DORSET NATURAL HISTORY
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DORSET NATURAL HISTORY AND ARCHAEOLOGICAL SOCIETY

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 GR 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 current redevelopment of the building as part of the Tomorrow's Museum for Dorset project. This will secure the home of 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.

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The tower crane used to construct the new Dorset Museum galleries looms over Dorchester. © DNHAS

The redisplay of the museum has allowed the opportunity to photograph objects in the collection. © DNHAS

The new Dorset Museum atrium takes form. © DNHAS

New photographs help appreciation of parts of the collection which are rarely noticed. © DNHAS

THE PORTABLE ANTIQUITIES SCHEME IN DORSET – THE FIRST 20 YEARS

Ciorstaidh Hayward Trevarthen

On the first of February 1999 one of the second group of trial projects for the Portable Antiquities Scheme (PAS) began in Dorset and Somerset. The aim of the scheme was (and remains) to encourage people to bring forward archaeological finds recovered in the course of metal detecting or other activities for identification and recording on to a national database for England and Wales (www.finds.org.uk/database). Having had various funding arrangements including the Heritage Lottery Fund, Somerset County Council, Dorset County Council and the Department of Culture Media and Sport, the scheme is currently hosted by the British Museum, Dorset Council and the South West Heritage Trust. Devon has also been added forming a tri-county team of Finds Liaison officers (FLOs), each with primary responsibility for one county.

I have had the privilege of working as Finds Liaison Officer (FLO) for Somerset and Dorset and later for Dorset alone, since the beginning and will attempt to give a flavour of the work of the scheme and the finds recorded in over 20 years. The finds identified and recorded by PAS serve to identify and characterise archaeological sites, adding to our understanding of past activity and informing research into people and the objects they made and used. Since 2005 the PAS network has covered the whole of England and Wales and Finds Liaison Officers record artefacts from all over this area. As a result many finds originating in Dorset appear under other institutional prefixes, particularly those of Somerset, Devon, Wiltshire and Hampshire.

To date, for the geographical county of Dorset, over 32,000 finds have been recorded in over 15,000 records. These objects range in date from the Lower Palaeolithic (up to 800,000 years ago) to the 19th and even 20th century for items of particular interest (although the usual cut-off date is around 1700). The greatest number of records are Roman (5631), with the second being Medieval (3134 records). These include, for example, 8312 records of coins and 1513 of brooches and buckles (the most common types of dress accessories recorded). Whilst most finds are of metal, items of pottery, tile, flint, stone and other materials are also frequently presented for recording.

In 1999 records were made on index cards and later transferred to an MS Access database. Things today are a little more sophisticated. Each record is given a code number which consists of the prefix of where it was found and a sequential number (e.g. SOMDOR1234), and these are mentioned below, and included in the figure captions, should you wish to look them up on the database.

Initially, without digital photography and with occasional used of a flatbed scanner, finds were only selectively photographed, sketched or illustrated. The first find recorded onto the PAS database for Somerset and Dorset was a penny of Richard II (Fig. 1). The finder has remained a regular reporter of finds and has more recently joined the team of volunteers working with the FLO in Dorset.

Finds Liaison Officers for the PAS liaise with a range of people who unearth finds. Amongst them

Figure 1 Silver penny from Stogumber, Somerset, minted in Durham and dating to 1483–1485 (SOMDOR1).

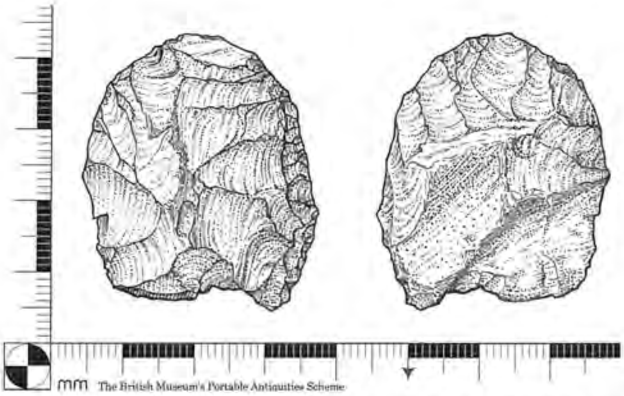


Figure 2 Discoidal flint knife of probable Early Bronze Age date from Fifehead Magdalen. (SOMDOR185). Drawing by Mike Trevarthen.

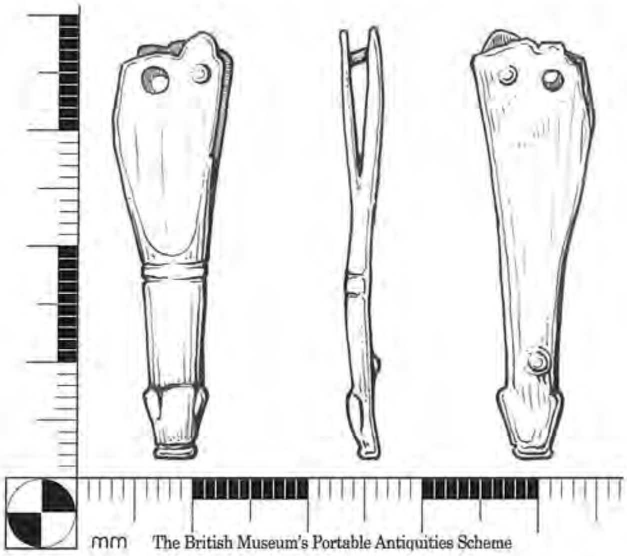


Figure 3 Early-Medieval copper alloy strap end with a stylised zoomorphic (animal head) terminal from Upwey (SOMDOR452). Drawing by Mike Trevarthen.

Figure 4 Silver denarius of the Roman Republic found in Winterbourne Monkton (SOMDOR1098).

are metal detector users, casual field walkers, gardeners, and dog-walkers. The first find added to the database from Dorset was a flint knife discovered by a 10 year-old boy who liked looking for interesting objects on his family's farmland in North Dorset (Fig. 2).

From very early on, the finds brought forward included some unusual and unexpected objects. I was initially warned not to expect much in the way of Early Medieval material, but as the illustration of a zoomorphic strap-end from Weymouth and recorded in 2001 shows, I had to learn about this period quite quickly (Fig. 3). The database currently holds over 300 records of this date for Dorset.

Relatively rare among over 4,300 Roman coins recorded in the geographical County of Dorset are those issued under the Roman Republic. There are 30 such coins recorded to date and the first two were added to the record in 2001. In Figure 4 is the second of these, a coin issued by the moneyers M. Aemilius Scaurus and P. Hysaeus in 58 BC , the reverse of which commemorates the surrender of the Nabataean King Aretas to M. Aemilius Scaurus.

Some objects begin as mystery items, some are resolved, but others remain unidentified. SOMDOR1531 (Fig. 5) is a beautifully decorated openwork mount recorded in 2002. The style of the zoomorphic decoration of opposing beasts, each with a three-clawed front paw raised, one with its head turned backwards and biting both of the animal's long tails, means it can be dated to the 11th Century, but its exact function remains uncertain.

Identifying some of the more unusual artefacts is made possible by kind assistance of PAS colleagues, curators and experts in local and national museums. A good example of this is a rare copper alloy vessel known as a chrismatory (Fig. 6). These were medieval containers for holy oils and this unusual three-chambered example was kindly identified by James Robinson (then curator at the British Museum).

Figure 5 11th century copper alloy openwork mount with zoomorphic decoration from Cranborne (SOMDOR1531).

Other object types are considerably more common and one of those is buckles. Ubiquitous, utilitarian or decorative, there are over 53,000 buckles recorded nationally on the database. 59 percent of these are dated to the Medieval and Post-Medieval periods. Figure 7 illustrates four examples recorded from Dorset in 2004.

A developing area of responsibility for me in the first years of the PAS was that of identifying and recording items of potential treasure, as defined under the Treasure Act 1996. From a handful of cases each year at the start of the scheme, there are now an average of around 40 cases reported in Dorset annually.

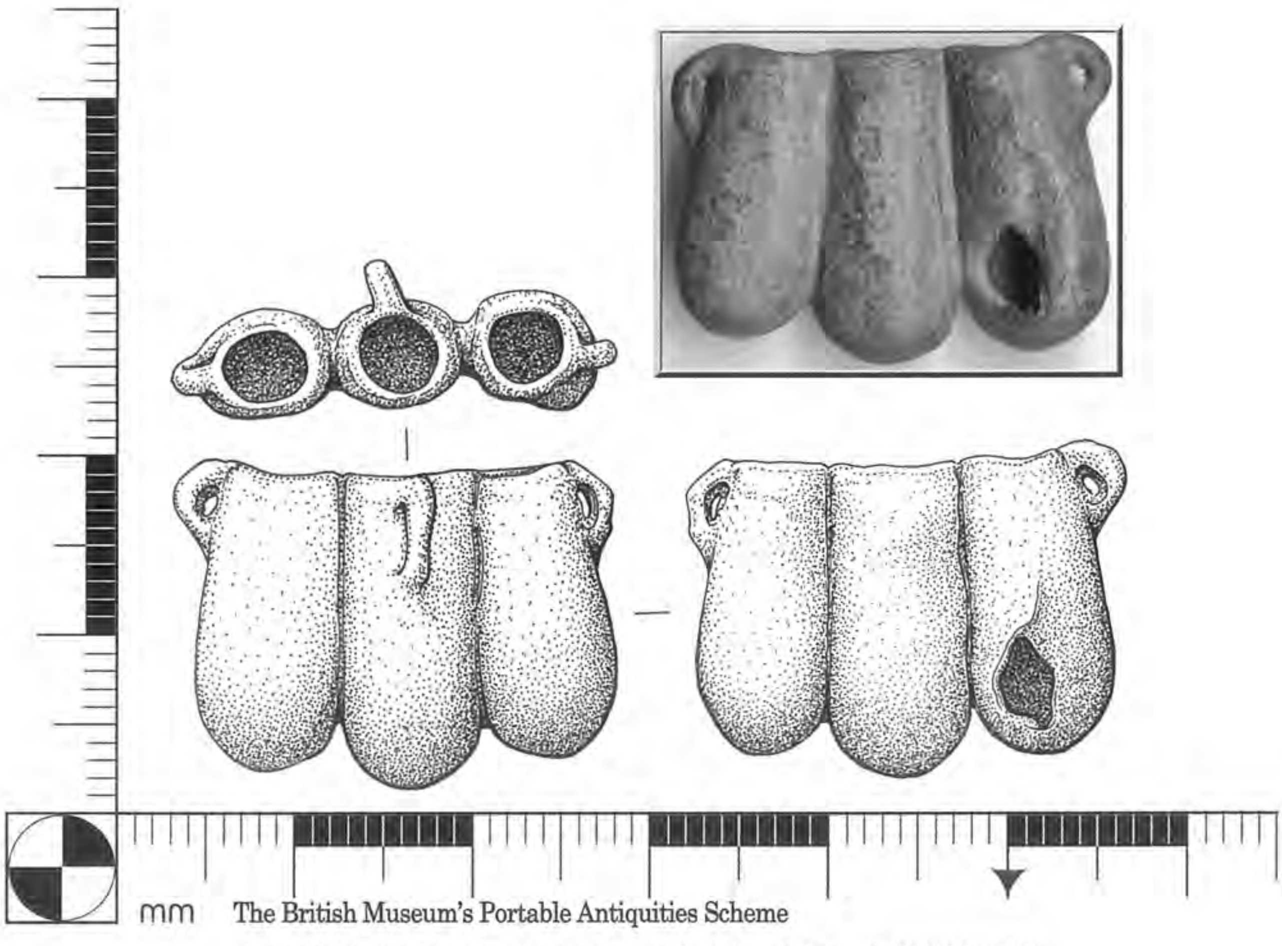


Figure 6 Medieval copper alloy chrismatory from Tarrant Rawston (SOMDOR1735).

Figure 7 Medieval and early Post-Medieval buckles. On the left are two examples with attached sheet metal plates, bottom left is a buckle with forked spacers to accommodate the end of the strap (and to which separate sheet metal plates were originally attached). Top right is a Post-Medieval example of one of the most common double looped forms.

Figure 8 Medieval gold finger ring (SOMDOR-0F2E13; Treasure case 2005 T456). Acquired by the Dorset County Museum. Tolpuddle.

The records for Dorset include coins of all periods. FLOs need to be able to identify coins using a range of specialist texts and this contributed to a very steep learning curve in the role (particularly for someone whose background in archaeology is of a distinctly prehistoric bent). The following images give an idea of the types and changes to the coinage used over a period of more than 1500 years.

Our local coinage begins in the Iron Age in the form of South Western uninscribed staters, ascribed to the

Figure 9 Iron Age stater with a stylised wreath on the obverse and a stylised horse on the reverse (SOMDOR-C08878). Compton Abbas.

Figure 10 Radiate coin of Gordian III dating to AD 240 (DOR-562842). Pamphill.

Durotriges tribe who inhabited the county. These coins were initially made of gold and transitioned over time into silver (Fig. 9) and eventually copper alloy.

Following the conquest under the emperor Claudius in AD 43, Roman coins become numerous in the archaeological record. Figure 10 is a coin of the third century, of a type where the emperor is depicted with the rays of the sun as a crown. During the rest of the third century this type becomes increasingly debased into copper alloy types and is one of the most numerous on the PAS database.

At the end of the Roman period, coinage was no longer in common use. The next coins to appear in the record for Dorset in any numbers are the early Anglo Saxon coins known as sceattas. These are rarely inscribed and in the main do not carry a recognisable bust of a ruler, instead bearing enigmatic stylised beasts, faces and symbols (Fig. 11). This is one of only 27 recorded from Dorset.

Figure 11 Silver sceat c. AD 720–740. On the obverse is a face surrounded by ten roundels and on the reverse is a stylised bird (SOMDOR-DF6636). Burleston.

Through the Early Medieval period the standard silver coinage of England was subject to many changes of design, first amongst the various kingdoms and continuing under the kings of All England. Portraits of various designs and obverse crosses become common on the later coinage and continue after the Norman Conquest into the Medieval period and later (Figs 12 & 13), until finally settling for several hundred years on a penny (and other denominations) with a crowned facing bust and a long cross with pellets in the angles (Fig. 14).

Post-Medieval coinage retains a tradition of largely silver coins in wide circulation and less common gold denominations. Coins of Elizabeth I are often loaned for recording (Fig. 15). Copper alloy coinage, not in use since the late Roman period, returned as farthing tokens under Charles I.

Prehistoric finds on the database, although not as numerous as the later material, are of interest and significance for the archaeology of Dorset. For example, there are several assemblages of worked flint and debitage that pinpoint previously unknown sites, and this information is being added to the Historic Environment Record for the County. Occasionally, an individual find can contribute in a similar way. One such is a *bout coupé* handaxe of Middle Palaeolithic date from near Swanage (Fig. 16). Handaxes like this are associated with Neanderthal

Figure 12 Penny of Aethelred II minted by Aethelmod in Chester in AD 991–997 (DOR-689BE7). Bournemouth.

Figure 13 Penny of Henry III minted by Willelm in London in 1248-1250 (DOR-BAF754). Bradford Peverell.

Figure 14 Penny of Edward I dating to 1280–1281, minted in York (DOR-77C5E2). Puddletown.

Figure 15 Sixpence of Elizabeth I, dated 1578 (DOR-AC0476). Buckland Newton.

occupation. Evidence of this date is sparse nationally, so the addition of this find to Dorset's record is significant.

Similarly important in identifying and characterising archaeological sites are ceramic finds such as pottery, clay pipe and tiles. The earliest pottery in the Dorset PAS records is Bronze Age, with more records of Roman and Medieval date (Fig. 17). Pottery and these other materials are recorded up to the early Post-Medieval period.

In the course of 20 years, there have been some exceptional and surprising objects submitted for recording and reporting. A photo of a silver ewer sent in 2013 gave little sense of the scale of the actual object when brought in. One of the largest objects to be reported through the Treasure Act, the early

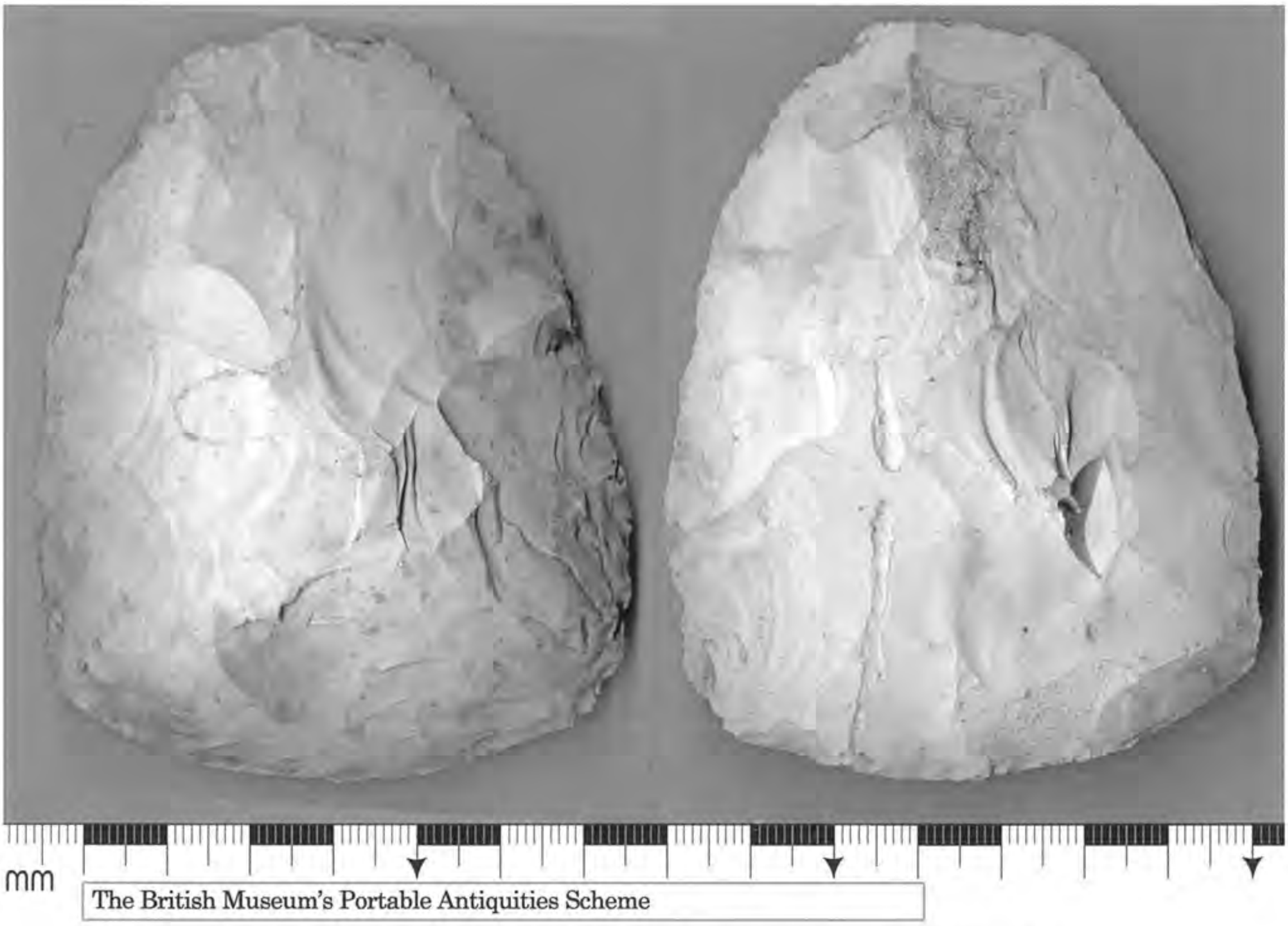


Figure 16 A Middle Palaeolithic *bout coupé* handaxe found near Swanage (DOR-57AD64).

17th century ewer (Fig. 18) is 29 cm tall and weighs over a kilogram. The hallmarks at the rim of the vessel date it to 1635–1636, assayed in London and with the maker's mark PB.

In 2014, the first *lunula* found in Dorset was reported. A crescentic ornament made of sheet gold with elegant angular terminals and decorated with incised patterns of lines and zig-zags, these Early Bronze Age objects are rare outside Ireland. This is only the thirteenth example from mainland Britain and only the third recorded on the PAS database. Its discovery prompted follow-up geophysical survey by the South Somerset Archaeological Research Group with assistance from members of the Stour Valley Search and Recovery Club, of which the finder was a member. The *lunula* was acquired by Dorset County Museum (Fig. 19), and will be returning to display in the new museum building.

Hoards and groups of objects deposited in a single event are reportable as treasure and several are found in Dorset each year. These are most commonly hoards of coins. In 2015 six coin hoards were recorded for the county; two of Iron Age date, two Roman, one Medieval and one Post-Medieval. Figure 20 shows a small hoard of late Roman silver coins. These deliberately buried coins are in comparatively good and clear condition, unlike coins lost in use, and have not been subject to edge clipping as often seen on coins which remained in circulation until later in the 4th century AD and beyond.

As mentioned previously, non-metal finds are an important component of the database records. There is a small, but active group of amateur fieldwalkers (who look for sites by systematically scanning the surface of ploughed fields) who regularly present their

Figure 17 Medieval pottery handle from a jug, found in Dorchester (DOR-BF9C74).

finds for recording. Consequently there are many assemblages of pottery and flint in the record. The groups of flint objects are particularly important in providing evidence for human activity at a time when few other traces survive in the landscape. An example can be seen in a large group of handaxes, scrapers, axeheads and other flint artefacts dating from the Lower Palaeolithic, Mesolithic, Neolithic and Early Bronze Age found around Tarrant Keyneston. Figure 21 shows one find from this group.

Personal adornments and dress accessories are frequently brought in for recording by metal detector users. Brooches were in common use during the Roman period. Used mainly to fasten clothing, they vary in greatly in form and decoration. The more highly decorated examples are often enamelled in bright, perhaps even garish, colours. The example in Figure 22, although incomplete, is an elaborate plate brooch with a central field of vivid blue enamel surrounded by a band of red. Inset into the red are small white discs made from sections of glass rod.

The identities of the owners of personal items such as brooches, buckles, finger rings etc. are generally lost to us after so many centuries. Occasionally,

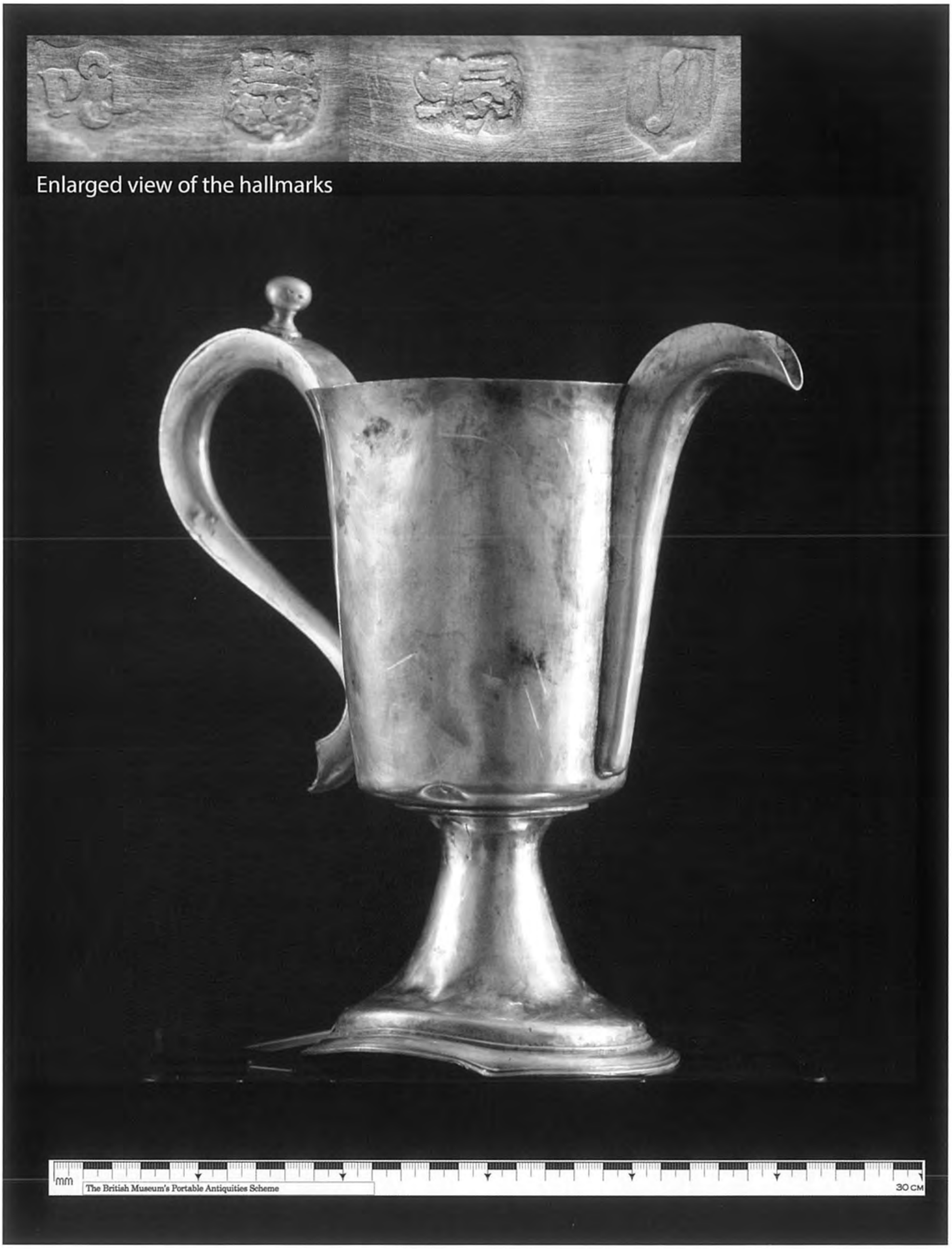


Figure 18 Large silver ewer from Kingston Russell (DOR-D03CB6; Treasure case 2013 T476) The inset shows detail of the hallmarks stamped near the rim of the vessel (not to scale).

