DORSET NATURAL HISTORY
AND ARCHAEOLOGICAL SOCIETY

PROCEEDINGS OF THE DORSET NATURAL HISTORY AND ARCHAEOLOGICAL SOCIETY

edited by Dr Clare Randall

Volume 143. 2022

ISSN 0070-7112

Typesetting by Frabjous Books ~ www.frabjousbooks.com

Printed by Short Run Press, Exeter, UK

For information on previous volumes of the *Proceedings*, the DNHAS monograph series, instructions for submissions and full Notes for Contributors please visit

https://dorsetmuseum.org/publications/

Contact: editor@dorsetmuseum.org

The Society acknowledges the generous assistance received in making this publication possible. All papers are peer reviewed, and the editorial team thanks all our volunteer reviewers and copyeditors.

DORSET NATURAL HISTORY AND ARCHAEOLOGICAL SOCIETY

Board Members and Officers

President
Susan, Lady Bradbury

Vice Presidents
Mr R N R Peers MA FSA FMA Mr G A L-F Pitt Rivers OBE DL
Mrs P Seaton Sir Philip Williams Bt Mrs G Yarker BEM FSA

Past Presidents
The Countess of Sandwich Mr G A L-F Pitt Rivers OBE DL
Captain M Fulford Dobson CVO OBE RN

Chairman of the Board of Trustees
Mrs J Lang

Vice Chairmen of the Board of Trustees
Ms T Chevalier Mrs S Merriott

Dorset Council Board of Trustees Representative
Cllr S Bartlett

Board of Trustees
Mrs S Welton Ms T Parsons
Mr D French Ms S James
Mr J Smyllie Ms M Wood

Interim Executive Director
Ms Elizabeth Selby

Editorial Team

Editor:	Clare Randall
Subject Editors:	Claire Pinder (Archaeology)
	Nigel Webb (Biology)
	Gordon Le Pard (Dorset Coast)
	David James (Fine Art)
	Giles Droop (Geology)
	Angelique Richardson (Literature)
	Mark Forrest (Local History)
	Jill Minchin (Local History)
Administration:	Anna Butler (Museum Secretary)

The Dorset Natural History and Archaeological Society came into existence in 1928 with the coming together of the Dorset County Museum (founded in 1845) and the Dorset Natural History and Antiquarian Field Club (founded 1875). The County Museum was Dorset's first conservation body, which was formed in opposition to a plan of Isambard Kingdom Brunel to drive the line of his railway through Poundbury hillfort west of Dorchester and Maumbury Rings to the south.

The museum collection had several homes in Dorchester and Sherborne until the early 1880s when a public subscription headed by the Prince of Wales raised the money to buy the site of the George Inn and employ G.R. Crickmay to design the first part of the present building in High West Street. The museum was opened by the "father" of British Archaeology, General Augustus Henry Lane Fox Pitt-Rivers on 7 January 1884. In 1938–9, Handel (now Williams) House was added through the generosity of Sir Robert Williams. Re-building during the 1960s and 70s was a precursor to the redevelopment of the building as part of the Tomorrow's Museum for Dorset project and which opened in 2021. This will provide a secure home for the Dorset Natural History and Archaeological Society into the future.

The Society exists to collect, conserve, record and publish geology, palaeontology, natural history, archaeology, architecture and local history, fine and applied arts, textiles and literature as they pertain to the County of Dorset. The Society's collections are of international importance. The Society also promotes research into many Dorset-related fields. It publishes this annual *Proceedings* which contains papers and shorter contributions on the wide range of subjects which the Society has an interest in. The occasional Monograph Series supplements the *Proceedings*, which allows for the publication of substantial archaeological reports.

CONTENTS

A NOTE ON THE THIRTEENTH-CENTURY CORONATION OF THE VIRGIN SCULPTURE IN THE DORSET MUSEUM

MATTHEW M. REEVE AND JONATHAN FOYLE

The Dorset Museum in Dorchester contains a remarkable early-thirteenth-century sculpture of the Coronation of the Virgin flanked by kneeling figures, which appears to be completely unknown by scholars (Fig. 1). It makes several claims for our attention, not least of which is the fact that it represents a precociously early example of what would be a common iconography in high and late medieval European art. As T.A. Heslop has shown (2005; see previously Zarnecki 1950), the Coronation of the Virgin originated in Romanesque England around *c.* 1100 in the now-lost imagery of the Chapter House at Worcester, the cloister sculpture at Reading Abbey, the tympanum at Worth Matravers (Dorset) and Quenington (Glos). In the West Country in particular, it would be the focus of the magnificent west façade of Wells Cathedral begun around 1220, and it would also feature on the iconography of contemporary English seals (Reeve, in press). But the material record upon which we would base this early history of Marian imagery is far from complete.

We have few representations of the Coronation of the Virgin in wall painting (Black Bourton, Oxfordshire and Sutton Bingham, Somerset represent precious thirteenth-century survivals); and in panel painting, the Coronation features in the commissions of Henry III (1216–72) which are now known only from documentation (PRO 1916–64, 261; Binski 2005, 163)[1], and occasionally in small-scale architectural ornament such as the ex-situ vault boss from Abbey Dore (Herefordshire) (Richardson 2000, 90-1, fig. 64.). Although originating in England, a fuller history of the Coronation of the Virgin in France and Italy at sites such as Senlis Cathedral around 1170 and Santa Maria Maggiore, Rome around 1300 has been charted by Philippe Verdier (1980; in general, Schine Gold 1987, 61–8). As such, adding a further example to the iconographical corpus is significant. It is the purpose of this brief essay to introduce the sculpture and to briefly consider its place within the development of the iconographical tradition.

The iconography of the Coronation of the Virgin in the art of the church was a development of the flourishing of interest in the Virgin Mary that began around *c.* 1100. This extraordinary sea change in the devotional sensibilities of medieval people saw the Virgin Mary substantially supplant Christ as the central focus for devotion. One key production of the new interest in Mary was the compilation of her miracles by William of Malmesbury around *c.* 1130 and his many successors. Another was the new interest in the Song of Songs in which theologians such as Honorius Augustodunensis, William of Newburgh and others interpreted the love between Solomon and the Queen of Sheba to be that between Christ and the Virgin or between Christ and the Church (see Fulton-Brown 2002; 2017; Rubin 2009; Clayton 2003; Ihnat 2016). A long list of commentaries on the particularly Marian reading of the Song of Songs would be produced from *c.* 1100–1300. The Coronation was the pivotal moment that signified their union as King and Queen of Heaven or, in allegorical terms, as Christ wedding the church or *Ecclesia*, his bride (Matter 1990; Astell 1990; Fulton 1996).

Figure 1 The Coronation of the Virgin (Dorset Museum, accession number 1905.31).

Our first reference to the sculpture is in the third edition of John Hutchins' *Dorset* where it is recounted that the sculpture was discovered in 1863 when a series of buildings were taken down to erect new cottages at the Yetminster corner of Thornford, Dorset (Hutchins 1868, 302). The editor supposes that the sculpture may have signalled the presence of a former chapel on site, although there is no further evidence for this. He also notes the presence of other "ecclesiastical remains" that were discovered at the same time, but there is no record of what these remains were nor of their present location. The

Figure 2 The Coronation of the Virgin, The De Brailes Hours *c.* 1240 (London, British Library MS 4999, f. 61r).

sculpture was then the subject of a one-page notice in *Somerset and Dorset Notes and Queries* by C.H. Mayo in 1895, who was able to correct aspects of Hutchins' description (Mayo 1895, 241). The sculpture was then located in the Rectory after discovery and came into the permanent care of the Dorset Museum in 1905.

The Coronation of the Virgin has been set into a modern wooden base on its bottom edge. The sculpture is carved from Ham Hill stone, a Somerset building stone used also for tombs and other church furnishings in later medieval Somerset and Dorset (Gittos and Gittos 2012). Now missing material from all four sides, it measures 15 in high × 14 in wide and the maximum thickness is 3 ¼ inches. The crowned heads of Christ and the Virgin were clearly once framed by an arch but it is broken on the dexter side. The Virgin's hands are raised in prayer and Christ's dexter hand is extended, having crowned the Virgin, while His sinister hand rests on the Book. This accords with our understanding of the iconography in England, where, as Nigel Morgan has noted, the gesture of Christ blessing (rather than crowning) the Virgin does not appear to enter English art until after *c.* 1275 (Morgan 2016, 106; Later examples such as painted nave pier at St Albans and the Ramsay Psalter, both *c.* 1300, show Christ raising his hand in benediction, Michael 2018, 34–35). Although showing the Virgin with hands extended rather than in prayer, the image can be compared with the contemporary imagery of the De Brailes Hours (Fig. 2; Donovan, 1991). The feet of both figures rest on a cluster of splayed foliage. The kneeling figures to either side are now difficult to interpret because we are missing many key details due to the eroded condition of the surface. However, the

Figure 3 Reverse of the Coronation of the Virgin (as in Fig. 1).

hair styles (where they can be determined) and the fashionable nature of their garments suggests that they are lay figures and in all likelihood a husband and wife, with the male at dexter and the female at sinister. This is seemingly confirmed by the absence of symbols of office (crozier etc) as we would expect from a bishop or abbot. The sculpture also lacks a micro-architectural model being donated by the patrons, which would suggest that they had paid for the building in which the sculpture was once set (Klinkenberg 2009).

Turning to the archaeology of the sculpture, the form of the stone betrays at least two phases of use as we would expect from its nineteenth-century discovery (Fig. 3). The original form is indicated by the remains of a border, being a raised strip once defining an edge of compound curves, with a surviving junction of two arcs set over the shoulder of the Christ figure. The arc of these curves is difficult to establish, but the sculpted area is too large to account for a quatrefoil around the sides and bottom. Instead, containing the figures centrally depends on a vertical edge to both sides rising into this springer, answered by a symmetrically opposite springer creating a superior central arch to frame the focal figures. This stilted trefoil arch can be compared with the Coronation of the Virgin relief of *c.* 1230 over the central west door of Wells Cathedral (Fig. 4), and in the mural painting of a crucifixion flanked by the Virgin and St John in the wall painting of the solar of the contemporary Treasurer's House, Martock, a product of the Wells school of the mid thirteenth century.

Figure 4 Coronation of the Virgin, focal point of west façade of Wells Cathedral, *c.* 1230.

The reverse (Fig. 3) presents three parallel vertical drill holes, relics of splitting the stone with small feathers and wedges to carefully achieve an even pressure by which to reduce its original thickness by removing an unknown section to the reverse. A chamfer remains of the original carved surface, to the sinister of the reverse face, so the reverse of the block was not regular. The hollow section by Christ's head was not the consequence of this splitting, as its chamfers were partly removed in the process. Hence, the sculpture appears to have been intentionally pierced, although that it was set within an architectural frame rather than seen in the round or illuminated from behind, is clear. The archaeology allows us to speculate that the original context is likely to have resembled something akin to the small super-arches over the arcading at Lincoln Cathedral's quire aisles (after 1192) (Fig. 5), though perhaps half a century later as spandrel carving developed into displays such as Worcester Cathedral's Lady Chapel (*c.* 1230) where similar flat borders may be seen, and the canopies of Chapter Houses like Lichfield (after 1249). After its original installation, the sculpture was – at some point – heavily trimmed around the edges, doubtless when reused. A plug of lead at the top of the central drill hole (obscuring the hole hence evidently subsequent to the splitting) betrays the later setting of the piece against masonry, chiselling around some edges suggesting preparation for a shallow sub-surface mounting of a centimetre or so depth.

In the absence of further evidence, the date of the sculpture must be determined on the basis of stylistic comparison. The robust plasticity of the figures and their deeply undercut limbs indicate a date well into the first half of the thirteenth century. Unsurprisingly, perhaps, the sculpture is closely related to what was surely the most important and influential atelier in the south-west in the early Gothic period, that centred upon Wells Cathedral.

Figure 5 Lincoln Cathedral, syncopated arcade with dado sculpture, *c.* 1200.

The Thornford Coronation can be closely compared with the Old and New Testament sculptures at Wells that populated the quatrefoil apertures running across the top of the lowest register carved around 1230–40 (Sampson 1998, 239–53). These small-scale sculptures feature either single figures or densely populated compositions set within deep quatrefoils. The figure of St John (Fig. 6). on the west façade compares closely to the figure of Christ with splayed knees and deep, V-shaped folds falling between his knees. The sculpture of Christ preaching (Fig. 7) provides a useful parallel to our Coronation image with a range of bodies with drapery wrapped around their thighs and with the background of the sculpture cut away to frame the figures, as on the Thornford Coronation. Also readily paralleled at Wells are the distinctive buds of trefoil-headed foliage that Christ and the Virgin rest their feet upon. Although the Thornford Coronation is too damaged to allow for more intimate comparisons, this indicates that it must be roughly contemporary with the Wells quatrefoils of *c.* 1230–40. The new style of the west façade would be influential for subsequent art and architecture in the south-west: it manifestly served as a training ground for a new generation of sculptors who would work across much of the south-west in England and Wales (cf. a useful overview in Thurlby 2008). The Thornford Coronation belongs squarely in this artistic milieu.

In light of the scant evidence for the Coronation of the Virgin before *c.* 1300, it is not possible to concisely locate the Thornford sculpture within the iconographical tradition. While we can point to a list of works of art featuring a monastic patron kneeling in prayer to the Coronation of the Virgin, as for example, on the Shaftesbury seal of *c.* 1230 (Fig. 8), the Thornford sculpture is an early example in monumental art of secular donors kneeling in prayer and witnessing the Coronation of the Virgin. Although we are unaware of another example of this date in English art, a close comparison is found in the stained glass panel of *c.* 1250 now in the Museum Schnütgen, which features the Coronation

Figure 6 St John, west façade of Wells Cathedral *c.* 1230.

of the Virgin above and two kneeling, secular donors described as THEODERVS and GERTRVDIS below (Fig. 9; Museum Schnütgen 2022).

The Thornford sculpture has no evidence of such identificatory inscriptions, although it is possible that these were executed in paint in the blank spandrel zones above each lay figure. In any case, this iconography would be common in later medieval art and would appear in monumental sculpture around 1250 at Moutiers St Jean (now at the Cloisters Museum, New York), where the donors appear to be retrospective representations of the first Christian kings of France, Clovis and his son Clothar, and on the Porte Rouge at Notre Dame *c.* 1260–70 which is flanked by figures conventionally identified as Louis IX and Marguerite de France (Forsyth 1978; Gaposchkin 2000). In manuscript painting, we can point to the appearance of secular donors bearing the arms of the Foliot and Bardolf families witnessing the Coronation of the Virgin atop a Tree of Jesse in the *Beatus* initial in the Ormesby Psalter around

Figure 7 Christ teaching, west façade of Wells Cathedral *c.* 1230.

Figure 8 Seal of Shaftesbury Abbey featuring the Coronation of the Virgin, *c.* 1230.

Figure 9 Coronation of the Virgin, stained glass panel *c.* 1250, Museum Schnütgen, Cologne.

1300 (Oxford, Bodleian Library, MS Douce 366, f. 9v; Law-Turner 2017). The Thornford sculpture may thus represent an example of a new transition of inserting lay patrons into the imagery of the Coronation of the Virgin, itself an instance of emulating the commemorative traditions manifest in the arts of the monastery.

In light of the condition of the sculpture, it would be hazardous to assert a particular provenance for it, although the evidence allows us to advance some interesting possibilities. The style of the sculpture and its material (Ham Hill stone) leaves no reason to doubt that it is anything other than a very local production of the South-West. The immediate environs of course had a number of significant buildings with Marian dedications, including Shaftesbury Abbey. Although now largely ruinous, its seal of *c.* 1220–30 bears some similarities with the Thornford sculpture (Fig. 8, cf. Fig. 1). A still more attractive candidate is nearby Sherborne Abbey (just 4.5 miles from Thornford) which had a magnificent Lady Chapel built in the early thirteenth century of which now precious little remains. Not only was Ham Hill stone used in the work at Sherborne, but the extant fabric of the Lady Chapel shows close links to the contemporary work at Wells Cathedral, which agrees with the stylistic evidence of the Thornford Coronation (Morris and Monckton 2005; Monckton 2000). Although the chapel is now lost, we can point to the tradition in English Lady Chapels of continuous dados of historiated imagery as in the Elder Lady Chapel at Bristol, the aforementioned chapel at Worcester, the Lady Chapel *Juxta Claustrum* at Wells, and so on (Reeve 2021). More research will be required to establish whether a specific location for the Thornford Coronation can be established. Although the precise location for the sculpture cannot now be determined, it is hoped that this brief paper will inspire further research into what is a rare survival of thirteenth-century Gothic art.

ACKNOWLEGEMENTS

The authors are grateful to Professor Julian Luxford for alerting us to the existence of this sculpture, to Professors Malcolm Thurlby, Nigel Morgan and T.A. Heslop for discussing it, and to the staff of Dorset Museum for facilitating access to it.

Note

1 An early survey of the evidence for the Coronation of the Virgin in England in the twelfth and thirteenth century is now in need. For the late middle ages, see Morgan (1993; 1994).

REFERENCES

Astell, A.W. 1990. *The Song of Song in the Middle Ages*. Cornell University Press, Ithaca, NY.

Binski, P. 2005. *Becket's Crown: Art and Imagination in Gothic England 1170–1300*. Yale University Press, New Haven and London.

Clayton, M. 2003. *The Cult of the Virgin in Anglo-Saxon England*. Cambridge University Press, Cambridge.

Donovan, C. 1991. *The De Brailes Hours: Shaping the Book of Hours in Thirteenth Century Oxford*. British Library, London and Toronto.

Forsyth, W.H. 1978. 'A Gothic Doorway from Moutiers-Saint-Jean', *Metropolitan Museum Journal* **13**, 33–74.

Fulton, R. 1996. 'Mimetic Devotion, Marian Exegesis, and the Historical Sense of the Song of Songs', *Viator* **27**, 85–116.

Fulton-Brown, R. 2002. *From Judgment to Passion: Devotion to Christ and the Virgin Mary, 800–1200*. Columbia University Press, New York.

Fulton-Brown, R. 2017. *Mary and the Art of Prayer: The Hours of the Virgin in Medieval Christian Life and Thought*. Columbia University Press, New York.

Gaposchkin, M.C, 2000. 'The King of France and the Queen of Heaven: the Iconography of the Porte Rouge of Notre Dame of Paris', *Gesta* **39:1**, 58–72.

Gittos, B. and Gittos, M. 2012. 'Medieval Ham Hill Stone Monuments in Context', *Journal of the British Archaeological Association* **165**, 89–121.

Heslop, T.A. 2005. 'The English Origins of the Coronation of the Virgin', *Burlington Magazine* **147: 1233**, 790–97.

Hutchins, J. 1868. *The History and Antiquities of the County of Dorset, vol. 4*. 3rd edn, London.

Ihnat, K. 2016. *Mother of Mercy, Bane of the Jews: Devotion to the Virgin Mary in Anglo-Norman England*. Princeton University Press, Princeton and Oxford.

Klinkenberg, E. 2009. *Compressed Meanings: The Donor's Model in Medieval Art to around 1300*. Turnhout, Brepols.

Law-Turner, F.C.E. 2017. *The Ormesby Psalter: Patrons and Artists in Medieval East Anglia*. Bodleian Library, Oxford, 106–8.

Matter, A. 1990. *The Voice of My Beloved: The Song of Songs in Western Medieval Christianity*. University of Pennsylvania Press, Philadelphia, 65–69.

Mayo, C.H. 1895. 'Ancient Carving, Thornford', *Somerset and Dorset Notes and Queries* June 1895.

Michael, M. 2019. *St Albans Cathedral Wall Paintings*. Scala Arts & Heritage Publishing, London.

Monckton, L. 2000. 'The Late Medieval Rebuilding of Sherborne Abbey: A Reassessment', *Architectural History* **43**, 88–112.

Morgan, N. 1991 'Texts and Images of Marian Devotion in Thirteenth-Century England', *England in the Thirteenth Century. Proceedings of the 1989 Harlaxton Symposium*. W.M. Ormrod (ed.) Stamford, Harlaxton Medieval Studies, 69–103.

Morgan, N. 1993. 'Texts and Images of Marian Devotion in Fourteenth-Century England', in N. Rogers (ed.), *England in the Fourteenth Century: Proceedings of the 1991 Harlaxton Symposium*. Watkins, Stamford, 30–53.

Morgan, N. 1994. 'The Coronation of the Virgin by the Trinity and Other texts of the Glorification of Mary in Fifteenth-Century England', *England in the Fifteenth Century: Proceedings of the 1992 Harlaxton Symposium. Harlaxton Medieval Studies* **4**, 223–241

Morgan, N. 1999 'Texts and Images of Marian Devotion in English Twelfth-Century Monasticism, and Their Influence on the Secular Church', *Monasteries and Society in Medieval Britain*. B. Thompson (ed.) Stamford, Harlaxton Medieval Studies **6**, 117–36.

Morgan, N. 2016. 'Some iconographic aspects of Opus Anglicanum', in M.A. Michael (ed.) *The Age of Opus Anglicanum*. Turnhout, Brepols, 91–115.

Morris R. and Monckton, L. 2005. 'Gothic Architecture and Worked Stones 1170–1650', in L. Keen and P. Ellis (eds) *Sherborne Abbey and School Excavations 1972–76*. Dorset Natural History and Archaeological Society Monograph **16**.

Museum Schnütgen 2022. *Museum Schnütgen* https://museum-schnuetgen.de/Wege-durch-die-Sammlung?kat=12 [Accessed 25 June 2022].

Public Record Office (PRO) 1916–64. *Calendar of Liberate Rolls preserved in the Public Record Office (1226–40) I*. PRO, London.

Reeve, M.M. 2021. 'Fragments from Wisdom's House: the Lady Chapel *Juxta Claustrum* at Wells Cathedral', in J. Luxford (ed.) *Medieval Gothic: Art, Architecture and Ideas. Tributes to Paul Binski*. Harvey Miller, New York, 186–97.

Reeve, M.M. in press. 'An Epithalamium in Stone: the West Façade of Wells Cathedral', *Journal of the British Archaeological Association* **175**.

Richardson, R. 2000.'People in the Abbey", in R. Showsmith and R. Richardson (eds) *A Definitive History of Dore Abbey*. Eardisley, Logaston Press, 85–97.

Rubin, M. 2009. *Mother of God: A History of the Virgin Mary*. Penguin Books Limited, London.

Sampson, J. 1998. *Wells Cathedral West Front: Construction, Sculpture and Conservation*. Sutton, Stroud.

Schine Gold, P. 1987. *The Lady and the Virgin: Image, Attitude and Experience in Twelfth Century France*. University of Chicago Press, Chicago, 61–8.

Thurlby, M. 2008. 'The Integration of Architecture, Imagery and Ornament in English West Country Gothic Architecture', in M.M. Reeve (ed.), *Reading Gothic Architecture*. Turnhout, Brepols, 75–92.

Verdier, P. 1980. *Le Couronnement de la Vierge: Les origins et premiers développements d'un theme iconographique*. Institut d'études médiévales, Montreal and Paris

Zarnecki, G. 1950. 'The Coronation of the Virgin on a Capital from Reading Abbey', *Journal of the Warburg and Courtauld Institutes* **13**, 1–12.

The authors: Matthew M. Reeve FSA is Professor of Art and Architectural History at Queen's University. He is the author of Gothic Architecture and *Sexuality in the Circle of Horace Walpole* and is now working on a book on the sculpture of Wells Cathedral. Dr Jonathan Foyle was Curator of Historic Buildings, Historic Royal Palaces and Chief Executive of World Monuments Fund Britain. His PhD examined Thomas Wolsey's Hampton Court Palace and he has authored seven books on English medieval buildings. His research interests include architecture, iconography, furniture and material culture. Correspondence: editor@dorsetmuseum.org

A 'JEWEL IN THE CROWN' OF EDWARDIAN CONGREGATIONALISM? BOURNEMOUTH 1901–14: PART 1

ROGER OTTEWILL

In the late Victorian and Edwardian eras Bournemouth prided itself as a town that gave particular attention to the spiritual needs of visitors and residents alike. One of the leading denominations in this respect was Congregationalism with it being the location of Richmond Hill Congregational Church – the largest affiliated to the Hampshire Congregational Union. From 1898 to 1937 the minister was the renowned Congregational statesman the Revd John Daniel Jones. Richmond Hill played a key role in establishing and supporting a number of Congregational causes in the area. In the first part of this two part article particular attention is given to those features of the demographic and social setting which enabled Congregationalism to flourish; the statistical record of Bournemouth's Congregational churches; and the ministers who led them sometimes during periods of considerable difficulty. Of varying personalities, these included the Revd Alexander Gibson at Charminster Road; the Revd William Moncrieff, at East Cliff; the Revd Francis Sloper at Boscombe; the Revd Harry Schofield at Pokesdown; and the Revd Alfred Martindale at Westbourne.

INTRODUCTION

Towards the end of the Victorian era it was claimed in a contemporary guide to Hampshire and the Isle of Wight that there were 'few towns where the spiritual needs of the population ... [were] provided for in such an ample manner as Bournemouth'. Moreover, it went on to provide a comprehensive list of the places of worship amongst which were the 'Congregational Churches in Sanatorium Road, Holdenhurst Road, Christchurch Road, Boscombe; Prince of Wales' Road, Westbourne; and Wimborne Road, Winton' (*Hampshire and Isle of Wight Illustrated Guide* 1894, 73). Due to the relative newness of Bournemouth all of these churches had been founded during the nineteenth century (see Table 1). The existence of such a large number of Congregational churches was an indication of the strength of this denomination in the rapidly growing coastal resort of Bournemouth during late Victorian and Edwardian periods.

In seeking to explain Congregationalism's standing in Bournemouth, a number of factors were at work. First, it was home to Richmond Hill (Fig. 1), the largest of the churches affiliated to the Hampshire Congregational Union (HCU). At the time Bournemouth was in the county of Hampshire. With a membership of between 600 and 700, this Church played a key role in supporting and/or establishing a number of other Congregational causes in the area. Even more pertinently, however, was the

Table 1 Bournemouth's Congregational Churches in 1901.

Name	Location	Founded	Sittings
Richmond Hill	Sanatorium Road[3]	1856	1200
East Howe[1]	---	1832	100
Longham[1]	---	1835	350
Pokesdown	Southbourne Road	1874	440
East Cliff	Holdenhurst Road	1877	1000
Malmesbury Park[2]	Malmesbury Park Road	1894	300
Boscombe	Christchurch Road	1887	500
Westbourne	Prince of Wales' Road	1891	600
Winton	Wimborne Road	1894	400

Notes

[1] Branch churches of Richmond Hill.
[2] Branch church of East Cliff.
[3] Later Bourne Avenue.
Source: *HCU Annual Report*, 1901.

Figure 1 Richmond Hill Congregational Church.

fact that between 1898 and 1937 Richmond Hill's minister was the leading Congregational statesman, the Revd John Daniel (J.D.) Jones. Elsewhere, Jones has been designated a 'cosmopolitan' pastor, but one who had great respect for his colleagues, who were far more 'local' in their orientation (Ottewill 2011b). His reputation was such that he was something of a 'celebrity', with his fame as a preacher attracting large numbers of 'ecclesiastical tourists' to Bournemouth thereby helping to boost the prestige of Congregationalism in the town and its environs. As reported in 1906:

> *'The majestic pile at Richmond Hill, to which a stream of worshippers flows Sunday after Sunday, has been called "the cathedral of Nonconformity in Hampshire" ... During Mr Jones's pastorate the church has flourished as never before ... On Sundays the handsome church is crowded, scores of visitors to Bournemouth, who have heard of this eloquent Welshman's preaching flocking to hear him'* (*Bournemouth Graphic* 18 May 1905).

Under Jones's leadership, in the years leading up to the First World War Richmond Hill continued to assist with the planting of new churches in the suburbs of Bournemouth, specifically Charminster Road (founded in 1901) and Immanuel Church, Southbourne (1910). Indeed, the church historian entitles his chapter covering Jones's pastorate, 'An Era of Expansion' (Davies 1956, 42–58).

In this respect, Richmond Hill can be seen as following the lead taken by the Congregational Church in Christchurch which had served as the catalyst for church extension in the Bournemouth area as it developed into a major tourist centre during the second half of the nineteenth century. As J.D. Jones himself pointed out, when chairing the public recognition meeting for the Revd James Learmount at the start of his ministry in Christchurch in 1901, 'the whole of the Congregational churches in Bournemouth and its immediate neighbourhood had originated from' the town, thereby acknowledging the debt owed to what he described as the 'mother church' (*Christchurch Times* 2 March 1901).

In fulfilling its role as a 'mother church', throughout the Edwardian era, Richmond Hill provided support, in human as well as financial terms, to its branch churches, with its annual meetings affording them opportunities to review their progress and highlight any challenges they faced. Furthermore, as will be seen, when Winton Congregational Church got into difficulties, Richmond Hill stepped in and resumed overall responsibility for the cause in 1908.

A second factor was that as a holiday resort and a convention centre, Bournemouth was visited by large numbers of people from elsewhere. In 1903, for example, it hosted the autumn assembly of the Congregational Union of England and Wales (Fig. 2). Thus, it received considerable attention from the media and this in turn benefited Congregationalism, in particular, and the religious life of the community more generally.

A third factor was that not only did Bournemouth's population experience a rapid increase but there was also a very high ratio of women to men in the population. Since women outnumbered men in the membership of Congregational churches often by a margin of two to one, this meant that the area was a very favourable recruiting ground, a point which is developed later.

A final factor was that there was what might be described as a symbiotic relationship between the religious and civic cultures of the town. As it was put at the celebrations to mark the 11th anniversary of the opening of Richmond Hill's new premises by Alderman John Elmes Beale, a local businessman, who founded a well known chain of department stores; a leading member of the borough council; and a Congregational deacon:'

> *'... the ambition of every member of the Town Council was to make Bournemouth more beautiful, both physically and morally. He was glad also to be present as deacon of that church, because as Christian people its members were doing all they could to make Bournemouth spiritually beautiful, their lofty ideal being to win Bournemouth for Jesus Christ (applause)'.*

At the time a key element of council policy, which was fully backed by the churches, was the application of the principle of a 'quiet Sunday' (Ottewill 2019a).

In Part 1 of this two part article, particular attention is given to the demographic and social setting within which Congregationalism flourished; the

Table 2 Distribution of the Population of Bournemouth in 1901 and 1911 by Gender.

Gender	1901			1911		
	Bournemouth		Hampshire	Bournemouth		Hampshire
	No	%	%	No	%	%
Male	17350	36.9	49.0	30564	38.8	49.7
Female	29653	63.1	51.0	48110	61.2	50.3
Total	47003	100.0	100.0	78674	100.0	100.0

Table 3 Distribution of the Population of Bournemouth in 1901 and 1911 by Age.

Age Band	1901			1911		
	Bournemouth		Hampshire	Bournemouth		Hampshire
	No	%	%	No	%	%
under 5	3330	7.1	10.6	5746	7.3	10.2
5 to 17	10130	21.6	25.9	15193	19.3	23.3
18 to 60	30830	65.6	58.1	51830	65.9	60.8
Over 60	2713	5.8	5.4	5905	7.5	5.8
Total	47003	100.0	100.0	78674	100.0	100.0

statistical record of the Congregational churches; and the ministers who led them, sometimes during periods of considerable difficulty. Part 2 focuses on the deacons, who served the churches as lay leaders, and their social standing, which was generally middle class, in keeping with the perceived milieu of many Congregational churches; aspects of church life, including music and work with children and young people; and the manner in which churches engaged with each other and across denominational boundaries, through the activities of the Bournemouth Free Church Council, and with the wider community.

Much of the evidence is drawn from contemporary newspaper reports and surviving Church records, many now held in the Dorset History Centre [DHC], as well as a small number of secondary sources relating to particular churches (Davies 1956; Turner Smith 1966; Dyer 1968; Michael 1970; Ottewill, 2019b; Ottewill 2022). Reflecting, in part, 'the spirit of the age', Edwardian newspapers devoted a considerable amount of copy to church affairs. Although press reports were frequently supportive and deferential in tone, they can often afford insights that are not necessarily available from elsewhere. To date, the relatively few secondary sources are essentially case studies focusing on particular periods in the life of a church.

In the conclusion to Part 2 an attempt is made to provide an overall assessment of the standing of Congregationalism in Edwardian Bournemouth. Some denominational historians, such as Reg Ward, describe the 'period between the middle of the nineteenth century and the First World War ... [as] the golden age of Congregationalism' (Ward 2003, 16). By contrast, Robert Tudur Jones in his *magnum opus* of the first 300 years of Congregationalism uses the phrase 'darkening skies' to describe the last decade of the nineteenth century and the Edwardian era in a chapter entitled 'The Beginning of Sorrows' (Jones 1962). In the light of this how far would it be true to say that Bournemouth was a 'jewel in the crown' of Edwardian Congregationalism?

THE SETTING

As described in *Kelly's Directories* for the early years of the twentieth century:

> *'Bournemouth is a rising and fashionable watering-place ... The town has increased rapidly, and contains many capacious and elegant mansions and villas, and is much frequented by invalids on account of its mild and genial atmosphere, its facilities for bathing, the pine woods and beautiful scenery in its neighbourhood'* (*Kelly's Directory* 1903, 66).

During the late nineteenth century the resort had expanded rapidly to include the neighbouring communities of Boscombe, Southbourne and Pokesdown. By the Edwardian era Boscombe was described as 'an important and rapidly rising suburb of Bournemouth' (*Kelly's Directory* 1903, 69); Southbourne-

Table 4 Bournemouth's Congregational Churches in 1901.

Church	Members	Sunday School Scholars	Teachers	Lay Preachers
Richmond Hill[1]	656	480	41	20
East Howe	33	86	11	
Longham	46	120	13	
East Cliff[2]	243	571	46	
Boscombe	203	170	26	3
Westbourne	42	51	8	2
Winton	93	418	26	
Pokesdown	106	140	15	2
Totals	1422	2036	186	27

Notes:
[1] Including Charminster Road.
[2] Including Malmesbury Park.

Source: *HCU Annual Report*, 1901.

Table 5 Bournemouth's Congregational Churches in 1911.

Church	Members	Sunday School Scholars	Teachers	Lay Preachers
Richmond Hill[1]	883	533	81	22
East Howe	44	86	11	
Longham	62	101	13	2
East Cliff[2]	361	422	61	3
Boscombe	247	179	49	3
Westbourne	91	59	6	1
Winton	160	304	30	
Pokesdown	111	193	14	
Totals	1959	1877	265	31

Notes:

[1] Including Charminster Road.
[2] Including Malmesbury Park.

Source: *HCU Annual Report*, 1911.

on-Sea as a 'watering place'; and Pokesdown as 'part of the borough and parish of Bournemouth' (*Kelly's Directory* 1903, 66). In 1900 Bournemouth acquired county borough status, thereby enhancing its kudos in municipal terms. During the first decade of the 20th century it continued its rapid expansion, with the population increasing from 47,003 in 1901 to 78,674 in 1911. Some of this was due to the extension of the boundaries of Bournemouth in November 1901 to include Pokesdown and Winton urban districts and part of Christchurch rural district. The basis of Bournemouth's economy as a holiday resort is clearly reflected in the data on occupations from the 1901 and 1911 censuses, with two of the largest categories of employment for males aged over 10 being 'food, tobacco, drink, and lodging' and 'conveyance of men, goods and messages'. Another major category was 'building, and works of construction' reflecting the town's rapid growth.

As has already been mentioned the population was skewed towards females. This is illustrated by the data in Table 2. In this respect Bournemouth was significantly different from the county as a whole. Moreover, given its favourable climate, there was also an increasing bias towards the elderly in Bournemouth's population when compared with Hampshire, as confirmed by the data in Table 3. Thus, the attraction of Bournemouth as a retirement area was already apparent.

With respect to the religious practices of Bournemouth's population, it is not possible to provide precise information since, unlike Portsmouth, Basingstoke and Whitchurch, no survey of churchgoing was undertaken by a local newspaper in the early years of the 20th century. However, in 1903 there was sufficient seating or sittings in Bournemouth's churches

Figure 2 CUEW.

collectively to accommodate approximately 44 per cent of the population, compared with only 18 per cent in Portsmouth and 21 per cent in Southampton. Approximate figures for the major denominations were Anglican churches 11700 sittings; Congregational, 4000; Wesleyan Methodist, 1600; Baptist, 1100; and Roman Catholic, 1000. Of course, seating does not equate to attendance, but on the basis of evidence from other parts of the county it is probable that on a typical Sunday evening many churches were two-thirds full, with at least one third of Bournemouth's population attending church on a regular basis. Some confirmation of this comes from a series of articles on the British Sunday published by the *Daily Telegraph* in 1905, with the town being renowned for its religiosity:

> *'With regard to the present aspect of Sunday at Bournemouth, it might be stated that numerous churches are filled to overflowing most Sundays, and the erection of new churches speedily secure crowded congregations. Visitors and townspeople alike very largely regard Sunday as a day set apart exclusively for religious observance, and public amusement is in almost every form discouraged'* (*Daily Telegraph* 6 October 1905).

How then did Congregationalism fare in what can be regarded as a propitious setting?

THE STATISTICAL RECORD

By the turn of the 20th century Congregationalists, in keeping with members of other Nonconformist denominations, had become assiduous compilers of statistics. Every year churches were required to submit to the HCU returns covering their memberships and Sunday schools. Those relating to Bournemouth's churches for the two census years of 1901 and 1911 have been collated in Tables 4 and 5 respectively. On the basis of the figures shown in Table 4, approximately 3.5 per cent of Bournemouth's adult population were members of a Congregational Church and 15 per cent of the population aged between 5 and 17 were Congregational Sunday school scholars. While the numbers may not appear to be very large, by comparison with Portsmouth and, to a lesser extent Southampton, Congregationalism in Bournemouth was flourishing. Moreover, members only represent one group, albeit the most committed, of those attending a Congregational church on a regular basis. Drawing upon evidence from elsewhere in the county, it is likely that in a typical congregation there would have been at least as many non-members as members and substantially more in the holiday season. To become a member it was necessary to make a declaration of faith, a step some non-members, generally known as adherents, did

Table 6 Bournemouth's Congregational Churches in 1914.

Church	Members	Sunday School Scholars (SSS)	Teachers	Lay Preachers
Richmond Hill[1]	935	557	79	22
East Howe	38	96	11	
Longham	64	107	13	
East Cliff[2]	402	700	64	
Boscombe	229	185	45	3
Westbourne	97	68	12	1
Winton	210	390	40	
Pokesdown	114	151	16	
Southbourne	125	38	6	1
Totals	2214	2292	286	27

Notes:

[1] Including Charminster Road (215 members).
[2] Including Malmesbury Park and Spring Road.

Source: *HCU Annual Report*, 1914.

not wish to make. However, this did not necessarily affect their loyalty to, and engagement with, the church they attended (Ottewill 2011a).

Comparing the figures for 1901 with those for 1911, at first sight the performance of the eight Bournemouth churches looks very impressive, with total membership increasing from 1422 to 1959. Every church grew in terms of its membership, although there was considerable variation with percentage increases ranging from over 110 per cent at Westbourne to as little as five per cent at Pokesdown. The overall increase was 38 per cent, compared with an increase in the total population of 32 per cent. This, coupled with the founding of the new church at Southbourne in 1910, suggests a spirit of enterprise enthused with evangelistic fervour. A sense of this can be gained from the following account of what happened at East Cliff, following the arrival of a new minister, the Revd William Moncrieff in early 1901. Here the membership increased from 150 in 1902 to 320, at the time of Moncrieff's premature death in 1907 (East Cliff Jubilee Souvenir 1927). Such endeavour was undoubtedly a feature of many, if not all, Bournemouth churches during this period.

However, there are a number of caveats. First, the increase in the adult, as opposed to total, population of Bournemouth was 43 per cent. Thus, membership of the eight churches as a percentage of the adult population actually fell from around 3.5 per cent to just under 3.4 per cent, although if the membership of Southbourne is included it remains at 3.5 per cent. Second, it needs to be reiterated that the gender balance of Bournemouth's population was an extremely favourable one as far as church membership was concerned. Likewise, the age distribution, since older people were more likely to join a church than the young. Third, while adult membership increased, the number of Sunday School scholars fell by 8.0 per cent and as a percentage of the younger members of the population from 15.0 to 12.4 per cent. Indeed, by 1911 the number of church members exceeded the number of Sunday School scholars, a relatively unusual state of affairs.

Between 1911 and the outbreak of the First World War, church memberships continued to increase, apart from at East Howe. At Southbourne, for example, after an hiatus caused by the ill-health of the first minister and an interregnum, in 1912 the new minister the Revd Baldwin Brindley reported that 'the congregation had doubled in five months, and he was told by the Church Treasurer that the regular church income had doubled what it was a year ago' (*Bournemouth Guardian* 15 June 1912). Moreover, the encouraging progress was sustained and two years later reference was made to the fact that 'during the previous twelve months membership had increased by 30 per cent' (*Bournemouth Guardian* 7 February 1914). Figures reported to the HCU show that Southbourne's membership increased from 63 in 1911 to 125 in 1914.

Table 7 Ministers of Bournemouth's Congregational Churches during the Edwardian Era.

Church	Minister	Period of Pastorate
Richmond Hill[1]	John Daniel Jones	1898-1937
	John Evelyn Thomas (Asst)	1908-1911
	Arthur Joseph Sadd (Asst)	1911-1915
(Charminster Road)	Alexander George Gibson	1901-1910
	Richard Lister Franks	1913-1917
(Longham)	Henry Edwin Ellison	1903-1922
East Cliff[2]	William Moncrieff	1901-1907
	John Philip Rogers	1908-1915
Boscombe	Francis Sloper	1894-1909
	Alfred Clegg	1910-1917
Pokesdown	Harry Schofield	1894-1916
Westbourne	Alfred Martindale	1901-1910
	John Harrison Milnes	1911-1917
Winton[3]	Ben Evans	1897-1908
	Howard Page James	1908-1918
Southbourne[4]	Alfred Reissmann (later Riceman)	1910-1911
	Richard Baldwin Brindley	1912-1919

Notes
[1] The ministers of Richmond Hill also served its branch churches at Charminster Road, East Howe and Longham.
[2] The ministers of East Cliff also had responsibility for the preaching stations at Malmesbury Park and Spring Road.
[3] Between 1908 and 1911 Winton was technically a branch church of Richmond Hill.
[4] Immanuel Congregational Church, Southbourne, was opened in 1910.

With respect to church extension, in 1913 the Executive Committee of the HCU was able to report, with a certain amount of satisfaction, that:

> *'... the completion and opening of the enlarged Church at Winton, Bournemouth, at a cost of £7,000, of which £5,500 has been raised. Westbourne Church has reduced its debt on the Church from £2,500 in 1911 to £1,350'* (HCU 1913).

It is also noteworthy, that the relatively wealthy Bournemouth churches made substantial financial contributions to the HCU thereby enabling it to subsidise the work of less well endowed churches elsewhere in the county. In 1901, for example, Richmond Hill donated £50 and by 1914 this had increased to £150 17s 9d plus a grant of £25 for Southbourne Congregational Church.

The distribution of the total membership between the churches in 1914 is shown in Table 6.

Such statistics reflected the ability of Congregationalism to thrive in Edwardian Bournemouth. However, again it needs to be borne in mind that the demographic profile of the area and many cultural considerations, such as attitudes towards the treatment of Sunday, although being eroded, remained extremely favourable.

CHURCHES AND MINISTERS

Given the standing of Congregationalism within Bournemouth it is not surprising that some high calibre ministers were attracted to its churches. As elsewhere, they were required to perform a variety of roles, including those of preacher, administrator, evangelist, politician, mediator and pastor. The names of those serving Bournemouth churches and the dates of their pastorates are provided in Table 7.

As previously mentioned, the towering presence amongst Bournemouth's ministers and within Hampshire Congregational circles more generally was J.D. Jones at Richmond Hill. He was undoubtedly a gifted preacher but not one associated with histrionics. On the contrary he 'was restrained, quiet, unhurried ... simple and homely. What was striking was his voice. The music of his Welsh voice cast a spell on his hearers' (Taylor 2008, 91). Indeed, it was this mellifluence that led some to suggest that Jones' preaching was more timbre than substance (Ottewill 2011b). However, 'if he did not possess the torrential flow of words that his predecessor [Ossian Davies] had, there was a fine, compelling power about his preaching which was greatly to the liking of his congregation' (Davies 1956, 45).

Charminster Road Congregational Church, Bournemouth, Completed and Opened, September 13th, 1905.

Figure 3 Charminster Road Congregational Church.

Given the demands made on Jones, it is not surprising that Richmond Hill often had at least one assistant minister. During the Edwardian period these were the Revds John Thomas, Arthur Sadd, Alexander Gibson, Richard Franks and Henry Ellison. Like Jones, Thomas was a Welshman. In 1908 he moved to Richmond Hill from Treforest, where he had been ordained two years earlier. Noted for his friendly disposition and the fact that 'he felt others' troubles as though they were his own', a particularly attractive quality was his 'fine spirit of ministry, and his unstinted devotion' (*Congregational Year Book* 1956, 526). After three years at Richmond Hill , in 1911 he accepted a call to the pastorate of Warwick Road Congregational Church in Coventry.

His successor, Arthur Sadd was from Essex. Although keen to undertake work overseas with the London Missionary Society, this was curtailed due to poor health. He came to Richmond Hill after two years visiting parts of Asia and took 'full pastoral charge during Dr Jones's visit to Australia' (*Congregational Year Book* 1961, 449).

Alexander Gibson's first pastorate was at Blyth in Northumberland from 1898 to 1901. He was then invited to be the first of J.D. Jones' assistant ministers, with particular responsibility for the daughter church at Charminster Road (Fig. 3). Under his watch 'the work at Charminster Road so prospered that after four years' new premises were built. Described as 'a friendly man, a welcome visitor to all, in joy or sorrow; eager, sincere, joyful, and of unfeigned sympathy', he was ideally suited for the pastoral aspects of Christian ministry (*Congregational Year Book* 1948, 494). As Webb records: 'Mr Gibson found Charminster Road Church nine years ago a mere handful of Christian people, but leaves it a large strong and progressive community, with all its departments in a healthy and growing condition' (Webb 1910, 99). At Gibson's farewell gathering, Mr F.G. Burrounghs, the secretary of the Sunday school, was fulsome in his praise, highlighting the interest

Figure 4 Longham Congregational Church.

Gibson took in children's work and his 'practical wisdom, generous enthusiasm, and brotherly kindness' (*Bournemouth Guardian* 3 December 1910). The substantial contribution of his wife, Eleanor, to the life of the church also received due recognition. From Bournemouth the Gibsons moved to St George's Middlesborough Congregational Church. As J.D. Jones pointed out at the valedictory service for them, 'St George's Church is the most important one in the entire district'. It might also 'be called the "Richmond Hill" of Middlesbrough. Only that instead of three branch churches, there were some 16 branch and mission churches in connection with it' (*Richmond Hill Magazine* January 1911, v).

Following Gibson's departure, Charminster Road was without a settled minister for two and half years. For the later part of the period, the ex-minister of Boscombe Baptist Church, the Revd Philip Henry Smith, served in this role receiving 'nothing but kindness and generous hospitality' especially given that 'his position there had been a somewhat difficult and delicate one' (*Bournemouth Guardian* 16 March 1912). In November 1912 he was forced to resign as

Figure 5 East Cliff Congregational Church.

Figure 6 Boscombe Congregational Church.

a result of illness, with the Church Secretary, Mr Worsley Benison, observing that: 'The high ideal of Christian duty held out to them by Mr Smith and the deep spirituality of his sermons, together with his other sincere and much appreciated work made his time with them a happy memory' (*Bournemouth Guardian* 22 February 1913).

In 1913 the Church acquired a replacement for Smith in the person of the Revd Richard Lister Franks. He had previously pastored the Congregational church in Shrewsbury where, as the Church Treasurer commented, he 'had won the affection and esteem of all his people' (*Bournemouth Guardian* 22 February 1913). Another speaker, the Revd Frank Leggatt, an 'intimate friend' of Franks observed that 'he would not make a dazzling first impression, but [he was] a man whose character and preaching would grow on them as time progressed' (*Bournemouth Guardian* 22 February 1913). A year later, Franks reported that 'all the institutions were ... moving slowly and steadily forward' (*Bournemouth Guardian* 7 February 1914). He remained at Charminster Road until 1917 when he moved to Gosport. In his official obituary it was recorded that he 'was a minister with a well-trained mind, a devout spirit and a confident faith [who had] a great capacity for making and keeping friends' (*Congregational Year Book* 1949, 499).

At Longham (Fig. 4), another of Richmond Hill's branch churches, the Revd Henry Ellison was minister for a lengthy period from 1903 to 1922. Prior to his call to Bournemouth, he had been an evangelist in association with Lewisham High Road Congregational Church in London (Surman Index). At his recognition service in May 1903 he 'feelingly acknowledged the warmth of his reception, not only that day, but since his arrival in Longham, and earnestly besought the united and prayerful co-operation of the members and congregation' (*Bournemouth Guardian* 23 May 1903). Apart from the longevity of his pastorate, there are other indications that this request received a positive response. At the fifth anniversary of his settlement in 1908 he 'briefly reviewed the progressive work of the past five years, and sincerely thanked all who had assisted him, including the Choir, Sunday School teachers, and church officers' (*Bournemouth Guardian* 09 May

1908). In 1912, he reported that he 'and members of the church had worked together harmoniously, with some gratifying results, and during the nine years he had been at Longham he had never known the condition of things look so healthy' (*Bournemouth Guardian* 10 February 1912).

After Richmond Hill, the second most prestigious Congregational church in Bournemouth was East Cliff (Fig. 5). Accordingly, the two ministers who served the church during the Edwardian era, the previously mentioned Revd William Moncrieff and the Revd Phillip Rogers, both had substantial gifts. Born in Perth in 1872 Moncrieff was 'a persuasive preacher of the love of God in Jesus Christ'. Moreover, he was 'an ardent student of the work of social reformers ... [and] took his full share in the political civic affairs of Bournemouth.' Sadly, however, his health suffered from all his strenuous activities and he died prematurely in 1907 (*Congregational Year Book* 1908, 188).

Rogers, a Welshman, was a worthy successor to Moncrieff. An effective preacher with a dynamic personality, he had 'a glorious sense of humour ... [and was] an inspiration to all who came his way' (*Congregational Year Book* 1971/2, 437). He was also active beyond the confines of East Cliff through engagement with the affairs of the local Free Church Council and the West Hants and East Dorset Sunday School Union (Ottewill 2019b).

During his fifteen year ministry at Boscombe Congregational Church (Fig. 6), the Revd Francis Sloper achieved a great deal especially with respect to the physical resources of the church, including a new lecture hall and improvements to the church's interior with respect to seating, heating and lighting (*Congregational Year Book* 1913, 187). Resisting a call to a London pastorate in 1900/1, Sloper provided the Church with much needed stability. Indeed J.D. Jones is quoted as saying, 'Bournemouth needs him, and cannot spare him' (*Bournemouth Guardian* 12 January 1901). As an indication of the respect in which he was held, in 1903 church members voted to increase his stipend from £250 to £300 per annum (Boscombe Minutes 1895–1905).

Alongside his ministerial responsibilities at Boscombe, he held various offices within the wider Free Church community, including President of the Bournemouth Free Church Council; Secretary and Chairman of the Western District of the HCU; and in 1907–8 the Chairmanship of the HCU. Thus, his reputation extended well beyond the confines of Boscombe Congregational Church.

By mid 1909, however, he felt the need to be 'release[d] from the burden of the pastorate, which ... [had] become heavier than he ... [could] bear', and for the ministerial baton to be handed on to 'a younger man, and a more eloquent preacher' who would lead the church 'into a larger work and a greater enthusiasm for the Kingdom of Heaven' (Boscombe Minutes 1905–1918). This decision may also have reflected his increasingly pessimistic view of what was happening. For example, Church minutes record that, in 1907 the 'pastor pleaded for greater enthusiasm being shown in connection with the work being done by the Bible Classes, Sunday School and C[hristian] E[ndeavour] Society and asked members to increase and support the circulation of the magazine' (Boscombe Minutes 1905–1918). While in early 1909 he made known his frustrations at what was described as 'the present religious condition of the country' which was in a parlous state due to, *inter alia*, the 'lack of family prayer ... the present love of excitement and pleasure'; the fact that 'teachers and leaders ... [did] not aim at conversion ... and neglect of the Bible' (Boscombe Minutes 1905–1918). These concerns undoubtedly weighed heavily with him and church members reluctantly came to the conclusion that 'the kindest course to pursue ... [was] to yield to the Pastor's wish' to resign (Boscombe Minutes 1905–1918).

From Boscombe, Sloper moved to Sherborne where he died in 1912. At the recognition service for his successor, the Revd Alfred Clegg, J.D. Jones described Sloper as 'a good minister, and one, who, by his consecrated life and fifteen years' labour with conspicuous success and magnificent devotion, had secured for himself a place absolutely secure in the affections and esteem of all Bournemouth people' (*Bournemouth Guardian* 10 September 1910).

With respect to Clegg, in the requisite vote of church members 96 were in favour of offering him the pastorate with only 1 against and 3 abstaining. Clearly this was a massive vote of confidence and

Figure 7 Westbourne Congregational Church.

one which proved to be well justified. His brother the Revd Robert Edgar Clegg, minister of Christ Church Congregational Church in Southsea from 1898 to 1906, commented at Alfred's recognition service that 'as time goes on, you will be more and more convinced of the wisdom of your choice'. While a speaker from Alfred's previous church in Berkhampstead observed that during his ministry there 'the diaconate had been uniformly harmonious ... [and he] had been the means of greatly strengthening the church, not only on account of his work in the pulpit, but on the sterling Christian character he had shown in connection with every organisation' (*Bournemouth Guardian* 10 September 1910).

Temperamentally, Clegg seems to have been a contrast with his predecessor, exuding a more positive outlook. For example, speaking at East Cliff Congregational Church's anniversary celebrations a few months after arriving at Boscombe, he commented that: 'Their Gospel ... was [one] of bright-heartedness through and through, it was a Gospel of joy, hope and optimism ... The world was not going to be saved by sadness ... it required a spirit of joy as its central motive' (*Bournemouth Guardian* 17 December 1910). Moreover, Clegg was not inhibited in demonstrating his position on contentious issues, such as the campaign for women's suffrage. Thus, in 1912 he chaired a meeting of the Bournemouth branch of the National Union of Women's Suffrage Societies and provided, from a Christian perspective, a closely reasoned justification for giving women the vote (*Bournemouth Guardian* 25 May 1912). What his congregation felt about this is not known.

Pokesdown Congregational Church, like Richmond Hill, enjoyed stability in its minister during the Edwardian era. The Revd Harry Schofield appears to have had an excellent rapport with church members as evidenced by the longevity of his time at Pokesdown, 22 years. It was also reflected in the reports given at anniversary celebrations by the Church Secretary. In 1912 he expressed the view that the pastor 'had been faithful to his trust and continued to preach the doctrine of the love of Christ as the Saviour of Mankind' (*Bournemouth Guardian* 17 February 1912; Ottewill 2022). A year later, at the age of 57, Schofield married Miss Alice Cheshire, leader

of the Young Women's Bible Class. In a display of brotherliness amongst ministers, the ceremony was conducted by J.D. Jones (Ottewill 2022, 210).

The first of Westbourne Congregational Church's (Fig. 7) two Edwardian ministers, the Revd Alfred Martindale had been brought up as an Anglican, with his parents hoping that he would become a minister in that denomination. However, after a short period in business he trained for the Congregational ministry at Rotherham College. He served as a co-pastor at Richmond Hill Congregational Church from 1883 to 1886 and for fifteen years at Harrold in Bedfordshire, before returning to Bournemouth in 1901. At his recognition service it was mentioned that his previous church was 'one of the most devout ... in the county ... [and that] he had been an earnest and sound worker there.' In his remarks Martindale confirmed that his teaching would always be Biblical and evangelical. Moreover, 'he hoped to be the faithful friend and pastor of all those who needed his assistance' (*Bournemouth Visitor's Directory* 01 June 1901). His ministry appears to have begun extremely well, with the Church Secretary commenting at the annual church meeting in January 1903: '[the] Pastor has shown himself a good leader in all good works – The Congregation has considerably increased' (Westbourne Minutes 1902–1914). However, notwithstanding the auspicious start to his ministry it is clear that problems arose and ultimately these resulted in him giving up the pastorate in 1910. In his letter of resignation Martindale referred to 'peculiar difficulties ... which, although you [i.e. the church members] have so patiently borne, & so bravely tried to cope with them, fall with special gravity on the minister – have made the strain upon me almost more than I can bear' (Westbourne Minutes 1902–1914). Although the difficulties were not specified, from the surviving church records there are some clues as to what these might have been. It is clear that following the increases at the beginning of his pastorate congregations subsequently declined. As the Church Secretary explained during the discussion triggered by Martindale's resignation letter, the congregation had numbered about 200 but 'thro' illness, death or removal to other neighbourhoods ... [it had] decreased until we now consider 120, a large one for us' (Westbourne Minutes 1902–1914). This undoubtedly exacerbated another problem,

Figure 8 Winton Congregational Church.

namely finance. The deficit on the church's current account was increasing, a significant component being interest on the outstanding debt connected to new premises, with the Church Treasurer describing the situation as 'serious'.

Nevertheless, it would seem that church members were deeply appreciative of Martindale's ministry and recognised that he had done his best in trying circumstances. His resignation was reluctantly accepted and significantly after his final evening service on 12 May 1910, he and his wife were presented with 'a cheque for £76.6.0 which had been contributed in sums of from one shilling to £10.' From Westbourne, Martindale moved to a pastorate in Mevagissey, Cornwall.

Given the state of affairs that had led to Martindale's departure it is perhaps surprising that the Church was

able to find a well qualified successor in a relatively short time. This was the Revd John Harrison Milnes, who had been minister of a church in Woking since 1904. His qualities, spelt out in a note from the Revd Richard Wells, Secretary of the Congregational Union of England and Wales, included the esteem in which he was held by colleagues; his ability to relate to children and young people; his preaching and leadership skills; 'his tact, patience, persistence & faith', and his commitment to the cause of temperance (Westbourne Minutes 1902–1914).

Moreover, it was noteworthy that during his time at Woking the Church raised £700 towards the building debt. Although Milnes had an academic temperament 'he was friendly rather than superior, he had scholarship but never paraded it' (*Mansfield College Magazine* July 1964). At his recognition service in April 1911, he made it clear that he wanted to blend the individualism of the personal gospel or, as he put it, the 'Old Gospel in modern speech' and 'the duty of leading men to the cross of Christ', with the collectivism of the social gospel by addressing 'some of the great social problems that confronted them' (*Richmond Hill Magazine* May 1911, xxxi).

At Winton Congregational Church (Fig. 8), the Revd Ben Evans was described as being 'of a studious nature ... [and] a rather shy and reserved disposition ... [yet] he was an excellent preacher' (*Congregational Year Book* 1932, 220). The first decade of the twentieth century, however, was a particularly testing time for the Church. Dyer, the Church historian, comments that 'very difficult times indeed were experienced ... and in 1908 Winton had to ask to be taken back under the wing of Richmond Hill' (Dyer 1968, 14). Therefore, it is curious that in November 1905 it was reported that: 'Another proof of the appreciation of the services of their Pastor, the Rev. Ben Evans, was afforded on Tuesday evening by the presentation to him of a purse of gold by the members of the church'. In accepting with gratitude a gift of £7, Evans said that 'he would always do his level best to warrant them at all times in giving their esteem and support to the work of God.' (*Bournemouth Visitor's Directory* 18 November 1905). On this occasion there was no sign of any discord or other difficulties. However, if there was a farewell gathering for him in 1908 prior to his departure for a pastorate in Yorkshire, it does not appear to have been reported. In the absence of any conclusive evidence, it is not clear whether any of the problems the Church faced were directly attributable to Evans.

Notwithstanding the comment of Mr Lane, a leading Congregational layman, made at the recognition service for Evans' successor, the Revd Howard James, that: 'The Church had had its ups and downs, more especially its downs' (*Bournemouth Guardian* 16 January 1909), the situation was subsequently transformed. James' 'ten year ministry made a great and lasting impression in the life and witness of ... [the] Church and under ... [his] wise leadership there was great advancement in the spiritual sense and in the development of Church premises' (Dyer 1968, 14). The latter was a reference to a substantial extension in 1912/13 with the enlarged church being 'of white brick and slate with open roof of pine' (*Bournemouth Guardian* 28 June 1913). It could accommodate 600 compared with 350 in the building it replaced. The extra seating was clearly needed since the Church was frequently 'filled to capacity' (Dyer 1968, 17). The changing fortunes of Winton were reflected in the membership data, with numbers falling from a high point of 100 in 1902 to a low point of 60 in 1907 and increasing to 210 in 1914. In 1913 at Richmond Hill's AGM, James gave 'a special tribute ... to the men of the diaconate at Winton for the mutual love and support given him which made his work a continual delight' (*Bournemouth Guardian* 15 February 1913).

Immanuel Church, Southbourne's first minister was the Revd Alfred Riceman (formerly Reissman). His previous charge had been at Hornsea in the East Riding of Yorkshire. Unfortunately, however, 'a breakdown in health ... [had] compelled him to terminate ... [a] most happy relationship' with his Church (Webb 1910, 85). It was J.D. Jones who persuaded him to come to Bournemouth and he commenced his pastorate in 1910. Sadly, however, just over a year later illness, which necessitated an operation (*Bournemouth Graphic* 17 February 1911), 'struck him down and he was never able afterwards to resume the pastoral ministry.' He had been 'a faithful servant and soldier of Jesus Christ, a strong man who had convictions which he was not afraid to declare and to defend' (*Congregational Year Book* 1960, 434). Although he only spent a few months at Immanuel it is clear that he and his 'gifted and

devoted wife', Gertrude, laid some firm foundations. Indeed, 'throughout his long life ... [she] served conscientiously and fully by his side' (*Congregational Year Book* 1960, 434). As the church historian records: 'Reading between the lines of the church minutes, it is evident that Mrs Riceman too, by her visiting and work among the ladies of the congregation, was held in deep affection by the whole church' (Turner-Smith 1966, 5).

Riceman's successor, the Revd Richard Baldwin Brindley appears to have been somewhat different in character. He came to Southbourne from Finchley and what was to be his final charge. At his recognition meeting he mentioned that 'he had served 29 years in the ministry, and for a man of his experience to come to such a small church was in some respects a venture of faith.' Although this might have sounded a little pretentious, it was clear from what was said by speakers from some of his previous churches that he was well respected for his 'strenuous toil' and 'devotion to ... pastoral work' (*Bournemouth Guardian* 10 February 1912). His ministry was 'characterised by conspicuous intellectual and spiritual power ... [and] up till the last he remained a cultured, painstaking and accurate student' (*Congregational Year Book* 1920, 94). Under his leadership the Church flourished. In early 1913, at Richmond Hill's AGM, he 'gave a glowing account of the progress' made including a move from Guildhall Road to the Carbery Estate; an increase in membership of over 50 per cent; and fund raising, with the debt on the new church premises being reduced by over £800, so that it now stood at £600. A year later, further increases in the membership and the clearing of the debt were reported, with Brindley commenting that the Church was located 'in the most respectable neighbourhood he had ever lived in.' One area of concern, however, was that they had few young people, and as the statistics indicated, 'they found it very hard to get a good Sunday school' (*Bournemouth Guardian* 07 February 1914). Brindley remained at Immanuel until his death, aged 64, in 1919.

Such a rich array of ministers reflected the variety of situations facing Bournemouth's Congregational churches. With most being relatively new and situated in areas where the population was rapidly expanding so the need for outreach and evangelism was very much to the fore. For Congregationalists, with their emphasis on the primacy of the local church, a mutually supportive relationship between ministers and their congregations was crucial. Indeed, Milnes expressed the hope in his first sermons at Westbourne, that 'in the new bond of fellowship and relationship between the pastor and people they might learn to look behind all human things ... to the things which were forever' (*Bournemouth Graphic* 27 January 1911). Inevitably, the source material tends to foreground situations where this was the case and to provide less evidence of situations where difficulties arose which, as indicated above, were particularly acute in the case of Alfred Martindale at Westbourne and Ben Evans at Winton. That said, in general it would appear that most ministers lived up to the expectations vested in them, with respect to the wide variety of roles they were called upon to perform, many of which were, to some extent, demonstrated through their involvement with the varied aspects of church life considered in Part 2 of this article.

To be continued.

ACKNOWLEDGMENTS

The author is very grateful to Alwyn Ladell for his help in selecting, and for his permission to use, the photographs that serve as the illustrations for this article. Thanks are also due to an anonymous reviewer for his/her observations on the text, some of which will be addressed in Part 2.

REFERENCES

Davies J.T. 1956. *The Richmond Hill Story, a brief survey of one hundred years of a great church.* Independent Press Ltd, London.

Dyer, L. 1968. *"The Church on the Hill": The Story and History of Winton Congregational Church 1868–1968.* Winton Congregational Church.

East Cliff Congregational Church Bournemouth Jubilee Souvenir 1877–1927 Bournemouth Guardian, Bournemouth.

Hampshire and Isle of Wight Illustrated Guide, 1894. Guide Printing and Publishing Co, Southampton.

Jones, R.T. 1962. *Congregationalism in England 1662-1962*, Independent Press Ltd, London

Kelly's Directory of Hampshire and the Isle of Wight 1903. Kelly's Directories, London.

Mansfield College Magazine No **165**.
Michael, T.N. 1970. *The Story of 150 Years. Pokesdown Congregational Church 1820-1970*. Pokesdown.
Ottewill, R. 2011a. 'Representations of Congregational Identity in Edwardian Hampshire', *The Local Historian*, **41(2)**, 149–60.
Ottewill, R. 2011b. 'Locals and Cosmopolitans: Congregational Pastors in Edwardian Hampshire 1901–1914', *Congregational History Society Magazine*, **6(3)**, 124–37.
Ottewill, R. 2019a. 'The Battle to Preserve Bournemouth's 'Quiet Sunday': The Tramways Question 1902–13', *Southern History* **41**, 70–91.
Ottewill, R. 2019b. ''A Flourishing Cause': East Cliff Congregational Church 1901–1914', *Congregational History Society Magazine*, **9(1)**, 23–42.
Ottewill, R. 2022. ''A Faithful Ministry': Pokesdown Congregational Church during the Edwardian Era 1901–14', *Notes and Queries for Somerset and Dorset*, **XXXIX (395)**, 203–17.
Richmond Hill Magazine and Congregational Record, **13(1)**, January 1911 and **13(5)**, May 1911.
Surman Index. https://www.qmul.ac.uk/sed/religionandliterature/research/surman-index/ [accessed November 2021].
Taylor, J.H. 2008. 'J.D. Jones - The Preacher', *The Journal of the United Reformed Church History Society*, **8(2)**, 91–99.
Turner Smith, N.A. 1966. *Living Stones: The Building of Immanuel Congregational Church, Southbourne 1910–1965*. Southbourne.
Ward, R. 2003. 'Professor Clyde Binfield: A Critical Appreciation', in *Modern Christianity and Cultural Aspirations*, D. Bebbington and T. Larsen (eds). Sheffield Academic Press, 334–342.
Webb, A. 1910. *The Churches of Bournemouth: 1910*. H&W, Bournemouth.

Published Sources

Bournemouth Graphic.
Bournemouth Guardian (various issues).
Bournemouth Visitor's Directory (various issues).
Christchurch Times.
Congregational Year Book (various years).
Daily Telegraph.

Original Sources

Boscombe Congregational Church Meetings (various years). Dorset History Centre, Reference: NP10/CM/1/2.
HCU Annual Report, 1913. Hampshire Record Office, Reference: 127M94/62/58.
Westbourne Congregational Church Minute Book, 1902–1914. Dorset History Centre, Reference: NP33/Accession 8165d.

The Author: Roger Ottewill retired in 2008 after 35 years in higher education and was awarded a PhD in Modern Church History by the University of Birmingham in 2015. His thesis, 'Faith and Good Works: Congregationalism in Edwardian Hampshire 1901-1914', reflected his particular interest in local religious history. This is combined with research in the fields of local political and administrative history, with particular reference to the 19th and 20th centuries. He has published articles in a wide variety of journals, including The Local Historian, Family and Community History, Southern History, Hampshire Studies, Congregational History Society Magazine and The Journal of the United Reformed Church History Society.Correspondence: editor@dorsetmuseum.org

A NEARLY-FORGOTTEN ENTOMOLOGIST

GEOFFREY TURNOCK

S.C. Scarsdale Brown gave an important collection of entomological material to Dorset County Museum (now Dorset Museum). However, his contribution to the study of entomology in this part of the country has never been properly acknowledged. This is addressed through a study of Brown's life, his association with natural history societies and his contributions to a variety of entomological journals. Of particular importance, and of lasting value, was his commitment to a proper appreciation of the history of entomological studies and of the individuals involved.

INTRODUCTION

The Mansel-Pleydell Prize in 1988 was awarded to Sidney Charles Scarsdale Brown for an essay entitled *A Biographical Account of Some Dorset Entomologists*. Insects are not constrained by county boundaries, but Brown, by profession a dentist, wanted to highlight the contributions made to the study of insects by a wide variety of individuals in Dorset, some local and others drawn to the area for professional reasons. Brown, as will become clear, was a highly competent entomologist, and he must be included in any list of people who contributed to the subject in Dorset. However, when Brown died in 2003 aged 100, his entomological legacy seems not to have been recognised with an obituary. This article seeks to address this deficiency by putting Brown's scientific work into its rightful context. It was the major local government reorganisation of 1974, in which his home town of Bournemouth was transferred from Hampshire to Dorset that allows Brown himself to be legitimately classified as a Dorset entomologist!

EARLY BACKGROUND AND PROFESSION

Brown was a dental surgeon in Bournemouth throughout his working life. Where he studied to become a dentist is not known. He listed his qualifications as LDS FDS RCS Edin. The training for someone to become a dental surgeon (LDS, Licentiate in Dental Surgery) was introduced in 1921 and became compulsory in 1925. For Brown to become FDS RCS (Royal College of Surgeons) Edin. shows he must have received further specialised training, although not necessarily in Edinburgh itself.

The Poole-Bournemouth area is where Brown had grown up. The resources of the General Record Office and censuses allow something of his family background to be pieced together. In becoming a dentist, he was not following a family tradition. His father, Charles Edwin Brown (1876–1953), described himself as a builder in the 1901 census, later becoming the manager of an estate, arranging the sale of plots of land and houses. Charles had followed his father, Sidney Brown, in the building trade. Sidney had moved with his growing family from Salisbury, where he had been born, to the Bournemouth area. The rapid development of the

town as a holiday resort made it an attractive location for an experienced builder; in 1881 Sidney Brown employed six men.

In 1899 Charles Brown married Vida Cecillia Jessie Betts in Poole. Vida was not from that part of the world, having been born in Tientsen, China in 1877. Her parents were both from London and her father, James Alexander Betts (1845–1892), had trained in the new profession of electrician. His work took him and his family overseas from time to time, although in the 1891 census they were all living in Kingston, Surrey. James died in Calcutta in 1892; when his son Lester got married in 1895, he wrote on his marriage certificate under Father's Profession, 'electrical engineer deceased'. James' widow, Ida, lived with Charles and Vida Brown and their three children: Vida Bernice, b.1900; Sidney Charles Scarsdale, b.1903; Cerita, b.1906. In 1938 Scarsdale Brown married Eveline Margaret Brooks; they had two sons, Christopher Morley and Douglas Charles.

Scarsdale, the name Brown preferred in later life, was also named after his grandfather, Sidney, and his father, Charles, respectively. Where Scarsdale was gleaned from is unclear. In Domesday there is a Hundred called Scarsdale, an area that is now north east Derbyshire, but there is no obvious family link to that part of the country. Whatever the reason for the choice, it is a distinctive name.

There are no details of Brown's schooling, but it was adequate to allow him to train for the newly-regulated profession of dentist and he obtained a Licentiate in Dental Surgery in 1930. Although, as explained above, legal regulation only came into effect in the 1920s, dental hospitals had been founded in major cities (for example, London, Leeds, Sheffield, Birmingham, Manchester, Edinburgh) in the late nineteenth century. These became centres for the training of dental surgeons, and Brown would have attended one such dental school. Whilst doing so he would have had experience of city life; despite this, Brown returned to his home town of Bournemouth to set up his practice as dental surgeon at some point in the early 1930s. He made sure he kept in touch with developments in his profession and in 1957 he was made a Fellow in Dental Surgery (FDS) by the Royal College of Surgeons of Edinburgh.

ENTOMOLOGY

In his home town, the Bournemouth Natural Science Society (BNSS) provided Scarsdale Brown with a venue for the development of his scientific interests outside his profession of dentistry. The records of the Society give an account by Margaret Brooks (no relation, as far as is known, to Scarsdale's wife) of his commitment to entomology (Brooks 1990). Brown joined BNSS in 1937, and he was Chairman of Entomology 1939–1948. After a gap of a few years, he rejoined the Society in 1967; he was President in 1975–76 (Fig. 1) and edited the *Proceedings* from 1978 to 1982.

Margaret Brooks was herself an expert on British butterflies and contributed to an important book (Brooks and Knight 1982) on their life histories. She had learnt from Scarsdale that as a young man he also had become interested in Macrolepidoptera. A key personal contact for Brown was Wilfred Parkinson Curtis, 1878–1968, (Brown 1988, where several obituaries are listed). Parkinson Curtis had trained as a solicitor and had a practice in Bournemouth. However, he was best known as a distinguished entomologist. He was a member of the Dorset Natural History and Antiquarian Field Club from 1897 and had helped to found BNSS in 1903. Encouraged by Curtis, Brown joined the Society for British Entomology, where he met other eminent entomologists including Lt.Cdr. F.C. Fraser and William Fassnidge. The latter suggested to Brown that he should extend his interest from Macro- to Microlepidoptera. Likewise, through another member, Philip Harwood, Brown started to collect and study insects from a wide variety of Orders in addition to Lepidoptera.

Micro-Moths

Expertise in the handling of the very small was to become a feature of Brown's career in entomology. It was certainly true for his work on micro-moths, included in *Illustrated Papers on British Microlepidoptera*, published in 1978 by the British Entomological and Natural History Society. The papers had originally been published in the *Proceedings and Transactions of the South London Entomological and Natural History Society* between 1944 and 1957. The purpose of the book was to bring together papers on micro-moths

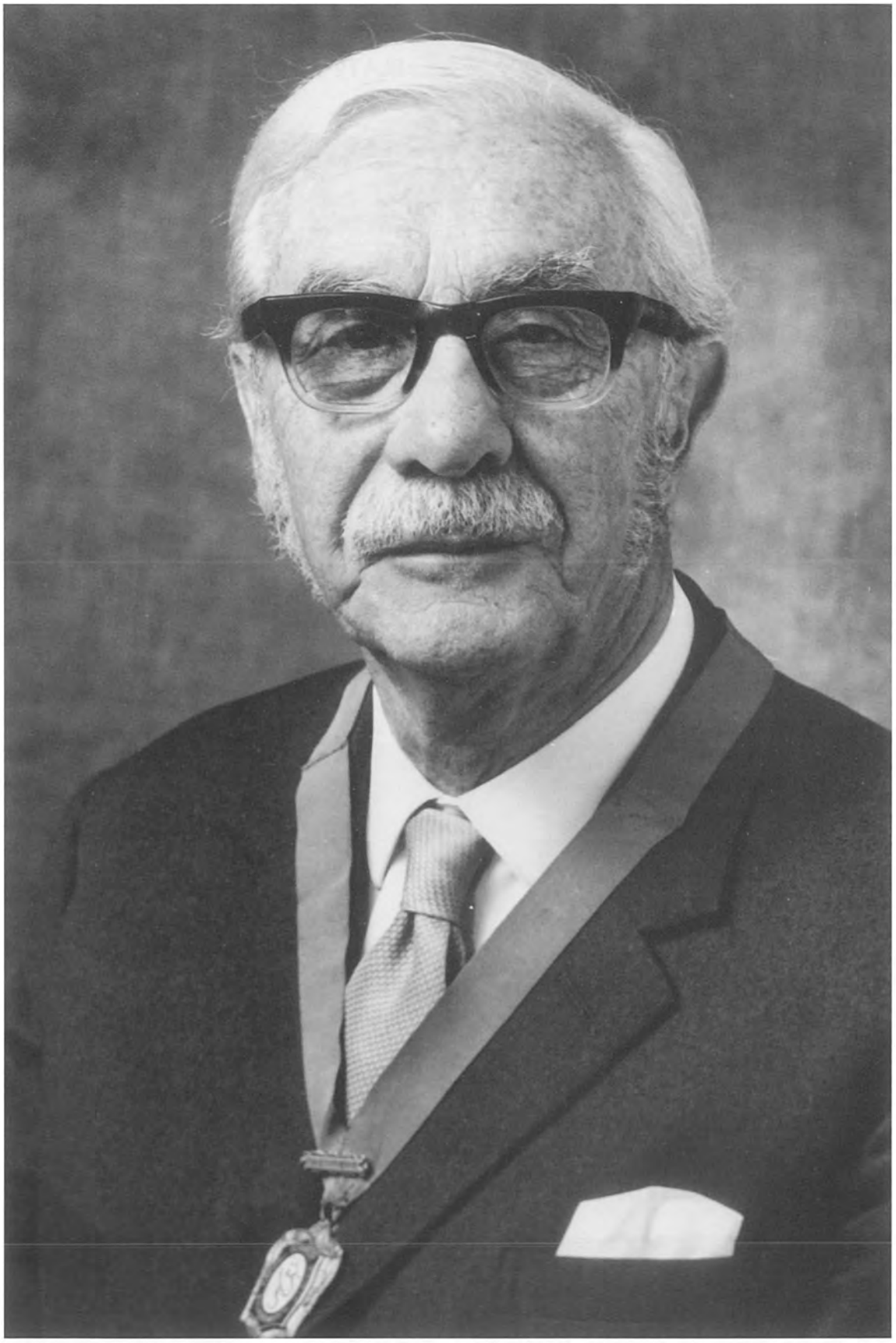


Figure 1 A photograph of Scarsdale Brown when he was president of the Bournemouth Natural Science Society 1975–76. By kind permission of the Bournemouth Natural Science Society.

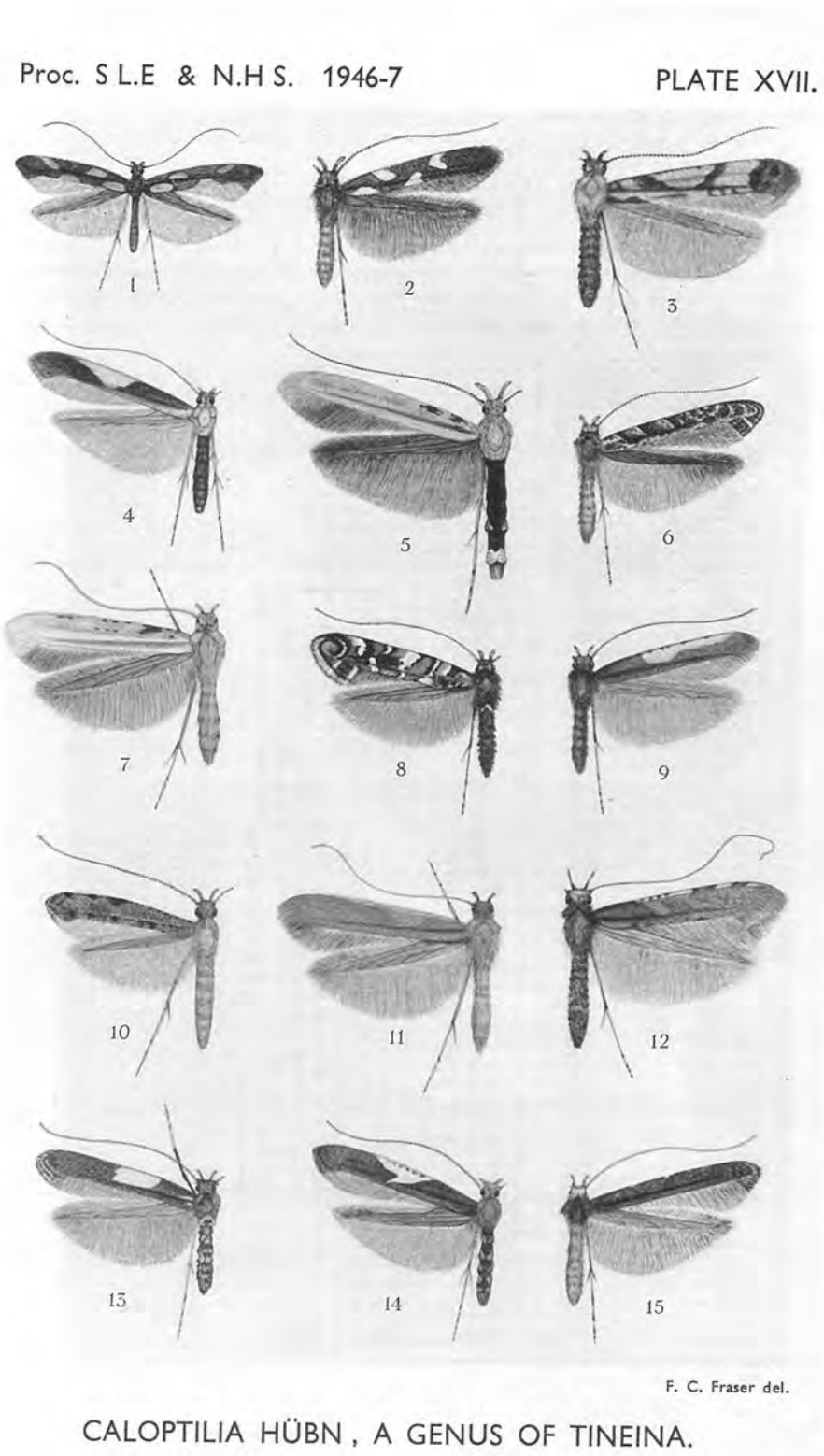


Figure 2 Micro-moths from Brown (1946–47), figured and coloured by F.C. Fraser. By kind permission of the British Entomological and Natural History Society.

for a wider audience. The specimens for both of Brown's papers were figured and coloured by his friend F.C. Fraser; today, in contrast, Wikipedia entries for micro-moths are routinely illustrated with colour photographs. In 1946 Brown read a paper on Caloptilia, a Genus of Tineina (Brown 1946–47). It is one of ninety eight genera in the Family Gracillaridae. The larvae (caterpillars) are leaf-miners. The adult moths have wingspans in the range of 5–20 mm and a selection of species is

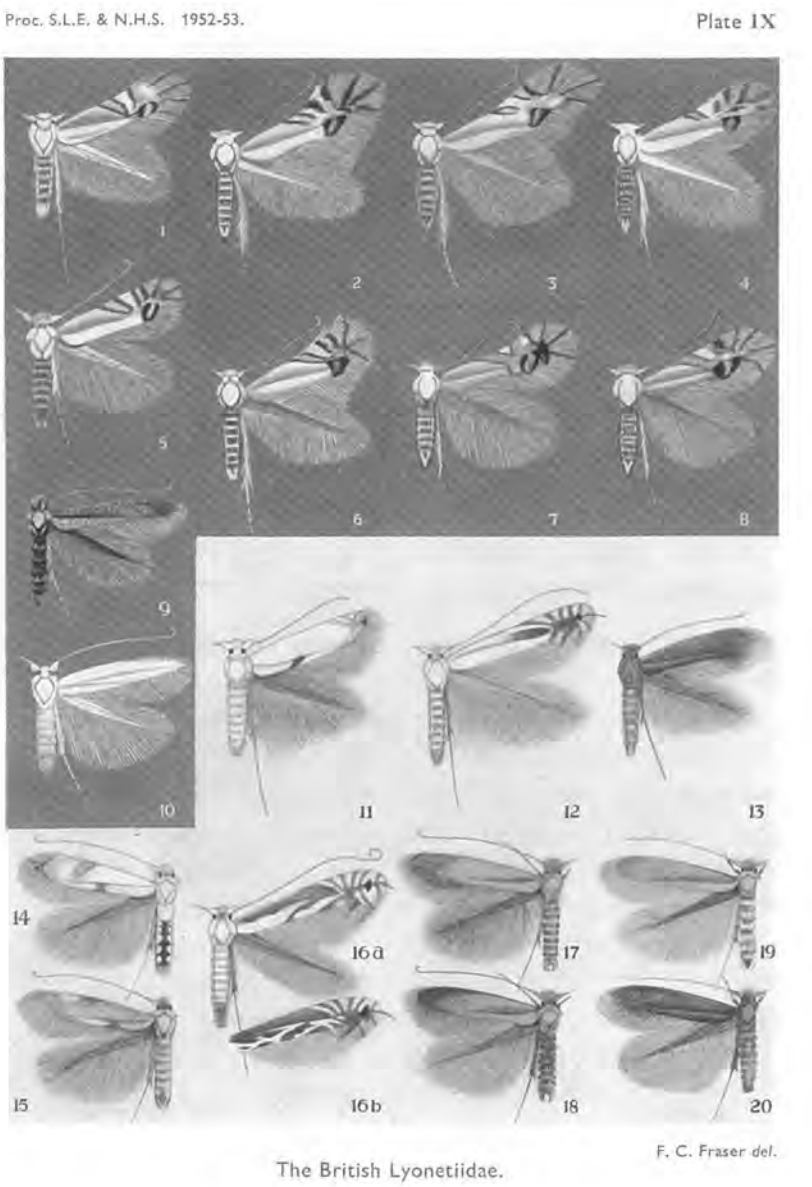


Figure 3 Micro-moths from Brown (1952–53), figured and coloured by F.C. Fraser. By kind permission of the British Entomological and Natural History Society.

illustrated (Fig. 2). Six years later, in 1952, Brown presented a description (Brown 1952–53) of British Lyonetiidae, another Family of leaf-miner micro-moths (Fig. 3), again with the assistance of F.C. Fraser. The slender-bodied adults rarely have wingspans of more than 10 mm.

Brown continued to develop an interest in what he called 'Nepticula mines'. This is evident in his collections and documents, now held in Dorset Museum in Dorchester (Table 1). Botanical specimens with leaf-mines were organised by Brown in two ways. One set was arranged in alphabetical order of plant genera, the other in alphabetical order of species of moth (genus: Stigmella). Alongside this material, there is a variety of other information, personal notes, reprints, maps, diaries and correspondence about 'Nepticula'. Brown in his own records seems to have used 'Nepticula' as a shorthand for Nepticulidae. In the taxonomy of micro-moths, Nepticula is a synonym of Stigmella, with the latter now generally used. Brown's 40-tray cabinet of insects in Dorset Museum (Table 1) includes two trays of carefully-set micro-moths.

A.M. Emmet (Emmet 1974) describes Brown's involvement in the discovery of a micro-moth new to Britain. He had been taken by Brown to Portland in October 1973 to look for leaf-mines on brambles made by *Nepticula auromarginella* Richardson. N.M.

Richardson, another important Dorset entomologist from an earlier generation, had found the species near Weymouth and described it in 1890. However, despite its proximity to Weymouth, Portland had not yielded any specimens. Emmet, with Brown's help, wanted to see if its range had now extended to Portland. Their search failed, but Emmet did find a leaf-mine he did not recognise. However, Brown recalled that he had a specimen in his collection from a colleague in Austria, and was able to identify it as a mine caused by the larvae of *Ectodemia erythrogenella* de Joannis. This small incident demonstrates both the depth of Brown's knowledge and his love of fieldwork.

'Fairy Flies'

Members of BNSS were well aware of Brown's manual dexterity in his early work setting micro-moths (Brooks 1990); this skill was equally evident when he turned his attention to a group of parasitoid Hymenoptera known colloquially as 'fairy flies' (Mymaridae). This family includes some of the smallest insects; one of the largest has a wingspan of only 3 mm. The larval stages of Mymaridae develop in the eggs of other insects such as dragonflies. To display the adults, Brown mounted them on microscope slides. Although Dorset Museum has a large number of entomological specimens on microscope slides from Brown, he gave those with Mymaridae to the Natural History Museum, in the hope that it would have at some point in the future the photographic resources to document the specimens he had so painstakingly collected and mounted. Volunteers at the Museum have helped to bring this to pass, and a blog (Notes from Nature, 2017) reported on the work with a photograph of one specimen, *Stephanodes elegans*. A high-resolution photograph, kindly supplied by Natalie Dale-Skey, of another specimen, *Litus cynipseus* Haliday, 1833 is shown in Figure 4. Brown's contrary labelling of his slides (Fig. 5) also drew ironic comment (Notes from Nature, 2017).

The same blog included a reference to a short publication (Brown 1973) that illustrates Brown's love of experimental fieldwork and attention to detail. After listing methods used for obtaining 'fairy flies', such as a sweep net or finding them trapped on spider's webs, he described what he had observed on mature plants of *Nicotiana sylvestris*. Grown from seed, by July the plants were about three feet high. What surprised Brown was the number of insects caught on viscid hairs on the underside of leaves, stems and bracts of flowers. Captive species included Coleoptera, Diptera and some others, but what most excited Brown were

Figure 4 *Litus cynipseus* Haliday, 1833; a high-resolution photograph of a specimen prepared by Brown, one of the slides of Mymaridae he gave to the Natural History Museum (NHMUK1015843). ©The Trustees of the Natural History Museum

Figure 5 The microscope slide of the specimen in Figure 4 to show Brown's contrary style of labelling! ©The Trustees of the Natural History Museum

considerable numbers of Mymaridae. He was able to remove about one hundred undamaged specimens with a camel hair brush; most were alive. The result, a biological method for gardening entomologists to entrap 'fairy flies'.

Entomological Societies

The growing acceptance of the Linnaean method for the systematic naming of animals and plants in the late eighteenth century facilitated the formal study of zoology and botany. Some degree of specialisation was inevitable and people with similar interests found ways of coming together to share knowledge and to publish data on new discoveries. Entomology was no exception, with the collecting of butterflies being particularly popular (Salmon 2000). In 1833, at a meeting in the British Museum, the Entomological Society of London was formed with the aim of promoting the science of entomology in all its branches. By the following year, there were 117 honorary members and 10 full members. Queen Victoria granted the society its royal charter in 1885, and in its centenary year of 1933 permission was granted for it to become the Royal Entomological Society. Scarsdale Brown's contribution to entomology was recognised in 1956 when he was elected a Fellow of the Royal Entomological Society (FRES).

There was also a need for less formal institutions and local venues where entomological enthusiasms could be shared. Reference has already been made to the South London Entomological and Natural History Society, to which Brown contributed. It was founded in 1872 and continues to this day as the British Entomological and Natural History Society. Brown (Brown 1950) describes the background to the society he had joined on the advice of Parkinson Curtis, the Society of British Entomology, and he wrote as its honorary secretary. The similarity of title is unfortunate, but it had begun as a local group in Southampton in 1920, quickly extending to the county, Hampshire, then to the south of England. Interest from other parts of the country continued and it became SBE in 1934.

As already described, Brown not only supported specialist entomological societies but also BNSS, the society in his home town of Bournemouth founded to foster an interest in all branches of science. Although Brown's professional work as a dental surgeon did not leave him with much spare time, he did contribute short papers on a variety of topics in journals largely dedicated to the work of amateur entomologists. His papers on micro-moths have already been described. Subsequently, he developed an interest in the history of entomology, the people involved and crucially where they had collected specimens of insects.

A classic work, *British Entomology* by John Curtis was published between 1824 and 1839. A collector in Dorset, James Charles Dale (1791–1872), who was later the subject of a detailed study by Brown, had a large collection of insects from Hampshire and Dorset. Dale, a wealthy man, gave Curtis many specimens and helped him in many other ways. Curtis in his book took care to credit the donors of insects he had received and also recorded where specimens had been collected. Brown took upon himself the task of tabulating the localities in Dorset and western Hampshire where Dale had collected. He visited as many of the places as he could. What he found was the loss of many habitats by the extension of farming during the war and by industrial and urban expansion. Brown's brief study (Brown 1956) was a pioneering attempt to document what is now called loss of biodiversity. It was dependent on knowing where and when particular species of insects had been located by Dale in the mid-nineteenth century. Brown concluded, 'Many collecting grounds known by Dale and Curtis have now gone for ever and others will in due time go the same way, for the destruction of the countryside is steadily progressing in Hampshire and Dorset'.

A few years later, Brown (1960) published a fascinating account of the history of the collecting of a moth, the speckled footman (*Coscinia cribum* L; the species is now *cribraria*). It weaves together records from John Curtis, J.C. Dale, his son C.W. Dale, and more recent collectors. A critical location for the moth was Parley Heath, a triangular-shaped area of heath and marshland of about six square miles with its apex on the Ringwood to Poole road. Now much-fragmented, Parley Heath was part of the barren heathland characteristic of south west Hampshire and south east Dorset.

Table 1 A summary of the entomological material donated by Scarsdale Brown to Dorset County Museum, now Dorset Museum, in 1986.

Item	*Comments*
Cabinet of insects	A cabinet with forty drawers arranged by Order/Family/Species.
Nepticula 'mines' (a)	Pressed leaf samples to show 'mines'; specimens in individual folders in 13 boxes, arranged in alphabetical order of plant genus.
Nepticula 'mines' (b)	Pressed leaf samples to show 'mines'; specimens in paper envelopes, stored in a large index card file and arranged in alphabetical order of species of moth (Genus: Stigmella). The target plant is named on each envelope.
Microscope slides	Eight boxes of slides of miscellaneous entomological material, including some 'mines'. There is a handwritten register prepared by Brown.
Miscellaneous	Eight dark blue ring-back files of a wide variety of information on Nepticula (notes, references, maps etc.). One black ring-backed file with reprints and diary on Nepticula.
Entomological correspondence	Four boxes; one specific to Nepticula.

Mapping the history of rare species continued to fascinate Brown. A rare dragonfly, *Oxygastra curtisii*, was one example (Brown 1980) and a moth, *Acrolepiopsis marcidella*, was another (Brown 1981). In the latter, there is reference to a classic book on British Lepidoptera (Meyrick 1928). Brown's own copy of this book had come down to him in 1974 from his early mentor, Wilfred Parkinson Curtis, after his death in 1968. This much-battered and well-annotated book was donated to the library of Dorset County Museum (now Dorset Museum) by Brown. A bookplate of his own design has the motto, 'Bright is the ring of words when the right man rings them', a quotation from a poem in *Songs of Travel* by Robert Louis Stevenson (Stevenson 1896); Brown lets us glimpse his appreciation of clarity of language.

Entomology, like any scientific discipline, requires accurate, technical literature. Brown was also aware of the importance of properly-documented collections of insects and that they should be accessible. He lamented (Brown 1960) that after the death of John Curtis in 1862 his pivotal collection of British insects was allowed to leave the country, being sold, together with a catalogue in manuscript form, to the National Museum of Victoria, Melbourne, Australia. On at least one occasion, Brown himself (Brown 1981) had to write to the curator of that museum for information about a species of moth believed to be in the Curtis collection. Fortunately, the collection of Curtis' collaborator, J.C. Dale, was given to the Hope Museum, University of Oxford. Brown in 1986 donated a substantial amount of entomological material (Table 1) to Dorset County Museum (now Dorset Museum). In the cabinet of insects, two trays are devoted to Microlepidoptera and are a tribute to his skill in mounting these tiny specimens. The origin of each insect in the collection is documented.

Entomologists in Dorset

Brown's interest in the history of entomological studies has already been mentioned in the context of some of his publications. After his retirement from dentistry, he further developed this aspect of entomology, beginning with research into the life and work of J.C. Dale (1791–1872). J.C. Dale was not only from Dorset but played a major role in the development of entomology in the United Kingdom, and so an obvious choice for Brown. The result, an essay entitled *J.C. Dale of Glanvilles Wootton*, was submitted for the Mansel-Pleydell prize in 1980. The prize that year was won by someone else and so Brown's essay was not published in the *Proceedings*

of the Dorset Natural History and Archaeological Society. However, a copy was given to the Hope Museum, Oxford, where Dale's precious collection of insects is held. In addition, Dorset Museum has a typescript of Brown's essay together with an extensive description of the specimens in Dale's collection in Oxford.

Fortunately, Brown was not deterred from pursuing his historical studies and submitted a second essay for the Mansel-Pleydell prize, this time successfully (Brown 1988). Its title was *A Biographical Account of Some Dorset Entomologists*. The qualification 'some' does not indicate a restricted study. On the contrary, the essay is a comprehensive source of information about entomologists based in Dorset from the beginnings of the subject through to the mid-twentieth century, by which time professional biologists based in universities had become established. This transition does not diminish the contributions that can still be made by amateur entomologists, especially in the context of collecting and recording.

Scarsdale Brown's essay dedicated to the life and work of J.C. Dale may not have been published, but the section on this entomologist in his subsequent prize-winning entry does give us an excellent summary of his earlier study. Alongside the entry on J.C. Dale there is an account of his elder (C.W. Dale) son's contribution to entomology. In many respects father and son have to be considered together, particularly in the context of what happened to the insect collections and the library accumulated at Glanvilles Wootton.

Brown had to pour over the details of many obituaries in diverse sources to extract the information he required. In total, he discusses 45 individuals, listed in alphabetical order in the essay. His objective was to describe for each person: family background; education; career; scientific interests, especially pertaining to entomology; publications; collections and the institutions to which they were eventually donated. Entries vary in length in rough proportion to the importance of individuals in the narrative of entomology in the county. That those who made only modest contributions are included matters, because they were part of the total picture. For example, at the end of one short account, Brown wrote, '[He] was not a scientific entomologist, but a field naturalist and collector ... observations and records were entered into his diaries and note-books or passed on to E.R. Bankes and W. Parkinson Curtis'. The latter in particular made good use of the entomological information passed on to him.

Some insect collections in part or in whole were given to the Hope Museum in Oxford or to the Natural History Museum, London. Within Dorset itself, Dorset County Museum was a major repository for insect collections made by local entomologists. As already noted, Brown himself joined their company. For anyone working on insect collections in DM, Brown's essay is an invaluable aid. It can quickly provide the context of a particular cabinet or box of slides

It would be invidious to list here all the 'major' Dorset entomologists included in Brown's study. However, one, Dr C.D. Day (1885–1968), does stand out, because he was born in Dorchester and succeeded his father as medical officer of health for the town and the surrounding area. Day was a consistent supporter of the museum and was made an honorary life member of the Dorset Natural History and Archaeological Society in 1947 for services to the society and the museum. He had wide scientific interests; as a young man he won the Mansel-Pleydell prize for an essay entitled *The Natural History of Bromston Pond* (Day 1912). Day collected all Orders of insects and made a special collection for DM, *The C.D. Day Collection of Dorset Insects*. The annotation of this collection is outstanding. It includes details of life cycles alongside, for example, nests made by solitary wasps. The result is a work of art as well as a scientific database of insects commonly found in Dorset. Day made a special study of Tachnid flies and supplied representative collections to a number of institutions. He found parasitoid insects particularly fascinating, because, in addition to two trays of Tachnid flies, DM also has a set of microscope slides with beautifully mounted Chalcid wasps.

REFLECTION

Scarsdale Brown had a demanding professional career as a dentist and yet he managed to find the time and energy to become a knowledgeable and competent entomologist. In this achievement he matched other entomologists from the county of Dorset whose work he studied and promoted; without doubt he must be included in their number.

Scientific writings rarely reveal much about personal character. One paper (Emmet 1974) does show Brown being delighted to help a colleague, whilst his serendipitous discovery of a new method of trapping 'fairy flies' (Brown 1973) tells us that he had a joy in life as well as in discovery, and this is also evident in the notes on Brown made by Brooks (1990). However, a final word can go to someone who was at one time a patient of Brown. Mr Duncan Curtis, having come across the Nature Blog described earlier, appended this personal comment to the blog (Notes from Nature, 2017) in 2020.

> *'When I was a child, Mr Scarsdale Brown (always "Mr Brown") was my dentist. Knowing that I was interested in insects, he very kindly gave me some Luna Moth caterpillars to keep, and these duly developed into pupae and eventually the very impressive moths themselves. My mum very helpfully screened-off the hallway so that they had room to fly properly and Mr Brown dropped by once or twice to see how they were getting on. He later gave me some stick insects which then became a feature of the family home. He always wanted to know how things were going and despite being a pre-teen child, he always had much to tell me about. I left home in 1980 and didn't see him after that, but his influence on me has been immeasurable. I think I owe my continued interest in wildlife and the environment to Mr Brown and the seed he planted all those years ago. His love of nature and entomology has now passed on to my two sons (age 29 and 32 respectively) has now passed on to my two sons and their respective families. So Mr Scarsdale Brown cast a long shadow.'*

ACKNOWLEDGEMENTS

Janet Davis, a colleague at Dorset Museum, gave valuable help in correcting errors in the manuscript. Kevin Denham's expertise with a scanner lies behind Figures 2 and 3. These plates are reproduced with the permission of the British Entomological and Natural History Society.

The photograph of Scarsdale Brown (Figure 1) was kindly supplied by the Bournemouth Natural Science Society. My nephew, Michael O'Reilly, a member of the same profession as Scarsdale Brown, helped me appreciate how and when regulation of dentistry was implemented.

I am most grateful to Natalie Dale-Skey of the Natural History Museum for supplying the photographs used in Figures 4 and 5. These images are ©The Trustees of the Natural History Museum, London, and are made available under Creative Commons License 4.0 (https://creativecommons.org/licenses/by/4.0/).

REFERENCES

Brooks, M. 1990. 'Some notes about local entomologists, past and present', *Proceedings of the Bournemouth Natural Science Society*, **63**, Part 2, 44–45.

Brooks, M. and Knight, C. 1982. *A Complete Guide to British Butterflies*. Jonathan Cape, London.

Brown, S.C.S. 1946–7. 'Caloptilia Hübn, A Genus of Tineina', *Proceedings and Transactions of the South London Entomological and Natural History Society*, 157–167 [or pp.38–48 in *Illustrated Papers on British Microlepidoptera;* see text].

Brown, S.C.S. 1950. 'History of the Society for British Entomology', *The Amateur Entomologists' Society Bulletin*, **9**, 89–90.

Brown, S.C.S. 1952–3. 'British Lyonetiidae', *Proceedings and Transactions of the South London Entomological and Natural History Society*, 110–116 [or pp.31–37 in *Illustrated Papers on British Microlepidoptera;* see text].

Brown, S.C.S. 1956. 'Notes on some Hants and Dorset localities mentioned by John Curtis in his *British Entomology*', *The Entomologists' Monthly Magazine*, **xcii**, 308–310.

Brown, S.C.S. 1960. 'A note on the early history of *Coscinia cribum* (L)', *The Entomologist's Record*, **72**, 92–94.

Brown, S.C.S. 1973. 'A novel method of obtaining 'Fairy Flies' (Mymaridae)', *The Entomologists' Monthly Magazine*, **108**, 94.

Brown, S.C.S. 1980. '*Oxygastra curtisii* (Dale, 1834) (Odonata: Corduliidae) in Bournemouth, an historical note', *The Entomologist's Record*, **92**, 118.

Brown, S.C.S. 1981. 'The history of *Acrolepiopsis marcidella* (Curtis, 1850) (Lep.: Acrolepiinae) in Britain', *The Entomologist's Record*, **93**, 205–207.

Brown, S.C.S. 1988. 'A Biographical Account of some Dorset Entomologists', *Proceedings of the Dorset Natural History and Archaeological Society*', **110**, 1–16.

Day, C.D. 1912. 'The Natural History of the Bhompston

Pond, near Dorchester', *Proceedings of the Dorset Natural History and Antiquarian Field Club*', **XXXIII**, 200–231.
Emmet, A.M. 1974. '*Ectodemia (Dechtiria) erythrogenella (de Joannis, 1907) (Lep.: Nepticulidae. A Species New to Britain*', *The Entomologist's Record*, **86**, 129–130.
Notes from Nature 2017. 'The dentist who collected fairy flies', http://blog.notesfromnature.org 2017/03/07.
Salmon, M.A. 2000. *The Aurelian Legacy: British Butterflies and Their Collectors*. Harley Books, Colchester, England.
Stevenson, R.L. 1896. *Songs of Travel and other verses* (*Bright is the ring of words* is on p.20). Chatto and Windus, London.

The Author: Dr Geoffrey Turnock was a senior lecturer in Biochemistry at Leicester University. Since retiring to Dorchester he has been a volunteer in the natural history section at Dorset Museum. He is also an Anglican priest. Correspondence: c/o editor@dorsetmuseum.org

AQUATIC INVERTEBRATES OF DORSET WINTERBOURNES: A COMPARISON WITH THE SMALL PERENNIAL CHALK STREAMS

JON A.B. BASS, PATRICK D. ARMITAGE AND GLORIA TAPIA

In most years, classic winterbourne reaches display regular dry periods from mid-summer until early or mid-winter. This study explored the invertebrate community composition response to winterbourne flow-start timing and occasional disruption of annual flow regime and compared the results with survey outcomes from locations with perennial flow on small Dorset chalk streams. Results indicated naturally lower invertebrate diversity in winterbournes can be accompanied by the presence of rare and resilient winterbourne-specific species.

INTRODUCTION

Chalk streams and winterbournes

Dorset streams arising from chalk outcrops have annual flow regimes linked closely to local groundwater conditions and flow dynamics are driven by their position on the spectrum from year-round inputs to those receiving just a small proportion of groundwater from chalk springs at times of peak groundwater levels. Regularity of supply and quality of this groundwater sets the scene for the annual development of aquatic fauna and flora, with additional influences from local topography, land use, historical channel realignments and annual in-channel maintenance. The classic downstream gradation of stream type from intermittent – to winterbourne – to transitional – to perennial-flowing stream (Punchard and House 2009) is influenced by natural and anthropogenic factors modifying ecological responses and related attempts to assess and manage stream quality. Against this backdrop, studies focused on Dorset stream invertebrates have established a useful baseline describing communities found in specific types of stream including winterbournes (e.g., Casey and Ladle 1976; Wright *et al* 1988; Armitage and Bass 2013). Confusingly, some Dorset villages and streams differ in the spelling of winterborne/winterbourne, we base our usage here on current Ordnance Survey maps.

Conservation and management options for winterbournes

The presence of flowing water is an obvious and attractive feature of streams and in most situations seasonal drying is viewed with alarm associated with displaced, stressed and or dying wildlife. Consequently several Dorset chalk stream headwaters that pass through villages receive 'flow

support' from pumped groundwater maintaining perennial flow for a short distance and supporting a wide range of aquatic wildlife (Winterbourne Abbas - South Winterborne; Broadmayne - Tadnoll Brook; Dewlish - Devils Brook; Alton Pancras - River Piddle; Yarde Lane - Pimperne Brook (Andy House, pers. Comm.). In a similar manner construction of connected ponds and lakes sufficiently deep to remain wet year-round are refuges for common aquatic species and a particularly large example is Milton Abbas lake - Bere Stream. This localised stream water supply manipulation for aesthetic purposes appears not to have greatly compromised the occurrence of a specialised aquatic community in many Dorset winterbournes, though losses may have occurred and further changes are probably inevitable as the pressures for housing development and associated environmental mitigation measures increase across the county.

Naturally meandering winterbourne channels are only present for short stretches as most reaches have been straightened and/or redirected for the convenience of field management and water supply. The 'puddling' of underlying chalk with reduced water losses even allowed short diversions from the valley floor, but these manipulations have restricted stream habitat diversity.

Some winterbournes have undergone rehabilitation projects and one example is the South Winterborne a tributary of the Dorset Frome. Sections with a straight over-deepened channel adjacent to Came Farm (2009) and Winterborne Monkton (2011) were re-meandered with areas of streamside tree-planting, aiming to enhance diversity of habitats and wildlife. These projects were delivered by the 'Dorset Wild Rivers' team within Dorset Wildlife Trust and provide localised benefits but current and future threats to winterbournes should also be addressed by effective management of:

- agrochemical legacies and pollutant interception;
- groundwater abstraction rates and naturalised stream flow;
- remeandering of canalised stream channels including buffer strips to trap soil run-off;
- areas with full adoption of the 'Stage zero' river valley landscape restoration concept (River Restoration Centre, 2020);
- appropriate annual channel maintenance minimising flood risk to adjacent properties;
- efficient interception and infiltration to groundwater of surface water drainage from fields, tracks, roads and urbanised areas.

These are topics common to most watercourses and relevant to the Dorset Council Local Plan consultation (2021) that will guide planning decisions on housing and business developments throughout the county until the late-2030s and beyond.

Persistence of winterbourne fauna and flora through severe droughts and floods

In most years classic winterbourne reaches display regular dry periods from mid-summer until early or mid-winter. This annual on-off flow regime dictates the presence of a somewhat restricted range of freshwater invertebrates including a few winterbourne-specific species. For many years Wessex Water has investigated impacts of groundwater abstraction and stream flow augmentation on the ecological integrity of chalk headwaters across Dorset, Wiltshire and parts of Hampshire. This information informs periodic reviews of water abstraction licence conditions and the consequences of stream flow support from groundwater pumping to mitigate reductions in flow period caused by abstraction. Wessex Water monitoring has also greatly extended the evidence-base on the state of small Dorset streams that are not routinely sampled by the Environment Agency, particularly where winterbourne conditions prevail.

Study area and objectives

The main objectives of the present study were to:

- monitor appearance of winterbourne invertebrates with respect to annual flow-start dates over an extended period (2010–2020);
- explore the influence of winterbourne flow-start timing on the invertebrate community composition following two to three months of flow;
- compare and contrast invertebrate communities of winterbournes and perennial chalk streams and their resilience to extreme hydrological events.

We recorded the extent of aquatic plants on sampling occasions but include no assessment of changes to plants or terrestrial invertebrates associated

with winterbournes and note that these have been under investigation elsewhere as potentially useful stream quality indicators (House and Punchard 2007; England *et al* 2019; Bunting *et al* 2020; Westwood *et al* 2021; Stubbington *et al* 2016).

Our earlier studies on the South Winterborne (Armitage and Bass 2013; Bass *et al* 2014), included monthly site visits and showed how an exceptional drought delayed the start of stream flow (2012), followed by high rainfall and a 10 month period of continuous flow (May 2012–June 2013) greatly modified the faunal community within a seasonally-drying section near Came Farm (NGR SY716889). The present study describes the longer-term context of these atypical flow events within a 10-year period based on annual semi-quantitative invertebrate samples taken two to three months after annual flow resumed. Over the last 50 years the only complete failure of winterbourne flow adjacent to Came Farm on the South Winterborne occurred in the droughts of 1975/76 and 2011/12, while perennial flow for 13 months was unknown prior to 2012/13.

METHODS

Sampling and Rationale

Stream invertebrate sampling followed the standard approach adopted by the Environment Agency (EA) to assess site 'quality' based on the aquatic macroinvertebrate community response to prevailing environmental stresses (Clarke and Davy-Bowker 2014). The method includes selecting a survey site representative of the adjacent stream reach and using a combination of streambed kick-sampling plus pondnet sweeps through vegetation with 3-minutes of sampling effort split in proportion to the habitats present (Murray-Bligh 1999). An additional 1-minute visual search of hard surfaces (large cobbles/submerged wood) is made to find examples of strongly attached invertebrates which are added to the sample. Restart of seasonal winterbourne flow depended on hydrological conditions in a particular year, providing the 'kick-start' to invertebrate community development and initial sample collection dates each year were within the period 2–3 months after flow commenced on the South Winterborne near Came Farm. This provided a consistent assessment of the invertebrate community between years and ensured inclusion of early emerging species.

Invertebrate sampling started in 2010 as reported in Armitage and Bass (2013). No standard kick-samples were collected in 2011 or 2012 following a period of extreme drought through autumn–winter 2011/2012 when no equivalent spring season sampling was practicable in 2012 as the start of stream flow was unusually late (early May 2012). Samples were obtained in each of the following years until 2020.

In spring 2010 we had undertaken monthly sampling to compare the occurrence of invertebrates at eight sites along the South Winterborne. The furthest upstream site above Winterbourne Abbas plus the four sites downstream from Martinstown become dry in early summer and display quite different invertebrate communities to those found at the perennial flow sites (Armitage and Bass, 2013). Utilising EA data taken in spring (Environment Agency (South Wessex) 'investigative monitoring' Low Flow Studies 1995–2005) we now explore the similar scenario on the North Winterborne, a tributary of the Dorset Stour which has perennial flow near its source (Winterborne Whitechurch) and winterbourne conditions downstream (near Winterborne Zelston). Contemporary EA WFD invertebrate sampling results from the winterbourne section of the Crichel Stream (2014) and a perennial flow site on the upper River Allen (2007) were also examined. Additional published survey data, relating to spring season samples from adjacent small perennial chalk streams across Dorset (Armitage *et al* 2015; 2018; 2020) were used to compare and establish the extent to which particular invertebrates are disfavoured by winterbourne conditions. Table 1 lists the sampling sites and data sources used.

On each sampling date at the South Winterborne Came Farm site environmental features were recorded including channel width, depth, substrate particle size, proportion of instream habitat types, percentage cover of submerged/emergent vegetation and water velocity (Table 2).

Table 3 Common stream invertebrate species widely recorded in perennial chalk streams and generally missing from Dorset winterbourne sites.

Piscicolidae	Fish Leech	*Piscicola geometra*
Hydrobiidae	Gastropod	*Potamopyrgus antipodarum*
Leuctridae	Stonefly	*Leuctra fusca*
Ephemeridae	Mayfly	*Ephemera danica*
Rhyacophilidae	Caddisfly	*Rhyacophila dorsalis*
Glossosomatidae	Caddisfly	*Agapetus fuscipes*
Hydropsychidae	Caddisfly	*Hydropsyche siltalai*
Leptoceridae	Caddisfly	*Mystacides azurea*

Winterbourne species, notable absentees and scope for colonisation

As invertebrate 'family' level examination can hide differences in species representation we explored the more subtle between-year differences at species level and related this to winterbourne flow start dates. Components of the stream invertebrate community display a variety of life cycle traits influenced to greater and lesser extents by winterbourne flow conditions. Where upstream perennial flow reaches occur certain widely distributed species arrive by downstream 'drift', with colonisation timing and rate of establishment influenced by distance from their upstream source and behavioural characteristics of individual species (Table 4A). What may be described as 'winterbourne specialists' are present as dormant aestivating larvae, pupae and/or adults that re-awaken in the stream bed when flow returns (Table 4B). Other species within some families persist as eggs in the dry stream bed and are triggered to hatch when flow returns at the appropriate time of year, with the capacity to remain unhatched and still viable if the winterbourne flow signal is disrupted until the following year (Table 4C).

Table 4 Invertebrate 'families' including species displaying (A) winterbourne colonisation by downstream 'drift', with timing rate of establishment (weeks/months) influenced by distance from their source and behavioural characteristics of component species. [Note: Elminthidae were not found at Came Farm in February-March throughout the present study], 'families' (B) which include species persistent in winterbournes as aestivating individuals that re-awaken in the stream bed as soon as flow returns, group (C) which include species persistent in winterbournes as dormant eggs within the stream bed which are triggered to hatch synchronously at the appropriate time of year with some requiring a period of cold exposure prior to flow returning.

