes (1973, 7–10) personally sorted seeds from five samples, each about 1kg, which had been washed on to a 1mm mesh. A small amount of one of the samples was sieved over a 0.06mm mesh,

Table 9 Other waterlogged plant remains

	Presence or no of items			
Samples (1962:)	*225*	*248*	*291*	*Hawkes*
Bryophyta (moss) stem with leaves	+	+	+	+
Bud scales and buds	5	2	1	+
Cereal-type stem fragments	+	+	+	?
Crataegus or *Prunus* sp. (hawthorn or sloe) thorns	2	–	–	–
Deciduous leaf fragments	+	–	–	+
cf. *Dryopteris* sp. (fern) petiole scales	+	+	–	–
Leaf abscission pad	5	2	–	–
Linum cf. *usitatissimum* L. (flax) capsule fragments	11	1	–	–
Medicago lupulina L. (black medick) pod	1	–	1	–
(*Myosotis* cf. *arvensis* (L.) Hill. (forget-me-not) cyme	–	–	–	+)
Papaver argemone L. (poppy) capsule lid	1	1	–	–
P. hybridum L. (poppy) capsule lid	2	1	–	–
P. argemone L. or *hybridum* L. (poppy) capsule lid	–	–	1	16
cf. *Sisymbrium officinale* (L.) Scop. (hedge mustard) siliqua base	–	–	1	–
Trifolium sp. (clover) calyx	1	–	–	–
Trifolium sp. (clover) capsule lid	–	–	1	–
Triticum dicoccum Schbl. (emmer wheat) glume base	–	–	1	–
T. cf. *dicoccum* Schbl. (emmer wheat) glume base	1	–	–	–
T. dicoccum Schbl. or *spelta* L. (emmer or spelt wheat) spikelet fork	1	–	–	–
Vicia or *Lathyrus* sp. (vetch or tare) pod fragment	1	–	–	–

NB + = present but unquantified; taxa in brackets identified by Hawkes were only represented by modern examples in samples 248 and 291.

Table 10 Carbonised seeds

		Number of seeds					
Samples (1962:)		*225*	*202*	*248*	*291*	*Hawkes*	*1001*
Fumaria sp.	Fumitory	1	–	–	–	–	–
Stellaria media gp.	Chickweed	–	–	–	–	–	1
Chenopodium album L.	Fat hen	1	–	–	–	–	1
Plantago lanceolata L.	Ribwort plantain	–	–	–	1	–	–
Galium aparine L.	Goosegrass	2	–	1	–	1	–
Tripleurospermum inodorum Sch. Bp.	Scentless mayweed	1	–	–	–	–	–
Bromus sterilis L.	Barren brome	–	1	–	–	–	–
cf. *B.* S. *Eubromus* sp.	Chess, lop-grass	–	–	1	–	–	–
Triticum cf. *dicoccum* Schbl.	Emmer wheat	–	–	–	1	–	–
Triticum sp.	Wheat	–	–	–	1	+	–
Hordeum sativum Jes. – twisted grain	Six-row barley	–	–	–	3	–	–
H. sativum Jes. – straight, hulled grain	Barley	–	–	–	2	–	–
H. sativum Jes. – straight grain	Barley	1	–	–	–	–	–
H. sativum Jes. – hulled grain	Barley	1	1	–	–	+	–
H. sativum Jes.	Barley	2	3	–	3	–	–
Cerealia gen. et sp. indet.	Cereal	1	1	–	5	11	–
Gramineae gen. et sp. indet.	Grass	–	–	–	1	–	–
Ignota		1	–	–	–	1	–
Total		11	5	2	17	13	2

NB + = present but unquantified.

Table 11 Carbonised chaff

	Number of items					
Samples (1962:)	*225*	*202*	*248*	*291*	*Hawkes*	*1001*
cf. *Triticum dicoccum* Schbl. (emmer wheat) rachis node	–	–	1	–	–	–
Hordeum sativum Jes. (six-row barley) rachis node	–	–	–	1	–	–
cf. *H. sativum* Jes. (barley) rachis fragment	1	–	–	–	–	–

which resulted in the recovery of some small seeds that would not have been retained by a 1mm mesh. He also identified seeds which had been picked out by Peter Osborne from a further 11 samples during the recovery of insect remains. Hawkes pointed out that his results should not be taken as a fully quantitative analysis, and comparison with the present results shows this to be so. Not only are seeds smaller than 1mm underrepresented, but there is also a strong bias shown towards seeds with a diameter greater than about 2.5mm.

Peter Hawkes presented his results as an overall total for each taxon. They have been reproduced in Tables 8–11 subject to certain alterations. Even though Hawkes' specimens have been lost, it is possible to check on the identifications, because he amply illustrated his thesis. Where identifications are not thought justifiable, they have been changed to a more appropriate taxonomic level. In a few cases it has been possible to take the identifications further. The grass florets illustrated by Hawkes were clearly modern contaminants, and they have been excluded from the total. Where remains identified by Hawkes were only represented by modern examples in the other samples, this has been indicated. It is possible that the abundant cereal straw noted both by Hawkes (1973, 4) and Osborne (1969, 55) included modern grass culms, which were present in sample 248. They are a pale yellow colour, and did indeed look very straw-like against the darker background of the other organic material in the sample. Ancient straw remains were few and fragmentary in the samples examined.

The origin of the assemblages

A high proportion of the taxa identified from samples 225, 248, and 291 occurred in all three samples, and they show similar relative abundances between samples. The differences between the results from these samples and those of Hawkes are readily explicable by the bias towards larger seeds shown by Hawkes' results and factors of identification. The botanical assemblage from the bottom 1.8m of the waterlogged sediments was apparently of uniform character (even though it probably accumulated over a period of not less than 20 years), and the results will be considered together.

The wood fragments, which comprised a major component of the organic sediments, seem to have

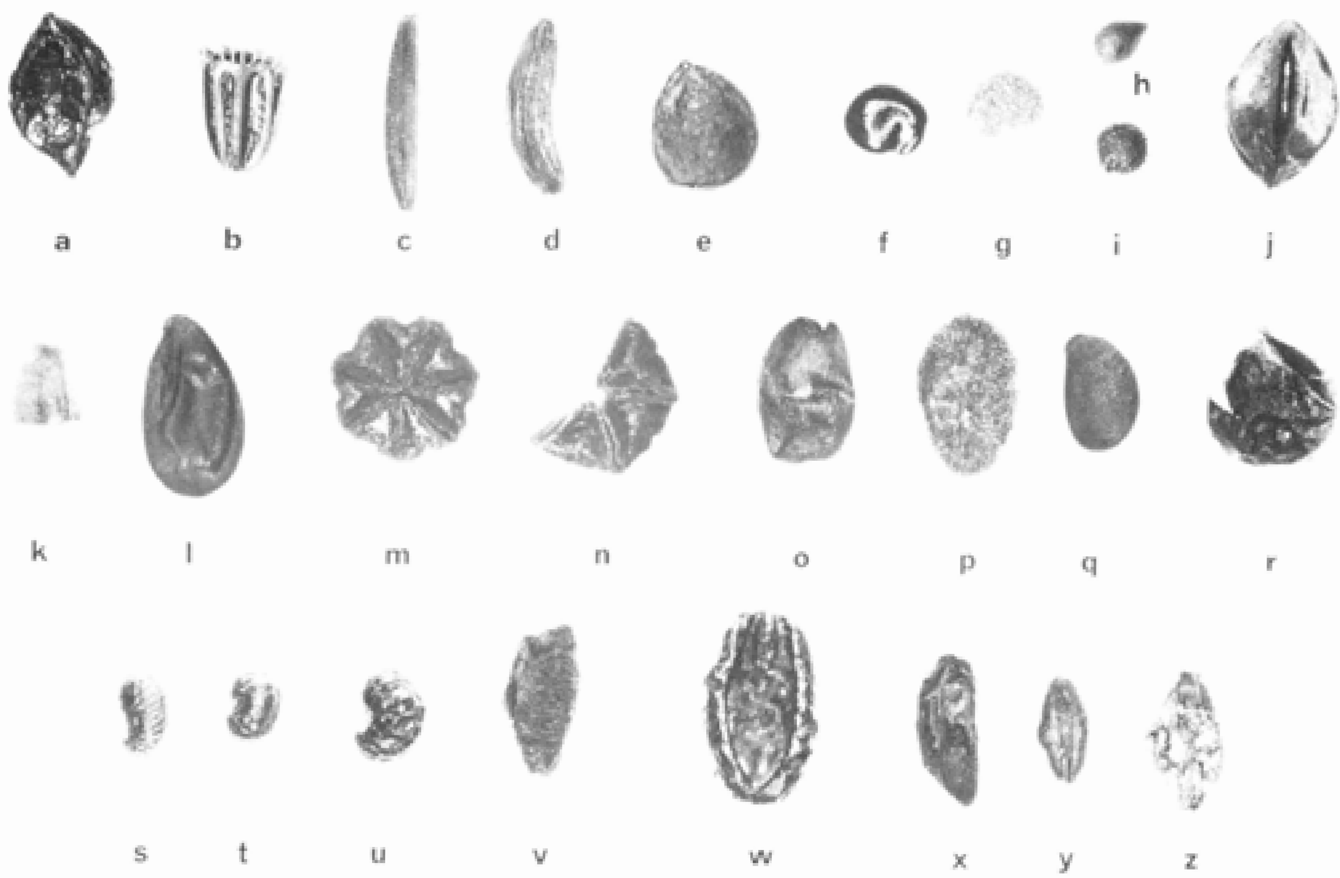


Fig 65 Seeds from the Wilsford Shaft: a Sanguisorba minor; *b* Scabiosa columbaria; *c* Leontodon *sp.; d* Picris hieracioides; *e* Ranunculus *cf.* bulbosus; *f* Atriplex *sp.; g* Hyoscyamus niger; *h* Aphanes arvensis; *i* Stellaria media *gp.; j* Fallopia convolvulus; *k* Linum *cf.* usitatissimum *capsule fragment; l* L. usitatissimum; *m* Papaver hybridum *capsule lid; n* P. argemone *capsule lid; o* Sisymbrium officinale; *p* Plantago major; *q* Linum catharticum; *r* Galium aparine; *s* Papaver argemone; *t* P. rhoeas, dubium, lecoqii, *or* hybridum; *u* P. somniferum; *v* Tripleurospermum inodorum; *w* Plantago lanceolata; *x* Triticum *cf.* dicoccum; *y, z* Hordeum sativum; *a–n, r ×6.5, o–q, s–w ×13, x–z ×3.1; a–u waterlogged, v–z carbonised; a–v, z Sample 225, w–y Sample 291*

been derived from wood brought to the site, because the other lines of palaeoecological evidence do not suggest a significant presence of woodland in the vicinity. Human activity must also be implicated in the origin of the charred plant remains, but the shaft does not seem to have been used for the deliberate dumping of refuse, and they probably represent stray items from crop processing near the site. The waterlogged seeds include a high proportion of annual weeds which, it is argued below, were of arable origin. Waterlogged crop remains were few. The weed seeds covered the full range of sizes, and the different species have a wide range of growth habits. They do not appear to represent any particular stage of crop processing. It is thought most likely that the weed seeds were mainly from plants growing nearby and that the seeds entered the shaft through natural agencies. There was no evidence that any of them had been deposited through ritual activity; indeed they would be consistent with debris which had accidentally fallen or been blown into a well.

Species records

The site is in the upper Salisbury Avon district of Wiltshire. All the taxa identified, with the exception of some of the crops, have been recorded as growing there in recent times (Grose 1957). There are archaeological records of all the crop species from Wiltshire (Helbaek 1952).

Given that waterlogged deposits from the chalk are very unusual and that there is a dearth of waterlogged remains from pre-Iron Age habitation sites, it is hardly surprising that some of the identifications constitute the earliest British records. Details of the more significant records from sample 225, the uncontaminated sample, are given below.

Papaver hybridum L.

(Samples 225 and 248). The capsule lids from the shaft provide perhaps the only reliably identified finds of this poppy from British archaeological deposits. It is now a rare annual weed of neutral and calcareous soils, closely associated with arable agriculture, but it seems formerly to have been of frequent occurrence in the district (Grose 1957, 106).

Papaver argemone L.

(Samples 225, 248, 291, and Hawkes). There are now many records of this poppy from Iron Age and later contexts (eg Lambrick and Robinson 1979, 83), and it has also been recorded from a later Bronze Age context in Oxfordshire (Robinson unpublished). It is an annual weed of light soils.

Papaver somniferum L.

(Samples 225 and 248). There are several records of Iron Age opium poppy from southern England (Green 1981, 143; Robinson unpublished), including a carbonised seed from Fifield Bavant, Wiltshire (Helbaek 1952, 222). The Wilsford specimens represent the first pre-Iron Age finds from Britain, but *P. somniferum* is well known from Neolithic and Bronze Age sites in Germany, Switzerland, and the Netherlands, where it sometimes occurs in contexts suggesting that it was a cultivated plant (J Renfrew 1973, 161–2; Waterbolk and van Zeist 1966, 575–6). In Britain it commonly occurs as a weed of gardens, allotments, and refuse tips, but in Central Europe it is also a member of arable communities. It is possible that it was an accidentally introduced weed, but it could have been cultivated in Britain during the Bronze Age as an oil crop, for its edible seeds, or as a medicinal plant.

Hyoscyamus niger L.

(Sample 225). Henbane is now a plant of sporadic occurrence inland in Britain, but it was formerly a common denizen of farmyards etc, and there are numerous records of it from the Iron Age onwards (eg Robinson 1981, 276). There is no reason to doubt its native status, because it also occurs in sandy coastal habitats (Clapham *et al* 1962, 670), but Wilsford provides the earliest example of it in association with human settlement.

Tripleurospermum inodorum Sch. Bp.

(Sample 225). It was possible to separate two well-preserved achenes of this species from the closely-related *Tripleurospermum maritimum*. The former is an annual weed of arable habitats and disturbed waste ground especially on well-drained soils, the latter is now a maritime perennial of dunes and shingle beaches. The Glacial records of *Tripleurospermum* sp. from the British Isles (Godwin 1975, 344) could, on ecological grounds, belong to either species (*see* the Late Devensian distribution of *Armeria maritima*: Godwin 1975, 307). *Tripleurospermum* sp. is a frequent component of carbonised weed assemblages from the Iron Age onwards (eg Jones 1978, 94), and it is interesting to have an early record of what is now the arable species.

The crops

Three crop species were identified from the Wilsford Shaft: *Triticum dicoccum* (emmer wheat), *Hordeum sativum* (six-row hulled barley), and *Linum usitatissimum* (flax). There is no reason to suspect the presence of hexaploid wheats amongst any of the *Triticum* grains or chaff which have not been fully identified. Nor is there any evidence for naked barley. Only the charred grains with adherent fragments of lemma and palea have been called hulled barley in Table 10, but the others tended either to have the lateral splits or the pair of dorsal ridges that also characterise the hulled varieties. Impressions in pottery of both emmer and hulled barley were identified from the Neolithic site at Windmill Hill and various Early to Middle Bronze Age sites in Wiltshire (Helbaek 1952, 224–7). These two cereals, along with naked barley, seem to have been the major cereals cultivated in the region at the same time as the accumulation of organic sediments in the shaft.

Flax remains are much less commonly found on prehistoric sites than cereal remains, but pottery impressions provide other early records from Wiltshire (Helbaek 1952, 205). Two Neolithic impressions from Windmill Hill measured 3.72mm and 4.07mm in length. Fifteen impressions were noted in an Early Bronze Age pot from Handley Down, the nine measurable impressions averaging 3.35mm in length. A single Middle Bronze Age impression was recorded from Winterbourne Stoke. The flax impressions from Windmill Hill are the earliest records from Britain, and they were also the largest recorded by Helbaek (1952, 199) from prehistoric Europe. His British Bronze Age records are all smaller. There are two measurable seeds from Wilsford, both from sample 225, which are 3.8mm and 3.9mm in length – a similar size to the Windmill Hill specimens. However, all the Neolithic and Bronze Age seeds from Wiltshire fall within what he regarded as a small-seeded race, the original cultivar brought into Central and Western Europe by the primary spread of flax cultivation (Helbaek 1960, 115–16).

At Wilsford, charred grains of barley are several times more abundant than emmer wheat, which does happen to be the trend shown by Early and Middle Bronze Age grain impressions from the region (Helbaek 1952), but the sample is too small to allow generalisations about the ratio between the cereals cultivated. The problem of assessing the relative importance of flax-growing in relation to cereal cultivation is that flax remains are more readily preserved by waterlogging than cereal remains, whereas cereal remains are particularly likely to become charred during crop processing which would have involved such treatment as the parching of hulled grain.

A full plough-arable weed flora (described below) evidently grew amongst the crops, although it is not possible to relate any of the weeds to particular crops. Remains of the characteristic flax weeds, *Camelina allysum* and *Camelina sativa,* which have been identified amongst flax remains on sites of later periods, are absent.

The vegetation and environment

A cursory glance through Tables 8–11 reveals, in addition to the crop species, numerous taxa that are annuals of disturbed ground, some distinctive calcareous grassland species, and a very few remains of scrub plants. More detailed interpretation is difficult, because many species will grow in a variety of habitats, not all of which need have occurred at Wilsford. A summary of the known ecological requirements or habitat preferences of all the taxa would not provide a straightforward interpretation of the vegetation of the site. As a result of differential seed productivity, dispersive powers, and survival, the tables do not even provide exhaustive lists of all the plants which grew in the vicinity of the site and their relative abundance.

A useful approach to interpretation is to look for species associations which, when due allowance is made for the problems of differential preservation etc, can be matched with the archaeological assemblages. Some information on the extent or proximity of the vegetation can be gained from their degree of representation in samples 225, 248, and 291 (which do not seem to have been subject to sampling bias), by applying a subjective judgement based on results from other archaeological sites and knowledge about seed productivity, dispersive powers, etc. For example, the 14 seeds of *Urtica dioica* in these three samples are but poor representation for a species of such prolific seed productivity, whose seeds often occur in their hundreds in similar sized samples, whereas the 30 seeds of *Sanguisorba minor* comprise a particularly rich find for this plant.

Jones (1984) and Greig (pers comm) have used the modern communities of the Zürich-Montpellier system of vegetation classification for comparative purposes. This system was devised to provide a well-defined series of named communities, against which any piece of vegetation can be compared. The communities are defined by the presence of certain highly characteristic species, or species groups, and differential species which serve to separate particular communities. The remaining members of the community, which have less diagnostic value because they are eurytopic or unpredictable in their occurrence, are given the status of companions. The Zürich-Montpellier school of phytosociology has not met with unqualified acceptance from British botanists. Most vegetation shows a continuum of variation between communities, and there has been opposition to what are seen as the artificial constraints imposed by the classification. Ill-conceived schemes of classification can result in the absurdity of the presence of a character species, which only ever occurs at a low frequency, being used to link two communities into a single syntaxon, even though the remainder of the vegetation, including dominant species, comprise almost non-overlapping ranges of taxa.

One virtue of phytosociology for palaeoecological interpretation is that it provides for comparison generalised species lists summarising the recording of many actual communities. It sometimes gives a firm basis at the plant community level for arguing about the presence of a particular habitat. The difficulty of just comparing the archaeological results with actual plant communities is that, amongst the minutiae of variation, it can be very difficult to recognise which differences have profound and which have trivial interpretative significance. Another advantage of the Zürich-Montpellier system is that, because it provides a hierarchichal classification, it is sometimes possible to make comparisons with higher syntaxa, even if the actual communities on a site cannot be recognised.

Most of the published phytosociological analyses are based on data from continental Europe. Even when the communities occur as distinct entities in Britain, the character and differential species applicable to the continent sometimes only have the status of rare aliens here. Fortunately for the interpretation of the Wilsford results, Silverside (1977) has completed the daunting task of producing a practicable classification of British arable weed communities.

Arable weeds – many seeds

Association Papaveri-Melandrietum noctiflori, diagnostic spp. gp.
Papaver (rhoeas)
P. hybridum
P. argemone
Arenaria cf. *serpyllifolia*

Alliance Caucalidion lappulae, character and differential spp.
Papaver somniferum (in Europe)
Fumaria (various spp.)
Veronica (polita)

Order Centauretalia cyani character and differential spp.
(*Sinapis arvensis*)
Viola (arvensis)
Atriplex (patula)
Aphanes arvensis
Aethusa cynapium
(*Odontites verna*)
Lapsana communis

Class Stellarietea mediae character spp. in the Caucalidion
Capsella bursa-pastoris
Stellaria media
Chenopodium album
Fallopia convolvulus
Anchusa arvensis
Tripleurospermum inodorum
Sonchus asper

Companions of the Caucalidion
Ranunculus (repens)
Sisymbrium officinale
Cerastium cf. *fontanum*
Medicago lupulina
Polygonum aviculare agg.
Linaria vulgaris
Galeopsis tetrahit agg.
Plantago major
P. lanceolata
Galium aparine
(*Cirsium vulgare*)
(*C. arvense*)

Ruderal weeds – few seeds

character and differential spp. of Order Sisymbrietalia with its Alliance Sisymbrion officinalis, and Order Onopordietalia with its Alliance Dauco-Melilotion
Papaver somniferum
Sisymbrium officinale
Malva sylvestris
Urtica urens
Hyoscyamus niger
Carduus (nutans)
C. (acanthoides)
(*Cirsium vulgare*)
Picris hieracioides
Bromus sterilis

additional character sp. of the Stellarietea
Sonchus oleraceus

additional companions of the Sisymbrietalia and Onopordietalia
Papaver (rhoeas)
Atriplex spp.
Rumex (crispus)
R. (obtusifolius)
Urtica dioica
Arctium spp.

Fig 66 Suggested composition of the phytosociological communities of arable weeds and ruderal weeds

Some care must be taken over the use of modern phytosociological data for arable communities, because they are mostly from communities which have been impoverished by the use of agricultural chemicals and mechanised farming. Silverside does, however, consider the arable weeds that are on the verge of extinction in Britain. A phytosociological classification does not exist for British chalk grassland, although there is a survey of other British limestone grasslands which provides much of the relevant classification (Shimwell 1971a; 1971b). A detailed study has, however, been made of the floristic composition of chalk grassland in Wiltshire (Wells 1975), which forms the basis of the classification adopted by the Nature Conservancy Council for English chalk grassland (Duffey *et al* 1974, 47).

Chalk pasture

Alliance Mesobromion erecti character sp.
Picris hieraciodes
differential spp.
Ranunculus cf. *bulbosus*
Medicago lupulina
Plantago lanceolata
Leontodon (hispidus)

Order Brometalia erecti character spp.
Sanguisorba minor
Gentianella (amarella)
Scabiosa columbaria

Companions of the Mesobromiom
Cerastium cf. *fontanum*
Linum cartharticum
Trifolium (repens)
T. (pratense)
Lathyrus pratensis
Potentilla cf. *reptans*
(*Euphrasia nemorosa*)
(*Cirsium acaule*)
Taraxacum (officinale)
Carex (flacca)
C. (humilis)

Scrub or mixed hedges

Order Prunetalia
woody spp.
Prunus spinosa
Crataegus cf. *monogyna*
Cornus sanguinea
Corylus avellana
Sambucus nigra

herbaceous spp.
Agrimonia eupatoria
Torilis cf. *japonica*
Glechoma hederacea
plus certain plants already listed as growing in the Sisymbrietalia and Onopordietalia such as:
Urtica dioica
Arctium spp.

Fig 67 Suggested composition of the phytosociological communities of chalk pasture and scrub/mixed hedges

It is readily possible to assign all but three of the minimum of 63 taxa of flowering plants (excluding crops) listed in Tables 8–11 amongst just four phytosociological communities (Figs 66 and 67). It is very likely that two further communities also occurred (Fig 68), but their presence has been obscured by their members being shared with the other communities.

Disturbed ground 1

The class Stellarietea mediae (Silverside 1977, 236) is particularly well represented, most of its character species being preserved. Seeds of *Stellaria media* and *Chenopodium album* are the most abundant species from samples 225, 248, and 291. The unified class Stellarietea has been used rather than the separate classes of the Chenopodietea and the Secalinietea because, under British climatic conditions, many of the Chenopodietea species that cannot survive continental winters are able to overwinter, making the differences between the classes much less distinct (Silverside 1977, 8–9, 236–7). The class includes communities of arable, disturbed ground, and ruderal sites. Character and differential members of the ruderal orders are mostly not very well represented and they are considered later. There are three arable orders that occur in Britain: the Polygono-Chenopodietalia, the Eragostietalia, and the Centauretalia cyani. The thermophilous weeds of the Eragostietalia (Silverside 1977, 307) were entirely absent. Of the remaining two orders, the Polygono-Chenopodietalia is a community of root crops, spring-sown cereals, gardens, and nitrogen-rich disturbed ground, for example around settlements. Its character and differential species include *Polygonum persicaria*, *Lamium purpureum*, *Chenopodium polyspermum*, *Solanum nigrum*, and *Urtica urens*, while the species of its basiophilous alliance that might be expected at Wilsford include *Thlaspi arvense*, *Polygonum lapathifolium*, and *Chenopodium ficifolium* (Silverside 1977, 240–3). All these taxa are familiar from waterlogged deposits associated with prehistoric settlements, for example from Iron Age sites in the Upper Thames Valley, yet only two of them were identified from Wilsford. *U. urens* is represented by three seeds in samples 225, 248, and 291, while *P. lapathifolium* is included in Hawkes' list. Seeds of these two species are sometimes very abundant in waterlogged deposits, so their presence in these samples counts as slight. The Centauretalia is an order of arable crops, usually cereals (Silverside 1977, 317–21). Some of its character species are likely to have been post-Iron Age additions to the British flora, but there is a reasonable representation of the remainder.

The Centauretalia comprises three alliances: the Arnoseridion minimae, the Aphanion arvensis, and the Caucalidion lappulae (Silverside 1977, 322–46). The Arnoseridion is a community of very base poor soils, and the Aphanion is an alliance of well-drained slightly acidic soils. They both include calcifuge species, such as *Aphanes microcarpa*, *Spergula arvensis*, and *Rumex acetosella*, which serve to differentiate them from the Caucalidion. The absence of acid soil species from Wilsford suggests the presence of a Caucalidion community. This alliance is restricted to south and south-east England, but this is primarily a factor of geology rather than climate. The Caucalidion is strictly confined to calcareous soils in Britain, primarily on the chalk, but including oolitic limestone and other strongly calcareous rocks.

Within the Caucalidion, the records of *Papaver hybridum*, *Papaver argemone*, and *Arenaria* cf. *serpylli-*

Trampled ground

Alliance Polygonion avicularis differential spp.
Polygonum aviculare agg.
Plantago major

Field edge

Alliance Convolvulo-Agropyrion repentis
a few species of the Brometalia and many species of the Stellarietea

Fig 68 Suggested composition of the phytosociological communities of trampled ground and field edge

folia suggest an affinity towards the association Papaveri-Melandrietum noctiflori (Silverside 1977, 352–4, table XLIX), a community of well-drained calcareous soils, particularly on the chalk. However, the interpretation runs into the problems of differences between ancient and modern arable floras. Two of the characteristic species of this association, *P. hybridum* and *P. argemone*, have virtually been eliminated from amongst the cereal crop but tend to survive on the edge of the ploughed area (Silverside 1977, 129). *Silene noctiflora* shows the highest degree of constancy in modern examples of the Papaveri-Melandrietum, and its seeds ought to survive under waterlogged archaeological conditions, but it is absent from Wilsford. However, there are no records for *S. noctiflora* given by Godwin (1975), and its status in the British flora is uncertain. It is possible that *S. noctiflora* is a post-Bronze Age introduction.

By far the majority of the waterlogged seeds from samples 225, 248, and 291 can be assigned to the syntaxa which comprise the alliance Caucalidion lappulae or occur as companions in the Caucalidion. Even though members of this alliance – indeed the whole family Stellarietea – tend to have prolific seed productivity and their seeds survive under waterlogged conditions, the abundance of their seeds suggests a strong presence of this community. This would imply arable or very recently abandoned arable in the vicinity. Different communities occur on disturbed ground around settlements within a very few years of their occupation commencing. Within less than 6–10 years after the abandonment of arable on chalk soils, Stellarietea communities are entirely replaced (Cornish 1954).

The wide range of taxa from the assemblage shows that a fully-developed weed flora grew amongst the Middle Bronze Age crops. The flora is characteristic of plough-arable, rather than spade or hoe horticulture. The only obvious absences from a fully developed British Caucalidion flora are *Avena fatua* and those late arrivals, such as *Agrostemma githago*, which reached Britain about 2000 years ago and are now on the verge of extinction as arable weeds in Britain. The soil at Wilsford was probably well suited for arable agriculture. There is no evidence from the weed flora for nutrient impoverishment; indeed the occurrence of *Stellaria media* and *Tripleurospermum inodorum* in the Papaveri-Melandrietum probably characterises the more nitrogenous soils (Silverside 1977, 354). The presence of *Galium aparine* is of particular interest. Jones (1978, 106) has noted that *G. aparine* normally germinates in the autumn rather than the spring, and therefore tends to occur as a weed in autumn-sown rather than spring-sown crops. *G. aparine* also grows in other habitats, so the waterlogged seeds need not necessarily have come from plants growing in the arable. Charred remains tend to show a much closer association with cereal cultivation. Unfortunately, few carbonised weed seeds were recovered from Wilsford, but *G. aparine* is the most abundant.

Disturbed ground 2

The class character species of the Stellarietea and the companion species listed in Figure 66 as growing in the Caucalidion can also occur in the Stellarietea communities of ruderal habitats, the orders Sisymbrietalia and Onopordietalia (Silverside 1977, 359–69). These are longer-lived communities, including biennials and perennials which cannot readily complete their life cycles where there is annual cultivation. The Sisymbrietalia is a pioneer community of ruderal habitats, for example abandoned cultivated land and tracksides, which can colonise rapidly but after about two years, if succession proceeds unhindered, gives way to other communities such as the Agropyretea repentis. *Sisymbrium officinale*, one of the character species of the alliance Sisymbrion officinalis of this order but also a companion species of the Caucalidion, was reasonably well represented in samples 225, 248, and 291. However, seeds of the biennial and perennial species of the Onopordetalia which act as differential species from the Polygono-Chenopodietalia and the Centauretalia, such as *Malva sylvestris*, are very few.

The Onopordietalia is a thermophilous ruderal order of large weeds, mostly annual or biennial. The only alliance of this order which certainly occurs in Britain at present is the Dauco-Melilotion. It occurs in such places as waste ground in settlements and on rubbish heaps, although its habitats need not necessarily be nutrient-rich. Seeds of this order are very few from samples 225, 248, and 291. A couple of achenes of *Carduus* sp. and an achene of *Carduus* or *Cirsium* sp. give but little evidence for the spiny element of this community. There was a single seed of *Hyoscyamus niger*, a member that favours nutrient-rich farmyards and old manure heaps.

It is not possible to differentiate between the Sisymbrietalia and the Onopordietalia from the Wilsford data. Although a ruderal community was probably present (Fig 66), its occurrence was either slight or at some distance from the shaft. Possibly it grew in neglected areas around a settlement, but the rich growth of these communities sometimes seen on old excavation spoil heaps serves as a reminder that it could also have become established on the unstable slopes of newly-constructed barrows.

Grassland

The second most numerous group of seeds in samples 225, 248, and 291 is from plants of dry, calcareous, grassland. Allowing for problems of selective preservation, an appropriate range of taxa is present to suggest the occurrence of chalk (or other limestone) grassland as described by Tansley (1939, 530). *Sanguisorba minor* and *Scabiosa columbaria*, species which attain the highest degree of constancy in chalk grassland and are almost exclusive to calcareous grassland, are, for a waterlogged archaeological deposit, particularly abundant. These two plants are amongst the character species of the Brometalia, the only order of the class Festuco-Brometea in Britain (Shimwell 1971a, 6–15; 1971b, 29–31). There are two Brometalia alliances, the Mesobromion erecti, which includes most of the chalk and limestone grasslands of the British Isles, and the Xerobromion, which occurs mostly on limestone cliffs in Britain. The Wilsford grassland clearly belonged to the Mesobromion, with species such as *Ranunculus* cf. *bulbosus* serving to differentiate it from the Xerobromion (Fig 67).

The chalk grasslands of Wiltshire have been divided into eight categories after extensive survey (Wells 1975; Wells *et al* 1976). It is not easy to classify the Bronze Age grassland at Wilsford because of the poor preservation of grass seeds, but the results seem most compatible with *Festuca ovina/rubra* grassland or *Carex humilis* grassland.

Lichen-rich grassland resulting from intensive grazing of rabbits on abandoned arable is not relevant here. There is no evidence of *Agrostis tenuis/Anthoxanthum/Viola riviniana* grassland, with such calcifuge members as *Potentilla erecta* as well as calcicoles that can occur if the upper part of a deep soil profile over chalk is non-calcareous. Nor was there evidence of *Festuca rubra/Helictotrichon pubescens* tussock grassland, a type of ungrazed chalk grassland with numerous ant hills.

Scabiosa columbaria does not readily grow in the tall *Arrhenatherum elatius* grassland, which tends to occur when arable on the chalk is abandoned and not grazed or only lightly grazed (Wells 1975, 117; Wells *et al* 1976, 598, 613). This vegetation also contains *Pastinaca sativa*, *Centaurea scabiosa*, and *Knautia arvensis*, tall herbs that are susceptible to grazing, but the seeds were not found. *Brachypodium pinnatum* grassland and *Bromus erectus* grassland perhaps result from invasion of pasture following a reduction in or cessation of grazing (Duffey *et al* 1974, 47; A Thomas *et al* 1957, 430), but these species can withstand a resumption of grazing. Dense *Brachypodium* grassland contains no other species and, even in mixed *Brachypodium* grassland, many of the grassland species identified, such as *Ranunculus bulbosus*, are rare or absent (Wells 1975, 116). *Bromus erectus* grassland retains a full complement of chalk grassland species when grazed (Wells 1975, 112–15). The only argument that can be advanced against its presence at Wilsford is the absence of much evidence for scrub that might also have become established at the time of colonisation by *B. erectus*.

Festuca ovina/rubra grassland is a floristically rich grassland in which grasses, particularly *F. ovina* L. and *F. rubra* L., provide the majority of the vegegation cover, but grazing by sheep and cattle (or rabbits) enables a large number of other herbs, including all the taxa identified from the Wilsford Shaft to compete successfully (Wells 1975, 106–10). The sward tends to be from 20 to 110mm tall. It is the most widespread type of chalk grassland in England and is not restricted to any particular aspect or soil depth. The community results from grazing and heavy grazing will eventually create it from most other types of chalk grassland, but, once established, it shows some resistance to change on cessation of grazing (Wells *et al* 1976). *Carex humilis* grassland has a low-grazed turf and shows a great floristic similarity to *Festuca ovina/rubra* grassland with the addition of *Carex humilis* Lys. (Wells 1975, 110–14). Its present English distribution is restricted to Wiltshire and Dorset. Only a single *Carex* nut was found in the samples, but at present *C. humilis* rarely sets viable seeds.

Well over 90% of the waterlogged seeds from samples 225, 248, and 291 can easily be assigned to the two Stellarietea communities; only 6% of them can be placed in the Mesobromion. However, the seed productivity of many of the Mesobromion species is less than that of the Stellarietea, and many of them have seeds which do not survive readily under waterlogged conditions. Therefore, this figure underrepresents the importance of Mesobromion vegetation in the vicinity of the shaft. Chalk pasture similar to modern, unimproved, grazed grassland on the Wiltshire chalk, but showing little evidence for the invasion of scrub, was probably a major part of the Middle Bronze Age landscape at Wilsford. From the botanical remains, it is not possible to suggest which particular domestic animals were grazed on it.

Scrub

In contrast to the abundance of wood fragments in the samples, particularly of oak, other remains of woody taxa are few. The wood was probably brought to the site, and it is possible that some of the other macroscopic remains, such as buds, were imported amongst undressed timber or firewood. The hazel nuts could have been collected for consumption. The woody taxa, listed in Figure 67 and identified from seed remains, comprise familiar members of the scrub which establishes itself on chalk grassland when grazing pressure is relaxed, although *Prunus spinosa* tends to be more characteristic of deeper soils over chalk (Duffey *et al* 1974, 126; Lloyd and Piggott 1967, 138; Salisbury 1952, 106–9). They are all also hedgerow shrubs. There are also a very few seeds of herbaceous species which tend to favour hedgerows and scrub, and which are not obvious members of the other communities that have been postulated. Some of the members of the ruderal community can also occur in such habitats, for example *Urtica dioica* and *Arctium* spp. Remains of the scrub taxa are very sparse; for example *Sambucus nigra* is the only woody

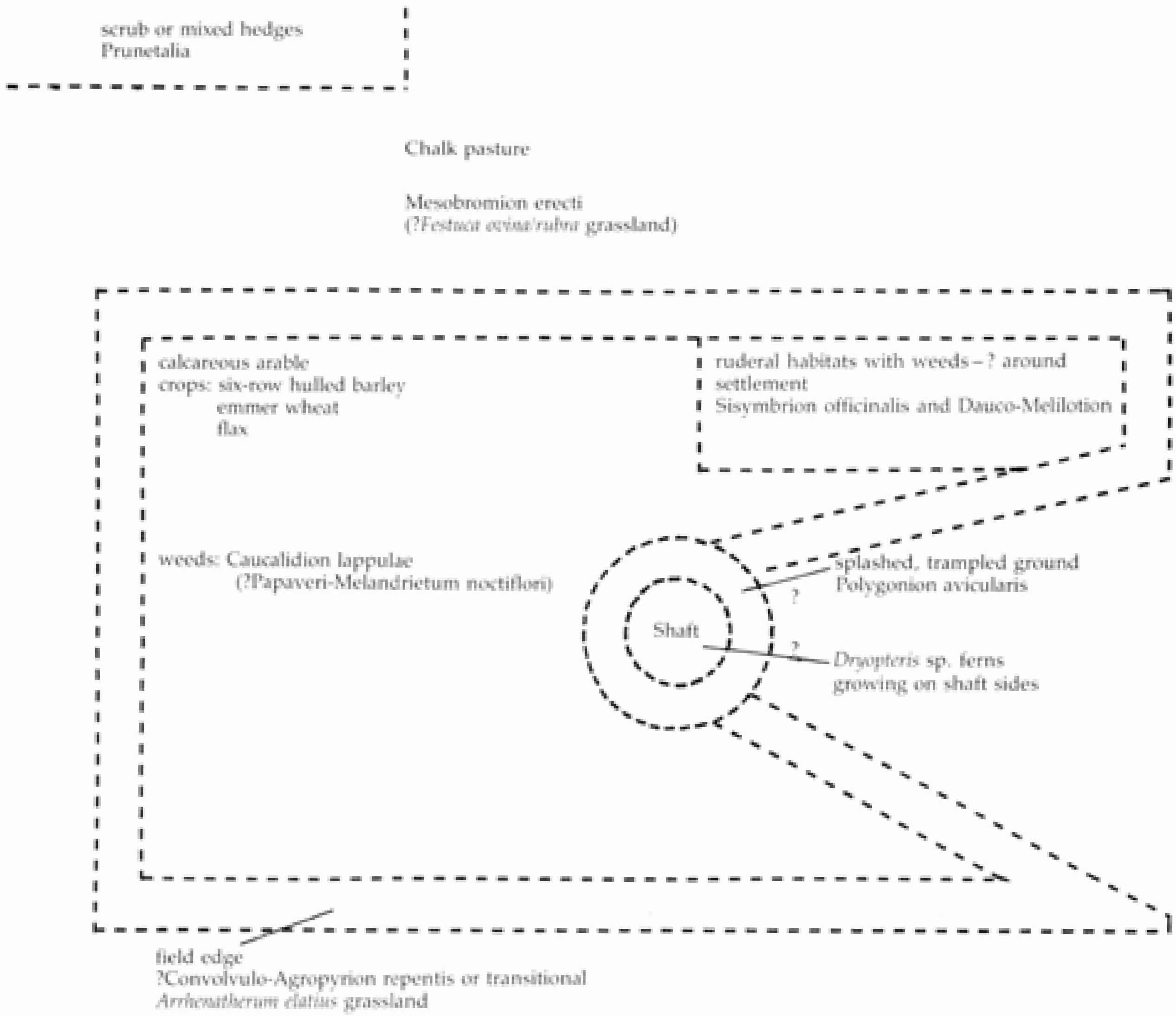


Fig 69 Summary of the suggested relationships between the various plant communities around the Wilsford Shaft; this also incorporates evidence from pollen and Coleoptera

species represented by more than a single seed in samples 225, 248, and 291. This community was either an insignificant or a distant aspect of the landscape. If the scrubby grassland now prevalent on the remaining parts of the Wiltshire chalk had been present in the vicinity of the site, or the shaft had been adjacent to hedges, not only would remains of the taxa listed in Figure 67 have been more abundant, but there would also have been a greater range, including for example *Rosa* spp., *Hypericum perfoliatum*, and possibly *Rubus fruticosus* agg. *Sambucus nigra* has a greater seed productivity than the other scrub species, which might account for its better representation, but it is possible that one or two elder bushes had become established around a settlement.

Other possible communities

The effects of trampling and splashing of water around the top of the shaft probably resulted in the soil becoming compact and somewhat anaerobic. Such conditions are generally hostile to plant growth, but a very restricted community comprising *Polygonum aviculare* agg. and *Plantago major* would have been able to establish itself around the bare patches of the most heavily trampled areas. This community belongs to the class Plantaginetea maioris, order Plantaginetalia maioris, alliance Polygonion avicularis (Silverside 1977, 375–89). It could also have occurred on the trampled ground of any settlement. Seeds were discovered of *P. aviculare* agg. and *P. major*, but both taxa are also common companions of the Stellarietea, so the presence of the Polygonion is uncertain.

Between the edge of the frequently disturbed ground occupied by Stellarietea communities and the pasture there was probably an ungrazed strip subject to occasional disturbance. Such a habitat would have been suitable for a transitional community between the classes Stellarietea and Molinio-Arrhenatheretea dominated by *Arrhenatherum elatius* (Silverside 1977, 391), although seeds of the tall umbellifers so typical of the Arrhenatheretea, such as *Pastinaca sativa*, are absent. Another possibility for the transitional community is the alliance of Convolvulo-Agropyretea repentis (Silverside 1977, 372–3). It is typically a community of banks, road verges, and the margins of arable and fallow fields. *Agropyron repens* (L.) Beav. is prominent and *Convolvulus arvensis* L. present; otherwise it comprises a few Brometalia and many Stellarietea species. Since the two communities between which it is transitional both occurred at Wilsford, it is not possible to assess its presence.