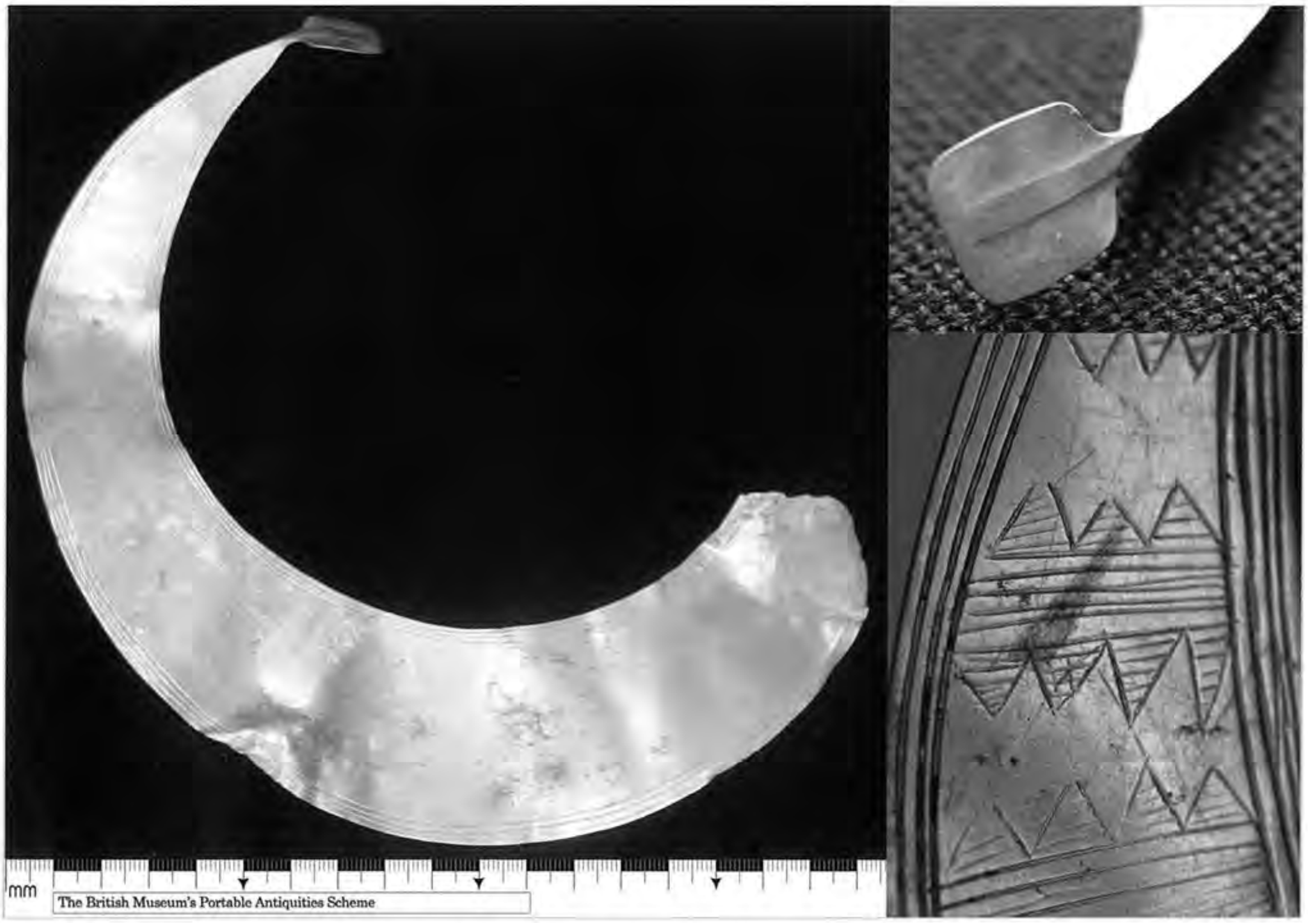


Figure 19 Early Bronze Age Lunula (DOR-2198F8; Treasure case 2014 T457) from the Tarrants. A unique find for Dorset. The insets show detail of the terminal (top right) and the incised geometric decoration (bottom right) (not to scale with the main image). Acquired by Dorset County Museum.

however, the person that wore and used an object chose to personalise it. Personal seal matrices, hawking vervals, thimbles, and jewellery sometimes bear names or initials of their owners (Fig. 23).

Through regular finds days, kindly hosted by many of Dorset's excellent museums, attendance at detecting club meetings and heritage events, I get the chance to meet with many finders. I can never predict what might be brought in to be loaned for recording. The interest and efforts of the hundreds of people who have taken the time to show me their finds have helped create an amazing online resource for Dorset, which is available to everyone for study and research via the online database.

Even after 20 years, there is always scope to find out something new, to make a new connection or discovery. Figure 24 shows a small example of the benefits of continued reporting and recording of objects. DOR-6B1DF4 was recorded as a probable dress accessory, perhaps part of a hooked clasp, and dated by its style, composition and construction to the Post-Medieval period. There it may have languished in uncertainty but for the arrival of another example, no less damaged, but with more of its component parts present. From this subsequent example (DOR-5EF8E) it was possible to identify both as finger rings. So far these appear to be the only two of this type recorded on the PAS database, but who knows what the next finder will bring?

The PAS in Dorset does not operate in isolation or without considerable input from others, so thanks are due to many people, too numerous to list. Thanks are owed to the finders in particular. Those who take the opportunity to offer their discoveries for recording are, of course, essential to the PAS. I am always

Figure 20 Late Roman silver coins from Pamphill. At the top are two larger, rarer denominations known as miliarenses and the other four are siliquae. The coins range in date from AD 367 to 388 and were issued under the emperors Valens, Gratian and Theodosius II (DOR-1B3ECD; Treasure case 2015 T194).

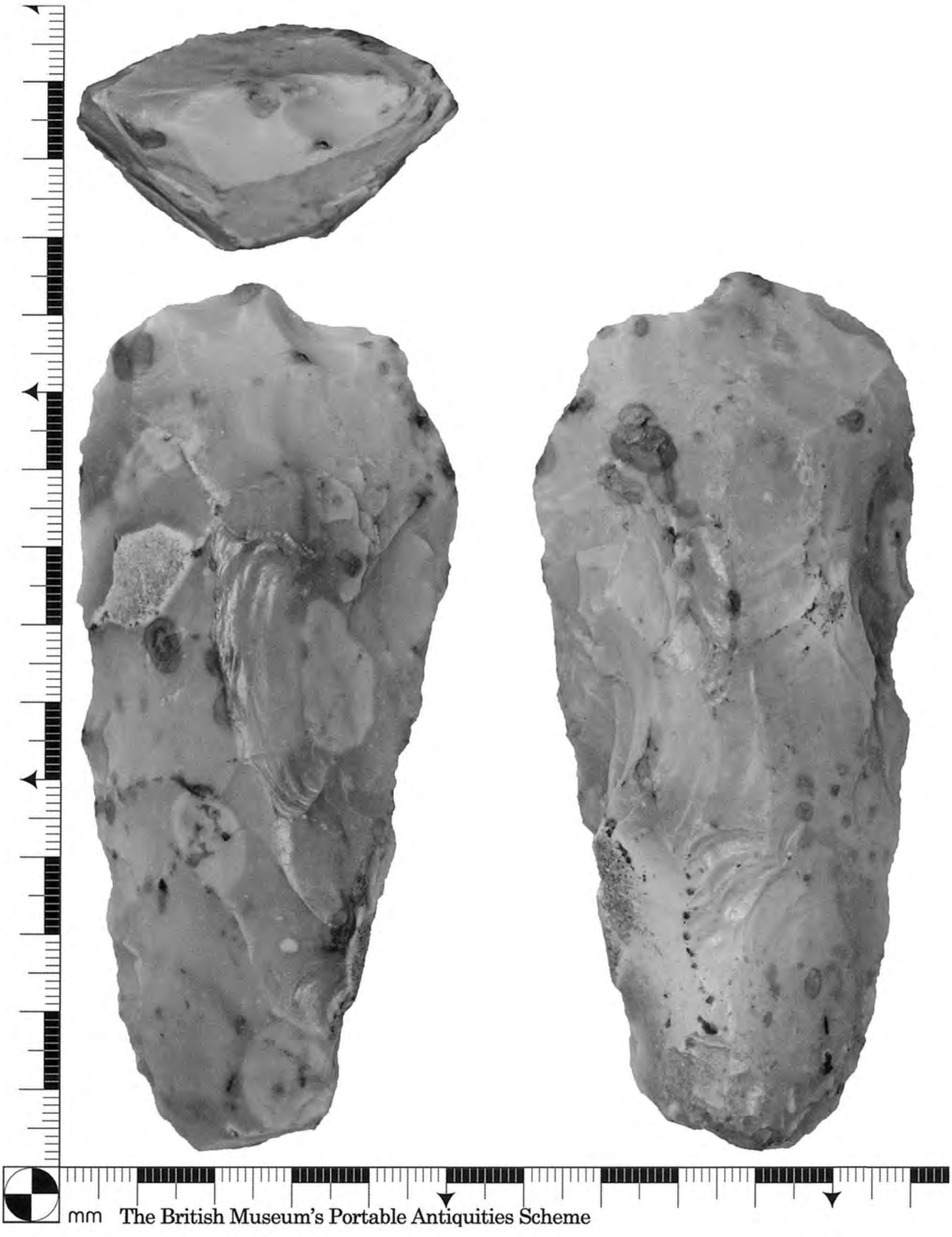
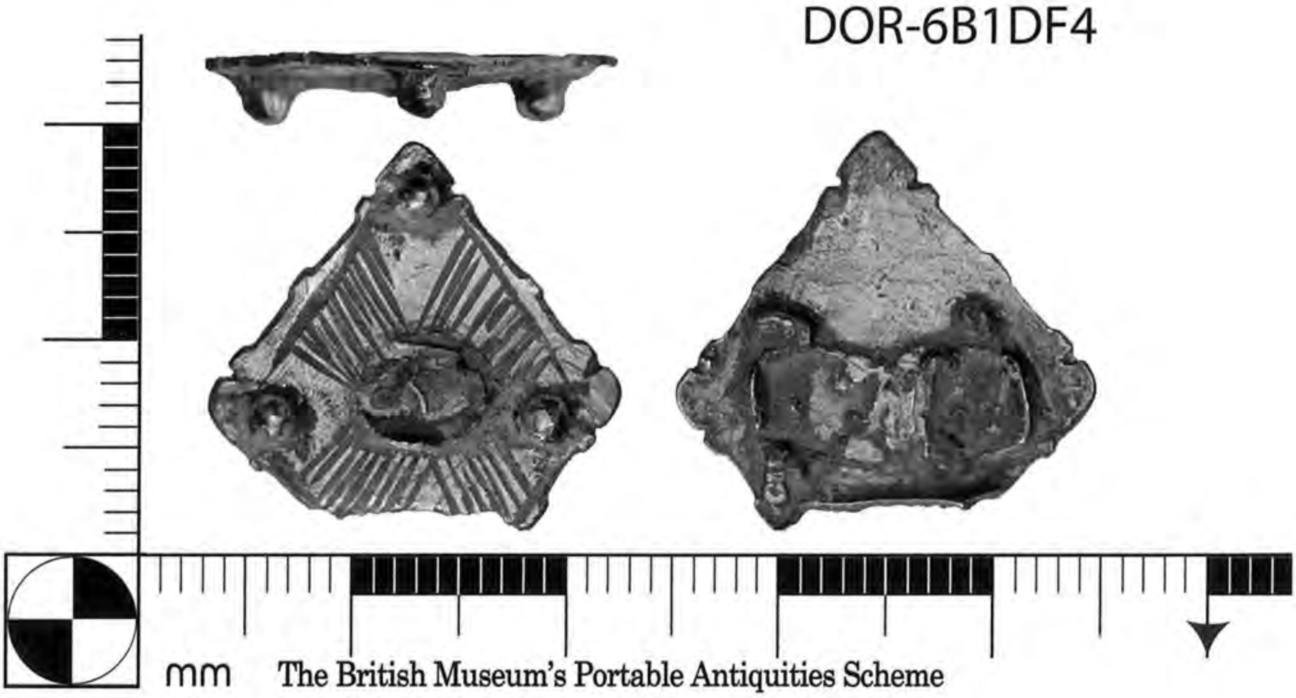


Figure 21 Mesolithic tranchet flint axehead from Tarrant Keyneston (DOR-064167).

Figure 22 Roman enamelled plate brooch from Bincombe (DOR-76AD22).

Figure 23 Gold finger ring from Lytchett Matravers. The bezel is a seal matrix bearing an incised image of a Talbot hound with the initials IB above. For good measure, the same initials have been inscribed on the back of the bezel. (DOR-A1BC3F; Treasure case 2018 T1033).



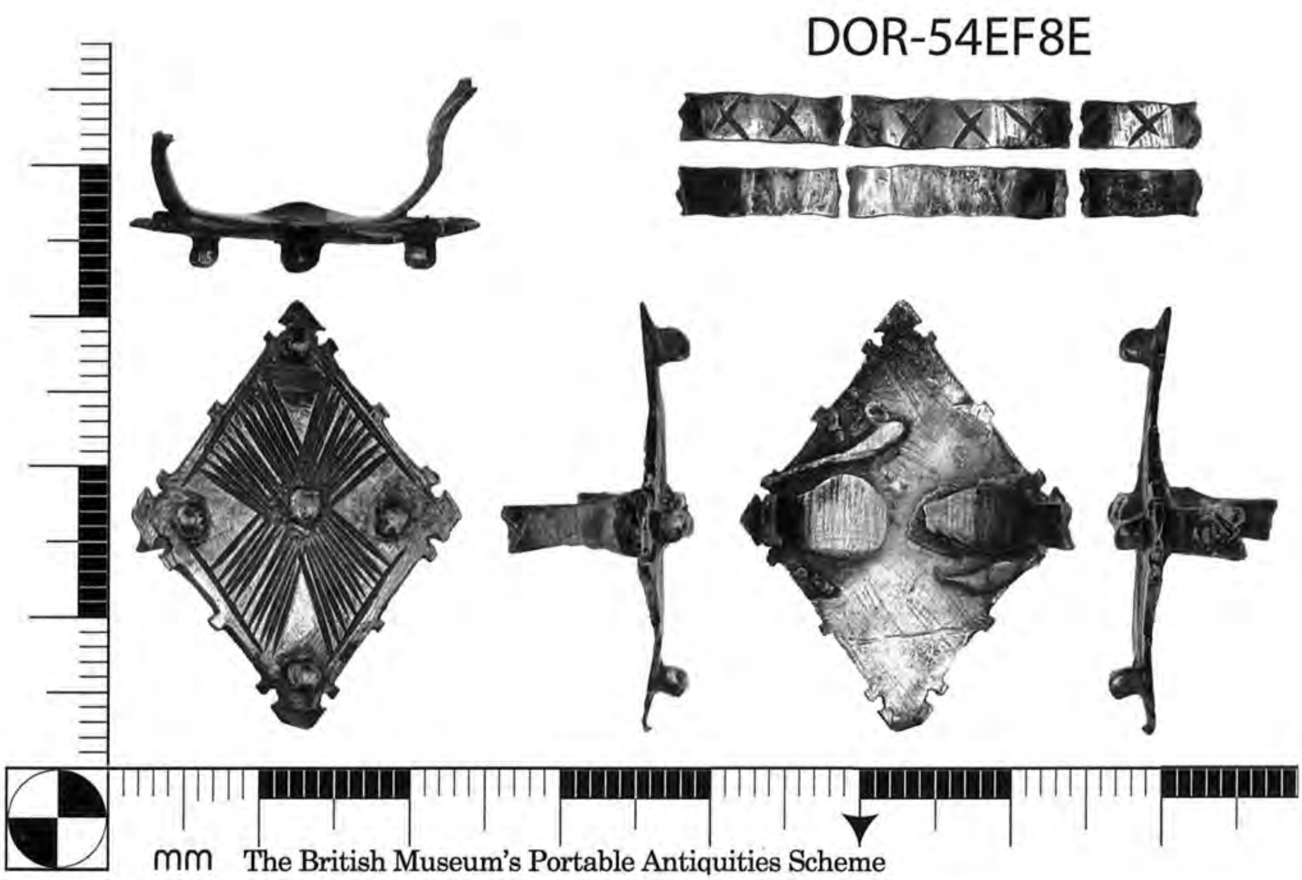


Figure 24 Two incomplete Post-Medieval gilded silver finger rings. At the top is the first found, from Uplyme, Devon (DOR-6B1DF4, 2018 T604) and the lower is a more complete example from Bettiscombe (DOR-54EF8E; Treasure case 2019 T1074).

grateful for their enthusiasm and interest (and for their patience while their finds are processed).

PAS colleagues (near neighbours, members of the SWHT team, and those beyond) have contributed to the database and assisted with identifications, advice and research. The mentorship and support of my managers in Dorset and Somerset through many years has allowed the scheme to establish and flourish. Particular thanks must go to Claire Pinder and Steve Minnitt who were there at the start.

The Dorset PAS team also includes an amazing group of dedicated volunteers: Lucy Bevan, Rachel Mowbray, John Slade, Sarah Kelman and David Grenfell (the latter being the longest serving volunteer having started in 2005). Their assistance has allowed for a significant increase in the number of finds recorded each year and for great improvements in the number of records with images.

Archaeological colleagues from outside the scheme have also kindly given time and effort in excavation and other fieldwork where important finds have been unearthed. These include the Bournemouth University Department of Archaeology and Anthropology, South Somerset Archaeological Research Group and Mike Trevarthen.

The author: Ciorstaidh Hayward Trevarthen is the Portable Antiquities Scheme Finds Liaison Officer (FLO) Dorset. More information can be found at: Finds.org.uk/database

THE DORSET ROTULUS: A NEWLY DISCOVERED SOURCE OF ENGLISH POLYPHONIC MUSIC

MARGARET BENT

Among the rich archival materials recently transferred from Melbury (Ilchester Estates) to the Dorset History Centre, are two fragments of polyphonic music of the early fourteenth century, now D-FSI, acc. 10959a and 10959b. Such discoveries are extremely rare, and this one is of considerable importance. The membranes come from a rotulus originating from the Benedictine monastery of Abbotsbury and were later used for archival binding. They contain portions of four large-scale motets; and together with fragments surviving in other sources, much of the music can be reconstructed. It has been studied by Margaret Bent, Peter M. Lefferts and Jared C. Hartt, authors of The Dorset Rotulus: Contextualising the Early English Motet (forthcoming).

INTRODUCTION

Musicologists are dependent on the vigilance and generosity of colleagues for information about new material that turns up in unexpected places. I was informed of a new discovery in private possession by Mark Forrest, archivist at the Dorset History Centre. With preliminary photographs, I was able to affirm its importance: two trimmed and nearly adjacent parchment membranes from the beginning of what must have been an imposing rotulus (a roll, or scroll) of the early fourteenth century, containing English polyphonic music. Fragments of liturgical plainsong (usually on four-line staves) are relatively common, and unless they honour an unusual saint, or come with a local context, they rarely extend our knowledge. High-art polyphonic music (part-music, usually on five-line staves, and in measured notation), on the other hand, is much rarer; and unlike the relatively stable plainsong, it went out of fashion and was discarded as it was superseded by new musical styles. I was able to provide a preliminary description of the four large-scale major compositions in the new source, all damaged and incomplete due to trimming. Three were known in fragmentary or different form elsewhere, and one was completely new. All four can now be restored, transcribed and performed.

THE DOCUMENTS

The two fragments are among the rich archival materials from Melbury (Ilchester Estates) recently transferred to the Dorset History Centre, now D-FSI, acc. 10959a and 10959b; they have now been conserved. Each is about 12 × 10 inches; they may not look very prepossessing, but as we have no complete, or even nearly complete, sources from the decades around 1300, and are entirely dependent on fragments recovered from book and document bindings, every new discovery is important.

The two fragments stood at the beginning of the rotulus, which is written in two columns. Both have been cut vertically, losing about half of the second column of each recto (and consequently of the first column of each verso). There is further damage, especially at the bottom of 10959a, whose upper and lower edges are now ragged, apparently from rodent damage. The top and bottom of 10959b have been trimmed off almost horizontally. Both were surely more regularly shaped and similar in size when used to cover now-lost documents. 10959a has a substantial top margin, and both fragments retain a small portion of left-hand margin on rectos, right-hand margin on versos. On each side of the rotulus, the motet on 10959a continues on 10959b with a loss of two staves between the fragments, followed by the second motet on that side. The fragments were either two consecutive membranes, or the top and bottom halves of a single membrane. Both rectos are flesh sides, versos the hair sides of the parchment, so they could be from a single membrane. If two membranes, the two-staff gap between them could account for the sewn join, perhaps cut off and discarded when the parchment was reused for binding. The four large-scale motets were composed and copied in England in the first quarter of the fourteenth century. They are:

10959a – 10959b recto

1 *Ascendenti sonet geminacio/ Viri Galilei/* [Tenor I]/ [Tenor II]

2 *Margareta pascens oves/* [Tenor I]/ [Tenor II]

10959a – 10959b verso

3 *Regina preminencie/ Gemma nitens/* [Tenor]

4 *Naufragantes visita/ Navigatrix inclita/* [Tenor I] *Aptatur/* [Tenor II]

10959a now measures (height x width) *c.* 313 × 280mm, and 10959b *c.* 319 × 251mm. But when projected to their original size, taking account of what has been trimmed, the two motets on the recto once occupied approximately 38 staves and the two on the verso 28 staves. The overall written space originally occupied just by the surviving motets with their continuations was *c.* 900 × 317mm on the recto and *c.* 664 × 317mm on the verso. The projected overall original dimensions including margins are *c.* 1020 × 400mm. This was once an imposing and extraordinarily large-format musical rotulus, with few or no surviving precedents in height and width. Even in its present state, an original width of written space of *c.* 317mm exceeds that for any rotulus or codex of polyphonic music of this period. It almost certainly contained more compositions; if there were two or more additional motets per side it would originally have been at least twice the height, and impressive indeed.

As with most musical genres at this period, the music is notated not in aligned score (which enables one person to read or play the entire texture) but in separate parts. Singers would not have visual control over all the parts, but needed to listen attentively to understand how they fitted together, just as string quartet players now have only their own part in front of them. In most books the equivalent parts would be on facing pages, if necessary with coordinated page turns. Here, the main texted parts are in parallel columns, with the more compactly notated supporting parts below. For these exceptionally long pieces, the roll format has the advantage that it can be spread out, enabling all three or four singers to see all their music at the same time without page turns.