A	
Planariidae	Flatworm
Erpobdellidae	Leech
Asellidae	Hoglouse
Gammaridae	Shrimp
Elminthidae	Riffle Beetle
B	
Lymnaeidae	Gastropod
Sphaeridae	Pea Mussel
Dytiscidae	Beetle
Limnephilidae	Caddisfly
C	
Plecoptera	Stoneflies
Ephemeroptera	Mayflies
Diptera	True Flies

Long-established and widely adopted invertebrate family level analyses and the more recently used combined family/species assessment of stream communities confirm winterbourne sites often support lower invertebrate diversity. However, interpretation of differences between perennial and winterbourne streams which include species-level comparisons and abundance trends also show winterbournes provide a contrasting niche for specialist taxa. Examples of species confined to winterbournes in this study were the mayfly *Paraleptophlebia werneri* (Pictet), a stonefly *Nemoura lacustris* (Pictet) and two blackflies *Metacnephia amphora* (Ladle and Bass) and *Simulium latipes* (Meigen). A few species were observed to be more frequent at winterbourne survey sites than on adjacent perennial chalk streams, with several examples from the Came Farm samples (Table 5). Based on the wider data sources examined Dorset winterbourne sites can also support larger numbers of the stonefly *Isoperla grammatica* (Poda), the Blue-Winged Olive mayfly *Seratella ignita* (Poda), a small ramshorn snail *Anisus leucostoma* (Millet), several caddisfly within the Limnephilidae and some dytiscid beetles, but all were absent or present in very low numbers at Came Farm in February 2013 during the unusual perennial flow conditions. Certain abundant

Table 5 Contrasting examples of invertebrate species abundance recorded in February-March from the South Winterborne (Came Farm) related to 'Early' (Oct-Nov, 2015, 2016, 2020), 'Late' (Dec-Jan, 2010, 2017, 2018, 2019) and 'Perennial' (for 13 months in 2013) winterbourne flow start dates.

	recorded ranges of abundance		
Came Farm flow start	Early	Late	Perennial
Invertebrate taxa			
Gammarus pulex aggr.(freshwater shrimp)	0-130	0-10	15-256
Nemoura lacustris (stonefly)	3-52	40-1202	0-1
Paraleptophlebia werneri (mayfly)	1-11	1-6	0
Rhyacophila dorsalis (caddisfly)	0	0	1-6
Hydropsyche siltalai (caddisfly)	0	0	2-5
Metacnephia amphora (blackfly)	4-156	13-330	0
Simulium latipes (blackfly)	0-27	5-91	0
Simulium ornatum group (complex) (blackfly)	150-522	0-27	962-1327
Simulium Wilhelmia group (blackfly)	0	0	54-85

species of perennial chalk streams generally exhibited reduced abundance levels at winterbourne sites, e.g., the shrimp *Gammarus pulex* (aggr.), riffle beetles (*Elmis aenea* (Muller) and *Limnius volckmari* (Panzer), and blackflies of the *Simulium ornatum* (Meigen group).

The highly unusual period of continuous flow on the South Winterborne (starting in mid-May 2012) saw replacement of most winterbourne specialist invertebrates by an influx of species associated with perennial streams in early spring 2013, as previously reported (Bass *et al* 2014). Re-establishment of the normal annual winterbourne flow cycle in 2014 saw a quick return of the winterbourne invertebrate community and over the 10-year study subtle faunal differences were associated with annual flow start dates. The volatility of invertebrate populations, particularly when examined at the species-level, weakens scope for useful interpretation from single annual samples. Nevertheless, there are interesting contrasts in abundance levels between years with 'early' (Oct–Nov), 'late' (Dec–Jan) winterbourne flow resumptions and also the 'perennial' flow year at Came Farm (Table 5) emphasising how natural differences in seasonal timing can confuse stream quality signals at winterbourne sites.

DISCUSSION

Stream quality status

In perennial streams physical and chemical variables are used to predict invertebrate community composition in the absence of stress (Murray-Bligh 1999), but the same 'Reference' state conditions do not apply to the special circumstances found in winterbournes which also preclude collection of a standard 'Autumn' invertebrate sample. Annual timing of winterbourne flow resumption modifies seasonal growth of aquatic and semi-aquatic plants within the channel and along the stream margins influencing water depth, velocity profiles and invertebrate community structure. Winterbourne plant communities respond to the prevailing flow regime and recent studies (e.g., England *et al* 2019; England *et al* 2021, Westwood *et al* 2021) are advancing the initial botanical work by Nigel Holmes (Holmes 1999) and utilising the Ellenberg plant species abundance score system (House and Punchard 2007). Scope for using terrestrial and semi-terrestrial invertebrates associated with winterbournes is also under investigation (e.g., Bunting *et al* 2019). In the present study we focussed on aspects of the 'winterbourne invertebrate signature' (Punchard and House 2009), rather than explore the development of quality indices for intermittently flowing streams which are the subject of research elsewhere (Stubbington *et al* 2016; White *et al* 2018; England *et al* 2019).

Flexibility of aerial colonisation and emergence from dormancy in winterbournes

Appearance of aquatic invertebrates in winterbournes arises from several sources and detailed information is currently incomplete. Studies on temporary streams elsewhere have described a 'seedbank' of

fauna ready to reappear when flow returns (e.g., Stubbington *et al* 2016). In Dorset winterbournes an early autumn flow resumption allows flying adult insects from adjacent streams to lay eggs and in some species these develop and hatch after a few days. A mid-winter or late-winter start to flow, at much lower prevailing air temperature, excludes egg-laying until spring (particularly by certain blackflies and non-biting midges). Presence of an upstream perennially-flowing reach gives scope for common and widely distributed aquatic invertebrates to arrive by downstream 'drift' once flow returns, with their colonisation timing and rate of establishment influenced by distance from their source and behavioural characteristics of individual species. Other species survive as dormant aestivating individuals and re-awaken in the stream bed when flow returns. A further group includes species that persist as eggs developing slowly within the stream bed and in winterbournes are only triggered to hatch at the appropriate time of year with some requiring a period of cold exposure to stimulate synchronised egg hatching when water returns (e.g., *Metacnephia amphora* [Bass 1998], *Nemoura lacustris* [Tapia *et al* 2017]). The starting date of annual winterbourne flow is therefore a critical factor additional to the familiar widespread constraints imposed by water quality in perennial streams. Throughout the present study we aimed to take invertebrate samples approximately two months after flow resumed each year in order not to miss the short-lived aquatic stages of some winterbourne invertebrates. By monitoring their presence and relative abundance over a decade that included unusual weather/stream-flow conditions a clearer picture of winterbourne invertebrate community dynamics and resilience emerged.

Presence of winterbourne species

Several freshwater invertebrates recorded from the lower reaches of the South Winterborne near Came Farm appear confined to winterbournes based on limited survey activities in these stream types both nationally and within Dorset. It seems highly likely that more winterbourne species await discovery. The first UK records of the mayfly, *Paraleptophlebia werneri* (as *P. tumida*) date back to the mid-20th century and *P. werneri* is still present in Hampshire Avon tributaries, e.g., the River Till and nearby Chitterne Brook (Punchard and House 2009) and has more recently been confirmed from a small number of winterbournes across Dorset, Wiltshire, Hampshire (Andy House pers. comm.) and West Sussex (Andrew Farr/Craig Macadam pers. comm.). The stonefly *Nemoura lacustris*, first recognised in the UK from the South Winterbourne at Came Farm in 2010 (Hammett 2012; Armitage and Bass 2013) also completes its short aquatic stage as a nymph in early spring. Occurrence records are currently known from 18 winterbournes with 16 quoted by Tapia, Bass and House (2017) including eight Dorset winterbournes.

Generally blackfly (Simuliidae) are rarely identified to species level in routine invertebrate surveys, but *Metacnephia amphora*, first described from specimens collected at Came Farm (Ladle and Bass 1975) and also *Simulium latipes* (Meigen) are easily distinguished from the more common simuliid species as larvae and pupae. Both occur for a short period in early spring and in some years adult flies emerge before seasonal stream monitoring traditionally starts. *Metacnephia amphora* has been recorded from several Dorset winterbournes (River Crane – Wright *et al* 1988; Devils Brook and Cheselborne – Wessex Water Low Flow studies, Andy House pers. comm.; Crichel Stream – EA WFD monitoring data) and is often the most abundant simuliid in early spring at Came Farm on the South Winterborne. *Metacnephia amphora* also occurs in Wiltshire, Hampshire (House and Punchard 2007) and as far east as winterbournes in West Sussex (Crosskey and Crosskey 2002), persisting as dormant eggs in the dry stream bed (Bass 1998). It is noteworthy that *Simulium latipes* is not confined to winterbournes and has been recorded from other types of seepage stream that dry out in summer (Crosskey and Crosskey 2002).

Winterbourne site quality defined by macroinvertebrates

Common invertebrate families shown to be absent or largely absent from winterbourne sites cover the full spectrum of sensitivity to organic pollution, based on the widely used BMWP/WHPT scores and derived average score per taxon (ASPT)(Clarke and Davy-Bowker (2014). Therefore despite a reduced taxon richness there is no marked drop

in ASPT suggesting no fall in the quality status of winterbourne sites assessed at invertebrate 'family' or mixed family/species level. A range of established indices and quality scores have been developed for faunal composition in perennial streams and rivers (e.g. river invertebrate classification tool – RICT [Clarke and Davy-Bowker 2014]; drought effect of habitat loss on invertebrates – DEHLI [Chadd *et al* 2017]; community conservation index – CCI [Chadd and Extence 2004]), with recent studies exploring the invertebrate community signal at intermittent flow sites (e.g., White *et al* 2018), utilising family and species-level monitoring data. Additional information on semi-aquatic and terrestrial taxa is expanding scope to develop the Monitoring Intermittent Streams (MIS) Index (England *et al* 2019). Such assessments were previously constrained on streams where invertebrate families and/or species are represented by winterbourne-specific taxa rather than the more widely distributed common taxa.

We postulate that winterbourne fauna will display modified community stress responses perhaps only loosely related to established indices (White *et al* 2019) and also acknowledge that fewer taxa present at winterbourne sites weakens scope to detect and compare site stress. However, rapid appearance of abundant aquatic invertebrates in winterbournes following the return of seasonal flow indicates how even streams which dry up have good capacity to recover from severe stress events via several invertebrate colonisation routes (Bilton *et al* 2001) once a specific stress is removed.

CONCLUSIONS

A small number of aquatic invertebrate species are confined to winterbournes and complete their short annual life cycle in several Dorset winterbournes. The series of contrasting winterbourne flow start dates at Came Farm on the South Winterborne (2010–2020) influenced the aquatic invertebrate community composition present each year 2–3 months after flow started.

Based on the invertebrate community comparison between Dorset winterbourne sites and adjacent perennial chalk stream sites, the winterbournes support fewer taxa but include some rare species, which contribute extra biodiversity and appear resilient to occasional years with no stream flow or perennial flow conditions. The cycle of naturally interrupted annual flow in winterbournes should be more widely recognised as a valuable feature and distinguished from situations where over-abstraction and/or poor catchment management degrades this unusual stream type.

ACKNOWLEDGEMENTS

Our thanks to Mitch Perkins for extraction of historical Environment Agency monitoring data, Andy House (Wessex Water) provided information on stream flow support by Wessex Water and related ecological monitoring, Fiona Bowles and Dave Cooling provided useful comments on winterbournes and an initial draft of this paper, Andy Miller permitted sampling access (Came Farm Estate), James Pretty (QMUL) and Dave Cooling clarified some critical invertebrate identifications.

REFERENCES

Armitage, P.D. and Bass, J.A.B. 2013. 'Long-term resilience and short-term vulnerability of South Winterbourne macroinvertebrates' *Proceedings of the Dorset Natural History and Archaeological Society* **134**, 43–54

Armitage, P.D., Bass, J.A.B., and Hawczak, A. 2015. 'The environmental quality of the Sherford River (Dorset) assessed with macroinvertebrate data', *Proceedings of the Dorset Natural History and Archaeological Society* **136**, 19–29

Armitage, P.D., Bass, J.A.B., Murphy, J.F. and Tapia, G. 2018. 'A comparison of the freshwater invertebrate fauna of the River Win (Dorset) present in 1993 and 2016, over a period with agricultural intensification across the catchment', *Proceedings of the Dorset Natural History and Archaeological Society* **139**, 72–82

Armitage, P.D., Bass, J.A.B, Tapia, G., and Murphy, J.F. 2020. 'Bankside and instream characteristics affect invertebrate biodiversity in the Owermoigne Stream (Dorset UK)', *Proceedings of the Dorset Natural History and Archaeological Society*, **141**, 61–69

Bass, J.A.B 1998. 'Last-instar larvae and pupae of the Simuliidae of Britain and Ireland: a key with brief ecological notes', *Freshwater Biological Association, Scientific Publication* **No 55**, 102.

Bass, J.A.B., Armitage, P.D. and Pretty J.L. 2014. 'Severe

drought and exceptional summer flooding: consequences for the South Winterborne macroinvertebrates', *Proceedings of the Dorset Natural History and Archaeological Society* **135**, 165–166

Bilton, D.T., Freeland, J.R. and Okamura, B. 2001. 'Dispersal in Freshwater Invertebrates', *Ann. Rev. of Ecol. and Syst.* **32**, 159–181.

Bunting, G., England, J., Gething, K., Sykes, T., Webb, J. and Stubbington, R. 2020. 'Aquatic and terrestrial invertebrate community responses to drying in chalk streams', *Water and Environment Journal*. ISSN 1747-6585

Casey, H. and Ladle, M. 1976. 'Chemistry and biology of the South Winterbourne, Dorset, England', *Freshwater Biology* **6**, 1–12.

Chadd, R. and Extence, C. 2004. 'The conservation of freshwater macroinvertebrate populations: a community-based classification scheme', *Aquatic Conservation* **14**, 597–624.

Chadd, R.P., England, J.A., Constable, D., Dunbar, M.J., Extence, C.A., Leeming, D.J., Murray-Bligh, J.A. and Wood, P.J. 2017. 'An index to track the ecological effect of drought development and recovery on riverine invertebrate communities', *Ecological Indicators* **82**, 344–356.

Clarke, R.T. and Davy-Bowker, J. 2014. *River Invertebrate Classification Tool Science Development Project: Modifications for WHPT and other Abundance-Weighted Indices.* Report to the Scottish Environment Protection Agency.

Crosskey, R.W. and Crosskey, M.E. 2002. 'A breeding site survey of Simuliidae (blackflies) in South East England. Part 2: Broad distributional findings', *Dipterists Digest* **9**, 137–149.

Dorset Council 2021. *Local Plan* https://www.dorsetcouncil.gov.uk/planning-buildings-land/planning-policy/dorset-council-local-plan.aspx [draft accessed June 2021].

England, J., Chadd, R., Dunbar, M.J., Sarremejane, R., Stubbington, R., Westwood, C.G. and Leeming, D. 2019. 'An invertebrate-based index to characterize ecological responses to flow intermittence in rivers', *Fundamental and Applied Limnology / Archiv für Hydrobiologie* **193** (1), 93–117.

England, J., Westwood, C., House, A., Hayes C., and Stubbington, R. 2021. 'Using plant communities to characterise biotic response to drying in chalk stream headwaters', *FBA News*, **81** Winter/Spring 2021

Hammett, M.J. 2012. '*Nemoura lacustris* Pictet 1865 (Plecoptera, Nemouridae – an addition to the British list', *Entomologist's Monthly Magazine* **148**, 43–45.

Holmes, N.T.H. 1999. 'Recovery of headwater stream flora following the 1989–1992 groundwater drought', *Hydrological Processes* **13**, *Special Issue*, 341–354.

House, A. and Punchard, N. 2007. *Assessing the ecological impact of abstraction on the winterbournes of the Hampshire Avon.* Wessex Water Report 859818

Ladle M. and Bass, J.A.B. 1975. 'A new species of *Metacnephia* Crosskey (Diptera: Simuliidae) from the South of England with notes on its habitat and biology', *Hydrobiologia* **47**, 193–207.

Murray-Bligh, J. 1999. *Procedures for Collecting and Analysing Macroinvertebrate Samples* – BT001. The Environment Agency, Bristol.

Punchard, N. and House A. 2009. 'The water and wildlife of the Hampshire Avon winterbournes', *British Wildlife* **21**, 11–19.

River Restoration Centre 2020. https://www.therrc.co.uk/blog/what-stage-zero-approach-river-restoration, August, 2020; [accessed June 2021].

Stubbington, R., Gunn, J., Little, S., Worrall, T.P. and Wood, P.J. 2016. 'Macroinvertebrate seedbank composition in relation to antecedent duration of drying and multiple wet-dry cycles in a temporary stream', *Freshwater Biology* **61**, 1293–1307.

Tapia, G., Bass, J.A.B. and House, A. 2017. 'Further occurrence records for the Winterbourne Stonefly *Nemoura lacustris* A.E. Pictet, 1865, (Plecoptera: Nemouridae)', *Entomologists Monthly Magazine* **154**, 4

Westwood, C.G., England, J., Hayes, C., Johns, T. and Stubbington, R. 2021. 'The Plant Flow Index: a new method to assess the hydroecological condition of temporary rivers and streams', *Ecological Indicators* **120**, (https://doi.org/10.1016/j.ecolind.2020.106964)

White, J.C., House, A., Punchard, N., Hannah, D.M., Wilding, N.A. and Wood, P.J. 2018. 'Macroinvertebrate community responses to hydrological controls and groundwater abstraction effects across intermittent and perennial headwater streams', *Science of the Total Environment*, **610**, 1514–1526.

White, J.C. Armitage, P.D., Bass, J.A.B., Chadd, R.P., Hill, M.J., Mathers, K.L., Little, S. and Wood, P.J. 2019. 'How freshwater biomonitoring tools vary sub-seasonally reflects temporary river flow regimes', *River Research Applications Special Issue*, 1–13.

Wright, J.F., Welton, J.S., Furse, M.T. and Gunn, R.J.M. 1988. 'The Macroinvertebrate Fauna of the Moors River and Uddens Water in Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **110**, 127–135.

The authors: Jon Bass, Patrick D. Armitage and Gloria Tapia. All have a long association with the East Stoke site and maintain similar interests in stream invertebrate ecology. Freshwater Biological Association, River Laboratory, East Stoke, Wareham, Dorset BH20 6BB. Correspondence: jon_bass@btinternet.com.

THE ENVIRONMENTAL QUALITY OF 13 NEW CONTRASTING STREAM SITES AND THEIR RELATION TO 69 SITES SAMPLED IN DORSET (UK) OVER THE LAST 27 YEARS

PATRICK D. ARMITAGE AND DAVE A. COOLING

As part of an ongoing series of small stream surveys, 13 sites in five separate areas were sampled in autumn 2020 and spring and summer in 2021. A total of 192 macroinvertebrate taxa were recorded from combined seasons samples. One Red Data Book (Rare) species (Hydrometra gracilenta) and eight either Notable or Regionally Notable Taxa were recorded from eight of the 13 sites. These included a specimen of our native crayfish Austropotamobius pallipes. *Seasonal differences were marked, and 82 taxa were found only in one season. Seven of the 13 sites were classed as of Good to High ecological quality by the national assessment methodology RICT. Four sites had high to very high conservation value (Community Conservation Index). The relation between the 13 sites and 69 sites surveyed over the last three decades was examined using a combination of hierarchical cluster analysis and Detrended Correspondence Analysis. Four major groups of sites were identified – two characterised by low conductivity, one comprising high conductivity sites and a group of heavily modified sites on two streams. Forty-four of the 82 sites were classed as of Good to High quality by RICT in contrast to only 30 sites in the high to very high CCI classification. The value of the dataset in setting a baseline for future comparisons is discussed in relation to stream modifications and possibilities for 'restorative' actions.*

INTRODUCTION

In 1994 the first author and co-workers started a programme of environmental quality surveys of small streams in eastern Dorset with a view to establishing a record of their macroinvertebrate communities which could be used for future comparison. At that time these habitats were not regularly monitored by the Environment Agency or its predecessors but in recent years the European Union and others have recognised the importance of small water bodies. This increased interest culminated in a workshop addressing the protection and management of these habitats (European Environment Bureau, EU Commission and Freshwater Habitats Trust 2013). Further recognition of the importance of these habitats in the UK is evident in a letter from the Freshwater Habitats Trust endorsing the Natural Capital Committee's recommendations for greater recognition and monitoring of small waters (Freshwaterhabitats.org 2020).

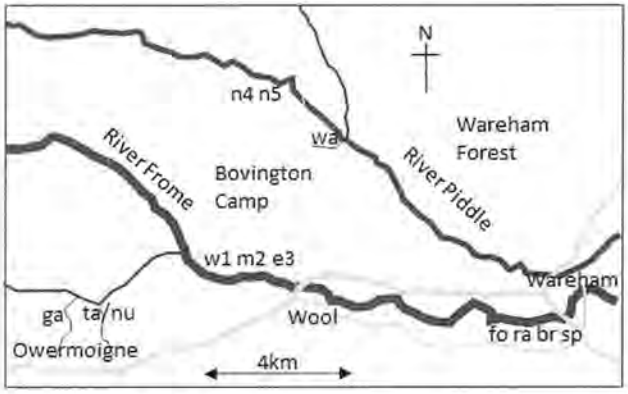


Figure 1 The location of the 13 sites.

Over the past 27 years we have surveyed all the main small tributaries of the lower Frome and additional streams flowing into Weymouth Bay and Poole Harbour but there are still a few water bodies which remain to be examined. In some cases, whole stream surveys have been difficult to achieve due to access problems. In these cases, sampling is restricted to sites with public access or where permissions have been obtained. In this current paper we examine 13 such sites, covering a range of conditions to assess their environmental quality and conservation status. In addition, we review environmental quality data from 69 sites on small Dorset Streams sampled over the last 27 years.

STUDY AREA AND METHODS

The stream sites (Figure 1) are located in four main catchment areas, Bovington North Ranges (**n4**-SY 83723 92380 and **n5**-SY 83896 92477) and the Warren Stream (**wa**-SY 85768 91119) flowing into the River Piddle; Bovington South Ranges (**w1**-SY 82678 87862, **m2**-SY 83105 87770, **e3**-SY 83561 97708) flowing into the River Frome; Povington Heath on the Lulworth Ranges (**fo**-SY 89418 85734, **ra**-SY 90310 85652) and Grange Heath (**br**-SY 91105 85504, **sp**-SY 91915 85614) also flowing into the Frome and the Tadnoll Brook (**nu**-SY 79333 86840, **ta**- SY 79331 86846, **ga**-SY 78245 86587) a main tributary of the Frome.

Bovington North Range

The two sites are on a stream draining about 85 hectares of bog and coniferous wood. Site **n4** is situated in an open area of the bog about 16m before the stream enters the wood. The channel cuts through peat and has a dense growth of *Potamogeton*. Site **n5** is about 200m downstream and is densely shaded.

Bovington South Range

The three streams drain an area of woodland to the northwest and some urban drainage from the Bovington Camp. The drainage pattern is complex due to a multitude of side channels and ditches but the area drained is approximately 193ha. The three sites (**w1**, **m2**, **e3**) are situated where the streams cross a track running from east to west. Samples were taken just upstream and downstream of the track.

Povington Heath

Two streams drain this area. Site **fo** is situated on the westernmost stream which flows mainly through open heath, draining an area of 650 ha. The site is situated just below a road bridge in a dense growth of *Rhododendron*. Site **ra** is on a small stream draining about 67 ha of coniferous woodland and was sampled in a shaded section just upstream of the road.

Grange Heath Area

Site **br** is situated 200m below a 4 ha 'lake' created as the result of quarrying activities. Site **sp** is situated on the Tollbar Stream which drains about 230 ha of woods and quarried land.

Warren

The stream drains about 18.5 ha flowing through wooded banks surrounded by arable and pasture fields before entering the Piddle. Site **wa** is very densely shaded.

Tadnoll

The Tadnoll Brook arises from the Chalk near the village of Broadmayne and flows through tertiary deposits of gravel and sand for about 10 km before joining the Frome. The catchment area of about 500 ha is mainly rural with grazing meadows and tilled land. The main channel is much divided and receives several small tributaries flowing into it from the south. Site **ga** is situated on one such small spring fed tributary which drains about 48 ha of farmland, mainly pasture. The site is open and crossed by a farm track. Site **ta** is on a side channel of the Tadnoll and is adjacent to **nu** which is situated on another

Table 1 Physical and chemical characteristics of the 13 small stream sites based on mean values from 3 seasons samples. [Distance is distance from source, Macrophytes 1 present 0 absent; Shade 1 low, 2 moderate, 3 dense; Modification, see text for details].

	w1	m2	e3	n4	n5	fo	ra	br	sp	wa	nu	ta	ga
Altitude (m OD)	19	15	13	34	30	6	6	8	8	34	23	23	30
Slope m km^{-1}	7	16	17	6	13	4	8	5	9	14	6	6	7
Velocity (cat.)	3	2	2	3	2	3	3	3	3	3	2	2	3
Distance (km)	0.4	0.4	0.4	0.9	1.1	4.0	1.2	0.2	1.3	0.9	1.1	6.5	1.4
Width (m)	1.7	1.5	1.8	1.3	1.8	3.0	1.2	1.0	4.8	1.0	1.4	1.6	1.4
Depth (cm)	10	8	6	16	12	16	8	6	7	4	18	14	11
Substratum cover (%)													
Boulder/Cobbles	5	6	5	0	4	0	10	2	21	4	2	1	37
Pebbles/Gravel	48	49	57	0	46	0	77	26	25	69	50	28	30
Sand	39	35	25	1	44	99	7	64	47	21	31	60	25
Silt/Clay	8	10	13	99	6	1	7	8	7	6	17	11	8
Conductivity (µS cm^{-1})	178	323	245	123	142	325	212	210	279	186	469	481	571
Macrophytes	1	0	0	1	0	0	0	0	0	0	0	0	1
Shade	2	2	2	0	3	3	2	1	1	3	2	2	1
Modification	5	5	5	0	0	0	2	2	5	3	6	6	5
pH	5.7	6.2	5.7	5.7	6.2	6.3	6.0	6.5	6.2	6.3	6.5	6.5	7.0

spring fed tributary which drains approximately 106 ha of mainly arable land.

The macroinvertebrate samples were collected using a standard 3-minute kick/sweep technique with a 900 mm mesh pond net (Davy-Bowker *et al* 2008). Samples were sorted live in the laboratory, preserved in 70 per cent alcohol and identified to the lowest practicable level wherever keys and life history stage allowed. Physical features of the sites were recorded at each visit together with measurements of conductivity taken with a portable meter (AUTOUTLET Portable Digital TDS & EC Meter) and pH was estimated with Macherey-Nagel Test Strips. Assessment of substratum conditions was carried out by visual inspection and recording the percentage cover of boulders and cobbles, pebbles and gravel, sand, silt, and clay and macrophytes. In addition to these variables a subjective measure of channel and bankside modification was devised. A score of 0 was given if there was no recent bankside modification (such as reinforcement or re-profiling), with severe modification to both banks scoring 3, and 1 and 2 as intermediate states. Similarly, no obvious channel modification (re-sectioning, weirs, dredging) scored 0, with maximum scoring 3, and 1 and 2 indicating intermediate states. A modification factor, MF, was calculated as the sum of the bank and channel scores giving a range from 0 to 6 for each site. A shading factor at each site was scored from 0 (open) to 3 (closed). Physical/chemical characteristics of the 13 sites are summarised in Table 1.

Data Treatment

The characteristics of the macroinvertebrate communities at the 13 sites and their seasonal changes were examined with a combination of an agglomerative hierarchical clustering technique (Wards Linkage with Bray-Curtis index as a distance measure) and Detrended Correspondence Analysis, (DCA) implemented with Community Analysis Package (CAP v 6.0), PISCES Conservation Ltd. We examined seasonal differences in species composition between sites using cluster analysis to define groups of sites and superimposed the groupings on an ordination plot derived from DCA analysis of square root transformed taxa data with down weighting of rare species. Species presence absence data from all sites sampled since 1994 was examined initially using cluster analysis of untransformed data with down weighting of rare taxa. The resulting main site groupings were superimposed on a DCA ordination of the same data. The relationship between axis scores and environmental variables was examined using Pearson product moment correlations.

Ecological quality was assessed using the River Invertebrate Classification Tool, (RICT) (Davy-Bowker *et al.* 2008). The ratio of an 'observed to expected' index value, the ecological quality ratio (EQR), is classified

by RICT into bands (High, Good, Moderate, Poor, and Bad). Spring and Autumn data are used for assessment. The final overall classification of a site is based on the minimum EQR value from the Average Score Per Taxon (ASPT), an index of organic pollution impacts and the number of scoring taxa (NTAXA), an index of general degradation. Application of the Community Conservation Index (Chadd and Extence 2004) provided information on the conservation 'value' of the 13 sites.

RESULTS

13 site survey – Fauna

In total, 192 taxa in 74 families were recorded from combined seasons samples taken at the 13 sites (Appendix 1). This total includes Sphaeriidae (pea mussels) species and Chironomidae (midges) at species or genus level but since quantitative data were not available at this taxonomic level, analyses were carried out at genus and sub-family level respectively for these groups. The total number of taxa per site (including Chironomidae) ranged from 35 to 72. Of the major groups, Diptera contributed the most taxa (73) of which 50 belonged to the family Chironomidae. Two other groups, Trichoptera (35) and Coleoptera (21) were relatively rich in species. The distribution of taxa in all major groups is shown in Table 2 for all sites. The composition, in terms of major faunal groups (based on the three seasons collections), is illustrated in Figure 2. The sites are arranged according to their general catchment areas and show marked differences in both composition and abundance between areas and sites within areas. High total abundances were recorded in the high conductivity 'western' sites **nu** and **ta,** (mainly Diptera and Crustacea), and **ga** (Crustacea and Ephemeroptera). Total abundance of macroinvertebrates was also high at the site **br** draining the small 'lake' where the fauna was dominated numerically by Mollusca (Gastropoda and Bivalvia) and Trichoptera (Hydropsychidae). Ephemeroptera were abundant at **n4** and at the 'western' sites and **sp**, but the component species were different with *Leptophlebia vespertina* at **n4** and *Baetis rhodani* at the other sites. The numbers of taxa recorded per season also varied widely (Figure 3) with most variation observed at the 2 'western' sites **nu** and **ta.**

Seventy-nine taxa occurred at one site only (unique taxa) including 13 Coleoptera, 12 Trichoptera and 18 taxa belonging to the Family Chironomidae (Appendix 1). Sites with the most unique taxa were **n4** (the bog site with 12 taxa), **br** (below the lake with 11) and **ta** (a side channel of the Tadnoll Stream with 13 taxa).

One Red Data Book (Rare) species (*Hydrometra gracilenta*) and eight either Notable or Regionally Notable Taxa (*sensu* Chadd and Extence 2004) were

Table 2 The distribution of taxa in major groups based on combined seasons data from each site.

	w1	m2	e3	n4	n5	fo	ra	br	sp	wa	nu	ta	ga	T
Tricladida	0	1	1	0	0	0	0	0	0	0	0	1	1	**1**
Gastropoda	2	1	1	1	1	1	1	3	2	1	5	2	1	7
Bivalvia	1	2	1	1	1	1	1	1	1	1	3	4	1	7
Oligochaeta	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Hirudinea	0	1	1	0	0	0	2	2	0	0	1	1	1	5
Hydracarina	0	1	0	1	1	1	1	1	0	1	1	1	0	1
Crustacea	3	4	2	0	0	2	3	3	4	2	6	5	1	6
Ephemeroptera	0	2	0	1	1	1	0	3	1	1	3	5	4	10
Plecoptera	4	3	3	5	5	4	2	3	2	4	5	4	0	8
Odonata	1	1	0	7	3	1	1	1	2	1	1	0	1	7
Hemiptera	0	0	0	3	0	0	2	3	0	0	0	2	0	8
Coleoptera	2	2	3	0	3	5	2	4	4	7	4	6	5	21
Megaloptera	1	1	1	0	0	0	0	0	0	0	1	1	0	1
Trichoptera	6	9	6	4	6	11	7	12	7	10	12	11	6	35
Microlepidoptera	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Diptera	14	23	22	18	14	12	19	17	17	26	29	28	21	73
Total taxa	35	53	42	42	36	40	42	54	41	55	72	72	43	192

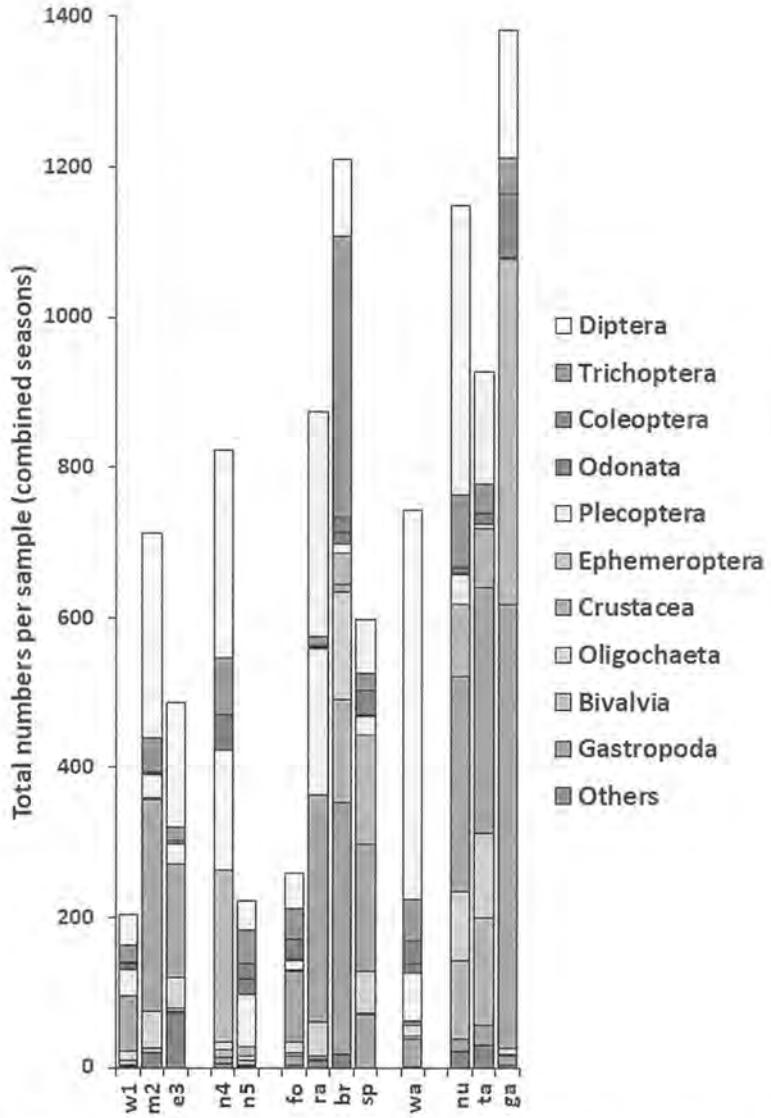


Figure 2 (colour) The faunal composition of the 13 sites based on combined autumn, spring, and summer samples.

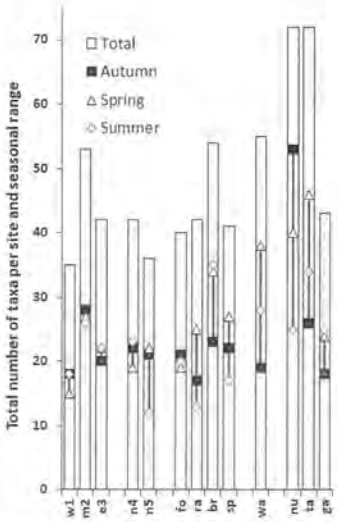


Figure 3 The total number of taxa and seasonal range for the 13 sites based on combined seasons data.

recorded from eight of the 13 sites. These included a specimen of our native crayfish *Austropotamobius pallipes* found in the summer sample at site **nu**.

Species number and abundance are useful descriptors of the fauna, but additional insight can be gained by observing differences in the total community of macroinvertebrates present at each site. A cluster analysis of quantitative species data from all seasons identified seven groups of sites. These are superimposed on a DCA ordination plot of the seasonal data (Figure 4). Group I contains all seasons samples taken at **br** below the lake. The group is characterised by the absence of Crustacea and the presence of a blackfly *Simulium noelleri* often associated with lake/reservoir outflows. Group II is

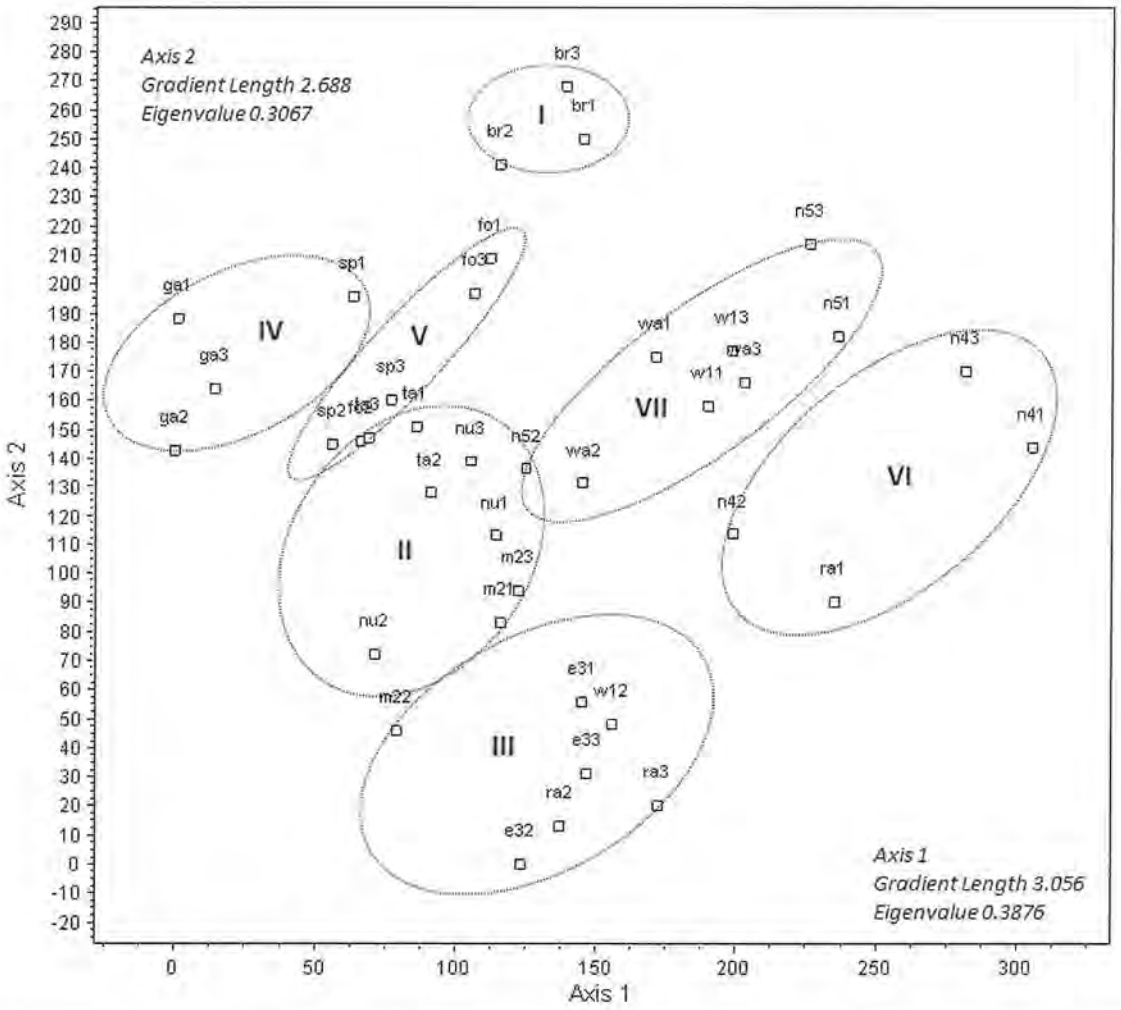


Figure 4 A Detrended Correspondence Analysis of seasonal species data from the 13-site survey. The suffixes 1,2, and 3 after the site code indicate spring summer and autumn samples respectively. Thus, **m22** is the summer sample at **m2** and **w11** is the spring sample at **w1**. The ellipses circumscribe site groupings identified from a preliminary cluster analysis of the species/site data. Also shown are Gradient lengths and eigen values for each axis.

made up mainly of spring and autumn samples from the 'western' sites **nu** and **ta** which share 30 and 26 taxa respectively with the Bovington South site **m1**. Group III comprises mainly spring and autumn samples from Bovington South. Group IV contains all season's samples from the 'western' site **ga** plus a spring sample from **sp**. All sites in this group were dominated numerically by high numbers of the mayfly *Baetis rhodani* and *Gammarus pulex*. Group V contains exclusively, samples from the two larger streams (**fo** and **sp**) in the Holme Lane area. Group VI comprises all season's samples from **n4** (Bovington North) and a spring sample from the Holme Lane site **ra**. Group VII includes all samples from the densely shaded sites **n5** and **wa** plus spring and autumn samples at **w1.**

The wide seasonal differences in the number of taxa recorded between some sites probably helps explain the fact that seasonal samples from the same site do not always group together and spring and autumn sites are frequently separated from summer samples in each group. A total of 82 taxa (including Chironomidae) were found only in one season (Table 3). Chironomidae contributed six, 14, and four taxa to the Diptera total for autumn, spring, and summer respectively.

In the ordination plot the Eigen values are equal to the maximised dispersion of the species scores on the ordination axes and are therefore a measure of the importance of these axes. In this case Axis 1 is the most important. A gradient length of four

Table 3 The numbers of taxa in major groups occurring only in single seasons in the 13-site data set

	Autumn	Spring	Summer
Hirudinea	2	1	0
Crustacea	0	0	1
Gastropoda	2	1	1
Ephemeroptera	0	1	1
Plecoptera	0	2	1
Odonata	2	0	0
Hemiptera	0	2	4
Lepidoptera	0	1	0
Coleoptera	2	5	6
Trichoptera	2	7	4
Diptera	9	17	8
Total	19	37	26

would indicate a complete turnover of species but if we compare autumn samples **ga3** and **n43** the sites share six taxa in common. Along Axis 2, br**3** and **ra3** have five taxa in common. Thus, not a complete turnover but a good separation of species along the axes. Axis 1 scores showed a statistically significant relationship with conductivity ($r = -0.8079$, $p<0.001$, n 39), the proportion of silt/clay in the substratum ($r = 0.5122$, $p<0.01$, n 39) and the degree of habitat modification of the site ($r = -0.5458$, $p<0.001$, n 39). On Axis 2 the proportion of Pebbles/Gravel was significantly related to axis scores with a mean percentage cover in Group I of 26 compared with Group III 63%.

13 Site survey – Environmental assessment

The national water quality assessment system, RICT (Davy-Bowker *et al* 2008) was applied to the 13 sites. RICT makes a site-specific prediction of the fauna expected at a site in the absence of any pollution and calculates various indices derived from that fauna, based on environmental variables recorded at the site. It is important therefore that the test site falls within the environmental ranges of sites within the reference database. The program assigns a 'suitability code' which gives the probability of a test site belonging to any group in the database. (1: > 5%, 2: < 5%, 3: < 2%, 4: < 1%, 5: < 0.1%). If any site has a 'code' greater than 4, then the predictions and classifications arising should be carefully reviewed to consider if they are appropriate. In our data set only the Bovington South Site **w1**, the Bovington North site **n4** and site **br** (below the small 'lake') had high suitability codes. Of the remaining sites, quality classifications ranged from Moderate (**e3**, **fo**, **ra**) to Good (**m2**, **n5**, **sp**, **ga**) with sites **nu**, **ta**, and **wa** classed as High.

Calculation of the Community Conservation Index (Chadd and Extence, 2004) indicated that one site **n4** had a '*very high*' conservation value, **wa, fo**, and **nu**, were classified as '*high*' and the remaining sites as '*fairly high*'. The exceptions **w1** and **ga** were classified as '*moderate*'. CCI accounts for overall community richness at the sites being assessed together with the relative rarity of species present. Thus, if a site has no high scoring taxa it will tend to have a low CCI, for example the site **ga** classified by RICT as of good quality is only given '*moderate*' conservation status. Also, rare taxa can inflate the conservation value, for example at **n4** the occurrence of *Hydrometra gracilenta* makes the site of '*very high*' conservation value whereas RICT classifies the site as Moderate. Thus the system, while drawing attention to rare or notable taxa, requires careful interpretation.

Comparison with other streams – Fauna

Eighty-two sites (including the 13 sites from the current survey) on small streams have been surveyed in the last 27 years. Details for each stream surveyed are presented in a series of publications in the Proceedings of the Dorset Natural History and Archaeological Society (Armitage *et al* 1994 – Armitage and Tapia 2021).

A total of 353 taxa (excluding Oligochaeta, Sphaeriidae and Chironomidae which were not recorded at species level in all the surveys) were recorded from the 82 sites. The highest numbers of taxa (60–70 per site) in combined season data were recorded at seven sites, five on chalk streams (Wool, Win and Jordan), one on the heavily modified Moreton Stream, and site two on the Bourne Stream below the outfall of a pond. In general, higher conductivity sites supported greater species richness ($r=0.3702$, $p=<0.001$, $n=82$) (Figure 5).

The relationship between the 13 sites examined in this study and data collected from small streams in the area since 1994 is illustrated in Figure 6 which shows the location of the 13 sites on an ordination

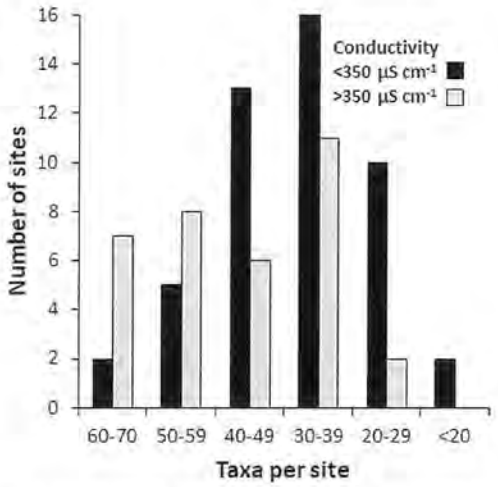


Figure 5 The numbers of taxa per site (in bands) in relation to conductivity of the 82 sites based on the mean of 3 seasons values.

plot of combined seasons species presence/absence data from the total of 82 sites on 27 streams.

Four major groups were identified by a cluster analysis of the data set. Group I, a small group of low conductivity sites including the Furzebrook Stream, Luckford Lake, and some sites on the Sherford River; Group II, a much larger and diverse group of low conductivity sites containing 10 of the 13 sites from the present survey. The remaining three sites **nu**, **ta**, and **ga** were found in Group IV which comprises mainly chalk stream sites on the Wool Stream, the Win, the Jordan, Owermoigne, Lulworth and the lower Sherford. Group III consists of the heavily modified sites on the Bourne and Bovington Streams. The

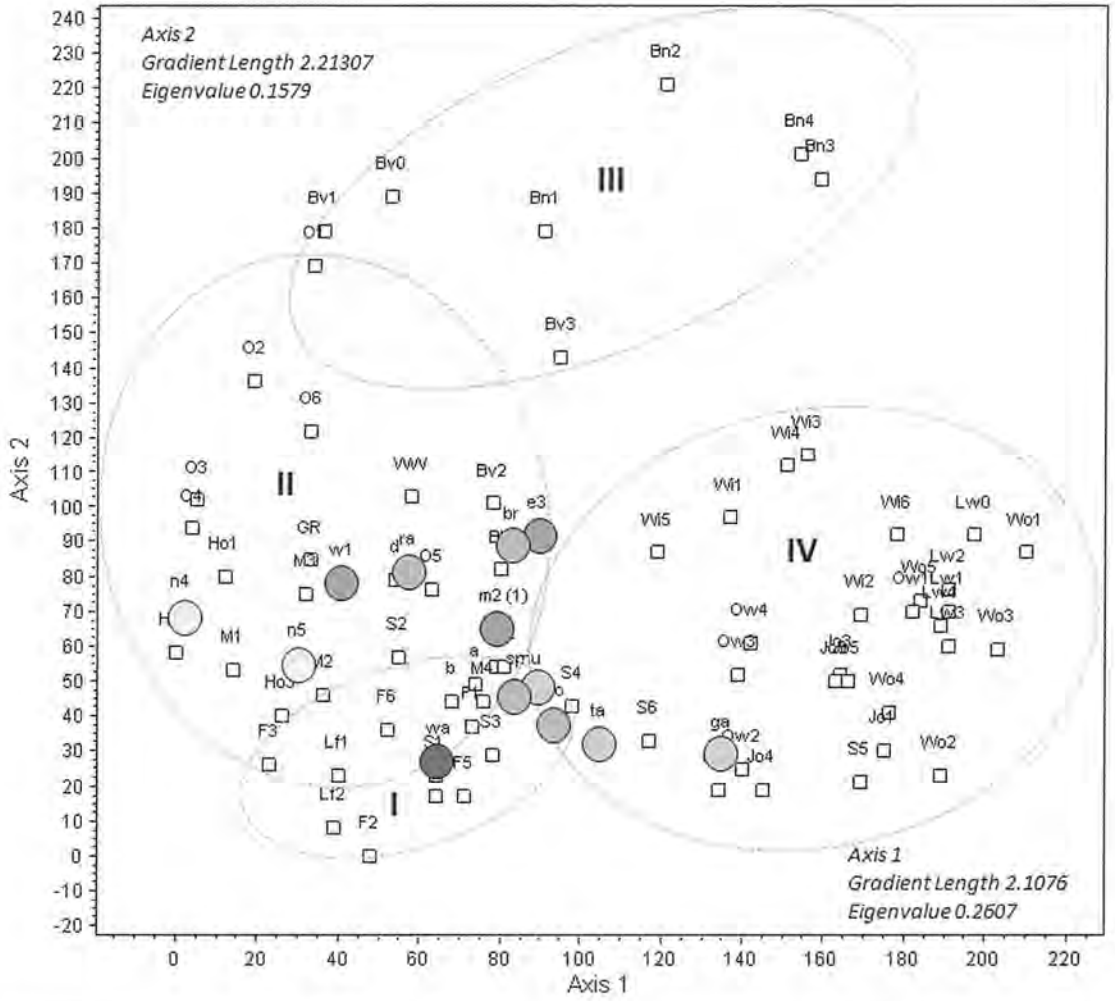


Figure 6 A Detrended Correspondence Analysis of 82 sites on small Dorset Streams based on species presence/absence data from combined seasons samples. The ellipses circumscribe the four main groups identified from a cluster analysis of the species/site matrix. Coloured circles show the location of the 13 sites in the plot (Blue -Bovington South, Yellow Bovington North, Green Holme Lane, Red Warren, Orange Western Sites. (Key to streams: - Lf Luckford Lake, Wi Win, Bn Bourne, Wo Wool, Ho Holy, Lw Lulworth, Jo Jordan, Bv Bovington, F Fursebrook, S Sherford, O Oakers, BU Burnbake, GR Greenland, WE Wytch East, WW Wytch West, M and a b d Moreton, Ow Owermoigne. The suffix numbers attached to these codes indicate sites along each stream where 1 is the top site.)

Bourne at the time of our original survey (Armitage *et al* 1995) was affected by general urbanisation effects and in addition a major influence on the stream was daily discharge of water originating from the Avon and Stour from Bournemouth and West Hampshire Water Works (Armitage and Blackburn 2010). The Bovington Stream drains the military ranges and is heavily modified with several sediment control systems (Armitage *et al* 2020).

Axis 1 scores showed a statistically significant relationship with conductivity (r= 0.8601, n=82, p=<0.001), stream width (r= 0.4774, n=82, p=<0.001), macrophyte cover (r= 0.3856, n=82, p=<0.001) the degree of habitat modification (r= 0.4202, n=82, p=<0.001) and shade (r= -0.4747, n=82, p=<0.001). No significant relationships of environmental variables with Axis 2 scores were observed.

Comparison with other streams – Environmental Assessment

In all the stream surveys carried out since 1994 the national environmental quality assessment methodology has been applied to the sites. Over the years the classification bandings have changed slightly as the method evolved. We therefore reviewed the past data and standardised the bands to the current system where five bands are recognised (High, Good, Moderate, Poor, and Bad).

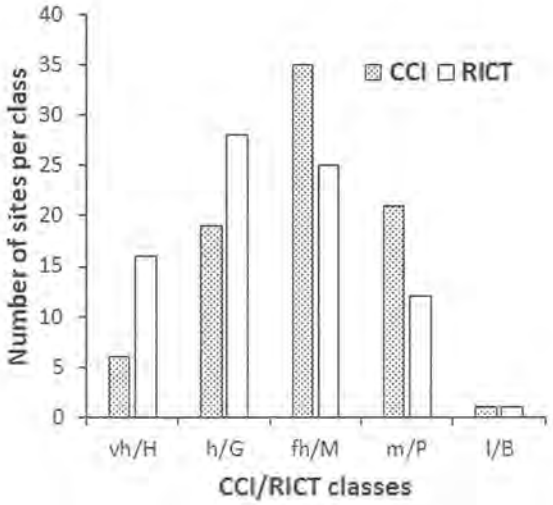


Figure 7 The number of sites in RICT and CCI classes in the 82-site data set. [CCI classes vh very high, h high, fh fairly high, m moderate, l low (*sensu* Chadd and Extence 2004); RICT classes H high, G good, M moderate, P poor, B bad]

Within this Dorset small stream data set, 44 of the sites were classed as High to Good by the RICT methodology. In contrast the Community Conservation Index placed only 30 of the sites in the very high to high category (Figure 7). Because the two assessment measures are using different criteria (broadly speaking, organic pollution tolerance for RICT, and community richness and the relative rarity of species present for CCI) a site may be given a different classification by the two methods. There is no statistically significant relationship between the RICT and CCI although both are correlated with the total number of taxa found at a site (r=0.4832, p=<0.001, n=82; and r=0.2495. p=<0.05, n=82, respectively). Conductivity, a significant variable in the ordination plot is not significantly related to RICT or CCI but is to the number of taxa.

Only in 18 cases did the methods give the same class to a site. Forty-six sites were within one class, 15 within two, and three within three classes. In this last case all three sites were classed as moderate by the CCI and High by RICT.

The CCI draws attention to the rarity of species in the sample. Fifty-two of the 82 sites had Red Data Book, Notable or Regionally Notable taxa including eight of the 13 sites surveyed in this study (Table 4).

DISCUSSION

Our current 13-site survey has contributed a wide range of sites to the small stream data base, and it is useful to consider these in relation to previous surveys carried out over the last three decades.

From the first known settlement of Dorset by Mesolithic hunters from around 10000 BP successive settlements have created an exclusively anthropogenic landscape of deforested arable land and enriched pastures. On poor sandy/gravelly soils, woodland was cleared giving rise to heathland. On more calcareous soils, the clearing of willow and alder carr in the valleys and subsequent channelisation of the original braided channel gave rise to chalk streams as we know them today (Westlake and Ladle 1995). Subsequently, changes to the landscape have involved forestation of heathland

Table 4 The occurrence of Red Data Book, Notable and Regionally Notable species in the 82 sites small stream data base. [CS Conservation Score where 10 is RDB Endangered, 9 is RDB Vulnerable, 8 is RDB Rare, 7 is Notable and 6 is regionally notable -sensu Chadd and Extence 2004; Site codes see Figure 6 legend.]

CS	Taxa	Sites
10	*Hydropsyche saxonica*	Lf3, F2, F4,
9	*Agabus brunneus*	Ho1, O5,
8	*Hydrometra gracilenta*	n4,
8	*Stictonectes lepidus*	Lf3,
7	*Batracobdella paludosa*	Jo4,
7	*Austropotamobius pallipes*	nu,
7	*Hydroporus marginatus*	Ho3, F1, S1, Lf1,
7	*Ilybius fenestratus*	Bn2,
7	*Deronectes latus*	fo,
7	*Gyrinus urinator*	Bv1, Bv3, GR, a, Ow4, sp, b,
7	*Hydraena testacea*	b,
7	*Riolus subviolaceus*	Jo5, S3, Wo2, Lw3, Wo3, Lw4, Jo1,
7	*Hydropsyche fulvipes*	fo,
7	*Dixa maculata* complex	Lf2, Lw1, Lw2, Ow1, F1, Lw4, Jo1, b,
7	*Dixella filicornis*	O6, S2,
6	*Planaria torva*	Wo1, Wo4, Wo2, Jo3, Wo3,
6	*Dina lineata*	Wi1, Wi2,
6	*Baetis buceratus*	Wo3, Lf1,
6	*Amphinemura standfussi*	F6, S4, F2, F3, S2, S6, F4, S1, Lf1, fo, ta, nu,
6	*Mesovelia furcata*	S6, S1,
6	*Lasiocephalus basalis*	br, M4, ta, fo, nu,
6	*Brachycentrus subnubilus*	S5,
6	*Simulium latipes*	O1, WW,
6	*Simulium angustitarse* group	d, e3, Wi1, Wi2, Lw3, F3, WW, M4, Lw4, Jo1, F4, Lf1, nu,

(Macdonald *et al* 1957) and more recently efforts have been made to remove coniferous plantations to reinstate heathland habitat (Bowen 2000). In addition to these changes there has been a significant increase in population size as exemplified by the Bourne Stream which flows through Bournemouth. In 1851 the population was 697, in 2003 it was 164,000 and in 2021 it was 193,467.

Against this backdrop of historical changes, we have a network of streams draining both acid and alkaline soils all of which have had major modifications in their catchment and in their channels. The range of modifications associated with our 82 sites data set is extensive (Table 5) and every stream has been affected in some way in the past. Although half the sites are classified as being of High to Good quality by the National RICT system, 38 sites are classed as of moderate to poor quality.

In recent years there has been considerable interest in the possibility of 'restoring' the environmental health of small water bodies including small streams (Riley *et al* 2018). Several courses of action are proposed which consider channel hydromorphological dynamics, riparian zones, and catchment activities but it is accepted that full 'restoration' to pristine conditions is possible only in relatively few environments where 'disturbance' has been slight. In our data set few of the streams are suitable for channel modifications or riparian management because they flow through urbanised areas where the cost of restorative action would be excessive due to work needed to redirect streams and funding to compensate landowners.

There may be opportunities in three of the streams which cross Holme Lane. The Tollbar Stream (**sp**) has been affected by quarrying activity resulting in extensive channelisation and sediment mobilisation. In the unlikely event that these activities will cease it will be necessary to encourage management which reduces the impact of disturbance. Sites **ra** and **fo** are situated on the military ranges and they probably offer the best opportunity for implementing restorative actions such as control of sediment mobilisation and the development of

Table 5 Historical modifications predating stream surveys and observed changes post survey. [Df deforestation, Sed sediment issues, Ld/Ch land drainage and channelisation, noc no observed change].

Stream	Abstraction	Agriculture and Land Drainage	Altered water chemistry	Cress bed	Culverts/Channelisation/Dredging	Forestry	Gardens	Lakes/Ponds/Mill	Organic Pollution	Quarrying	Urbanisation/Road runoff/Sediment mobilisation	Changes post survey
Luckford Lake	-	-	-	-	1	-	-	1	-	-	-	Df
Win	-	1	-	-	1	-	-	-	-	-	1	Sed
Bourne	-	-	1	-	1	-	-	-	-	-	1	noc
Wool	-	-	-	1	1	-	-	-	-	-	1	Dr
Holy	1	-	-	-	1	-	-	1	-	-	-	Df
Lulworth	1	-	-	-	1	-	-	-	-	-	1	noc
Jordan	1	-	-	-	1	-	-	-	-	-	1	noc
Bovington	-	-	-	-	1	-	-	1	-	-	1	Sed
Fursebrook	-	-	-	-	1	-	-	-	-	-	-	noc
Sherford	-	-	-	-	1	-	-	1	1	-	1	noc
Oakers	-	1	-	-	1	1	-	-	-	-	-	noc
Burnbake	-	1	-	-	1	1	-	-	-	-	-	noc
Greenland	-	-	-	-	1	1	-	-	-	-	-	noc
Wytch East	-	-	-	-	1	1	-	-	-	-	-	noc
Wytch West	-	-	-	-	1	1	-	-	-	-	-	noc
Moreton	-	-	-	-	1	-	1	1	-	-	1	Ld/Ch
Owermoigne	1	-	-	-	1	-	-	-	-	-	1	noc
Bovington South	-	-	-	-	1	-	-	-	-	-	1	noc
Bovington North	-	-	-	-	-	1	-	-	-	-	-	Df
Holme Lane **fo**	-	-	-	-	1	1	-	1	-	-	1	noc
Holme Lane **ra**	-	-	-	-	1	1	-	-	-	-	-	noc
Holme Lane **br**	-	-	-	-	1	-	-	1	-	-	-	noc
Holme Lane **sp**	-	-	-	-	1	1	-	-	-	1	1	noc
Warren	-	1	-	-	-	1	-	-	-	-	-	noc
Western **nu**	-	1	-	-	1	-	-	-	-	-	-	noc
Western **ta**	-	-	-	-	1	-	-	-	-	-	-	noc
Western **ga**	-	1	-	-	1	-	-	-	-	-	-	noc

riparian vegetation to protect the stream channel from disturbance.

Is restoration necessary? We would argue that from a cost/benefit point of view attempts to introduce sinuosity, altering channel morphology and establishing riparian zones are not suitable in most of our sites. Either because the available reach length for restoration is very short, or the streams already have reaches with 'natural' characteristics. Small streams are particularly vulnerable to disturbance. Channel restoration leading to sediment mobilisation and substratum disturbance can be a problem in lowland streams where flows are insufficient to flush sediment away. Areas (refugia) from which recolonisation can occur

may be removed (Korsu 2004). Where streams are already channelised it is to drain agricultural land and enforced changes may not be acceptable. It is important to keep stakeholders sympathetic to proposed restorative action. In some cases, historical modifications have resulted in an increase in biodiversity as seen in the ornamental gardens on the Moreton Stream (Armitage and Tapia 2021) and in our present study **br** below the man-made lake contributed 11 taxa not found in the other 12 sites.

The original objectives of our surveys starting in 1994 was to establish the environmental quality of small streams in the area and create a database which could be used for future comparisons. We have only resurveyed two streams, the Bovington and the Win. The former stream has been seriously affected by sediment mobilised from military activities in the catchment and in our initial survey (Armitage *et al* 1999) the quality of the stream was not good. Since then, a series of sediment control measures were implemented which have resulted in improved quality (Armitage *et al* 2020). The Win was resurveyed following worries that agricultural activities in the catchment may have affected the stream environmental quality. Our findings (Armitage *et al* 2018) showed reduced species diversity and abundance along the whole of the Win system possibly associated with increased fine sediment deposition, but it was concluded that the reduced environmental quality of the Win was more likely due to a combination of factors acting together on the stream benthos.

We do not believe that in-channel and riparian management is the best course of restorative action for streams in our data set. The Bovington and Win studies illustrate the importance of catchment activities in determining stream quality and we suggest that controlling detrimental aspects of catchment management would be more effective in improving the environmental health of the streams.

Our surveys over the last 27 years have produced detailed data on the species composition of a wide range of sites most of which had not been surveyed. This information has value (as seen above) in providing a baseline for future comparisons. Most of the streams do not appear to have had obvious modifications since our original surveys but it is worth noting that oaks, birch, and pine trees bordering a section upstream of site two on the Luckford Lake were felled after 1997. The bottom site on the Win over the last two years been bypassed by a straight channel taking water directly into the Frome. This is a counterproductive measure because sediment which used to deposit on the weeded bend of the stream is now carried directly into the Frome. The downstream section of the Wool Stream has been dredged but this seems to be a regular occurrence and occurred during the first survey (Armitage and Blackburn 1998). The Holy Stream despite being a Site of Special Scientific Interest (SSSI) has been encroached upon by the creation of a Gibbon enclosure by Monkey World. This involved tree felling. Further deforestation appears to be occurring upstream of site 2. The rare water beetle *Agabus brunneus* occurred at the top site and it is hoped that further catchment disturbance will not destroy its habitat. Land drainage and channelisation in an adjacent field affected the Moreton Stream just above the Gardens. The effects of these activities have not been investigated but the availability of data before disturbance can help assess their impacts if the need arises.

SUMMARY

The National quality assessment method RICT requires samples to be taken in autumn and spring but our data show that summer samples can contribute taxa not found in the other seasons. This may be particularly relevant in small streams where environmental features may vary considerably between seasons.

Conductivity is positively correlated with number of taxa but there is no significant correlation with the environmental assessment parameters RICT and CCI. So hard water chalk streams have more taxa but in this dataset are not necessarily of higher environmental quality than soft water streams.

In the 82-site data set 44 sites were classified as being of High or Good environmental quality by RICT and 30 as very high to high by CCI. The two assessment methods RICT and CCI did not always give the same

class to a site because they were measuring slightly different parameters. RICT essentially assesses organic pollution and CCI is useful at drawing attention to rarer species of conservation 'value'.

All sites have been subject to historical modifications in their catchments, but the modification factor used in our study (which applied to disturbance/modification at the sample site did not properly reflect these and showed no significant correlation with RICT, CCI or number of taxa but was significantly correlated with Ordination axis scores.

In general, the sites in our data set do not merit restorative action because the reaches available for 'restoration' are short and costs associated with redirecting streams and compensating landowners are likely to be high.

ACKNOWLEDGEMENTS

We are grateful to Steven Stobart (Training Safety Officer, UK Defence Training Estate – South West) for allowing access to the military training grounds at Bovington. We also thank our colleagues at the East Stoke River Laboratory for encouragement and help with identification.

REFERENCES

Armitage, P.D., Bass, J.A.B., Murphy, J.F., and Tapia, G. 2018. 'A comparison of the freshwater invertebrate communities of the River Win (Dorset) present in 1993 and 2016, over a period with agricultural intensification across the catchment', *Proceedings of the Dorset Natural History and Archaeological Society* **139**, 72–82.

Armitage, P.D. and Blackburn, J.H. 2010. 'Historic land-use and the influence of catchment characteristics on faunal communities of small streams, Dorset, UK', *Freshwater Forum*, **28**, 2–25.

Armitage, P.D., Blackburn, J.H. and Symes, K.L. 1995. 'The environmental quality of a small urban water course, the Bourne Stream, assessed with macroinvertebrate data', *Proceedings of the Dorset Natural History and Archaeological Society* **117**, 117–122.

Armitage, P.D., Blackburn, J.H., Wiggers, R. and Harris, I. 1999. 'The environmental quality of the Bovington Stream and its effects on the adjacent River Frome (Dorset), assessed with macroinvertebrate data', *Proceedings of the Dorset Natural History and Archaeological Society* **121**, 123–128.

Armitage P.D., Murphy, J.F., Pretty, J.L., Davy-Bowker, J., Tapia, G., Arnold, A. and Jones J.I. 2020. 'Faunal community change in the sediment impacted Bovington Stream and the River Frome (Dorset)', *SN Applied Sciences* **2:1913** | https://doi.org/10.1007/s42452-020-03736-5

Armitage, P.D., Symes, K.L. and Blackburn, J.H. 1994. 'Environmental quality assessment of the Win stream (Dorset) using macroinvertebrate data', *Proceedings of the Dorset Natural History and Archaeological Society*, **116**, 105–110.

Armitage, P.D. and Tapia, G. 2021. 'Channel modifications, habitat diversity, and macroinvertebrate species richness in the Moreton Stream (Dorset, UK)', *Proceedings of the Dorset Natural History and Archaeological Society*, **142**, 103–115.

Bowen, H.J.M. 2000. *The Flora of Dorset*. Pisces Publications, Newbury.

Chadd, R. and Extence, C. 2004. 'The conservation of freshwater macroinvertebrate populations: a community-based classification scheme', *Aquatic Conservation: Marine and Freshwater Ecosystems*, **14**, 597–624.

Davy-Bowker, J., Clarke, R., Corbin, T., Vincent, H., Pretty, J., Hawczak, A., Blackburn, J., Murphy, J., Jones, I. 2008. *River Invertebrate Classification Tool. Final report.* Edinburgh, UK, Scotland, and Northern Ireland Forum for Environmental Research (SNIFFER), Available from: -http://eprints.bournemouth.ac.uk/16550/2/SNIFFER_WFD72C_RICT_Final_Report_-_Davy-Bowker%2C_Clarke_et_al_2008.pdf [Accessed January 2022].

European Environment Bureau, EU Commission and Freshwater Habitats Trust, 2013. *Report of the Workshop on the Protection and Management of Small Water Bodies Brussels, 14th November 2013.* At https://freshwaterhabitats.org.uk/wp-content/uploads/2014/11/SWB-workshop-report_final.pdf [accessed January 2022].

Freshwaterhabitats.org 2020. https://freshwaterhabitats.org.uk/news/letter-to-natural-capital-committee-on-small-waters/.

Korsu, K. 2004. 'Response of benthic invertebrates to disturbance from stream restoration: the importance of bryophytes', *Hydrobiologia*, **523**, 37–45.

Macdonald, J., Wood, J.F., Edwards, M.V. and Aldhous, J.R. 1957. 'Exotic forest trees in Great Britain' *Forestry Commission Bulletin* **30**, 1–167.

Riley, W.D., Potter, E.C.E. *et al* 2018. 'Small water bodies in Great Britain and Ireland: Ecosystem function, human-generated degradation, and options for restorative action', *Science of the Total Environment* **645**, 1598–1616. doi.org/10.1016/j.scitotenv.2018.07.243

Westlake, D.F. and Ladle, M. 1995. 'River and stream ecosystems of Great Britain', in C.E. Cushing, K.W. Cummins, and G.W. Minshall (eds). *River and stream ecosystems*. Elsevier, Amsterdam, 343–388.

The authors: Patrick D. Armitage and Dave A. Cooling. Freshwater Biological Association, River Laboratory, East Stoke, Wareham, Dorset BH20 6BB Correspondence: parmitage@fba.org.uk.

THE CONSERVATION OF BIODIVERSITY AS EXEMPLIFIED BY A BEETLE SURVEY OF WOOL

TONY WARNE

The conservation of biodiversity is a priority worldwide but in Britain despite considerable effort it is currently failing because the application of policies is inadequate. A 25 year study of the beetles of Wool Parish in Dorset recorded over 1000 species, about 25% of all species found in Britain. By recording beetles from over 90 biotopes and combinations of biotopes their distribution, requirements and mobility is examined in the context of biodiversity conservation. Wool is an undervalued parish for wildlife, perhaps because Purbeck District has many very important areas for wildlife, many of international or national importance, that are also very scenic. Wool in comparison is not only undervalued but is seen as an area where expansion of the built-up areas can be can proceed with little ecological damage. This study demonstrates that this view is a mistake and simply due to the lack of knowledge of what is there. This study shows that current national mechanisms for biodiversity conservation are inadequate but while there are improvements being made in policy much will depend on their application and subsequent appropriate countryside management.

INTRODUCTION

The policy to maintain or enhance biodiversity appears relatively simple but its application is beset by problems. Frequently only the best known habitats and species of wildlife are included and generally only those that are rare or endangered. If we are to maintain biodiversity as a whole then a much wider view is needed and several fundamental questions need to be asked:

1. How is biodiversity distributed in the landscape?
2. Are there distinct communities and how do they relate to each other?
3. To what extent does focussing on Statutory or Priority areas contribute to the overall conservation of biodiversity?
4. Where there are mosaics is overall biodiversity simply a product of the number of biotopes or are there interactions and synergies between them and what is the importance of combinations?
5. If a biotope is damaged or destroyed can it be replaced *in situ* and what would be the consequences of its re-creation elsewhere (mitigation)?

The gap between policy and practice is demonstrated by several influential organisations, simultaneously advocating caution whilst also seeing little problem with destruction of biotopes. Some see mitigation as a last resort and only when essential with time being needed for compensatory biotopes to establish. Others believe biodiversity can re-establish quickly and that there may even be biodiversity gain following development.

In "The Pattern of Animal Communities" Elton (1970) two types of survey are identified: strategic surveys that are large scale comprehensive and integrated, and tactical surveys that are smaller and with a narrower scale. The latter have been the vogue in recent times but to advance on a large front such as community ecology and thence biodiversity conservation there need to be both strategic and tactical studies. There seems to be a tendency for the current biodiversity conservation policies to be based largely on the tactical studies.

The interdependence of species is recognised yet the targets and actions set are too often for individual species rather than the communities in which they exist and that support them. Are the present target species really indicators of wider biodiversity? Particular biotopes are selected but again their relationship to the surrounding biotopes and landscape is not considered. By only focusing on individual biotopes and individual species, often just those already covered by statutory designations, there is a danger that they become islands within the landscape rather than a functional part of it. Intercommunication between "islands" of biotope may become more difficult as land between becomes increasingly used by less wildlife hospitable activities such as building or intensification of agriculture.

Currently invertebrates (such as butterflies and pollinating insects) are faring badly according to the overview of indicators in the assessment of change (DEFRA 2014; 2020). This indicates that the commitment to the conservation of biodiversity since the Earth Summit in 1992 biodiversity has actually continued to be lost even in a country such as England where we claim to be active in its promotion. There are plenty of data showing insect decline and the repercussions for birds in relation to agricultural intensification (Benton *et al* 2002, Sotherton *et al* 1989) but this kind of data has not been used to improve our understanding of wider biodiversity and its conservation.

There appears to be a lack of information about how biodiversity is distributed in the landscape. The diversity of living organisms is such that this can only be done on a limited scale and for a limited number of species. Some studies suggest that there are parallels between different groups of plants and animals and so this is put into practice by focussing on key species and priority biotopes. There is a need for wider scale assessments to see whether this focus on key species and priority biotopes is delivering all the objectives of biodiversity conservation.

LOCATION AND METHODS

The District of Purbeck in Dorset is an extremely rich area for biodiversity in the UK, indeed it may be one of the richest. There is a 10km square in Purbeck with one of the highest numbers of higher plants recorded in the BSBI Plant Atlas and a map showing where the greatest number of larger moths have been recorded shows this area of southern England to be amongst the richest (Butterfly Conservation). Purbeck has contrasting acid heathland and calcareous grasslands and Poole Harbour and Studland have extensive maritime and para-maritime biotopes. However within this exceptional richness the Parish of Wool appears to be something of a "Cinderella" area being left out of the ANOB and ignored by the Wild Purbeck Project because it has well above the average proportion of developed land (15-18%) for a village in the district. As a result, it is seen as one with further potential for development of housing and local industry even though, as will be demonstrated, its biodiversity is just as rich as other areas of Purbeck.

On the face of it Wool is an unremarkable parish with no picture book appeal. For over 100 years about 30% to 40% has been a military training area. Bovington Training Area (BTA) includes some of Turnerspuddle Heath SSSI, a small portion of Winfrith Heath SSSI also lies within Wool (Fig. 1). Both are a part of the Dorset Heaths SPA, SAC and Ramsar sites of international importance. The River Frome that runs through Wool is an SSSI and is the most Western chalk stream in England. Wool also has Sites of Nature Conservation Importance (SNCI) and a Local Nature Reserve (LNR). Many of the woodlands are ancient woodland and almost all of the farmland is farmed organically. The existence of the military training area for over 100 years means that it predates the use of agrochemicals and in effect the land is also "organic". Most importantly throughout there is good linkage between the varied biotopes.

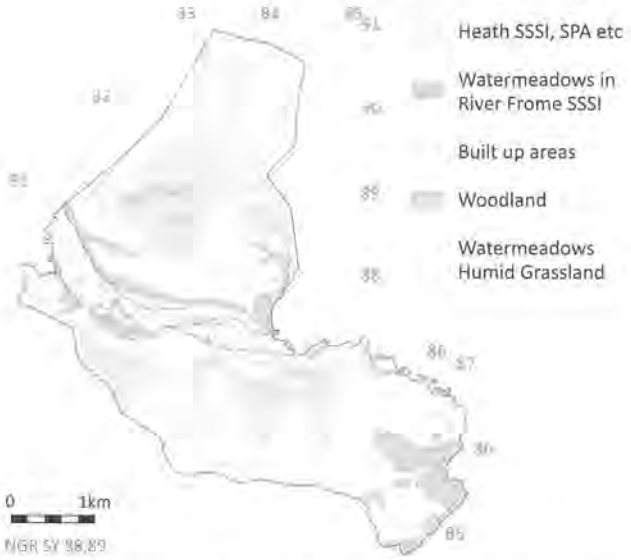


Figure 1 The parish of Wool showing the major habitat types.

Biotopes referred to below are defined by the CORINE Biotopes classification (CEC 1994).

Biotopes to the north of Bovington Camp are divided between *Atlantic Erica Ulex Heath* and *Purple Moor-grass Wet Heath* and their variants. Damage to these biotopes from military training has created a series of variants and some of these have an individual importance such as *Dystrophic Pools* mostly created by compaction by vehicular use. Damage and loss of heathland has also occurred through planting conifers. The heath biotopes, pristine and damaged, are not only vegetationally related but are geographically related, adjacent or close to each other.

The more varied biotopes to the South of Bovington Camp are also mostly connected and include some very contrasting junctions such as the woodland with the water meadows. There is some isolation in the case of enclosed farmland (organic) and the road verges. Though verges are often cited as examples of corridors, in reality they are fragmented by roads as far as many flightless invertebrates are concerned, the railway line provides a less fragmented corridor. On the southern area, loss of biodiversity may have occurred as agriculture developed throughout history, but at some point there was a dramatic change when sheep grazed grasslands were converted to arable. The land to the immediate South of Bovington Camp within the BTA was formerly farmland but because it was on soils overlying the Bagshot beds its quality and productivity must have been fairly low and since it came within the BTA (apart from military training) its use has only been grazing. Some of the grazed grassland has been improved but not consistently as it is difficult to manage within the military training area so that many areas have become overgrown grassland. The woodlands on the BTA are almost all ancient seminatural woodland but are vulnerable to surrounding land uses because they form a very narrow band between the Bagshot beds and the River Frome valley water meadows – indeed this junction means that some of the woodland is wet and has plants encroaching from the water meadows. New deciduous woodland has been planted by the MoD alongside the existing woodlands to make them more robust and to encourage the new woods to acquire a woodland flora and fauna from the adjacent woodland. The water meadows form a complex of biotopes with ditches and streams lined by *Medium tall Waterside Communities* adjoining *Atlantic and sub Atlantic Humid Meadows* which in winter can become flooded and are therefore partly *Flood Sward*.

Elsewhere in Wool the road system usually has a band of road verge either side in total amounting to about five hectares. Road verges are subject to considerable disturbance including compaction, smothering by enriched soil from ditch clearance, pollution from motor vehicles, digging to lay cables and in places regular mowing, Some invasion by bramble is beneficial as it supports a great range of wildlife especially pollinators but in places it displaces other herbaceous vegetation.

DAMAGE AND DISTURBANCE.

Wool Heath has been used for military training for over 100 years and for much of that time has been used for tank training. Black and white aerial photographs dated 1947 show extensive visible damage from tank tracks. About 30 years ago, a concrete All-Weather Driving Circuit (AWDC) was constructed removing a large area of the heath from damaging activities. The undamaged heath is now part of Turner's Puddle Heath SSSI. Damage and disturbance occurs in many ways:

1. Physical disturbance is widespread and if the chemical balance of the soil is not changed physically damaged biotopes can repair themselves given time.
2. Chemical damage is a much greater problem and may take a very long time to recover requiring, for example, leaching of the chemicals from the soil surface layers. The AWDC track itself is concrete and there is probably some calcium leaching from this, perhaps with some calcium rich concrete dust from abrasion by tanks washing on to the adjacent soils which were very disturbed during construction of the AWDC. In places there are either pockets of calcium rich soil within the Bagshot Beds or the Bagshot Beds are shallow and more chalky soil from beneath them was brought to the surface during construction. The vegetation of a two to three metre strip on either side of the circuit has developed a more ruderal pioneer vegetation rich in species such as Birds-foot Trefoil (*Lotus corniculatus*), Tormentil (*Potentilla erecta*) and Selfheal (*Prunella vulgaris*) and with many bare areas.
3. There are unsurfaced tracks across the heath and in particular a track parallel to much of the AWDC. During dry weather in the summer, use of these tracks can generate dust clouds that settle on adjacent vegetation that can have an impact on insects. Hard dusts can abrade the surface of the cuticle of insects and cause dehydration.
4. The Bagshot beds are extremely varied and vary from very coarse gravel to layers of clay or almost clay with fine particle size. In wet weather this fine material can wash from disturbed areas onto the undisturbed Heath and this may then dry to form a firm surface that impedes drainage and may also contain higher calcium levels which seems to suit mostly ruderal plants of wetter ground. The army has installed settling ponds to intercept silt and prevent it washing into the Frome.
5. Conifer planting on the heath can be considered as a type of disturbance as these plantations retain a suppressed heath flora in the ground layer that can revert to heath when the conifers are felled. Some of the surveys were to see how well invertebrates recolonised an area reverted to heath to compensate for heath destroyed in 2001-2 to construct improved military training facilities.
6. Fires are a regular cause of damage to heathlands throughout the Poole Basin but fortunately have been less frequent within the restricted military area of the BTA. A fire on Cranesmoor within the study period although extensive only caused superficial damage as this area is wet heath preventing it burning the most sensitive areas.

THE SURVEY

Over the last 25 years invertebrates on the BTA were surveyed as a contribution to the work of the MoD's Conservation Liaison Group for the Bovington and Lulworth Ranges

These surveys have been undertaken using a wide range of techniques as and when possible or when needed to provide advice for range management. They cannot therefore give much insight into invertebrate population dynamics. Some techniques giving quantitative data were included such as pitfall trapping, Malaise trapping and light trapping. These cannot be used everywhere, simply because logistically this is not feasible but there are also practical issues. Light traps need to have a power source and be visited daily; Malaise traps are vulnerable to interference and damage both human and by deer but do have the great advantage that they can be installed for about eight months of the year and so provide a continuous stream of data against which data from point in time visits can be seen. The results from these survey techniques are also very variable because of weather conditions. Within the BTA most surveys had to be conducted at weekends to avoid military training. Sweeping, and for the last 15 years or so, suction sampling have been the most widely used methods along with simple collecting, for example by trampling the marginal vegetation of ditches and ponds.

From the large body of invertebrate data recorded for Wool, beetles have been selected as the subject of this analysis because of the very large proportion of the British beetle fauna recorded (25%), and because beetles are spread throughout the landscape. The heaths are particularly important for some Invertebrates such as ants, bees and wasps (Hymenoptera, Aculeata) but these are less significant in other biotopes.

In order to analyse the mainly unstructured data on the beetle fauna of Wool the main consistent element is that the data was all collected by one person, so that the constraints and limitations found in the field are known and can be taken into account. Unstructured data from multiple sources and surveyors might be very much more difficult to assess.

For each invertebrate sample site a list of the main

components of the flora was made, and from this it is possible to identify the biotope. For conservation assessments and management all species need to be classified within a single system and biotopes, by definition, are supposed to be based on both the flora and fauna, although in practice they are mostly defined by their flora mainly because invertebrate communities have been traditionally grouped other ways. There are several systems for classifying biotopes which need to be more than just a vegetation classification. For this analysis CORINE has been used as it has been available for over 25 years and has been utilised for several surveys in the past. CORINE is a branching classification that enables one to go as far as is useful and in some cases to add subdivisions particularly to enable manmade and damaged biotopes to be included.

Frequently invertebrates are found at the junction of biotopes or in mosaics so to assess this it is necessary to include a means of recording all biotopes. In practice, in almost all cases this only involves two biotopes so a spreadsheet or database to analyse the results needs to be able to include both.

The first level of output can be simply the number of species in particular biotopes or combination of biotopes. Data can be added into the database to enable the selection of species that are Nationally Notable or Rare, the selection of biotopes that are priority habitats, selections that are SPA, SAC, Ramsar, SSSI, SNCI etc. At a further level plant associations with species can be added or any other attribute of a species or biotope that might be useful for making assessments.

The outputs from the database can not only be used to show what species have been found in what biotopes, or combinations of biotopes, but also the range of biotopes and their frequency in which a species is found. This can be used to examine the role of cover and vegetation structure in relation to species and enables comparison of closely related species. This could be used to indicate where changes or adjustments in management might be used to favour particular species.

Pantheon (Webb *et al* 2018) is a database tool developed by Natural England and the Centre for Ecology and Hydrology to analyse invertebrate sample data to improve the understanding of the resources and structures used by invertebrates within the sample locations and aid their conservation. Pantheon has been used here to increase insight into invertebrate samples but unfortunately it does not use a standard biotope classification. It has been used as part of this analysis to examine some biotope data in more detail.

One problem of a landscape scale survey is the amount of survey needed. To assess any particular biotope how many species gives a good or adequate picture of that biotope? In this account biotopes with100 species, or more, have generally been set but that is likely to be only a small proportion of the potential number of beetles in any biotope.

A second problem is that in a parish scale survey such as that of Wool there are probably well over 100 biotopes and their combinations depending on how fine a scale these are divided. At present about 90 biotopes and combinations of biotopes have been surveyed but there are still some gaps.

Some biotopes are relatively small and have few recorded species while the *Bluebell Oak Forest* biotope while not extensive, has over 400 species recorded, and the unsurveyed woodland in the south of the parish would certainly expand this number considerably.

Analysis has shown that to reach for example 100 species on the nutrient poor biotopes on Wool Heath requires 50% more samples and to reach 300 species would require 2.5 to 3 times the number compared with the more nutrient rich and productive biotopes to the south of Bovington Camp.

RESULTS

Over about 25 years just over 1,030 or about 25% of the British species of beetles (Coleoptera) have been collected in Wool Parish (Fig. 2). The collection of 2268 samples hasproduced 17,430 records of beetles throughout the parish. These samples come from about 90 CORINE biotopes and combinations of biotopes. Quantitative data was recorded for pitfall

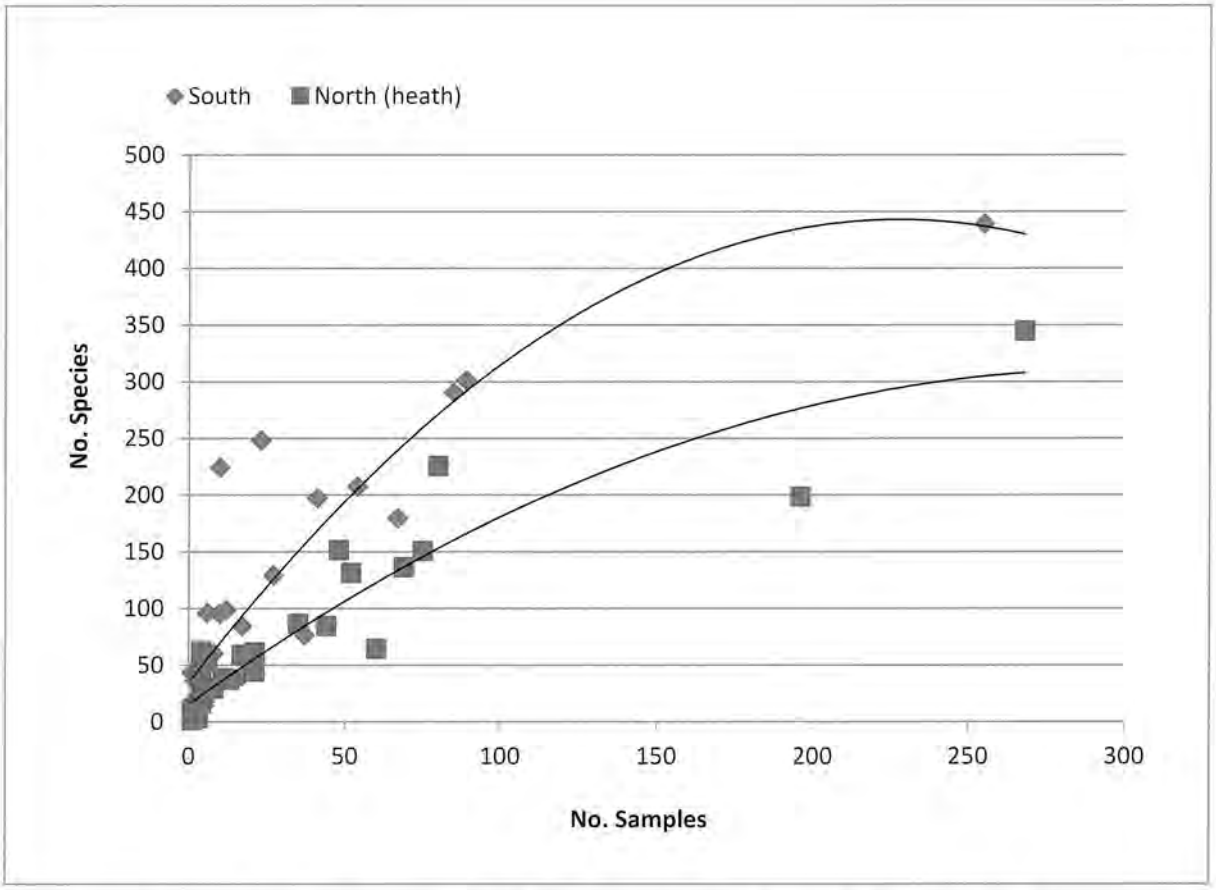


Figure 2 Species samples collected in Wool parish. North: The accumulated species for samples from the heath and associated biotopes (Squares). South: The accumulated species for samples from the more productive biotopes (Diamonds).

traps and Malaise traps. This constitutes the basic body of data entered on an Access database allowing the following analysis. The results and analysis are presented to answer the questions asked in the introduction.

Question 1. How is biodiversity distributed among the biotopes in the landscape?

Plotting species on the 10km sq National Grid is the usual method of showing the national distribution of species and this can be used to show how many are recorded in all parts of Britain, as for example for Larger Moths (Fox *et al* 2013). More locally by plotting the numbers of beetles on the 1km sq grid covering Wool (Fig. 3) it can be seen that the highest number of species (641) have been recorded in a square that includes a large number of very contrasting biotopes all in close proximity: the River Frome, ponds, woodland, water meadows, dry overgrown pastures and scrub. The next highest square just to the north

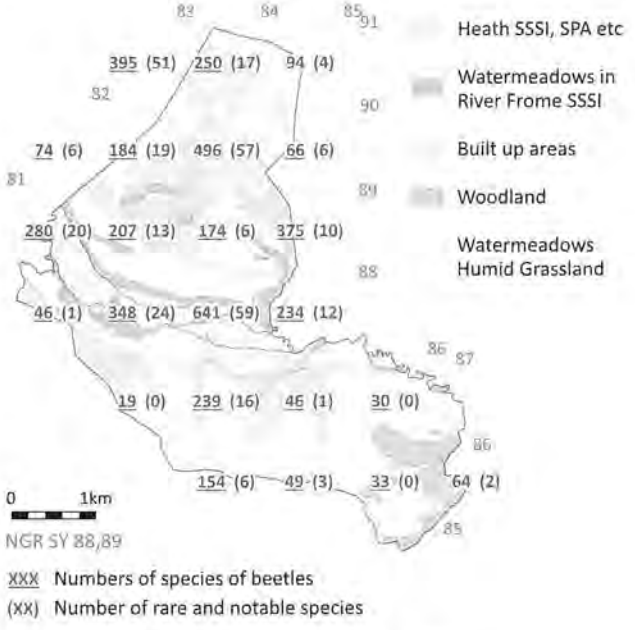


Figure 3 Distribution in 1km squares.

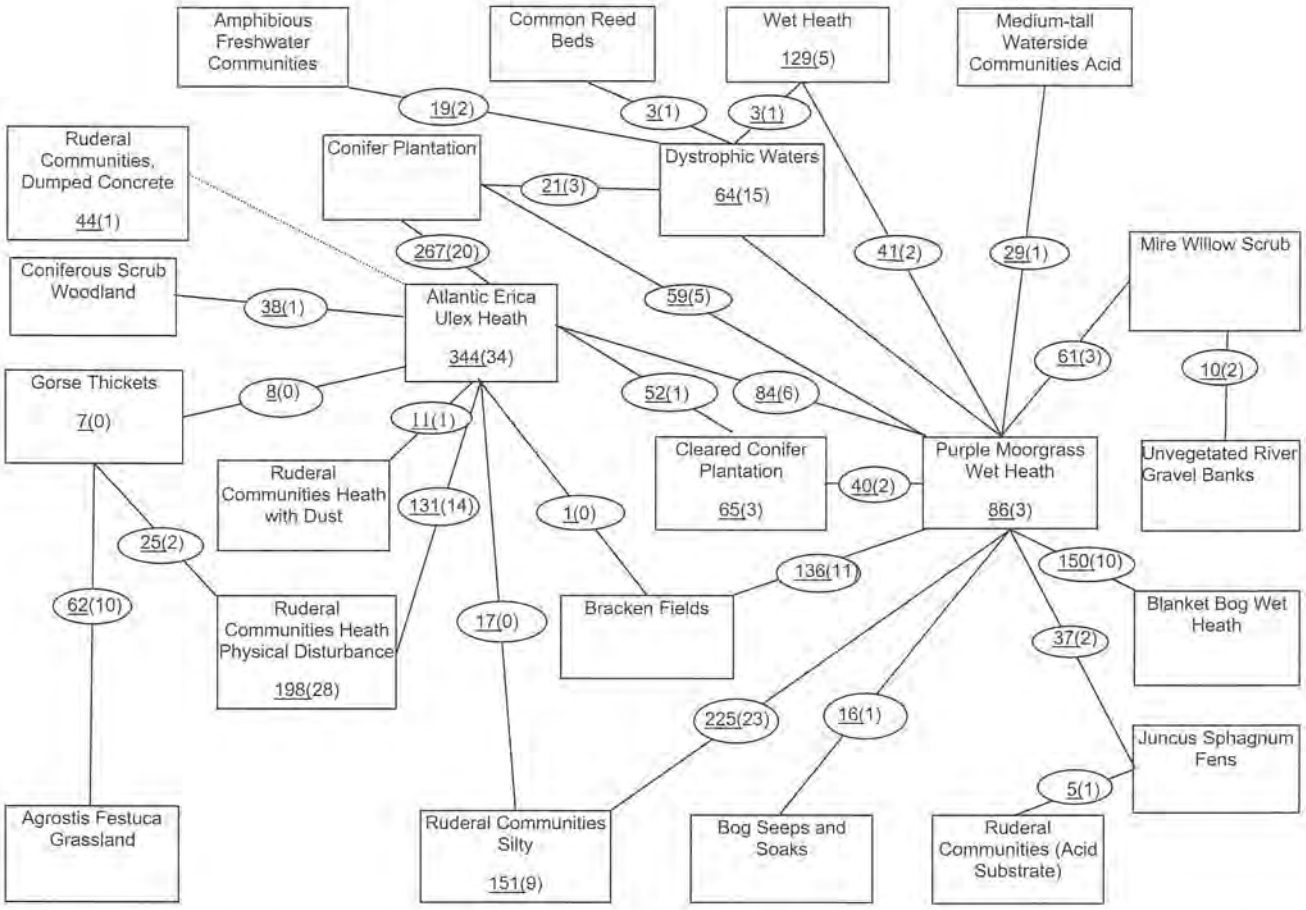


Figure 4 Species / Biotopes Distribution on Wool Heath, North of Bovington Camp. Rectangles = CORINE Biotopes, Ovals = Combinations between biotopes, first No, underlined = Beetles recorded, second No., in brackets= Number of Nationally Rare and Notable species

of Bovington Camp, including a part of it, has 490 recorded species and is mainly heath and damaged heath. Some areas clearly have high numbers of recorded species simply because more survey effort has been expended as for example in square SY8281 where there was considerable survey to record the changes following pine felling to restore heath.

Plotting total records on a grid does not say much except by indicating the importance of areas where there are many varied biotopes in close proximity. Areas where there are high numbers do not necessarily correspond to areas where there is currently much wildlife protection. More useful to the conservation of biodiversity is having the species related to the biotopes in which they occur.

Diagrams to show the numbers of beetles collected in biotopes found in Wool have been drawn to show not only the number of beetles found in each biotope but in the combinations between them (Figs 4 and 5). These combinations may be edges or mosaics but for many invertebrates whose larvae and adults require different biotopes these combinations may be very important. The diagrams also show how "damaged" biotopes relate to the undamaged. The resulting diagram is consequently large and complex and so for convenience needs to be presented in two parts, that relating to Wool Heath and adjacent areas North of Bovington Camp and biotopes to the South covering the former farmland, woodland, water meadows, road verges, organic farmland and ruderal communities. There are few biotopes that bridge these two areas, except conifer plantations, because Bovington Camp was largely built on the transition between these two contrasting areas to take full advantage of the heath for military training.

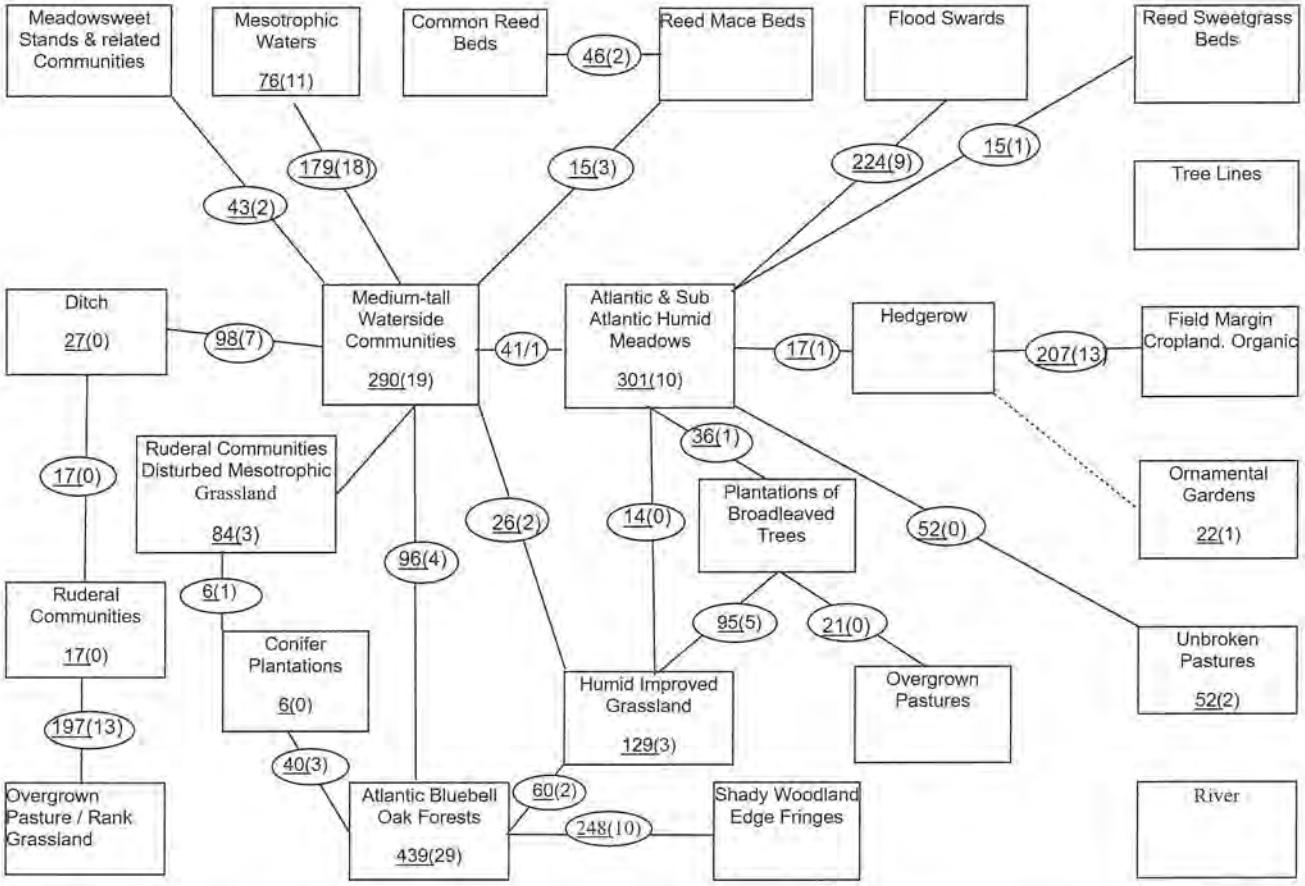


Figure 5 Species / Biotopes Distribution in areas to the South of Bovington Camp. Rectangles = CORINE Biotopes, Ovals = Combinations between biotopes, first No, underlined = Beetles recorded, second No., in brackets= Number of Nationally Rare and Notable species

On the diagrams the CORINE biotopes are shown as rectangles while the combination between them are shown as oval boxes lying on the connecting lines. The total number of beetles is the first figure underlined, the second figure in brackets is the number of Nationally Rare and Notable species. The proportion of Rare and Notable species, however, requires careful interpretation in particular as aquatic Coleoptera skew the results as families of these include a higher proportion of Rare and Notable species.

The diagrams cannot show the proximity of the biotopes on the ground but on Wool Heath in particular almost all lie adjacent to each other and for the remainder the only break is the wide concrete track of the AWDC. To the south most of the biotopes on the water meadows lie adjacent to each other. Even the *Ornamental Gardens* that have been surveyed can lie adjacent to *Tree Lines*, *Hedgerows* or *Humid Meadows* although the junction may be too abrupt to survey easily.

The diagrams show that some biotopes are at the core of the area's biodiversity richness. On the heaths *Atlantic Erica Ulex Heath* and *Purple Moor-grass Wet Heath* are two hubs around which most of the other biotopes occur, for the former there are ten and the latter 12 links with other biotopes. These two hubs contrast, the former is dry and the latter wet and this dryness and wetness are important for the distribution of many of the species. The biotopes to the South of the parish are less clearly arranged around hubs but the *Medium tall Waterside Communities* and *Atlantic and sub Atlantic Humid Meadows* do each have eight and seven links respectively with other biotopes with which they form junctions or mosaics.

The diagrams show that many combinations of biotopes are important. Both the diagrams and

the cluster analysis show that using a range of collecting techniques on a biotope produces a more balanced view than for those where results are based on a single technique. Species recorded from the *Shady Woodland Fringe / Atlantic Bluebell Oak Forest* were all caught in a Malaise trap with a collecting tray beneath. Species recorded for the *Atlantic Humid Meadow / Flood Sward* combination were all collected from flood debris. These are both methods that tend to collect mobile species, either actively flying or passively transported by water, that are consequently widely distributed common species. The *Atlantic Humid Meadow* and its combinations with *Overgrown Pasture* and *Unbroken Pasture* may reflect a history of drainage and grazing "improvement" over a long period resulting in a lower proportion of rarer species. Any bias from collecting technique, presence of aquatic species or the history of a site, needs to be carefully considered before drawing conclusions.

The diagrams show a general distribution of beetles across all biotopes and except in a few cases a similar general distribution of the Rare and Notable species. None of the biotopes surveyed appear to be impoverished. Typically *Bracken Beds* would show as impoverished but unfortunately this biotope was only surveyed in a combination with *Purple Moor-grass Wet Heath* so has species numbers typical of the heath biotopes. Conversely some of the disturbed heath and heath habitats created by damage are much richer than the undisturbed heath but Webb (1989) found that smaller heaths in Dorset had a richer invertebrate fauna than large, less disturbed, heaths and that there was an edge effect with neighbouring biotopes, this perhaps reaches a peak in these disturbed heath biotopes. Overall, the diagrams show biodiversity spread across all biotopes irrespective of condition or damage.

Question 2. Are there distinct communities and how do they relate to each other?

Two subsets of beetles with very contrasting life requirements from the 17 biotopes for which over 100 species of Coleoptera recorded were analysed in more detail. They are also two of the most common groups of species: Carabidae (Ground beetles), 134 species or nearly 13% of all species recorded, and Chrysomelidae and Curculionoidea, (Leaf beetles and Weevils), 282 species or nearly 27% of the species recorded (Figs 6 and 7). Carabidae were amongst the most common species, but they were mostly collected by pitfall trapping and as this was only carried out in about half the biotopes, they were poorly represented in some samples so these were discarded, leaving 12 of the possible 17 biotopes for cluster analysis. The dendrogram for the Chrysomelidae and Curculionoidea is better as it includes more species and more biotopes because sweeping and vacuum sampling were both the most productive for these species and were also the most widely used sampling techniques.

The cluster analysis dendrograms below broadly conform to the groupings of biotopes shown on the Species / Biotopes Distribution diagrams with the main separation between the nutrient poor heaths to the North of Bovington Camp and the more varied and nutrient rich biotopes to the South and a separation between wet and dry biotopes.

Anomalies occur in the dendrograms because some of the samples were of species collected by a single or limited number of collecting techniques particularly by Malaise trapping but also the sample collected from flood debris. The sample from Cranesmoor, *Purple Moor-grass Wet Heath X Blanket Bog Wet Heath (*1)*, may not only be because of the reliance on Malaise trapping. It may be because Cranesmoor is to some extent isolated (1km approx.) from other heathland by surrounding pine plantations, but is geographically closer (300m approx.) to the southern biotopes with some limited direct contact via some much modified grassland. The Chrysomelidae and Curculionoidea from the Atlantic *Humid Grassland / Flood Sward* (*2) were all collected from flood debris and *Medium tall Waterside Communities / Mesotrophic Water* (*3) has a high number of aquatic species unlike almost all other biotopes. The dissimilarity between the *Bluebell Oak Forest* and its *Shady Woodland Fringes*, even though these are adjacent, may again be because of collecting technique differences; the former surveyed by a wide range of techniques but not Malaise trapping, the latter wholly by Malaise trapping. The placing of the Malaise trap on the *Shady Woodland Fringe* was primarily to investigate exchange via a short ride through the woodland

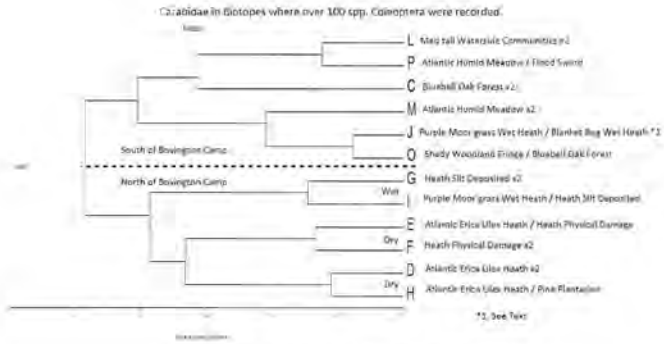


Figure 6 Incidence of Carabidae.

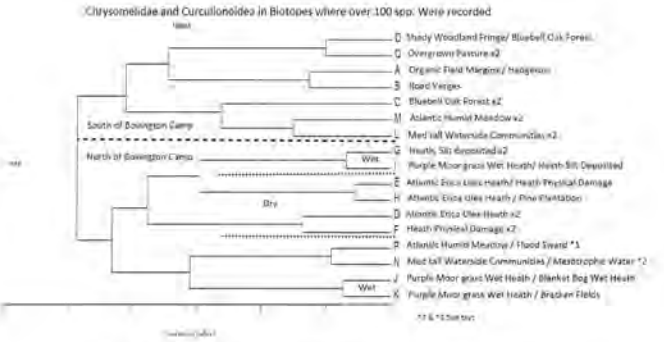


Figure 7 Incidence of Phytophagous species

belt between the water meadows to the south and the former farmland to the north.

The road verges and organic field margins are broadly similar for phytophagous species. The differences lie in the presence of some species associated with arable weeds mostly annuals on the field margins whereas road verges communities, unless recently disturbed, tend to be composed of a dense mat of mainly perennial plants.

Further cluster analyses were run to look in more detail at the biotopes for phytophagous species. Firstly the most common species were removed, 33 that occur in nine or more biotopes of the 17. This did not change the groupings of the cluster analysis showing that the most common species can occur across almost the full range of biotopes including the division between the nutrient poor heath North of Bovington Camp and the more varied nutrient rich biotopes to the South.

There is a suggestion from the Malaise trap data there may be a drift across the landscape of species that feed on Brassicaceae, in particular from oilseed rape fields to the South of Wool, but removing 15 of these species from the cluster analysis did not make any obvious change.

A cluster analysis of the Rare and Notable species produced the same distinction between the North and South areas but as the analysis was for comparatively few species the finer subdivisions indicated more of the sampling bias.

The Species/ Biotope Distribution Diagrams and the Cluster Analysis show that there are distinct communities of Coleoptera for each biotope each with a typical species abundance distribution- a small number of very common species, many abundant and frequent species and a very large number of uncommon species. The small number of abundant and frequent species occurred throughout the communities, the large number of uncommon species mostly being those that define the communities.

Table 1 Distribution of Coleoptera by designated site status.

Site status /designation	Total Number of Coleoptera	% Total Coleoptera	Number of Rare & Notable spp.	% Rare & Notable spp.
Whole Parish Total	1032	100%	153	15%
SPA,SAC,Ramsar - statutory	217	21%	18	8.20%
SPA,SAC,Ramsar, SSSI & ptSSSI - statutory	363	35%	29	8%
SPA,SAC,Ramsar, SSSI & ptSSSI , LNR - statutory	440	42%	36	8.2%
SNCI (non statutory)	566	55%	40	7%
SPA,SAC,Ramsar, SSSI & ptSSSI , LNR,SNCI – combined statutory & non statutory	677	66%	63	9.3%
Only recorded outside statutory designated areas (by subtraction)	355	34%	89	25%
Total recorded outside all designated areas - combined statutory & non statutory	936	91%	127	13.6%
Total recorded outside Statutory designated areas	1013	98%	146	14.4%

Question 3. Does focussing on Statutory or Priority areas contribute to the conservation of biodiversity?

There are two sets of areas that are included in policies for biodiversity conservation. The first is areas covered by current statutory designations; the second is areas of Priority Habitats listed under the Natural Environment and Rural Communities Act 2006.

Statutory Designated areas

Wool has several areas covered by a number of statutory nature conservation designations (described earlier in Location and Methods). The best heaths are within the Turner's Puddle SSSI an area of International Importance. The River Frome SSSI is an area of National Importance and a portion of Eight Acre Coppice is a Local Nature Reserve (LNR). Site of Nature Conservation Importance (SNCI) is a local non-statutory designation that can be taken into account by local planning authorities, most or all of the ancient woodland is covered by this designation as is a small Humid Meadow. Other areas are not covered by any nature conservation designation although the road verge from Burton Cross running south is a notified road verge for the conservation of some locally uncommon plants. The organic farmland is subject to a Higher Level Stewardship agreement though this confers no wildlife conservation status. The table below gives the number of beetles and the number that are Rare and Notable recorded for the various designated areas, combinations of designated areas and the number recorded in the SNCI.

Only 42% of the recorded species have been found in the statutory designated areas (Table 1) so 58% are outside any form of statutory protection and are therefore outside areas currently subject to measures for conservation of biodiversity. This 58% of species includes those found in the SNCI, which include many more species mainly because this designation largely brings in ancient woodland of which only a tiny portion is included in the statutory Local Nature Reserve. Almost all of the recorded beetles, 98%, have been found outside the statutory designated areas.

BAP Priority Habitats

Under the Natural Environment and Rural Communities Act 2006 in order to conserve biodiversity a list of types of habitats which are of principal importance for the purpose of conserving biodiversity must be produced. A list of BAP priority habitats has therefore been produced by Natural England.

A number of these habitats that comply with the criteria in the UK Biodiversity Action Plan priority habitat descriptions are present in Wool. These habitats can be assessed using the Coleoptera and other qualifying criteria. Some of the habitats in Wool clearly fit the criteria because they are already covered by statutory designations but there are several other areas that also fit the criteria.

Qualifying habitats

Rivers
The River Frome SSSI runs through Wool, it has one of the largest colonies in Britain of the uncommon Reed Beetle *Donacia bicolora,* a BAP Species on its Tall Marginal Communities.

Ponds
Dystrophic ponds occur on Wool Heath. These correspond floristically to the Mediterranean Temporary Ponds of the Habitats and Species Directive. Two Red Data and 13 nationally scarce beetles have been recorded from them.

Arable Field Margins
These are managed as organic farmland supported by a Higher Level Stewardship Agreement. Over 200 species of beetles have been recorded including 14 nationally scarce species. Many of the phytophagous beetles feed on plants such as Dock and are very abundant and may consequently provide considerable natural control of these species. Many other species are associated with nowadays much less common "arable weeds". These field margins include the associated hedgerows. A comparison of results from the organic fields with nearby comparable but conventionally farmed fields showed the organic fields to have a 33% greater beetle fauna. The Oil Beetle *Meloe proscarabaeus,* a BAP Species, has been found on these field margins.

Lowland Mixed Deciduous Woodland
Most of the woodlands in Wool are Ancient Woodland though some of these have been modified by conifer planting.

Coastal and Floodplain Grazing Marsh
The water meadows are a complex, a large part of which is *Humid Grassland* and *Flood Swards* with water filled ditches, water margins and reedbeds. This complex of biotopes is rich in beetle species including 34 Rare and Notable species.

Lowland Heathland
The lowland heathland on Wool Heath is SPA, SAC and Ramsar and it is part of the Turner's Puddle SSSI. Amongst the beetle fauna are two BAP Species *Cicindela sylvatica* and *Poecilus kugelanni.*

Lowland Blanket Bog
The *Lowland Blanket Bog* of Cranesmoor is part of the SPA, SAC and Ramsar site and also part of Turner's Puddle SSSI.

Open Mosaic Habitats on Previously Developed Land
In the case of Open Mosaic Habitats on Previously Developed Land the term "previously developed land" does not precisely fit as it is in the Bovington Training Area where some of the disturbance is ongoing although a large proportion is historic (pre-AWDC). The heathland damaged by tank training on Wool Heath has many of the characteristics of this habitat and the criteria defining this habitat are met on all counts. Typical of post industrial biotopes this damaged heath has many pioneer plants with bare ground between. The *Dystrophic Ponds* are often within these areas as many are a product of vehicular compaction. These areas are as is typical for post industrial biotopes; very rich in species with nearly 15% the beetles recorded Rare or Notable.

Priority Habitats (Table 2) include twice the proportion (84%) of the beetle fauna as sites with statutory protection (42%).This is because of the inclusion of Woodland, Flood-plain grazing marsh, Arable field margins and Open mosaic habitats on previously developed land. This shows that Priority Habitats are potentially a much better basis for biodiversity conservation but this will depend very much on the policies applied to selection of these and the application of appropriate management.

Question 4. Are there interactions and synergies between the biotopes?

Many animals need mosaics or combinations of biotopes, these range from large to small scale combinations. For example, birds such as nightjar

Table 2 Coleoptera in BAP Priority Habitats. *River Frome Insufficient Data

Priority Habitat	Total Number of Coleoptera	% Total Coleoptera	Number Rare & Notable spp.	% Rare & Notable spp.
Whole Parish Total	1032	100%	153	15%
Rivers (R.Frome)	*			
Ponds (Dystrophic)	87	8.4%	17	20%
Ponds (All)	234	23%	31	13.20%
Arable Field Margins	207	20%	14	6.80%
Lowland Deciduous Woodland	478	46%	33	6.90%
Coastal & Floodplain Grazing Marsh	468	45%	34	6.70%
Lowland Heath	342	33%	34	7.30%
Blanket Bog	148	14%	11	7.40%
Open Mosaic Habitats on previously Developed Land	199	19%	29	14.60%

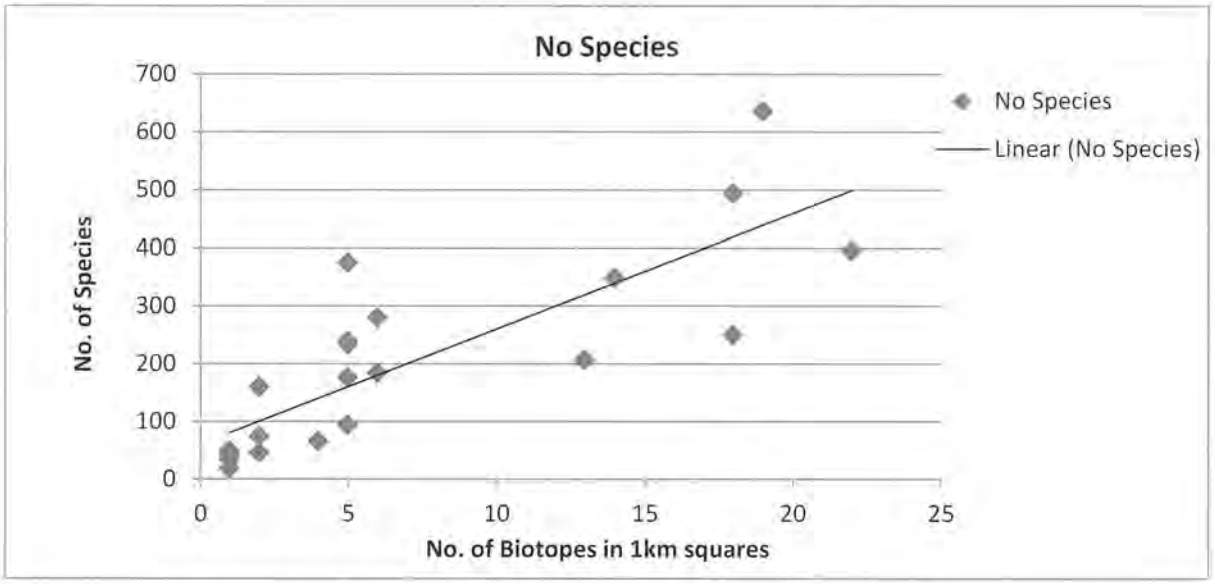


Figure 8 The number of beetles recorded from 1km squares increasing with the number of biotopes from which species were recorded.

need large scale combinations, nesting on Wool Heath and feeding on moths over the woodland, water meadows and organic farmland to the south to small-scale combinations needed by insects whose larvae may occupy quite different biotopes to the adults or in the case of bumblebees that may nest in well-drained but flower poor areas and forage in flower rich wetter areas where the soil may be quite unsuitable for nesting.