Items resembling the leaf stem scales of *Dryopteris* sp. were found in samples 225 and 248. It is possible that these ferns had become established on the walls of the shaft under the conditions of low light intensity and high humidity that would have prevailed.

Seeds from three taxa of flowering plant remain unclassified. Two seeds of *Polygonum lapathifolium* were identified by Peter Hawkes. Although primarily a Polygono-Chenopodietalia species, it can occur in other Stellarietea communities. *Bromus* S. *Eubromus* sp. is represented by both waterlogged and charred caryopses in samples 225, 248, and 291. Members of this subgenus (*B. mollis* agg. or *B. secalinus* L.) commonly occur in archaeological assemblages of charred plant remains belonging to the Centauretalia.

Peter Hawkes (1973, 39) identified a seed of *Juncus* cf. *effusus* gp., but lost it before it could be described. It is unlikely that the tussock rushes grew on the site. Possibly the seed was misidentified, or perhaps it reached the site as a result of long-distance transport.

Climatic implications

The flora from the Wilsford Shaft does not contain the northern element shown by the chalk grassland of the Yorkshire Wolds that at present only occurs in wetter or more shaded habitats in southern England (C Smith 1980, 195). However, nor does the assemblage include those chalk grassland plants with a continental distribution which are rarities in Britain, mostly being restricted to the north-east end of the Chilterns, but which are characteristic of the French chalk south of the Somme Valley (C Smith 1980, 198–200). Fruits of *Succisa pratensis* are absent. This species can be very abundant in the chalk grasslands of Wiltshire and along the south coast, and its high constancy helps distinguish these grasslands from the drier chalk grasslands of south-east England (Wells 1975, 106). *S. pratensis*, however, is not common in all localities with unimproved chalk grassland in Wiltshire (Wells *et al* 1976, 623). The chalk grassland flora, therefore, suggests that the Middle Bronze Age climate of Wilsford was either similar to, or slightly warmer/drier than at present. The weed flora is consistent with this interpretation.

Conclusions

The macroscopic plant remains from the Wilsford Shaft provide a uniquely detailed glimpse of the Middle Bronze Age agricultural and pastoral landscape of the Wiltshire chalk. Remains from relatively few plant communities were recovered and these communities are mostly distinctive, enabling them to be readily recognised. There was not the confused assemblage of remains from many different disturbed ground communities such as commonly occurs in waterlogged deposits on occupation sites.

A summary of the suggested relationship between the various plant communities at Wilsford, drawing also on the evidence from pollen (pp 75–8) and Coleoptera (pp 96–9), is shown in Figure 69. Arable was clearly a close and major aspect of the landscape around the shaft, since there was no evidence to suggest that the arable weed remains had been transported to the site. However, the pollen and Coleoptera, which provide information from a greater catchment area than naturally dispersed macroscopic plant remains, suggest that grassland predominated. Therefore, a far boundary has been placed around the area of arable in Figure 69. The pollen evidence adds *Helianthemum chamaecistus* Mill. and *Plantago lanceolata* L. to the chalk pasture community, while the Coleoptera provide overwhelming evidence from dung beetles for the presence of domestic herbivores on the grassland. Weed communities of ruderal habitats and nitrogen-rich disturbed ground of the sort that tends to occur around settlements are badly represented by macroscopic remains. The shaft seems to have been situated at the conjunction of pasture and arable, with any settlement some little distance away or absent. The pollen and insect evidence confirms that scrub was a minor or distant component of the landscape.

Most of the evidence that is now being retrieved about Neolithic to Middle Bronze Age crops in Britain is from charred plant remains, and just four crops tend to be found: emmer wheat, bread-type wheat, six-row hulled barley, and six-row naked barley. In contrast, a more diverse range of crops has been found on waterlogged sites of this date in Central Europe. The discovery of flax and opium poppy from Wilsford might suggest that non-cereal crops were significant in Britain too.

The results from Wilsford stress the importance of the evidence that can be gained from earlier prehistoric waterlogged deposits associated with otherwise dry landscapes. Every opportunity ought to be taken to investigate such sites on the chalk.

Plant fibres

by Philippa Tomlinson

Methods

Material in 15 tubes from three sample numbers (1962:202, 225, and 291) was examined. The fibres were soaked in 88% lactic acid, which helps to clear the cells and make them more readily visible (Tomlinson 1984). The fibres were examined under an ordinary light microscope (Leitz) and also under polarised light and phase contrast. Reference books used are as listed below.

Results

The complete list of results is given in microfiche. Detailed descriptions of each type of material are given here.

Bast fibres

Bast fibres are fibres which occur beneath the epidermis of many plants. Some of them are useful for making cloth or rope, although not all bast fibres are necessarily used for these purposes. Thus, when bast fibres are found in isolation, one cannot be certain that they were once used in cloth or rope.

The bast fibres from Wilsford were from fragments several centimetres long. The fibres were clumped together, a feature which distinguishes hemp from flax. The individual (ultimate) fibres had relatively blunt ends. The ultimates varied in thickness between 12 and 23µm. They had thick walls (approx 5µm) and a fairly thick lumen (approx 7µm). Under phase contrast, spiral markings were not seen. However, a drying twist test (Anon 1975) showed the fibres to be twisted in an anticlockwise direction (Z-twist), unlike flax which is S-twist.

Under polarised light, cross-lines were clearly visible crossing the walls, but relatively rarely crossing the whole width. X-shaped 'knees', which are so characteristic of flax, did not occur. They also occur in hemp, but it is thought that they only appear when the fibres have been processed or mechanically stressed (Körber-Grohne 1967). The ashing test (Anon 1975), which should reveal the presence of cluster crystals in hemp, was carried out on two of the fibres, but no crystals were found. Professor Körber-Grohne kindly examined a few of the Wilsford fibres and suggested that the lumen is too thick and the whole fibre too coarse for hemp. She also thought that they were possibly modern because of the very good preservation.

These fibres, therefore, are certainly not flax (*Linum usitatissimum* L.). They have some of the characteristics of hemp (*Cannabis sativa* L.) (Mauersberger 1954; Körber-Grohne 1967; Haas 1985; Anon 1975) but not all. Textiles can very often be positively identified if they have small pieces of characteristic epidermis still attached to them. Without these it is impossible to provide a positive identification of these individual fragments.

Dicotyledonous plant fibre with epidermis

This fragment of plant stem had some fairly long bast fibres still attached to an epidermis. The ultimate fibres were short and were not likely to have been suitable for use in a textile or rope. The epidermis had multicellular, glandular trichomes (hairs). The cell pattern, stomata, and glands are shown in the drawings in microfiche. The stomata had no subsidiary cells (anomocytic) and were scattered across the stem. The cells were variable shapes, but mostly oblong with oblique or straight end-walls. The cells in the areas around the stomata were more irregular in shape. The cell walls were moderately thick and somewhat pitted. Cuticular striations occurred, running in straight lines up the stem and crossing cell walls. It has not been possible to identify this plant, but the characteristics are very similar but not identical to some members of the Solanaceae (Moeller 1928).

Wood fragments

Small fragments of wood fibres, with rays and vessels, were identified as coniferous wood because of the presence of bordered pits on the rays. These are not fragmentary enough to be paper fibres, which have similar bordered pits.

Xylem tracheid fibres

There were at least two types of tracheid occurring in these samples, as well as xylem spiral thickenings. These types occur in many plant taxa and cannot be identified further on their own.

Gramineae fragments

These consisted of the veins of grass leaves which had mostly become disengaged, forming long fibres. A few of the veins had fragments of epidermis still attached. These had the various features typical of grasses, such as long cells and short cells, dumb-bell shaped stomata, and prickles along the margins. Some of the silica cells were also visible along the veins. Further identification was impossible with such small fragments.

Mosses

There were some small fragments of moss stem. These have not been identified, as the leaves had mostly become detached; for a report on other moss material, *see* pp 95–6.

Roots, rhizomes, and fungal hyphae

There were a variety of roots, generally characterised by the pattern of cells and the presence of short cells and root hairs. Some of the roots were of Gramineae (grasses). Moss rhizoids were also present. The fungal hyphae were entwined in some of the other plant fibres.

Cottonwool fibres

There were several clumps of fairly short, loosely-twisted, white fibres. Each fibre was twisted and there were reversals in the direction of the twist every 100µm (approx) along the length of the fibre. The fibres were very variable in thickness from about 14µm to 25µm. Modern cottonwool reference material and the descriptions in Anon 1975 and Schoch 1985 compare very well with these fibres. Cottonwool fibres are composed of the seed hairs of *Gossypium* spp., although modern cottonwool may also contain man-made fibres such as viscose. Presumably this is contamination from the excavation, subsequent storage, or processing.

Indeterminate plant fibres

Other bast fibres with thin walls and a thick lumen were present. These had no other features to make further identification possible. It should also be noted that Michael Ryder records the existence of plant fibres among the material examined by him (pp 121–4).

Cordage

by Penelope Walton

During the excavation the discovery of well-preserved rope was recorded (Ashbee 1963, 119). By 1986 this rope had mostly deteriorated quite badly. The surviving pieces can be described as follows:

1962:23 ?95ft (28.5m) Several strands, three 65mm long, the remainder 25–35mm long, of vegetable fibre, twisted in the S-direction (clockwise); all are 6–8mm wide. The longer three pieces may have been originally twisted in the Z-direction (anti-clockwise) in the manner of 1962:175.

1962:24; 71b; 100; and 142 Fragments of vegetable material described on excavation as 'rope', possibly originally as 1962:23.

1962:71a 96ft 6in (27.9m) Two pieces, one 65mm and one 55mm long, both with maximum width 15mm, of S-twisted woody material; bark still present; two pieces probably originally twisted together. Wood identified by A R Hall as hazel (*Corylus*).

1962:160 Described on excavation as 'rope fragments' but now disintegrated.

1962:175 100ft 7in (30.2m) A flattened cord illustrated in Figure 62, 80mm long and 13mm wide; 3-ply, Z-twisted from three S-twisted strands; identified by A R Hall as plant, probably plant stem fibre.

1962:322 Described on excavation as a 'plait' but now disintegrated.

Discussion

1962:71a appears to be a 'withe', that is a flexible piece of wood, twisted and used for binding. 1962:175 is a 3-ply cord of vegetable fibre. The other finds are poorly preserved, but 1962:23, 24, 71b, 100, and 142 resemble 175 in fibre and may originally have been from similar cords.

Thick plied cords were used as belts in the costume of Bronze Age Denmark, but they were made exclusively of wool or hair (Broholm and Hald 1940). Cords of vegetable fibre are not a common find, possibly because they would decay more rapidly than those of animal fibre. A fine plied thread of vegetable fibre was found under the skull of a female burial at Garton Slack in Yorkshire, and a 2-ply piece of string, possibly grass, was excavated at Silbury Hill, Wiltshire (Henshall 1950, 155). However, the association of the cord finds from Wilsford Shaft with the withe may indicate that they too were used as bindings.

Martin Bell comments: The cord could also have been used as binding in the construction of the buckets or the sewn wooden vessel (*see* report by Veryan Heal, Chapter 4). Some of the fragments might originally have formed part of ropes used to haul the buckets in and out of the shaft.

Buds

by Carole A Keepax

The buds were initially studied by the present writer as part of an undergraduate dissertation (Attwater 1972). This work has been re-examined in the light of a further paper on identification (Tomlinson 1985). In order to facilitate comparison, the descriptions have been reorganised to follow the scheme laid down in the more recent work, and Tomlinson's terminology has been adopted.

Origin of samples

The samples available were 'tank sludge'. This had already been partly sorted, and only one entire bud and one bud fragment were recovered by examination of the material at 1×5 magnification. Eleven further buds were discovered in the seed collection from the site, perhaps indicating that the unsorted deposits may have been initially much richer in bud material; indeed further buds, not included in this report, have been found during Mark Robinson's analysis (Table 9).

Condition and treatment of buds

The buds were generally well preserved. The hairs on the margins of the scales were often intact. The buds from the seed collection had been dried and were hard and brittle. They were softened by soaking in 5% sodium hydroxide for a few minutes or in distilled water for a few days. They were then thoroughly washed in warm water.

The buds were dissected, and the shape and arrangement of the individual scales recorded. The scales were black or dark brown and were soaked in dilute peroxide bleach solution until clear. Some maceration of the scales occurred, the inner and outer surfaces often separating.

The scales were washed, stained with aqueous malachite solution, and mounted in glycerol jelly.

Identifications and interpretation of results

Four buds were identified as *Corylus avellana* L., two (possibly four) as *Betula* sp., two as *Quercus* sp., and the remainder were unidentified. All of these taxa were represented in the pollen analysis and were the dominant twig types (*see* Table 12).

The presence of entire buds in the deposits would tend to indicate the presence of trees in close proximity to the site, but this is not borne out by the other environmental evidence. It could be taken as evidence for the incorporation of material into the shaft by man. If this was the case, it might also explain why no bud scales were recovered from the deposits. These are light, shed in great numbers, and easily transported by the wind. If trees had occurred in the vicinity of the site, scales might have been expected in the deposits. However, the poor recovery from the samples makes it difficult to assess the validity of this point.

Description of buds

Detailed descriptions of the buds are given in microfiche. Similar buds are described together, with an indication of which were observed to display each feature (eg B6 = Bud 6).

Leaves

These have had a sad history. Two individually-numbered finds (1962:164 and 224) from the excavation were described as leaves, but neither can now be located. Consequently 34 fragments (mostly tiny) of leaves were sorted from the wet samples sieved at Lampeter and sent to Kew in July 1986 in the hope that some might be identifiable; unfortunately they were lost at Kew before this could be done.

Wood identification

by Jane P Squirrell

Introduction

The 1962 excavation of the Wilsford Shaft produced very large quantities of waterlogged wood from below *c* 94ft (28.2m). The difficult conditions under which the wood was recovered and its fragmentary nature have complicated the analysis. The recovered wood consisted of both worked (eg bucket staves and bases) and unworked, broken fragments, as well as roundwood and twig material. The writer has been responsible for identification of the unworked wood only. Much of the worked wood had previously been identified by H Greaves (Imperial College) and G C Morgan (then at the Ancient Monuments Laboratory). The identifications made by Greaves and Morgan are incorporated into this report and listed in the microfiche, as well as being incorporated into Veryan Heal's discussion of the wooden artefacts themselves (Chapter 4).

The wood was conserved by the Ancient Monuments Laboratory *c* 1968 using the polyethylene glycol (PEG) impregnation technique. This stabilised the wood by replacing the water with a wax-like substance. A small proportion of worked wood was conserved by freeze-drying, but this wood is now very light and fragile. Since treatment the collection had been stored in polythene bags within cardboard boxes in the Ancient Monuments Laboratory, London.

The method of, and the length of time since, the excavation, together with the fragmented nature of the wood, most of which was PEG-impregnated, made it impossible during the present examination to identify all the material, and therefore it was necessary to be selective.

Methodology

A visual examination of each bag in the collection was undertaken, and a general assessment made of its state and condition. The contents varied from a few to several hundred pieces and ranged in size from around 10mm to around 100mm in length. Representative samples from both the fragmented wood and the roundwood were removed for identification, labelled, and rebagged. Samples which required elution to remove surface PEG before identification were split into two, and one half was labelled and rebagged as the type specimen.

Results and conclusions

During the examination and identification, it was noted that the unworked wood collection consisted of two distinct groups of material:

i broken fragments
ii roundwood and twigs.

The results of identifications presented in the microfiche are summarised in Table 12.

Although mostly amorphous and described as unworked by the excavators, the broken fragments included some pieces of wood with worked edges. However, the fragmented nature of most of these pieces made it impossible to assign them to any object

Table 12 Summary of the numbers of identified wood fragments

Latin name	*Common name*	*Probable wooden artefacts*	*Wood fragments*	*Roundwood and twig*
Quercus sp.	Oak	31	41	10
Alnus sp.	Alder	45	30	2
Fraxinus	Ash	5	4	–
Tilia sp.	Lime	–	1	–
Pinus sylvestris	Scots pine	–	1	–
?*Quercus ilex*?	?Evergreen oak?	–	1	–
?Rosaceae	–	–	1	–
Corylus avellana	Hazel	–	–	9
Betula sp.	Birch	–	–	8
Cornus sanguinea	Common dogwood	–	–	1

type. Table 12 shows that oak and alder were the most common identified species, the same species that Greaves and Morgan identified for the worked objects. Much of the recovered worked wood appears to have been from buckets constructed from oak and alder; it is possible, therefore, that some of the unworked wood assemblage is connected with the manufacture of these wooden objects. The microfiche, therefore, includes the identifications of all the unworked wood fragments examined, together with those pieces of worked wood previously identified by Greaves and Morgan. These identifications have been checked and confirmed wherever possible.

The right-hand column in the table (12 – summarising the microfiche) gives the identifications of the roundwood and twig material and shows that oak, hazel, and birch were the most common identified species. The tentative identification during the excavation of wicker and basketry (which are not now in an identifiable condition) may suggest that the roundwood and twigs were associated with their construction. Whilst it is usual for hazel, birch, and even alder to be used in the making of these types of objects, oak is not commonly used, which suggests that the oak fragments may have been associated with some other activity.

The single identification of common dogwood is fortuitous and interesting because common dogwood is a vigorously growing shrub plant, which, when cut back, sends up good coppice shoots and suckers and is commonly associated with oak woodland. The tentative identification by Greaves of a single specimen of *Quercus ilex* should be regarded as highly suspect, because this species is generally considered to be a sixteenth-century introduction to Britain (Hart and Raymond 1973).

The nature of the recovery, as described above, makes it difficult to comment on the relative abundance of individual tree genera, or on the relationship between the mature wood and the roundwood and twig material. However, it is possible for all the identified species to occur together as a mixed deciduous woodland, which suggests that all the timber may have come from within the same area.

We are grateful to Mark Robinson for the following further comments on the wood: 'All the identified species could occur on the chalk, but a more likely habitat for *Alnus* is neighbouring river valleys. The absence of wood of thorny species (eg *Prunus spinosa* and *Crataegus* sp.) suggests either that all the wood was from proper closed or managed woodland or, if scrub was also being exploited, only certain species were being collected. This makes an interesting comparison with the seeds (pp 78–90) which include no evidence of woodland and only a slight presence of mixed thorny scrub.'

Dendrochronology

The Wilsford wood is unsuitable for dendrochronological dating, because the number of rings present in any one piece, including the larger worked wood, is insufficient for the analysis.

Charcoals

by Maisie Taylor

Considering the size of the waterlogged wood assemblage from the bottom of the shaft, there was only a very small number of charcoals (*c* 13 identifiable pieces). They do, however, provide some botanical evidence from the upper parts of the shaft. The identifications are presented in Table 13, and it should be noted that, apart from the oak in sample 202 and samples 21 and 111, they consisted of very small pieces which made identification difficult.

Table 13 Charcoal identifications

Number	*Depth*	*Identification*
1960:21	6.2ft (1.8m)	*Quercus* sp.
1960:111	11.5ft (3.5m)	*Corylus avellana* or *Alnus glutinosa*; immature *Quercus* sp.
1960G:26	29.5ft (8.9m)	*Corylus avellana* or *Alnus glutinosa*; *Betula* sp.
1960G:53	57.5ft (17.3m)	*Betula* sp.
1960G:1001	*c* 60ft (18m)	*Corylus avellana* or *Alnus glutinosa*; *Betula* sp.
1962:248	*c* 98.5ft (29.6m)	*Corylus avellana* knot and other fragment
1962:202	*c* 101ft (30.3m)	Knot – probably immature *Quercus* sp.; *Betula* sp.; *Fraxinus excelsior*; immature *Fraxinus excelsior*; *Corylus avellana* or *Alnus glutinosa*

Fungi

by D N Pegler

The material examined included two pieces (1962:168 and 307), tentatively identified during the excavation as fungus, and eight pieces (202/51; 248/97; 291/18; 296; 500; 501; 504; 506), which had originally been described as leather and were also examined by Michael Ryder (pp 121–4). All this material was below 93ft (27.9m) and can be identified as *Bovista nigrescens* Pers. which is a common, grassland puffball type fungus (class Gasteromycetes), now much flattened. The leather-like material represents the inner structure (the gleba), comprising a tangle of capillitial threads which function to disseminate the spores. What is of particular interest is that there are records of *B. nigrescens* on a number of other archaeological sites, eg Skara Brae, Orkney; Stanwick, Yorkshire; Vindolanda, Northumberland; and Scole, Norfolk (Watling 1974). At Wilsford the nature of the associated biological material, which was also to a large extent derived from chalk grassland, makes it uncertain whether these puffballs came to be in the shaft as a direct result of human usage. However, their occurrence on some of the other sites certainly does suggest deliberate collection in those instances, and their most commonly suggested function is to staunch bleeding for which purpose they are known to have been used in historical times (Watling 1974). A report on a sample of supposed leather from the shaft, which also proved on analysis to be fungal in origin, is in the microfiche.

Four other samples were examined:

Sample 225 Black spots which are pycnidia of a Coelomycete (fungus), but spores not recovered and indeterminate. *Endogone macrocarpa* (Tul.) Tul. (fungus, order Endogonales).

Sample 248 *Hypoxylon* species (fungus, order Xylariales). *Endogone* sp., probably also *E. macrocarpa*.

Sample 291 Wood impregnated with hyphae of a dematiaceous hyphomycete (fungus). *Endogone macrocarpa*. Coelomycetes, probably *Coryneum* species. *Ophiobolus* sp. (fungus, class Loculoascomycetes, order Pleosporales), probably grew on herbaceous stem.

Sample 202 Spores present but material almost certainly represents insect faeces.

Some comment should be made about the occurrence of *Endogone*. These are a group of subterranean fungi which may well have been growing naturally in the soil. They always grow in association with tree-roots, usually beech trees in the case of this species.

Algae

In sample 1962:248 Mark Robinson noted the occurrence of a single oospora of *Chara* which inhabits calcareous freshwater. D Pegler noted some possible blue green algae (Cyanophyta) in sample 1962:248. Blue green algae were the first colonisers of the Overton Down Experimental Earthwork bank (Jewell and Dimbleby 1966) and consequently are likely to have colonised the shaft walls or spoil heaps round the shaft.

Mosses

by G W Dimbleby and E C Wallace

Remains of mosses were recognised and collected from the lowest deposits in the shaft between 95ft 2in (28.6m) and 100ft 1in (30m).

Identification

Initially a sample of the Wilsford material was submitted to the bryologist E W Jones, primarily to establish whether identification was possible. He was at once able to identify three species: *Eurhynchium praelongum*, *E. swartzii*, and *Hypnum cupressiforme*.

As this was a preliminary examination, no record was kept of which samples were submitted, but it is remarkable that one of these three, *Hypnum cupressiforme*, was not recorded in any of the later analyses. This is a common moss and easily recognisable given good material. As Jones was able to distinguish the two species of *Eurhynchium*, it was apparent that preservation was good enough to show anatomical detail, so encouraging a more detailed study.

As these preliminary identifications were made on material of unrecorded provenance, they cannot be used in interpretation. This will therefore be confined to the more detailed analyses carried out some five years after the excavation by E C Wallace, then Secretary of the British Bryological Society, who examined samples 1962:183, 156, and 19 plus four individual unspecified samples in bottles. A copy of his longhand notes has been deposited with the site archive. He commented that the material was mainly in a good state of preservation (some of it was actually green when first recovered from the shaft – *see* report by George Hendry below, p96), but some of the moss stems were much eroded and only leaf fragments remained, eg costa of leaf, and a few adjacent leaf cells.

Results

In a brief report Wallace presented his results in the following form:

(a) Frequent
- *Neckera complanata* (Hedw.) Hüben
- *Hylocomium splendens* (Hedw.) B. S. eb
- *Eurhynchium swartzii* (Turn.) Cum.

(b) Scarce
- *Eurhynchium praelongum* (Hedw.) Hobk.
- *Acrocladium cuspidatum* (Hedw.) Lindb.
- *Camptothecium lutescens* (Hedw.) B. S. eb

(c) Few stems observed
- *Eurhynchium riparioides* (Hedw.) Rich.
- *Thamnium alopecurum* (Hedw.) B. S. eb
- ?*Brachythecium glareosum* (Spruce) B. S. eb (1 stem only).

Some of these mosses are also noted by Philippa Tomlinson in her examination of possible herbivore dung (pp 124–6). A nomenclatural change should be noted: *Thamnium* in this report = *Thamnobrium* in her report.

Interpretation

This section is based primarily on Wallace's observations, with other relevant points added, particularly as to archaeological context. As has been noted in the introduction, there is little evidence for stratigraphy in the basal waterlogged part of the shaft and we are probably justified in treating the whole assemblage as one. It is, however, noteworthy that *Eurhynchium swartzii* occurred only at the highest levels at which moss material was found.

Taking the assemblage as a whole, the species recorded are all characteristic, even today, of chalk grassland. Whether that grassland was like the short turf so characteristic before the myxomatosis epidemic, or the taller grass which followed that epidemic, is not indicated with certainty by the mosses alone (*see* pollen report, pp 75–8). Certainly some of the mosses could occur in taller grass or even in hedgerows, but Wallace observed that the six species listed under (a) and (b) above are all plants of chalk grassland and chalk slopes, such as would be found adjacent to a trackway. As he states, they could all be found today about a farm in Wiltshire. Nevertheless, he comments on the absence of several common associates of these six species, such as *Ctenidium molluscum* and *Pseudoscleropodium purum*; perhaps we should also add *Hypnum cupressiforme*, which Jones recorded but which was not present in Wallace's samples.

In an assemblage of this sort it is not possible to apply any estimate of Frequency, beyond the rough categories Wallace used, and it is quite impossible to extrapolate from the relative abundances to any estimate of the occurrence of different habitats in the immediate vicinity. The fact that species were not present probably says more about the inadequate representation in the samples than it does about any differences between Bronze Age moss floras and those of today.

Nevertheless, there are suggestions of other habitats in the neighbourhood. *Eurhynchium swartzii* is a moss which, in addition to grassland, also grows on fallow land, particularly in the second and third years, and the species recorded under (c) above as infrequent perhaps also suggest other habitats in the vicinity, without giving any indication of where or how dominant these habitats might have been. Both *Thamnium alopecurum* and *Eurhynchium riparioides* favour damp habitats, and the latter in particular would grow on hardpacked chalk. Wallace allows himself the speculation that it could have been growing at the mouth of the shaft. The *Thamnium*, he points out, could have come from a more sheltered habitat such as scrub, where it will grow either on the ground or on the roots of trees.

This last observation is as near as we can get with the moss flora to supporting any theory that this site would have been more wooded in the past than it is today. At the end of his report Wallace asks whether any observations had been made on the modern moss flora there. Unfortunately they have not, but it is an exercise that could still be done and might reward the effort.

Biochemical studies

by George Hendry

In 1978–9 the writer was provided by Professor G W Dimbleby with some samples from Wilsford Shaft as part of a wider study of the biochemistry and chemistry of chlorophyll breakdown. The samples were of waterlogged non-woody plant material from the base of the shaft, and the material was described as green when first exposed, the greenness decaying with time. On analysis the Wilsford material contained no detectable chlorophyll but instead a derivative, phaeophytin, but at barely detectable concentrations (less than 10 picomoles per gram wet weight). No carotenoid derivatives were found. The interpretation is as follows:

1. the plant remains examined were substantially of roots rather than shoots, such as deeply dug turves
2. the remains were harvested alive and do not represent senescing tissue (such as autumn leaves)
3. the complete absence of chlorophyll suggests that the remains were for some period maintained in a dry state and exposed to atmospheric oxygen; waterlogging may therefore be a secondary development
4. the greenness referred to on excavation is not due to chlorophyll, but most likely to the oxidation (to a colourless or brown state) of green phenolic-based compounds characteristic of plant shoots and leaves; the green colour would have been derived as a result of reducing (waterlogged) conditions.

Insects

by P J Osborne

Introduction

The extraordinarily well-preserved and abundant insects recovered from samples taken from the bottom of the Wilsford Shaft have already been extensively discussed in an earlier paper by the present writer (1969). A further report is included here, chiefly for the sake of completeness, but also to reassess the data in the light of further experience and by comparison with other sites discovered since 1969. Clearly, unless gross misinterpretations were made before, the conclusions are likely to be broadly the same, but it may be that the *Journal of Animal Ecology* is not included in the usual reading of all archaeologists, so that a restatement of the main ideas may be useful.

The samples (listed in microfiche) consisted of a matrix of comminuted wood and other vegetable debris, plus a quantity of chalk fragments, immersed in a liquid mixture of alcohol, formaldehyde, and glycerin, which amounted to roughly 23 litres altogether. Although the insects from each sample were sorted and are stored separately, no differences in either the appearance of the matrix or in the contained beetle faunas could be seen, so for the purpose of interpretation the deposit has been regarded as a single unit.

Although the usual practice, nowadays, for concentrating insect remains from an organic matrix prior to sorting is to use paraffin flotation, the Wilsford beetles did not require this as they floated in water without any treatment, possibly on account of their impregnation with glycerin. In the writer's experience the sight of these bowls of water entirely covered by a scum of irridescent green, blue, and black beetle fragments has never since been equalled.

Since the species list has been largely published by Osborne (1969), it is presented here in microfiche; however, it should be noted that this list includes a number of further identifications and the nomenclature has been updated to correspond with Kloet and Hincks (1977). Some small samples, which had not previously been examined, yielded a few beetles but no new species so these have been omitted from the list, while some pieces of timber suspected of showing damage due to wood boring beetles were also looked at but without confirmation of the supposed beetle damage. In addition, one of the original samples was re-examined using paraffin flotation. The float was sorted meticulously, chiefly in the hope of finding traces of Orthoptera, an order normally very uncommon in either archaeological or Pleistocene deposits and apparently absent from Wilsford, despite a seemingly perfect environment for at least the acridid grasshoppers. Still no trace of these insects was found despite extremely careful searching. Nevertheless, it was gratifying to see how few worthwhile beetle remains had been overlooked during the previous sorting, nearly 20 years before!

In the faunal list (in microfiche) species added since 1969 are denoted by an asterisk (*), while those no longer found living in Britain are indicated by a plus sign (+). The numbers given are the smallest number of individuals which must have been present to contribute the skeletal parts identified. In the case of *Aphodius*, however, as a number of species were identified, not always on the same sclerite, and a much larger number could not be diagnosed specifically, a composite figure for the entire genus is given. In the genus *Geotrupes*, too, an overall figure is given because, although a vast number of fragments were recovered, few of them were specifically distinctive.

Implications of the fauna

The local environment

This is unequivocally a fauna of meadowland or pasture. By far the most abundant group of beetles identified is that which includes species which live in the dung of grazing animals such as cattle or sheep, particularly the genera *Geotrupes*, *Aphodius*, and *Onthophagus*, accounting for nearly half of all the individual beetles recorded. If this figure is augmented by the inclusion of those species which are frequently but not invariably found in this pabulum, such as the histerids, most of the recorded hydrophilids and the staphylinid genus *Anotylus*, plus the geotrupid *Typhaeus*, then the proportion associated with dung rises to 50%. Of the remainder of the fauna, particularly those species represented by high numbers of individuals and which might be presumed to have been living in the immediate neighbourhood, a very high proportion are inhabitants of open meadowland. Thus, with the possible exception of the single specimen of *Loricera pilicornis*, all the carabid ground beetles are found in grassland, frequently on a dry chalky or sandy substrate. The various chafer beetles, especially *Phyllopertha horticola* and *Omaloplia ruricola*, are residents of grassland where their larvae live in the soil at the roots of grass and other plants, a habitat shared by the elaterids *Agrypnus murinus* and *Agriotes sputator*. The members of the families Chrysomelidae, Apionidae, and Curculionidae are all phytophagous in this country and are frequently restricted to a single host plant or group of plants. The most numerous of these phytophages recorded were *Crepidodera ferruginea*, which lives on herbaceous plants, particularly thistles and nettles, *Hypera punctata* which is attached to Leguminosae such as clover and lucerne, and *Mecinus pyraster* whose food plant is *Plantago lanceolata*. Amongst the remaining phytophages these same three food plant groups recur, whilst other plants indicated include *Hieracium*, *Helianthemum*, *Malva*, *Papaver*, *Polygonum*, and *Achillea millefolium*, all of which could be constituents of a grassland or arable ground flora. Most of the other members of the beetle fauna are eurytopic and would fit comfortably into this picture of open grassland. The species which are incompatible are so few as to be insignificant. Those which are attached to trees are particularly sparse and are *Mycetochara humeralis* and *Strangalia melanura*, which both develop in dead wood, and *Scolytus* which lives beneath the bark of dead or dying trees. These three species only total four individuals between them and could easily be accounted for as accidental introductions or as strays brought in by the wind.

Anobium punctatum, the 'Furniture Beetle', was recovered in numbers which could not so easily be discounted, but this beetle requires dry seasoned wood, so that trees which have fallen to the ground and become rotten do not provide it with a suitable habitat. Although it does occur outside today, it is vastly more common indoors where man has provided an abundant habitat by using timber as a structural material. It seems likely, therefore, from the numbers recovered, that there might have been some wooden structure near the mouth of the shaft, erected by the original excavators.

A cursory glance at the list suggests a noteworthy contingent of water beetles, including *Helophorus*, *Hydrobius*, and *Hydraena*. From this section the majority species, *Helophorus nubilus*, must be excluded, as it is not often found in water, but mostly amongst vegetation often in dry conditions. Balfour-Browne (1958) states that he has never found more than one example at a time in water, but that he saw it in large numbers amongst grass on high ground on the Berkshire Downs – an environment very similar to that envisaged at Wilsford! Of the water beetle group only *Helophorus* sp. is left after this exclusion, except for a single specimen each of *Hydraena* sp. and *Hydrobius fuscipes*. The common aquatic *Helophorus* species fly readily and tend to allow themselves to fall when water appears beneath them – a habit often leading to mistakes when they descend in numbers on the tops of cars, or new tarmac, or some other unsuitable shiny surface. If the ten recorded specimens fell into the Wilsford Shaft in this way, it would suggest that there were times at which the water level rose high enough to show a reflecting surface from directly above and that the mouth of the shaft was not covered. Equally well, they might have descended into water nearby and been simply splashed down the hole.

The climate at the time of deposition was originally thought to have been much like that of today (Osborne 1969). Now, however, the writer is inclined to the view that conditions were rather warmer than at the present time. The basis for this supposition is principally the profusion of members of the genus *Onthophagus* recovered. These beetles all live in the dung of grazing animals, a habitat which they share with a number of other genera including *Aphodius*. Despite this common habitat, whereas *Aphodius* is widespread from the Scottish Highlands southwards, *Onthophagus*, except for *O. ovatus*, is found only in the south of England. Across the continent from north to south *Onthophagus* becomes progressively more common in relation to *Aphodius*, so that, perhaps by mid-France, their numbers are roughly equal. In southern France and Spain *Onthophagus* is very abundant, leading Fabre (1918), working at Avignon, to refer to 'the swarming population' under a single mule dropping.

Obviously at Wilsford *Onthophagus* was extremely numerous, far more so than could be expected in southern England today. Its numbers equalled those of *Aphodius* and the majority of the individuals identified were *Onthophagus fracticornis*, a species placed on the British List on the strength of a few specimens without data located in old collections. Recently, however, a single male of *O. fracticornis* was identified among a series of specimens of *O. similis* housed in the Hope Entomological Collections, Oxford, which had been collected by P Harwood at Perranporth, Cornwall in April 1911 (Mark Robinson, pers comm).

Onthophagus nutans, another species common at Wilsford, has only been recorded in Britain once this century. Such an assemblage appears to be out of place in today's British climate and would be more likely to occur in mid-France, for example. Another dung beetle, *Aphodius quadriguttatus*, which does not live in Britain today, was recorded, and this also becomes more widespread going south. To this rather subjective assessment may be added the evidence from a similar, though smaller, fauna from Bidford-on-Avon, Warwickshire, with a series of radiocarbon dates in the Late Bronze Age (Osborne in press). Here again, despite the more northerly location, *Onthophagus* individuals equalled those of *Aphodius* in numbers and this time included *O. taurus*, a widespread species further south on the continent but one which, though on the British List, has not been recorded in this country since early in the nineteenth century. It seems at least possible that these early records may have been based on continental specimens imported to add lustre to collectors' cabinets, a practice not unknown at the time. It is noteworthy that after the Bronze Age *Onthophagus* does not figure prominently in archaeological faunas. The author has examined assemblages from Iron Age, Roman, Saxon, and medieval sites and, although *Onthophagus* occurs sporadically in these, it is never in profusion to equal Wilsford, nor in comparable numbers to those of *Aphodius*. All this leads to the conclusion that the Bronze Age climate was somewhat warmer than that of today, perhaps similar to that of mid to northern France or to that of the long hot British summer of 1976. The remainder of the fauna at least does not contradict this hypothesis. Some of the species, notably *Omaloplia ruricola* and *Liparus coronatus*, are confined to the very south of Britain today, but as Wilsford itself is in the south this carries little weight. Both species, however, were recorded in the Warwickshire site already mentioned which is outside their present range. The only 'dissentient voice' from Wilsford is that of the chafer *Melolontha hippocastani*, which in Britain today is restricted to the Scottish border and further north. On the continent, however, it is widespread, so that its distribution in Britain is probably controlled by some factor other than climate.

Evidence of man's activities

From the very large numbers of dung beetles present it seems that the Wilsford Shaft must have been a point at which dung-dropping animals congregated, and the most obvious reason for this would be that the shaft was dug as a well. Timber structures near the top, the presence of which is suggested by the numbers of *Anobium punctatum* recovered, might then have been barriers to prevent the animals from falling down the hole or winching apparatus and troughing from which the animals could drink. Nearby troughs could have been the source of the *Helophorus* species discussed above. This view gains support from the fact that the original excavators had been at pains to preserve verticality and smooth sides (Ashbee 1963), which would have been necessary if buckets of water were being hauled up, and from the presence in the debris at the bottom of the shaft of remains of rope and wooden tubs (Ashbee 1963). Although it seems an immense labour to dig such a shaft in the hope that water may be discovered, the writer is assured (F Mosely, pers comm) that such a practice is still carried on today in the more primitive parts of Arabia. Holes are apparently sunk to great depths, often on no more secure a basis than a hunch or a dream, usually by somebody who specialises in these predictions, or on the inspiration of a folk memory perhaps going back many generations. Often, if the shaft is in unstable material, it is necessary to line it with brick as work progresses, sometimes to hundreds of feet. The fact that such an undertaking can frequently end in impervious rock with no sign of water shows that the size of the task and the improbability of the outcome are not necessarily deterrents.

A small group of beetle species which today are associated with man was found. These include *Dermestes laniarius*, a species of bacon beetle not found in Britain today, *Ptinus fur*, a beetle loosely associated with stored food products, and *Stegobium paniceum*, the 'Drugstore Beetle', another inhabitant of man's stored foodstuffs which was not recognised from Wilsford in the 1969 paper. The *Dermestes* is particularly interesting for, although not a British species today, it was present in some numbers at Wilsford. Members of this genus live on dead animal matter of many different kinds (the bone and animal fibre reports suggest that animals fell or were discarded into the shaft). The corpses on a gamekeeper's gibbet are one typical habitat, while hides and skins in warehouses are another, as well as

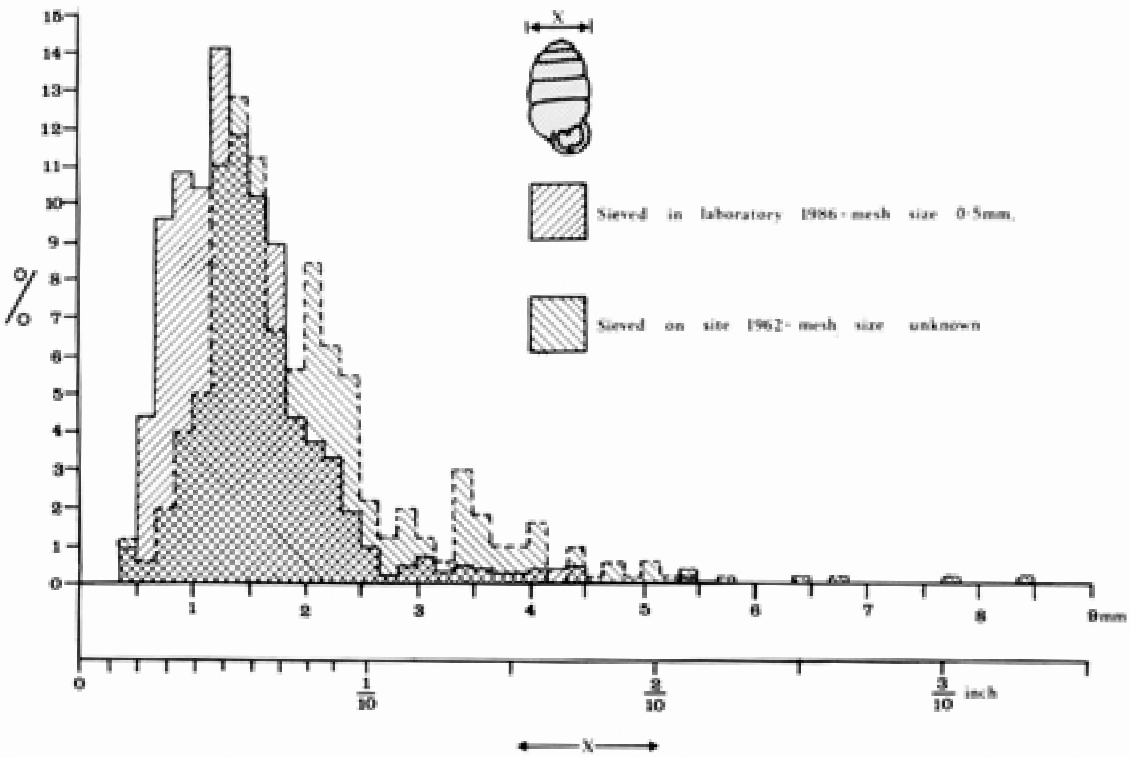


Fig 70 Histograms comparing the maximum diameters of mollusc shells in the samples sieved during the excavation with those sieved recently using 0.5mm as the smallest mesh

stored food of animal origin, accounting for the vernacular name of the group. Other species of *Dermestes*, notably *D. peruvianus*, have succeeded in establishing themselves here after presumably accidental introduction, and it is suggested that *D. laniarius* was imported in the same way, perhaps in skins, but failed to become established due to lack of suitable habitat. *Stegobium paniceum* and *Ptinus fur* are minor pests of stored food, of both animal and vegetable origin. Although *Stegobium* is most often found in man's foodstuffs, *Ptinus fur* may be found occupying bird's and wasp's nests (the bird bones show that swallows nested in the shaft), or living on such substances as rat droppings as often as eating stored products. So although the *Ptinus* was recorded in some numbers and was probably associated in some way with man, its exact role at Wilsford was uncertain.