Each side of both fragments is ruled in double columns with a central gap. Double graphite guidelines for the text run unbroken across the central gutter; these are present on the rectos but not the versos. The same graphite is used for vertical rules to demarcate the vertical columns and margins on both sides of the rotulus. Small details of alignment and 'waves' indicate that a rastrum (a five-nibbed pen) was used. Musical staves in each column often align with each other across the gutter, though some do not. But the final staff of the top voice of *Regina/ Gemma* (on 10959a^v), and four staves of its lower voice on 10959b^v, run across the full written width. This attests advance planning of the required ruling, as does the indentation of staves to receive initials, whether or not these were supplied; all this was planned before copying each piece. The recto-verso alignment of staves is remarkably close, so that very similar remnants of the two missing staves that once linked the two fragments are visible on each side.

The layout was very carefully planned overall. Text and music are nearly perfectly coordinated with texted and untexted passages; this involved writing the text first, placing the music above it, leaving the right amount of space for untexted musical passages, and planning the layout of the whole piece, including appropriate staff ruling (two columns or one) and indentations. The gap in the middle of 10959b^v staff 3 preceding the conspicuously spaced-out notes of the texted portion again attest that the words were written first. In a few places, the squashing or overrun of music at the ends of lines is a clear indication that the text for the next section was already in place on the next line. Small gaps in the music before a new text section similarly attest the placing of words first.

Ink colour is consistent, and the close coordination of ruling and text-music placement denote the work of a single scribe. The text hand is neat and accurate, a textura semi-quadrata with rotunda elements and some minor inconsistencies. The music is exceptionally carefully and handsomely notated; the appearance of the whole is entirely professional.

10959a^r must have been the beginning of the rotulus: it has a large head margin, and two florally-decorated three-staff initials in red and blue, the azurite now oxidised to a greenish appearance, for A[*scendenti*] and V[*iri*]. The A also has a small beast at its base, and both initials project outward a tracery of fine red lines and curlicues. On the verso, a three-staff indentation was intended for G[*emma*] in the second column, but not provided. On 10959b^r a decorated two-staff red M[*argareta*] in column 1 has infill and tracery in black ink, and column 2 has a single-staff unadorned red M. On 10959b^v a two-staff unadorned red N[*avigatrix*] heads this piece in the right-hand column, and below it for the tenor is a single-staff gap for the missing A of *Aptatur*, signalled by a guide letter a. Thus only one initial was entered for the surviving incipits of the verso, leaving gaps intended for a three-staff initial (G) and a one-staff initial (A). In that respect, this was not a finished product. Insofar as the assignation of three-staff, two-staff, or one-staff capitals presents a hierarchy, the equal status of *Ascendenti* and *Viri* at the start of the rotulus is clear. Less clear is why the equal upper parts of *Margareta pascens* should have been differentiated by a two-staff and a one-staff initial respectively. The main initials, while not artistically notable, are more elaborate than found in workaday music manuscripts.

We must regret the destruction of the rotulus, but rejoice that at least a small part of it survived because it was recycled as waste. The interior (recto) side is now cleaner than the exterior dorse (verso); the verso sides presumably became dirtier thanks to their subsequent external position in binding. Both fragments have a vertical fold, through which there are pairs of sewing holes; each was once used as the sewn cover of a document. No document has as yet been identified as having ever been attached to either leaf. It is likely that both were used on the same document, not least because the chances of two adjacent fragments from the same original manuscript surviving together is otherwise low. The width of the document(s) to be covered presumably corresponded to about a column and a half of the rotulus. Since neither fragment is folded in the gap between the columns, the whole width of the rotulus would not have sufficed to wrap round a document of that width, which increases the likelihood that the leaves formed the front and back covers respectively of the same document, overlapped and stitched through the spine, and from which they have been further cut down and damaged. The width of the rotulus may not have sufficed for sideways use in a single wrap-around.

The two membranes are now different in size, but this would not originally have been so if they were used to cover the same convolute. The missing staves between them may have rendered them more equal in size. Especially the larger fragment has suffered further damage and must have been more regular. Some of the paired sewing holes between them are similarly positioned; although no exact overall correspondence can be established, it may not anyway have been exact between the front and back of a large informally bound convolute. In the pre-restoration images, traces of thread can still be seen.

The name John Hayward in a hand of around 1600 at the top of 10959a^v presumably refers to the contents of the document for which the fragments formed a wrapper. Mark Forrest reports that this was a rather common name in the area, with no obvious linkage to a specific place, and that there are Haywards and Haywoods in Abbotsbury in the sixteenth and seventeenth century parish registers, but also wills for Haywards in Abbotsbury and at least twenty other Dorset parishes between 1550 and 1750 (Mark Forrest pers.comm 2 August 2019). He adds that it is just as likely, if this was the name of a tenant or steward, that he came from part of the Ilchester estate in Somerset or elsewhere. There is no reason to link it to a famous holder of the name, the English historian, lawyer and politician, Sir John Hayward (*c.* 1564 – 27 June 1627), who wrote on several topics of royal succession, but with no known connection to Dorset. Although the destruction and repurposing of the rotulus could have occurred at any time from the late fourteenth century, the presence of this name raises the possibility that it may have been dismantled after transfer to Strangways ownership.

Working backwards, the two fragments (long separated from any documents they had served to cover) were found among other papers in a chest at Melbury House in Melbury Sampford near Evershot,[1] since 1500 the seat of the Strangways family, which was subsequently combined by marriage with the earls of Ilchester, a peerage created for Stephen Fox, first Baron Ilchester, in 1756. The family was henceforth known as Fox-Strangways, with a succession of earls of Ilchester; their property as Ilchester estates.[2]

Sir Henry Strangways (*c.* 1465–1504) acquired Melbury Sampford *c.* 1500 through his second marriage to the widow of William Browning of Melbury. The estates in Dorset were increased by a grant in 1543 of the nearby Benedictine abbey of St Peter at Abbotsbury following its surrender to the king and dissolution in 1539. Sir Giles Strangways I (1486–1546) was Sir Henry's first son by his first wife Dorothy. He paid £2000 to the Court of Augmentations for the abbey site and manor in 1543, having since 1541 leased the manor from the last abbot, who then became the vicar at the Abbotsbury parish church of St Nicholas. A strong connection between family and abbey dates back to *c.* 1450. All lands at Abbotsbury, the abbey site, advowson, and estate management documents seem to have transferred seamlessly to the family at the Dissolution. It was a condition of the sale that the abbey buildings be dismantled. Strangways used those materials to construct a family mansion house on the site; this was subsequently destroyed in a gunpowder explosion in the civil war in 1644. Any monastic archives stored in that house would have been completely destroyed, but much of the family archive, including what still survives, must have been kept at Melbury (Keynes 1989, 207–43).[3]

Monastic administrative documents would have been stored either in this house or at Melbury. Of these, there survive manor court rolls and accounts from the early fourteenth century onwards, and rentals, surveys and charters that are even earlier — four charters are Anglo-Saxon. The family were known to hold the abbey's cartulary in the seventeenth century, which contained an account of the foundation of the abbey, but it has not been seen since the time of the civil war. There is disappointingly little for us in these archives, but there is the strongest possible likelihood that these membranes came to Melbury from the dissolved abbey, either serving as wrappers for abbey documents from which they have become detached, or from use as waste parchment to protect post-Reformation documents relating to a John Hayward; and that their musical provenance was the wealthy Benedictine monastery of Abbotsbury.

A minster dedicated to St Peter existed by the early 1000s, but the name Abbotsbury exists in a tenth-century charter of King Edmund, suggesting the presence of an earlier monastic establishment. In the mid eleventh century, around 1044, the Scandinavian Christian Orc (Ork, Urk, Urkir, Orcus) together with his wife Tole (Tola, Thola, Thole) reformed the minster into a Benedictine monastery staffed with monks and led by an abbot. Orc had been the local representative and steward of King Canute and continued to serve Edward the Confessor. New buildings of the eleventh and twelfth centuries, including a Norman abbey church, were replaced in a major building campaign of the later thirteenth and early fourteenth centuries, probably starting with a Gothic church and perhaps the abbot's lodging, before the Black Death. A surviving seal may show the Norman church. Isolated fragments of twelfth- and thirteenth-century materials have been identified, and floor tiles of local Dorset manufacture from the original pavement of the Gothic church have been dated to the decades around 1300 (Morris, 2002).[4] Although the monastery was relatively modest in size, its wealth is attested by this ambitious campaign, coeval with the likely date of the musical manuscript. The buildings and fragmentary buildings now standing were erected after c. 1350. Apart from some foundations, only two fourteenth-century buildings survived the destruction of the monastic buildings at the Dissolution: the enormous thatched tithe barn, and the isolated chapel of St Katherine, to be discussed below. Sparse evidence survives about the monastic library at Abbotsbury (Sharpe, 1996; Morris, 2020; Watson, 1987; Hearne 1774).[5] In any case, music and liturgical manuscripts would have been stored and used separately.

MUSICAL CONTENTS

The four motets are listed above and will now be described in summary form. Two of the four (both on the recto) are 'voice-exchange' motets, in which the upper parts alternate text and melisma (= untexted music) and then switch parts with each other so that it would sound like a repeat, with only one part singing verbal text. Three of the four motets were already known from other fragments in various stages of incompleteness, damage, or different versions. In all cases the new source contributes valuable and sometimes radical new material to inform more complete reconstructions, or indeed different versions, of the pieces attested elsewhere. A fourth piece not hitherto known turns out to be extremely interesting, a motet invoking the Virgin Mary and St Nicholas.

1. *Ascendenti/Viri*. The recto contains the upper voices, in two columns side by side, of this Ascension motet. It is in fact monotextual, but partial simultaneous sounding of the main text (*Ascendenti*) with its refrain (*Viri galilei*) makes it sound bitextual in performance. This piece is unusual, as despite the voice exchange, there is no alternation of texted and melismatic segments. Each stanza exchanges music *and* text between the top two parts. The upper parts are fully notated, followed by two lower parts in damaged form. The text 'Viri Galilei' is based on the Introit antiphon at the Feast of the Ascension:

> Viri Galilei, quid admiramini aspicientes in celum?
>
> Alleluia: quemadmodum vidistis eum ascendentem in celum,
>
> ita veniet. Alleluia. Alleluia. Alleluia.

The motet has six sections which correspond to six three-line stanzas in irregular and mostly rhyming couplets, each preceded or followed by the refrain 'Viri Galilei, quid vos admiramini?' The equality of the texts and the refrain-like voice exchange may be reflected in the text's 'twinning' of the trumpets ('geminacio tubarum').

The tenor phrases are laid out so that each segment of the lower parts starts a new staff, a rare instance of format corresponding to musical structure, reflecting the text-driven planning of space. I know of only one other case in which similar formal divisions, such as isorhythmic periods, are articulated by layout in this way.

This motet was known from an incomplete version in London, Westminster Abbey, 12185, fol. 1^r, lacking its facing verso; the whole piece can now be reconstructed. The two remaining folios of that MS contain motets for Ascension, Trinity Sunday, St Michael, and St Nicholas; two of the four pieces here are for Ascension and St Nicholas.

2. *Margareta*. Following the continuation of *Ascendenti/Viri* on the recto are the two upper voices of a huge nine-stanza, seven-section, four-voice voice-exchange motet on St Margaret. They are again presented in double columns and lack their end and the lower voices. There is a small overlap between the end of the surviving portion and four binding strips which contain fragments of the remaining music in London, British Library, Add. 40011B (the Fountains fragments). Together they yield the full verbal text, and a nearly complete reconstruction of the music is now possible. *Margareta* exceeds in scale the hitherto largest surviving voice-exchange motet, *Rota versatilis*, on St Katherine; both of these were in the Fountains strips (Bent, 1981)[6] which, in addition to these two motets on saints Margaret and Katherine, contains a motet on William of York and one each probably addressed to Mary and Jesus.

Figure 1 D-FSI accession 10959a recto. *Ascendenti sonet geminacio/ Viri Galilei/*.

Figure 2 D-FSl accession 10959b recto. *Margareta pascens oves/.*

Rotulus format allowed the full writing out of repeats, whereas when these large pieces were notated in book form they were often compressed (without repeats) in order to accommodate them on a single opening. When the music to be repeated was notated only once, full performance would have required singers to exchange across the book opening, to alternate between facing pages, a layout that may have encouraged abbreviated performance, although the lower parts of such compact presentations sometimes retained repeat indications. With the open-ended format of a roll, even with a very long piece, each upper part could be written out in full, as here. Now that the full extent of this motet is known, it confirms that the format of the Fountains strips must also have been a rotulus.

3. *Regina/Gemma*. The verso of the Dorset rotulus opens with this Marian motet, with three different texts; the beginning of the tenor text is missing. The upper voices are written in the parallel columns; the lowermost tenor part is written across the page on continuous staves below them. Cantus I is unique in both text and music; although it occupies the cut-off left-hand column, fortunately only a few notes are lost at each line change. Much of the tenor that is lost with the gap between the membranes can be musically but not textually restored from a shorter and simplified two-voice version of this piece in Cambridge, Gonville and Caius College, 512/543, notated in score, with the same text under each voice. Tiny fragments of the texted tenor and Cantus I voices of this three-voice version survive in another fragment, London, British Library, Harley 3132; these do little more than attest another copy of the three-part version, but the Dorset fragment permits a nearly-complete reconstruction of what must have been the original form. The Caius manuscript also contains motets on Mary, Peter, the Apostles, Katherine, Thomas of Canterbury, and Pentecost.

4. *Naufragantes/Navigatrix*. This follows *Regina/Gemma* on the verso; it is a hitherto unknown and formally unique four-voice motet addressing the Virgin Mary and St Nicholas. The plainsong tenor *Aptatur*, apparently originally for the obscure St Winnoc, took on a life of its own in the thirteenth-century motet tradition and was used in (now) fourteen motets. One other motet on *Aptatur* honours St Nicholas, but only this new motet presents the tenor on Bb and presents it in an unprecedented way. A second lower voice is partially preserved in the left-hand column; both lower voices have text at the beginning of the motet. It has a uniquely complex system of chained text exchange set to different music; there is a basis in musical repetition with variation, but no voice exchange as such.

The presence of a motet featuring St Nicholas in a manuscript from Abbotsbury is telling. St Nicholas was the patron saint of many constituencies, including sailors and fishermen, on account of the legend that he averted destruction of his ship in a terrible storm by rebuking the waves. From its opening and much-repeated words ('Naufragantes', 'navi', 'nautas'), the motet emphasizes the saint's protective maritime qualities together with the Virgin as star of the sea ('Navigatrix', 'stella marina'). Abbotsbury is just a mile from the coast, and from the still-famous swannery that formerly belonged to the abbey and supplied it with meat. Fishing was a major local industry. The abbey site's spectacular view of Chesil beach and the cove it forms with Portland Bill were the scene of many shipwrecks. Abbotsbury was vulnerable to attacks from the sea, so Nicholas was an obvious choice as a protective patron.

The church of St Nicholas was built in the late fourteenth or early fifteenth century as the parish church of Abbotsbury, alongside the Benedictine abbey church of St Peter. Parts of the church date from the eleventh century, including possibly a stone carving on the west face of the tower which may date from the founding of the abbey; its north wall and north porch date from the early fourteenth century.

In the course of contextualizing the repertory, a few possible candidates for the further missing contents arose, some of them because they were preserved alongside those motets elsewhere, or because of generic affinity. The fragmentary concordant sources have motets on saints Margaret and Nicholas as well as on Mary and Jesus, subjects of the four Dorset motets; they also have motets on St Peter, the dedicatee of Abbotsbury, and St Katherine, who inspired particular devotion at Abbotsbury. These may have been among additional compositions on the rotulus. On the basis of the four preserved

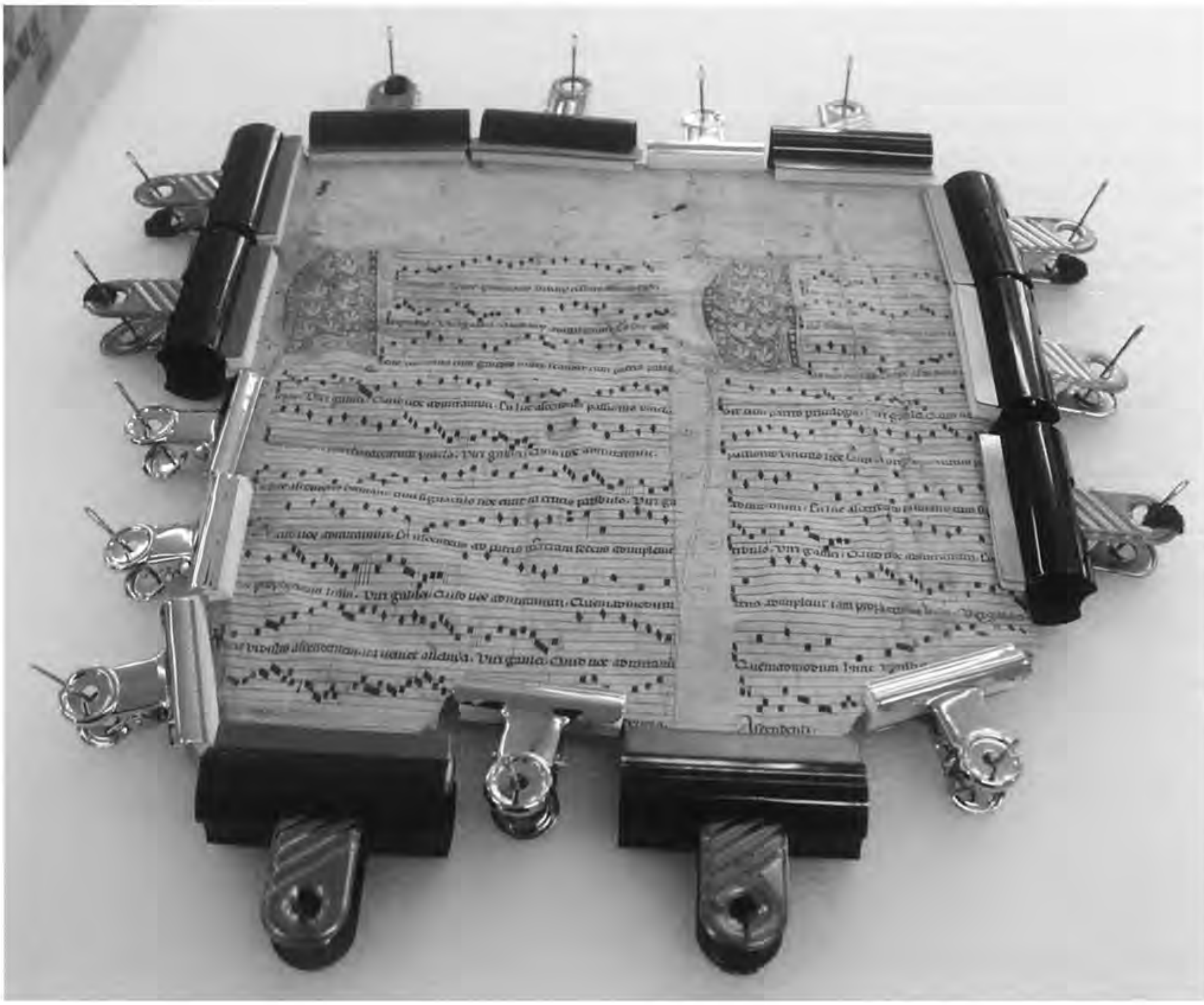


Figure 3 Conservation of the manuscript D-FSI accession 10959a at the Dorset History Centre.

pieces, the compiler seems to have been interested in collecting large-scale motets of considerable formal interest. Because of the particular suitability of roll format to the full notation of large-scale voice-exchange motets, such as the two motets on the recto, a very strong candidate is *Rota versatilis*, on St Katherine. Until the full extent of *Margareta* became known, it was the longest and most ambitious such motet, also with a stanzaic text. Like *Rota versatilis*, *Margareta* was too long to be notated in full on the facing pages of a book, and 'book' copies of *Rota versatilis* were notated in abbreviated form. *Rota versatilis* is in all senses a companion piece to the Dorset motets, and in its fully-notated form was literally a companion to *Margareta pascens* in the Fountains strips, another rotulus. It was cited in a treatise of 1326, which thus yields a terminus ante quem for its composition, and a guide to the dating of similar compositions. It is a strong candidate to have been included on grounds of its high quality and great musical interest, but there are even stronger reasons for its candidacy. The cult of St Katherine was widespread in the late middle ages, but devotion to her was particularly strong at Abbotsbury in the fourteenth century, even more strongly attested than the local devotion to St Nicholas.

Three survivals from Abbotsbury attest this devotion. The first of these is the miraculously preserved St Katherine chapel built by the monks as a pilgrimage chapel outside the abbey precincts, one of a handful of chapels of this kind which are located outside their monasteries. Its isolated setting allowed the monks to withdraw from the monastery during Lent for private prayer and meditation. It is a sturdy rectangular structure built of the local golden buff limestone (Morris, 2020, part I, 2.5.7), situated in a magnificent position overlooking Chesil Beach and Portland Bill, and virtually unaltered since, apart from the removal of its elaborate decoration. The naming of this chapel was part of a wider cult of St Katherine adopted by the abbey.

The second attestation of local veneration is an almost intact breviary of Abbotsbury dating from around 1400, a remarkable survival which came to light only in 2003. It came from Rouen after centuries of uncertain whereabouts on the continent, and was acquired by Lambeth Palace library in 2004.[7] Both the chapel and the breviary are some decades later than our music fragments, but there is no reason to doubt that the abbey's prosperity (including an ambitious building programme) was well established at an earlier date and able to support a rich culture including music. The breviary is presumed either to have been owned by the abbot, or to have been produced for use in the St Katherine chapel. A Katherine wheel is depicted in more than half of the 35 small initials, and in 21 of the 24 most elaborately decorated ones.[8] The text of *Rota versatilis* likewise places particularly strong emphasis on the wheel on which the saint's tormentors attempted to kill her. The word *rota* occurs five times, four of them at the beginning of a line.

The calendar of the breviary (fols. 2–7) designates five categories of observance: in copes, in albs, twelve lessons, three lessons, and commemorations, as in the Westminster Missal of similar date. The saints are in general assigned the same rank as in other Benedictine calendars published by Wormald in the same volume: Katherine and Nicholas *in cappis*, Margaret with twelve lessons. Feasts are entered in black, purple, or red ink, but the colours do not correlate with the status of the feasts and seem to be assigned on decorative grounds. The calendar includes the dedication of the abbey on 12 October ('Dedicatio ecce. s. pet. apli. abbodesbur', fol. 6^{v}, *in cappis*, as are most of the major feasts of St Peter) and the obits of the founders mentioned above, the Scandinavian Christian Orc (or Urki), a follower of King Cnut, and his wife Tola (or Tole), on 21 November and 26 June (fols. 7^{r}, 4^{v}, *in cappis*); they refounded the monastery not later than the 1050s. The marble coffin containing the remains of Orc and Tole was still to be seen in the parish church in the seventeenth century, but was buried nearby in 1750 (Keynes, 1989, 223). Also featured are several obscure saints, some British and some specifically from the West Country. 'Dompnus Rogerus Abb' (16 October, *in albis*) is probably the Roger de Brideton (d. 1258) who was abbot from 1244–56. Local benefactors are also commemorated: Thomas and Eleanor de Luda (fol. 3^{r}, 14 May and 8 May, *in albis*) were buried in the gothic church in the early fourteenth century. Their double gravestone was later split in two and shared between the parish churches of Askerswell and Whitchurch Canonicorum. The distinction given to their obits (*in albis*) suggests that they must have contributed significantly to the abbey's wealth in precisely the period when our musical rotulus was compiled. There is also an Alice Russell (fol. 5^{r}, 7 September, *in albis*) who is likely to be Alice Russell of Kingston Russell, died 1377 (Hutchins 1973, II, 189). Most of the other saints accord with those in a slightly older calendar from Abbotsbury (*c.* 1300), which names neither the founders, nor other contemporaneous commemorations, but is identified solely on the basis of its inclusion of the Abbotsbury dedication feast on 12 October. The calendar appears in a miscellaneous volume, London, British Library, Cotton MS Cleopatra B. ix, fols. 54^{v}–60^{r} (Wormald, 1939, 1–13).