On the basis of simply recording beetles in the 1 km squares where they were found (Fig. 8) a steady increase in species recorded indicates that there is a doubling of species as the number of biotopes that that are present in those squares double. However, these records are for adult beetles only and recording does not reflect the whole life histories of species that for larvae and other stages depend on biotopes other than where the adults were found.

A Malaise trap was set up in a short ride between Little Perry Coppice and Blindman's Wood. This trap

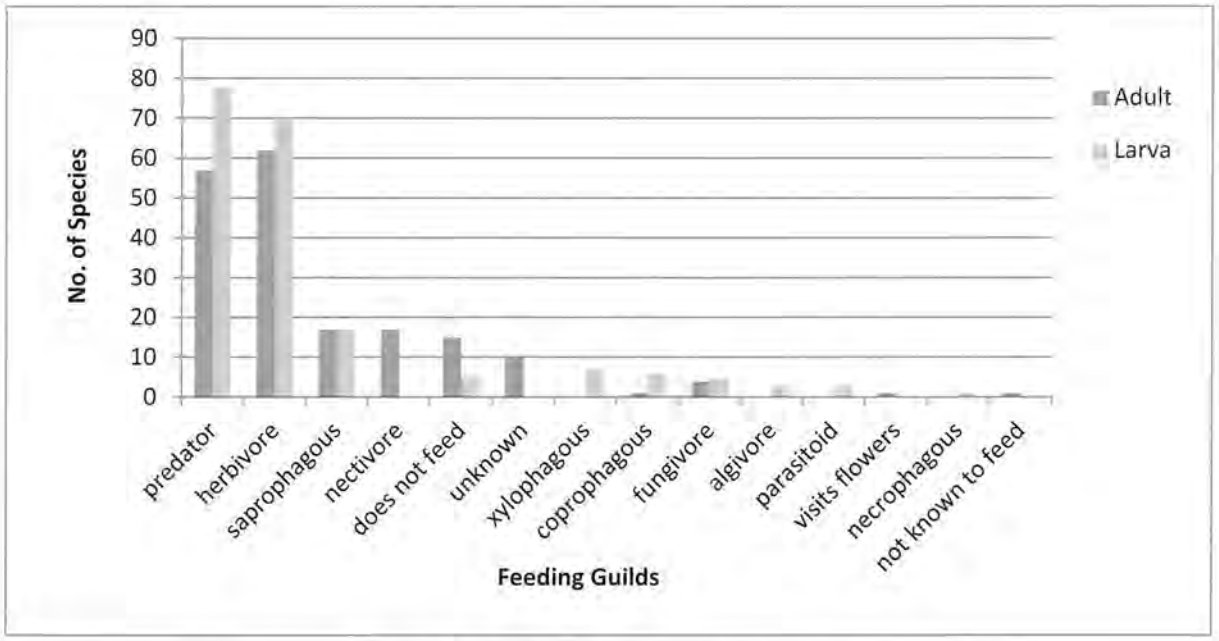


Figure 9 Number of species within feeding guilds.

was made to collect separate samples from each side and with a tray of preservative to collect species that drop when encountering the central panel of the trap rather than climbing up. This trap showed that a very large number of beetles were flying between the water meadows and the former farmland to the North as well as from the adjacent woodland, showing that there is considerable beetle mobility in the area. Analysing the feeding guilds of the species caught (Fig. 9) shows that they cover the full range of opportunities found in 1km square SY8387. Using Pantheon the data is extrapolated to show the larval feeding guilds based on the recorded adults. The differences between larval and adult feeding guilds shows that there may be many species where larvae and adults feed in different biotopes such as Xylophagous species where the larvae feed on dead wood but the adults are usually found visiting flowers. Many of the species with Phytophagous larvae that feed on particular species or related species of plants have adults found on the flowers of a wide range of other species.

In 1km square SK8387 11 of the 19 biotopes from which beetles were recorded (Fig. 10) are components of the water meadows and a greater correspondence between these might be expected but examination of the results indicates they are not as related as might be expected. Although these biotopes are related geographically they are structurally dissimilar, the *Humid Grasslands* are generally grazed to a short turf while others are tall. They also vary in their hydrological conditions so that the *Medium Tall Waterside Communities* are generally in or close to the water levels of the river, ditches and ponds. Where there is a junction or mosaic between biotopes the combination may relate to one or both "parent" biotopes. Comparison of the six biotopes with the most species recorded (more than 90) shows around 50% of species were only found in a single biotope despite extensive recording and that only 1% were found in all six biotopes.

On Wool Heath where similar biotopes are adjacent, such as undamaged and damaged heath, there may be beetles in common but they are probably exploiting the same resources. As can be seen from the species / biotope diagrams Wool has many very contrasting biotopes adjacent to each other. Malaise traps were set up on the abrupt junction on the South edge of Great and Little Perry Coppices with the water meadows Malaise. The traps collected separate samples from each side and were installed on the line of the junction to examine the interaction between these contrasting biotopes. Although a number of species were caught equally or close to equally on

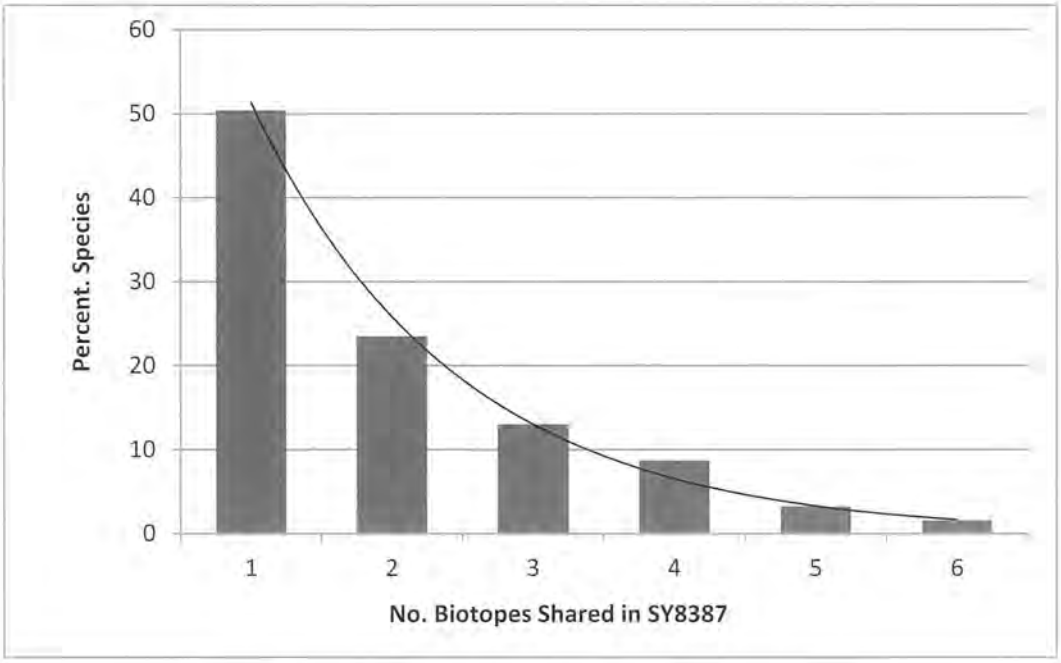


Figure 10 Percentage of species by number of biotopes in SY8387.

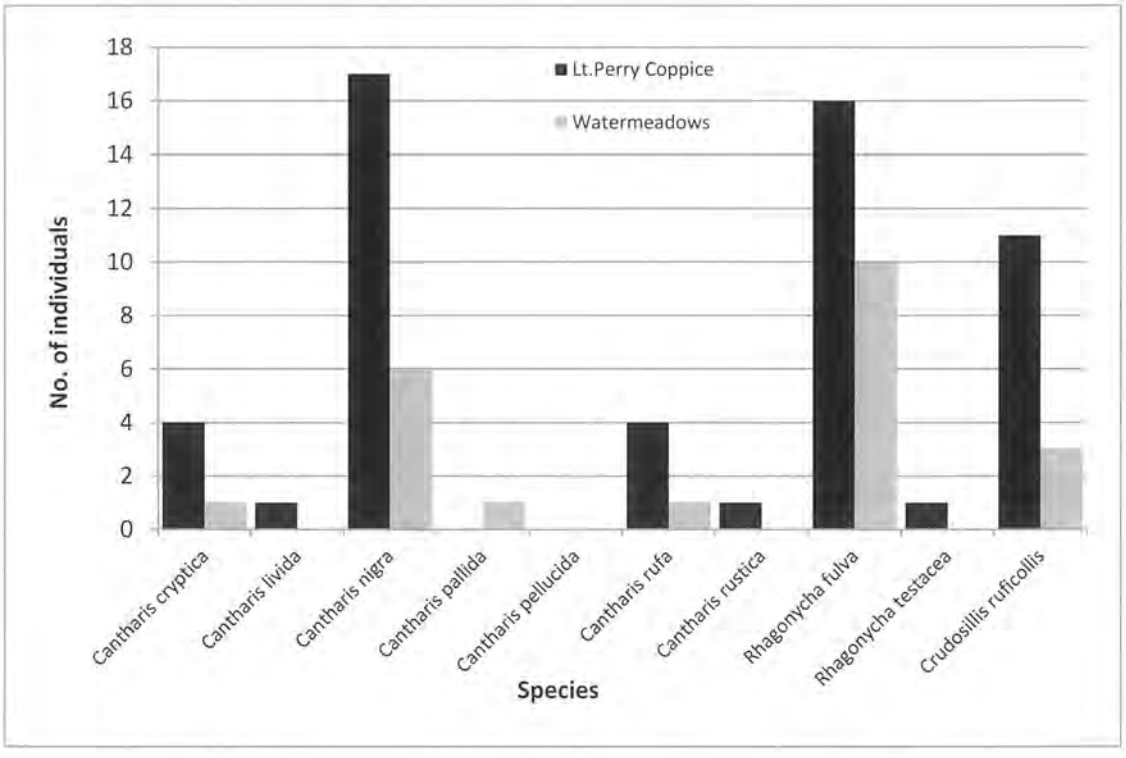


Figure 11 Abundance of species between coppice and water meadows

both sides a few species and most notably most of the Cantharidae (Soldier Beetles) were caught flying from the woodland (Lt. Perry Coppice) to the water meadows (Fig. 11).

The results from this type of survey must be treated with great caution as many species simply fly towards the light (Wood to Meadow) whereas it seems comparatively few will fly from light to

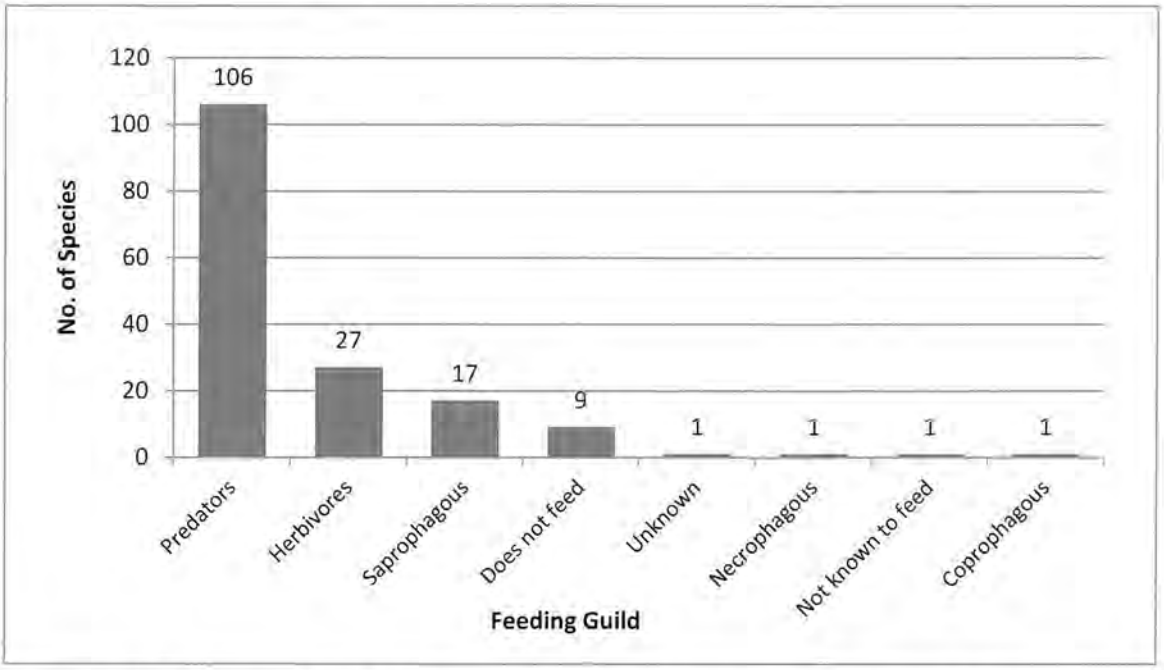


Figure 12 The number of adults of Coleoptera in each feeding guild found in Flood Debris at Woolbridge

dark (Meadow to Wood). However the adults of species such as Cantharidae feed on pollen and are frequently found on the heads of Apiaceae, notably hogweed, but the larvae generally occur in wooded areas: in loose soil under logs etc where they are predatory on worms and insect larvae etc (Luff 1991). Clearly much more data on these biotope junctions is needed but for a very large number of species where the adults and larvae require very different resources there is likely to be the need for a combination of biotopes as illustrated above by the Cantharidae.

A considerable number of Harlequin Ladybirds (*Harmonia axyridis*) were caught in a Malaise trap in October/ November 2011 on Wool Heath and were probably on their way from a larval feeding area to find a suitable hibernation area (usually communal for this species). It follows that there may be other species that need suitable biotopes for hibernation as well as different larval and adult biotopes.

Wider scale interactions – Corridors through Wool

The most obvious and clearly functional corridor is the Frome and the water meadows either side. The Frome itself is a continuous corridor from its source to Poole Harbour and while the water meadows either side can vary in extent they are particularly extensive in Wool. Floods normally occur in winter when the invertebrate fauna is washed off the meadows and carried downstream where it may be deposited on other water meadows. Examination of flood debris has shown that a very large proportion are beetles, the air held beneath their elytra may make them buoyant and well suited to this type of passive transport. Clearly as this is passive many individuals will probably end up in unfavourable biotopes and a large number may be washed out to sea and die in the salt water. Flood debris can be trapped by taller vegetation often indicative of ungrazed areas and these may not be suitable for species that for example are associated with the dung of grazing animals. However, as most of these are able to fly they may be able to relocate themselves locally once the weather becomes warmer.

Analysis using Pantheon showed nearly 60% the species recovered from flood debris (Fig. 12) are predators and just less than 30% are phytophagous. The predators include a small number of water beetles but most are terrestrial and probably subsist on the large range of small invertebrates that thrive in wet decaying vegetation or the dung of grazing

animals. The phytophagous species are mostly those whose host plants occur across a wide range of wet and moderately dry biotopes, most feed on herbs and a few on *Salix* spp. Only three of the herbivores recorded are associated with plants restricted to the water meadows.

If there are flight corridors for beetles these are more difficult to identify, probably most insects cross the landscape at random without using any particular feature to guide them. It is likely that geographical or vegetational features channel them passively as locating Malaise traps adjacent to hedgerows and the edges of woodland increases catches considerably. Insects have highly developed scent sensors and may therefore fly direct to their host plant or when flying randomly be attracted by encountering the scent of the host plant. It is therefore not possible to clearly identify corridors for beetles as might be possible for birds or other groups of larger animals. However, there may be a corridor or a channel following the Bovington Stream on the East edge of Wool as two rare beetles only found in *Dystrophic Pools* on Wool Heath have been caught to the south by a light trap well away from the heath, following dry weather when the pools dried up. A type of corridor exists where there are continuous belts of vegetation such as road verges but when these are broken by roads or other hard surfaces these will act as a barrier (Mader 1984).

Barriers to interactions

Bovington Camp and the adjacent conifer plantations on the Bovington Training Area form a substantial East – West barrier across the parish that is continued by conifer plantations outside the ranges, to the East in East Stoke and to the West in Morton (Fig. 13). The effect of this barrier might in theory be measured but in practice this would be extremely difficult. The results from Malaise traps have provided most of the data about mobile insects. The new housing planned for Wool will also create a second barrier to North-South passage of insects by filling the gap between the Winfrith UKAEA nuclear and Dorset Technology site through East Burton to Wool. This will potentially isolate the water meadows corridor from the heaths to the north and the chalklands and woodland to the south dividing the parish in three.

Question 5. If a biotope is destroyed or damaged can it be repaired or recreated?

Re-creation of biotopes or mitigation for their loss is neither easy nor quick for invertebrates. Experience elsewhere of the recovery of heathland following fire (Author: Surveys of Jersey Heaths) suggests that while vegetation may return to a "favourable condition" in about five years, at least 10 to 15 years are needed for invertebrates to re-establish and even after this there will be some species that were previously present that will not have returned.

In 2001 - 2002 the MOD set aside some areas on Wool Heath for heath re-creation following improvements in the military training facilities that had resulted in some loss of heath. Some small areas had cut heather spread out after seed set and a large area had a strip of conifer plantation felled to release the suppressed heath flora that had survived in the ground layer. For invertebrates seeding a new area relies on their being able to fly or walk from existing heath to recolonise the area; felling conifers has some advantages as some invertebrates survive with the heath ground flora beneath the pines but this is dependent on the subsequent development of the released vegetation. If bracken or self seeded conifers form a large part of the regeneration, the heath fauna may be less likely or unable to develop so monitoring and management may be needed to steer the direction of restoration.

The strip where pines were felled to restore heath lies in a shallow valley where the centre is wet with an intermittent stream. The area adjacent to the stream is mainly swampy with Salix sp. and *Molinia* becoming only *Molinia* in a strip parallel to the stream below the restoration area. In 2001, 2, 3, 11 and 13 Malaise Traps were used to monitor this area. Fifty-nine phytophagous beetles were caught in these traps; seven species associated with *Salix* spp. were the most common tree feeding species as this was the most common broadleaf tree in the valley, two species associated with birch and three others with broadleaf trees in general were caught. Relatively few beetles are phytophagous on Heather and only one was caught, *Micrelus ericae*, in very small numbers and three species associated with *Ulex* with the gorse weevil *Exapion ulicis* in reasonably large numbers. A large proportion of the beetles caught are associated

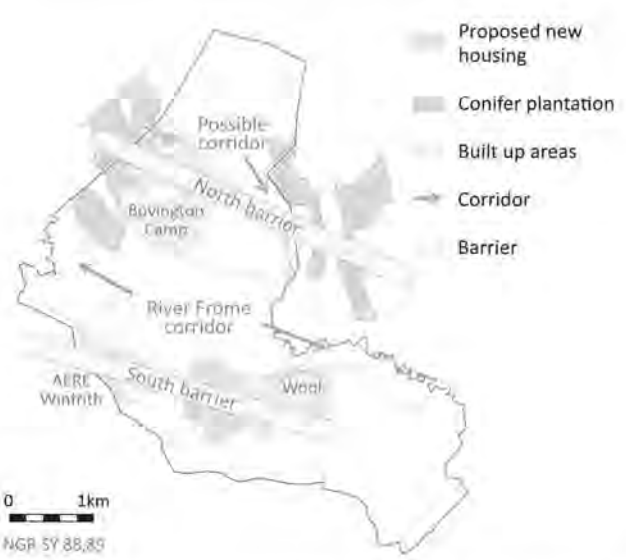


Figure 13 Barriers and corridors to movement of invertebrates.

with the plants of the disturbed Heath: *Trifolium spp., Lotus, Vicia, Plantago Verbascum* and *Veronica*. The flora of the disturbed heath biotopes is generally stress tolerant – ruderal and the associated fauna is likely to be similar so thrive by seeking out new plants to colonise, these colonists are unlikely to find suitable host plants in the Heath restored by pine felling. Species associated with the Brassicaceae are an ever present component of Malaise trap catches even in the middle of heathland and are probably from oilseed rape fields to the South of Wool. They were caught equally abundantly before and after the pine felling again agreeing with their general aerial presence independent of management changes on the Heath. *Exapion ulicis* by contrast was only present in small numbers in 2000 to 2001 before the pine felling but much larger numbers 2011 and 2013 some indication that recolonisation is taking place.

This slow recolonisation requires time and by 2013 these had still not yet reached a "favourable condition" for invertebrates so that further monitoring is still needed. Malaise traps installed in the felled area showed that although there were a large number of insects flying over the area, relatively few were likely colonists but that in any case it is a slow process perhaps progressing in steps rather than in a single migration.

DISCUSSION

Few sites in Britain have over 1000 species of beetle recorded: The New Forest, Windsor Forest, the Oxford area, Wicken Fen, Monks Wood, and a few others, most of these are protected areas or Nature Reserves. A parish scale survey such as this is rare although nearly 150 years ago C.W. Dale compiled a list of 920 beetles found in Glanvilles Wootton in mid-Dorset. Beetles form just over 7% of the species of wildlife in Britain therefore in Wool about 1.8% of British wildlife is covered by this account of which overall 14.7% are Rare and Notable species, a fairly significant component. This number of beetles is about 40% of the species recorded for Dorset. For at least one BAP species (*Donacia bicolora*) the population on the edge of the Frome in Wool is probably one of the largest in Britain. However, there is no definition of the level at which invertebrate assemblages forming a significant component of biodiversity should be taken into consideration for conservation.

Although we have a substantial audit of British insect biodiversity, without associated biotope data this limits its application so that it can only be used to plot distribution maps within various timeframes to show increases or decreases in distribution. It would seem essential to include biotope data based on an existing system used by specialists in other components of fauna and flora so distribution changes can be related to biotope changes, climate change and other parameters. In this paper CORINE is used, though EUNIS would be equally suitable. The National Vegetation Classification (NVC) is a vegetation classification and does not fit the wider requirements of recording this type of audit data and also requires considerable botanical expertise to use it to its full extent.

In 1987 a Symposium on Calcareous Grasslands – Ecology and Management was convened by the British Ecological Society and the Nature Conservancy Council. Several of the presentations covered invertebrates and the lack of consideration they receive in the assessment and management of nature reserves. Some of these accounts recommended a much better integration of the fauna and flora, not as a series of unconnected actions but an overview

(Jones Walters 1990; NCC 1988). In his presentation Jones Walters proposed much more integration of the then new National Vegetation Classification with the invertebrate fauna. The value of being able to integrate the fauna and flora of calcareous grasslands was clearly demonstrated but this has not been taken further. Now there is an even greater need for the wide use of this integration for the assessment and management of biodiversity.

Valuing wildlife is exceedingly difficult, rarity (RDB - up to 15 10km squares in Britain) or national scarcity (Na and Nb - 15 to 100 10km squares in Britain) is frequently used but value does not just depend on the rarity of a species but on how it may relate to the wider general ecology of an area. In the vast majority of cases for invertebrates we know very little about this, except for example where the quality of water affects aquatic species that are fed upon as larvae by fish, or as adults by waterside birds and more widely where beetles are part of the food of birds and mammals. To apply a value at present it is only possible to use the current Rare or Notable designations applied to beetles, these are under revision to fit IUCN criteria but this is not complete therefore cannot be used at present. There is also a problem that species (usually adults) recorded by simple presence may not reflect the sites where they breed and develop giving a false picture of their distribution.

While rarity is at present the only available criterion on which to base an assessment of invertebrates such as Coleoptera, this contrasts with vegetation assessments where communities and the assemblages of species are used and with birds that are assessed on the basis of population size. In the Nature Conservation Review (Ratcliffe 1977) a number of criteria were included for assessing sites, later these were restated for assessing the value of nature reserves for management planning and now these have been restated in a guidance paper *Natural Environment* produced by Ministry of Housing, Local Communities and Local Government (2020) for wider use in planning. Some of these criteria may be used to evaluate individual species or assemblages. To these criteria may be added "contribute to ecosystem services". This is noticeable on the organic farmland where the dung of grazing animals is incorporated into the soil by invertebrates. It contrasts with conventional agriculture where the widespread use of ivomectins to treat grazing animals harms dung invertebrates; this slows the assimilation of dung into the soil, and also the organic arable field margins that support substantial populations of beetles that can reduce weed growth.

Natural England has produced a very useful Evidence Information Note *EIN004 Summary of evidence: Biodiversity 2015* (Natural England 2015). Section 3 identifies a wide range of aspects of biodiversity that are known but more importantly many that are not known or are insufficiently known. When surveys of Wool were started 25 years ago the objective was simply to compile an inventory of invertebrates on the MoD Bovington Training Area, Dorset (BTA) but because data on the flora of each sample site was also collected the opportunity to consider the beetles within the biotopes where they were found was an obvious next step. The biodiversity evidence summary for example states in Para 4.18 "We know little about how species assemblages relate to priority habitats and ecosystems and how changes in species affect habitats and ecosystems. We need a better understanding of the traits and requirements of species, how they interact within ecosystems and the potential importance of functional diversity for maintaining ecosystem function". For beetles, let alone invertebrates as a whole, this amounts to a colossal task but the results here begin to show ways this might be done.

There are many other paragraphs in the evidence summary to which some of the results from this analysis provide additional insight. The assessment of a landscape scale distribution of biodiversity shows that contributions to overall biodiversity occur throughout the landscape and are not confined to particular biotopes. For beetles the current focus on statutory sites for conservation of biodiversity only includes 42% of species though this is substantially improved to just over 80% if Priority Habitat types are considered. The effectiveness of Priority Habitat conservation means to achieve this extent of species inclusion will depend very much on how the policies are applied and on how these sites are managed. "We know little about how species assemblages relate to priority habitats and ecosystems" (EN),

to learn more of this, surveys have to relate to a standard biotope recording system. "How they interact within ecosystems" is particularly important for invertebrates where different stages of the life-cycle require different biotopes. The vulnerability of species to loss of one component of the suite they depend on makes change almost inevitable. For example grass tussocks of *Dactylis glomerata* and *Deschampsia cespitosa* and other grasses can be very important for the hibernation of invertebrates yet tussocky grassland is an anathema to many conservation managers. Clearly, following Natural England's evidence summary, a management plan to address "What we don't know" is needed.

The analysis of the beetle fauna of Wool shows just how difficult it may be to identify the ecosystem functions in a landscape, particularly corridors and connectivity - things that are often mentioned in planning documents but in practical terms are rarely put into action. In Wool, one of the factors contributing to the richness of the area is proximity if not juxtaposition of biotopes to each other. This should allow a fairly free exchange between biotopes, but clearly much more survey of the interactions between biotopes is needed. Intensive agriculture and built development are identified as the most important factors causing species loss. While Wool Parish has a beneficial agricultural regime it already has a very high proportion of built environment for a parish of its size and more is proposed that may have a considerable impact by creating barrier to north south movement across the parish and beyond.

Some biodiversity declines have been spectacularly reversed particularly by "wilding". This is not feasible for the great proportion of the countryside but the organic farming in Wool is a great contributor to the richness of the area. Worldwide studies have shown organic farming creates an average 30% increase in biodiversity and in species numbers. A very considerable improvement to ecological networks has been demonstrated by the Conservation Headlands experiment by the Game Conservancy. While the experiment was designed to look at enhancing game bird numbers it clearly had a considerable benefit to the whole ecology of the study area (Sotherton *et al* 1989). There is a need to utilise what we already know, for example since organic farming techniques encourage at least a 30% increase in species and populations it suggests application of these practices into wider agriculture would provide an effective support for biodiversity.

CONCLUSIONS

Two things come out most strongly from this analysis of beetle diversity:

1 That Wool has very considerable biodiversity spread fairly evenly across a very wide range of biotopes.
2 That nationally the mechanisms to conserve biodiversity are not adequate for landscape scale biodiversity conservation.

On the face of it the first is a local conclusion. The value of Wool for biodiversity has been disregarded for many years and as a result it is seen as a suitable area for development. This may well apply to many parishes across England but the combination of assets in Wool makes it very unusual as it has: military training areas that have existed for over 100 years and predate agrochemical use. It includes an extensive area of lowland heath, there is organic farmland, a scatter of ancient woodlands, a corridor of river and water meadows, all of which makes for a very wide range of often contrasting semi-natural biotopes adjacent or very close to each other. Protecting this combination of biotopes is essential and the proposals for a National Park covering Purbeck and other adjacent areas must include Wool.

At a national scale the current application of policies does not adequately conserve the biodiversity of areas such as Wool; policies are only as good as their application. The success of the policy to conserve and if possible enhance biodiversity is totally dependent on the favourable management of the countryside. A number of things are unclear at present about the application of this policy particularly whether it will be based on selected sites or an overall view. This landscape survey of Wool suggests that overall application is needed as the biotopes that make up the countryside do not exist in isolation but in combinations that are needed to provide for the whole life-cycle of many species.

Monitoring the success of management is essential so that the success or failure of biodiversity enhancement projects can be assessed and if appropriate modified. Local authorities have been given a role in these policies but in Purbeck monitoring only extends to listing the existence of sites and their area rather than whether there is actual change in biodiversity. Under the NERC Act 2006 Local Authorities are required to take into account the conservation of biodiversity in exercising their functions. Local Authority countryside management services are an indispensible part of achieving this yet are usually one of the first to be affected by financial cutbacks.

Good data is pivotal to biodiversity conservation and Dorset Environmental Record Centre needs to be consistently well funded to carry out this role. Data itself also needs improvement by using established biotope classifications to unite data from multiple sources. There also needs to be more encouragement for surveys that help improve the understanding of the wildlife of the countryside. Education is an unfulfilled element of biodiversity conservation policy and could be applied to train surveyors to carry out monitoring as is being done by the National Trust.

Organic farming gives a 30% improvement in biodiversity so needs more support and encouragement. The example of Wool demonstrates that an organic farming regime is a simple way to enhance biodiversity and as these schemes already have Higher Level Stewardship funding this needs much wider application. Monitoring the effects is essential to see that the objectives are being delivered and that payments are based on the results. If development threatens organic farmland the developer should be expected to finance its re-establishment.

Restoration of watermeadow management presents an opportunity to enhance biodiversity. There is a proposal to manage nitrogen levels in the River Frome and restoration of water meadows management would provide a cost-effective and proven addition to a number of at present unproven proposals for this. The water meadows in Wool are already rich with beetles and other invertebrates, while many of the birds that formerly used them have disappeared. The invertebrate fauna is enriched each year by species being passively brought downstream in flood debris.

The countryside is continually evolving and part of this may involve some damage and recovery with the establishment of pioneer communities. Activities using the countryside may be in considerable competition. While the MoD is present on Wool Heath to provide military training it has an agreement that wildlife conservation should be a priority whenever possible and has a conservation liaison group to advise on this. This type of commitment could be extended more widely to other landowners and users.

The time needed to re-establish the invertebrate communities of biotopes following loss or damage is not appreciated but is considerably longer than the time needed for vegetation to reach a favourable condition. A thriving invertebrate fauna provides in turn food resources for many birds.

Biodiversity enhancement is always possible for existing biotopes but what is seen as biodiversity gain is very vague as far as invertebrates are concerned. The idea that the conditions found on the organic field margins with their hedgerows could be recreated within housing development is over optimistic and even establishment on a separate site is going to require many years. Within housing the desire for "tidiness" on the one hand and dumping of waste and alien plants on the other will both discourage wildlife. Biodiversity gain is a goal that obfuscates the real problem of loss and damage to the countryside by building development and agricultural intensification. These issues should have very thorough investigation before they become enshrined in policies. There may be areas where there are already large intensively farmed fields where gain might be made but in an area such as Purbeck loss of biodiversity can be the only consequence of any intensification of agriculture or building. Many of the claims for biodiversity gain are not based on much evidence as most sites and do not have preliminary survey before change takes place to enable any comparison with what might appear afterwards. The evaluation of the Biodiversity Offsetting Pilot Programme commissioned by

DEFRA raises many problems in particular the lack of expertise to undertake them and their greater expense compared with current schemes. But these evaluations were only of the setting up of such schemes not of whether they actually deliver the planned result.

The questions asked in the introduction have all been considered with reference to beetles in the Parish of Wool. Clearly there is a great deal more work needed to see how other groups of wildlife fare under the current biodiversity maintenance policies and their application but the greatest importance must be to apply the policies to their fullest extent as quickly as possible otherwise biodiversity will continue to decline in Britain

ACKNOWLEDGEMENTS

I am extremely grateful to the Army's Bovington Training Area managers over the last 25 years for their help and patience allowing me access. Rachel Palmer and Susan Vithana have very helpfully commented on the manuscript and enabled me to clarify several passages. Thanks are due to Tara Fairclough for producing the final versions of Figures 1, 3 and 13.

REFERENCES

Benton. T.G., Bryant, D.M., Cole, L. and Crick, H.Q.P. 2002. 'Linking agricultural practice to insect and bird populations: a historical study over three decades', *Journal of Applied Ecology* **39,** 673–687.

Commission of the European Communities (CEC) 1994. *CORINE biotopes* European Environment Agency, Luxembourg.

DEFRA 2014. *Evaluation of the Biodiversity Offsetting Pilot Programme Final Report Vol 1.* DEFRA, London.

DEFRA 2020. *Biodiversity 2020: A strategy for England's wildlife and ecosystem services.* DEFRA, London.

Elton, C.S. 1970. *The Pattern of Animal Communities.* Chapman & Hall, London.

Fox, R., Parsons S., Chapman W., Wowed, I P., Warren, M.S., and Brooks D.R. 2013. *The state of Britain's Larger Moths.* Butterfly Conservation and Rothamsted Research, Wareham, Dorset.

Jones-Walters, L.M 1990. 'A New approach to the management of Chalk Grassland with particular reference to the integration of conservation measures for Invertebrates', In S.H. Hillier, D.W.H. Walton, and D.A. Wells (Eds.) *Calcareous Grasslands, Ecology and Management.* Bluntisham Books, Bluntisham, Huntingdon.

Luff M.L. 1991. *Beetle Larvae Pt IV. A Coleopterist's Handbook.* J. Cooter (Ed) AES.

Mader, H.J. 1984. 'Animal Habitat Isolation by Roads and Agricultural Fields', *Biological Conservation* **29** 81–96.

Ministry of Housing Communities and Local Government 2020. *Natural Environment.* https://www.gov.uk/government/organisations/ministry-of-housing-communities-and-local-government

Natural England 2015. *EIN004 Summary of evidence: Biodiversity 2015.* Natural England, London.

Nature Conservancy Council 1988. *Site Management Plans for Nature Conservation.* NCC, Peterborough.

Ratcliffe, D.A. 1977. *A Nature Conservation Review Part 1 & 2.* Cambridge University Press, Cambridge.

Sotherton, N.W. Boatman, N.D. and Rands, M.R.W. 1989. 'The "Conservation Headland" experiment in cereal ecosystems', *The Entomologist* **108,** 135–143.

Webb, J., Heaver, D., Lott, D., Dean, H.J., van Breda, J., Curson, J., Harvey, M.C., Gurney, M., Roy, D.B., van Breda, A., Drake, M., Alexander, K.N.A. and Foster, G. 2018. Pantheon - database version 3.7.6 www.brc.ac.uk/pantheon [Accessed 18 May 2020]

Webb N.R. 1986. *Heathlands.* New Naturalist. Collins, London.

Webb N.R. 1989. 'Studies on the Invertebrate Fauna of Fragmented Heathland in Dorset, UK. and the Implications for Conservation', *Biological Conservation* **47,** 153–165.

The author: Tony Warne holds a BSc in Zoology and a PhD from the University of Nottingham. He has worked for the Nature Conservancy Council and as a nature conservation consultant. He is a Fellow of the Royal Entomological Society (FRES). Correspondence: editor@dorsetmuseum.org

THE KNOWLTON PROJECT: KNOWLTON CIRCLES, A PROGRAMME OF SURVEY AND EXCAVATION AT A LATE NEOLITHIC HENGE COMPLEX AND EARLY BRONZE AGE FUNERARY LANDSCAPE IN EAST DORSET, 1993–7

JOHN GALE AND STEVE BURROW
with a contribution by Mark Maltby

A programme of survey and excavation undertaken between 1993 and 1997 explored the previously under investigated complex of prehistoric earthworks at Knowlton located in the east of Dorset. The complex is dominated by a relatively compact group of late Neolithic henge monuments that exhibit a variance in size and form, that set it apart from other known examples. That the grouping of earthworks was to become a focus for the development of a densely populated late Neolithic and early Bronze Age funerary complex hints at a ritual complex that was most likely in use for a thousand years.

Using tightly focussed topographic and geophysical surveys and targeted excavation it has been possible to begin the process of deconstructing the monuments so as to better understand their morphological characteristics and chronological development. This in turn enables us to begin to compare and contrast these structures with comparative sites located elsewhere.

The complex is shown to embody characteristics that suggest that its origins lie in the traditional monument building forms of the middle Neolithic at the start of the 3rd millennium. It would also appear that whilst the developing complex would embrace new forms of monument in harmony with developments further afield, the evidence suggests that the theme of a ritual and ceremonial complex closely allied to funerary practices was maintained into the 2nd millennium B.C.

INTRODUCTION

Until quite recently our collective understanding of the group of late Neolithic earthwork monuments known as 'henges' has been dominated by studies which have concentrated on sites located within the chalklands of Wessex (Fig. 1) in the south of England (Darvill 1997; Cleal *et al*, 1995; Renfrew 1973, 539–58; Wainwright 1989; Whittle 1996, 274–6). Some more recent syntheses have also considered henges from further afield in an on-going debate about their form, function and indeed whether they should be regarded as a homogenous group at all (Gale 2017, 102–119; Harding A. 2000, 267–75; Harding, J. 2000, 31–4; 2003; Richards 1996). Largely overlooked has been the complex of earthworks located in east Dorset on Cranborne Chase that are

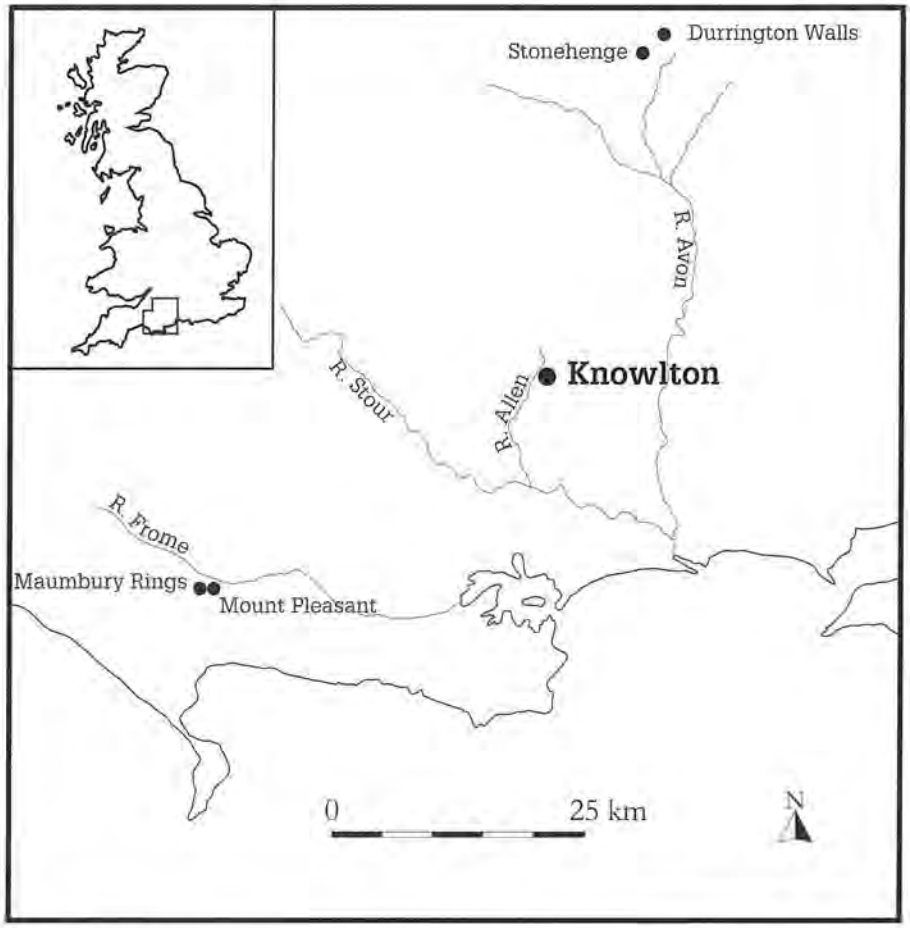


Figure 1 Location of Knowlton and other related sites mentioned in the text.

known collectively as Knowlton Circles or Knowlton Rings. This apparent oversight is largely the result of a lack of detailed field investigation having taken place at the complex. This, in turn, has limited the scope for detailed synthesis and interpretation with previous evaluations reliant on basic ground observations supplemented for the most part by aerial photographic data (Harding and Lee 1987, 129; Green 2000, 88–90). With this in mind the authors designed a programme of field investigations (Burrow and Gale 1994) with exploratory fieldwork commencing in 1993 with a series of small targeted archaeological surveys taking place seasonally through to 1997 (Fig. 2). This non-intrusive work was supplemented by a short season of excavation at the Southern Circle in the summer of 1994 funded jointly by English Heritage (now Historic England) and Bournemouth University.

THE ARCHAEOLOGICAL AND HISTORICAL BACKGROUND OF THE KNOWLTON COMPLEX.

The earthworks that constitute the Knowlton complex consist of a group of large banked and ditched enclosures and round mounds (RCHME 1975; Harding and Lee 1987; Gale 2012; 2017) in varying states of preservation. The phasing of the component parts of the complex is weakly defined and without extensive excavations detailed information about their date and sequence will remain elusive. However, the majority are likely to have been constructed between *c.* 2800 BC–1750 BC (based upon their general morphological associations, their close spatial articulation and comparison with documented examples elsewhere). It would appear that by the early 2nd millennium BC a complex of at least two hundred earthworks (most of which are no longer visible to the naked eye) was created within an area of less than 3km^2.

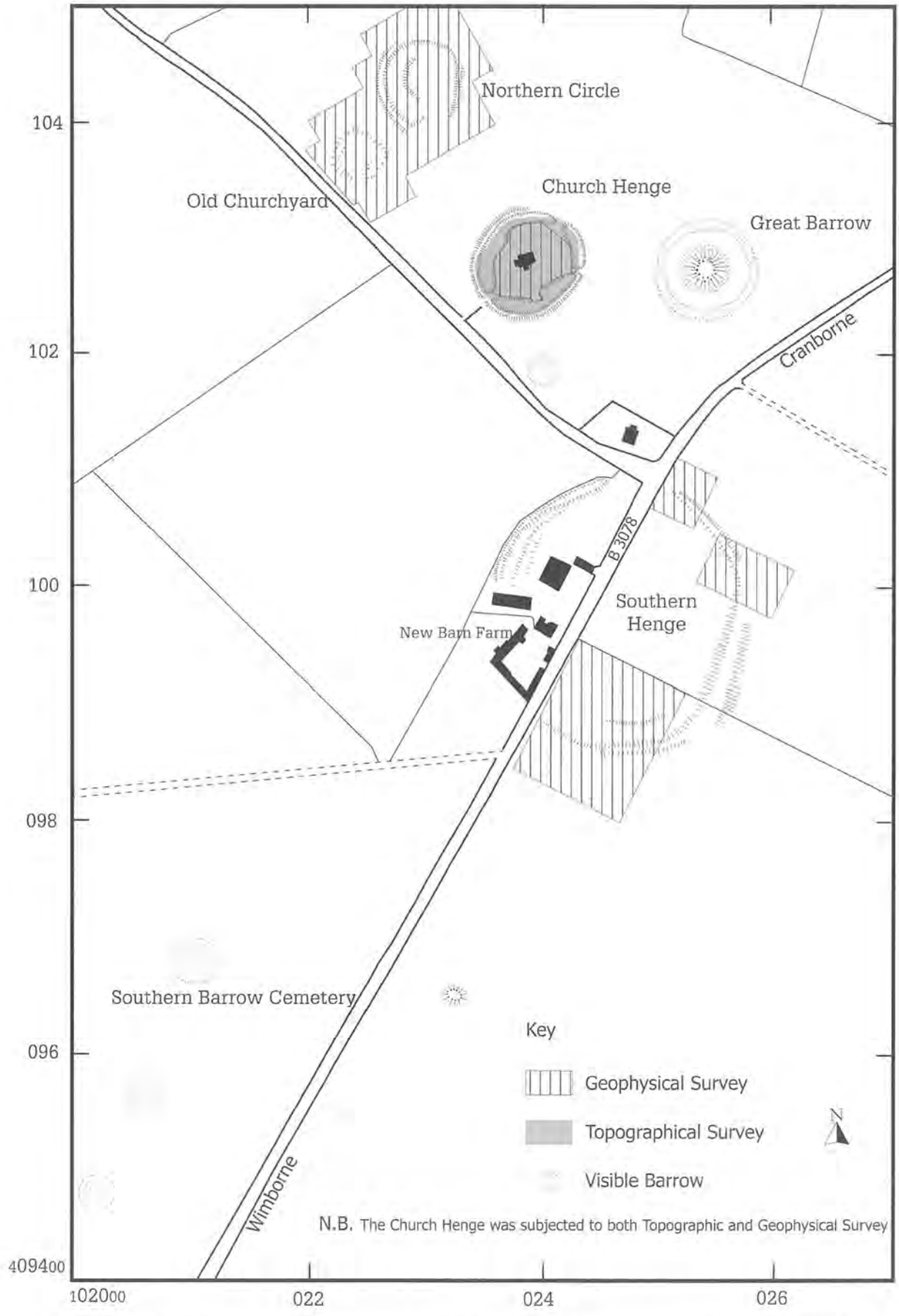


Figure 2 Location of archaeological surveys conducted at the principal monuments within the complex 1993–7.

Figure 3 Aerial photograph of Church Henge looking north, © John Gale.

The complex lies on a low chalk spur of the gently sloping east bank of the upper Allen valley (Fig. 1). The large banked and ditched enclosures are all located between *c.* 275m – 730m from the current course of the River Allen and all have unrestricted views down the valley to the south-west, where the Allen ultimately merges with the River Stour near to the town of Wimborne. The enclosures are all slightly elevated, lying around 55m above Ordnance Datum (aOD) which gives the monuments an element of prominence when they are approached – in particular from the south, south west and the river valley. At least three of the enclosures have traditionally been classified as henges (RCHME 1975; Harding and Lee 1987) dating from the end of the later Neolithic period. Such connections between henge monuments and low lying valley locations frequently associated with water are not unusual (e.g. Harding 2003, 54–56; Richards 1996) but the meanings behind such associations are difficult to define and interpret and may in part be cosmological, utilitarian or a combination of both.

The four enclosures within the complex are individually distinctive but are difficult to classify and date. The best preserved enclosure, commonly referred to as the Church Henge or Central Henge (Fig. 3), and the much larger but poorly preserved Southern Circle are generally accepted as late Neolithic henge monuments, although neither earthwork lends themselves to the now more dated classification based upon the number of entrances (Atkinson 1951; Harding and Lee 1987).

The Southern Circle's large size means that it is frequently included within the group of large henge enclosures or mega-henges found within Wessex (Durrington Walls, Marden, Mount Pleasant and occasionally Avebury), but although it is similar in size and scale of construction to these better known monuments, there is little evidence to indicate settlement or domestic activity and therefore its inclusion within this weakly defined sub-group remains somewhat tentative.

In 2000 a local farmer brought to the attention of archaeologists the discovery of two large heathstones or sarsens that had been brought up by the plough in the vicinity of the Southern Circle some thirty years previously (Lewis *et al* 2000; Bradley 2007,

395–6). One of the stones had pecked into one of its surfaces a motif of four concentric circles of a form similar to that found in Grooved Ware decoration on vessels discovered at the nearby excavations at Down Farm, and is common more widely as a rock art motif in the north and west of Britain and Ireland. However, the context of the discovery is uncertain and the stones may have come out of the henge or may have been contained within one of the levelled barrows nearby. In either case it does indicate the possibility of a megalithic component to the complex. The further discovery of additional heathstones in the vicinity of the Church Circle in 2005 by dowsers may further promote the inclusion of megaliths within the complex, although here once again the context is unsure and may relate to masonry associated with the medieval church, which makes prodigious use of heathstone in both its foundations and superstructure.

Both northern enclosures (North Circle or 'D' shaped enclosure and the 'Old Churchyard') have been almost completely levelled over the centuries but nonetheless retain a level of individuality which marks them out as morphologically distinctive. It is largely by association with the other two enclosures that the 'D' shaped enclosure has been tentatively ascribed as a late Neolithic henge (Harding and Lee 1987). The 'Old Churchyard' on the other hand is rarely considered to be contemporaneous, but could be.

In addition a large number of ring ditches, mostly identified through aerial photography (Stoertz 2007, 40–43), formed an extensive barrow cemetery that is clearly focussed upon the enclosure complex (Gale 2012). In common with the other large Wessex henge enclosures the presence of a large round mound is found in the form of the double ditched Great Barrow to the north-east of the Church Henge. This mound is currently covered with thick and well established vegetation that precludes any field survey. The mound is approximately 41m in diameter and 6.4m high with two ditches surrounding it; both are visible only as crop marks (Grinsell 1959, 174; Stoertz 2007, 40–43). The possibility raised by the aerial photographs that the outer ditch had an external bank (Green 2000, 89) and Barber *et al* (2010, 155–7) might suggest that this monument may also be henge related. However, the outer ditch was pierced by the excavation of a pipe trench in 1958 resulting in an impromptu watching brief supplemented by a speedily conducted small-scale archaeological excavation. The presence of an external bank to the outer ditch was not confirmed but it was possible to establish that the ditch was approximately 1.5m in depth and flat-bottomed with a mean diameter of around 108m. The discovery of several burials along the line of the pipe trench and within the interior of the enclosing outer ditch were unaccompanied by grave goods but were thought to be Christian Saxon (Field 1962, 117–124). The re-use of prehistoric mound sites for Anglo Saxon burial is not uncommon in the area as has been recently discovered at the nearby High Lea Farm Barrow Group only 3km to the south (Gale *et al* 2008).

ARCHAEOLOGICAL SURVEY 1993–7

A total of five magnetometer, one resistivity, and two topographic surveys were completed within five discrete areas of the Knowlton landscape (Fig. 2). The results of remote sensing (LiDAR) have since also become available and in some instances offer better resolution than the field derived topographic surveys (Southern Circle) (Fig. 6).

The upstanding earthworks at the Church Henge showed the greatest potential for analysis having been largely protected by their incorporation into the later medieval monument. Consequently topographic survey here required a high level of resolution (in this case sampling the elevation at a horizontal resolution of less than 1m) that was made possible by the use of a Differential Global Positioning System (DGPS) (Figs 4 and 5).

To evaluate the below ground archaeology the principal monuments in the complex were subjected to geophysical survey. Although both magnetometry and resistivity were deployed, preliminary surveys showed that the nature of the lithology and the dominance of negative features meant that magnetometry was the more responsive technique. Consequently, resistivity survey was limited to the Church Henge, which contained structural features that are known to respond well to the technique.

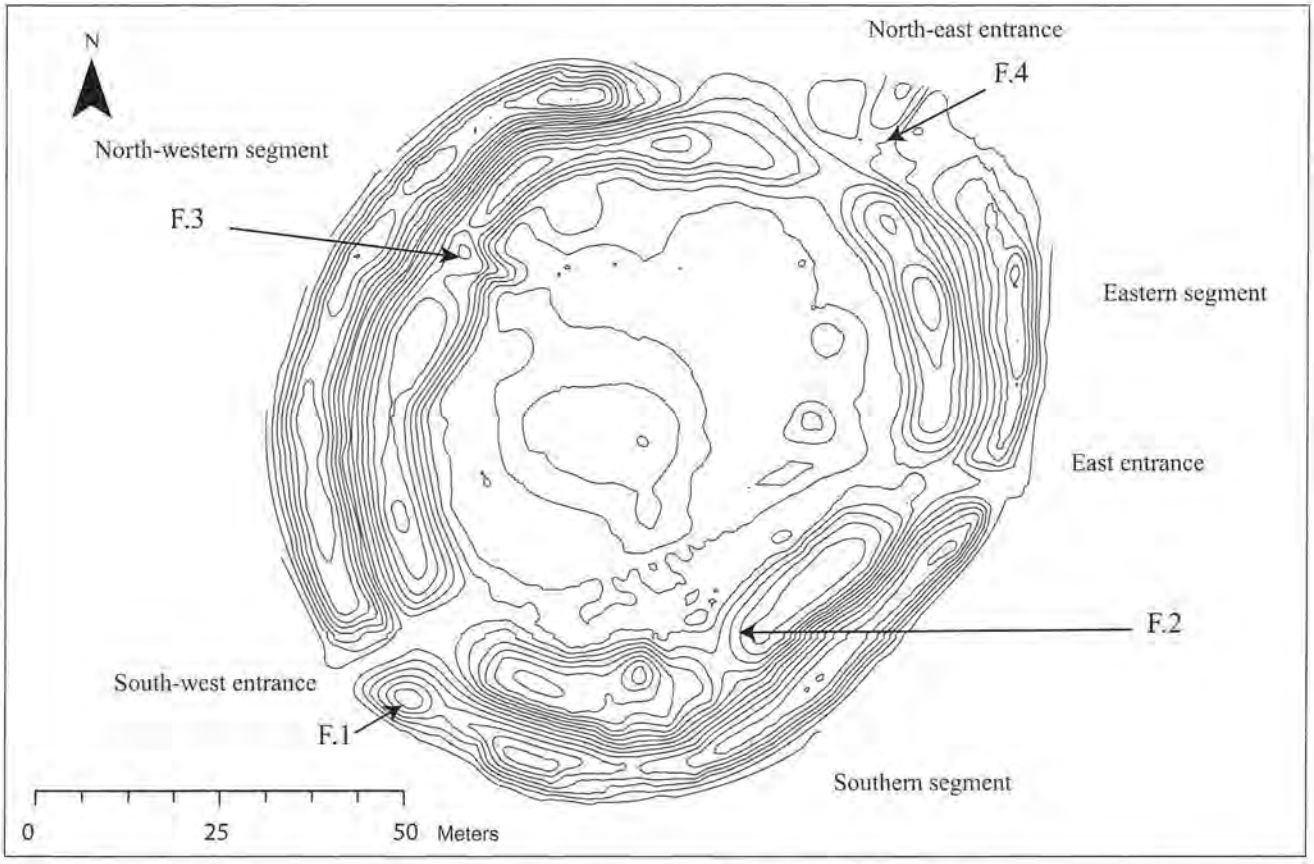


Figure 4 Contour plot of Church Henge, with features noted in the text.

Magnetometry at Knowlton was undertaken using a Geoscan FM36 fluxgate gradiometer. Survey resolution was conducted with a survey interval of 1m × 1m throughout with the exception of Church Henge where a 0.5m × 0.5m interval was adopted. Resistivity was conducted using a Geoscan RM15 resistivity meter fitted with twin-probe array and a survey resolution of 1m × 1m.

THE CHURCH HENGE

The Church Henge (Fig. 3) is a sub-circular earthwork with overall dimensions of 111.3m (east – west) by 96.7m (north – south), the external bank is *c.* 9.0m wide and survives to *c.* 2.0m above ground level. Around the interior face of the bank is a pronounced lip or terrace which may indicate later modification (Warne 1872, 102; RCHME 1975, 115). The ditch is heavily damaged probably through quarrying, evidenced by its irregular form. It varies in width between 7.3m – 14.5m and is *c.* 2.0m deep at its lowest point, with an average depth of 1.5m. Three entrances split the bank and ditch on the south western, north eastern and eastern sides (Fig. 4).

The henge's interior is dominated by a ruined medieval church which is surrounded by its own pentagonal enclosure 50m (north-east – south-west) by 38m (north-west – south-east), visible on the ground as a very shallow bank. Other earthworks in the interior include two small mounds, one within, and the other apparently situated on top of the churchyard enclosure (Fig. 5), which may represent debris from Victorian clearance of the attendant graveyard or possibly the Ministry of Works refurbishment of the site in 1961.

Topographic survey

The contour plot and Digital Elevation Model of the site provide considerable detail to add to existing topographic plans of the monument (e.g. RCHME 1975, 115 and Figs 4 and 5). The henge was set on a

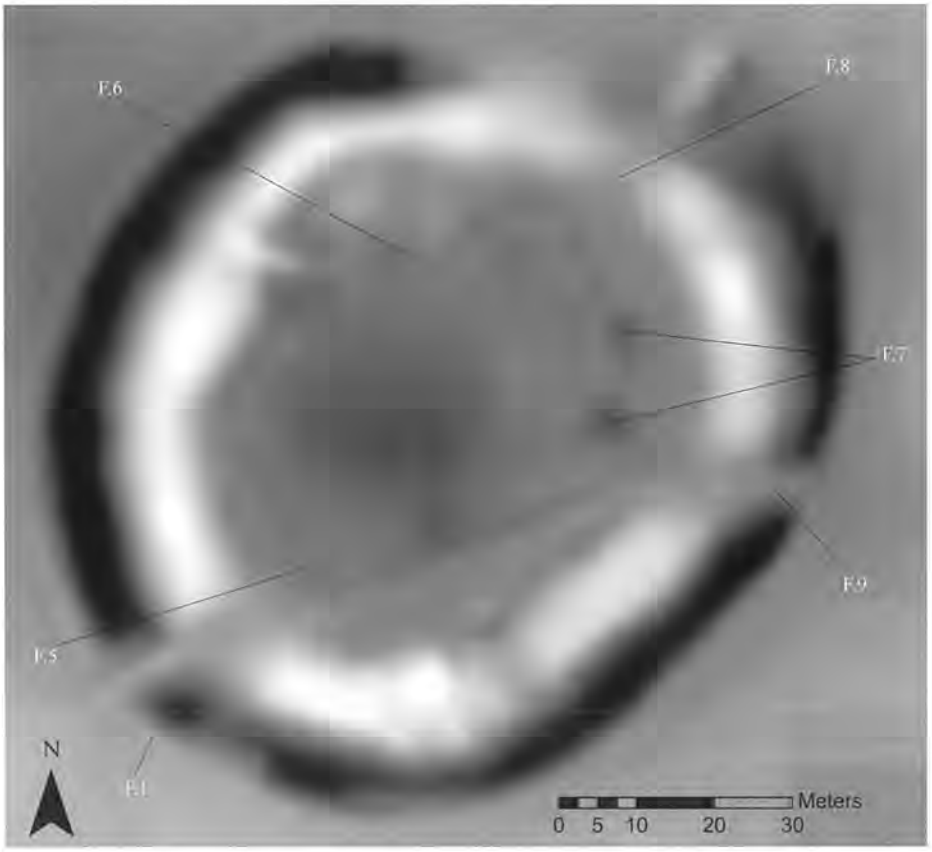


Figure 5 Shaded relief plot of the Church Henge, with features noted in the text. N.B. Scaling of elevation – white = low, black = high.

slight downward slope running north-east to south-west, with a drop of *c.* 0.4m over the width of the monument.

The southern segment and south-west entrance

The southern segment of bank shows several peaks along its length which may reflect later damage in the intervening areas. Interestingly, the western-most of these effectively blocks the line of sight from the outside of the henge, through the south-western entrance, to its centre (see F1 on Fig. 4). Instead, attention is channelled along the south face of the church. The possibility that this is a later addition designed to achieve precisely this effect deserves consideration, although it is possible that a view to the centre of the henge was part of the original design. Taking the argument one step further, the RCHME (1975, 114) considers that the whole of this south-western entrance may be secondary, perhaps encouraged by the angularity of the southern end of the bank and ditch in the north-western segment, and its omission from Warne's description (1872). However, the topographic survey provided little evidence to support this view, with nothing to indicate the slumping of an in filled ditch. The clue that indicates that an original entrance (south-west) was almost certainly located here lies in the causeway of the ditch at this point which appears to be considerably wider than the current entranceway through the bank. Defined by its ditch terminals, the causeway would seem to be articulated towards the centre of the henge. It is possible that the western end of the southern segment of the bank was extended to narrow the gap to better facilitate the construction of a lych-gate during the medieval use of the monument. If one were to peel away this western end of the bank, back to the point whereby the crest of the bank rises in elevation, the gap in the bank would more accurately match its companion causeway. This interpretation would result in a wide entranceway that allowed views in and out of the henge towards the river valley to the south-west. If

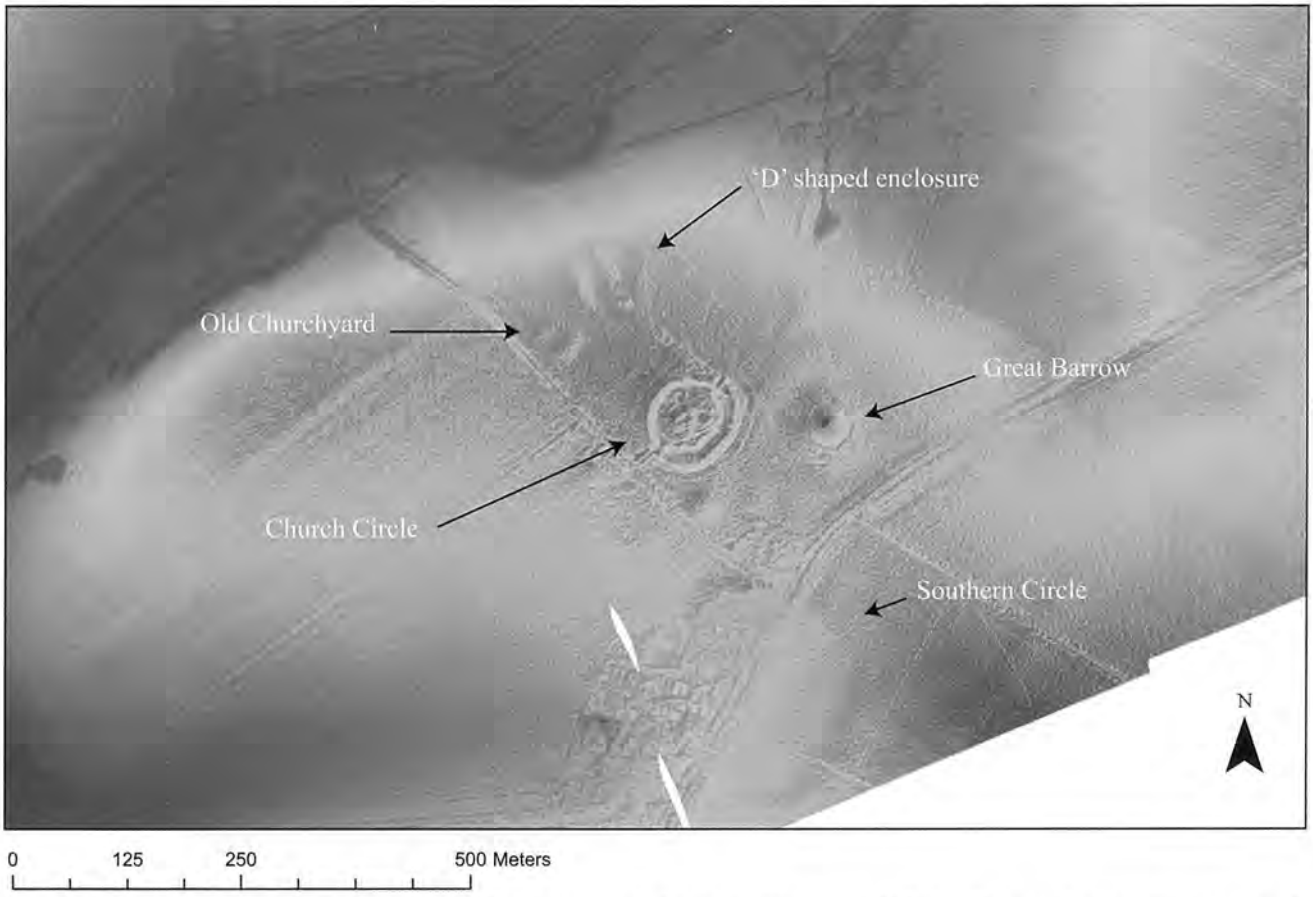


Figure 6 Digital Elevation Model (shaded relief) of the topographic features based upon LiDAR data. The tear showing as a white streak is the effect of nil data being recorded at these locations. (*LiDAR data supplied under Licence from Environment Agency*).

so, this may be part of its original design or perhaps a remodelling later in prehistory, ideas that need to be tested through excavation.

The ditch in the southern segment apparently consists of two joined sections, with the survey clearly showing a marked rise at its mid-point (see F2 on Fig. 4). The eastern section is regular in form but its western counterpart is irregular, possibly a result of later quarrying.

The north-western segment and north-eastern entrance

The bank along the north-western segment has a uniform height with little evidence of damage. The ditch inside it has not however survived so well with much evidence of secondary quarrying along its inner face. One area of quarrying in particular provides a natural walk-way from the interior of the enclosure into the ditch, and it may indeed have been intended as such (see F3 on Fig. 4).

At its north-eastern end the bank is truncated by damage which has considerably altered the north-eastern face of the monument and is presumably that change in the banks line and form referred to by Warne (1872, 102). The ditch continues past this artificial bank terminus to join the eastern ditch segment via a sunken causeway (F8 on Fig. 5). This evidence would suggest that the north-eastern entrance is secondary (*contra* Atkinson 1951, 102), being formed by the removal of the outer bank and the infilling of the ditch.

The linear feature (F4 on Fig. 4, and also visible on F8 on Fig. 5) outside the north-eastern entrance corresponds with a silage pit shown on the Royal Commission plan (RCHME 1975, 115), which is now largely in-filled.

The eastern segment and entrance

The eastern segment of the henge is also seemingly badly damaged with the bank becoming diffuse at its northern end. At its southern end, the terminal of the bank at the eastern entrance exhibits the same angularity as noted for the northern face of the south-western entrance. Again, there seems to be no obvious reason to suggest that this is not an original feature. The south face of the entrance is, however, less easily interpreted. Here the bank extends past the ditch terminal, blocking much of the entrance causeway, and creating a line of sight, which passes from the exterior of the monument to the front of the church (F9 on Fig. 5). Although this feature bears comparison with the suggested later remodelling of the bank at the south-western entrance (F1 on Figs 4 and 5), in this instance there is no evidence to suggest any extension of the bank after the Neolithic. However, it is possible that the bank was pierced and a causeway added to facilitate access to the Church from the east during the Medieval/Post Medieval periods. Of course, the irregularity of form to the banks and ditches could be original and the monument was intended to display such characteristics or simply was incomplete but this would appear to be unlikely.

THE CHURCHYARD

The shaded relief plot (Fig. 5) shows the basic five-sided form of the churchyard boundary within the interior of the henge. The boundary survives as a low bank (less than 10cm high for much of its length). Two entranceways through it are apparent, one opposite the south-western entrance of the henge (F5 on Fig. 5), the other on the northern face of the churchyard (F6 on Fig. 5). This latter entrance into the churchyard faces the quarry-pitted northern ditch and may be a secondary feature related to one of the rebuilding phases of the church.

The most intriguing features along the line of the churchyard are the two mounds at its eastern corner. The more northerly of the pair overlies the churchyard boundary (F7 on Fig. 5), the relationship of the other with the churchyard is uncertain. These features will be discussed further below.

Geophysical survey

Magnetometer survey

The magnetometer survey (Fig. 7) of the Church Henge was conducted in the spring of 1996. Given the number of visitors to the Church Henge it is perhaps not surprising that the interior of the site showed many magnetic spikes denoting isolated metal fragments. More surprising is the lack of response of the ditch to the magnetometer survey since, in general, ditches typically produce very clear signatures with an enhanced magnetic response. This would indicate that the ditches have been slowly infilling from the eroding banks with little or no magnetically enhanced material forming within them. This is probably because the upstanding banks have prevented the in-coming wash of medieval and later plough soils.

There are a number of strong and localised anomalies elsewhere on the site. The first of these (F1 on Fig. 7) correspond to the two mounds visible on the topographic survey. Their strong signatures suggests that they are composed of burnt material, a view supported by the presence of several pieces of brick / tile eroding from animal holes on the mounds.

Similar features can be seen in the ditches of the eastern and part of the southern segments (F2 and F3 on Fig. 7). It would seem likely that these correspond to rubble clearance, possibly during the early 18th century renovation phase or perhaps in a tidy-up after the collapse of the roof in the latter part of the same century. The possibility of such magnetic responses being part of activity contemporary with the prehistoric use of the monument cannot be completely discounted but given the intensity of use in the medieval period is probably unlikely. Interestingly the sunken causeway separating the ditch (at the north-east entrance) does not show a similar response which may indicate that the entrance causeway is original or that the infilling of magnetically enhanced deposits (F2 on Fig. 7) has been removed. Feature F4 on Figure 7 may relate to a similar episode of debris clearance, although in this instance it is interesting to note that the Ministry of Works photographs taken at the end of the consolidation of the Church Henge in the early 1960s show a pile of building rubble in this area.

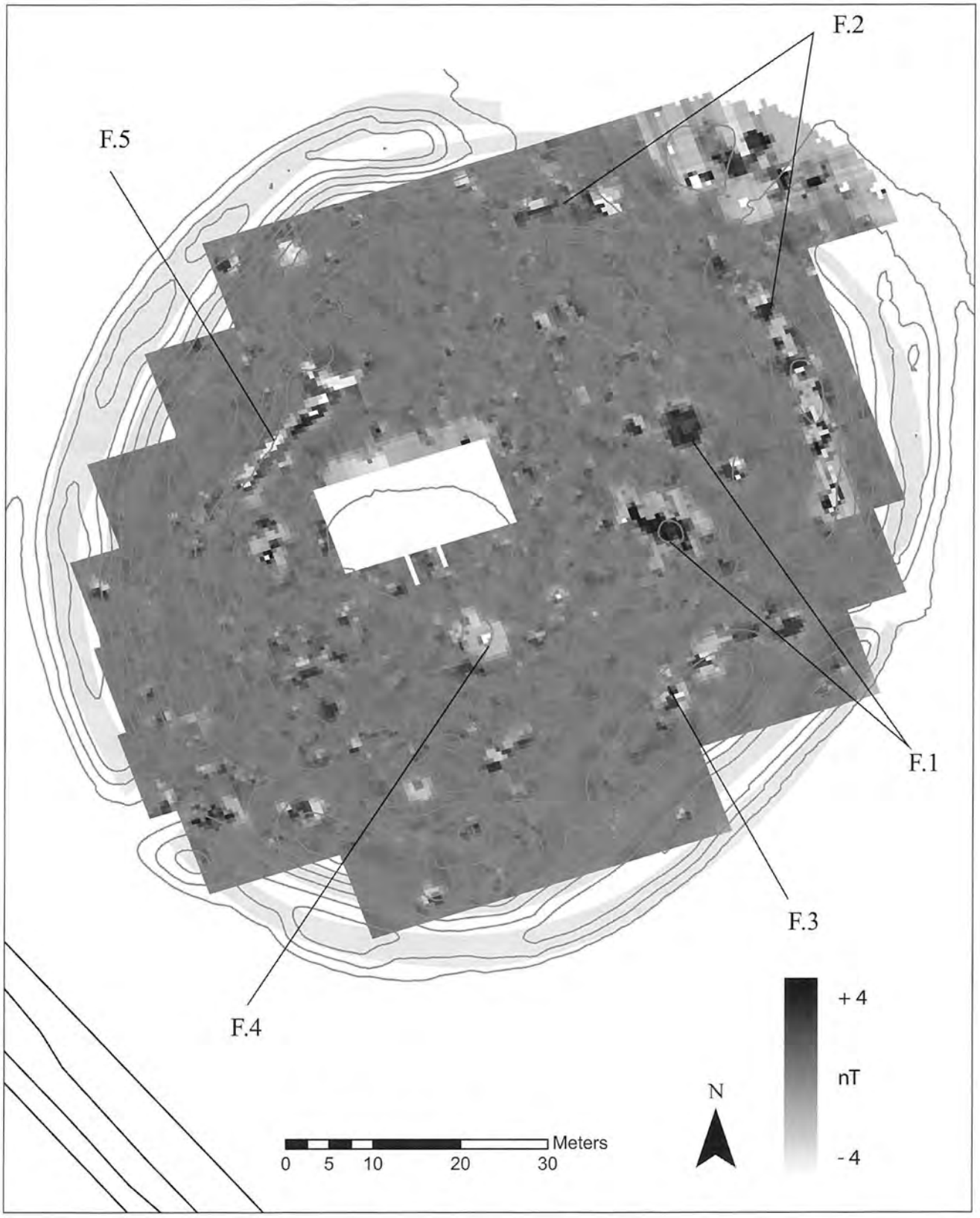


Figure 7 Results of the magnetometer survey (fluxgate gradiometer) of the interior of the Church Henge with features noted in the text: The survey is superimposed over a 50cm interval contour plot with the O.S. topography showing as a grey tint also underlying the geophysical plot. Base map data supplied under license © Ordnance Survey GB Topography

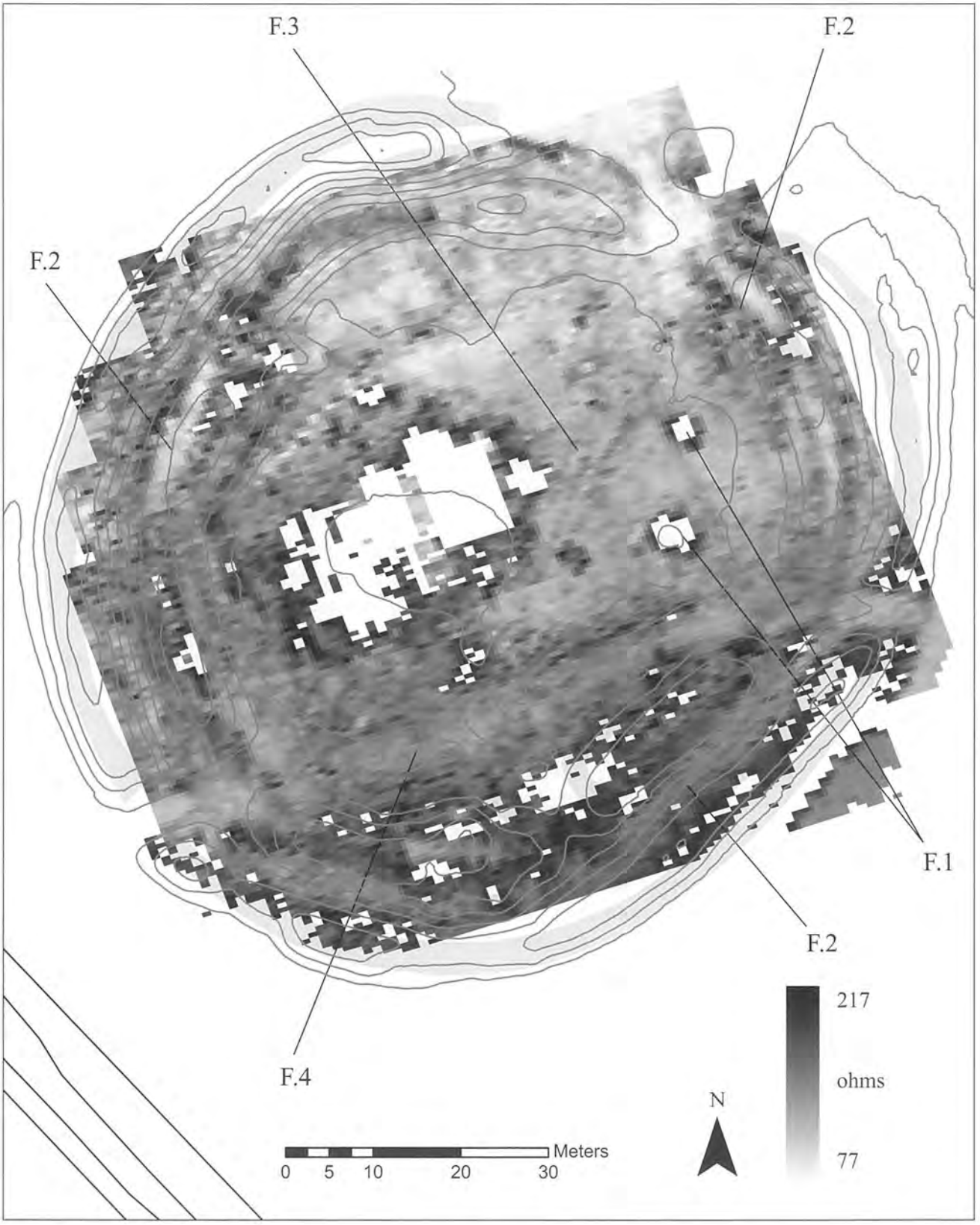


Figure 8 Results of the resistivity survey of the interior of the Church Henge with features noted in the text. The survey is superimposed over a 50cm interval contour plot with the O.S. topography showing as a grey tint also underlying the geophysical plot. Base map data supplied under license © Ordnance Survey GB Topography

A final feature of interest (F5) is a strong linear anomaly running north-east to south-west. This feature corresponds to the line of the churchyard boundary observed in the topographic survey and is presumably associated with it.

Resistivity survey

The resistivity survey (Fig. 8) of the Church Henge was carried out in the autumn of 1996. Elements of the bank and ditch circuit are visible on the plot and the two mounds described in the topographic and magnetometer surveys above are also clearly visible on the resistivity plot as areas of high resistance (F1), corresponding with the suggestion that they are rubble piles with little soil matrix. The churchyard mound also shows up as an area of high resistance due to soil compaction. A curvilinear feature with high resistance (F2 on Fig. 8) corresponds to the northern side of the churchyard and matches the magnetic feature F5 on Figure 7. This can be seen to curve around the west side of the church. Concentric with this is a feature with low resistance (F2), located immediately inside the churchyard and extending the length of the magnetic feature F5.

Unique to the resistivity survey is a linear anomaly (F4). This anomaly appears to run from the south-western entrance, crossing the southern side of the henge interior, before petering out towards the eastern entrance. This feature may correspond to a trackway visible on photographs pre-dating the 1960s renovation, which was presumably used as an access route from Lumber Lane into the fields around the henge. F3, an indistinct linear anomaly running diagonally across the interior from north-east to south-west, is also likely to be the remains of a trackway, passing from the north-eastern entrance, south of the church, and connecting with F4 on Fig. 8.

This summarises the major and most easily explicable features revealed by the survey, however, there are several other anomalies in the dataset that may reflect an archaeological origin. The low resistance displayed by the causeway of the north-eastern entrance is curious but difficult to explain. If the entrance is indeed artificial, as suggested previously in relation to F2 on Figure 7 then it is possible that the signature reflects the infilling of the ditch. Proof of such a hypothesis must however wait upon excavation.

Discussion

The primary value of the three surveys has been in providing information about the later life of the henge. Most intriguing is the possibility that the south-western and eastern entrances have been modified and partially blocked. In both cases the effect has been to channel the eye towards the front face of the church rather than the centre of the monument. This view contradicts that of the Royal Commission (RCHME 1975, 114) who regarded only the eastern entrance as original. The secondary nature of the north-eastern entrance seems likely with the infilling of the ditch on this side being matched by the large scale demolition of the adjacent bank. However, it is not beyond the bounds of possibility that the demolition of the northern segment also removed all traces of an original opposed entrance to that in the south -west.

In producing his classification of henges, Atkinson (1951, 82) divided the site type into two classes, those with a single entrance (Class I), and those with double, opposed entrances (Class II). The conclusion presented here is that the Church Henge may have originally had two un-opposed entrances. A review of site plans in Harding and Lee (1987, fig 27c) and Clare (1986) confirms that this is indeed unusual. It should however be noted that un-opposed entrances have been recorded at other henges within Wessex, although they have normally been associated with larger henge enclosures such as Marden and Mount Pleasant. Given the proximity of the Church Henge to Knowlton's own possible henge enclosure, the Southern Circle, it is perhaps not surprising that this regional tradition should be present at Knowlton too.

THE SOUTHERN CIRCLE

The Southern Circle measures about 225m in diameter, although the detail of its form is heavily masked by damage resulting from agricultural disturbance and the building (in 1745) of New Barn Farm (Whittock unpub) within its interior (Fig. 2). In addition, the Wimborne – Cranborne turnpike road

(now the B3078) passes through its interior which has significantly damaged the south-western quadrant of the monument.

The henge bank survives best along its north-western side where it still rises to *c.* 1.2m in height in places and until recently was topped by dense vegetation including a plantation of yew trees along its crest. Development at the site by its current owner in 2016 removed this vegetation and now provides for clearer observations to be made. The bank is, however, heavily denuded as it arcs to the north and meets the junction of Lumber Lane and the B3078. At this point the in-filled ditch can be traced as a depression in the road surface. In its north-eastern quadrant the bank and ditch are visible as low earthworks, whilst in the south-east these traces are fainter still. The south-western quadrant to the west of the B3078 has been largely destroyed by the construction of farm buildings.

The question regarding the original configuration of entrances at the Southern Circle has been previously discussed but with little clear resolution. Piggott and Piggott (1939, 154) and Harding and Lee (1987, 129) preferred not to guess at the location of possible entrances, whilst Atkinson (1951, 102) believed there were two entrances, one in the north-west and possibly a second in the south-east. Burl (1969, 22) claimed entrances on the east-north-east and west sides on the basis of apparent anomalies on aerial photographs but none of the claims have been subject to meaningful investigation, prior to this study.

Topographic survey

The eastern half of the Southern Circle has been under an arable regime for many years which has had a cumulative impact on the henge's state of preservation, with the remnant bank and ditch of the henge surviving as barely perceptible earthworks. The south-east field was subjected to a topographic survey in 1993 with a Total Station at a spatial resolution of 5m. However in the intervening period LiDAR has greatly exceeded this both in terms of extent and spatial resolution.

The bank and ditch show up clearly on the LiDAR derived Digital Elevation Model (Fig. 6), although the extent of damage on the southern side of the monument is clear. In part, this may be a consequence of earth movement along the line of the B3078, although it is more likely that it is a factor of differential ploughing of the field's headlands on either side. There is a clear rise in ground level of about 0.1m between the south-east and north-east fields, presumably as a result of down-slope soil movement during ploughing. Interestingly this raises the possibility that any internal features in the north-east field will be better preserved than those in the field to the south.

Geophysical Surveys

The Southern Circle: south-east field

A magnetometer survey was conducted over the south-east field of the Southern Circle over a four week period in 1993 and 1994 (Fig. 9).

The most pronounced feature is the henge ditch, which shows up as a clear anomaly up to 15m wide (F1 on Fig. 9). It is continuous across the south-east field, refuting Atkinson's suggestion that an entrance might be located in this area (1951, 102). The nature of the ditch changes at F2 on Fig. 9. This is accompanied by an increase in the level of iron spikes which form a north – south linear zone in this area. It is possible that these represent a relict line of the Wimborne – Cranborne turnpike road.

The set of linear features running south-east – north-west (F3 on Fig. 9) probably mark the line of a trackway visible on Taylor's map of 1795 and the 2nd edition Ordnance Survey 2 inch map. Aerial photographs (e.g. RCHME: NMR 4554/45) shows the trackway turning west at the limits of the geophysics plot and travelling down an existing hedge line towards the River Allen.

The locations of these anomalies were all suggested by aerial photographs prior to the gradiometer survey. Another anomaly which one might reasonably have expected to show up within the survey area corresponds to the shallow gullies revealed during the 1994 excavation (see below for detailed description and discussion). Their location is shown at F4 on Figure 9, but they are barely traceable on the plot and it is unclear as to

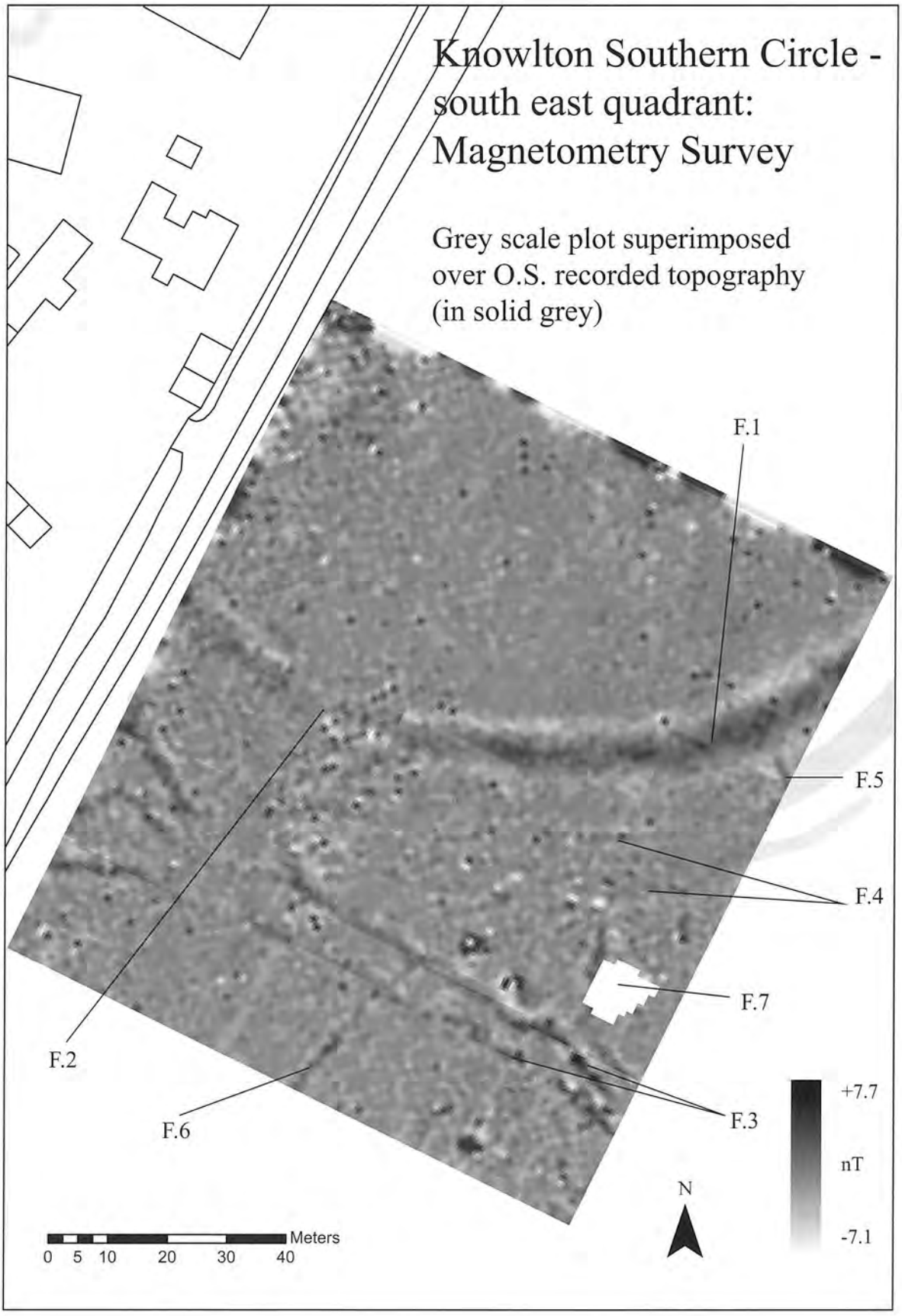


Figure 9 Results of the magnetometer survey (fluxgate gradiometer) of the Southern Circle (south-east quadrant) with features noted in the text. The survey is superimposed over O.S. topography showing as a grey tint underlying the geophysical plot. Base map data supplied under license © Ordnance Survey GB Topography

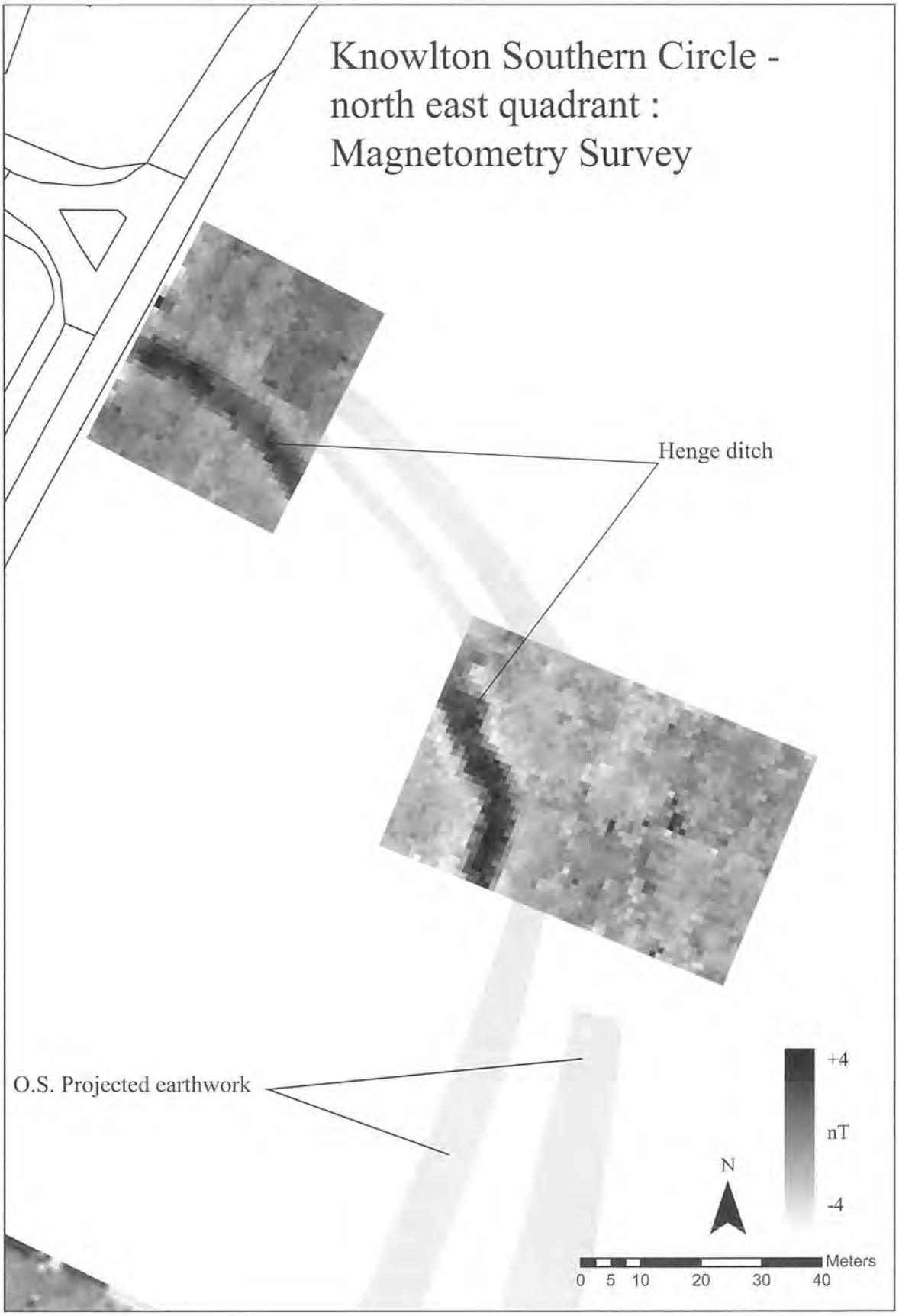


Figure 10 Results of magnetometer survey (fluxgate gradiometer) at the Southern Circle (north-east quadrant) at the previously suspected entrance locations (Atkinson 1951 and Burl 1969). The survey is superimposed over O.S. topography showing as a grey tint underlying the geophysical plot. Base map data supplied under license © Ordnance Survey GB Topography

the extent to which they follow the circuit of the enclosure.

Additional linear anomalies can be seen at F5 and F6 on Fig. 9, these remain to be explained. F6 on Fig. 9 crosses the line of the relict trackway (F3 on Fig. 9) and possibly curves in the direction of the enclosure.

The survey did not reveal any anomalies within the interior of the henge. However, this is not evidence for absence. The sample resolution of 1m × 1m, means that negative features such as post-holes and stake holes would be undetectable, although larger pits might have been expected to be revealed if present.

The Southern Circle: north-east field

Magnetometer surveys

As part of the field survey programme conducted alongside the 1994 excavation of the Southern Circle, two areas were surveyed along the north-eastern quarter of the Southern Circle ditch (Fig. 10). The intention was to explore possible locations for entrances within this portion of the circuit.

The first area (Figs 2 and 10) was placed at the junction of the ditch with the line of the B3078. A 40 × 40m area was surveyed at this point. No evidence was found for a break in the ditch (see Fig. 10). The second survey area (Figs 2 and 10) was located to explore an apparent irregularity along the line of the ditch, visible on an aerial photograph published in Harding and Lee (1987, 126). This irregularity is presumably the cause of Burl's (1969) suggestion that there is an entrance within this portion of the ditch circuit. Working from a plot of the aerial photographs, the survey area was located using an area of 40 × 60m was examined.

No break in the ditch was located within the survey area (see Fig. 10), however, a kink can be clearly seen where the ditch changes direction. No other part of the ditch displays this same irregularity.

THE NORTHERN CIRCLES

The two northern enclosures within the Knowlton complex survive as slight earthworks on the gently sloping hillside approximately 100m north-west of the Church Henge. They are the least studied of the Knowlton enclosures. The two enclosures are generally referred to as the Northern Circle and 'Old Churchyard'.

The Northern Circle was excluded from Atkinson's list of henges (1951, 102), being described instead as a 'D-shaped enclosure'. Burl (1969, 11) also excludes it from his corpus although he notes the Church Henge as "Knowlton North." Clare (1986, 311) places this site within his list of "sites sometimes described as henges", whilst Harding and Lee (1987, 123, 128) classified it as a "possible henge". The difficulty in classifying the Northern Circle stems chiefly from the unusual elongated shape of the ditch, which measures roughly 40 × 70m, with an entrance at the short, southern end. Its external bank brings the total size of the monument to about 78 × 93m (RCHME 1975, 115).

The presence of a line of yew trees bisecting the site makes it difficult to appreciate the form of the monument from the ground. A review of early Ordnance Survey maps suggests that this line of yews originally extended from the River Allen, through the Northern Circle, and past the Church Henge, towards the Great Barrow.

The 'Old Churchyard' has a sub-circular external ditch, approximately 62m at its widest diameter. The external ditch, places it outside the strict definition of a henge, although similar sites of Neolithic age are known, for example, Llandegai Henge A (Houlder 1968; Lynch and Musson 2001). A further feature which militates against the inclusion of this enclosure within the henge family is the marked angularity of the plan form of the bank, as seen on the Ordnance Survey 1:2,500 map (1901).

The name the 'Old Churchyard' appears on the 2nd edition Ordnance Survey map, although its origins are uncertain. There is no documentary evidence that Knowlton ever had its own burial ground making it

likely therefore that the name 'Old Churchyard' has become attached to the enclosure possibly through misplaced tradition rather than reality (Field 1962).

Geophysical survey

Magnetometer survey

Geophysical survey (Fig. 11) was carried out on these sites in August 1995. The survey clearly shows the ditches (F1 and F3) belonging to both of the enclosures, but unfortunately neither the remaining banks, nor any additional features were revealed. A composite plan showing both a contour plot of the banks and the geophysical survey of the ditches is given as Figure 12.

The Northern Circle

The atypical shape of the Northern Circle ditch was confirmed by the magnetometer results. Far from being a henge-like circle it is lozenge shaped, with a neatly defined entrance at the southern end (F2 on Fig. 11). In plan form this ditch bears a resemblance to that exhibited by several Dorset long barrows, for example Holdenhurst (Piggott 1937), Thickthorn (Drew and Piggott 1936), and especially Wor Barrow (Pitt-Rivers 1898), which has a ditch of very similar size and orientation as the Northern Circle. However, to define this monument as a long barrow would be to ignore the contradictory evidence presented by the presence of an external bank. It is likely therefore that any similarity may be entirely circumstantial although the shape may allude to an earlier tradition of monument form retained in folk memory.

The 'Old Churchyard'

Despite producing a clear result on the magnetometer survey the 'Old Churchyard' classification remains somewhat problematic. The slightly squashed south-western side of the enclosure ditch might indicate that it is respecting the line of Lumber Lane and is thus of a late date. However, the evidence is enigmatic. It could be argued that the line of the ditch is as irregular as that of many other prehistoric enclosures and that any apparent alignment with the road is purely circumstantial. Set within the sub-circular ditch circuit is the internal bank. This is not visible on the magnetometer survey but survives as a slight rise on the ground (see Fig. 11).

A surface scatter of burnt flint was found during fieldwork, which is suggestive of prehistoric activity. It cannot however, be said with any certainty that this is directly related to the use of the site rather than being residual. Interestingly the ditch (F3 on Fig. 12) surrounding the bank has a clear causeway (F4) to the north-east which was previously undetected and is therefore likely to represent an entrance. The earthwork as recorded in the 1901 O.S 2nd edition 1:2500 map implied a singular entrance but to the south-west which is possibly reflected in the magnetometer survey but the presence of a causeway in the ditch is less sure. The results do contain a fair degree of magnetic noise within the enclosure which might suggest activity contemporary with the monument's use but there is little to suggest anything specific.

The date of the 'Old Churchyard' cannot, therefore be considered to have been proven. Although we could argue that the 'Old Churchyard' enclosure was an integral part of the Knowlton henge complex, we cannot rule out the possibility that the site's name does in fact reflect a medieval or later origin for the earthworks.

Discussion

The geophysical survey of the Northern enclosures has greatly improved our understanding of both monuments. The arrangement of banks and ditches has been affirmed showing that the composition and form of the two enclosures was quite different, reflective perhaps of different origins or indeed purposes. Despite the fact that both enclosures exhibit characteristics that might at first exclude them from direct association with 'Classic' henge forms, they each retain sufficient associations to suggest that they may indicate variant forms, possibly earlier in date. The origins of the 'Old Churchyard' remain stubbornly elusive and will only be properly resolved by excavation. The presence of an external ditch has been confirmed but this does not preclude its contemporaneity with the remainder of the complex. Its most likely comparator is the Llandegai A enclosure excavated in 1966–7 which similarly contained an internal bank (Lynch and Musson, 2001: 36–55). However, the plan of Llandegai A was of a regular circle of both bank

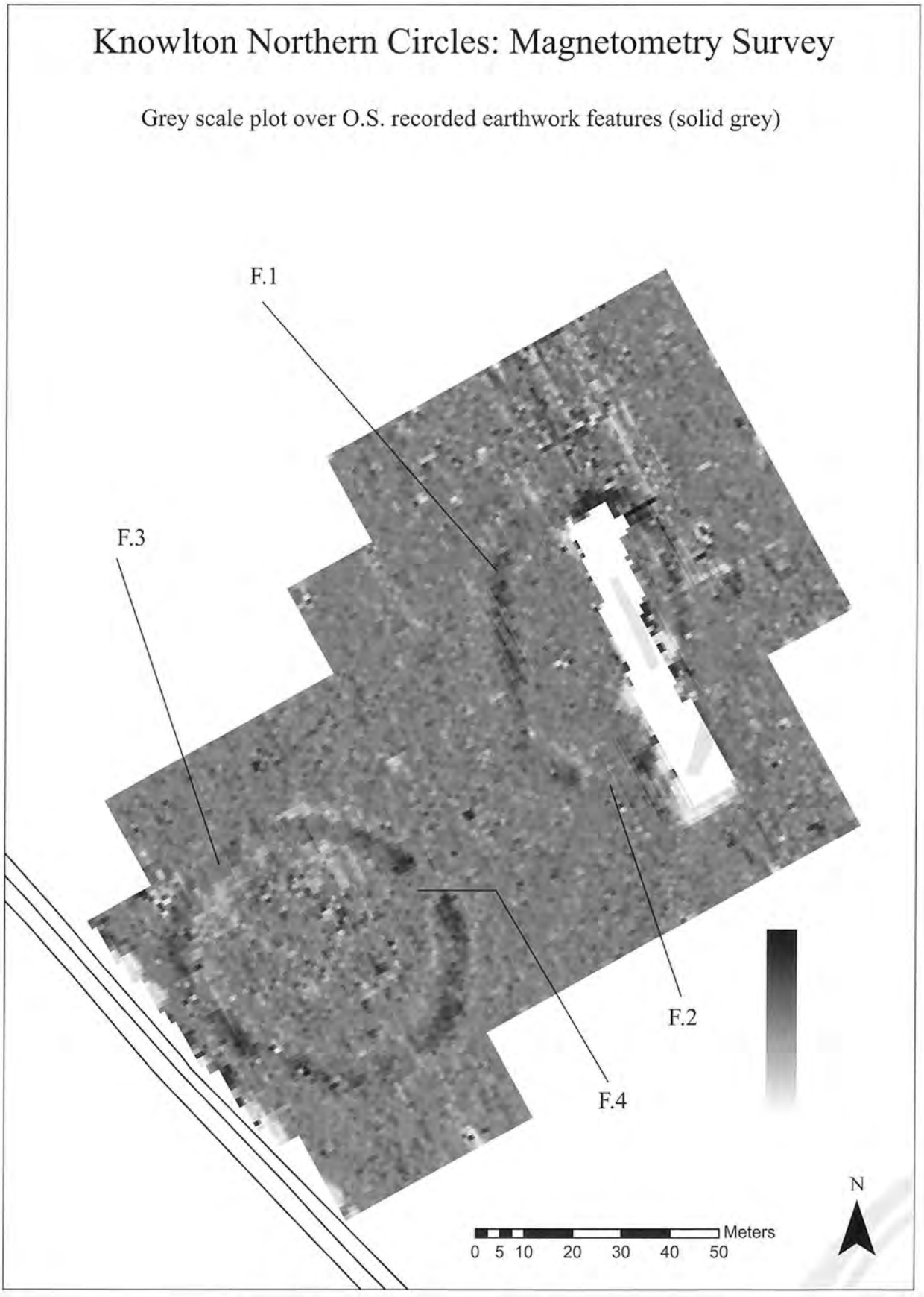


Figure 11 Results of the magnetometer survey (fluxgate gradiometer) of the Northern Circles ('D' shaped enclosure – upper; 'Old Churchyard' – lower). The survey is superimposed over O.S. topography showing as a grey tint underlying the geophysical plot. Base map data supplied under license © Ordnance Survey GB Topography

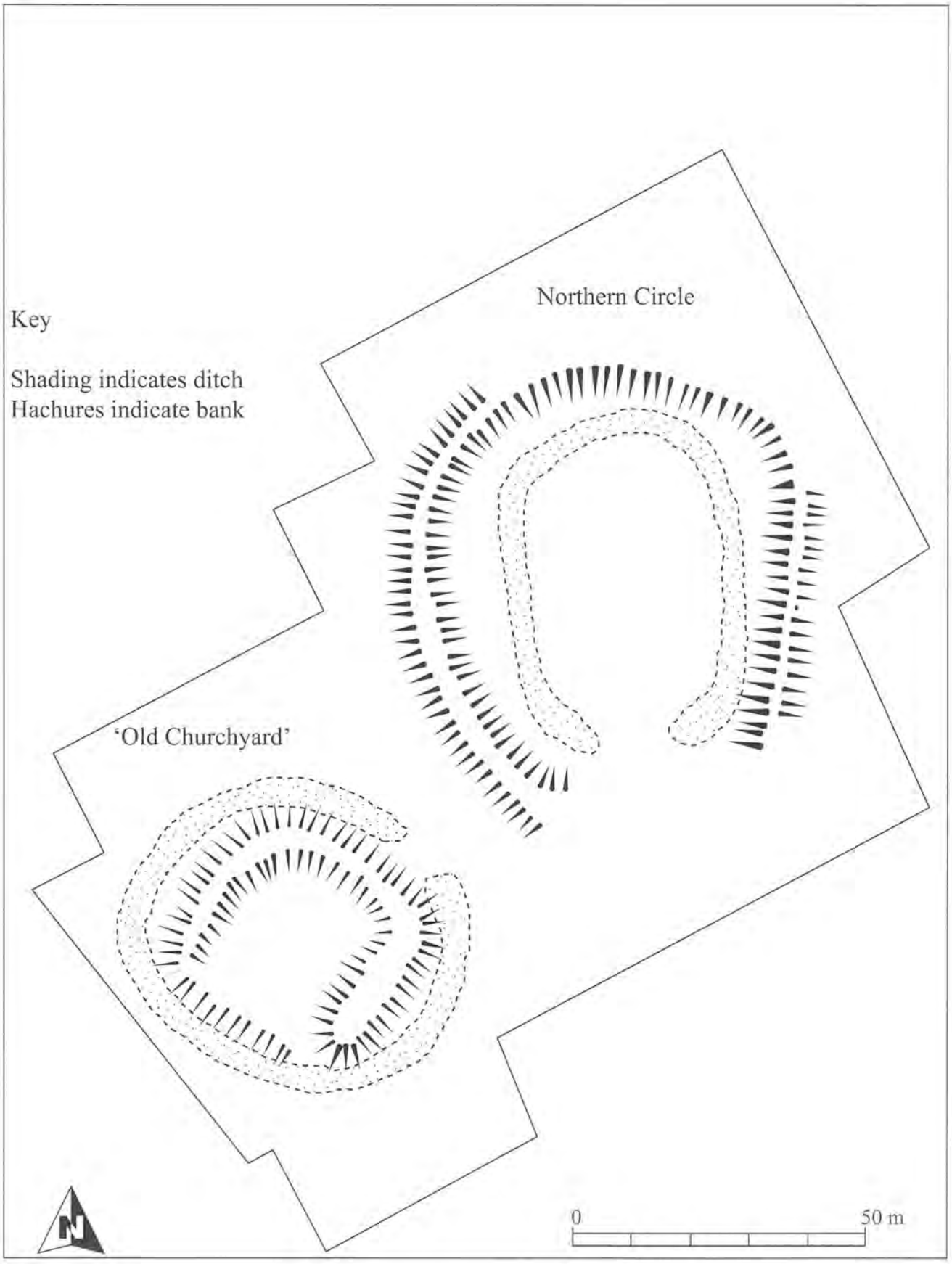


Figure 12 Plot of the ditches derived from the geophysical survey of the Northern Circles, overlain on hachure plan derived from the OS 1901 2nd edition 1:2500 map.

and ditch whilst the bank of the 'Old Churchyard' has a distinctly rounded rectangular form (Fig. 12). A recent re-evaluation of Llandegai A has raised doubts on it being a Neolithic monument (Gibson 2018, 109–112), although its origin is still unclear.

EXCAVATION AT THE SOUTHERN HENGE 1994

As discussed above, the largest monument within the Knowlton complex is the Southern Circle. On a simplistic morphological level it is usually appended to the small list of mega-henges or henge enclosures that comprise Durrington Walls and Marden (Wiltshire) and Mount Pleasant (Dorset) (Fig. 1) (Wainwright 1971, 1979, 1989; Wainwright and Longworth 1971). To this list the site of Avebury in Wiltshire can also be added, although this site contains complex stone settings more normally associated with some 'classic' henges (Harding and Lee 1987, 31; Harding, J. 2003, 20–22).

As the various surveys described here have shown, the Southern circle is one element of a major Neolithic and early Bronze Age complex, the understanding of which has been considerably hampered by the lack of intrusive fieldwork especially with regard to the recovery of material to reliably date any of the monuments.

Our present knowledge of the role and status of Wessex henges is considerably influenced by the partially excavated sites of Durrington Walls (Wainwright and Longworth 1971; Parker Pearson 2007 and 2012), Mount Pleasant (Wainwright 1979) and Marden (Wainwright 1971). These have traditionally been viewed as habitation sites (e.g. Wainwright 1989) and interpretations drawn from the above excavations have sometimes been extrapolated onto the Knowlton example, e.g. Wainwright (1979) and Barrett *et al* (1991). The Knowlton complex is, however, unique amongst these sites in containing three or four henges.

The Excavation

The excavation took place over a six-week period during August and September 1994. The choice of where to conduct this exploratory excavation was driven principally by a desire to exact a maximum amount of information whilst minimising potential impact. As most of the western portion of the monument is incorporated into the modern farm and its outbuildings, the area selected was located in the south-eastern quadrant (Fig. 13). This has been subjected to a fairly constant and vigorous arable regime over the last century or more, resulting in the progressive erosion of the henge bank, with most of it gravitating down the slope and subsequently further in-filling the already barely observable internal ditch. The focus for the excavation was the surviving bank and ditch, which were considered to be the most likely source for the recovery of data from stratigraphically secure contexts. An initial trench was therefore excavated across the bank and ditch (Fig. 13).

Plough-soil excavation and sampling

The plough-soil was initially sampled to assess its depth and content in terms of cultural material. A 10% sample was evaluated by placing nine, 1m × 1m test pits over the proposed excavation trench. These test pits were excavated by hand, with only the overburden of plough-soil (Context 010) being removed. All the plough-soil from these test pits was sieved through 1cm meshes with all finds recovered.

Cultural material retrieved from the plough-soil consisted of worked flint, burnt flint, fragments of brick and tile and occasional pieces of slag, glass and pottery. None of the materials recovered was either unusual or particularly diagnostic and most showed signs of extensive abrasion from plough action. Most of the fragments of pottery, tile, brick and tile and glass were of post-medieval date.

The remainder of the plough-soil was then removed by machine stripping.

Principal archaeological features

Following the removal of the plough soil via machine the following features were excavated and recorded:

The Henge ditch

The excavation confirmed that the Henge ditch was a very substantial feature (Fig. 14). Excavation

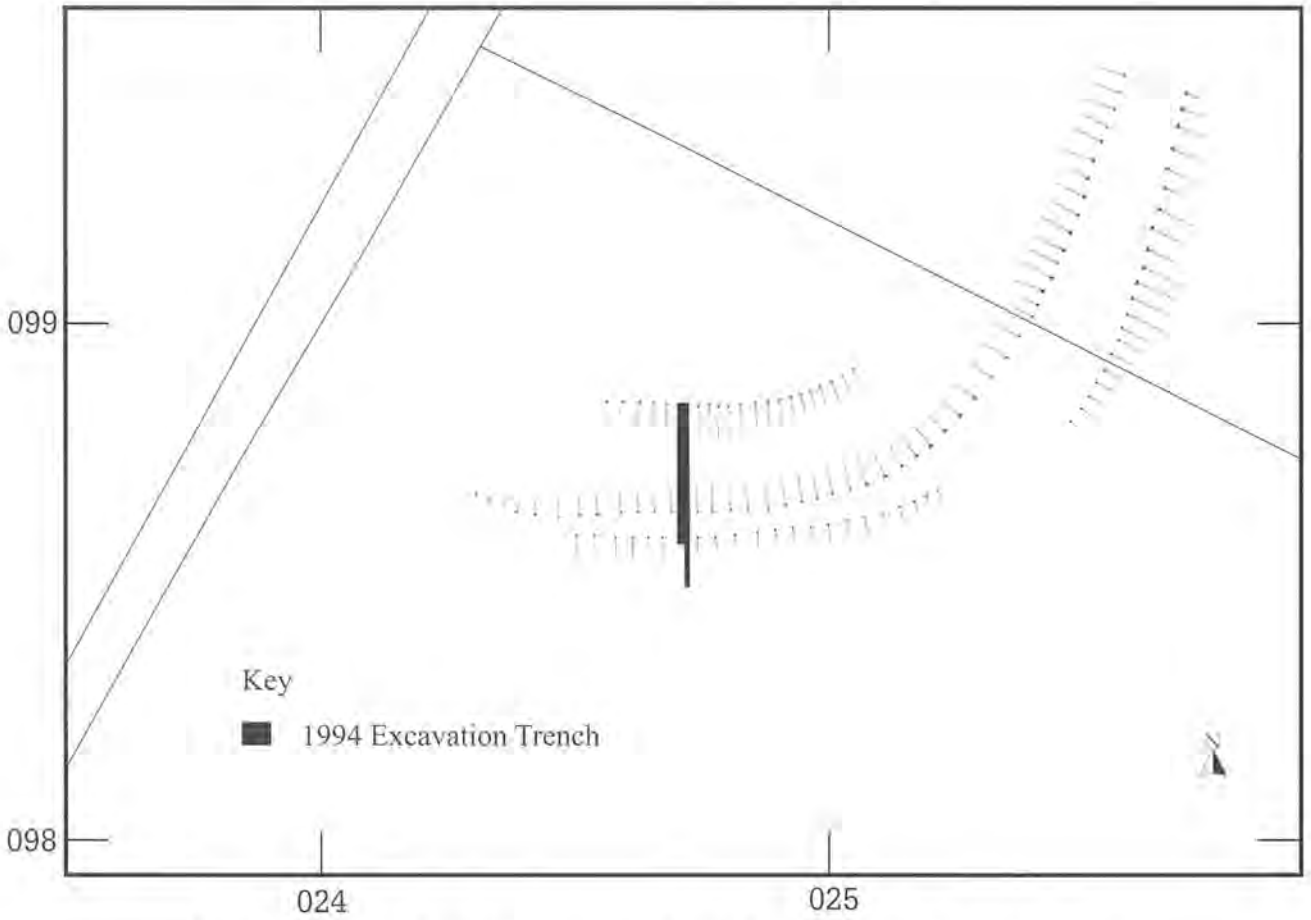


Figure 13 Location of the 1994 excavation trench at the Southern Circle (south-east quadrant).

continued until a depth of 4.25m (below present ground level) was reached with no clear sign of the base. At this stage, following health and safety advice, the hand excavation of the ditch was reluctantly brought to a halt. However, before the ditch was back-filled the excavated base was probed with a 5cm-diameter corer. The corer was inserted at three equally spaced points at the base of the excavated deposits and on all three occasions appeared to meet considerable resistance at a total depth of 4.75m below current ground level. The compacted material within the corer appeared to indicate that the fill was uniform and consistent with the earliest excavated fill (Context 44/46) already partially exposed (Figs 14 and 15), with a noticeably thin layer of chalky silt beneath it .

Beneath the overburden of plough-soil (Context 01), the ditch was defined by the well-sorted layer of sandy silt loam (Context 03). This layer would appear to be a plough wash which precedes the present cultivation horizon, and probably survives only where the underlying chalk naturally, or artificially, dips below the reach of the depth of the modern plough. This layer contained the largest quantity of artefacts unearthed during the excavation with material ranging from struck flints to post medieval brick, tile and unglazed earthenware, which are clearly residual. As well as forming a sealing layer for the ditch fills proper, Context 03 also incorporates the only surviving soil on the berm between the ditch and bank. A layer lying immediately below this plough wash and almost indistinguishable from it (Context 14) probably represents the settling out of re-deposited bank material. This lens of colluvium would appear to be the result of episodic ploughing that has gravitated into the remnant shallow scoop of the ditch and is identified by a much higher proportion of fragmented chalk in its matrix. It is likely therefore that Contexts 3 and 14 are essentially contiguous.