Summary

The detritus from the bottom of the Wilsford Shaft produced a very rich and extensive insect fauna composed chiefly of beetles, but also including skeletal remains of many examples of the common earwig, *Forficula auricularia*, and a small number of unidentified bugs (Hemiptera) and parasitic Hymenoptera. The beetles showed, almost unanimously, an area of rather dry grassland with a population of grazing animals. The climate was probably warmer than at present. It is suggested that the shaft was sunk as a well, probably to provide water for the livestock grazing in the area.

Landsnails

by Martin Bell

Molluscs and bones are the only two sources of environmental evidence present through most of the shaft fill: in the case of molluscs from a depth of *c* 19ft (5.7m) to the bottom, though with an unfortunate gap from 60ft (18m) to 94ft (28.2m). The samples examined consist of 12 dry samples taken by Peter Gray from the upper part of the shaft. These include a number of samples of chalk, probably the product of physical weathering of the cone, and a number of soil patches which have been tentatively interpreted as fallen topsoil or turf. Two further dry samples were taken by Paul Ashbee at *c* 95ft (28.5m), where organic material was beginning to appear. Molluscs have also been examined from four of the jars of wet sediment from below 96ft (28.8m). These samples are believed to have been sieved during the excavation. As explained in the introduction to this chapter (p 72), we do not know the mesh size used. As this created difficulties of interpretation, not only for the molluscs but also for the wide range of other biota with which they were associated in these basal deposits, it was important to get some idea of the sieve size used. This was done by measuring the maximum size of all the shells using a graticule. Figure 70 compares size histograms from the wet samples, believed to have been sieved during the excavation, with samples sieved recently using 0.5mm as the smallest mesh sorted. With the

Table 14 Landsnails; nomenclature follows Waldén (1976)

Sample number	*1960 9*	*1960 1002*	*1960 15*	*1960 ?*	*1960 17*	*1960 1003*	*1960 20*	*1960 21*	*1960 26*	*1960 51*	*1960 53*	*1960 1001*	*1961 91*	*1961 94*	*1962 291*	*1962 248*	*1962 202*	*1962 225*	*1962 By hand*
Material	C	C	C	?C	C	S	S	C	S	S	S	C	D	D	W	W	W	W	W
Depth (ft)	19.75	?21.6	22.3	24.75	25	26	29.25	29.25	29.5	45–6	57.5	?c 60	94.5	95	96.5	98.25	98.7–101	100–2	94–base
Depth (m)	5.9	?6.5	6.7	7.4	7.5	7.8	8.8	8.8	8.9	13.5–8	17.3	?c 18	28.4	28.5	29	29.5	29.6–30	30–30.6	28.2–base
Weight of sediment (g)	894	619	1453	513	204	372	867	833	859	2860	2126	156	871	1045	–	–	–	–	–
Pomatias elegans (Müller)	+	+	1	+	+	+	1	+	1	1	6		1	+	+		+	+	2
Cochlicopa lubrica (Müller)	1																		
Cochlicopa lubricella (Porro)															1				
Cochlicopa spp.									2	5	1		1		4		1	+	1
Vertigo pygmaea (Draparnaud)									1	2	1	1	1	2	3				
Pupilla muscorum (Linnaeus)	21	3	3	7	20	61	15	9	58	63	84	56	38	51	86	3	5	8	11
Vallonia costata (Müller)	3			2	2	16	1		7	9	6	16	7	12	40	3		5	4
Vallonia pulchella (Müller)											1			1	3			1	
Vallonia excentrica Sterki	8		1	4	6	28	16	1	19	121	58	46	18	18	81	6	2	10	3
Acanthinula aculeata (Müller)														1					
Ena obscura (Müller)										1						1			
Punctum pygmaeum (Draparnaud)										1					3			1	
Discus rotundatus (Müller)						+		+			2		2	1	3			+	5
Vitrina pellucida (Müller)									1					2					
Vitrea contracta (Westerlund)							1				1			2					
Nesovitrea hammonis (Ström)											1			1					
Aegopinella pura (Alder)															1				
Aegopinella nitidula (Draparnaud)							1			3	3		8	11	24	6	12	28	80
Oxychilus cellarius (Müller)														1	7	1		1	2
Limacidae		1				4	3			5			1	3					
Clausilia bidentata (Ström)					1		1			2	1			2	2	+		1	
Candidula intersecta (Poiret)															4	2			7
Helicella itala (Linnaeus)	2		1	1	3	10	6	2	8	10	8	6	4	8	45	4	4	2	80
Trichia hispida (Linnaeus)	2		+	1	2	11	14	1	10	31	5	8	2	1	38	2	1	6	40
Arianta arbustorum (Linnaeus)																	+		
Helicigona lapicida (Linnaeus)						+													
Cepaea hortensis (Müller)																			3
Cepaea spp./*Arianta*										3	3		1	1		+	+	+	1
Total	37	4	6	15	34	130	59	13	107	257	181	133	84	118	345	28	25	63	239

NB C = chalk; S = soil; W = wet sample; D = dry sample from waterlogged layer.

recently-sieved samples the sieve size is shown quite clearly by the way the histogram steps up at *c* 0.5mm. The samples sieved during the excavation certainly do contain a proportion of material as small as 0.5mm, but they contain substantially fewer shells between 0.5mm and 1.15mm than the recently-sieved samples. This could imply the use of a sieve of *c* 1/24–1/20in (1mm–1.25mm) on site but *only* if separation was relatively inefficient and a significant proportion of smaller material was retained, which in view of the volume of sediment processed would not be surprising. Assuming that the presence of fewer small shells in the site-sieved samples is the result of the use of a larger sieve rather than of some other factor, such as preservation, comminution, or age structure, then we need to consider how serious the implications of this are for interpretation. Fortunately we can compare the species composition of the site-sieved samples with the two samples from the top of the waterlogged fill which had survived in a dry state. In fact, the mollusc assemblages themselves are virtually identical. One change in species composition, which may possibly be attributable to the sieve-size factor, is the somewhat smaller percentages of *Pupilla muscorum* in the site-sieved samples. Clearly, we must exercise some caution in the interpretation of assemblages from the four site-sieved samples, but the general impression is that, although some smaller shells have probably been lost, this does not seem to have introduced any major distorting influence.

Methods

The methods used are basically those outlined by J G Evans (1972). The dry samples were processed using dilute hydrogen peroxide as necessary to help disaggregate the sediment. It was not, however, used on samples 1961:91 and 94 which contained organic material. The dry samples were sieved down to a mesh size of 0.5mm, except for 91 and 94 which were sieved down to 250µm. The underlying wet samples were washed on a nest of sieves down to 125µm. They were sorted for molluscs as well as seeds and a range of other biological evidence (as listed in the microfiche).

Results

The results are presented in Table 14 and diagrammatically in Figure 71. On the summary diagram in this figure the ecological groups are as defined by J G Evans (1972). Percentage histograms have not been plotted for samples containing less than 50 shells: in these cases, species presence has been indicated by a dot. Plus signs (+) indicate species, in samples containing more than 50 shells, which are present at less than 1.5%.

The first point to make about the sequence is its remarkably uniform nature from the topmost samples to the bottom. Throughout it is a restricted assemblage of low ecological diversity in which a small group of species predominate, ie *Pupilla muscorum*, *Vallonia excentrica*, *Vallonia costata*, *Trichia hispida*, and *Helicella itala*. There is really only one clear change through the sequence, the greater abundance of *Aegopinella nitidula* in the basal six samples from the waterlogged part of the shaft. No other species shows a clear parallel increase. The chalk samples taken by Gray generally contain very few shells, but the species present in these samples are the same as those in the larger assemblages from his fallen topsoil or turf samples.

One other point which should be noted is the occurrence of *Candidula intersecta*, six shells from the samples and seven retrieved by hand during the excavation. This species was introduced during medieval or later times; the shells were much fresher than the rest of the assemblage and clearly represent contamination introduced during excavation or sieving.

Interpretation

Such a restricted assemblage of low diversity implies a limited range of niches favourable for molluscan life. The predominant species listed above are generally found in dry open habitats. In trying to establish more precisely the nature of this environment, we are hampered by a number of problems. It has been argued by Cameron (1978) and K Thomas (1985) that the study of sub-fossil assemblages needs to move away from an autecological approach, based on the habitat preferences of species individually (eg the summary diagram on the right of Figure 71), towards a synecological approach based on the analysis of communities and associations. However, we have very little comparable information about present-day mollusc communities. The difficulties are exacerbated in the type of dry open environment indicated at Wilsford by the fact that modern arable and pastoral habitats have both been invaded by Helicellid molluscs introduced during and since the medieval period. Furthermore, modern arable assemblages are not a precise analogue for those of prehistory which would have had more weed cover, less disturbance by the plough, and therefore probably higher organic matter levels. These factors make it difficult to distinguish between arable and some grassland assemblages on the basis of mollusc evidence alone. In many palaeosol assemblages interpretation is, of course, aided by the presence of an undisturbed, earthworm-sorted profile indicating pasture, or a mixed soil indicating arable. Elsewhere, as at Wilsford, we have to rely on the limited present-day studies from other areas of the chalk, on what we know of the present-day Mollusca on archaeological sites around Stonehenge, and on somewhat unsatisfactory inferences from other sub-fossil assemblages.

The general composition and restricted nature of the Wilsford assemblage is comparable to present-day faunas of short chalk grassland reported by Chappell *et al* (1971) and Morris (1968). Such studies indicate that taller grassland will contain a wider range of species, including those which favour more shady conditions (eg *Punctum pygmaeum* and *Vitrea contracta*). Data presented by Cameron and Morgan-Huws (1975) from the South Downs imply that a

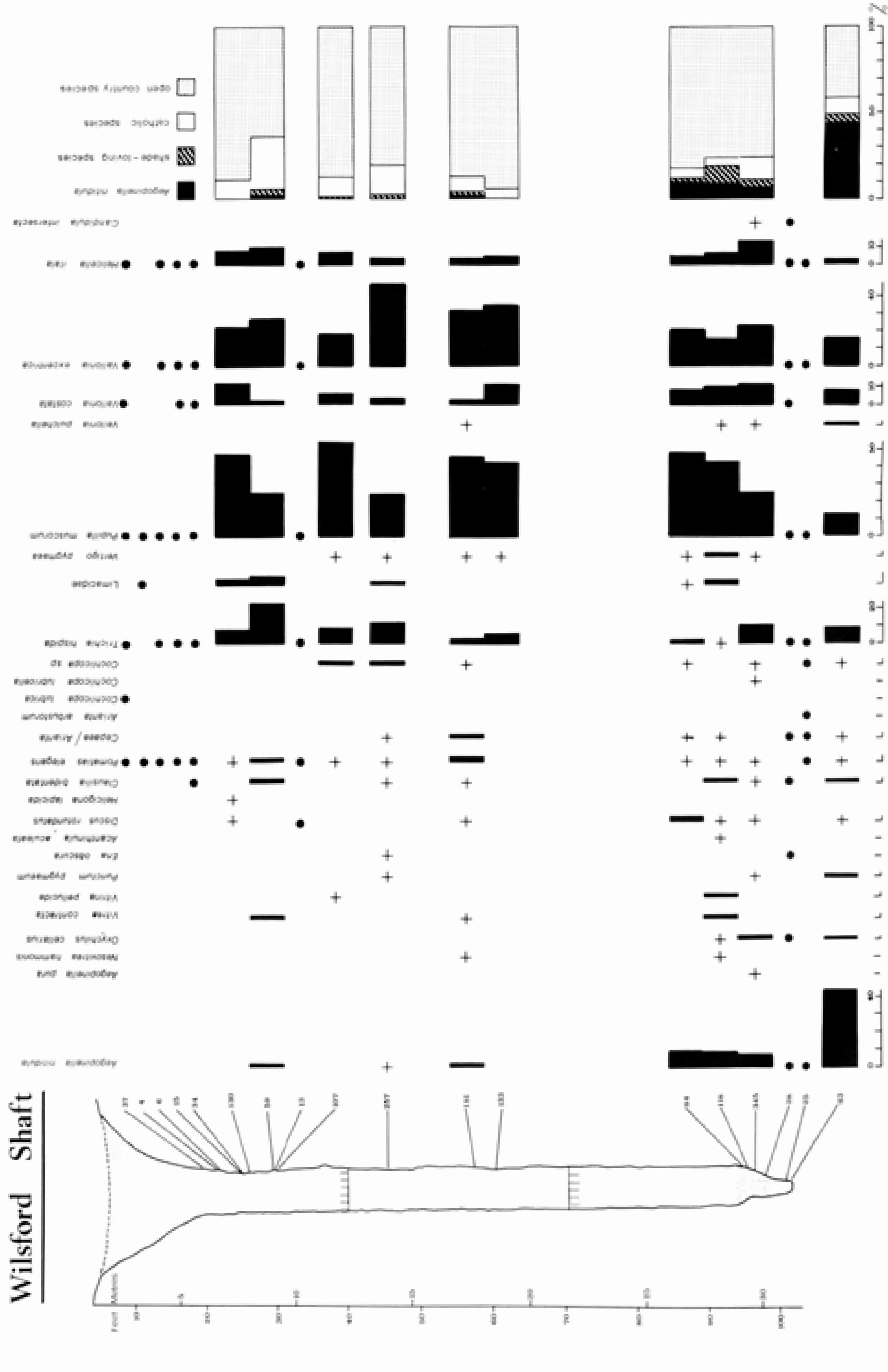


Fig 71 Mollusc diagram

sward more than *c* 4in (100mm) thick is likely to have supported such species as *Aegopinella pura* and *Vitrea contracta*, which are poorly represented here, and *Carychium tridentatum* which is totally absent. The relative abundance of *Aegopinella nitidula* seems oddly out of place in this otherwise zerophilic assemblage. It could relate to areas of damper grassland, because this species does reach 6% even in the present-day mowed turf at Woodhenge (J Evans and Jones 1979) where the rest of the assemblage is typical of open habitats. Another possibility is that this species had colonised some particularly favourable microhabitat, such as the ferns which Mark Robinson has shown grew on the shaft walls, or the wooden structure which stood at its top.

Most abundant among the Wilsford assemblage is *Pupilla muscorum*, a species which does not seem to be affected by the extent of grazing (Morris 1968) and has been shown to be more abundant on grassland with well-worn and trampled areas than in tall grassland (Chapell *et al* 1971). Also consistently present at *c* 5–10% in the assemblage is *Helicella itala*, which is characteristic of dry grassland, particularly where the sward has been kept short by grazing. There is evidence that this species has declined in recent times (Preece 1980), which may explain its absence from the present-day faunas studied by Morris (1968) and Chapell *et al* (1971). This species and, more surprisingly, *Pupilla muscorum* are only represented by small numbers in the published present-day turf assemblages from the Stonehenge area at Stonehenge itself (J Evans 1984) and Woodhenge (J Evans and Jones 1979).

If we look at sub-fossil assemblages, we see that *P. muscorum* is the most abundant species in a clearly earthworm-sorted buried soil below the Durrington Walls henge bank (J Evans 1971) and many comparable sites elsewhere on the chalk (J Evans 1972). *P. muscorum* reaches considerable abundance in lynchet assemblages (K Thomas 1977; Bell 1983, fig 15), especially where sedimentary changes show that cultivation was giving way to earthworm sorting and presumably therefore to grassland, eg the top of the Overton and Fyfield Down lynchets (J Evans 1972, 319). Dry valley colluvial assemblages on the other hand are of more direct arable rather than field edge derivation. Here some of the species present at Wilsford (the Vallonias, *Trichia hispida*, and Limacidae) predominate, but *P. muscorum* is less abundant. Despite the difficulties of using modern arable as an analogue, these trends are in line with the absence of both *P. muscorum* and *H. itala* in present-day arable.

In conclusion, it is clear that we have an open agricultural environment with some bare ground; less certain is the extent to which the latter was created by factors such as animal trample as opposed to cultivation. On balance, the assemblage seems more like what we would expect in grazed and broken grassland. Since some of the closest comparanda are with lynchet assemblages, which by definition relate to the margins of cultivated land, the picture is not necessarily at variance with Mark Robinson's argument that the site lay close to the conjunction of arable and pastoral land.

Xerophile as the Wilsford assemblage is, it does not include *Truncatellina cylindrica*, described as Britain's only indigenous obligatory xerophile and known from five comparable prehistoric assemblages in the Stonehenge area (J Evans 1972, 140). It is, however, also absent at Stonehenge itself (J Evans 1984) and at Coneybury (Bell and Shackleton 1982), and its present distribution (which does not include Wiltshire) is described as very local (Kerney and Cameron 1979).

We need now to consider the temporal perspective of the sequence. The samples of soil from the chalky fill have been interpreted as fallen turf or topsoil. Assuming that this material is likely to derive from the full depth of the contemporary soil profile, the absence of any significant number of shade-loving species implies that the landscape had been cleared and open for some considerable time prior to the making of the shaft. The very uniform nature of the molluscan sequence as a whole implies a basically similar, dry open landscape before shaft construction, during its functional life, and over the period when its fill accumulated up to *c* 19 ft (5.7m). It has been argued that this fill could have accumulated within less than *c* 150 years.

Hand-collected shells

During the sieving on site of sediments below 94ft (28.2m), a number of shells were picked out by hand. These are listed in Table 14, but they add little to the overall picture. They do, however, illustrate the point first put forward by Sparks (1961) regarding the greatly distorted picture presented by hand-picked shells. There is a clear bias against the smaller species and in favour of larger ones, eg *Helicella itala*, *Trichia hispida*, and *Aegopinella nitidula*. If nothing else, the puzzling occurrence of the latter species in significant numbers at the bottom of the shaft is confirmed.

Small vertebrates

by P E Yalden and D W Yalden

Nearly all the small vertebrate material comes from the waterlogged lower part of the shaft, below 94ft (28.2m). The bones were extracted during sieving on site, during Peter Osborne's beetle analysis, and more recently during sieving of four waterlogged samples at Lampeter. The only material discussed here not from the basal deposits are all the Sand Martin bones and four toad or frog bones, which were found at 57ft (17.1m), and two mouse vertebrae at 60ft (18m). Having noted these exceptions, the assemblage will be discussed as one sample. The following taxa have been reliably identified.

Mammalia

Insectivora

Sorex minutus Pigmy Shrew. Facial half of a skull; also two humeri and one pelvis which are very small and must be this species.

Sorex araneus Common Shrew. One larger humerus is probably of this species.

Rodentia

Apodemus sp., probably *A. sylvaticus* Wood Mouse. One right and five left jaws; two left maxillae; isolated upper teeth, two m^1 and one m^2; also one pelvis and two tibiae.

Microtus agrestis Field Vole. Two skulls, one right jaw, and one isolated m^1.

Clethrionomys glareolus Bank Vole. One right jaw.

Numerous postcranial bones of rodents are also present, but these are not readily identifiable to species.

Aves

Passeriformes

Hirundo rustica Swallow. One left humerus, two metacarpals, two proximal halves of ulnae, one tibia, one tarsometatarsus, tips of both upper and lower beaks. Some of these bones are rather porous and clearly those of a juvenile bird. The size of the bones matches Swallow reference material well; although *Delichon urbica* House Martin approaches Swallow in size, our reference specimens are perceptibly smaller.

Riparia riparia Sand Martin. One humerus, one metacarpal, two scapulae, one coracoid, one proximal phalanx of finger 2. These are all much smaller than either Swallow or House Martin, but match reference Sand Martin specimens.

Alauda arvensis Skylark. Two intact and three partial humeri; five metacarpals, two femora, two tibiae, two tarsometatarsi, two ulnae, one proximal phalanx of finger 2. These all have the distinctive morphology and (among British birds) distinctive size of Skylark. There are also one humerus, one ulna, and one tibia that are perceptibly smaller than our reference Skylark; they might represent a small Skylark or might be the much rarer *Lullula arborea* Woodlark. The Woodlark is smaller than Skylark (roughly 30g against 40g), but we have no reference specimen.

Amphibia

Anura

Rana temporaria Common Frog. Nine maxillae, five radioulnae, 14 ilia, 12 femora, 16 tibiofibulae.

Bufo cf. *bufo* Common Toad. One radioulna, seven ilia, five femora, four tibiofibulae, one sacral vertebra.

Anuran remains were much the most abundant small vertebrate specimens, and their bones are readily recognisable. Distinguishing *Rana* and *Bufo* is less easy, but *Rana* have teeth in the upper jaw, while *Bufo* do not, the limb proportions, particularly of hind limbs, differ considerably, and the ilium is also distinguishable (Holman 1985). A further 57 long bones, and numerous vertebrae, phalanges, and skull fragments of Anurans, were also present.

Discussion

In interpreting the small vertebrates, it is essential to consider their taphonomy. If they represent an accumulation of raptor or owl pellet remains, they could be collected from a wide area and a wide range of habitats. On the other hand, if they arrived of their own volition, they might indicate something of the local environment.

In Britain, the majority of predators rely heavily on *Microtus agrestis* for their diet, and its remains dominate most collections of owl pellets. Similarly, the most usual birds tend to be abundant open ground or farmland species such as Meadow Pipit *Anthus pratensis* or House Sparrow *Passer domesticus* (eg Yalden 1985). This collection is not dominated by such species, nor is the material sufficiently abundant to represent the accumulation of pellet debris at a regular raptor or owl roost. It seems much more plausible that the pit acted as a pitfall trap, accumulating occasional victims. The predominance of Anura certainly indicates this, because no British bird of prey relies on anurans for its diet. Of course, one cannot rule out the occasional contribution from a passing owl.

The most informative species is the Skylark, a characteristic bird of open grassland, including downland. Skylarks require some longer or tussocky grassland to conceal their nests and are not found in very tightly grazed or mown areas. The Pigmy Shrew and Field Vole also imply some longer grassland, since they both require that the vegetation provide cover as well as food (grass itself for the Field Vole, insects in the grass for the shrew). Even if some of the lark bones are actually Woodlark, rather than Skylark, that too is a bird of open, scrubby woodland; the Bank Vole and Wood Mouse also imply at least some scrubby cover nearby. The Swallow also indicates open country, since it usually feeds low over grassland. Moreover Swallows seem particularly to favour the vicinity of large ungulates, such as cattle (in Britain), or antelope and zebra (in Africa); this accords with Osborne's (1969) interpretation of the beetle fauna. Swallows are known to nest in caves and pits, caves probably being their natural nest site before buildings became available, and the juvenile bones suggest that at some time they nested within the shaft. The presence of Sand Martin is by contrast enigmatic. Sand Martins excavate nest holes in sandy banks of rivers or quarries and would not be likely to enter a pit. They do, however, hunt over open ground, often near ungulates, as do Swallows.

The abundant anurans probably owe their presence largely to the effectiveness of the pit as a pitfall trap, since they are notoriously vulnerable to pitfalls. However, they do also hibernate in damp ground, sometimes underwater, under stones, and even in caves. This habit might predispose them to investigate a damp pit in what might otherwise be a dry

Table 15 Numbers of bones (and teeth) identified to species and of unidentified fragments of animal bones below 25ft (7.5m); all Middle Bronze Age

	Unit 2	*Unit 1b*	*Unit 1a*	*Total*
Identified bones and fragments				
Sheep/goat				
adult	3	24	18	45
young	27	0	7	34
foetal	0	4	58	62
total	30	28	83	141
Ox	8	10	12	30
Pig	0	0	2	2
Horse	0	0	0	0
Dog	0	0	4	4
Fox	0	0	*	*
Total identified	38	38	101	177
Unidentified fragments				
Medium mammal	0	8	156	164
Large mammal	0	3	15	18
Miscellaneous	1	0	33	34
Total unidentified	1	11	204	216
Total				
Identified + unidentified	39	49	305	393
Percentage identified	97.4	77.5	33.1	45.0

* a caudal vertebra of a dog *or* a fox

Table 16 Numbers of bones (and teeth) identified to species and of unidentified fragments of animal bones in the cone above 20ft (6m); those from Unit 4 have been dated to the Early Iron Age

	Unit 4 assoc	*Unit 4 ?unassoc*	*Unit 4 total*	*Unit 3*
Identified bones and fragments				
Sheep/goat	0	61	61	8
Ox	14	23	37	2
Pig	0	0	0	0
Horse	16	11	27	0
Dog	0	2	2	1
Red deer	0	3	3	0
Roe deer	0	1	1	0
Fox	0	1	1	0
Total identified	30	102	132	11
Unidentified fragments				
Medium mammal	0	17	17	0
Large mammal	0	77	77	1
Miscellaneous	0	59	59	5
Total unidentified	0	153	153	6
Total				
Identified + unidentified	30	255	285	17
Percentage identified	100	40.2	46.3	64.7

environment. Like the Field Vole and Pigmy Shrew, they imply a surrounding landscape with at least some longer grass or other vegetation for cover, certainly not the tightly-grazed downland of recent memory.

Large mammals

by Caroline Grigson

The study of the remains of large mammals from Wilsford Shaft will be divided into three main parts: a taphonomic analysis, a description of the species represented, and a consideration of the economy that they represent. The numbers of bones and teeth identified and unidentified in each of the main levels are summarised in Tables 15 and 16; the identifications are listed in the microfiche.

Taphonomic analysis

An important aspect of the faunal analysis is the taphonomic history of the domestic animals and the light that this sheds on the function of the shaft. Do they represent carcasses, or skeletons, or parts of carcasses, or parts of skeletons? Were they deposited deliberately in the shaft, or did they fall in with other products of natural weathering? Do they represent animals that died naturally, or animals that were slaughtered, dismembered, or butchered? For the taphonomic analysis the domestic animal remains will be discussed in four main stratigraphic units:

1. bones found on the base or in the lower part of the shaft in waterlogged conditions and dated to the Middle Bronze Age
2. bones in the upper part of the shaft above the water-table amongst the chalk rubble, also Middle Bronze Age
3. bones in the lower part of the cone between 20ft (6m) and 11ft 6in (3.4m); these were few in number and are probably also Middle Bronze Age
4. bones in the upper part of the cone, some of which have been directly dated to 2400 bp, the Early Iron Age; the five bones found above 3ft 8in (1.1m) were poorly preserved, of very uncertain date, and will not be discussed further.

Unit 1a: bones at, or near, the base of the shaft, between the bottom at 101ft (30.3m) and 94ft (28.2m)

The majority of the animal remains come into this unit which comprises all those excavated in 1962. Because they are concentrated into only 7ft (2.1m) of waterlogged deposit, they will be treated as a single assemblage dating from about 3200 BP, an ox frontlet from this unit having been dated 3200±80 BP (OxA-1229).

Preservation

Most, but not all, of the bones are very well preserved. Their colour ranges from golden-brown to dark brown and is sometimes intense and sometimes pale. Modern breaks usually reveal a chalk-coloured interior to the bones. The few long bones that are poorly preserved are flaking longitudinally and circumferentially.

Stratigraphy

Although a record was kept of the precise depth at which each object was found, it is unlikely that the stratigraphy was level. The falling deposits probably formed a weathering cone, and bones or carcasses falling into the shaft would have tumbled down the slopes of the cone, not necessarily reaching the lowest exposed levels. With fluctuations in the water-level, carcasses, and perhaps skeletons and bones, would have been lifted, disturbed, and mixed.

Associated bones

There are two main groups of bones of young lambs or kids that appear to be from the same skeleton or skeletons. One of these is 1962:287 (94ft 3in–95ft, 28.3–28.5m). The bones found together include fragments of two dorsal vertebrae, a scapula, a humerus, a radius, part of a distal epiphysis of a metapodial, a proximal phalanx, a middle phalanx, a right calcaneum, a right astragalus, a posterior cuneiform, and three sesamoids. The metapodial and phalanges appear to be from the same foot, and the calcaneum, astragalus, and cuneiform are from the same ankle (Fig 72). The second group (1962:293, 96ft 6in–97ft 6in, 29–29.3m) consists of unerupted teeth (including an m_4), two ribs, part of a distal epiphysis of a metapodial, a proximal phalanx, and a middle phalanx (Fig 73). At various levels between 94ft (28.2m) and 98ft (29.4m) were other isolated lamb or kid remains: two frontal fragments (one of which is lamb not kid), some unerupted cheek teeth, including an m_4, a maxilla with m^2 erupting, a mandible fragment with m_4 erupting, another mandible fragment which may be a pair with that in 1962:293, fragments of dorsal vertebrae, two sternebrae, three more ribs, another humerus, another radius, a pelvis fragment, a tibia, two unmatching vertical halves of metapodials, a metatarsal with the halves fused, another proximal phalanx, and two more middle phalanges.

The pattern of bone element distribution (Table 19 in microfiche), in which almost all parts of the body are represented, and the fact that some bones are clearly from the same animal, and some are spatially associated, suggest that the bones come from complete skeletons. At least two young animals are represented: this is indicated by the mandible with m_4 erupting contrasted with the mandible with unerupted cheek teeth, and by the presence of two sets of metapodials in different stages of fusion. The shape of one of the frontal fragments suggests that at least one of these young animals was a lamb. As sheep's wool was also preserved in the waterlogged deposits (*see* pp 121–4), this suggests that at least two complete lambs' carcasses found their way into the shaft, even though with many of the lambs' bones it

Fig 72 Bones that appear to be from the same foetal or neo-natal lamb (or kid) from near the bottom of the shaft (1962:287; 94ft 3in–95ft, 28.3–28.5m)

is not possible to ascertain to which skeleton each bone belonged. One lamb was neonatal (on the basis of tooth eruption: Habermehl 1975), and the other was either neonatal or an unborn (perhaps aborted) foetus, because it was represented by unfused metapodial halves (ie metapodials II and III) which fuse *in utero* or very soon after birth (Prummel 1987). It seems probable that these bones represent at least one aborted and one stillborn lamb which were dumped in the shaft. Presumably they relate to sheep breeding in the immediate vicinity.

Some sheep/goat vertebrae were found in associated sets (as detailed in the following section).

Butchery and cutmarks

An atlas and an axis of a sheep or goat (1962:239, 101ft, 30.3m) and three later cervical vertebrae of a lamb or kid (1962:293, 96ft 6in–97ft 6in, 29–29.3m) were found in two associated sets. Each set is represented by the left side only, the vertebrae having been sagitally split.

Two ox distal humeri, left and right but not a pair (1962:80, 97ft 4in, 29.2m, and 1962:159, 98ft 9in, 29.6m), have distinct break marks which may suggest deliberate breakage. Similarly an ox proximal radius (1962:84, 97ft 9in, 29.3m) appears to have been hacked off at the mid-point of the shaft. A humerus shaft, probably of pig (1962:159, 98ft 9in, 29.6m), from the same level as one of the ox humeri noted above, has a deep cut mark on the proximal end of the shaft.

Clearly all bones showing signs of butchery or cutmarks can be regarded as having been utilised and presumably represent refuse which has fallen into the shaft from domestic, or at least culinary, activities taking place near the mouth of the shaft.

Bone element representation

Details of the bone element representation are given in microfiche (Table 19). Those of young lambs (or kids) and those in spatial association have already been discussed; the remaining sheep/goat, ox, and pig bones seem to be represented in a quite haphazard fashion, and even though most of them are broken, there is nothing to indicate how they came to be in the shaft, nor what was done to them prior to falling in. The high proportion of unidentified fragments may be due to fracture in falling or to the incorporation of comminuted culinary refuse. Three of the caudal vertebrae of a dog may come from the same animal (1962:153, 99ft 3in, 29.8m; 1962:109, 98ft 3in, 29.5m; and 1962:293, 96ft 6in–97ft 6in, 29–29.3m).

Unit 1b: bones just above the base of the shaft, between 89ft 6in (26.9m) and 80ft (24m)

These were still in what were, at times, waterlogged conditions and should perhaps be considered as belonging to Unit 1a; however, they are separated from them by a sterile layer 4ft 6in (1.4m) in depth. The globular urn was near the top of these levels at 82ft (24.6m). They were excavated earlier in the 1961 season.

Fig 73 Bones from a second foetal or neo-natal lamb (or kid) from near the bottom of the shaft (1962:293; 96ft 6in–97ft 6in, 29–29.3m)

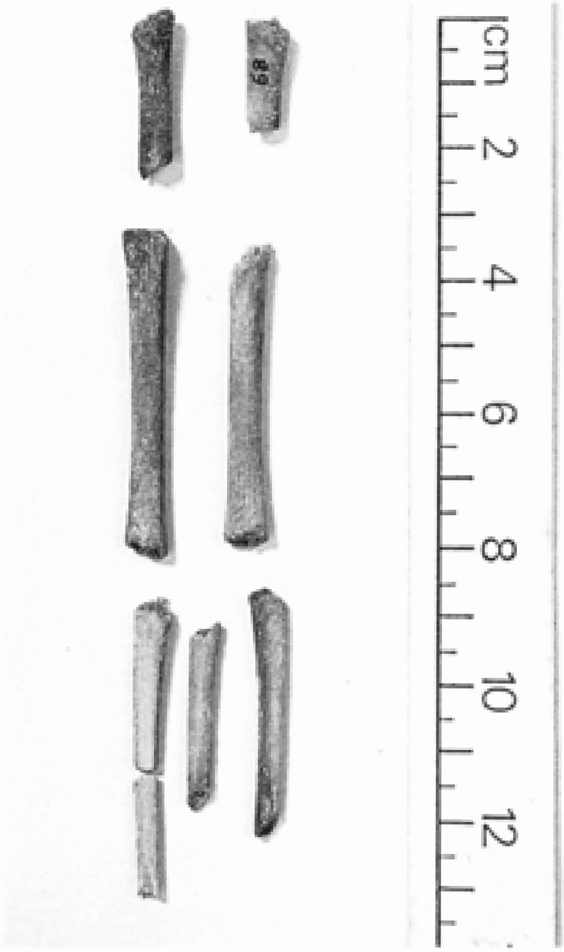


Fig 74 Metapodial halves from a third foetal or neo-natal lamb (or kid) from near the bottom of the shaft (1961:89 at 89ft 6in, 26.9m)

Preservation

Preservation of the bones in Unit 1b is much the same as in Unit 1a.

Associated bones

Six foetal or neonatal sheep/goat bones were found in association: two tibia shafts, four metapodial vertical halves, and two long bone shafts (1961:89, 89ft 6in, 26.9m; Fig 74). The metapodial halves are clearly from two different metapodials and it is likely that they are the remnants of a foetal lamb or kid, similar to that found in the lower level, but with only a few bones surviving.

In the same level (1961:89, 89ft 6in, 26.9m) there were a large number of sheep/goat bones (some of which were definitely of sheep). Several could be articulated: a right distal metacarpal with a right anterior inner proximal phalanx; a right distal humerus with proximal radius and ulna; lumbar vertebrae V and VI with sacral vertebra I; and a cervical vertebra VII with a dorsal vertebra I. The two sets of vertebrae are in very different states of fusion and a slightly different state of preservation, and seem to come from different animals. Find 1961:88 (89ft, 26.7m) includes a sheep's calcaneum, navicular, and proximal metatarsal which can be articulated. It is possible that these associated finds are the remains of two entire sheep, one adult and one younger (with unfused cervical vertebrae).

Butchery and cutmarks

The only trace of possible butchery in this unit is a sheep/goat proximal metacarpal which has been vertically broken in half, a form of damage that seems to be confined to human butchery practice.

Bone element representation

The elements of different parts of the skeleton of sheep/goats are fairly equally distributed (Table 20 in microfiche) and, as stated above, it is possible that the older sheep bones come from two carcasses. So many bones are absent or damaged that one cannot be at all certain of this.

There is nothing to shed light on the origin of the cattle bones in this unit.

Unit 2: bones stratified at various levels between 75ft (22.5m) and 25ft (7.5m)

Stratigraphy

Although the differences between the radiocarbon dates obtained from material in Units 1 and 2 are not statistically significant (*see* Housley and Hedges, Chapter 5), there is a direct correlation between the depths at which the dated bones and other material were found and the chronological order of their dates. It seems likely that this reflects different depositional events, albeit within a short span of time.

Two almost identical dates were obtained on the animal remains in Unit 2: 3130±60 BP (OxA-1215) for a sheep skull (1960:G35) at 43ft 9in (13.1m) and 3130±70 BP (OxA-1214) for an ox skull (1960:G25), which was found at a higher level, 29ft 6in (8.9m). The Deverel-Rimbury urn was amongst these levels at 60ft (18m), but no artefacts were found between it and 25ft (7.5m), except for one or two bone tools. These levels were excavated towards the end of the 1960 season and in the early part of the 1961 season.

Preservation

Bone above 75ft (22.5m) is chalky in colour and texture, in the state familiar to anyone who has worked with more usual archaeological material from the chalk downland, that is yellowish-white with surface erosion. The one exception was an ox pelvis from near the bottom of the unit (1961:62, 72ft, 21.6m) which was golden-brown with a dark brown to black patina on one side.