The third testimony is the tiny damaged seal of Walter de Stokes (abbot 1348–54), allegedly used in 1353 and showing St Katherine with a wheel. It is the later of two seals surviving from Abbotsbury, both as sulphur casts in the British Library acquired by the British Museum in 1884.[9] The cataloguer must have known that the original seal was attached to an Abbotsbury document dated 1353, held elsewhere, but this cannot now be located. Neither the date, the association with Abbotsbury and Abbot Walter, nor that St Katherine is represented, could have been known from the seal cast alone.[10] Walter apparently succeeded to the abbacy after his predecessor fell victim to the Black Death, but he is reported to have maintained an extravagant lifestyle and misappropriated the resources of the monastery, to the extent that the bishop of Salisbury intervened.[11]

In any case, the music is earlier than mid century, and the prosperity attested by the later building programme and the breviary is later.

CONCLUSION

As noted at the outset, it is much more common to find fragments of liturgical plainsong reused to bind books or documents than the much rarer polyphonic music. The fact that three scholars have found enough to say about this manuscript, its musical contents and their comparands to fill a book (see endnote 1), is some indication of the importance of this discovery. These fragments together with the Lambeth Palace manuscript add considerably to our knowledge of the daily experience of veneration at Abbotsbury.

ACKNOWLEDGEMENTS

What began as an article for a musicological journal has become a collaborative book: Margaret Bent, Jared C. Hartt and Peter M. Lefferts, *The Dorset Rotulus: Contextualising the Early English Motet* (Boydell, Woodbridge, forthcoming). The reader is referred to this for further documentation, and for full detail and analysis of the music. Colour digital images of the fragments can be viewed on the Digital Image Archive of Medieval Music, www.diamm.ac.uk. The authors are grateful to Andy Poore (Forest & Heritage Land Manager, Ilchester Estates), Mark Forrest, formerly Collections Archivist at the Dorset History Centre, and Jenny Halling Barnard, Conservator at the Dorset History Centre.

NOTES

1. The music leaves, loose in the box, may have been in a relatively modern folder also found in the box, labelled in a nineteenth- or twentieth-century hand as 'Fragments of old accounts & of civil law writings which appear to have no interest'. They were evidently placed in this folder on their recent discovery and removal for archiving.
2. Sir Giles I's eldest son Sir Henry Strangways predeceased his father in 1544 at the siege of Boulogne. His wife was Margaret Manners. Their eldest son Giles Strangways II (1528–62) was 16 years of age when his father's death made him heir apparent to his grandfather Sir Giles Strangways I who took steps to secure his inheritance. Sir Giles II rebuilt the present house after his father's death in 1546, and it has been adapted in several stages since.
3. Much of the present account draws on Simon Keynes, 'The Lost Cartulary of Abbotsbury', *Anglo-Saxon England* 18 (1989): 207–43, which includes an impeccable and detailed report of what can be known about the Strangways family archive, including medieval documents from Abbotsbury. It also reports the sorry loss and dispersal of large quantities of material that had been roughly inventoried in 1604 when handed over to a younger scion of the Strangways family by his guardian (213–17). As to the custody of the archive: 'In 1959 the archive began to be transferred from Melbury to the Dorset County Record Office at Dorchester, where it remains on deposit' (220); this transfer continues. However, Keynes also reports that 'a vast quantity of the papers of the Ilchester family, from their home at Holland House, were sold to the British Museum in 1960, and are now BL Add. 51318–52254' and that 'books and manuscripts from Holland House were sold at Sotheby's between July 1962 and July 1964' (240, n. 157).
4. P. Morris, *Abbotsbury Historic Landscape Research Project: Synthesis Report No. 1*. Ilchester Estates, Melbury Sampford, Dorchester (unpublished, comp. 2002). Part I, Section 2.1 gives rich documentation about the Saxon and Norman periods; a short Section 2.2 reports that very little is known of the abbey in the twelfth and thirteenth centuries; and Section 2.5 fully documents the buildings, including the yield from excavations. The surviving buildings and monuments are also described in detail, with diagrams including the destroyed abbey buildings, in *An Inventory of the Historical Monuments in Dorset, Volume 1, West*. Royal Commission on Historical Monuments (London, 1952), 1–11 and associated plates; available online at https://www.british-history.ac.uk/rchme/dorset/vol1/pp1-11.
5. For the available information see Richard Sharpe, ed., *English Benedictine Libraries: The Shorter Catalogues* (London, 1996), Morris, *Abbotsbury Historic Landscape*, p. B1, as well as Andrew G. Watson, ed. *Supplement to the Second Edition of Medieval libraries of Great Britain: A List of Surviving Books*, ed. N. R. Ker (London, 1987), which records one book with the abbey's *ex libris*, now in the Wormsley Library of Sir Paul Getty (*olim* Camarillo [California], Doheny Memorial Library, 7): 'Zach. Chrysopolitanus. s. xii ex.', and two books assigned on other evidence, but none of these is among the six titles mentioned in John Leland's *Collectanea*; see Thomas, Hearne, ed. *Joannis Lelandi Antiquarii De Rebus Britannicis Collectanea*. Vol. 4. Third Edition (London, 1774), 4: 149. For further details of Abbotsbury books see http://mlgb3.bodleian.ox.ac.uk/mlgb/browse/.

6. See Margaret Bent, 'Rota versatilis: Towards a Reconstruction'. In *Source Materials and the Interpretation of Music: A Memorial Volume to Thurston Dart*, ed. Ian Bent, (London, 1981), 65–98; a revised version is Chapter 5 in *The Dorset Rotulus: Contextualising the Early English Motet*. The only other known St Margaret piece from this period is *Virgo vernans velud rosa*, a very long sequence notated in score, though a largely illegible fragment in Oxford, Bodleian Library, MS Savile 25 appears to contain the words 'crucis ligna carcere draco' and might therefore also be on St Margaret,
7. Lambeth Palace Library, MS 4513. For complete images see http://images.lambethpalacelibrary.org.uk/luna/servlet/s/20v977. The online catalogue description reports: '14th–15th cent. (*c.* 1400), England (South-West: Dorset). Vellum, 214 × 135mm, ff. 9–310. 25 elaborate illuminated initials. Purchased from Bernard Quaritch Ltd., London'. The breviary text begins and ends imperfectly, and lacks approximately eleven other leaves in the text. The services for Thomas Becket (fols. 19, 245) are cut away.
8. Lambeth Palace Library, MS 4513 folios. 28^{v}, 82^{v}, 100^{r}, 141^{r}, 145^{v}, 149^{v}, 153^{v}, 162^{v}, 204^{r}, 207^{r}, 239^{r}, 241^{v}, 244^{r}, 246^{r}, 252^{v}, 273^{v}, 276^{r}, 279^{v}, 283^{v}, 294^{r}, 297^{r}. Three decorated initials incorporate a crowned 'M', representing the Virgin Mary (fols. 209^{r}, 226^{r}, 266^{v}). Fol. 144^{v} is illustrated in Julian M. Luxford, *The Art and Architecture of English Benedictine Monasteries, 1300–1540: A Patronage History* (Boydell, Woodbridge, 2005), plate no. 39, where it is described as early fifteenth century. Luxford's book contains numerous further references to Abbotsbury.
9. The diameter of the very worn older seal, LXII.22, is 5.8cm. The later seal, LXII.23, is 2.6cm, with about a third missing on the left. From Walter Stephen Moule, *Abbotsbury: The Parish Church, the Abbey and other Points of Interest* (Dorchester, 1946), 15, unnumbered note: 'Casts of an 11th century seal of the Abbey (seal LXII 22), and of the seal of Abbot Walter may be seen in the county museum. The seal of Abbot Walter shows St Katherine with a wheel; the Abbot kneeling before her. The originals are in the British Museum.' From W.G. de Birch, *Catalogue of Seals in the Department of Manuscripts in the British Museum*. Vol. 1. (London, 1887), 422, no. 2540: 'A quatrefoiled panel, Katherine with a Wheel, the abbot kneeling before her, damaged (B.M., Seals, LXII 23)'.
10. The earlier matrix (seal LXII.22) 'would appear to date from the late eleventh or early twelfth century'Keynes, 'The Lost Cartulary' 212, n. 38, and may depict the front of the Norman abbey church. Keynes also reports that the original seal is on a charter in The National Archives, Deeds of Surrender, no. 1 (E322/1), so it is possible that the original document with Walter's seal may also be in The National Archives if the two seals travelled together. Neither de Birch, *Catalogue of Seals*, nor Julian Harrison of the British library, nor I can read the remaining inscription on that seal.
11. See William Page, ed., *The Victoria History of the County of Dorset*. Vol. 2. (London 1908). The account under Religious houses, Benedictine monks, Abbotsbury, pp. 48–53, deals only with accounts of the foundation and administration, and neither with the earlier nor the later building campaign. The account on p. 51 blames Abbot Walter for the poverty of the monastery in the few years of his abbacy in the mid fourteenth century. Presumably the fortunes had recovered after the low point of the Black Death before the evidence of late fourteenth-century expenditure. This does not affect the evidence of the monastery's prosperity and building programme at an earlier date. Morris, *Abbotsbury Historic Landscape*, Part I, 2.7, gives a complex and balanced account of his abbacy.

REFERENCES

Bent, M. 1981. 'Rota Versatilis: Towards a Reconstruction', in Bent I. (ed.) *Source Materials and the Interpretation of Music: A Memorial Volume to Thurston Dart*. London: Stainer and Bell. pp. 65–98

Bent M., Hartt J.C. and Lefferts P.M. forthcoming. *The Dorset Rotulus: Contextualising the Early English Motet*. Woodbridge: Boydell.

De Birch, W.G. 1887. *Catalogue of Seals in the Department of Manuscripts in the British Museum*. London: British Museum.

Hutchins, J. 1973. *History and Antiquities of the County of Dorset*, 3rd edition 1861–1874 in four volumes (Westminster: J.B. Nichols and Sons).

Keynes, S. 1989. 'The Lost Cartulary of Abbotsbury'. *Anglo-Saxon England* **18**, pp. 207–43.

Luxford, J.M. 2005. *The Art and Architecture of English Benedictine Monasteries, 1300–1540: A Patronage History*. Woodbridge: Boydell.

Morris, P. 2020. *Abbotsbury Historic Landscape Research Project: Synthesis Report No. 1*. Ilchester Estates, Melbury Sampford, Dorchester (unpublished).

Moule, W.S. 1946. *Abbotsbury: The Parish Church, the Abbey and other Points of Interest*. Dorchester.

Page, W. (ed.) 1908. *The Victoria History of the County of Dorset*. **2**. London: HMSO.

Sharpe, R. 1996. *English Benedictine Libraries: The Shorter Catalogues*. London: Britsih Library.

Thomas, H. (ed.) 1774. *Joannis Lelandi Antiquarii De Rebus Britannicis Collectanea*. Third Edition, London: Benjamin White.

Watson, A.G. (ed.) 1987. *Medieval libraries of Great Britain: A List of Surviving Books* (Ed. N.R. Kerr), *Supplement to the 2nd Edition*. London: Royal Historical Society.

Wormald, F. (ed.) 1939. *English Benedictine Kalendars after A.D. 1100*. **1**. London: Henry Bradshaw Society.

Online Resources

An Inventory of the Historical Monuments in Dorset, Volume 1, West. Royal Commission on Historical Monuments (London, 1952), 1–11. https://www.british-history.ac.uk/rchme/dorset/vol1/pp1-11.

Digital Image Archive of Medieval Music, www.diamm.ac.uk.

Bodleian Library catalogue, Abbotsbury manuscripts, http://mlgb3.bodleian.ox.ac.uk/mlgb/browse/

Lambeth Palace Library, MS 4513. For complete images see http://images.lambethpalacelibrary.org.uk/luna/servlet/s/20v977.

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MARY ANNING (1799–1847) OF LYME REGIS, AND THE GREAT STORM OF 1824

MICHAEL A. TAYLOR

During the Great Storm of 1824, the house and fossil shop of Mary Anning (1799–1847), fossil collector of Lyme Regis, in Cockmoil Square, was supposedly flooded. This popular but physically unlikely story is probably based on misreading Anning's report of flooding in her brother Joseph's premises, and copying a tale set in a house on the Buddle Bridge over the River Lim before 1811 in a children's book. The heroine of Lyme Regis by Harriott Forde included this uncorroborated, improbable and, to the Great Storm of 1824, irrelevant 'tradition.' It is suggested that following a close reading of primary sources it is probable that this was a local corruption of the story of the flooding of Joseph Anning's house/shop confused by later fossil-dealers who appropriated the name of Anning's 'Fossil Depôt.' The Great Storm story therefore exemplifies the inaccuracy characteristic of much writing about Anning, and the care that must be taken in using secondary sources about her life.

INTRODUCTION

Mary Anning the younger (1799–1847), fossil collector and dealer, is today a popular figure of Lyme Regis history and tourism. Initially, together with her mother the older Mary (*c.* 1764–1842) known as 'Molly', she traded from a house and shop in Cockmoil Square, on part of the site of the present-day Lyme Regis Museum. Many books and websites assert that the sea swamped the ground floor of this house during the Great Storm of 22/23 November 1824, and sometimes add that Anning had to be rescued from an upstairs window. The storm, a southerly hurricane with an evident storm surge combined with a spring high tide, certainly caused harm to life and property in Lyme Regis, as reported by George Roberts, local schoolmaster and historian (Roberts 1824a; 1824b; 1834, 174, 236–238; Le Pard 2000). Sea walls and property on the exposed seafront were badly damaged. Still, there is a major discrepancy. No flood in the Anning house is mentioned in a report by Anning herself, and accounts of her by Roberts and other reliable contemporaries, such as the geologist William Buckland and his son Frank, and the resident of Lyme Regis Henry Rowland Brown (Roberts 1834; Taylor and Torrens 2014a; 2014b). The present paper considers the problem by reassessing original sources available in the Dorset History Centre, Lyme Regis Museum and Dorset County Museum. This has included trade directories, land tax lists, images and various documents as well as census information, parish records and wills.

THE COCKMOIL SQUARE FOSSIL SHOP

In the 1824 land tax list signed off on 17 April (none survives for 1825), 'Mary Anning' is occupier of a 'house' rented or perhaps subleased from one John

Hutchings, who leased it from the Corporation of Lyme Regis. The late John Fowles identified the house as a property on the south side of Cockmoil Square, from the newly rediscovered survey of Corporation property by John Drayton of about 1824–1825, and an 1842 sketch labelled as the 'House in which the famous Mary Anning lived when she first sold fossils' (Fig. 1; Fowles 1989; 1991; Draper 2005, 2013; John Fowles, pers. comm. 1985).

This Anning house is often described as backing onto the sea, perhaps because the Lyme Regis Museum (formerly Philpot Museum), lying on the same site, lay open to seaward until the 1990s extension of the sea defences and the 2017 construction of the eponymous Mary Anning Wing. In fact, the Annings' house was surrounded by others on all three seaward sides: on two sides by the L-shaped house of the shoemaker John Bennett, and on the third by the buildings occupied by the schoolmaster Mr Blackmore, and other cottages next to the Guildhall (Figs 1–5). The assumption that the Annings' house had a seaward facade has led to its misidentification as the Bennett house, or the adjacent Cockmoil Street lodging house owned by Martha Love (Figs 1 and 2; Anon. 1830; Draper 2005, plate 6; 2013).

THE GREAT STORM

Anning's account of the Great Storm, in a letter to Frances Bell, on 29 November 1824, is routinely adduced as evidence for the flooding story. Yet Anning's text plainly refers only to her brother's house or shop, as suggested by Pierce (2014, 91–92; Grant 1827, 132–133):

> Every bit of the walk, from the [Assembly] rooms to the Cobb, is gone; and all the back parts of the houses, from the fish-market [in a covered loggia at the front of the Custom House] to the gun-cliff, next the baths. My brother lost, with others, a great part of his property.

Her only living brother Joseph (*c.* 1796–1849) did indeed have a separate shop. He must be the 'Jos.

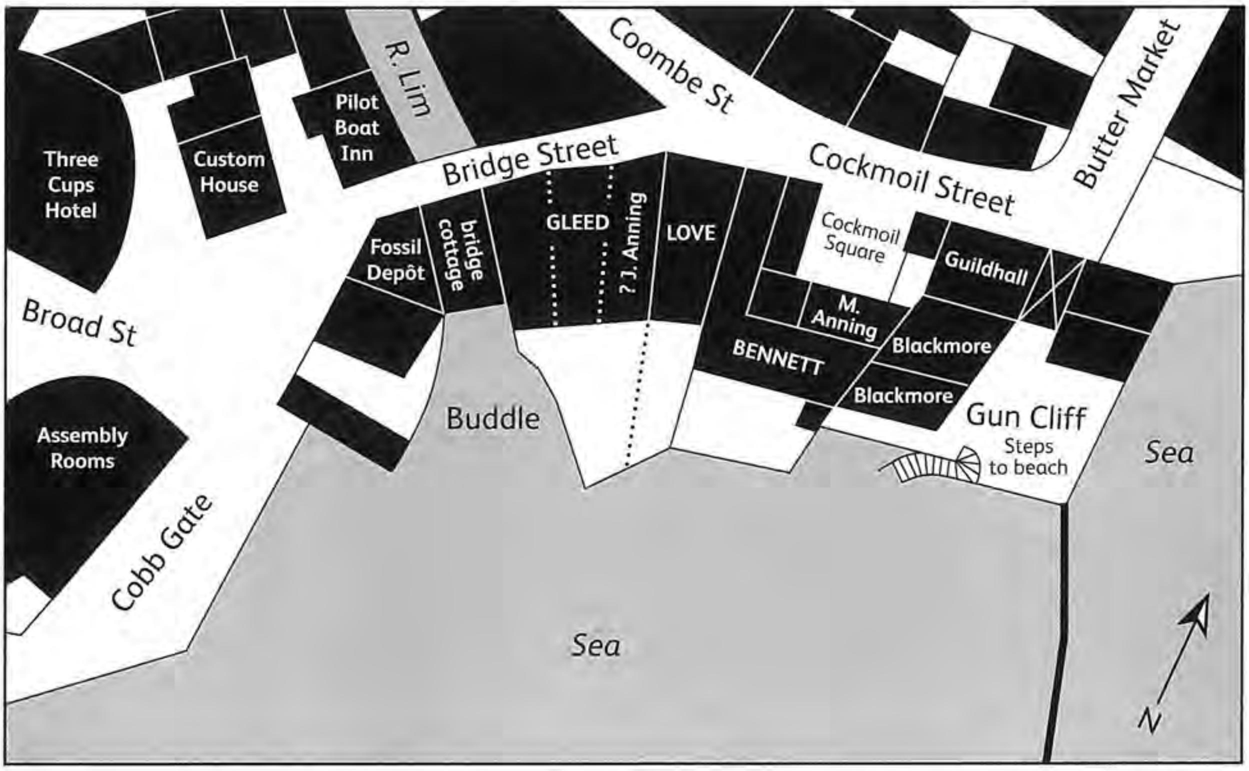

Figure 1 Diagrammatic sketch map Bridge Street, Lyme Regis, with relevant owners or tenants, *c.* 1824 (not to scale). The 'Fossil Depôt' is not Anning's shop but a later business established in the 1850s. Based on a town survey of *c.* 1824, apparently by John Drayton (Lyme Regis Museum 2016/12); Drayton's sea walls survey of 1827 (Lyme Regis Museum 1993/144); Tithe Map of 1841; and the Cox and Davis chart of 1854 (Lyme Regis Museum 1986/267-1).

Figure 2 Charles Marshall *Lyme Regis*, print of 1832 showing the Cockmoil Square area from the south-west, vertically exaggerated by the artist. Love's house is the pale one on the left, with the Bennetts' to its right (Lyme Regis Museum 1946/6). Copyright and courtesy of Lyme Regis Museum.

Anning' – a rare name in Lyme – who rented or more probably leased a 'cottage' or small house in Bridge Street from Reverend John Gleed, Independent minister of Lyme Regis, and occupied it for about 1822–1826 (Figs 1–3 and 6; Anon. 1829; Draper 2011, 93; Taylor in prep). Joseph seems to have occupied only part of the house in question, which raises the possibility that, as a bachelor, he only occupied the shop and still slept and ate at the family home in Cockmoil Square (Anon. 1829). Mary's description exactly matches this shop's location (Figs 1, 2 and 6).

It is unclear whether Mary's reference to 'property' included Joseph's possible leasehold as well as his tools, stock in trade, and personal possessions. In any case, Mary's account is strongly corroborated by records of the fund set up to aid those who sustained losses in the Storm. A single page of the final account, *Storm subscription. The Treasurer in account with the Subscribers*, supports this (Dorset County Museum; Roberts 1834, 174). Joseph received £8. Other recipients included his neighbours Martha Love, and (perhaps) the Mr Moore who occupied another of Gleed's houses. Gleed himself suffered losses in the storm, probably at his own house next to the Lim (Taylor in prep). The Bennett and Blackmore properties were also damaged, and Bennett was made a payment from the fund Warner and Bennett Gupta 1997). However, Molly and Mary Anning did not receive a payment, consistent with their house not being flooded, although admittedly this did not prove that. There is no suggestion of a level of destruction to the Bennetts' property of the kind needed to expose the Annings' house as suggested by Warner and Bennett Gupta (1997, 37, 39). The mention of damage to cellars occupied by the Annings is not backed by specific citations, and is possibly a misinterpretation of Anning's and Roberts's reports.

It is possible that further confusion arose from the apparent destruction of the Annings' house in the mid-19th century, maybe in two storms of 1867 (Draper 2005, 11; Bull 2015). The wording of the 1887

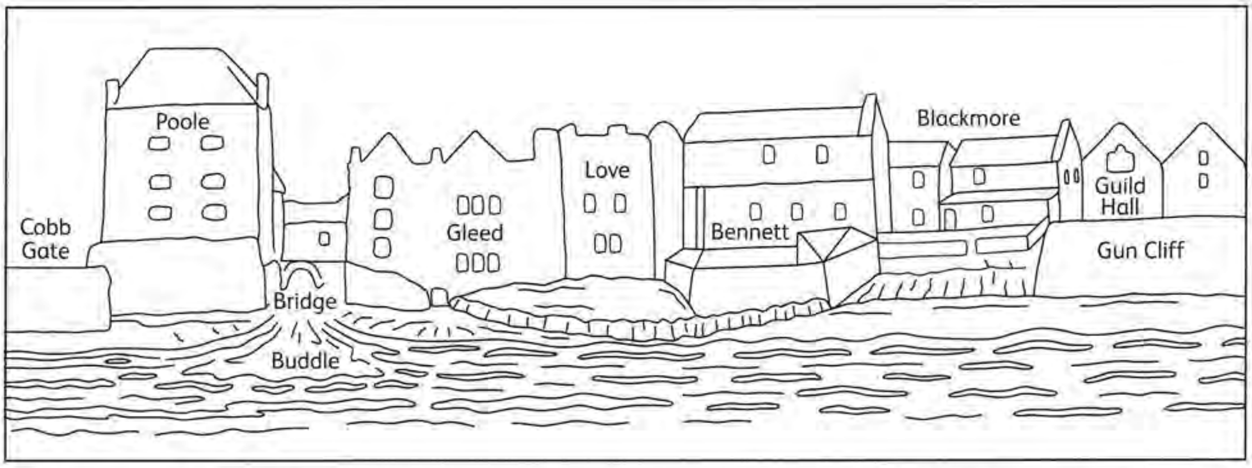

Figure 3 Interpretive diagram of central Lyme Regis from seaward, redrawn from a sketch in Drayton's 1827 survey (Lyme Regis Museum 1993/144). The drawing appears to show the Anning family's house partly visible from seaward, but this is plainly a draughting error for the building in question is on the Blackmore plot (cf. Fig. 4).

deeds cited by Bull (2015) refers only to destruction 'by storm or tempest', but the Museum site was certainly clear by the late 1880s.