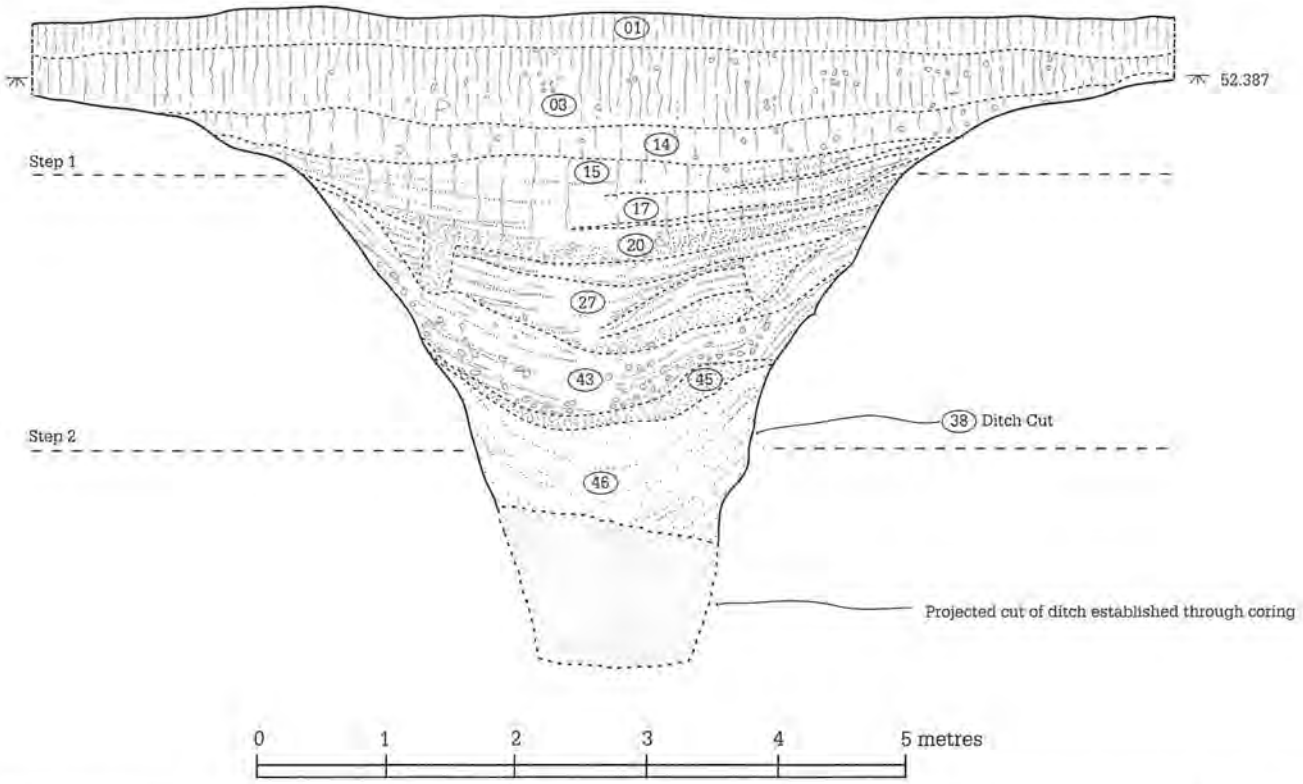


Figure 14 Henge ditch section (east facing) showing the principal fills. N.B. The location of the revetment slots (Contexts 29 and 40) can be seen clearly in the stratigraphic sequence of ditch deposits.

The henge ditch was originally excavated into the solid chalk with an apparent emphasis on depth rather than width. The current ditch profile is problematic on two counts, firstly the lower element is as yet unconfirmed by excavation and secondly the upper half has a distinctive weathering cone, which has greatly exaggerated the width of the feature. The current profile of the ditch has a maximum width of 9m and a depth of approximately 4.75m (including the measurements resulting from the coring of the basal deposits). The original width and depths of the ditch were certainly much different, and it is estimated that they were approximately 3.75m and 4.75m respectively (Fig. 16). It is of course unknown if this estimation of the ditch profile was constant throughout the circumference of the monument.

With the angle of the lower ditch sides (75°) being so acute the rapid weathering of the ditch edges (at the surface particularly) was likely to have taken place in a relatively short space of time (Jewell and Dimbleby 1966; Ashbee 1989, 147; 2004). There is no evidence for any form of revetment from the initial construction phase and therefore the collapse of the upper edges was inevitable and perhaps predictable by the constructors? Such a deposit would have primarily consisted of chalk, and the earliest deposit excavated (Context 44/ 46) was entirely consistent with this.

Immediately following this in-filling of the ditch with natural chalk there was a period of relative stabilisation abruptly sealed by a final slump of a very humic silty loam, (Context 45) which would appear likely to be turf which was later confirmed through analysis of the soil micromorphology (Lewis 2007, 134–8).

The secondary fills of the ditch are characterised by further weathering of the ditch sides interspersed with episodes of colluvial in-filling (Contexts 27 and 43) and a further slump of humic material (Context 37 – not shown on Fig. 14). Within some of the colluvial in-filling episodes there is fragmented chalk rubble, which most likely originates at least in part from the eroding henge bank. Following the

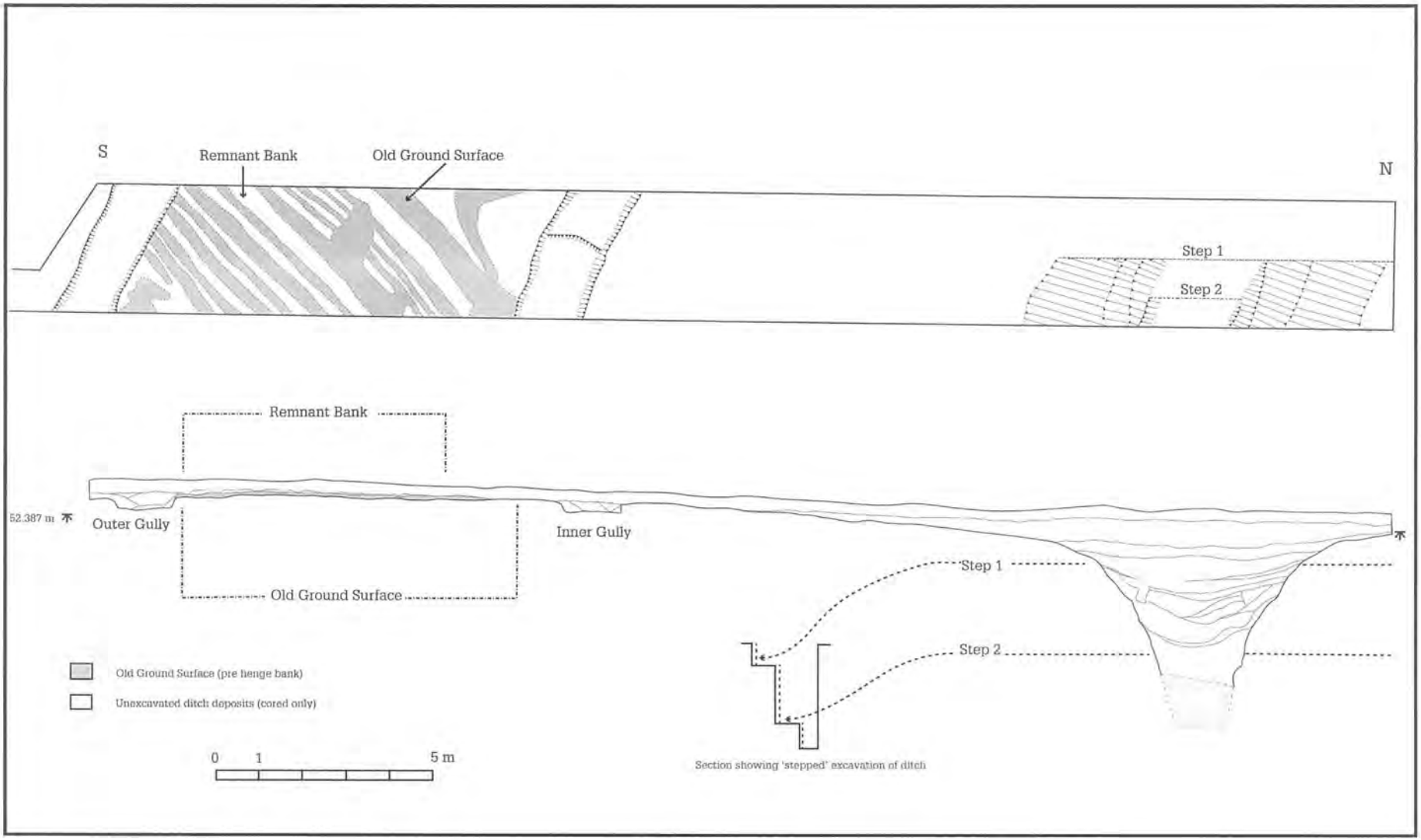


Figure 15 General plan and section (east facing) of the primary features of the 1994 excavation

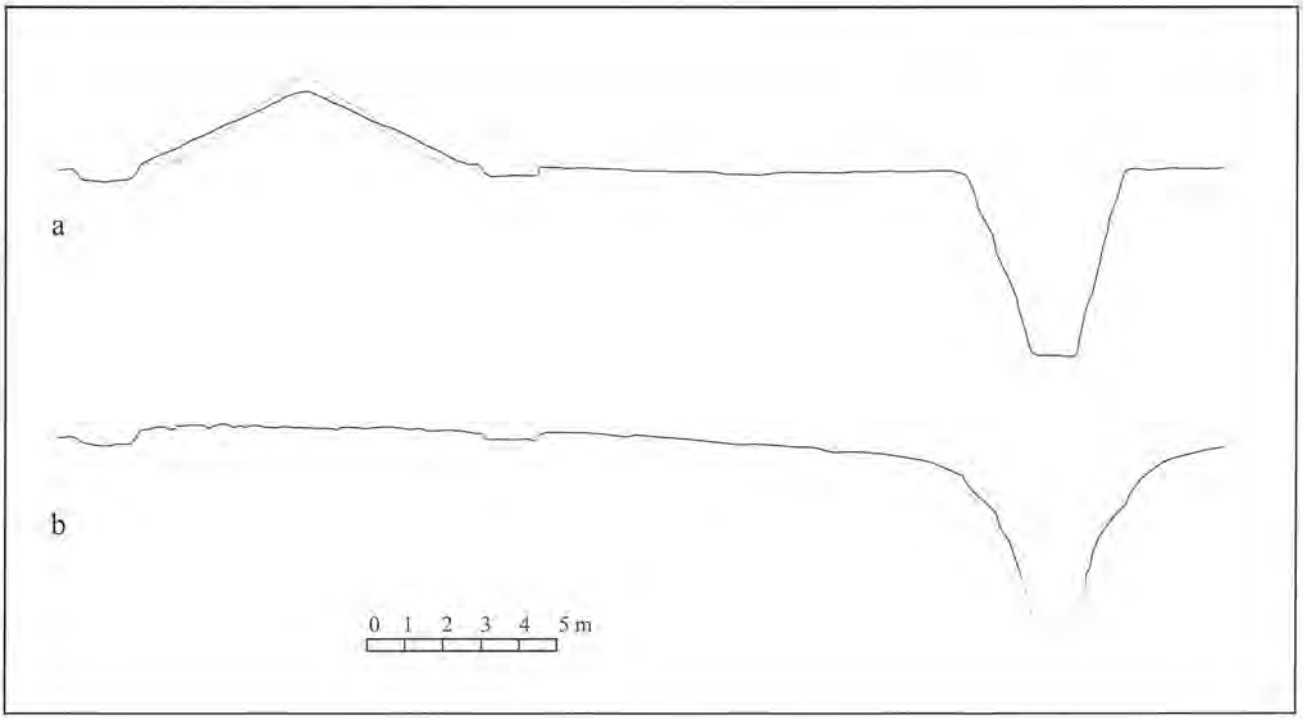


Figure 16a Projected profile of the henge bank, re-definition gullies, berm and ditch (N.B. the dashed line projects the alternative possible original form of the bank with a slightly smaller footprint with increased elevation prior to the later addition of the re-definition gullies); b Profile of excavated relict monument 1994.

deposition of the colluvial layer 27 the monument appears to have undergone a period of repair or re-use evidenced by what appears to have been an attempt to halt the natural in-filling of the ditch. Two slots were cut into the ditch deposit (Contexts 27) into which a fence or timbers were inserted. The slots were cut parallel to the ditch sides (Figs 14, 15, 17a and 17b) and shadows or ghosts of the base of timbers could be seen within the slots. The effectiveness of this attempt at revetment is impossible to assess but it is clear that whilst the revetment on both sides of the ditch was instigated at the same time, the slot on the outer face prevailed for a longer period. This may suggest that the revetment was allowed to decay naturally, a view which is supported by the lack of firm evidence to suggest that the revetment constructions were replaced, or repaired. Both slots were slightly angled so that the top of the post/fence would have pointed inwards. At the time of the revetment the depth of the ditch would have been little more than 1.5m. During the use of this revetment the henge ditch appears to undergo a period of re-use defined by the formulation of a stabilisation horizon (Context 20). These layers also witness a change in the molluscan profile (Allen 2007, 183–5) and Context 20 also contains a relatively high quantity of worked flint.

Whatever the rationale behind the revetment of the ditch sides, the limited evidence for a build-up of deposits behind the posts suggests that they were neither very high nor particularly long lived, especially for the inner (northern) revetment. Following the demise of the revetment the silting of the ditch continued with the formation of layers 17 and 15. These contexts consist of similar silty clay loams whose deposition within the ditch is entirely consistent with the abandonment of the enclosure. Slight variations or acceleration in the accumulation of the deposits are probably due to localised breaking up of soils for agricultural purposes over a long period.

The berm

The presence of a berm (Figs 15 and 16) between the bank and ditch at the southern henge is still faintly observable on the ground, most notably in the north-

Figure 17a Photograph of henge ditch – northern revetment slot (Context 40) fully excavated

Figure 17b Photographs of henge ditch – southern revetment slot (Context 29) partially excavated with fill (Context 28) intact.

Figure 17c Photograph (looking north) showing both revetment slots and the surface they were cut through within the contemporary ditch profile.

eastern quadrant. It has also been identified through the evaluation of aerial photographs (Harding and Lee 1987, 129).

For the accurate measurement of the width of the berm it is of course essential to know the original location of the edges of both the bank and ditch. With both elements affected by erosion, this measurement can only be estimated. At the point of excavation this measurement was calculated from an estimation of the original ditch edge (with the projected weathering cone removed – see Fig. 16) and the inner edge of the bank (defined as the southern edge of the Inner Gully). The berm at this point was 13m

wide but the evidence of aerial photography suggests that the width varied around the circumference of the monument.

Upon excavation the berm showed evidence of repeated plough damage. Plough-marks were observed in the upper weathered chalk bedrock from the northern lip of the Inner Gully where the overburden solely consisted of modern plough soil (Context1). Approximately 3m to the north of this the overburden also consisted of layer 3 which immediately overlay weathered bedrock. Once again this bedrock was scarred by plough marks but with much less intensity than those to the south. This might suggest that the layer 3 was associated with earlier plough activity. The last 4–5m of the berm nearest the henge ditch have been subject to the weathering of the ditch edges and consequently the plough soil-bedrock interface at this point is impossible to assess with any accuracy.

The bank

The visibility of the bank (Figs 16, 18 and 19) at the site of the excavation was minimal but could be defined as a slight mound, approximately 0.15m high before excavation.

After removal of the modern plough soil from the bank, a layer of heavily compacted chalk was identified (Contexts 7 and 8), which had been substantially damaged by plough activity. Plough marks scarred the surface of this layer penetrating down to the soil layer below (Fig. 15 and 18). The layer of compacted chalk was delimited to the north-west and south-east by parallel shallow flat bottomed gullies (Inner Gully 18 and Outer Gully 31). This layer (average depth of 0.07m) was all that remained of what must have once been a substantial bank constructed of chalk, the excavated up-cast from the henge ditch. The size and shape of the original bank is difficult to determine due to the small fraction that survives. However, its original form was also altered by the insertion of stratigraphically later flanking Inner and Outer Gullies. It is clear from the excavation that there are no traces of *in situ* bank surviving beyond these gullies in either direction. Molluscan evidence suggests that the gullies could be associated with the revetment of the henge ditch (Allen 2007, 185) probably indicating that they were inserted after the original construction of the bank.

A 10m × 1m axial extension of the excavation trench was opened to confirm the presence/absence of bank material to the south of the outer gully (Fig. 13). No evidence of bank material or an earlier buried soil was found. Consequently the banks width at the point of excavation was approximately 8m.

The (OLS) old land surface

With the exposure of the fragmentary remains of the henge bank at the Southern Circle it was immediately apparent that where the ploughshare had pierced the bank, it had cut into a humic deposit of clay loam (Context 6). This deposit was subsequently identified as a buried soil (Figs 15, 18 and 19), which was substantially preserved under the remaining henge bank to a depth averaging 0.16m. Before the remaining bank material was removed a section line was introduced to excavate the eastern half of the deposits. The removal of the bank material (Contexts 7 and 8) followed by the OLS (Context 6) in this eastern section, revealed a further deposit of a Brown Soil (silt loam – Context 26) which appeared to represent a lower horizon of humic material beneath the ancient turf (Fig. 19).

The Inner and Outer Gullies

The gullies were located along the flanks of the henge bank (Figs 16, 20, 21a and 21b) and were remarkably uniform in size. Both gullies consisted of generally vertically sided, flat bottomed cuts into the natural chalk bedrock. The inner gully (width 1.5m–1.6m, depth 26–30cms) lying on the inner flank of the henge bank, appears to have been at least partially truncated by later plough disturbance and therefore the original depth may have been greater. The outer gully (width 1.3m–1.4m, depth 30–37cms) appears to have survived the ravages of plough events.

However, environmental evidence clearly demonstrates that the molluscs represented in the fills of both gullies are not comparable to those encountered in the primary fills of the ditch or of those identified in the old land surface. On ecological, statistical, species diversity and taxonomic grounds comparable

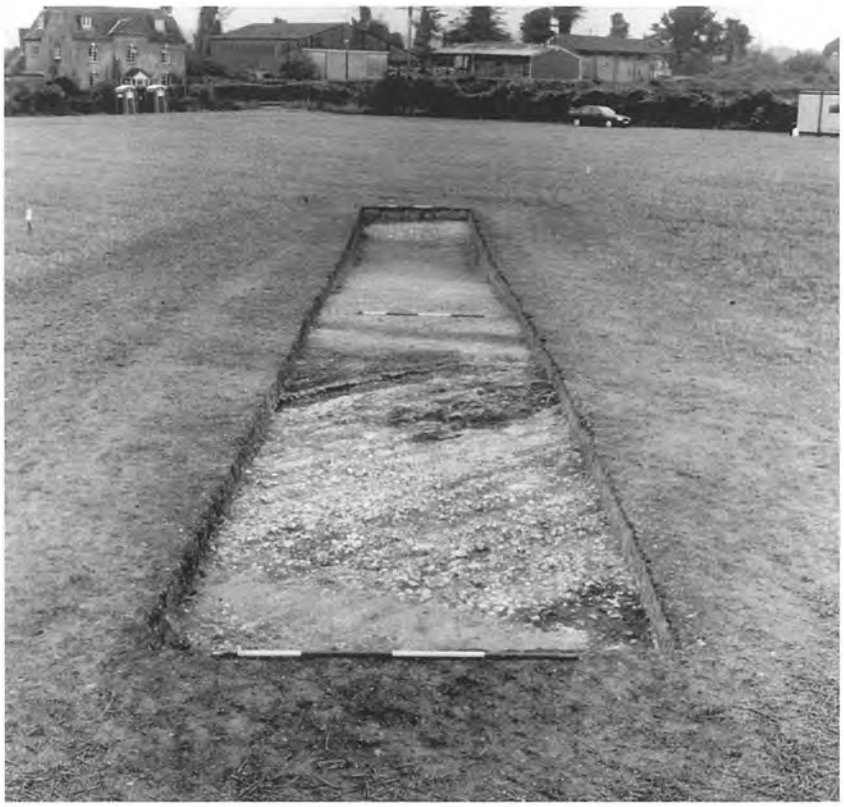


Figure 18 Photograph (looking north) of relict bank – showing as chalk rubble within the trench closest to the camera. The darker patches are the underlying old land surface (OLS).

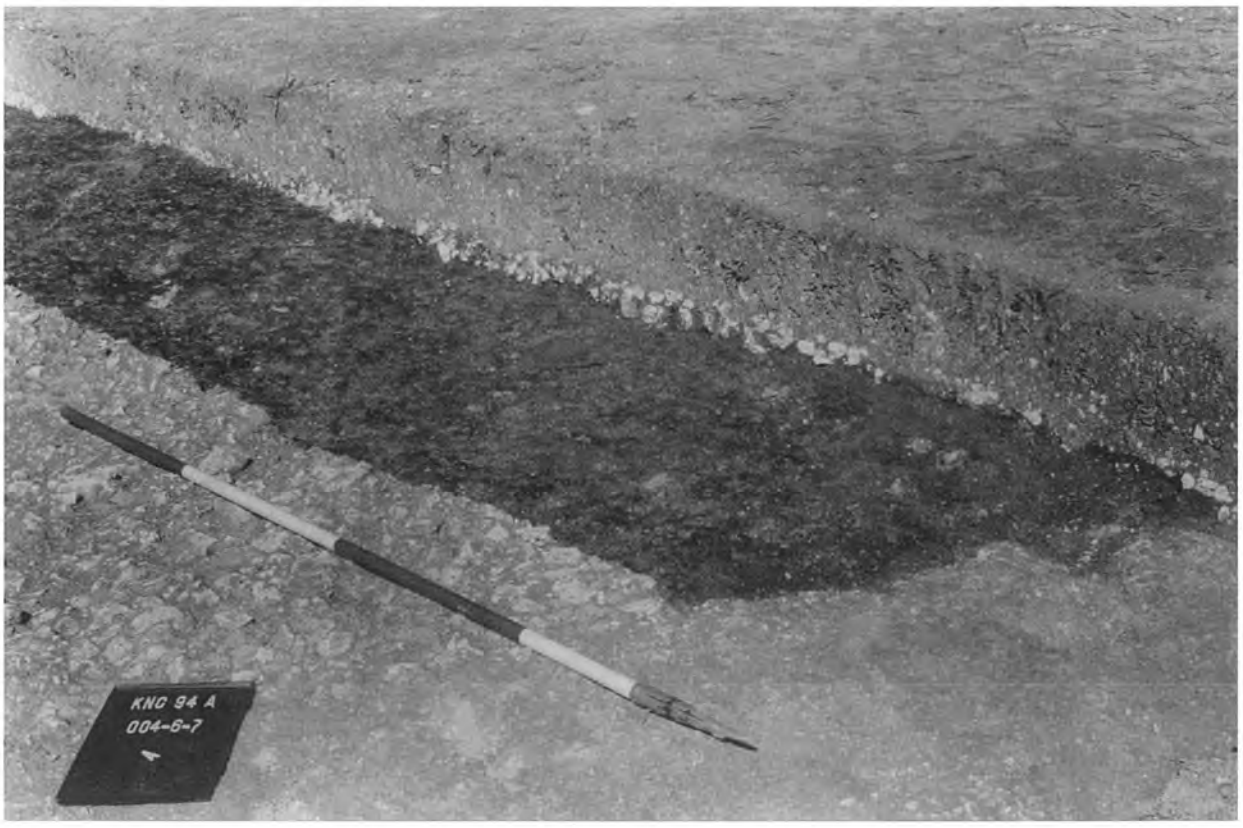


Figure 19 Photograph (looking north-east) showing exposed OLS with the barely surviving residual bank showing in the baulk section and also under the ranging rod. N.B. the tip of the ranging rod is lying on the upper fill of the southern re-defintion gulley.

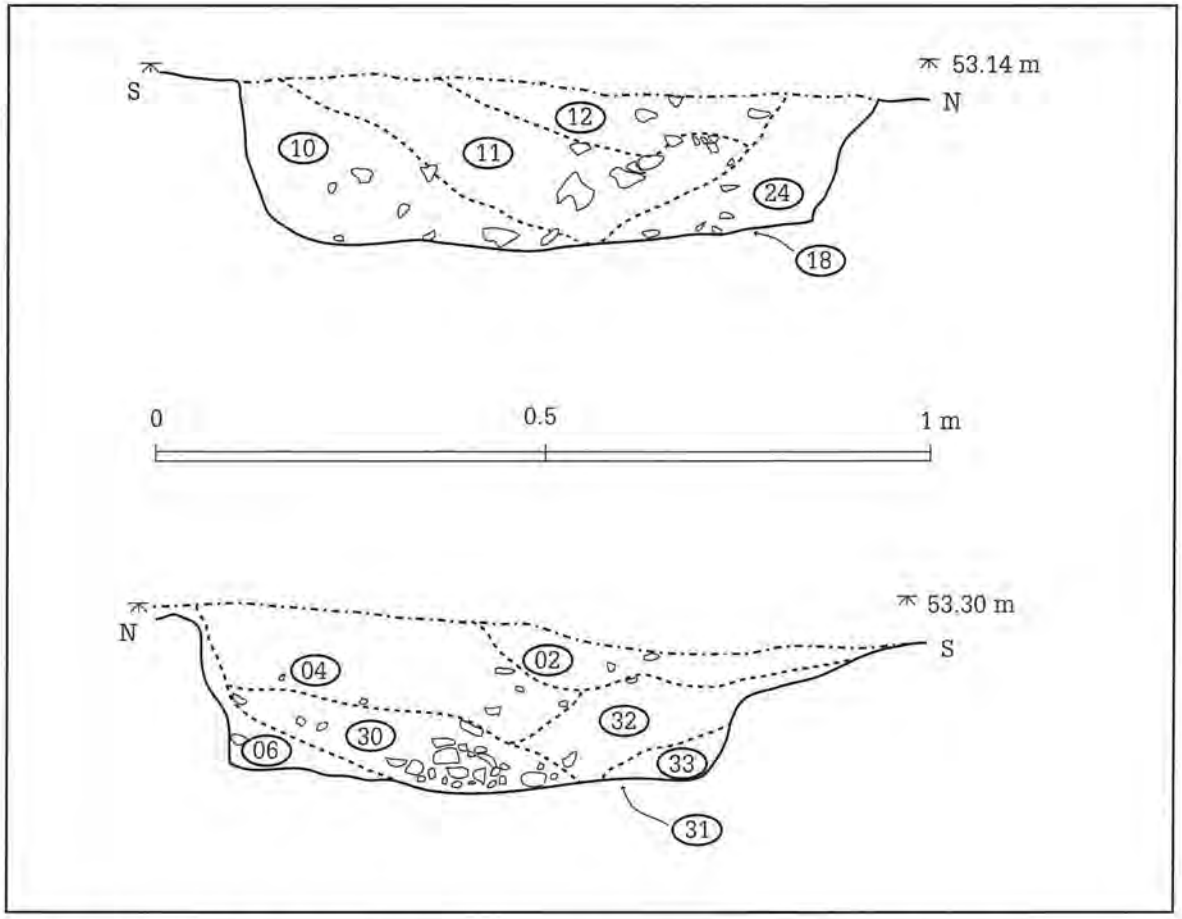


Figure 20 Section of Re-definition Gullies. Upper: northern gulley (east facing), lower: southern gulley (west facing)

molluscan evidence is encountered towards the top of the secondary fills, or with the stabilisation horizon – context 20 (Allen 2007, 185). Therefore, the environmental evidence would indicate that the construction of the gullies took place during a later episode of activity and therefore these features were not part of the original design, layout and construction.

The small but notable step (3–5cms) in the Inner Gully (Figs 16 and 21a) is not repeated in its companion and its purpose is unclear, although it could indicate the joining of two lengths of trench dug at slightly different times and/or by different gangs/individuals. No datable or diagnostic artefacts were recovered from either gully.

The Finds

Lithic material (Flint)

A total of 304 worked flints (Table 1) were recovered during the excavation from 16 recorded contexts. The great majority was recovered from the fills of the henge ditch (38) or the fills of the two gullies flanking the henge bank (18 and 31). Accordingly most of this material is likely to be residual, having been washed in.

No deliberately fashioned tools or artefacts displaying use wear or secondary working were identified, and consequently it seems likely that this was debitage from manufacturing located near or within the monument. This interpretation is strengthened by the identification of five cores, two core rejuvination flakes and a single core trimming flake.

Although generalisations on the chronological affinities of waste material are possible (Pitts 1978) the small size of this assemblage makes such interpretations problematical. The material is uniformly 'chunky' in character, with no recorded blades and flakes that exhibit large and unprepared

Figure 21a Photograph of northern re-definition gulley after excavation. The step in the base of the gulley is just identifiable close to the near side baulk.

Figure 21b Photograph of southern re-definition gulley after excavation. This photograph was taken before the southern end of the trench was extended.

Table 1 Struck flint

Context N°	Phase	Complete Flakes	Cortical Flakes	Broken Flakes/Shatter	Cores	Core trimming/rejuvination
6	1	11	6	50	-	-
26	1	2	1	14	-	-
7	2a	13	1	17	-	-
8	2a	1	1	-	-	-
27	3	13	8	1	-	-
39	3	2	2	-	-	-
42	3	8	8	2	-	-
20	4b	59	39	27	5	3
25	4b	2	2	2	-	-
2	5	9	4	6	-	-
4	4b?	5	6	3	-	-
10	4b	3	-	2	-	-
11	4b	8	4	12	-	-
12	4b	8	1	11	-	-
13	6	1	1	-	-	-
14	6	2	2	1	-	-
Totals	-	157	85	147	5	3

striking platforms. 48.3% of the worked flints are either broken flakes or shatter from the reduction process. Of the remaining complete flakes (157), 36.9% exhibit hinged or plunging terminals, which would be entirely consistent with a later Neolithic – early Bronze Age date. The absence of any worked flint from the oldest ditch deposits may indicate that the earliest phase of the monument and its initial use took place on a relatively clean site. The presence of material in later deposits may therefore reflect a change in activities and use of the monument.

Comment

The largest body of material recovered from the assemblage came from the stabilisation horizon of the henge ditch (Context 20 and 25). This

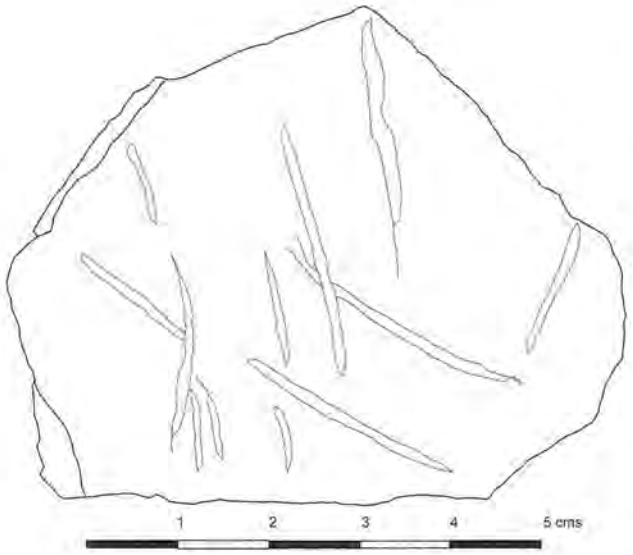


Figure 22 The incised chalk plaque/block

material is clearly associated with the reduction and manufacture of flint during a period of stabilisation in the monument's decline. There is no clear evidence to suggest that the material represents *in situ* knapping but it may be waste dumping from a working area nearby.

Other lithics

An incised chalk block (Fig. 22) was recovered from the base of the southern revetment slot fill (Context 28) within the henge ditch. The incisions on a single face of the block form a cross-hatched pattern, and may have originally been from a larger block. Chalk objects and chalk with incised pictograms are a relatively rare but identifiable find on Neolithic and Early Bronze Age sites in southern England (Vatcher 1969; Drewett 1986; Harding 1988; Teather 2016). That the incised marks are made on an otherwise unworked chalk block may suggest that it is part of a larger work possibly akin to the *in situ* pictograms discovered on vertical ditch surfaces at Flagstones in Dorchester (Woodward 1988, 270).

Ceramics

The ceramic material was extremely poor both in terms of quality and quantity. Whilst a range of pottery from later periods was found, this summary only considers the material likely to be related to prehistoric activity, all of which was very fragmentary and abraded. None of the sherds were larger than 6cm^2 and most measured only 2–3cm^2. As a consequence, none of the sherds was of a diagnostic form. The majority contained flint inclusions and are possibly Neolithic in date but this remains unconfirmed.

None of the prehistoric pottery recovered was conclusively *in situ*, and all displayed characteristics consistent with them having been exposed for a considerable time, or washed into the upper fills of the ditch.

Environmental considerations

As part of the excavation strategy the monument was sampled to examine the palaeo-environment through the detailed analysis of soil micromorphology and molluscan data. This work was reported in full in 2007 (French *et al*) but the following short summary is provided to give an outline of landscape development and the environmental context of the complex. The report on the small animal bone assemblage from the excavation is published here for the first time.

The analysis of the soil micromorphology (Lewis 2007, 134–138) concentrated upon the buried soil underneath the chalk bank of the henge and a turf slump in the primary fill of the main henge ditch. The buried soil was comprised of a fairly shallow grassland rendzina that exhibited little evidence of a surface horizon which suggests that the surface was de-turfed prior to the excavation of the ditch and the throwing up of the bank. Additionally, within the lower part of the buried topsoil traces of charcoal and bone suggest the proximity of a cultural deposit or possibly pre-henge cultivation. Similarly, the slumped deposit was confirmed as such with little evidence for extensive *in situ* stabilization being probably buried relatively quickly by weathering of the chalk.

The molluscan evidence from the buried soil indicated the predominance of open, well established grassland with no shade loving species present further suggesting the absence of woodland in the proximity of the soon to be built monument (Allen 2007, 176–186). The presence of mollusca from species more attuned to longer vegetation and

Table 2 Southern Circle: Site Phasing * denotes alternative phasing of Gullies (re-definition gullies).

Site Phase	Activity	Site Features	Context no.'s	Period
1	Pre-Henge activity	Old Land Surface	34, 26, 6	Late Neolithic
2	Henge construction	Gullies cut (possible)*	18, 31	Late Neolithic
		Main Henge ditch cut	38	
		Henge Bank constructed	7, 8	
3	Henge (Intemediary stage)	Main Henge ditch fills	47, 46, 45,42.2, 44, 43, 42.1, 39, 37, 27	Late Neolithic
		Gully fills (possible)*	24, 10, 11, 12–33, 6.1, 30, 32, 42, 2	
4	Henge (Re-definition)	Ditch Revetment slots cut	29, 40	Late.Neo/EBA
		Re-definition Gullies cut (probable)*	18, 31	
5	Henge decline & abandonment	Ditch revetment slot fills	41, 28	Late.Neo/EBA
		Main Henge ditch fills	25, 20, 23, 22	
		Re-definition Gullies fills (probable)*	24, 10, 11, 12–33, 6.1, 30, 32, 42, 2	
6	Post- Henge	Main Henge ditch fills	17, 16, 15, 14, 13, 3	post EBA>
7	Modern era	Plough soil	1	Modern
		Disturbed Henge bank	5	

woodland within the secondary fills of the ditch probably occur due to the slowing down of the sedimentation process and the stabilisation of the monument. However, the species present are more indicative of those associated with leaf litter and small shrubs which are possibly related to a phase of monument abandonment or at the very least a lack of maintenance.

Co-incident with the insertion of the revetment to the ditch, the species of mollusca present in the associated upper secondary fills are once again dominated by open grassland species that seem to indicate a possible re-use of the monument.

Animal bones, by Mark Maltby

A small assemblage of generally eroded and fragmented bones was recovered and is described by association with context and site phasing (Table 2).

Context 46 – primary fill of henge ditch

A cattle right scapula (Fig. 23) was found in quite good condition with little erosion damage. About 75% of the bone survived but the articular surface was absent, precluding any ageing or metrical evidence. It probably belonged to an adult animal. Having been found within a primary fill of the henge ditch, it may have been utilised in the initial construction of the monument. However, unfortunately the condition of the scapula was too fragmented to offer conclusive proof of this but this interpretation would be entirely consistent with similar occurrences and interpretations of scapula from Neolithic excavations elsewhere (Atkinson 1979, 102–4). The scapula was later dated to the second half of the 3rd millennium BC, Beta 141096, 3890±60 BP (2570–2190 cal BC 95% probability).

Context 27 – secondary fill henge ditch

Two cattle tibia were recovered. One (left) possessed a proximal epiphysis that had just fused, indicating it belonged to an adult but not elderly animal. About half of the bone survived. Most of the shaft of the second tibia (right) survived. The distal portion of the shaft of a cattle humerus was also identified. The distal half of a pig humerus was also recovered. The distal epiphysus had fused indicating that it belonged to an animal probably over one year old. All four bones were eroded.

Figure 23 Cattle scapula shown In situ within henge ditch fill

Context 20 – henge ditch stabilisation layer

The proximal end of a cattle left metacarpal was recovered. This had a maximum proximal breadth of 57.7mm. It was heavily eroded. Two sheep/goat tooth fragments were also found. One of these was a lower third molar, belonging to an animal over two years old.

Context 25 – henge ditch stabilisation layer

Shaft fragments of cattle left metatarsal and a sheep/goat left tibia were found. Both bones were eroded.

Context 42 – gully fill

part of the body of a heavily eroded thoracic vertebra was found. It belonged to a large mammal, the size of a cow, but not specifically identifiable.

Context 17 – tertiary fill henge ditch

An eroded unidentified large mammal fragment was recovered.

Context 3 – plough-wash in henge ditch

Two eroded unidentified large mammal fragments were found

Little can be determined from such a small and poorly preserved sample. Cattle bones were the most commonly identified, although preservation conditions favoured their survival. Only one bone was measurable but this and the other bones were of a size typical of domestic cattle rather than the wild aurochs. Pig (probably domestic) was also present in the secondary fills but sheep/goat bones and teeth were not encountered below the tertiary fills. Erosion damage hindered the identification of butchery marks or gnawing.

Discussion

The programme of work undertaken not only confirms the potential archaeological wealth of the southern henge monument, but also serves as a reminder as to the fragility of the survival of such information. The following sub-sections review the

research objectives in the light of the results of the excavation.

ARCHAEOLOGICAL PRESERVATION AND THE CONDITION OF THE MONUMENT

With the exception of the western third of the monument the remainder is subject to annual ploughing. As a consequence of this and earlier agricultural activity the bank and ditch are today only visible in favourable circumstances. The excavation revealed that the last 0.03 – 0.05m of the base of the bank had survived, still protecting a pre-henge old land surface (OLS) but in places this had been pierced and damaged by ploughing. It is likely that this OLS survives to a greater extent throughout the eastern circumference of the monument, where the protecting henge bank appears to be better preserved. However, the continued survival of this valuable cultural and environmental context is threatened by the current agricultural regime. Indeed, it is entirely possible that since the excavation took place most of the OLS from the south-eastern quarter of this monument will have been destroyed. The henge bank that overlies the OLS will disappear at a quicker rate, and any chance of understanding the techniques employed in its construction will be severely compromised. The ditch remains largely unaffected by ploughing and provides a significant archaeological resource both for environmental data and potentially for cultural material.

The internal platform for the most part, is on a slight gradient with the ground falling from east to west. There is no doubt that the interior will have suffered substantially from plough activity. Any sub-surface features such as pits and post-holes may have survived but contemporary surfaces will have been most certainly destroyed. It is possible that the eroding bank may have provided a protective layer over deposits close to the bank, but most of this eroded material will have gone into the internal ditch.

CULTURAL AFFINITIES AND ASSOCIATIONS

Probably the most disappointing aspect of the excavation was the paucity of cultural material recovered. The pottery and flints were largely un-diagnostic, and give few clues as to the type of activity that took place at the site, but is entirely consistent with the site having been kept clean.

The incised chalk plaque recovered from the secondary ditch fills (Fig. 22) is paralleled by the chalk objects found in the excavations at Maumbury Rings and Mount Pleasant (Wainwright, 1979). Often found in association with Grooved ware (although not at Knowlton) these chalk objects remain enigmatic and offer little tangible evidence of their purpose or utility.

The lack of cultural material has also seriously impeded the understanding of the monument's chronological development. Whilst an excellent relative sequence of events can be charted (Table 2) for the life of the monument, firm anchors for the sequence are limited to the single radiocarbon date from the primary fills of the henge ditch, Beta-141096, 3890±60BP (2560–2190 cal BC 2 sigma). The use of a cow scapula as a constructional tool in the digging of the ditch is of course commonly found in sites in southern England, a practice that is associated with late Neolithic and the earliest Bronze Age sites.

Current interpretation of the monument relies on the evidence provided by the structural detail revealed by our fieldwork and previous surveys. As previously indicated, it is tempting to append the monument to the list of henge enclosures in central southern England. Certainly the ditch, bank and general size of the monument share similar themes. Perhaps the most striking structural feature of the southern henge is the depth of the ditch compared with its width. The original depth of the ditch is likely to have been approximately 4.75m with a width at its lip of 3.75. Thus, the ratio of depth to width is 1.27:1. This ratio is extreme when compared with other Wessex henge enclosures, and is only surpassed by that found at Avebury, and the oft cited shaft henges such as Maumbury Rings and Wyke Down in Dorset. The depth of the ditches at Avebury are the deepest of all averaging some 9 metres where sampled. A projection of the section excavated by Gray (1935) with its weathering cone removed reveals a depth width ratio of 1:1. Why were the ditches at Avebury and the Southern Circle at Knowlton excavated so

deeply into the sub strata with all the attendant dangers of collapse, when it would be so much easier and safer to extract chalk from a wide ditch? In 2004, Paul Ashbee suggested of Avebury that the ditches were deliberately dug this way in order that they would weather quickly – i.e. to look old fast. In any case it suggests that the depth and form of the ditch were considered to be of primary importance in the design of the henge and consequently it may indicate that the ditches are not to be regarded simply as a quarry to provide material for the attendant bank. The depth of the ditch at the Southern Circle contrasts greatly with the outer ditch for the Great Barrow, the only other monument in the complex to have been excavated (Field 1962). Here observations suggested a relatively shallow ditch proportional to depth. In recent years much has been made of the possible celestial associations of circular enclosures of the later Neolithic and early Bronze Age (MacKie 1977, 93–110; Wood 1978; North 1996; Ruggles 1996, 15–27). Perhaps it is time to consider instead the possible chthonic associations that may be implied by the depth of the ditches, for the Southern Circle at least.

The volume of chalk excavated from the ditch does however have important connotations in relation to reconstruction of the bank. With only the base of the bank remaining, the only way to estimate its original height is by assuming that all of the ditch material was piled onto the bank adjacent to where it was originally excavated. The volume of chalk excavated from the ditch based on the dimensions given above and drawn from the excavated ditch sample would amount to approximately 8.9m^3 per linear metre (assuming a 'V'- shaped profile). If the total volume of the extracted material was utilised, a bank with a base of 8 metres would only be 1.8m high. This figure is an estimation based on the circumferences of both the bank and the ditch (735m and 613m respectively). It also assumes that both features are regular circles (which of course they are not). Interestingly, where the bank is best preserved (north-east quadrant) a footprint of 10m and an approximate height of 1.4m produces a cubic capacity only 2.8% greater than the suggested original height based on the excavated sample. The angle of the resulting suggested profile would be approximately 24 degrees which sits comfortably within the acceptable angle of rest of piled chalk (Wainwright and Longworth 1971).

CONCLUSIONS

The level of detail and new data on the component parts of this complex have clearly provided information through which the origins and development of the complex as a whole can be more firmly contextualised.

The choice of location for the builders of the complex is interesting in that there is little evidence to indicate any substantive activity or settlement in the immediate environs prior to the enclosures themselves. Intensive activity for the earlier Neolithic is, of course, not very far away with a plethora of sites and monuments occupying land to the north and west (Barrett *et al* 1991; Green 2000) but at Knowlton the landscape appears to have been relatively under exploited although the environmental evidence for clearance is established. It is possible to view this apparent lack of activity as not accidental and that the location was venerated as a special place that set it aside from settlement and for a time at least even free from funerary and associated ritual practices.

As with so many other henge concentrations the close presence of a river (in this case the River Allen) is surely not accidental (Richards 1996). Similarly, the occurrence of dolines in close proximity may likewise have marked out the location as a place of great significance within contemporary belief systems (Gale 2012, 164). The coincidence of the location of the river with the dolines can of course be taken collectively or as separate phenomena that may reflect shifts in cosmological or religious beliefs over the lifetime of the use of the monuments but as yet we have no evidence to develop this idea further. Ultimately, that such a special place would draw in a more tangible form of veneration via monuments that perhaps reflect a change in the social and religious traditions during the 3rd millennium BC is consistent with models suggested elsewhere (Harding 2003, 23–33).

The principal components of the group – the enclosures – each display aspects of variability that

sets them apart whilst clearly exhibiting spatial and temporal cohesiveness. It seems likely that the individual distinctiveness of the enclosures hint to a progressive sequence of construction at a locale that probably held great significance to the society (s) that built them. This is in marked contrast to clusters of contemporary monuments exemplified by the complex at Thornburgh for example, where the enclosures are much more uniform in size and form (Harding 2003, 90–9). The enclosures at Knowlton seems to exhibit an 'organic' development of constructional forms that seem to embody a number of traditions that may hint at both a longer period of development and possibly variance in purpose linked to the likely rituals practised within them.

The form of the Northern Circle is of specific interest in terms of its likely primacy as the founding monument in the eventual sequence of enclosures that were to emerge. Its sub-rectangular or 'D' shaped form is highly reminiscent of long barrow forms and so-called mortuary enclosures, and may suggest a style of monument construction that is rooted in an earlier tradition. Similar developmental and transitional forms for henge type enclosures have been established in recent years with the identification of so-called 'formative henges' (Harding 2003; Burrow 2010, 182–196) usually associated with enclosures having segmented ditches typified by Flagstones in Dorchester, or those with a marked circular form but with internal banks such as found at Llandegai A in Gwynedd (Lynch and Musson 2001, 36–55) and the first phase of Stonehenge. That the 'Old Churchyard' has an internal bank may also imply a position early in the sequence of enclosures at the complex, although at this stage this has to be considered as speculative. In all these cases there is a strong association with funerary practice (Harding 2003, 17) and therefore the occurrence of a local variance in forms as displayed by the Northern Circle and possibly the 'Old Churchyard', may equally be associated with a funerary tradition. On this basis this first phase of monument building at the complex is likely to have taken place during the first half of the 3rd millennium B.C.

The chronological sequence for the development of the remaining enclosures in the complex is less clear. The theme of funerary practices would appear to find continuity at Knowlton with the Great Barrow exhibiting possible henge characteristics that would seem to herald the beginnings of an extensive and dense barrow cemetery, in the immediate environs and further afield along the Allen Valley well into the Bronze Age and possibly beyond (Gale 2012). At this time its place in the sequence of enclosures remains unresolved although in all likelihood it would have appeared after the Northern Circle.

The addition of both the Central and Southern Circles in the form of 'classic' henge structures around the middle of the 3rd millennium B.C. would appear to herald the confirmation of the complex's importance as a ritual centre at this time. The adoption of the more common henge form may indicate the adoption of a package of new practices possibly religious and a movement away from a cosmology with a more ancestral focus. That the two enclosures exhibit such variance in scale may indicate either a chronological or utilitarian imperative to their foundation but without further fieldwork this remains once again speculative. The case for the Southern Circle to be included in the still rather vague classification as a 'henge enclosure' is still limited and material associated with settlement is still absent, most notably from the ditch.

Perhaps the most surprising detail to emerge from this programme of fieldwork is the reworking of the Southern Circle. The revetment of the ditch coupled with an apparent re-defining of the external bank by the cutting of shallow flanking gullies seems to mark a re-use for this particular monument. If such a re-working were to have taken place over the whole of the monument this would indicate a major investment in its continued use, but its function at this junction remains unknown.

The complex as a whole seems to be 'book-ended' by funerary symbolism and features that mark it out as a major centre in which the embodiment of a landscape for the dead is manifest. That the focus for this complex was aligned and located with respect to the eastern bank of the River Allen is surely no accident, especially when this co-locates with the presence of dolines, similarly restricted to the east bank of the river (Gale in preparation). The likely longevity for the use of the complex displayed in the

extensive barrow cemeteries that are focussed on it only further enhance the potency of this very special landscape; a landscape that is only now beginning to slowly reveal its buried past.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the early guidance of Timothy Darvill in support of this work and also our colleague Alan Hunt who allowed us to incorporate some of the survey work into the teaching schedule of undergraduates at Bournemouth University during 1996–7. During the later stages of this report the text benefitted greatly from the input and advice of Mark Gillings, Mike Parker-Pearson, Mark Maltby and Mike Allen all of whom managed to introduce a degree of brevity and helpful comments that were much appreciated and needed. Assistance in the initial transcription of the original line drawings from pen and ink to digitised versions was greatly assisted by Mark Dover who produced Figures 1 and 2.

Throughout the surveys and the 1994 excavation, Paul Gosling of English Heritage was instrumental in negotiations that led to formal permission to work on the Scheduled areas. Without his support, and that of the Knowlton landowners, no survey would have been possible. For permission to excavate at the Southern Circle additional gratitude is formally acknowledged posthumously both to the late 10th Earl of Shaftsbury the Right Honourable Anthony Ashley-Cooper and the previous tenant farmer the late Spencer Jones. The geophysical and topographical surveys at the Northern enclosures were facilitated by the assistance of Phillip Ryman of the Shaftsbury Estate.

Although the deep excavations encountered during the excavation of the henge ditch exceeded that suspected during the planning of the excavation the authors wish to acknowledge the support and help both in staff and materials offered by Bournemouth Water Company. The excavation team was drawn from undergraduate students at Bournemouth University with additional support from the membership of East Dorset Antiquarian Society, all of whom performed excellently. Their contribution is greatly acknowledged.

Many individuals within the Knowlton area offered time and advice during the course of the field work, but special mention should be made of John and Della Day of the East Dorset Antiquarian Society who generously offered access to their own aerial photographs, and knowledge of the area. Martyn Whittock also kindly made available his unpublished work on Knowlton church and the medieval settlements of Brockington and Knowlton. Thanks are also offered to Martin Green, who freely gave of his encyclopaedic knowledge of north-east Dorset's archaeology.

All errors and omissions are unintended and are the sole responsibility of the authors.

REFERENCES

Allen, M.J. 2007. 'Land use and landscape development: the molluscan evidence – the South Circle at Knowlton', in C. French, H. Lewis, M.J. Allen, M. Green, R. Scaife and J. Gardiner (eds) *Prehistoric landscape development and human impact in the upper Allen valley, Cranborne Chase, Dorset*. McDonald Institute for Archaeological Research, Cambridge, 176–186.

Ashbee, P. 1989. *Wilsford Shaft: excavation 1960–2*. Historic Buildings and Monuments Commision, London.

Ashbee, P. 2004. 'Early ditches: their forms and infills', in R. Cleal and J. Pollard (eds) *Monuments and Material Culture*. Hobnob Press, Salisbury, 1–14.

Atkinson, R. 1951. 'The henge monuments of Great Britain', in R. Atkinson, C.M. Piggott and N.K. Sandars, *Excavations at Dorchester, Oxon*. Ashmolean Museum, Oxford, 81–107.

Barber, M., Winton, H., Stoertz, C., Carpenter, E. and Martin, L. 2010. 'The Brood of Silbury? A Remote Look at Some Other Sizeable Wessex Mounds', in J. Leary, T. Darvill and D. Field (eds) *Round Mounds and Monumentality in the British Neolithic and Beyond*. Neolithic Studies Group Seminar Papers **10**, 153–173.

Barrett, J.C., Bradley, R. and Green, M. 1991. *Landscape, Monuments and Society: The prehistory of Cranborne Chase*. Cambridge University Press, Cambridge.

Burl, A. 1969. 'Henges: internal features and regional groups', *Archaeological Journal* **126**, 1–28.

Bradley, R. 2007. 'The decorated heathstone from Knowlton', in C. French, H. Lewis, M.J. Allen, M. Green, R. Scaife and J. Gardiner (eds) *Prehistoric landscape development and human impact in the upper Allen valley, Cranborne Chase, Dorset*. McDonald Institute for Archaeological Research, Cambridge, 395–6.

Burrow, S. 2010. 'The Formative Henge: Speculations Drawn from the Circular Traditions of Wales and

Adjacent Counties', in J. Leary, T. Darvill and D. Field (eds) *Round Mounds and Monumentality in the British Neolithic and Beyond*. Neolithic Studies Group Seminar Papers **10**, 182–96.

Burrow, S. and Gale, J. 1994. *Knowlton: Southern Circle. A Project Design for an Archaeological Investigation*. Unpublished report, Department of Conservation Sciences, Bournemouth University.

Clare, T. 1986. 'Towards a reappraisal of henge monuments', *Proceedings of the Prehistoric Society* **52**, 281–316.

Cleal, R.M.J., Walker, K.E. and Montague, R. 1995. *Stonehenge in its Landscape: Twentieth Century Excavations*. English Heritage Archaeological Report **10**.

Darvill, T. 1997. *Ever Increasing Circles: The Sacred Geographies of Stonehenge and its Landscape*, Proceedings of the British Academy, **92**, 167–202.

Drew, C. and Piggott, S. 1936. 'The excavation of long barrow 163a on Thickthorn Down, Dorset', *Proceedings of the Prehistoric Society* **2**, 77–96.

Drewett, P. 1986. 'The excavation of a Neolithic oval barrow at North Marden, West Sussex, 1982', *Proceedings of the Prehistoric Society* **52**, 31–51.

Field, N. 1962. 'Discoveries at the Knowlton Circles, Woodlands, Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **84**, 118–124.

French, C., Lewis, H., Allen, M.J., Green, M., Scaife, R. and Gardiner, J. (eds) 2007. *Prehistoric landscape development and human impact in the upper Allen valley Cranborne Chase, Dorset*. McDonald Institute for Archaeological Research, Cambridge.

Gale. J. 2012. 'Late Neolithic Henge Monuments as Foci for Evolving Funerary Landscapes: Knowlton Henge Complex and the Barrow Cemeteries of the Allen Valley, Dorset, UK – A Case Study', in W. Bebermeier, R. Hebenstreit, E. Kaiser and J. Krause (eds) 'Landscape Archaeology. Proceedings of the International Conference held in Berlin 6th–8th June 2102', *eTopoi Journal for Ancient Studies Special Volume* **3**, 161–7.

Gale, J. 2017. 'Knowlton Circles: A Later Neolithic and Early Bronze Age Ceremonial Complex and Its Environs—A Review', *Landscapes* **18**, 102–119.

Gale, J., Hewitt, I. and Russell, M. 2008. 'Excavations at High Lea Farm, Hinton Martell, Dorset: An Interim Report on Fieldwork Undertaken During 2006–7', *Proceedings of the Dorset Natural History and Archaeological Society* **129**, 104–114.

Gibson, A. 2018.' Llandegai A – Sancuary or Settlement?', *Archaeologia Cambrensis* **167**, 109–112.

Gray, H. St. G. 1935. 'The Avebury Excavations 1908–22', *Archaeologia* **84**, 99–162.

Green, M. 2000. *A Landscape Revealed: 10,000 Years on a Chalkland Farm*. Tempus, Stroud.

Grinsell, L.V. 1959. *Dorset Barrows*. Dorset Natural History and Archaeological Society, Dorchester.

Harding, A. 2000. 'Henge monuments and landscape features in northern England: monumentality and nature', in A. Ritchie (ed) *Neolithic Orkney in its European Context*. McDonald Institute for Archaeological Research, Cambridge, 267–75.

Harding, A.F. and Lee, G.E. 1987. *Henge Monuments and Related Sites of Great Britain*. BAR, Oxford. British Archaeological Reports (British Series) **175**.

Harding, J. 2000. 'Later Neolithic Ceremonial Centres, Ritual and Pilgrimage: the Monument Complex of Thornbouough, North Yorkshire', in A. Ritchie (ed) *Neolithic Orkney in its European Context*. McDonald Institute for Archaeological Research, Cambridge, 31–46.

Harding, J. 2003. *Henge Monuments of the British Isles*. Tempus, Stroud.

Harding, P. 1988. 'The chalk plaque pit, Amesbury', *Proceedings of the Prehistoric Society* **54**, 320–6.

Houlder, C. 1968. 'The henge monuments at Llandegai', *Antiquity* **XLII (166)**, 216–221.

Houlder, C.H. 1976. 'Stone axes and henge-monuments', in G.C. Boon and J.M. Lewis (eds) *Welsh Antiquity: essays mainly on prehistoric topics presented to H N Savory upon his retirement as Keeper of Archaeology*. National Museum of Wales, Cardiff, 55–62.

Jewell, P.A. and Dimbleby, G.W. 1966. 'The experimental earthworks at Overton Down, Wiltshire, England: the first four years', *Proceedings of the Prehistoric Society* **32**, 313–42.

Lewis, H. 2007. 'Knowlton South Circle soil micromorphology', in C. French, H. Lewis, M.J. Allen, M. Green, R. Scaife and J. Gardiner (eds) *Prehistoric landscape development and human impact in the upper Allen valley, Cranborne Chase, Dorset*. McDonald Institute for Archaeological Research, Cambridge, 134–8.

Lewis, H., French, C. and Green, M. 2000. 'A Decorated Megalith from Knowlton Henges, Dorset, England', *PAST* **35** http://www.ucl.ac.uk/prehistoric/past/past35.html#knowlton [Accessed 08/01/15].

Lynch, F. and Musson, C. 2001. 'A prehistoric and early medieval complex at Llandegai, near Bangor, North Wales: Excavations directed by C.H. Houlder 1966–67', *Archaeologia Cambrensis* **150**, 17–143.

MacKie, E. 1977. *The Megalith Builders*. Phaidon, London.

North, J. 1996. *Stonehenge: Neolithic Man and the Cosmos*. Harper Collins, London.

Ordnance Survey 2014. [FileGeoDatabase geospatial data], Scale 1:1250, Tiles: GB, Updated: 22 May 2014, Ordnance Survey (GB), Using: EDINA Digimap Ordnance Survey Service, http://digimap.edina.ac.uk, [Downloaded: Wed Nov 19 10:36:35 GMT 2014]

Parker Pearson, M. 2007. 'The Stonehenge Riverside Project: excavations at the east entrance of Durrington Walls', in M. Larson and M. Parker Pearson (eds) *From Stonehenge to the Baltic: cultural diversity in the third millennium BC*. BAR, Oxford, British Archaeological Reports (International Series) **1692**, 125–44.

Parker Pearson, M. 2012. *Stonehenge: exploring the greatest Stone Age mystery*. Simon and Schuster, London.

Piggott, S. 1937. 'The excavation of a long barrow in Holdenhurst parish, near Christchurch', *Proceedings of the Prehistoric Society* **3**, 1–14.

Piggott, S. and Piggott, C.M. 1939. 'Stone and Earth Circles in Dorset', *Antiquity* **XIII**, 152–155.

Pitt Rivers, A.H.L.F. 1898. *Excavations in Cranborne Chase, near Rushmore, vol. IV*. Privately printed.

Renfrew, C. 1973. 'Monuments, mobilisation and social organisation in Neolithic Wessex', in C. Renfrew (ed) *The Explanation of Cultural Change*. Gerald Duckworth, London, 539–58.

Richards, C. 1996. 'Henges and Water: Towards an Elemental Understanding of Monumentality and Landscape in Late Neolithic Britain', *Journal of Material Culture* **1 (3)**, 313–336.

Royal Commission on Historic Monuments, 1975. *County of Dorset, Vol 5: East Dorset*. HMSO, London, 113–116.

Ruggles, C. 1996. 'Archaeoastronomy in Europe', in C. Walker (ed) *Astronomy before the Telescope*. British Museum Press, London, 15–27.

Stoertz, C. 2007. 'Aerial photographic survey of Knowlton Circles', in C. French, H. Lewis, M.J. Allen, M. Green, R. Scaife and J. Gardiner (eds) *Prehistoric landscape development and human impact in the upper Allen valley, Cranborne Chase, Dorset*. McDonald Institute for Archaeological Research, Cambridge, 40–43.

Teather, A. 2016. *Mining and materiality: Neolithic chalk artefacts and their depositional contexts in southern Britain*. Oxford, Archaeopress.

Vatcher, F. De M. 1969. 'Two incised chalk plaques near Stonehenge Bottom', *Antiquity* **43**, 310–11.

Wainwright, G.J. 1971. 'The excavation of a later Neolithic Enclosure at Marden, Wiltshire', *Antiquaries Journal* **5**, 177–239.

Wainwright, G.J. 1979. *Mount Pleasant, Dorset: Excavations 1970-1971*. Society of Antiquaries, London (Report of the Research Committee **XXXVII**)

Wainwright, G. 1989. *The Henge Monuments: Ceremony and Society in Prehistoric Britain*. Thames and Hudson, London.

Wainwright, G.J and Longworth, I.H. 1971. *Durrington Walls: Excavations 1966-1968*. Society of Antiquaries, London (Report of the Research Committee **XXIX**).

Warne, C. 1872. *Ancient Dorset*. D. Sydenham, Bournemouth.

Whittle, A. 1996. *Europe in the Neolithic: The creation of new worlds*. Cambridge University Press, Cambridge.

Whittock, M. 1988. 'The Deserted Medieval Village of Knowlton', *East Dorset Antiquarian Society Journal* **3**, 28–33.

Wood, J.E. 1978. *Sun, Moon and Standing Stones*. Oxford University Press, Oxford.

Woodward, A. 1992. *Shrines and sacrifice*. Batsford, London.

Woodward, P. 1988. 'Pictures of the Neolithic: discoveries from the Flagstones House excavations, Dorchester, Dorset', *Antiquity* **62**, 266–74.

The authors: John Gale and Mark Maltby, Department of Archaeology and Anthropology, Faculty of Science and Technology, Bournemouth University, Poole, Dorset, UK BH12 5BB. Steve Burrow, St. Fagans National History Museum, Cardiff. UK CF5 6XB. Correspondence: editor@dorsetmuseum.org

EVALUATION EXCAVATION OF AN IRON AGE ENCLOSURE WITHIN HIGH WOOD, KINGSTON LACY ESTATE, PAMPHILL

MARTIN PAPWORTH
with contributions by Phil Harding and Ann Garvey

In 1987, an embanked enclosure with an internal ditch which had been cut by the remains of disused quarries, was identified on the summit of the hill known as High Wood. Earthwork and geophysical surveys were carried out and in 2008 an excavation trench was cut across the south-west side of the enclosure bank. Finds included a displaced Upper Palaeolithic flint blade and examples of flint technology typical of the Early Neolithic period mixed with burnt flint, cores, tools and flakes of flint dated to the Late Bronze Age. No in situ remains dating to the Neolithic or Bronze Age were encountered. The ceramic evidence revealed that the bank of the enclosure had been built over occupation debris dating to the later Middle Iron Age and that the enclosure bank was probably built in the Late Iron Age-Early Romano-British period. At this location, the enclosure ditch was found to have been cut away by a quarry, the filling of which contained later Romano-British pottery indicating that gravel was dug here to cap the nearby Roman roads.

INTRODUCTION

The Kingston Lacy Estate was bequeathed to the National Trust following the death of Mr H.J.R Bankes in 1981. This land covers 4000 hectares and lies north and west of Wimborne Minster and includes large parts of the parishes of Shapwick and Pamphill, with areas of heathland and forest in Holt.

The Estate has a dense array of archaeological sites and is essentially a triangle bounded by three rivers: the Stour to the south; the Allen to the north east and the Tarrant to the west. At its centre and at the highest point is the hillfort of Badbury Rings and from here the land slopes downwards as a series of undulating spurs and coombes towards the river valleys.

However, Badbury is one of two high positions, the other is High Wood which is shrouded by ancient woodland and lies 500m to the east. They are separated by a saddle of land and the Roman surveyors used this dip of ground between two knolls as a survey marker. Their road from Poole Harbour turns and divides at this point (Fig. 1).

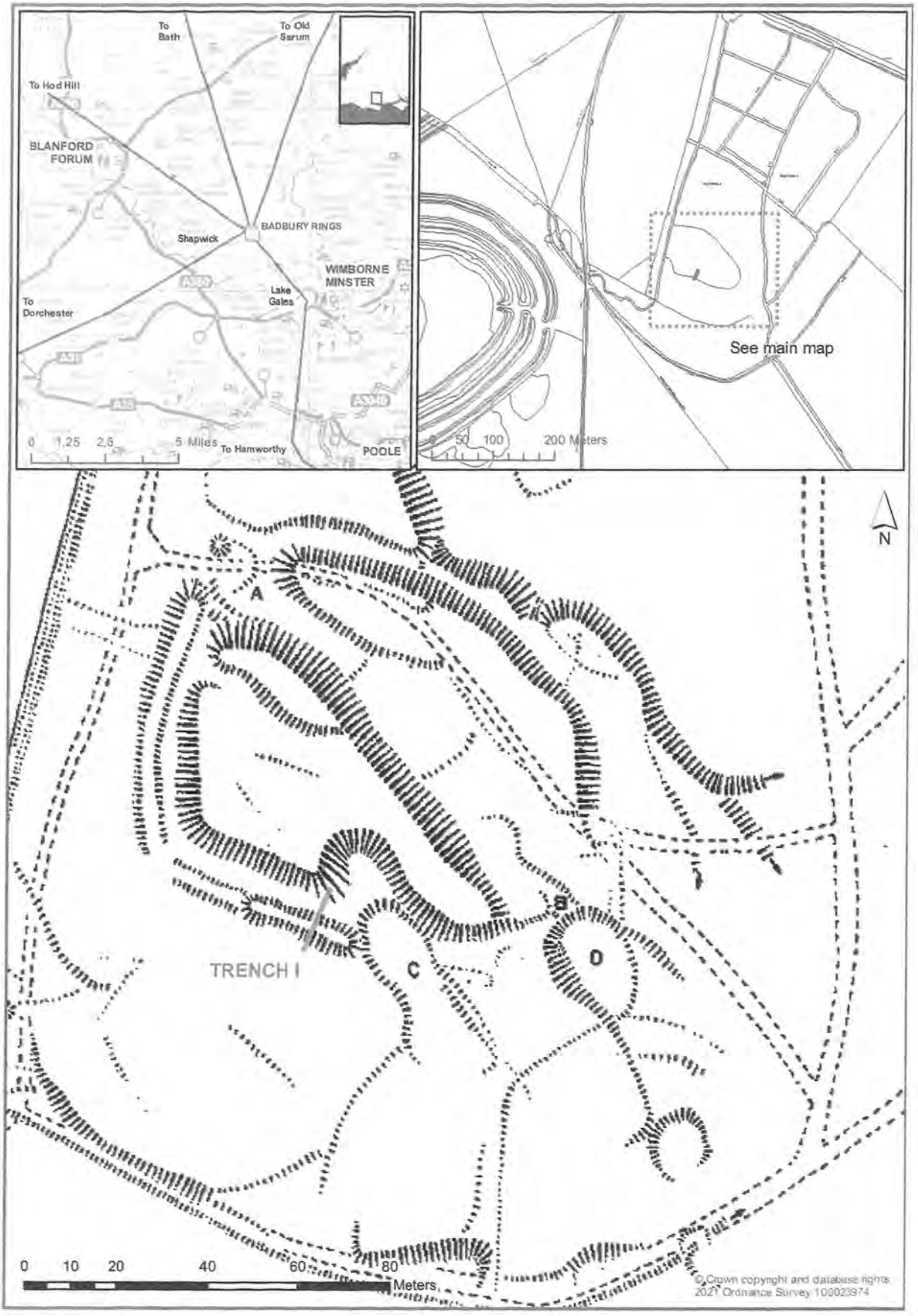


Figure 1 Location map to show High Wood in relation to Badbury Rings and Roman roads including the position of the 2008 excavation trench in relation to the RCHME earthwork survey (Corney 1992, 70).

The prominent hillfort earthworks of Badbury have long been valued as an important archaeological site but because of its tree cover, High Wood's archaeology has remained obscure. The trees themselves and the earthworks they shroud demonstrate a landscape stratigraphy that is intriguing.

The tertiary geology which caps the tops of High Wood and Badbury lies near the western edge of Palaeocene and Eocene deposits consisting of interlaminated fine clays, silts, and rounded flint pebbles. The last being particularly noticeable at this location. This geology is a remnant of a wider coverage which has been eroded over many thousands of years to expose the underlying Cretaceous chalk, the bedrock of the arable fields surrounding the hills.

BACKGROUND

Earthworks were first noted on the summit of High Wood (ST970030) during the National Trust archaeological survey of the Kingston Lacy Estate (Papworth 1988, 142). At that time, the terrain was difficult to understand within the woodland. However, the initial visit took place in the spring following the great storm of October 1987. By this time, the winter clearance of fallen timber debris had made the earthworks more discernible. During the same visit, the skeleton of a Bronze Age woman was exposed, torn from the ground and seen amongst the roots of one of the fallen 18th century beech trees (Papworth 1999, 155–158).

An earthwork survey was subsequently carried by RCHME (Riley and Corney 1992, 70) and this revealed a sub- rectangular enclosure defined by a ditch measuring 3–4m wide and up to 0.8m deep, with an external bank 3m wide and up to 0.3m high. Quarry pits had damaged the centre, east and north sides of the enclosure but it was estimated that it originally enclosed 0.5 hectare and measured 110m north-west to south-east and 100m north-east to south-west (Fig. 1).

Mark Corney categorised this site as a Tombstone or 'D' shaped enclosure of later Iron Age or Early Romano-British date (Riley and Corney 1992, 71), similar to those listed by Collin Bowen (1990, 91) on Cranborne Chase. However, the position of the ditch inside the bank and the occasional finds of worked flint amongst the leaf litter across the site suggested an earlier date (Richards 1992, 71). The earthwork may have been a possible henge-like structure dating to the Neolithic period and as such it would represent the earliest earthwork known within the Badbury environs.

Subsequently, a magnetometry survey was conducted across the most accessible and least quarried south half of the enclosure (Stewart 2015).

Most recently an analysis of the LiDAR data (Environment Agency) has enabled the earthworks under High Wood to be seen in detail (discussed below and see Papworth 2019, 137–9).

A small excavation across the bank and ditch was carried out in May 2008 to recover dating evidence that would improve interpretation and lead to enhanced conservation management of the site, the subject of this report (see Figure 1 for the location).

DOCUMENTARY HISTORY

High Wood consists of areas of hazel coppice and mature timber trees, mainly oak and beech. This woodland has been managed for centuries and evidence for this can be seen at its heart, on the upper east slope, where a block of gnarled and twisted pollarded oaks remain *in situ*.

The first named record of High Wood dates to 1564 (PRO DL44/103) when it was part of a group of copses surveyed for Queen Elizabeth I within her duchy of Lancaster.

> 'Itm thei sayethe that the name of one of the copses ys commonlye called hywoode copes [and] conteynythe by estymacon xxvi acres the wch copes ys yet well'.

It lay near the centre of Badbury deer park and warren, part of the manor of Kingston Lacy (Papworth 1998, 45–62). It is likely that Badbury and High Wood were tree-covered in the medieval period as there are various references in the medieval accounts of underwood and timber being brought from

Figure 2 Extract from the 1742 map.

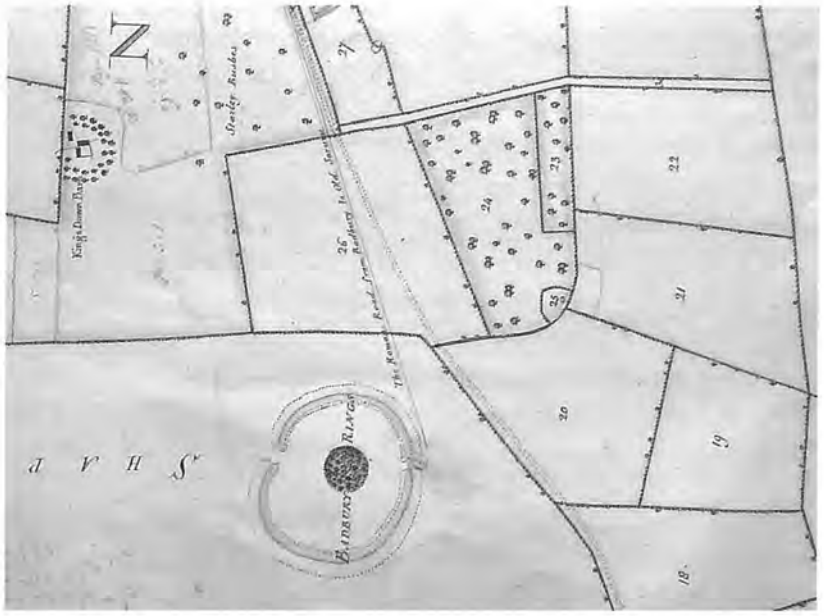


Figure 3 Extract from the 1773-4 map showing details of Badbury and High Wood.

Badbury Warren to mend the manorial buildings. For example, in the reeve's account for 1422–1423:

> 'And John Walwayn and John Brownyng felling 50 small oaks in Badbury
>
> for making studs for the said chamber 14d. And Thomas Russell and John Legg carrying 70 oaks from Badbury as far as the manor in total 6s 8d' (DHC D/BKL CG3/15)

The earliest map is dated 1742 (Fig. 2) and shows rights of way across the Kingston Lacy Estate (D/BKL). Many of the copses mentioned in 1564 are named and at that time, 'High Wood' only covered the southern part of its present area with 'Presly Coppice' occupying the northern part. A boundary line is drawn across the two woodland blocks and around the centre of 'High Wood', four possibly five

circular areas are marked within the woodland and these may indicate active gravel quarrying.

William Woodward's more detailed map of 1773–4 (D/BKL) (Fig. 3) shows High Wood covering the same area as in 1742 but by this time the east to west boundary across the centre of the wood is not depicted and neither are the possible quarry pits. The name 'Pressley Coppice *newly planted*' is given to a thin strip of enclosed woodland along the northern half of the east side. The other division of the wood is a much smaller oval enclosure in the south-east corner described as 'Cuckoo Pound'.

A new beech plantation extended the southern edge of the wood by about 100m between 1774 and 1808 (OS 1st edition) and between 1808 and 1847 the east side of the wood was extended by the same amount (W/TM 1847). The outline of the wood has remained the same since that time, though in recent years, naturally seeded trees, particularly ash, have been allowed to develop on the margins. These lie to the south and east, encouraged as part of the New Barn Farm set aside scheme, until 2016 when the fields were returned to arable.

The enclosure on the summit of the hill is now (2022) clear of trees and is managed under grass.

THE EXCAVATION

The combined evidence, as summarised above, meant that the date of the High Wood earthwork enclosure was unclear. Although it had been compared with a later prehistoric feature, the stray finds of Neolithic flint suggested an earlier origin for the site.

It was hoped that the sequence of events could be determined from a single trench which would recover stratified dating material from the bank and ditch of the enclosure, as well as recovering information from the buried ground surface beneath the bank and from one of the quarry pits.

Using the earthwork survey and following a close examination of the site on the ground, the National Trust gave consent for an area of undergrowth, ash and sycamore saplings to be cleared at ST96915 03070. This was over a portion of the enclosure bank and internal ditch, at a point where the edge of one of the old gravel pits cut into the ditch (see Figure 1).

The trench (Fig. 4) had to be positioned to avoid mature trees, old stumps and coppice stools. It was excavated on the south side of the enclosure and was aligned NNE to SSW measuring 15m long and 1.2m wide. It crossed the bank and ditch at a right-angle to create a clear section through the stratigraphy.

As the High Wood trench soils derived from compacted sands and fine clays mixed with gravel, they were acidic and therefore bone and other organic material did not survive, apart from some flecks of charcoal, charred plant remains and pollen. The roots of the established tree cover had disturbed the stratigraphy of these deposits preventing the extraction of reliable environmental evidence. Sampling and analysis of environmental material on Badbury Rings in 2004 had demonstrated this. Even when deposits were sampled at a deeper level (from a house platform below a boundary bank), it was demonstrated that significant bioturbation had taken place (Chisham and Scaife 2019, 164–166).

Burnt and worked flint fragments were recovered while removing the leaf litter (1) and rooty topsoil (2). These contexts covered the length of the trench. Below this were sandy soils but leaching had made it difficult to differentiate separate deposits within the trench. Therefore, the deposits were excavated in 30mm spits with fragments of pottery and pieces of worked flint levelled and plotted onto a series of plans of the trench. The pottery and significant flint artefacts were given small find (SF) numbers and some of these are located on the plan and section (Fig. 5) and described in the text e.g. SF131. The trench was initially excavated 1.2m wide but pressure of time meant that it was later narrowed to 0.6m wide with only the west side excavated below layers (19); (17); (21) and (10).

Stratigraphic Description

Context (1) extended the length of the trench and was a chocolate brown leaf mould 0.05–0.15m deep, a layer consisting of roots and vegetation litter mixed with some sandy soil and Heathstone (ferruginous

Figure 4 The trench across the south-west side of the High Wood Enclosure bank looking north east after excavation, May 2008.

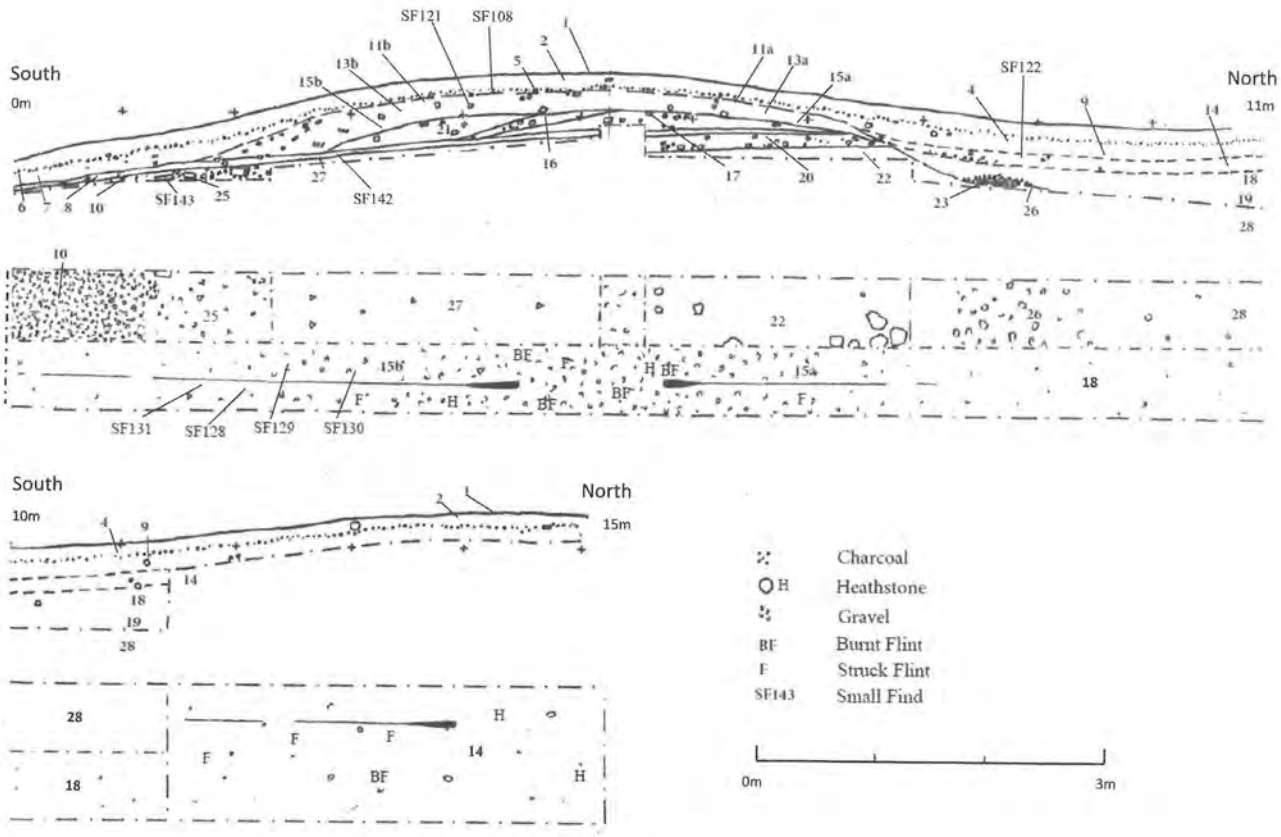


Figure 5 Plan of the High Wood excavation trench with the west facing section showing locations of contexts and some small find numbers.

sandstone) fragments with 30 struck flint flakes and 10 burnt flints.

This overlay (2) which also covered the entire trench, a dark brown loamy clay and yellow-ochre sand with fragments of Heathstone including three fragments of burnt Heathstone. Finds of flint included 25 struck flint flakes, one core and seven burnt flints. The burnt stone was concentrated across the bank.

Below (2), the 15m long trench was divided into zones which will be considered separately in this description, 0m being at the south end of the trench.

Layer (3) was allocated to the area of the quarry (11.5–15.0m) at the north end of the trench, layer (4) at the position of the enclosure ditch (8.0m–11.5m), layer (5) over the bank (2.5–8.0m) and (6) on the exterior south side of the enclosure (0m–2.5m).

The Quarry

Layer (3) consisted of a yellow-ochre sand and clay matrix mixed with occasional pebbles and fragments of Heathstone 0.3m deep. Two fragments of pottery were found, one oxidised SF102 and one reduced SF104 were Romano-British fabrics. Four burnt flints, seven struck flakes, and a core were recovered. Of particular interest was SF 105 an Upper Palaeolithic blade (see Harding below and Figure 7)

Below (3) was (12), a bright yellow-orange fine sandy clay with occasional pebbles. This layer was excavated 0.1m deep and in the upper 0.03m of this were found five struck flints, a core, a burnt flint, a fragment of Heathstone and a fragment of burnt Heathstone. Below this, no finds were encountered.

No further excavation took place below 0.1m within this northern 3.5m of the trench.

The Inner Ditch

Layer (4) was a dull yellow-ochre compacted loamy fine sand 0.06m deep and contained 22 struck flint flakes, one fragment of burnt flint, a fragment of Heathstone, a flint core, a flint scraper SF101 and a sherd from an oxidised Romano-British jar SF103.

Below (4) was layer (9), a 0.08m deep dull yellow-ochre sandy fine clay with occasional charcoal flecks. It contained six struck flint flakes, two fragments of burnt flint, a fragment of Heathstone and two flint cores. Two abraded fragments of Romano-British pottery were found SF114 and SF117.

Below (9) was layer (14), a 0.12m deep yellow to orange stiff sandy clay containing three struck flint flakes, three fragments of burnt flint, a fragment of Heathstone and a flint core. There were two fragments of Romano-British pottery; a Black Burnished rim sherd from a flanged bowl SF122 (Figs 5 and 8) and a fragment of grey ware SF124.

Below (14) was layer (18) which was up to 0.08m deep, a compacted orange-yellow fine clay with mottled light grey sand within it and occasional charcoal flecks. It contained two struck flint flakes, two cores and a fragment of Heathstone.

Below (18) was layer (19) which was up to 0.22m deep, a bright orange stiff sandy clay with much light grey sandy clay and moderate pebbles 30–50mm^3 and very occasional charcoal flecks. It contained a fragment of Heathstone and two sherds of Romano-British oxidised pottery one crudely made SF127 and the fragments of a fine rim with an internal burnish crushed into the surface of pebble layer (23).

Between (19) and (28) at 8.8m from the south end of the trench was (23) which was a 0.5m long and 0.05m deep distinctive dense concentration of pebbles mixed with a purple grey silty sand. It seems to be a localised dump of stones and part of the filling.

Below (19) was layer (28) which was over 0.18m deep, an orange, stiff plastic clay containing very occasional pebbles with occasional flecks and patches of grey clay. No finds were encountered in this layer which was not fully excavated.

Though it was hoped to differentiate remains of the inner ditch [24] from the later cut of the quarry [29], it was concluded from the excavation that, at this location, the quarry had removed the ditch and cut into the side of the enclosure bank.

The quarry cutting was [29] and filled with (3)/(4); (9)/(12); (14); (18); (19); (28). The depth of the quarry was not determined.

Quarry [29] cut through (5); (11); (13); (15); (17); (20); (22); (23) and (26). It seems likely that the flint finds in the upper layers of the quarry filling were derived from the eroding bank deposits.

The Bank

The bank was excavated using its summit as a dividing line. Finds collected from the north slope were allocated the letter 'a' and from the south slope 'b'. Contexts (5); (11); (13) and (15) were divided in this way and at this point it became clear that the north slope had been cut away by the quarry and layers were given unique numbers and removed in sequence from the south side.

Therefore finds from (15a) for example include finds from earlier layers within the bank exposed by the cutting of quarry [29].

Below (2) was layer (5), a 0.03m deep yellow to ochre fine compacted sand, mottled with dark brown sandy loam and disturbed by roots. It contained 10 struck flint flakes, 26 burnt flints, 15 fragments of Heathstone and three flint cores. There were three sherds of oxidised abraded pottery all from the south slope of the bank (5b) two dated to Late Iron Age/Romano-British period and one to the Late Iron Age.

Below (5) was layer (11), a 0.05m deep yellow-orange fine sandy clay with a moderate number of pebbles 30–50mm^3. It contained seven struck flint flakes, 13 burnt flints, five fragments of Heathstone and two fragments of burnt Heathstone and a fragment of charcoal. There were five fragments of pottery, all body sherds dated to the Late Iron Age SF109 from (11a) and SF110–112 and SF115 from the south bank slope (11b)

Below (11) was layer (13), a 0.08m deep bright yellow to ochre fine sandy clay with moderate flecks and patches of orange plastic clay and occasional to moderate charcoal flecks. It contained 5 struck flint flakes, 3 fragments of Heathstone and 8 burnt flints. There were 9 fragments of pottery, 3 from (13a) SF116 (2 joining pieces) and SF119 (base sherd) and 6 from the south slope (13b) SF118 (2 joining), SF120 (rim sherd, see below and Figure 8), SF121 (2 joining rim sherds) and body sherd SF125.

Below (13) was layer (15), a 0.08m deep bright yellow to orange compacted sandy clay mottled with very numerous flecks and patches of light grey sandy clay and occasional to moderate pebbles up to 30mm3. It contained 2 struck flint flakes, 3 fragments of Heathstone and 8 burnt flints. There were 9 fragments of pottery, all categorised as Late Iron Age and from the south slope of the bank (15b) SF126 and SF128–132, SF133 (2 sherds) SF 134 (2 sherds parts of a jar rim) (Fig. 5)

Below (15) were layers (16), (17) and (21). On excavation, these were found to be a series of layers overlying one another and dipping towards the south and out-cropping at the north slope of the bank where the bank had been cut away by [29].

Layer (21) was 2m long and 0.2m deep and was a dump of material against (16) forming the south slope of the bank below (15). An orange to yellow compacted sand with occasional charcoal flecks and pebbles up to 50mm^3 with very occasional burnt Heathstone and flint nodules. The layer contained two struck flint flakes, five Heathstone fragments and seven burnt flints. There were seven pottery fragments, SF 136 was a rim sherd categorised as Late Iron Age, SF138–140 were categorised as Middle to Late Iron Age and SF141 (a cluster of three sherds, comprising two rims and a base sherd each of a different fabric) categorised as Middle Iron Age. The Middle Iron Age sherds having different fabric composition compared with finds from (15) and layers above.

Layer (21) overlay (16). Layer (16) was between (21) and (17) at the crest of the bank. It was a distinctive layer of ochre compacted sandy clay with numerous charcoal flecks and moderate burnt Heathstone lumps. In section, it showed as a lens of material up to 0.1m thick and 1.3m long sloping towards the south. It contained four burnt flints. At the junction of (16) with (15) was found an abraded sherd of pottery SF126 categorised as Late Iron (see Garvey pottery report below)

Layer (16) overlay (17). Layer (17) formed the internal north slope of the bank below (15a). In the section it measured to 0.18m thick and 2.4m wide sloping towards the south. A bright yellow to orange fine

compacted sandy clay mixed with very numerous flecks of grey sand, occasional charcoal flecks and bright orange clay flecks with a moderate number of pebbles up to 50mm³. It contained two struck flint flakes, two fragments of Heathstone, and five burnt flints. A broken iron nail head and shaft were found together as SF141 in this layer.

Layers (21), (16) and (17) overlay (27) which outcropped on the north slope at the interior edge of the bank (see below *'Beneath Bank North'*).

The Exterior South side of the Enclosure

Below leaf mould layer (2) at the south edge of the trench was layer (6), which was a 0.6m deep yellow to ochre fine compacted sand mottled with dark brown sandy loam containing five struck flint flakes, a fragment of Heathstone and three burnt flints.

Below (6) was (7), a 0.06m deep bright yellow-yellow brown fine compacted sand with occasional pebbles average size 30mm³. It contained four fragments of Heathstone, a flint core and nine burnt flints.

Beneath the Bank (south)

Layers (6)–(7) were spits of similar material containing material which had eroded downslope from the bank.

Below (7) was (8), a 0.05m deep yellow to yellow brown compacted fine sand containing two fragments of Heathstone, one of burnt Heathstone and one burnt flint. It continued under (15b) the southern edge of the bank material. (8) was the equivalent of (27) which continued this layer across the trench to the north where it was observed to underlie layers (21), (16) and (17).

Layer (8) covered (10) which was 0.07m deep and interpreted as a constructed yard surface consisting of a compacted layer of pebbles 30–80mm³. Within this was a block of pebble conglomerate and two lumps of Heathstone 80mm³, Between the stones was a yellow to ochre fine sand with occasional charcoal flecks fragments of burnt Heathstone, a burnt flint and a flint core.

Below (10) was (25), a bright orange to yellow compacted sandy clay with occasional pebbles 30–50mm³ and very numerous charcoal flecks and lumps with patches of red clay. Within this layer was found two large conjoining rim sherds (Fig. 6) from a Middle Iron Age bowl SF143. Layer (25) was not fully excavated and was the bottom layer seen at the south end of the excavation.

Contexts [10] and (25) predated the bank (15b) but were only excavated for 2.2m from the south section at 15.0m to 12.8m (measured from point 0m at the north end of the trench).

Beneath the Bank (north)

Time constraints meant that a full section across the bank down to bedrock was not possible and therefore the trench was narrowed to 0.6m wide from 6.5m–11.5m from the south end of the trench. This cutting was below the centre of the bank to sample the deposits where they had been cut by the quarry [29] to the north.

Figure 6 Excavation of Middle Iron Age rim SF143 and area of charcoal within context (25) at the south end of the trench below the enclosure bank.

Here, bank layer (17) overlay (27), which was up to 0.15m deep, a bright orange to yellow compacted sand with occasional pebbles and mottled with numerous flecks of grey sandy clay. It contained eight struck flint flakes, one core, two Heathstone fragments and two burnt Heathstone fragments. It included a flint blade SF145 and two small fragments of pottery (Fig. 5) including a base possibly Middle Iron Age from their fabric SF142.

Context (27) was 0.08m deep at 9.5m and became shallower towards the north, fading away at 8.0m from the north trench edge. (27) overlay layer (20).

Layer (20) was cut by the quarry [29] and was a light yellow-orange clay sand 0.18m deep. Mottled and mixed with (20) was much light grey sand between very numerous pebbles 30–80mm^3 and occasional charcoal flecks. (20) contained many struck grey-black flint flakes and became greyer with more Heathstone lumps up to 150mm^3 towards the bottom of the layer. This may be the equivalent to layer (10) seen on the south side of the trench.

Below (20) was (22) which was partly excavated where it was exposed by the quarry cut [29] (between 6.0m–7.0m from the north edge of the trench). This was a 0.3m deep bright orange-yellow compacted sandy clay with very occasional pebbles and Heathstone lumps. No finds were recorded from this layer.

Below (22) was (26), a red to orange clay with moderate pebbles 30–80mm^3 which was exposed in the quarry cutting [29] between 5.5m–6.0m from the north end of the excavation. No finds were recorded from this layer.

The Finds

WORKED FLINT, BY PHIL HARDING

An assemblage of 162 pieces of worked flint was recovered from 27 contexts (Table 1) at the excavation of the bank and ditch at High Wood; of these, three pieces are burnt. There were also 87 pieces of burnt unworked material, principally from the bank and the exterior beyond the bank. The assemblage can be divided into three chronological periods.

Upper Palaeolithic

A massive broken blade (SF105, layer (3) quarry filling; Figure 7), 117mm long and 47mm wide, was recovered from the quarry pit which cut the enclosure ditch. The dorsal surface is heavily patinated, the ventral surface less so, but it is lightly stained by iron minerals from the local Reading Beds. The differential condition of both surfaces suggests that the blade may well have been undisturbed for a long time; however, there is considerable post-depositional edge damage indicating that it is not undisturbed. Both ends are missing; the distal end is patinated and was broken at the time of manufacture but the damage to the proximal end is more recent. It is therefore impossible to characterise the butt or features of platform preparation, although it was almost certainly removed using a soft hammer. The negative scars on the dorsal surface are all parallel, indicating that the blade was removed from a carefully prepared core. These scars also indicate that there were striking platforms at both ends of the core, which was considerably bigger than the blade.

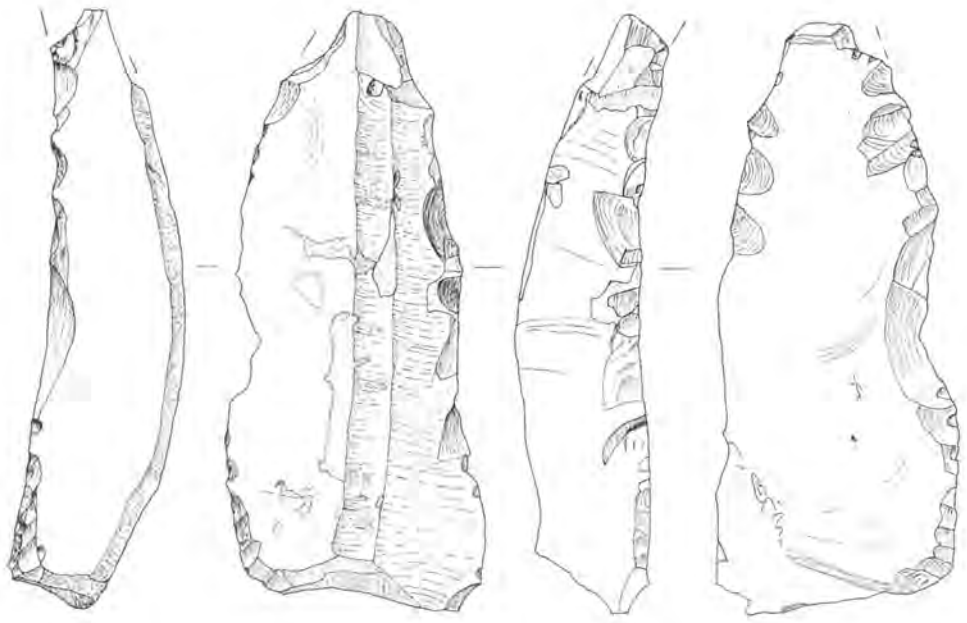
The size, condition and technology used indicate that this isolated blade is from the Upper Palaeolithic period (40,000–10,000 BC). As such, it is an important indicator that groups of hunters may have been operating on this area of the Chalk in southern England during the Last Glacial (Devensian) period.

Neolithic

Twenty five pieces of worked flint were found from all phases of the site that were characterised by a white surface patina. Of this group the largest quantity, eight pieces, was collected from below the bank and represents the most securely stratified material from the excavation; artefacts from the bank and quarry undoubtedly represent redeposited material. Morphologically, this element of the flint assemblage includes five blades and a blade core. The technology is also distinctive, including evidence for platform abrasion, soft hammer percussion, narrow flake butts and platform rejuvenation, with retouched pieces represented by a backed blade from the exterior of the site. Taken together this material can be

Table 1 Flint by type and by feature group.

	Quarry	Exterior	Ditch *quarry*	Bank	Below Bank	None *Earlier 10/20*	**Total**
Blade Cores	0	0	0	0	0	1	**1**
Flake Cores	1	1	2	3	0	1	**8**
Broken Cores/ Core fragments	0	0	0	2	1	4	**7**
Blades	0	0	0	0	0	1	**1**
Broken Blades	1	1	1	1	0	1	**5**
Bladelets	0	0	0	0	0	0	**0**
Broken Bladelets	0	0	0	0	0	1	**1**
Flakes	5	13	13	20	3	17	**71**
Broken Flakes	1	5	11	8	4	13	**42**
Rejuvination Tablets	0	0	0	0	0	1	**1**
Chips/micro debitage	0	0	0	0	0	1	**1**
Other Tools	0	1	0	0	0	0	**1**
Debitage	0	5	3	6	0	4	**18**
Miscellaneous Retouched	2	0	0	1	0	2	**5**
Burnt Number	0	0	1	2	0	0	**3**
Burnt Weight	0	0	0	0	0	0	0
TOTAL WORKED	10	26	30	41	8	47	162
Burnt Unworked Number	7	16	9	26	0	29	**87**
Burnt Unworked Weight in grams.	290	1371	736	1983	0	430	4810



105

0 3cm

Figure 7 Broken Upper Palaeolithic flint blade SF 105

safely regarded as providing firm evidence for pre-enclosure activity, most probably of Early Neolithic date (e.g. SF145 blade layer (27).

Late Bronze Age

The remainder of the worked flint (136 pieces) is characterised by an unpatinated, hard hammer struck, flake-based assemblage in mint condition. This material was absent from below the bank but was incorporated in its make-up, indicating that it pre-dated or was, at the very least, contemporary with its construction. Two flakes from the exterior of the monument are of sufficiently similar raw material and condition to suggest that they may have been removed from the same nodule. This material is distinctive by its lack of refinement. The eight flake cores include examples that were produced using both rotating and single platform technology and are often accompanied by areas of incipient cones, caused by mis-hits, on the striking platform. The retouched pieces include no formal retouched tools but are characterised by retouched flakes, all with denticulate edges.

The assemblage is restricted in terms of quantity but is an important component to the results of the excavation. Material of this type is notable for its lack of technological refinement but is nevertheless very typical of industries produced during the early part of the last millennium BC and conventionally regarded as being of Late Bronze Age date. Industries of very similar type have been described elsewhere in Dorset (Harding 1991). The technology and typology of the industry is sufficiently consistent to indicate that this represents a single industry and is not part of a multi-period residual scatter of material. The condition also suggests that it is little disturbed and may have been incorporated into the monument soon after its manufacture. The evidence of the pottery currently suggests that the enclosure is of Late Iron Age date; the worked flint hints that the construction of the enclosure may be of an earlier date or was refurbished later in the first millennium BC. There is currently little reason to believe that distinctive flint working of this type extended into the Middle-Late Iron Age.

Conclusion

The very small-scale excavation through the bank and ditch of the enclosure at High Wood has produced a small but nevertheless interesting assemblage of worked flint. The results of the examination have demonstrated three distinct and quite separate phases of activity at the site.

The first and earliest is represented by only a single object. The importance of this object lies in its discovery. There is nothing of a similar age at the site to confirm occupation of the hill at this time although the presence of iron staining makes it likely that it represents a casual loss or was discarded at the site rather than a curio that was picked up by occupants of the later prehistoric enclosure. Traces of Upper Palaeolithic occupation are known from Dorset but they are nevertheless rare, and all discoveries, including individual pieces such as this, add to and confirm the distribution of human groups in this period.

The second phase of activity demonstrates Neolithic activity, most probably early Neolithic, at the site. The quantity of material is small but is sufficiently consistent in both condition and technology to indicate that it forms a distinctive phase of occupation at the site.

The largest quantity of worked flint is of a type that is found across much of southern England in the Late Bronze Age, when flint working, as a skill, is understood to have been in serious decline. This assemblage is sufficiently diagnostic and of a consistent typology, technology and condition to confirm that it relates to activity, probably occupation, on the site in the early part of the first millennium BC. The worked flint assemblage has provided evidence to extend the duration of activity on the hill into the Last Glaciation. It may not overturn the later chronology of the site, although it does suggest that later activity, possibly the construction of the enclosure itself, may be earlier than that demonstrated by the associated pottery.

Pottery, by Ann Garvey

Introduction

This report considers a small amount of pottery from the excavations at High Wood which produced a total of 119 sherds, weighing 1,065 grams with a mean sherd weight of 8.9grams (Table 2).

Table 2 Pottery recovery by feature.

Feature	No. of pieces	% by number of pieces	Weight (g) of pieces	% by Weight of pieces	Mean Sherd weight
Quarry	2	1.7	7	0.7	3.5
Ditch	25	21.0	247	23.2	9.9
Bank	50	42.0	251	23.6	5.0
Bank Ex	42	35.3	560	52.6	13.3
TOTAL	119	100.0	1 065	100.0	8.9

The characteristics of the pottery suggest a date range from the late Middle Iron Age to the Roman period. The pottery was very fragmented and abraded as demonstrated by the mean sherd weight, its condition due largely to the local acidic soils. A few larger pieces were found, with the largest diagnostic rim pieces being at either end of the ceramic date range for the site. These were the 3rd–4th century AD Black Burnished flanged bowl from the quarry filling SF 122 (Fig. 8) layer (14) and the 4th–2nd century BC Middle Iron Age jar rim from below the enclosure bank SF 143 (Fig. 8) layer (25).

The aim of this report is to compare form and fabric with other sites in the region and to consider if the pottery had been produced in the local area. Other variables to be considered are manufacturing techniques such as firing, surface treatment and evidence of decoration to help with the chronological sequencing of the pottery.

This assemblage was analysed using the pottery recording system recommended by the Prehistoric Ceramic Research Group (PCRG 1997). The sherds were studied macroscopically using a binocular microscope (×10 magnification) to identify fabrics and surface treatments. The reference collection used to classify fabric and form was based on Badbury Rings (Garvey 2006) and Shapwick (Mepham 2001; Seager-Smith and Mepham 2003) as these reports were local to the High Wood Enclosure.

Fabrics

The fabric groups were defined by their clay matrix and range of inclusions, and then categorised into fabric groups by dominant inclusion type, with the main fabric identified at High Wood being of quartz sand (96.6%). It has been suggested that sandy fabrics become more dominant during the Middle to Late Iron Age, *c.*4th–1st century BC (Davis 1987, 151; Lancley and Morris, 1991, 122). Only four sherds were from other groups, two were flint tempered and two grog tempered fabrics (Table 3).

The most abundant quartz sand fabric in the assemblage was Q4, it is known to have come from the Poole Harbour area and is a coarser early variant of a *Durotrigan* Poole Harbour fabric (Garvey 2006, 7). This relates well to finds from Badbury Rings and indicates that most of the pottery dates to the Late Iron Age. Possible fabrics from the Middle Iron Age period are Q1, Q7 and F3 fabrics. PRN 47 (SF 142, layer 21) is a good example of the Q1 fabric found at Shapwick. Roman fabrics are QIO and Q6 as they are of a finer fabric

Flint and grog were probably manufactured in the local area as the clay matrix is quartz sand. However, the grog itself could be made from recycled imported pots but this would only be seen in petrological analysis. At High Wood, the flint tempered sherds are associated with the Middle Iron Age contexts and the grog pieces were found in Late Iron Age or Roman period deposits.

Fabric Descriptions

Italics indicate descriptions from Shapwick (Mepham 2001; Mepham and Seagar Smith 2003). The other descriptions are from Badbury (Garvey 2019, 155–158)

Q1 Soft, fine clay matrix with common (20–30%), well sorted, rounded quartz <lmm; sparse iron oxide and organic material.

Q4 Soft, (but not easily scratched) moderately fine clay matrix with very common (30–40%), well sorted, rounded quartz measuring 0.25–0.5mm, though some

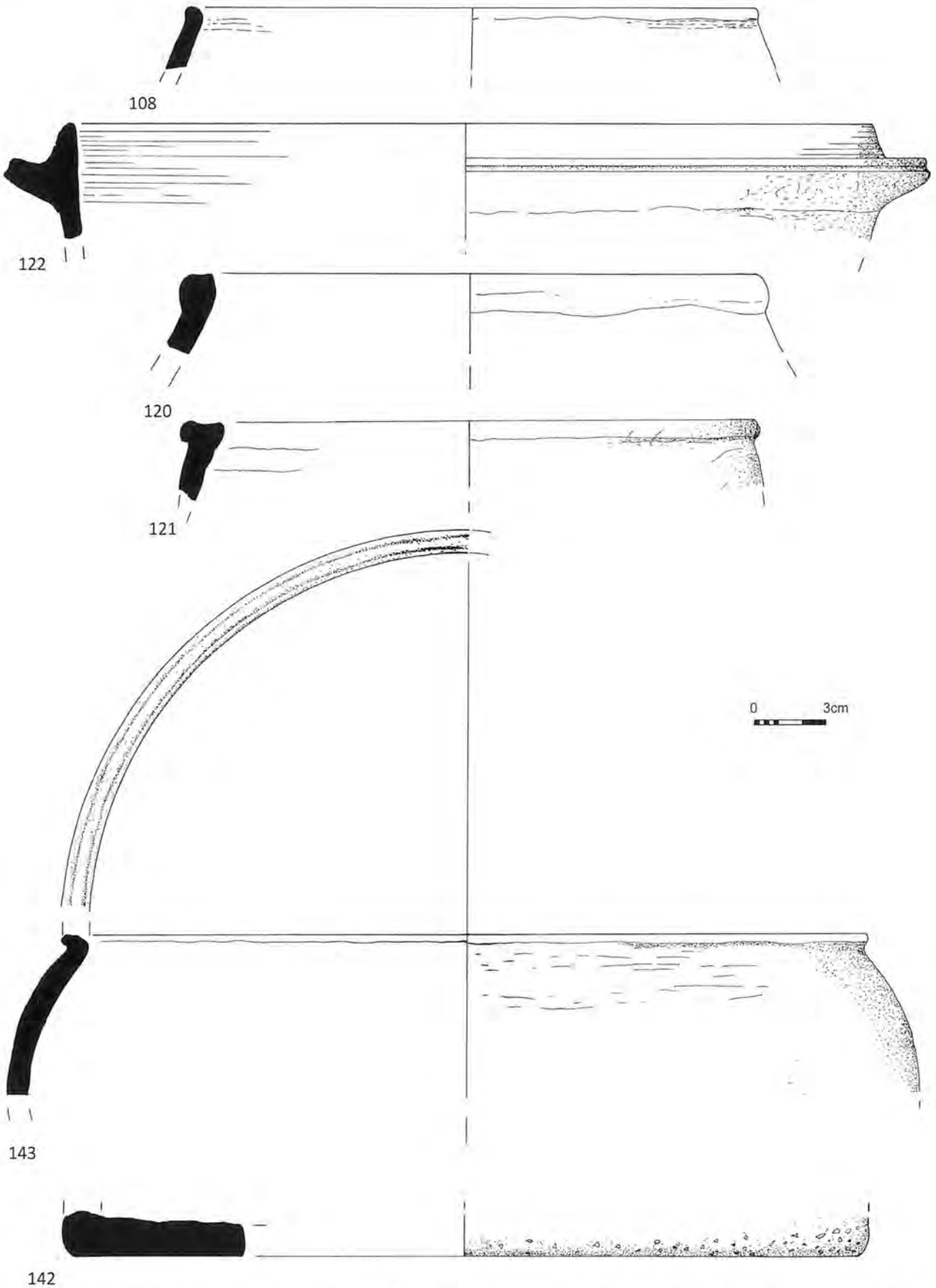


Figure 8 Illustrated pottery with small find numbers: SF108 context (5); SF 122 context (14); SF120 and SF121 context (13b); SF 143 context (25); SF142 context (21).

Table 3 Fabrics by group.

Fabric Types	No.	% by No. of Pieces	Weight of Pieces (g)	% by Weight of Pieces	% of Overall fabric Group
F3	2	1.7	84	8.3	1.7
G2	2	1.7	22	2.2	1.7
Q1	9	7.6	197	19.4	
Q4	69	58.0	447	44.0	
Q6	9	7.6	206	20.3	
Q7	9	7.6	9	0.9	
Q10	5	4.2	17	1.7	
Q11	14	11.8	34	3.3	96.6
TOTAL	119	100	1016	100	100

grains can be <lmm. Can also contain sparse (3%) flint measuring <2mm and/or 1% Iron and/or 3% carbonaceous voids. Sandy feel and hackly fracture (Like Q7 /Q1 but medium) (QUCM).

Q6 Hard, fine fabric, containing common 20–25%, moderately sorted sub-rounded quartz measuring <0.25mm. Can also contain sparse (3%) flint measuring <1mm and moderate (10%) of Iron. Sandy feel and hackly fracture (Like QI 1 but more Iron). (QUCF)

Q7 Soft (but not easily scratched), coarse fabric with common (20–25%), moderately-sorted, sub rounded quartz mostly measuring 1mm though some are less. Can also contain sparse (3%) flint measuring <2mm, and/or 1% Iron and/or 3% carbonaceous voids. Sandy feel and hackly fracture (Like Q4/Q11 but Course). (QUCC)

Q10 Soft (but not easily scratched), very fine fabric containing abundant (40%) well-sorted quartz measuring <0.125mm, though some grains measure 0.25mm. Clay matrix slightly micaceous and contains sparse (5–7%) iron and or glauconite. Smooth feel and smooth fracture. (QUAVF)

QII Soft (but not easily scratched), fine fabric, containing common (30%) well sorted sub-rounded quartz measuring <0.25mm. Can also contain sparse (3%) flint measuring <2mm and/or 1% Iron and/or 3% carbonaceous voids (like Q7/Q4 but finer). Smooth feel and irregular fracture. (QUCF)

F3 Soft (but not easily scratched) fine sandy clay matrix containing common (20–25%) of poorly sorted grey angular flint inclusions, measuring <2mm. The fabric also contains rare (1%) linear voids. Granular feel and conchoidal fracture (FLCC).

G2 A soft coarse fabric containing moderate (10–15%) amount of sub-rounded grog; measuring <2mm along with sparse (7%) linear voids and can contains rare (1–2%) flint. Soapy feel and irregular fracture. (GRMC)

Forms

There were 47 diagnostic sherds identified at High Wood. Twenty-four rims and 23 flat base pieces. Of the rims the most common were bowls accounting for 54.2% of the total (Table 4). Unfortunately, most of the rims and bases were small and fragmented. Therefore, there were no complete vessel profiles in this assemblage able to demonstrate vessel capacities.

Rim Series Descriptions (Bold descriptions from Brown 2000):

BCI.O Simple hemispherical bowl with thickened out curving rim top. Similar to Maiden Castle. At Maiden Castle they appear with BC3.

BC2.O Simple hemispherical bowl with an undifferentiated rim which distinguishes them from BCI. At Maiden Castle they appear with BC3 (Sharples: 1991 : 197).

BC3.1 Bowls with straight or gently curving profiles and a proto-beaded or beaded rim. These vessels are considered to be a Durotrigian styled vessel in fabrics from Wareham/Poole Harbour (Brown: 1987:210).

JCI.O Large barrel-shaped jars with distinctly flattened rim tops, the rim is sometimes slightly upstanding and squared, possibly to allow for the securing of a cloth or fabric cover.

JC2.O This category includes jars of varying sizes with rounded profile. The mouth is always narrower than the shoulder diameter.

JC3.11 A sub-variety of JCI which has an out-turned rim with lid seating.

JD4.O Tripartite jar with elongated or everted rim.

PAI.2 Vessels with sides incurving slightly towards the top, usually with undifferentiated rims. Vessels are tall. Sand-tempered fabrics predominate and finish is generally coarse.

PA3.O This is a general category to contain small sometimes crudely made vessels with straight sides.

B1 Simple round base.

Table 4 Forms found at High Wood and compared with data from Maiden Castle (Brown 1991) and Danebury (Brown 2000).

Form Type	No.	Vessel Group	% by No. of Pieces	Weight of Pieces (g)	% by Weight of Pieces	% of Overall Form Group	Maiden Castle Date Range	Danbury Date Range
BC1.0	1	Bowl	4.2	12	2.3		6F-6H	CP4-7
BC2.0	7	Bowl	29.2	6	1.2		6D, 6G, 61-1	CP4-7
BC3.1	5	Bowl	20.8	45	8.8	54.2	6E-6H	CP8-9
JC2.0	3	Jar	12.5	140	27.3		6E-7A	CP5-7
JC1.0	3	Jar	12.5	57	11.1		6E-6H	CP3-7
JC3.11	2	Jar	8.3	158	30.8		6D-7A	CP8+
JD4.0	1	Jar		5	1.0	37.5	6E-7A	CP8-9
PA1.2	1	Saucepan	4.2	82	16.0		6F & 61-1	CP3-5
PA3.0	1	Saucepan	4.2	8	1.6	8.3		CP3-5
TOTAL	24		100.0	513	100.0	100.0		

Table 5 Occurrence of forms at Maiden Castle (red indicates majority of forms found in these phases).

MC Rim form dating	Phase 6D	Phase 6E	Phase 6F	Phase 6G	Phase 6H	Phase 7a
		----------	----------			

BC1.0		----------			----------	
BC2.0		----------	----------	----------	+++++++	
BC3.1		----------	----------	----------	----------	
JC1.0	----------		----------	----------	+++++++	
JC2.0			----------	+++++++	+++++++	
JC3.11			----------	----------	+++++++	
JD4.0			----------		----------	----------
PA1.2					----------	----------
PA3.0						----------

Based on the ceramic phasing at Maiden Castle (Table 4), the forms found at High Wood span a long time period. This is due to the style of the forms remaining consistent throughout the Middle and Late Iron Age period. (Woodward 1999).

Correlation of form and fabric can be seen below in Table 6. Q4 can be seen to be the fabric that occurs most within the rim assemblage.

Manufacturing Evidence

Consideration of the manufacturing techniques of this assemblage suggests that the middle Iron Age and the early late Iron Age pottery had been handmade. The late Iron Age and Roman wheel-made pottery fragments were mainly found in fabrics Q6/Q10. The firing technique used for the majority of the Iron Age pottery would have been a bonfire kiln (Rice 1987). Table 7 indicates that irregular firing

Table 6 Fabric and form correlation.

Form	Q1	Q4	Q6	Q10	G2	F2	Total
BCI.O					1		1
BC2.O		7					7
BC3.1			5				5
JCI.O		3					3
JC2,O	3						3
JC3.11			2				2
JD4.O				1			1
PAI.2						1	1
PA3,O		1					1
TOTAL	3	11	7	1	1	1	24

Table 7 Firing conditions present

Firing Condition	No. of Sherds	% by No. of Sherds
Unoxidised Firing (UNOX)	12	10.1
Oxidised Firing (OX)	25	21.0
Oxidised surfaces, unoxidised core (OUO)	22	18.5
Irregular Firing (IR)	60	50.4
TOTAL	119	100.0

accounts for 54% of the assemblage, indicating that oxygen in the fire had not been controlled to either oxidise or unoxidise the pottery.

Surface Treatment

Table 8 demonstrates that smoothing was the main type of surface treatment found on the pottery (71%). This was followed by 18% of the sherds being smoothed on the outside and burnished on the inside (SM/BU). It has been suggested that burnishing internal surfaces helps to control the porosity of the vessel and reduces the penetration of liquids or oils from the contents that are in the vessel, thereby extending the use life of the vessel (Rice 1987, 232-233). Smoothing and Burnishing is a common treatment during the later Iron Age (Seager Smith *et al.* 1997, 110).

Evidence of use

Four diagnostic sherds had evidence of abrasion (AB). These were SF127 (19) - interior; SF120 (13b) - just below the rim; SF136 (21) - rim interior surface; and SF 142 (21) just below the rim and upper interior surface.

Decoration

Only three diagnostic rims had evidence of incised decoration (IC) found just below the rim. These were BC3.1; SF127 (19) and JCI SF121 (13b) and SF 134 (15b). The remainder of the assemblage had no decoration. Incised decoration is associated with the late Iron Age and Roman period and is characteristic of *Durotrigan* pottery (Wainwright and Davis, 1995).

Vessel Wall Thickness

In this assemblage vessel wall thickness category 3 (7-9mm) and 4 (9-1 1mm) were the most common. Morris has noted that category three is a common feature during the Late Iron Age (Morris per comm).

Table 8 Surface treatment.

Surface Treatment	No of pieces	% of the No. of pieces
SM	84	71%
SM/BU	22	18%
BU	8	7%
BU/SM	1	1%
Unidentified	4	3%

Summary

By comparing form and fabric with other sites in the region it can be stated that the pottery from the High Wood enclosure had a time span from the late middle Iron Age to the early Roman period. In addition, scraps from the quarry, including a flanged bowl fragment, were of later Roman date. The condition of the pottery had been affected by the acid soil conditions of the site.