Associated bones

An incomplete pair of sheep/goat forefeet with a distal humerus (1960:G38 and 1960:G40), as well as two incomplete pairs of hind feet (1960:G37, 1960:G38, 1960:G39, 1960:G40), were spatially and stratigraphically associated at a depth of about 44ft (13.2m) (Figs 77–80). One of the metacarpals and

Figs 75–80 Skull and footbone fragments of sheep from a higher level in the shaft, perhaps representing heads and hooves, or fleeces, from two animals; the skulls were at 43ft 9in (13.1m) and the footbones at 44ft (13.2m); the fore and hind feet in Fig 78 are the pairs of those in Fig 80; the hind feet in Figs 77 and 79 are a pair and are from a different animal to those in Figs 78 and 80

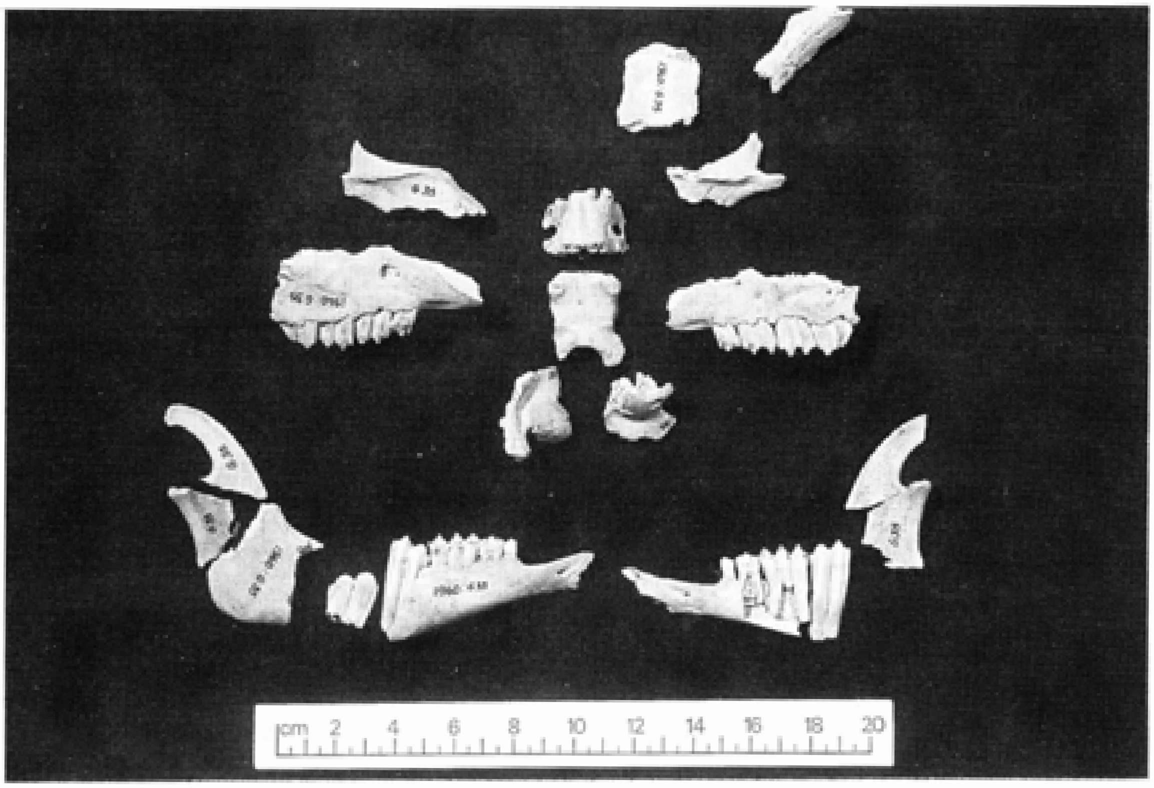


Fig 75 Sheep skull (1960:G35), directly dated to the Middle Bronze Age at 3130±60 BP OxA-1215

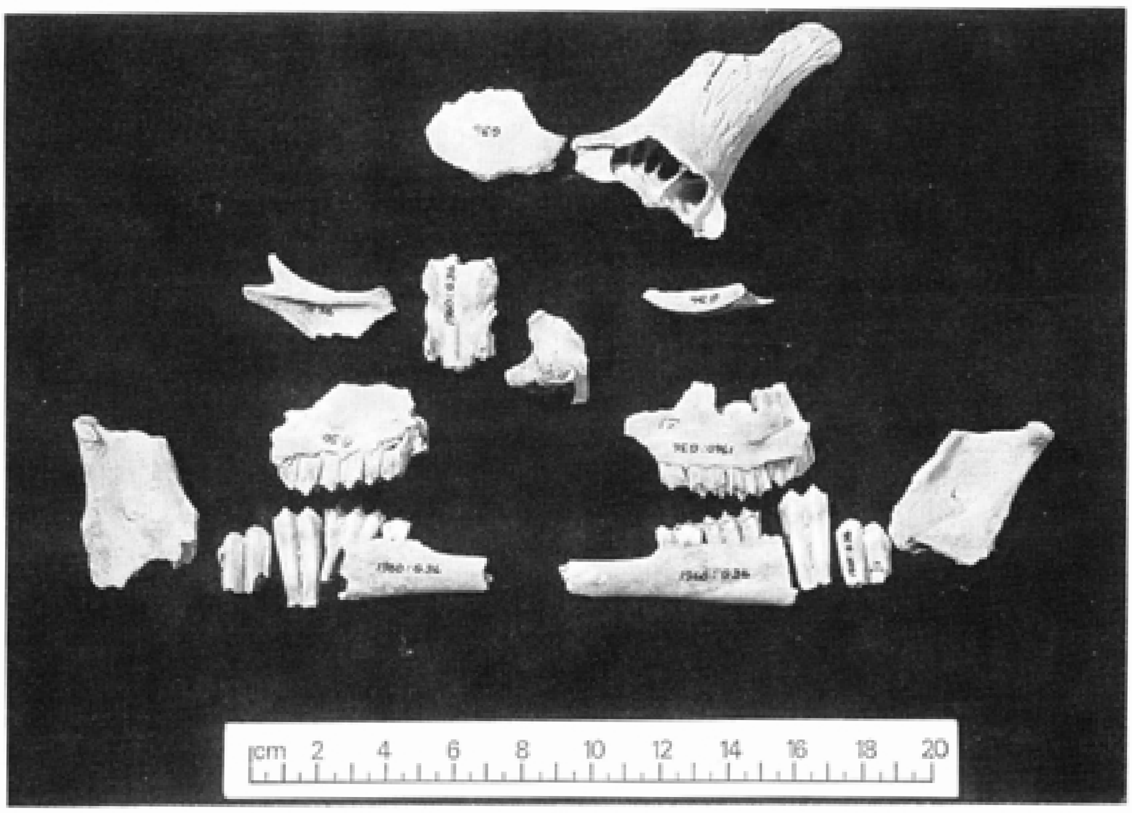


Fig 76 A second sheep skull (1960:G36)

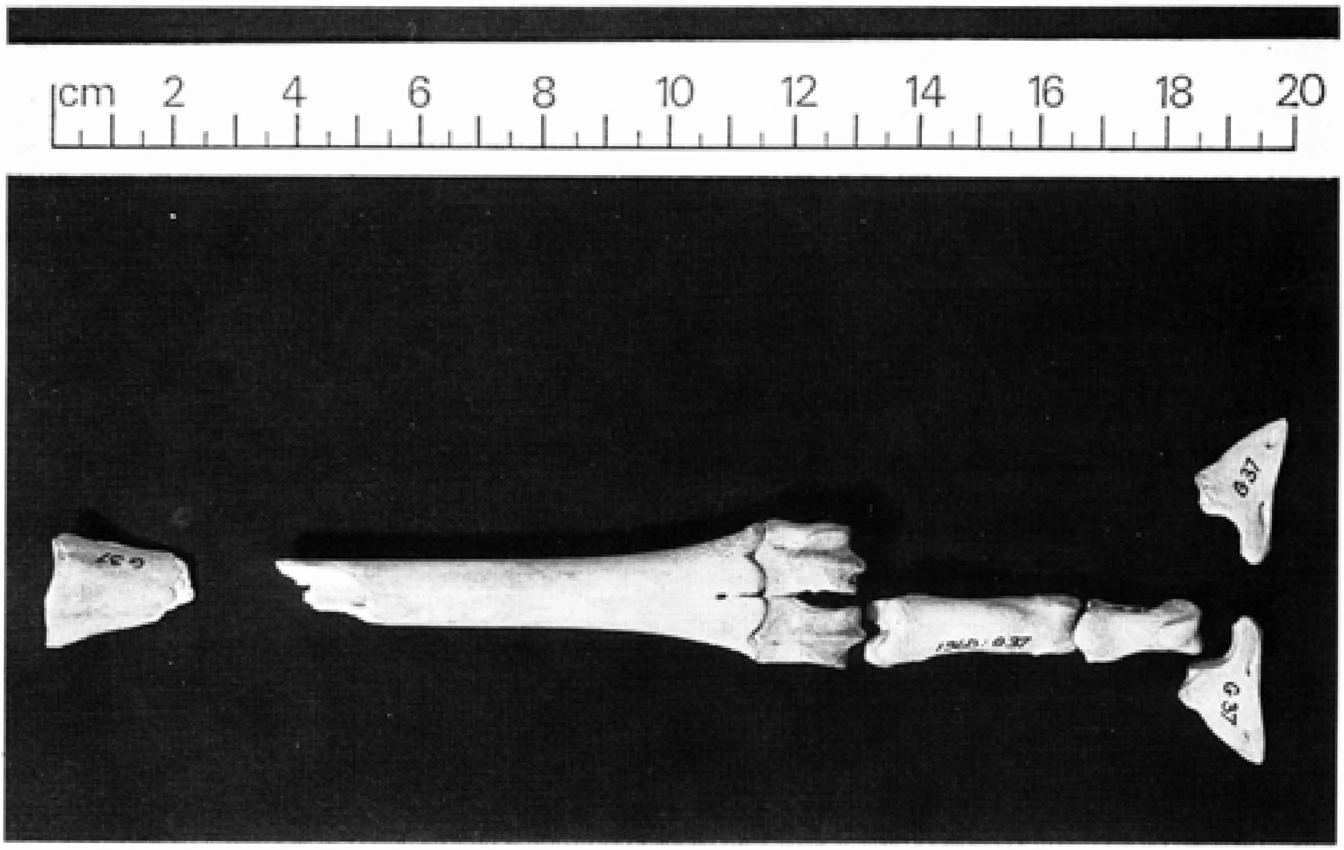


Fig 77 A right hind foot of a sheep (1960:G37)

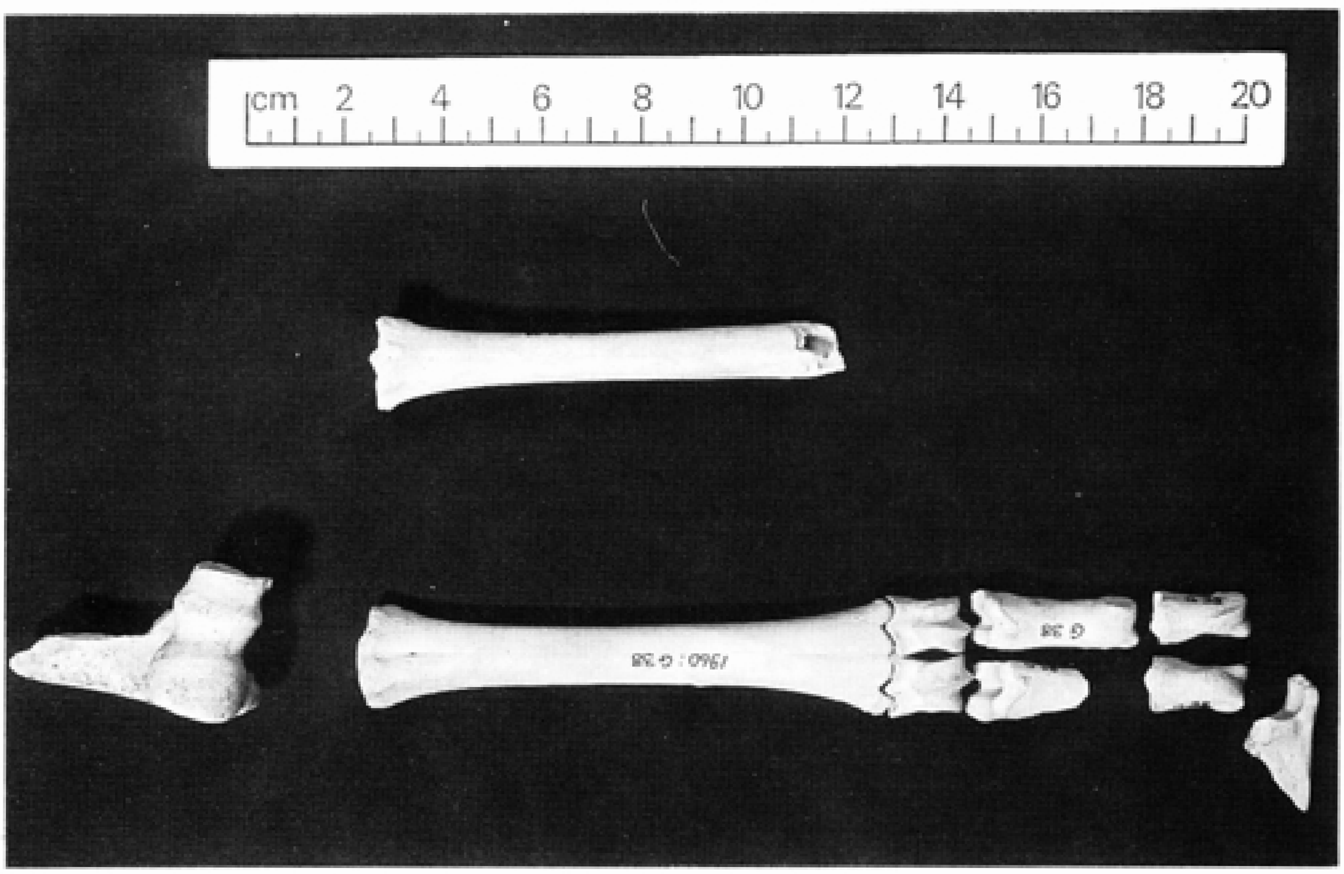


Fig 78 Bottom: left fore foot; top: right hind foot (1960:G38)

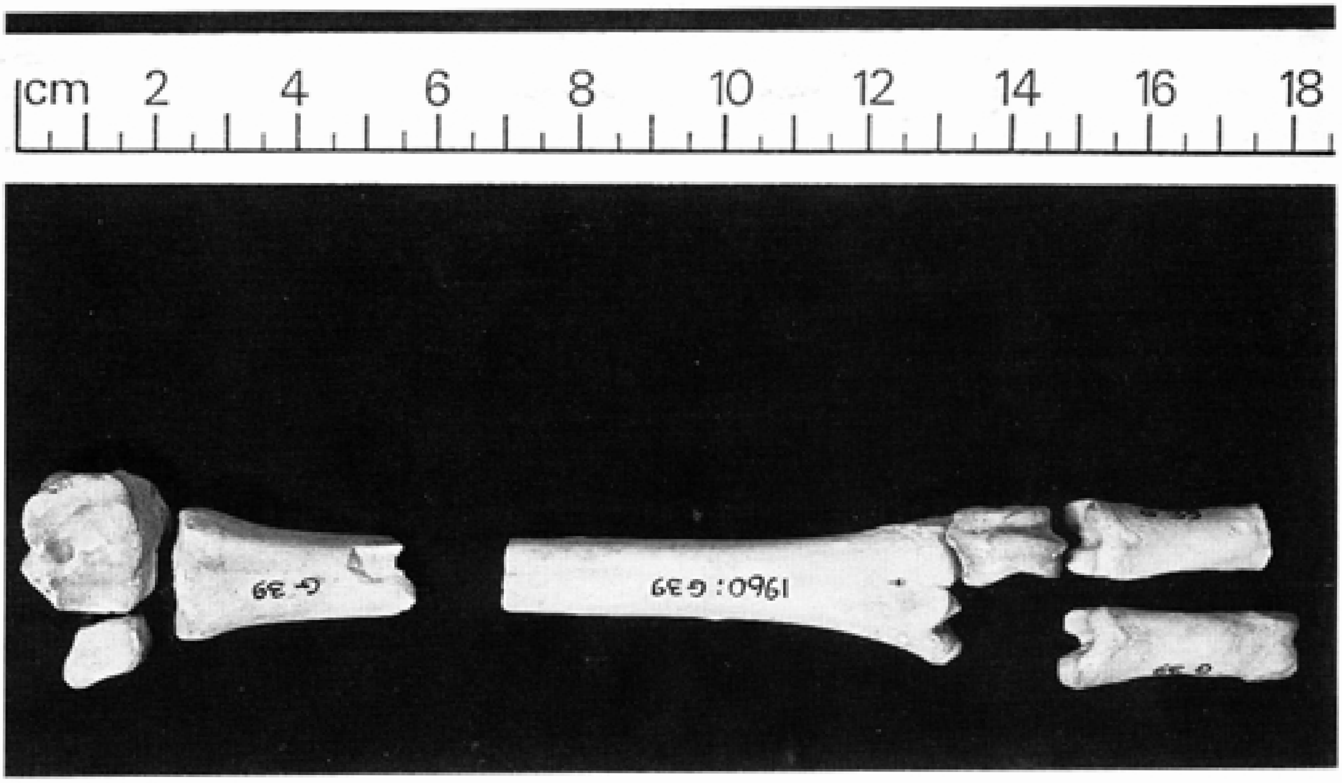


Fig 79 Left hind foot (1960:G39)

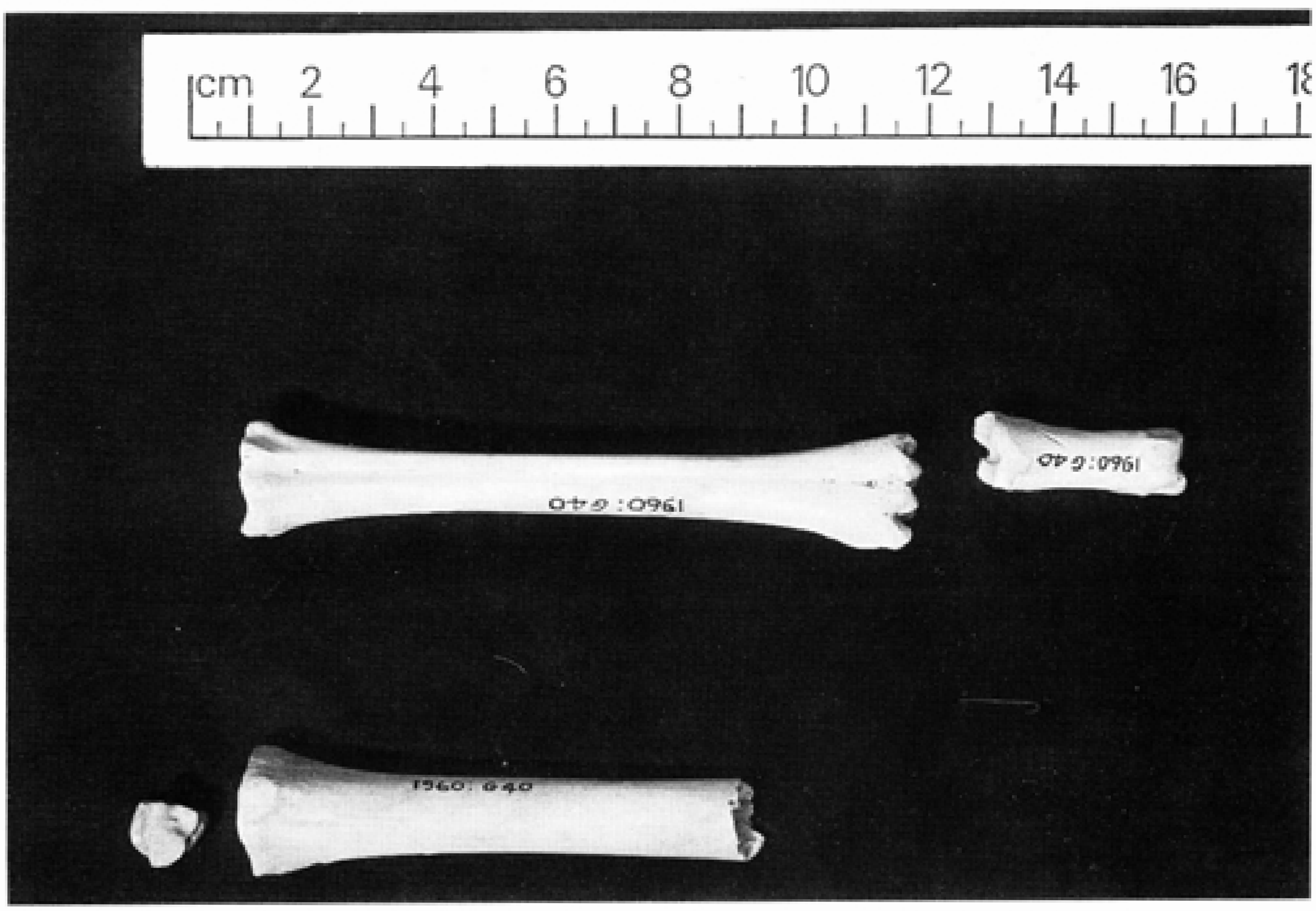


Fig 80 Bottom: right fore foot; top: left hind foot (1960:G40)

three of the metatarsals are complete distally and the epiphyses are unfused, indicating an age of less than 24 months. The epiphyses of three of the four surviving sets of proximal phalanges are in the process of fusing (ie aged about 13 months), and one has fused (older than 13 months). All the middle phalanges are fused (age more than 8 months). Thus the feet of two young animals are represented, one aged about 13 months and the other between 13 and 24 months (Grigson 1988; Silver 1969). Many of the bones can be distinguished to species, using the criteria of Boessneck (1969), and in all cases sheep are indicated.

In addition, at nearly the same level (43ft 9in, 13.1m), there are the remains of two sheep skulls (1960:G35 and 1960:G36) (Figs 75 and 76). Both are broken into hundreds of pieces, but clearly came from young animals, one a young male. The skulls are probably from the same animals as the footbones and could represent fleeces that had been thrown into the shaft. Although they could be the remains of carcasses from which the best meat bones had been removed, the possibility that they were ritually deposited has to be seriously considered in view of the occurrence of 'head and hoof' burials in prehistoric England, especially as no other bones were found in the same levels.

Two parts of ox pelvis (1961:62, 72ft, 21.6m and 1961:66, 73ft 6in, 22m) which seem to be part of the same bone suggest only that the 'levels' were not level, these pieces being separated by 1ft 3in (0.4m) of depth.

The remains of an ox skull (1960:G25, 29ft 6in, 8.9m) may be associated with the very broken remnants of an ox vertebra in the same level (1960:G26, 29ft 6in, 8.9m) and an ox dorsal vertebra (1960:G24, 29ft 11in, 9m) which could be from the same animal.

The surface erosion of the bones in this level would have removed most superficial cutmarks, but slight parallel scratches on the right frontal of the ox frontlet (1960:G25, 29ft 6in, 8.9m) may indicate that the hide had been removed from the skull.

Gnawing

One bone, an ox rib I (1960:G56, 57ft 6in, 17.3m) may have been gnawed by a dog.

Bone element representation

The preponderance and spatial association of sheep foot bones and skulls in depths 43–4ft (12.9–13.2m) have already been discussed. The majority of the remaining sheep/goat bones and the ox bones also suggest patterns (Table 21 in microfiche) with a preponderance of skulls: a sheep skull (1960:G19, 26ft 6in, 8m), a young sheep/goat skull (1960:G23, 29ft 6in, 8.9m), and two ox skulls (1961:66, 73ft 6in, 22m and 1960:G25, 29ft 6in, 8.9m). All were very broken, probably since deposition.

The fact that such a high proportion (97.4%) of the bones in these levels could be identified perhaps suggests that the majority are not the products of comminuted domestic refuse.

Unit 3: bones in the lower part of the cone, between 20ft (6m) and 13ft (3.9m)

The few bones in this unit probably date from the Middle Bronze Age.

Preservation

The bones are quite well preserved, nearly all of them light yellowish fawn in colour with some surface erosion.

Associated bones and butchery

Two sets of the sheep/goat vertebrae were found in the lower cone deposits. One (1960:G8) consisted of the centra of dorsal vertebrae II and III, which, although they lacked epiphyses, looked as though they came from the same animal. The other set (1960:G3) consisted of the centra of four vertebrae, probably dorsal vertebrae XI, XII, and XIII, and lumbar vertebra I. Although all the epiphyses are unfused and missing and dorsal vertebra XIII was represented by only a small fragment, they all appear to come from the same animal. Both sets of vertebrae consist of the left sides of the centra only and appear to have been vertically split. Presumably they were deliberately deposited in the cone when held together by ligaments and, perhaps, meat.

A dog's metacarpal (1960:G11) consisted of a complete shaft with the epiphyses unfused and missing and showed no signs of utilisation.

Bone element representation

Two sets of vertebrae were found together, but otherwise the bones were at different heights in the deposits and show no particular pattern of bone element representation (Table 22 in microfiche).

Unit 4: bones in the upper part of the cone between 11ft 6in (3.5m) and 3ft 8in (1.1m) in depth

Stratigraphy

From 3ft (0.9m) to 11ft 6in (3.5m) the layers in the central area of the cone consisted of brown silts, surrounded by deposits of compact weathered chalk; the deposits below 11ft 6in (3.5m) in both the cone and the top of the shaft consisted of chalk rubble. The contents of the cone seem to have been produced by weathering of the sides of the top of the shaft and the surrounding land surface. The majority of the animal (and human) bone comes from a fairly discrete deposit, between 7ft 4in (2.2m) and 9ft 6in (2.8m) in depth, which also contained the only diagnostic pottery found, an Iron Age vessel.

The radiocarbon dates obtained from this unit and their relationships to one another are discussed in detail by Housley and Hedges (Chapter 5). Four direct dates were obtained, two on human bones (2360±60 BP, OxA-1212 and 2320±80 BP, OxA-1211) and two on equid bones (2480±60 BP, OxA-1213 and 2450±60 BP, OxA-1210). The combined age estimate for the equid bones (which are almost certainly from the same individual) is 2465±42 BP. The human and

Figs 81–3 Some of the 'anatomically-associated' equid bones from the Early Iron Age levels in the cone at Wilsford Shaft

Fig 81 A pair of lower first molars (1960:3; 3ft 10in, 1.2m, and 1960:59; 5–10ft, 1.5–3m) from the same pony; see also Fig 89, B and C

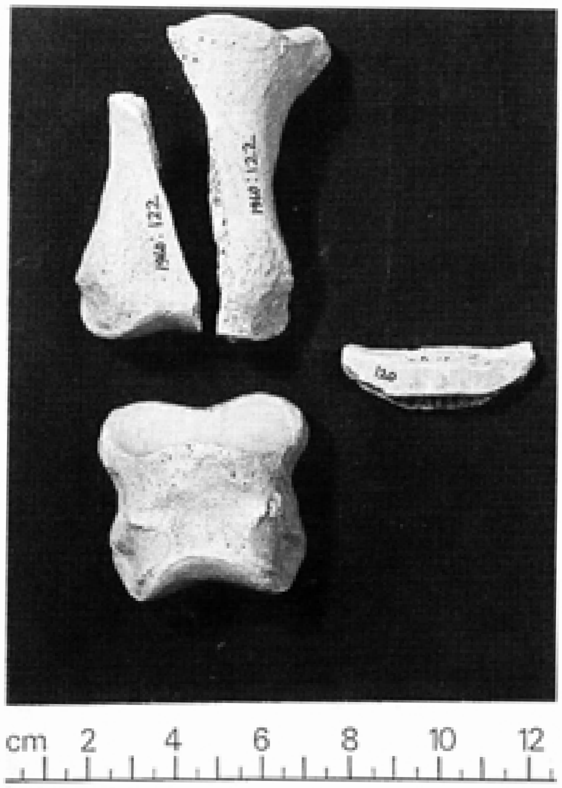


Fig 82 Proximal phalanx (1960:122; 8ft 6in–9ft, 2.6–2.7m), middle phalanx (1960:121; 8ft–8ft 6in, 2.4–2.6m), and distal sesamoid (1960:120; 7ft 8in, 2.3m), all from the same hind foot

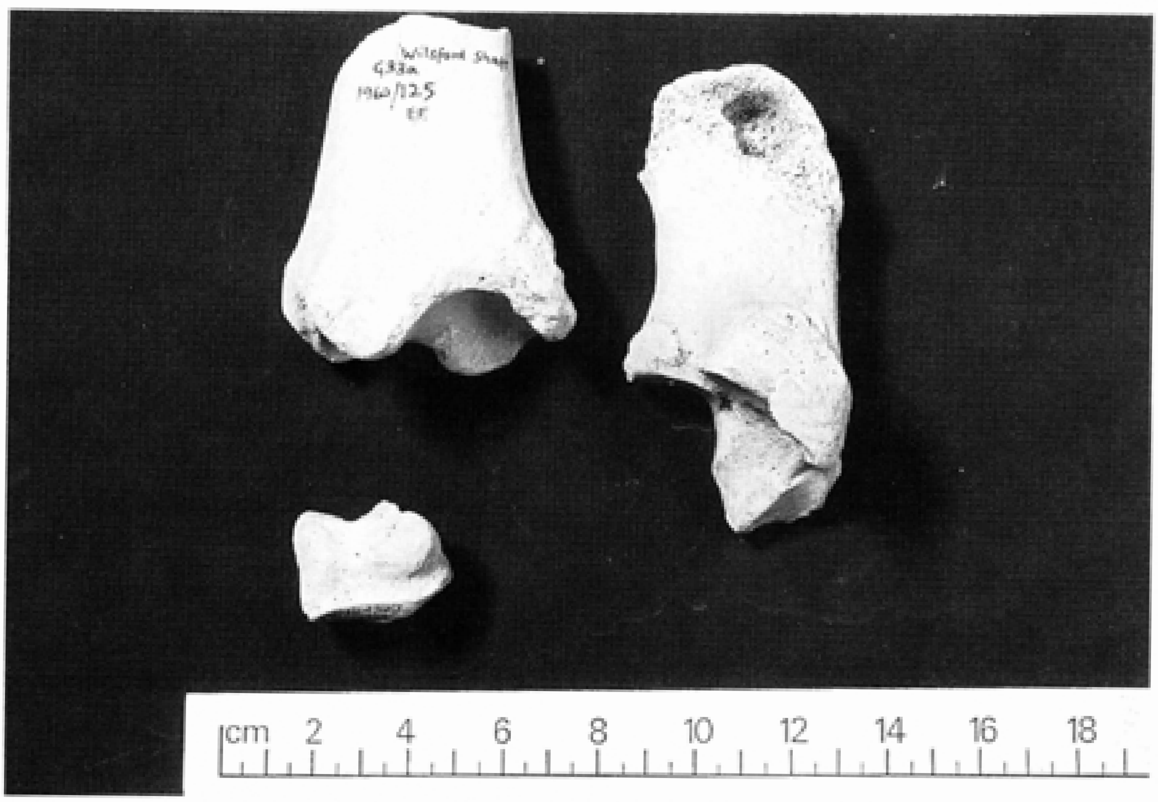


Fig 83 Distal tibia and cuboid (both 1960:125; 9ft–9ft 6in, 2.7–2.9m), and calcaneum (1960:25; 7ft 8in, 2.3m); despite the differences in level, all come from the same ankle; this is confirmed by the almost identical direct dates obtained from the cuboid (2480±60 BP OxA-1213) and the calcaneum (2450±60 BP OxA-1210)

equid dates are not significantly different from one another and can be combined to 2413±32 BP. Although the equid bones could date from the earliest part of the maximum span of the calibrated date range (760–400 Cal BC), ie Late Bronze Age, it is more probable that all the bones date from the sixth or fifth centuries BC.

Excavation was carried out on both sides of a north–south baulk to a depth of about 10ft (3m); however after very heavy rain part of this baulk, between 5ft (1.5m) and 10ft (3m), collapsed. The numerous bones that it contained had to be retrieved without any record of their precise depth, and many of them were broken by the collapse; they are listed under find number 1960:59 in the microfiche. A further problem is that some of the deposits in the top of the cone were traversed by rabbit holes, the digging of which must have disturbed the bones and perhaps destroyed some of the more fragile ones. As usual in excavations of the time (1960) the spoil from the excavation was not sieved and indeed much of it must have been unsuitable for sieving.

Preservation

The majority of the bones from the excavations of 1960 lay in the higher cone deposits, mostly between 9ft 9in (2.9m) and 7ft 4in (2.2m) deep. They were in the same state of preservation as most of the bones in the lower cone, although some of them were rather dirty, presumably reflecting the dark colour of some of the silts. Two of them (1960:114, 11ft 6in, 3.5m and 1960:115, 11ft 5in, 3.5m) were exceptionally well preserved, suggesting that they had not been rolled or moved since deposition and that they had been lying in very wet, alkaline conditions.

Associated bones

The only bones that were found in spatial association and that seem to come from the same individual were: 1960:27, right lower third and fourth premolars of an equid; 1960:125, a distal tibia and cuboid of an equid; 1960:66, two metatarsals of a dog.

However, many of the other bone fragments seem to come from the same individual and sometimes even the same bone, even though they were stratigraphically separated. These include the nine fragments of an ox cranium (1960:92, 1960:94, 1960:102, 1960:103, 1960:119, and 1960:125), all found at levels between 7ft 7in (2.3m) and 9ft 6in (2.8m). A lower right fourth deciduous molar (1960:85, 7ft 3in, 2.2m) is the pair of one in a mandible fragment (1960:120, 7ft 8in, 2.3m), but both are probably from a younger animal than the cranium.

The equid bones have the most elaborate associations. A right lower first molar (1960:3, 3ft 10in, 1.1m) is a pair with a left lower first molar (1960:59, from the baulk between 5ft and 10ft, 1.5–3m). They are illustrated in Figure 81. Two fragments of sacrum (1960:71, 7ft 5in, 2.2m and 1960:72, 7ft 7in, 2.3m) appear to come from the same bone. A posterior proximal phalanx (1960:122, 8ft 6in–9ft, 2.5–2.7m), a posterior distal sesamoid (1960:120, 7ft 8in, 2.3m), and a posterior middle phalanx (1960:121, 8ft–8ft 6in, 2.4–2.5m) can all be articulated and clearly come from the same foot. They are very similar in terms of size, preservation, and general appearance to an anterior middle phalanx (1960:44, 4ft 9in, 1.4m) and an anterior proximal phalanx (1960:119, 8ft 2in±2in, *c* 2.5m), and it is likely that all of them come from the same foot or at least the same individual equid (Fig 82). Similarly, a right calcaneum (1960:25, 7ft 8in, 2.3m) can be articulated with the right distal tibia and cuboid (1960:125, 9ft–9ft 6in, 2.7–2.9m) already mentioned and clearly comes from the same ankle. The date obtained on the calcaneum (2450±60 BP, OxA-1210) and that on the cuboid (2480±60 BP, OxA-1213) are virtually identical. These bones may well be from the same individual as the foot bones listed above; however they are not from the same individual as the ankylosed left ankle (1960:127, 8ft 6in, 2.6m). They are illustrated in Figure 83.

These anatomical associations suggest that, in addition to the unassociated bones, an ox skull and articulated parts of at least one equid and one dog were deposited in the cone and that at some stage they must have been very disturbed, bones from the same limb being separated by between 3ft 9in and 4ft 3in (1.1–1.3m). Despite the associations, many bits of the ox skull, dog ankle, equid dentition, and equid ankle and foot are completely missing.

Bone element distribution

The pattern of bone element distribution in Unit 4 (*see* Table 23 in microfiche) is rather haphazard except for the preponderance of ox skull bones, which can be explained by the likelihood that the fragments and probably most of the teeth come from the same skull, and the high number of equid foot and ankle bones, which are thought to be derived from only one or two individuals. This probably indicates that most of the unassociated bones (which are mostly of sheep/goats and cattle) are present as the remains of domestic rubbish.

Butchery

As quite a few bones were broken in the collapse of the baulk and since excavation, it is possible that some were more complete than they are now, but the only complete bones are the associated foot and ankle bones of equids.

One large mammal long bone fragment (1960:29) is a half cylinder that has apparent chop marks at one end. The distal end of an ox humerus (1960:119) had distinct cut marks on the posterior surface about 10mm above the epiphysial line, probably indicating defleshing. One equid middle phalanx had a slight groove on the posterior surface of the diaphysis, and a proximal phalanx of an equid (1960:119) had a shallow groove and cut marks on it as did a calcaneum (1960:25), which may suggest that the skin had been stripped off, but all these marks could have been acquired in excavation. None of the other equid foot or ankle bones showed any sign of butchery or cut marks.

Worked bones

Three bones showed signs of having been worked (Fig 40; *see* p 42). A sheep-size femur shaft cylinder (1960:80) had a circumferential groove; it had also been gnawed, which is rather odd as one would not expect a gnawed bone to have been suitable or retrieved for working, nor would one expect a dog to gnaw a bone which had no flesh left on it. A sheep/goat tibia shaft (1960:59) had been grooved circumferentially at the centre and then broken at the groove. The third worked bone is a red deer antler tine (1960:120), probably a trez tine, which had been grooved and then broken off around its base. Its tip was smooth, but this may well be natural.

Gnawing

The following bones had been gnawed, presumably by dogs: a humerus shaft of an equid or an ox (1960:115), an ox metacarpal shaft (1960:119), another ox humerus shaft (1960:107), an ox radius shaft (1960:78), a sheep/goat humerus shaft (1960:105) and tibia shaft cylinder (1960:59), the worked sheep-size femur shaft cylinder (1960:80) already mentioned, which is particularly interesting as Binford and Bertram (1977) maintain that long bone cylinders characterise dog-gnawed assemblages, and three large mammal long bone shaft fragments (1960:30, 1960:99, and 1960:113). All of these gnawed bones are among those that were not anatomically associated, but one of the less definitely associated bones, the equid middle phalanx (1960:44) with possible cut marks, had also been gnawed, suggesting that it had been lying about on the surface before being deposited in the cone. However, this is the only equid bone that had been gnawed.

Taphonomic results

The taphonomic study of the animal bones from the Wilsford Shaft leads to some interesting, if very tentative, conclusions. The presence of at least three neonatal lambs in Unit 1 perhaps indicates pastoral activity, that is sheep breeding, in the area round the mouth of the shaft, whereas the haphazard bone element representation of the remaining sheep, cattle, and occasional pig bones in these levels with the signs of a few butchered bones suggest the presence of culinary refuse as well. In the higher level, Unit 2, the over-representation of skulls of cattle and sheep (sometimes associated with foot bones) and the near absence of small fragments could have a ritual rather than a domestic or pastoral significance. However, the conditions of preservation in Unit 2, which was dry, were not nearly as good as in the lower, waterlogged levels, and, if there had been any foetal bones amongst those from Unit 2, it is unlikely that they would have survived.

It could be argued that as long as the shaft contained water, animal remains that were considered as rubbish were either thrown in or fell in by accident from the surrounding area. However, once the silting reached the level of the water, the shaft and the land immediately around it was no longer intensively used for pastoral or culinary activities, and occasionally parts of animals and other objects were deposited in the shaft, perhaps for some ritual activity associated with the adjacent barrows.

Only 17 fragments of bone were found in Unit 3 (the lower part of the cone). Like those in the shaft they seem to represent discrete episodes of deposition, spanning a length of time, of either prepared joints of sheep/goat vertebrae or of domestic rubbish. They may have arrived in the cone from several different sources, but all must ultimately relate to human activity around the mouth of the cone.

Most of the 285 animal bones found in Unit 4 (the upper cone deposits), and particularly those that were anatomically associated with one another, come from the same level as the Iron Age pot and the human bones. They probably date from the sixth or fifth centuries Cal BC. Of the two equid bones that come from the same ankle, one (the calcaneum dated to 2450±60 BP, OxA-1210) was found *above* the human bones and the other (the cuboid dated to 2480±60 BP, OxA-1213) was *below* them, suggesting either disarticulation of the bones before deposition or the disturbance of the deposits after deposition or both.

The associated animal bones in Unit 4, with one exception, show no signs of butchery, cutmarks, gnawing, or burning; most of them were clean and not weathered, stained, or attacked by humic acid in the way in which bones suffer when they are exposed on the surface or lie in superficial or earthy deposits. This suggests that parts of equids, and also of cattle and dogs, which had not been eaten, were discarded into the cone and quickly buried either by weathering of the cone or deliberately by people. Thus, the taphonomy of the anatomically-associated bones in the upper cone suggests unusual human discard behaviour: whether or not this should be interpreted as ritualistic is uncertain.

The unassociated animal bones in Unit 4, which are almost all of sheep/goats and cattle, were also concentrated in the same levels as the human bones. Although, like the human bones and the associated animal bones, none of them was burnt, some showed signs of butchery, or gnawing, or both, and the pattern of bone element distribution was rather haphazard; they were therefore probably part of ordinary domestic refuse.

The animals

Sheep *Ovis aries*

25 of the 206 sheep/goat bones were positively identified as sheep, using the criteria of Boessneck (1969), and as no goats were identified it is likely that the only caprines represented at the Wilsford Shaft were sheep.

Samples of measurable sheep bones from English prehistoric sites are small and the numbers of published comparable dimensions are even smaller. Nevertheless, almost all the dimensions from the Early Neolithic at Windmill Hill (Grigson 1965) are slightly larger than those from Runnymede Bridge in the Late Bronze Age (Done 1980), and Jarman *et al*

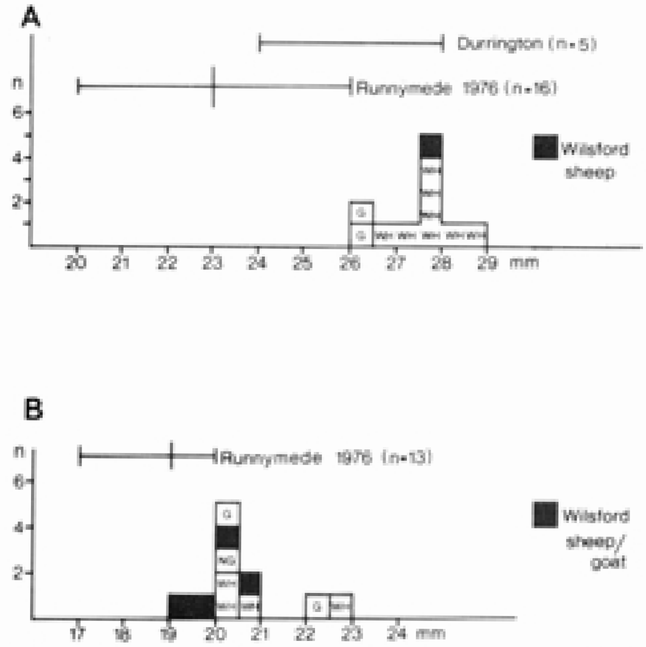


Fig 84 The size of the sheep and sheep/goat bones from the Middle Bronze Age and Early Iron Age at Wilsford Shaft compared with those from Neolithic and Bronze Age sites in England: A radius proximal breadth (Bp); B metacarpal proximal breadth (Bp); WH = Windmill Hill – earlier Neolithic (Grigson 1965); NG = Newgrange – Beaker (Wijngaarden-Bakker 1986); G = Grimthorpe – Bronze Age (Jarman et al *1968); Durrington range – Late Neolithic – from Harcourt (1971); Runnymede ranges – Bronze Age – from Done (1980)*

(1968) showed a small but significant diminution between the Late Bronze Age at Grimthorpe and the Iron Age at Barley. Clearly size differences in prehistoric sheep – whether diachronic or geographical – are worth investigating.

Measurements of the Wilsford sheep (and sheep/goat) bones are given in microfiche (Table 24). Where comparisons with other sites are possible, the Wilsford bones seem to be of the same size as those from Early Neolithic Windmill Hill and Cherhill (Grigson 1983), Beaker Newgrange (Wijngaarden-Bakker 1974; 1986), and Late Bronze Age Grimthorpe; bones from all of these sites are a little larger than those from the Late Neolithic at Durrington Walls (Harcourt 1971) and the Late Bronze Age at Runnymede Bridge (Fig 84). The sample sizes are too small for definite conclusions to be drawn.

The Middle Bronze Age sheep sample is too small and the taphonomic tableau is too diverse for detailed analysis of the demography of the sheep bones. Adult, young, and foetal bones are represented, and the presence of what seem to have been complete skeletons of foetal and neo-natal lambs has already been mentioned as suggestive of sheep breeding in the vicinity.

A few of the sheep/goat jaws and teeth can be aged using the criteria of Deniz and Payne (1982) and indicate animals of 2.5–4.5 months (wear stage B), 8–32 months (C, D, or E), 2–3 years (E) (two animals), 3–4 years (F), and 4–8 years (G or H). One radius had the proximal epiphysis fused and the distal epiphysis unfused indicating an age of 10 months–3 years, two other fused proximal radii indicate animals aged 10 months or more, and a fused distal radius an age of 3 years or more; an unfused distal humerus less than 10 months, a fused distal humerus 10 months or more, two fused distal tibiae 1.5 years or more, and a pelvis fused at the acetabulum 3.5 years or more (Silver 1969). Clearly a wide range of ages is represented, but there are not enough ageable teeth or bones to allow a detailed analysis. The presence of a mandible of one very young animal shows that the conditions of preservation in the upper part of the cone must have been reasonably good.

One Early Iron Age lower third molar of a sheep or goat (1960:59) has swollen, ridged roots. This is a common feature in archaeological finds, but does not seem to have been described on modern material (Miles and Grigson in press; Baker and Brothwell 1980). It is probably the result of infection caused by crowded conditions, or the overuse of pasture, or both.

Ox *Bos taurus*

There can be no doubt that all the cattle bones which can be measured (Table 25 in microfiche) or assessed by eye come from domestic cattle (*Bos taurus*) and not from the wild ox (*Bos primigenius*).

The two humeri from near the base (1962:159, 98ft 9in, 29.6m and 1962:80, 97ft 4in, 29.2m) are very different in size and probably come from a bull and a cow at extreme ends of the contemporary size range (Fig 85).

However, a dimorphism is also present among three skull fragments that is not only due to the animal's sex. The first is the horncore from near the base of Unit 1 (1962:21, 95ft 2in, 28.5m), which has been directly dated to 3200±80 BP (OxA-1229) and is of the same size and proportions as the horncores of cows of Neolithic type from Windmill Hill (Grigson 1965; 1982a) and Hemp Knoll (Grigson 1980); it is illustrated in Figure 86. The second is a frontlet (Fig 87), found at 73ft 6in (22.1m), and of the same size and proportions as those of young domestic bulls from Windmill Hill. The find of an ox skull in a Beaker barrow at Hemp Knoll dated to about 1800 bc suggested that cattle of the Neolithic type survived into at least the Early Bronze Age. It was either succeeded by or overlapped in time with smaller cattle, conveniently though incorrectly named '*Bos longifrons*', which were prevalent from the Middle Bronze Age onwards. The question is whether this small 'Celtic ox' was produced by an autochthonous diminution over time of the 'Neolithic ox', or whether it was imported from the Continent by Bronze Age people and, if so, when (Grigson 1980; 1982b).

The third ox skull is a frontlet (1960:G25), which was found at a higher level in Unit 2 at 29ft 6in (8.9m). It has a short, stubby horn which definitely represents an adult 'Celtic ox' (Fig 88). It has been directly dated to 3130±70 BP (OxA-1214).

The dates obtained on the ox remains show that domestic cattle of Neolithic type survived until at least 3200 BP and that the 'Celtic ox' was present at 3130 BP: both dates lie in the Middle Bronze Age.