THE FLOOD IN THE BUDDLE BRIDGE HOUSE

Another popular modern source for the 1824 flood is the statement that '"the Anning family [...] found that the ground floor of their home had been washed away during the night"' (Lang 1939, 144). William Dickson Lang, was a fine geologist and historian of Anning and her contemporaries. However, there he was only quoting a recent piece in the *Morning Post* newspaper by one 'Marygold Watney', presumably the novelist Marigold Watney (1931). Lang at once continued, '[t]his incident is also mentioned [...] by H. A. Forde, [...] an account which does not give a single reference or authority for any of its statements'. Hugh Torrens (1995, 273–274) identified this author and account as Harriott Anne Forde and the story included in *The Heroine of Lyme Regis*, published in 1925. Torrens was even less impressed (1995) than Lang by this moralizing little book for children, which in his view started the long stream of such Anningiana.

Despite Lang's strictures, Forde did identify one source, 'Annie Anning', a 'little cousin' of Mary's who lived near enough to rush round when the 'Duke of Saxony', (that is, the King), visited Mary's shop. To her disappointment, he was not wearing a crown (Forde 1925, 16–17). This royal visit was in 1844, to the Broad Street shop (Torrens 1995, 269). Annie can therefore be identified with some confidence as Gracia Anna Maria Anning (1832–1917), called simply 'Anna' in the 1841 census, and daughter of Simeon Anning (1795–1864), baker and confectioner also of Broad Street, and his first wife Grace or Gracia Anna Maria Davey (*c.* 1794/5–1846). It is quite plausible that Annie and Mary were cousins, if not necessarily first cousins. Their fathers were born in the same nearby country town of Colyton, Devon and both families attended the Independent Chapel, where Annie was baptised in 1832. Simeon was also an executor for Mary's brother Joseph's widow Amelia in 1858. In 1856 Annie married Charles Brown of the ironmonging family a few doors away in Broad Street. One wonders if Forde got an introduction through knowing Henry Rowland Brown, Annie's new brother in law, in the London literary milieu.

Forde's book, however, credited local 'tradition' for its flooding tale (1925, 4–5):

> Bridge Street [...] was where the Annings lived at first. Their house was on the bridge itself [...] There is a tradition in Lyme Regis about this house that the Annings lived in. One stormy night the family was alarmed by a tremendous crash close to them. Richard Anning, the father, immediately got up to find out what had happened; groping his way carefully from his bedroom, he was suddenly aware of a great gap and a

Figure 4 Postcard of the Gun Cliff area from south-west, around 1889–1900, showing on the left what may be initial ground works for building the Philpot (now Lyme Regis) Museum (completed 1901) on the sites of the Bennett and Anning families' houses (Bull 2015, 48; Lyme Regis Museum 2013/33-6). Copyright and courtesy of Lyme Regis Museum.

> rush of water, where the staircase should have been. The wind was very high, and the sea violently dashing some wreckage against his house, it had broken in the walls, and has positively scooped out the wooden staircase on its exit; leaving however the upper floor uninjured, from which, in the morning, the family were rescued through a window.

The Buddle Bridge, carrying Bridge Street over the River Lim, indeed bore a small house (perhaps divided into two) on its seaward side only (Figs 1, 6; Draper 2011, 90–91, 128–129; Taylor in prep). The booklet seemingly stated, wrongly, that there were bridge houses on both sides of the street, and also referred to the demolition of the bridge houses during street widening (Forde 1925, 4). However, Forde died in 1896, long before the demolition of the houses in 1913 (Taylor in prep). Plainly Forde's manuscript was posthumously revised. The obvious suspect is one (or both) of her two literary-minded sisters, Georgiana Mary Forde and Eleanor Anne Bulley (Torrens 1995, 273) The Bulley family into which Eleanor married was from Cheshire, with no evident links to the Lyme/Teignmouth Bulleys (Michael Cayley, pers. comm. 2019). The question is what was inserted: merely a helpful interjection as to why the bridge house was not now there? Or the entire bridge flood story, which would push its earliest documented publication to the 1920s?

In general, Watney's piece was a fairly balanced effort based on George Roberts's writings (Torrens 1995, 273). However, part of her story was plainly derived from Forde (Watney 1931):

> [...] the family had the unpleasant experience of waking one morning to find that the ground floor of their house had been washed away during the night.
>
> Their home was on Bridge-street, that curious little row of buildings which spanned the mouth of the river [...] everyone was rescued alive out of a bedroom window.

Although there is no explicit reference to a bridge house, this is implicit in the wording, and other clear links to Forde's book are the emphasis on the bridge, the ground floor being washed away, and the upper window escape (the ground floor being later confusingly transmogrified via American writers to the 'first' floor). Forde's account does not date the incident, except insofar as it mentions Richard Anning, who died in 1810. Watney must have inferred the date from this mention combined with a sloppy assumption that Mary the fossilist-to-be was present, 'a few years' after the infant Anning was struck with lightning, an incident which actually happened in 1800. The timing of publication supports the idea that Forde's booklet was Watney's source. It is however possible that they shared an unknown common source especially if the bridge story was added to Forde's manuscript *c.* 1925. Lowton (1997, 36–37) quotes what appears to be a third source, 'written more with entertainment value in mind than reliable recording of historical facts'. Unfortunately Lowton

Figure 5 A. The Gun Cliff area from the east, drawing of 19 August 1825 by unknown artist. The Anning family house is screened from the east by other buildings (Lyme Regis Museum 1979/18-4). Copyright and courtesy of Lyme Regis Museum. B. Interpretive sketch of detail by the author.

Figure 6 Mouth of the Lym, watercolour by Lady Pittar, 1891, showing the bridge. The pedimented house on the right was Love's, with Gleed's houses to its left. Joseph Anning probably occupied part of the ground floor and perhaps first floor next to Love. The future Museum site is vacant (Lyme Regis Museum 1991/102-2). Copyright and courtesy of Lyme Regis Museum.

gives neither reference nor date for this source, which I have been unable to trace, and therefore to evaluate. Moreover, the quoted reference to 'the first door on the right beyond the bridge' does not match the bridge cottage. One wonders if it was actually the first '*street* on the right', which would match the Cockmoil Square location.

Did such an incident happen? Surviving images suggest that the bridge house was indeed wooden, at least in its superstructure, and reworked several times (Fig. 6; Taylor in prep). But it is difficult to see how a piece of flotsam heavy enough to do damage, such as a mast, could be flung high enough by the waves. Matters become more promising for, say, masts and spars as protruding from a ship in trouble. Yet it is hard to see how even a beached hulk could get far up, and into, the shallow Buddle, where the Lim flows out onto the beach in a narrow gap between the seawalls. Either way, such an event would have been newsworthy, even though Mary Anning herself did not become a sustained celebrity till well after 1810 (Torrens 1995; Taylor and Bull 2015). Yet there is no such known report (Richard Bull, pers. comm. 2019). As for whether the Annings ever lived there, there is no evidence for where they lived until the family moved to Cockmoil Square around 1808/1810, recorded in land tax records. This is at least consistent with the bridge story being set before Richard's death in 1810. But writers with local knowledge, such as Roberts, the Bucklands, and Brown, failed to describe such a romantic little tale about the Annings. Brown did, however, quote Anning's letter dealing with her brother's loss in the Great Storm in the second edition of his *Beauties of Lyme Regis and Charmouth*, presumably making this better known locally than Grant's original book (Brown [1859], 51; Taylor and Torrens 2014a).

Figure 7 Market Square and west end of Bridge Street, mid-1850s to c. 1858. On the left is the Pilot Boat Inn, and opposite it is 1 Bridge Street, signed 'Moore's Fossil Depot', with a (modern) whale's shoulder blade (Lyme Regis Museum 2000/7-481). Copyright and courtesy of Lyme Regis Museum.

What at once arouses suspicion is the presence of other fossil dealers in this specific location. John Gleed almost certainly rented the bridge house in the 1820s to supplement his own next door, and he certainly collected and may have traded in fossils (Taylor in prep). Moreover, on the other side of the bridge, at the Cobb Gate end of Bridge Street, there was a shop which sold fossils for many years from the 1850s until around 1910. It was and is routinely confused with Anning's, no doubt partly because it – surely deliberately – reused the title of Fossil Depôt by which Anning's successive shops in Cockmoil Square and Broad Street were sometimes known (Figs 1, 7; Anon. 1826; Anon 1892a, 5). The signs in successive images in the Lyme Regis Museum collection attest its owners till its final demolition for street widening in 1913 (Taylor in prep). After operating elsewhere in Lyme from at least 1839, trade directories and photographs indicate the fossil and music dealers William Moore and his wife Sarah set up here in the mid-1850s (Graham Davies, pers. comm. 2019). On Sarah's death, William soon married Harriet Symes from Burstock in 1866, and almost as soon died in 1867. Harriet married James Dollin in 1871 and continued the business (Anon. 1892b; Taylor and Torrens 1987). One C. Seager had taken over by November 1895 (Anon. 1895). Latterly, the Fossil Depôt was occupied by the fishmonger Sidney Curtis, son of the Back Beach fisherman William Curtis and another Harriet Moore. Lang remembered it as the 'fossil shop, partly fishmonger's, which used to stand between the bottom of Broad Street and the sea. Here one might buy both recent and fossil fish at the same counter' (Lang 1936, 6, fig. 6). To add to the confusion, another fishmonger, one Gush, occupied first one and later both bridge houses as shown by the movement of his signboard in photographs and the 1900 and 1910 censuses (Draper 2011, 129; Taylor in prep).

This strongly suggests that the 'tradition' of the Annings in the bridge cottage was a muddle of various misremembered elements. Two such elements were the Fossil Depôt's name and location. Another was the escape through the window. It might seem an obligatory embellishment of Dorset oral tradition about the Great Storm for example at Fleet (Le Pard 2000, 26), but such an incident certainly happened on the Cobb in the Great Storm (Roberts 1834, 237). An Anning/flood linkage of sorts existed in Anning's letter as quoted in Brown's local guide. All this was probably accreted onto the romantic and highly visible element of the bridge cottage just next door to the Fossil Depôt and, like it, a picturesque highlight in the townscape, often captured by artists and photographers in the collection at Lyme Regis Museum (figs 6 and 7; Draper 2006, 2011; Lyme Regis Museum 2008). There would be all the more time for this conflation to develop, without any inconveniently surviving locals to correct the story, if the tale was inserted in the 1920s, after Forde's death.

DISCUSSION AND CONCLUSION

Not a lot is left of the story of Mary Anning, the Great Storm, and the flood in the fossil shop. It was physically unlikely, even impossible. The commonly quoted source, the letter to Frances Bell, is evidence to the contrary. Another favourite source, Forde's bridge story, smells of later conflation. Even if it were true (for we admittedly do not know where the Annings lived pre-1808), it is irrelevant to Cockmoil Square in 1824. All this, of course, exemplifies the misreading of sources, unwarranted assumptions, sloppy checking, and optimistic conflation of unrelated events, that contribute to the degradation of historical fact in much writing about the unfortunate Miss Anning (Torrens 1995; Taylor and Torrens 2014b). This highlights the fact that considerable care needs to be taken in reading the secondary sources in pursuit of Mary Anning's life and times. The accuracy of her story has to a degree been the victim of her 19th and early 20th century fame and popularity. It is however clearly possible to clarify matters with careful and systematic analysis of the range of statutory, pictoral, and other original sources available in the collections of the Dorset History Centre and local museums. On the positive side, this paper has clarified the history of the Anning family, and suggested questions for future research, particularly about the bridge cottages, as well as the history of development of Lyme Regis during the 19th century.

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REFERENCES

Anonymous, 1826. 'Miss Mary Anning's Fossil Depôt is removed [...]', *Sherborne Mercury* 22 July, 4.

Anonymous, 1829. 'Lyme Regis, Dorset. To be sold, by auction [...]', *Sherborne Mercury*, 24 August, 4.

Anonymous, 1830. 'Lyme Regis, Dorset. To be let, for a term [...]', *Sherborne Mercury* 22 November, 4.

Anonymous, 1892a. *Lyme, fifty years ago*. Turner, Lyme Regis.

Anonymous, 1892b. 'Suicide of the Lyme fossilist', *Bridport News*, 10 June, 5.

Anonymous, 1895. 'The Old Fossil Shop at Lyme Regis', *Bridport News*, 29 November, 8.

Brown, H. R. 1857. *The beauties of Lyme Regis, Charmouth, the Land-slip, and their vicinities topographically and historically considered*. Daniel Dunster, Lyme Regis (reprinted 1997, Lymelight Press, Lyme Regis).

Brown, R. 1859. *The beauties of Lyme Regis, Charmouth, the Land-slip, &c.* Second edition. Longman, Brown, Green and Longmans, London.

Bull, R. 2015. 'Lyme's battle with the sea: part 2: a town on the brink', http://www.lymeregismuseum.co.uk/lrm/wp-content/uploads/2016/08/sea_defences_part_ii_walls_jetties_etc.pdf [accessed November 2019].

Caddy, I. 1993. *Lyme voices 2*. Lyme Regis (Philpot) Museum, Lyme Regis.

Draper, J. 2005. *Cockmoile Square and the Museum area, Lyme Regis. Archaeological assessment and historical survey.* Unpublished report for Lyme Regis Museum.

Draper, J. 2006. *Lyme's first photographers.* Lyme Regis Museum, Lyme Regis.

Draper, J. 2011. *Lyme Regis past & present.* Reprint edition. History Press, Stroud.

Draper, J. 2013. 'The Anning house (now demolished)', in K. Shaw (ed.) *Historic houses of Lyme Regis.* Part 1. Lyme Regis Society, Lyme Regis, 2–4.

Forde, H.A. 1925. *The heroine of Lyme Regis: the story of Mary Anning, the celebrated geologist.* Wells Gardner, Darton, London.

Fowles, J. 1989. 'That the Museum was on the site of Mary Anning's birthplace [...]', in J. Fowles and L.-A. Bawden, *Lyme Regis Museum Curator's Report 1987–1988* [...]. Lyme Regis Museum, Lyme Regis, reprinted 1991 in *The Geological Curator* **5**, 230.

Goodhue, T.W. 2018. 'The other Anning house', in K. Shaw (ed.) *Historic houses of Lyme Regis. Part 4.* Lyme Regis Society, Lyme Regis, 17–21.

Grant, J. 1827. *A memoir of Miss Frances Augusta Bell, who died in Kentish Town, on Monday, the 23d of May, 1825* [...]. Hatchard, London.

Lang, W.D. 1936. 'Anning, of Lyme, collector and vendor of fossils, 1799–1847', *Natural History Magazine* [of the British Museum (Natural History)], **5**, 64–81.

Lang, W.D. 1939. 'Mary Anning (1799–1847), and the pioneer geologists of Lyme', *Proceedings of the Dorset Natural History and Archaeological Society* **60**, 142–164.

Le Pard, G. 2000. 'The Great Storm of 1824', *Proceedings of the Dorset Natural History and Archaeological Society* **121**, 23–36.

Lowton, R. M. 1997. *Mary Anning family and friends.* Old Forge Fossil Shop, Lyme Regis.

Lyme Regis Museum, 2008. *Edwardian Lyme Regis. Drawings by Harold Falkner.* Lyme Regis Museum, Lyme Regis.

Pierce, P. 2014. *Jurassic Mary: Mary Anning and the primeval monsters.* History Press, Stroud.

Roberts, G. 1824a. 'Lyme. November 26', *Western Flying Post & Sherborne Mercury*, 29 November, 3.

Roberts, G. 1824b. *An accurate account of the storm at Lyme, on the 23rd of November, 1824. As contained in a Letter addressed to the Editor of the Sherborne Mercury, with a supplement, containing remarks up to the present time.* Jessep, Lyme Regis.

Roberts, G. 1824c. *Extract from the 'Western Flying Post, Sherborne & Yeovil Mercury' November 29th, 1824.* Sherborne, Dorset [pamphlet reprint of Roberts 1824a; copy in LYMPM].

Roberts, G. 1834. *The history and antiquities of the Borough of Lyme Regis and Charmouth.* Bagster, London.

Taylor, M.A. in prep. 'The Reverend John Gleed (1785–1870), Independent minister and fossil collector of Bridge Street, Lyme Regis', *Proceedings of the Dorset Natural History and Archaeological Society.*

Taylor, M.A. and Bull, R. 2015. 'A token found at Lyme Regis, Dorset, England, apparently associated with Mary Anning (1799–1847), fossil collector', *Proceedings of the Dorset Natural History and Archaeological Society* **136**, 63–67.

Taylor, M.A. and Torrens, H.S. 2014a. 'An account of Mary Anning (1799–1847), fossil collector of Lyme Regis, Dorset, England, published by Henry Rowland Brown (1837–1921) in the second edition (1859) of *Beauties of Lyme Regis*', *Proceedings of the Dorset Natural History and Archaeological Society* **135**, 62–70.

Taylor, M.A. and Torrens, H.S. 2014b. 'An anonymous account of Mary Anning (1799–1847), fossil collector of Lyme Regis, Dorset, England, published in *All the year round* in 1865, and its attribution to Henry Stuart Fagan (1827–1890), schoolmaster, parson and author', *Proceedings of the Dorset Natural History and Archaeological Society* **135**, 71–85.

Taylor, M.A. and Torrens, H.S. 2014c. 'An anonymous account of Mary Anning (1799–1847), fossil collector of Lyme Regis, England, published in *Chambers's Journal* in 1857, and its attribution to Frank Buckland (1826–1880), George Roberts (c. 1804–1860), and William Buckland (1784–1856)', *Archives of Natural History* **41**, 309–325.

Torrens, H.S. 1995. 'Mary Anning (1799–1847) of Lyme; "the greatest fossilist the world ever knew"', *British Journal for the History of Science* **28**, 257–284.

Warner, J. and Bennett Gupta, P. 1997. *The Bennetts of Lyme Regis 1762-1911.* Dovecote Press, Wimborne.

Watney, M. 1931. 'Mary Anning – first woman geologist', *Morning Post*, 4 February 1931, p. 8.

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NEW INSIGHTS ON AN ENIGMATIC SPHENODONTIAN JAW FROM DORSET

JORGE A. HERRERA-FLORES

A specimen in the Society's collection of a virtually complete sphenodontian reptile jaw from the Jurassic coast of Dorset is re-examined. A previous study suggested that this specimen was closely related to Opisthias rarus *from the Late Jurassic of the Morrison Formation, USA. Here, I present preliminary results of a re-examination of the Dorset sphenodontian jaw: my study confirms the close relationship between the Dorset jaw and* Opisthias, *but I also demonstrate that the Dorset specimen presents notable morphological differences from* O. rarus *which suggest that it might represent a new species.*

The Dorset County Museum is notable for its rich palaeontological collection which includes beautifully preserved specimens from the Jurassic coast of Dorset of crocodiles, marine reptiles and microvertebrates such as lizards and sphenodontians (Evans and Searle 2002). The Sphenodontia are a group of reptiles that originated in the Triassic and were highly successful during the Mesozoic, but today are only represented by a single species, the Tuatara of New Zealand (Jones *et al.* 2013). Among the fossils housed at Dorset County Museum, there is an almost complete sphenodontian jaw (DORCM G.10831) embedded in a fragment of rock matrix (Fig. 1A), which has been of uncertain origin and phylogenetic affinity for many decades. Few details of the finding of DORCM G.10831 are known, but accession notes indicate that it comes from the Purbeck Limestone Group at Durlston Bay in Dorset which belongs to the lowermost Early Cretaceous (Berriasian) (Cope 2012), and is thus *c.* 140–145 Ma old (Ogg *et al.* 2008). A preliminary study of DORCM G.10831 was carried out by Evans and Fraser (1992) who concluded that the Dorset specimen had a general shape and tooth morphology similar to that of the sphenodontian *Opisthias rarus*. It should be noted that *O. rarus* is a species that was described more than a century ago by Charles W. Gilmore from the Late Jurassic of Morrison Formation at Quarry 9, Como Bluff, Wyoming, USA (Gilmore 1909).

To investigate more about the taxonomy of DORCM G.10831, and to examine details of the labial view of the jaw, which is still embedded in the rock matrix, I asked Dorset County Museum for a short-term loan to perform CT scanning at the facilities of the Palaeobiology Research Group of the University of Bristol. Once at Bristol, at least four attempts to CT scan the lower jaw were made but, unfortunately, all of them failed due to the thickness and iron-rich composition of the rock matrix. Nevertheless, in early 2018 I had the opportunity to visit the palaeontological collection of the Smithsonian Institution in Washington DC, USA, to review several specimens of fossil lepidosaurs, including the type specimen of the sphenodontian *Opisthias rarus*, which helped me carry out a better comparison between this species and the Dorset specimen.

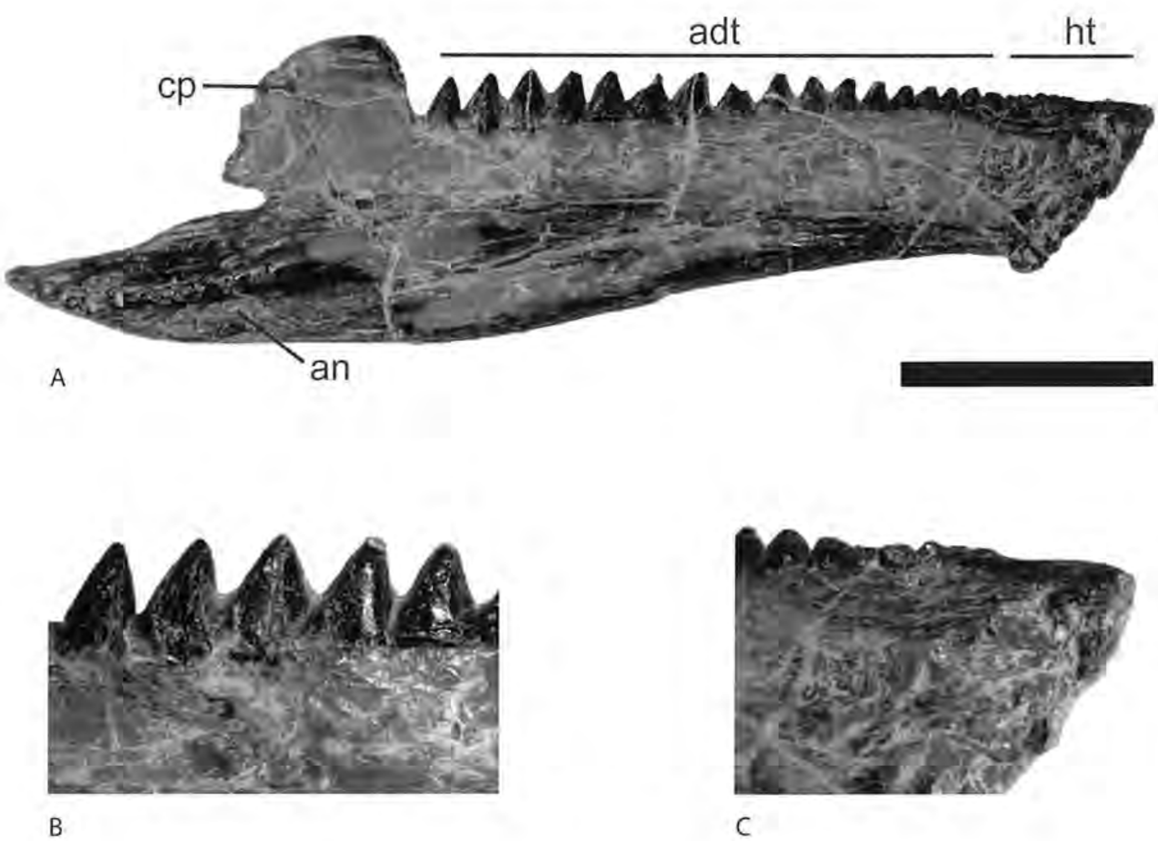

Figure 1 DORCM G. 10831. A, lingual view of the sphenodontian jaw from Dorset, scale bar = 10mm. B, additional teeth with the typical pyramidal-like shape of *Opisthias* but lacking the lateral grooves and flanges present in teeth of *O. rarus*. C, symphyseal region of dentary is noticeably damaged making it difficult to observe any trace of a caniniform tooth. Abbreviations: cp, coronoid process; an, angular; adt, additional teeth; ht, hatchling teeth.