Looking at the production of the pottery, it can be stated that for the Late Iron Age, a high dominance of sandy fabrics was used. Q4 is the most dominant fabric found at High Wood which is known to have come from the Poole Harbour area. This is a coarser early variant of a *Durotrigan* Poole Harbour fabric (Garvey 2006,7). The Middle Iron Age fabrics for High Wood appear to be Q1, Q7 and F3. Fabrics associated with the Roman period appear to be Q6 and QIO and G2.

The forms identified remain consistent throughout the late Middle Iron Age and into the early Roman period. Decoration was present on just three sherds; this can be associated with the Late Iron Age/Roman period. The majority of vessels identified were Bowls (54%) followed by Jars (37.5%). The function and use of the pottery has been considered but unfortunately there was a lack of use wear evidence on the small abraded pieces.

THE HIGH WOOD ENCLOSURE: CONCLUDING DISCUSSION

Palaeolithic to Bronze Age

The Upper Palaeolithic blade found in the quarry backfill (Fig. 7) is likely to have been disturbed during quarrying and then discarded. It has been dated to 10,000–40,000 BC and is the oldest artefact recorded from the Kingston Lacy Estate (Harding above).

Initially, finds of flint had suggested a Neolithic date for the earthwork. Following lithic analysis of the 2008 finds it was confirmed that there had been occupation here in the earlier Neolithic period though no *in situ* Neolithic features were encountered. Similar lithic evidence was found in Trench II on the summit of Badbury in 2004 (Leivers 2019, 160) and these finds, though disturbed, indicate that both hilltops were occupied during this period.

The flint finds from Badbury also have a clear later Bronze Age signature (Harding this report), though very few finds could be attributed to the later Neolithic and earlier Bronze Age. This seems surprising for these prominent places given the density of sites dated to this period within the wider landscape (see below).

Iron Age

Despite the lithic evidence, Mark Corney's interpretation of the High Wood enclosure (1992, 70–1) as a Late Iron Age earthwork has been supported by the results of this small excavation. The stratified pottery from the upper deposits in the bank proved consistently to be of this date. However, it is now clear that the enclosure represents only one of several occupation phases at this site. This prominent hilltop location has been a focus of intermittent activity dating back as far as the Upper Palaeolithic period.

The lower bank deposits included later Middle Iron Age pottery and this may indicate that there were two phases of bank construction, as suggested by the stratigraphic record. However, these finds are likely

to have been derived from the material quarried to create the bank, disturbing occupation debris from an earlier, perhaps unenclosed, hill-top settlement. Certainly, the amount of burnt and struck flint found in the bank layers demonstrates this disturbance of earlier deposits.

The bank sealed a Middle Iron Age layer, dated by large fragments of pottery and indicating domestic occupation of the site before the earthwork was built. The number and quality of the later Bronze Age flint from the site led the lithics specialist (Harding above) to consider whether the earthwork dated from this period though the ceramic evidence is too strong to allow this.

Identifying the separate deposits to date the enclosure ditch in relation to the quarry stratigraphy was not possible as it was demonstrated during the excavation that the ditch had been completely removed by the quarry at this location. However, from the earthwork survey (Corney and Riley 1992, 70–71, fig. 1), it was clear that the quarries cut the line of the ditch and bank and were therefore later. An excavation of an undisturbed section of the ditch would be required to find its dimensions. The ditch would almost certainly have been the source of the bank material and therefore should date to the period *c.* 100BC–AD50.

Romano-British

The finds analysis demonstrated that all the latest material recovered from the site was found in the filling of the quarry [29]. This was exclusively Romano-British and indicated that the quarries were active during this period. On the west side of Badbury, along the Dorchester Roman road, mole hills and erosion occasionally show that the road is capped with pebbles similar to those found on top of Badbury and High Wood. Therefore, road construction may have been one of the uses for material from the High Wood pits. It is likely these quarries were re-visited and extended over a long period of time, potentially up to the 18th century if the marks on the 1742 map (DHC D/BKL; Fig. 2) indicate quarry locations. However, no post-Roman finds were recovered from the backfilling layers of [29] to suggest use following the Roman period.

LiDAR ANALYSIS

Woodland has obscured High Wood's ground surface since at least the 14th century, but LiDAR analysis (Fig. 9) now enables the previously hidden earthworks to be seen. These LiDAR images demonstrate the geological change from chalk to the tertiary deposits as ovoid breaks of slope 250–300m across, capping both Badbury and High Wood. They show this transition around High Wood summit as a ring of hollows 10m–20m across. Though alternative interpretations might include natural solution hollows or platforms for round houses, their arrangement at the junction of geological change make them most likely to be quarry pits for gravel.

Their regularity and scale at High Wood, may suggest some form of monumental prehistoric pit enclosure, though of course it would not be possible to prove this without further excavation.

The LiDAR evidence for quarrying shows either as this pit ring or as long irregular hollowed areas (largely Roman?) cut across the summit, generally following a north-west to south-east alignment. At the east end of the High Wood enclosure this elongated quarry is crossed by a slight boundary bank which in turn encloses the group of ancient pollarded oaks, demonstrating that the quarry here has been disused for hundreds if not thousands of years.

The High Wood enclosure with its outer bank and internal ditch is clear on the LiDAR, particularly to the south west but it can also be traced along its north side despite parts of its alignment being cut by the later quarries. There is a suggestion of a break in the centre of the north side which may have been the original entrance into the enclosure. The magnetometry survey of the southern, unquarried part of the site (Stewart 2015) gives some additional detail of the interior in the form of a 4–5m wide ditch-like anomaly across the south-west interior but there are no other features such as enclosures, pits or ring ditches discernible.

Further north-east, the LiDAR indicates the boundary which once divided High Wood and Presly Copse, shown on the 1742 map (DHC D/BKL; Fig. 2). North of this, a group of rectilinear features, aligned north-

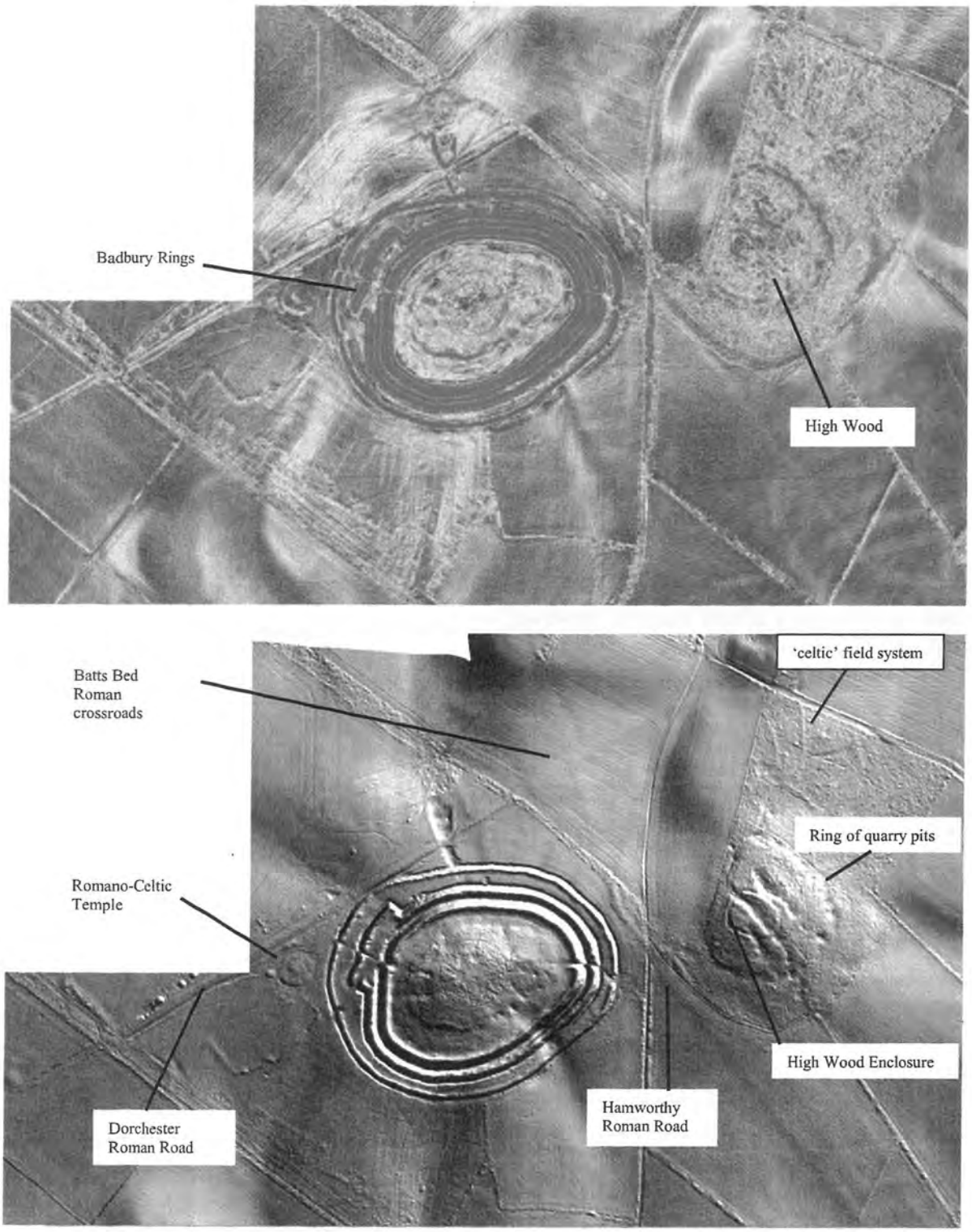


Figure 9 LiDAR plots showing features described in the text. © Harry Manley/Bournemouth University (2016). © and/or database right Environment Agency (2015).

west to south-east, are interpreted as remnants of a 'Celtic' field system. These earthworks have survived beneath the woodland here but elsewhere, though traceable as soil marks on air photographs, have largely been levelled by arable farming across the wider landscape.

Topography and Landscape Setting

Badbury and High Wood are a pair of hills, each occupied by a significant Late Iron Age site. Badbury with ditches external to its banks and High Wood with an internal ditch. Badbury hillfort was designed to protect the interior from the outside and conversely, the role of High Wood seems to have been to keep something in, perhaps something valuable or sacred. The excavation has provided no evidence to expand this idea. Iron Age sites with interior ditches are not common and examples usually date to an earlier period such as the Late Neolithic henges at Knowlton 8km north-east of High Wood; or Late Bronze Age enclosures like that found at Crab Farm 1.5km to the south-west. At Crab Farm the internal ditch had been backfilled *c.* 1000 BC and included a 'votive' offering of a cow and calf burial (Papworth 1992, 52–54).

At High Wood, the finds in and around the enclosure bank provided no indication of a ritual function for the site. Immediately west of Badbury Rings are the earthworks of the Romano-Celtic temple where coins and other finds demonstrate a concentration of votive deposits dating from the Late Iron Age to the end of the Roman period (Papworth 2014, 242–271). Perhaps the function of High Wood was for containment of livestock, but the excavation has not demonstrated anything to prove or disprove this hypothesis. Such a use would seem to be inconvenient so far from a water source, though the same could be said for the occupants of the round houses within Badbury Rings.

High Wood and Badbury as a Landmark

Another aspect of the site to be considered is its distinctive topographic location. Not only as a strategic position to construct a hillfort and enclosure but as a landmark for those potentially seeking sightlines to negotiate the countryside. There is no doubt that the Roman road builders chose the gap between High Wood and Badbury as a survey position where they created a Roman road junction. At this point, the roads to Old Sarum, Bath and perhaps Hod Hill branch to the north, north-west and west from the Hamworthy road. However, what evidence is there for any pre-Iron Age significances for the double hill?

Prehistoric monuments are often found at hilltop locations, the ramparts of a hillfort being the latest reworking of a series of occupations at such significant places. For example, the Early Neolithic causewayed enclosures in close proximity to Maiden Castle and Hambledon Hill and the Bronze Age burial mounds retained within Eggardon Hill and Pilsdon Pen. Many others could be cited and stray stone artefacts like those found at High Wood show that people were drawn to these high places in Mesolithic and earlier times.

The geomorphology of the land has remained largely unchanged since prehistoric communities viewed it and therefore there is an opportunity to plot known archaeological sites in relation to distinctive topographic landmarks and attempt to draw meaning from the distribution.

Studies in the alignments and positions of barrow groups demonstrate that the Bronze Age builders were making statements, they wished for the burial place of their ancestors to be seen and appreciated from a distance, and monuments were perhaps placed to mark a location to look out from. The position of the round barrow on the summit of Cley Hill, Wiltshire is a good example of this, creating a clear marker in the landscape to be seen at a distance. Perhaps linear groups of barrows were placed to mark annual solar and lunar events. The gap between Badbury and High Wood has been considered in this way.

Research on the barrow group at High Lea Farm, 4.5km north-east of High Wood, revealed seventeen Bronze Age ring ditches and barrows in close proximity. They were concentrated in three alignments focused on the largest barrow at the south-west edge of the group. It was suggested that the central sightline focused on the double hill of Badbury and High Wood, a prominent horizon feature from this location. This alignment was found to mark the position of the sunset at winter solstice in the Early Bronze Age (Bennett and Gale 2017, 127–136). However, this is a broad target and no precise fixed point like the Cley Hill barrow was identified on the skyline. Potentially there was once a discrete group of trees or a lost earthwork feature here which once provided a more

accurate earlier Bronze Age marker for this event. However, geophysical surveys across Badbury and High Wood have not located ring ditches or other features on their summits which would support this suggestion.

There are at least fourteen earthwork or ring ditch sites which form the Badbury barrow group (Papworth 2019, 140) but this group trends along the contour lines following the west side of the hillfort, out of sight of High Lea. Recently, the Badbury barrow group alignment has been linked to the position of the Bronze Age summer solstice over Woodbury Hill (Milwain 2020, 154–5), but landscape observations of this kind are generally difficult to prove or disprove unless associated with something like a designed stone structure; for example, the light through the passage grave of New Grange, Ireland or at Stonehenge, where the earthwork avenue is aligned with the framed stone trilithons to capture the mid-winter sunset.

At Badbury/High Wood, evidence of another two barrows has been found under or close to the line of the Hamworthy Roman road where its course passes between the twin hills (Papworth 1999, 157–8), otherwise burial mounds are absent from this area. There is now evidence for over 130 round barrows on the Kingston Lacy Estate and these are clustered on or generally follow the lines of local hill tops, ridges or are seen as false crests when viewed from the coombs and valleys (Papworth 1992, 72; National Trust Heritage Records Online).

This local density of barrows makes the absence of such sites on the summits of Badbury and High Wood seem conspicuous. It gives the impression that this locally prominent place was exclusive in the Late Neolithic and Early Bronze Age, though this absence of earthwork and artefactual evidence enables nothing more to be said than that.

CONCLUSION

The investigation described in this report has greatly improved our understanding of this place. It has brought together the historical and archaeological evidence to demonstrate that beneath a woodland, managed since medieval times, there were once quarries. These contained later Roman pottery in their backfilling and it is reasonable to suggest that High Wood was a source for the capping material found on the late Roman Dorchester Road on the west side of Badbury. The quarries cut through an enclosure which can now be dated to the later Iron Age from pottery stratified within its bank. This demonstrates that the enclosure was in use when Badbury Rings hillfort was also occupied.

The enclosure bank, overlay Middle Iron Age occupation and the lithic evidence, though redeposited, has revealed that there were also periods of occupation on the hilltop in the later Bronze Age and earlier Neolithic periods. The hiatus of evidence extending from the later Neolithic to the earlier Bronze Age is unexplained given the density of sites dating to this period in the wider landscape. However, the 2008 trench was only a small surgical archaeological incision into this place. Another nearby excavation may well find evidence from this period.

Finally, the find of the Upper Palaeolithic axe now provides a deeper time narrative for the Kingston Lacy Estate and demonstrates how much more there is to discover within this landscape.

ACKNOWLEDGEMENTS

Many thanks to Chris Green, Fay Pendall, Dave Stewart, Meg Sims, Christine Beer, Jackie Buxton, James Grasby and Nicky Ravenhill for helping to dig the trench amongst the trees, despite the clouds of insects. Thanks also to National Trust Area Ranger Peter Samson for providing tools, backup and support. Thank you to Maggie Foottit for the finds illustrations and to Gareth Davies for creating the location plan. Particular thanks to Nancy Grace the site supervisor and organiser of the trench-side 50th birthday party.

DOCUMENTS

Dorset History Centre (DHC)

1847: Tithe Map of the Parish of Wimborne Minster (T/WM)

Bankes of Kingston Lacy and Corfe Castle Family Estate Archive (D/BKL)

1380–1457: Kingston Lacy Manorial Accounts (CG3/1–3/23)

1742: 'A Plan of the Roads across the North Common Field and the Down belonging to the Manor of Kingston Lacy and through Badbury Warren taken by a Scale of about Six inches to the mile July the 22,1742' (N/A/2/22)

1773–4: 'A Survey of the Manors of Kingston Lacy, Shapwick, Shapwick Champayne and Tomson in the County of Dorset taken for Henry Bankes Esquire Lord of the said Manors in the Year 1773 and 1774 by William Woodward'

Public Record Office (PRO)

Kingston Lacy. Survey of the Warren 1564 (DL44/103) Duchy of Lancaster Archive

BIBLIOGRAPHY

Bennett, G.A. and Gale, J. 2017. 'Lines of enquiry: Linear organisation of the High Lea Farm Bronze Age barrow cemetery', *Proceedings of the Dorset Natural History and Archaeological Society* **138**, 127–136.

Bowen, H.C. 1990. *The Archaeology of Bokerley Dyke*. HMSO, London.

Brown, L. 1987. 'The Pottery', in B. Cunliffe, *Hengistbury Head, Dorset, vol 1: The Prehistoric and Roman Settlement, 3500B. C.—AD 500*. Oxford University Committee for Archaeology Monograph **13**, Oxford University Press, Oxford.

Brown, L. 1991. 'Later prehistoric pottery', in N.M. Sharples, *Maiden Castle Excavation and field survey 1985-86*. English Heritage Archaeology Report **19**, Historic Buildings and Monuments Commission for England, London, 185–205.

Brown, L. 2000. 'The Pottery', In B. Cunliffe (ed). *The Danebury Environs Programme Volume 1'. 'The Prehistory of a Wessex Landscape*. Oxford University Committee for Archaeology Monograph **49**.

Chisham, C. and Scaife R. 2005. *Badbury Rings, Dorset: Palaeoenvironmental Assessment Report*. Unpublished report by Wessex Archaeology for the National Trust.

Corney, M. and Riley, H. 1992. 'An Earthwork Survey in High Wood', *Proceedings of the Dorset Natural History and Archaeological Society* **114**, 70–1.

Davies, S.M. 1987. 'The Coarse Pottery', in P.J. Woodward (ed). *Romano-British Industries in Purbeck*. Dorset Natural History and Archaeological Society Monograph **6**, DNHAS, Dorchester, 150–7.

Garvey, A. 2006. *The Iron Age Pottery from Badbury Rings*. Unpublished report for the National Trust.

Garvey, A. 2019. 'Prehistoric Pottery', in M. Papworth, 'Excavation and Survey at Badbury Rings, Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **140**, 155–159.

Harding, P. 1991. 'Stratified Groups from Rowden and Cowleaze', in P.J. Woodward, *The South Dorset Ridgeway Survey and Excavations 1977-84*. Dorset Natural History and Archaeological Society Monograph **16**, 74–87.

Lancley, J. and Morris, E. 1991. 'Local Coarse Wares', in P.W. Cox and C.M Hearne (eds), *Redeemed from the Heath, The Archaeology of Wytch Farm Oilfield (1987-90)*. Dorset Natural History and Archaeological Society Monograph **9**, DNHAS, Dorchester, 122–132.

Leivers, M. 2019. 'Worked and Burnt Flint', in M. Papworth, 'Excavation and Survey at Badbury Rings, Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **140**, 130–171.

Mepham, L. 2001. *Iron Age Pottery from Shapwick*. Unpublished report for the National Trust.

Milwain, R. 2020, 'Additional Lines of Enquiry: Preliminary Investigations of some more Round Barrow Cemetery Arrangements', *Proceedings of the Dorset Natural History and Archaeological Society* **141**, 145–160.

Morris, E.L. 1994. 'The organisation of Pottery Production and Distribution in Iron Age Wessex', in E.L. Morris and A. P. Fitzpatrick, *The Iron Age in Wessex: Recent Work*. Trust for Wessex Archaeology, Dorchester, 26–28.

Morris, E.L. 2002. 'Staying Alive: the Function and Use of Prehistoric Ceramics', in A. Woodward and J.D. Hill (eds), *Prehistoric Britain, The Ceramic Basis*. Oxbow Books, Oxford, 54–61.

National Trust 2022. National Trust Heritage Records Online, https://heritagerecords.nationaltrust.org.uk. [Accessed 03/07/2022].

Papworth, M. 1988. 'An Enclosure in High Wood, Pamphill', *Proceedings of the Dorset Natural History and Archaeological Society* **110**, 142.

Papworth, M. 1992. 'Excavation and Survey of Bronze Age Sites in the Badbury area, Kingston Lacy Estate', *Proceedings of the Dorset Natural History and Archaeological Society*, **114**, 47–76.

Papworth, M. 1998. 'The Medieval Manorial Buildings of Kingston Lacy: Survey and Excavation Results with an Analysis of the Medieval Account Rolls 1295–1462', *Proceedings of the Dorset Natural History and Archaeological Society* **120**, 45–62.

Papworth, M. 1999. 'Kingston Lacy, High Wood Inhumation', *Proceedings of the Dorset Natural History and Archaeological Society* **121**, 155–158.

Papworth, M. 2008. *Deconstructing the Durotriges, a definition of Iron Age communities within the Dorset environs*. BAR, Oxford, BAR British Series **462**.

Papworth, M. 2014. 'The Romano-Celtic Temple at Badbury Rings, Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **135**, 242–271.

Papworth, M. 2019. 'Excavation and Survey at Badbury Rings, Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **140**, 130–171.

PCRG 1997. *The Study of Later Prehistoric Pottery: General Policies and Guidelines for Analysis and Publication.* Prehistoric Ceramics Research Group Occasional Papers **2**, Oxford.

Rice, P.M. 1987. *Pottery Analysis: A Source Book*, University of Chicago Press Chicago, IL.

Richards, J. 1992. 'The worked flint from High Wood', *Proceedings of the Dorset Natural History and Archaeological Society* **114**, 71.

Seager Smith, R.H., Mills, J.M., Comey, M, and Dickinson, B. 1997. 'Late Iron Age and Roman Pottery', in R.J.C Smith, F. Healy, M.J. Allen, E. Morris E. Barnes and P.J. Woodard, *Excavations along the route of the Dorchester By-pass, Dorset (1986-8).* Wessex Archaeology Report **11**, 102–118.

Seagar Smith, R. and Mepham, L. 2003. *The Pottery from Shapwick, Dorset.* Unpublished report for the National Trust.

Sharples, N.M. 1991. *Maiden Castle Excavation and Field Survey 1985-86.* English Heritage Archaeology Report **19**, Historic Buildings and Monuments Commission for England, London.

Stewart, D. 2015. *Magnetometer Survey, High Wood.* Unpublished survey for National Trust.

Wainwright, G.J. and Davis S.M. 1995. *Balksbury Camp, Hampshire Excavations 1973 and 1981.* English Heritage Archaeological Report **4**, Historic Buildings and Monuments Commission for England, London.

Woodward, A. 1999. 'When did pots become domestic? Special pots and everyday pots in British prehistory', *Medieval Ceramics* **22–3**, 3–10.

Woodward, P.J., Davies, S.M. and Graham, A.H. 1993. *Excavations at Greyhound Yard, Dorchester 1981-4.* Dorset Natural History and Archaeological Society Monograph Series **12** DNHAS, Dorchester.

The Author: Dr Martin Papworth is an archaeologist with the National Trust. Correspondence: editor@dorsetmuseum.org

BURYING THE FALLEN AT MAIDEN CASTLE HILLFORT, DORSET

REBECCA REDFERN AND CHRISTINE HAMLIN

The Iron Age burials excavated from the eastern entrance of Maiden Castle hillfort by Sir Mortimer Wheeler in the 1930s show a mixture of 'local' (Durotrigian) funerary traditions, as well as those seen at other hillforts (i.e. prone burials). Research by Stewart and Russell (2017) suggests that they could had been made by and for people from outside of the region. In order to investigate their hypothesis, we adapted a landmark forensic archaeology article published by Komar (2008) to understand whether the 'agent of burial' at the hillfort were the Durotriges. This was achieved by looking at variables such as numbers of individuals buried, presence of bindings, body position, grave-goods and seasonality using faunal remains. We used funerary and bioarchaeological data from cemetery sites across Dorset in order to place the findings in context, and also drew on recent isotope data available for two adult males from the site. The results strongly suggest that the majority of burials had been undertaken by the Durotriges community, with a minority either taking place during times of 'stress', such as inter-community violence or in episodes of ritual violence, which was a feature of Iron Age Britain.

INTRODUCTION

The Context of an Interpretation

Mortimer Wheeler's (1943) report of the excavations undertaken at Maiden Castle hillfort between 1934 and 1937 was published towards the end of the Second World War, after the United Kingdom had undertaken Operation Dynamo in 1940 to rescue Allied military personnel stranded at Dunkirk in France and experienced the Battle of Britain and the Blitz (1940–1941). The times in which Wheeler was working and writing were unprecedented, even for an ex-Army Officer, and when the burials with their evidence for lethal injuries were encountered, these wider factors must have contributed to his interpretation, such as naming one of the burial areas the 'Belgic War Cemetery' (see also, Carr 2012, 235). In his unpublished correspondence with Dr G. M. Morant, about the human remains, one can see how Wheeler pushes and challenges Morant, asking for details and possibilities, with Morant in one letter (14/2/1937) writing, "I am afraid that my remarks will seem to you rather inadequate, there are anthropologists, as you probably know, who will tell you the pedigree of a single skeleton, but I am unable to do that." Wheeler understood the value of a good story, and in the site report even offers advice about the need to work with the media and how to raise extra funds by selling off "trivial oddments such as beach-pebble slingstones" (Wheeler 1943, 3) (see Moshenska and Schadla-Hall 2011). In writing a narrative about native resistance

and battling an invading army, Wheeler drew upon the experiences and anxieties of the British people to create a powerful story that continues to influence the hillfort's perceived character, particularly in the minds of the public (e.g. Macpherson 2010).

Reconsiderations of Wheeler's narrative

This interpretation of the archaeological data has not gone unchallenged, particularly following Niall Sharples' 1985–1986 excavations at Maiden Castle and subsequent reassessment of Wheeler's 1930s work. Sharples (1991a) emphasised that the evidence for the Roman conquest was slight, especially when compared to the Roman ordnance discovered at Hod Hill in northeast Dorset (Richmond 1968, Stewart and Russell 2017). D. W. Harding's (2016, 191) review of Iron Age burials in Britain also suggested that the Maiden Castle interments were "a formal cemetery, as opposed to remains resulting from massacre and random disposal", such as the human remains recovered from Bredon Hill in Gloucestershire (Western and Hurst 2014; Western 2008).[1]

More recently, Stewart and Russell (2017, 160), in their reassessment of Dorset hillforts, noted that Maiden Castle had been largely abandoned in the late Iron Age and was not 'battle-ready', and question whether it even 'belonged' to the Durotriges, who inhabited Dorset at the time. While Stewart and Russell (2017, 158) support Sharples' (1991a; 1991b) suggestion that many of the people buried at the site had died in episodes of violence that pre-dated the Roman invasion and were buried following (for the most part) local funerary traditions, they do not discount the possibility that some of them had died during the Claudian conquest in AD 43. As Sharples (1991c, 125) had, they concluded that "none of the individuals represented can be proved to have died in defence of the hillfort, only that they were finally laid to rest there" (Stewart and Russell 2017, 169).

Work by Smith (2017, 149–150), based on the publication by Bishop and Coulston (2006), has proposed that the weapon embedded in the vertebra of male P7 was not a Roman ordnance, but is instead a small late Iron Age javelin head, an identification also made by Inall (2012) in her thesis (*contra* Gilliver in Redfern, 2011). This finding underscores the conclusions of Redfern and Chamberlain's (2011) reassessment and revision of the Maiden Castle demographic data, which suggested that combatants were interred alongside those who had experienced natural deaths. We now also know, that this included people whose natal and/childhood identities were not local – male P7 and the male he was buried alongside (P7A) spent their early childhood further north and east of Dorset, and potentially, outside of Britain (Redfern *et al.* 2021).[2] Together, these new perspectives, allow us to revisit the funerary and bioarchaeological evidence, and to explore Stewart and Russell's (2017, 162) hypothesis that "interment [at Maiden Castle] can be viewed as a deliberate act by subsequent communities to hijack and rewrite the significance of an earlier, perhaps even ancestral, monument for burial that was the key element of Durotrigian culture".

To undertake this investigation, our research employs a landmark forensic article published by Komar (2008) based upon her work in Bosnia and Iraq, and a re-examination of the published archaeological reports for Crow Creek (*c.* AD 1325, South Dakota, USA) and the Battle of Towton (*c.* AD 1461, Yorkshire, England). Her study demonstrated that the 'agent of burial' – either "self or friend (same ethnic group, relatives, or associated army)" or "other or enemy (different ethnic group or opposing armed forces)" (2008, 124) – can be identified in both forensic and archaeological contexts using funerary and osteological data.

Whilst acknowledging the resonance and influence that the dead have in the lives and communities of the survivors, witnesses and descendants (e.g. Dwyer 2009; Jessee 2012; Renshaw 2010), Komar does not dwell on the 'power' that the handling, manipulation and burial or reburial of the dead has on or for a community and its wider social networks, as well as on or for the perpetrators. This is because, in many cases, such deaths are considered to be outside social norms, being 'unnatural' or 'polluting' (Novak 2008; Anstett and Dreyfus 2017), and these individuals may thus be left unburied (Kalmar Läns Museum 2019) or, conversely, undergo complex funerary rituals (Gummesson *et al.* 2018) – such as 'self' burying 'other' at the Iron Age site of Alken Enge in Denmark, where body parts from the defeated were processed,

separated and manipulated over many months (Molleson *et al.* 2016). Other forensic, ethnographic and historical studies have shown that the disposal of bodies during violence can result in their near-destruction and fragmentation (Smith *et al.* 2017; Melbye and Fairgrieve 1994), and emphasise that the nature of the violence can determine whether public or concealed burials took place (Mikellide 2014).

SITE AND MATERIALS

Maiden Castle hillfort is located 1km from the modern County town of Dorchester in Dorset, and consensus holds that this area of Britain was inhabited by the Durotriges in the late Iron Age (Papworth 2011; Cunliffe 2014; Cunliffe 2009; Gale 2003; Putnam 2007; Whimster, 1981). Archaeological data indicate the hillfort served many purposes for the Durotriges over time: as a settlement, a burial ground, a place for metalworking, and as a manifestation of centralised power (Sharples 1991a). Wheeler's (1943) phasing of the hillfort and cemetery was based on Hawkes' (1939) 'ABC' cultural divisions, as the 1930s excavations were undertaken to test these divisions (Hawkes 1978). Today, Wheeler's 'Iron Age A' group (300–100 BC) consists of burials likely dating to the middle Iron Age, whilst the 'Iron Age B' and 'Iron Age C' burials and the 'Belgic War Cemetery' are attributed to the late Iron Age (LIA; 1st century BC to 1st century AD) (Table 1) (Figure 1).[3] Both Sharples (1991a) and the second author (Hamlin 2007) believe that Wheeler's groupings have created false divisions between the burials in and behind the hillfort's eastern entrance, as these burials reflect normative Durotrigian funerary traditions, though Maiden Castle is the only burial location in the confederation's territory to have multiple burials.[4]

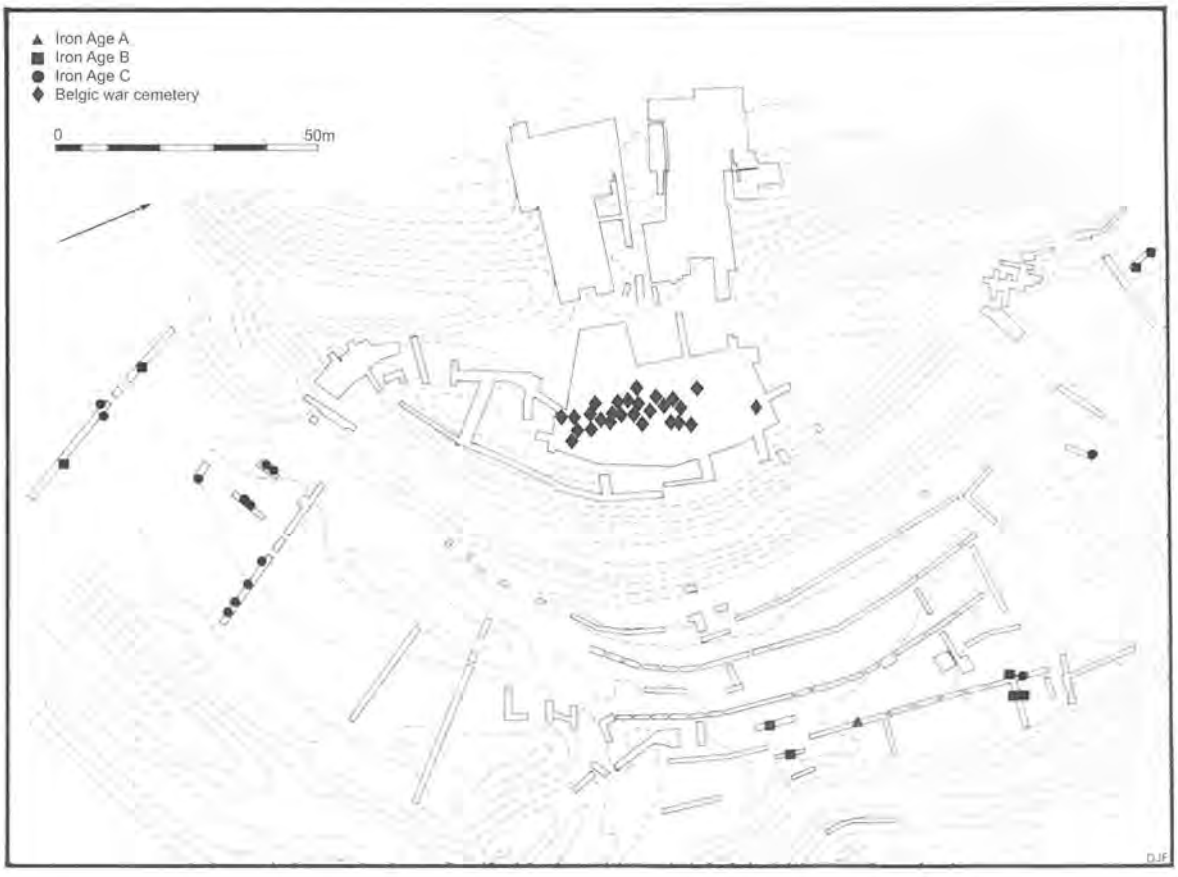


Figure 1 Map showing the location of Iron Age A/B/C and Belgic War cemetery burials in the eastern entrance (after Sharples 1991c, Fig. 90. Redrawn by Rapson) (Redfern and Chamberlain 2011, Fig. 2).

Table 1 Summary of Wheeler's (1943) burial phasing and their characteristics

Wheeler phase	Date/period	Funerary characteristics
Iron Age A	300–100 BC (middle Iron Age)	Burials in pits or existing features within the hillfort. No grave-goods
Iron Age B	1st century BC–1st century AD (late Iron Age)	
Iron Age C		Burials in the ramparts and ditches of the eastern entrance. A small number of individuals were buried with grave-goods
Belgic War Cemetery		Burials placed directly behind the eastern entrance

The Durotrigian Funerary Tradition

The Durotrigian funerary tradition is one of only three in Iron Age Britain that included the consistent interment of individuals with a distinctive grave goods assemblage (cf. Cunliffe 2009; Whimster 1981).[5] Despite its name, however, the Durotrigian rite was not utilised by all subunits of the Durotrigian confederacy; it was, rather, limited to those occupying the southern portion of the territory, particularly in the Dorchester/Weymouth area (Valentin 2003, 45). This rite was characterised by flat-grave inhumation cemeteries at farmstead settlements and hillforts, with graves containing flexed/crouched individuals interred with what Whimster (1981, 37) termed "a limited but distinctive range of grave goods." These inclusions were typically of the following types: animal remains, which are commonly interpreted as food offerings meant to sustain the deceased on an afterlife journey; pottery, the most common type of which was Black Burnished Ware (BBW); personal ornaments such as brooches and finger- or toe-rings; and utilitarian items such as hobnailed footwear, tools and weapons (Hamlin 2007, 286–289, 301–305). Our description of normative Durotrigian funerary behaviour in this paper is based on the second author's 2007 survey of LIA burials in Dorset, which included and expanded upon earlier work by Wheeler (1943), Whimster (1981) and Philpott (1991). Importantly, it included a complete review of Wheeler's unpublished excavation field notes and photographs, which are held by Dorset Museum. The unpublished data were compared with Wheeler 1943 to correct publication errors (see Hamlin 2007, Appendix C) (Fig. 2). The LIA Dorset reference sample used in this study (N=125) included 1st century BC/1st century AD burials from Alington Avenue, Fordington, Dorchester (N=6) (Davies *et al.* 2002); Flagstones, Dorchester (N=7) (Smith *et al.* 1997); Fordington Bottom, Bradford Peverell (N=11) (Smith 1993); Maiden Castle (N=67) (Wheeler 1943); Manor Farm, Portesham (N=5) (Valentin 2003); Pins Knoll, Litton Cheney (N=6) (Bailey 1967); the Portesham 'Mirror Burial' (N=1) (Fitzpatrick 1997); Poundbury Camp, Dorchester (N=8) (Farwell and Molleson 1993); Tolpuddle Ball, Tolpuddle (N=2) (Hearne and Birkbeck 1999); and Whitcombe Farm, Whitcombe (N=12) (Aitken and Aitken 1991).

The Maiden Castle Sample

A total of 86 Iron Age individuals were included in Wheeler's original report and analysis (Goodman and Morant 1940; Morant and Goodman 1943), though only 62 are present in the Duckworth Collection (University of Cambridge) (Redfern 2011). Re-analysis of these human remains by the first author established that 74.2% had sustained trauma before (ante-mortem) and/or at the time of death (peri-mortem), which was observed in 87.5% of adults in the LIA 'Belgic War Cemetery' (BWC), 54.4% of IA B (LIA), and 75% of IA 'C' (LIA) group. No subadults or individuals in the Middle Iron Age 'A' group had evidence for ante- or peri-mortem trauma. The trauma found in the LIA population consisted of sharp-force injuries inflicted by bladed or projectile weapons and blunt-force injuries produced by direct

Figure 2 Excavation image of burials from the Belgic War cemetery in the eastern entrance ©Society of Antiquaries and Historic England

blows to the victims' bodies, including by projectiles. Adults of both sexes presented with multiple injuries produced by sharp and/or blunt weapons. The distribution and type of trauma showed that individuals had been stabbed, suffered defensive injuries to their arms and hands, sustained blows to the face, and/or were decapitated. In the case of one female (P19), sharp-force injuries to the lower leg would have prevented her from fleeing her attacker (Redfern 2011; Redfern 2009). Detailed information about the bioarchaeological evidence for violence and catastrophic mortality are fully described and illustrated in Redfern (2011) and Redfern and Chamberlain (2011).

Demographic analysis found that the difference in the distribution of subadults and adult males and females was statistically significant, as the hillfort had more males present, and the LIA individuals (see Table 2) – particularly those from the BWC – conformed to a catastrophic mortality profile and had a younger age-at-death when compared with other contemporary cemeteries from Dorset (Redfern and Chamberlain 2011).

METHODS

This study drew on data collected for the authors' theses and later publications, which captured funerary and bioarchaeological data from the site archive held at Dorset Museum and the Duckworth Collection about the burials and human remains excavated at Maiden Castle and published by Wheeler (1943) (see (Hamlin 2007; Redfern 2006; 2012; 2011; Redfern and Chamberlain 2011). These data were compared with the variables identified by Komar (2008) (Table 3), though we were unable

Table 2 Summary of the basic demographic information. For the Maiden Castle population, these data are based on the individuals present in the archive (see Redfern and Chamberlain 2011, 71, Table 1, Figures 3 and 4; Redfern 2011 118, Table 2).

Sites	Subadults (< 18 years old)		Adult males		Adult females		Total
	N	%	N	%	N	%	
Reference sample	48	54.5	23	26.1	17	19.3	88
Maiden Castle (total)	23	30.7	35	46.7	17	22.7	75
Iron Age A	2	100	-	-	-	-	2
Iron Age B	4	36.4	1	9.1	6	54.5	11
Iron Age C	1	6.2	7	43.7	8	50	16
Belgic War cemetery	-	-	22	68.7	10	31.2	32

Table 3 Summary of the Komar (2008, after Tables 2 and 3) mortuary variables included in this study.

Variable group	Variable detail	Observation
Agent of burial	Self/friend	Shared social grouping, relative or associated combatants
	Other/foe	Enemy or opposing military force
	Neutral party	Neither self or foe
Total number of graves	• Single	Self: single interments
	• Multiple (2-9 individuals)	Self/other: <10 individuals
	• Mass (> 10 individuals)	Other: mass
Grave type	• Primary	Self: normative Other: body disposal
	• Secondary	Self/Neutral: to provide normative burial. E.g. recovery of surface-deposited remains or to ensure the deceased are placed in the 'right' location Other: movement of remains to evade detection
Spatial distribution	• Cemetery	Self/Others
Grave construction	• Manual • Natural feature • Undetermined	Other more likely to use natural features
Grave marking	• Marked • Unmarked	Veneration exclusively associated with self or neutral
Body position (single)	• Supine • Prone • Side/erratic	Erratic: exclusively a feature burial by others

Body position (multiple/mass)	• Orderly placement • Erratic commingling • Erratic deposition of parts	Self: orderly Other: erratic
Body covering	• Clothing • Nude • Blanket or other covering	Self/Neutral/Others: this depended on body decomposition, availability of covering, and normative burial rites
Coffins	• Present • Absent	Veneration exclusively associated with self or neutral
Binding, gags, and blindfolds	• Present • Absent	Majority observed in burials by others, but can be self in extenuating circumstances – not wanting to closely handle a decomposing body or because of notions about 'pollution'
Evidence of burning (not for cremation)	• Present • Absent	Other more likely to purposefully burn bodies

to include many features proposed by her study. Data regarding grave depth, for instance, were not present in either the unpublished site notes held at Dorset Museum or in Wheeler's published report (1943, 337–360). Nor did we address the presence/absence of coffins, as these are rarely found in Late Iron Age Dorset and were not normative to the Durotrigian funerary tradition (Hamlin 2007; Blackmore *et al.* 1979). Discussion of grave-markings was not possible as, again, these were not normative to the Durotrigian tradition,[6] nor was the manner of grave construction (manual vs. mechanical) included, as mechanical digging equipment did not exist in Iron Age Britain. Also not addressed were the presence/absence of clothing/body coverings, as no textiles dated to the LIA have been recovered in mortuary contexts in Dorset (Hamlin 2007),[7] nor was the presence/absence of evidence for burning of the corpse, as no burning or charring has been observed (see Symes *et al.* 2015). In her publication, Komar acknowledged that identifying contemporaneous graves is challenging for archaeologists, but the issue can be resolved by creating temporal horizons based on material culture, a suggestion made possible at Maiden Castle because of the pottery and metalwork placed with many of the individuals. These were used by Sharples (1991a; 1991c) to re-phase the cemetery and reflect the dating used by the authors in this study.

Additionally, we included three variables not discussed in Komar's work that provide period- and territory-related data relevant to determining the agent of burial: the presence/absence of grave goods; whether the grave goods were typical of Durotrigian burials; and the archaeological evidence for seasonality based on the faunal remains of lambs (Davis 2012). Since the Durotrigian grave goods assemblage so often included the presence of animal remains, they could tie the Maiden Castle burials to the event of 43 AD so vividly described by Wheeler. As the primary sources for the Claudian invasion state that it occurred in after the winter of 42/43 AD and continued in the south throughout the summer (Tacitus 1973, 18; Todd 2007, 45–46). Iron Age pastoral agriculture was dominated by sheep, and lambing season is influenced by temperature and weather (Hansen and Wooster 2005; Albarella 2007). Britain's climate during the late Bronze Age and early Iron Age is believed to have deteriorated with increasing rainfall, but then subsequently recovered (Roberts 1989; Cunliffe 2014). It has been suggested

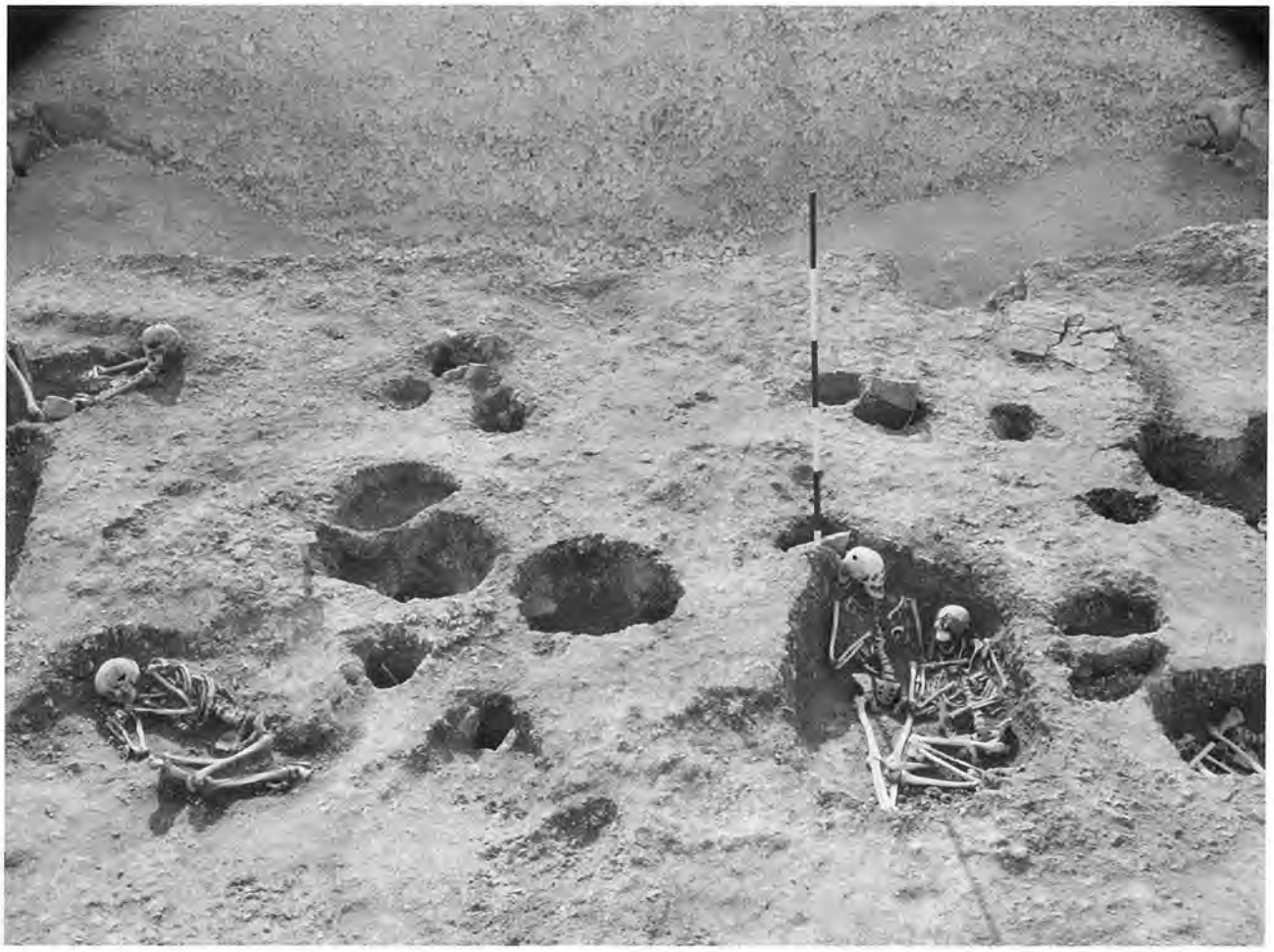


Figure 3 Excavated burials from the Belgic War cemetery in the eastern entrance ©Society of Antiquaries and Historic England

that prior to improvements in animal husbandry practices during the Roman period (Albarella *et al.* 2008), lambing occurred only once a year, typically during the spring and, possibly, into early summer (Hansen and Wooster 2005; U. Albarella, pers.comm).

Chi-Square tests with significance set at $P= 0.05$ were applied to investigate burial type (see Hamlin 2007, 118–121), and the same were also used in the demographic analysis by Redfern and Chamberlain (2011, 71).

RESULTS

After the exclusion of the elements noted above, the following variables from Komar's study remained for examination: the minimum number of individuals per grave (MNI); the presence/absence of binding, gags or blindfolds; and body position.

Agent of burial and minimum number of individuals (MNI)

Komar (2008, 125) found that the number of individuals placed in a single grave was a statistically significant indicator of the agent of burial: single interments were predominantly attributable to 'self', multiple burials (more than one, but less than 10 bodies per grave) were associated both with 'self' and 'other', whilst mass graves (those with more than 10 individuals) were exclusively 'other'. In the LIA Dorset sample (N=120 for whom data were available), single inhumation was the majority rite (N=108, 90.0% of sample) and multiple internments were rare (N=12, 10.0% of sample). Multiple interments were found only at Maiden Castle (Hamlin 2007)[2] though even there (N=64 for whom data on this variable were available) they were uncommon (N=12, 18.8% multiple vs. N=52, 81.1% single). The sole multiple burial in the LIA 'B' and 'C' groups was of two infants

Figure 4 Excavation image of the burial of P14 (25-29 year old female) ©Society of Antiquaries and Historic England

(R2 and R3 in Pit R1). All other multiple burials were recovered from Wheeler's BWC, a statistically significant difference (P=0.0004) when compared with groups 'B' and 'C'. Within the BWC specifically, 61.8% of individuals (N=21) were interred singly, 29.4% were definitively multiple burials (N=10: P7/P7A; P19/P19A; P22/P23; P24/P25; P26/P27), and 8.8% were 'unknown' MNI (N=3: P16, P17, P18; described by Wheeler [1943, 353] as "three skeletons, all fragmentary...and possibly all originally in the same shallow grave").[8] All definitively multiple burials included two individuals, with two female-male pairs (P19/19A, P26/27) and three male-male pairs (P7/7A, P22/23 and P24/25) (Fig. 3). All these individuals had sustained peri-mortem trauma, including P19, a 35–39 year old female with a sharp-force weapon injury to her right radius and her left lower leg, as well as multiple blunt-force injuries to her cranium. Given that single interment was the norm in LIA Dorset, including at Maiden Castle, we propose that the agent of burial for the multiple burials at the site was 'self' in extenuating circumstances, most likely in the aftermath of armed conflict.

Presence of bindings, gags or blindfolds

Based on the unpublished Maiden Castle excavation notes, photographs taken during excavation, and Wheeler's published report, one individual appears to have had her hands bound when she was interred (Fig. 4). This 25–29 year old female (P14) had three peri-mortem sharp-force weapon injuries to her head and at least three stabbing injuries visible on one right rib. She was buried "lying on the face [prone]...arms bent behind the body (possibly bound at the time of death)" (Wheeler 1943, 353). Her position is illustrated in a photograph taken at the time and shows her arms were flexed at the elbow behind her back, with her hands (left-over-right) resting just above her hips. The positioning of her

Figure 5 Excavation image of the burial of P29 (30-34 year old male) ©Society of Antiquaries and Historic England

hands conforms to archaeological examples of hand/wrist binding, such as those from Early Medieval (5th–11th centuries AD) execution cemeteries (Reynolds 2009, 165) (see also Buckberry 2014; 2010). The treatment of this individual conforms to burial by 'other', though 'self' in extenuating circumstances cannot be ruled out, as forensic studies have shown that when people have to bury or rebury their dead

very quickly, it is often not possible to remove clothing or bindings due to decomposition or they are unwilling to do so due to socio-cultural notions of 'pollution' (amongst others, Hepner *et al.* 2018; Petrović-Šteger 2009).

Agent of burial and body position

Komar (2008, 125) proposes that "erratic", or non-traditional, treatment of the body is exclusively a feature of burial by 'other'. The normative rite in the Durotrigian mortuary tradition (N=108 for whom these data were available) was positioning the body in a crouched/flexed position on its right or left side (52/108, 48.1%) or on its back (supine; 45/108, 41.7%). Prone burial was uncommon (N=11/108, 10.2%; Hamlin 2007, 131). Six of the prone burials in this sample were discovered at Maiden Castle: two individuals from the LIA 'C' group (T21 and T27, both female); and four from the BWC (males P12 and P29, and females P14 and P26) (Fig. 5).[9] Both LIA 'C' individuals exhibited evidence of trauma: T21 was a 36–45 year old female with peri-mortem rib fractures and blunt-force cranial trauma, and T27 was a 30–34 year old female with peri-mortem injuries to the ribs, right forearm (likely defensive wounds), blunt-force blows and projectile damage to cranium. Of the four BWC prone individuals, three of the four exhibited evidence for trauma. P12 was an adult male (>18 years) with peri-mortem defensive injuries to the forearms and rib, and multiple sharp-force injuries to the cranium, whist P29 was a 30–34 year old male with no evidence for peri-mortem injuries. P14 was a 25–29 year old female with peri-mortem injuries whose hands were bound behind her back (discussed above). P26 was a 30–34 year old female who had peri-mortem blunt-force injuries to the front and sides of her cranium. She was buried with her face downwards, her legs bent backwards at the knees, her left arm bent underneath her body and right arm by her side. She was placed on top of the right side of male P27, who was supine (Wheeler 1943, 354–355). We posit the combination of prone burial and trauma suggests these burials conform to Komar's (2008, 125) category of burial by 'self' in extenuating circumstances. P14, as noted above, is possibly burial by 'other', though burial by 'self' in extenuating circumstances cannot be ruled out.

Grave goods presence/absence

The inclusion of grave goods, as noted earlier, was a common feature of the Durotrigian funerary rite. In the Dorset reference sample, 76 (60.8%) of the 125 individuals for whom grave goods data were available were interred with at least one item. Of these, 39 of the 76 (51.3%) were male, 31 (40.8%) were female, and 6 (7.9%) were sex-indeterminate. Grave goods were typically included with the majority of individuals at most sites, with a generally even distribution of goods between males and females, which is why the inclusion of grave goods is described as 'normative' in the Durotrigian tradition. That does not, however, mean that grave goods are always recovered at LIA mortuary sites in Dorset: at the Flagstones site, for instance, none of the dead was buried with grave goods (Smith *et al.* 1997). Nor is the distribution of grave goods always gender-neutral: males represent 50.7% of the Maiden Castle sample, yet received 61.8% of the grave goods. This underscores the fact that the Durotriges were a confederacy, not a hegemonic entity, and use of the descriptor 'normative' is intended to describe funerary behaviour at the majority of sites.

Since Maiden Castle contributed the largest number of individuals to the aggregate LIA Dorset sample (67/125), these data were removed from the combined sample to determine if the site differed from the overall patterning of the other sites. The Dorset reference sample contained 58 individuals when those from Maiden Castle were removed. Of these, 42 (72.4%) were recovered with grave goods; this included 18 males (42.9%), 19 females (45.2%), and five (11.9%) sex-indeterminate.

When the Maiden Castle data were considered in isolation, LIA burial groups 'B', 'C' and BWC (N=67 for whom grave goods data were available) included 34 individuals (50.7%) interred with at least one item. These included 21 males (61.8%), 12 females (35.3%), and one sex-indeterminate (2.9%). When data from the three LIA groups – LIA 'B', LIA 'C' and BWC – were considered separately, it was found that the inclusion of material culture was rare in LIA 'B' burials (4/15, 26.7%), whilst more than half the LIA 'C' (10/18, 55.6%), and BWC (20/34, 58.8%) individuals were interred with at least one item. That the total overall

rate of grave goods inclusion was lower at Maiden Castle than at the majority of sites in the LIA Dorset sample may be reflective of the fact that the cemetery could have been a communal burial space for those who died elsewhere (Sharples 1991c; Hamlin 2007) – which included people who had spent their early childhoods outside of Durotrigian territory (Redfern *et al.* 2021). Therefore, is representative of either communal ideas related to the manner of one's death or, conversely, representative of the wider range of intra-community funerary variants.[10] Even so, the pattern of grave goods inclusion with a majority of individuals at Maiden Castle was consistent with the recognised regional pattern and suggests that the agents of burial were 'self', sometimes 'self' in extenuating circumstances. This was underscored by a consideration of the grave goods inclusion rates for those at Maiden Castle with evidence of trauma: of the 34 individuals with at least one grave inclusion, 26 (76.5%) were individuals with evidence of trauma. This includes the adolescent female (T29, LIA C) who was buried holding an arrow (Wheeler 1943, 350–351), but had suffered multiple peri-mortem blunt-force injuries to her cranium (Redfern 2011).[11] This indicates that even in extenuating circumstances, those burying the dead at Maiden Castle followed normative Durotrigian practices and underscores the agent of burial as 'self'. That the 26 individuals with evidence for both grave goods and trauma included 19 males and seven females is consistent with Redfern and Chamberlain's (2011) 'catastrophic mortality profile' for Maiden Castle (see also Sharples 1991c, 125; Hamlin 2007, 81).

Grave goods type

The grave goods, most frequently included with Durotrigian dead were, as noted earlier, animal remains, pottery, personal ornaments and utilitarian items (Hamlin 2007, 286–289, 301–305).

Of the 76 individuals in the Dorset reference sample with whom at least one grave good was recovered, 35 were recovered with animal remains. Of these, 16 (45.7%) were male, 16 (45.7%) were female, and three were sex-indeterminate (8.6%). Pottery was recovered with 44 individuals: 25 males (56.8%), 14 females (31.8%), and five sex-indeterminate (11.4%). Personal ornaments were recovered with 24 individuals: eight males (33.3%), 15 females (62.5%), and one sex-indeterminate (4.2%). Utilitarian items were recovered with 13 individuals: eight males (61.5%) and five females (38.5%). That the number of individuals with a particular grave good type (N=116) exceeds the total number of individuals (N=76) reflects the fact that some individuals were interred with more than one type of inclusion.

When data from Maiden Castle was excluded, the Dorset reference sample contained 42 individuals with whom at least one grave good was recovered. Of these, 26 were recovered with animal remains. This included 11 males (42.3%), 12 females (46.2%), and three sex-indeterminate individuals (11.5%). Pottery was recovered with 24 individuals: 12 males (50.0%), eight females (33.3%), and four sex-indeterminate (16.7%). Personal ornaments were recovered with 16 individuals: four males (25.0%), 11 females (68.8%), and one adult of indeterminate sex (6.3%). Utilitarian items were recovered with six individuals: four males (66.7%) and two females (33.3%). As noted above, that the number of individuals with a particular grave good type (N=72) exceeds the total number of individuals (N=42) indicates multiple inclusion types with a single individual.

Of the 34 individuals recovered with grave goods in the LIA Maiden Castle burial groups ('B', 'C' and BWC combined), nine were recovered with animal remains: five males (55.6%) and four female (44.4%). Pottery was recovered with 20 individuals: 13 males (65.0%), six females (30.0%), and one sex-indeterminate adult (5.0%). Personal ornaments were recovered with eight individuals: four males (50.0%) and four females (50.0%). Utilitarian items were recovered with seven individuals: four males (57.1%) and three females (42.9%). As noted above, that the number of individuals with a particular grave good type (N=44) exceeds the total number of individuals (N=34) indicates the inclusion of more than one item type with some individuals.

Twenty-six (26) of the 34 individuals interred with at least one grave good exhibited evidence of ante-mortem and/or peri-mortem trauma, as discussed above. When considered as a separate sample, only groups LIA 'C' and BWC were represented. Of the three individuals recovered with animal remains,

all were male (100%). Pottery was recovered with 16 individuals: 11 males (68.7%), four females (25.0%), and one sex-indeterminate adult (6.3%). Personal ornaments were recovered with five individuals: three males (60.0%) and two females (40.0%). Utilitarian items were recovered with two individuals: one male (50.0%) and one female (50.0%). A total of 26 items were recovered with the 26 individuals with trauma, a per-individual number lower than that when the combined LIA Maiden Castle groups ('B', 'C' and BWC) is considered. This supports the possibility that these individuals were buried in extenuating circumstances.

Seasonality

At Maiden Castle, four burials contained animal inclusions. The presence of lambs in the graves of two males (P9 and P12) suggests they died in the springtime (U. Albarella, pers.comm). This does not, however, exclude the possibility that those with mutton (male P19A and P20 adolescent female) may also have died at that time, as older sheep tend to be slaughtered at the end of their natural life or usefulness, such as when they can no longer be milked, as modern sheep only produce milk for the first 80–100 days after lambing (Wikipedia 2019).

DISCUSSION

Our application of Komar's (2008) funerary model to determine whether the LIA burials excavated at the Maiden Castle hillfort over eight decades ago were made by the autochthonous Durotriges or by 'others' found that the majority of variables conformed to burial by 'self' or 'self in extenuating circumstances'. These results confirm Sharples' (1991a; 1991b; 1991c) conclusions that the burials of those with peri-mortem violent injuries had been undertaken by the Durotrigian community since they conformed to their distinctive inhumation rite, an interpretation continued into recent scholarship (Stewart and Russell 2017; Harding 2016). The presence of multiple burials at this site is unique amongst Durotrigian cemeteries, with the majority containing individuals who had lethal peri-mortem injuries and evidence for over-kill (Redfern 2011). Excavation evidence from conflict sites (Holst 2005) shows that, in addition to mass graves being used to bury the dead near or on battlefields, the dead may frequently be buried singly or multiply (in small numbers) in formal cemeteries some distance from where they met their death. At Maiden Castle, the multiple burials may include combatants and/or victims of both sexes who died in episodes of violence. The hillfort is also distinctive for having a high number of prone burials containing individuals with peri-mortem weapon injuries. Prone burials are commonly interpreted as reflecting non-normative or deviant inhumations (Murphy 2008). However, as the majority of prone burials from LIA Dorset have been found at Maiden Castle and contain individuals with skeletal injuries[12] – such as female P26 and male P27, both of whom had received multiple peri-mortem injuries to the head – it is likely that their burial position was related to the social identity and/or the nature of the individual's death (see Giles 2015). For Iron Age communities, creating prone internments appears to be a feature of ritual violence – subjugating a group's 'othered', and a feature of what is increasingly being recognised as a highly complex, lengthy and varied inhumation tradition in Britain (see Booth and Madgwick 2016; Giles 2020).

It is also likely that the same meaning applies to female P14, whose internment was the only one at the site – and in all Dorset – that conforms to burial by 'other' as well as 'self in extenuating circumstances'. For us, the binding of her hands has visual resonance with bodies found during forensic excavations of mass graves, such as those in Guatemala (Flavel and Barker 2016). However, IA communities could have viewed the arrangement of her body as signifying ritual violence and/or normative funerary practices, whereby bodies were manipulated and arranged after death, often allowing them to be curated and revisited, and placed in locations of significance (Booth and Madgwick 2016; Tollefsen 2019; 2021).

The presence of lamb remains in burials suggests the interment of some individuals during the spring. Given that the embedded projectile found in the vertebra of P7 is now considered to be an Iron Age weapon, the lamb bones are the only data that correlate with the documentary evidence for the Claudian invasion in the spring of 43 AD (Todd

2007). However, such timing was not exclusive to the invasion, as violence in this period was likely to have included raiding activities (Cunliffe 2009). These are often organised to steal crops or to ensure they were destroyed before harvest-time, as the decimation of growing plants in the spring would cause food shortages and social stress (Brink and Price 2008; Hendrix and Brinkman 2012). As work on pre-Contact North American populations shows, raids could be organised to take place when people were undertaking agricultural labour, and therefore vulnerable to attack and capture (amongst others, Osterholtz and Martin 2017; Turner and Morris 1970; Keeley 2016).

A consideration of the data suggests the people interred at Maiden Castle, particularly those from the LIA 'C' and BWC, were buried by their community (self), although this may include during periods of social stress – 'self' in extenuating circumstances. Therefore, the violence that led to their deaths and subsequent funerary treatment requires further exploration, as it is very unlikely to reflect just one type of violent act; we know that many different forms existed in IA society, including ritual, inter-personal and organised violence between combatants/communities[13] (Redfern 2019; Aldhouse Green 2001; 2005). The 'web of violence' model (Hamby and Grych 2013; Turpin and Kurtz 1997) posits all types of violence within a society are connected, with rates and types fluctuating in response to social change or unrest, such as intimate partner violence increasing during times of conflict (Engle Merry 2009). Although we can 'see' that different forms existed in the LIA, our ability to understand their meaning and power is difficult since they represent temporally unique socio-cultural and political constructions that have no contemporaneous record written by the communities themselves.[14] The distribution, type and presence of multiple injuries observed in the people buried at Maiden Castle have been shown to correspond to those sustained during episodes of organised violence, which in this period includes inter-tribal conflict, raiding and, potentially, fighting against the Roman army during the Claudian conquest of 43 AD (Redfern 2007; 2011; Redfern and Chamberlain 2011). Therefore, their burial, as Stewart and Russell (2017, 162) propose, served "to ... rewrite the significance of an earlier ... monument for burial". Developing their statement further, we propose that their violent deaths were transformed by performative violence through their funerals and choice of burial location to have power for the Durotrigians, making the hillfort (and their territory) a space for shared identity, a place for remembrance and, if some or all of these people were killed by the Roman army, perhaps a memorial of resistance.[15]

Though the injuries observed on the skeletons of many individuals from this hillfort conform to conflict, it is by no means definitive that they died in such a scenario.[16] The description of ritual violence in Iron Age societies both in Britain and across Europe is graphic and bloody (Aldhouse Green 2001), as typified by Tacitus' (1973, XIV, 30–31) famous description of Anglesey *c.* 60–61 AD: "It was their religion to drench their altars with the blood of prisoners and consult their gods by means of human entrails". The presence of people buried prone, as well as the unique interment of P14, which conforms to both 'other' and 'self' in extenuating circumstances, all find parallels in examples, such as Danebury and Lindow Man, identified by Aldhouse Green (2001; 2005) in her work on sacrifice, captives and enslavement in IA Britain (see also Giles 2020; Redfern 2020). Although the IA pit burials and deposits of disarticulated human bone at Maiden Castle have been interpreted as reflecting 'partible individuals' or 'special deposits', thus reflecting ritual behaviours and complex funerary rites[17] (Sharples 2010; 2014; Redfern 2008), it is Aldhouse Green's (2001; 2005) and Giles' (2020) work that focuses on the reasons why individuals subjected to this ritual violence were selected, raising the under-explored hypotheses of enslavement and captivity in IA communities.[18] Their writing suggests that power resided not only in the person's social identity and value, but in the worth of their physical body and the transformative experience or 'drama' of their deaths.[19] Considering that structured or 'ritual' deposits of modified and/or disarticulated human remains maybe found close to or within other burial areas in IA Dorset (e.g. Gussage All Saints (Redfern 2008)), the inclusion of individuals who died during performative acts of violence may not have been outside Durotrigian 'normative' rites at all, especially given that these burials date to a period of social stress, conquest and colonisation. The choice of

Maiden Castle as a location for their bodies to be interred may well reflect socio-political statements of power by the Durotriges.

CONCLUSIONS

The study strongly suggests that the individuals excavated at Maiden Castle hillfort were buried by their community (self), although some burials took place during times of social stress ('self in extenuating circumstances'). This finding supports Wheeler's (1943, 63) interpretation, "the survivors crept forth from their broken stronghold, and in the darkness, buried their dead as nearly as might be ... the task was carried out anxiously and hastily and without order, but even so, from few graves were omitted those tributes of food and drink which were the proper and traditional prerequisites of the dead." This acknowledgement of normative rites in the midst of danger is also echoed by the First World War artist, Paul Nash, who visited the excavations, and described the skeletons as "sprays of blanched sprigs and branches" (English Heritage 2021). For Wheeler, it is clear that his emphasis is on resilience to invasion and that the hillfort's archaeology could contribute to this public feeling. Close comparison of the excavation archive and published writings about the site raises numerous inconsistencies and contradictions,[20] but one must be mindful that Wheeler was skilled at making archaeology famous, ensuring that he had the funds and the press exposure he needed to deliver a project (Moshenska and Schadla-Hall 2011). This is uncomfortable to us, but we must be mindful of what the United Kingdom had experienced in the war, and not forget the passing of his wife, Tessa Verney-Wheeler in 1936, who had jointly directed the excavations at Maiden Castle but had been subsumed by the "Wheeler brand" (Carr 2012, 211).

The evidence for the burials taking place during times of social stress, may well include the Claudian conquest (Sharples 1991c; Stewart and Russell 2017). Though in the present study, the only evidence to support this is the inclusion of lamb joints as grave goods.[3] In contrast to other contemporaneous burial sites in Dorset, body positioning at the hillfort shows great diversity in the LIA and many of those interred both singly (e.g. female T21) and in the site's already-unique multiple burials have unusual body positioning and limb arrangements (e.g. female P26/male P27 vs. males P7/P7A). Some show a blending of normative and non-normative funerary elements, such as P14, a female with both ante-mortem and peri-mortem trauma who was buried prone, and likely bound, but with a leg of lamb and personal ornament (finger-ring). This suggests that we are not 'seeing' just one type of violence, both in the remains of the people and their funerary treatment. It is likely that these burials include individuals whose deaths played a role in performative acts of violence undertaken by the Durotriges as expressions of social and political power. Aldhouse Green's (2001) work reminds us that they may not be combatants (see also Redfern 2020), a convenient narrative persuasively argued by Wheeler (1943), but instead raises the possibilities of victims of inter-community warfare, captives and the enslaved, and the power that their bodies held when transformed by death.

ACKNOWLEDGMENTS

We would like to dedicate this work to the memory of Peter Woodward, who supported and encouraged us both in our study of the Durotrigians.

We remain most grateful to curators past and present at Dorset Museum for all their help and support during our research activities, and also the Historic England Image Archive and the Society of Antiquaries for providing the excavation images and giving us permission to use them in this work. We would also like to thank the reviewers for their help and support. RR would like to thank Prof. Niall Sharples for his many conversations about Maiden Castle; Prof. Umberto Albarella (University of Sheffield) for his advice about Iron Age lambing and seasonality; Drs Martin Smith (University of Bournemouth) and Yvonne Inall (University of Sydney) for their help with weapon identification; Dr Derek Hamilton (SUERC) for his advice about isotopes and C14 dating; and Dr Trish Biers, curator of the Duckworth Laboratory (University of Cambridge), for supporting her research visit to undertake further analysis on T29, and recording T17's sex and puberty data for us during the covid-19 pandemic. Thanks are

also given to Dr Heather Bonney (NHM) for searching the Oakley archive for us and making time during the pandemic to support our research.

NOTES

1 Defining a 'massacre' burial is highly problematic, as both bioarchaeological evidence for prehistoric and historic examples shows there to be a high degree of diversity in the funerary record, see Anderson and Martin (2018). The forensic and historic literature also discusses how using the term 'massacre' can be misleading (see, Anstett and Dreyfus 2017; Docker 2012)

2 This should not be taken to mean that the men were non-Durotriges or 'outsiders'. It is evident from work in east Yorkshire and elsewhere in Britain that many communities were formed by people born locally and from further away (Halkon 2020; D.Hamilton pers. comm).

3 The Iron Age date of these burials is widely accepted by the academic community (amongst others, Harding 2016, 181–191). During the recording of human remains by the first author, notes in the box of P12 stated that their femora had been given to Dr I.T. Oakley for C14 dating (only the bone immediately above the condyles and distal articular surfaces of the femora are extant). The first author is tremendously grateful to the Natural History Museum (London) for searching Dr Oakley's archive following the lifting of covid restrictions in summer 2020. Unfortunately, no dating information was extant. Sadly, it was not possible to undertake dating using the extant dental samples used by Redfern *et al.* (2021) (D. Hamilton pers.comm). A discussion of dating and the IA can be found in Hamilton *et al.* (2015).

4 The Weymouth Relief Road excavations (Brown *et al.* 2014) were not included in the study, as the archive could not be accessed prior to and during the covid pandemic, making us reliant on our PhD datasets.

5 Outside Dorset, one finds the Arras Culture inhumation tradition (Brewster 1975; Carter and Hunter 2003; Cunliffe 2009; Dent 1982; Jay and Richards 2006; Stead 1991; Whimster 1981), associated with the tribal territory of the Parisi, and the Aylesford-Swarling cremation rite (Birchall 1965; Bushe-Fox 1925; Cunliffe 2009; Hill 1995; Stead and Rigby 1986; 1989; Whimster 1981), used in the Catuvellauni, Trinovantes and Cantii community areas (Cunliffe 2009, 133, 193). The disposal technique most widely utilized across Britain was likely excarnation through exposure (Cunliffe 2009, 507; Whimster 1981, 190).

6 There is one possible LIA grave marker in Dorset, which still appears to be unparalleled in the UK. At Fordington Bottom, two large iron rings, each with double-spiked loops were recovered from the upper fills of grave 555 (skeleton SF 4042). Single post-holes, located centrally, either side of the grave were also found and are stratigraphically contemporary with the grave cut. One of the iron rings has mineralised wood, this suggests that they were originally attached to a wooden post or structure which rested in the post-holes. The grave fill also contained a fragment of an iron bar (Smith *et al.* 1997).

7 It should be noted that a 20–35 year old male P34 (BWC) had a fragmentary iron dress-clasp "beside the left shoulder", which may indicate that their body was clothed for burial (Wheeler 1943, 355). We also draw the reader's attention to the work of Adams (2014; 2017).

8 Of the latter, Wheeler (1943, 353) wrote, "..."three skeletons, all fragmentary (damaged by plough), and possibly all originally in the same shallow grave." Since these interments were not definitively single or multiple, they were excluded from consideration.

9 T21 (IA C) was buried 'lying on face... left arm bent at side, legs bent back from knee only' (Wheeler 1943, 350). Neither P26 or P27 was buried with grave-goods, but the male P27 was wearing an iron bracelet on his left wrist (Wheeler 1943, 354–355).

10 At the time of writing, stable isotope evidence for mobility has only been published for seven LIA individuals from Dorset. The results show that people who had spent childhoods outside of Durotrigian territory were buried following the community's burial rites- including males P7 and P7A from Maiden Castle (Redfern *et al.* 2021).

11 The dental age of T29 was 15 years old ± 36 months, and her long bone length and epiphyseal fusion suggested an age of 10–12 years old. Her cervical vertebra maturation score was stage 1 (Lewis *et al.* 2016; Shapland and Lewis 2014; 2016).

12 Note, that the majority of injuries sustained over a life-time are limited to the soft-tissue, and it is possible for somebody to be killed by a sharp-weapon that does not penetrate the underlying bone (Redfern 2016).

13 At present, no evidence for child or elder abuse has been identified, and although females with nasal, rib and scapula bone fractures have been reported, it is difficult to determine whether these were exclusively caused by intimate partner violence or during other

forms of violence (both can result in fractures to these bones) (Redfern 2017), as it seems that for some communities in IA Britain, female participation in organised violence was commonplace (Redfern 2012; 2016; 2020).

14 Social science studies have shown that what a community accepts, defines and practices as violent activities or behaviours is temporally and culturally situated (Aijmer and Abbink 2000; Kirmayer *et al.* 2008). We only have Roman primary source evidence which describes various types of human sacrifice and trophy-taking (Aldhouse Green 2001; Armit 2011).

15 These types of behaviours and concepts are frequently observed in societies which have or continue to experience civil war or ethnic cleansing, where the dead are manipulated, reburied or commemorated for socio-political resistance or maintain the interests of controlling powers (Violi 2012), such as in Rwanda (Jessee 2012), Spain (Ballbé and Steadman 2008), and Bolivia (Canessa 2009).

16 Several individuals have peri-mortem stabbing injuries to the torso (e.g. P23 [BWC] and T16 [IA B]). T16 also has peri-mortem sharp-force injuries associated with defensive behaviour (to forearms and left hand), and three males from the BWC have evidence for attempted decapitation blows on their mandible (Redfern 2011). Evidence for stabbing injuries and decapitation have been identified in bog bodies from Northern Europe (Brothwell and Gill-Robinson 2001). It is notable that the treatment of these individuals is different to combatants discovered elsewhere Britain, such as Bredon Hill (Western and Hurst 2014) and East Yorkshire (Giles 2012; King 2010). Furthermore, the first author is aware that context bias impacts on interpretation, see (Nakhaeizadeh *et al.* 2014).

17 Taphonomic analysis of the human remains from Danebury hillfort suggests that the treatment of these body-parts and bones is more complicated than we have assumed, and therefore, the remains from Dorset are likely to be too. One possible example of such complex burial practice is the male adolescent (T17, IA B) who was buried in a flexed position, and his skull was only represented by his mandible, and other limb and torso bones were missing (Wheeler 1943, 347). See, Booth (2015) and Booth and Madgwick (2016).

18 At present, only seven individuals have been sampled for stable isotope analysis of childhood residency in Dorset, including P7 and P7A. Results show that four individuals, including P7 spent their childhoods outside of Dorset, further north and east, and possibly from the Continent (Redfern *et al.* 2021). The authors consider that this dataset is too small to suggest whether mobility played a role in the inclusion of P7 and P7A at the hillfort.

The reader is directed to the works of Cameron (2008; 2011; 2015; 2016) regarding the socio-political and economic power of captives and the enslaved in pre-State societies. For the presence of captives in IA Britain, see Redfern (2020).

19 Although, Aldhouse Green (2001) expresses this as 'drama', it can also be conceptualised as 'performative violence' or 'poetics of violence' (Murer 2014; Pérez 2016; Whitehead 2004). Excluding injuries, no differences in health were observed between individuals given normative vs. non-normative burial treatments in Dorset (Redfern, unpublished), and between those at Danebury vs. formal cemetery populations from Britain (see Redfern 2019).

20 For example, in the site report, Wheeler (1943, 63) writes, "a series of [BWC] graves had been roughly cut, with no regularity either of outline or of orientation, and into them had been thrown, in all manner of attitudes – crouched, extended, on the back, on the side, on the face, even sitting up – thirty-eight skeletons of men and women, young and old; sometimes two persons were huddled together in the same grave." Only very rarely does Wheeler mention skeleton identifiers (i.e. P2), meaning that it is often impossible to confirm or identify which individuals he is writing about. Here, the 'sitting up' position of one individual could not be confirmed in the site notebooks or published report, both (only very briefly) note orientation and body positioning.

REFERENCES

Adams, S. 2017. 'Personal Objects and Personal Identity in the Iron Age: the case of the earliest brooches', in T. Martin and R. Weetch *Dress and Society: Contributions from Archaeology*. Oxford, Oxbow Books, 48–68.

Adams, S.A. 2014. *The first brooches in Britain: from manufacture to deposition in the Early and Middle Iron Age*. Unpublished PhD thesis, University of Leicester.

Aijmer, G. and Abbink, J. 2000. *Meanings of violence. A cross cultural perspective*. Oxford, Berg.

Aitken, G.M. and Aitken, G.N. 1991. 'Excavations at Whitcombe, 1965–1967', *Proceedings of the Dorset Natural History and Archaeological Society* **112**, 57–94.

Albarella, U. 2007. 'The end of the sheep age: people and animals in the late Iron Age', in C.C. Haselgrove and T. Moore (eds) *The later Iron Age in Britain and beyond*. Oxford, Oxbow Books.

Albarella, U., Johnstone, C. and Vickers, K. 2008. 'The development of animal husbandry from the late Iron Age to the end of the Roman period: a case study from south-east England', *Journal of Archaeological Science* **35**, 1828–1848.

Aldhouse Green, M. 2001. *Dying for the Gods: human sacrifice in Iron Age and Roman Europe.* Stroud, Tempus Publishing Ltd.

Aldhouse Green, M. 2005. 'Ritual bondage, violence, slavery and sacrifice in later European prehistory', in M. Parker Pearson and I.J N. Thorpe (eds) *Warfare, violence and slavery in prehistory.* Oxford, BAR International Series **S1374**, 155–164.

Anderson, C.P. and Martin, D.L. (eds) 2018. *Massacres. Bioarchaeology and forensic anthropology approaches.* Florida, Florida University Press.

Anstett, É. and Dreyfus, J.-M. 2017. 'Introduction: Corpses and mass violence: an inventory of the unthinkable'. *Human remains and mass violence.* Manchester, Manchester University Press.

Armit, I. 2011. 'Headhunting and social power in Iron Age Europe', in T. Moore and X-L. Armada, (eds), *Atlantic Europe in the first millennium BC. Crossing the divide.* Oxford, Oxford University Press, 590–607.

Bailey, C.J. 1967. 'An early Iron Age/Romano-British site at Pins Knoll, Litton Cheney. Final report', *Proceedings of the Dorset Natural History and Archaeological Society* **89**, 147–159.

Ballbé, E.G. and Steadman, D.W. 2008. 'The political, social and scientific contexts of archaeological investigations of mass graves in Spain', *Archaeologies* **4**, 429–444.

Birchall, A. 1965. 'The Aylesford-Swarling culture: the problem of the Belgae reconsidered', *Proceedings of the Prehistoric Society* **31**, 241–367.

Bishop, M.C. and Coulston, J.C.N. 2006. *Roman military equipment from the Punic Wars to the Fall of Rome.* Oxford, Oxford University Press.

Blackmore, C., Braithwaite, M. and Hodder, I. 1979. 'Social and cultural patterning in the late Iron Age in southern England', in B.C. Burnham and J. Kingsbury (eds.) *Space, hierarchy and society. Interdisciplinary studies in social area analysis.* Oxford, BAR International Series **59**, 93–111.

Booth, T.J. 2015. 'An investigation into the relationship between funerary treatment and bacterial bioerosion in European archaeological human bone', *Archaeometry* **58**, 484–499.

Booth, T.J. and Madgwick, R. 2016. 'New evidence for diverse secondary burial practices in Iron Age Britain: A histological case study', *Journal of Archaeological Science* **67**, 14–24.

Brewster, T.C.M. 1981. *The excavation of Garton and Wetwang Slacks.* London, British Museum Press.

Brink, S. and Price, N. (eds.) 2008. *The Viking World.* Oxford, Routledge.

Brothwell, D. and Gill-Robinson, H. 2001. 'Taphonomic and forensic aspects of bog bodies', in W.D. Haglund and M.H. Sorg (eds) *Advances in Forensic Taphonomy: Method, Theory, and Archaeological Perspectives.* London, CRC Press, 119–134.

Brown, L., Hayden, C. and Score, D. (eds) 2014. *'Down to Weymouth town by Ridgeway'. Prehistoric, Roman and later sites along the Weymouth Relief Road.* Dorchester, Dorset Natural History and Archaeological Society Monograph **23**.

Buckberry, J. 2014. 'Osteological evidence of corporal and capital punishment in Later Anglo-Saxon England', in J.P. Gates and N. Marafioti (eds) *Punishment in Anglo-Saxon England.* Woodbridge, The Boydell Press, 131–148.

Buckberry, J.L. 2010. 'Off with their heads: the Anglo-Saxon execution cemetery at Walkington Wold, east Yorkshire', in E.M. Murphy (ed.) *Deviant burial in the archaeological record.* Oxford, Oxbow Books, 148–168.

Bushe-Fox, J., Plunkett 1925. *Excavation of the Late-Celtic urn-field at Swarling, Kent.* Reports of the Research Committee of the Society of Antiquaries of London No. **V**. Oxford, Society of Antiquaries of London.

Cameron, C.M. (ed.) 2008. *Invisible citizens: captives and their consequences.* Utah, University of Utah Press.

Cameron, C.M. 2011. 'Captives and culture change. Implications for archaeology'. *Current Anthropology* **52**, 169–209.

Cameron, C.M. 2015.' Commodities or gifts? Captive/Slaves in small-scale societies', in L. Wilson Marshall (ed.) *The Archaeology of Slavery. A comparative approach to captivity and coercion.* Carbondale, Center for Archaeological Investigations, Southern Illnois University Carbondale Occasional Paper No **41**, 25–40.

Cameron, C.M. 2016. 'The Variability of the Human Experience: Marginal People and the Creation of Power', *Archeological Papers of the American Anthropological Association* **27**, 40–53.

Canessa, A. 2009. 'Forgetting the revolution and remembering the war: memory and violence in highland Bolivia', *Historical Workshop Jorunal* **68**, 173–98.

Carr, L.C. 2012. *Tessa Verney Wheeler.* Oxford, Oxford University Press.

Carter, S. and Hunter, F. 2003. 'An Iron Age chariot burial from Scotland', *Antiquity* **77**, 531–535.

Cunliffe, B. 2009. *Iron Age communities in Britain. An account of England, Scotland and Wales from the seventh century BC until the Roman Conquest.* London, Routledge.

Cunliffe, B. 2014. *Iron Age Britain.* London, BT Batsford.

Davies, S.M., Bellamy, P.S., Heaton, M.J. and Woodward, P.J. 2002. *Excavations at Alington Avenue, Fordington, Dorchester, Dorset, 1984-87.* Dorchester, Dorset Natural History and Archaeological Society Monograph Series **15**.

Davis, S.J. 2012. *The archaeology of animals.* London, Routledge.

Dent, J.S.D. 1982. 'Cemeteries and settlement patterns on the Iron Age on the Yorkshire Wolds', *Proceedings of the Prehistoric Society* **48**, 437–457.

Docker, J. 2012. 'The origins of massacres', In P.G. Dwyer

and L. Ryan (eds) *Theatres of violence. Massacre, mass killing and atrocity throughout history.* Oxford, Berghahn Books, 3–16.

Dwyer, P.G. 2009. '"It still makes me shudder". Memories of massacres and atrocities during the Revolutionary and Napoleonic wars', *War in History* **16**, 381–405.

Engle Merry, S. 2009. *Gender violence: a cultural perspective.* Chichester, Wiley-Blackwell.

English Heritage. 2021. *The people of echoscape.* Available https://www.english-heritage.org.uk/visit/places/maiden-castle/echoscape/ [Accessed 10/7/2022]

Farwell, D.E. and Molleson, T.L. (eds), 1993. *Excavations at Poundbury 1966–80, Volume II: the cemeteries.* Dorchester, Dorset Natural History and Archaeological Society Monograph Series **11**.

Fitzpatrick, A.P. 1997. 'A 1st century AD Durotrigian burial with a decorated Iron Age mirror from Portesham, Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **118**, 51–70.

Flavel, A. and Barker, C. 2016. 'Forensic anthropology and archaeology in Guatemala', in S. Blau and D.H. Ubelaker (eds.) *Handbook of forensic anthropology and archaeology.* Oxford, Routledge, 426–441.

Gale, J. 2003. *Prehistoric Dorset.* Stroud, Tempus Publishing Ltd.

Giles, M. 2012. *A forged glamour: landscape, identity and material culture in the Iron Age.* Oxford, Windgather Press.

Giles, M. 2015. 'Performing pain, performing beauty: dealing with difficult death in the Iron Age', *Cambridge Archaeological Journal* **25**, 539–550.

Giles, M. 2020. *Bog bodies: Face to face with the past.* Manchester, Manchester University Press.

Goodman, C.N. and Morant, G.M. 1940. 'The human remains of the Iron Age and other periods from Maiden Castle, Dorset', *Biometrika* **XXXI**, 295–312.

Gummesson, S., Hallgren, F. and Kjellström, A. 2018. 'Keep your head high: Skulls on stakes and cranial trauma in Mesolithic Sweden', *Antiquity* **361**, 74–90.

Halkon, P. (ed.), 2020. *The Arras Culture of Eastern Yorkshire-Celebrating the Iron Age: Proceedings of "Arras 200-celebrating the Iron Age." Royal Archaeological Institute Annual Conference.* Oxford, Oxbow Books.

Hamby, S. and Grych, J. 2013. *The web of violence. Exploring connections among different forms of interpersonal violence and abuse.* Amsterdam, Springer.

Hamilton, W.D., Haselgrove, C. and Gosden, C. 2015. 'The impact of Bayesian chronologies on the British Iron Age', *World Archaeology* **47**, 642–660.

Hamlin, C. 2007. *The material expression of social change: the mortuary correlates of gender and age in late Pre-Roman Iron Age and Roman Dorset. 2 vols.* Unpublished PhD thesis, University of Wisconsin-Milwaukee.

Hansen, G. and Wooster, C. 2005. *Living with sheep: everything you need to know to raise your own flock.* Guilford, Connecticut, The Lyons Press.

Harding, D.W. 2016. *Death and burial in Iron Age Britain.* Oxford, Oxford University Press.

Hawkes, C.F.C. 1939. 'The ABC of the British Iron Age', *Antiquity* **XXXIII**, 170–182.

Hawkes, C.F.C. 1978. 'The ABC of the British Iron Age', in S.S. Frere (ed.) *Problems of the Iron Age in Southern Britain.* (2nd ed) London, University of London Institute of Archaeology Occasional paper, 1–16.

Hearne, C.M. and Birkbeck, V. 1999. *A35 Tolpuddle to Puddletown bypass DBFO, Dorset, 1996-8, incorporating excavations at Tolpuddle Ball.* Salisbury, Trust for Wessex Archaeology Report No. **15**.

Hendrix, C. and Brinkman, H.-J. 2012. *Food insecurity and conflict dynamics – causal linkages and complex feedbacks.* [Online]. Food and Agricultural Organization of the United Nations. Available: http://www.fao.org/fileadmin/templates/cfs_high_level_forum/documents/FI-ConflictDynamics-Hendrix_Cullen.pdf [Accessed 08/04/2019 2019].

Hepner, T.R., Steadman, D.W. and Hanebrink, J.R. 2018. 'Sowing the dead. Massacres and the missing in Northern Uganda', in C.P. Anderson and D.L. Martin (eds) *Massacres. Bioarchaeological interpretations of the human past: local, regional, and global perspectives.* Gainsville, University of Florida Press, 136–154.

Hill, J.D. 1995. *Ritual and rubbish in the Iron Age of Wessex.* Oxford, BAR British Series **242**.

Holst, M. 2005. 'Human remains from sites of conflict', in T.L. Sutherland, (ed.) *Battlefield archaeology – a guide to the archaeology of conflict.* British Archaeological Jobs Resource, 29–32. Available at http://www.bajr.org/documents/bajrbattleguide.pdf [Accessed 10/7/2022]

Inall, Y. 2012. *In search of the spear people: the archaeology of Iron Age weapons and warfare in east Yorkshire in their European context.* Unpublished PhD thesis, University of Hull.

Jay, M. and Richards, M.P. 2006. 'Diet in the Iron Age cemetery population at Wetwang Slack, East Yorkshire, UK: carbon and nitrogen stable isotope evidence', *Journal of Archaeological Science* **33**, 653–662.

Jessee, E. 2012. *Promoting reconciliation through exhuming and identifying victims of the 1994 Rwandan genocide.* Africa Initiative Discussion Paper Series **4**.

Kalmar Läns Museum. 2019. *Sandy Borge.* [Online]. Available: https://www.sandbyborg.se/en/home/ [Accessed 08/04/2019 2019].

Keeley, L.H. 2016. 'Food for war, war for food, and war on food', in A.M. Vanderwarker and G.D. Wilson (eds) *The Archaeology of Food and Warfare.* New York Springer, 291–302.

King, S.S. 2010. *What makes war? Assessing Iron Age warfare through mortuary behaviour and osteological patterns of violence.* Unpublished PhD thesis, University of Bradford.

Kirmayer, L.J., Lemelson, R. and Barad, M. (eds) 2008. *Understanding trauma. Integrating biological, clinical and cultural perspectives.* Cambridge, Cambridge University Press.

Komar, D. 2008. 'Patterns of mortuary practice associated

with genocide. Implications for archaeological research', *Current Anthropology* **49**, 123–133.

Lewis, M., Shapland, F. and Watts, R. 2016. 'On the threshold of adulthood: a new approach for the use of maturation indicators to assess puberty in adolescents from medieval England', *American Journal of Human Biology* **28**, 48–56.

Macpherson, D. 2010. *Defenders of Mai-Dun: a story of the Roman assault on Maiden Castle.* Egland, Roving Press Ltd.

Melbye, J. and Fairgrieve, S.I. 1994. 'A massacre and possible cannibalism in the Canadian Arctic: new evidence from the Saunaktuk site (NgTn-1)', *Arctic Archaeology* **31**, 57–77.

Mikellide, M. 2014. 'Burial patterns during times of armed conflict in Cyprus in the 1960s and 1970s', *Journal of Forensic Sciences* **59**, 1184–1190.

Molleson, L., Tjellden, A.K.E, Hertz, E. and Holst, M.K. 2016. 'The postmortem exposure interval of an Iron Age human bone assemblage from Alken Enge, Denmark', *Journal of Archaeological Science Reports* **10**, 819–827.

Morant, G.M. and Goodman, C. 1943. 'Human bones', in R.E.M. Wheeler *Maiden Castle, Dorset.* London, Research Report for the Committee of the Society of Antiquaries **12**, 337–360.

Moshenska, G. and Schadla-Hall, T. 2011. 'Mortimer Wheeler's Theatre of the Past', *Public Archaeology* **10**, 46–55.

Murer, J.S. 2014. 'Understanding collective violence: The communicative and performative qualities of violence in acts of belonging', *Criminological Approaches to International Criminal Law.* 1107060036 Available at https://research-repository.st-andrews.ac.uk/bitstream/handle/10023/11998/Murer_2014_Understanding_collective_violence_AAM.pdf?sequence=1&isAllowed=y [Accessed 24/07/2022]

Murphy, E.M. (ed.) 2008. *Deviant burial in the archaeological record.* Oxford, Oxbow Books.

Nakhaeizadeh, S., Hanson, I. and Dozzi, N. 2014. 'The power of contextual effects in forensic anthropology: a study of biasability in the visual interpretations of trauma analysis on skeletal remains', *Journal of Forensic Sciences* **59**, 1177–1183.

Novak, S. 2008. *House of mourning: a biocultural history of Mountain Meadows Massacre.* Salt Lake City, University of Utah Press.

Osterholtz, A.J. and Martin, D.L. 2017. 'The poetics of annihilation: On the presence of women and children at massacre sites in the Ancient Southwest', in D.L. Martin, and C. Tegtmeyer (eds) *Bioarchaeology of Women and Children in Times of War.* New York, Springer, 111–128.

Papworth, M. 2011. *The search for the Durotriges. Dorset and the West Country in the late Iron Age.* Stroud, The History Press.

Pérez, V.R. 2016. 'The poetics of violence in bioarchaeology: Integrating social theory with trauma analysis', in M.K. Zuckerman, and D.L. Martin (eds) *New Directions in Biocultural Anthropology.* New York, Wiley, 453–569.

Petrović-Šteger, M. 2009. 'Anatomizing conflict – accommodating human remains', in H. Lambert and M. McDonald (eds) *Social bodies.* Oxford, Berghahn Books.

Philpott, R. 1991. *Burial practices in Roman Britain: a survey of grave treatment and furnishing AD 43–410.* Oxford, BAR British Series **219**.

Putnam, B. 2007. *Roman Dorset.* Stroud, Sutton Publishing Ltd, 47–76.

Redfern, R. 2008. 'New evidence for Iron Age secondary burial practice and bone modification from Gussage All Saints and Maiden Castle (Dorset, England)', *Oxford Journal of Archaeology* **27**, 281–301.

Redfern, R. 2009. 'Does cranial trauma provide evidence for projectile weaponry in late Iron Age Dorset?', *Oxford Journal of Archaeology* **28**, 399–424.

Redfern, R.C. 2006. *A gendered analysis of health from the Iron Age to the end of the Romano-British period in Dorset, England (middle and late 8th century B.C. to the end of the 4th century A.D.).* Unpublised PhD thesis, University of Birmingham.

Redfern, R.C. 2007. 'A bioarchaeological analysis of violence in Iron Age females: a perspective from Dorset England (mid to late seventh century BC to the first century AD)', in O.P.Davis, N.M. Sharples and K.E. Waddington (eds) *Changing perspectives on the first millennium B.C.* Oxford, Oxbow Books, 139–160.

Redfern, R.C. 2011. 'A re-appraisal of the evidence for violence in the late Iron Age human remains from Maiden Castle hillfort, Dorset, England', *Proceedings of the Prehistoric Society* **77**, 111–138.

Redfern, R.C. 2012. 'Violence as an aspect of the Durotrige female life course', in S. Ralph (ed.) *The archaeology of violence. Interdisciplinary approaches.* Albany NY, State University of New York Press, 63–97.

Redfern, R.C. 2016. *Injury and trauma in bioarchaeology. Interpreting violence in past lives.* Cambridge, Cambridge University Press.

Redfern, R.C. 2017. 'Identifying and interpreting domestic violence in archaeological human remains: a critical review of the evidence', *International Journal of Osteoarchaeology* **27.1**, 13–34.

Redfern, R.C. 2019. 'Gendered violence in late Iron Age and Roman Britain', in L. Fibiger, P.G. Dwyer and J. Damousi (eds) *The Cambridge World History of Violence.* Cambridge, Cambridge University Press, 320–341.

Redfern, R.C. 2020. 'Iron Age 'predatory landscapes': a bioarchaeological and funerary exploration of captivity and enslavement in Britain', *Cambridge Archaeological Journal* **30.4**, 531–554.

Redfern, R.C., Beaumont, J., Montgomery, J. and Hamlin, C. 2021. 'Acquiring skills, travelling to fight: mobility in elite individuals from Iron Age Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **142**, 155–183.

Redfern, R.C. and Chamberlain, A.T. 2011. 'A demographic analysis of Maiden Castle hillfort: Evidence for

conflict in the late Iron Age and early Roman period', *International Journal of Paleopathology* **1**, 68–73.

Renshaw, L. 2010. 'The scientific and affective identification of Republican civilian victims from the Spanish Civil War', *Journal of Material Culture* **15**, 449–463.

Reynolds, A. 2009. *Anglo-Saxon deviant burial customs*. Oxford, Oxford University Press.

Richmond, I. (ed.) 1968. *Hod Hill, volume 2*. London, The Trustees of The British Museum.

Roberts, N. 1989. *The Holocene: an environmental history*. Oxford, Blackwell.

Shapland, F. and Lewis, M.E. 2013. 'Brief communication: A proposed osteological method for the estimation of pubertal stage in human skeletal remains', *American Journal of Biological Anthropology* **151**, 302–310.

Shapland, F. and Lewis, M.E. 2014. 'Brief communication: A proposed method for the assessment of pubertal stage in human skeletal remains using cervical vertebrae maturation', *American Journal of Biological Anthropology* **153**, 144–153.

Sharples, N. 1991a. *Maiden Castle. Excavations and field survey 1985–6*. English Heritage Archaeological Reports. London, English Heritage.

Sharples, N. 1991b. 'Warfare in the Iron Age of Wessex', *Scottish Archaeological Review* **8**, 79–89.

Sharples, N. 1991c. *English Heritage Book of Maiden Castle*. London, BT Batsford Ltd.

Sharples, N. 2010. *Social relations in later prehistory. Wessex in the first millennium BC*. Oxford, Oxford University Press.

Sharples, N. 2014. 'Problems and opportunities: Iron Age burial traditions in southern Britain', in A. Cahen-Delhaye and G. De Mulder, (eds.) *Des espaces aux espirits. L'organisation de la mort aux âges des Métaux dans le nord-ouest de L'Europe*. Actes du Colloque de la C.A.M. et de la S.B.E.C. Études et Documents Archéologique 32, Namur, Belgium, Service Public de Wallonie, 141–159.

Smith, M. 2017. *Mortal wounds: the human skeleton as evidence for conflict in the past*. Barnsley, Pen & Sword.

Smith, P.A., Raven, M.D., Walshe, K., Fitzpatrick, R.W. and Pate, F.D. 2017. 'Scientific evidence for the identification of an Aboriginal massacre at the Sturt Creek sites on the Kimberley frontier of north-western Australia', *Forensic Science International* **279**, 258–267.

Smith, R.J.C. 1993. *Excavations at County Hall, Colliton Park, Dorchester, Dorset, 1988*. Salisbury, Wessex Archaeology Report No **4**.

Smith, R.J.C., Healy, F., Allen, M.J., Morris, E.L., Barnes, M. and Woodward, P.J. 1997. *Excavations along the route of the Dorchester by-pass, Dorset, 1986–8*. Dorchester, Wessex Archaeology Report No **11**.

Stead, I.M. (ed.) 1991. *Iron Age Cemeteries in East Yorkshire. Burton Fleming, Rudston, Garton-on-the-Wolds, and Kirkburn*. English Heritage Archaeological Report no **22**, London, English Heritage and the British Museum Press.

Stead, I.M. and Rigby, V. (eds) 1986. *Baldock. The excavation of a Roman and pre-Roman settlement, 1968–72*. Britannia Monograph Series No. **7**, London, Society for the Promotion of Roman Studies.

Stead, I.M. and Rigby, V. 1989. *Verulamium: the King Harry Lane site*. English Heritage Archaeological Report no **12**, London, English Heritage in association with British Museum Publications.

Stewart, D. and Russell, M. 2017. *Hillforts and the Durotriges. A geophysical survey of Iron Age Dorset*. Oxford, Archaeopress.

Symes, S.A., Rainwater, C.W., Chapman, E.N., Gipson, D.R. and Piper, A.L. 2015. 'Patterned thermal destruction of human remains in a forensic setting', in C.W.Schmidt and S.A. Symes, (eds) *The analysis of burned human remains*. London, Academic Press, 15–54.

Tacitus 1973. *The Annals: Agricola and the Germania*. London, Penguin Books.

Todd, M. 2007. 'The Claudian Conquest and its consequences', in M. Todd (ed.) *A companion to Roman Britain*. Oxford, Blackwell Publishing, 42–59.

Tollefsen, E. 2019. *Messing with bodies. Exploring curation and funerary treatments in Iron Age Britain*. Paper presented at the Iron Age Research Student Symposium 2019, University of Cardiff. Available: https://www.academia.edu/39136906/IARSS_2019_Paper_Messing_with_Bodies_Exploring_Curation_and_Funerary_Treatments_in_Iron_Age_Britain [Accessed 10/7/22]

Tollefsen, E. 2021. *To Decay or Not to Decay? That is the Question: Understanding the Complexities and Nuances of Different Mortuary Treatments in Iron Age Britain (c. 800 BC–AD 100)*. Paper presented at the Iron Age Research Student Symposium 2021, University of Liverpool. Available: https://www.academia.edu/49124810/IARSS_2021_Paper_To_Decay_or_Not_to_Decay_That_is_the_Question_Understanding_the_Complexities_and_Nuances_of_Different_Mortuary_Treatments_in_Iron_Age_Britain_c_800_BC_AD_100_ [Accessed 10/7/22]

Turner, C.G. and Morris, N.T. 1970. 'A massacre at Hopi', *American Antiquity* **35**, 320–331.

Turpin, J. and Kurtz, L. R. (eds.) 1997. *The web of violence. From interpersonal to global*. Chicago, University of Illnois Press.

Valentin, J. 2003. 'Manor Farm, Portesham, Dorset: excavations on a multi-period religious and settlement site', *Proceedings of the Dorset Natural History and Archaeological Society* **125**, 23–69.

Violi, P. 2012. 'Trauma site museums and politics of memory: Tuol Sleng, Villa Grimaldi and the Bologna Ustica Museum', *Theory, Culture and Society* **29**, 36–75.

Western, A.G. and Hurst, J.D. 2014. '"Soft heads" evidence for sexualized warfare during the later Iron Age from Kemerton Camp, Bredon Hill', in C.J. Knusel and M.J. Smith (eds) *The Routledge Handbook of the Bioarchaeology of Human Conflict*. London, Routledge, 161–184.

Western, G. 2008. *Bredon hillfort*. Paper presented at the 10th annual conference of the British Assocation of Biological Anthropology and Osteoarchaeology, Oxford.

Available at http://www.babao.org.uk/index/babao-conference-2008 [Accessed 10/7/2021].

Wheeler, R.E.M. 1943. *Maiden Castle, Dorset*. Research Report for the Committee of the Society of Antiquaries London, Volume **12**, London.

Whimster, R. 1981. *Burial Practices in Iron Age Britain: A discussion and gazetteer of the evidence c. 700 B.C. - A.D. 43.* Oxford, BAR British Series **90**.

Whitehead, N.L. (ed.) 2004. *Violence.* Michigan, School of American Research.

Wikipedia. 2019. *Sheep milk* [Online]. Available: https://en.m.wikipedia.org/wiki/Sheep_milk [Accessed 13/3/19].

The Authors: Rebecca Redfern: Museum of London, 150 London Wall, London, EC2Y 5HN, and School of History, Classics and Archaeology, Faculty of Humanities and Social Sciences, Newcastle University, NE1 7RU. Christine Hamlin is an independent researcher. Correspondence: rredfern@museumoflondon.org.uk or chamlin999@gmail.com

FURTHER EVIDENCE FOR A ROMANO-BRITISH CEMETERY IN THE VICINITY OF THE GROVE: INVESTIGATIONS ON THE SITE OF THE FORMER GROVE SCHOOL AND ARTS CENTRE, SCHOOL LANE (NOW SUSSEX COURT), DORCHESTER

KIRSTEN EGGING DINWIDDY
with contributions by
Grace Perpetua Jones and Katie Marsden,
Phil Harding, L. Higbee, and Lorraine Mepham

Wessex Archaeology undertook mitigation works during the redevelopment of the site of the former Grove School and Arts Centre, Dorchester. Substantial depths of made-ground, known to have occurred in the 17th to 19th centuries during the construction of the school, were underlain by redeposited chalk layers and a buried soil which potentially relate to the establishment of the Roman town defences. The work also revealed 15 Romano-British inhumation graves, 11 of which were fully excavated. Most of the burials were coffined and several included hobnailed footwear; one was accompanied by a ceramic jar. These findings corroborate previous evidence for a sizeable Romano-British cemetery in the vicinity of The Grove, between the north-western side of the town walls and the renowned Poundbury cemetery. This work provides some insights into the lives of some of those who lived, worked and died in and around Roman Dorchester, and highlights the ample scope for further study of the cemetery-related assemblages recovered from the site and its surroundings.

PROJECT BACKGROUND AND SITE

In 2017, Wessex Archaeology was commissioned by East Boro Housing Trust to undertake a two-trench evaluation on the site of the Former Grove School and Dorchester Arts Centre, Dorchester and, in 2019, to archaeologically monitor all below-ground works during the site's redevelopment and renovation operations. The archaeological work, including this article, was required by the Local Planning Authority to satisfy certain conditions attached to the planning consent.

The triangular parcel of land is within a residential area on the north-western periphery of Dorchester's historic core, situated at the southern end of School Lane, between The Grove (the B3147) and West Mills

Road (National Grid Reference 368842 090973; Fig. 1). During the period of monitoring, the site comprised areas of hardstanding, overgrown lawns and gardens, and the remnants of recently-demolished structures.

The mid-19th-century Grade II listed core of The Grove School building (National Heritage List for England ref. 1219747) was retained and renovated as part of the redevelopment (Fig. 2).

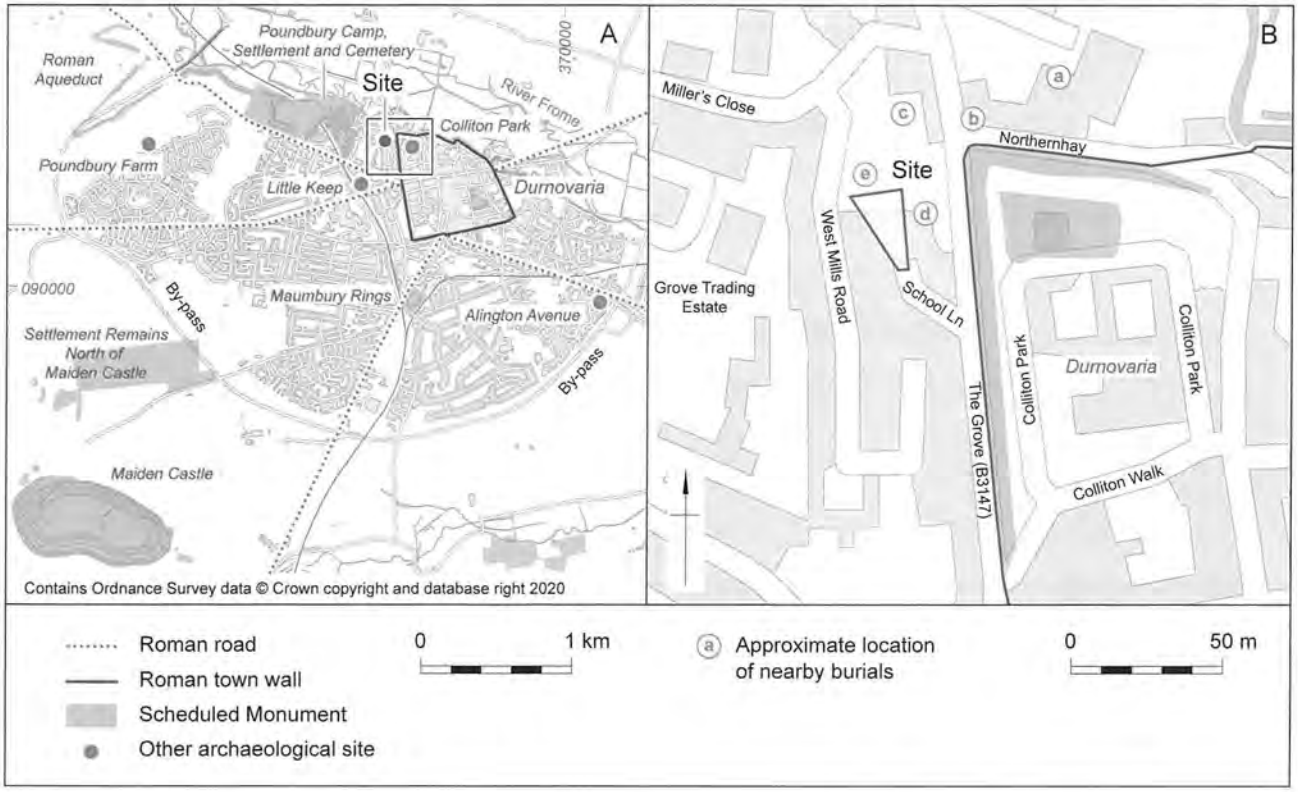


Figure 1 Site location, with other sites mentioned in the text.

Figure 2 Site viewed from the north-west, with the footings for the new building in the foreground and the (former Grove) school building behind, top right.

The 0.11-hectare plot ranged in elevation from approximately 69.5 m above Ordnance Datum (OD) to the south to *c.* 66 m OD in the north, reflecting its position on the edge of southern slopes of the Frome Valley. The surface of the Portsdown Formation Chalk bedrock (BGS 2020) was encountered at between 0.7 m (south) and 2.10 m (north) below the existing ground surface. The frequent observation of periglacial scarring suggests that there had been little horizontal truncation of the bedrock, despite such truncation being noted just to the north (Jackson 1976).

The below-ground works comprised the footings for the 'New Building' in the north, a small trench close to the centre of the site (Trench 26) and a series of trenches in, under and around the still-standing School structure (Fig. 3; trenches not individually labelled). The deep, confined and often unstable trenches severely restricted access, hampering the excavation and recording, and necessitating some approved and safety-led procedural adjustments. It was also agreed with the relevant parties that in this case an enhanced assessment (rather than full analysis) of the human remains would be adequate, on the premise that the assemblage would be available through the Dorset Museum for appropriate study in the future.

ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

The wealth of evidence for activity in the Dorchester region – from the Palaeolithic period onwards – has been detailed and discussed at length elsewhere (e.g., RCHME 1970; Gale 2003; Putnam 2007), and therefore a targeted précis is offered below.

The site lies within the vicinity of several important prehistoric sites and monuments (Fig. 1A; RCHME 1970, 531–92; Sparey Green 1987; Sharples 1991; Royall 2011; Historic England interactive map), including the Iron Age Hillfort of Poundbury Camp, only a few hundred metres to the west of the site. Around AD 60, it was in the view of these in that Dorchester's Roman precursor (*Durnovaria*) was established – its location perhaps influenced by an earlier religious shrine or military camp (Woodward *et al* 1993; Trevarthen 2008). The town soon became a thriving and important administrative centre supplied by a rich, productive agricultural hinterland (Smith 1993; Smith *et al* 1997; Davies *et al* 2002; Trevarthen 2008; Egging Dinwiddy and Bradley 2011). Sizeable earthen ramparts were installed by the 2nd century AD, the outer edge of which was projected to coincide with the former Grove School site (RCHME 1970, 546; Startin *et al* 1973; Jackson 1976). Parts of the 4th-century limestone walls still exist today, as do the remains of a Roman town house in Colliton Park, just 60 m east of the site (Fig. 1A; Durham and Fulford 2014; Smith 1993).

Under Roman law it was illegal to make a burial within the bounds of a town, but the desire to be remembered and remain close to the world of the living meant that formal Roman cemeteries were usually situated immediately outside the town, often along major thoroughfares (RCHME 1970, fig. 354; Burnham and Wacher 1990). *Durnovaria* was served by several extra-mural cemeteries, although fewer burial sites are recorded to the north, where it is bounded by the Frome Valley (RCHME 1970). The site of the most significant of the town's cemeteries – the primarily late Roman cemetery at Poundbury Camp – lies less than a few hundred metres west of the Former Grove School site, along the western approach road to Ilchester (now Poundbury Road). Just south of the same road is the site of the smaller Little Keep cemetery, notable for its high proportion of 'deviant' burial styles (Fig. 1A; Farwell and Molleson 1993; Egging Dinwiddy 2009; McKinley and Egging Dinwiddy 2009).