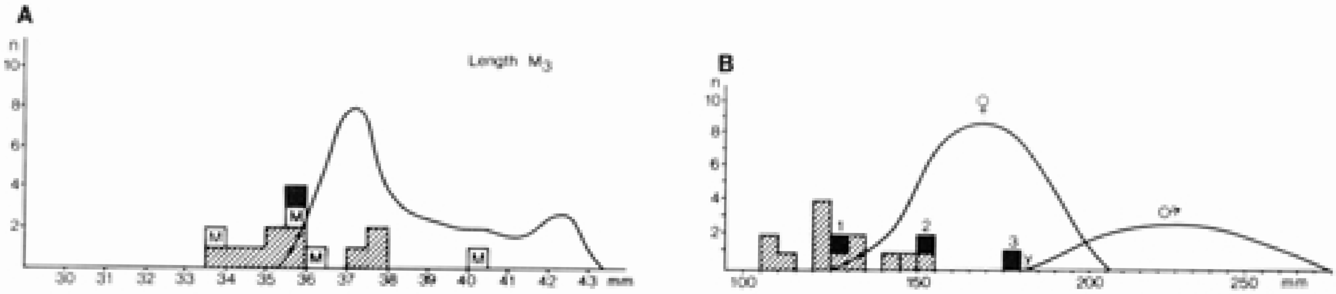


Fig 85 The size of the cattle bones and teeth from the Middle Bronze Age at Wilsford Shaft: A lower third molar length – the curved line represents cattle from earlier Neolithic sites, the hatched squares are Bronze Age material, and M = Milton Lilbourne; B horncore basal circumference – the black squares are Wilsford, 1 = 1960:G25 (29ft 6in, 8.9m), of unknown sex, but 'Celtic ox' size and shape, dated to the Middle Bronze Age at 3130±70 BP OxA-1214, 2 = 1962:21 (95ft 2in, 28.5m), female of Neolithic type, dated to the Middle Bronze Age at 3200±80 BP OxA-1229, 3 = 1961:66 (73ft 6in, 22.1m), young male of Neolithic type, undated but stratified between 1 and 2; the curved line represents cattle at Windmill Hill – earlier Neolithic (Grigson 1982a); the hatched squares are Bronze Age sites – Rams Hill (Carter 1975), Jarlshof (Platt 1932–3 and 1933–4), Snail Down (Clutton-Brock and Jewell forthcoming), Minnis Bay (Jackson 1943), Boscombe Down (Jackson 1937), Runnymede (Done 1980)

Unfortunately, the ox skull that was stratified between the lower and higher skulls did not contain enough collagen to be dated. On the two mean dates the two types of cattle at Wilsford are separated by 70 years, but statistical analysis (Chapter 5) shows that the maximum difference between the dates is 115 years and the actual difference may well have been less. Indeed, the differences between the various Middle Bronze Age dates are not statistically significant. However, as already stated, there is a direct correlation between the depths at which the dated bones and other material were found and the chronological order of their dates, and it seems likely that this reflects different depositional events, albeit within a short span of time.

Whether or not the 'Neolithic' and 'Celtic' types of cattle were contemporary, whether one developed into the other, or whether the 'Celtic ox' appeared suddenly is still uncertain, but the radiocarbon dates suggest that the change from one to the other in southern Britain can be pinpointed to within 100 years, that is between 1515 and 1400 Cal BC, during the Middle Bronze Age.

There are too few ageable bones to allow quantification of the sexes or ages at death of the cattle whose remains were found in the shaft, although both young and adult animals are represented. The presence of an adult cow and a young bull in the Middle Bronze Age fits in with the general pattern of cattle husbandry proposed by Legge (1981) for the midden at Grimes Graves, in which most of the bulls were killed off when young and most of the cows were kept into old age for breeding and perhaps for milk. It does not follow that the pattern was universal in this period.

The ageable cattle remains from the Early Iron Age at Wilsford are a pair of lower deciduous fourth molars (1960:85 and 1960:120) which are between stages j and k (Grant 1982). Estimates of the age at which they are replaced by the permanent premolars vary from 24 to 42 months (Grigson 1982c), but clearly these are from quite young animals. A humerus with both epiphyses and a fragment of pubis that is unfused at the acetabulum are from animals of less than 18 months, a fused pelvis indicates an animal of 18 months or more, and a fused proximal radius one of 15 months or more. There are too few ageable bones for much to be said about the pattern of ageing of the cattle, but it seems unlikely that any were kept into extreme old age.

An interesting ox tooth was found in the lower part of the cone. It was a lower third molar (1960:G6) in which the third (or distal) pillar is reduced to a thin flange of cement with a ridge of enamel. Such reductions in the distal pillar of the lower third molar have been recorded in various wild ungulate populations and in some domestic stocks (Miles and Grigson in press); they seem to be of genetic origin, as they tend to occur in isolated populations. A deformed lower third molar was also found in the Bronze Age at Milton Lilbourne (Grigson 1986), suggesting inbreeding amongst the cattle at both sites.

Red Deer *Cervus elaphus*

Only three red deer bones were found at Wilsford: an antler tine, a mandible fragment, and a tibia shaft. The antler tine was clearly worked, as discussed earlier. The mandible fragment included a lower fourth deciduous molar, so clearly comes from a young animal, probably one that had been eaten. The same is true of the tibia shaft. This was a cylinder and the ends may have been chewed off by a dog, but there are no clear tooth marks. This was one of the few dark-stained bones and seems to have had a different taphonomic history from most of the others, perhaps having been exposed on the surface before becoming incorporated into the deposits.

Roe Deer *Capreolus capreolus*

There was only one roe deer bone (1960:59) at Wilsford Shaft. It was found in the cone, so probably dates from the Early Iron Age. It is a shaft of a metatarsal, which is an easy bone to distinguish from those of sheep and goats even when it is fragmentary. It is very large compared with modern roe

Figs 86–8 Horncores and skulls of domestic cattle from Wilsford Shaft, showing the change in horncore shape and size from the 'Neolithic' to the 'Celtic' type

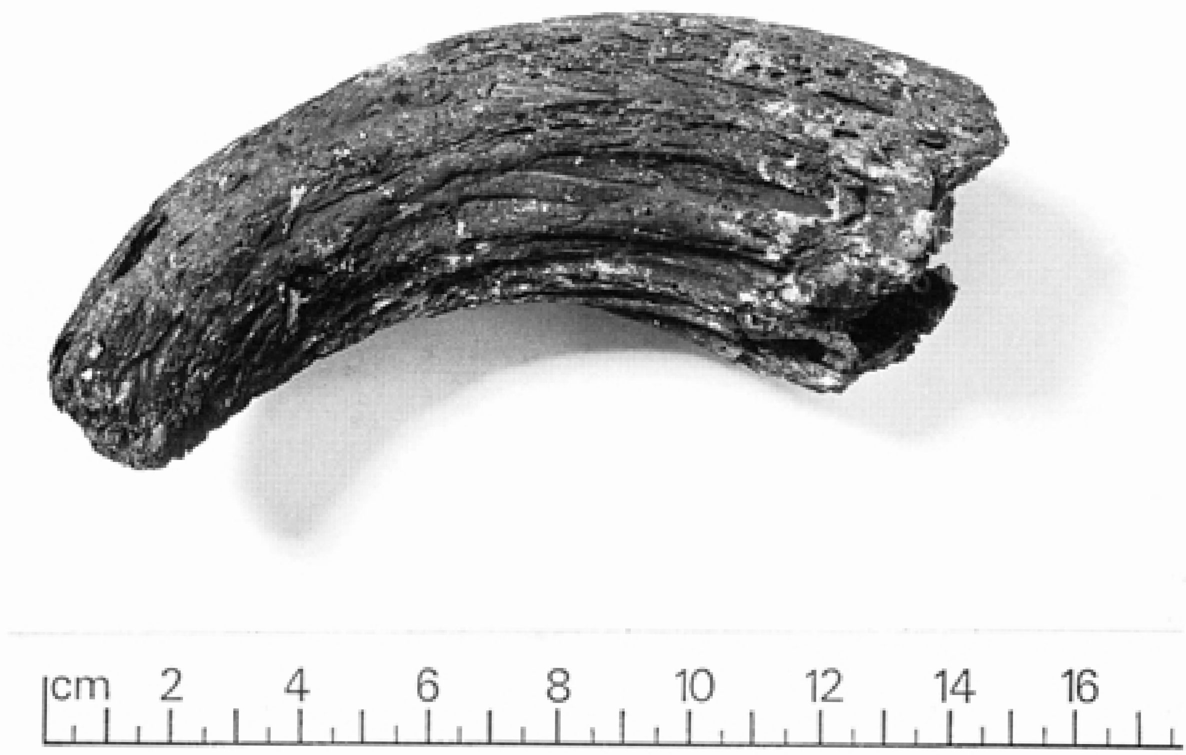


Fig 86 From a female of Neolithic type (1962:21; 95ft 2in, 28.6m), directly dated to the Middle Bronze Age at 3200±80 BP OxA-1229; its torsion is greater than normal and the tip of the core has been broken off

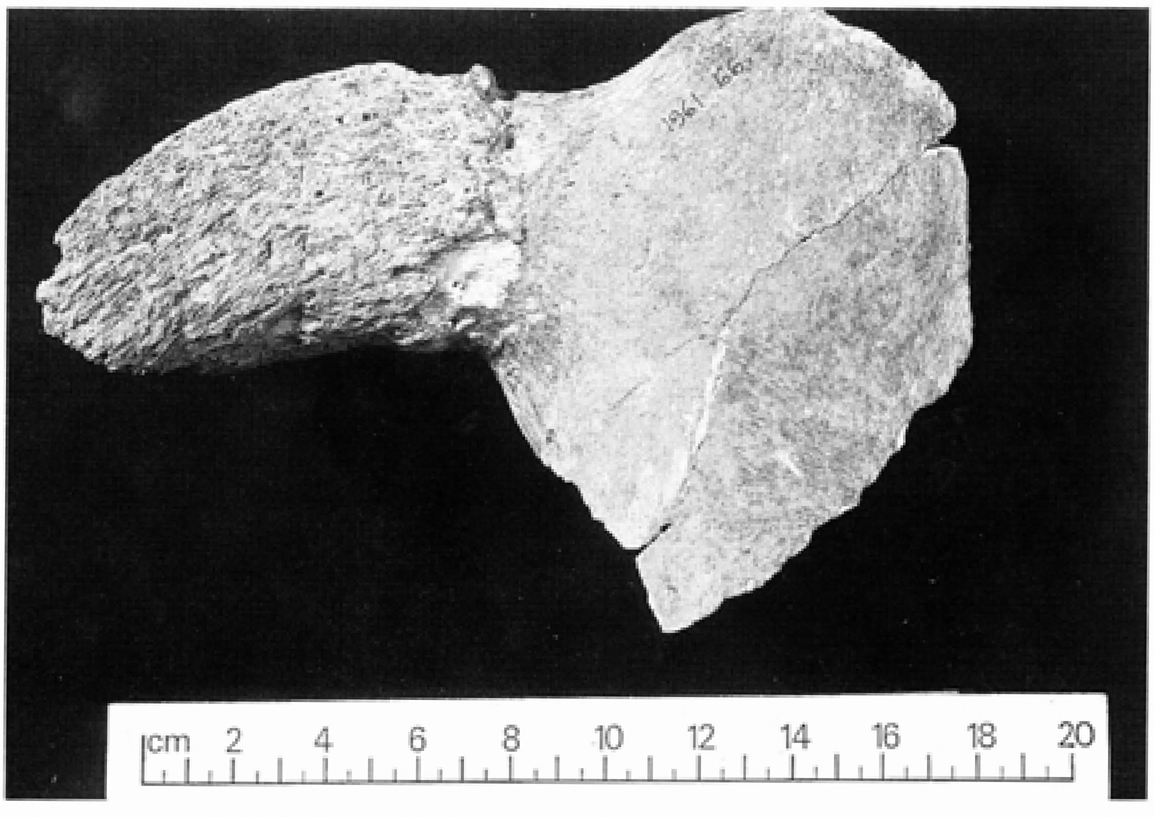


Fig 87 From a young male of Neolithic type (1961:66 73ft 6in, 22.1m), undated but stratified between 1962:21 and 1960:G25

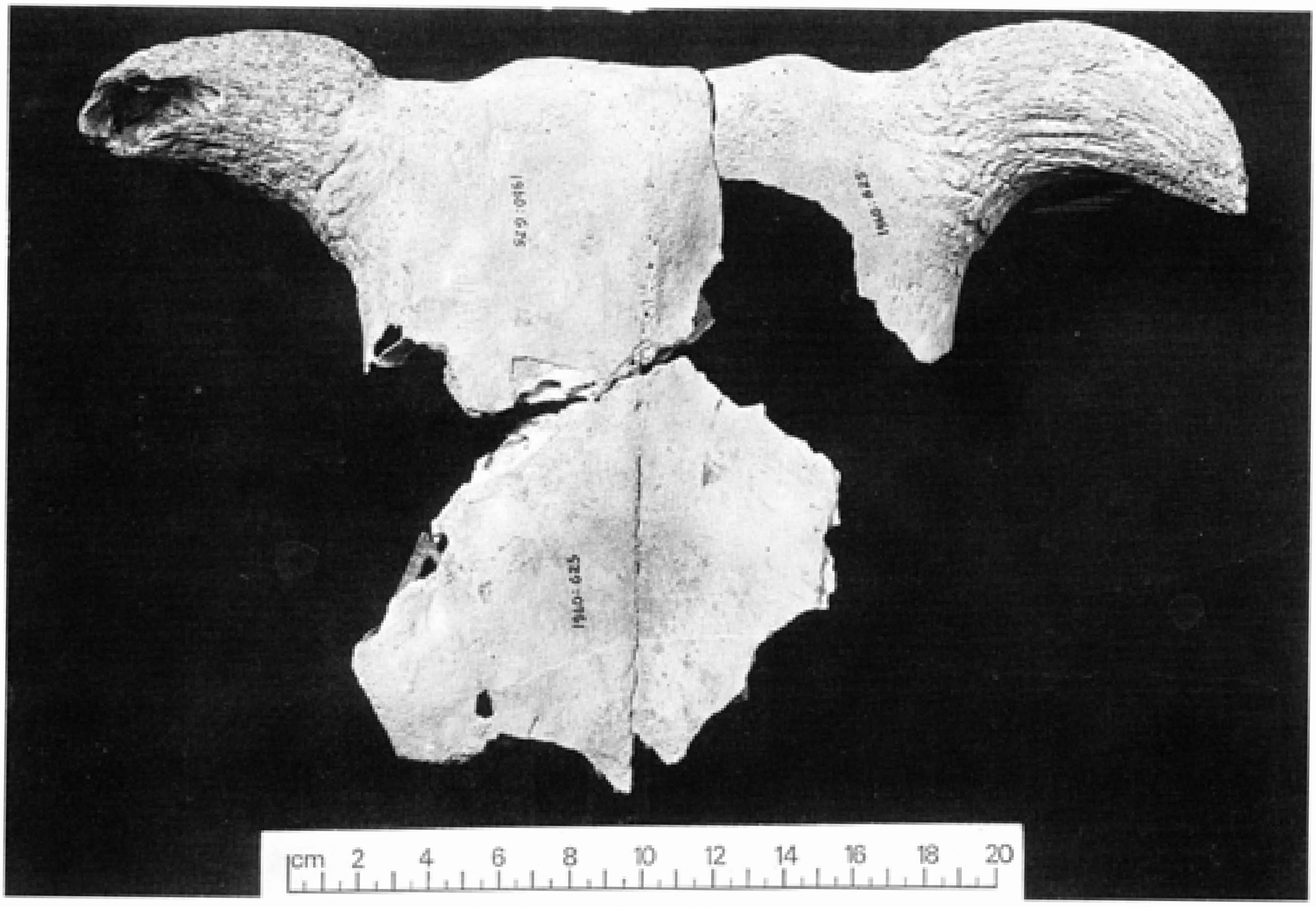


Fig 88 From an animal of unknown sex, of 'Celtic ox' size and shape (1960:G25; 29ft 6in, 8.9m), directly dated to the Middle Bronze Age at 3130±70 BP OxA-1214

deer, but it is known that earlier prehistoric roe deer were large (Grigson 1983). The measurement is given in microfiche (Table 26).

Pig ***Sus scrofa***

Only two bones can be ascribed to pigs, both from the Middle Bronze Age. Although they are fragmentary, it can be seen that they are of quite small size and there is no reason to suppose that they come from wild boar.

Equids cf. ***Equus caballus***

Equid bones were found only in the Early Iron Age levels. Although it is always assumed, probably correctly, that the equids found on Late Neolithic, Bronze Age, and Iron Age sites are ponies (*Equus caballus*), this has only rarely been tested. On the basis of criteria established by Davis (1980) and Eisenmann (1981), the equid teeth from Milton Lilbourne, a Bronze Age site in north Wiltshire, certainly were of ponies (Grigson 1986), and so were those dating to the Iron Age from Hook in Hampshire (Davis 1987). The same is true of those from Wilsford Shaft. This is shown by the shape of the protocone in the upper second premolar (Fig 89A), and by the moderate degree of penetration of the lingual fold towards the buccal fold in the lower first molars (Fig 89B and C) and lower third premolar (Fig 89D).

Using criteria established by Davis (in prep), the equid proximal phalanx from Milton Lilbourne was also shown to be caballine (Grigson 1986). As the method being developed by Davis involves the analysis of six measurements of each proximal phalanx, it cannot be used to identify phalanges from published sets of measurements which usually include one, two, or rarely three measurements. However, the main distinction which he established was that the proximal phalanges of donkeys (*E. asinus*) are more slender than those of ponies and horses (*E. caballus*); Compagnoni (1978) reached the same conclusion on the basis of three measurements of each of a large number of modern horse and donkey phalanges. The use of Compagnoni's scattergrams and indices confirms that the Late Glacial equid phalanges from Gough's Cave (Currant 1986) were caballine and so were those from the Late Neolithic of Newgrange in Ireland (Wijngaarden-Bakker 1974; 1986), Bronze Age Runnymede (Done forthcoming), Milton Lilbourne (Grigson 1986), and Balksbury (Harcourt 1969). However, on this basis the one complete phalanx from Wilsford Shaft (Fig 90) is either *asinus* or intermediate between *asinus* and *caballus*. This seems highly unlikely, especially as the teeth are definitely caballine. The apparent slender-

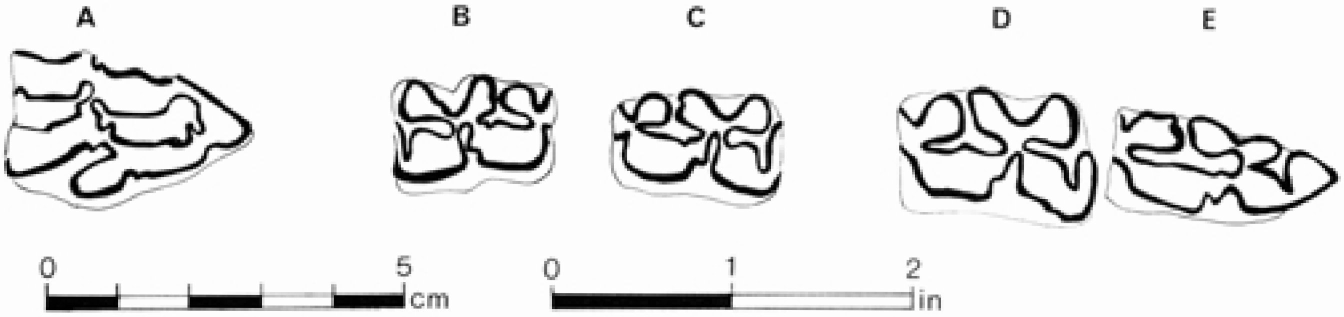


Fig 89 The occlusal surfaces of the cheek teeth of ponies from Wilsford Shaft: A upper right second premolar (1960:59); B lower left first molar (1960:59); C lower right first molar (1960:3); D lower right third premolar (1960:27); E lower right second premolar (1960:27); B and C appear to be a pair from the same animal; E and D were found together and are from the same jaw; in A the shape of the protocone, and in B, C, and D the penetration of the buccal fold towards the lingual fold, indicate ponies, Equus caballus

ness of this bone is due to its unusually great length; Figure 91 shows that its breadth is normal for a prehistoric domestic pony.

The main reason for believing that ponies from the Late Neolithic onwards in Britain were domesticated is their sudden appearance in large numbers in the Late Neolithic, especially at Newgrange (Wijngaarden-Bakker 1974; 1986). Although it is said that horses do not undergo diminution with domestication, Figure 91 shows that the Wilsford and Milton Lilbourne phalanges, as well as those from Newgrange and other Bronze and Iron Age sites, are considerably smaller than those from the Late Glacial. The measurements of the equid remains from Wilsford Shaft are set out in microfiche (Table 27).

Levine (1982) has produced curves relating the height of the crown of the cheek teeth of New Forest ponies to age at death. Although her material is not directly comparable to that from Wilsford, her results can be used to give a rough indication of age. On this basis the upper second premolar (1960:59) is from an animal aged about 13 years; the two lower molars (1960:3 and 1960:59, which may be from the same animal) from one aged 4 years; the lower second and third premolars (1960:27, same jaw) from an animal aged 4–5 and 5–6 respectively, say about 5 years. Clearly some ponies were being kept into old age, which suggests that they were used as living animals, perhaps for riding or draught, rather than for eating.

The state of epiphysial fusion of the long bones indicates the presence of adult animals: two proximal tibiae fused – 3 years or more; two distal tibiae fused – 20 months or more; tuber calcis fused – 3 years or more; two proximal phalanges fused – 13 months or more; and two middle phalanges – 9 months or more (Silver 1969).

A proximal metatarsal which is pathologically fused with the cuboid, navicular, and cuneiforms of the ankle above it (1960:127) is shown in Figure 92. This condition is known as spavin and usually develops only in old animals that have been used for carrying or pulling heavy loads (Baker and Brothwell 1980).

Dog *Canis familiaris* and Fox *Vulpes vulpes*

The only bones that can be ascribed to dogs in the Middle Bronze Age at Wilsford Shaft are four caudal vertebrae, possibly from the same individual, although one recovered from one of the sieved samples (1962:248, 98ft 3in–98ft 9in, 29.5–29.6m) is rather small and could be from a fox.

The only bones of dogs in the Early Iron Age are

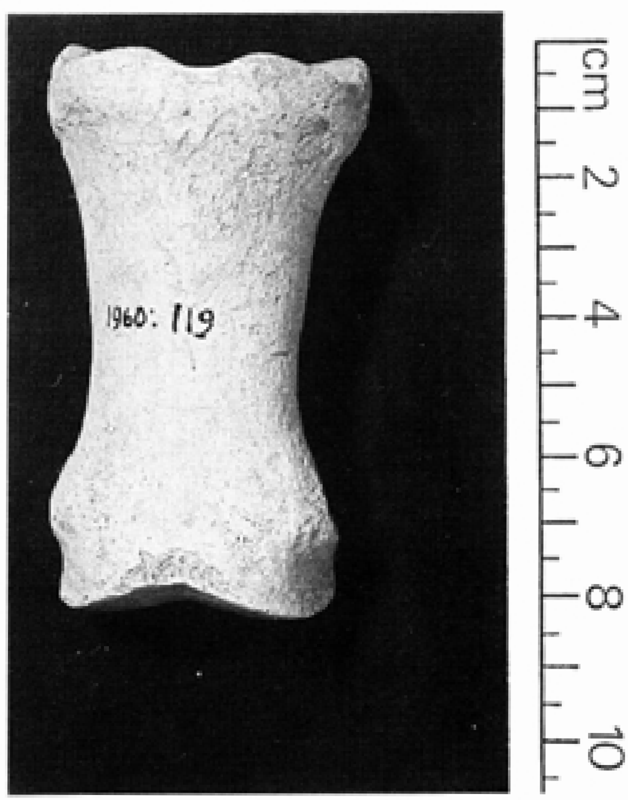


Fig 90 The equid proximal phalanx (1960:119) from the Early Iron Age at Wilsford Shaft; although it is of normal breadth for a pony, Equus caballus *(see Fig 91), it is unusually long, so that its proportions approach those of a proximal phalanx of a donkey,* Equus asinus

two metatarsals, one very fragmentary, probably both from the same young animal. That dogs were present in the vicinity is also indicated by the fact that many of the animal bones had been chewed by carnivores. The presence of a single bone fragment (a distal tibia) of a fox (*Vulpes vulpes*) calls for no further comment.

The economy

Middle Bronze Age

Although a total of 141 bones can be ascribed to sheep, compared to 30 of ox and 2 of pig (Table 15), many of them probably come from single skeletons, and, as the complicated taphonomic history of the deposits precludes the calculation of the minimum number of individuals present, the relative numbers of domestic ungulates cannot be quantified at all accurately. Probably sheep outnumber cattle by *about* 5:3. Despite the higher proportion of sheep bones, cattle would have contributed far more meat (and perhaps milk) than sheep to the local diet, because they are so much larger. The contribution of pigs must have been minimal; perhaps one or two joints were introduced into the vicinity of the shaft.

Although sheep tended to be more frequent on Early, Middle, and Late Bronze Age sites in southern England than they were in Beaker or Late Neolithic times (Grigson 1981), such a very high proportion has not been recorded before for the Bronze Age. The presence of carcasses of foetal and young lambs may indicate pastoral activity in the area, at least until the shaft silted up, and this is reinforced by the high number of other sheep remains. It has been suggested that the increase of sheep in the Bronze Age is related to the introduction of woolly sheep (Grigson 1981): the sheep's wool at the base of the shaft (if it is Bronze Age – *see* p 123) provides confirmation that at least some of the sheep were woolly at this time, although no spinning or weaving equipment was found in the shaft.

Early Iron Age

The varied taphonomic history of the bones from the cone deposits makes an assessment of the economic role of animals during this phase of the site rather hazardous. It seems likely that the spatially- and anatomically-associated bones represent animals, or parts of animals, that have not been eaten and which are the residue of some form of special activity, so these are excluded from the present discussion.

None of the 61 sheep/goat bones were in anatomical association with one another (Table 16). Some of the 11 upper teeth, amongst the 23 ox bones and teeth listed as unassociated, might have belonged to the cranial fragments that seem to comprise the same skull, so the true number of unassociated cattle bones and teeth is between 14 and 23.

On this basis it seems that sheep outnumber cattle by very roughly 4:1, rather more than in the Middle Bronze Age deposits. Despite the higher proportion of sheep bones, cattle would have contributed more meat (and perhaps milk) than sheep because they are so much larger. In southern England such high proportions of sheep are usual in the Iron Age (Cunliffe 1978; Grant 1984) in contrast to the Bronze Age (Grigson 1981). Although the absence of pig bones is in keeping with the pastoral economy of the chalk downlands, it may actually be due to the small size of the sample.

The main problem comes with the 11 equid bones that were not in association. None of them shows definite signs of butchery or working, none of them had been gnawed, they were few in number, and some were from old animals. So, despite their rather haphazard pattern of element representation, it seems likely that they too represent 'special' rather than culinary activity. This does not mean that equids had no economic importance – presumably they were ridden or used for traction when they were alive – but there is no evidence to suggest that their meat formed part of the diet of the people who used the cone and its surroundings.

Ceremony

The taphonomic reasons for considering that the ox skulls and the sheep heads and hoofs in the Middle Bronze Age at Wilsford Shaft, as well as the ox skull and equid ankles and feet present in the Early Iron Age, might have been there as a product of ceremonial, or at least special, activity have already been discussed in detail. Both ox skulls and 'head and hoof' burials interpreted as hides are quite common at Neolithic and Bronze Age ceremonial sites. Ritual deposits of horses, or parts of horses, are also known from later prehistoric sites. It is possible that the possession of cattle and ponies had prestigious overtones, particularly as it is thought that ponies were first used for riding in the Late Bronze Age (Burgess 1974; Britnell 1976; Grigson 1981). However, it cannot be claimed that the faunal remains provide definite evidence for ceremonial use of either the shaft or the cone in the Middle Bronze Age or Early Iron Age.

Possible skin and hair fibres

by M L Ryder

Possible hair fibres

Forty samples of apparent hair or wool fibres were supplied in tubes of preserving mixture, composed of 30 parts Industrial Methylated Spirit, 60 parts glycerol, and 10 parts 40% aqueous formalin solution. Such wet preservation is unnecessary and made analysis more difficult. All hair and skin samples are from the 1962 excavation of waterlogged deposits below 94ft (28.2m).

Methods

Ten of the 40 'fibre' samples were sub-sampled. Those most like hair or wool were taken first, and the rest were taken at random. The material was dried on filter paper and then prepared as whole mounts for microscopical examination in Euparal mounting

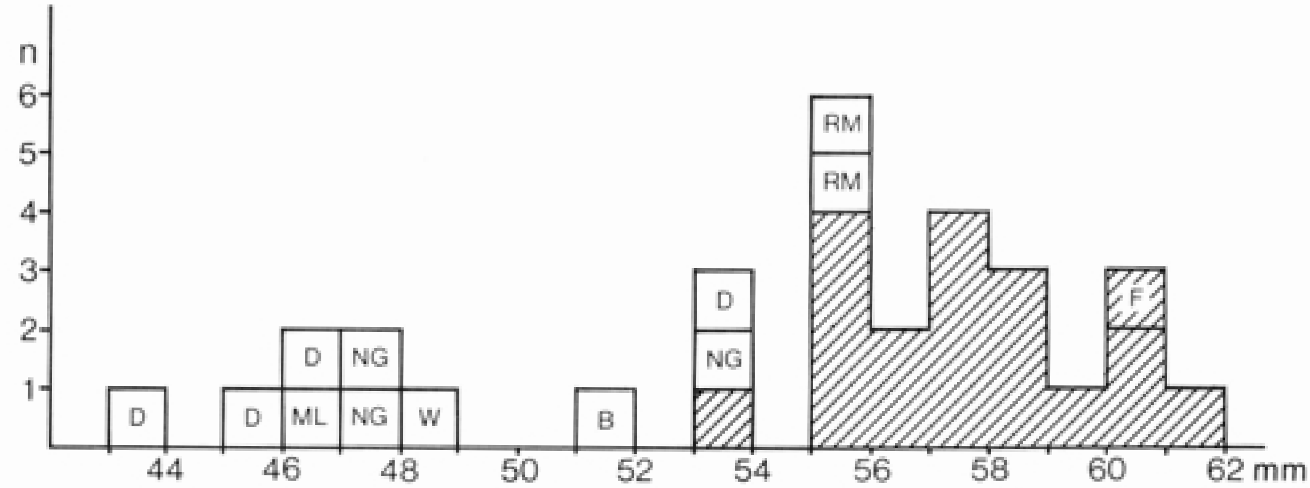


Fig 91 The size of equids at Wilsford Shaft and other Iron Age, Bronze Age, and Beaker sites compared with that of wild ponies of the Late Glacial; W = Wilsford Shaft – Early Iron Age; B = Balksbury – Iron Age (Harcourt 1969); RM = Runnymede 1978 – Bronze Age (Done forthcoming); ML = Milton Lilbourne – Bronze Age (Grigson 1986); NG = Newgrange – Beaker (Wijngaarden-Bakker 1974 and 1986); D = Durrington Walls – Late Neolithic (Grigson nd); F = Flixton – Late Glacial (Fraser and King 1954); the hatched squares are Gough's Cave – Late Glacial (Currant 1986)

medium. Fibre diameter measurements to give a diameter distribution were made of the five specimens that appeared most like hair or wool after a preliminary microscopic examination. The standard International Wool Textile Research Organisation method was used with a projection microscope set at a magnification of 500× (Ryder and Stephenson 1968; Ryder 1986).

Identification

Samples 225/11, 248/23, 248/36, 248/56, and 291/192 had what appeared to be brown fungal mycelia of varying degrees of fineness. Thus, what appeared to be animal fibres to the naked eye turned out to be plant material. The writer's experience of mycelia is restricted to those of microbial organisms and, when measurements of the other fibres were being made, it was realised that the mycelia in some samples (eg 291/192) were relatively coarser, ie comparable in width to cotton fibres (seed hairs). Sample 291/192 also contained a fragment of a blade of grass with spikes on the edge. No attempt was made to make a specific identification of this or the other plant material.

The remaining samples all appeared to be hairs or textile fibres and were measured to produce fibre diameter distributions, which are given in Table 17. Each specimen will, however, be described individually below.

248/22 Under the ordinary microscope this appeared like brown cattle hair frayed into the component cortical cells. The fibre diameter measurements were, however, typical of flax fibres (Table 17), only the smallest value (5 microns) being comparable with the diameter of a cortical cell from mammalian hair. Since there was no evidence of either weave or spinning twist, these were almost certainly not fragments of spun yarn or cloth. They are probably groups of bast fibres from a plant stem. Since bast fibres from other species (eg nettle) can have a similar fibre diameter to flax, it is not possible on this evidence to give a firm specific identification (Ryder and Gabra-Sanders 1987).

248/41 This appeared like the above specimen in apparently having brown hairs with longitudinal striations suggesting the cortical cells.

Fig 92 An equid ankle joint (1960:127) from the Early Iron Age at Wilsford Shaft in which the proximal metatarsal is fused to the other ankle bones, a condition known as spavin, indicating old age and probable use of the animal for weight bearing or draught

There was also mycelia-like plant material. There was, however, nothing such as surface cuticular cells to confirm the identification as hair and this was identified as plant, despite the greater diameters of the 'ultimates' (Table 17). Such variation in plant fibres is brought about by the extent to which the 'ultimates' (cells) remain attached to one another or become separated. Separation of the ultimate fibres in flax is brought about by the retting process, and the lack of separation in this instance indicated by the greater fibre diameters is further evidence against textile activity.

202/29 This is fine sheep's wool typified by the fibre crimp (waviness). It has the discoloration typical of archaeological specimens, but apparently no natural pigmentation. White wool has been found as early as the Bronze Age and wool as fine as this has been found from that period (Ryder 1983a; *see* discussion).

291/211 The bulk of this sample consisted of sheep's wool, but of semi-fine quality comparable with that of the modern shortwool or British Down fleece type. It was white to the naked eye, and the complete lack of natural pigmentation or discoloration when viewed under the microscope casts doubt on it being as old as the Bronze Age. Only the mass of white fibres was measured (Table 17). The sample also contained some brown or discoloured fibres and some wool dyed blue, as well as white flax and also white cotton, which virtually confirm the mass (or much of it) as a recent intrusion. Finally, there was a single fur fibre of a type found in animals such as the mouse. Single fibres of a different type often occur in modern wool as contaminants and go unremarked (*see* discussion).

291/29 The straightness of these hairs coupled with the clear granules of natural pigment within them leads to their identification as cattle. This identification is supported by the hair diameter measurements (Table 17). The relative fineness of the fibres and concentration of the pigment on one side of the hairs are features found in Bronze Age cattle, but the hairs are too well preserved to be of such great age (Ryder 1984). This hair also contained some blue wool fibres, which supports the conclusion that the entire mass is a later intrusion (*see* discussion).

Discussion

Wool remains are usually received in the form of cloth, and cattle hair in the form of coat staples (locks). Identifications are therefore usually made not on single fibres or hairs, but on assemblages in either wool yarns or tufts of hair. This method gives the fleece or coat type, which cannot be obtained from individual wool fibres or hairs.

Had specimen 202/29 formed the yarn of a textile, it could have been ascribed to the Bronze Age. As already indicated, white wool of this fineness has been found in cloth on Bronze Age sites and been assumed to have been combed, completely lacking hair, from a hairy medium fleece (Ryder 1983b). If it is truly of Bronze Age date, then it must represent wool at the stage between harvesting from the fleece and spinning.

Specimens 291/29 and 291/211 are almost certainly later intrusions not of Bronze Age date. They could aptly be described as 'bits of fluff' and could well have become added during the excavating or sieving process. Such an efficient method of retrieval clearly calls for measures to avoid contamination with extraneous material from the clothing of the operators and other sources akin to those used in microbiology. In addition, or as an alternative, it might be useful to carry out a control sieve to discover what extraneous material might be expected.

Possible skin

There were 28 samples of possible mammalian skin (described as leather), about half of which were in preserving solution and half in a dry condition. Unlike in the case of the fibres, it was advantageous that the material was wet. A previous preliminary investigation in 1962 of similar material by Dr K Kershaw of Imperial College had come to the conclusion that it was leather. Another sample submitted in 1963 was reported on by Miss B M Haines of the British Leather Manufacturers Research Association and proved to be fungal (report in microfiche).

Methods

Four of the wet and four of the dry 'skin' samples were sectioned histologically by the method in

Table 17 Fibre diameter measurements

Sample identity	*Range*	*Fibre diameter in microns*[1] *Mean ±*	*Standard deviation*	*Mode*[2]	*Pearson coeff skewness*	*Diameter distribution*	*Medullated (hairy) fibres*	*Naturally coloured fibres*	*Fleece type*
248/22	5–21	11.4	±4.1	11	0.528	symmetrical	–	–	flax
Modern flax	4–21	11.8	±3.8	10	0.225	symmetrical	–	–	flax
248/41	42–81	59.2	±17.5	–	−2.667	continuous	–	–	plant 'fibres'
202/29	9–23, 27, 31	17.6	±3.5	17	0.022	symmetrical	0	0	sheep's wool
291/211	8–37, 42	23.2	±8.1	19 & 21	0.454	symmetrical	3%	0	sheep's wool
291/29	17–49	32.4	±10.2	30	0.502	continuous	0	93%	cattle hair

NB 1: one micron = 0.001mm; 2: the mode = the most frequent diameter.

appendix I of Ryder and Stephenson 1968. The dry samples were first treated in the softening fluid of Ryder 1963. The sections obtained were stained by the Sacpic method, which was shown by Ryder 1963 to give different colours according to whether the skin was fresh, tanned, and/or degraded.

Identification

This provided the same difficulties of identification as experienced by others. To the naked eye the material appeared fawn and leaf-like. No specimens were black like Roman leather, and none showed any evidence of human working. The thickness was in keeping with the skin of an animal no larger than that of a sheep.

The numbers sampled were 202/51, 248/97, 291/18, and 501 wet with 296, 500, 504, 506 dry. There was no difference in the findings from the wet and dry samples.

The difficulty is that fungal mycelia are probably of similar size and appearance to the connective tissue fibres of skin. No known fungal material of this nature was available for comparison, and its staining reaction with 'Sacpic' is unknown.

All the material had a fibrous meshwork structure in which the fibres were finer, and the meshes more open, than usual in the skin of deer, goats, and sheep. The fibres stained either blue or green (the stain of fresh or oil-tanned skin such as chamois, which a previous investigation had used for comparison), or light maroon (the colour produced by degradation). No specimen had the dark maroon coloration of vegetable-tanned skin. Each sample had a 'border' of maroon debris that in previous investigations has been associated with degraded epidermis. Some of these maroon areas contained spore-like bodies, also staining maroon. It is noteworthy that not a single sample had any hair follicle remains. These are not always present in leather, but are usually found in fresh skin, which this seems more likely to be.

On balance it can be said that these samples could be skin (probably from a sheep), but unfortunately there is not a single conclusive feature. If it is skin, it has certainly not been worked and could derive from an animal which fell into the shaft. On the other hand, one would expect such skin to have the wool intact or at least wool follicle remains. Since this examination was unable to establish with certainty whether the material was leather or fungal, the same samples were submitted to D Pegler, who reports (pp 94–5) that he regards them all as fungal, except for some material in sample 506 which was definitely not fungal and did not appear to be plant but could not be positively identified.

Other animal hairs

by Philippa Tomlinson

Among the plant fibres examined by the writer were a number of animal hairs distinguished by the characteristic scales on their surfaces. 1962:225/19 had a tuft of very short hairs in a clump; the ends of the hairs were broken. Two hairs in 1962:291 had a ladder type medulla with uniserial and multiserial ladder types (Wildman 1954). The scales formed a double chevron pattern. These characteristics are typical of hare/rabbit hairs.

Possible herbivore dung

Parasitological studies

by Andrew K G Jones

Introduction

Three small vials containing compressed pellets of vegetable matter were submitted in order to determine if the material was ancient faeces. The pellets varied in size between roughly 5 and 12mm across by 1 to 3mm thick. They were irregular in shape, some being sub-circular, others rounded, while some were markedly angular. The material submitted was a small sample of similar pellets, which were recovered from several samples in the waterlogged base of the shaft. It is unlikely that such a volume of material could have accidentally become incorporated into the deposits.

Methods

However, air-borne contamination of the shaft fills was considered to be a problem. In order to counter this, samples of pellets were carefully washed in warm running water to remove the preservative and any fine objects adhering to their surface. One gram of washed pellets (approximately 10) from each of the samples 1962:248/7, 248/109, and 291/184 was placed in 14ml of dilute sodium pyrophosphate solution for disaggregation. This process was facilitated by teasing apart the compressed vegetable material and gently shaking the vessel containing the suspension. It should be noted, however, that despite much effort, disaggregation was never complete.

The samples were then poured through a freshly-flamed 250 micron aperture meshed sieve to remove coarse particles. Measured aliquots of the filtrate were placed on microscope slides with two drops of warmed glycerine jelly as a mountant. Samples were scanned at ×120 and all ova and cysts measured using an eyepiece graticule calibrated to a stage micrometer at ×400.

Results

The overall appearance of the material, when viewed using both low power dissecting and transmission microscopes, suggested that the pellets were indeed faecal in origin (*see* Tomlinson report, below). The bulk of the cellular material was triturated fragments of grass stem and leaf in a form consistent with having passed through a herbivore's gut. Secondary thickening annuli and fragments of spiral thickening of xylem vessels also showed that the material had partly decomposed. Moss leaves were also present.