After reviewing the type (USNM 2860) and paratype (USNM 2858) of *Opisthias rarus* and other related material, I confirmed that DORCM G.10831 has some of the key features typical of *Opisthias*, such as the slightly curved pyramidal shape of the additional teeth (Fig. 1B). Nonetheless, the general shape and tooth morphology of DORCM G.10831 are not "identical" to that of *Opisthias* from Morrison Formation as was previously suggested (contra Evans and Fraser 1992). It must be noted that the taxonomy of *O. rarus* is poorly known and problematic and a thorough taxonomical review is needed (e.g. Throckmorton *et al.* 1981; Maldonado 2013; Herrera-Flores and Stubbs 2018); nonetheless, DORCM G.10831 posseses some notable differences from *O. rarus* that suggest that it is a different but closely related species. For example, the general shape of DORCM G.10831 is more robust than that of *O. rarus*, a feature that is especially noticeable in bones such as the angular and the coronoid process (Fig. 1A); also, the additional teeth in DORCM G.10831 lack the grooves and flanges present on the lateral sides of the additional teeth of *O. rarus*, and there is an important difference in the number of additional and hatchling teeth (Fig. 1C) between DORCM G.10831 and *O. rarus*.

I consider that the morphological differences mentioned above strongly suggest that DORCM G.10831 could represent an undescribed species of *Opisthias*, which also confirms that the diversity of the genus has been widely underestimated. Nevertheless, it is still necessary to include DORCM G.10831 in a phylogenetic analysis to infer its relationship with regard to other sphenodontians. Luckily, it seems that the re-examination of an old specimen is leading to the discovery of a new species, which once again shows the importance of taking a second look at those specimens of small vertebrates that have not been re-examined for many years. I hope the future description of DORCM G.10831 as a new taxon will help to increase our knowledge of the diversity of early lepidosaurs from the Purbeck Limestone of Dorset (Evans and Searle, 2002).

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REFERENCES

Cope, J.C.W. 2012. *Geology of the Dorset Coast*, Geologists' Association Guide **22**, The Geologists' Association, London.

Evans, S.E. and Fraser, N.C. 1992. 'A sphenodontid jaw (Reptilia: Lepidosauria) from the Upper Jurassic of Dorset', *Proceedings of the Dorset Natural History Society* **113**, 199–200.

Evans, S.E. and Searle, B. 2002. 'Lepidosaurian reptiles from the Purbeck Limestone Group of Dorset, southern England', *Special Papers in Palaeontology* **68**, 145–159.

Gilmore, C.W. 1909. 'A new rhynchocephalian reptile from the Jurassic of Wyoming, with notes on the fauna of Quarry 9', *Proceedings of the US National Museum* **37**, 35–42.

Herrera-Flores, J.A. and Stubbs, T.L. 2018. 'A re-evaluation of the taxonomy and diversity of the Late Jurassic sphenodontian *Opisthias rarus* Gilmore 1909 (Lepidosauria: Rhynchocephalia)', *13th Symposium on Mesozoic Terrestrial Ecosystems and Biota*, Bonn, Germany.

Jones, M.E., Anderson, C.L., Hipsley, C.A., Müller, J., Evans, S.E., and Schoch, R.R. 2013. 'Integration of molecules and new fossils supports a Triassic origin for Lepidosauria (lizards, snakes, and tuatara)', *BMC Evolutionary Biology* **13**, 208.

Maldonado, J. 2013. *Opisthias* (Sphenodontia) From the Aaron Scott Quarry (Morrison Formation, Jurassic Period) of Central Utah. *Geological Society of America Annual Meeting, Abstracts with Programs*.

Ogg, J.G., Ogg, G. and Gradstein, F.M. 2008. *The Concise Geologic Time Scale*, Cambridge University Press, Cambridge.

Throckmorton, G.S., Hopson, J.A. and Parks, P. 1981. 'A redescription of *Toxolophosaurus cloudi* Olson, a Lower Cretaceous herbivorous sphenodontid reptile', *Journal of Paleontology* **55**, 586–597.

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A TEMPORARY SECTION OF THE ZIGZAG ZONE (BATHONIAN STAGE, MIDDLE JURASSIC) IN SOUTHERN DORSET

JOHN G. HUXTABLE and MARK H. HANLEY

Historically the Zigzag Zone has been considered both as of latest Bajocian or of earliest Bathonian age, dependent upon the region of its occurrence. Many of the fossil ammonite species to be found in the Lower Bathonian present features that have a close affinity with those of the subjacent Bajocian. A new exposure at Burstock of the Zigzag Zone, which includes the Zigzag Bed, is described, together with the ammonite species recorded, re-affirming the basal Bathonian age of the Zigzag Zone of south Dorset.

INTRODUCTION

Around the turn of the 19th century, the abundance of the remains of fossil ammonites to be found in the rocks of the Bajocian Stage had become well known, attracting collectors and researchers both in continental Europe and in Britain. The succession of limestones is known as the Inferior Oolite Group (Barron *et al.* 2012), the highest limestone beds of which, in early literature, were referred to as the 'top limestones' but are now termed the Burton Limestone, belonging to the Parkinsoni Zone. Above was a highly condensed rock that appeared to contain a mix of ammonites which included species of the subjacent Parkinsoni Zone but with many new forms. Following the research by d'Orbigny in France (d'Orbigny 1842–1851), investigations by Oppel of German sections resulted in his erection of a Zigzag Zone which he included in his 'Bath-Gruppe' (Oppel 1865, 309), which was of basal Bathonian age. This position was subsequently confirmed for the British succession, Arkell (1933, 255) having demonstrated that the ammonite fauna described by Buckman from the Dorset coast at Burton Bradstock were of Zigzag Zone age, later confirmed in his monograph (Arkell 1951–58). We would also refer to the extensive work by Torrens (1965, 1974, 1980), which established the chronostratigraphic position of the Zigzag Zone as basal Bathonian (Fig. 1). Whilst the area around Broadwindsor was well known for presenting sections that included the Zigzag Zone, including the Zigzag Bed, the cessation of quarrying limited further research to the remaining extant location at Horn Park (Callomon and Cope 1995), now a Site of Special Scientific Interest. Advantage must be taken to record any temporary exposure.

DESCRIPTION

New but temporary excavations nearby to the old Grange Farm Quarry, Burstock (ST428 024) are recorded. Situated in a small pasture field adjacent to

STAGE	ZONE	SUBZONE	FAUNAL HORIZON	LITHOSTRATIGRAPHY
Lower Bathonian	Asphinctites tenuiplicatus	Not erected	Asphinctites tenuiplicatus (unproven in Dorset)	INFERIOR OOLITE FORMATION (PARS)
	Zigzagiceras (Zigzagiceras) zigzag	Yeovilensis	Oppelia (Oxycerites) yeovilensis	
		Macrescens	Morphoceras (Morphoceras) macrescens	
		Convergens	Parkinsonia (Parkinsonia) convergens	
Upper Bajocian (Pars)	Parkinsonia parkinsoni	Parkinsonia (Parkinsonia) bomfordi	Parkinsonia (Parkinsonia) bomfordi	

Figure 1 A simplified lithostratigraphical table for the basal Lower Bathonian.

another old quarry in which can be seen the Burton Limestone, the location was previously visited and recorded by one of us (JGH 1997, 129) as evidence of the Zigzag Bed was seen in rabbit scrapings at the field edge. A small trench was subsequently excavated that confirmed the presence of the Zigzag Zone. To elaborate the earlier data, a new and expanded section was excavated (September 2019), and the details from both then used to develop a model section (Fig. 2). Whilst the field presented a flat, even surface, we were surprised to discover that in a short distance of 8.0m, the overburden of the Lower Fullers Earth clay (LFE) had thickened from 0.70m to 1.90m, which may either indicate a substantial southward dip of >8º or a minor fault. The measured succession was as follows, from the top downwards:

Bed 5. Topsoil, unconsolidated and merging with the underlying clay with scattered lumps of weathered limestone. 0.20m

Bed 4. Lower Fuller's Earth. This is a senna-coloured clay, silty, quite stiff despite weathering which has

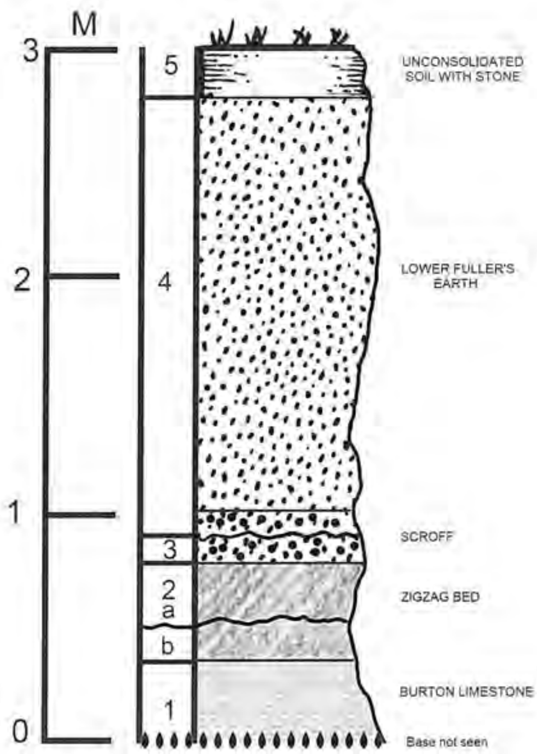

Figure 2 A diagrammatic section of the Zigzag Zone and Burton Limestone (pars.) as recorded at Burstock, Dorset.

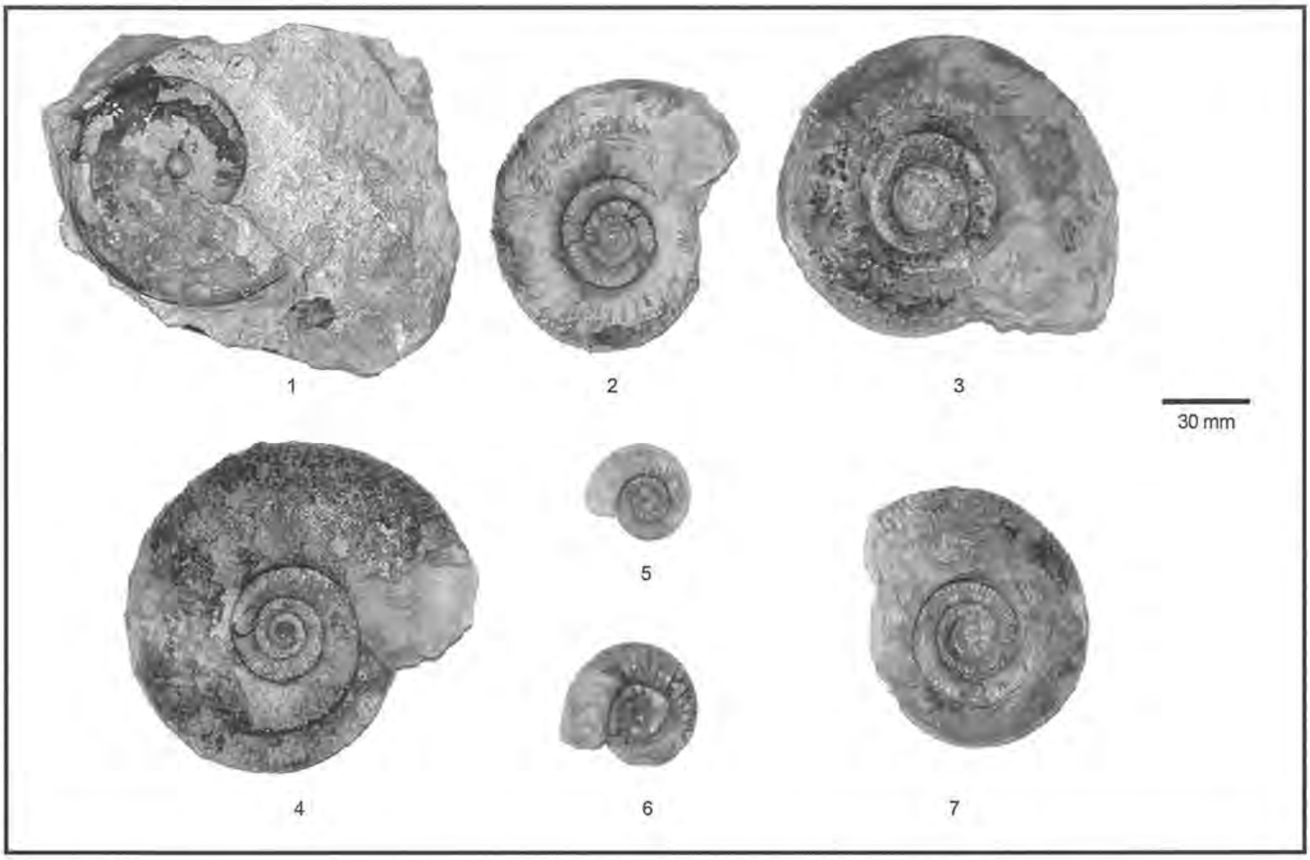

Figure 3 Ammonite specimens referenced in the text. 1. Oppelia (*Oxycerites*) fallax (Gueranger 1805), (G.15309); 2. *Procerozigzag crassizigzag* (Buckman 1892), (G.15310); 3. *P. crassizigzag* (G.15311); 4. *Procerites subprocerum* (Buckman 1892), (G.15312); 5. *Zigzagiceras euryodos* (Schmidt 1846), (G.15313); 6. *Procerozigzag pseudoprocerus* (Buckman 1892), (G.15314); 7. *Procerites* cf. *tmetolobus* (Buckman 1923), (G.15315).

de-calcified the upper 30cm, becoming more plastic, very tenacious and a rich mid-brown colour. It breaks down to a medium to coarse-grained sand of oxidised iron-stained lithic clasts. The macro-fauna is sparse, comprising occasional terebratulid brachiopods cf. *Sphaeroidothyris* and belemnite guards. Towards the base, small nodular lumps of grey marl appear that are the de-calcified remains of bivalves. 1.90m

Bed 3. Scroff. Buckman (1910, 65) introduced the term "Scroff" for this layer of marl, which proved much harder than we previously encountered due to the lack of weathering. A moderately well-cemented, cream coloured limestone (wackestone), it contains abundant but mostly fragmented ammonites, often eroded or rotten, within patches of a buff-coloured, somewhat gritty marl that is veined by ferruginous seams and cemented to bed 2(a). Fairly frequent small examples of *Oxycerites* sp. (Fig. 3.1) suggest that the higher Yeovilensis Subzone may be found nearby if the limestone platform continues to dip. The ammonite genera that could be identified are predominently *Procerites* sp. and *?Procerozigzag* sp. indet. This bed is known to be locally absent, so the top of the Zigzag Bed becomes rotten, very hummocky with clasts of rotted limestone as seen here only in the initial trench due to the greater thinness of the LFE, with resultant weathering. 0.10cm

Bed 2. Zigzag Bed. This bed is highly variable in thickness and may be found up to 45cm thick, as at the nearby former quarry at Horn Park (Callomon and Cope 1995, Fig. 10), where it can be divided into four levels. However, at the new site a much reduced thickness of only two levels, designated 2(a) and 2(b), was determined, based on the presence of the subzonal indices although, as is usual, the zonal index is a rarity and not found. The upper portion of 2(a) may appear nodular, due to a colour mix of a dirty

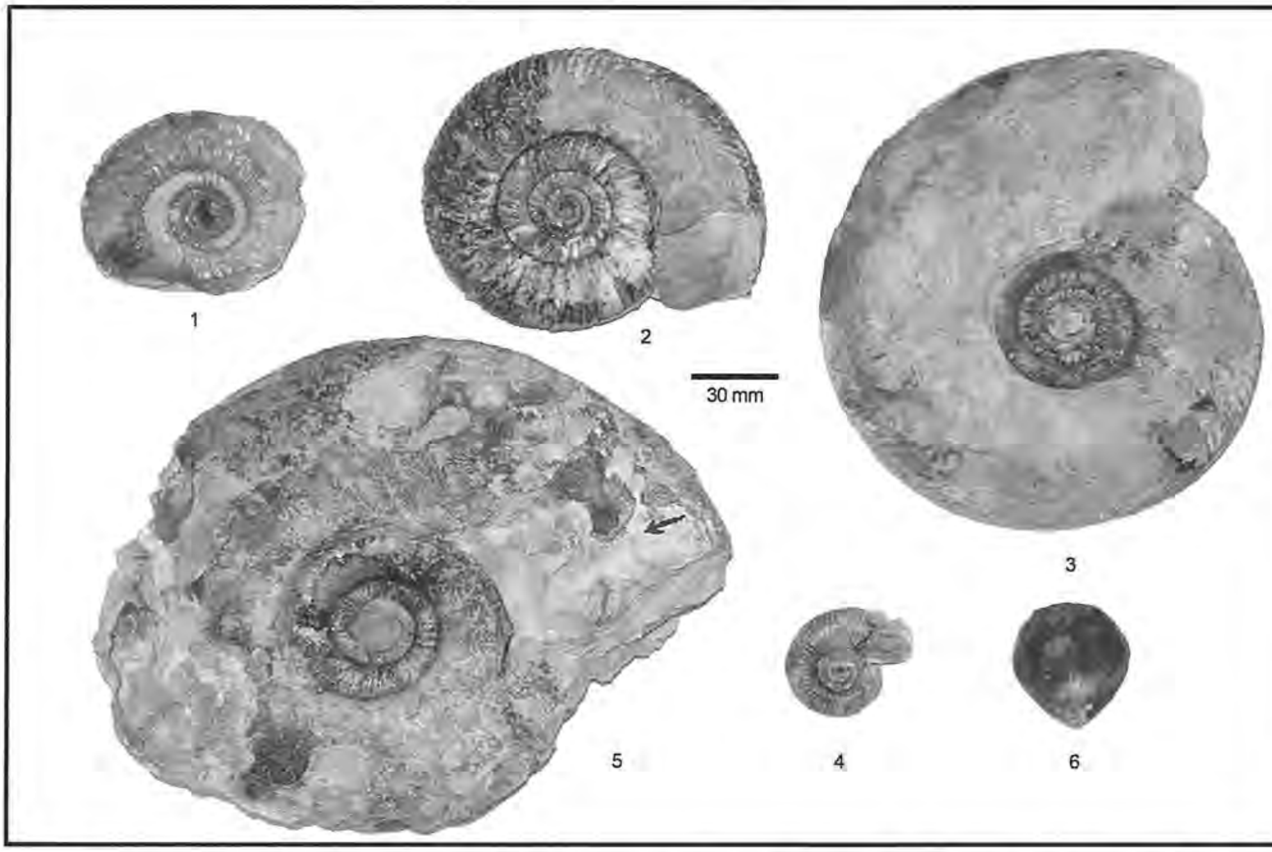

Figure 4 Ammonite specimens referenced in the text. 1. *Parkinsonia Gonolkites) convergens* (Buckman 1925), (G.15316); 2. *Parkinsonia (P.) pachypleura* (Buckman 1925), (G.15317); 3. P. (P.) *pachypleura* (G.15318); 4. *Parkinsonia* (P.) *dorni* (Arkell 1951), (G.15320); 5. *Procerites* cf. *schloenbachi* (de Grossouvre 1919), (G.15321); 6. *Aulacothyris crewkernensis* (Buckman and Davidson 1884), (G.15319).

yellow, buff, greyish-cream with patches of rusty-brown mottling. Overall, thicker portions of the Zigzag Bed rock present a cream-coloured limestone with sparry and micritic calcite components, also being blue-hearted, locally pyritic, with scattered, softer ferruginous patches. The composition of 2(a) is more argillaceous than the lower level, 2(b), the arenaceous nature of which may account for the better preservation of the ammonites. As noted in the first excavation, the strata below the LFE are fissured, allowing the clay to migrate into any crack or other weakness in the lower limestones.

Bed 2(a). Macrescens Subzone. The presence of *Morphoceras macrescens* (Buckman), although partly corroded, enabled us to delimit this rock from the lower portion and assign the ammonite fauna accordingly. Whilst the generally poor preservation of the ammonites limits species identification, we note the following. *Procerozigzag crassizigzag* (Buckman) (Figs. 3.2; 3.3); the first specimen, being encrusted by numerous worm casts and trails, indicated prolonged exposure on the sea floor, so contributing to sedimentary condensation; *Procerites subprocerum* (Buckman) (Fig. 3.4); *Zigzagiceras eurydos* (Schmidt) (Fig. 3.5); *Procerozigzag pseudoprocerus* (Buckman) (Fig. 3.6); *Procerites* cf. *tmetolobus* (Buckman) (Fig. 3.7). Other faunal elements were limited, only large pectinids, usually poorly preserved, belemnite guards and scattered brachiopods. 0.20cm

Bed 2(b). Convergens Subzone. The relative abundance of the subzonal index *Parkinsonia (Gonolkites) convergens* (Buckman) (Fig. 4.1) is as expected but other ammonite fauna are disappointing. Fairly common is *Parkinsonia (P.) pachypleura* (Buckman) (Fig. 4.2); a second figured specimen shows most of the body chamber (Fig. 4.3); *P. (P.)* cf. *dorni* (Arkell) (Fig. 4.4); *Procerites* cf. *schloenbachi* (de Grossouvre) (Fig. 4.5), which was found in the top of the Zigzag Bed. Commencement of body chamber is indicated by an arrow. The early zigzagiforme ribbing, becoming more widely spaced and robust before fading on the final whorl, which is compressed and smooth to give a parkinsoniforme appearance, suggests a transient and rare form as discussed by Arkell *et al.* (1957, 181–3). This basal bed was firmly cemented to the subjacent Burton Limestone, the terminal stratum of the Inferior Oolite of Dorset. 0.15cm

Bed 1. Burton Limestone (Parkinsoni Zone), which proved unfossiliferous in the upper, rubbly part but is probably of Bomfordi Subzone age. This was not excavated but measuring the adjacent quarry edge indicated a thickness of >1.5m.

DISCUSSION

The area around Beaminster/Broadwindsor is a classic location for the Dorset Zigzag Zone, providing many of the ammonite holotypes recorded by Buckman (1909–1930) and subsequently revised by Arkell (1951–58), who confirmed their Bathonian age whilst observing that the Zigzag Bed 'usually forms the top of the Inferior Oolite Series'. The area in which we have recorded the temporary sections was originally first noted by Richardson (1929) who observed 'The true Zigzag Bed – similar to its equivalent at Burton Bradstock – is to be seen in an old quarry about a quarter mile west of Broadwindsor'. Because many of the ammonite holotypes acquired by Buckman were labelled 'Grange Quarry', that location has been the assumed provenance for those labelled simply 'Broadwindsor'. We mention this detail for accuracy of identification, although whether that quarry was worked at the same time is unknown. The Grange Quarry was defunct by 1916.

The extensive research by Torrens has firmly established the basal Bathonian age of the Zone in Europe, followed by a proposal to establish a Global Boundary Stratotype Section and Point (Bas Auran, France) (Torrens 1987). A Bathonian Correlation Chart (Torrens 1980) has already confirmed the stratigraphical position of the base of the Bathonian in south Dorset as at the top of the Inferior Oolite Group. Any new recorded section may be interpreted accordingly, highlighting any local features, such as the condensation of the strata, or recognising that the ammonite zones/subzones as time-related units that are not facies-controlled and may therefore present different lithologies.

Finally, whilst taphonomic comment was not intended, we noted that some ammonoid remains preserved at the junction of the Scroff with the subjacent limestone, appeared to be re-sedimented eroded moulds. This suggests lithification was affected by local seafloor current action influencing the final burial of the re-sedimented moulds, indicating a low rate of sedimentation and so of sediment accumulation associated with sediment starvation, a scenario that fits well for explaining the condensation of the rock of the Zigzag Bed in southern Dorset.