The presence of a Romano-British cemetery in the vicinity of The Grove – close to the north-western corner of the ramparts and perhaps influenced by a pre-Roman trackway – has long been suspected (RCHME 1970, 531–92; Margary 1967). In 1841, meadow levelling in the Northernhay region (Fig. 1B, a) revealed the remains of at least two inhumation burials and three almost certainly Roman ceramic vessels; unusually, one individual had been buried wearing an iron collar. A further two Romano-British burials were discovered *c.* 90 m north-west of the site during the construction of the New Compasses Inn (now a private dwelling), close to the junction of The Grove and Northernhay Road (Fig. 1B, b). Groundworks at the eastern end of Miller's Close

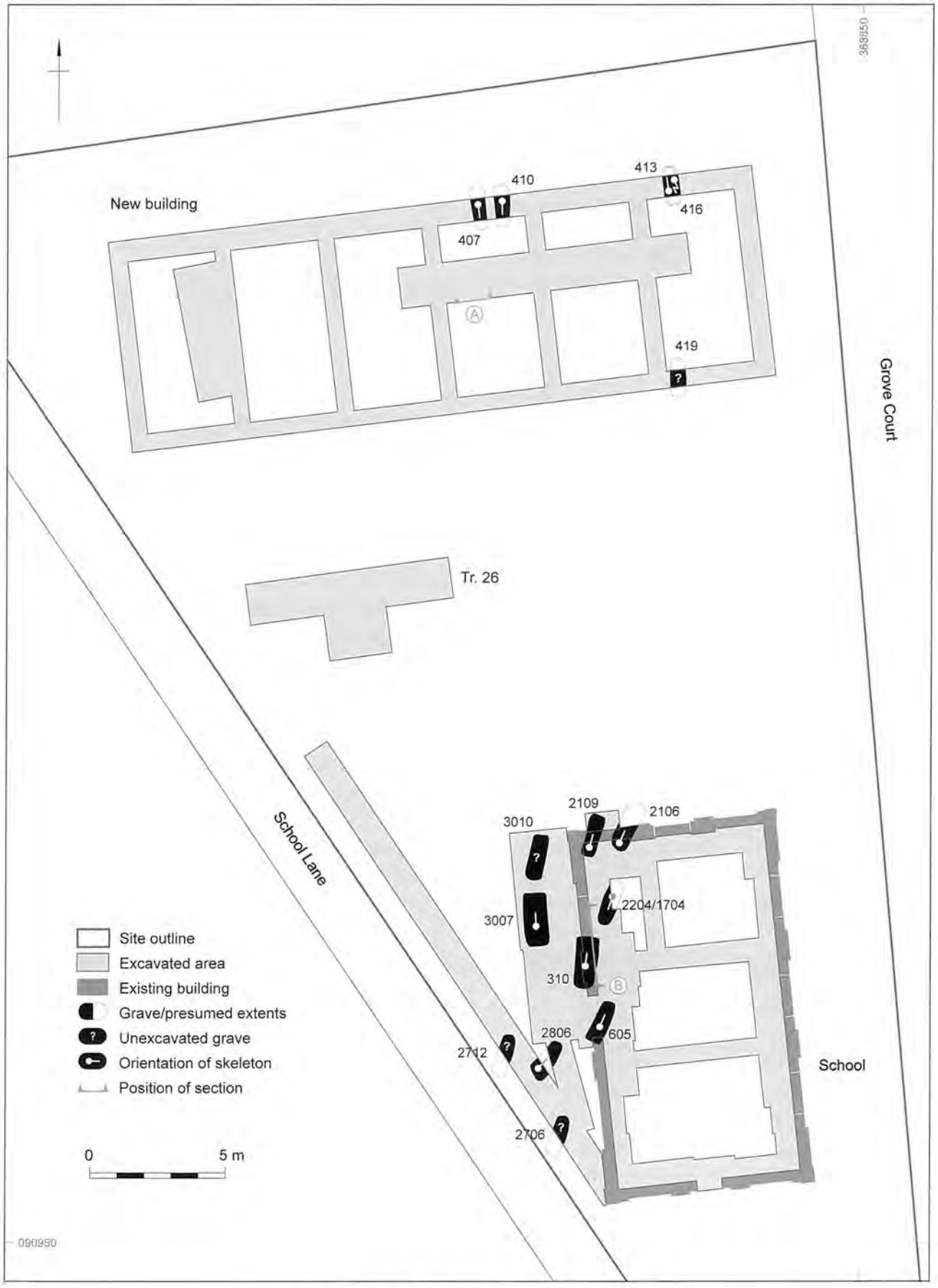


Figure 3 Site plan, showing location of the burials.

in 1963 exposed at least another 14 Romano-British burials, while over the next two years three more were found between School Lane and The Grove (Fig. 1B, c & d; RCHME 1970, 571b). In 1976, Jackson described the discovery of another two intercutting inhumation graves during the construction of garage blocks for Grove Court, which still stand immediately to the north of the site (Fig. 1B, e).

Although post-Roman activity was identified in and close to Poundbury Camp, evidence indicates that the land within and around the walls was predominantly used as farmland (Farwell and Molleson 1993). Early medieval Dorchester (*Dorneceaster or Dornwaraceaster*) was similarly utilised, with the principal areas of activity tending to be dispersed and peripheral to the town (Sparey Green 1987). However, by the end of the period it was a recognised market town and was furnished with a Norman castle soon after. The booming wool trade saw medieval Dorchester prosper and become an important commercial and political centre with the capacity to refurbish its aged defences. Despite this, John Speed's 1611 map of Dorchester demonstrates that even after more than a millennium since the Roman town was abandoned, vast swathes of land within the walls remained undeveloped. Despite plague and fire, the 17th-century settlement's leaders were able to fund the re-establishment of its fortifications, in a vain attempt to protect the town from the ravages of the Civil War.

By the early 18th century, the town's defences little served their original purpose and so were remodelled into boulevards known as 'The Walks'; their circuit remains largely intact today. The Grove School itself was built in 1836, one of many public amenities established in the name of social reform. Most recently the School and grounds were home to the Dorchester Arts Centre (1992–2015).

ARCHAEOLOGICAL RESULTS

The recent investigations found evidence for prehistoric to modern human activity in, or in the vicinity of, The Grove, Dorchester (Figs 1 and 3). The most significant findings relate to the Roman occupation of Dorchester, particularly the town defences and one of its extra-mural cemeteries.

To reiterate, the nature of the groundworks associated with the development and renovation meant that trenches were often small, deep and unstable, and included obstacles such as foundations, utilities and shoring. Archaeological observations, excavation and recording were consequently severely restricted; methods (including post-excavation) were adjusted accordingly.

Prehistoric activity

Above the chalk bedrock and across much of the site was a light brown, silty-clay subsoil which contained a few pieces of struck flint (context 3005, near the north-west corner of the School). These, and a few pieces from a later feature (see below) are residual and broadly reflect prehistoric activity within the wider vicinity.

Roman activity

A small fragment of Roman samian pottery and a few pieces of animal bone were recovered from a buried soil close to the School's north-west corner (context 3004). The 0.1–0.3 m thick deposit was observed across the southern part of the site and was typically sealed beneath a series of redeposited chalk layers. The latter deposits varied in extent and depth (0.1–0.6 m) and contained just a single base from a Black-burnished ware ceramic vessel (context 704, within the School footprint). It is considered that at least the bottom-most of these chalk layers represent large-scale Roman landscaping, such as those relating to the north-western corner of the town ramparts as described in RCHME (1970, 531–92, fig. 173a & 174a).

The Grove cemetery

Fifteen inhumation graves were encountered, 11 of which were to be disturbed by the works and required full excavation and recovery of the burial remains (Fig. 3; Appendix 1).

Graves typically encroached into the natural chalk bedrock and the resultant chalk rubble formed

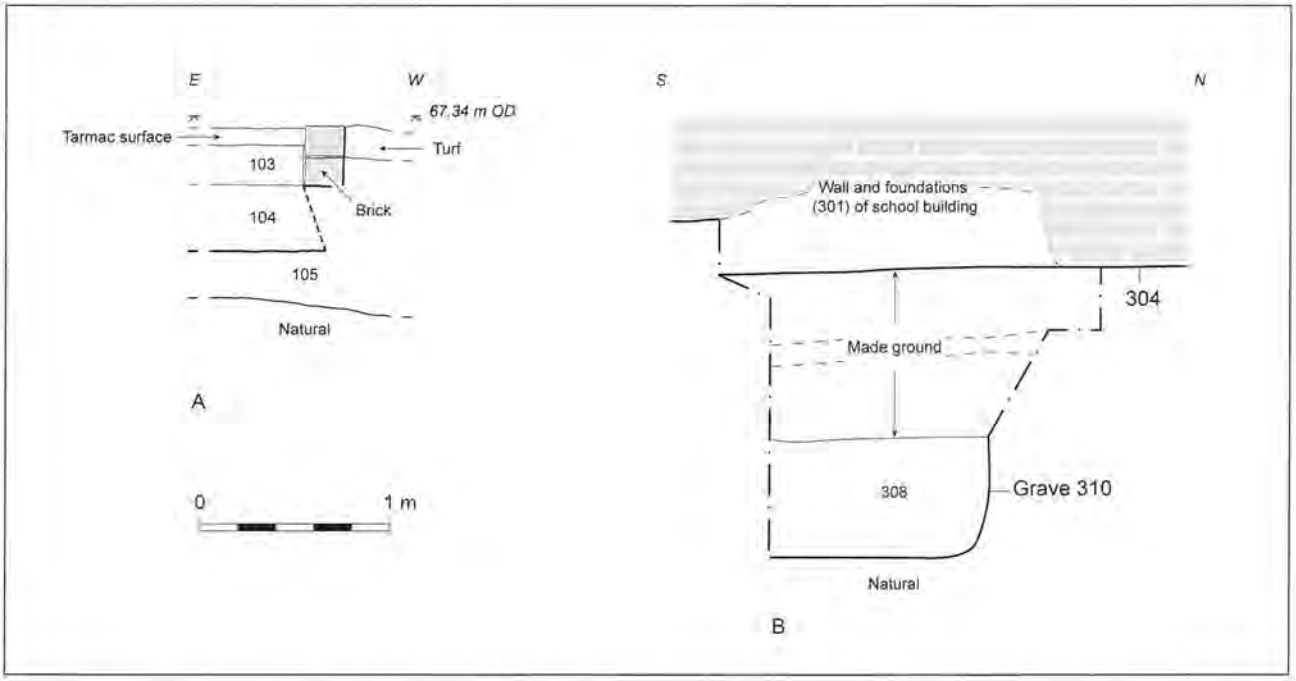


Figure 4a North-facing section within the western part of the new building footprint. b East-facing section within the school building (western side).

a large component of the grave fills. Grave cuts survived to depths of 0.15 m to 1.00 m (average 0.48 m), with their bases ranging between 0.7 m and 3 m below the existing surfaces in the northern and southern parts of the site, respectively (estimated to be 65 to 66 m OD). Graves to the north were found beneath moderate depths of garden soils, whilst those in the southern portion of the site lay under substantial depths of overburden (Figs 2–6). The nature of the investigations (see above) meant that it was not possible to confirm the stratigraphic relationship between the exposed graves and the redeposited chalk layers and buried soil described above.

Most graves were, or appeared to be, rectangular in plan with flat bases and steep to vertical sides and were typically aligned north–south or NNE–SSW. It was only possible to gauge the length of a single grave (2.0 m), whilst the several measurable widths ranged from 0.50 m to 1.16 m (average 0.69 m) (Fig. 3). The suggestion of rows and plots – particularly in the northern area – demonstrate a degree of formality and cemetery planning. The close intercutting of graves 413 and 416 imply deliberate re-use of a grave plot, while it appears that grave 605 had been re-used, the original occupant's bones being found wholly redeposited in the backfill around the articulated remains of the second occupant. The redeposited bone from otherwise unrepresented individuals within graves 413 and 2204 are testament to the disturbance of burials (intentional or otherwise) whilst the cemetery was still in use.

The skeletal remains of 13 adult burials were found relatively intact and within 0.20 m of the base of their respective graves. There was no obvious pattern regarding the orientation of the body, with examples with the head placed at the northern, southern and WNW ends (Fig. 3). Most burials had been made in the Romano-British 'standard' style, i.e., extended and supine, while the corpse in grave 416 had been lain on its right side with the legs flexed – a fashion more akin to the local *Durotrigian* style of burial (Farwell and Molleson 1993; Smith *et al* 1997; Davies *et al* 2002; Egging Dinwiddy and Bradley 2011, 44). The unusual position of the left arm of the body placed in grave 310 is worthy of note (Fig. 7). The presence and locations of iron nails indicate that 10, possibly 12, burials had been made coffined. Seven individuals had been

Figure 5 Photograph of burial remains 3008 in grave 3007, viewed from the south, showing excavation depth and conditions to the west of the school (1m scale).

buried with hobnailed footwear either worn on or placed by the feet, and one man had been buried with a Black-burnished ware jar. Animal bones demonstrate that three burials included offerings of joints of meat (pig and sheep/goat), a practice also recorded in the cemetery at Poundbury Camp and at the more rurally situated Poundbury Farm, Dorchester (Buckland-Wright 1993, 110–1; Grimm 2011, 137; Higbee 2019).

Post-Roman activity

Several extensive deposits of made-ground (typically grey/brown silty clay and between 0.15 m and 1.0 m thick) were observed across the southern half of the site, below the 19th-century School building (Fig. 3 and 4b–6). While it was not possible to confirm the dates for each episode of major landscaping, it is suggested that the most substantial might relate to the extensive remodelling of the ramparts into 'The Walks' in the early 18th century, and the construction and use of the mid-19th century Grove School – as suggested by the clay pipes and building debris recovered from contexts 305 and 402 (see below). Again, these are broadly comparable with deposits recorded close to the ramparts and described in the RCHME (1970, 531–92, fig. 173a & 174a).

Figure 6 Photograph of the remains of burial 606 in grave 605, situated partially under the western wall of the school building (1m scale).

Figure 7 Photograph showing the unusual placement of the left arm in the remains of an adult female (309; grave 310) (1m scale).

HUMAN REMAINS

by Kirsten Egging Dinwiddy

The assemblage comprises the skeletal remains of 13 Romano-British burials and a small quantity of contemporaneous redeposited bone, and adds to the collection of human bone recovered from the vicinity of The Grove since the mid-19th century.

Methods

It was agreed that the entire collection would be best served if fully analysed and reported on as a whole (a task beyond the scope of this article and project) and, as such, the 2019 material has been subject to a brief assessment only, with the aim of highlighting its existence and potential for future research.

Standard osteological methods were used to assess the age and sex of the individual (Bass 1987; Beek 1983; Buikstra and Ubelaker 1994; Scheuer and Black 2000), to describe the condition of the bone (McKinley 2004) and to briefly note gross pathological changes and skeletal morphological variations (Berry and Berry 1967; Finnegan 1978; Mann *et al* 2016). It has not been possible to make detailed descriptions of specific lesions or collect data for the calculation of prevalence rates.

The project parameters did allow for the collection of a limited set of measurements, taken where possible to estimate stature and calculate cranial indices (Bass 1987; Brothwell and Zakrzewski 2004; Trotter and Gleser 1952; 1958).

Results

Below is a summary of the observations; Appendix 2 tabulates the observations by burial context and includes a little more detail.

Disturbance and condition

The silt-rich, chalky backfills, generous grave depths, the formal cemetery layout and substantial layers of overburden (see above) all allowed for the good to excellent preservation of the bone (grades 0–3, the poorest being the redeposited bone) and light fragmentation. Breaks are largely fresh and reflect the nature of the burials' discovery, others relate to the construction of the School. Some disturbance also occurred while the cemetery was still in use, demonstrated by quantities of disarticulated bone

within grave fills and intercutting between graves (413 and 416; Fig. 3). The disarticulated bones from grave 605 represent the remains of a primary burial, disturbed and redeposited when the grave was re-used some years later. Such evidence infers the re-use of defined cemetery plots over time, as often occurs with family plots and favoured locations. It is also possible that unmarked and long-forgotten graves had been disturbed inadvertently.

Between 10% and 92% of individual skeletons found *in situ* were recovered (Appendix 2; average 55.7%), depending on the nature of their discovery and their accessibility at the time of excavation, rather than previous truncation or decay.

The occasional patches of iron residue can be attributed to nearby hobnails and coffin nails, while the green staining on a male pelvis (2110) and a thumb bone (female 3008) are almost certainly derived from prolonged proximity to otherwise undetected copper-rich objects.

Demography

A minimum of 16 individuals are represented (Table 1), all but one of which are adults (93.8%; 53% female, 40% male, rest undetermined); most had survived into or beyond their fourth decade. The only non-adult (6.2%) was represented by a single perinatal bone found redeposited in the grave of male 2205. These proportions are clearly not in keeping with a 'normal' living population – to provide perspective, the 2011 census revealed that 21% of the living UK population was under 18 (ONS 2020). At Poundbury Camp, where the remains are considered more representative of the local Roman population, the percentage of non-adults is 34.3%, whilst the idiosyncratic population buried at Little Keep included only 10.3% non-adults (Molleson 1993, table 62; McKinley 2009, table 2). However, it is likely that a proportion of the cemetery population has been lost to development over the years, or still exist below the depths of overburden in the vicinity of The Grove, so it would be misleading to discuss further at this stage. That said, that the only non-adult remains are those of a perinate is interesting. For various cultural reasons, such young individuals are seldom found in formal Roman mortuary-related settings, instead they are more often found in contexts associated with the world of the living – e.g., domestic, agricultural and industrial (Gowland *et al* 2014, 69; Philpott 1991; Pollock 2006, 172–5; Moore 2009; Struck 1993; Scott 1999).

Table 1 Minimum number of individuals.

age category	MNI total
immature	
foetus/perinate	1 (U)
adult	
>18 yr	1 (U – left *in situ*)
25–40 yr	1 (M)
30–40 yr	1 (M)
35–45 yr	3 (2 F, 1 M)
>35 yr	3 (3 F)
40–50 yr	1 (F)
40–55 yr	1 (M)
45–55 yr	1 (M)
55–65 yr	1 (F)
>55 yr	1 (M)
>65 yr	1 (F)
adult subtotal	*15 (8 F, 6 M)*
Total	16

KEY: MNI – minimum number of individuals; F – female; M – male; U - unsexed

Morphological variation

The differences and similarities in the human skeleton can provide information regarding diversity, as well as offering insights into the physical lives of those studied. However, their interpretive potential is not straightforward, as specific skeletal anomalies are often complex in origin and can be subject to many factors, e.g., genetics, nutrition, environment, biomechanics and activity (Tyrrell 2000, 292). The skeletal indices, select non-metric traits and notes on general morphology are in Appendix 2, and briefly discussed below.

SKELETAL INDICES

The average stature estimates compare well with the period average and broadly with those from nearby cemeteries (Table 2), suggesting a similar access to resources and a degree of homogeny within the population. The local propensity towards female long-headedness (dolichocrany) is exhibited in the 2019 Grove material, while the males do not follow the local trend towards mesocrany (medium). However, the Grove sample sizes are

Table 2 Average stature estimates and cranial indices, with selected comparative data.

	average stature estimate		average cranial index	
	M	F	M	F
Grove	1.70 m (5 individuals)	1.60 m (7 individuals)	81.4 – *brachycranic* (3 individuals)	74.1 – *dolichocranic* (2 individuals)
Alington Avenue [3]	1.69 m	1.57 m	*mesocranic*	*dolichocranic*
Little Keep [4]	1.70 m	1.56 m	76.7 – *mesocranic*	73.6 – *dolichocranic*
Poundbury Camp [1]	1.66 m	1.61 m	76.4 – *mesocranic*	77.1 – *mesocranic*
Poundbury Farm [2]	1.66 m	1.62 m	78.7 – *mesocranic*	73.8 – *dolichocranic*
Period average [5]	1.69 m	1.59 m	–	–

[1] – Molleson 1993, 167–8; [2] – Egging Dinwiddy 2019a, table 9; [3] – Waldron 2002, 151; [4] – McKinley 2009, 70, table 3; [5] – Roberts and Cox 2003, 163

small and, like in the other local assemblages, the ranges are wide.

Non-metric morphological variation

Overall, there is a fair degree of sexual dimorphism, although most display strong muscle attachments, implying everyday life involved a measure of rigorous occupation – a common finding for the period and region.

Observed dental anomalies within the assemblage include the common congenital absence of the third molars, retained deciduous teeth, impaction, shovelling of the incisors, and variations in tooth size, shape and number of cusps. Interestingly, the dentition of female 2108 includes several of these variations (Appendix 2).

Metopism – observed in 309 and 606 – is the genetically-linked retention of the central frontal suture (i.e., on the forehead; Berry and Berry 1967; Gardner 2016); a few cases are recorded at Poundbury Farm, Little Keep and Poundbury Camp. Cranial sutures can also incorporate small additional bones (ossicles), some of which may also have a hereditary aspect, such as the uncommon sagittal ossicles seen in both 411 and 417. Cases are also recorded in the Poundbury Camp assemblage, but at Little Keep, neither metopism nor sagittal ossicles were observed (Molleson 1993, 168–9; McKinley 2009).

Bony prominences (tori) are present on the three mandibles (408 and 2205, and 417) and on the palates of 417, 2108 and 3008; examples are recorded in mandibles from Little Keep, Poundbury Camp and Poundbury Farm. Suggested aetiologies include a genetic predisposition, direct trauma and/or pressure (e.g., bruxism, and non-masticatory use of the jaws (Neville *et al* 2002, 21; Egging Dinwiddy 2011b, 103–4; 2015, 380; Auškalnis *et al* 2015)). Other cranial anomalies include precondylar tubercles and a pharyngeal foveola, both of which are rare and appear on the base of the skull of 3008 (Mann *et al* 2016, 325, 390–1). A small oval depression on the inner surface of the mandible of male 408 (a Stafney's defect) was likely formed by pressure from abnormal salivary tissue – an uncommon, usually asymptomatic condition that usually affects middle-aged men (Mann *et al* 2016, 454–8; Branstetter *et al* 1999).

Various observed coalition and similar developmental defects, usually the result of anomalous numbers of centres of ossification, have been identified in several carpal bones (408, 2205 and 414), tali (*os trigonum*: 408, 408a and 2110), navicular (several cornuate, one unfused tubercle) and hallux sesamoids (2205 and 2807) (see Appendix 2). *Os acromiale* – the non-union of the epiphysis of the acromion process – is linked to repeated, prolonged strain on the affected shoulder from an early age (Stirland 2005, 121; Roberts and Cox 2003, 152). This anomaly is present in both scapulae of 606, a man whose upper limbs and shoulders show signs of strength and joint deterioration. Likewise, the case from Poundbury Farm (a female) is also linked to strenuous activity (Egging Dinwiddy 2011), while McKinley (2009) suggests the high rate at Little Keep (15.6%) might be partly related to genetics.

Pathology

Most of the represented individuals have some form of pathological lesion, most of which can be attributed to advancing age. See Appendix 2 for a summary for each individual.

Dental disease

Calculus – a build-up of calcified plaque, linked to a diet rich in soft carbohydrates (Hillson 1986, 278) – is present on most of the teeth in all nine of the observable dentitions (five female, four male). In life, these plaque-covered, bacteria harbouring deposits trap food and other debris between the teeth and gums. The bacterial excretions can lead to inflammation of the gums (gingivitis) which can cause widening and resorption of the tooth socket margins (periodontal disease; Ogden 2005), and dental caries. Indications of both are observable in eight dentitions, equally divided between the sexes.

Smooth, spherical periapical voids (seen in three female and four male dentitions) are typically caused by granuloma – sacs of fibrous tissue that form in response to injury of the dental pulp. Larger voids may represent cystic granuloma, while more disorganised lesions are usually associated with abscesses, the purulent contents of which can cause wider inflammation and bony reactions, including chronic sinusitis – a condition evident in the facial sinuses of several individuals in this assemblage (Appendix 2; Soames and Southam 2005, 65–84; Dias and Tayles 1997; Ogden 2007, 283–308).

The extent and severity of most dental diseases are often age-related, and can lead to tooth loss, as demonstrated in six dentitions from The Grove.

The observed dental attrition is flat and moderate with frequent mild chipping of the occlusal edges. Occasional buffing, palatal polishing, faceted and/or irregular wear were also noted. Most can be attributed to diet or mal-occlusion; however, certain patterns may suggest the habitual non-masticatory use of the teeth and jaws (Egging Dinwiddy 2011b, 103–4; 2015, 380).

Stress indicators

One female and three male dentitions have enamel defects (Appendix 2), reflecting the temporary slowing/cessation of enamel production – i.e., dental enamel hypoplasia – in response to childhood physiological stress, such as malnutrition, poor health and/or disease (Hillson 1986, 37; Lewis and Roberts 1997). Pitting of the orbital roof (*cribra orbitalia*) – seen in the orbits of four males and three females – is considered symptomatic of anaemia, whether related to deficiency in iron or vitamin B_{12} and their various causative factors (*ibid*; Walker *et al* 2009). The second to fifth sacral vertebrae of male 606 showed signs of *spina bifida occulta*, the predominant cause of which is an insufficient supply of folic acid (vitamin B_9) during foetal development (Aufderheide and Rodríguez-Martín, 1998, 61). Widespread changes in the trabecular bone, collapsed lumbar vertebrae and the overall lightness and fragility of the elderly female remains (417) indicate long-standing osteoporosis, a metabolic condition related to advancing age, hormonal changes, inactivity, and/or a variety of chronic underlying complaints (Waldron 2009, 118–22).

Trauma

Traumatic injury amongst the male contingent comprise a healed broken nose (411), several damaged teeth and healed fractures in 2205 (distal right radius and first metatarsal). Healed fractures amongst the females comprise one to a distal left ulna shaft (414), another to the midshaft of a right radius (3008; Fig. 8); a degeneration-related fracture is evident in an acetabular rim (hip) of 309. The latter also had an injury which resulted in the permanent separation of the posterior portion from the main part of the fifth lumbar vertebra (spondylolysis), a condition that often results from excessive hyperflexion of the lower spine, particularly where there is a morphological predisposition (Salter 1999, 372–4; Ortner and Putschar 1985, 357–8; Ward *et al* 2010). Minor exostoses – small bony growths usually associated with direct trauma – are present on a finger and a fifth metacarpal (females 417 and 414, respectively).

It is often not possible to determine the exact nature of a traumatic incident from a skeletal lesion alone; most of the above could have been the result of a fall or a direct blow, intended or not. At Poundbury Farm, which served a farming population, traumatic injuries were more frequent and varied suggesting

Figure 8 Photograph of the right radius of adult female 3008, showing a healed, misaligned mid-shaft fracture (3cm scale).

a more risk-laden lifestyle, compared to those involved in more sedentary trades and occupations as one might expect within the town – such as was suggested for the Little Keep population, although these are also described as recidivists, due to the greater numbers of injuries likely related to interpersonal violence (McKinley 2009).

Infection and inflammation

Infection is the leading cause of death, now and in the past. It is caused when diverse types of pathogens are introduced into the body via direct trauma, ingestion or inhalation. Acute infections allow little time for a bony reaction prior to death and so rarely cause skeletal lesions. Chronic infections, however, can cause bone to proliferate, resorb or both. While some specific infections can be identified from

Figure 9 Photograph showing the abnormal ankylosis of the 3rd meta-phalangeal joint from the left hand of adult male 2110 (3cm scale).

patterns of skeletal changes, many cannot. As with any infection, disruption, destruction or blocking of various essential structures can have grave consequences, whilst sepsis – the body's extreme reaction to infection – is a potential and often fatal outcome.

Dental infections are implicated in the formation of new bone on the mandible of 417 and the maxilla of 606, as well as within the facial sinuses of several individuals (sinusitis). Modest new bone on the tibial shafts of 411 and 2205 suggest a lingering irritation of the periosteum, including a possible venous ulcer. Small patches of new bone on a thoracic vertebra and the innominate of 414a suggest some form of chronic abdominal infection. The destructive lesions in the tarso-metatarsal joints in the feet of elderly female 417 could represent osteomyelitis, septic arthritis, or an autoimmune condition such as rheumatoid arthritis or one of the seronegative spondyloarthropathies (Waldron 2009, 46–57). Several joints in the hands of older male 2110 show similar lesions, and his left third metacarpo-phalangeal joint is fully ankylosed (Fig. 9). The same individual also has distinctive changes to the lumbo-sacral body surface that indicate chronic inflammation of the intervertebral disc (rather than degenerative disc disease or trauma). Discitis is a condition seen repeatedly in autoimmune disease sufferers and is also commonly caused by the migration of bacteria such as *Staphylococcus aureus*, or *Escherichia coli* from the gut or genitourinary tract often resulting in pain and disability – particularly in older males (Salter 1999, 221; Viroslav 2012; Egging

Dinwiddy 2019b, 211–2). These levels and types of infection are in keeping with the patterns seen at Poundbury Farm and Little Keep.

Joint disease

Joint diseases represent the most recorded conditions in archaeological skeletal assemblages. Similar lesions (e.g., osteophytes and pitting) can form in response to several different disease processes, as well as reflect wear-and-tear.

Lumbar and/or thoracic vertebrae in seven spines have the depressed defects that indicate the prolapse of intervertebral disc material (Schmorl's nodes) – a phenomenon that usually results from excessive loading and twisting of the spine in adolescence and early adulthood (Rogers and Waldron 1995, 27; Roberts and Manchester 1997, 107) (Appendix 2). The cervical and lumbo-sacral spines of five older individuals show the classic pitting and disfigurement associated with degenerative disc disease – the typically age-related breakdown of the intervertebral disc (Rogers and Waldron 1995, 270). Lesions indicative of osteoarthritis (e.g., osteophytes, heavy pitting, eburnation and/or gross morphological changes; Rogers and Waldron 1995, 43–4) are present in the joints of the axial skeleton of seven individuals and are particularly advanced in the remains of elderly female 417 (Appendix 2). Lone osteophytes were recorded in multiple joints in 11 skeletons, predominantly affecting those of the axial and upper limbs. Lone pitting was observed in the (mostly axial) joints of seven individuals. Disruption and pathological damage to the superior part of the acetabular rim (hips) of 408 and 414b, suggest femoro-acetabular impingement or acetabular rim syndrome (Shaw 2017), while changes to the one or both proximal humerus of three individuals indicate some degeneration of the shoulders' rotator cuff (Clement *et al* 2012).

Miscellaneous

Enthesophytes – bony growths at the sites of tendon and ligament insertions relating to old age, traumatic stress and various diseases (Rogers and Waldron 1995, 24–5; Havelková and Villotte 2007) – were identified on six skeletons of each sex. As is often observed, the Achilles attachment of the calcaneum is a common site, while a more widespread distribution coincides with advancing age and increased robusticity/strength (e.g., 408 and 417). Overall, however, the upper limbs and axial skeleton are most frequently affected, which suggests most people made good use of these in their day-to-day life.

Hyperostosis frontalis interna is a common, benign condition characterised by deposits of smooth new bone on the endocranial surface of the frontal bone. It predominantly manifests in elderly women and is thought to be influenced by hormonal changes following the menopause (She and Szakacs 2004). The condition was observed in three of the female crania.

Several small, dome-shaped bony projections observed on the exocranial surface of male 408, are ivory or button osteomata, i.e., commonly recorded benign bone growths. The small, smooth-walled cavities in some of the carpal bones of 309 and 2110 most likely represent asymptomatic and idiopathic pseudo-erosions or solitary bone cysts (Eiken and Jonsson 1980; Rogers and Waldron 1995, 61–3).

Discussion

Based on these preliminary findings, the cemetery appears to have been used by the local, largely town-based population, including family groups, but potentially with a bias towards adults. Levels of childhood stress, trauma and infection suggest that their lifestyles were relatively low risk and broadly comparable to their local urban counterparts, but seemingly a little less hazardous and physically demanding than those in a more rural situation, such as those at Poundbury Farm (Molleson 1993, table 51; McKinley 2009, 29; Egging Dinwiddy 2011a; 2019a). Activity-related changes appear broadly consistent with a population more occupied in trade and crafts, than in strenuous labouring. As this assemblage comprises middle-aged and older adults, dental and joint diseases and other age-related conditions will undoubtedly appear more prevalent/extensive than in a more demographically balanced population.

FINDS

by Grace Jones and Katie Marsden, *with* Phil Harding (flint), Lorrain Higbee (animal bone), and Lorraine Mepham (post-Roman pottery and clay pipe)

Prehistoric

Five pieces of prehistoric flint were residual in layer 3005 and grave 3007 (fill 3009). All are undiagnostic flakes and not closely datable.

Roman

Pottery

The 11 sherds (115 g) of Roman pottery include eight from a single, Black-burnished ware vessel, found in fill 408 of grave 407. It is a small, thin-walled jar with everted rim (120 mm rim diameter; profile reconstruction not possible), of late 3rd to 4th-century date (Seager Smith and Davies 1993, type 3). It is likely that this vessel, and any contents, were placed as grave goods. A rim fragment from a larger, Black-burnished ware everted rim jar was recovered from fill 2107 of grave 2106. It is broken at the neck/shoulder join; the type and date are therefore uncertain. Other Roman pottery comprises a base sherd of Black-burnished ware from a layer of redeposited chalk (704), and a small piece of Central Gaulish samian, of 2nd-century date, from buried soil 3004.

Iron

The iron assemblage comprises 98 nails and 405 hobnails. The nails derive from 12 graves and garden feature 404, where they are likely to represent the remains of coffins. All are flat-headed types (Manning 1985, type 1B) 55–80 mm in length, but most are 65–70 mm. The round heads are typically 15–20 mm in diameter, except for one of 25 mm diameter from grave 3806. Mineral-replaced wood survives on several nails. The quantities recovered from each grave are variable, ranging from two (grave 410) to 21 (grave 605).

Hobnails were recovered from seven graves. They are dome-headed and 15–20 mm in length where measurable. Several clusters of two, three or four hobnails are joined by the remains of mineral-replaced leather. The hobnails represent the remains of leather soled footwear; types include studded shoes (*calceus*), sandals (*solea*) or military boots (*caliga*) (Clarke 1979, 322). Hobnails were used throughout the Roman-British period and are not closely datable. The greatest concentrations were recorded from grave 2109 (115 hobnails), grave 605 (109 hobnails), grave 310 (85 hobnails), grave 407 (73 hobnails) and grave 2806 (18 hobnails). The two hobnails present in graves 410 and 3007 may be stray finds. In the case of graves 605 and 2806 the footwear appears to have been worn or placed at the foot-end of the grave. The hobnails found in grave 309 were located between the knees/shins. It was not possible to ascertain the placement of the footwear in the other features.

Building materials

Building material of Romano-British date include a fragment from a base coat of sandy lime mortar and a finer sandy lime plaster topcoat with white painted surface, both from layer 307. An abraded and featureless brick fragment was recovered from layer 503. Both are from trenches in or close to the School.

Animal bone

The Romano-British animal bone (11 fragments, 47 g) includes fragments from three graves. A sheep/goat radius came from grave 310, a pig scapula from 416 and an unidentifiable fragment from 407. The sheep/goat and pig bones are both right-sided elements from the forequarters and probably represent food offerings placed in the graves. Bones from buried soil deposits 804 and 3004 include the left mandible from a fox and a right pig humerus.

Post-Roman

Pottery

Two abraded sherds (7 g) of pottery in a medieval sandy ware, one glazed, were intrusive in fill 607 of grave 605. These have been identified as West Dorset sandy ware, comparable to products of the 13th-century kiln at Hermitage (Field 1966), but probably manufactured at several centres between the 13th and 15th centuries. Pottery of post-medieval and modern date comprises single sherds of redware (19 g) from made ground layer 305, English stoneware (19 g) and two Verwood-type earthenware sherds (43 g)

from garden feature 404, and an unglazed redware flowerpot fragment (21 g) from layer 402.

Ceramic building material
Two brick fragments of post-medieval or modern date were recorded from layer 305 and as an intrusive find in grave 410 (fill 411). A piece of roofing slate was also recovered from layer 305.

Clay pipe
Three clay pipe fragments were recovered from layers 305 and 402. They include a bowl fragment with part of a maker's mark visible, including the letters 'BS', and two stem fragments. Other examples of the BS mark have been found in Dorchester and identified as possibly belonging to Bartholomew Sayer (or Sawyer) of East Woodhay in Hampshire, who married in 1728; the bowl is dated 1680–1720 (Watkins 1966, 221, fig. 3, 3).

Animal bone
Animal bone amounting to 23 fragments (15 g) came from contexts of post-medieval/modern date or were unstratified. Most came from topsoil 401, the identified bones include two sheep bones, a tibia and calcaneus, a pig scapula, a rabbit femur, and several bones from an immature dog including the left mandible, a radius, metacarpal and rib. In addition, a cattle left radius and a few unidentifiable fragments were retrieved from the spoil heap.

DISCUSSION

Although there were considerable difficulties in excavating, recording and recovering the evidence, the efforts have enabled an enhancement of the record and a better understanding of the nature and state of the archaeology. The results provide more pieces of the puzzle, which correspond with the various observations published since the 19th century. The deep deposits of made-ground not only link to an important change in the use of the defences in the 18th century (corroborated by the clay pipe pieces) and the later development of the town and social reform, but they have also substantially protected much earlier features and deposits. Based on the stratigraphy and (albeit limited) artefactual evidence, the earliest of these are likely to be linked to the establishment of the town's Roman defences. The most significant findings, however, relate to the purported Roman cemetery in the vicinity of The Grove, filling in gaps to provide a better understanding of the cemetery layout and nature of the burials. Artefacts from the graves have provided more evidence regarding Romano-British burial rites, whilst a brief assessment of the skeletal remains has allowed some insight into the lives of some of those who lived, worked and died in the *Durnovaria* area. More importantly, this highlights the potential (and need) for further study of the 2019 material and findings together with those from the previous excavations in the locale.

ACKNOWLEDGEMENTS

The project was commissioned by East Boro Housing Trust, and Wessex Archaeology is grateful to Pam Palmer and Karen Allan. Steve Wallis, Dorset Council Senior Archaeologist, monitored the fieldwork and is thanked for his advice and comments on this article. The fieldwork, managed by Andrew Manning, was undertaken by Alistair Zochowski, Lee Newton and Steven Froud. Wessex Archaeology is particularly grateful for the co-operation and assistance offered by the site contractors, Cooke Construction. The post-excavation stage was managed by Kirsten Egging Dinwiddy. Thanks are also due to Lynn Wootten for undertaking the x-radiography, Grace Jones for editing the finds section, to Bob Clarke, Philippa Bradley and Andrew Valdez-Tullett for reviewing and editing the article. The illustrations were produced by Rob Goller and Nancy Dixon.

ARCHIVE

The physical archive – labelled with the unique Wessex Archaeology codes 117170 and 117171 – will be deposited with the Dorset Museum in due course; the digital archive will be submitted to the Archaeology Data Service (ADS) repository (https://archaeologydataservice.ac.uk/).

REFERENCES

Aufderheide, A.C. and Rodríguez-Martín, C. 1998. *The Cambridge Encyclopaedia of Human Palaeopathology*. Cambridge University Press, Cambridge.

Auškalnis, A., Bernhardt, O., Putniene, E., Šidlauskas, A., Andriuškevičiūtė, I. and Basevičienė, N. 2015. 'Oral bony outgrowths: prevalence and genetic factor influence. Study of twins', *Medicina* **51(4)**, 228–32.

Bass, W.M. 1987. *Human Osteology*. Missouri Archaeological Society, Columbia.

Beek, van, C.G. 1983. *Dental Morphology: an illustrated guide*. Wright PSG, Bristol.

Berry, A.C. and Berry, R.J. 1967. 'Epigenetic variation in the human cranium', *Journal of Anatomy* **101(2)**, 261–379.

Branstetter, B.F., Weissman J.L. and Kaplan S.B. 1999. 'Imaging of a Stafney bone cavity: what MR adds and why a new name is needed', *American Journal of Neuroradiolology* **20(4)**, 587–9 http://www.ajnr.org/content/20/4/587.full [accessed November 2020].

British Geological Survey (BGS) *Geology of Britain viewer* (classic). https://mapapps.bgs.ac.uk/geologyofbritain/home.html [accessed November 2020]

Brothwell, D. and Zakrzewski, S. 2004. 'Metric and non-metric studies of archaeological human remains', in M. Brickley and J.I. McKinley (eds), *Guidelines to the Standards for Recording Human Remains*. British Association for Biological Anthropology and Osteoarchaeology and Institute for Field Archaeology, 24–30.

Buckland-Wright, J.C. 1993. 'The animal bones', in D.E. Farwell and T.I. Molleson *Excavations at Poundbury 1966–80 Vol. II The Cemeteries*. Dorset Natural History and Archaeological Society Monograph **11**, 110–11.

Buikstra, J.E. and Ubelaker, D.H. (eds) 1994. *Standards for data collection from human skeletal remains. Proceedings of a seminar at the Field Museum of Natural History organised by Jonathan Haas*. Arkansas Archaeological Survey Research Series **44**. Fayetteville, Arkansas.

Burnham, B.C. and Wacher, J. 1990. *The 'Small Towns' of Roman Britain*. Batsford, London

Clarke, G. 1979. *The Roman Cemetery at Lankhills*. Winchester Studies **3**: Pre-Roman and Roman Winchester. Clarendon Press, Oxford.

Clement, N.D., Nie, Y.X. and McBirnie, J.M. 2012. 'Management of degenerative rotator cuff tears: a review and treatment strategy', *Sports Medicine, Arthroscopy, Rehabilitation, Therapy and Technology* **4**, 48, https://dx.doi.org/10.1186%2F1758-2555-4-48 [accessed November 2020].

Davies, S.M., Bellamy, P.S., Heaton, M.J. and Woodward, P.J. 2002. *Excavations at Alington Avenue, Fordington, Dorchester, Dorset, 1984–87*. Dorset Natural History and Archaeological Society Monograph **15**.

Dias, G. and Tayles, N. 1997. 'Abscess Cavity – a misnomer', *International Journal of Osteoarchaeology* **7**, 548–54.

Durham, E. and Fulford, M. 2014. *A Late Roman Town House and its Environs: The Excavations of C.D. Drew and K.C. Collingwood Selby in Colliton Park, Dorchester, Dorset 1937–8*. Society for the Promotion of Roman Studies, London.

Egging Dinwiddy, K. 2009. *A Late Roman Cemetery at Little Keep, Dorchester, Dorset*. Wessex Archaeology online report, https://www.wessexarch.co.uk/our-work/little-keep-dorchester-late-roman-cemetery [accessed January 2021].

Egging Dinwiddy, K. 2011a. 'Unburnt bone', in K. Egging Dinwiddy and P. Bradley, *Prehistoric Activity and a Romano-British Settlement at Poundbury Farm, Dorchester, Dorset*. Wessex Archaeology Report **28**, 110–32.

Egging Dinwiddy, K. 2011b. 'An Anglo-Saxon Cemetery at Twyford, Near Winchester', *Hampshire Studies 2011: Proceedings of the Hampshire Field Club and Archaeological Society* **66**, 75–126.

Egging Dinwiddy, K. 2015. 'Roman', in Chapter 13 – Human Bone, in P. Andrews, P. Booth, A.P. Fitzpatrick and K. Walsh, *Digging at the Gateway, Archaeology landscapes of south Thanet: The Archaeology of East Kent Access Phase II. Volume 2: The Finds and Environmental Reports*. Oxford Wessex Archaeology Monograph **8**, 374–390.

Egging Dinwiddy, K. 2019a. *Further Prehistoric and Romano-British activity at Poundbury Farm, Dorchester, Dorset*. Wessex Archaeology online report, https://www.wessexarch.co.uk/sites/default/files/field_file/60027_Further%20Prehistoric%20and%20RomanoBritish%20activity%20at%20Poundbury%20Farm%2C%20_online%20publication%20FINAL.docx%281.0%29.pdf [accessed January 2021].

Egging Dinwiddy, K. 2019b. 'Human bone', in P. Andrews, J. Last, R. Osgood and N. Stoodley, *A Prehistoric Burial Mound and Anglo-Saxon Cemetery at Barrow Clump, Salisbury Plain, Wiltshire: English Heritage and Operation Nightingale excavations 2003–14*, Wessex Archaeology Monograph **40**, 189–222.

Egging Dinwiddy, K. and Bradley P. 2011. *Prehistoric Activity and a Romano-British Settlement at Poundbury Farm, Dorchester, Dorset*. Wessex Archaeology Report **28**.

Eiken, O. and Jonsson, K. 1980. 'Carpal bone cysts', *Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery* **14(3)**, 285–90.

Farwell, D.E. and Molleson, T.I. 1993. *Excavations at Poundbury 1966–80 Vol. II The Cemeteries*. Dorset Natural History and Archaeological Society Monograph **11**.

Field, N.H. 1966. 'A thirteenth-century kiln at Hermitage, Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **88**, 161–75.

Finnegan, M. 1978. 'Non-metric variations of the infracranial skeleton', *Journal of Anatomy* **125(1)**, 23–37.

Gale, J. 2003. *Prehistoric Dorset*. The History Press, Cheltenham

Gardner, S. 2016. 'A persistent metopic suture: a case report', *Austin Journal of Anatomy* **3(1)**, 1049.

Gowland, R.L., Chamberlain, A. and Redfern, R.C. 2014. 'On the brink of being: re-evaluating infanticide and infant

burial in Roman Britain', *Journal of Roman Archaeology Supplementary Series* **96**, 69–88.

Grimm, J. 2011 'Animal bone', in K. Egging Dinwiddy and P. Bradley, *Prehistoric Activity and a Romano-British Settlement at Poundbury Farm, Dorchester, Dorset*. Wessex Archaeology Report **28**, 133–42.

Havelková, P. and Villotte, S. 2007. 'Enthesopathies: test of the reproducibility of the new scoring system based on current medical data', *Slovenská Antropológia* **10**, 51–7.

Higbee, L. 2019. 'Animal bone', in K. Egging Dinwiddy, *Further Prehistoric and Romano-British activity at Poundbury Farm, Dorchester, Dorset*. Wessex Archaeology online report, 17–21. https://www.wessexarch.co.uk/sites/default/files/field_file/60027_Further%20Prehistoric%20and%20RomanoBritish%20activity%20at%20Poundbury%20Farm%2C%20_online%20publication%20FINAL.docx%281.0%29.pdf [accessed January 2021].

Hillson, S.W. 1986. *Teeth*. Cambridge University Press, Cambridge.

Historic England interactive map: https://historicengland.org.uk/listing/the-list/map-search?clearresults=True/ [accessed June 2022]

Jackson, M. 1976. 'A Note on Romano-British Burials in The Grove, Dorchester, 1975', *Proceedings of the Dorset Natural History and Archaeological Society* **97**, 52–3.

Lewis, M. and Roberts, C. 1997. 'Growing pains: the interpretation of stress indicators', *International Journal of Osteoarchaeology* **7**, 581–6.

Mann, R.W., Hunt, D.R. and Lozanoff, S. 2016. *Photographic Regional Atlas of Non-Metric Traits and Anatomical Variants in the Human Skeleton*. Charles C. Thomas Publisher Ltd, Springfield, Illinois.

Manning, W.H. 1985. *Catalogue of the Romano-British Iron Tools, Fittings and Weapons in the British Museum*. British Museum Press, London.

Margary, I.D. 1967. *Roman Roads in Britain* (2nd edn). John Baker Ltd, London

McKinley, J.I. 2004. 'Compiling a skeletal inventory: disarticulated and co-mingled remains', in M. Brickley and J.I. McKinley (eds), *Guidelines to the Standards for Recording Human Remains*. British Association for Biological Anthropology and Osteoarchaeology and Institute for Field Archaeology, 13–16.

McKinley, J.I. 2009. 'The human remains', in K. Egging Dinwiddy, *A Late Roman Cemetery at Little Keep, Dorchester, Dorset*. Wessex Archaeology online report, 11–35. https://www.wessexarch.co.uk/our-work/little-keep-dorchester-late-roman-cemetery [accessed January 2021].

McKinley, J.I. and Egging Dinwiddy, K. 2009. "Deviant' burials from a late Romano-British cemetery at Little Keep, Dorchester', *Proceedings of the Dorset Natural History and Archaeological Society* **130**, 43–61.

Molleson, T.I. 1993. 'The human remains', in D.E. Farwell and T.I. Molleson, *Excavations at Poundbury 1966-80 Vol. II The Cemeteries*. Dorset Natural History and Archaeological Society Monograph **11**, 142–214.

Moore, A. 2009. 'Hearth and home: the burial of infants within Romano-British domestic contexts', *Childhood in the Past* **2(1)**, 33–54.

Neville, B.W., Damm, D., Allen, C. and Bouquot, J. 2002. *Oral and Maxillofacial Pathology* (2nd Edn). W.B. Saunders, St Louis, USA.

Ogden, A.R. 2005. *Identifying and Scoring Periodontal Disease in Skeletal Material*. Biological Anthropology Research Centre, University of Bradford.

Ogden, A.R. 2007. 'Advances in the palaeopathology of the teeth and jaws', in S. Mays and R. Pinhasi, (eds), *Human Palaeopathology: New directions in diagnosis and interpretation*. Wiley, Chichester, 283–308.

ONS 2020. Age groups: main facts and figures https://www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity/demographics/age-groups/latest [accessed June 2022]

Ortner, D.J. and Putschar, W.G.J. 1985. *Identification of Pathological Conditions in Human Skeletal Remains*. Smithsonian Institution Press, Washington.

Philpott, R. 1991. *Burial Practices in Roman Britain*. BAR British Series **219**. Tempus Reparatum, Oxford.

Pollock, K.J. 2006. *The Evolution and Role of Burial Practice in Roman Wales*. BAR British Series **426**. John and Erica Hedges, Oxford.

Putnam, B. 2007. *Roman Dorset*. Tempus Publishing Ltd, Stroud.

RCHME 1970. *An Inventory of the Historical Monuments in Dorset, Volume 2, South east*. Her Majesty's Stationery Office, London. https://www.british-history.ac.uk/rchme/dorset/vol2 [accessed June 2022].

Roberts, C. and Cox, M. 2003. *Health and Disease in Britain from Prehistory to the Present Day*. Sutton, Stroud.

Roberts, C. and Manchester, K. 1997. *The Archaeology of Disease*. Sutton, Stroud.

Rogers, J. and Waldron, T. 1995. *A field guide to Joint Disease in Archaeology*. Wiley, Chichester.

Royall, C. 2011. *South Dorset Ridgeway Mapping Project*. Dorset County Council and English Heritage. https://historicengland.org.uk/research/results/reports/6891/TheNationalMappingProgramme_SouthDorsetRidgewayMappingProject_ResultsofNMPmapping [accessed June 2022]

Salter, R.B. 1999. *Textbook of Disorders and Injuries of the Musculoskeletal System: an introduction of orthopaedics fractures and joint injuries, rheumatology, metabolic bone disease, and rehabilitation* (3rd edn). Lippincott, Williams and Wilkins, Baltimore.

Scheuer, L. and Black, S. 2000. *Developmental Juvenile Osteology*. Academic Press, London.

Scott, E. 1999. *The Archaeology of Infancy and Infant Death*. BAR International Series **819**. Archaeopress, Oxford.

Seager Smith, R.H. and Davies, S.M. 1993. 'Roman pottery', in P.J. Woodward, A.H. Graham and S.M.

Davies, *Excavations at Greyhound Yard, Dorchester 1981–4*. Dorset Natural History and Archaeological Society, Monograph **12**, 202–89.

Sharples, N. 1991. *Maiden Castle. Excavations and Field Survey 1985–6*. English Heritage Archaeological Report **19**, London.

Shaw, C. 2017. 'Femoroacetabular Impingement Syndrome: A Cause of Hip Pain in Adolescents and Young Adults', *Missouri Medicine, the Journal of the Missouri State Medical Association* **114**(4), 299–302. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6140084/ [accessed November 2020].

She, R. and Szakacs, J. 2004. 'Hyperostosis frontalis interna: case report and review of literature', *Annals of Clinical and Laboratory Science* **34(2)**, 206–208. http://www.annclinlabsci.org/content/34/2/206.full [accessed November 2020].

Smith, R.J.C. 1993. *Excavations at County Hall, Dorchester, Dorset, 1988 in the North-west Quarter of Durnovaria*. Wessex Archaeology Report **4**, Salisbury.

Smith, R.J.C., Healy, F., Allen, M.J., Morris, E.L., Barnes, I. and Woodward, P.J. 1997. *Excavations Along the Route of the Dorchester By-pass, Dorset, 1986–8*. Wessex Archaeology Report **11**, Salisbury.

Soames J.V. and Southam S.R. 2005. *Oral Pathology* (4th edn). Oxford University Press, Oxford.

Sparey Green, C. 1987. *Excavations at Poundbury, Dorchester, Dorset, 1966–1982: Volume 1: The Settlements*. Dorset Natural History and Archaeological Society Monograph **7**.

Startin, D.W.A., Smith, K. and Green, C.J.S. 1973. Excavations for the Dorchester Excavation Committee, interim report, 1972. *Proceedings of the Dorset Natural History and Archaeological Society* **94**, 80–81.

Stirland, A.J. 2005. *The Men of the Mary Rose: Raising the Dead*. Stroud, Sutton.

Struck, M. 1993. 'Kinderbestattungen in romano-britischen Siedlungender archäologische Befund', in M. Struck (ed.) *Römezeitliche Graber als Quellen zu Religion, Bevölkerungsstruktur und Sozialgeschichte. Institut für Vorund Frühgeschichte, Mainz*.

Trevarthen, M. 2008. *Suburban life in Roman Durnovaria: Excavations at the former County Hospital Site, Dorchester, Dorset 2000-2001*. Wessex Archaeology, Salisbury.

Trotter, M. and Gleser, G.C. 1952. 'Estimation of stature from long bones of American whites and Negroes', *American Journal of Physical Anthropology* **10(4)**, 463–514.

Trotter, M. and Gleser, G.C. 1958. 'A re-evaluation of estimation of stature bases on measurements of stature taken during life and of long bones after death', *American Journal of Physical Anthropology* **16(1)**, 79–123.

Tyrrell, A. 2000. 'Skeletal non-metric traits and the assessment of inter- and intra-population diversity: past problems and future potential', in M. Cox and S. Mays (eds) *Human Osteology in Archaeology and Forensic Science*. London, Greenwich Medical Media, 289–306.

Viroslav, A.B. 2012. 'MRI Web Clinic - July 2012: Discitis', *Radsource*: http://radsource.us/discitis/ [accessed November 2020].

Waldron, T. 2002. 'The human remains' in S.M. Davies, P.S. Bellamy, M.J. Heaton and P.J. Woodward, *Excavations at Alington Avenue, Fordington, Dorchester, Dorset, 1984–87*. Dorset Natural History and Archaeological Society Monograph **15**, 147–54.

Waldron, T. 2009. *Palaeopathology*. Cambridge Manuals in Archaeology. Cambridge University Press.

Walker, P., Bathurst, R., Richman, R., Gjerdrum, T. and Andrushko, V. 2009. 'The causes of porotic hyperostosis and *cribra orbitalia*: a reappraisal of the iron-deficiency-anaemia hypothesis', *American Journal of Physical Anthropology* **139**, 109–25.

Ward C.V., Mays, S., Child S. and Latimer B. 2010. 'Lumbar vertebral morphology and isthmic spondylosis in a British medieval population', *American Journal of Physical Anthropology* **141**, 273–80.

Watkins, E. 1966. 'Clay tobacco pipes found in Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **88**, 216–33.

Wessex Archaeology 2017. *The Former Grove School, School Lane, Dorchester: Archaeological Evaluation*. Unpublished client report ref. 117170.02.

Woodward, P.J., Graham, A.H. and Davies, S.M. 1993. *Excavations at Greyhound Yard, Dorchester, 1981–1984*. Dorset Natural History and Archaeological Society Monograph **12**.

The author: Kirsten Egging Dinwiddy is a Research Manager, at Wessex Archaeology. For over two decades, Kirsten has been involved in a wide variety of archaeological projects, from field to publication. She is an established author and human bone specialist, with a particular interest in Roman and later periods. Her publications include those associated with the extensive excavations at Poundbury Farm, west of Dorchester. Correspondence: k.dinwiddy@wessexarch.co.uk

APPENDIX 1: GRAVE CATALOGUE

grave burial *fill*	GRAVE shape	 dimensions (m)	 orientation	BURIAL type	 position	 human remains	associated artefacts/ *residual/redeposited finds*
310 309 *308, 311*	rect.	1.10* x 0.8 x 0.6	S–N	coffined	extended, supine	309: adult female *311 R: ? = 309*	43 hobnails (between lower legs) 12 flat-headed coffin nails *6 standard coffin nails* *43 dome-headed hobnails*
407 408 *409*	sub-rect.	0.8* x 0.57 x ?	N–S	coffined	extended, supine	408: adult male *409a R: adult ?female (=?)* *409b R: = 411*	79 g South-east Dorset Black-burnished ware everted rim jar. Seager Smith Type 1, with band of acute lattice burnished decoration. 1st century BC–2nd century AD 74 dome-headed hobnails 9 standard coffin nails *pottery*
410 411 *412*	?rect.	?	?N–S	coffined	?extended	adult male	3 hobnails 2 standard nails
413 414 *415*	rect.	0.8* x 0.5 x 0.15	N–S	?coffined	extended, supine	414: adult female *414a & 415 R: adult (= add. indiv.)*	5 standard coffin nails
416 417 *418*	rect.	0.65* x 0.6 x ?	NNW–SSE	coffined	?flexed, on right side	adult female	4 standard coffin nails
419 unobs	?rect.	0.8 x 0.6 x unobs	unobs	unobs.	?extended	adult-sized grave	unobs
605 606 *607*	sub-rect.	2.0 x 0.6 x ?	SSW–NNE *607: unobs.*	coffined *607:?in situ/ ?coffined*	extended, supine *unobs.*	606: adult male *607: adult male*	113 dome-headed hobnails (55 from left foot; 58 ??right) 18 standard coffin nails *pottery*
2106 2108 *2107*	sub-rect.	1.0* x 0.3* x 0.6	SSW–NNE	coffined	extended, supine	adult female	10 standard coffin nails *pottery*
2109 2110 *2111*	sub-rect.	1.5 x 0.6 x ?	SSW–NNE	coffined	extended, supine	adult male	112 dome-headed hobnails 3 ?standard coffin nails
2204/1704 2205 *2206/1706*	rect.	1.0* x ? x ?	NNE–SSW	coffined	extended, supine	2205: adult male *2206 R: foetus/perinate*	8 standard coffin nails
2706	?rect.		?NNE–SSW	unobs	unobs	unobs (left *in situ*)	unobs
2712	sub-rect.		?NNE–SSW	unobs	unobs	unobs (left *in situ*)	unobs
2806 2807 *2808*	sub-rect.	1.22* x 1.16 x ?	WNW–ESE	coffined	extended, supine	adult female	17 hobnails (at feet) 17 standard coffin nails
3007 3008 *3009*	rect.	*c.* 1.9 x 0.75 x ?	S–N	coffined	extended, supine	adult female	9 standard coffin nails
3010	sub-rect.	*c.* 1.8 x 0.6 x ?	?NNE–SSW	unobs	unobs	unobs (left *in situ*)	unobs

KEY: * – incomplete; unobs – unobservable; R – redeposited; *NB restricted access prevented some observations; human bone details in Appendix 2*

APPENDIX 2: SUMMARY OF HUMAN BONE ASSESSMENT RESULTS

context	grave	deposit type	quantification (approx.)	age/sex estimate	pathology, morphology, stature & basic indices	condition
309	310	coffined	92%	adult 55–65 yr female	amtl; calculus; dental caries; hyper-eruption; spondylolysis – L5 (non-union, bilateral) Sch – Ts (incl. ivory infill); ddd – Cs, L5–S1; oa – ribs, acetabulae (left small fracture inferior margin); op – C1–2 af, Cs bsm, ribs, femur heads; pitting – T c-vs, ribs, sterno-claviculars; enth – pubic bones, finger phalanges, left calcaneum; rotator cuff degeneration (bilateral); solitary bone cysts – carpals; Mv – small individual, metopism (slight cresting), moderate flat attrition & slight chipping, multiple infraorbital foramina, sutural ossicles (lambdoid), unusually broad auricular surface, vestigial 12th ribs (cranial shift), septal aperture, hypotrochanteric fossae, cornuate navicular *stature: 1.55 m; cranial index: 70.83*	0–2; slight fragmentation, heavier on ribs & sacrum; mostly complete or near complete
311	310	R = 309	7% l.	adult >35 yr female	op – knee, calcaneum; enth – calcaneum; cortical defect – proximal articular surface hallux phalanx; Mv – small individual, angular fibula, double calcaneal facets, accessory navicular (tip of large tuberosity), occasional facet – navicular & cuboid *stature: 1.60 m*	0–1; few breaks, fresh
404	layer	R = ??417	2%	adult >35 yr	destructive lesion – proximal MtT (rheumatoid? *cf.* 417); oa – talus; op – calcaneum; enth – tarsals	1–4; mostly 1–2
408	407	coffined (recently disturbed) a) R? b) see 411	48% a) 20% a.u.l. b) see 411	adult >55 yr male a) adult >35 yr ?female b) see 411	abscess; calculus; dental caries; DEH; pd; periapical void; *cribra orbitalia* (wormy, healed, mod-severe); sinusitis (dental); exocranial hyperporosity; fracture – distal right radius articular surface (healed); oa – right acetabulum, right distal humerus, knees; op – C1 af, occipital condyles, right glenoid, right proximal humerus, right olecranon, radius head, distal right radius & ulna, right femur head, tarsals; pitting – radius head; enth – innominate, right proximal & distal humerus, right ulna, right proximal 2nd MtC (?coalition), femora, tibial tuberosities, distal right tibia, calcaneum; acetabular rim syndrome (impingement); rotator cuff degeneration (right humerus); cortical defect – costo-clavicular; ivory osteoma (x 8 subtle) – frontal; Mv – large individual, large, broad low skull, large orbits & nasal aperture, narrow external auditory meatus, double occipito-atlas facets, moderate flat dental attrition, some chipping & palatal wear, shovelled incisors, sutural ossicles (lambdoid, asterion), deviated septum, mandibular tori, mylohyoid bridge, small Stafney's defect, acetabular crease, odd morphology/?coalition – capitate & hamate, large Poirier's facet (right), *os trigonum*, occasional facet – navicular (cornuate), cuboid & 1st MtT, double calcaneal facet, chunky MtTs *stature: 1.69 m; cranial index: 83.24* a) Sch – Ts, Ls; ddd – L; op – tarsals; pitting – T c-v, ribs; enth – calcaneum; Mv – small/medium sized individual, coarse lower limb surfaces, cresting – ulna, fibula, vestigial 12th rib (cranial shift), *os trigonum*, occasional facet – navicular (also cornuate), double calcaneal facet *stature: 1.72 m* b) see 411	0–1; some end erosion, mostly fresh breaks a) 0–3; some old breaks, some eroded b) see 411
408/411	407/410	*ex situ*	4 small bags of frags	MNI 3 (see 408 & 411)	–	0–2; fragmented, mostly fresh
411	410	inh. burial (recently disturbed)	50%	adult 30–40 yr male	abscess; ?amtl/absence maxillary M3; calculus; dental caries; DEH (pronounced), pd; *cribra orbitalia* (healed pitting); sinusitis (dental); pnb – tibiae shafts (lamellar, slight); exocranial hyperporosity; fracture – nasal margin (healed); Sch – Ts, Ls (not sure same individual); op – ribs, 1st MtC-P, knees; enth – calcaneum; cortical defect – costo-clavicular, left proximal hallux phalanx; Mv – medium-sized individual, skull not overly masculine, sutural ossicles (sagittal), divided hypoglossal foramen, multiple infraorbital foramina, light, flat dental attrition, partially fused hyoid, acetabular crease, flat sacrum, spinal asymmetry, accessory transverse foramina,	0–1; mostly fresh breaks some older & eroded; some heavy fragmentation

					septal aperture, crested ulnae, third trochanter, double calcaneal facet, occasional facet – navicular (cornuate) *stature: 1.70 m*	
414	413	?coffined a) R ? = 415	45% a) 8% a.u.	adult 35–45 yr female a) adult >45 yr male	abscess; amtl/congenital absence M3; calculus; dental caries; DEH; pd; *cribra orbitalia* (healed, slight pitting); Pacchionian depressions; expanded diploe; HFI (faint); fracture – left distal ulna shaft (healed), distal articular surface proximal finger phalanx; sinusitis (dental); op – C1–2, Ts, ribs, distal radii, carpals; exo – left 5th MtC shaft; coalition – triquetral; Mv – smaller individual, strong deltoid attachments, pinched occipito-atlas facets, light dental attrition (some buffing), accessory tubercles – medial incisors, dental crowding & rotation, pseudo facets T spinous processes *stature: 1.56 m* a) pnb – T, right innominate; oa/acetabular rim syndrome – right acetabulum; proximal left ulna; op – proximal left ulna, finger IPs; enth – proximal left ulna, finger phalanges; Mv – large individual	1–3; eroded, slight fragmentation; old & fresh breaks a) 1; old breaks (dry); paler colour than 414
415	413	R ?= 414a	1 bone a.	adult >35 yr	op – L5 ap; Mv – fairly large L5	2–4; old damage & erosion
417	416	coffined	35%	adult >65 yr female	amtl; calculus; hypercementosis; pd; periapical void; osteoporosis (widespread); HFI (slight); expanded diploe; *cribra orbitalia* (healed, slight pitting); pnb – mandible (dental), cuneiform; sinusitis (dental); endocranial vessel impressions; destructive lesion – MtT, ?tarsal (*cf.* 404); ddd – Cs; collapse – Ls; oa – Cs, Ts, Ls (advanced & extensive), ribs, sterno-claviculars, acromio-claviculars, right scaphoid, right distal 1st MtC; op – occipital condyles, Cs, Ts, Ls bsm, right acetabulum, right glenoid, proximal ulnae, wrists, hands & fingers; pitting – right temporo-mandibulars; enth – adjacent to hypoglossal foramina, hyoid, C1–2, innominate, clavicle shafts, proximal & distal humeri, proximal ulnae, midshaft radii, fingers; exo – proximal dorsal finger phalanx; Mv – sutural ossicles (coronal, parietal notch, sagittal/lambda *cf.* 408), mandibular tori, palatine torus, uneven dental attrition, some very heavy, faceted, vestigial rib - ?lumbar/?cervical (spinal shift), accessory transverse foramina, accessory sacral facet, hypotrochanteric fossa, very flat proximal femur & tibia (*platymeric index (R): 77.45; platycnemic index (R): 62.0)*	0–3; moderate to heavy fragmentation; friable, fragile; old & fresh break
unexc	419	?coffined/*in situ*	unexc	unexc	left *in situ*	left *in situ*
606	605	coffined a) ?in situ/coffined	68% a) 18% a.l.	adult 35–45 yr male a) adult 25–40 yr male	calculus (moderate); dental caries (large, interdental); periapical voids (incl. abscess, fistula & granuloma); impaction – left maxillary 1st incisor; pd (moderate, esp. molars); sinusitis (dental); pnb – maxilla (dental); *cribra orbitalia* (healed); *spina bifida occulta* (S2–5); Pacchionian depressions; endocranial vessel impressions; Sch – Ts & Ls; oa – lower Ts; pitting – Ts ap, medial clavicles; onset rotator cuff degeneration; enth – calcanea; cortical defect – proximal humeri shafts; plastic change – C4 left transverse foramen (soft tissue mass); Mv – metopism, frontal keeling, sutural bones (asterion, bregmatic, epipteric, parietal notch), heavier anterior tooth wear, variant incisor (small, semi-pegged left second maxillary), dental crowding, *os acromiale* (both), strong cresting – ulna, accessory facets – naviculars, peroneal tubercles *stature: 1.68 m; cranial index: 82.70*	0–2; old & fresh breaks, some edge erosion a) 1–3; old & mostly fres breaks, some erosion
704	–	?R	1 bone, 1 frag l.	adult >18 yr	–	0; fresh breaks
2108	2106	coffined	45% (most s.a.u.; 2 small frags l.)	adult 40–50 yr female	amtl; calculus (slight); dental caries; pd; *cribra orbitalia* (severe pitting); HFI (slight); endocranial vessel impressions; sinusitis; Sch – Ts; op – acetabular rim; pitting – T ap; enth – rib tubercles; Mv – very small, pronounced female traits, pronounced exocranial frontal vessel impressions, divided hypoglossal, small teeth, impaction – right maxillary incisor, retained deciduous mandibular molars & ?maxillary canine, 2 cusp maxillary 2nd molar, congenital absence maxillary M3, light dental attrition, chipping, palatine torus (slight), double atlas facets,	1–4; mostly 3–4; some moderate to heavy fragmentation, many near complete bones

					accessory sacral facet, acetabular crease, 1st coccyx fused to sacrum, upper limb some strength (esp. humeri) *stature: 1.63 m*	
2110	2109	coffined	50% a.u.l.	adult 40–55 yr male	destructive lesion – L4–S1 (?discitis), left 1st carpo-MtC, left 1st & 2nd MtC-P, right 5th MtC-IP, 5th finger IPs ankylosis – left 3rd MtC-P; oa – acetabulae,; op – proximal & distal ulnae, right distal radius, carpals, femur heads, left 1st & 2nd MtTs occasional facet, finger IPs; pitting – L ap, hamate; enth – radial tuberosities, proximal ulnae, fingers, posterior femora, patellae, proximal fibula, tibial tuberosities, calcanea; solitary bone cyst? – toe phalanx; Mv – exostoses in trochanteric fossae, Poirier's facets, facets of Walmsley, lateral squatting facet, *os trigonum*, cornuate naviculars, occasional facets – 1st MtTs *stature: 1.70 m*	0–1; localised fragmentation, some heavy, most slight; old & fresh breaks, smaller bones mostly complete
2205	2204/1704	coffined	90% a) 1 partial bone l.	adult 45–55 yr male a) foetus/ perinate	amtl; calculus; dental caries; DEH; periapical void; pd; *cribra orbitalia* (severe, healed, localised wormy); pnb – tibiae shafts (lamellar, ?ulcer right); fracture – left maxillary medial incisor & medial mandibular incisors, right 1st MtT shaft (healed); Sch – Ts, Ls; ddd – Cs, Ts, L; oa – Cs ap, Ts, ap & c-v, L5–S1 ap; op – C1–2 af, Ts bsm, c-v & tp, Ls ap, S1 bsm, ribs, acetabulae, acromio-clavicular, left glenoid, distal radii, carpals, finger IPs, femur heads, toe IPs; pitting – medial clavicle; enth – fingers, calcaneum; cortical defect – costo-clavicular; Mv – large individual, large skull, slight metopic crest, sutural ossicles (lambdoid & asterion), multiple mastoid foramina (left large), moderate to heavy attrition, heavy chipping & palatal polish, shovelled incisors, pronounced mandibular tori, mylohyoid bridges, coalition – capitate(s), double faceted hallux sesamoid, small occasional facet left navicular, right cuneiform separated facets, double calcaneal facets, symphalangism – 5th toe *stature: 1.73; cranial index: 78.35* a) –	0–4; mostly 1–2; some localised heavy erosion; axial & some ends fragmented, skull near complete a) 1–2; end eroded; old break
2807	2806	coffined	10% l.	adult >35 yr female	op – toe IPs; enth – ankles, calcanea; Mv – small individual, lateral squatting facet, occasional facet – left 1st MtT, bifurcated hallux sesamoid (coalition) *stature: 1.54 m; platycnemic index: 71.52*	0–4; all but left fibula 0–2; old, & fresh breaks, localised heavy fragmentation, some complete bones
3008	3007	coffined	80%	adult 35–45 yr female	calculus (heavy); dental caries; pd; periapical void; Pacchionian depressions; sinusitis (dental); fracture – right radius midshaft (healed, some mal-alignment); Sch – Ts, Ls; op – Ts bsm, tp, ribs; pitting – ribs; enth – manubrium, fingers; cortical defect – distal right humerus; Mv – medium/small individual, some less feminine skull traits, sutural ossicles (coronal & lambdoid), palatine torus, pre-condylar tubercles, *fossa navicularis basioccipital* (rare), well-spaced & positioned dentition, slight palatal polishing (facet) & small chips, moderate to light dental attrition, small maxillary M3s, acetabular crease, robust deltoid tuberosities & ulnae cresting, septal aperture, occasional facets – navicular, 1st MtTs *stature: 1.62 m; cranial index: 77.30*	0–2; mostly near complete elements, skull too. some heavier fragmentation (axial) & a little erosion

KEY: s.a.u.l. – skull, axial skeleton, upper limb, lower limb (where not all skeletal regions are represented); amtl - *ante mortem* tooth loss; DEH – dental enamel hypoplasia; pd – periodontal disease; HFI – *hyperostosis frontalis interna*; pnb – periosteal new bone; C, T, L, S – cervical, thoracic, lumbar, sacral vertebra(e); af – articular facet; as – articular surface; ap – articular process; bsm – body surface margins; c – costo-vertebral; tp – transverse process; Sch - Schmorl's node; ddd - degenerative disc disease; oa – osteoarthritis; op – osteophytes; enth – enthesophytes; exo – exostoses; MtC/MtT (-P) – metacarpal/metatarsal (-phalangeal); IP – interphalangeal; Mv – morphological variation; M3 – third molar

A BIOARCHAEOLOGICAL ANALYSIS OF THE PREVALENCE OF RHINOSINUSITIS ACROSS TWO ROMANO-BRITISH AND EARLY MEDIEVAL POPULATIONS

TAREQ N. RAJAB AND ANNA M. DAVIES-BARRETT

The prevalence of skeletal changes related to rhinosinusitis was investigated in a sample of 53 skeletal individuals from the rural agricultural sites of Late/Post Romano-British Tolpuddle Ball, Dorset and Early Medieval Llangefni, Anglesey. The frequency across both sites was similar, ranging between 63.6% and 70%, respectively. The effect of rural agricultural environments on rhinosinusitis development is discussed, alongside a consideration for the contribution of aetiological factors related to subsistence economies, activities specific to the sex of individuals, diet and movement of people. Exposure to household air pollution (HAP) from indoor fires, poor ventilation and harmful particulate matter (PM) through agricultural activities was likely common across both sites. However, while the movement of people and trade with Dorchester is considered, the primary influence of rhinosinusitis at Tolpuddle Ball may have been the engagement in animal husbandry and close interactions with fauna. Cereal grain cultivation at Llangefni also likely influenced prevalence throughout the population with exposure to harmful PM and a carbohydrate-rich diet resulting in dental diseases that likely caused infections of the maxillary sinuses. This paper presents the first study of rhinosinusitis in archaeological populations from Dorset and Wales, providing further information on rural agricultural groups in these regions during the Romano/Post-Romano and Early Medieval periods.

INTRODUCTION

Respiratory diseases place a substantial burden on current health services globally, with over two billion individuals consistently exposed to low air quality, resulting in the death of over four million people every year (Ferkol and Schraufnagel 2014, 405; Forum of International Respiratory Societies 2017, 7). Approximately 16% of the United States' adult population suffers from rhinosinusitis, resulting in an annual healthcare cost of roughly $5.8 billion (Hamilos 2000, 213; Slavin *et al.* 2005, S20). Therefore, the study of past populations, using rhinosinusitis as a marker of respiratory health, provides a greater understanding of the history of this respiratory disease whilst also allowing a common modern health condition to be presented in a useful and historical context.

Rhinosinusitis is defined as the inflammation of the lining of the paranasal sinuses (air cells located within the facial bones, Figure 1). Inflammation develops in response to an infection of the upper respiratory tract, which consists of the nose, nasal cavity, mouth and throat (Rosenfeld 2016, 962;

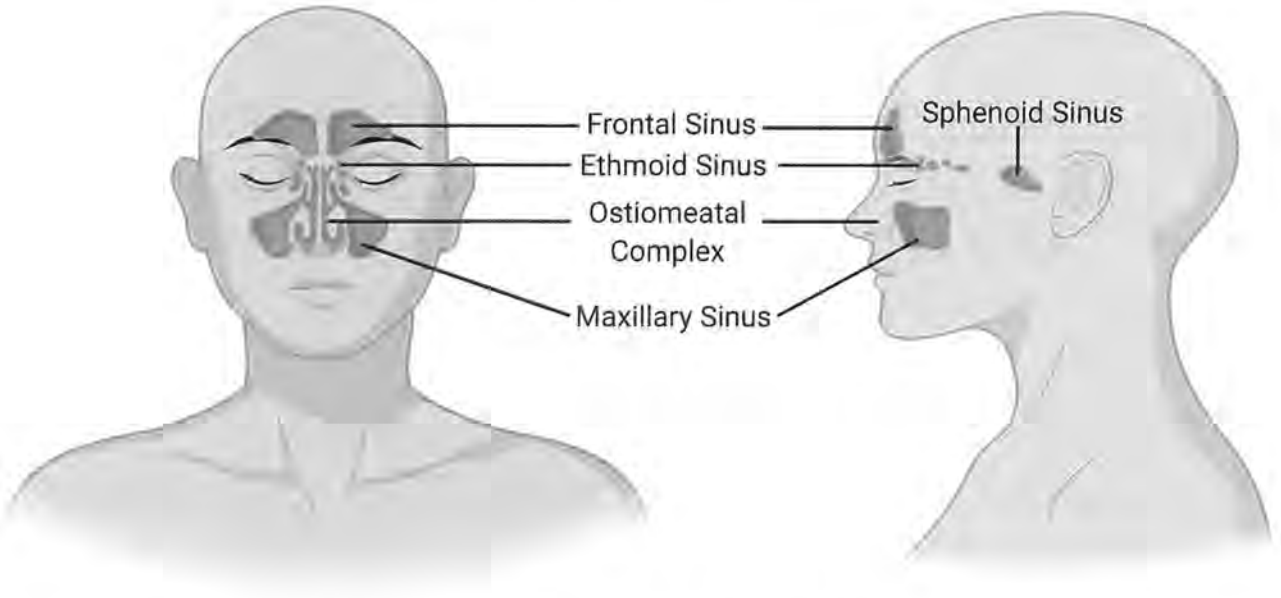


Figure 1 The positioning of the paranasal sinuses within the facial region of the skull (created with BioRender.com)

Slavin *et al.* 2005, S16; Ah-See and Evans 2007, 358). Symptoms of rhinosinusitis include nasal obstruction, rhinorrhoea (nasal discharge), coughing, headaches and dental pain (Steele 2005, 466; Slavin *et al.* 2005, S16). Whilst the resolution of symptoms after four weeks indicates an instance of acute rhinosinusitis (a common condition), symptoms that persist over eight weeks represent a chronic form of the disease (Slavin *et al.* 2005, S19–20).

Healthy paranasal sinuses help provide sufficient ventilation and drainage of mucus within the eight air-filled cavities (Perić and Gaćeša 2008, 699; Ah-See and Evans 2007, 360). If the lining becomes inflamed, the small drainage holes (the ostia) of the sinuses and the narrow channels that form the drainage pathways from the paranasal sinuses (known as the ostiomeatal complex) become congested, causing further narrowing of the channels (Slavin *et al.* 2005, S22; Steele 2005, 466). Blockage of the ostia resulting from congestion, lining thickening, and mucus secretion causes the sinus chambers to become gradually smaller (see Figure 2). These changes result in the production of an acidic environment and negative air pressure within the sinus chambers (Steele 2005, 466; Newman *et al.* 1994, 363; Brook 2009, 129; Wald 1995). This environmental change within the sinuses ensures that anaerobic bacteria can proliferate and ultimately cause infection of the upper respiratory tract (Brook 2009, 129; Brook 2012, 214).

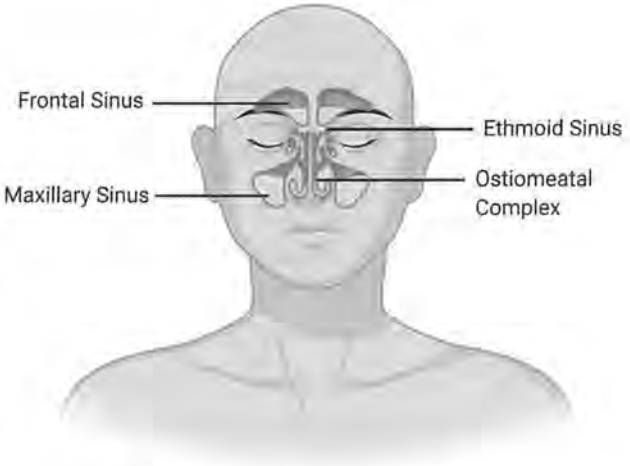


Figure 2 An example of inflamed paranasal sinuses with an accumulation of mucus in each sinus cavity (created with BioRender.com)

Today, in many developing countries, the use of biomass fuels for both cooking and heating is widespread, putting these populations, in particular, at a much greater risk of developing respiratory diseases (Torres-Duque *et al.* 2008, 578). In rural India alone, close to 90% of all energy produced is generated through biomass fuels such as wood and

crop residues (Torres-Duque *et al.* 2008, 578). As low air quality poses a serious threat to an individual's respiratory health today, this likely equally impacted the health of past populations, where biomass fuels were the predominant source of energy.

Bioarchaeological studies involve the investigation of organic remains, often human osteoarchaeological remains, from archaeological sites to address questions surrounding past human activities and health. The ability to identify osteological changes associated with infection and inflammation within both the paranasal sinuses and upper respiratory tract as a whole have allowed bioarchaeological studies to further our understanding of rhinosinusitis in the past (Boocock *et al.* 1995, 483; Lewis *et al.* 1995, 497; Roberts 2007, 795). Aetiological factors such as air quality, climate, socio-economic status and infectious diseases have been suggested to influence the prevalence of rhinosinusitis within a given population (Sundman and Kjellström 2013a, 4457b; Lewis *et al.* 1995, 499; Kowaleski 2014, 584). Therefore, when the findings of bioarchaeological studies are placed in conjunction with those of clinical studies, researchers can produce a clearer understanding of rhinosinusitis, observing its prevalence within past populations and presenting a common modern health condition in a valuable historical context.

Based on the study by Rajab (2021), this paper aims to identify the prevalence of rhinosinusitis in both a Romano-British population from Tolpuddle Ball, Dorset and an Early Medieval population from Llangefni, Anglesey, Wales, comparing two distinctly different British populations of two chronological historical periods. The lack of previous studies on respiratory diseases across both Dorset and Anglesey ensures that this study helps to provide a greater understanding of rhinosinusitis in both these rural populations and each county as a whole.

RHINOSINUSITIS AND AIR QUALITY IN THE BIOARCHAEOLOGICAL RECORD

The combustion of biomass fuels exposed and continues to expose both modern and past populations to particulate matter (PM) (Boman 2006, 446). However, it is the type of fuel used, the quality of ventilation in an individual's surroundings and, most importantly, the duration that they are exposed to PM that ultimately leads to the development of rhinosinusitis (Fullerton *et al.* 2008, 843; Clark *et al.* 2013, 1122; Bruce *et al.* 2000, 1079). Beyond these critical factors, overcrowding and poor sanitation also serve as key considerations for the prevalence of rhinosinusitis across a population (Lewis *et al.* 1995, 499; Roberts 2007, 795).

Contrary to more recent studies of the prevalence of rhinosinusitis, early research suggested that the condition was uncommon in past populations. In an early study using an endoscopy of complete crania of British individuals, Wells (1977, 177) observed that rhinosinusitis prevalence across 15 British archaeological sites, dating between the Romano-British to Late Medieval periods, only ranged from between 2.8% and 6.8%. It was not until Boocock *et al.* (1995) introduced new diagnostic criteria for rhinosinusitis that prevalence rates across archaeological populations were considerably higher. For example, Sundman and Kjellström (2013a, 447, 450) used the diagnostic criteria, studying the remains of a population from Sigtuna, a medieval town in Sweden, and found that 94.5% (259/274) of the population had bone changes consistent with rhinosinusitis. However, prevalence rates presented by various studies may be affected by variability in inter-site preservation and the calculation of prevalence rates, in differences in inclusion criteria (such as the required completeness of the sinuses), and in the use of endoscopy, which can sometimes provide only an incomplete visualisation of the sinus. While almost all bioarchaeological studies of maxillary rhinosinusitis post-1995 have employed the methods outlined by Boocock and colleagues (1995), studies have subsequently developed these methods, and approaches and criteria vary. This can have implications for the inter-study comparability of data.

In bioarchaeological literature, differences in the prevalence of rhinosinusitis across rural and urban populations have been observed over time. One such study, carried out on two later Medieval populations from Yorkshire, observed a prevalence at the urban settlement (St. Helen-on-the-Walls, York) of 55% (134/245), higher in comparison to

the rural settlement (Wharram Percy), where the prevalence was 39% (106/268) (Lewis *et al.* 1995, 497). Urban settlements are often suspected of possessing higher rates of rhinosinusitis due to the proximity of the population to industrial activity and the air pollution generated as a consequence, as well as greater household crowding and poorer sanitation in such environments (DiGangi and Sirianni 2016, 162; Lewis *et al.* 1995, 504; Khanna and Gharpure 2013, 15). Furthermore, regardless of the historical period, urban settlements are generally engaged in a wider range of industry and produce more air pollution than rural settlements (Betsinger and DeWitte 2021, 98).

However, rural settlements also possess risk factors for rhinosinusitis, producing various particulates from agricultural activities and animal husbandry, such as pollen, fungi and pathogens from regular exposure to animals, which can all increase the risk of rhinosinusitis development (Roberts 2007, 802; Lewis *et al.* 1995, 504; Sundman and Kjellström 2013b, 4458). In fact, in a recent study comparing the difference in prevalence between a rural site (19th-century Middenbeemster, The Netherlands) and an urban centre (17th – 19th century Arnhem, The Netherlands), Casna *et al.* (2021, 7) identified that there was only a slight difference in prevalence between the two vastly different populations. A total of 51.3% (38/74) of the rural Middenbeemster population possessed markers of chronic maxillary sinusitis, with 55.4% of Arnhem's urban population similarly affected (Casna *et al.* 2021, 7). These results suggest that while living in urban settlements may theoretically negatively impact an individual's respiratory health, the risk factors of rural environments, while different, are capable of having a similarly detrimental impact on respiratory health (Casna *et al.* 2021, 9). Roberts (2007, 792) studied the prevalence of rhinosinusitis across both urban and rural archaeological sites from across North America, Africa and Europe, observing an average prevalence of 48.5% at urban agricultural sites and 45.0% at rural agricultural sites. The findings of this study help to further the notion that, while aetiological factors of rhinosinusitis at urban and rural sites may be different, they may be similarly detrimental to respiratory health.

Nonetheless, different archaeological sites possess a considerable amount of variability in the prevalence of rhinosinusitis across their respective populations, with several aetiological factors such as living environments, climate and socio-economic status, all having a varying degree of impact on each settlement. Differences in demography, such as sex and age, are also important considerations, given the potential differences in occupation and time of exposure to harmful particulate matter between individuals and different social groups (Lewis 2016, 161; Davies-Barrett 2018, 33). This is further complicated by the fact that within each respective population, the prevalence of rhinosinusitis may vary between individuals of different socio-economic backgrounds, regardless of the rural or urban nature of the settlement and population in question.

An additional consideration is the life courses of Roman and Early Medieval populations. The excavation of the late Roman cemetery at Poundbury, Dorset, identified that growth in both males and females occurred roughly two years later than the European populations of today (Harlow and Laurence 2002, 15). Additionally, Harlow and Laurence (2002, 14, 15) conclude that human growth and development is essentially dependent on access to resources, with higher status children developing faster than those of lower status, ensuring that the life course is as much a cultural construct as it is a description of biological aging. Similarly, life expectance and development in the Early Medieval period was ultimately affected by class status, while, much like the Roman period, adolescence was also determined to have lasted longer than modern populations, ranging from between 14 and 21 years of age (Gilchrist 2012, 34, 46). Ultimately, the life courses of both historical periods have the potential to influence the results of this study. The length of adolescence, the age at which children started working and sex-specific roles during both these historical periods have the ability to affect the prevalence of rhinosinusitis through the duration of time spent exposed to harmful particulate matter.

ODONTOGENIC RHINOSINUSITIS

The maxillary sinuses are located directly above the roots of the upper molars. Odontogenic (meaning originating from the teeth) rhinosinusitis arises

Figure 3 A map of Dorset in the South of England, marking Tolpuddle Ball's geographical location, where the Late/Post Romano-British population of this study originated (Ordnance Survey 2021).

through the spread of pathogens directly from the oral cavity into the maxillary sinuses (Kim 2019, 1; Psillas *et al.* 2020, 475). Over time, the bone between the sockets of the teeth and the sinus becomes gradually thinner, leaving a structure known as the Schneiderian membrane, located between the maxillary sinus cavity and the oral cavity, vulnerable (Mehra and Jeong 2009, 238; Psillas *et al.* 2020, 475; Little *et al.* 2018, 111). Often the roots of the maxillary molars can penetrate the maxillary sinus cavity itself (Brook 2006, 349). Bacteria located on the outside of a tooth begin to break down the tooth enamel over some time, eventually infecting the pulp of the tooth (Psillas *et al.* 2020, 475; Lopatin *et al.* 2002, 1058). The protrusion of the molar roots into the maxillary sinus cavity, or their location directly below the thin bone of the sinus floor, is vital because it provides resultant tooth infection and pus formation a direct route into the sinus cavity, producing sinus infection (Psillas *et al.* 2020, 475). Two potential markers of an odontogenic route of infection are an oroantral fistula (a channel formed within the bone between the tooth root and the sinus floor by pus formation) and the presence of dental caries (Boocock *et al.* 1995, 485).

Panhuysen *et al.* (1997, 612) implemented a set of criteria to include periapical abscesses, oroantral fistulae, periodontitis, and antemortem tooth loss as associated with odontogenic rhinosinusitis. Odontogenic rhinosinusitis was recorded in 56.8% (24/44) of individuals compared with 41.3% (19/46) that possessed a rhinogenic route of sinus infection (Panhuysen *et al.* 1997, 613). However, as dental disease is common in archaeological populations and not every instance of dental disease leads to a sinus infection, such a wide range of criteria will likely lead to the overdiagnosis of odontogenic sinusitis. Liebe-Harkort (2012, 393) also observed that 56.7% (34/60) of individuals with rhinosinusitis possessed periapical lesions, identified by antemortem bone destruction around the root of a tooth. Ultimately, regardless of

what diagnostic criteria are implemented, it remains difficult to differentiate between bone changes originating from either rhinogenic or odontogenic routes of infection (Merrett and Pfeiffer 2000, 312).

TOLPUDDLE BALL (LATE/POST ROMAN)

Archaeological mitigation works were initially undertaken at Tolpuddle Ball (Figure 3) due to the construction of the A35 Tolpuddle/Puddletown Bypass in Dorset. The Romano-British material from Tolpuddle Ball was excavated by the Archaeological Field Unit of Liverpool University in 1993 and Wessex Archaeology in 1998. The individuals included in the current study were buried in the Late/Post Romano-British cemetery excavated in 1998, located roughly 75m away from the initial 1993 excavations. The cemetery itself dates to between AD 340 and 670 and is characterised by West-East aligned graves arranged in a series of rows, with extended burials and no grave goods (Hearne and Birbeck 1999, 58, 225–229). Although this includes, at the earliest, the latter end of Roman rule in Britain, many of the individuals buried at Tolpuddle Ball are from the Post-Roman period. Generally, both preservation and condition of bone across all excavated burials were particularly poor, with over 65% of individuals unearthed in a badly fragmented state (Hearne and Birbeck 1999, 161).

It is estimated that during the Romano-British period, approximately 90% of the population resided in rural settlements, with towns and urban centres only making up a small portion of the total population of Britain's provinces (De la Bédoyère 2013, 182). Archaeological evidence related to rural Romano-British populations has exhibited substantial differences in how people lived, with settlement habitation ranging from caves to small roundhouses, with very little development and change to farmsteads over time (De la Bédoyère 2013, 182). While data from Tolpuddle Ball does suggest that the population was initially quite slow to adopt changes brought about by the Roman Empire, artefactual and structural assemblages also provide evidence for a change in the nature of the settlement from the second century AD onwards (Loader and Hearne 1999, 225). A typical Roman-style rectangular building with unmortared wall footings, dated to this period, provides some archaeological evidence for a change in construction methods at the site (Loader and Hearne 1999, 221). However, a delay in adopting Roman construction methods is evident across Dorset, with limited evidence of villa development earlier than the late third century (Mattingly 2007, 400). Additionally, although the majority of coins found at Tolpuddle Ball are dated to the middle to late fourth century AD, Tolpuddle Ball's initial slow adoption of the changes brought by the Roman Empire does not appear to have hampered the population economically as it did the other settlements around Dorchester (Loader and Hearne 1999, 226). Instead, Loader and Hearne (1999, 225) suggest that Tolpuddle Ball was a settlement that became relatively prosperous, developing an increasing social and economic status.

During the first century AD, the Roman conquest led to the expansion of settlements and the adaptation of already existing land divisions in southern Britain, resulting in changes in land-use patterns from the earlier Iron Age (Allen 2016, 132; Putnam 2007). Furthermore, Allen (2016, 89) highlights that in areas such as the Middle Thames valley and the Sussex Coastal Plain, there is evidence for settlement abandonment and dislocation after the conquest, suggesting that such changes also point towards substantial alterations in land usage. With the start of the Romano-British period came further agricultural changes in Britain, with improvements in storage and crop processing technology, extended periods of cultivation, and a greater emphasis on animal husbandry (Taylor 2007, 115). Although Tolpuddle Ball was capable of engaging in both arable and pastoral agriculture, there is very little indication of any processing of crops beyond the archaeological evidence of a grain drainer and a quernstone (Loader and Hearne 1999, 221). On the other hand, the large quantity of sheep and cattle remains dated to the Romano-British period suggests that, instead, the site was extensively engaged in animal husbandry (Loader and Hearne 1999, 221–222). The larger quantity of sheep remains indicates that they were raised predominantly for meat consumption at the site. In contrast, fewer cattle remains may imply that they were bred primarily for stock, potentially being transported to the markets in Dorchester to form part of the meat supply (Loader and Hearne

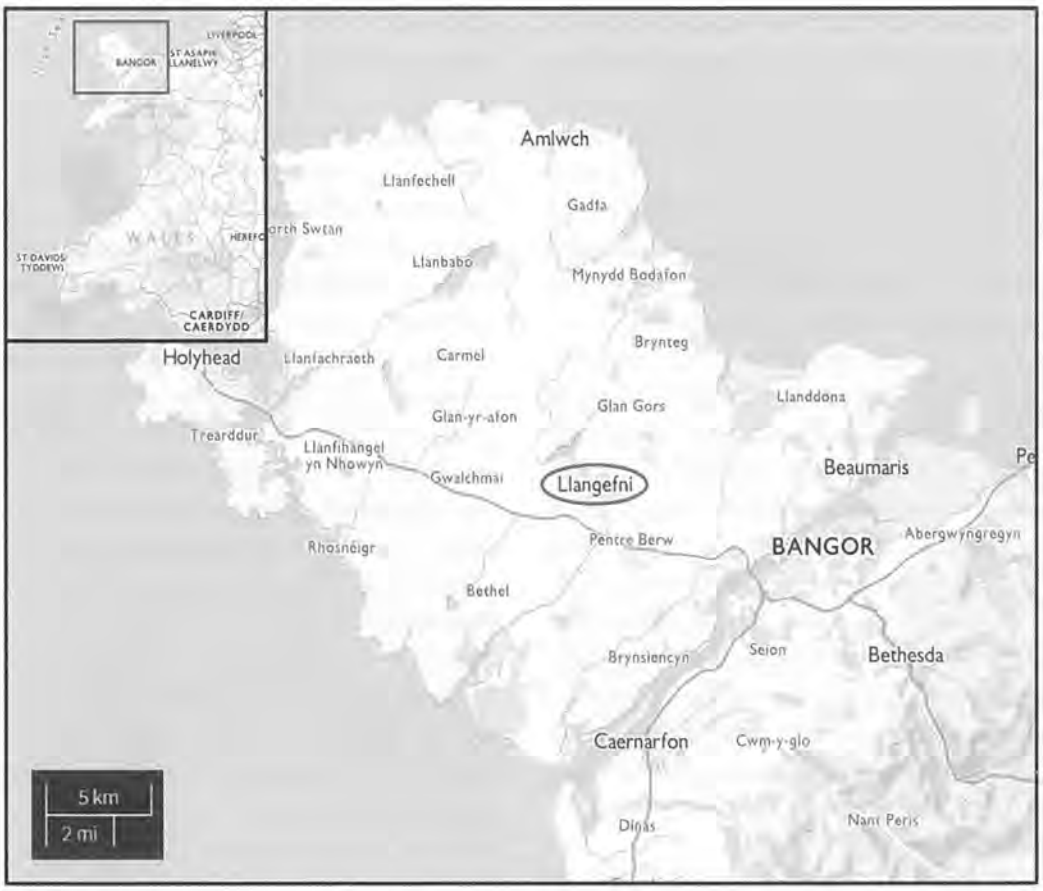


Figure 4 A map of Anglesey in the North West of Wales marking the geographical location of the Llangefni, where the Early Medieval population of this study originates (Ordnance Survey 2021).

1999, 221–222). The presence at Tolpuddle Ball of a stamped ceramic roof tile sourced directly from Dorchester further reinforces the idea that there may have been a trade relationship between the two settlements (Loader and Hearne 1999, 225–226).

Evidence of metalworking, textile manufacturing, hide and skin production and, particularly unusual for a Romano-British site, the preparation of leather all imply that Tolpuddle Ball did engage in craft production, albeit at a small scale (Loader and Hearne 1999, 222). Individuals engaged in craft production at the site were likely exposed to harmful PM detrimental to their respiratory health (Sundman and Kjellström 2013b, 4458). However, the greatest impact may have come from agricultural activities at Tolpuddle Ball, through exposure to particulates such as pollen, dust, fungal spores and bacterium such as *Mycobacterium Tuberculosis*, that would have spread through close interactions with cattle and sheep (Roberts, 2007, 803; Ameni *et al.* 2011, 359).

It is important to note that while the earliest internments at Tolpuddle Ball's cemetery are dated to the Late Romano-British period, the majority are post-Roman (Hearne and Birbeck 1999, 226–227). The cemetery continues in use until the late 7th century AD and shares very close parallels with a 7th – 8th century AD cemetery at Ulwell near Swanage, such as West-East aligned graves and an absence of grave goods (Hearne and Birbeck 1999, 227–229; Cox 1988). However, there is no contemporary evidence for a settlement of that particular period at Tolpuddle Ball. Furthermore, contemporary settlement evidence at nearby Poundbury is also poorly understood, and timber buildings at Alington Avenue are only potentially dated to a similar period (Sparey Green 1987; Davies *et al.* 2002).

LLANGEFNI (EARLY MEDIEVAL)

Material from Llangefni (Figure 4) included in

this study was excavated at two separate sites at Llangefni Link Road in 2016 by Brython Archaeology and Llangefni College Campus Site Extension in 2017 by Archaeology Wales. The Llangefni College Campus Site Extension cemetery is roughly dated between the fourth and eighth centuries AD (Faillace and Madgwick 2019, 14). At the second site of Llangefni Link Road, there is a current lack of carbon dating to provide any specific range for the cemetery's use beyond the fact that the remains were determined to have been from the Early Medieval period from at least the fifth century onwards (Rusu and Madgwick 2017, 3). Across both cemeteries, a total of 82 inhumation burials were excavated, 33 of which were included in this study, with 51.5% of individuals (17/33) originating from Llangefni Link Road (Faillace and Madgwick 2019, 1; Rusu and Madgwick 2017, 1). Additionally, much like Tolpuddle Ball, preservation at Llangefni was particularly poor, with skeletal completeness below 10%, regarded as a consequence of the acidic soil of Anglesey (Rusu and Madgwick 2017, 22; Faillace and Madgwick 2019, 3, 6).

Little is known about the Early Medieval population of Llangefni beyond the individuals unearthed at the two cemeteries and, unfortunately for much of Wales in the fifth century, there is a lack of contemporary evidence for any Post-Roman changes (Davies 1978, 6). Nonetheless, it is agreed that most of Wales subsisted on a mixed farming economy across a primarily rural population (Davies 1982, 31–50). In particular, Anglesey is thought to have produced more grain than any other part of Wales during the Medieval period (Davies 1982, 12). Consequently, there was likely a focus on agriculture for much of the island's population. Both males and females equally engaged in food production, with animal husbandry playing a vital role in raising animals for use as beasts of burden (Davies 1982, 39). Similarly to Tolpuddle Ball, engagement in regular agricultural activities would have ultimately exposed individuals to various forms of PM, including pollen, dust and fungal spores that may have caused infection and inflammation within the paranasal sinuses (Roberts, 2007, 803).

With the current lack of any associated settlement at Llangefni, it is difficult to determine what style of habitation the population lived in. It is not unlikely that many individuals continued to live in their Romano-British period settlements in Wales into the fifth century, as can be seen from hut group settlements at Grainanog and Cefn Graianog II in Gwynedd (Davies and Arnold 2000, 158; Evans 2011, 6). At the Early Medieval settlement of Rhuddgaer in the South-East of Anglesey, not far from Llangefni, there is evidence for the continued use of a sub-rectangular shaped building with stone footings that is dated to the Romano-British period (Hopewell and Edwards 2017, 20). However, for much of Britain, Early Medieval housing often relied on the local availability of materials; timber houses with wattle and daub infill, along with clay or stone floors, were often the most commonly built (Steane 2014, 190–191). Many of the most typical houses of the period included small cots, one-roomed houses and long-houses that could provide enough accommodation for both people and animals (Steane 2014, 190). Any shared habitation with animals was likely to have deteriorated sanitary conditions, increasing the spread of bovine tuberculosis and other pathogens that can cause infection of the paranasal sinuses, as seen in modern rural communities today (Shitaye *et al.* 2008, 318; Daborn *et al.* 1996, 30S–31S). It is also suggested that windows would not have been plentiful at this time, reducing household ventilation and exposing individuals to high levels of household air pollution (Steane 2014, 191–192; Gordon *et al.* 2014, 823).

MATERIALS & METHODS

Both maxillary and frontal sinuses of adult individuals (≥20 years old) from Tolpuddle Ball and Llangefni were studied for osteological changes associated with rhinosinusitis. However, maxillary sinuses without a complete alveolar bone in the first to third molars region were all categorised as unobservable. Four individuals from phase 5 and sixteen individuals from phase 5A at Tolpuddle Ball were studied for evidence of rhinosinusitis. At Llangefni, sixteen individuals from Llangefni Campus Site and seventeen individuals from Llangefni Link Road were included in this study. The age and sex of individuals from Tolpuddle Ball were previously estimated by McKinley (1999), while Faillace and Madgwick (2019) and Rusu and Madgwick (2017)

estimated the age and sex of individuals from Llangefni Campus Site and Llangefni Link Road, respectively. Probable male and probable female data from both Tolpuddle Ball and Llangefni populations were pooled with definite male and definite female data, respectively. Both individuals of unknown and estimated sex were recorded for evidence of rhinosinusitis. Each individual was also categorised into one of five different age groups: adolescent (16–19 years), young adult (20–34 years), middle adult (35–49 years), old adult (50+ years) and unknown adult (20+ years), following the criteria set out by Buikstra and Ubelaker (1994).

Although observation of bone changes within the maxillary sinuses was the study's primary objective, frontal sinuses were also studied to provide insight into the respiratory health of individuals that did not possess adequately preserved maxillary sinuses (Table 6). No invasive methods were used in this study. Both maxillary and frontal sinus infection data were pooled together to form a total prevalence rate for rhinosinusitis in each population (Table 1).

DEGREE OF PRESERVATION & COMPLETENESS

Individuals were selected for analysis based on how well their sinuses were preserved. The preservation scoring system employed by this study was originally developed by Sundman and Kjellström (2013a) and later modified by Davies-Barrett (2018). Depending on the degree of completeness, each observed sinus was placed into a preservation range of either '<5%', '5–24%', '25–49%', '50–74%' or '75–100%'. A score of at least 25% represents the preservation of at least one sinus floor or wall. As a score of <5% was considered too low to present any accurate findings; any sinuses that scored as such were not included in the results. Frontal sinuses are often highly variable in size and shape (Christensen and Hatch 2018, 231). Therefore, they were recorded with a preservation score of either '>50%' or '<50%'.

EVIDENCE OF INFECTION & INFLAMMATION

A handheld lens was used to make macroscopic observations of any osteological changes characteristic of rhinosinusitis. Bone changes in the paranasal sinuses were identified using the methods set out by Boocock *et al.* (1995), which consist of observation of one of four osteological changes associated with rhinosinusitis: pitting, spicule-type bone formation (Figure 5), remodelled spicules, and white pitted bone formation. For a description of each bone change, see Boocock *et al.* (1995). For an individual to be recorded as having rhinosinusitis, these changes were required to be present in at least one sinus (Boocock *et al.* 1995; Merrett and Pfeiffer 2000; Lewis *et al.* 1995; Sundman and Kjellström 2013a; Davies-Barrett *et al.* 2021). Although only one sinus per individual was required for inclusion in this study, the unilateral and bilateral presence of rhinosinusitis in both maxillary and frontal sinuses was also recorded where possible, preservation permitting.

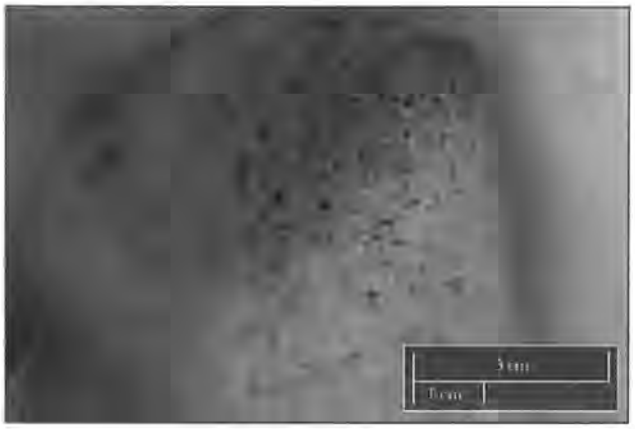


Figure 5 Photograph of spicule formation. Site – Tolpuddle Ball (Phase 5) – SK908, left maxillary sinus. For examples of other bone changes associated with rhinosinusitis, see (Boocock *et al.* 1995). Image, T. Rajab.

SIGNS OF DENTAL PATHOLOGY

Maxillary sinuses displaying bone changes characteristic of rhinosinusitis were observed for the presence of either an oroantral fistula or an abscess (Figure 6). Previous bioarchaeological studies have failed to set out consistent criteria for identifying odontogenic infections of the sinuses. Instead, this study used an adaptation of the simple recording method set out by Davies-Barrett (2018), in which an oroantral fistula and abscess are recorded as present, absent or unobservable. Left and right maxillary sinuses were recorded for dental-related pathological

Table 1 The total number of individuals analysed alongside the breakdown of the number of males, females and ages from Tolpuddle Ball and Llangefni.

Site	Number of Individuals	Males	Females	Unobservable Sex	Young Adults (20–34)			Middle Adults (35–49)			Old Adult (50+)	Unknown Adult
					Males	Females	Unknown	Males	Females	Unknown		
Tolpuddle Ball	**20**	30% (6/20)	65% (13/20)	5% (1/20)	25% **(2/8)**	62.5% **(5/8)**	12.5% **(1/8)**	33.3% **(4/12)**	66.6% **(8/12)**	0% **(0/0)**	0% (0/20)	0% (0/20)
					40% **(8/20)**			60% **(12/20)**				
Llangefni	**33**	24.2% (8/33)	60.6% (20/33)	15.2% (5/33)	Males 31.2% **(5/16)**	Females 56.2% **(9/16)**	Unknown 12.5% **(2/16)**	Males 20% **(3/15)**	Females 66.6% **(10/15)**	Unknown 13.3% **(2/15)**	3% (1/33) **(Female)**	3% (1/33) **(Unknown Sex)**
					48.4% **(16/33)**			45.4% **(15/33)**				

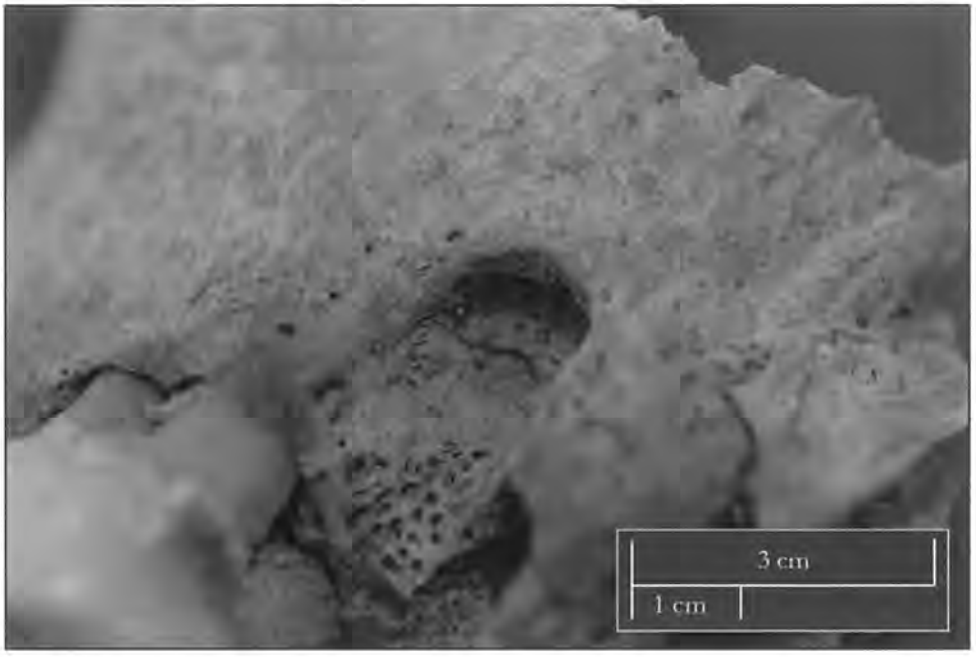


Figure 6 A periapical lesion (abscess) located in the alveolar bone belonging to the upper left third molar of SK5198. Site – Tolpuddle Ball (Late/Post Romano-British Cemetery Phase 5A). Image, T. Rajab.

Table 2 The percentage of combined left and right maxillary sinuses from Llangefni and Tolpuddle Ball within their respective completeness score ranges.

Site	0-4%	5-24%	25-49%	50-74%	75-100%
Llangefni	21.2% (15/66)	31.8% (22/66)	37.9% (24/66)	9.1% (5/66)	0.0% (0/66)
Tolpuddle Ball	25.0% (10/40)	22.5% (9/40)	42.5% (17/40)	7.5% (3/40)	2.5% (1/40)

changes individually. A direct route between the oral cavity and sinus – an oroantral fistula – was only considered as present if the opening was surrounded by remodelled bone (after Liebe-Harkort, 2012; Roberts *et al.* 2007; Sundman & Kjellström, 2013a). The remodelled bone helps distinguish between an oroantral fistula and post-mortem damage that may have resulted from abrasion (Lewis *et al.* 1995, 502). Abscesses were macroscopically observed by the associated breakdown of alveolar bone and were recorded as 'present', 'absent' or 'unobservable' (Mehra and Jeong 2009, 239). In order to accurately record the role of dental pathology in rhinosinusitis development, the alveolar bone of all three maxillary molars was required to have been both present and observable within a sinus. If the alveolar bone of one or more of the three molars was unobservable, there could be no certainty that the missing alveolar bone did or did not possess the evidence required to categorise the route of infection as either rhinogenic or odontogenic.

CALCULATION OF PREVALENCE AND STATISTICAL ANALYSIS

Prevalence rates were calculated as n/N; 'n' being the number of individuals presenting with bone changes

Table 3 Prevalence rates of rhinosinusitis at Tolpuddle Ball and Llangefni, alongside frequencies of unilateral and bilateral signs of infection in the maxillary and frontal sinuses.

Site	Total Prevalence	Sex		Age		Unilateral Infection			Bilateral Infection	Only One Sinus Observable
		Males	Females	Young Adult	Middle Adult	Left Sinus	Right Sinus	Combined Total		
Tolpuddle Ball	70% (14/20)	**66.6%** (4/6)	**69.2%** (9/13)	**75.0%** (6/8)	**66.6%** (8/12)	8.3% (1/12)	8.3% (1/12)	16.6% (2/12)	50.0% (6/12)	33.3% (4/12)
Llangefni	63.6% (21/33)	**75.0%** (6/8)	**60.0%** (12/20)	**56.3%** (9/16)	**75.0%** (12/16)	19.0% (4/21)	14.3% (3/21)	33.3% (7/21)	42.9% (9/21)	23.8% (5/21)

typical of rhinosinusitis, and 'N' being the number of observed individuals within the total sample with at least one maxillary sinus present. This is often referred to as the crude prevalence (CPR; see Klaus, 2014, 301–304). A Fisher's exact test (denoted as [FET]) was used to investigate significant differences in the prevalence of rhinosinusitis between groups, with a p-value of <.05 considered to indicate a statistically significant difference.

RESULTS

Sinus completeness across both sites was poor, with most sinuses presenting a completeness score of no higher than 49% (Table 2). Total prevalence included a combination of both maxillary and frontal sinusitis. The prevalence of rhinosinusitis across both sites was similar, with 70% (14/20) of individuals from Tolpuddle Ball presenting evidence for rhinosinusitis, compared with 63.6% (21/33) from Llangefni (Table 3). No statistically significant difference in the prevalence of rhinosinusitis was found between the two sites ([FET] p = .768). Additionally, 14.3% (2/14) of individuals with rhinosinusitis at Tolpuddle Ball only showed signs of frontal sinus infection, while 28.6% (4/14) individuals had both maxillary and frontal sinus infections (Table 6). At Llangefni, on the other hand, there were no individuals included in this study that showed signs of solely frontal sinus infection. However, 33.3% (7/21) of individuals displayed signs of both maxillary and frontal sinus infection.

Rhinosinusitis was slightly more common in males at Llangefni (75%, 6/8), compared with females (60%, 12/20) ([FET] p = .669). Furthermore, 75% (12/16) of middle adults had rhinosinusitis compared with 56.3% (9/16) of young adults ([FET] p = .458). In contrast, at Tolpuddle Ball, 69.2% (9/13) of females had rhinosinusitis compared with 66.6% (4/6) of males ([FET] p = 1). At 75% (6/8), young adults were also the most commonly affected, with 66.6% (8/12) of middle adults presenting evidence for rhinosinusitis ([FET] p = .1) (Table 3). While no statistically significant differences were found between age or sex groups at either site, tests of statistical significance between groups were likely hindered by the small sample sizes in each category.

Table 4 The percentage of different bone changes within affected maxillary sinuses, by individual.

Site	Pitting	Spicule Formation	Remodelled Spicules	White Pitted Bone
Llangefni	66.6% (14/21)	42.9% (9/21)	42.9% (9/21)	14.3% (3/21)
Tolpuddle Ball	57.1% (8/14)	78.6% (11/14)	50.0% (7/14)	35.7% (5/14)

Observable in 66.6% (14/21) of individuals with evidence for rhinosinusitis, pitting was identified as the most common bone change within the Llangefni population. In contrast, while 57.1% (8/14) of individuals with rhinosinusitis from Tolpuddle Ball also showed signs of pitting, the most common bone change was spicule formation, which was identified in 78.6% (11/14) of individuals (Table 4).

The influence of dental pathology on the development of rhinosinusitis remains unclear across both sites, with 76.2% (32/42) and 79.2% (19/24) of sinuses from Llangefni and Tolpuddle Ball, respectively, categorised as unobservable (Table 5). However, 40% (4/10) of observable sinuses with evidence for rhinosinusitis from Llangefni were associated with dental disease. In contrast, 20% (1/5) of observable sinuses with evidence for rhinosinusitis from Tolpuddle Ball were recorded as having an odontogenic infection.

DISCUSSION

The preservation of both the maxillary and frontal sinuses and the maxilla bone can influence the ability to record the prevalence of pathologically-related bone changes accurately. Sundman and Kjellström (2013a, 454) identified a significant correlation between the preservation of a sinus and the frequency of osteological changes within it, with well-preserved sinuses far more likely to possess evidence of rhinosinusitis. Overall, sinus preservation at Tolpuddle Ball and Llangefni was poor, with 90% (36/40) and 92.4% (61/66) of sinuses, respectively, possessing a preservation score of no higher than 49%. Poor sinus preservation adversely affected the sample size in the current study and the reliability of subsequent results, limiting the interpretations drawn from them and should be borne in mind in the following discussion.

Tolpuddle Ball possessed a slightly higher prevalence of 70% (14/20) in comparison with Llangefni, where prevalence was 63.6% (21/33). When compared with the Romano-British sites of Lankhills (35.1%, 26/74) and Roman London (31.8%, 28/88) (Bernofsky 2010, 142–143), however, Tolpuddle Ball possessed a substantially higher number of individuals with rhinosinusitis. Similarly, Llangefni presented a higher frequency of rhinosinusitis than in adults at the Early Medieval (8th–11th C. AD) sites of Raunds, Northamptonshire (50.5%, 55/109) (Roberts 2007, 799) and Black Gate Cemetery, Newcastle-upon-Tyne (32.8%, 21/64) (Swales, 2019). Available prevalence rates of rhinosinusitis in comparable populations to the ones included in the current study are few. However, the prevalence rates at Tolpuddle Ball and Llangefni are evidently higher in comparison with other contemporary British rural and urban archaeological populations. There are several reasons why the results presented here may vary compared with other similar studies. Firstly, risk factors for rhinosinusitis may have been higher in populations examined in the current study than those investigated in comparable studies (see below). However, it should also be noted that a potential lack of consistency between studies in the recording methods utilised likely impacts the recorded prevalence of rhinosinusitis, ultimately leading to

Table 5 The percentage of maxillary sinuses at Llangefni and Tolpuddle Ball that displayed signs of an odontogenic sinus infection (presence of an oroantral fistula and abscess formation) in comparison to those with rhinogenic infection (absence of an oroantral fistula and abscess formation). Sinuses without complete M1–M3 alveolar bone were categorised as unobservable. Right and left sinuses pooled. Sex and age groups of each population are pooled together.