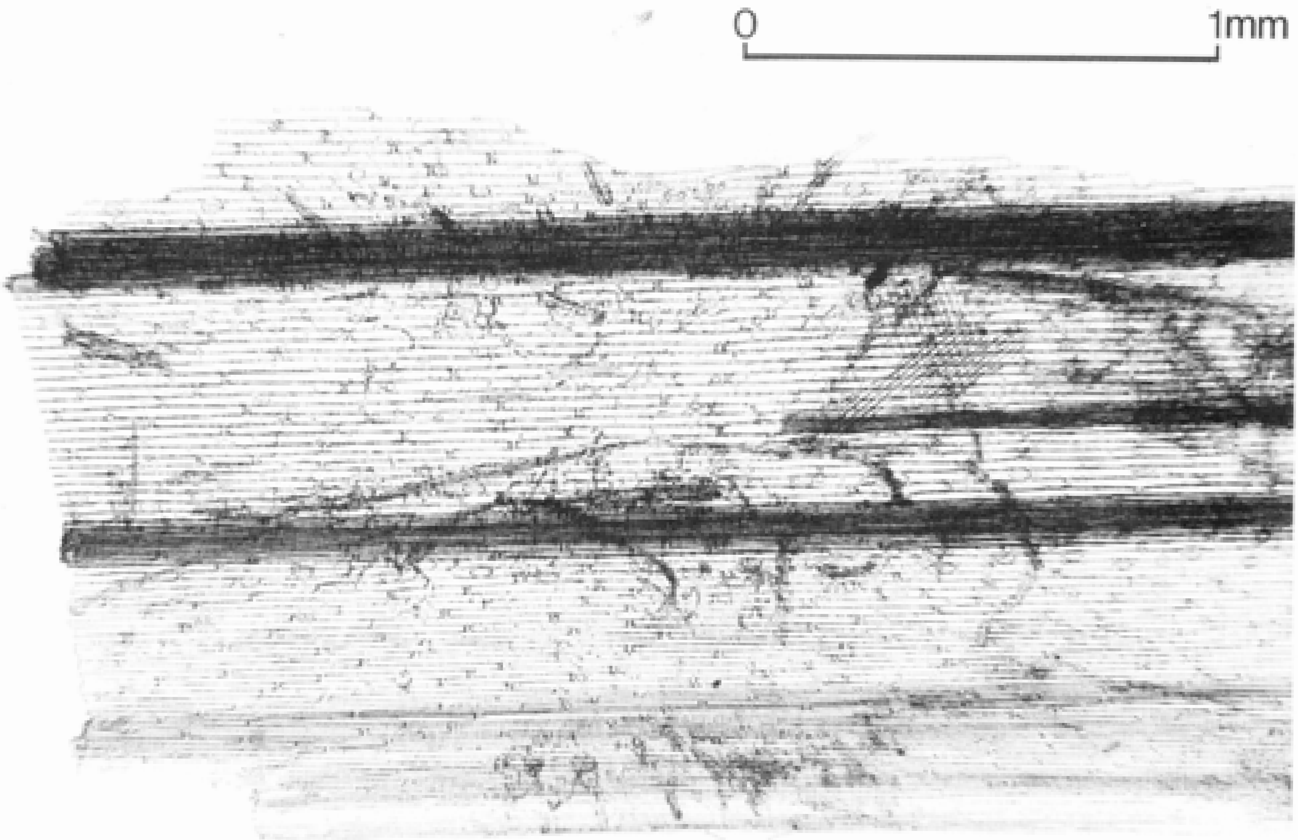


Fig 93 Fragment of Gramineae leaf, showing cut end (perhaps cut by the teeth of the herbivore) from the herbivore dung pellets; note the veins and pattern of long and short cells

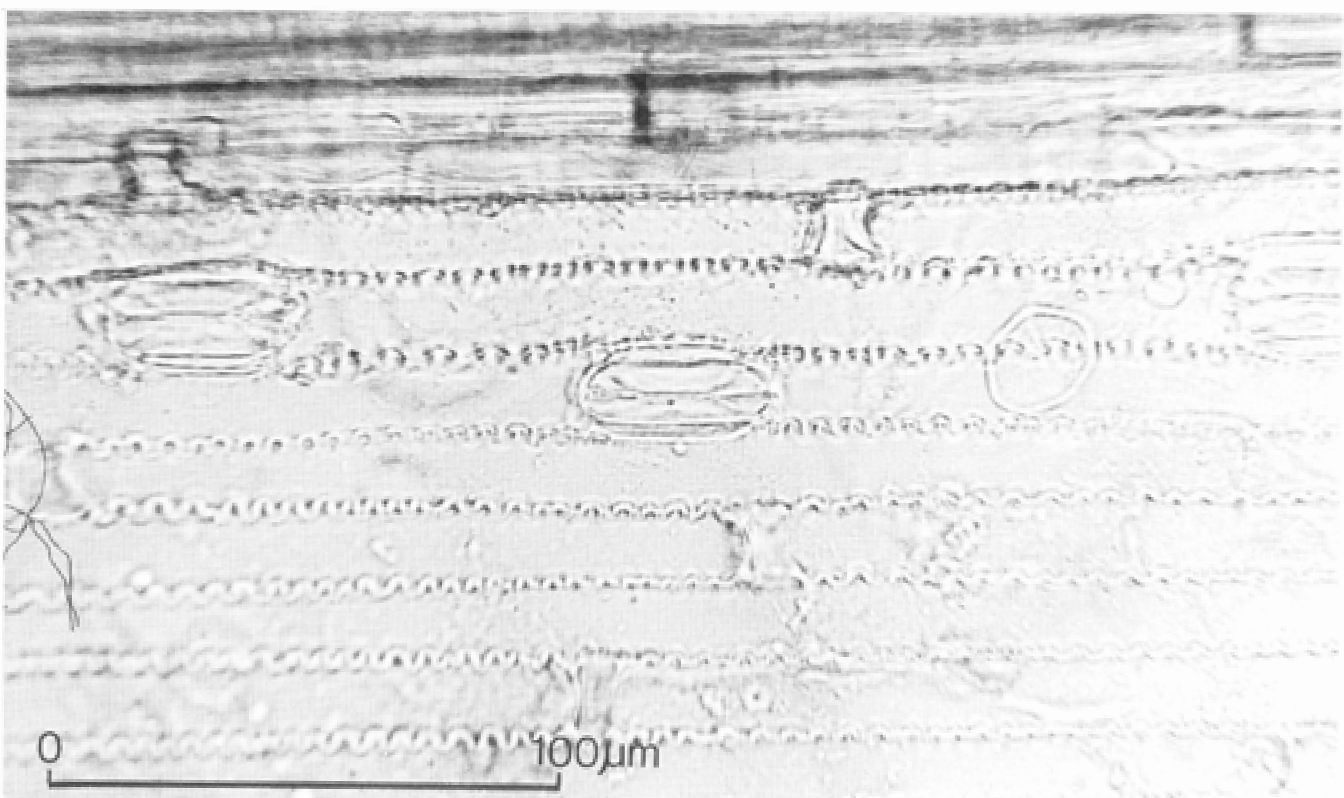


Fig 94 Gramineae epidermis from the herbivore dung pellets; note the thicker-walled, narrow cells over the vein at the top, and the typical Gramineae-type stomata; the silica bodies in the short cells are almost saddle-shaped

The filtrate contained large numbers of pollen grains, principally of grasses (Gramineae). Fungal spores were present in low concentrations in all samples; these were not further identified.

One sample contained structures which were identified as oocysts of coccidian parasites, probably *Eimeria* or *Isospora*. Coccidia are common protozoan parasites of the epithelial cells of some part of the intestine of many vertebrates. Oocysts may be interpreted as faecal indicators. The oocysts from sample 248/109 were roughly pear-shaped structures which could not be further identified, although they appeared to possess a terminal micropyle. They measured approximately 8×7.5 microns.

In addition, ovoid structures, which at first sight resembled the eggs of intestinal nematodes, were also present. These were relatively thick-walled and overall measured roughly 62×25 microns and lacked any distinctive features; several were enclosed in an outer envelope measuring 65×29 microns. These structures were shown to Professor D L Lee of the Department of Agricultural Zoology at the University of Leeds, who was unable to identify them. He did, however, agree that both the form and composition of the original pellets were consistent with herbivore faeces.

While it is impossible to be certain which species produced the pellets, the species most likely to be responsible include sheep, goat, and hare.

Conclusion

Two lines of evidence suggest that material from the Wilsford Shaft was faecal in origin. First, the samples were composed of triturated grass fragments which had begun to disintegrate. Second, low concentrations of coccidian oocysts (Protozoa) were found in one sample. No helminth eggs were identified. The material is almost certainly herbivore dung.

Plant macrofossil analysis

by Philippa Tomlinson

Material was examined from the three samples studied by Andrew Jones. These were found to contain many small fragments of grass leaves (Figs 93 and 94). The larger of these fragments ranged in size from 5–8mm long by 1–2mm wide. They nearly all had torn, straight ends which are typical of grass leaves that have been chewed by a herbivore. The epidermal features were all characteristic of grass leaves. There were many grass pollen grains. These were all less than 30μm in width, which suggests that they are not cereal grains. There were a few fragments of moss. One of the smaller mosses was a whole plant which still had its rhizoids attached. There were a number of grass flowers, some still containing pollen, but not seeds. There were a few *Stellaria media* (L.) Vill. seeds. The mosses included *Thamnobryum alopecurum* (Hedw.) Nieuwl., *Eurhynchium* Br. Eur. sp., and *Neckera complanata* (Hedw.) Hüben; nomenclature follows A Smith (1978). These species were also present among the mosses identified by Wallace (*see* pp 95–6).

Human bones

by Janet Henderson

A small quantity of human bone, which had been extracted from the animal bone, was examined. This consisted of disarticulated material found in the deposits at the top of the shaft during Edwina Proudfoot's 1960 excavation. The lowest bones are two adult left femurs at 8ft 6in (2.6m). The only human material associated with the bottom of the shaft was a deciduous juvenile incisor from 1962:248, 98ft 6in (29.6m). A catalogue of all the human bones is given in microfiche. Observations were hampered by the nature of the material (single bone finds), but an attempt was made to assess the number of individuals present, their age and sex and, where possible, to retrieve information with respect to skeletal anomalies and abnormalities. It was noted that none of the bone showed evidence for burning.

It was possible to suggest that a minimum of five individuals were represented in this material (two infants, one juvenile, and two adults). This analysis was based solely on similarities between samples (mainly of bone, but location was also examined); there was no conclusive evidence (matching bones etc) which might have provided proof in any case. Not all samples could be included in these individuals, therefore it must be noted that the figure of five individuals is very much a minimum. Additionally, it was noted that the only positive match was made by the skull fragments from 74 and 77: this however contributed nothing to the results. The breakdown of individuals is given in Table 18.

Both adults were tentatively identified as male. It was also noted that, of the fragments of adult bone which could not be assigned as individuals, any sex indicators that were present suggested male rather than female. Attribution of sex was not attempted for the infants or juvenile owing to the inaccuracies of the methods currently available.

Apart from number of individuals, age, and sex, only one other observation could be made. One pelvic fragment showed evidence for sub-periosteal

Table 18 Human bones, breakdown of individuals by sample numbers and location

Individual	*Sample 1960:*	*Location by sample N*	*S*	*D*
Infant (birth ±)	62	–	–	–
	67	7ft 7in	8ft 2in	1ft 4.5in
	83	7ft 6in	8ft 2in	1ft 5in
	88	6ft 10in	8ft 8in	1ft 10in
	89	7ft 6in	7ft 11in	1ft 10in
	100	7ft 5in	8ft 3in	1ft 6.5in
	100	7ft 2in	7ft 5in	1ft 5in
	100	7ft 8.5in	8ft 6in	10.5in
Infant (3–6 months)	73	7ft 9.5in	8ft 9.5in	1ft 6in
	121	–	–	2–2ft 6in
Juvenile (5–10 years)	80	7ft 6in	8ft 2in	1ft 5in
	125	–	–	1ft 3in–3ft 6in
Adult	59	N–S baulk, all levels		
	127 (1)	N–S section, at 8ft 6in depth		
Adult	127 (2)	N–S section, at 8ft 6in depth		

new bone, which was considered most probably to be indicative of an infection. No further observations could be made on this sample.

Analysis of residue on a pottery sherd

by John Evans

Microscopic examination of the black residue on the inner surface of a body sherd found in 1962 at 96ft 6in (28.8m) showed it to have a vesicular appearance. This suggested that the deposit had been burned on to the pot during a thermal process (such as cooking). It was not an *ad hoc* deposit that had been produced by natural decomposition processes.

Initially the deposit was examined by infrared spectroscopy: the resulting spectra suggested the presence of a complex organic mixture. The sample was then subjected to soxhlet extraction using a series of solvents of different polarities, namely hexane, chloroform, 2-propanol, and water. Each extraction took three hours. The resultant extracts were then concentrated and examined by various chromatographic techniques, including thin-layer, gas-liquid, and high performance liquid chromatographies. The data obtained indicated the presence of a very complex system. Unfortunately the levels of most of the substances present were too low to enable identification. However, the presence of beeswax was confirmed. Additionally there was a fat/oil system present that was almost certainly vegetable in origin as no cholesterol was detected. An aromatic system was also detected, possibly a flavone, but it was not possible to identify it with certainty. No palmitoleic acid was detected, so fish and fish-related products could be ruled out. No sugars or starch were detected.

Conclusion

Such results make it difficult to draw a conclusion. It seems certain, however, that the system involved beeswax and a vegetable oil. The suspected flavones suggest plant colouring matter, but whether the system was a 'wine' of some sort or a deliberate extraction like a scent, it is not possible to say.

7 General considerations

Introduction

The conclusions to the Wilsford Shaft report as a whole are put forward here on two fronts: Martin Bell deals with the environmental evidence and Paul Ashbee is concerned with the archaeological evidence and comparisons with other shafts; the evidence of the weathering cone was discussed by Edwina Proudfoot in Chapter 2. We have come unashamedly to very different conclusions about the critical question of the shaft's function. This reflects the different types of data under consideration and to some extent the differing schools of archaeological thought to which we both adhere.

Martin Bell was trained as an environmental archaeologist; he deals particularly with biological evidence, settlement patterns, and palaeoeconomy and is naturally inclined towards a functional interpretation. Paul Ashbee has long been involved in the study of ceremonial archaeology (Ashbee 1970; 1960) and has developed his ideas into a social archaeological narrative of British prehistory (Ashbee 1978b); he is particularly concerned therefore with disentangling the non-material component of prehistoric monuments such as Wilsford. These two points of view are, of course, a microcosm of wider, perfectly valid, and important debates within archaeology as a whole. For this reason, we have resisted the temptation to put forward specious compromise conclusions as regards function with which neither of us would probably have been entirely happy. Instead, we have chosen to adopt something more like the structure of a debate, attempting to put forward our respective points of view in a sharply-focused way. We hope that this will enable the reader to evaluate the various arguments. We hope also that it has the advantage of highlighting the various problems which must be confronted by future research.

Environmental conclusions

by Martin Bell

At the time of the excavation Wilsford Shaft was described as a test tube of history. Now, 25 years later, it has lived up to its initial promise and provided us with the fullest picture we have of the natural history of any piece of Bronze Age countryside in Britain. It is virtually unprecedented to find such a wide range of palaeoenvironmental evidence on a single site and in a single context. On many peat sites, such as the Somerset Levels where pollen, macrofossils, and insects are preserved, molluscs and animal bones seldom survive. On the chalkland, where nearly all of our evidence is in the form of Mollusca, animal bones, and soils, we have very little data on pollen, non-charred macrofossils, and insects. Here at Wilsford all these aspects are represented and are accompanied by many other environmental indicators.

The different types of evidence are inherently likely to have been derived from catchments of differing sizes and to have reached the shaft in a variety of ways. Put most simply, the pollen is likely to provide a more regional picture; some of the seeds and insects which could be wind transported might have derived from a fairly large tract around the shaft – in the case of insects these constitute the background fauna described by Kenward (1975). Other biota, such as perhaps the dung beetles, molluscs, and mosses, are likely to relate to much more localised conditions round the top of the shaft. A number of the other animals, particularly some lambs and most of the small vertebrates, seem literally to have fallen in. The wooden and other artefacts (eg ropes, pins, and beads) are virtually certain to have been introduced by human agency whether deliberately or accidentally, and with them may have come other biota which it is less easy for us to identify as artefactual; eg the wooden buckets might have been caulked with moss or other material like prehistoric boats (Wright and Churchill 1965). We also have the wider problem of establishing to what extent man played a direct part in the formation of the basal organic deposits as a whole. Other complicating factors can also be identified: we know that *some* of the pollen, moss, and seeds reached the shaft in herbivore dung (pp 124–6), but we have no idea what proportion of the biota arrived in this way. In confronting these questions we are most fortunate in having such a range of types of evidence, which can be combined and contrasted in order to achieve an integrated picture of the environment from which they derived.

Indicators of woody species and shade

Virtually all sources of evidence, particularly pollen, insects, seeds, molluscs, and mosses, agree with the view that we are dealing with a basically open landscape with very few trees. From this unequivocal evidence it seems virtually certain that the abundant wood was brought to the shaft by man. We know that some of it came in the form of buckets and other wooden artefacts. It also seems highly probable that there was some form of wooden structure or barrier at the top of the shaft. This would explain the absence of beetles which are confined to woodland itself, but the presence of beetles, particularly the abundant *Anobium punctatum*, which inhabit dead timber and are therefore abundant in wooden structures. The few buds might easily have come to the site on the quite abundant roundwood and twigs; the species represented by both categories of data are the same. This material might conceivably have been used in the making of a wattlework barrier. The leaves have sadly not been identified, but, assuming they were from woody species, it is perhaps most probable that they were introduced with twigs or blown from a distance. During the excavation it was observed that between seasons beech leaves blew in from the nearest source hundreds of yards away. Another possible explanation for the leaves, buds, and roundwood is that tree foliage was being brought to the site as supplementary feed for animals, perhaps in winter. The many short lengths of broken roundwood and comminuted twiggy material are certainly reminiscent of the recently-examined detritus from the stall-feeding of animals at the Swiss Neolithic lake village of Weier (D Robinson and Rasmussen forthcoming). There is, however, no positive evidence of leaves from woody species in the herbivore dung examined. The moss *Thamnium (Thamnobryum) alopecurum* is present in the dung; it is generally associated with damp, shaded habitats where it grows on the ground or on the roots of trees. This implies either that animals were grazing in more shaded habitats or that material was brought from such areas as animal feed. It is not easy to offer possible explanations for the occurrence of the fungus *Endogone* which is generally found in soil associated with beech trees. Beech was not present among the plant macrofossils but is represented in the pollen spectra. The presence of bank vole implies the existence of scrubby cover somewhere, but there is only the very slightest evidence of scrub invasion from the pollen, seeds, beetles, and molluscs, which suggests either that scrub habitats were some distance from the shaft or of a very localised nature.

Indicators of grazed grassland

That grazed grassland formed a major component of the landscape round the shaft is clear, particularly from the insect evidence, *c* 50% of which consists of species likely to be associated with dung; of the rest most are species of open meadowland. Confirmatory evidence comes from herbivore dung and the aborted and neo-natal lambs, which in Caroline Grigson's opinion indicate sheep-breeding near the mouth of the shaft. The presence of sheep certainly makes sense in the context of the short sward, less than *c* 4in (0.1m), suggested by both the seed and mollusc evidence. This does not of course rule out the possibility that other species were grazed in the area. As regards the composition of the grassland plagioclimax maintained by these animals, Mark Robinson's work on the seeds has shown that it most closely resembles the *Festuca ovina/rubra* or *Carex humilis* grassland communities found on the chalk today. Among the pollen, grasses are the most abundant taxa, and Professor Dimbleby draws attention to a number of other taxa which suggest the presence of grazed chalk grassland communities. To this picture we can add detail in the form of grassland puffballs, moss species, and even that most characteristic of birds of open downland, the skylark. Some of the grassland seems to have been disturbed and broken; this is indicated by the seed and mollusc evidence and is inherently likely in the context of the large numbers of animals which seem to have congregated round the top of the shaft. It is also evident that some rather longer grass existed somewhere in the area, as suggested by the toads, frogs, skylark, pigmy shrew, and field voles, for many of which the shaft undoubtedly served as a pitfall trap.

Indicators of arable activity

If the insect evidence comes down unequivocally in the form of a major pastoral component to the landscape, the seed evidence is equally unequivocal in indicating a significant proportion of arable land. This is not to say that the seeds and insects are presenting a contradictory picture, but rather telling us about different facets of the same landscape. The rich habitat provided for beetles by herbivore dung means that these species are likely to numerically swamp any component derived from much less favourable arable land, which will otherwise be better represented by the seed evidence. Species of disturbed ground form the largest group of species represented by the seeds and Mark Robinson presents cogent arguments which indicate that the majority of them are derived from arable habitats. Cereals are also relatively common among the pollen (3–4%), considering the limited extent to which their pollen is dispersed. Some indication of the crops grown comes from the small assemblage of charred seeds of barley, emmer wheat, and flax, and there is a hint of autumn sowing from charred *Galium aparine* seeds. It also appears that some of the arable land may have been abandoned. Many of the plant species of disturbed ground are found on arable which has recently been abandoned, ie for a period of less than 6–10 years. We seem to have, therefore, a fluctuating boundary between pastoral and arable land and clear evidence that both regimes were present close to the shaft. Thus, Mark Robinson's conclusion that the shaft lay at the conjunction of pastoral and arable land seems eminently reasonable.

Habitats within the shaft

Though of minor importance, this aspect adds a little more detail to the emerging picture. We know that swallows were nesting in the shaft. It also seems likely that the fern *Dryopteris* grew on the shaft walls, which, as E C Wallace speculated, would have provided a suitable damp habitat for one of his moss species (*Eurhynchium riparioides*).

Evidence for a settlement?

Paul Ashbee and Edwina Proudfoot report that no evidence was found for a settlement at the time of the original excavation. Nor has more recent survey of the Stonehenge area by the Royal Commission on the Historical Monuments of England and the Trust for Wessex Archaeology (J Richards, pers comm) produced any evidence of an associated settlement. The nearest Bronze Age settlement is at Longbarrow Cross Roads half a mile (0.9km) to the west (RCHME 1979, 22). The number of archaeological artefacts (excluding buckets) from the shaft is relatively small and of a restricted range. There is certainly some evidence of domestic activity: some of the bone was butchered, and there is a small quantity of pot sherds. However, the biological evidence is a good deal less varied, in terms of its ecological origins and the economic activities represented, than material found in waterlogged deposits on urban sites or in wells associated with major foci of human activity. For examples of well assemblages, *see* Skeldergate (Hall *et al* 1980); Farmoor (Lambrick and Robinson 1979, 110); Rudston (Stead 1980); and Catsgore (Ellis 1984). The absence of such variety at Wilsford is a crucial piece of evidence against the argument that material was deliberately dumped in the shaft by man. The low proportion of economic plants among the seeds and the paucity of crop processing waste, together with the modest size of the animal bone assemblage (excluding animals which fell in), all come together to suggest that the shaft was not in the immediate vicinity of a settlement.

Peter Osborne's beetle evidence, particularly the abundance of *Anobium punctatum*, argues for the presence of a wooden structure near the top of the shaft; this could have been a wooden barrier or winch house. Mark Robinson (pers comm) argues from the beetle evidence for the existence of a perhaps more substantial structure, noting that *Anobium punctatum* ('furniture beetle') and *Ptinus fur* (associated with stored food products) are almost as abundant here as from the Barton Court Villa Roman wells (Robinson 1986) and are far more abundant than would be expected on a site in an open landscape without buildings. He also notes that *Stegobium paniceum* is particularly associated with dry farinaceous material such as granary waste and stored animal food, this being the first record of a proper stored-product pest from a British prehistoric site. The implication is, therefore, that near the top of the shaft was a building, perhaps a barn containing stored food.

The shaft within the Stonehenge landscape

The shaft is less than 1 mile (1.6km) from Stonehenge and the largely molluscan evidence for the evolution of this landscape has recently been reviewed by John Evans (1984) in the context of his work at Stonehenge itself. We know that, like the rest of the chalk, the area was once wooded; molluscan faunas relating to this phase survived in pre-henge contexts at Durrington Walls (J Evans 1971) and Woodhenge (J Evans and Jones 1979). We have noted already that there was no sign of woodland in the vicinity of Wilsford Shaft and the area seems to have been cleared much earlier. At Durrington Walls the landscape was open by the Middle Neolithic, and there is possible evidence of cultivation followed by the development of short-turf grassland. Likewise, at Woodhenge, grassland was established before henge construction *c* 1800 bc, and that site supported grazed grassland throughout the period when the henge ditches were silting. This was not, however, the case at Stonehenge (J Evans 1984) and Coneybury (Bell and Shackleton 1982), where surprisingly there is clear evidence for scrub or woodland regeneration in the later Neolithic or Early Bronze Age secondary ditch fills. There is, as Whittle (1978) has pointed out, evidence for parallel regeneration at about this time in a variety of landscape types in the British Isles. All the evidence suggests that in the Stonehenge area this regeneration was comparatively short-lived. By the time the great barrow cemeteries were being constructed, the land on which they were built was dry open grassland as indicated by molluscan evidence from Boscombe Down (Newall 1931), Earl's Farm Down (Christie 1964; 1967), and Greenland Farm (Christie 1970). Though presumably somewhat later than the majority of the barrows, the Wilsford evidence gives us a particularly detailed picture of one spot within the Bronze Age landscape. By this date we are clearly looking at a man-made agricultural landscape with both pastoral and arable aspects. Much of the environmental evidence from the shaft indicates a pastoral landscape, but the seeds and pollen in particular show that arable land also lay nearby. Interestingly, this evidence comes from a part of the Stonehenge landscape where the Royal Commission survey (RCHME 1979) does not record 'Celtic' fields, the nearest traces being *c* 400yd (0.35km) to the south-west (Fig 95). This emphasises that the surviving record of prehistoric fields does not necessarily indicate their original extent. Even so, the Commission's survey shows the probably pastoral area of Stonehenge with its many barrows surrounded by a rough arc of 'Celtic' fields (which are admittedly undated). Some of the fields approach to within *c* 650yd (0.6km) of Stonehenge, but they begin on average *c* 1 mile (1.6km) distant. The shaft is this distance from Stonehenge, so the environmental evidence that it lay close to the boundary between arable and pastoral land seems perfectly sensible in the context of its surrounding prehistoric landscape.

Arable evidence around Stonehenge is reinforced by the presence of wind-blown silts, almost certainly the product of deflation from ploughed land, in the Y-holes at Stonehenge (Cornwall 1953), possibly in the Stonehenge ditch (J Evans 1984), and within the ditch fill of Netheravon Bake long barrow (R Entwistle, pers comm). As regards the subsequent history of the landscape, we know that conditions were similarly open until Wilsford Shaft had sedimented to within 19ft (5.7m) of the top. Thereafter our only evidence comes from Mollusca in ditch silts at Stonehenge, Woodhenge, and Coneybury. At all of these sites, open grassland seems to have been maintained until recently, with the exception of an undated arable episode at Coneybury and other arable activity inferred from deep colluvial deposits at Durrington Walls (Wainwright and Longworth 1971).

Climate and palaeohydrology

In dealing with a man-made agricultural landscape, it is of course most difficult to isolate environmental changes and occurrences of biota which relate to climatic as opposed to anthropogenic factors. However, Peter Osborne argues for a slightly warmer Middle Bronze Age climate on the basis of insect species which are absent or less abundant in southern England today. His argument is a convincing one because it is based particularly on dung beetles, the habitat for which has expanded rather than contracted as a result of subsequent human activity. Parallel evidence for a notably drier climate in the

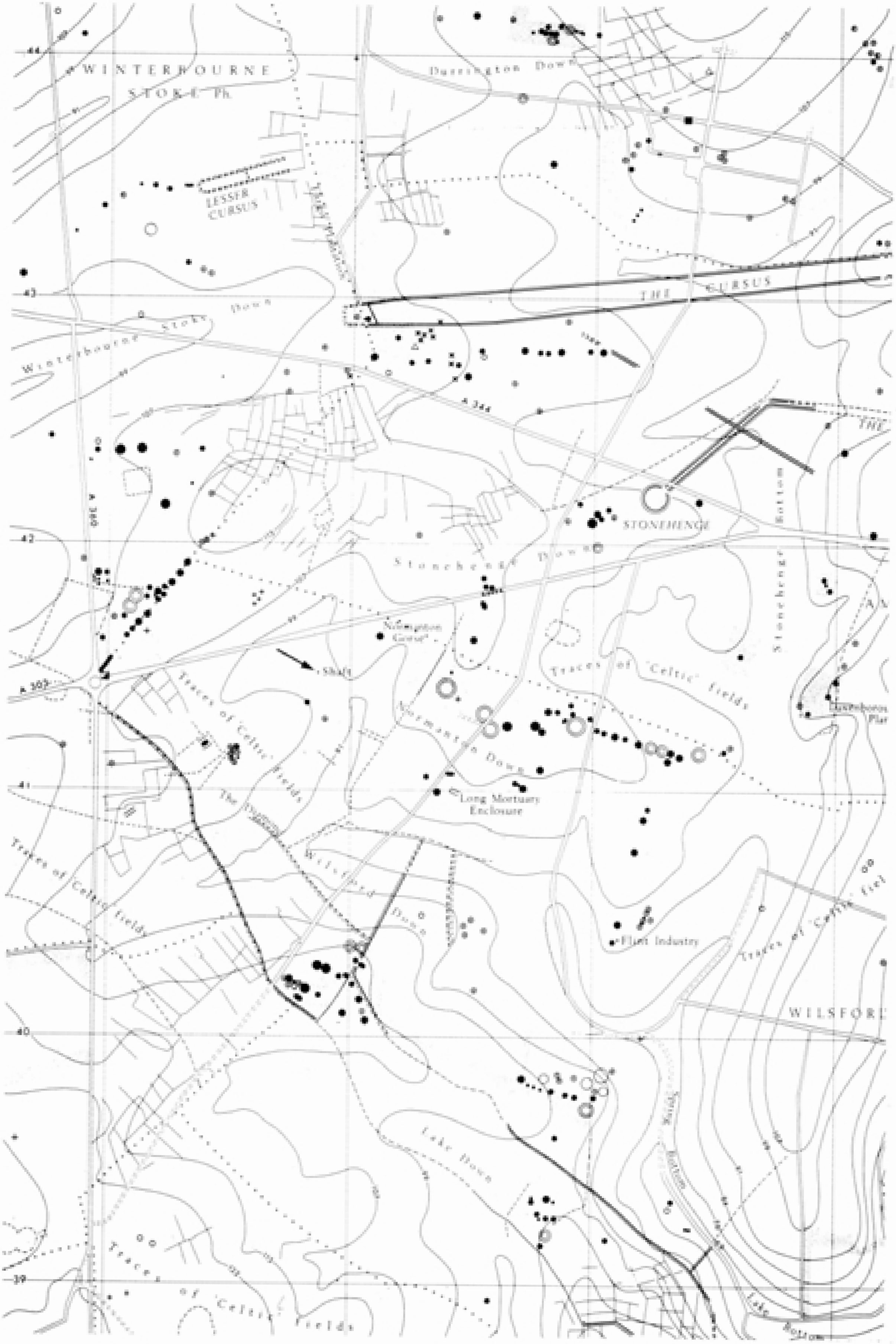


Fig 95 Map of the area south-west of Stonehenge, showing the location of Wilsford 33a (indicated as 'Shaft') on land bracketed between two ancient tillage systems (Royal Commission on the Historical Monuments of England)

area during the Neolithic and Bronze Age comes from the occurrence on five prehistoric sites (though not at Wilsford) of the xerophile mollusc *Truncatellina cylindrica* which is not found in Wiltshire today (J Evans 1972, 140). A drier climate is also suggested by the already mentioned Bronze Age aeolian sediments in an area where, even under the extensive arable agriculture of today, the deflation of arable land is not occurring. It could be argued that the higher loess content of prehistoric soils (Catt 1978) made them more susceptible than modern soils to deflation. Furthermore, evidence for drier conditions might relate to grazing pressure and agricultural intensity. Nonetheless, prehistoric cultivation methods are inherently less likely than those of today to have given rise to loss of both organic matter and structural stability. Surface drying is likely to have been less of a problem with a well-developed weed flora and scratch ploughing. Many chalk soils still contain high proportions of loess, yet, despite a growing awareness of the effects of fluvial erosion, particularly during major storm events on chalk soils (Burnham and Pitman 1987), there does not appear to be evidence of significant present aeolian erosion on chalk in Wessex or the south-east. Consequently, the aeolian silts deserve serious consideration as possible evidence of a somewhat drier Bronze Age climate in this area.

This brings us to the contemporary water-table, for which Wilsford Shaft provides one of the few pieces of hard evidence available from the chalkland. Elsewhere there are suggestions that seasonal streams once rose higher and more frequently than they do today (Bell 1981), and this is certainly suggested for the Hampshire chalkland by the Anglo-Saxon charter evidence (Pelham 1964, 102; Aldsworth 1974). At Wilsford conditions began to get damp in the shaft at *c* 70ft (21m) and, when emptied of infill, the shaft held *c* 8ft (2.4m) of water when not pumped, suggesting that the 1962 water-table was at *c* 215ft (65m) OD, since the top of the shaft was at 309ft (92.7m) OD and it was 101ft 6in (30.5m) deep. These figures compare very closely with an estimate made by G Bisson of the Geological Survey in 1961 before the base of the shaft had been reached. He calculated, on the basis of a recorded well half a mile (0.9km) to the west at Longbarrow Cross Roads where the water-table is at 165ft (50m) OD, that the water-table in the vicinity of the shaft would be at *c* 200–225ft (60–67.5m) OD. The other recent well records given in Appendix E also indicate a modern water-table between 200 and 259ft (60–77.7m) OD. It would presumably not have been possible in the Bronze Age to dig the shaft to any great depth below the water-table at any given time. In view of the fact that the basal organic deposits must have been waterlogged virtually continuously since deposition, it seems clear that the Middle Bronze Age and modern water-tables at this particular spot were virtually the same.

Function

Having assembled the environmental evidence and reviewed what it can tell us of the contemporary landscape, we must now bring this information to bear on the site's most controversial aspect – its function. The general archaeological view, put forward by Ashbee (1963), S Piggott (1973), and Ross (1968), and argued by Paul Ashbee in his archaeological conclusions to this report, is that the shaft had a ritual function. There are aspects of our evidence which might support this. Caroline Grigson has drawn attention to the over-representation of animal skulls and to the possible fleeces. The presence of human bone might be regarded as significant. However, with the exception of a single deciduous tooth at 98ft 6in (29.6m) which could have been lost during life, the human bone was all within the top 8ft 6in (2.6m) of the shaft. Furthermore, radiocarbon dating of two human femurs at this level gave results of 2320±80 BP (OxA-1211) and 2360±60 BP (OxA-1212), showing that they were *c* 800 years later than material at the base of the shaft, most of which dated to *c* 3150 uncalibrated years BP (Chapter 5). The human skeletal material is therefore unlikely to have any functional relationship to what was going on at the bottom of the shaft. We could perhaps point to a few minor, unexplained, out-of-place biota among the assemblage and seek to explain these in ritual terms. The fact is, however, that Wilsford presents a much more uniform and consistent picture than is usual for deposits that are in any way comparable. In fact, there is very little here which is not logically explicable in terms of material accumulating from closely-adjacent ecosystems. There is *no* evidence from the biological material of a placed ritual deposit.

A critical question is whether the shaft was ever finished. Paul Ashbee, in his archaeological conclusions, argues that the rather curiously shaped and irregular bottom, compared with its well-finished walls, indicates that it was unfinished. The original excavators, he suggests, may have been forced to abandon work when water flooded in from a fissure. Alternatively, the present writer would argue that, if the primary objective of its excavators had been to reach water, the shaft may well have been finished. The rough, irregular base could therefore be explained as the result of attempts to deepen the shaft as much as possible below the waterline in order to ensure a consistent and adequate depth of water at the base.

An alternative to the ritual hypothesis was first put forward by Peter Osborne (1969) in his seminal paper on the insect evidence, where he argued that the shaft was a well. Now that the complete range of biological evidence has been examined, nothing has been found which contradicts in any major way Osborne's interpretation. Indeed, the overall environmental picture seems strongly to support his hypothesis. Large numbers of grazing animals were present in the area, leading to disturbed and trampled ground round the shaft; at its top was a hypothesised wooden structure, perhaps a barn; and at the bottom the most abundant artefacts were wooden buckets and also fragments of rope. The absence of clear evidence of a settlement suggests that the shaft's primary function may have been to water stock.

Clear-cut as the picture may seem to be from the biological evidence alone, there is, as our two contrasting sets of conclusions to this report clearly demonstrate, still room for other interpretations. Paul Ashbee emphasises that, as far as we know, Bronze Age communities had no way of predicting that they would hit water. The same argument might, however, be applied to Romano-British and later communities, which certainly did sink wells presumably without any certainty of reaching water. Early agricultural communities might have been able to make certain predictions on the basis of areas of the landscape where springs and seasonal streams broke out during periods of exceptionally high water-table.

A critical element in support of Paul Ashbee's interpretation is that we have no certain wells which are in any way comparable in terms of their engineering achievement at such an early date. The earliest, well-dated, deep examples seem to be Romano-British. Bronze Age examples are either shallow or of rather uncertain date. Pryor (1980, 176) has identified shallow wells of second millennium date at Fengate, and Bradley (1978, 50) has drawn attention to some other possible prehistoric examples. One site which does deserve serious consideration as a possible parallel is the Belle Tout shaft revealed by a cliff fall on the Sussex coast in the early 1970s (Bradley 1974). It was dug from within a Beaker settlement subsequently enclosed within a hillfort. The shaft at Belle Tout was originally considered to be Iron Age or later in date, but it may be significant that recent work (Drewett 1982) has shown that it contained a sherd of Middle Bronze Age pottery in its fill. Certainly the biological potential of this site, if anything survives on the foreshore after 16 years of erosion by the sea, demands urgent attention.

We may also question why Middle Bronze Age communities should have gone to such tremendous efforts to sink the shaft at this particular spot. Paul Ashbee sees this as explicable within the general context of the Stonehenge ritual landscape. If, on the other hand, the aim was to water stock, why were the animals not taken down to the river valley 2 miles (3.2km) away? Osborne (1969, 564) has suggested that if dairying was being practised (and this could presumably have involved goats and sheep as well as cattle), then such a journey might have been deleterious to the milk supply. Michael Ryder (pers comm), however, suggests that this would not necessarily have been the case.

Some light may, however, be thrown on this problem if we examine what was happening in the contemporary natural and cultural landscape. We know that the natural landscape was open and perhaps rather drier than it is today. Man's attempts to practise pastoral and arable activity on the site under these conditions provides one possible scenario for the making of the shaft. This becomes more explicable still in the context of contemporary cultural developments. The Middle Bronze Age is marked by considerable evidence for the emergence of an organised agricultural landscape. On Dartmoor vast tracts were divided up by reave systems apparently laid out over a fairly short period of time *c* 1300 BC (Fleming 1983). On the chalk it is during the Middle Bronze Age that we find the earliest clear evidence for considerable tracts of regular field systems (Bradley 1978; 1984), which in a number of cases can be related to specific agricultural settlements sometimes with associated cemeteries and, particularly significantly, ponds. Recent survey in the Stonehenge area (J Richards, pers comm) has shown that field systems with associated settlements appear during the Middle Bronze Age. In view of the manifest difficulties of watering stock on the chalk downland and a possibly rather drier climate, the area should perhaps be regarded as somewhat marginal from the agricultural point of view. Perhaps we should see Wilsford Shaft as a result of the expansion of more intensive arable and pastoral land-use into a facet of the landscape, the exploitation of which had hitherto been limited by water availability. The question is whether that expansion was part of the widespread Middle Bronze Age trend noted above, or whether it was related in some more specific, though perhaps not purely ritualistic, way to Stonehenge itself. The considerable labour expended in sinking a well at this particular spot could relate to the need to water large numbers of stock, present because of the central role which the area played in the cultural and ceremonial landscape of Bronze Age Wessex. The investment of labour together with the unusual width of the shaft and its well-dressed walls, to which Paul Ashbee draws particular attention, might even be seen as a symbolic statement by a particular community regarding their right and capacity to utilise what the environmental evidence clearly shows was an agricultural landscape within 1 mile (1.6km) of Stonehenge.

Archaeological conclusions

by Paul Ashbee

Pond barrow and shaft

Such allusions as have been made to the monument, since the publication of the interim notes (Ashbee 1963; 1966a), have focused upon the shaft, displaying little or no regard for the pond barrow. This is despite the recorded details of its appearance and aerial photographs (Fig 4) prior to ploughing (Grinsell 1957, 225). Yet, as was stressed at the outset, the shaft was exposed when the systematics employed in the pond barrow's excavation led to the emptying of the weathering cone. It is inescapable, therefore, that the 'pond barrow' was the top of a weathered, silted-up shaft and that its encircling bank had, in the first instance, been built with the chalk rubble removed from its depths.

The shaft was about 100ft (30m) in depth from the ancient surface and nearly 6ft (1.8m) in diameter. Some 2826cu ft (79.6cu m) of solid chalk had been hewn out by the Bronze Age artisans, which means that around 4945cu ft (139.4cu m) of rubble had to be brought to the surface (Jewell 1963, 28). This could have produced an encircling bank about 8ft (2.4m) in breadth and almost 4ft (1.2m) high. Within the shaft there were neither traces of recessing for timbers nor footholds. Thus ingress and egress must have involved the use of serial ladders, either of timber or rope, which left no trace. Spoil removal would have required some form of winching or hauling gear. Any traces of posts or beams at surface level, such as were found bracketing the well-head beneath the Romano-British earthwork at Winterslow (Vatcher 1963, 203), would have been destroyed by the weathering back of the shaft's lip and the formation of the great inverted conical shaft-top weathering cavity.

At most, only two men could have worked in the shaft, one wielding an antler pick and one loading chalk rubble into baskets and regulating their passage to the surface. The weight of 1cu ft (0.03cu m) of solid moist chalk is about 1cwt (50.8kg) (Jewell 1963, 50). Thus with an extraction rate, which would have perforce diminished with depth, of about 1.5cwt (76.2kg) per hour, a total of the order of 3300 man-hours, that is some 420 eight-hour man-working days, might have been involved in no more than shaft-sinking. Winching, tipping, and presumably simultaneous bank-building have to be added. There was also plumbing, profiling, and axe-dressing. It is therefore difficult to envisage the entire undertaking as having involved less than a year's intense, organised labour on the part of a team of ten men.

It is inescapable that pond barrow and shaft are integral parts of an inseparable whole. At the outset there was a bank-encircled shaft; weathering and denudation reduced the bank and infilled the shaft. It is therefore possible that other pond barrows in the vicinity of Stonehenge (Figs 1 and 6) and, for that matter, elsewhere in Wessex, some of considerable size, are also the tops of bank-encircled, silted-up shafts. Careful measurement of bank volumes and comparison with pond capacity could perhaps provide indications, which practical geophysical methodology might test.

Shafts in Britain and beyond

Pits and shafts, as distinct from pond barrow shafts, were noticed from time to time during the nineteenth century (T Wright 1854, 176–8; Neville 1855; Brent 1859; Baudry and Ballereau 1873; Hussey 1874). In England, the belief that some of these had been dug for non-material, ritual ends, rather than as storage pits or wells, stems from the examination of a Kentish example undertaken by J P T Burchell in 1946 (Ogilvie 1982). The excavation of the Holzhausen *Viereckschanze*, a quadrilateral earthwork enclosure of late La Tène date in southern Germany, encountered three shafts (Schwarz 1960; 1962; 1975). A study of these in their European setting, which cited a considerable amount of early work, showed the existence of discrete groups in Germany and France (Schwarz 1962, Bei 5, 4).

The excavation at Wilsford was concurrent with excavation of the Holzhausen shafts and, although not known at the time, similar methods were employed (Schwarz 1962, Abb 9–16). The excavations led to the recollection of Hampshire's Swanwick shaft, examined in 1927–8, which, like the smaller Holzhausen shaft (Schwarz 1975, 340, Abb 14, 1), had a vertical timber set in its bottom, around which there were traces of organic compounds, and later Bronze Age loomweights in its infill (C Fox 1928; 1930; S Piggott 1963). Comprehensive regional studies (Ross 1967; 1968; Wait 1985, 51–82, 320–40) have shown the predominantly later Iron Age and Romano-British affinities of the shafts encountered mostly in south-eastern England (Ross 1968, fig 67). When the nature of the Wilsford Shaft became apparent, the earliest directly comparable equivalents were those within Maumbury Rings in Dorset (Ashbee 1963, 120; 1966a, 228), which have since been re-examined and republished in greater detail (Bradley 1975). Within the bank of the apparent henge monument, the ditch had been a series of pits up to 35ft (10.5m) in depth below the original surface. The reconsideration conceded the possibility that they might have been associated with non-material considerations (Bradley 1975, 37–8).