CONCLUSION

The much greater thickness of the Zigzag Zone in mainland Europe would suggest that the southern region of Dorset received only limited input of sediments by comparison, but as each stratum represents an unknown period in time, as likewise do the intervals above and below, the presence of a comparable ammonite fauna is essential to enable correlation (q.v. Callomon 1995). The area around Beaminster/Broadwindsor is recognised as a classic locale for the Zigzag Zone, enabling extensive lists of the representative ammonite faunas (Buckman 1909–1930; Arkell 1950–58; Dietze and Chandler 1997; Huxtable 1997). Whilst it was noted that there is 'a high degree of taxonomic similarity between the Bomfordi (terminal Bajocian Stage) and Convergens (initial Bathonian Stage) subzones (Pavia *et al.* 2008), the latter is confirmed by the incoming of *Parkinsonia (Gonolkites) convergens* (op. cit. p. 287). Therefore we are able to confirm that the Zigzag Bed and Zone at Burstock are conformable with the chronostratigraphical position for the basal Bathonian.

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The figured and other specimens are donated to the Dorset County Museum, Dorchester, the former recorded under DORCM G.15309-15321.

REFERENCES

Arkell, W.J. 1933. *The Jurassic System in Great Britain.* Oxford.

Arkell, W.J. 1951–1958. *Monograph of English Bathonian Ammonites.* Palaeontographical Society, London.

Arkell, W.J., Kummel, B., Miller, A.K., Schindewolf, O.H., Sylvester-Bradley, P.C. and Wright, C.W. 1957. 'Mesozoic Ammonoidea' in R.C. Moore (ed.), *Treatise on Invertebrate Palaeontology, Part L, Mollusca 4, Cephalopoda, Ammonoidea*, Geological Society of America, University of Kansas Press.

Barron, A.J.M., Lott, G.K. and Riding, J.B. 2012. *A Stratigraphical framework for the Middle Jurassic of Great Britain and the adjoining continental shelf.* British Geological Survey, Keyworth, Research Report RR/11/06.

Buckman, S.S. 1910. 'Certain Jurassic (Lias-Oolite) strata of south Dorset and their correlations', *Quarterly Journal of the Geological Society, London* **66**, 52–89.

Buckman, S.S. 1909–1930. *Yorkshire Type Ammonites.* Parts 1–7, Wheldon and Wesley, London.

Callomon, J.H. 1995. 'Time from fossils: S.S. Buckman and Jurassic high-resolution geochronology' in M.J. Le Bas (ed.), *Milestones in Geology*, 127–150. Geological Society, London, Memoirs, **16**.

Callomon, J.H. and Cope, J.C.W. 1995. 'The Jurassic Geology of Dorset' in P.D. Taylor, (ed.), *Field Geology of the British Jurassic*, 51–103. Geological Society, London.

Dietze, V. and Chandler, R.B. 1997. 'New Ammonites from the Zigzag Bed of Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **119**, 109–116.

d'Orbigny, A., 1842–1851. *Paleontologie francaise. Terrain oolitiques ou Jurassique, 1, Cephalopodes.* Masson, Paris.

Huxtable, J.G. 1997. 'A new Dorset Record of the Zigzag Zone (Lower Bathonian Stage, Middle Jurassic)', *Proceedings of the Dorset Natural History and Archaeological Society* **119**, 129–133.

Oppel, A. 1865. 'Geognostische Studien in den Ardeche Departement', *Palaeontologische Mitteilungen aus dem Museum des Koeniglichen Bayerischen Staates* **5**, 305–322.

Pavia, G., Fernandez-Lopez, S.R. and Mangold, C. 2008. 'Ammonoid succession at the Bajocian-Bathonian transition in the Bas Auran area, Digne district, South-East France', *Rivista Italiana di Paleontologia e Stratigrafia* **114**, 287–311.

Richardson, L. 1929. 'The Inferior Oolite and contiguous deposits of the Burton Bradstock-Broadwindsor district', *Proceedings of the Cotteswold Naturalists Field Club* **23**, 253–264.

Torrens, H.S. 1965. 'Revised Zonal Scheme for the Bathonian Stage of Europe', *Carpatho-Balkan Geological Association, VII Congress, Reports* **2**, 47–55.

Torrens, H.S. 1974. 'Standard zones of the Bathonian', *Memoires du Bureau des Recherches Geologiques-Minieres, Paris* **75**, 581–604.

Torrens, H.S. 1980. 'Bathonian correlation chart' in J.C.W. Cope (ed.), *A correlation of Jurassic rocks in the British Isles, Part 2, Middle and Upper Jurassic*, Geological Society Special Report **15**.

Torrens, H.S. 1987. 'Ammonites and Stratigraphy of the Bathonian rocks in the Digne-Barreme area (South-Eastern France, Dept. Alpes de Haute Provence)'. (Notes for a revision constructed from material left by Carlo Sturani), *Bolletino della Societa Palaeotologica Italiana* **26**, 93–108.

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TEMPORARY EXPOSURES OF THE CRACKMENT LIMESTONE (MIDDLE JURASSIC, LOWER BATHONIAN) AT MILBORNE PORT, SOMERSET

JOHN T. WHICHER and ROBERT B. CHANDLER

Two temporary exposures of the Inferior Oolite, Crackment Limestone at Milborne Port, Somerset are described. They are of interest as exposures in this area are poor or infrequent. The ammonites enable the rocks to be dated as convergens *faunal horizon, Convergens Subzone, Zigzag Zone of the Lower Bathonian. A perisphinctid ammonite atypical of this horizon is described and the variability of the palaeobiospecies of* Parkinsonia convergens *(S. Buckman) at the* convergens *faunal horizon level is shown to include discoidal, evolute variants.*

INTRODUCTION

We describe two temporary exposures, close to one another in Milborne Port, Somerset, which provide new geological information in an area where there have been relatively few exposures in the past. The town lies close to the Dorset border and the description here concerns the Middle Jurassic, Crackment Limestone, the upper part of the Inferior Oolite Formation which underlies much of the adjoining area of Dorset.

The geological setting of Milborne Port is aptly described in Collinson's 'History of Somerset', published in 1791. "The situation is very pleasant being in a vale nearly surrounded by fine hills and in a healthful soil. This parish contains about four thousand acres of land and feeds annually about two thousand five hundred sheep. The enclosed part is mostly arable and produces good crops of all sorts of grain: the soil is stone rush. There is maul and stone for rough building and for repair of roads: but it is of a soft kind and quickly turns to dirt. It contains few (if any) fossils." (Collinson 1791).

Milborne Port is situated within an area underlain by a block of Upper Inferior Oolite limestones. To the west lies the Poyntington fault which displaces the block about 3km south (Barton 1989). To the east the regional dip results in progressively younger rocks of the Lower Fuller's Earth Member of the Fuller's Earth Formation, Fuller's Earth Rock Member and Frome Clay Formation appearing at the surface. A number of temporary exposures have been recorded in the area, primarily in the Fuller's Earth Rock Member. The nearby Laycock Railway Cutting (ST 6785 2134) is the best single exposure of this formation in South Somerset. Exposures of the Lower Bathonian, Zigzag Zone are rare; the only locality in the area to have yielded fossils *in situ* is at Goathill Farm (ST 6745 1715). It is thus of interest to record two new temporary exposures of the Crackment Limestone (Zigzag Zone, Convergens Subzone) at Gainsborough on the western edge of the town.

During two phases of construction, one small trench for pipe installation in 1998 and a large scale housing project close by in 2019, rocks were exposed yielding relatively common ammonites adequate to provide an age in terms of ammonite faunal horizons as employed by Callomon and Chandler (1990).

Repositories

Specimens are part of the Wessex Cephalopod Club Collection and carry the prefix WCC. Specimens will be deposited in the Dorset County Museum, Dorchester.

LOCAL DETAILS

The Inferior Oolite Formation constitutes the lower part of the Middle Jurassic and includes the Aalenian, Bajocian and part of the Lower Bathonian (sub)stages. On the Dorset coast there is a marked lithological change at the top of the Zigzag Bed (see Fig. 1) into the mudrocks of the Fuller's Earth Formation of the Great Oolite Group. On the border of Dorset and Somerset in the region of Milborne Port the upper extent of the limestone facies, which extends to a higher horizon, is termed the Crackment Limestone and is palaeontologically included in the Lower Bathonian, Zigzag Zone. The subdivision of the Inferior Oolite Formation is given in Fig. 1. The upper part, of consideration here, is taken to begin at the base of the Banksii Subzone of the Niortense Zone coincident with the base of the Upper Bajocian Substage. Locally in the Sherborne area of Dorset there is no marked lithological change from subjacent strata across this boundary, criteria for division being based on palaeontological grounds. Above there is a transition into less fossiliferous, rather fine-grained, massive limestones that extend into the Lower Bathonian.

Historically the upper part of the Inferior Oolite Formation has been subdivided, from below upwards, into the Sherborne Building Stone (Richardson 1932), the Rubbly Beds (Buckman 1893) and the Crackment Limestone (White 1923). This has been formalised by Chandler *et al.* (2014) with the erection of the Sherborne Limestone Member, comprising the Sherborne Building Stone Beds and the Redhole Lane Beds above and the Combe Limestone Member comprising the Rubbly Beds. The strata of the Crackment Limestone that lie above these are 6–10m thick and form an important part of the Inferior Oolite in the Bradford Abbas, Sherborne, Milborne Port area.

The Geological Survey Technical Report on the geology of the Milborne Port district (Barton 1989) describes the Crackment Limestone as 'thinly bedded white limestones interlayered with pale brown marl, clay or marly limestone. The sequence is poorly fossiliferous'.

The most extensive, though inaccessible, exposures of the Crackment Limestone occur in the road cutting on Crackment Hill (ST 6677 1870). Richardson (in White 1923) described some 9m of well bedded cream to white limestones with marly partings

<table>
<tr><th colspan="4">Lithostratigraphy</th><th>Biostratigraphy</th><th rowspan="2">Zone</th><th rowspan="2">Subzone</th><th colspan="2" rowspan="2">Stage/ Substage</th></tr>
<tr><th colspan="2">North Dorset</th><th colspan="2">South Dorset</th><th>faunal horizon</th></tr>
<tr><td colspan="2">Lenthay Beds</td><td colspan="2">The Scroff</td><td>yeovilensis</td><td rowspan="3">Zigzag</td><td>Yeovilensis</td><td colspan="2" rowspan="3">Bathonian (part)</td></tr>
<tr><td rowspan="2">Crackment Limestone</td><td rowspan="14">Inferior Oolite</td><td colspan="2" rowspan="2">Zigzag Bed</td><td>macrescens</td><td>Macrescens</td></tr>
<tr><td>convergens</td><td>Convergens</td></tr>
<tr><td rowspan="4">Halfway House Fossil Bed</td><td rowspan="4">Burton Limestone</td><td>Sponge Bed</td><td>bomfordi</td><td rowspan="5">Parkinsoni</td><td>Bomfordi</td><td rowspan="12">Bajocian</td><td rowspan="12">Upper Bajocian</td></tr>
<tr><td rowspan="3">Truellei Bed</td><td>pseudoferruginea</td><td rowspan="3">Truellei</td></tr>
<tr><td>truellei</td></tr>
<tr><td>parkinsoni</td></tr>
<tr><td rowspan="3">Combe Lst. Mem.</td><td colspan="2" rowspan="4">Astarte Bed</td><td>rarecostata</td><td>Acris</td></tr>
<tr><td>tetragona</td><td rowspan="3">Garantiana</td><td>Tetragona</td></tr>
<tr><td>subgaranti</td><td>Garantiana</td></tr>
<tr><td>Sherborne Lst. Mem.</td><td>dichotoma</td><td>Dichotoma</td></tr>
<tr><td rowspan="4">Oborne Roadstone Bed</td><td colspan="2">? unproven</td><td>davidsoni</td><td rowspan="4">Niortense</td><td>Baculata</td></tr>
<tr><td colspan="2">Red Conglomerate</td><td>polygyralis</td><td>Polygyralis</td></tr>
<tr><td colspan="2" rowspan="2">? unproven</td><td>aplous</td><td rowspan="2">Banksii</td></tr>
<tr><td>banksii</td></tr>
</table>

Figure 1 Lithology and ammonite faunal horizons, zones and subzones of the Inferior Oolite (Bajocian) of Dorset and Somerset, UK.

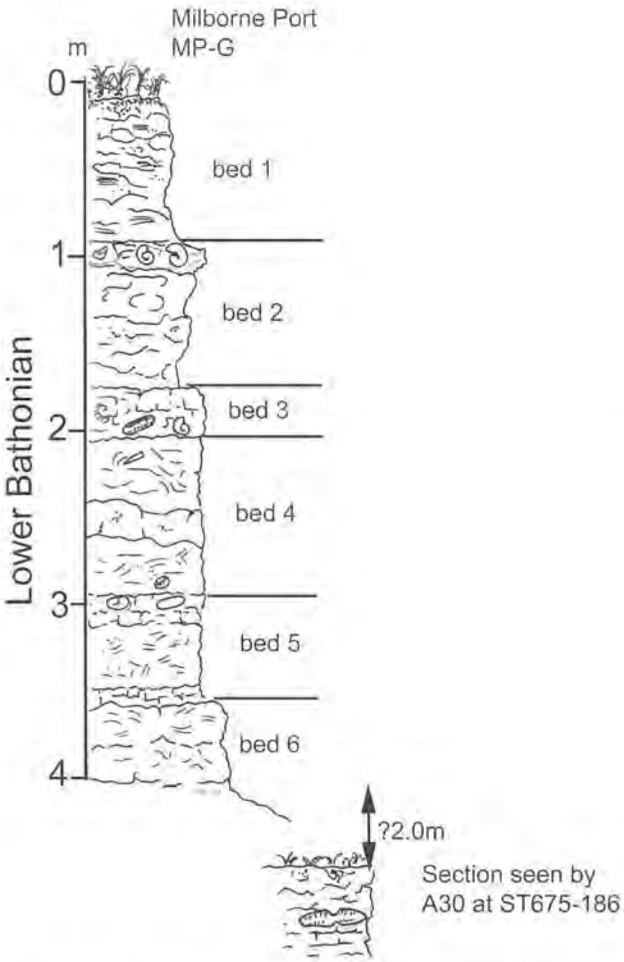

Figure 2 Diagrammatic representation of the exposures.

from here and from an adjacent quarry, now filled in, near Crackmore Lodge. He recorded few fossils, other than the ubiquitous *Pholadomya* sp., *Pleuromya* sp., *Sphaeroidothyris sphaerodalis* (Sowerby) and *Belemnopsis bessina* (d'Orbigny). The absence of ammonite records unfortunately did not allow identification of the precise stratigraphical horizon. Collections made by G.A. Kellaway, of the Geological Survey, and the Rev Joseph Fowler in a trench extending from Poyntington Hill (ST 6220 2000) to Combe Hill (ST 6680 1930) (Kellaway 1938) in 1936 and at other temporary sites at Wheathill Lane and near Ven House yielded the ammonites *Parkinsonia convergens* (S. Buckman), *Parkinsonia. pachypleura* S. Buckman and *Procerites* spp. The Crackment Limestone is exposed in a railway cutting 300m east of Oborne Lane (ST 6592 1852) (Barton 1989). A temporary exposure near Castle Farm, 250m NNW of Sherborne Old Castle (ST 6475 1708), exposed 2m of rubbly shelly limestone with *P.* aff. *pachypleura* and *Procerites* sp., indicating the Zigzag Zone (Barton 1989). A locality near Goathill Farm (ST 6745 1715) yielded many *Parkinsonia* spp. and *Morphoceras macrescens* (S. Buckman), indicating the Zigzag Zone, Macrescens Subzone (Torrens 1969). Further north Richardson (1916) described an exposure in the road cutting of the disused Milborne Port railway station (ST 6752 2090) revealing 3.5m of shelly limestones attributed to the Crackment Limestone. North-north-east of the old station a trench (ST 6751 2100 to 6753 2103) exposed 0.4m of fossiliferous limestones containing gastropods, bivalves and a *Parkinsonia* sp. resembling Crackment Limestone. Chandler *et al.* (1999) found rocks containing *Procerites subprocerus* (S. Buckman), *Parkinsonia subgaleata* (S. Buckman) and *P. pachypleura* indicating the Zigzag Zone, Convergens Subzone on the eastern edge of Sherborne.

Barton (1989) concluded that the Crackment Limestone spans the Convergens and Macrescens subzones of the Zigzag Zone and that the overlying Lenthay Beds are within the Yeovilensis Subzone.

THE EXPOSURES

The building site

Centred on ST6725 1860, section at Fig. 2.

This extensive very shallow excavation covers an area of several hundred square metres just north of the A30 and west of Gainsborough, at the western end of Milborne Port. There have been many small deeper excavations for drainage pipes and for the 'retention pond'. Over a number of visits to the site at various stages of development a composite section was compiled. The section is as follows.

There appears to be a slight northward dip. Bed thicknesses are approximate. Beds are numbered downwards as no comparable records have been published.

The section

From above (Fig. 2):

Top soil and building waste.

Bed 1. Hard limestone (*c.* 0.30m) at top, brown, marly mudstone patches, burrowed, broken into rubbly slats downward. *c.* 1m.

Bed 2. Hard, massive to blocky, brown, fine-grained limestone, intensely burrowed with traces of limonite at burrow edges. At the top (-1.0m) a level of hard, mid-brown, fine-grained limestone forming a continuous bank; fossils in distorted and poor condition. All as internal moulds mostly fragments of large ammonites. *c.* 1m.

Bed 3. Hard, massive, brown-orange, banded in parts by burrowing; burrowed, fine-grained limestone with abundant broken, small-shell debris. Fossils fairly common including *Parkinsonia* spp., *Procerites* spp. and large ammonite body-chambers. Bivalves, including oysters, belemnites. *c.* 0.30m.

Bed 4. Massive, thick-bedded limestone, brown, fine-grained with two levels of irregular, impersistent stone bands, burrowed, slatty in parts. Occasional ammonites. Marly degraded limestone at base, fissile. *c.* 1.0m.

Bed 5. Limestone as above, separated from bed above by a thin broken-up stone band at the top. Occasional ammonites, bivalves and a single brachiopod. *c.* 0.5m.

Bed 6. Hard limestone band at top (0.20–0.25m). Massive, brown limestone below divided into two roughly equal courses by a wavy parting. No macrofossils seen. *c.* 0.5m.

Fossils have been collected from all over the site, in particular with the help of the personnel of the groundwork contractors, CJL Construction Ltd. It is thus impossible to assign fossils to particular beds, although we have a specimen *in situ* from Bed 3 (Table 1).

The fauna is dominated by large parkinsonid macroconchs which are ascribed to *P. convergens*, and *P. subgaleata*. The microconchs are ascribed to *P. pachypleura*. The perisphinctids *Procerozigzag pseudoproceras* (S. Buckman), *P. subprocerus* and *Procerites* sp. occur as does *Oxycerites fallax* (Guéranger). *Pholadomya lirata* (J. Sowerby) is common (Table 1; Figs 3–5).

A30 roadside excavation

Located at ST6740 1855, section at Fig. 2.

Excavation at the junction of Gainsborough and the A30 about 130m to the south east of the previous site.

The section

From above (Fig. 2):

Top soil 0.01m

Yellow limestone, fine grained and mostly soft with abundant brown muddy pockets. Some harder areas with a little sand and congregations of finely broken echinodermal debris. Due to the proximity of the surface the rock was badly weathered, and broken and little bedding could be made out. Fossils occur throughout but are scarce apart from ammonites, *Parkinsonia* spp. Belemnites, bivalves, and one nautiloid were also found. *c.* 0.75m.

The fauna is identical to the previous section with *P. convergens*, *P. subgaleata* and *P. pachypleura*.

DISCUSSION

The paucity of fossiliferous exposures of the Crackment Limestone in the Milborne Port area make these excavations worthy of record. In south Dorset a number of horizons belonging to the Lower Bathonian are mixed in the Zigzag Bed. At Milborne Port it appears possible to discriminate a portion of strata belonging to the Convergens Subzone of the Zigzag Zone. The main ammonite occurrences are a continuation of those of the highest Upper Bajocian along with the addition of new forms and the disappearance or reduction in abundance of others.

Characteristic parkinsonids are present in these excavations which give a reliable indication of the age of the sediments. *P. convergens* and *P. subgaleata* differ only in the latter being slightly more inflated and reaching a larger size (Arkell 1951). It is reasonable to

Table 1 Table of locations and biometry of specimens recorded. Phragmocone diameters are estimated due to overlapping of the body-chamber in all cases. BS, Building site; A30, A30 roadside excavation. Specimens denoted with an asterisk are figured. The morphospecies members of each genus in the list probably constitute a palaeobiospecies group at that specific stratigraphical level.

Morphospecies	Location	Diameter mm	Phragmocone diameter mm	WCC accession number
Parkinsonia convergens	BS	110	-	5664 *
P. convergens	BS	260	200	5683
P. convergens	BS	200	-	5685
P. convergens	BS	200	120	5666 *
P. convergens (evolute form)	BS	220	130	5669 *
P. convergens (evolute form)	BS	230	140	5682
P. convergens (evolute form)	BS	220	190	5686
P. convergens (evolute form)	A 30	400	290	5672
P. convergens (evolute form)	A 30	250	190	5673 *
P. convergens (evolute form)	BS	220	220	5684 *
Parkinsonia subgaleata	BS	200	140	5667 *
Parkinsonia pachypleura	BS	120	90	5662 *
P. pachypleura	BS	110	75	5663 *
P. pachypleura	BS	120	80	5678
P. pachypleura	BS	65	-	5679
P. pachypleura	BS	130	80	5680
P. pachypleura	BS	110	-	5681
P. pachypleura	BS, Bed 3	120	80	5699
P. pachypleura	A 30	110	80	5674
P. pachypleura	A 30	120	-	5675
P. pachypleura	A 30	100	-	5676
P. pachypleura	A 30	80	-	5677
Procerozigzag pseudoprocerus	BS	170	-	5670 *
P. pseudoprocerus	BS	fragment	-	5687
P. pseudoprocerus	BS	150	90	5688
P. pseudoprocerus	BS	fragment	-	5689
Procerites subprocerus	BS	90	90	5660 *
Procerites sp.	BS	300	210	5668 *
Oxycerites fallax	BS	90	85	5665 *
O. fallax	BS	110	70	5671

assume (Callomon personal communication, Dietze *et al.* 2000) that they represent variants of the same, rather characteristic, palaeobiospecies. Some of the specimens obtained reach a large size (see Table 1), becoming quite evolute and may represent a new morphospecies of the genus *Parkinsonia*, as their morphology represents a new variation on that seen in specimens from the Convergens Subzone to date. The large size may be due to favourable environmental conditions. The accompanying microconchs centred on *P. pachypleura* and spp. aff. are more conservative in morphological variability. The parkinsonids indicate a faunal horizon within the Convergens Subzone and place the sediments at the base of the Zigzag Zone. No specimens of *M. macrescens* were found suggesting the absence of sediments representing the higher Macrescens Subzone in these excavations.