Site	Rhinogenic	Odontogenic	Unobservable
Llangefni	14.3% (6/42)	9.5% (4/42)	76.2% (32/42)
Tolpuddle Ball	16.6% (4/24)	4.2% (1/24)	79.2% (19/24)

Table 6 The percentage contribution of maxillary and frontal sinus infection towards the overall prevalence of rhinosinusitis across both sites.

Site	Maxillary & Frontal Sinus Infection	Only Maxillary Sinus Infection	Only Frontal Sinus Infection
Llangefni	33.3% (7/21)	66.6% (14/21)	0.0% (0/21)
Tolpuddle Ball	28.6% (4/14)	57.1% (8/14)	14.3% (2/14)

discrepancies in the comparability of prevalence rates. While the current study and the vast majority of other studies after 1995 present prevalence rates of rhinosinusitis consistently by individual (CPR) using methods outlined by Boocock *et al.* (1995), slight alterations to the methods employed, and differences in preservation and completeness within and between populations may also influence the frequencies of rhinosinusitis observed within different studies. For example, a population with greater preservation and completeness may record a higher prevalence of rhinosinusitis than one with poor preservation and incomplete sinuses.

Using archaeological data, it is also possible to explore the potential risk factors that may have affected the results obtained within the current study. However, the small sample sizes at both Tolpuddle Ball and Llangefni make any discussion of the differences in the overall prevalence of rhinosinusitis across both populations difficult. Nonetheless, while rhinosinusitis appears to have been a common affliction at both sites, there were likely differences in the aetiological factors that made the route of rhinosinusitis development slightly different for both populations.

While Tolpuddle Ball may not necessarily have possessed the cohesion associated with other settlements that were part of Dorchester's surrounding area, there is undoubtedly archaeological evidence to suggest a relationship with its greater surroundings (Hearne and Birbeck 1999, 226). Although archaeological evidence for grain drying and leather preparation at Tolpuddle Ball exists, the settlement was primarily engaged in animal husbandry and may have been linked to Dorchester's meat supply, transporting cattle by hoof (Hearne and Birbeck 1999, 222). Evidence for the trade of stone, stamped roof tiles from Dorchester, pottery and glass vessels also implies that the settlement was one of increasing prosperity, engaged in trade with other settlements across Dorset (Hearne and Birbeck 1999 225–226). Raw materials and other goods would likely have been obtained through trade with the production sites of Purbeck (Hearne and Birbeck 1999, 226). Additionally, isotope analysis of individuals from Poundbury Camp, Dorchester, has identified that there were immigrants from as far away as Greece buried at the site, suggesting that there was an increase in the mobility of the population in this area compared with the Iron Age and Early Roman period (Richards *et al.* 1998, 1251).

However, it is important to note that while a number of individuals buried at Tolpuddle Ball's cemetery were from the Late Romano-British period, the majority are largely dated to between the 5th and late 7th century AD.

The movement of people required for trade may have led to the spread of infectious diseases that could have ultimately produced infection of the paranasal sinuses, making it an essential consideration for the prevalence rate at Tolpuddle Ball (Yue *et al.* 2017, 1; Tatem *et al.* 2006, 332). However, at Llangefni, and during the Early Medieval period in Wales, the primary focus of the population was the agricultural means of supporting life (Davies 1982, 31). Consequently, these individuals were likely engaged in less trade than Tolpuddle Ball's Romano-British population (Davies 1982, 31). At present, there are still questions around the presence of Early Medieval rural markets in Anglesey; however, what is certain is that if the population of Llangefni was engaged in trade, it was not with a settlement of equal size to Dorchester (Steane 2014, 126; Davies 1982, 51; Hearne and Birbeck 1999, 226). Additionally, while such an observation is applicable to the Late Romano-British population buried at Tolpuddle Ball, the majority of comparisons regarding the movement of people are made between the post-Roman population and the archaeological evidence of earlier individuals.

Nonetheless, while most of such market connections appear to have declined substantially during the transition into the post-Roman period in the early 5th century AD, there is evidence for a continued occupation of settlements in Dorchester's surrounding area (Sparey Green 1987; Davies *et al.* 2002). Archaeological evidence of the production of Black Burnished Ware pottery at the Dewlish villa, Dorset, into the 5th century AD itself suggests that at least some locations in Dorset remained occupied (Gerrard 2010; Hewitt *et al.* 2021). Beyond the known locations of post-Roman/Early Medieval burial sites, the patterns of settlements from this particular period in Dorset are currently poorly understood; however, at least some continuity of the underlying rural economy may perhaps be assumed.

As the earliest evidence for tuberculosis in Britain was found during the Roman period, Roberts and Cox (2003, 119) suggest that the disease was first brought to Britain from continental Europe, where some of the earliest cases of tuberculosis have been found. Therefore, it is likely that tuberculosis proliferated in Britain due to the increased trade and contact with Romans from the continent (Roberts and Cox 2003, 119). Tuberculosis is capable of causing mucosal thickening and nasal polypi development in the maxillary sinus cavity, resulting in infection and inflammation (Slavin *et al.* 2005, S29; Sanehi *et al.* 2008, 87; Rayapati *et al.* 2018, S126). Lewis (2011, 12) studied the prevalence of tuberculosis across sub-adults at Poundbury Camp, the primary cemetery for people living in Dorchester, identifying distinctive skeletal changes associated with tuberculosis in 4.2% (7/165) of individuals, with another 6.1% (10/165) of individuals possessing lesions that were suggestive of pulmonary infection. Additionally, Farwell and Molleson (1993, 190) studied the adult population of Poundbury Camp and identified several individuals with both tuberculosis and signs of non-specific infectious disease. Radiography of one individual demonstrated evidence for new bone formation and destructive changes in the disc plates of the cervical and thoracic vertebral bodies suggestive of chronic infectious disease, such as tuberculosis (Farwell and Molleson 1993, 190; Verlaan *et al.* 2007, 1129).

While identification of tuberculosis at Poundbury Camp was limited to skeletal evidence, which affects only a small proportion of individuals suffering from a tuberculous infection, these results do suggest that the disease may have been more prevalent in Romano-British society than initially thought (Lewis 2011, 12). Given the trade relationship between Dorchester and Tolpuddle Ball, individuals that traded between the two settlements may have been at risk of spreading infectious respiratory diseases between their respective populations. McKinley (1999, 168) identified one individual from Tolpuddle Ball's Late/Post Romano-British cemetery that possessed bone changes characteristic of tuberculosis. This individual (SK5135) was also included in the current study and was determined to have had skeletal evidence for rhinosinusitis.

Regular and close interactions with fauna at Tolpuddle Ball may have also increased the population's exposure to zoonotic diseases, such as bovine

tuberculosis and brucellosis through inhalation of infected aerosols (Kirkhorn & Garry 2000, 707). There is currently a lack of information on the living conditions in Roman Dorchester. However, identifying tuberculosis within the population could suggest that its inhabitants and their animals were all living within close proximity of one another (Lewis 2011, 20). The Romans did not see any distinction between occupational and living activities within their homes, combining their living quarters and working environments, ultimately reducing air quality and increasing the likelihood of developing respiratory diseases and infections (Roberts and Cox 2003, 125). Furthermore, considering the movement of people through both trade and immigration, as well as the potential crowded public spaces of Dorchester and the close interaction with animals such as cattle, it is likely that there was an increased opportunity for disease transmission and nasal infection at the settlement, particularly for cattle traders from Tolpuddle Ball (Richards *et al.* 1998, 1251; Lewis 2011, 20; McKinley 1999, 158).

However, a range of sources of nasal irritants related to animal husbandry activities, such as exposure to dust, animal allergens, and mites, were likely to have contributed to rhinosinusitis development at the site. Although the focus on animal husbandry at Tolpuddle Ball may have reduced exposure to inorganic dust, it is still likely that the working population would have been regularly exposed to organic dust such as animal dander and pollens that lead to inflammation of the upper respiratory tract (Kirkhorn & Garry 2000, 706; Davies-Barrett 2018, 313). While the population at Llangefni also likely had close interactions with beasts of burden, Anglesey was focused primarily on cereal grain cultivation, which was also likely the focus at Llangefni (Edwards *et al.* 2005, 44; Thomas 1968, 1). As a result of the ploughing, tilling and harvesting involved in grain cultivation, these individuals were likely regularly exposed to various mixed organic and inorganic PM, which could have placed them at equal risk of developing rhinosinusitis as those from Tolpuddle Ball, albeit as a result of slightly different aetiological factors (Kirkhorn and Garry 2000, 705; Woelber *et al.* 2016, 4–5; Schenker 2000, 664).

The differences in agricultural activity are also an essential consideration for the differences in risk factors at these two sites because of the resulting differences in diet. Due to the production of cereal grains at Llangefni, it is likely that the diet for the population was carbohydrate-rich, which would substantially increase the likelihood of developing dental caries, periodontal disease and periapical lesions (Woelber *et al.* 2016, 4–5; McKinley 1999, 171). Although only 23.8% (10/42) of individuals from Llangefni possessed sufficiently preserved alveolar bone to determine whether paranasal sinus infection was either odontogenic or rhinogenic, 40% (4/10) of these individuals had an odontogenic route of infection, potentially as a result of the population's carbohydrate-rich diet. In contrast, while only 20.8% (5/24) of alveolar bone was determined to have been 'observable' at Tolpuddle Ball, 80% (4/5) were from individuals with rhinogenic infections. McKinley (1999, 166) studied the dental health of the individuals from Tolpuddle Ball and identified that the prevalence of dental diseases across the Late/Post Romano-British population was substantially lower than in the earlier populations of the settlement. This suggests that the focus on animal husbandry at the site provided the population with a protein-rich diet that did not contain many carbohydrate-rich cereals and coarse foodstuffs (McKinley 1999, 166; Hearne and Birbeck 1999, 228). However, the interpretation of results of the dental health of past populations from bioarchaeological studies is often complicated by the fact that the presence of dental disease alone is not enough to diagnose an individual with odontogenic sinusitis. Specifically, an abscess does not necessarily mean an individual suffered from odontogenic sinusitis. Instead, a direct connection into the maxillary sinus cavity serves as more reliable evidence (Roberts 2007, 797). As a consequence, although the study of the populations of both Tolpuddle Ball and Llangefni has provided a slight insight into the impact of dental disease on rhinosinusitis development, the poor degree of preservation in conjunction with the small sample sizes ensure that differentiating between rhinogenic and odontogenic routes of infection across the entirety of their respective populations remains problematic.

Although the 2.6% difference in prevalence between males and females at Tolpuddle Ball may suggest a uniform exposure of both sexes to the various aetiological factors at the site, however; it remains

difficult to draw any definite conclusions (see Table 3). Nonetheless, potential uniform exposure may have resulted from constant exposure to low air quality and pathogens through similarities in occupation across the population, such as various activities undertaken in indoor and outdoor environments and occupations such as animal husbandry (DiGangi and Sirianni, 2017, 162; Boocock *et al.*, 1995, 493; Lewis *et al.*, 1995, 502). At Llangefni, there was a larger 15% difference in prevalence between sexes, with 75% (6/8) of males and 60% (12/20) of females possessing rhinosinusitis. While the inflating effect of calculating prevalence from small sample sizes must be borne in mind, this could hint at differential exposure of males and females to risk factors for rhinosinusitis at this site.

Differences in the prevalence of rhinosinusitis in males and females have been observed in other bioarchaeological studies. Roberts (2007, 799) identified that females within archaeological populations such as those from Wharram Percy in Yorkshire and Chichester in Sussex were more likely to have rhinosinusitis, with males only having a higher prevalence in four of fifteen sites included in the study. Roberts (2007, 801) suggested that females may have spent more time indoors than their male counterparts, experiencing consistent exposure to household air pollution and particulate matter from sources such as hearth fires. This is consistent with modern studies of exposure to household air pollution in rural-based females from developing countries (Perez-Padilla *et al.* 2010, 1080–1081). Sundman and Kjellström (2013a, 456) also identified that the prevalence of rhinosinusitis was higher in males at Sigtuna, suggesting this to be a consequence of increasing industrialisation of the settlement, exposing males that worked in workshops to more smoke and harmful PM. However, due to a lack of archaeological settlement data for both Llangefni and Tolpuddle Ball, it is difficult to further investigate the impact of HAP on the prevalence of rhinosinusitis, particularly concerning differential exposure between the sexes.

There are also further observable differences in prevalence between age groups at Tolpuddle Ball and Llangefni. At Tolpuddle Ball, 75% (6/8) of young adults had rhinosinusitis compared with 66.6% (8/12) of middle adults. Given that earlier bioarchaeological studies have identified that prevalence increases with age, it is unusual that the opposite was observed here (Panhuysen *et al.* 1997, 612; Merrett and Pfeiffer 2000, 310; Liebe-Harkort 2012, 392). Older individuals are expected to have a higher prevalence due to the relationship between time of exposure to harmful PM and infection of the paranasal sinuses, where individuals who have prolonged exposure to low air quality are more likely to develop rhinosinusitis (Davies-Barrett 2018, 350). However, an expected trend was identified at Llangefni, where 75% (12/16) of middle adults were affected by rhinosinusitis compared with 56.3% (9/16) of young adults. Importantly, however, although no significant differences were also observed by Sundman and Kjellström (2013a, 454–455), it has been suggested that it is, in fact, the severity of bone change that continues to develop with age, rather than the overall prevalence of the condition. Unfortunately, given the poor preservation of sinuses across both Llangefni and Tolpuddle Ball, it was impossible to precisely record the extent of bone change.

While these results do not provide any statistical significance between sex, age and prevalence of rhinosinusitis, this does not necessarily conclude that various aetiological factors related to rhinosinusitis do not apply to different groups. In fact, within both sex and age groups at both sites, there were likely numerous risk factors at play, culminating in equal exposure to harmful PM among groups. Furthermore, it is likely that both Dorset and Welsh populations of this study did in fact have more in common than originally thought. Nonetheless, the lack of substantial structural archaeological evidence at Tolpuddle Ball and Llangefni, alongside their small sample sizes, ensures that questions will persist.

CONCLUSION

By comparing the Late/Post Romano-British population of Tolpuddle Ball and the Early Medieval population of Llangefni, a slightly higher prevalence of rhinosinusitis was identified at Tolpuddle Ball. However, a prevalence of 70% (14/20) and 63.6% (21/33) at Tolpuddle Ball and Llangefni, respectively,

suggests that the condition was particularly prevalent across both populations. Given that both populations originated from rural agricultural communities and possessed a relative prevalence of rhinosinusitis, it is likely that they both shared similar aetiological factors related to their exposure to harmful particulate matter as a consequence of their indoor living environments and subsistence activities. This study provides one of the first insights into the respiratory health of an archaeological population from both Dorset and Anglesey and the first to study the prevalence of rhinosinusitis across both Late/Post Romano-British and Early Medieval populations from these counties in Britain.

While the study of odontogenic sinusitis within both populations helps to provide a slight insight into the dental health of each settlement, the true influence of dental disease on rhinosinusitis development is unclear. Poor preservation and small sample sizes ultimately limit our understanding of odontogenic sinusitis within these populations and consequently, ensure that the interpretation of the aetiology of rhinosinusitis, particularly surrounding the quality of air and rhinogenic or odontogenic routes of infection, is not fully understood. Although this limits the discussion of inter-site differences, the results of this study serve as a comparator for future research into the respiratory health of Dorset and Anglesey's past populations.

ACKNOWLEDGEMENTS

Acknowledgements must go to the Dorset Natural History and Archaeology Society and particularly the collections team of Dorset Museum, Brython Archaeology, and Archaeology Wales, for kindly granting access to the Tolpuddle Ball and Llangefni assemblages respectively.

REFERENCES

Ah-See, K. and Evans, A. 2007. 'Sinusitis and its management', *British Medical Journal* **34(7589)**, 358–361. doi: 10.1136/bmj.39092.679722.be.

Allen, M. 2016. 'The South', in T. Brindle, A.T. Smith, M.G. Allen, and M. Fulford, *The Rural Settlement of Roman Britain*. Society for the Promotion of Roman Studies.

Ameni, G., Vordermeier, M. et al. 2011. 'Mycobacterium tuberculosis infection in grazing cattle in central Ethiopia', *The Veterinary Journal* **188(3)**, 359–361. doi: 10.1016/j.tvjl.2010.05.005.

Bernofsky, K. 2010. *Respiratory health in the past: a bio-archaeological study of chronic maxillary sinusitis and rib periostitis from the Iron Age to the Post Medieval Period in Southern England*. Unpublished PhD Thesis, Durham University.

Boman, C. 2006. 'Shedding new light on wood smoke: a risk factor for respiratory health', *European Respiratory Journal* **27(3)**, 446–447. doi: 10.1183/09031936.06.00000806.

Boocock, P., Roberts, C.A. and Manchester, K. 1995. 'Maxillary sinusitis in Medieval Chichester, England', *American Journal of Physical Anthropology* **98(4)**, 483–495. doi: 10.1002/ajpa.1330980408.

Brook, I. 2009. 'Sinusitis', *Periodontology 2000* **49(1)**, 126–139. doi: 10.1111/j.1600-0757.2008.00293.x.

Brook, I. 2012. 'Anaerobic bacteria in upper respiratory tract and head and neck infections: Microbiology and treatment', *Anaerobe* **18(2)**, 214–220. doi: 10.1016/j.anaerobe.2011.12.014.

Bruce, N., Rogelio, P.P. and Rachel, A. 2000. 'Indoor air pollution in developing countries: a major environmental and public health challenge', *Bulletin of the World Health Organization* **78(9)**, 1078–1092.

Casna, M., Burrell, C. et al. 2021. 'Urbanization and respiratory stress in the Northern Low Countries: A comparative study of chronic maxillary sinusitis in two early modern sites from the Netherlands (AD 1626–1866)', *International Journal of Osteoarchaeology* **31(5)**, 891–901. doi: 10.1002/oa.3006.

Christensen, A. and Hatch, G. 2018. 'Chapter 20 – Advances in the Use of Frontal Sinuses for Human Identification', in K. Latham, E. Bartelink, and M. Finnegan, eds. *New Perspectives in Forensic Human Skeletal Identification*. London, Academic Press.

Clark, M., Peel, J., et al. 2013. 'Health and Household Air Pollution from Solid Fuel Use: The Need for Improved Exposure Assessment', *Environmental Health Perspectives* **121(10)**, 1120–1128. doi: 10.1289/ehp.1206429.

Cox, P.W. 1988 'A Seventh Century Inhumation Cemetery at Shepherd's Farm, Ulwell near Swanage, Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **110**, 37–47.

Daborn, C.J., Grange, J.M. and Kazwala, R.R. 1996. 'The bovine tuberculosis cycle – African perspective', *Journal of Applied Bacteriology* **81**, 27S–32S. doi: 10.1111/j.1365-2672.1996.tb04595.x.

Davies, J. and Arnold, C. 2000. *Roman and Early Medieval Wales*. The History Press Ltd.

Davies, S.M., Bellamy, P.S., Heaton M.J. and Woodward

P.J. 2002. *Excavations at Alington Avenue, Fordington, Dorchester, Dorset, 1984-87*, Dorset Natural History and Archaeological Society Monograph **15**.

Davies, W. 1978. 'Land and Power in Early Medieval Wales', *Past and Present* **81(1)**, 3–23. doi: 10.1093/past/81.1.3.

Davies, W. 1982. *Wales in the Early Middle Ages*. Leicester, Leicester University Press, 31–50.

Davies-Barrett, A. 2018. *Respiratory disease in the Middle Nile Valley: A bioarchaeological analysis of the impact of environmental and sociocultural change from the Neolithic to Medieval periods*. Unpublished PhD Thesis, Durham University.

De la Bédoyère, G. 2013. *Roman Britain: A New History*. 2nd ed. London, Thames & Hudson.

DiGangi, E. and Sirianni, J. 2016. 'Maxillary Sinus Infection in a 19th-Century Almshouse Skeletal Sample', *International Journal of Osteoarchaeology* **27(2)**, 155–166. doi: 10.1002/oa.2526.

Edwards, N., Lane, A., et al. 2005. 'Early Medieval Wales: A Framework for Archaeological Research', *Archaeology in Wales* **45**, 33–46.

Evans, R. 2011. *Cefn Graianog Quarry Archaeological Assessment*. Gwynedd Archaeological Trust, 3–13. Available at: https://diogel.gwynedd.llyw.cymru/swiftlg/imagetemp/39918-228389.pdf.

Faillace, K. and Madgwick, R. 2019. *The Human Bone from Llangefni College Campus Site Extension – Llangefni, Anglesey*, Unpublished report, 1–42.

Ferkol, T. and Schraufnagel, D. 2014. ‚The Global Burden of Respiratory Disease', *Annals of the American Thoracic Society* **11(3)**, 404–406. doi: 10.1513/annalsats.201311-405ps.

Forum of International Respiratory Societies 2017. *The Global Impact of Respiratory Disease*. 2nd ed. Sheffield, European Respiratory Society, **29**.

Fullerton, D., Bruce, N. and Gordon, S.B. 2008. 'Indoor air pollution from biomass fuel smoke is a major health concern in the developing world', *Transactions of the Royal Society of Tropical Medicine and Hygiene* **102(9)**, 843–851. doi: 10.1016/j.trstmh.2008.05.028.

Gerrard, J. 2010.' Finding the Fifth century: A late Fourth century and early Fifth century pottery fabric from south-east Dorset', *Britannia* **41**, 293–312.

Gilchrist, R. 2012. 'Experiencing Age: the Medieval Body', in R. Gilchrist (ed) *Medieval Life Archaeology and the Life Course* Woodbridge, Boydell & Brewer, 32–67.

Gordon, S., Bruce, N., et al. 2014. 'Respiratory risks from household air pollution in low and middle income countries', *The Lancet Respiratory Medicine* **2(10)**, 823–860. doi: 10.1016/s2213-2600(14)70168-7.

Hamilos, D. 2000. 'Chronic sinusitis', *Journal of Allergy and Clinical Immunology* **106(2)**, 213–227. doi: 10.1067/mai.2000.109269.

Harlow, M. and Laurence, R. 2002. *Growing up and growing old in Ancient Rome*. London, Routledge.

Hearne, C. and Birbeck, V. 1999. *A35 Tolpuddle to Puddletown bypass DBFO, Dorset, 1996-8: incorporating excavations at Tolpuddle Ball 1993*. Salisbury, Wessex Archaeology.

Hewitt, I., Putnam, M., Milward, J. and Monteith, J. 2021. *Dewlish Roman Villa, Dorset. Bill Putnam's Excavations 1969-1979*. Dorchester, Dorset Natural History and Archaeological Society Monograph **25**.

Hopewell, D. and Edwards, N. 2017. 'Early Medieval Settlement and Field Systems at Rhuddgaer, Anglesey', *Archaeologia Cambrensis* **166**, 1–36.

Khanna, S. and Gharpure, A. 2013. 'Correlation of Increased Sinusitis and Urban Air Pollution', *Indian Journal of Science Research & Technology* **1(1)**, 14–17.

Kim, S. 2019. 'Definition and management of odontogenic maxillary sinusitis', *Maxillofacial Plastic and Reconstructive Surgery*, **41(1)**, 1–11. doi: 10.1186/s40902-019-0196-2.

Kirkhorn, S. and Garry, V. 2000. 'Agricultural lung diseases', *Environmental Health Perspectives* **108(suppl 4)**, 705–712. doi: 10.1289/ehp.00108s4705.

Klaus, H. 2014. 'Frontiers in the bioarchaeology of stress and disease: Cross-disciplinary perspectives from pathophysiology, human biology, and epidemiology', *American Journal of Physical Anthropology* **155(2)**, 294–308. doi: 10.1002/ajpa.22574.

Kowaleski, M. 2014. 'Medieval People in Town and Country: New Perspectives from Demography and Bioarchaeology', *Speculum* **89(3)**, 573–600. doi: 10.1017/s0038713414000815.

Lewis, M. 2011. 'Tuberculosis in the non-adults from Romano-British Poundbury Camp, Dorset, England', *International Journal of Paleopathology* **1(1)**, 12–23. doi: 10.1016/j.ijpp.2011.02.002.

Lewis, M. 2016. 'Work and the Adolescent in Medieval England AD900–1550: The Osteological Evidence', *Medieval Archaeology* **60(1)**, 138–171. doi: 10.1080/00766097.2016.1147787.

Lewis, M., Roberts, C. and Manchester, K. 1995. 'Comparative study of the prevalence of maxillary sinusitis in later Medieval urban and rural populations in Northern England', *American Journal of Physical Anthropology* **98(4)**, 497–506. doi: 10.1002/ajpa.1330980409.

Liebe-Harkort, C. 2012. 'Cribra orbitalia, sinusitis and linear enamel hypoplasia in Swedish Roman Iron Age adults and subadults', *International Journal of Osteoarchaeology* **22(4)**, 387–397. doi: 10.1002/oa.1209.

Little, R., Long, C., et al. 2018. 'Odontogenic sinusitis: A review of the current literature', *Laryngoscope Investigative Otolaryngology* **3(2)**, 110–114. doi: 10.1002/lio2.147.

Loader, E. and Hearne, C. 1999. 'Tolpuddle Ball Cemetery (Phase 5A): W2405.17', in: C. Hearne, and V. Birbeck, *A35 Tolpuddle to Puddletown Bypass DBFO, Dorset, 1996-8: Incorporating Excavations at Tolpuddle Ball 1993*. Salisbury, Wessex Archaeology.

Mattingly, D. 2007. *An Imperial Possession: Britain in the Roman Empire, 54 BC - AD 409*. London, Penguin UK.

McKinley, J. 1999. 'Human Bone from Tolpuddle Ball', in C. Hearne and V. Birbeck, *A35 Tolpuddle to Puddletown Bypass DBFO, Dorset, 1996-8: Incorporating excavations at Tolpuddle Ball 1993*. Salisbury, Wessex Archaeology.

Mehra, P. and Jeong, D. 2009. 'Maxillary sinusitis of odontogenic origin', *Current Allergy and Asthma Reports* **9(3)**, 238–243. doi: 10.1007/s11882-009-0035-0.

Merrett, D. and Pfeiffer, S. 2000. 'Maxillary sinusitis as an indicator of respiratory health in past populations', *American Journal of Physical Anthropology* **111(3)**, 301–318. doi: 10.1002/(sici)1096-8644(200003)111:3<301::aid-ajpa2>3.0.co;2-0.

Newman, L., Thomas, A.E., et al. 1994. 'Chronic Sinusitis', *JAMA* **271(5)**, 363–367. doi: 10.1001/jama.1994.03510290045035.

Panhuysen, R., Coenen, V. and Bruintjes, T. 1997. 'Chronic maxillary sinusitis in Medieval Maastricht, The Netherlands', *International Journal of Osteoarchaeology* **7(6)**, 610–614. doi: 10.1002/(sici)1099-1212199711/12)7:6<610::aid-oa366>3.0.co;2-q.

Perez-Padilla, R., Schilmann, A. and Riojas-Rodriguez, H. 2010. 'Respiratory health effects of indoor air pollution', *The International Journal of Tuberculosis and Lung Disease* **14(9)**, 1079–1086.

Psillas, G., Papaioannou, D., et al. 2021. 'Odontogenic maxillary sinusitis: A comprehensive review', *Journal of Dental Sciences* **16(1)**, 474–481. doi: 10.1016/j.jds.2020.08.001.

Putnam, W. 2007. *Roman Dorset*. Stroud, Tempus.

Rajab, T. 2021. *A Bioarchaeological Analysis of the Prevalence of Rhinosinusitis across Romano-British and Early Medieval Populations*. Unpublished MSc Dissertation, Cardiff University.

Rayapati, D., Prashanth, N., et al. 2018. 'Tuberculosis of the maxillary sinus masquerading as a facial abscess, a unique occurrence', *Journal of Oral and Maxillofacial Pathology* **22(4)**, S126–S130. doi: 10.4103/jomfp.jomfp_119_16.

Richards, M., Hedges, R.E.M., et al. 1998. 'Stable Isotope Analysis Reveals Variations in Human Diet at the Poundbury Camp Cemetery Site', *Journal of Archaeological Science* **25(12)**, 1247–1252. doi: 10.1006/jasc.1998.0307.

Roberts, C. 2007. 'A bioarcheological study of maxillary sinusitis', *American Journal of Physical Anthropology* **133(2)**, 792–807. doi: 10.1002/ajpa.20601.

Roberts, C. and Cox, M. 2003. *Health & disease in Britain: from prehistory to the present day*. Gloucester, Sutton Publishing.

Rosenfeld, R. 2016. 'Acute Sinusitis in Adults', *New England Journal of Medicine* **375(10)**, 962–970. doi: 10.1056/nejmcp1601749.

Rusu, I. and Madgwick, R. 2017. *The Human Remains from the Llangefni Link Road*. Unpublished Report, 1–32.

Sanehi, S., Dravid, C., et al. 2008. 'Tuberculosis of paranasal sinuses', *Indian Journal of Otolaryngology and Head & Neck Surgery* **60(1)**, 85–87. doi: 10.1007/s12070-008-0027-8.

Schenker, M. 2000. 'Exposures and health effects from inorganic agricultural dusts', *Environmental Health Perspectives* **108**, 661–664. doi: 10.1289/ehp.00108s4661.

Shitaye, J., Tsegaye, W. and Pavlik, I. 2008. 'Bovine tuberculosis infection in animal and human populations in Ethiopia: a review', *Veterinární Medicína* **52(8)**, 317–332. doi: 10.17221/1872-vetmed.

Slavin, R., Sheldon. L., et al. 2005. 'The diagnosis and management of sinusitis: A practice parameter update', *Journal of Allergy and Clinical Immunology* **116(6)**, 13–47. doi: 10.1016/j.jaci.2005.09.048.

Sparey Green, C. 1987 *Excavations at Poundbury Volume 1: The Settlements*, Dorchester, Dorset Natural History and Archaeological Society Monograph **7**.

Steane, J. 2014. *The Archaeology of Medieval England and Wales*. London, Routledge.

Steele, R. 2005. 'Chronic Sinusitis in Children', *Clinical Pediatrics* **44(6)**, 465–471. doi: 10.1177/00099228054400601.

Sundman, E. and Kjellström, A. 2013a. 'Chronic Maxillary Sinusitis in Medieval Sigtuna, Sweden: A Study of Sinus Health and Effects on Bone Preservation', *International Journal of Osteoarchaeology* **23(4)**, 447–458. doi: 10.1002/oa.1268.

Sundman, E. and Kjellström, A. 2013b. 'Signs of sinusitis in times of urbanization in Viking Age–Early Medieval Sweden', *Journal of Archaeological Science* **40(12)**, 4457–4465. doi: 10.1016/j.jas.2013.06.010.

Swales, D. 2019. 'A biocultural analysis of mortuary practices in the later Anglo-Saxon to Anglo-Norman Black Gate Cemetery, Newcastle-upon-Tyne, England', *International Journal of Osteoarchaeology* **29(2)**, 198–219. doi: 10.1002/oa.2729.

Tatem, A., Rogers, D. and Hay, S. 2006. 'Global Transport Networks and Infectious Disease Spread', *Advances in Parasitology*, 293–343. doi: 10.1016/s0065-308x(05)62009-x.

Taylor, J. 2007. *An Atlas of Roman Rural Settlement in England*. York, Council for British Archaeology.

Thomas, C. 1968. 'Thirteenth-Century Farm Economies in North Wales', *The Agricultural History Review* **16(1)**, 1–14.

Torres-Duque, C., Maldonado, D., et al. 2008. 'Biomass Fuels and Respiratory Diseases A Review of the Evidence', *Proceedings of the American Thoracic Society* **5(5)**, 577–590. doi: 10.1513/pats.200707-100RP.

Verlaan, J., Oner, F. and Maat, G. 2007. 'Diffuse idiopathic skeletal hyperostosis in ancient clergymen', *European Spine Journal* **16(8)**, 1129–1135. doi: 10.1007/s00586-007-0342-x.

Wald, E. 1995. 'Chronic sinusitis in children', *The Journal of Pediatrics* **127(3)**, 339–347. doi: 10.1016/s0022-3476(95)70061-7.

Wells, C. 1977. 'Disease of the maxillary sinus in antiquity', *Medical & Biological Illustration* **27(4)**, 173–178.

Woelber, J., Bremer, K., et al. 2016. 'An oral health optimized diet can reduce gingival and periodontal inflammation in humans – a randomized controlled pilot study', *BMC Oral Health* **17(1)**, 1–8. doi: 10.1186/s12903-016-0257-1.

Yue, R., Lee, H. and Wu, C. 2017. 'Trade routes and plague transmission in pre-industrial Europe', *Scientific Reports* **7(1)**, 1–10. doi: 10.1038/s41598-017-13481-2.

The authors: Tareq Rajab is a recent graduate of Cardiff University's MSc Archaeological Science program and has a keen interest in respiratory health and the development of respiratory disease in past populations. He is a coordinator at the Tareq Rajab Museum in Kuwait. Anna Davies-Barrett is a palaeopathologist with a specialism in respiratory disease and its relationship to environmental, social, and economic changes in the past. She is currently a research associate at the University of Leicester, and has previously worked as a lecturer at Cardiff University and bioarchaeologist at the British Museum. Contact: editor@dorsetmuseum.co.uk

THE LOST MEDUSA MOSAIC FROM HALSTOCK, DORSET

STEPHEN R. COSH

A mosaic with the head of Medusa was found at Halstock in 1817. Subsequently lost, the records of it were partial and confusing. However, the finding of a painting in 2003 has now given us a better idea of the mosaic's appearance and helped to piece together the story of its discovery, while facilitating a better understanding of the mosaic itself.

INTRODUCTION

The search for imagery and information concerning the lost Medusa mosaic, found at Halstock, Dorset in 1817, has been a long and fascinating process. It was the subject of a very thorough article by Ron Lucas (1991), who, following the death of Ted Large, had taken over the excavations at the Roman villa which were conducted from 1967–1985. The excavation report (Lucas 1993, 18) makes only a fleeting allusion to the Medusa mosaic in the discussion of Room 1.9. This room, lying close to the baths and partially beneath the course of Common Lane, was thought to be the original location of the mosaic, but apart from loose red and white tesserae, nothing else had survived. It was certainly in the appropriate location and accords well with the dimensions of the pavement as reported in the 19th century which was about 14 feet (4.26m) square. This compares with about 4.50m square for Room 1.9 when excavated (Fig. 1).

Because of its loss, we rely on accounts and images from the 19th century for the design of the Medusa mosaic. This has been well researched by Lucas (1991), so only a brief summary is included here. However, a painting of the mosaic has since come to light and now gives a better understanding of the pavement and its recording.

DISCOVERY

The mosaic's discovery was first reported in a letter to the *Gentleman's Magazine* dated 24th December 1817 from John Bellamy (1783–after 1851) who lived nearby and had visited the site the previous day. The mosaic had been found during ditch-digging in Common Lane west of the village of Halstock, and at the instigation of the landowner, Henry Stephen Fox-Strangways, third Earl of Ilchester, the pavement was fully exposed. It was then protected within a structure of wood and thatch at his expense. Bellamy hoped to send a 'faithful drawing' of the mosaic to the editor, but stated 'the frost setting in severely, deprived me of the animation necessary to complete my purpose' (Bellamy 1818, 5; Gomme 1887, 56–8).

There is no evidence that the mosaic was ever drawn by Bellamy, and from what little is known of this gentleman's life (except for family details and a summons for breach of the peace in 1834, before moving to Guernsey), he is not recorded as showing further interest in Dorset antiquities. He left a rather incomprehensible description of the mosaic's geometric scheme, and of each of the figures in the corners: 'a warrior in his helmet, the back of which is represented having a double cross in an oblique position from right to left, extending far over the shoulders'; and a central 'face

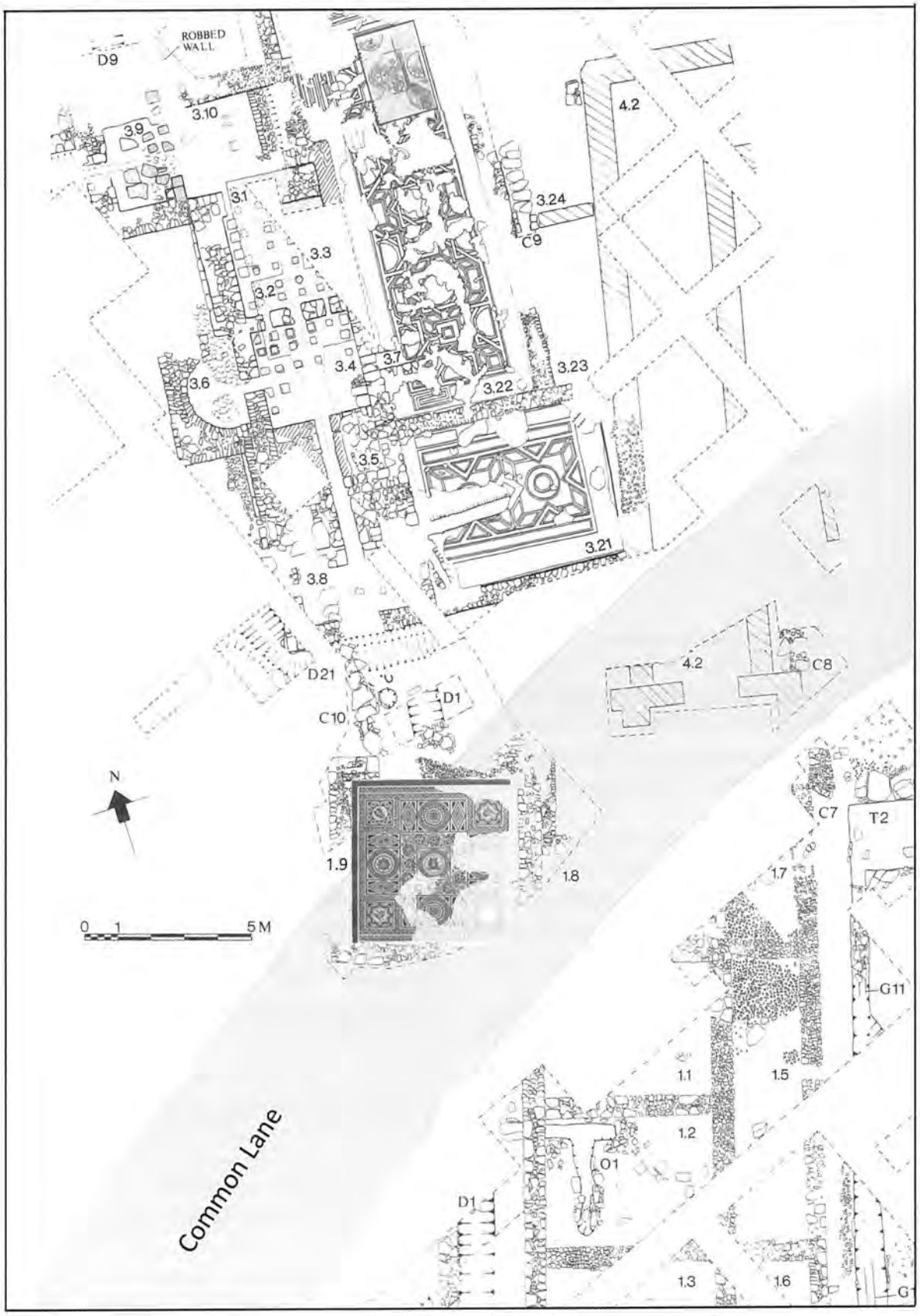


Figure 1 The Medusa mosaic superimposed within Room 1.9 on the north-west part the site plan (based on Lucas 1993, figs 5 and 7). The location of part of the mosaic shown on Samuel Lysons' coloured drawing is shown outlined red.

ornamented with a sort of irregular ruff or crest round the whole forehead as far as the ears'. This made identification of the figures difficult, although following the discovery in 1963 of the iconic mosaic from Hinton St Mary with a central bust of Christ (or at least a Christian) with further busts in the corners, Smith (1965, 100 note 25) speculated that the two mosaics had similar subject matter. He was perhaps influenced by Bellamy's hints of Christian content ('our Lord's thorny crown' and 'the symbol of the Cross') within the pavement.

In the *History of Dorset* Vol 4 (Hutchins 1870, 465), is an account of the mosaic, which is described as: 'a large circle with figures, flowers and devices in the centre, and a medallion figurehead in each corner, forming a square floor'. This does not slavishly follow Bellamy, who does not mention flowers, although this could conceivably be an interpretation of his 'large mathematical encircled star'. Crucially, it erroneously states that the mosaic was found about 1830, long after Bellamy's report, and provides further information about the mosaic's subsequent fate. It was believed that treasure lay beneath the pavement, with the consequence that local villagers broke into the cover building, then called 'a slated brick house', and 'destroyed much of the pavement'. This building was then demolished at the request of the third earl, probably not very long after the mosaic's discovery, but it may have survived longer. There is no other known mention of it after about 1818.

John Hutchins himself never saw the mosaic (he had died in 1773). The description must have been added prior to the publication of the third edition of his history in 1870, probably by its editor, William Shipp (1807–73), best known for his exploration of the villa at Tarrant Hinton, near his home in Blandford Forum, in the 1840s. It is possible that Shipp (or whoever supplied the details) saw the actual mosaic, but this is unlikely because it would have been after 1830 when he believed it was found. However, by then, it had probably already been destroyed. The source for the information is unknown, and the description of the mosaic may have been based on an illustration now lost to us. As will be discussed below, two mosaics found 1817–18 are conflated in this account.

Apparently overlooked by scholars, including Lucas, is the incidental mention of a mosaic with 'the head of Medusa at Halstock, in Dorset' in a booklet dated 1831 about the villa at Pitney in Somerset by Sir Richard Colt Hoare (1832, 19). This implies that he knew what the centrepiece of the mosaic looked like and was not reliant on Bellamy's account. Hoare's connection with the site also cropped up in the research by Lucas. He reported that as a starting point for investigations into the history of the mosaic, the Holland House papers of the Fox-Strangways family in the British Library were examined (Lucas 1991, 135). Two letters were found which mention the mosaic. One from Lady Ilchester refers to a visit by Hoare in January 1818. In another from the Earl's son, probably written in January 1819, he hoped that 'some drawing or print will be made' showing the mosaic and suggested that it might be removed to Melbury House.

This mention of Sir Richard Colt Hoare (1758–1838) prompted Lucas to examine his papers in the Stourhead Collection of Wiltshire Record Office. A letter from the Revd Thomas Rackett of Spetisbury, dated 19th January 1818, was located. This not only described the mosaic's discovery and appearance, but was also accompanied by a rough sketch (Lucas 1980, 22–23; 1991, 136–37). Rackett (1756–1840) was a keen antiquary and naturalist who, famously neglecting his parish duties, sought interesting specimens throughout the county (Neale 2000). His sketch (Fig. 2) shows that about two thirds of the pavement survived and had the head of Medusa at the centre, noting that it had been orientated wrongly on his drawing. At last, sense could be made of the abstruse written descriptions, but this was only a monochrome sketch. Clearly Medusa was at the centre as she often appears on mosaics, probably to ward off evil spirits, but the interpretation of the corner busts was more problematic. The best guess after the picture's emergence, was that personifications of the Winds occupied the corners, as on other mosaics in the area (including Frampton), and on the Medusa panel from Brading, Isle of Wight (Witts 1994, 7). Rackett also noted that further exploration of the site was planned for the spring of 1818.

The first letter in the Holland House papers also mentions a forthcoming visit by Samuel Lysons,

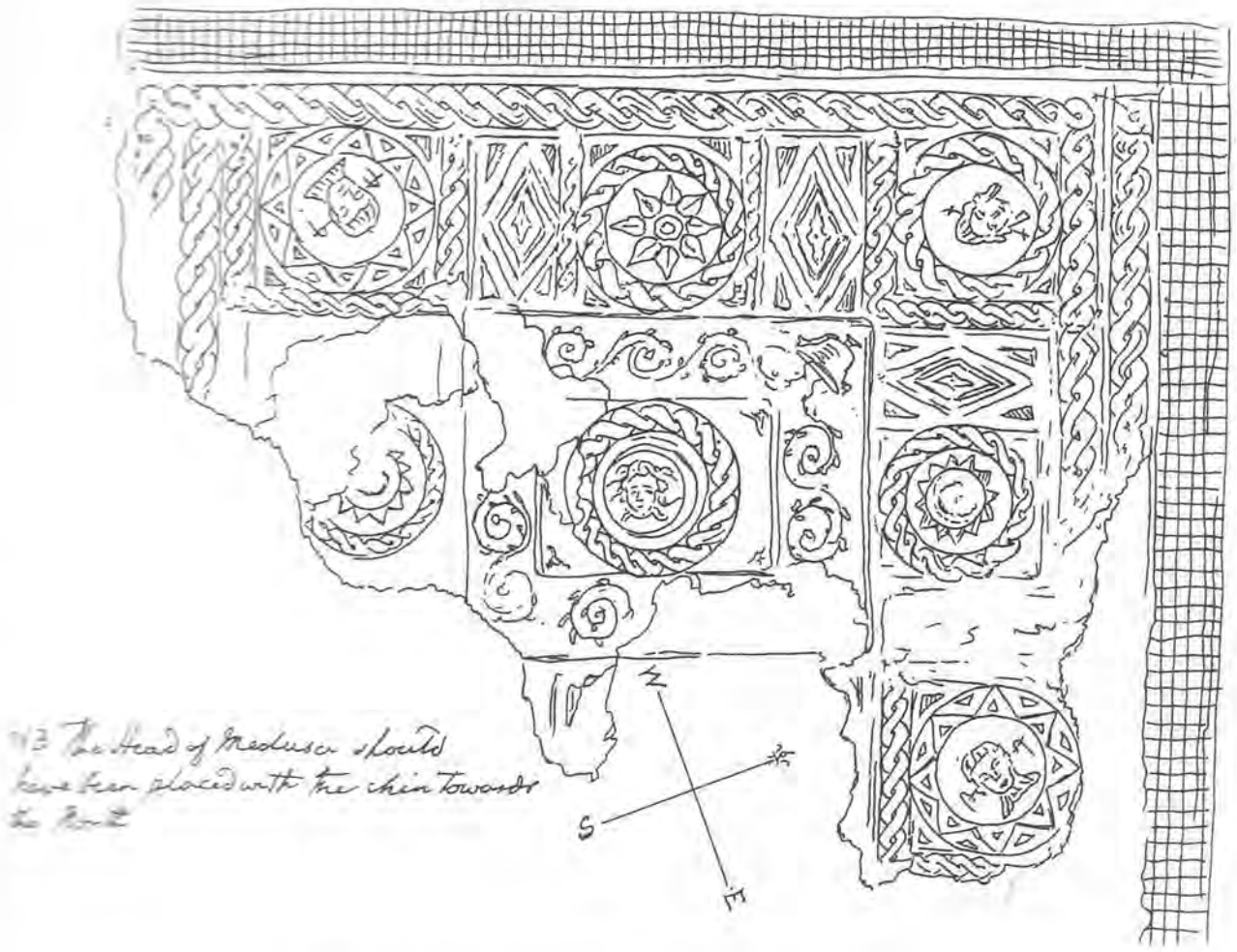


Figure 2 Drawing by Thomas Rackett of the Medusa mosaic, 1818.

which was of even greater significance. Lysons (1763–1819) was a renowned antiquary, pioneer archaeologist and a skilful artist who drew, and had engraved, many of the mosaics known at that time, which were published in his *Reliquiae Britannico-Romanae*, comprising three large-format volumes (1813–17). The Medusa mosaic was not included.

In 1971, a large mosaic of interlaced squares was excavated in Room 3.22 at Halstock, part of which was overlain with 'modern' bricks (Lucas 1993, 40). This corresponded with the account given in Hutchins (1870, 465) where it was stated, 'The house was taken down and the pavement covered in bricks, the earth and turf being replaced as before'. It then became clear that the Medusa mosaic in the cover building and the mosaic covered in bricks were not the same, and that two mosaics were known in 1818. It is probable that the bricks were wrongly assumed to have come from the demolished cover-building, hence the difference from Bellamy's contemporary account that it was of wood and thatch. Furthermore, Anne Rainey recognised the 1971 mosaic as the same one shown on a drawing in the library of the Society of Antiquaries of London, attributed to Samuel Lysons (Society of Antiquaries of London, Red Portfolio, Gloucestershire; Rainey 1971, 147–50, fig. 13; Rainey 1973, 91–2) (Fig. 3a). A comparison with the same part of the mosaic as found in 1971 (Fig. 3b) demonstrates the accuracy of Lysons and how he did not spend time on shading elements that were repeated.

Although there was nothing on the drawing to indicate the provenance of the mosaic, it had been believed to have come from Cirencester where mosaics of a similar style had been found (Smith

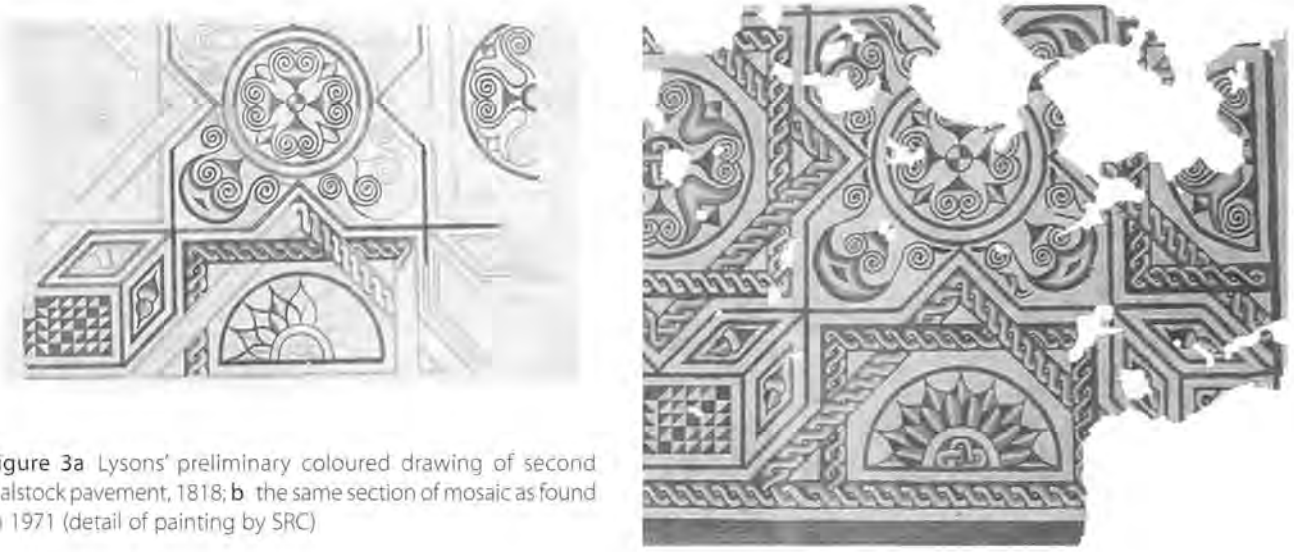


Figure 3a Lysons' preliminary coloured drawing of second Halstock pavement, 1818; **b** the same section of mosaic as found in 1971 (detail of painting by SRC)

1969, 100, note 2). There can now be no shadow of a doubt that the second Halstock mosaic was depicted. So Lysons *had* visited Halstock in 1818 and drawn one of the mosaics. Interestingly, when a test trench was dug across the *porticus* mosaic at Frampton during excavations directed by Miles Russell of Bournemouth University in 2019, the pavement recorded by Lysons in 1797 had been covered in 'modern' roofing slates. It is possible to speculate that Lysons advised that the Halstock mosaic should be re-buried in a similar way.

Lucas posed the question: 'if both [pavements] were open at the same time would it have been easier [for Lysons] to draw and produce possibly a more attractive picture?'. He suggested that 'The answer to this may be that because a temporary building had been erected around the mosaic with the portraits ... and because it was intended to rebury the geometric mosaic then it would be more important to first make a record of the latter pavement' (Lucas 1991, 135).

'REDISCOVERY'

In 2003, while researching for the Romano-British mosaic corpus, the author was invited to examine a collection of paintings and engravings at Lydney Park in Gloucestershire. He was surprised indeed to find a dusty painting that was immediately recognisable as the Medusa mosaic from Halstock, in good condition except that it was curled and damaged at one end (Fig. 4). The caption below the painting reads: 'No 1 ROMAN PAVEMENT at Halstock, Dorsetshire, drawn by J. Lickman from an original sketch by Mr Lysons'. This answers Lucas's question – Lysons *did* make a drawing of the Medusa mosaic. In the collection was a second Lickman painting of a mosaic, also stated as from Halstock and based on a preliminary drawing by Lysons. This one, however, was actually from the villa at Wellow, Somerset, which Lysons must have visited after it had been re-exposed in 1807 (Cosh and Neal 2005, Mosaic 219.2). Sadly Lysons died in 1819 before he could complete the paintings himself. The whereabouts of his original drawings, on which Lickman based his paintings (if they still exist), are unknown.

Lickman was clearly commissioned to draw two mosaics from Halstock found in 1817–18, working up Lysons' preparatory drawings, but was perhaps supplied with the wrong 'sketch' for one of them. He would not have seen either mosaic personally, even if they were still exposed or extant at that time, as we know from his correspondence that travelling away from home was too difficult for him as a schoolmaster and widower with a young family. Presumably he should have been working from the drawing almost certainly by Lysons in the library of the Society of Antiquaries of London for his painting of the second Halstock pavement.

Unfortunately, for the present author, the discovery of Lickman's painting came too late to be included

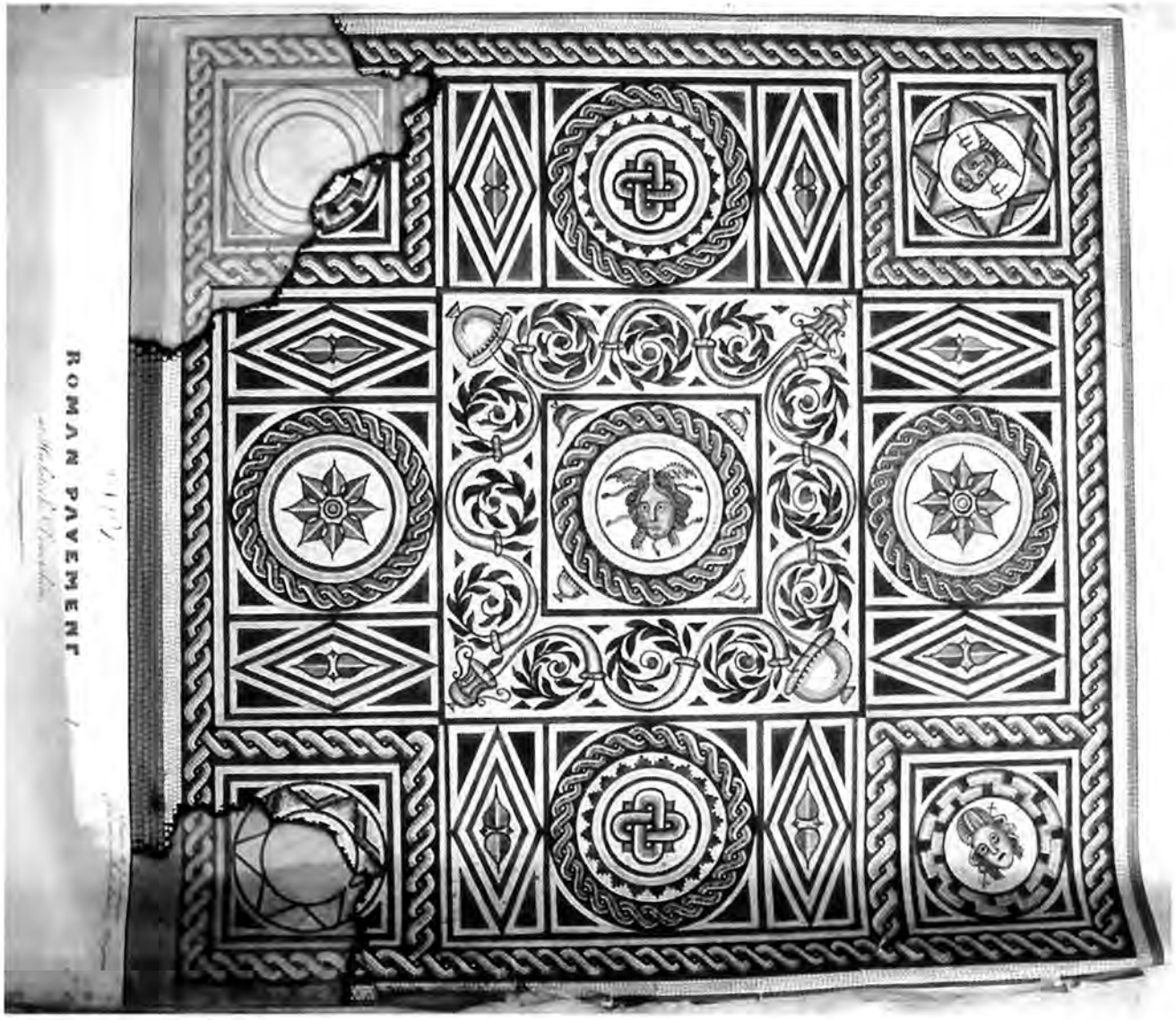


Figure 4 Lickman's painting of the Medusa mosaic based on a lost Lysons sketch *circa*, 1829–30.

properly in the appropriate volume of the corpus, *Roman Mosaics of Britain*, which had by then been type-set. However, an illustration of it (Fig. 5) was hastily created to replace the intended frontispiece, based on Lickman's painting but showing the extent of survival as indicated on Rackett's sketch, along with a brief explanatory caption (Cosh and Neal 2005, iii–iv, frontispiece). Therefore the mosaic's entry merely summarises what was known prior to 2003 (Cosh and Neal 2005, Mosaic 170.1).

So, how did Lickman come to paint the beautiful Medusa mosaic from Halstock? John Lickman (1774–1844) was a schoolmaster at Hatherden near Andover, Hampshire, but was also a Methodist preacher and an accomplished draughtsman and artist (Cosh 2004; Coldicott 2012). In 1823 he painted a detailed picture in the style of Lysons, of the newly-unearthed mosaic from Thruxton, Hampshire, near his home, for the landowner who was an acquaintance of his; it was the only one of Lickman's paintings to be issued as engravings (Henig and Soffe 1993). This illustration came to the notice Sir Richard Colt Hoare. In 1992, paintings by Lickman of the two mosaics from Bramdean, Hampshire emerged in the library of Stourhead, the former home of Hoare who was Lickman's patron (Witts 1993). As far as is known, these and a version of Lickman's known Thruxton illustration are the only ones which remain there. Unless some

Figure 5 Composite painting by SRC based on Rackett's sketch and Lickman's painting.

of the Lydney Park collection were original works rather than copies of those painted for Hoare, it is possible that others were lost in the devastating fire at Stourhead in 1902 which destroyed the contents of the upper floors. At some time in the late 1820s, Lickman was requested to paint mosaics for Rt Hon Charles Bragge Bathurst (1754–1831). Like Hoare, he was also a keen antiquary and had investigated the famous Roman temple complex on the Lydney estate in Gloucestershire which he had inherited in 1804. He also collected engravings, and this interest led to the commissioning of Lickman. These, including the Halstock painting, currently form part of the private collection of his descendant, Viscount Bledisloe of Lydney Park.

If Lysons' lost 'sketch' was anything like his surviving drawing of the other Halstock mosaic, it would have provided enough information on the scheme, motifs and colours; repetitive features were probably not completed in detail. This is often reflected in Lysons engravings where lengths of guilloche and other repetitive bands of decoration forming the scheme are shown as being complete, but breaks are indicated in figured panels. This is particularly evident in his engravings of the Frampton mosaics, which have given the impression that figured work had been deliberately destroyed in an act of iconoclasm. Lickman does show breaks in the appropriate corners of the Halstock pavement but they do not correspond in shape or extent to those on Rackett's sketch taken from the actual mosaic.

There was almost certainly less surviving than Lickman shows, as, before Rackett's visit, Bellamy had already noted the 'great dilapidation' and 'mutilated state' of the pavement (Bellamy 1818, 5). Lickman shows only two busts surviving in the corners instead of three – it is likely that Lysons did not draw the bust which was a repeat of the one diagonally opposite but perhaps merely made a note. Lickman was probably forced to employ a degree of artistic licence. The group of four vessels from which issue the foliate scroll around Medusa where Rackett shows only one is a case in point, and, without the benefit of Lysons' drawing, it is not certain how authentic these are. Nevertheless, Lickman's other paintings demonstrate remarkable accuracy where they can be checked, but on this occasion he was working from someone else's preliminary drawing, where the extent of survival was probably not indicated in detail.

The discovery of Lickman's painting may answer another question as to why in Hutchins' history it is stated that a mosaic was found in 1830. This does not follow Bellamy and, from the extra information given, there was at least one alternative source. It is possible that the editor, Shipp or his correspondent, saw a version of Lickman's painting, perhaps the one which was presumably done for Sir Richard Colt Hoare. We do not know precisely when Lickman painted the Medusa mosaic, but his pictures of other mosaics date between 1823 and 1829 where known. The Pitney pavements in Somerset that he so successfully copied from drawings and tracings, were executed in 1829 (Cosh 2004, 8). It is possible that the Halstock mosaic was painted, or at least dated 1830 – presumably it cannot be later as Bathurst died in 1831. It can therefore be speculated that the painting bore the date 1830, which was mistakenly taken to be the date of the mosaic's discovery.

RECONSIDERING THE MOSAIC

As Lickman's painting came to light so close to the time of the publication of *Roman Mosaics of Britain Vol II*, there was no opportunity to discuss the mosaic except to say in the caption '... at least one bust, previously thought to represent a wind, more closely resembles a theatrical mask' (Cosh and Neal 2005, iv). Such masks, which indeed sometimes appear helmet-like, are included on mosaics throughout the Empire, occasionally with theatrical props behind them as at Halstock. A close match for the obliquely-placed prop appears on a mosaic from Walramsneustrasse, Trier (Hoffman *et al* 1999, tafel 88). No other certain examples of masks have been found on Romano-British mosaics, although a well-drawn example features on painted wall-plaster from Leicester (Ling 1985, 28–9, pl. 11). Villa owners often appeared to demonstrate their literary interest by including scenes from classical literature, notably Ovid's *Metamorphoses* or Vergil's *Aeneid*. In Dorset this can be seen in the choice of subject matter on the mosaics of Frampton. Famously, scenes from the *Aeneid* are depicted on a mosaic from Low Ham, Somerset which are thought to be derived from an illustrated manuscript (Cosh and Neal 2005, Mosaic 207.1). The choice of depicting theatrical masks is much in the same spirit.

The style of the Medusa mosaic at Halstock does not resemble the others on the site, which can be attributed to the Corinian Saltire Group, and particularly share many features with those at Lopen, Somerset and Old Broad Street, London. These large and skilful pavements were doubtless by itinerant craftsmen, possibly based locally in Ilchester or in Cirencester and who accepted distant commissions. Neither can the Medusa mosaic be linked to Smith's Durnovarian Group as he first surmised, based solely on Bellamy's account. Nevertheless, it seems to have

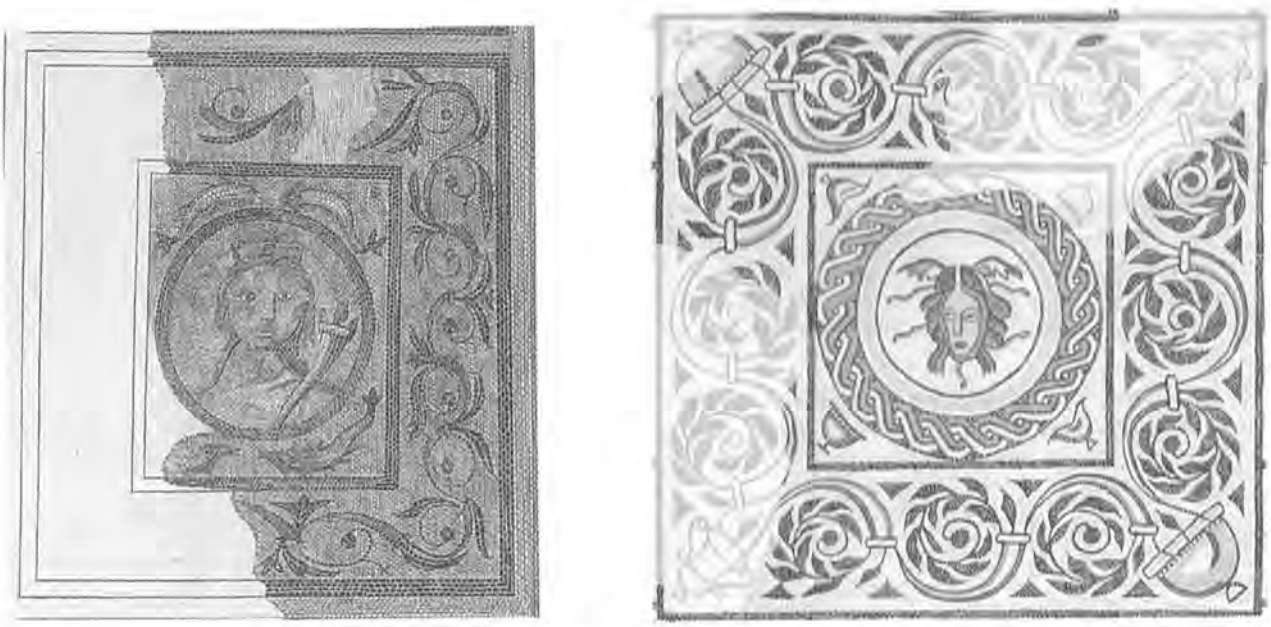


Figure 6 Comparison of the centrepieces at Whatley, Somerset (left) and Halstock (right).

been a high-quality piece, described by Rackett as 'rich and elegant', and 'the prevailing colours are blue and white but there is an intermixture of red and yellow in the border, in the heads and other parts'. Its date is unknown although, if Lucas was correct in locating the mosaic as paving Room 1.9 originally, it would seem to have been laid over a disused and infilled hypocaust sealing a late-third-century coin (Lucas 1993, 18). This suggests an early-fourth-century date, although a later dating is possible; the nearby 'Corinian' style mosaics appear to be post AD 350.

The scheme with its nine medallions imposed on an underlying eight-by-eight grid cannot be closely matched elsewhere; this would have helped to date it on stylistic grounds. The central part with a bust surrounded by foliate scroll springing from an undulating line of cornucopiae and terminating in red circles is reminiscent of the centrepiece of one of the panels at Whatley (Nunney), Somerset, dated to the first half of the fourth century (Cosh and Neal 2005, Mosaic 222.1). Unfortunately today it is known mainly from a rather inept Victorian drawing; little else there is comparable (Fig. 6). A similar scroll occurs at Dewlish on an otherwise very different mosaic (Cosh and Neal 2005, Mosaics 222.1 and 164.8). On his sketch, Rackett shows extra bands of guilloche at two ends (three bands at one of them is probably an error); such extra bands are not unusual, for example at Ilchester Mead (Cosh and Neal 2005 Mosaic 203.5), and are normally added when the room is not perfectly square, which is perhaps not the case at Halstock, and Lickman does not show them. However, it seems an odd thing for Rackett to invent, and Lysons may well have only drawn the square panel. It is impossible to judge how precisely matched is Lickman's version to the original, especially as it was based on an unknown Lysons drawing; we cannot even be sure that this was coloured as was his known drawing of the other mosaic at Halstock. However, as depictions of mosaics from the period go, it must be regarded as a fair representation of the lost Medusa mosaic and certainly adds to our knowledge of this pavement.

BIBLIOGRAPHY

Bellamy, J. 1818. 'Letter to the editor', *Gentleman's Magazine* **88** pt I, 5–6.

Coldicott, D. 2012. 'John Lickman of Hatherden 1774–1844, Schoolmaster and Mosaic Artist', *Lookback at Andover: Journal of the Andover History and Archaeological Society* **3 (3)**, 112–20.

Cosh, S.R. 2004. 'John Lickman (1774–1844)', *Mosaic* **31**, 6–11.

Cosh, S.R. and Neal, D.S. 2005. *Roman Mosaics of Britain. Vol II South-west Britain.* Society of Antiquaries of London, London.

Gomme, G.L. 1887. *The Gentleman's Magazine Library: being a classified collection of the chief contents of the Gentleman's Magazine from 1731 to 1868. Romano-British Remains. Part I.*

Henig, M. and Soffe, G. 1993. 'The Thruxton villa and its mosaic pavement', *Journal British Archaeological Association* **146**, 1–28.

Hoare, R. Colt 1832. *Pitney Pavement, discovered by Samuel Hasell Esq. of Littleton, A.D. 1828; and illustrated from his notes.*

Hoffman, P. von, Hupe, J. and Goethert, K. 1999. *Katalog der römischen Mosaike aus Trier und dem Umland,* Trier.

Hutchins, J. 1870. *The History and Antiquities of the County of Dorset, Volume IV* (Third edition).

Ling, R.1985. *Romano-British Wall Painting.* Shire Archaeology.

Lucas, R.N. 1980. 'The intriguing mosaic of Halstock', *Mosaic* **2**, 22–3.

Lucas, R.N. 1991. 'The Halstock mosaic found in 1817', *Proceedings Dorset Natural History and Archaeological Society* **113**, 133–38.

Lucas, R.N. 1993. *The Romano-British villa at Halstock, Dorset: Excavations 1967–1985,* Dorset Natural History and Archaeological Society Monograph Series **13**. Dorset Natural History and Archaeological Society, Dorchester.

Lysons, S. 1813–17. *Reliquiae Britannico-Romanae I, parts i–iv.*

Neale, F.D. 2000. *Eminent Talents: The History of the Reverend Thomas Rackett 1756–1840, Rector of Spetisbury, Dorset.*

Rainey, A. 1971. 'The mosaics of the Halstock villa, Dorset', *Proceedings Dorset Natural History and Archaeological Society* **93**, 146–51.

Rainey, A. 1973. *Mosaics in Roman Britain.* David & Charles, Newton Abbot.

Smith, D.J. 1965. 'Three fourth century schools of mosaic in Roman Britain', in G. Picard and H. Stern (eds) *La Mosaïque Gréco-Romaine* II, Centre Nationale de la Recherche Scientifique, Paris, 95–116

Smith, D.J. 1969. 'The mosaic pavements', in A.L.F. Rivet (ed.) *The Roman Villa in Britain,* Routledge and Keegan Paul, London, 71–125.

Witts, P.A. 1993. 'Mosaic drawings held at Stourhead', *Mosaic* **20**, 24.

Witts, P.A. 1994. 'A "new" mosaic from Gloucestershire with a possible representation of Winds', *Mosaic* **21**, 7.

The author: Stephen R Cosh D Litt FSA, archaeological writer and illustrator, is co-author of the Romano-British mosaic corpus and writer of numerous articles on aspects of Roman Britain and specialist reports on mosaics (including Colliton Park, Dorchester and Dewlish villa, Dorset). Correspondence: c/o editor@dorsetmuseum.org

MEDIEVAL POTTERY FROM THE OLD MANOR, STRATTON, DORSET

ROSEMARY MAW AND LORRAINE MEPHAM

An excavation carried out in the garden of the Old Manor at Stratton, following the removal of a disturbed post-medieval pit, revealed part of a medieval building, probably used for baking and possibly also brewing, defined by a substantial flint wall. A well, built of flint cobbling and limestone slabs, was also found.

A large quantity of medieval pottery, dating between the 11th/12th and 15th centuries, was recovered, including a significant collection of Poole Harbour whiteware. The assemblage serves to illustrate the sources of supply of this rural manor in the hinterland of Dorchester. The high proportion of finewares, including some French imports, reflect the higher status nature of the manorial site, although the majority of the assemblage can be seen as a locally produced utilitarian repertoire ideally suited to use in the outbuildings from which it was recovered.

INTRODUCTION

Investigations at the Old Manor in Stratton (NGR SY65079371) began in 2013 with the recovery of a dump of 17th- to early 18th-century glass bottles and pottery in a large pit in the garden. The discovery of the pit, and subsequent investigations in the garden of the Old Manor, have been briefly described in an interim report (Maw 2015). This report gives a fuller description of the findings, including further investigations carried out after the completion of the interim report, and also a full description and discussion of the substantial medieval pottery assemblage recovered. Details of other finds (ceramic roof tiles and plain floor tiles, lava quernstones and animal bone) are held in the project archive.

HISTORICAL BACKGROUND

The origins of Stratton Manor may lie in the Saxon period, as an estate belonging to Sherborne. The village name means 'settlement on a street'; the street was the Roman road which connected Dorchester and Ilchester (Putnam 2007, 62), and the projected line of the road runs across the garden of the Old Manor (Fig. 1). Rich early Saxon burials have been found in the neighbouring village of Bradford Peverell (Hawthorne 1981). Stratton is not mentioned in *Domesday*, probably because it was considered as part of Charminster.

The first chapel was built in Stratton in the 12th century, and a stone church in the 13th century. The estate of Stratton was listed as one several prebendal manors in a general transfer of land to the Diocese of Salisbury, each supporting a canon of the cathedral;

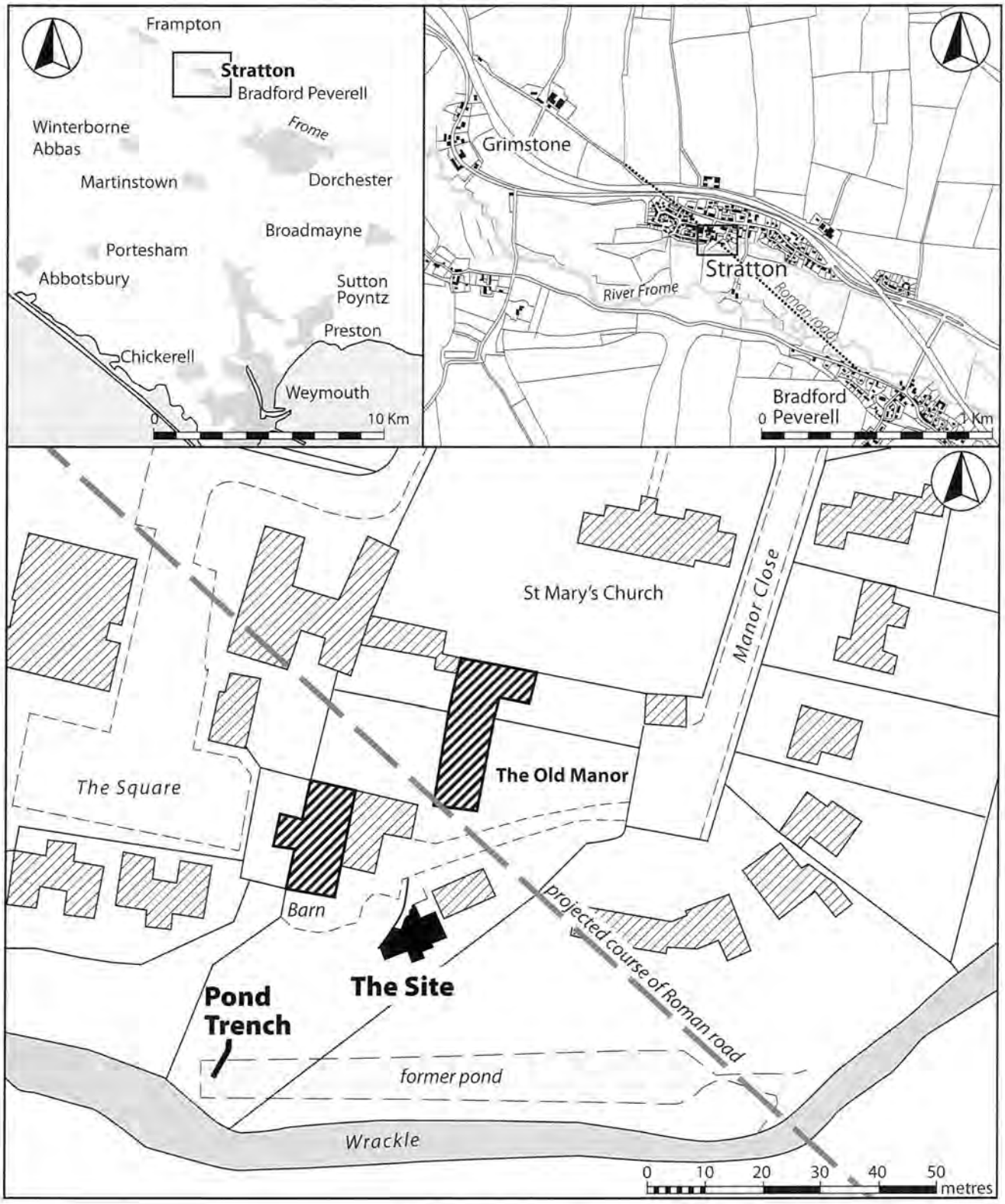


Figure 1 Site location plan

the earliest recorded Prebendary of Stratton was Daniel de Campo in 1226 (Greenway 1991). The stone manor house would have been built next to the church at this time, providing a home for the Prebendary's bailiff or farmer, a place where the manor court could be held. Some evidence of an earlier house survives in the gable ends of the present Old Manor and architectural stone reused in the house.

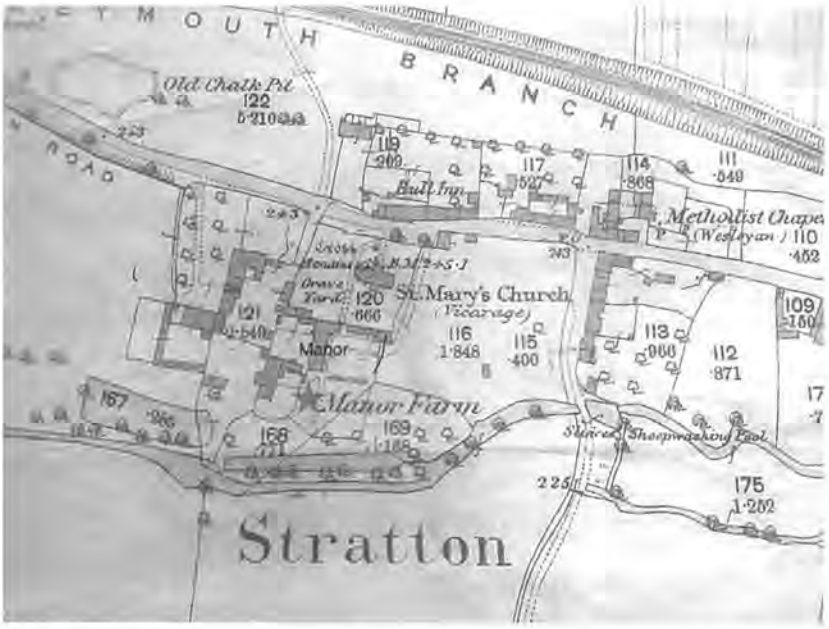


Figure 2 1890 Ordnance Survey map (extract); red star marks site location

The documentary references to Stratton in the 14th century record more difficult times, not just visitations of the plague but also economic recession and a degree of lawlessness no doubt taking advantage of the social and political disruption, as evidenced by raids on the manor (Thurley 2018, 12) and the church suffering damage and neglect (Timmins 1984).

THE ARCHAEOLOGICAL INVESTIGATIONS

The site of the excavation lies to the south of the main house, which may have been the site of the original medieval house and which adjoins the churchyard. Adjacent, to the south-west, is a tithe barn which parish records show to have existed in the 17th century. The excavation site is level with the water meadows and now, like them, is liable to flood. There is a medieval fishpond and a later canal shaped pond at the bottom of the garden, separated from the Wrackle, which is a winterbourne stream. The excavation area (Fig. 1) appears as orchard on old maps (Fig. 2) and was probably used as such after the area was abandoned in the 16th or 17th century.

Beneath a post-medieval rubbish pit, excavations revealed the remains of a medieval building with a substantial outer wall, at a depth of about 1m below the present ground surface. Only a small area of the southern part of the building could be excavated, bounded on the north by a garden wall and a modern garden room. The building had been infilled with building rubble (layer 400) comprising large flint cobbles, ham stone, limestone, mortar and ceramic roof tiles, but also incorporating much medieval pottery.

Features pre-dating the building (Fig. 3)

The earliest features on the site were a gully (D1) found within the building, and at least three ditches outside it (D2–4) (Fig. 4). Exploration of these proved difficult because of the high water table, but during dry periods sections could be dug. Gully D1 ran north-south on the eastern side of the excavated section of the building and appeared to run underneath a north-south offshoot of the external wall. It contained one sherd of 13th-/14th-century Poole Harbour whiteware pottery, the only piece of whiteware to be found inside the building. The gully was probably a drain from the main house to the north.

Outside the building to the south, ditches D2 and D3 ran east-west across the site and D4 north-south; all were cut into the underlying alluvium. No stratigraphic relationships between the ditches

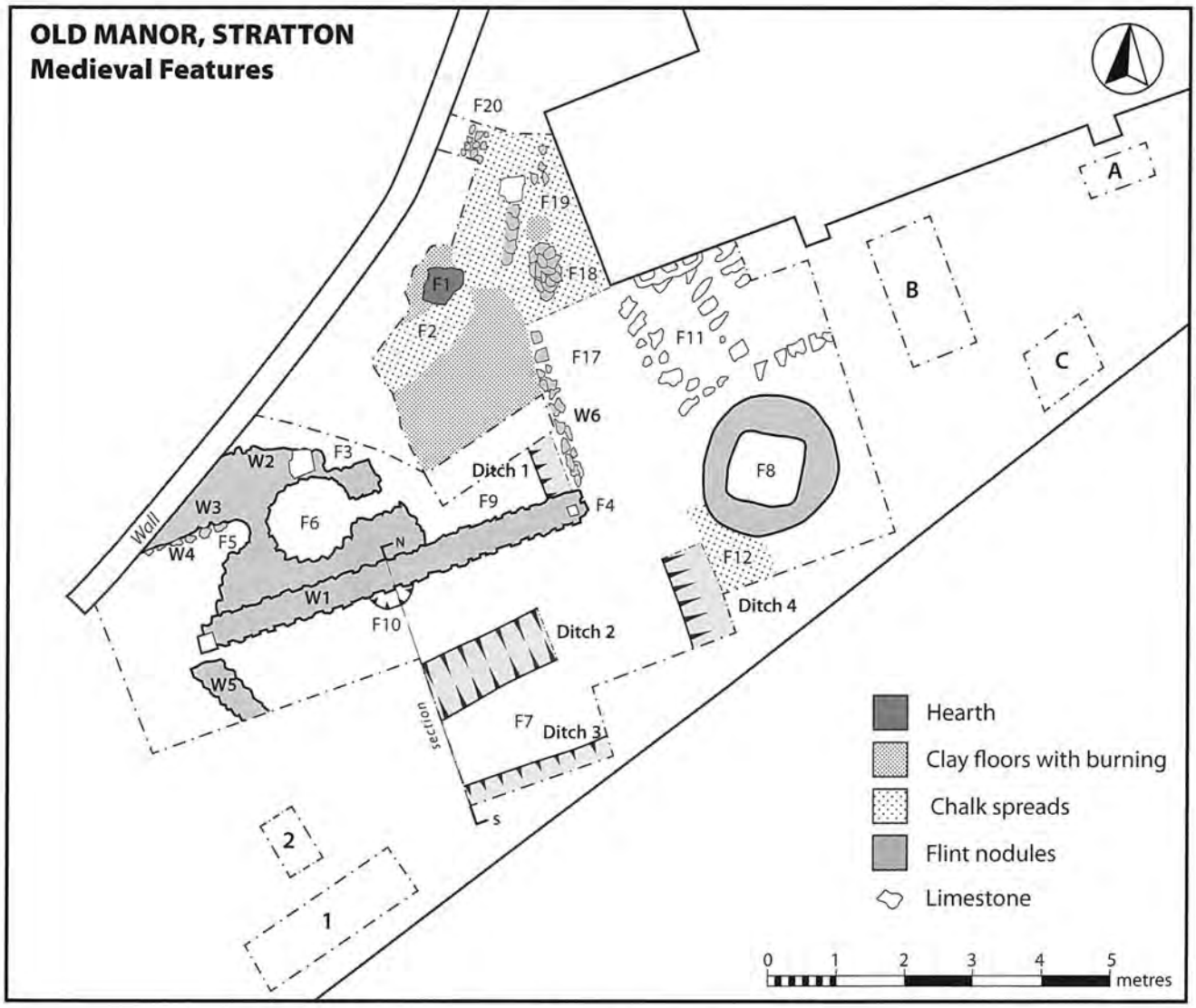


Figure 3 Medieval features

Figure 4 Ditches 2 (to right) and 3 (partly under section to left), north-east facing section

Figure 5 Wall (W1), view from south-west; wall W5 in foreground

were observed. One of the ditches (D2) produced an Early/Middle Saxon bone double-ended pin-beater. In addition, the southern wall of the building cut a small pit (F10), which contained one sherd of 12th-/13th-century Wessex coarseware pottery.

The outer wall

A substantial north-east to south-west wall (W1) marked the southern extent of the building; a length of approximately 7m was exposed (Fig. 5). The wall was faced with flint cobbles laid horizontally (up to five courses survived), bonded by sticky yellow clay and with a rubble fill. It appeared to have been constructed directly on the alluvial terrace. At the western end, a square limestone slab was set into the wall and at that point a less substantial wall ran north-west to south-east (W5) The eastern end appeared to have been truncated by an area of disturbance; at this point, a possible less substantial wall ran north-west to south-east from it across the interior of the building (W6).

Figure 6 Oven (F6), view from north-east

There was evidence of other wall lines (W2–W5) to the north and west of W1, some of which disappeared under the boundary wall. Just inside the eastern end of W1 and resting against the wall, part of a 13th-/14th-century curfew handle (Fig. 17, 36) was found in a spread of yellow clay (F9), possibly a floor surface.

Oven complex

A circular oven (F6) with a massive flint-built surround directly abutted the outer wall (Fig. 6). There was a clearly defined entrance on the eastern side, where deposits of burnt clay and black sooty earth were found. The oven had a clay floor, and a large limestone slab, of uncertain purpose, was set into the north wall. There was a posthole in the oven wall on the north side. The full extent of the oven wall was not exposed as it ran under the boundary wall to the north-west. A smaller feature (F5) was inset into the western side. Pottery from the oven included West Dorset sandy wares (jug and jar) and Wessex coarsewares (jar), suggesting a 13th-/14th-century date.

Hearth

The hearth (F1), located to the north-east of the oven, comprised a limestone slab (0.68 x 0.58 m) with traces of burning on top. The surrounding clay floor showed signs of burning, and there were also areas of thin crushed chalk. A cut made through the

Figure 7 View from north-east across excavated area, well (F8) in foreground and wall W1 top right

clay floors showed that these lay on natural flints resting on alluvium.

Well

The well (F8) lay to the east of the oven, and beyond the surviving line of wall W1 (Figs 7–8). It appeared first as a roughly circular feature embedded in the rubble that lay across the site. The diameter at the top was approximately 1.15m. The upper construction was formed of flint cobbles laid horizontally and sloping inwards and had large sherds of 13th-/14th-century Poole Harbour whiteware pottery deliberately placed to support the outer edges, including an almost complete jug profile (Fig. 17, 37).

The well was sectioned (Fig. 9) and, at a depth of about 1m, well-constructed cobbled walls appeared; the lower section was rectangular. By this stage the water table had been reached and further progress was made with the use of a pump. Three riven limestone slabs (at a depth of around 1.5m) lined what was believed to be the base of the well (Plate 8); the fourth side continued as flint cobbles. The chalky bottom of the well was probed but the pressure of water made it difficult to establish whether this was the true bottom or not.

Figure 8 Well showing flint cobbles above limestone slab lining

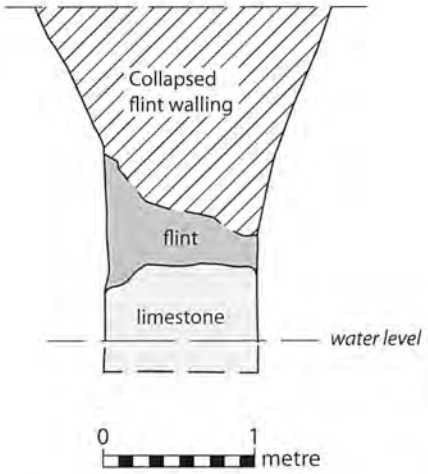


Figure 9 Well (F8); schematic west-facing section

The well produced a large quantity of pottery (over 300 sherds), and in composition this group echoes that of the overall assemblage. Two bunghole spouts in West Dorset sandy ware (15th-century or later) were found in the upper fill, but lower layers contained 13th-/14th-century West Dorset sandy ware jugs, jars, bowls/dishes, skillets and costrels (Fig. 11, 4–5, 8–10; Fig. 13, 15, 21, 23, 25–7), Wessex coarseware jars, jugs and curfews, and a couple of residual tripod pitcher sherds (Fig. 20, 52), Poole Harbour whiteware jugs (Fig. 17, 43), Donyatt jugs (Fig. 20, 53–4) and local coarseware jars.

OLD MANOR, STRATTON
West Section

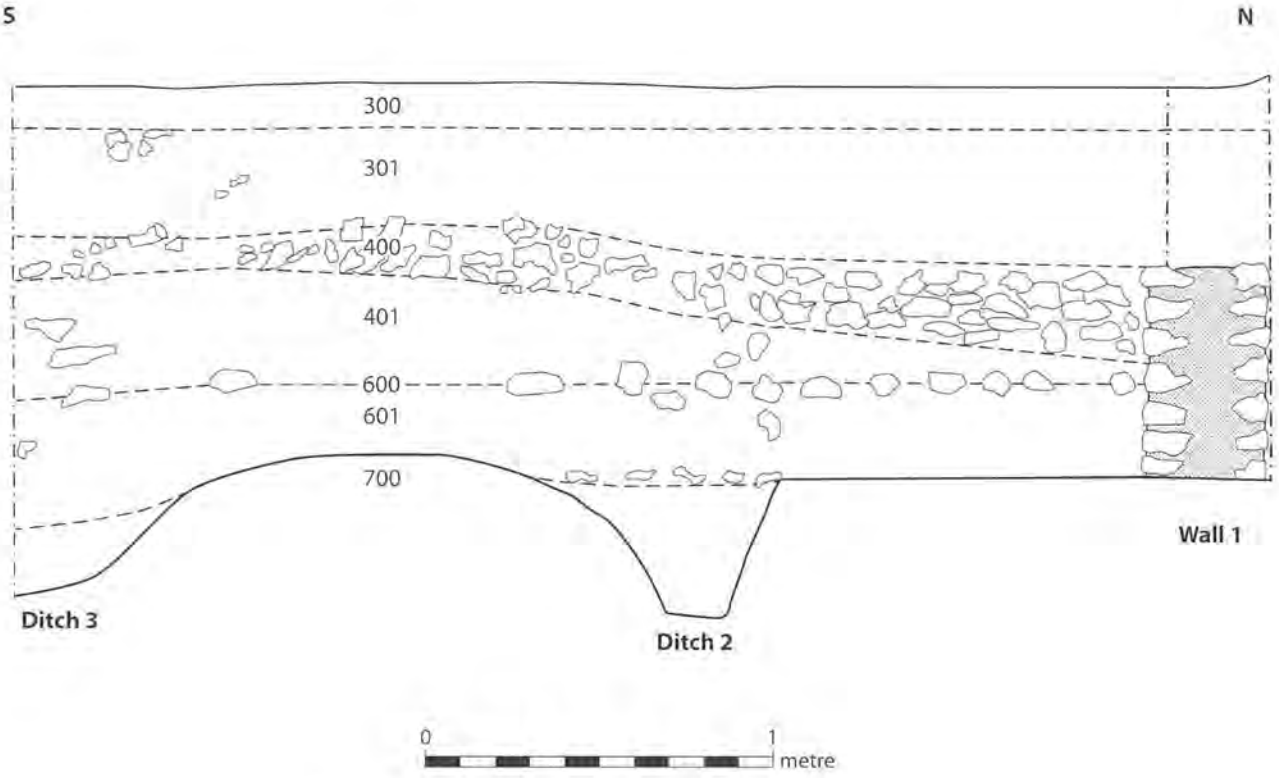


Figure 10 East-facing section across excavated area south of building

Outside the building

To the south of wall W1, rubble layer 400 thinned out, and beneath it was a dark occupation layer interspersed with occasional large flint cobbles and containing animal bone and quantities of pottery (401). Below this again was a second layer of large flints (600), level with the bottom of the wall and the top of the well, then an area of homogeneous dark brown sandy loam (601) (Fig. 10).

This area outside the building (Fig. 7) was where most of the pottery and other refuse appeared to be concentrated, in layers 401 and 601, and here the pottery was frequently observed to be deposited in what appeared to be discrete dumps of mixed sherds, and as though they had been buried in separate shallow scoops rather than disposed of in larger pits. These deposits of pottery occurred at least a metre away from the wall. The area was explored to the south as far as the hedge line. The upper layer (401) produced mainly later West Dorset sandy and Donyatt wares. Below this, layer 601 was characterised by 13th-century Poole Harbour whitewares, Wessex coarseware, local coarsewares and early West Dorset sandy wares; a few residual Saxo-Norman vessel forms were also seen in layer 601 (Fig. 11, 1–2). Of note in 601 were a West Dorset sandy ware jug with an applied cross on the shoulder (Fig. 13, 17–18), and an unusual multi-handled, Poole Harbour whiteware slip-decorated jug (Fig. 17, 38). Other vessels from this area include another slip-decorated whiteware jug (Fig. 17, 39), a Wessex coarseware dripping dish and two skillets (Fig. 13, 24, 31, 32) and part of costrel rim with a joining sherd from the well (Fig. 13, 27).

Extension to north

A further area was explored to the north and east of the area covered by the post-medieval pit. It was not possible to determine whether this area was inside or outside the building that housed the oven. Beneath an upper rubble layer (F17) were clay and chalk floors similar to those observed around hearth F1. Areas of burnt clay, gravel and large flints defined floor levels, of chalk and burnt clay (F18) and (F19) a deposit of stones. There was a line of large flints immediately to the south of the (modern) boundary wall (F20) which yielded part of a barrel costrel (Fig. 13, 26). This was clearly a working area, but the small area excavated did not enable any further definition.

Further small test pits were dug around the excavated area: pits A, B and C to the east and pits 1 and 2 to the west (see Fig. 3). These yielded similar deposits and further pottery, including (from test pit 1 on the south-western edge of the excavated area) body sherds from a Poole Harbour whiteware jug with slipped decoration featuring a lattice design with applied floral pads (Fig. 17, 40).

THE POTTERY

Methods of analysis

Recently published guidance outlines the levels of analysis appropriate for pottery of all periods (Barclay *et al.* 2016). In line with these standards, the pottery assemblage was subjected to full fabric and form analysis, following a recording system based on that used by Wessex Archaeology (Morris 1994). Following the initial sorting of the pottery into broad ware groups (reflecting the major ware traditions), a limited amount of sub-division of these into individual fabric types was carried out, based on the size, range and frequency of inclusions. Additional fabric types not falling into the major ware traditions were also identified. The definition of vessel forms follows nationally recommended nomenclature (MPRG 1998), but also accommodates diagnostic vessel parts (rims, bases, handles, etc) for which overall vessel form is uncertain. Rim diameters were measured where possible, but a high proportion of rims were not measurable and hence Estimated Vessel Equivalents (EVEs) are not used here. Other attributes recorded included manufacturing technique, surface treatment, decoration and evidence for use (including repairs). Quantification throughout has been by sherd count and weight (grammes). All data have been recorded in spreadsheet format (Excel), and these data form part of the project archive.

Description of the Assemblage

The assemblage amounts to 5146 sherds, weighing 89,434g. Analysis resulted in the identification of 25 separate fabric types, which are grouped here by ware tradition as far as possible. It is recognised that some fabric types represent variations of a single ware rather than discrete types. Table 1 gives a quantified breakdown of the assemblage by ware type, and Table 2 presents the correlation of vessel form to ware type.

Saxon wares

Eight sherds of early/middle Saxon pottery were identified. All sherds are in medium-grained sandy fabrics (grouped here as Fabric Q400), although there is some variation in the coarseness of the quartz inclusions.

Q400: fine to medium-grained sandy fabric; moderate well sorted subrounded quartz <0.5mm; irregular firing.

At least one sherd is burnished externally. Seven of the sherds are undiagnostic body sherds, all occurring residually (within soil build-up 601, well F8 and F17), but the eighth (found unstratified) is a rim sherd, externally thickened but slightly distorted through burning. All five sherds are dated broadly between the 5th and 8th centuries.

Saxo-Norman wares

Four fabric types were identified as belonging to the Saxo-Norman tradition (10th–early 12th century). Two are wheelthrown and two handmade; all are likely to represent regional rather than local ceramic traditions.

E400: Cheddar-type ware; hard-fired, containing moderate, poorly sorted quartz <1mm; rare limestone <2mm, mostly leached out; some examples also contain rare flint and/or greensand; wheelthrown.

Table 1 Totals by fabric

Date	Fabric code	No. sherds	Wt. (g)	Gp % of total wt
Early/Middle Saxon	Q400	7	200	0.2%
Saxo-Norman	C400	31	516	
	E400	22	399	
	F400	40	785	
	Q401	7	75	2.0%
West Dorset sandy	E425A	2620	47,526	
	E425B	426	10,528	
	E425C	259	4368	
	E425D	153	1690	71.7%
Wessex coarsewares	E422A	24	509	
	E422B	77	1631	
	E422C	246	4537	7.5%
Poole Harbour whiteware	E426B	22	483	
	E426A	168	3677	
	E426C	20	248	
	E426D	29	329	5.3%
Local coarsewares	F401	483	5596	
	Q402	404	4325	11.1%
Imports	E520	5	52	
	E520b	11	149	0.2%
Donyatt	E427	68	1024	1.1%
Other misc wares	Q403	1	48	
	Q404	6	56	
	Q405	1	14	
	Q406	16	669	0.9%
	Total	5146	89,434	

C400: Hard-fired sandy matrix containing sparse limestone and rare flint; probably handmade but possibly with rims finished on a turntable.

F400: Hard-fired sandy matrix containing sparse subangular/subrounded flint inclusions, rare greensand; handmade.

Q401: Wheelthrown, medium-grained grey sandy ware, relatively thick-walled.

Table 2 Vessel forms by fabric (maximum number of vessels, based on rims unless otherwise stated)

	Jar	H Jar	J/B	D/B	Skil	Jug		?TP	Curfew		Cost	Cist	Total
Fabric type						R	H	H	R	H			
Q400	1												1
C400	10												10
F400	6		2										8
Cheddar	10												10
Wessex coarsewares	39	1		2		5	7		12	1			67
W Dorset	169		197	195	3	79	55				2	5	705
Poole Harbour	1			1		3	5						10
Saintonge						1	1						2
F401	49		15	1				1					66
Donyatt						3	1						4
Q402	76			5		2	2						85
Q403						1							1
Q406											2		2
Total	**361**	**1**	**214**	**204**	**3**	**94**	**71**	**1**	**12**	**1**	**4**	**5**	**971**

Key: Cost = costrel; Cist = cistern; D/B = dish/bowl; H = handle; H jar = handled jar; J/B = jar/bowl; R = rim; Skil = skillet; TP = tripod pitcher

It is possible to define a small Saxo-Norman component amongst the assemblage, falling into these four fabrics. Three of these have wide-ranging parallels amongst the regional Saxo-Norman ceramic traditions, although known examples from Dorset are not numerous; there are few published assemblages of this date.

Fabric F400 belongs to the tradition of Upper Greensand-derived wares which represent the products of the large-scale Late Saxon to medieval industry based in the Blackdown Hills south of Taunton. This industry had its origins in the Late Saxon period and was supplying flint-/chert-tempered wares to a large area of the south-west through to at least the 13th century (Allan 2003; Allan *et al* 2010; Allan 2021, fig. 17.5). Only a small number of sherds have been identified here, and these are exclusively in jar forms with short out-turned rims with simple rounded profiles. Blackdown Hills products were recorded from pre-Conquest levels at Sherborne Old Castle (Mepham 2015, 172–3, fabric Q430), and also made up most of the late 12th-/early 13th-century assemblage from that site (Allan 2003). Flint-tempered wares from Winterborne Stickland, dated typologically to the 10th/11th century, are also probably from the same source although not recognised as such (Mepham 2003, fabrics FL400, FL401).

One wheelthrown fabric can be paralleled amongst wares from the Saxon royal palaces at Cheddar. The poor condition of the sherds renders a precise match somewhat uncertain – there are points of similarity with several (Rahtz 1979, 310, fabrics CC, E, EE). There are ten jar rims (Fig. 11, 3); the rims are sharply everted, with simple rounded profiles, a form particularly characteristic of the Saxo-Norman period. Cheddar-type wares are found widely across the south-west, although none as yet in this part

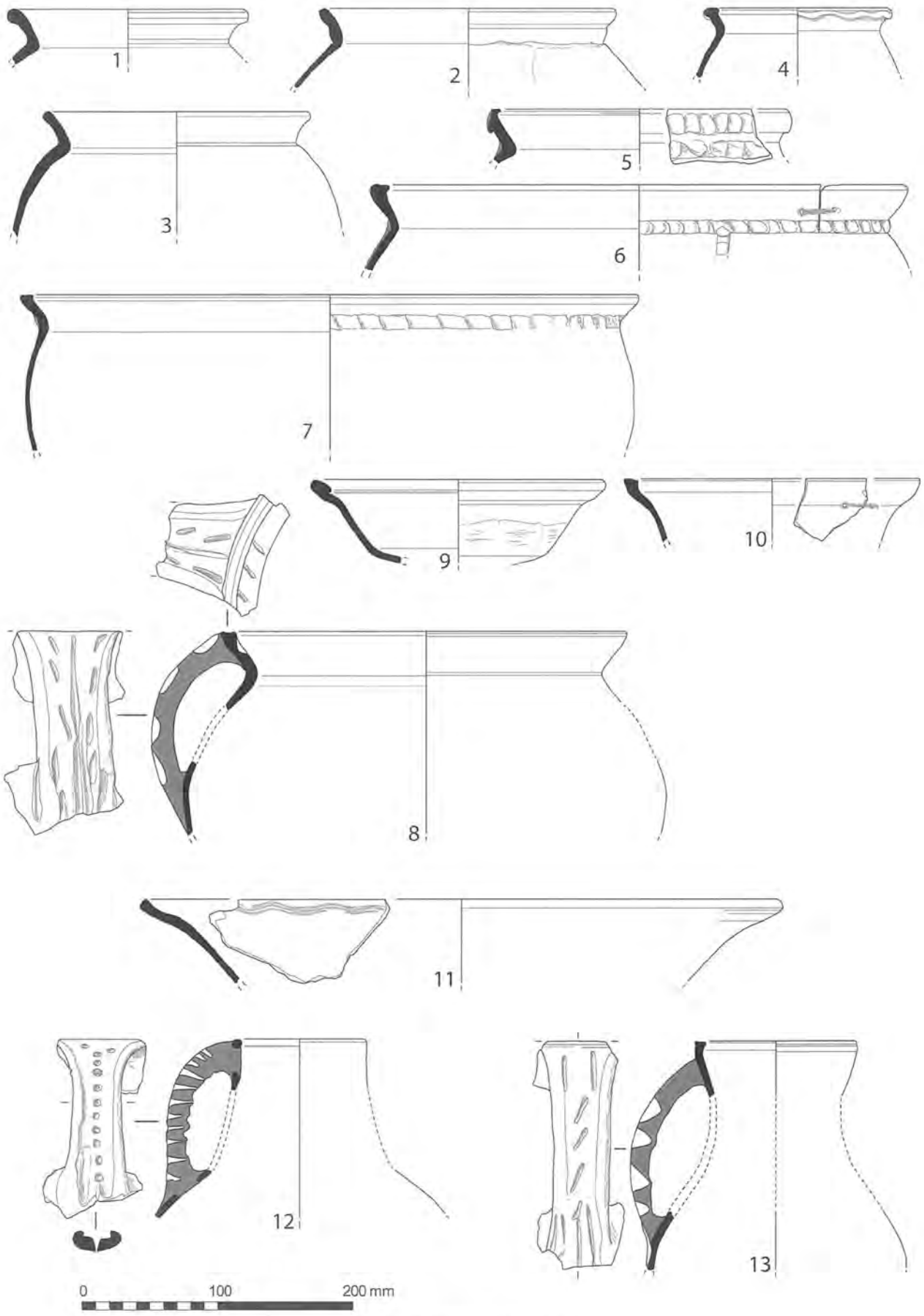


Figure 11 Pottery (nos 1– 13)

of Dorset. Examples have been recorded at Putton Lane, Chickerell (Mepham 2020), Ilchester (Pearson 1982, 170, type A4, fig. 80, 555–60) and Winterborne Stickland (Mepham 2003, fabric QU400). More recent research has matched some of the Cheddar-type wares (Rahtz's fabrics C and CC) with the Upper Greensand-derived wares (Allan *et al.* 2010, 171), although another type (fabric E) may have been made in south or central Wiltshire (*ibid.*, 168; Vince 1984, ch. 11, 12–16).

The other two fabrics are of uncertain source but may also be regional imports. Similar jar rims (rounded, with short, everted rims) are seen here in a handmade calcareous ware (Fabric C400) (Fig. 11, 1–2). Limestone-tempered wares in Saxo-Norman jar forms are recorded from Wareham (Hinton and Hodges 1977, fabric B, fig. 15, nos 1, 7, 15).

The fourth fabric in this chronological group (Fabric Q401), although distinctive by virtue of its grey sandy fabric and wheelthrown manufacture, has not as yet found any known parallels. Only seven sherds were identified, including the base of a thick-walled jar.

To this small group could be added a handful of sherds in Wessex coarseware, and possibly also in West Dorset sandy ware, that could belong to tripod pitchers of 11th-/12th-century date (see below).

West Dorset sandy wares

These wares form by far the largest group in the assemblage (72.3% of the total by sherd weight). They comprise fine-grained sandy wares which have a smooth, sometimes slightly powdery feel.

E425A: the most common variant is hard-fired, ranging from a bright orange-red to buff-brown in colour, sometimes with a pale grey core; well sorted, subrounded quartz <0.25mm; smooth, slightly powdery texture; equivalent to Sutton Poyntz fabric Q401 (Mepham 2007) and Sherborne Old Castle fabric Q404 (Mepham 2015).

E425B: as E425A but containing rare subangular flint inclusions <1mm and occasional limestone; equivalent to Sutton Poyntz fabric Q402.

E425C: a smaller proportion has been distinguished on the basis of being particularly hard-fired to a dark grey-brown colour; probably present at both Sutton Poyntz and Sherborne Old Castle but not distinguished from the main fabric type.

E425D: variant of E425A, hard-fired to a reduced pale grey/brown colour.

The basic repertoire of vessel forms seen here comprises jars, bowls/dishes and jugs. Rim profiles for both jars and bowls are frequently flat-topped and internally bevelled. Jars and bowls/dishes can share a similar body profile, although the latter show a more open profile with the equivalent of the jar neck appearing as a flanged rim; this has made it difficult in many cases, where profiles do not extend below the rim itself, to distinguish between jars and bowls/dishes. Rim diameter can give a clue: jar sizes range from the smallest at 140mm (Fig. 11, 4) to upwards of 300mm (Fig. 11, 6) and possibly up to 400mm (the majority are over 200mm), but there is a significant overlap with bowls/dishes, which start at around 220mm (Fig. 11, 9–10) and extend up to nearly 500mm. The larger jars would be more suited to storage (of dry goods) than for cooking, but sooting was observed on some vessels (none of them of measurable diameter). There are no complete jar profiles, although from the upper parts these appear to be confined to rounded forms. It is assumed that at least some of the wider bases belong to these vessels, and these are frequently thumbed. One vessel with a knife-trimmed base (Fig. 11, 9) qualifies as a dish on the basis of the rim:height ratio (MPRG 1998, form 5.3), but this is the only surviving complete profile, so other open forms remain broadly classified as bowls/dishes; profiles are flared or slightly rounded. The size range of the bowls/dishes also argues for a potential range of functions – smaller examples could have been used as kitchen- or tablewares, while a function in baking (for proving dough) or dairying (as cream pans) is possible for the wider vessels.

One jar is handled (Fig. 11, 8), with one, or possibly two opposed handles with slashed decoration. Other strap handles may have belonged to similar vessels, but in the absence of evidence to the contrary have been assumed to belong to jugs (see below).

Figure 12 Repairs to vessels in West Dorset sandy ware

The jars and bowls/dishes also share decorative traits. Examples of both carry applied thumbed strips around the neck (Fig. 11, 5–7) in one case combined with another row of thumbed around the outside of the rim, or at the base of the bowl flange; applied vertical strips (Fig. 11, 6) are assumed to belong exclusively to jars. One bowl has curvilinear combing inside the rim (Fig. 11, 11). One jar has a finger-impressed 'pie-crust' rim (Fig. 11, 4), but this example stands out from the rest not just on decoration but also by virtue of its small size; finger-impression is more often seen on 11th–12th-century vessels in the region and this may therefore be an early form.

Of particular interest is the presence of two repaired vessels, a jar and a bowl/dish (Fig. 11, 6, 10; Fig. 12). Both vessels have cracks in the rim bound together with strands of copper alloy wire (two or three strands twisted together) inserted through post-firing perforations. Two other body sherds have small perforations that could also be repair holes. Parallels for this have not been found amongst the local or regional coarsewares, and the repair of coarseware vessels in itself is unusual, given the relative ease with which they could be replaced, from an industry that clearly dominated the local market. It would be tempting to link the incidence of repairs with the period of economic decline in the later medieval period (see below, Discussion) and to support this it can be noted that one of the wired vessels, and the two body sherds with repair holes, are in the hard-fired fabric (E422C) which on the basis of its general stratigraphic position here (found in upper layers 400 and 401) could represent a later development of the ware type.

It is in the jugs that the potters apparently demonstrated a greater variety in form and decorative treatment. Again, no complete profiles could be reconstructed, but upper parts could belong to rounded, shouldered or pear-shaped forms (Fig. 11, 12–13; Fig. 13, 14–16), and bases were frequently thumbed. Where pouring aids are present, these comprise neatly pulled lips. Glaze, when used, generally appears as a dull olive-green and is often thin and patchy. The strap handles are slashed and stabbed in a range of designs, with no two handles identical (Fig 11, 12–13; Fig. 13, 21). One vessel carries stamped decoration in the form of gridded circles across the handle/body junction (Fig. 13, 20). There is a similar handle from Sherborne Old Castle in the Bean collection in Dorset Museum (author's observation). Decoration on the body is less common, but a small proportion of vessels have vertical white or (very occasionally red) slip stripes (Fig. 13, 15), or applied vertical strips, while some carry close-spaced horizontal tooled or incised lines creating a 'rilled' effect on upper bodies and/or necks (Fig. 13, 16). Rilling tends to be a 14th-century and later technique, and rilled jugs were found in a 15th-

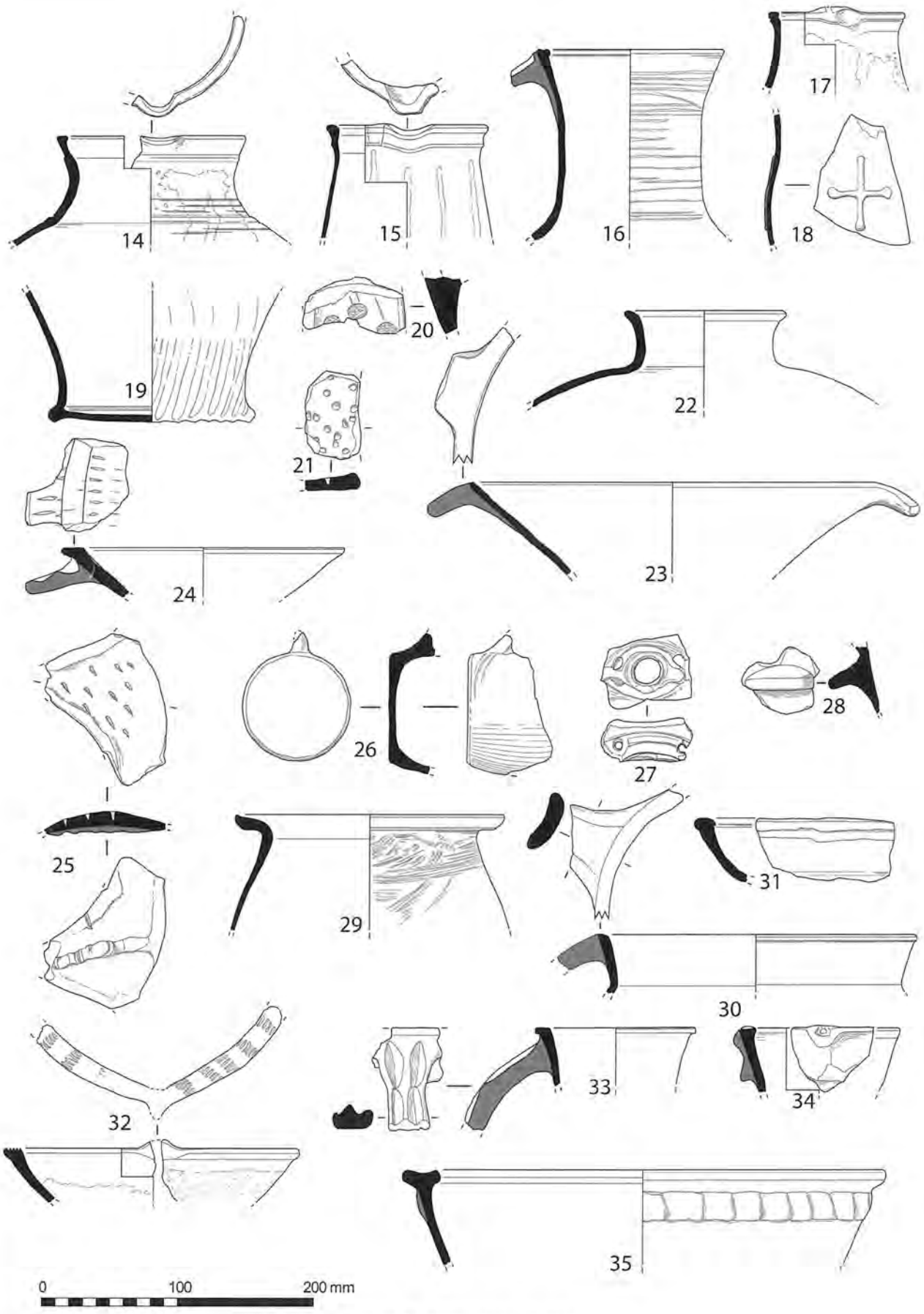


Figure 13 Pottery (nos 14–35)

century context at Greyhound Yard, Dorchester (Draper 1984, fig. 158, 48–9). Of note is one jug with a cross in light relief on the shoulder (Fig. 13, 18); no parallel for this has been found, but it is tempting to see an ecclesiastical connection, particularly given the proximity of the manor to the church and the presence of a fragment of 13th-century decorated floor tile in the top of the well. Three tripod feet were found, from tripod jugs; these are unlikely to be earlier than 13th century, but five glazed body sherds with combed and applied decoration could have belonged to earlier tripod pitchers. If so, this provides important evidence for pre-13th-century production of West Dorset sandy wares.

Other forms are represented, but in very small numbers. There are three skillets (Fig. 13, 24–5), and one bowl with an integral lug handle (probably one of two opposed handles: Fig. 13, 23); another lug handle on a flared body (Fig. 13, 28) could have belonged to a similar vessel. There are at least two costrels, both of barrel form. Cisterns have been identified on the basis of two bunghole spouts; their overall form is uncertain, although one rim from a high-shouldered jar or jug (Fig. 13, 22) could be from the upper part of one of these vessels. There is at least one strainer (three body sherds with multiple pre-firing perforations).