It has not always been possible to reconcile the contents of the majority of these shafts with material considerations. This has led to the belief that they had a ritual function. Oblique support for this has been extrapolated from the iconography, myths, and literature of the Celtic world (Kimmig 1965; Powell 1971, 202–3; S Piggott 1975). In practice, it is often difficult to separate shafts, and their supposed qualities, from springs and wells, which had similar attributes besides also attracting votive offerings (Heierli 1907; Shetelig *et al* 1937, 155; Ross 1967, 20–33; Wait 1985, 54). Shafts and pits were not unknown in the ancient Mediterranean world. On three days of the year the cover of the *mundus*, or round pit, in Italian cities and on the Palatine was removed and the gate of the underworld opened. There dwelt the hostile spirits of the dead (*Manes*), known euphemistically as the 'kindly ones', and when the cover stones were removed, they were supposed to emerge. Pausanias describes how at Titane, a town in Sicyonia, a priest performed secret rites in four pits to soothe the fury of the winds, while Philostratus said how the cthonic gods welcomed ceremonies performed in the hollow earth (Harrison 1903, 47, 68, 125). In Homer's *Odyssey*, the Latin *mundus* is a *bothros*, via which contact could be made with the underworld to whose denizens libations could be poured. Odysseus recounts (*Odyssey*, XI, 25–50, 97–9) how he went to the kingdom of Persephone to get advice from the dead Tiresias and was to vow an offering for his safe return upon the instructions of Circe, by digging a *bothros* and pouring a libation to all the dead. Then he took the sheep brought for the occasion and cut their throats over the pit. Thereupon the shades gathered around. However, Odysseus, sitting sword in hand, kept them at bay until Tiresias should come, drink of the blood, and thus become capable of speech. G M Young had the possible relevance of these passages in mind when he made his prescient observations regarding pond barrows (1934, 459). Clearly there are many things pertaining to pits and shafts which evade the strict application of archaeological inference, for it is near impossible to define the kind of evidence that should demonstrate ritual functions. Indeed, in terms of Christopher Hawkes' vivid definition (1951, 6), the situation 'stands indebted to historical material', much of it indirect and impervious as well as remote. Nonetheless, it is only by the correlation of such diverse sources that the penetration into the substrates of non-material activity is possible, for there are no other means.

Most of the European mainland's shafts, like the *Viereckschanzen* with which some are associated, belong to late Iron Age or Roman times (Schwarz 1960; 1962; 1975). However, while in Britain they are mostly of similar date, it is possible to point to a number of Neolithic and Bronze Age shafts. An apparently earlier Neolithic shaft was encountered on Cannon Hill, near Maidenhead in Berkshire (Bradley *et al* 1978), which was not dissimilar to the series explored on Eaton Heath, Norwich (Wainwright 1973). The chalk-cut shafts in Maumbury Ring (Bradley 1975) are later Neolithic, while there are East Anglian examples of Beaker affinity (Smedley and Jarvis 1957; Wacher 1958). If the pond barrows, like Wilsford 33a, all prove to signify shafts, they would complement that examined at Swanwick (C Fox 1928; 1930), which had later Bronze Age loomweights in it (S Piggott 1963), and like those of later times would show concerted employment as elsewhere (Schwarz 1962, Bei 5, 4).

Presumably particular people were intimately involved in the design and sinking of Neolithic and Bronze Age shafts as well as the siting, size, and modification of barrows. They could not be other than the precursors of the Druids, the latter thought of as figures of later prehistory whose chroniclers may have been regaled with accounts of usages long past (Ashbee and Ashbee 1981, 25; Ashbee 1986, 87). It may be significant therefore that, unlike those upon the European mainland (Schwarz 1975, 349), shafts in Britain have a considerable antiquity and continuity of use. As Kendrick observed (1927, 75), Druidism must have been long established in this country to the point where, as Caesar (*De Bello Gallico*, VI, 13) claimed, *disciplina in Britannia reperta*. The origins seem to have been in Britain, whence it was exported.

The shaft and the Stonehenge surround

When the pond barrow's (and shaft's) siting was indicated at the outset, this was not pursued except in relation to the barrow groups. It appears, however, primarily from the evidence provided by the water-preserved shaft-bottom deposits, that it was at no great distance from differing ecosystems, pastoral and arable. This is corroborated by the outcome of the close examination of the field monuments in a select area around Stonehenge undertaken by the Royal Commission on the Historical Monuments of England (1979).

It has emerged that the area immediately around Stonehenge, particularly to the north, east, and south, is likely to have been old pasture which was not ploughed in antiquity, but included ancient ('Celtic') field systems tilled in the vicinity, particularly to the west. It can be seen (Fig 95) that the Wilsford Shaft is, and may well have been when sunk, almost encompassed by such fields and their attendant boundary banks (RCHME 1979, xiii). Indeed, as Mark Robinson's evidence (Chapter 6) suggests, the cultivated area was at one juncture very close to the shaft-top.

The environmental evidence from the shaft, which supports the erstwhile existence of contrasting ecosystems, amplifies our conception of Stonehenge in later Bronze Age times. Wind-blown soil deposits have been found in one of the Y holes (Cornwall 1953, 138–40) and, with prevailing winds, the cultivated fields close by the shaft could have been its source. These empty Y and Z holes may, it has been contended, point to a timber-framed component of Stonehenge having been dismantled and removed (Ashbee 1978b, 150–54, 181). If pond barrows imply shafts, their sinking may not have been unconnected with this sombre event.

Condition and use

An excavation's outcome must be shown to integrate into, and perhaps extend, known prehistory, for this indicates the considerations which attended the work in the field (S Piggott 1963, 13). The shaft's immediately relevant counterparts were indicated in the interim reports (Ashbee 1963; 1966a), but, since then, there has been a dramatic extension of knowledge of shafts within the Western European scene. Shafts are an unexplored dimension, for Wilsford 33a is unique. It is earlier than the great number of other examples and, facilitated by the nature of the chalk, it has retained sophisticated qualities not apparent elsewhere.

Although other pond barrows in the vicinity have not as yet been explored with consideration of the possibility that they may denote shafts, the Wilsford 33a excavation has changed beyond all measure our concepts of their place among the many barrows sited around Stonehenge (Fig 6) and on the Dorset Downs (RCHME 1970, 429–30). Their totality shows that the motivations must have been compelling. They could have been an echo of the principles inherent in Maumbury Rings (Bradley 1975), when the grouped pond barrows on Lake Down (Wilsford (S) 76a, 77, 77a, 78, 85; Grinsell 1953, 170; 1957, 225) were concluded, or perhaps a wholesale and grandiose endeavour to invoke the essentialities beneath the barrow groups with which they are intimately associated. The resources needed for the concerted sinking of such shafts would have placed them high in any hierarchy of endeavour (C Renfrew 1973, 547).

During the excavation it was thought that a new form of inordinately deep grave had perhaps been encountered, for examples of some depth were not unknown (Grinsell 1941, 102). There was, however, no burial, and the narrow bottom stage, which had impinged upon a water-bearing fault, was thought to point to an unfinished shaft. The presence of wooden and other artefacts, animal bones, and a large amount of amorphous organic material inclined such provisional conclusions as were possible towards an extramundane, ritual explanation (Ashbee 1963). Since then, and at the expense of the pond barrow, a straightforward materialistic motive has sometimes been preferred (Osborne 1969, 564; Bradley 1978, 50), although the ritual interpretation has been widely accepted (S Piggott 1965, 232; Ross 1967, 25–6; 1968, 257; S Piggott 1973, 383; 1975, 89; 1978, 50; Coles and Harding 1979, 263; Megaw and Simpson 1979, 27; Burl 1981, 205–6).

Some allusions by classical writers may refer to English shafts, but this is far from certain. The elder Pliny (*Lib* XVII (8), 4) claims that in Britain chalk for manure was obtained from deep pits. As it was said that their bottoms *branched*, they have during the past century become almost inextricably confused with the deneholes: deep pits sunk, probably since the sixteenth century, for a similar purpose (Crawford 1933; Hogg 1941; Caiger 1954; 1960). Tacitus (*Germania*, XVI, 4) ambiguously refers to underground cavities for the concealment of commodities and other uses by people, while it has been claimed that Diodorus Siculus (V, 21), deriving from Pytheas, mentions underground repositories for corn storage. These last appear to have been 'underground buildings' rather than the storage pits of the Iron Age sites of the chalklands (Frere 1959). Tacitus and Diodorus are normally thought to have had agricultural practices in mind, as, indeed, the context of the passages suggests. However, as it appears that the details given by some Greek and Roman writers were based upon information then already ancient (Ashbee 1986, 87), the possibility that these difficult passages preserve a distant, garbled recollection of shafts cannot be entirely eliminated.

One different issue is whether the shaft was ever finished. Martin Bell has suggested that *if* the objective was to reach the water-table, then that was achieved. It is possible, however, that the shaft may not have been finished. This is primarily because of the character of the constricted cavity, honeycombed and scored with antler-pick marks, at the shaft's bottom, which impinged upon a fissure from which water flowed. Given much the same flow in antiquity, any further deepening would have been impossible. Indeed, it could be thought that the various pieces of buckets and rope remain from a vain attempt to clear the water, which was subsequently abandoned. The antler-picks and other tools were presumably salvaged. There is also the axe-dressing of various parts of the shaft's interior – it may have been the intention to dress the interior completely and obliterate the patent evidence of the various controlled stages by which it was sunk. Excluding such things as the shale ring, amber beads, and bone points, as well as the animal bones, there is the absence of a specific deposit. Indeed, much of the organic accumulation, from which the environmental information has been wrested, would appear to be incidental and from the closely-adjacent ecosystems.

An aspect of this shaft-bottom deposit was that it represents a waterlogged biological assemblage on the chalk, which normally carries dry sites, and a wide range of materials survived.

A straightforward, materialistic explanation that the shaft was simply a well has been put forward in the conclusions to the environmental reports. A well has been defined as a means for obtaining water from the earth vertically beneath the spot at which it is required, where it is not obviously present on the surface (Bromehead 1942, 142). This interpretation was first put forward, in terms of his own work upon the insect remains, by one of our contributors (Osborne 1969, 564). They show that cattle had at some time been close by the shaft-top, and Osborne argues that the cattle must have been watered, and so the shaft was a working well. Similarly, it has been seen to have contained 'ropes and a bucket' (Bradley 1978, 50) and thus, 'pending complete publication', there was no evidence that it was more than a well. In the light of the cited details, the claims cannot be entirely contradicted for the shaft encountered water, and pieces of wooden buckets, besides cordage, were found!

In chalk a well yields only when the groundwater in open cavities, such as fissures or bedding planes, is tapped. If sunk in the mass of the rock itself, without penetrating a fissure or other channel, it could be practically dry. Until recently, the sinking of a well was an incursion into the unknown and the unpredictable. The first well sited upon strictly scientific principles to reach water in agreement with anticipation appears to have been sunk in Derbyshire in 1795 (Bromehead 1942, 149). The Wilsford Shaft did encounter a water-bearing fissure, but, nonetheless, it could be contended that this was unpredictable, the intention having been, as is shown by the constricted cavity at the bottom, further descent into the solid chalk. Martin Bell has suggested that the constricted base may be the result of over-deepening below the water-level, and the buckets are seen as relating to the functioning of the well. Alternatively, it may be that the pieces of buckets remain from a vain attempt to contend with water that was flooding into an unfinished shaft. In functional terms the buckets were small and out of scale with the great shaft, the bottom of which was unsuitable, if the water level was low, for the drawing of water. A further factor, in the light of the pond barrow's excavation and the encounter with the shaft, is the inherent possibility of numbers of shafts adjacent to the major barrow groups in Wiltshire and Dorset. Admittedly, water is heavy and awkward to transport for any distance, but if it were claimed that these were also wells, a search for water upon an unbelievably wholesale and indiscriminate basis would have been undertaken during later Bronze Age times! This is not to deny the possibility of water-seeking wells in prehistoric Britain. Indeed, shallow wells or tites (Bromehead 1942, 142) have been encountered in a broadly Neolithic context at Fengate (Pryor 1980, 175), although the first unquestionable deep wells in the chalk are the Romano-British examples encountered by Pitt Rivers (1887, 27–8).

As far as can be seen, the pattern of north-western European deep-well sinking was brought about by Roman innovation or influence (Clark 1944, 8).

It has been shown that the shaft may have been unfinished because of the incursion of water, that the remains of wooden containers represent abandoned receptacles, and that much of the environmental material is such as would result from an accumulation from closely-adjacent ecosystems. This, it might be thought, could mitigate against its consideration as having been sunk for non-material, ie ritual ends. Nonetheless, there are aspects of the evidence, direct and indirect, which support such a notion and allow this shaft to take its place as a precursor to those of Iron Age and Roman times.

Substantially, the scale and character of the shaft, with the surrounding bank of the pond barrow which was an integral part of the formula, together with its sophisticated, partially-dressed interior, mitigates against mere utility. Nonetheless, there are problems of definition between wells and shafts, and formal characteristics alone would not necessarily separate one from the other (Wait 1985, 54–5). There is, however, the pond barrow component, and such barrows, as has been shown, are uniform in appearance and, for the most part, associated with particular barrow groups. These might be shafts, some of much greater size than the present example, and not all of them may have encountered water. Thus the possibility of their dedication to cthonic entities, intimately associated with barrows and groups of barrows, could be envisaged.

There is at the bottom of the Wilsford Shaft the absence of a formal deposit, as for example at Swanwick (C Fox 1928; 1930) or Holzhausen (Schwarz 1975, 340, Abb 14), unless the remains of wooden containers and possibly baskets were so designated when work was abandoned. As the ladders were seemingly withdrawn, for no traces of the means of ingress were found, it would have been possible for all to have been salvaged. In this context it is not easy to account for the shale ring, amber beads, and bone pins as other than votive deposits, for it is difficult to see how, even as articles of personal adornment, they could have been merely discarded or 'lost'. As personalia they would not be out of place in the spectrum of Wessex grave furniture from the area (Annable and Simpson 1964). Moreover, they are akin to the objects of moderate value regularly recovered from the later Iron Age and Romano-British shafts (Wait 1985, 80). It must also not be overlooked that the majority of the animal remains were concentrated within the bottom seven feet (2.1m) of the shaft and were intermingled, presumably by the agencies of water, with the wood. The greater parts of at least two young sheep or goats are represented, and some of the bones bear cut-marks from butchery. These could be from ceremonies at the shaft-top, and the incidence of similar remains throughout the infill could point to their recurrence during the silt-up period – about half a century. The traces of the presence of cattle close by the shaft-top could be from those brought there for such observances. Indeed, sheep were slaughtered when Odysseus summoned the shade of the dead Tiresias via a pit or shaft. The bones of cattle, sheep, horses, and dog are all of creatures that have clear affiliations with the Celtic Iron Age supernatural (Ross 1967, 297–353), and therefore their incidence in a forerunner need not occasion surprise. Cattle were, however, not always killed at the head of a shaft. In Brittany until recent times, cattle were driven many miles to be sprinkled with water from a sacred well (Johnson 1912, 482), which practice might have been a survival from earlier times; as has been stressed, it is not always possible to separate shafts and wells. Similarly, there is the Irish cult of holy wells (E Evans 1949, 163) which are for the most part tites or merely springs, all with specific qualities. Such ritual wells offer one possible way in which the contrasting environmental and archaeological considerations offered in this report might be reconciled.

Inevitably, such conclusions as are possible regarding the nature of the Wilsford 33a pond barrow and shaft are tentative in the extreme. It is likely to have been unfinished. It had seemingly fortuitously impinged upon a water-bearing fissure, and thus, for a time at least, it could have provided water. Its class, character, and contents suggest that it may have been dedicated to non-material ends. At the most, it is possible to say that, although earlier, it is not greatly at variance from either its few early counterparts or its later Iron Age and Romano-British successors.

Envoi

As Sir Thomas Browne (Gosse 1905, 119) said in his contemplation of *Urn-Burial* some three centuries ago: 'What song the Syrens sang, or what name Achilles assumed when he hid himself among women, though puzzling, are not beyond all conjecture.' The essential temper of this comment illustrates the elusive nature of the problems encountered, when it is likely that a particular archaeological monument is an expression of that most difficult of all dimensions: society's non-material considerations. However, when such situations are buttressed by literary sources and iconography, a modicum of flesh can be put upon the extremely bare bones. For example, in literature there is in Ireland's *Cath Maige Tuired* (The battle of Mag Tuired) the account of slain warriors revived through being cast into a well over which spells have been chanted (Sjoestedt 1949, 10; MacCana 1958, 54). It is balanced by the iconography of the renowned Gundestrup cauldron (Klindt-Jensen 1961). Kimmig (1965) has suggested that the famous 'sacrifice' scene (Klindt-Jensen 1961, 14, fig 10) shows a victim about to be thrust head-first into a shaft within an enclosure. Indeed, the foot-warriors carry an uprooted tree upon their spear-points, recalling the trees and branches found in France's Vendee shafts (Schwarz 1962, 64, Abb 31, 3c). However, the burdened, flagging foot-warriors are balanced by the seemingly-invigorated cavalrymen galloping away. Thus the possibility of a revivification ritual, rather than a sacrifice, cannot be entirely discounted.

At the present time, the Wilsford Shaft is unique in that it came to light as a result of the excavation of one of the *c* 25 pond barrows in the vicinity of Stonehenge. In the interim report (Ashbee 1963, 120) it was said that the possibility that other pond barrows in the locality, some of considerable size (Grinsell 1957, 225), are the tops of silted-up shafts must be seriously considered (Appendix B). It has been shown that their dish-like depressions may well have been the last stage of natural weathering and infill, and that the encircling banks may have been formed from the spoil removed when the shafts were sunk. Careful measurement of bank volumes, with appropriate appreciation of weathering and denudation and comparison with pond capacity, could give indications to be checked by a programme using geophysical methods. The critical investigation of further patent pond barrows, preferably one or more of those which yielded ambiguous or even negative results to the excavators of an earlier age (eg Wilsford (S) 76a, 77, 77a, 78a; Grinsell 1957, 225), is now an imperative.

Appendix A

Pond barrows in Wiltshire and Dorset

by Paul Ashbee

Pond barrows are associated with and integral to the lines and groups of barrows surrounding Stonehenge, in the vicinity of Avebury, and along the Dorset Downs. These assemblages were in a pioneer study considered as *linear*, *nuclear*, and *dispersed* (Ashbee 1960, 34). This classification has been refined, and a *group* is considered to consist of four or more barrows, while the terms *compact*, *linear*, and *scattered* have been introduced (RCHME 1970, 423). *Compact* and *linear* combinations can be subdivided, and *scattered* is a loose, dispersed number of barrows. This terminology was devised expressly for the 14 component groups of barrows which, with satellite musters, comprise the South Dorset Ridgeway barrow group, one of the most remarkable prehistoric relict landscapes in the British Isles.

Within the area around Stonehenge (Fig 6) pond barrows, including Wilsford 33a, are associated with three linear and three compact groups. The Lake Down Group, some two miles (3.2km) to the south of Stonehenge (RCHME 1979, map 2) has its pond barrows as the focal feature. To the east of the River Avon, pond barrows are in a linear, a compact, and a scattered formation, while one appears as attendant upon a triple-barrow. The two pond barrows in the vicinity of Avebury are both in linear associations. Two of Wiltshire's possible pond barrows are distant from Stonehenge and Avebury, but, nonetheless, one relates to a compact and the other to a scattered group. On the Dorset Downs, pond barrows are in four linear and two compact arrangements, while numbers of pond barrows are ingredients of particularly large barrow groups with multiple arrays. Five pond barrows are appreciably in excess of 100ft (30m) in diameter. One is near Avebury, the others ancillary to Dorset groups.

An outcome of the excavation of Wilsford 33a, a western outlier of the Normanton linear group, has been the demonstration of the inherent possibility that the pond barrows, as a class of monument, may denote silted-up, embanked shafts, their form being largely the result of natural processes. With this feasibility in mind, the pond barrows close by Stonehenge, in the vicinity of Avebury, and elsewhere in Wiltshire, besides those on the Dorset Downs, are listed below, beneath the barrow groups with which they are associated, together with indications of the diameters of their central concavities and their overall diameters. For Wiltshire and Dorset, the particulars are from L V Grinsell (1957, 225; 1959, 172–3), and for Dorset, from the Royal Commission on Historical Monument's volume (1970, 420–80). Their Dorset pond barrow numbers are concordanced with those initially developed by L V Grinsell. Further details, and the National Grid References, are to be found in the works cited. The ditched pond barrows (Grinsell 1957, 226) are not included, as they have the nature of ring-works, nor are uncertain pond barrows.

The Stonehenge pond barrows

The Lake Down group

The four, perhaps five, pond barrows are the focal monuments of this compact group. In order of size, they are:

a Wilsford (S) 77, concavity diameter 45ft (13.5m), overall diameter 81ft (24.3m)
b Wilsford (S) 78, concavity diameter 42ft (12.6m), overall diameter 80ft (24m)
c Wilsford (S) 76a, concavity diameter 35ft (10.5m), overall diameter 63ft (18.9m)
d Wilsford (S) 77a, concavity diameter 29ft (8.7m), overall diameter 59ft (17.7m)
e Wilsford (S) 85, concavity diameter 18ft (5.4m).

The Winterbourne Crossroads group

Two pond barrows are intimately associated with this linear group, one of which (Winterbourne Stoke 3a) overlaps the ditch of the bell barrow (Winterbourne Stoke 4) on its south-western flank. A third pond barrow (Winterbourne Stoke 23) lies just to the north, while a fourth (Winterbourne Stoke 64) is almost three-quarters of a mile (1.2km) distant to the west.

In order of size, they are:

a Winterbourne Stoke 12, concavity diameter 58ft (17.4m), overall diameter 96ft (28.8m)
b Winterbourne Stoke 23, concavity diameter 50ft (15m) (approx), overall diameter 90ft (27m) (approx)
c Winterbourne Stoke 3a, concavity diameter 36ft (10.8m), overall diameter 66ft (19.8m)
d Winterbourne Stoke 64, concavity diameter 32ft (9.6m), overall diameter 50ft (15m).

The Durrington group

Four, perhaps five, pond barrows lined this linear-irregular group which flanks the northern side of the eastern end of the Cursus, while two more may have existed further eastwards (RCHME 1979, 2 (149), 3). Only one is extant, although the sites of the others are known. The details of the extant example are: Durrington 51a, concavity diameter 36ft (10.8m), overall diameter 66ft (19.8m).

The Durrington Down group

A pond barrow adjoins this compact group on its north-western corner: Durrington 10, concavity diameter 50ft (15m).

The Wilsford group

A pond barrow is integral to this compact group: Wilsford (S) 63, concavity diameter 46ft (13.8m), overall diameter 94ft (28.2m).

The Wilsford Down group

A pond barrow adjoins this compact group on its south-western corner: Wilsford (S) 36, concavity diameter 39ft (11.7m), overall diameter 69ft (20.7m).

The Normanton group

The Wilsford 33a pond barrow and shaft could be seen as a distanced attachment to the western end of this linear-irregular group: Wilsford (S) 33a, concavity diameter 42ft (12.6m), overall diameter 66ft (19.8m).

Pond barrows east of the River Avon

Amesbury Down

A possible association with the triple-barrow (Amesbury 91): Amesbury 92a, concavity diameter 30ft (9m), overall diameter 62ft (18.6m).

Silk Hill group

The pond barrow is within this linear-irregular group which has scattered outliers: Figheldean 39, concavity diameter 30ft (9m).

Milston Down group

The pond barrow is a component of this compact group: Milston 45a, concavity diameter 63ft (18.9m), overall diameter 95ft (28.5m).

Pond barrows associated with Avebury

Avebury Down group

The pond barrow is a component of this linear-irregular group: Avebury 42a, concavity diameter 33ft (9.9m), overall diameter 55ft (16.5m).

Bishops Cannings North Down group

This pond barrow, the largest of its kind, with a bank 2ft (0.6m) in height and a concavity depth of 3ft (0.9m), is a component of the linear-irregular group, with scattered outliers on this down: Bishops Cannings 14, concavity diameter 92ft (27.6m), overall diameter 128ft (38.4m).

Wiltshire pond barrows distant from Stonehenge and Avebury

Whitesheet Hill, Mere

An outlier of the scattered group of barrows on Whitesheet Hill: Mere 8b, concavity diameter 20ft (6m).

Down Farm group, Pewsey

The pond barrow is at the southern margin of this compact group of barrows: Pewsey 5a, concavity diameter 42ft (12.6m).

Pond barrows on the Dorset Downs

Poor Lot barrow group

Six pond barrows are among this large group which combines compact with focal monument (a large barrow) and linear-irregular characteristics. In order of size they are:

a Winterbourne Abbas 17 (RCHME 30), concavity diameter 90ft (27m), overall diameter 120ft (36m)
b Winterbourne Abbas 35 (RCHME 32), concavity diameter 36ft (10.8m), overall diameter 78ft (23.4m)
c Kingston Russell 26f, concavity diameter 36ft (10.8m), overall diameter 72ft (21.6m)
d Winterbourne Abbas 26a (RCHME 16), concavity diameter 33ft (9.9m)
e Kingston Russell 26a (RCHME 7m), concavity diameter 21ft (6.3m), overall diameter 39ft (11.7m); upon excavation (Farrar 1954, 89) it was thought to have been oval, 45ft (13.5m) by 39ft (11.7m), bank-crest to bank-crest
f Kingston Russell 26b (RCHME 7n), concavity diameter 21ft (6.3m), overall diameter 39ft (11.7m).

Culliford Tree barrow group

Four, perhaps five, pond barrows are integral to this substantial group which combines linear-geometric, linear-irregular, and compact with a focal monument (a bank barrow) characteristics. In order of size they are:

a Winterborne Came 24a (RCHME 23), concavity diameter 46ft (13.8m), overall diameter 124ft (37.2m)
b Whitcombe 13a (RCHME 6), concavity diameter 80ft (24m), overall diameter 120ft (36m); this barrow, now destroyed, was thought by L V Grinsell to have been a disc barrow but was considered a pond barrow by RCHME
c Broadmayne 8a (RCHME 25), concavity diameter 60ft (18m), overall diameter 90ft (27m)
d Broadmayne 5 (RCHME 23), concavity diameter 50ft (15m)
e Whitcombe 2a (RCHME 12), concavity diameter 45ft (13.5m), overall diameter 75ft (22.5m).

Big Wood barrow group

The pond barrow is contiguous with a disc barrow in this linear-irregular group: Winterborne St Martin 41a (RCHME 87), concavity diameter 36ft (10.8m), overall diameter 78ft (23.4m).

Ridge Hill barrow group

The pond barrow is at the south-eastern end of this linear-geometric, linear-irregular, group: Weymouth 10a (RCHME 406), concavity diameter 45ft (13.5m), overall diameter 75ft (22.5m).

Sheep Down barrow group

The pond barrow could be considered as the focal monument of this small, compact group: Winterbourne Steepleton 19c (RCHME 46), concavity diameter 21ft (6.3m), overall diameter 51ft (15.3m); after excavation (Atkinson *et al* 1951) this was considered to have a concavity 30ft (9m) in diameter and an overall diameter of 54ft (16.2m).

Three Barrow Clump barrow group

The pond barrow is at the north-eastern corner of this compact group which has linear-irregular characteristics: Winterbourne Abbas 2a (RCHME 42), concavity diameter 33ft (9.9m), overall diameter 63ft (18.9m).

West Hill barrow group

The pond barrow is the penultimate at the south-western end of this linear-geometric group: Bincombe 39a (RCHME 63), concavity diameter 60ft (18m), overall diameter 90ft (27m).

Appendix B

Pond barrow shafts and their silting

by Paul Ashbee

It has been shown that the shaft's infill (p 26; Fig 8) was chalk rubble, that is silting derived from the weathering and denudation at the top (Fig 21). Such silting, although well-known from barrow and other ditches upon the chalklands, has not hitherto been encountered, or recorded, in detail within the cor.straints of what appeared at the outset to have been a cylindrical vertical cavity.

Through a series of observations (Pitt Rivers 1898, 24; Curwen 1930; Cornwall 1958, 58–9; Ashbee 1966b, 30) coupled with the results which have emerged from the Overton Down Experimental Earthwork (Jewell 1963; Jewell and Dimbleby 1966), something of the processes involved in the natural infill of the linear chalk-cut ditches flanking long, or encircling round, barrows can be appreciated. In these ditches, silt is the product of area. The sides (and ends) break up and the derivative material falls to the bottom. It follows that a narrow ditch must contain a deeper aggregation of silt than a wider one of the same depth. In the wider ditch, the rubble accumulates over a greater bottom area and there is not the interleaving of slides brought about by the restricted width. However, a rapidly-deepening accumulation in a narrow ditch could diminish the source-area more swiftly than in a wide ditch of the same depth. The vertical bottom parts of many chalk-cut ditches could point to processes acting in this manner. Ditch-infilling is a process in time, describing an exponential curve (Cornwall 1958, 58, fig 3, 6), and, in theory, a level surface should be restored and all trace of a depression obliterated after an infinite time-lapse. Ideally, ditches of identical dimensions dug at different times might be put into chronological order, being at different stages of the silting process. However, there are inhibitory factors such as the proximity of barrows and banks, windborne deposits, and animal and human disturbances.

Although the silting process within a shaft is, fundamentally, the same as that of a ditch, the constraints, namely the relationship between its sides and bottom, are dramatically different. Had the Wilsford Shaft terminated in a flat bottom, and thus been cylindrical, the area of the bottom would be but a very small part (0.0104) of the area of the sides. It proved not to be so, but nonetheless this assumption permits an approximate assessment of quantity, progress, and apparent outcome.

Within the Wilsford Shaft there had been weathering to a depth of 40ft (12m) and the weathered shaft below the cone extended to a depth of 20ft (6m). The remainder was unweathered and, apart from water erosion, was much as it was when initially sunk. With the analogy of a ditch in mind, it would appear that the lower 60ft (18m) of the shaft was rapidly infilled from the top and thereafter the process slowed, the weathered part of the cylindrical shaft infilling first, and then the weathering cone. Indeed, the layered infill of alternating fine and coarse rubble, separated by light humus, of the weathering cone could relate to the apparently annual layers observed during the earlier stages of the Overton Down Experimental Earthwork (Jewell and Dimbleby 1966, 340, 5).

As has been observed above, the excavation of the Wilsford Shaft has called into question the nature of pond barrows as a class of monument. Their banks may be no more than spoil from shafts, while their 'ponds', which give the series its name, are the circular, dished depressions marking the near final stages of their insilting. Such excavations as have been undertaken were either inconclusive or ambiguous in their results, so there is the inherent possibility that these monuments mark a series of shafts. The top of the Wilsford Shaft, the 'pond' of the pond barrow and the weathering cone beneath it, correspond with the characteristic 'trumpet-mouthed' ditch profile which develops because of the progressive weathering of sides originally steep and straight (Jewell and Dimbleby 1966, 339, 1). When such a ditch is infilled with the products of progressive weathering, it is normally visible as a depression, flanking a long barrow or encircling a round barrow, which is usually an unequivocal indicator of its erstwhile magnitude. It follows, therefore, that a small pond barrow, such as Wilsford (S) 85, with a 'pond' only 18ft (5.4m) in diameter, could be the top of a shaft perhaps only about 3ft (0.9m) in diameter, while the largest in Wiltshire, Bishops Cannings 14, with a 'pond' 29ft (8.7m) in diameter, could conceal a stupendous cylindrical shaft more than 12ft (3.6m) across!

Although surface indications might show the magnitude of a silted shaft, there is no certain determinant of depth other than by excavation. This impasse may be ultimately resolved by radar sensing, but this is in the future. Only the banks of the largest pond barrows provide any indication of the spoil that might have been taken from a shaft. The excavation of comparable shafts, on the mainland of Europe and in this country, shows that, at Holzhausen (Schwarz 1975, 340, Abb 14) for instance, there were shafts up to 120ft (36m) deep and more modest examples descending to only about 30ft (9m). The average depth of the shafts at Maumbury Rings was 34ft (10.2m) below the present-day surface (Bradley 1975, 8), and they may have been deeper. That at Swanwick (S Piggott 1963) was 24ft (7.2m) deep while the later Iron Age and Roman series in Britain were more modest, although relatively deep ones were encountered (Wait 1985, 76, fig 3, 3). Thus, there is the inherent possibility that surface indications, the 'ponds' of the pond barrows, may denote, albeit only approximately, their depth!

With the foregoing in mind, the better-recorded pond barrows of Wiltshire and Dorset (Grinsell 1957, 225; 1959, 172–3) have been listed in terms primarily of the diameters of their 'ponds' in Table 28. These, it is thought, could indicate the calibre of the shafts beneath them. In addition, the depths of such 'ponds' have also been listed. Undoubtedly the weathering, denudation, and final infill by silting of shafts are attended by the same numerous factors as in the case of ditches.

Nonetheless, because of the nature of such filling, which is a process in time (Cornwall 1958, 58–9), and the constraints of a shaft, there is the possibility that, within groups of much the same size, the shallower 'ponds' denote the older shafts and the overtly deeper the more recent. Although there are large and small pond barrows, most are either 30–40ft (9–12m) or 40–50ft (12–15m) in diameter. This could point to a shaft series of about the same dimensions as Wilsford, with some smaller, perhaps only 5ft (1.5m) in diameter, and some larger, of the order of 7ft (2.1m) in diameter. Such an increase in diameter would then mean a greater collecting area; an increase in depth could bring about broadly the same rate of silting. However, with shafts of large diameter accentuated settlement of the infill is a possibility.

Appendix C

Photographs taken in the shaft, and of material therefrom, by E Blomfield (Inspectorate of Ancient Monuments Photographer), 28 August 1962 and thereafter.

Photographs taken on 28 August 1962

In the shaft

A5971/11 Junction of weathered upper part of shaft with unweathered lower part; axe-dressing can be seen
A5971/12 The lower part of the shaft at *c* 84ft (25.2m) which has been smoothed by water-table fluctuations
A5971/13 Axe-dressing of east side at *c* 42ft (12.6m)
A5971/14 Axe-dressing and smashed-off flint nodules
A5971/16 Smashed-off flint nodules and axe-dressing looking upwards
A5971/17 Axe-dressing of east side at *c* 42ft (12.6m)
A5971/18 Vertical striations in the upper part of the shaft, caused by falling rubble from weathering
A5971/9 *c* 75ft (22.5m), broken-off flint nodules on the west side with axe-dressing below them
A5971/10 Axe and antler-pick dressing of south side at *c* 70ft (21m)

Material from the shaft

A5971/1 Bone pins and amber beads
A5971/2 Piece of cord
A5971/3 Fragments of slotted container stave ends
A5971/4 Fragments of container staves
A5971/5 Pieces of container staves; six pieces have been fitted together to show style of construction
A5971/8 Stave and ?bowl fragments

Photographs taken in the Ancient Monuments Laboratory

Photographs taken during November 1965, June 1967, November 1967, and May 1968.

Negative	*Date*	*Subject*
G10509/3	10/11/1965	Piece of cord *c* 3.5in (75mm) long
G10509/2	24/11/1965	Side view of broken container base fitted to broken staves
A7339/1	5/6/1967	Reconstructed part of scoop and stave-ends set together
A7339/2	5/6/1967	Comminuted wood recovered by wet sieving
A7339/3	5/6/1967	Part of scoop and set-together stave-ends
A7339/4	5/6/1967	Chalk-coated stave pieces
A7454/1	30/11/1967	Differentially-treated pieces set together
A7454/2	30/11/1967	Perforated stave-ends from sewn containers
A7454/3	30/11/1967	Reconstructed container base, freeze-dried
A7454/4	30/11/1967	Substantial pieces of wood, including an upper stave-end
A7454/5	30/11/1967	Detail of a slotted stave-end
A7596/1	28/5/1968	Amorphous pieces
A7596/2	28/5/1968	Reconstructed container base
A7596/3	28/5/1968	Detail of a thickened, slotted stave-end

Table 28 Pond barrows: their depressions ('ponds') and depths

Diameters	*Pond barrow*	*Recorded diameter*	*Depth*
Wiltshire			
10–20ft (3–6m)	Wilsford (N) 1a	18ft (5.4m)	6in (0.2m)
	Wilsford (S) 85	18ft (5.4m)	1ft 6in (0.5m)
20–30ft (6–9m)	Mere 8b	20ft (6m)	1ft (0.3m)
	Wilsford (S) 77a	29ft (8.7m)	6in (0.2m)
30–40ft (9–12m)	Amesbury 92a	30ft (9m)	9in (0.2m)
	Figheldean 39	30ft (9m)	2ft (0.6m)
	Winterbourne Stoke 64	32ft (9.6m)	6in (0.2m)
	Avebury 42a	33ft (9.9m)	1ft (0.3m)
	Wilsford (S) 76a	35ft (10.5m)	1ft (0.3m)
	Durrington 51a	36ft (10.8m)	1ft (0.3m)
	Winterbourne Stoke 3a	36ft (10.8m)	2ft (0.6m)
	Wilsford (S) 36	39ft (11.7m)	1ft (0.3m)
40–50ft (12–15m)	Pewsey 5a	42ft (12.6m)	1ft (0.3m)
	Wilsford (S) 33a	42ft (12.6m)	2ft (0.6m)
	Wilsford (S) 78	42ft (12.6m)	3ft (0.9m)
	Wilsford (S) 77	45ft (13.5m)	3ft 6in (1.1m)
	Wilsford (S) 63	46ft (13.8m)	2ft (0.6m)
50–60ft (15–18m)	Winterbourne Stoke 12	58ft (17.4m)	2ft (0.6m)
60–70ft (18–21m)	Milston 45a	63ft (18.9m)	6in (0.2m)
70–80ft (21–4m)			
80–90ft (24–7m)			
90–100ft (27–30m)	Bishops Cannings 14	92ft (27.6m)	3ft (0.9m)
Dorset			
10–20ft (3–6m)	Chaldon Herring 4a	9ft (2.7m)	3in (0.1m)
	Winterborne Steepleton 26a	18ft (5.4m)	slight
20–30ft (6–9m)	Kingston Russell 26a	21ft (6.3m)	1ft (0.3m)
	Kingston Russell 26b	21ft (6.3m)	1ft (0.3m)
30–40ft (9–12m)	Winterborne Steepleton 19c	30ft (9m)	2ft (0.6m)
	Winterborne Abbas 2a	33ft (9.9m)	6in (0.2m)
	Winterborne Abbas 26a	33ft (9.9m)	1ft (0.3m)
	Winterborne Steepleton 26b	33ft (9.9m)	2ft (0.6m)
	Swanage 6a	33ft (9.9m)	2ft 6in (0.8m)
	Winterborne Steepleton 25a	36ft (10.8m)	6in (0.2m)
	Kingston Russell 26f	36ft (10.8m)	1ft (0.3m)
	Winterborne Abbas 35	36ft (10.8m)	1ft 6in (0.5m)
	Winterborne St Martin 41a	36ft (10.8m)	2ft 3in (0.7m)
40–50ft (12–15m)	Whitcombe 2a	45ft (13.5m)	6in (0.2m)
	Weymouth 10a	45ft (13.5m)	9in (0.2m)
	Winterborne Came 24a	46ft (13.8m)	9in (0.2m)
	Broadmayne 5	50ft (15m)	6in (0.2m)
50–60ft (15–18m)	Winterborne Came 31a	53ft (15.9m)	1ft 6in (0.5m)
	Bincombe 39a	60ft (18m)	6in (0.2m)
	Broadmayne 8a	60ft (18m)	1ft (0.3m)
60–70ft (18–21m)	Winterborne Steepleton 10a	65ft (19.5m)	1ft 6in (0.5m)
70–80ft (21–4m)	Winterborne St Martin 52a	76ft (22.8m)	4ft (1.2m)
80–90ft (24–7m)			
90–100ft (27–30m)	Winterborne Abbas 17	90ft (27m)	1ft (0.3m)

Appendix D

Latex impressions

Impressions made by E Cripps, Ancient Monuments Laboratory, 27 August to 31 August 1962.

1 Axe-dressing zone on east side at about 42ft (12.6m)
2 Deep axe-chasing on the north-west side at about 42ft (12.6m)
3 Antler-pick marks on the east side at about 69ft (20.7m)
4 Vertical antler-pick marks on the south side at about 71ft (21.3m)
5 Axe-dressing on the south side at about 60ft (18m)
6 Deep axe-dressing on the north-west side at about 70ft (21m).

The plaster casts made from these impressions are now housed in the Salisbury and South Wiltshire Museum, The King's House, The Close, Salisbury.

Appendix E

Details of wells and their water-levels in the vicinity

Near Long Barrow Cross-Roads

(NGR SU 089415)
The top is 365ft (109.5m) above OD and water was encountered at a depth of 200ft (60m), 165ft (49.5m) above OD. It was a poor-yielding well. Access was not given on 31 August 1962.

Countess Farm

(NGR SU 136427)
The top is 350ft (105m) above OD, and during the winter of 1905 (well drilled 20 January 1905) water was encountered at a depth of 145ft (43.5m), 205ft (61.5m) above OD. In 1962 it was found to have been concreted in and abandoned.

King Barrows

(NGR SU 135420)
The top is 363ft (108.9m) above OD and water was encountered at a depth of 100ft (30m), 263ft (78.9m) above OD. In 1962 the water stood at a depth of 166ft (49.8m).

Springbottom Farm

(NGR SU 125396 approx)
An abandoned well, the top of which was about 253ft (75.9m) above OD. It sometimes overflowed in winter.

Pump House

(NGR SU 125396 approx)
This well, south-east of Springbottom Farm, at about 200ft (60m) above OD, had a summer–winter water-level fluctuation of about 17ft (5.1m).

Appendix F

The excavation's plant and its use

by Paul Ashbee

Excavation is essentially the removal of deposits in the reverse order in which they were laid down. Silt in a chalk-cut ditch is derived from the sides which were often originally vertical but, as they weather, develop a characteristic 'trumpet-mouthed' profile. Indeed, the lowermost layers of such silt normally preserve something of the sides, and the bottom, of the original cut (Jewell and Dimbleby 1966, 339–40). Only if a ditch is exceptionally deep will it demand more than bucket-aided spoil removal (eg Gray 1934, pl XLV, fig 2). When, however, the infills initially of the great pit below the 'pond' of the pond barrow, and thereafter the shaft, had to be removed, special plant had to be marshalled and even devised and developed.

In the light of the beliefs obtaining in 1960 regarding the nature of pond barrows, the initial excavation was designed as total and by quadrants (Ashbee 1960, 185). The spoil from these was taken to dumps by wheelbarrows along running planks. When the weathering cone had been dug out to a depth of about 9ft (2.7m), the cross baulks could no longer be maintained and thus had to be progressively removed. For some time in each quadrant, and subsequently to a depth of about 14ft (4.2m), access was by a short ladder and spoil removal entailed a roped bucket. To explore to a greater depth, a platform supported by a steel scaffolding was constructed across the cavity (Fig 96). From this there was a vertical ladder for access, while spoil was brought up by a powered hoist in a large latrine bucket. When the top of the circular shaft was encountered, it was impracticable for more than one person at any one time to excavate its chalk rubble infill. In the event, the shaft was excavated in 1960, with extended, suspended ladders and with the hoist, working in the open shaft, to a depth of more than 60ft (18m).

When further work was planned for 1961 under the direction of the present writer, the methods employed in the previous year were considered unmanageable. Also, because of the need to descend and ascend a vertical ladder as well as work directly beneath the hoist's heavy iron bucket, they were thought unsafe. It was considered that there should be provision for safer access and spoil removal, lighting, air (a precaution against concentrated carbon dioxide), and a telephone. Groundwater was also a possibility, and a pump was thought desirable.

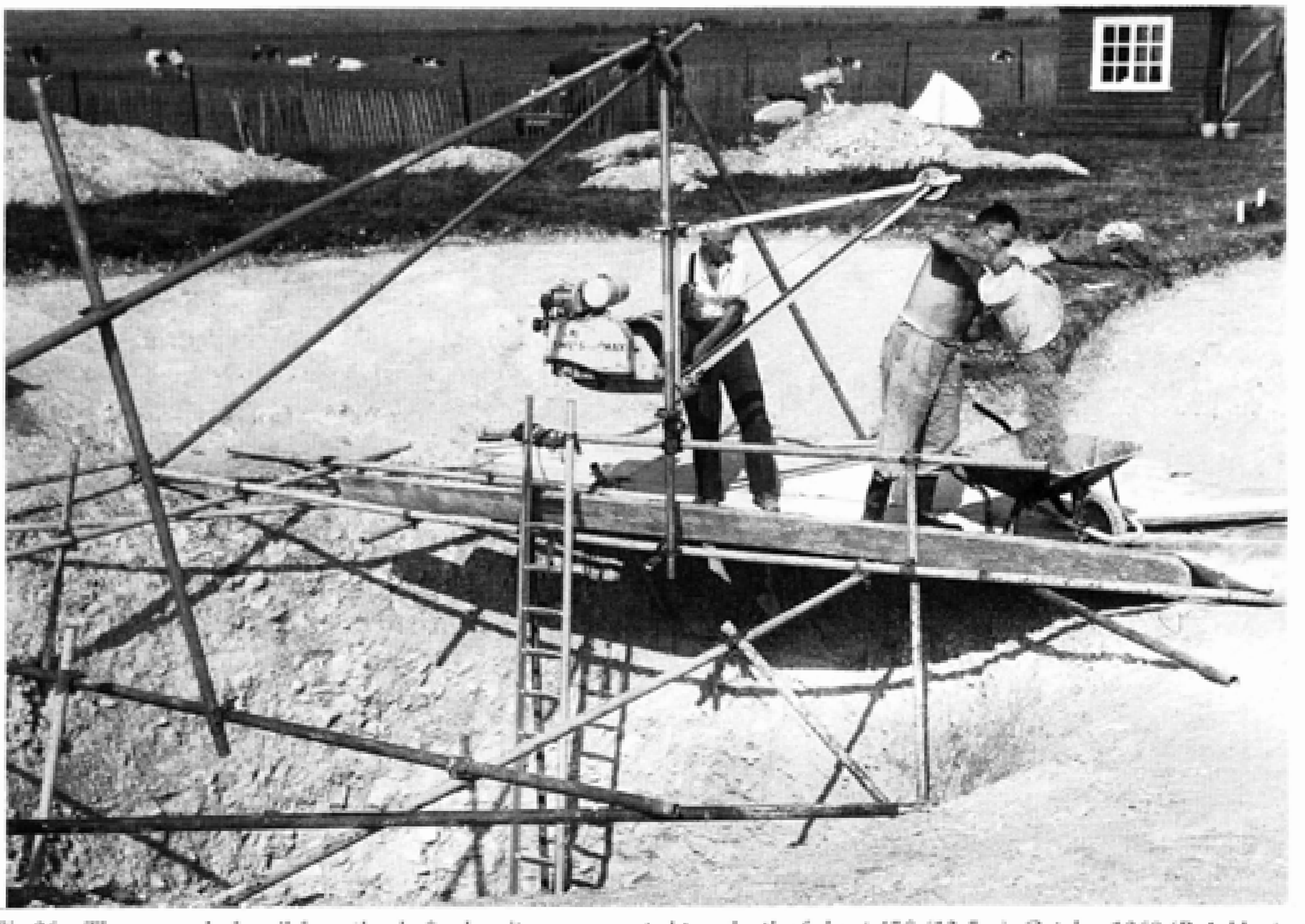


Fig 96 The removal of spoil from the shaft when it was excavated to a depth of about 45ft (13.5m), October 1960 (P Ashbee)

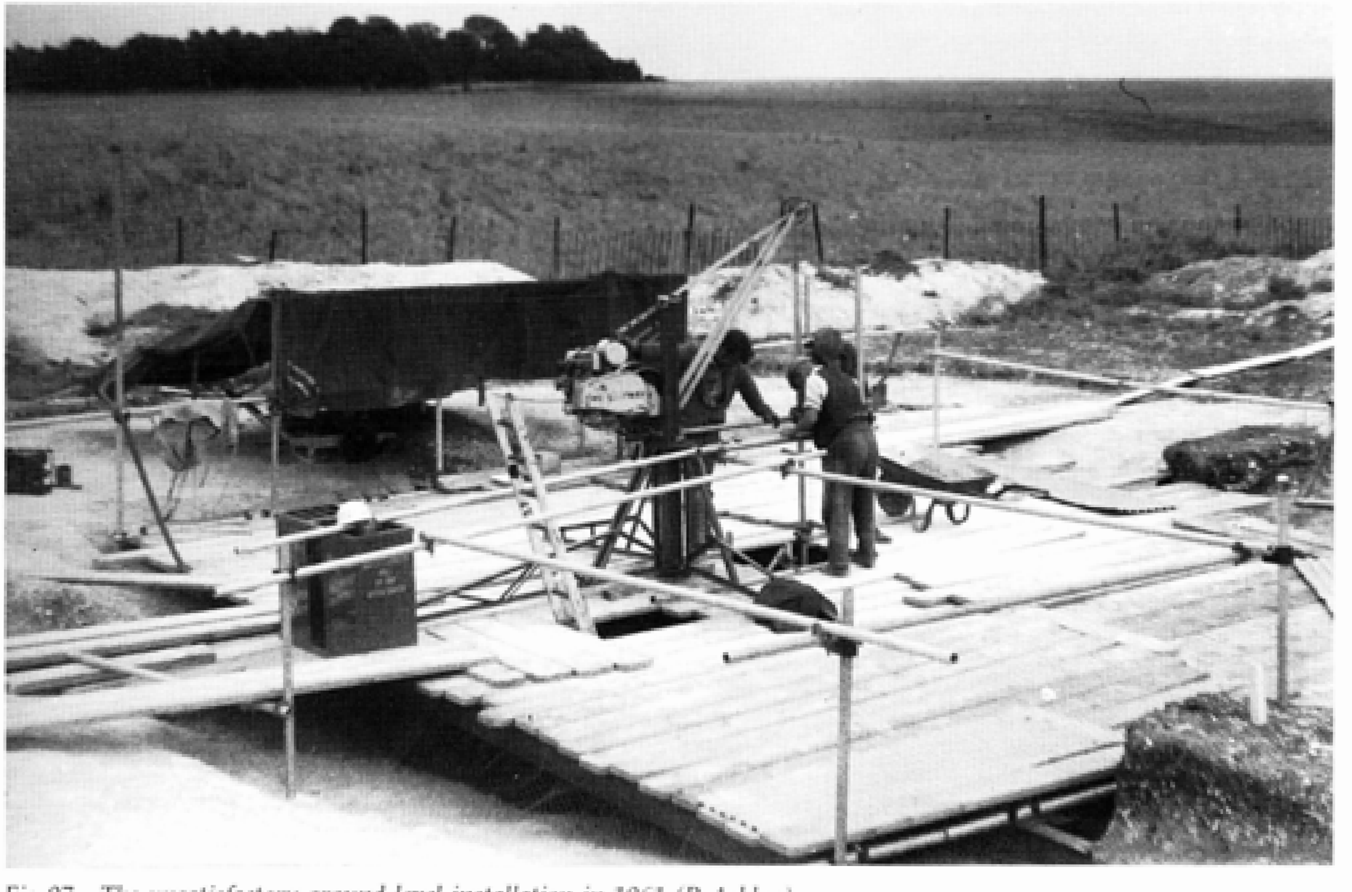


Fig 97 The unsatisfactory ground-level installation in 1961 (P Ashbee)

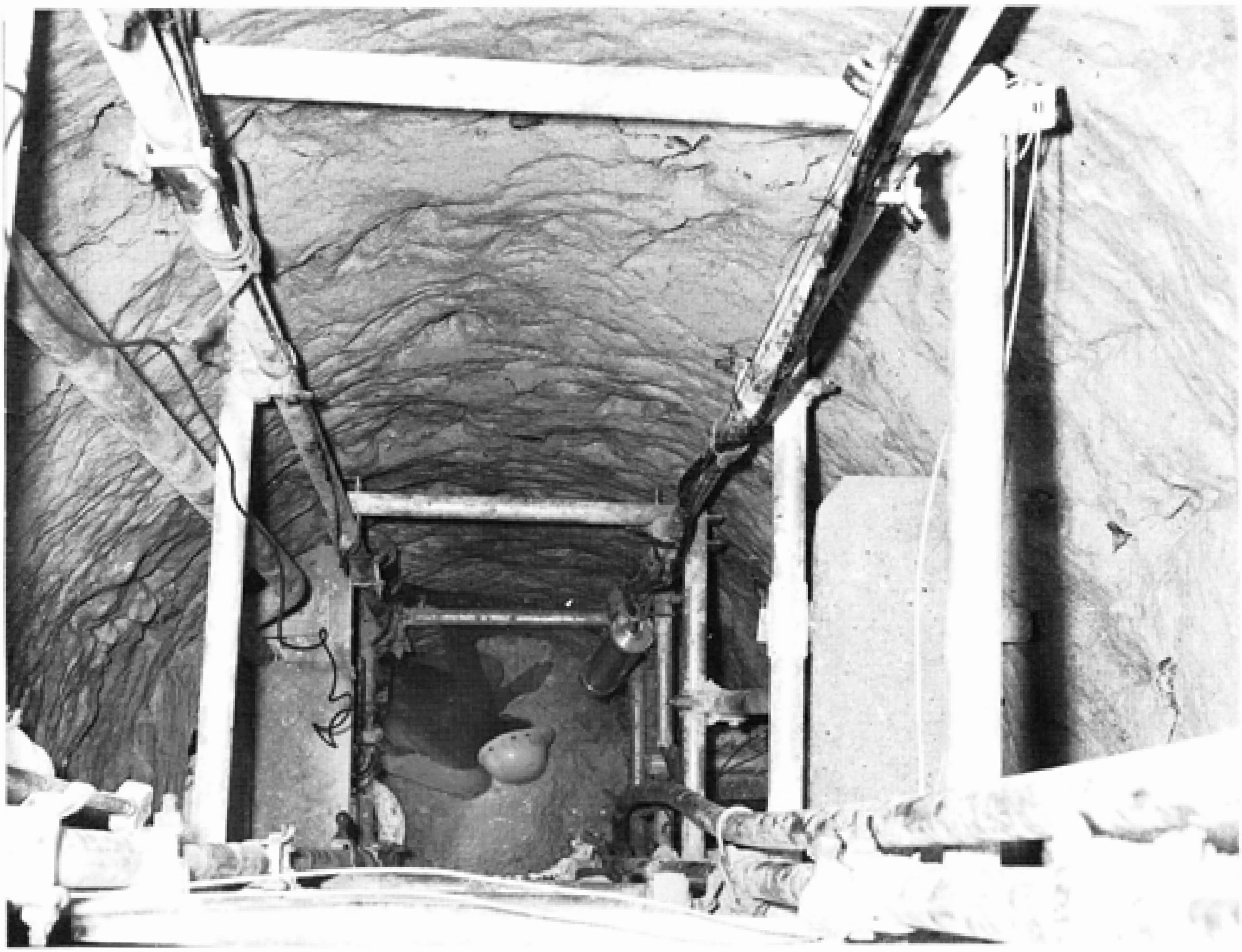


Fig 98 Excavation of the shaft's lower infill (R C L Ashbee monitored by closed-circuit television): the access scaffolding and television camera were necessary for safety and control in the confined space (E M I Electronics Ltd)

To resolve the problems of safe access and spoil removal, the Ancient Monuments Inspectorate's Architect in Charge caused a comprehensive steel-scaffolding supported platform to be built, completely covering the top of the weathering cone (Fig 97), from which a suspended system extended down into the shaft. This provided stages for a series of ladders and a clearway for spoil removal. All other provision was in the hands of the local contractor.

At the outset, the only lighting was a 40W tungsten bulb in a plastic holder at the end of some well-worn flex and, because of the lack of cables and pipes, the generator and air compressor had been sited at the lip of the shaft with deafening effects, while field telephones had been found (but with stale batteries). Moreover, the platform had no shelter, so the mechanical hoist, supplied with a frayed cable, no shackle, and a heavy iron well-bucket, could not be controlled in the dark shaft, while there were neither safety fences nor nets to guard against objects being accidentally precipitated into the confines of the working area. As was anticipated, sudden heavy rain short-circuited the uninsulated lighting and stopped the generator, which was beyond the capacities of the contractor's workmen to restart. In addition, a pump could not be provided to clear the quantity of water which had drained into the shaft and had augmented the water-table, which unknowingly had been reached. It emerged that the contractors were not qualified to maintain the plant that had been provided, and failures meant that the site was sometimes out of action for days at a time.

In 1961 the site could have been in action for 53 days, but chalk rubble was excavated and raised only on 14 days. The remaining 39 days were spent wrestling with the problems posed by the malsiting of plant, inadequate lighting, continual electrical and mechanical failures, the lack of roofing, communication, and the inability of those responsible to provide a pump to stem the deep and ever-rising water. The Architect in Charge visited the site only once and did nothing, while the Ministry of Works' officials in London seemed ineffectual and unhelpful. It was not until October that the good offices, sound common sense, and practicalities of Messrs W Fryer and W J Knapp, the Superintendents of Works (Ministry of Works, Bristol), prevailed and plant adequate to the enterprise was provided.

When work was planned for 1962, every endeavour was made to eliminate the persistent electrical and mechanical failures of the previous year. Thus a Clerk of the Works, George Symcox, and a resident engineer, Thomas Hargreaves, from the Bristol Ministry of Works depot, were appointed to tend and maintain the excavation's plant. At an initial site meeting the archaeological objectives were explained and the attendant problems, structural, electrical, and mechanical, were discussed. Among other things, there was recognition that a measure of site safety, a matter unusual on archaeological excavations at that time, was involved and rules were drawn up. The organisation was tested to the full on 31 July for, near the end of the day, the water-pump seized up and the electrical generator fused. Work began again 48 hours later on 2 August, and thereafter such failures were few. Indeed, progressive modifications and adjustments were made to suit particular and changing circumstances as the work advanced. A happy working relationship developed between all concerned which manifested itself when speedy improvisations for wet-sieving and photography were needed. The cordial co-operation of the resident operative and maintenance principals, supported by the Bristol Superintendent of Works, was at that time without parallel.

Communication with whomsoever might be working at the bottom of the shaft was by telephone, but there was also a visual link via a closed-circuit television system, lent to the excavation by EMI Electronics Ltd of Hayes, Middlesex (Fig 98). The camera in the shaft and the screen in the site hut allowed trowelling to be monitored and limited decisions made. Descent and ascent of the shaft could take 15 minutes. It was also possible to take photographs of pieces emerging in difficult positions. Televised supervision of the removal of the quantities of organic materials from the shaft bottom was exercised, and effective discussions, besides economies of time, were possible.

During excavation the sides of the shaft, below the level of frost weathering, were touched as little as possible by metal trowels and fill was removed with a wooden spatula. To aid scrutiny of the various aspects of the shaft's interior a powered water-hose was finally used to clean such features as axe-chasing and antler-pick marks.

Appendix G

The weathering of the shaft

by Edwina and Bruce Proudfoot

Introduction

The Wilsford 33a pond barrow was found on excavation to be a 100ft (30m) deep shaft, comprising at the surface a weathered funnel or cone, 20ft (6m) deep by approximately 36ft (10.8m) wide at the top over a cylindrical shaft 80ft (24m) deep by 6ft (1.8m) in diameter.

Observation during excavation confirmed that the cone was a product of the weathering process and that weathering was least at the base of the shaft and greatest towards the surface. Weathering was found to extend a third of the distance into the shaft, ie to 40ft (12m) from the surface and 60ft (18m) from the base, but the shaft maintained its general form with a diameter of approximately 6ft (1.8m) to 80ft (24m) from the base, ie 20ft (6m) from the surface.

The top 20ft (6m) of the shaft was found to have weathered back from the funnel or cone described in this report. When the shaft had filled to 20ft (6m) from the surface, the sides of the upper part had weathered back to some 17ft 6in (5.3m) diameter at the surface, as indicated by the angle of the cone sides. Weathering of the sides of the cone continued, so that the diameter had increased to some 22ft (6.6m) by the time the shaft and lower part of the cone had filled to 90ft (27m) from the base, 10ft (3m) from the surface. Normal weathering proceeded until the top of the cone was approximately 36ft (10.8m) wide, some 3ft to 4ft (0.9m to 1.2m) below the surface at the centre. At this stage, weathering slowed down sufficiently for a turf layer to form (Fig 13, layer 3). Finally, this central hollow was deliberately filled in.

Reconstruction

An ideal model can be postulated to account for the features observed during the excavation and recognised as a weathering cone. Shaft and weathering cone have been assumed to be symmetrically disposed, contrary to excavation findings which showed that the cone was not in fact entirely symmetrical with the shaft.

First, a cylindrical shaft 6ft (1.8m) in diameter and 100ft (30m) deep is assumed. This would be maintained during the active use of the site, but the lip of the shaft would collapse as soon as it was abandoned or left unprotected and exposed to weathering. The excavated chalk at the top of the shaft would be quickly attacked by such processes as freeze/thaw and wetting/drying, causing contraction and expansion as well as loosening of the chalk and wedging-off of blocks of chalk. Such loosened material, falling from the lip, would accumulate in the shaft.

As suggested by the excavated profile, weathering at the mouth of the shaft would have continued to 80ft (24m) above the base, ie 20ft (6m) below the surface. This would have formed a weathering cone that would have been approximately 18ft (5.4m) [17ft 6in (5.3m)] wide at the surface on the basis of the sloping sides of the shaft, between 12ft (3.6m) and 20ft (6m) from the surface. The volume of material weathered from the sides of the shaft would have been 600πcu ft (17πcu m). This would have accumulated in the shaft and occupied a greater volume than previously.

Experience in the construction of the experimental earthwork at Overton Down suggested that an appropriate expansion factor to employ would be between 1.25 and 1.75 (Jewell 1963, 25). As the material accumulating in the shaft would have fallen

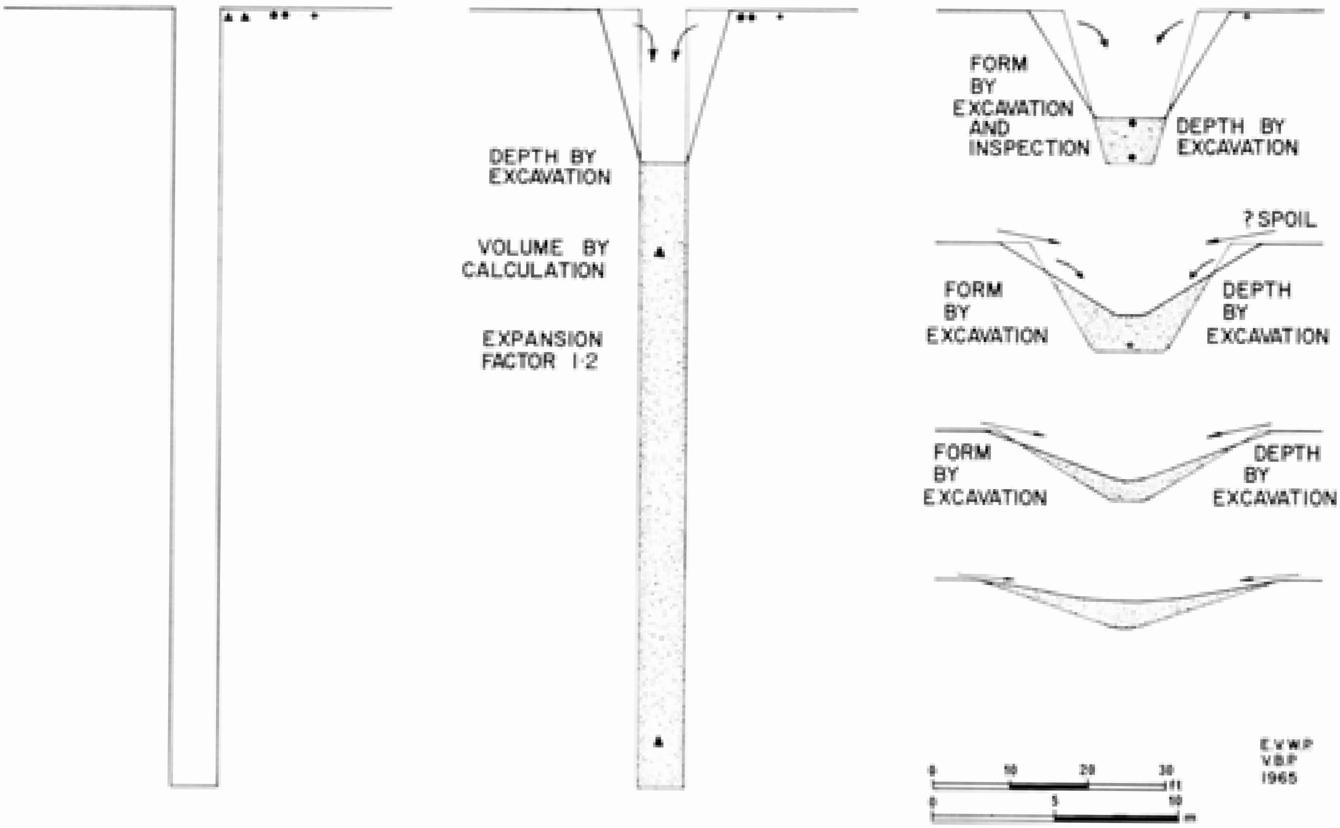


Fig 99 Reconstruction of the stages of weathering of the shaft and its filling, showing how artefacts lying at the surface could become incorporated in the filling

through a considerable height, it would have broken up and compacted on landing, so that a factor near the lower end of the range would be appropriate in the present case (Jewell 1963, 28). Using a factor of 1.2, the volume occupied would be approximately 750πcu ft (22.9πcu m). The volume of shaft below 20ft (6m) from the surface has been calculated as 720πcu ft (20.4πcu m). The agreement of these figures would suggest that the original assumptions as to the size of the primary weathering cone that developed around the shaft were correct.

Next, the weathering of the truncated cone so formed should be considered. When the shaft, 6ft (1.8m) wide, had filled to 80ft (24m) from the base, the upper part (20ft; 6m) had also weathered, so that the width at the ground surface would be now 17ft 6in (5.3m). Material weathered from the upper sides would have accumulated in the cone.

At the sides of the cone the fill would be at the angle of repose and, as it accumulated, it would protect the base of the slope from further weathering. Since the cone would be narrow in the lower part, material would not be able to accumulate at the angle of repose for long, and therefore the centre would be filled with material resting at a lower angle.

Although it is possible to calculate the future shape of an unweathered rock surface protected by freely-accumulating scree, it has not been possible to develop a mathematical framework for the conditions at Wilsford with material accumulating in the confined area. However, the generalised forms for an unweathered rock surface and the specific forms calculated for the ditch sides at Overton permit the data observed during excavation at Wilsford to be fitted into the theoretical sequence shown in Figure 99.

As the cone filled, the processes by which material was derived from the cone edges would have changed. Initially, weathered material would have fallen freely from the edges to accumulate below. As the slope of the top of the weathering cone more nearly approached the angle of repose of the weathered material of the filling, ie 30° at 86ft (25.8m) from the base, 14ft (4.2m) from the top, and as its sides probably became stabilised by vegetation, the material would be mainly washed into the cone. This stage would have occurred when the cone was some 30ft (9m) wide and filled to some 6ft (1.8m) from the surface. Above this the cone would have continued to fill, progressively more slowly, until it reached the stage recorded before it was deliberately filled in, some 3–4ft (0.9–1.2m) from the modern surface, by which stage a continuous vegetation cover existed (Fig 13, layer 3).

Implications

1 When the shaft ceased to be used and maintained, the weathering process would have started. Already material could have been deposited accidentally or deliberately in the base of the shaft.

2 Material within 5–6ft (1.5–1.8m) of the original top edge of the shaft and within approximately the top 12in (0.3m) of the surface could have accumulated within the lower part of the shaft. Finds made at the base of the shaft could have derived from the surrounding land surface, and could therefore have been contemporary with, or earlier than, the digging of the shaft. Such finds could have derived from deposits unrelated to the shaft itself. In addition there could be items accidentally or deliberately introduced into the shaft. These conditions would only apply to non-perishable remains and not to perishable organic materials, which would not have survived in the topsoil surrounding the shaft. Organic material found at the base of the shaft would therefore have been contemporary with its use. Any wooden superstructure left near or at the shaft-head at the time of abandonment should have been found near the bottom of the shaft, as it would have fallen in when the supporting ground in the vicinity itself collapsed into the shaft.

3 The lowest 80ft (24m) of the shaft could have been filled relatively rapidly by analogy with the rate at which the ditch sides at the Overton Experimental Earthwork weathered – perhaps a few decades at most.

4 By similar reasoning, material present in the area surrounding the shaft could have been incorporated within the shaft until it had filled to within a few feet of the surface. Such material could have been contemporary with the use of the shaft or from earlier and unrelated deposits.

5 There seems no reason to suggest that the spoil excavated from the shaft – ie the bank described by Grinsell and earlier writers (1957, 225) – contributed to its filling, since there would have been sufficient material for the weathering cone to have completed the filling of the shaft.

6 Once surface wash had become the dominant process in the erosion of the weathering cone, material earlier than the shaft would have been less likely to accumulate in the filling because the surface would have stabilised. Any such material accumulating thereafter might be abraded. Material in the upper levels could also have been derived from a late use of the general area or the partly-filled weathering cone.

7 No account has been taken at this stage of any possible pre-existing depression, either natural or artificial, eg a pond barrow as conventionally understood prior to the excavation of Wilsford 33a, although a disturbed feature could have yielded artefacts that would have accumulated in the shaft itself. The dimensions of any shaft feature would have been insufficient to modify the volumetric arguments advanced above.

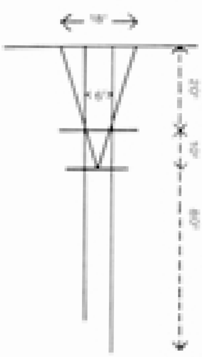
8 Nor has account been taken of any possible lowering of the chalk surface by weathering, since the dimensions would again be insufficient to modify the volumetric arguments proposed.

9 The spoil derived from the digging of the shaft could have been used to create the low bank recorded at some distance from the centre of the site and noted by Grinsell and others (1957, 225). This would have lain beyond the perimeter of the eventual total weathered zone, until the very latest stages when the weathering cone had reached the level to which it had filled naturally, as indicated by the buried surface (Fig 13, layer 3). This buried surface was subsequently covered when the bank was pushed into the central hollow to fill it.

10 The latest recorded dimensions of the site (Grinsell 1957, 225) indicate a bank spread to 12ft (3.6m) and 1ft (0.3m) high. The diameter of the site was given as 42ft (12.6m). It has not been possible from these dimensions to work out the original size of the bank. No traces of bank were found during the excavation, although it is possible that the slope of the buried turf line at the outer edges of the hollow indicates the inner edge of the bank. On photographs taken earlier, after the site had been levelled, a ring of clean chalk was recorded between the field soil and the infilled depression (Figs 2 and 3). This ring may have represented the less-weathered chalk that had been protected by the bank, and thus may indicate the former position of the bank, but no trace of it was obvious at the time of the excavation, some six years after the photographs were taken, during which period the ground had been cultivated.

Calculation

The volume of material filling the cone and the volume of material in the shaft may be expressed:



V_1 Volume of cone = $\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi 9^2 \cdot 30 = 810\pi$ cu ft (22.9π cu m)

V_2 Volume of apex = $\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi 3^2 \cdot 10 = 30\pi$ cu ft (0.85π cu m)

V_3 Volume of cylinder = $\pi r^2 h = \pi 3^2 \cdot 20 = 180\pi$ cu ft (5.1π cu m)

Volume of weathered material = $V_1 - (V_2 + V_3) = 600\pi$ cu ft (17π cu m)

Volume of shaft below weathering cone = $\pi r^2 h = \pi 3^2 \cdot 80 = 720\pi$ cu ft (20.4π cu m)

Expansion factor $720 \div 600 = 1.20$

Summary

The excavation of the presumed pond barrow, Wilsford 33a, in 1960, led to the baring of a weathering cone and the top of a shaft 6ft (1.8m) in diameter. Subsequent work during 1961 and 1962 revealed that it was of the order of 100ft (30m) in depth. Removal of chalk rubble involved considerable engineering and the provision of lighting and air. At its bottom the shaft had encountered a fissure which allowed the ingress of water. Thus a range of objects and materials were preserved by waterlogging in a manner not normally encountered upon the chalklands of Wiltshire.

Within the weathering cone Iron Age pottery and human and animal bones were found. Deeper within the shaft, there was later Bronze Age Deverel-Rimbury pottery, while at a greater depth, and within the amplitude of the water, there were the remains of wooden containers and other wooden objects, bone pins, amber beads, and a shale ring. These, particularly at the bottom of the shaft which was continuously waterlogged from prehistory, were accompanied by quantities of environmental material, domestic animal bones and fibres, small vertebrate remains, roundwood fragments, bud scales, insect remains, molluscs, pollen, seeds, fungi, moss, plant fibres, dung, and pieces of rope.

Human and animal bones from the shaft top together with pieces of the wooden containers from the bottom provided ten radiocarbon accelerator dates. The dates comprised two groups: from the upper 10ft (3m), four dates *c* 450 bc and, from the primary fill, five centring upon 1200 bc. One piece of a wooden container yielded a date of about 2700 bc.

Below the range of weathering and the scars of falling debris, antler-pick and broad-bladed bronze axe marks were visible upon the sides of the shaft. The constricted bottom bore numerous waterworn pick-marks and, as it had been abandoned before completion, showed the methods of the prehistoric engineers. A template, plumbed at regular intervals, must have been used to ensure circularity and verticality.

It has been possible to calculate the time taken in prehistory to sink such a shaft, while the processes of weathering and denudation which produced the surface profile are examined.

The wide range of environmental evidence from the depths of the shaft provides the most detailed picture that we have at present of the natural history of a Bronze Age site. The various sources all indicate an unwooded landscape of short grassland grazed by sheep. There was some disturbed ground, presumably arable land, at no great distance. A wooden structure stood at the top of the shaft, but there was no evidence for settlement in the immediate locality. The assemblage provides the earliest records for certain species of plant and animal.

Two unashamedly different conclusions have been reached in the light of the archaeological and the environmental evidence. Shafts (not however beneath apparent pond barrows), often of Iron Age or Roman date, occur in England and the immediate mainland of Europe. For the most part, they are interpreted as a means of access to the beings of the underworld, many containing material that could be construed as offerings. At Wilsford the deposit is considered to be an incidental accumulation, as the shaft could have been abandoned because of the influx of water. The environmental material, however, leads to a consideration of the possibility that the shaft may have been a well sunk for the watering of stock. The bones and other traces of such animals were among the assemblage recovered, indicating that animal-related activities took place in proximity to the shaft.

Appendices detail other pond barrows and the calibre of the shafts that could be beneath them; indicate wells and their water-levels in the vicinity; describe the arrangements for the excavation, its plant, and concomitant problems; and discuss the weathering and silting of the shaft in terms of the volume of its infill. Further detail for the environmental reports is provided on microfiche.

Résumé

La fouille du tumulus d'étang, Wilsford 33a, a mit à nu en 1960 un cône détérioré et le sommet d'un puits 6 pieds (1.8m) en diamètre. Pendant 1961 et 1962 la continuation du travail a révélé qu'il avait une profondeur à l'ordre de 100 pieds (30 m). Déblayage du débris de craie a nécessité l'ingénieurie et la provision de lumière et d'air. À son fond le puits a recontré une fissure qui a permis l'entrée d'eau. Ainsi une groupe d'objets et des matériaux étaient préservés par consequence d'être détrempés dans une manière rarement recontrée sur les terres crayeuses de Wiltshire.

À l'intérieur du cône détérioré, on a trouvé de la pôterie et des os – des humains et d'animaux – de l'âge du fer. Dans le contenu du puits il y avait de la pôterie 'Deverel-Rimbury' du dernier âge de bronze et, plus profonde, et à moins de l'amplitude de l'eau, il y avait les restes des vaisseaux et des autres objets en bois, les épingles d'os, des perles d'ambre et un bague de schiste argileux. Ceux-ci, particulièrement au fond du puits ou la saturation par l'eau était toujours présente, étaient accompagnés par des quantités de matérial environnemental, des os et fibres d'animaux doméstiques, des restes des petits vertebrés, des fragments de bois-rond, des écailles de bourgeon, des restes d'insectes, dont la plûpart coléptère, de pollen, des graines, des champignons, de mousse, des fibres de plantes, de crotte, et des bouts de corde.

Les os des humains et d'animaux de partie supérieure du puits avec les morceaux des vaisseaux de bois de la partie inférieure ont donné dix dates obtenus par mesurements des niveaux de carbone-14. Ils ont compris deux groupes: de l'haut de l'ordre de 450 avant de Jésus-Christ et cinque qui centraient sur 1200 avant de Jésus-Christ. Un morceau d'un vaisseau a donné une date de 2700 avant de Jésus-Christ.

Au dessous de la portée de la détérioration et les cicatrices causés par débris en tombant, quelques

marques étaient visibles qui sont causés par les pics de bois de cerfs et des haches bronzes avec des larges lames. Le bout resserré porta nombreuses marques des pics qui sont usés par l'eau et, parce que le puits était abandonné avant son achèvement, ils indiquent les méthodes des ingénieures préhistoriques. Un patron, appliqué par intervalles regulières, a été utilisé pour assurer que le puits restait circulaire et vertical.

C'était possible de calculer le temps pris, en préhistoire, pour creuser un tel puits pendant qu'on examinait les procés de détérioration et de dénudation qui ont produit un tumulus-d'étang ('pond-barrow').

La grande portée d'evidence environnemental du fond du puits fait un tableau le plus détaillé qu'on peut obtenir au present de l'histoire naturelle d'un site de l'âge de bronze. Tous les divers sources indiquent un paysage sans bois avec l'herbage – un pâturage des moutons. Pas loin il y avait du terrain perturbé, qu'on présume a été arable. Il y avait un structure de bois au sommet du puits, peut-être dans les environs immédiats. L'assemblage donnait les plus vielles exemples de certains espèces de plantes et des animaux.

On a distingué deux conclusions complémentaires, mais pas forcément contradictoires en tenant compte de l'évidence archéologique et environnemental. Les puits, pas cependant sous les tumulus-étang manifestes, quelques fois datés de l'âge de fer ou des Romains, sont très répandus à l'Angleterre et sur le continent européen près de l'Angleterre.

La majorité d'entr'eux paraissent comme un moyen d'acceder les êtres des enfers et un bon nombre ont contenu des objects qui peuvent être expliqués comme des offrandes. À Wilsford le dépôt est considéré d'être une accumulation fortuite quand le puits a été abandonné peut-être à cause de l'affluence d'eau. Le material environnemental conduit à une consideration de la possibilité que le puits a pu être un puits creusé pour arroser le bétail dans un paysage asséché. Les os et d'autres vestiges de ces animaux ont été découverts au milieu de l'assemblage.

Les appendices séparés detaillent les autres tumulus-d'étang et le calibre des puits qui peuvent-être y dessous; indiquent des puits avec les niveaux de l'eau dans la vicinité; décrirent les fouilles, ses méthodes et les problèmes concomitants; et détaillent la détérioration et l'envasion du puits en vertu de la volume de son remplissage. Les détails supportifs pour les études environnementaux sont fournis sur microfiches.

Zusammenfassung

Die Ausgrabung des 'pond-barrows' (eingetiefter Grabhügel), Wilsford 33a, im Jahre 1960 legte einen Verwitterungstrichter und die Öffnung eines 1.80 m (6 Fuß) weiten Schachtes frei. Die anschließenden Arbeiten in den Jahren 1961 und 1962 zeigten, daß es sich dabei um einen Schacht von ungefähr 30m (100 Fuß) Tiefe handelte. Für die Entfernung des Kreidegerölls wurden technische Hilfen benötigt einschließlich Beleuchtung und Frischluftzufuhr. An der Sohle war der Schacht auf einen Felsriß gestoßen, durch den Wasser eintrat. Dieser Wassereinbruch führte dazu, daß eine große Anzahl an Gegenständen und Materialien im Schachtsumpf in einer Weise erhalten blieben, wie man sie auf dem Wiltshire Kreidegebiet normaler weise nicht antrifft.

Innerhalb des Verwitterungstrichters wurden eisenzeitliche Keramik sowie menschliche und tierische Knochen festgestellt. Etwas tiefer im Schacht wurde spätbronzezeitliche Deverel-Rimbury-Keramik gefunden, während sich in größerer Tiefe und innerhalb des Wasserspiegels die überreste von hölzernen Gefäßen und anderen Holzgegenständen, Knochennadeln, Bernsteinperlen und ein Tonschieferring fanden. Diese Funden waren, im Besonderen auf der Schachtsohle, wo von Anfang an sumpfige Voraussetzungen bestanden hatten, mit großen Mengen Umweltsmaterials vermengt, wie zum Beispiel Haustierknochen, Fasern, Reste kleiner Wirbeltiere, Knüppelholzfragmente, Knospenschuppen, Insektenreste (meistens Käfer), Pollen, Samen, Pilze, Moose, Pflanzenfasern, Dung und Seilenden.

Menschen- und Tierknochen aus der oberen Schicht des Schachtes ergaben im Zusammenhang mit den Holzgefäßfragmenten aus der Sohlschicht zehn C-14 Messungen. Diese zerfielen in zwei Gruppen: in der oberen Schicht waren vier Daten um 450 v. Chr. und in der Sohlschicht fünf um 1200 v. Chr. geballt. Ein Holzgefäßstück ergab ein Datum von ungefähr 2700 v. Chr.

Unterhalb der Verwitterungsgrenze waren die Spuren fallenden Gerölls, die Einschnitte von Geweihhacken und breitklingiger Bronzeäxte an den Schachtwänden erhalten. Die beengte Sohle des Schachtes zeigte mehrere verwaschene Hackenspuren auf, und da der Schacht vor seiner Vollendung aufgegeben worden war, ist die Arbeitsweise der vorgeschichtlichen Ingenieure deutlich erkennbar. Eine Lehre, in regelmäßigen Abständen ausgelotet, war benutzt worden, um die Regelmäßigkeit des Durchmessers und die Lotrechtigkeit des Schachtes zu gewährleisten.

Es ist möglich zu errechnen, wie lange in vorgeschichtlicher Zeit gebraucht worden war, um diesen Schacht zu senken, während zu gleicher Zeit die Verwitterungs- und Abtragungsvorgänge, die einen 'pond-barrow' entstehen lassen untersucht werden.

Die umfangreiche Sammlung an Umweltbefunden aus der Tiefe des Schachtes ergibt den ausführlichsten Einblick in die Naturgeschichte einer bronzezeitlichen Fundstätte, den wir bisher besitzen. Die verschiedenen Quellen deuten alle auf eine waldlose Landschaft mit von Schafen geweidetem Trockenrasen hin. Nicht weit entfernt war das Weideland umgebrochen worden, wahrscheinlich als Ackerland. Ein Holzgerüst stand über der Öffnung des Schachtes, aber es finden sich keine Hinweise für eine Siedlung in der unmittelbaren Nachbarschaft. Die Fundgruppierung enthält die frühesten Belege für gewisse Planzen- und Tierarten.

Zwei sich ergänzende aber nicht notwendigerweise gegesätzliche Schlußfolgerungen sind auf Grund des archäologischen und umweltlichen Befundes erreicht worden. Schächte – jedoch nicht unter offensichtlichen 'pond-barrows' – oft eisenzeitlichen oder römischen Datums, sind in England und auf dem unmittelbar angrenzenden europäischen Festland Weitverbreitet. Größtenteils scheinen sie einen Zugang zu den Wesen der Unterwelt darzustellen und viele enthalten Fundmaterial, welches als Opfergaben angesehen werden kann. Die Ablagerungen in Wilsford jedoch werden als zufällige Ansammlung angesehen, da der Schacht, vielleicht wegen des Wassereinbruches, aufgegeben worden war. Der umweltliche Befund führt dazu die möglichkeit zu erwägen, daß der Schacht als Brunnen gegraben wurde, um das Vieh in einer austrocknenden Landschaft zu tränken. Die Knochen von diesen und andere Hinweise auf diese Tiere waren in dem sichergestellten Fundmaterial enthalten.

Aufzählung der Appendizes: weitere 'pond-barrows' und die errechneten Ausmaße der Schächte, die unter ihnen liegen könnten; führt Brunnen und deren Wasserspiegel in der näheren Umgebung auf; beschreibt die Ausgrabung, die Problematik der Pflanzen und die damit verbundenen Fragen; berichtet eingehend über die Verwitterung und Verschlammung des Schachtes wobei auf die Masse seiner Auffüllung Bezug genommen wird. Für die Umweltforschung förderliche Einzelheiten sind auf Mikrofiche beigefügt.

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Looking down into the Wilsford Shaft from the east side, October 1960.