Fine sandy wares were produced at Hermitage (13 miles/21km to the north of Stratton), where one kiln was excavated (Field 1966); the kiln was dated on pottery typology to the second half of the 13th century, while admitting the possibility of earlier material, but the presence of at least one bunghole vessel (Field 1966, fig. 9, 40) suggests that the date range extends into the 14th century if not later (Allan 2003, 76 n.2). This is supported by evidence from other excavated assemblages in west Dorset such as that from Sutton Poyntz (Mepham 2007) and Sherborne Old Castle; two stratified groups from the latter site were dated to the late 14th or 15th century (Mepham 2015, 174–5). Hermitage-type wares form part of a wider tradition of sandy ware manufacture in west Dorset, and other production sites within the distribution area are likely (Spoerry 1988, 34; 1990, fabric S1, 14, fig. 6). The tradition was clearly a major supplier to the manor from at least the 13th century and through the medieval period.

Wessex Coarseware

Coarse sandy wares of a type common across much of east Dorset and into south-east Wiltshire have recently been defined as 'Wessex coarseware' (Mepham 2018a). These are hard-fired, quartz-rich fabrics containing rounded to subrounded quartz and very few other macroscopically visible inclusions, with pimply surfaces, frequently scratch-marked. They cover a range of coarseness, and there is a broad chronological progression from coarse to fine.

E422A: coarsest variant as defined in Salisbury (Mepham 2000a), with quartz grains <1mm and deep scratch-marking.

E422B: medium-grained variant; quartz grains <0.5mm and shallower scratch-marking.

E422C: finest variant; quartz grains <0.25mm, and scratch-marking reduced to shallow brushing.

Jars dominate the range of vessel forms seen here. Rim profiles include a few examples of the classic sharply out-turned rim with simple rounded profile, seen in the Salisbury area from the late 11th century into the 13th century (Musty *et al* 1969, fig. 7, type I), as well as the similarly dated variant with a slight lid-seating (Fig. 13, 29; *ibid*, type II), rims with externally thickened profiles and those with a stubby, squared profile, often with a groove running along the top. The latter form (Barton *et al* 1992, cat nos 1–13) does not appear before the 13th century. One jar is handled, possibly two-handled (Fig. 13, 30).

Open forms are scarce: there is one bowl and one dish, possibly a dripping dish (Fig. 13, 31). Another shallow vessel, with a pulled lip and combing on top of the rim, is almost certainly a skillet (Fig. 13, 32). There are also a few jugs (Fig. 13, 33–4), and a few sherds that could have belonged to 11th-/12th-century tripod pitchers (a rim, and body sherds with rouletted, combed and applied decoration). One jug rim (Fig. 13, 34) has an attachment scar, presumably for a decorative element, although precisely what that might have been is uncertain.

However, the product which was supplied exclusively by this industry was the curfew (Fig. 14); a maximum of 12 vessels are represented by rims (Fig. 13, 35),

Figure 14 Wessex coarseware curfew sherds (composite)

Figure 15 Poole Harbour whiteware sherds showing range of colours

and there is at least one handle (Fig. 15, 36), although smaller fragments of other strap handles could well have belonged to curfews rather than jugs. These vessels were essentially inverted bowls with a looped handle on top (Musty *et al* 1969, fig. 23, no. 195), but they can generally be distinguished on the basis of their heavy rims, and the presence of applied thumbed strips above the rim. Curfews date to the 13th century or later, and they tend to be confined to urban sites, or to higher status rural sites.

Figure 16 Poole Harbour whiteware jug with subsidiary handles

While good parallels for all of the Stratton vessels can be commonly found in Salisbury and/or Poole, and at multiple sites across south-east Dorset, their source cannot be more closely defined within the overall distribution area of Wessex coarseware. One source is known at Laverstock, just outside Salisbury, and another is postulated in the Poole Harbour/Purbeck area (Hinton and Hodges 1977); production in the Verwood area of east Dorset, the centre of the post-medieval pottery industry, is also suggested by documentary references (Spoerry 1988). Stratton lies towards the western extent of the distribution of Wessex coarseware, which forms a small proportion of this assemblage (7.4% by sherd weight) but could have drawn its supplies from more than one source. Recent analysis, supported by radiocarbon dating,

has suggested an origin for this industry in the mid-late Saxon period (Mepham 2018b), but its *floruit* was between the 12th and 14th centuries, and this is likely to be the date range of the wares seen at Stratton, with a focus on the 13th and 14th centuries, as suggested by the vessel forms represented and the higher proportion of the finest variant E422C.

Poole Harbour whiteware

The Poole Harbour 'whitewares' in fact cover a wider colour range, from almost pure white through buff to pale salmon pink (Fig. 15), often varying within a single sherd, and a sand content ranging from macroscopically invisible (giving a very fine, almost powdery texture), through to wares which could almost be described as 'coarsewares', with prominent quartz inclusions and a gritty texture. The group has been sub-divided here on the basis of colour and/or coarseness, and on manufacturing technique. The majority of the group consists of a handmade, fine-grained white- or off-white-firing fabric, though it should be noted that distinction between handmade and wheelthrown wares has not proved possible for individual sherds. One fabric variant is a distinctive salmon pink colour throughout. Poole Harbour whitewares make up 5.3% of the Stratton assemblage by sherd weight.

E426A: White to pale pink, medium-grained (subrounded quartz grains <0.5mm); used for both thicker-walled, handmade jugs with clear (yellow) glaze and decoration consisting of vertical strips and pellets; and also thinner-walled jugs with either yellow or green glaze.

E426B: White-firing, fine-grained, wheelthrown fabric; subrounded quartz grains <0.5mm; identified here only in two thin-walled vessels.

E426C: White to buff, coarse-grained (subrounded quartz grains <1mm); mainly green-glazed.

E426D: as E426A but firing to a distinct salmon-pink colour throughout.

Vessel forms appear to be exclusively jugs. These include both wheelthrown, thin-walled and well-made vessels (Fig. 17, 38, 41) as well as handmade, thicker-walled and more crudely handmade vessels (Fig. 17, 37, 39); the latter are in the majority. Jug profiles are rounded, convex or pear-shaped; there is at least one baluster form (Fig. 17, 39). Handles are of strap or rod form and are generally either stabbed or slashed in some way. One unusual wheelthrown jug, particularly thin-walled with an evenly ovoid profile, has a rod handle (the opposite side where a lip may have been is missing); at right angles to the rod handle, one on each side, are two small secondary handles (Fig. 16; Fig. 17, 38). No parallel has been found for this jug, although there is some slight resemblance to the 'strut jugs' produced by the Laverstock kilns in Wiltshire (Musty *et al* 1969, fig. 21, nos 166–9). The three-handled Saintonge jugs imported into Poole and Southampton, for example, are quite different, each having one large strap handle and two further smaller ones, and a large pouring spout.

Most vessels are at least partially glazed, the glaze colour ranging from pale yellow (a clear lead glaze on off-white vessels) to mottled apple green or olive-green, and the jugs are frequently decorated with either an iron-rich slip or applied flat strips in simple linear/curvilinear designs, sometimes combined with pellets (Fig. 17, 39; Fig. 18), but the use of thin vertical applied or pinched-up strips is also known (Fig. 17, 41). Other motifs include a slipped lattice design with floral pads, and inverted horseshoe motifs (Fig. 17, 37, 40; Fig. 19). The iron-rich slip has a tendency to 'bleed' into the glaze, and the direction of the colour runs indicate that these vessels were fired upside-down. The visual variety seen here (and also on whitewares from other sites) suggests a vibrant industry in which the potters experimented with various vessel forms and decorative styles, many of which are likely to have drawn their inspiration from contemporary continental imports, in particular from northern France. The lattice/floral design, for example, is paralleled very closely by a Kingston ware jug (Pearce and Vince 1988, fig. 52, 10; pl. 10) and more generally by highly decorated jugs from the London ware industry; both industries were copying Rouen and other north French jugs in the early to mid-13th century.

Whitewares have been recorded in some quantity in Poole and in the surrounding area of south Dorset (Jarvis 1992, fabrics 4 and 5; Barton *et al* 1992) and also at Sherborne Old Castle (Mepham 2015,

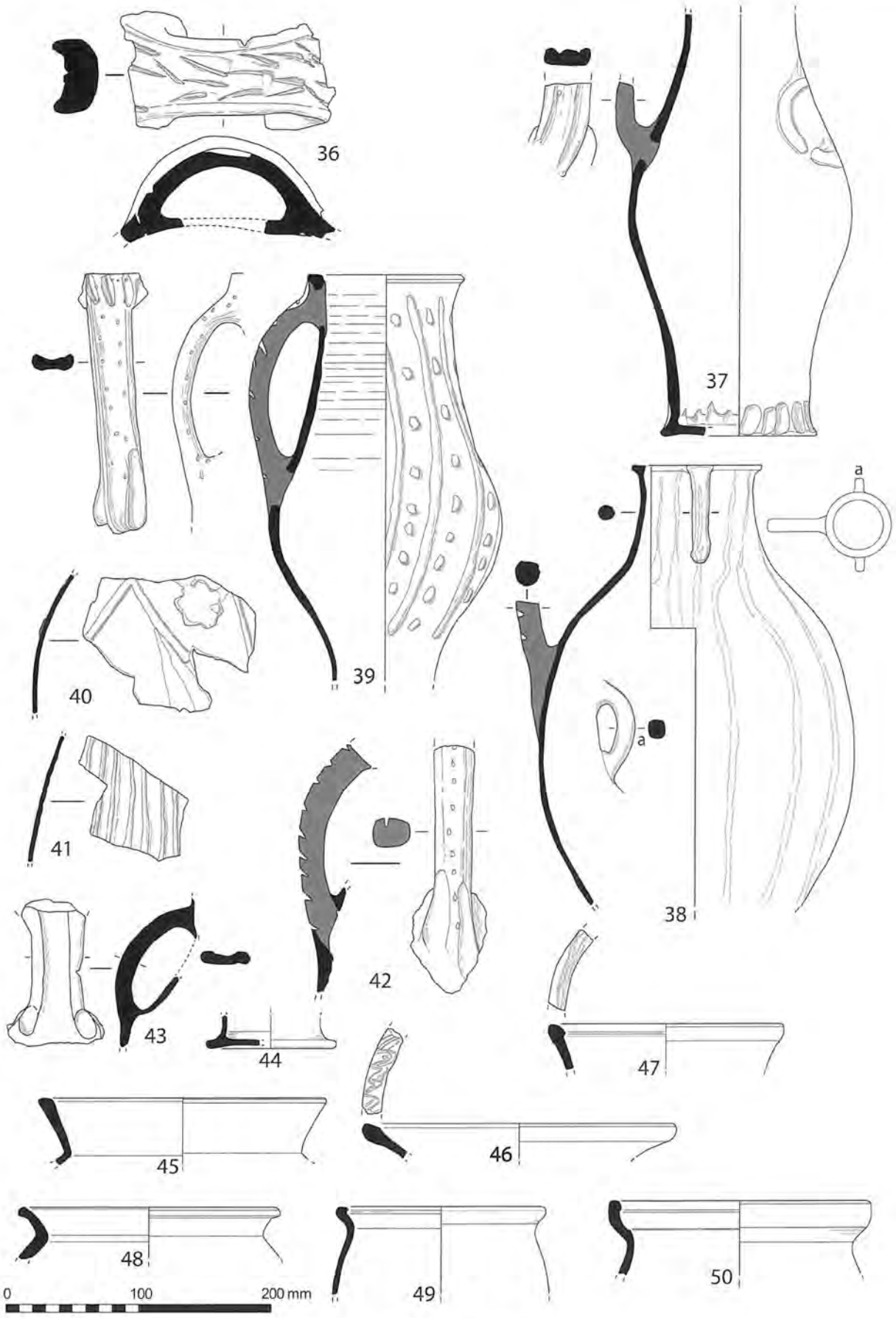


Figure 17 Pottery (nos 36–50)

Figure 18 Poole Harbour whiteware jug decorated with strips and pellets

Figure 19 Poole Harbour whiteware jug with inverted horseshoe slip motif

fabric group 5); 'Dorset whitewares' have also been identified in Southampton, although apparently all as wheelthrown jugs, one of which echoes the strip-and-pellet decoration seen at Stratton (Brown 2002, 16–17, fig. 15, 121). Examples of Poole Harbour whitewares have also been recorded as far afield as Cleeve Abbey in Somerset (Allan 1999, 46–7) and Exeter, Plymouth and Launceston in the south-west (Allan 1984, 31). The date range focuses on the 13th and 14th centuries, and jug forms are overwhelmingly predominant. A group of Poole Harbour jugs from a manorial site at Sutton Poyntz, sharing many of the decorative characteristics of the Stratton jugs, was associated with Saintonge polychrome jugs of the later 13th or early 14th century (Mepham 2007).

This group of whitewares is one of several found in central southern England – another group, linked by the use of the same clay sources (Reading Beds), although some distance to the north, is centred on the kilns at Laverstock, outside Salisbury (Musty *et al* 1969). Although very similar in appearance, Laverstock and Poole Harbour whitewares can generally be distinguished macroscopically; no sherds of Laverstock finewares were seen here. The ultimate inspiration for both the Laverstock and Poole Harbour jugs is thought to be the imported French wares seen in Poole and other ports along the south coast – this is suggested here by the direct imitation of decorative schemes such as the lattice design (also seen in Poole: Barton *et al* 1992, cat. no. 649). The Poole whiteware jugs, however, also have their own characteristic motifs, such as the horseshoes seen at Stratton and at the Wareham kiln site (Milward 2017).

Until recently the source of the Poole Harbour whitewares was unknown, although on the grounds of distribution assumed to be somewhere in the Poole/Purbeck area – there are a variety of pale-firing clays accessible in this area, in lenses of different colours and textures. These include the fine, pure white ball-/pipeclay found at Norden, near Corfe Castle, used extensively by the later

Staffordshire industries but possibly not much exploited earlier due to difficulties in working it, unless mixed with other clays (see Spoerry 1990, 14). The putative source area has now been confirmed by the discovery of a kiln in Wareham (Milward 2017). Wasters from the site (which may include the products of more than one kiln dumped into the backfill of another) indicate the manufacture of jugs, some with the simple linear and 'horseshoe' slipped decorative schemes seen at Stratton and characteristic of the 13th and early 14th century, but also some baluster forms which appear later (14th or 15th century) (Blinkhorn n.d.).

Local coarsewares

Coarsewares which are essentially sandy, but also containing various combinations of flint, calcareous inclusions (chalk or limestone) and/or greensand are presumed to be of at least relatively local manufacture. The two fabrics defined here each cover a range of variation in the frequency and size of inclusions. They form 10.3% of the Stratton assemblage by sherd weight.

F401: Coarse fabric with sparse to moderate, poorly sorted subrounded to subangular, patinated flint <2mm; occasional greensand (not in all examples); rare to sparse quartz <0.5mm.

Q402: Medium-grained sandy fabric (subrounded quartz grains <0.5mm) with rare flint, very occasional chalk/limestone.

The source of these wares is unknown, but similar types have been recorded across south and south-west Dorset, for example at Sutton Poyntz (Mepham 2007, fabrics C400, F400), Woolcombe (Poulsen 1983, fabrics 1 and 2) and Bridport (Mepham 2000b, fabrics F400, F401). They were used primarily for jars, generally internally bevelled in Fabric F401 (Fig. 17, 45–9), or with convex ('dished') profiles in Fabric Q402 (Fig. 17, 50). There is also a strap handle in Fabric F401 (Fig. 20, 51), and three tripod feet in Fabric Q402 (Fig. 20, 52), which presumably belonged to a tripod pitcher(s); it may be noted that these vessels appear to have continued in use in Dorset well into the 13th century, as suggested by a well stratified group from Dorchester (Draper and Chaplin 1982, 49, cat no. 126). Dorchester also provides parallels for the internally-bevelled and convex-profiled jar rims (*ibid.*, fig. 21), which are also seen at West Stafford (Draper 1975).

At Woolcombe a very local source for the flint-gritted wares was postulated, with similar wares recorded at Toller Porcorum and Compton Valence (Poulsen 1983, 80). Spoerry included flint-gritted wares in his group S4/C2 and noted that while these wares appeared to form a continuous distribution across a section of west Dorset, in fact it might represent two discrete distributions, one coming in from south-west Somerset (and thus probably from the Blackdown Hills: see above, Fabric F400), and the other on the west and south sides of the Dorset chalklands (Spoerry 1990, 7, fig. 6).

Donyatt-type slipwares

There is a small group of slip- and sgraffito-decorated wares (classified together here as fabric type E427) which have been identified as originating from the Donyatt production centre in south Somerset (Coleman-Smith and Pearson 1988), although the difficulties of attributing these West Country-style slipwares to specific production centres is acknowledged (D. Dawson pers. comm.). This is exacerbated when dealing with plain body sherds, and at Sherborne Old Castle Donyatt and West Dorset sandy wares were noted as being macroscopically very similar (Mepham 2015, 168–9).

E427: Donyatt-type ware: hard-firing sandy ware (sparse fine sand); rare subangular flint <0.5mm; wheelthrown, firing orange-red.

Only a small number of sherds have been identified here; they are all likely to represent jugs, at least one of them with characteristic sgraffito decoration (Fig. 20, 53–4). Donyatt wares from the production centre are conventionally dated as 14th-century or later. Their scarcity at Stratton might be expected in an area where the West Dorset sandy wares were clearly dominant but could also have a chronological explanation – pottery clearly datable to the later 14th or 15th century is very scarce at Stratton.

Imports

A small number of body sherds in fine white- to pale

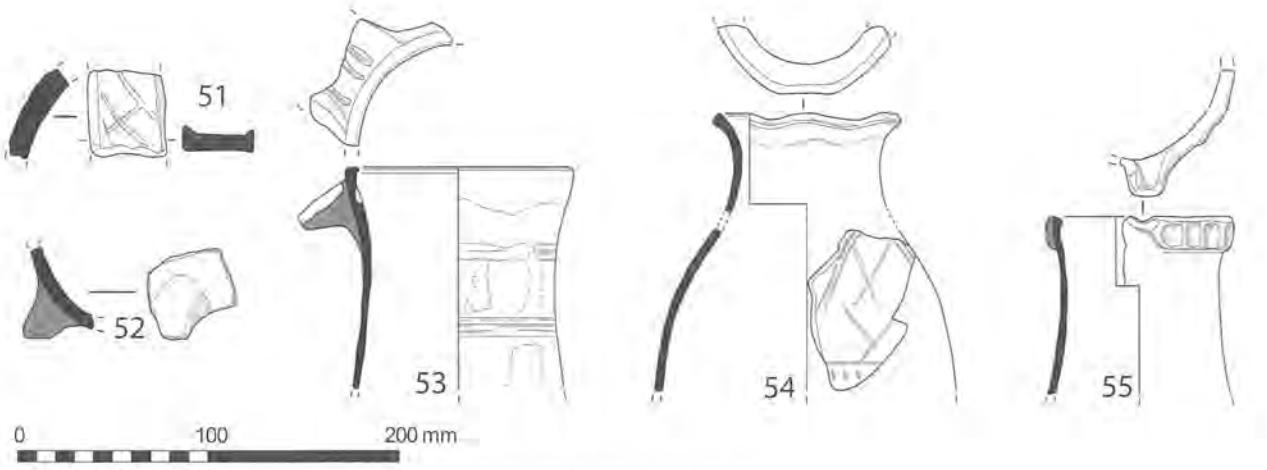


Figure 20 Pottery (nos 51–5)

pink-firing fabrics (E520), mostly glazed have been identified as imported wares, probably Saintonge monochrome whitewares. Their date range is 13th to 14th century, and they are almost certainly from jugs of some form; sherds include one rim and one rod handle.

Fabric E520: fine white to salmon-pink; silty fabric, rare fine iron-stained quartz <0.25mm; micaceous, smooth feel.

Wares of unknown source

Four fabrics, each represented by a small number of sherds, in most cases probably representing a single vessel, remain unidentified to type/source.

Q403: Hard-fired, medium-grained sandy fabric (sub-rounded quartz <0.5mm); slightly overfired to grey colour with paler margins, external dark olive-green glaze.

Q404: Hard-fired, fine silty matrix containing fine quartz (<0.25mm), firing orange-pink; wheelthrown; olive-green glaze.

Q405: Hard-fired, medium-grained sandy fabric (sparse subrounded quartz <0.5mm); 'pimply' interior surface with much smoother exterior; firing mid-orange.

Q406: Hard-fired, medium-grained fabric (sparse subrounded quartz <0.5mm); slightly 'soapy' texture; wheelthrown; firing pale salmon pink.

The only example of Fabric Q403 is a rim from a wheelthrown jug in a fine, pale-firing fabric, appearing as pale grey but probably burnt or overfired), green-glazed, with a pinched lip and a neatly thumbed strip applied around the rim, probably 14th-century (Fig. 20, 55). Six body sherds in a hard, fine sandy fabric (Q404), firing orange-pink, belong to a wheelthrown glazed jug decorated with vertical red slip stripes, dating to the 13th-/14th-century. A single sherd in a hard, pimply fabric (Q405) is of completely unknown type, and uncertain date.

The small group of sherds in Fabric Q406 all appear to belong to costrels, of which there are at least four, all barrel forms (Fig. 13, 26–7). There are traces of glaze. The form indicates a 14th-century or later date, and the pale-firing colour suggests a source somewhere on the London Clay and Reading Beds. There are possible parallels from Poole, where two costrels are illustrated in what sounds like a very similar fabric, identified as a local ware and dated as 15th-century (Barton *et al* 1992, fig. 67, nos 755–6).

List of illustrated vessels (Figs 11, 13, 17, 20)

1 Sharply everted jar rim, externally thickened; Saxo-Norman calcareous ware (C400). PRN [Pottery Record Number] 5, occupation layer 601.
2 Sharply everted jar rim, simple profile; visible junction between body and rim; Saxo-Norman calcareous ware (C400). PRN 6, occupation layer 601.
3 Jar rim; Cheddar-type ware (E400). PRN 18, occupation layer 601.
4 Small rounded jar with finger-impressed rim; West Dorset sandy ware (E425B). PRN 309, feature F8 (well).

5 Jar rim, externally thickened and finger-impressed; applied impressed strip at neck/body junction; West Dorset sandy ware (E425A). PRN 253, feature F8 (well).
6 Jar rim, thickened and with internal bevel; applied thumbed strip around neck, plus vertical strip extending down from neck; paired post-firing repair holes joined by copper wire (three strands twisted together); West Dorset sandy ware (E425B). PRN 249, occupation layer 601.
7 Convex jar with internally bevelled rim, wide-mouthed; applied thumbed strip around neck; West Dorset sandy ware (E425A). PRN 313, occupation layer 601.
8 Handled jar rim; strap handle, slashed; internal incisions at handle/body junction; West Dorset sandy ware (E425A). PRN 223, feature F8 (well).
9 Flared dish with flanged, internally bevelled rim; knife-trimmed basal angle; West Dorset sandy ware (E425A). PRN 314, feature F8 (well).
10 Bowl rim with flanged profile; post-firing repair hole below rim, with three strands of twisted copper wire threaded through hole; West Dorset sandy ware (E425A). PRN 59, feature F8 (well).
11 Flared bowl with slightly flanged rim; curvilinear combing inside rim; West Dorset sandy ware (E425A). PRN 251, occupation layer 601.
12 Jug, upper part with straight-sided, slightly inturned neck; strap handle with line of deep stabbed dots (piercing handle); West Dorset sandy ware (E425A). PRN 201, feature F8 (well).
13 Jug, upper part with flared rim and strap handle, slashed; West Dorset sandy ware (E425A). PRN 307, unstratified.
14 Jug rim with pulled lip; slight cordon on shoulder; no handle surviving; externally glazed; West Dorset sandy ware (E425A). PRN 187, occupation layer 601.
15 Jug rim (slightly collared, shallow neck zone) with pulled lip; no handle surviving; vertical painted white stripes; glazed; West Dorset sandy ware (E425A). PRN 235, feature F8 (well).
16 Jug rim and long cylindrical neck; stump of strap handle; tooled horizontal 'rilling' around neck; glaze spots; West Dorset sandy ware (E425A). PRN 273, occupation layer 601.
17 Jug rim, slightly out-turned; pinched lip; patchy glaze; West Dorset sandy ware (E425A). PRN 298, occupation layer 601.
18 Jug body sherd with applied cross with rounded terminals (on shoulder); possibly same vessel as no. 15; patchy glaze; West Dorset sandy ware (E425A). PRN 299, occupation layer 601.
19 Jug base; slightly waisted profile; vestigial thumbing around base; West Dorset sandy ware (E425A). PRN 306, occupation layer 601.
20 Jug strap handle (from basal junction with body); impressed grid stamps on handle; glazed; West Dorset sandy ware (E425A). PRN 304, unstratified.
21 Jug strap handle with multiple random large stabbed/deep impressed dots; West Dorset sandy ware (E425A). PRN 60, feature F8 (well).
22 High-shouldered, rounded jar (or jug/cistern) with sharply everted rim; West Dorset sandy ware (E425B). PRN 272, occupation layer 601.
23 Flared bowl with everted, flat rim with integral horizontal lug(s); West Dorset sandy ware (E425B). PRN 364, feature F8 (well).
24 Skillet rim and handle; handle slashed, and internal incisions also at handle/body junction; internally glazed; West Dorset sandy ware (E425A). PRN 213, occupation layer 601.
25 Skillet handle, triangular; slashed on top, thin applied thumbed strip on underside; West Dorset sandy ware (E425A). PRN 245, feature F8 (well).
26 Barrel costrel, one end with trace of shoulder lug; medium-grained sandy fabric of unknown source (Q406). PRN 310, feature F20 (line of flints in north of excavated area).
27 Costrel rim with paired pierced lug handles; medium-grained sandy fabric of unknown source (Q406). PRN 248, occupation layer 601 / feature F8 (well).
28 Lug handle with cut-out/pre-firing perforation above; vessel form uncertain; West Dorset sandy ware (E425A), glazed externally and internally. PRN 212, occupation layer 601.
29 Jar rim (Laverstock type 2); shallow scratch-marking externally and internally; Wessex coarseware (E422C). PRN 61, feature F11 (laid slabs to north of well F8).
30 Rim and handle from handled jar (handle springing from rim); Wessex coarseware (E422C). PRN 53, occupation layer 601.
31 Shallow dish profile, probably dripping dish; Wessex coarseware (E422B), heavily sooted internally and over rim. PRN 40, occupation layer 601.
32 Skillet rim, with beginning of pulled lip; combing on top of rim (short strokes); Wessex coarseware (E422C), glazed internally. PRN 114, occupation layer 601.
33 Jug rim with narrow strap handle; long indentations (finger-smeared?) down handle; Wessex coarseware (E422C). PRN 108, occupation layer 601.
34 Jug rim with applied ?handle stump; glazed; Wessex coarseware (E422B). PRN 184, feature F8 (well).
35 Curfew rim; applied thumbed strip above rim; Wessex coarseware (E422C). PRN 35, occupation layer 601.
36 Curfew handle, slashed; slashed 'keying' internally at handle/body junctions; Wessex coarseware (E422C). PRN 36, yellow clay layer/floor surface (F9) just inside W1.
37 Convex jug, most of profile, handmade; strap handle and thumbed base; applied strip 'horseshoe' on upper part; Poole Harbour whiteware (E426A), yellow glaze. PRN 117, occupation layer 401, placed on outer edge of well construction.
38 Rounded jug with rod handle and one (of two?) subsidiary small rod 'handles'; vertical manganese

slip stripes; Poole Harbour whiteware (E426B). PRN 119; occupation layer 601.

39 Baluster jug, handmade; strap handle, stabbed; decorated with vertical applied strips and pellets; Poole Harbour whiteware (E426A), pale olive-green glaze. PRN 115, occupation layer 601.

40 Body of decorated jug; applied slip strips in lattice design, with applied pads at intersections; Poole Harbour whiteware (E426A), green glaze. PRN 301/2, test pit 1, occupation layer 601.

41 Jug body with applied narrow vertical strips, close-spaced; Poole Harbour whiteware (E426B), green glazed. PRN 120, occupation layer 601.

42 Jug rod handle; stabbed dots in line down handle; Poole Harbour whiteware (E426A), green glazed. PRN 142, occupation layer 601.

43 Jug strap handle; Poole Harbour whiteware (E426A), green glazed. PRN 143, feature F8 (well).

44 Jug base, possibly baluster form; Poole Harbour whiteware (E426A), green glazed. PRN 145, occupation layer 401.

45 Jar rim, slightly thickened and flattened; flint-gritted coarseware (F401). PRN 1, occupation layer 601.

46 Internally bevelled rim; vessel form uncertain; curvilinear tooling along rim bevel; flint-gritted coarseware (F401). PRN 2, occupation layer 601.

47 Internally bevelled jar rim; curvilinear tooling along rim bevel; flint-gritted coarseware (F401). PRN 3, unstratified.

48 Sharply everted jar rim, externally thickened; flint-gritted coarseware (F401). PRN 4, occupation layer 601.

49 Convex jar with internally bevelled rim; flint-gritted coarseware (F401). PRN 308, feature F8 (well).

50 Jar rim, dished profile; sandy coarseware (Q402). PRN 25, occupation layer 601.

51 Strap handle from jug; tooled intersecting arcs down handle; flint-gritted coarseware (F401). PRN 10, unstratified.

52 Tripod foot; sandy coarseware (Q402). PRN 21, feature F8 (well).

53 Jug rim and stump of strap handle, slashed; Donyatt-type ware (E427), horizontal painted white slip bands, glazed. PRN 233, feature F8 (well).

54 Jug rim and body (all probably one vessel); white slipped with incised sgraffito 'lattice'; Donyatt-type ware (E427). PRN 275, feature F8 (well).

55 Jug rim and pinched spout; applied thumbed strip around rim; fine glazed sandy ware of unknown source (Q404), slightly overfired?, green-glazed. PRN 166, unstratified.

DISCUSSION

Chronology

There are six early/middle Saxon sherds (5th–8th century), and activity on the site at this period is supported by the recovery of a bone pinbeater, although no features could be definitively dated to this period. A small Saxo-Norman component (10th–early 12th century), has been identified, including Upper Greensand-derived wares from the Blackdown Hills and possible tripod pitcher sherds in Wessex coarseware; again, there are no features or deposits that can be tied to this period.

The majority of the medieval assemblage seems to fall into a date range of 12th to 14th century, with a distinct focus in the 13th to early 14th century. The contrast with Sherborne Old Castle, where Upper Greensand-derived wares dominated the late 12th–early 13th-century assemblage, may be pertinent here, providing a strong indicator that there is little pottery of this date from Stratton.

After this, there appears to be a continuation of the ceramic sequence through to the late 17th-/18th-century pit group, although the definition of late medieval groups is a less clear-cut exercise. This is a difficulty experienced across Wessex, either because of a decline in the production and circulation of pottery in the face of competition from metalwares, because of the effects of the Black Death on the pottery industry (Marter 2021), or non-recognition due to the continued production of known medieval wares with little discernible change into the late medieval period.

From the pottery, the later medieval period is marked by the appearance, probably sometime in the 14th century, of Donyatt ware jugs and West Dorset sandy ware bunghole vessels and plainer jugs. Some hint of a restriction in pottery supply is given by the repaired West Dorset vessels, although it is not possible definitively to date these to the period after the mid-14th century.

In terms of deposition, while the post-medieval pit group, which is relatively tightly dated, seems to represent a single clearance episode of pottery and glassware (or a series of episodes over a relatively limited period), the medieval assemblage clearly reflects accumulation of refuse over a considerable period – three or four centuries – and the definition of discrete episodes of deposition was not possible, although a general distinction between 'earlier'

(13th- to early 14th-century, layers 600 and 601) and 'later' (14th- to 15th-century, layers 400 and 401) stratigraphic groups could be discerned.

The scope for dating the structures of the possible bakehouse/brewing complex on ceramic grounds is, therefore, limited; all that can be offered is the evidence of what appears to have been a continuous sequence of activity from at least the 12th century and through the medieval period. The buildings are thought to have gone out of use when the water table became higher, possibly due to the introduction of the water meadows in the early 17th century (Cook and Williamson 2007, 5, 9).

The buildings

The partial building excavated seems likely to have been a bakehouse (and possibly also a brewhouse) which, together with the fishponds, might have provided sustenance not only for the Manor House itself but also for the Manor tenants. This must have been a relatively common arrangement on manorial sites, although archaeological parallels are not particularly common. A cluster of comparable sites are known in Kent, for example at Fulston, where bakery/brewery buildings (containing an oven and possible brewing hearth) were located within a possible manorial complex, and there is documentary evidence to suggest that this functioned for the benefit of all the tenants (Powell *et al* 2009).

The excavated area seems an unlikely spot for a building, since it is now liable to flooding. The barn on the west, now converted into two houses but probably the tithe barn known to have existed in the 17th century, also floods and had a floor inserted above the original flagged floor. The area to the west is bounded by the Wrackle, a spring-fed winterbourne which in turn borders a canal used as a fishpond, visible on the tithe and other maps (Fig. 2). The canal is bordered to the east by an irregular fishpond of medieval date. The whole area to the west of the Wrackle was converted into water-meadows, probably in the 17th century, which might explain the rise in water levels causing the medieval buildings to flood, and to be abandoned.

From the evidence of the pottery, the baking/brewing complex dates at least to the establishment of the Prebend in the 13th century, the rubble layer over it marking the destruction of the complex. The post-medieval pit excavated in 2013 was partly infilled with rubble from the demolished building.

The well probably also dates to the 13th century. Interestingly, its building technique (flint cobbling above a base formed of Purbeck limestone slabs) has a direct parallel in a large Iron Age pit found at Worth Matravers (Ladle 2018, fig. 59). The irregular construction above the cobbled walls in the well may well relate to other, later uses. Hemp is known to have been grown here in the 14th century (from an inventory of goods held by the Prebend of Stratton, dated 1337; Thurley 2018, 22) and would have needed a retting pit.

In functional terms, the large numbers of jars and bowls in the West Dorset sandy wares may relate specifically to the use of the brewhouse and bakehouse, the former used for dry storage and the latter for mixing malt or dough. The high number of jugs seems excessive if used solely as tableware – these may have been supplied primarily by the Poole Harbour whitewares, while the West Dorset jugs may have fulfilled some more utilitarian function (see below). The later medieval bunghole vessels are more directly linked with brewing.

Sources of supply

As is the case for Sherborne Old Castle and other sites across the south-west, Saxo-Norman wares from Stratton included at least a small component from the Blackdown Hills in Somerset, while the Wessex coarseware industry of east Dorset, with its origins possibly as early as the middle Saxon period, was also a supplier.

From the main period of occupation, from the 13th century onwards, the major sources of supply – sandy wares from west Dorset, glazed whitewares from Poole Harbour, sandy coarsewares from Poole Harbour and/or east Dorset, other coarsewares from source(s) as yet unknown but probably somewhere in south Dorset – suggest that the Manor may have

acquired the majority of its supplies via the market at Dorchester (less than 5km to the east), or possibly via Frampton market (3km to the north-west), although some direct supplies cannot be ruled out, nor means of movement other than purely trade. Excavated assemblages from Dorchester show a similar range of ware types in 13th-century deposits, although Poole Harbour whitewares do not seem to be particularly common there. There are hints of possible 'special commissions' – for example, the jug in West Dorset sandy ware with an applied cross on the shoulder, which it would be tempting to see as a vessel specially made for ecclesiastical use. The very small number of imported Saintonge wares are most likely to have come via Dorchester, but ultimately from the coast, possibly through Weymouth. They add a significant inland findspot to the distribution of Saintonge wares in the south-west (Allan 2021, fig. 17.28).

Given the site's location, the range of coarsewares is not unexpected, with Wessex coarsewares competing with West Dorset sandy wares and other coarsewares of probable south Dorset origin. There is some indication, however, that Wessex coarsewares were supplying some forms perhaps not available from more local sources: these include all of the curfews and the handled jar.

Social context

Within Dorset, large pottery assemblages have been excavated from urban centres (e.g. Dorchester, Poole, Christchurch, Wimborne, Wareham), and from castles (e.g. Corfe, Wareham, Sherborne). These have provided the framework for much of the discussion of the ceramic sequence of the region, and the identification of the major ware traditions. In the rural hinterland, however, there are relatively few published assemblages, and these have tended to be of relatively small size. Stratton therefore provides a relatively rare opportunity to examine a rural assemblage of significant size.

Comparisons with other rural sites in the area highlight the variety of wares seen at Stratton, and in particular the high proportion of fine glazed tablewares (5.5% by sherd weight). Sites such as Woolcombe, Holworth, West Stafford, Wytch Farm and West Mead, near Bere Regis have yielded comparable coarsewares, but Poole Harbour whitewares are scarce (Poulsen 1983; Rahtz 1959; Draper 1975; Lancley and Mepham 1991; Mepham 1999). This seems to be true even in Dorchester, though only selected groups have been published. The proportion of finewares seen at Stratton is therefore unusual in a rural context. There are dangers in using ceramics to determine social status (as these form only part of the overall material assemblage of the period), but the pattern in Dorset does seem to be for finewares (Poole Harbour whitewares and imports) to be concentrated in Poole (a major port), where they were probably easily accessible to the whole population. Outside Poole, however, finewares have a much more limited distribution into the hinterland, focusing on 'high status' sites such as castles, such as Corfe, Wareham and Sherborne (Renn 1960; RCHM 1960; Mepham 2015). The proportion of finewares at Stratton (5.5% by sherd weight) thus puts it on a par with these sites, and also with two other manorial sites, both close to Weymouth, at Sutton Poyntz and Chickerell respectively (Mepham 2007; 2020), although the proportion of continental imports is significantly lower at Stratton than at Sutton Poyntz (Mepham 2007).

The distinction observed here between the finer glazed jugs in Poole Harbour whiteware, frequently slip-decorated and the coarser, plainer vessels in West Dorset sandy ware, could reflect a functional differentiation between serving vessels for the table (finer) and vessels for decanting and storage (coarser), as suggested by a recent survey of pottery from Christchurch (see Jervis 2011, 140). Jervis linked the finer jugs to rich merchants' houses in ports such as Southampton; they are found less frequently in the inland towns and are even less common in the rural hinterland, occurring only at castles and manorial sites (ie. 'high status' sites). At Stratton, there is a marked distinction in distribution of the Poole Harbour whitewares (only one sherd found within the building, all others found outside) and the West Dorset sandy wares, which are found across the whole site. This could be taken in support of a pattern of use which confined the whitewares to the main house (subsequent discard occurring outside the buildings), while the out-buildings were served by the coarser wares.

CONCLUSION

The recovery of a substantial medieval assemblage from The Old Manor, Stratton has provided a useful dataset through which to examine the supply to, and consumption of, pottery on a manorial site in the rural hinterland of Dorchester. There are clear comparisons with other manorial and 'high status' sites in Dorset in terms of the range of wares and vessel forms used, although each assemblage has its own distinctive character. The market at Dorchester was almost certainly Stratton's main source of supply of both local and regional (and even imported) wares, although other sources, both direct and indirect, may also have been exploited. The assemblage is predominantly utilitarian, and this may at least partly reflect the use of the excavated building as a bakehouse and/or brewhouse, but the manor's inhabitants also used a range of glazed tablewares, including imported vessels. On this evidence, their most prosperous period seems to have been the 13th to early 14th century; waning fortunes thereafter due to plague and economic recession may be reflected in an increasing reliance on utilitarian vessels from the local industry, some of which were repaired. There was also a resurgence of prosperity in the 17th and 18th-centuries as the material from the post medieval pit shows.

ARCHIVE

The project archive will be deposited with the Dorset Museum, Dorchester. It will comprise written, drawn and photographic records of the excavations, analytical pottery data, and a sample of the medieval pottery assemblage. A selective approach has been adopted for the pottery given its size and largely repetitive nature. The sample for deposition includes:

- the fabric type series
- the illustrated vessels
- all early/middle Saxon and Saxo-Norman pottery
- all Poole Harbour whitewares
- all of the less common medieval wares
- a selection of diagnostic vessel forms in West Dorset sandy ware and Wessex coarseware.

A full explanation of the selection process is included in the project archive. Some of the material not selected for deposition will be retained at the Old Manor, where it will be used as a teaching and handling collection.

ACKNOWLEDGEMENTS

The publication of this report was made possible by a grant from the Dorset Archaeological Committee. The extract from the 1890 Ordnance Survey map is reproduced by kind permission of Dorset Museum. Grateful thanks for advice go to John Allan, Peter Bellamy, Dan Carter, Laurence Keen, Jonathan Monteith, Clare Randall, John Thurley and the late Peter Woodward. Help and support for the excavation were provided by volunteers of the Dorset Museum archaeological collections team, and thanks in particular go to Stuart Ackerman, Richard Breward, Robert Lancaster, Allan Prentice and Liz Simmons.

REFERENCES

Allan, J.P. 1984. *Medieval and Post-Medieval Finds From Exeter 1971-1980*. Exeter Archaeological Report **3**.

Allan, J. 1999. 'Cleeve Abbey: the pottery', *Proceedings of the Somerset Archaeological and Natural History Society* **142**, 41–75.

Allan, J. 2003. 'A group of early 13th-century pottery from Sherborne Old Castle and its wider context', *Proceedings of the Dorset Natural History and Archaeological Society* **125**, 71–82.

Allan, J. 2021. 'The local, regional and other European pottery, 900–1550', in S. Rippon and N. Holbrook (eds) *Studies in the Roman and Medieval Archaeology of Exeter*. Oxford, Oxbow, 461–501.

Allan, J., Hughes, M.J. and Taylor, R.T. 2010. 'Saxo-Norman pottery in Somerset: some recent research', *Proceedings of the Somerset Archaeological and Natural History Society* **154**, 165–84.

Barclay, A., Knight, D., Booth, P., Evans, J., Brown, D. H., and Wood, I. 2016. *A standard for pottery studies in archaeology*. Historic England.

Barton, K.J., Cartwright, L., Jarvis, K.S. and Thomson, R.G. 1992. 'Catalogue of the pottery', in I.P. Horsey, *Excavations in Poole 1973–1983*. Dorset Natural History and Archaeological Society Monograph **10**, 65–128.

Blinkhorn, P. n.d. *Pottery from Pound Lane, Wareham, Dorset (site 0127)*. Unpublished report for Bournemouth University.

Brown, D.H. 2002. *Pottery in Medieval Southampton c. 1066–1510*. Southampton Archaeological Monograph **5** / Council for British Archaeology Research Report **133**.

Coleman-Smith, R. and Pearson, T. 1988. *Excavations in the Donyatt Potteries*. Chichester: Phillimore.

Cook, H. and Williamson, T. 2007. *Water Meadows, History, Ecology and Conservation*. Macclesfield: Windgather Press.

Draper, J. 1975. 'A group of thirteenth-century pottery from West Stafford, Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **97**, 60–2.

Draper, J. 1.984. 'Medieval pottery', in P.J. Woodward, S.M. Davies and A. Graham, *Excavations at Greyhound Yard, Dorchester 1981–4*. Dorset Natural History and Archaeological Society Monograph **12**, 290–300.

Draper, J. and Chaplin, C. 1982. *Dorchester Excavations Vol 1*. Dorset Natural History and Archaeological Society Monograph **2**.

Field, N.H. 1966. 'A thirteenth-century kiln at Hermitage, Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **88**, 161–75.

Greenway, D.E., 1991 *Fasti Ecclesiae Anglicanae, 1066–1300, vol. 4, Salisbury*. [Accessed online 14 March 2021: Fasti Ecclesiae Anglicanae 1066-1300 | British History Online (british-history.ac.uk)].

Hawthorne, J.B. 1981. 'A further grave', *Proceedings of the Dorset Natural History and Archaeological Society* **103**, 126.

Hinton, D.A. and Hodges, R. 1977. 'Excavations in Wareham, 1974–5', *Proceedings of the Dorset Natural History and Archaeological Society* **99**, 42–83.

Jarvis, K.S. 1992. 'Introduction to the pottery', in I.P. Horsey, *Excavations in Poole 1973–1983*, Dorset Natural History and Archaeological Society Monograph **10**, 62–5.

Jervis, B. 2011. 'Pottery from two medieval tenements in Christchurch', *Proceedings of the Dorset Natural History and Archaeological Society* **132**, 131–44.

Ladle, L. 2018. *Multi-period Occupation at Football Field, Worth Matravers: Excavations 2006–2011*, Oxford: British Archaeological Reports British Series **643**.

Lancley, J. and Mepham, L. 1991. 'Medieval pottery', in C.M. Hearne and P.W. Cox, *Redeemed From the Heath: the archaeology of the Wytch Farm oilfield (1987–90)*. Dorset Natural History and Archaeological Society Monograph **9**, 136–43.

Marter, P. 2021. 'Catastrophe and ceramics: a preliminary assessment of the impact of the Black Death of 1348–50 on pottery in England', in A. Richardson and M. Allen (eds), *Building on the Past: medieval and postmedieval essays in honour of Tom Beaumont James*. Oxford: British Archaeological Reports British Series **662**, 107–15.

Maw, R. 2015. 'The Old Manor, Stratton', *Proceedings of the Dorset Natural History and Archaeological Society* **136**, 149–50.

Medieval Pottery Research Group [MPRG] 1998. *A Guide to the Classification of Medieval Ceramic Forms*. MPRG Occasional Paper **1**.

Mepham, L. 1999. 'Medieval pottery from West Mead', in C.M. Hearne and V. Birbeck, *A35 Tolpuddle to Puddletown Bypass DBFO, Dorset, 1886–8, incorporating excavations at Tolpuddle Ball 1993*. Salisbury: Wessex Archaeology Report **15**, 127–32.

Mepham, L. 2000a. 'Pottery', in M. Rawlings, 'Excavations at Ivy Street and Brown Street, Salisbury, 1994', *Wiltshire Archaeological and Natural History Magazine* **93**, 29–37.

Mepham, L. 2000b. 'Pottery', in D. Godden, J. Grove and R.J.C. Smith, 'Medieval and post-medieval Bridport: excavations at 43 South Street, 1996', *Proceedings of the Dorset Natural History and Archaeological Society* **122**, 115–9.

Mepham, L. 2003. 'The pottery', in C. Butterworth, 'Multi-period finds from Quarleston Farm, Winterborne Stickland, 1994–5', *Proceedings of the Dorset Natural History and Archaeological Society* **125**, 147–50.

Mepham, L. 2007. 'The medieval pottery', in M. Rawlings, *By a Crystal Brook: Early riverside settlement and a medieval chapel at Sutton Poyntz, Dorset*. Salisbury: Wessex Archaeology, 58–66.

Mepham, L. 2015. 'The pottery', in P. White and A. Cook, *Sherborne Old Castle, Dorset: Archaeological investigations 1930–90*. Society of Antiquaries of London, 158–85.

Mepham, L. 2018a. 'Town and Country: production and distribution of Laverstock wares', *Medieval Ceramics* **39**, 17–28.

Mepham, L. 2018b. 'Pottery', in P. Orczewski, 'Saxon and medieval settlement on the northern edge of Wimborne Minster, Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **139**, 145–9.

Mepham, L. 2020. 'The pottery', in C. Randall, *'Anciently a Manor': excavations of a medieval site at Lower Putton Lane, Chickerell, Dorset*, Dorset Natural History and Archaeological Society Monograph **24**, 57–72.

Milward, J. 2017. 'Results of an archaeological excavation at Pound Lane, Wareham', *Proceedings of the Dorset Natural History and Archaeological Society* **138**, 96–101.

Morris, E.L. 1994. *The Analysis of Pottery*. Salisbury: Wessex Archaeology Guideline 4.

Musty, J., Algar, D.J. and Ewence, P.F. 1969. 'The medieval pottery kilns at Laverstock, near Salisbury, Wiltshire', *Archaeologia* **102**, 83–150.

Pearce, J. and Vince, A. 1988. *A Dated Type-Series of London Medieval Pottery. Part 4: Surrey Whitewares*. London and Middlesex Archaeological Society

Pearson, T. 1982. 'The post-Roman pottery', in P. Leach, *Ilchester Volume 1. Excavations 1974–5*. Western Archaeological Trust Excavation Monograph **3**, 169–217.

Poulsen, J. 1983. 'Excavations on a medieval settlement at Woolcombe Farm, Toller Porcorum 1966–1969', *Proceedings of the Dorset Natural History and Archaeological Society* **105**, 75–81.

Powell, A.B., Barnett, C., Grimm, J.M., Mepham, L., Phillpotts, C. and Stevens, C.J. 2009. 'A medieval enclosure and bakery or brewhouse at Fulston Manor, Sittingbourne', in P. Andrews, K. Egging Dinwiddy, C. Ellis, A. Hutcheson, C. Phillpotts, A.B. Powell and J. Schuster, *Kentish Sites and Sites of Kent: a miscellany of four archaeological excavations*. Salisbury: Wessex Archaeology Rep **24**, 175–97.

Putnam, B. 2007. *Roman Dorset*. Stroud: Tempus.

Rahtz, P.A. 1959. 'Holworth – medieval village excavations', *Proceedings of the Dorset Natural History and Archaeological Society* **81**, 127–47.

Rahtz, P.A. 1979. *The Saxon and Medieval Palaces at Cheddar*. Oxford: British Archaeological Reports British Series **65**.

RCHM 1960. 'Excavations in the West Bailey at Corfe Castle', *Medieval Archaeology* **4**, 29–55.

Renn, D.F. 1960. 'The keep of Wareham Castle', *Medieval Archaeology* **4**, 56–68.

Spoerry, P.S., with Hart, V. 1988. 'Documentary and other evidence for medieval and post-medieval ceramic production in Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **110**, 29–35.

Spoerry, P. 1990. 'Ceramic production in medieval Dorset and the surrounding region', *Medieval Ceramics* **14**, 1–17.

Thurley, J. 2018. *The Manorial Records of Stratton, translated by John Thurley, with contextual analysis and historical interpretation*. Unpublished records in Dorset History Centre.

Timmins, T.C.B. (ed.) 1984. *The Register of John Chandler, Dean of Salisbury, 1404-17*, Wiltshire Record Society **39**.

Vince, A.G. 1984. *The medieval ceramic industry of the Severn Valley*, unpublished PhD thesis, University of Southampton [accessed online, July 2020: https://archaeologydataservice.ac.uk/archives/view/alan vince_eh_2010/downloads.cfm?archive=thesis].

The authors: Lorraine Mepham is a freelance pottery specialist and Rosemary Maw is an independent research archaeologist. Correspondence: mlorraine806@gmail.com

MEDIEVAL SEALS FROM CRANBORNE CHASE

NICK GRIFFITHS AND MARTIN GREEN

The purpose of this note is to record five personal seals of significant interest recovered through metal detecting on arable land in Cranborne Chase, including an unusual unfinished example.

MINCHINGTON, DORSET, 1

A circular seal of copper alloy, and probable 13-14th century date.

The central motif is an erect cleaver, perhaps suggestive of a butcher, the handle depicted with diagonal binding.

The inscription is crudely cut but mostly legible:

S(igillum) GUILEBERTHURS, surely a garbled attempt at GUILEBERTUS, the Latin form of the Norman-French name GILBERT, popular in the 12-13th, centuries, but rarer after 1400. (Postles and Rosenthal 2006,177f.) The name is perhaps best exemplified by Gilbert of Sempringham (*c.* 1083–1189), founder of the Gilbertina religious order; also an inscribed ewer from Gower, IE SUI LAWR GILEBERT: 'I am the Laver (called) Gilbert', probably early 14th century. (Lewis 1987, 2f, figs. 2 and 3)

The final part of the inscription reads DESTOK?E, or more probably DESTOCHE; the last three letters are faint and blurred, perhaps because the upper part of a seal has the most pressure applied in use, and may therefore be more worn. STOCHE is a common alternative to STOKE, especially in Domesday Book, e.g. STOCHE for Stoke Abbott, Dorset. (Ekwall 1970, 443–5). There are several meanings for Stoke, but a general sense is 'a cattle or dairy farm.'

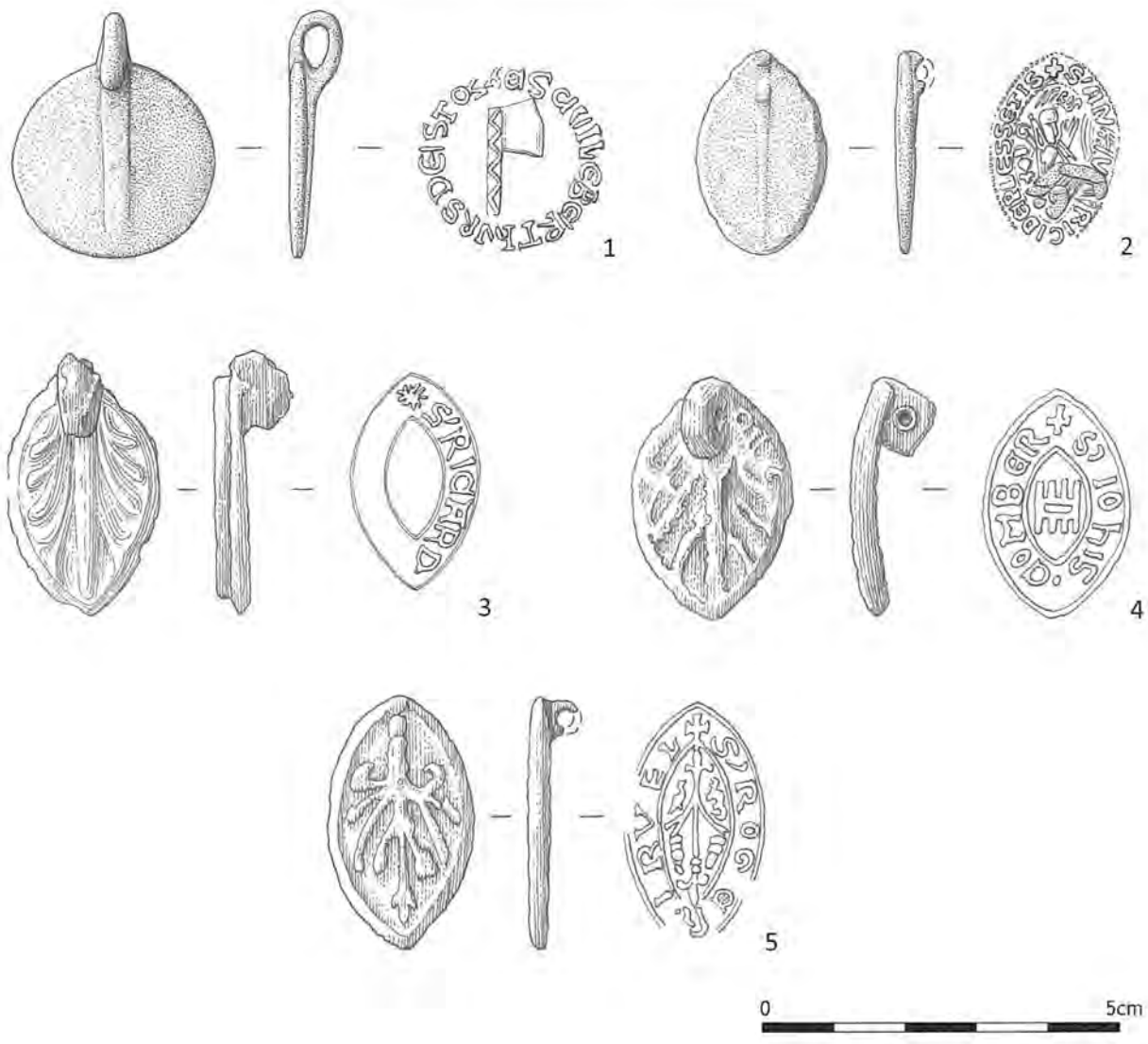
WIMBORNE ST. GILES, 2

A vesica-shaped (pointed oval) seal of copper alloy, probably of 13–14th century date. The central motif and the inscription are both damaged in the lower area by grooves, perhaps intended to deface the seal. This is a not uncommon means of 'cancelling' the seal, either on the death of the owner, or when the seal had been replaced by another. (These grooves are shown stippled on the figure).

The surviving part of the motif suggests a kneeling figure, facing right, with hands raised in prayer; above is a crude ?bird, perhaps intended to represent the Holy Ghost in the form of a dove, given the praying figure. He is bareheaded and has a bow and quiver over his shoulder.

The inscription, although damaged, is of interest; after the initial S' (for sigillum, 'seal') there are several badly cut letters, perhaps AN?V; one or two letters lost, then ?IRICI; this could be the genitive ending of a name such as HEN]RICI, 'of Henry.' The inscription is bordered by beading.

Unusually, the rest of the inscription is expressed in full and is legible: DEPLESSETIS, 'of Plessetum.' Plessetum is recorded in 1228 as the Latin Form of the name Pleshey, in Essex, the name being derived from Old French *plasseis* or *plarissiet*, meaning 'an enclosure, park or forest formed by a plashed hedge, i.e. one made with bent and interwoven branches. (Ekwall 1970, 369). Since the meaning can include (deer) parks, it may have signified a local, Dorset, park, the name now being lost. Wimborne St.Giles had two deer parks (Cantor and Wilson, 1968, 244f); the seal may have been that of a local park warden or huntsman.



WIMBORNE ST. GILES, 3

A vesical-shaped lead seal, found at Wimborne St. Giles. The face of the seal is unfinished, incised parallel lines border the area where the inscription would run, but with no central motif and only the beginning of the text: a star(?) followed by S'RICARD (S(igillum) Ricard(i))_ 'the seal of Richard.....'

The reverse has a simple foliage spray, probably intended to represent a lily, the fleur-de-lys of the Virgin Mary. The suspension 'loop' remains a rough casting with no indication that the hole was ever drilled through.

The form and decoration can be paralleled on other seals – one from Chale, Isle of Wight, also unfinished, has a plain face and an incomplete loop (PAS IOW-50BD5D). Lead seals of this form probably date from *c.* 1200 to the early 14th century; thereafter seals are normally of copper alloy or silver, and circular forms become the most common.

Partly finished seals are not unknown: a fine copper alloy seal from Salisbury (Saunders and Saunders 1991, 34, fig. 8; 38, nr.25) has an unfinished shield and helmet, lacking heraldry, and no inscription; however, it may have been discarded during manufacture as the shank and loop have been bent.

The most noteworthy feature of the Wimborne St. Giles seal is the partial inscription: the seal may have been abandoned as the inscription is very

close to the edge and would probably have broken away with use. Alternatively, it may have been a speculative 'blank': as Richard was a popular name in the 12th–13th centuries, it may have been prepared in the expectation that, sooner or later, a Richard would come along seeking a seal, and the text could be completed. On balance, the former explanation seems the more likely, that it was abandoned unfinished, though why it was not then melted down for reuse is a mystery.

CRANBORNE, 4

Vesica-shaped lead seal; it has an angular loop on the rear, with a drilled hole now filled with corrosion. A finely lettered Lombardic inscription with a linear border follows a cross:

S'IOHIS.COMBER, S(igillum)Ioh(an)is Comber, the seal of John (the) Comber.'

The central motif is a simple depiction of a double-sided comb, a type well known in both wood and bone (Egan and Pritchard 1991, 366f.).

Comber clearly means 'Comb-maker,' and this is an unusual example of a craftsmen's seal with a 'trade-motif' and matching surname. The reverse has a worn rendering of the lily spray as seen on nr.3.

CRANBORNE, 5

Vesica-shaped lead seal, with a small, broken loop on the rear. The inscription has a damaged linear border, but is completely legible; following a cross, S'ROGERIRVEL, S(igillum) Rogeri Ruel, 'the seal of Roger Ruel.'

Ruel (or Rule) as a surname is uncommon; it is unlikely to refer to the obscure Scottish saint, Rule, and may be an abbreviation of a place-name. However, surnames were becoming normal by the first half of the 13th century, as shown by a Royal Messenger, Reynold Sanz Surnum, 'Reynold without a surname,' in 1226–7. (Hills 1994,87).

The central motif is odd; what appears at first sight to be a lily has a fleur-de-lys at both top and bottom, and two small birds on the branches, which also have ?buds at the ends. The reverse has a clear version of the lily motif seen on nrs. 3 and 4.

ACKNOWLEDGMENTS

Seal No1 was found by Chris Jay and kindly brought to our attention by Simon Meaden of Myncen Farm who retains it. Seals 2 and 3 were found by Stuart Burgess who kindly donated them to the Down Farm Museum where the other two reside under the care of one of the authors of this note (MG)

REFERENCES

Cantor, L.M. and Wilson, J.D. 1968. 'The Medieval Deer-Parks of Dorset, VIII,' *Proceedings of the Dorset Natural History and Archaeological Society* **90**, 241–8.

Egan, G. and Pritchard. F. 1991. *Dress Accessories, c.1150–c.1450. Medieval Finds from Excavations in London.* Boydell Press, London.

Ekwal, E. 1970. *The Concise Oxford Dictionary of English Place-Names.* OUP, Oxford.

Hill, M.C. 1994. *The King's Messengers, 1199–1377.* Alan Stroud Publishing, Stroud.

Lewis, J.M. 1987. *Datasheet* 7. Finds Research Group, 700–1700, Oxford.

Postles, D. and Rosenthal, J.T. 2006. *Studies on the personal name in Later Medieval England and Wales.* Medieval Institute Publications, Studies in Medieval Culture, **44**.

Saunders, P. and Saunders, E. 1991. *Salisbury Museum Medieval Catalogue, Part 1.* Salisbury Museum, Salisbury.

THE ABBEY BARN, ABBOTSBURY

MICHAEL HEATON

The author reported in 2007 observations made during repair of the roof of the western half of the Abbey Barn at Abbotsbury in 2005 (Heaton 2007). The following short note relates observations made during repair of the masonry of the roofless eastern half of the barn, undertaken during the summer of 2021.

The building needs little introduction to readers of this journal. Possibly the longest tithe barn in Britain, it is ascribed a 15th century date by the Statutory List (Ref. 1305209) description. It was sequestered along with the rest of the abbey precincts in 1541 and has remained in the ownership of the Strangways family ever since, whose 18th century female members sponsored the construction of Abbotsbury Castle (dem. 1913) and the Tropical Gardens, amongst other things.

Observations made in 2005 identified evidence of a hammer beam or arch-braced roof, an ornate entablature and a parapet similar to that of St Catherine's Chapel, on the western half. The eastern half has been without a roof since at least the early 18th century, when the Buck Brothers (fl. 1724-1759) dedicated an engraving to Sir Thomas Strang(e)ways Horner (1699-1741) showing the north wall and north door nearly 50% absent, the roof wholly missing, but, possibly, the south door open.

OBSERVATIONS

Visual analysis of the mortars present suggests the barn was modified and repaired in four broad phases between the late 17th and mid 20th century; the mortars varying from soft, clay-rich mixes of sand/grit and poorly hydrated 'fat' lime to hard, grey cementitious grouts of Portland cement. The two doors were blocked with rubble bonded in the weakest of these; the putlogs and localised plastic repairs were filled with a clean, white mix of sand/grit/gravel and 'fat' lime; and the wallheads and exposed foundations had been re-set in very hard, cementitious mixes of well-gauged aggregate of Portland Cement and – probably – hydraulic limes, some similar to Ministry of Works specifications of the 1930s.

A single roof corbel of elongated profile survives on the inner face of the north wall. Of greatest interest, however, is the remains of the entablature at the east end (Figure 1). The east gable retained, apparently *in situ*, a short length of a decorated entablature that incorporated drainage channels, elements of which survived along the north and south walls in a very degraded condition. Totalling *c.* 910mm high and formed of three dressed blocks that extended through the full *c.* 900mm thickness of the wall, it comprised a 180mm thick cavetto architrave, a plain 390mm thick frieze and 340mm thick cavetto cornice with the traces of a parapet running along its outer edge. The architrave also ran along the outer faces of the south and north walls, but its moulding had survived in only short, badly eroded lengths. The occluding joints of the cornice blocks incorporated half 100mm diameter vertical channels that emptied into horizontal channels in the top of the frieze blocks, discharging down the face of the frieze. The north and south walls had been equipped with projecting spouts of octagonal profile set into the frieze, presumably below vertical channels in

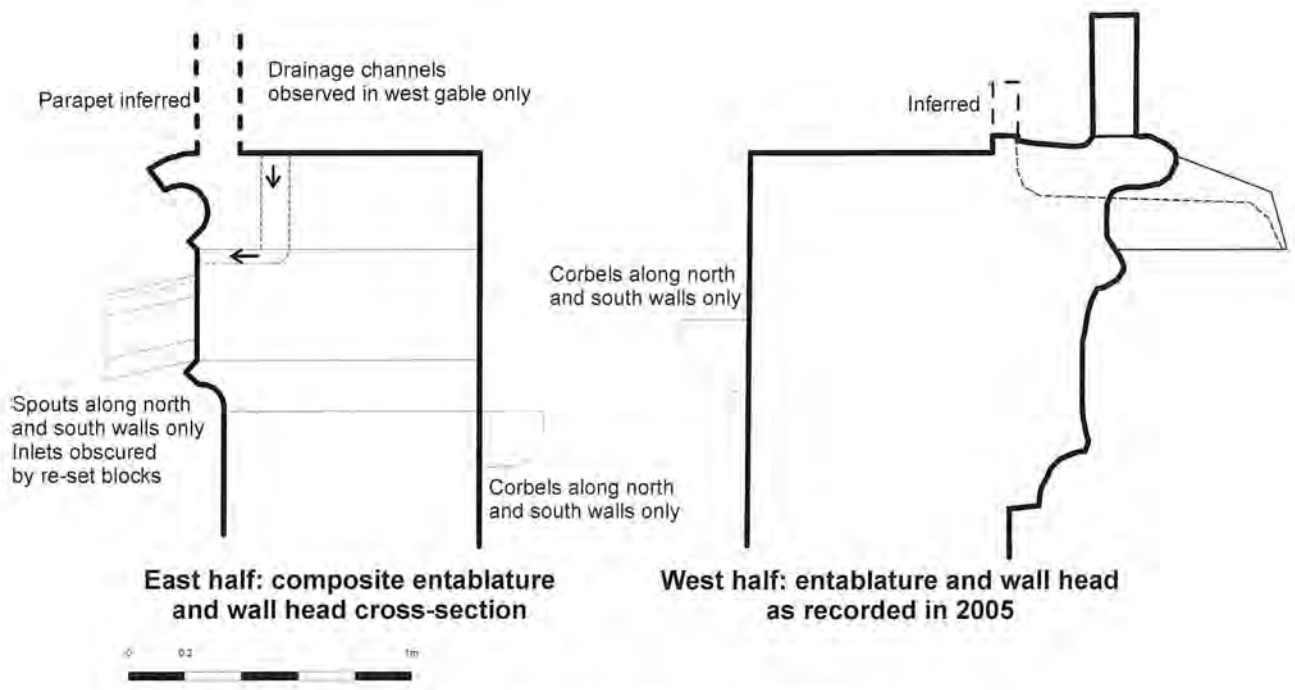


Figure 1 Cross-section through the entablature.

the frieze. As none of the latter was observed along the north and south walls, all the cornice blocks of the south and north wall must have been replaced in antiquity.

DISCUSSION

Assigning chronological dates to mortars on the basis of their visible characteristics is highly unreliable, partly because there is little comparative work published and partly because mortars were mixed in small batches with the materials to hand and therefore tended to be of variable qualities. Nonetheless, the author's observations elsewhere and the small amount of published analysis (cf. Pavia and Bolton 2000; Lynch 1994) suggests that broad generalisations can be made. Medieval mortars, especially those prepared for a large project such as this barn, tended to have an evenly 'gauged' mix of sand/grit/gravel and lime tailored to the metric characteristics of the masonry blocks – coarse for irregular blocks with large voids and finer for more accurate work. Post-medieval mortars, particularly those of the 17th and early 18th century, often include clay/loam and fragments of coal cinders. Mortars of the later 18th and 19th centuries were mixed with clean sand and lime when used for accurate or hidden work – such as rendering or pointing – but for hidden work and in urban areas incorporated increasing amounts of coal ash – 'Spanish' – as a cheap admixture, giving them a distinctive grey colour. The masonry of the eastern half of the abbey barn was therefore modified and repaired during four broad phases during the late 17th – mid 20th centuries.

Was the eastern half built at the same time as the western half, as is pre-supposed by received chronology? The entablature and rainwater disposal system of the eastern half differs significantly from that of the western half, as do the profiles of the roof corbels. Admittedly, the moulding detail of the western half was badly eroded when recorded in 2005, but the essential forms of the two entablatures, their rainwater disposal systems and the level of the corbels relative to the nominal bearing surface of the roof structure are significantly different in the two halves of the barn. This suggests the two halves were built at different times, or at least to slightly different designs.

The entablature, unlike the simple cornice, as an architectural motif is not a feature of medieval buildings in Britain: it is a Classical feature. Received architectural history tells us that such features were introduced during the early 17th century through the work of Inigo Jones, though others – such as Wootton – had been writing about them since the later 16th century and Rennaissance interpretations of Classical details have been identified, for instance, in the early 16th century chantry chapels of Christchurch Priory. The author is unaware of any 15th century buildings of this scale incorporating Classical entablatures. It seems possible, therefore, that the tithe barn of Abbotsbury Abbey was built in two stages during the early 16th century, not the 15th century.

The rainwater system of the western half and the main walls of the eastern half, in employing spouts, conforms to models adopted at many large medieval buildings, albeit in a less decorative iteration without gargoyles. The spouts of the two halves are different, but there is nothing chronologically specific to either form. The spout-less system of the east gable of the eastern half is, however, as far as the author is aware, without a British comparator (cf. De Castro and Pires 2021). It would not have been able to cope with large amounts of water without drenching the wall face beneath it, so seems to have been designed cognisant of the relatively sheltered position of the east gable wallhead. It is the more sophisticated of the two systems and the entablature mouldings are sharper – although this is the protected end of the building. This might suggest that the eastern half was built after the western half.

The construction history of the barn structure appears to be more complex than the simple '15th C' date ascribed by the Statutory List description, possibly built into phases commencing in the early 16th century initiation and incorporating a sophisticated rainwater disposal system at its sheltered east end and a Classical entablature unparalleled in a medieval British building. The latter, possibly, means that the abbey barn is one of Britain's largest surviving Renaissance buildings. The significance of that extends beyond simple art history. The author has identified a link between Catholic owners and the use of Mediterranean architectural motifs – such as *spolia* - in 17th and 18th century England (Heaton 2019). Notwithstanding the possibility that the Strangways were Catholics (cf. Heilbron 2021), the incorporation of a Renaissance motif in a monastic building in the early 16th century suggests that the monastic orders and Catholicism in general were functioning as conduits for Renaissance aesthetic culture, hitherto accepted as the preserve of the aristocracy. Finally, it appears to have been curated, as a ruin, during the late 17th – 19th centuries by the Strangways: the role of ruins within aesthetic landscapes of that period is well-documented (Carter *et al* 2017). What is perhaps not yet recognised is the extent to which landowners went to maintain the material fabric of those ruins.

ACKNOWLEDGMENTS

The repair works were grant-aided by Historic England, managed by Samuel Wheeler of Philip Hughes Associates and undertaken by Sally Strachey Historic Conservation. The archaeological investigations were funded by Ilchester Estates.

REFERENCES

Carter, M., Lindfield, P.N., and Townshend, D. 2017. *Writing Britain's Ruins.* British Library Publishing, London.

De Castro, C.R. and Pires, A. 2021. 'From regulation to everyday construction practice: The Lisbon Building Codes between 1864 and 1930', *Proceedings of the Seventh International Congress on Construction History, Lisbon, Portugal, July 2021.*

Heaton, M.J. 2007. 'Roof of the Abbey Barn, Abbotsbury', *Proceedings of the Dorset Natural History and Archaeological Society* **128**, 120-3.

Heaton, M.J. 2019. 'Spolia Britannica: The Historical Use of Salvaged Building Materials in Britain', *Construction History* **34/2**, 1-16.

Heilbron, J.L. 2021. *The Ghost of Galileo.* Oxford University Press, Oxford.

Lynch, G. 1994. *Brickwork: History, Technology and Practice.* Routledge, London.

Pavia, S. and Bolton, J. 2000. *Stone, Brick and Mortar: Historical Use, Decay and Conservation of Building Materials in Ireland.* Wordwell, Bray, Co. Wicklow.

DORSET ARCHAEOLOGY IN 2021

Tenants Hill, Kingston Russell SY 57550 87965

During the 2019 season, eight postholes, seven pits, another posthole or small pit, and sections through a curvilinear gully were excavated in Trench 3. In May 2021, this trench was reopened and extended to the north and west. This uncovered further postholes, which could now be seen to form elements of a large roundhouse with an internal ring beam around 10.2m in diameter. The entrance to this building opened to the east-south-east and was aligned on the stone circle at the opposite end of the field. The structure had been built on a flat platform, which was created by truncating a slight irregular mound and backfilling adjacent depressions. The building was dismantled at the end of its life and structured deposits were placed in some of the resulting post voids. Outlying features included two pits packed with fire-cracked stones, and pits filled with feasting debris. Additionally, two further cremation deposits were also recovered.

A large quantity of struck lithic material, indicative of an extended sequence of prehistoric activity, was also recovered from the topsoil and subsoil within Trench 3. The earliest element of this assemblage was an unstratified late Neanderthal handaxe (Mousterian of Acheulean Tradition, *c.* 60–40,000 BP). A preliminary assessment of the collection indicates that it also contains one or two late upper Palaeolithic scrapers, some later Mesolithic bladelets and associated debitage, an early Neolithic leaf-shaped arrowhead made from Portland chert, together with scrapers, cores, and flakes broadly indicative of later Neolithic and earlier Bronze Age lithic industries.

Anne Teather and Jim Rylatt,
Past Participate

Dorset VIP, South Dorset Ridgeway SY 60454 91930 to SY 64056 84492

Between July 2019 and May 2021 a team from Oxford Archaeology South has been working on behalf of National Grid and Morgan Sindall along the route of a scheme to remove 9km of overhead power lines and replace them with underground cables. Located in the Dorset Area of Outstanding Natural Beauty, the scheme lies *c.* 3.5km to the west of Maiden Castle, running from Winterbourne Abbas on the A35 south to Friar Whaddon, some 5km NW of Weymouth. The 'VIP' stands for Visual Impact Provision, with the project aiming to improve the beauty of this fantastic landscape. The excavation stage is now complete.

A number of prehistoric monuments and features have been recorded including ten round barrows, an earthen long barrow, over 300 Neolithic and Bronze Age pits, 28 Bronze Age burials including 23 cremations and five inhumations, and numerous Bronze Age and later field system ditches. The majority of the pits have been of Neolithic date with pottery dating from the early to late Neolithic, including examples of grooved ware. Along with the pottery, the pits have produced large assemblages of struck flint ranging from a handful of pieces to over 650 pieces per pit, and including blades, arrowheads and axe heads.

The investigations have also recorded a small Roman settlement located on the South Dorset Ridgeway. The site was identified through trial trenching in 2018, and comprised small enclosures of late Roman date, with a corn dryer and several millstones indicating crop processing. Eight rectangular stone-built structures have since been recorded which were terraced into the hillside. These had limited evidence of floor surfaces, and the absence of ceramic roof tiles

suggests thatched roofs. Two additional crop-drying or malting ovens were also identified, with a further large malting oven exposed on the exterior edge of one of the buildings. The recovery of 41 inhumation burials provides evidence of the inhabitants of the settlement. The burials encompass all age ranges from neonates to adults, and artefacts recovered from burials include complete pottery vessels, a bead bracelet (glass, metal and shale) and a number of hobnailed shoes. The neonates and juveniles were predominantly buried in stone-lined cists, or at least under a capping stone, while the adults were mostly within coffins. Pottery from the graves has been dated to the early Roman period and possibly of *Durotrigian* origin, perhaps suggesting that the settlement covers a broader period than previously thought.

During the evaluation works seven inhumation burials, comprising four juveniles in cists and three adults, were identified cutting through an earthen bank. The bank was L-shaped in plan and encloses an exposed hilltop. The bank itself is not yet dated, but one of the burials recovered during the evaluation produced a radiocarbon date of cal AD 660–770. A further 129 inhumations and five cremations were identified during the main excavation works (Fig. 1). The graves were arranged in rows suggesting a formalised cemetery and full age range of individuals was identified. Further radiocarbon dating will be required to establish the longevity of the cemetery but this number of individuals suggests a relatively sizeable population in the area during this period. Saxon migration into West Dorset is not thought to have occurred until the mid- to late 7th century, meaning our individuals could be some of the final post-Roman occupants of the area or some of the earliest Saxons.

John Boothroyd
Oxford Archaeology South

1 Shapwick Road, Hamworthy, Poole SZ 00274 90234

A watching brief was conducted during building works between June and September 2021 by Bournemouth University Archaeological Research Consultancy. Features relating to the 1st century Roman supply depot and later habitation of Lower Hamworthy were found across the site. One trench contained well preserved remains of a Roman kiln with an oven chamber opening onto a large raking pit. The kiln was a complicated multi-phase feature and hand dug extensions to the contractor's trenches were necessary to fully investigate and record it. After the kiln had gone out of use several small gullies and pits were dug in this area before a larger pit was created and entirely filled with blocks of unfired clay. This clay was presumably raw material collected to build and maintain features similar to the decommissioned kiln, implying continuity of this industry in the immediate area.

Two large pits were found close to the kiln and likely post-dated it. As the pits had been cut into the underlying sand geology and below the depth of the water table, they had very unstable sides and were likely filled soon after they were dug. When they were partially filled the narrow boundary between the pits collapsed and the upper fills, which included a deposit of marine mollusc shells, spanned across both features.

Four Roman ditches were also recorded on the site in addition to the side of a possible air-raid shelter, located beneath adjacent land that was formerly part of the Pilkington's Tile Works.

Jonathon Milward
Bournemouth University Archaeological Research Consultancy

28 High West Street, Dorchester SY 6903 9068

Terrain Archaeology recorded a number of features revealed during renovation of 28 High West Street, Dorchester, between March and July 2021. A single late second century Roman pit was found in the back garden and two wells were found below the house, both truncated by the construction of the basement of the house in the early-19th century. One well lay beneath the basement passage at the bottom of the stairs down into the basement. This well cut

Figure 1 Excavation of early medieval burials on the route of the VIP.

a rectangular pit. The pit was not examined and is undated, but possibly Roman. The well is possibly Roman or medieval in date. The other well lay beneath the rear wall of the basement and had been adapted to be used as a drain from the kitchen. It is also most likely to be Roman or medieval in date.

Peter Bellamy
Terrain Archaeology

Roman 'villa' at Hinton St Mary ST 7840 1600

During August and September 2021, archaeologists from the British Museum, Barbican Research Associates and Albion Archaeology completed a four-week evaluation season at Hinton St Mary. The project was a research and training excavation involving undergraduates from Cardiff University, with the support of Historic England who granted Scheduled Monument Consent. Funding was provided by a private patron, Dr Mike Watts, the British Museum, and The Roman Research Trust. The project was only possible through the support of the landowner Katie Scorgie, the local community and the Pitt-Rivers Estate, to whom the project directors offer their warmest gratitude.

The internationally renowned mosaic at Hinton St Mary with its possible depiction of Christ in the central roundel was discovered in 1963 and acquired by the British Museum in 1965. Although follow up excavations were conducted at the time these were limited in nature and provided little information on the context of the mosaic, with a suggestion made that the mosaic was part of a courtyard style villa, the standard villa type of the 4th century AD. Subsequent geophysical survey in the 1990s suggested that there were more buildings to the south of the room in which the mosaic had been found, but the nature of these structures and their dating was not clear.

Six evaluation trenches were excavated in order to gain a better understanding of the underlying archaeology with a view to possible further excavations. The trench nearest to where the mosaic was discovered located the course of a wall that extended at least 14m to the southeast, but the purpose of the wall was unclear (Fig. 2). The other trenches – which were intended to ascertain if the 'wings' of a courtyard villa could be located – failed to locate similar high-status structures contemporary with the mosaic. Rather, they suggested the presence of yards and possible ancillary buildings, likely to have been agricultural in nature rather than for human occupation. In summary, the evaluation indicated that further fieldwork will be required to establish if the mosaic was part of a stand-alone structure or a building complex and where – if this building complex exists – this is located.

Richard Hobbs
Britain, Europe & Prehistory, the British Museum

Keeper's Lodge, Kingston Lacy, Wimborne ST 9838 0130

In 2019 and 2021, members of the East Dorset Antiquarian Society carried out a programme of work agreed by the National Trust on behalf of the tenant, Mr David Smith. Six areas were targeted to investigate the possible origins and development of the site, which was recorded on the William Woodward estate map of 1774 (Smith 1995). Geophysical surveys and ground penetrating radar were used prior to excavation. Spoil heaps and trenches were monitored using metal detectors.

Keeper's Lodge, a timber-framed, thatched house dates to 1563 and probably replaced an earlier medieval building. Trenches placed directly east of the present building (Figure 3) located hearthstone blocks forming the foundation of the original east end of the building which was demolished (without record) in the 1960s. An area measuring approximately 7.25m × 8m contained three rooms, one of which was a kitchen containing a stone and brick fireplace built into the east wall. The date of construction could not be determined, however the large heathstones used for the foundation resembled those used at the 15th century Lodge Farm, also on the Kingston Lacy estate (Papworth 1994). Brick drains were recorded on the south and north sides of the building. Fragments of 16th/17th century hand-made brick, stone window surrounds, lead window

Figure 2 View of the north end of the trench next to the location of the Hinton St Mary mosaic, facing NW, 1m and 2m scales.

Figure 3 Aerial view of the Keeper's Lodge excavation, 2021

cames and window glass suggest material which was probably associated with the Tudor building.

There was no evidence for three barns which had been located south of the house. It is likely that 19th/20th century earth-moving works and garden development had destroyed any trace of these buildings. Subsequently, large quantities of household rubbish and building material were used to level the area.

The east-west medieval road from Wimborne to Blandford shown on the 1774 map had run through the estate; this was replaced in 1786 by a turnpike road (now the B3082). A trench on the south boundary of the garden revealed the presence of this 2.8m wide, cambered road which had been surfaced with compacted cobbles and flints. A substantial 2.9m wide and 0.9m deep ditch survived on its northern side; the excessive width was probably due to regular cleaning and scouring during its long period of use. After the road was abandoned, a brick garden wall was constructed on the ditch base; this had been dismantled in the late 19th/early 20th century.

There was no evidence for Rabby's Dairy noted on the 1774 map, and which was located on the site's extreme southern boundary. The area is now under light woodland. The presence of building debris and large amounts of medieval and post-medieval pottery indicates buildings in the vicinity which appear to have been comprehensively demolished.

Scattered prehistoric flintwork is evidence for Neolithic and Bronze Age activity. Pottery bowls and jars dating to the 12th–14th centuries are strong evidence for medieval occupation. Most of the material finds are 18th/19th century in date. This

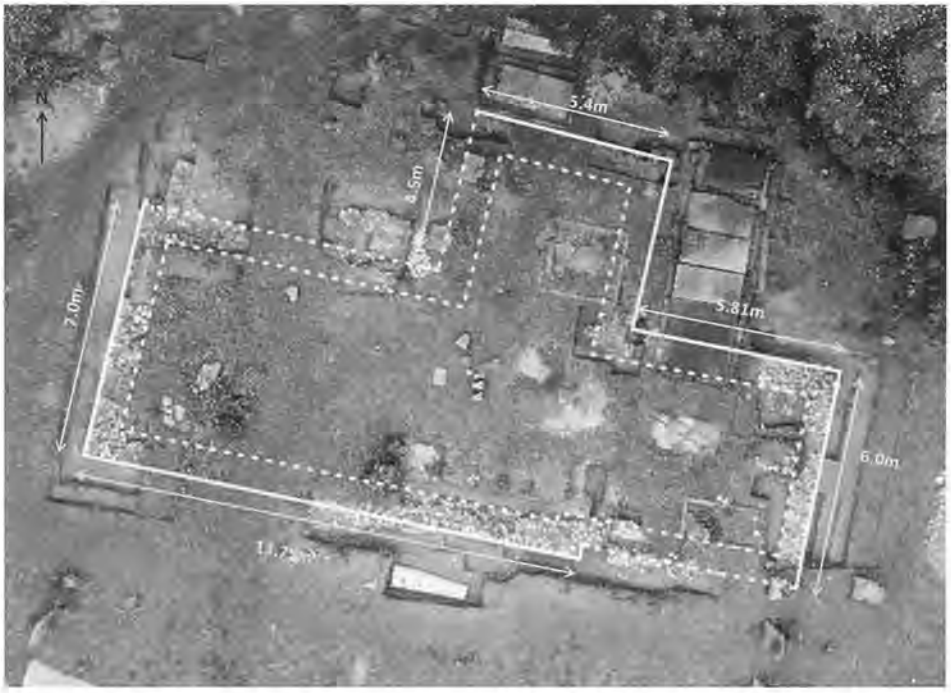


Figure 4 Aerial view of Wimborne All Hallows under excavation with dimensions.

included large numbers of 19th century wine and beer bottles, commensurate with the use of building as a gamekeeper's residence. Domestic ceramics and glassware are typical for working-class households at this time.

References

Papworth M. 1994. 'Lodge Farm, Kingston Lacy Estate, Dorset', *Journal of the British Archaeological Association* **147**, 57–121.

Smith, D.N. 1995. *Kingston Lacy an Undiscovered History* (privately published)

Lilian Ladle
East Dorset Antiquarian Society

Wimborne All Hallows SU 02383 12577

In 2020 the East Dorset Antiquarian Society was invited to investigate the Wimborne All Hallows graveyard. It is an evocative site which often resembles a nature reserve, with lopsided headstones appearing through the undergrowth. It is located in the Cranborne Chase chalklands, a short distance north of Wimborne St Giles, on a slight promontory overlooking the River Allen. The church was demolished in 1733, soon after the parish had been merged with Wimborne St Giles. A project proposal was accepted and a small team assembled to survey the graveyard and undertake a restricted archaeological investigation. The fieldwork ran over two seasons in 2020 and 2021 and was subject to national Covid-19 restrictions.

Although the site had been systematically cleared during demolition and compromised by post demolition graves, especially during the Victorian era, sufficient lengths of wall remained to enable the footprint of the church to be established and the structure assessed (see Fig. 4). The building is typical of Cranborne Chase churches with walls of carefully laid flint, and quoins and other features primarily constructed of greensand ashlar and some heathstone. The roof comprised rows of ceramic tiles, with a coxcomb ridge; fragments of limestone roof tiles suggested the lower rows were of stone slates. The church comprised a nave and chancel dating from the 12th/13th century, with a tower, unusually positioned on the north side, provisionally dated to the 15th century; a south facing porch, identified from the historic record, is likely to date to the same period. The status of the church was revealed through the quality and nature of the finds, which included a small assemblage of degraded

medieval glass dating to the 12th/13th century, evidence of at least two tapered cross slab coffin lids in Purbeck Marble dating to the 13th century (one of which was complete), and fragments of inlaid floor tiles with Wessex-style designs dating to the late 13th/14th century. Post-excavation work continues and a site report is being prepared. Two Open Days were held and a half day conference is arranged for early October to share the findings with the local community.

Andrew Morgan
East Dorset Antiquarian Society

Land South East of Lodden Lakes, Gillingham ST 81162 25534

An evaluation by Cotswold Archaeology revealed an alluvial deposit containing residual medieval and post-medieval finds. Ditches and a burnt flint deposit were exposed in plan, but were unexcavated due to flooding.

Niomi Edwards and Steve Bush
Cotswold Archaeology

The Willows, Bridport Road, near Dorchester SY 6478 9032

Terrain Archaeology carried out a watching brief during the installation of a new electricity supply to The Willows in September 2021. The route of the cable trench ran between two round barrows in the Wireless Station Barrow Cemetery. No archaeology was revealed.

Peter Bellamy
Terrain Archaeology

Land off Wheelers Lane, Canford Magna SZ 04482 96658

Evaluation trenching by Cotswold Archaeology revealed ditches likely to relate to land management, drainage or division. The ditches themselves were undated, although a single flint was recovered, along with a few modern finds.

Majbritt Trim
Cotswold Archaeology

Poole Museum, High Street, Poole SZ 0087 9030

Terrain Archaeology carried out a watching brief during the digging of a series of test pits at Poole Museum, in July 2021, as part of opening-up works to inform the proposed museum development project. Two test pits were opened up outside the north and south walls of the Town Cellars, both revealing probable post-medieval and modern deposits. Three test pits were dug at Scaplens Court in the internal courtyard and outside the rear wall of the house, which revealed a series of soil layers, some including oyster shell and animal bone, but no dating evidence. These are assumed to be primarily post-medieval in date.

Peter Bellamy
Terrain Archaeology

Corn Exchange North Street, Dorchester, SY 6927 9079

Terrain Archaeology undertook building recording of cellars beneath the car park to the rear of the Corn Exchange, North Square, Dorchester in June 2021. The cellars run along the North Square frontage, but only two cells are accessible – a third cell to the south had been filled with concrete. They are probably 18th century in date. The cellars are constructed in brick and stone with brick barrel vaults over. There is a blocked window in the north cell and possibly another in the next cell to the south, but this has been destroyed by later repair. A series of cement-lined brick vats were built within the cellars, possibly in the later 19th century, and these may have been used for curing hams and

bacon. It is possible that the cellars continued to be used after the demolition of the original 18th century building and the construction of the Market House in 1848.

Peter Bellamy
Terrain Archaeology

4 Prince of Wales Road, Dorchester SY 6921 9025

In July 2021, Terrain Archaeology carried out an archaeological evaluation of the proposed site for new supported living accommodation at 4 Prince of Wales Road, Dorchester. Three trenches were excavated across the site. No significant archaeological features were revealed. All three trenches revealed the same stratigraphic sequence comprising a post-medieval agricultural soil over the natural chalk, sealed below a late nineteenth century garden soil, with the uppermost part of the sequence relating to landscaping activity and the formation of a car park in the 20th and 21st centuries.

Peter Bellamy
Terrain Archaeology

Land North of Commercial House, Barrack Road, Dorchester SY 6860 9072

Terrain Archaeology carried out a watching brief during the initial ground investigations and subsequent groundworks for the construction of a new apartment building in the former Depot Barracks in Dorchester, in March to August 2021. No archaeological features or finds pre-dating the modern period were revealed as the area had been heavily terraced to form the barracks in the 1870s.

Peter Bellamy
Terrain Archaeology

Nothe Fort, Barrack Road, Weymouth SY 6866 7877

In January 2021, Terrain Archaeology carried out a watching brief during repairs to the existing foul drain on the north side of Nothe Fort. Most of the groundworks were along the line of the existing drain with a short length of new drain trench which exposed a small part of the clays that formed the earthen defences added to the north side of the fort in 1913.

Peter Bellamy
Terrain Archaeology

DORSET RAINFALL 2021

JOHN OLIVER

Rainfall totals across Dorset over the year as a whole were very close to the 1991–2020 average but there were some large swings from average from one month to the next as can be seen in Table 1. The wettest station in 2021 was Cerne Abbas with 1289.7mm and the driest was Portland Bill with 582.0mm. The highest daily rainfall total was 70.1mm, recorded at Forde Abbey on 28th June.

There were lengthy dry periods during the early to mid-spring with most places reporting no rain between 15th to 23rd March and 28th March to 26th April. May was the wettest on record (1856) only drying out in the last six days and persisting until about 16th June. Dry periods of ten days or more occurred in most places from 13th to 22nd July, 22nd August – 7th September and 7th – 17th October. November was quite unsettled but with only small daily amounts of rain it was the driest in 140 years.

The low-ground of south Dorset did not record a single day with lying snow during the year. Further inland there were a handful of days with a transient snow cover. At Shaftesbury snow was observed falling on 17 days and it lay on seven days and attained a maximum depth of 4cms on 24th January.

Table 1 Monthly Rainfall and Thunder days in 2021.

	Rain days		Rainfall (mm)			Thunder days	
Month	**>0.2mm**	**Av***	**Total**	**Av.***	**% Av.***	**Total**	**Av.***
January	20	18	126.6	106.4	119	0	2
February	16	15	87.0	76.1	114	1	1
March	10	14	42.6	68.4	62	0	1
April	4	13	13.2	67.1	20	1	3
May	20	12	141.5	56.8	249	3	4
June	10	11	65.8	56.9	116	2	3
July	15	12	101.9	56.8	179	8	4
August	10	14	34.0	73.8	46	2	5
September	9	12	48.1	72.6	66	0	3
October	14	16	200.6	111.6	180	2	3
November	10	18	15.5	119.0	13	0	2
December	19	18	104.8	113.3	92	0	1
Year	**157**	**173**	**981.6**	**978.8**	**100**	**19**	**32**

Av.* refers to the period 1991 – 2020

30-YEAR AVERAGES

From 2021 the standard 30-year reference period in use for establishing a 'recent average' has been updated to span the years from 1991 to 2020. This period produced the highest rainfall average in the records and was more than 50mm above the 1981–2010 figure.

The complete series of 30-year averages used in Dorset Rainfall is shown in Table 2. This is believed to be a fair representation of the changing rainfall trends but it should be borne in mind that the Rainfall Network itself is also ever changing with regard to the number of contributing stations and their location.

Table 2 30-year averages of the annual Dorset rainfall.

Years	mm	Years	mm
1861 – 1890	871	1931 – 1960	926
1871 – 1900	867	1941 – 1970	924
1881 – 1910	833	1951 – 1980	915
1891 – 1920	875	1961 – 1990	883
1901 – 1930	913	1971 – 2000	910
1911 – 1940	930	1981 – 2010	925
1921 – 1950	916	**1991 – 2020**	**979**

HIGH 24-HOUR RAINFALL EVENTS IN 2021

Rainfall data obtained from more than 50 stations showed falls of more than 25mm were recorded somewhere across the county on 24 days in 2021 compared with 26 days in the previous year. On five days at least 20 stations registered in excess of 25mm, all of these in the month of October. A brief account of these events is given below.

2 October

Rain was persistent throughout the day and heavy at times in association with a frontal system over northern France and the English Channel. The Portland and Weymouth area received just under 20mm of rain while much of the north, west and south-west of the county collected 20–30mm. The highest totals were measured across mid-Dorset from Evershot eastwards and including the Purbeck area.

(Swanage 41.4mm; Winterborne Zelstone 41.0mm; Tarrant Monkton 39.0mm)

4 October

Thunder was heard at West Moors during the early hours and this was a day of sunny intervals (especially during the morning) and occasional showers. Thickening cloud late in the day heralded a period of rain, heavy at times, of three - four hours duration that affected all areas overnight. The highest totals were measured in two zones, one south-east of a line from Abbotsbury to Wareham to West Moors and the other was north and west of a line from Charminster and Bradford Peverell to Hazelbury Bryan and Iwerne Minster. Falls in both of these zones were close to 30mm. Elsewhere rainfall totals were generally about 15–20mm.

(Cerne Abbas 32.9mm; Weymouth 32.2mm; Melbury Sampford 31.5mm)

18–20 October

The 18th was a mild and cloudy day with occasional morning drizzle being replaced by an afternoon of quite heavy rain as fronts crossed southern England. The highest total recorded on this day was about 20mm. The 19th dawned exceptionally mild with overnight minimum temperatures of 15C. The day itself was mainly dry and increasingly breezy. Any intervals of morning sunshine were short-lived as thickening cloud eventually brought heavy and persistent rain during the evening and overnight period. This was the wettest day of the year for the majority of stations. All of the county except Portland (15mm) received more than 25mm of rain with the heaviest falls across central west Dorset.

(Charminster 64.0mm; Sydling 58.9mm; Bradford Peverell 56.0mm)

The 20th was a blustery day with inland gusts of about 35mph around the middle of the day. The wind did help to break up the cloud allowing some periods of sunshine before another frontal system spread

heavy rain across the region during the evening. This was the wettest day of the year across some parts of north and west Dorset with falls of 50mm.

(Shaftesbury 53.6mm; Melbury Sampford 48.5mm; Iwerne Minster 43.7mm)

The three-day aggregate rainfall exceeded 75mm over most of west Dorset from the Chesil coast as far east as Bere Regis, Blandford and Compton Abbas. This zone also extended a finger north to Shaftesbury and Gillingham. An area from West Compton (Eggardon Hill) and Rampisham eastwards to Cerne Abbas and Puddletown received more than 100mm.

(Charminster 112.3mm; Melbury Sampford 111.7mm; West Compton 110.4mm)

30 October

Moderate and at times heavy rain affected the whole of the county during the early hours of the 31st but had generally cleared through by 0900hrs GMT, the measured totals being 'thrown back' to the 30th. West of a line from West Bay to Evershot and east of a line from Portesham through Dorchester to Milton Abbas received 15–24mm of rain. Between the two lines and covering most of west and central Dorset up to the Wiltshire border, falls were generally 30–40mm. In the middle of this zone in an area from Eggardon Hill to Stratton northwards to Stalbridge and Sturminster Newton falls exceeded 50mm in places.

(Cerne Abbas 55.6mm; Sydling 50.1mm; King Stag 47.4mm)

THUNDERSTORMS

Thunder was reported as heard on 19 days in 2021 compared with 24 days the previous year and an average of 32 days. It was the seventh successive year to produce a deficit. The first recorded thunder of the year was from Gillingham on 16th February and the latest was from the Shaftesbury / Gillingham area on 20th October. The first widespread thunder of 2021 occurred in the form of showers on 17th May and affected most of the county with a few places noting three separate storms. Lightning struck a chimney stack in Bournemouth and the associated power surge damaged electronic equipment and cut off the internet to the whole street.

Following several sunny and increasingly hot days with temperatures into the low 30s Celsius thunderstorms spread north from France during the evening of 23rd July. These storms rumbled on into the early hours of the 24th with associated rainfall generally between 10–20mm. Thunder was heard across most of the northern half of the county during the evening of 26th July following a day of virtually unbroken sunshine and temperatures close to 26C. Rainfall for the day amounted to 25mm at East Stour.

GENERAL WEATHER SUMMARY 2021

The mean temperature across the county in 2021 was the lowest since 2013 but still about 0.1C above the 1991–2020 average.

January (The frostiest since 2010)

The 1st dawned very cold and frosty with what was to be the lowest temperature of 2021 at about -6C.

The cold but mainly dry theme was maintained until the 10th when the north-easterly wind backed into the west and introduced a much milder but unsettled regime. During the last three weeks of the month sunny periods and showers were interspersed with more prolonged spells of rain. Occasional brief incursions of polar air allowed precipitation to turn wintry over the higher ground with some small accumulations of snow especially on the 24th.

(HiMax 13.3C 28th Hurn; LoMax -1.0C 7th East Stour; HiMin 9.8C 20th Thornford; LoMin -6.6C 1st Hurn;

HiRain 38.8mm 29th Nottington; Sun 37hrs 57% Hurn)

February

The first five days were mild and breezy with rain at times. After a calm day on the 6th, the wind freshened from the north-east ushering in a week of very cold and windy weather. The temperature

on the 8th and 9th barely rose above zero, the cold accentuated by gusty winds of up to 35mph. Most places were dry during this period apart from a few snow flurries. The 14th was a very wet day across the county and marked the transition to a mild and unsettled pattern that persisted for the remainder of the month.

(HiMax 14.4C 24th Wimborne; LoMax 0.5C 9th Dorchester; HiMin 11.2C 24th Blandford;

LoMin -5.3C 11th Blandford; HiRain 29.4mm 14th Dewlish; Sun 55hrs 69% Hurn)

March (The driest since 2015)

Sunshine amounts and temperatures were close to average for much of the month but a rather cold spell 4th – 9th produced some overnight frosts. An isolated warm and increasingly sunny day on the 16th saw the temperature rise as high as 18C. On the 30th sunshine and a gentle south-easterly airflow brought some exceptional warmth with maxima widely reaching 20C. Most of the rain fell between the 9th – 13th and 25th – 26th but falls were never particularly heavy.

(HiMax 21.3C 30th Blandford; LoMax 6.2C 4th East Stour; HiMin 9.6C 29th Thornford; LoMin -5.0C 8th Hurn; HiRain 16.2mm 12th Wimborne; Sun 116hrs 95% Hurn)

April (The driest since 2011)

An exceptionally dry month for most places but with some localised exceptions. The average rainfall across the county was just 13mm and many places reported no rain at all until the 27th. Most of east Dorset remained dry on the 27th but further west falls of 2–8mm were noted. The area between Swyre and Wyke Regis north-eastwards to Gillingham received about 10mm but embedded within this zone and taking in Friar Waddon, Charminster, Bradford Peverell, Cerne Abbas and Minterne Magna totals approached 30mm. It was the sunniest month of the year with a total of 231 hours recorded at Bournemouth. On ten successive days from the 17th sunshine was virtually unbroken. Daytime temperatures that had been close to average did rise into the rather warm category in the fourth week. The wind was predominantly east or north-easterly throughout the month and tended to fall calm overnight and with clear skies it was the frostiest April in more than 60 years.

(HiMax 19.4C. 27th Wimborne; LoMax 8.0C 6th/7th East Stour; HiMin 9.0C 1st Wimborne;

LoMin -5.2C 7th Hurn; HiRain 28.8mm 27th Friar Waddon; Sun 231hrs 130% Hurn)

May (Wettest since records commenced in 1856)

The 1st began sunny and cold with a widespread rural frost but it was a cloudy, cool and breezy month overall with frequent showers or lengthy periods of rain. Winds gusted to 50mph in Dorchester on the 3rd – the highest recorded in May for more than 25 years. Rainfall totals exceeding 25mm were registered on five days during the month, mainly across the higher ground in the west of the county where more than 40mm fell on the 12th. With pressure building on the 26th the weather at last dried out and the month ended generally sunny and increasingly warm.

(HiMax 27.3C 31st Wimborne; LoMax 10.6C 5th Blandford; HiMin 12.9C 20th Wimborne;

LoMin -1.7C 7th Hurn; HiRain 48.8mm Toller Down; Sun 161hrs 76% Hurn)

June

The dry conditions continued through the first half of the month with periods of warm sunshine and temperatures peaking in the high 20s Celsius. Falling pressure on the 16th heralded a much more unsettled period with some rain at times. The 21st was a cloudy and cool day with outbreaks of rain and a chilly north-easterly breeze. The last week was a little warmer with some showers that proved thundery in places on the 27th and 28th. On the latter date Forde Abbey recorded 70mm in thunderstorms that caused some flash flooding and damage to road surfaces and properties just over the county border in the Chard area of Somerset.

(HiMax 29.4C 13th Thornford, 14th Wimborne; LoMax 13.0C 21st Dorchester; HiMin 16.1C 11th Thornford;

LoMin 5.0C 23rd Hurn; HiRain 70.1mm 28th Forde Abbey; Sun 183hrs 84% Hurn)

July (Wettest since 2012)

The month began and ended quite unsettled with rain at times and temperatures near average. On the afternoon and evening of the 5th and into the early hours of the 6th rainfall was heavy at times. More than 25mm fell at West Moors and Wimborne and also in the Bournemouth area. Overnight rain 11th/12th was persistent and again heavy in many places with close to 40mm measured at Wareham and Wimborne. The period from the 13th – 23rd was dry, mostly sunny and very warm or hot. The heat peaked between the 19th and 23rd when the mercury hit 33C well inland. Thunderstorms on the 24th produced 44mm of rain in the extreme west of the county at Forde Abbey.

(HiMax 33.1C 21st Blandford; LoMax 16.0C 11th Dorchester; HiMin 19.3C 22nd Thornford;

LoMin 8.8C 11th Hurn; HiRain 41.2mm 11th Wimborne; Sun 204hrs 92% Hurn)

August (Driest since 2013)

A rather cloudy month overall but much drier than usual with most places reporting less than half of the average rainfall. Most of the rain fell in the first eight days with the only thunder of the month recorded on the afternoon of 6th from Shaftesbury and Gillingham and also East Stour where it was heard again on the morning of 7th. The last ten days were dry, under the influence of high pressure but amounts of cloud often remained quite large. The highest temperatures were registered between the 22nd – 26th before tapering off again towards month end.

(HiMax 25.6C 22nd Wimborne; LoMax 17.6C 5th Dorchester; HiMin 17.1C 12th Wimborne;

LoMin 6.3C 28th Hurn; HiRain 15.0mm 8th Broadmayne; Sun 142hrs 72% Hurn)

September

Day maximum temperatures were mostly above average until the last few days of the month and reached record breaking September values of 30C well inland on the 6th and 7th. Cloudier conditions with some showers arrived on the 8th and 9th increasing the humidity with night minima in many places of 17C. Fresher conditions followed and early rain on the 14th cleared and the next ten days were dry and pleasantly warm with a good deal of sunshine. The last six days of the month became progressively cooler with some rain at times, the heaviest across northern and eastern parts of the county on the 28th and 30th.

(HiMax 30.2C 6th Blandford; LoMax 15.2C 29th Blandford; HiMin 17.3C 10th Wimborne;

LoMin 3.7C 30th Hurn; HiRain 20.5mm 28th Shaftesbury Sun 138hrs 89% Hurn)

October (Wettest since 1976)

The heaviest rainfalls of the month fell 1st – 4th, 18th – 20th and 28th – 31st. Between these periods there were some dry spells, notably the 7th – 17th when the weather was generally pleasantly warm with some sunshine and only light breezes. A cold front slipped south-eastwards across Dorset overnight into the 21st with some quite heavy rain and gusty winds that reached 40mph even well inland and ushered in the two coldest days of the month with maxima no higher than 13C.

(HiMax 20.2C 10th Wimborne; LoMax 12.0C 22nd Dorchester; HiMin 15.7C 19th Blandford;

LoMin 1.0C 22nd Hurn; HiRain 64.0mm 19th Charminster; Sun 95hrs 88% Hurn)

November (Driest since 1879)

The mean air pressure for the month was about 5mbs above the average with the wind blowing mainly from the west or northwest. Any approaching frontal systems were quite weak affairs by the time they reached Dorset and produced very little rain. Sunshine and temperatures were very close to average overall but it did turn briefly rather cold

on the 27th and 28th, with a little snow observed falling on the former date.

(HiMax 15.7C 9th East Stour; LoMax 5.1C 27th Blandford; HiMin 11.9C 10th Wimborne;

LoMin -4.8C 29th Hurn; HiRain 8.6mm 11th Melbury Sampford; Sun 75hrs 99% Hurn)

December

A very cloudy and unsettled month with rain at times but daily totals were never too large. There was a dry interlude in most places from 14th – 21st, but still with very little sunshine. The dullest December for at least six years and mostly mild although the weather turned briefly rather cold from 17th – 23rd as the wind veered into the east. The last three days of the year were exceptionally mild with maximum temperatures very close to record breaking values.

(HiMax 14.9C 29th Hurn; LoMax 6.2C 21st East Stour, Blandford; HiMin 13.1C 30th Wimborne;

LoMin -3.5C 3rd Hurn; HiRain 22.5mm 25th Charminster; Sun 34hrs 58% Hur

The Society is grateful to all observers for their continuing support of the Dorset Rainfall Network.

Please return your completed 2022 Rainfall Register to Dorset Museum or the Rainfall Editor as soon as possible after 1st January 2023.

Correspondence: editor@dorsetmuseum.org

ADDENDUM TO 2021 REPORT

The line for December was missing from Table 1 in the 2020 Report in PDNHAS vol 142.

This table replaces the one printed:

Table 1. Monthly Rainfall and Thunder Days in 2020

	Rain Days		Rainfall (mm)			Thunder Days	
Month	**>0.2mm**	**Av.***	**Total**	**Av.***	**% Av.***	**Total**	**Av.****
January	21	18	111.2	97.2	114	1	2
February	24	15	171.0	71.3	240	2	1
March	14	16	67.4	72.2	93	1	1
April	7	13	54.9	62.3	88	1	3
May	4	13	4.0	57.6	7	1	4
June	14	11	76.0	52.7	144	8	3
July	11	11	36.9	51.8	71	2	4
August	15	12	129.4	62.8	206	5	5
September	8	13	45.9	71.3	64	0	3
October	22	17	185.2	109.2	170	1	3
November	18	17	85.0	109.3	78	1	2
December	23	18	166.6	107.2	155	0	1
Year	**181**	**174**	**1133.5**	**924.9**	**123**	**24**	**32**

Av.* refers to the period 1981 – 2010. Av.** refers to the period 1986 – 2015.

OBITUARIES

ANTHONY JOHN HOUSSEMAYNE DU BOULAY

Anthony du Boulay was a renowned connoisseur, collector, and scholar in the field of Chinese ceramics and works of art. He was a pupil at Winchester College from 1943 to 1946, in the house named after its first housemaster, Revd. J.T.H. du Boulay, a cousin of Anthony's grandfather. Anthony retained a great affection for the school throughout his life and his generosity made possible the creation of a new museum for the College's collections, which opened in 2016. His last published work was a catalogue of the Duberley Collection (2019) of Chinese ceramics housed in its museum.

Whilst at Winchester College Anthony developed his incredible eye for quality. He purchased a large blue and white vase at a country house auction for just a couple of pounds which was an extraordinary survival from the Vauxhall factory and now regarded

as one of the most important pieces of 18th century British porcelain in the world. It was perhaps not surprising that Anthony joined Christie's in 1949, initially working on the front counter. This excellent foundation gave him a practical understanding of the management and movement of objects, a discipline he later encouraged at the Dorset County Museum. Anthony was at Christie's during an era of ground-breaking scholarship in Chinese art and was fortunate to know many of the leading lights in this field. He was promoted Head of Christie's Porcelain Department, and became a Director by 1963. Whilst head of the Chinese department he was responsible for many headline grabbing discoveries. Four years later he became President of Christie's Geneva in 1967 before setting up their New York saleroom in 1976, followed by several years in Paris.

Retirement in 1980 saw Anthony become an Honorary Adviser on Ceramics to the National Trust of England and Wales. He was given the fascinating job of separating items of national importance left to the nation in lieu of inheritance tax from those either given to the National Trust, or still owned by the family. Many of the descriptions he encountered were woefully inadequate such as a magnificent George III settee at Petworth listed simply as *an easy chair*!

The thirty years spent cataloguing ceramics in National Trust houses allowed Anthony free reign to develop his refined taste and impeccable eye, and time to study and enhance his own collection of Chinese ceramics and works of art. With his wife Judith (née Makgill Crichton Maitland) he visited China a number of times. They were privileged to be amongst the first foreign visitors in Xian to see the tomb of the Qin Emperor on a visit marking the 30th anniversary of the founding of the People's Republic. Anthony's contribution to scholarship in the field of Chinese ceramics and works of art cannot be underestimated. He wrote many catalogues and several books on his subject, among them *Chinese Porcelain: Pleasure and Treasures* (1963); *Chinese Porcelain* (1973) and *Christie's Pictorial History of Chinese Ceramics* (1984).

During this period Anthony became the chairman of the French Porcelain Society and served several terms on the Council of the Oriental Ceramics Society. He appeared as an expert on *Antiques Roadshow* and its precursor, *Going For a Song*. Anthony and Judith built a lovely house, designed by their friend Anthony Jaggard (obituary *Proceedings of the DNHAS* 2021, 251), overlooking the water meadows near Sydling St. Nicholas. Anthony also served on the London Diocesan Advisory Committee for the Care of Churches, and was a director of the French Huguenot Hospital (La Providence) in Rochester, Kent. He and Judith were both actively involved in the early days of fund raising for the Joseph Weld Hospice.

From 1991 Anthony served on this Society's council, becoming chairman between 1996–1999 and retiring in 2001, though he remained a Vice-President. In addition he was closely involved with the exhibition committee for some time, where he brought his expertise and connections to bear. Through their charitable trust established in 1975 they supported a variety of individuals and organizations, including the recent development of Dorset Museum. Anthony was a generous benefactor to the museum, donating the portrait of *Sir John Browne (1696–1784)* by Thomas Hudson and a portrait bust of Vespasian to the collection and most recently generously funding the Anthony and Judith du Boulay Art Space.

An impulsive, generous and sociable character, Anthony was a mentor to many young people interested in a career in the decorative – and what he described – as 'flat arts'. As munificent hosts Anthony and Judith took great pleasure in encouraging young collectors and academics, many of whom are now distinguished figures in the art world. His *Telegraph* obituary (10 February 2022) observed 'that his tendency to volatility was masterfully controlled by his wife to whom he was dedicated. She was able to transfix him with a steely glance and a laconic "Really, Anthony" if matters got out of hand. All who knew the couple understood that she was his greatest find of all. She predeceased him by six weeks.'

Anthony John Houssemayne du Boulay 16 July 1929–1 February 2022

Judith Elizabeth Du Boulay (née Makgill Crichton Maitland), 28 July 1933–21 December 2021

Gwen Yarker

ROSEMARY JANE GOAD

Rosemary was an active member of the Dorset Natural History and Archaeological Society for many years, serving as a board trustee, and advising on editorial matters and human resources. She edited exhibition and display text, and was much involved with South West Arts.

Brought up in Surrey, her war years were spent as a boarder at a fashionable, though distinctly unacademic girls' school, whose fellow pupils included Eliza Oxley – a life long friend who introduced her to Dorset – and Judith du Boulay (née Makgill Crichton Maitland; see obituary of Anthony Du Boulay, in this volume). She later reminisced that though she learnt Greek dancing, the school boasted no science laboratories. Instead the girls were steeped in the London theatre with famous actors like Edith Evans frequently visiting the school.

In her early twenties Rosemary worked in Switzerland, Hong Kong and in Provence where she helped the former President of Hungary, Mihály Károlyi, with his memoirs. By 1953, she was back in London sharing secretarial duties at Faber & Faber for T.S. Eliot with Valerie Fletcher, soon to become Eliot's wife. As assistant to the new young editor Charles Monteith, she ran the slush pile, sifting through submissions and spotting potential – working with, amongst others, William Golding, Ted Hughes and Seamus Heaney. An early champion of Hughes's wife Sylvia Plath, she pushed for Faber to republish *The Bell Jar*, after Plath's death. Rosemary's intellect and publishing instinct saw her appointed as Faber's first female director in 1970 and championing the work of Kazuo Ishiguro, later a Nobel Prize winner. Most famously, her enthusiasm for P.D. James's first book, *Cover Her Face*, was the beginning of a personal and professional relationship lasting over fifty years. P.D. James often stayed with Rosemary in Dorset where her visits to the Dorset County Museum inspired her research for *The Murder Room*, 2003, her novel set in a private museum. In 2010, James studied the portraits in the *Georgian Faces Portrait of a County* exhibition whilst working on *Death Comes to Pemberley*, 2011.

Rosemary's retirement from Faber in 1988 prompted a punning poem from Seamus Heaney, calling her *the goad we never kick against*. She shuttled between her

flat in Mayfair and cottage at Holmebridge, where she owned fishing along the River Frome. Rosemary's energy, altruism and sheer *joie de vivre* meant she was never short of commitments and was unstinting in her gift of time to innumerable organisations in London and Dorset. Age Concern, the Skinners' Company, the Type Museum, the Frome, Piddle and West Dorset Fisheries Association, the Arts Society, as well as DNH&AS and Dorset County Museum and all benefited from Rosemary's expertise. Long after retirement Rosemary gave her expertise freely and with great acuity, editing the *Proceedings of the Dorset Natural History and Archaeological Society*, friends' books and even the memoirs of Jerry Hall. For many years, she ran the bookstall at Charminster village fête, providing many copies of P.D. James and Faber books, making the fête a destination of the summer.

A meticulous, solicitous conversationist, empathetic and generous listener, Rosemary was someone with a truly remarkable capacity for friendship. She found humour in every situation but was certainly not naïve – Seamus Heaney wrote of her *unfooled smile.* The British Library captured the story of Rosemary's life in publishing for Book Trade Lives – featuring the experiences of people working in publishing and bookselling in Britain from the 1920s onwards. Rosemary was commemorated in a wonderful obituary in *The Times* (1 October 2021) and a literary memorial service in the City of London in December 2021.

Rosemary Jane Goad 4 November 1928–11 September, 2021

Gwen Yarker