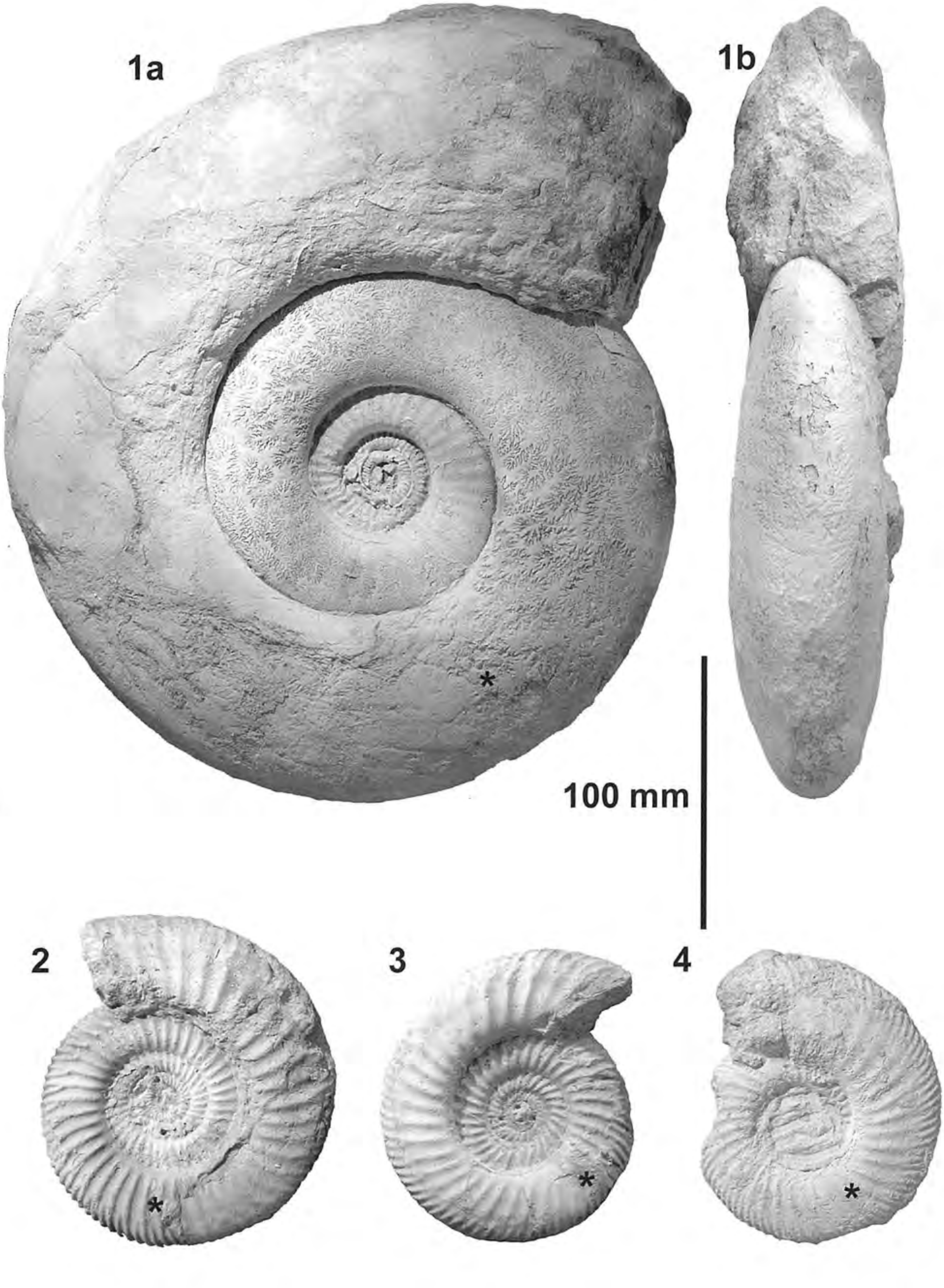

Figure 3 1a, b. *Procerites* sp., (WCC 5668). 2, 3. *Parkinsonia pachypleura* (S. Buckman), (WCC 5662, WCC 5663). 4. *Parkinsonia convergens* (S. Buckman), (WCC 5664). Asterisk indicates last preserved septum of the phragmocone.

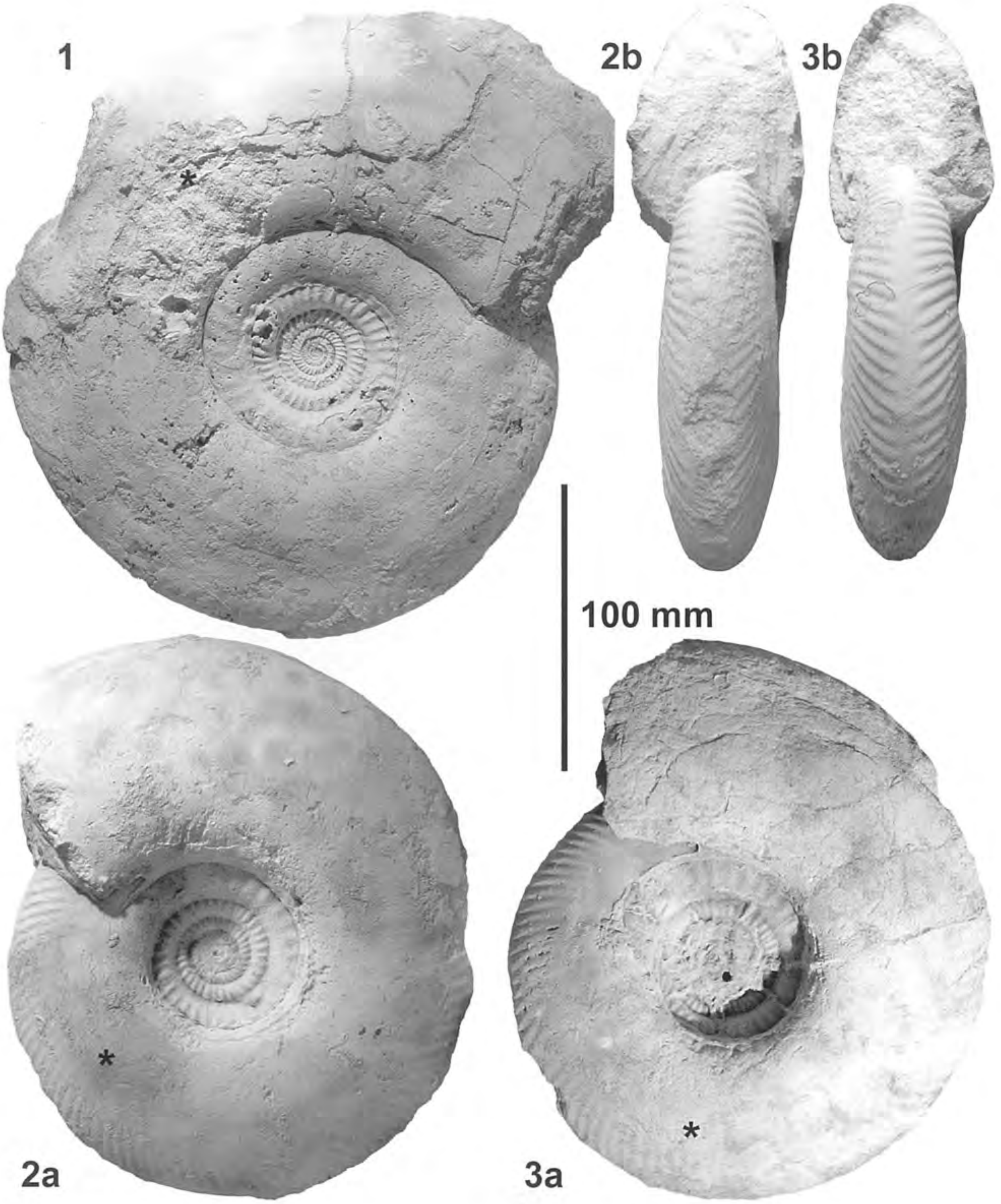

Figure 4 1a, b. *Parkinsonia convergens* (S. Buckman), (evolute form, WCC 5669). 2a, b. *Parkinsonia convergens* (S. Buckman), (WCC 5666). 3a, b. *Parkinsonia subgaleata* (S. Buckman), (WCC 5667). Asterisk indicates last preserved septum of the phragmocone.

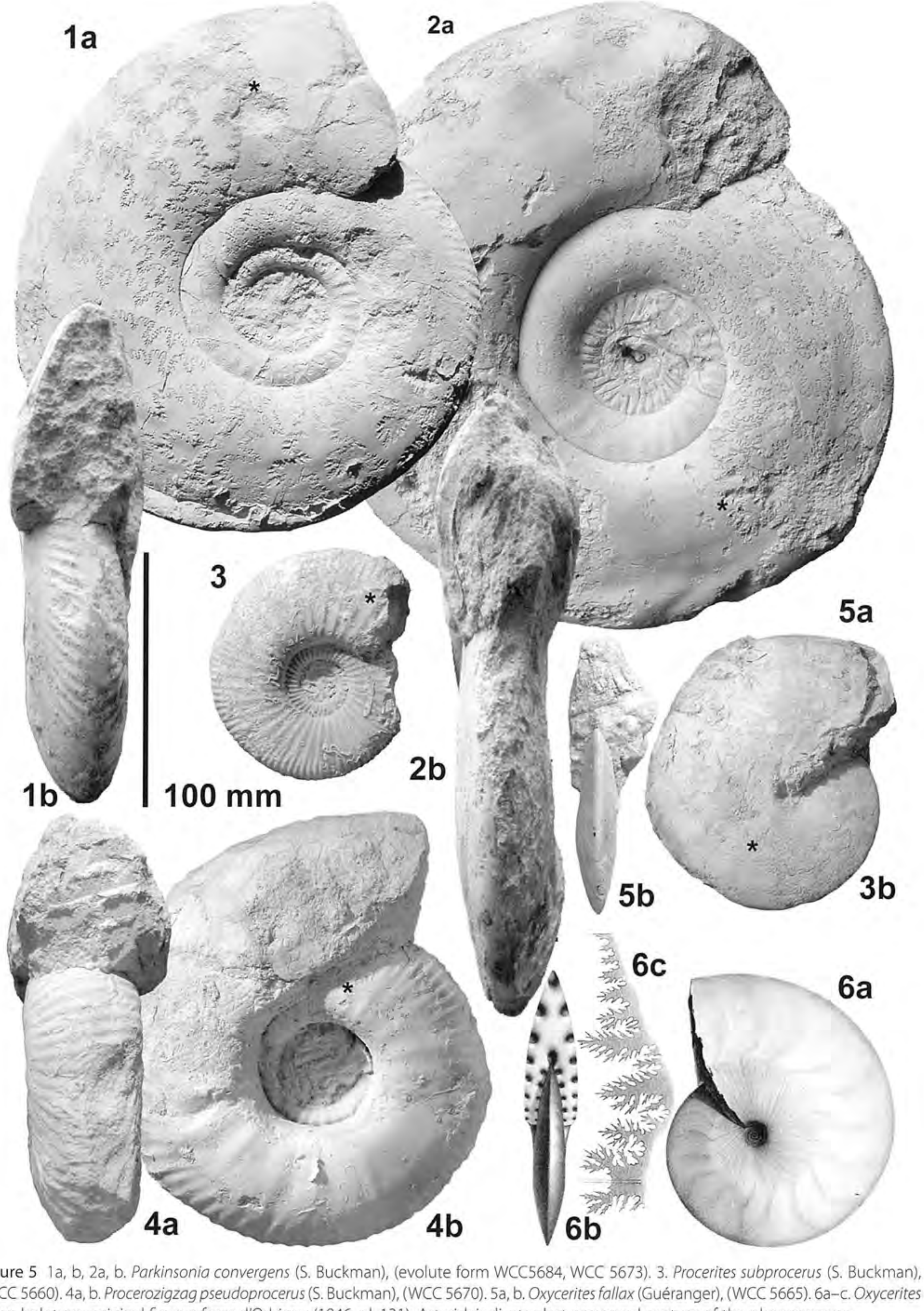

Figure 5 1a, b, 2a, b. *Parkinsonia convergens* (S. Buckman), (evolute form WCC5684, WCC 5673). 3. *Procerites subprocerus* (S. Buckman), (WCC 5660). 4a, b. *Procerozigzag pseudoprocerus* (S. Buckman), (WCC 5670). 5a, b. *Oxycerites fallax* (Guéranger), (WCC 5665). 6a–c. *Oxycerites fallax*, holotype; original figures from d'Orbigny (1846, pl. 131). Asterisk indicates last preserved septum of the phragmocone.

The morphospecies of perisphinctids, *Procerozigzag* and *Procerites* collected all occur in the Convergens Subzone as described by Fernández-López *et al.* (2007, fig. 14 for the Parvum Subzone, which is of the same age as the Convergens-Subzone) in SE France. There is diversification of this group into various morphologies which at the Convergens Subzone level again form a plexus of variability traditionally given various morphospecies names. The specimen shown in Fig. 3, 1 has the complex suture line of a perisphinctid but is not typical of forms known from this horizon. It resembles *Procerites mirabilis* Arkell from the Upper Bathonian, Retrocostatum Zone. The microconchs include *Zigzagiceras* spp., but we have not been able to recover any examples from these excavations.

The extremely oxyconic oppelids that occur at this horizon are the subject of some debate. In the British literature they are typically referred to *Oxycerites fallax* (Guéranger 1865) and species aff. However in Germany *Oxycerites aspidoides* (Oppel, 1857) has been taken as the typical Parkinsoni Zone form, but they are probably synonymous. To further complicate matters the Upper Bathonian Aspidoides-Schichten was named after it due to a mis-identification of *Oxycerites* specimens that historically have been found higher up in the Bathonian. Elmi, Rioult and Gauthier (1994) faced with the difficulties of the stratigraphical location of specimens in the old collections, and taxonomic issues surrounding these names recommend using *Oxycerites yeovilensis* (Rollier 1911) for '*A. fallax*' *sensu* Arkell, *Oxycerites limosus* (Buckman 1925) and for '*O. aspidoides*' *sensu* Elmi and Mangold (1966). We have named our specimens *Oxycerites fallax* (Guéranger, 1865) following Arkell (1951, 56) and based on comparison with the figure of d'Orbigny (1846), shown here Fig. 5, 4a–c. This specimen is clearly a macroconch and common examples of it occur seamlessly from the Truellei Bed of the Parkinsoni Zone and into the Lower Bathonian, Zigzag Bed and probably above. Due to the discoid morphology and lack of ornament, any distinction by morphospecies name between the variability range of specimens from the Parkinsoni to Zigzag zones is totally subjective.

The two exposures described are probably of the same approximate horizon as indicated by the fossils and the lie of the land. The first exposure is at 91m above mean sea level, while the second is 3m lower at 88m according the the Dorset topographic map (https://en-gb.topographic-map.com/maps/s2gu/Dorset/).

The age range of the Crackment Limestone has been a subject of debate over the years. For many years Buckman (1891, 503) was of the opinion that it passed laterally into the Lower Fuller's Earth (clay facies) on the Dorset Coast and was thus younger than the Zigzag Bed of South Dorset. Later he withdrew this suggestion (Buckman 1927, 51) but it was nonetheless incorporated into both Richardson's, (Richardson 1911, 22; 1928, 36; 1932, 49) and Arkell's publications (Arkell 1933). The collections of Kellaway and Fowler cited above (Kellaway and Wilson 1941) and Sylvester Bradley at Halfway House (Arkell 1951) firmly place the upper part of the Crackment Limestone in the Convergens Subzone with the lower part in the Parkinsoni Zone. The Zigzag Bed of south Dorset is now recognised to be a 'homogeneous deposit' containing elements of both Macrescens and Convergens subzones which around the Broadwindsor area can be discriminated into levels to some extent.

CONCLUSIONS

The two sites at Milborne Port enable for the first time the establishment of a high-precision biostratigraphical subdivision of part of the Crackment Limestone into ammonite faunal horizons. The occurrence of *P. convergens*, *P. subgaleata* and *P. pachypleura* confirm that both exposures are of approximately the same biostratigraphical horizon and lie in the *convergens* faunal horizon, Convergens Subzone, Zigzag Zone of the Lower Bathonian.

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REFERENCES

Arkell, W.J. 1933. *The Jurassic System in Great Britain*. Clarendon Press, Oxford.

Arkell, W.J. 1951–1958. *A monograph of English Bathonian Ammonites*. Palaeontographical Society, London.

Barton, C.M. 1989. *Geology of the Milborne Port District (Somerset and Dorset) 1:10 000 sheet ST61NE*. Technical Report of the British Geological Survey, Onshore Geology Series, WA89/60.

Buckman, S.S. 1913–1930. *Type Ammonites*. Wheldon and Wesley, Thame and London.

Buckman, S.S. 1891. 'On certain Ammonite zones of Dorset and Somerset', *Geological Magazine* **8**, 502–504.

Buckman, S.S. 1893. 'The Bajocian of the Sherborne district: its relation to subjacent and superjacent strata', *Quarterly Journal of the Geological Society* **49**, 479–522.

Callomon, J.H. and Chandler, R.B. 1990. 'A review of the ammonite horizons of the Aalenian-Lower Bajocian stages in the Middle Jurassic of southern England', in S. Cresta and G. Pavia (eds), Atti del meeting sulla stratigrafia del Baiociano. *Memorie Descrittive della Carta Geologica d'Italia* **40**, 85–112.

Chandler, R.B., Glover, L. and Smith, D. 1999. 'A Temporary Section in the Inferior Oolite (Middle Jurassic) at Coldharbour Business Park, Dodge Cross, Sherborne', *Proceedings of the Dorset Natural History and Archaeological Society* **120**, 69–72.

Chandler, R.B., Whicher, J., Dodge, M. and Dietze, V. 2014. 'Revision of the stratigraphy of the Inferior Oolite at Frogden Quarry, Oborne, Dorset, UK', *Neues Jahrbuch für Geologie und Paläontologie - Abhandlungen* **274**, 133–148.

Collinson, J. 1791. *The History and Antiquities of the County of Somerset: Collected from Authentick Records, and an Actual Survey Made by the Late Mr. Edmund Rack. Adorned with a Map of the County, and Engravings of Roman and Other Reliques, Town-seals, Baths, Churches*. R. Cruttwell, Bath.

Dietze, V. and Schweigert, G. 2000. 'Zur Stratigraphie und Ammonitenführung des Ober-Bajociums und Bathoniums, insbesondere der Zigzag-Zone, Convergens-Subzone, von Röttingen (östliche Schwäbische Alb, Südwestdeutschland)', *Stuttgarter Beiträge zur Naturkunde, Serie B (Geologie und Paläontologie)* **284**, 1–15.

Elmi, S. and Mangold, C. 1966. 'Étude de quelques Oxycerites du Bathonien inférieur', *Travaux et Documents des Laboratoires de Géologie de Lyon* **13**, 143–182.

Elmi, S., Rioult, M. and Gauthier, H. 1994. 'Oxycerites fallax' in J.-C. Fischer (ed), *Révision critique de la Paléontologie française d'Alcide d'Òrbigny*, 1. *Céphalopodes jurassiques*, 118–120.

Fernández-López, S., Henriques, M., Mangold, C. and Pavia, G. 2007. 'New early Bathonian Bigotitinae and Zigzagiceratinae (Ammonoidea, Middle Jurassic)', *Rivista Italiana di Paleontologia e Stratigrafia* **113**, 383–399.

Guéranger, E. 1865. 'Étude sur l'Ammonites discus Sowerby, suivi de la description du Nautilus Julii Baugier', *Annales de la Société Linneenne de Maine-et-Loire* **7**, 184–190.

Kellaway, G.A. and Wilson, V. 1941. 'An outline of the geology of Yeovil, Sherborne and Sparkford Vale', *Proceedings of the Geologists' Association* **52**, 131–174.

Kellaway, G.A. 1938. *Report on recent excavations in the Sherborne District*. Geological Survey of Great Britain, unpublished report.

Oppel, A. 1856–1858. *Die Juraformation Englands, Frankreichs und des südwestlichen Deutschlands*. Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg, Stuttgart.

Orbigny, A.d'. 1842–1851. *Paléontologie française. Description Zoologique et Géologique de tous les animaux des mollusques et rayonnés fossiles de France. Terrains Oolitiques ou Jurassiques. Tome Premier*. Masson, Paris.

Richardson, L. 1911. 'On the sections of Forest Marble and Great Oolite on the railway between Cirencester and Chedworth, Gloucestershire', *Proceedings of the Geologists' Association* **22**, 95–115.

Richardson, L. 1916. 'The Inferior Oolite and contiguous deposits of the Doulting-Milborne-Port district (Somerset)', *Quarterly Journal of the Geological Society* **71**, 473–520.

Richardson, L. 1928. 'The Inferior Oolite and contiguous deposits of the Burton Bradstock-Broadwindsor district, Dorset', *Proceedings of the Cotteswold Naturalists' Field Club* **23**, 35–68.

Richardson, L. 1932. 'The Inferior Oolite and contiguous deposits of the Sherborne district, Dorset', *Proceedings of the Cotteswold Naturalists' Field Club* **24**, 35–85.

Rollier, L. 1911. *Les Faciès du Dogger ou Oolithique dans le Jura et les Régions Voisines*. Mémoire publié par la Fondation Schnyder von Wartensee à Zurich, George et Cie, Zurich.

Torrens, H.S. 1969. 'Field Meeting in the Sherborne-Yeovil District', *Proceedings of the Geologists' Association* **80**, 301–324.

White, H.J.O. 1923. *The geology of the country south and west of Shaftesbury*. Memoir of the Geological Survey of Great Britain, Sheet 313 (England and Wales).

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BANKSIDE AND INSTREAM CHARACTERISTICS AFFECT INVERTEBRATE BIODIVERSITY IN THE OWERMOIGNE STREAM (DORSET UK)

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

As part of an ongoing series of stream surveys, four sites along the length of the spring-fed Owermoigne Stream, from the village to its junction with the Tadnoll Stream, were sampled in summer and autumn in 2018 and in spring in 2019. A total of 100 taxa were recorded from the four sites. The caddis fly Synagapetus dubitans, *a species only recently discovered in the UK, was recorded at the two sites closest to the spring source and this record is the southernmost occurrence of the species to date. Ecological quality classifications ranged from Moderate at sites 1 and 2 to High and Good at 3 and 4 respectively. A comparison with the fauna of three other local spring-fed chalk streams using cluster analysis found that the 20 sites fall into four distinct groups representing the four streams. This indicates that despite similar source water chemistry and hydrology the local bankside and instream channel characteristics strongly determine the faunal community. Every site on the Owermoigne Stream is anthropogenically impacted but in the absence of polluting agents the sections running through farmland provided the most habitat diversity.*

INTRODUCTION

As part of a continuing series of studies of Dorset watercourses (Armitage and Blackburn 2010, Armitage *et al.* 2018) the Owermoigne Stream was studied to provide additional data on spring-fed chalk streams. The stream is small, with an estimated annual discharge of less than $0.1m^3 s^{-1}$ and therefore is not monitored by the Environment Agency. Despite the small size, some of these streams contribute to the main flow of the River Frome and it is important that their characteristics are recorded. It is the aim of this paper to describe the macroinvertebrate fauna of the stream and to use this information to assess the environmental quality.

STUDY AREA AND METHODS

Owermoigne Village lies north of hills (Moigns Down) rising to a height of 130m, composed of Chalk, Portland and Purbeck Beds. The stream arises at about 50m O.D. from a spring in the village and flows north through Reading Beds, London Clay and Bagshot Beds which overlay the chalk. The stream flows through the village and mixed farmland for about 2.5km before joining the Tadnoll Brook, a tributary of the main River Frome (Fig. 1).

Site 1 receives water from spring sources through culverts and is situated at the roadside in Owermoigne. Despite there being no shade, aquatic macrophytes

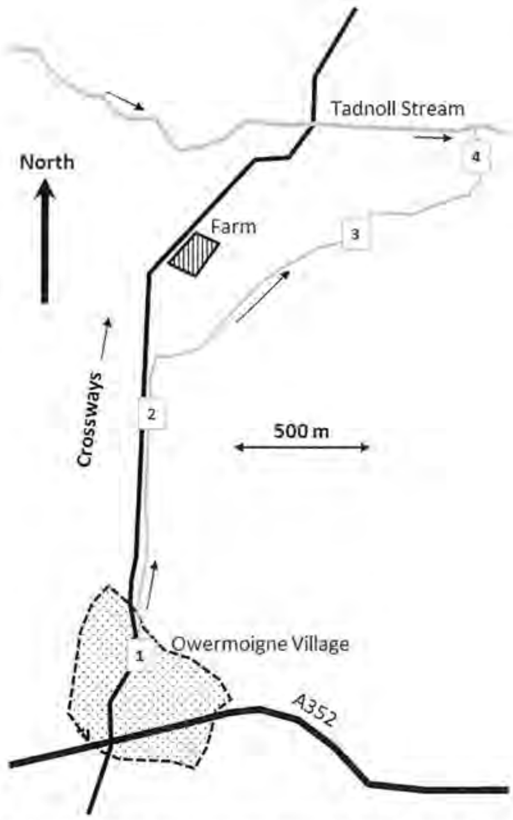

Figure 1 Sketch map showing location of the four sites on the Owermoigne Stream.

are generally lacking with only a few isolated clumps of *Glyceria* sp. The site was dry in autumn but flowed again in spring when small patches of algae covered the substratum. Local villagers report seasonal drying in some years has occurred at this site only since the 1960s. The banks are low and the vegetation mown and trimmed. About 20m downstream the channel narrows and flows under the road before continuing northwards close to an area of disused fish ponds.

Site 2 is situated about 1km below the source in a straight channelized section flowing through densely shaded woodland. No aquatic macrophytes were present and the channel lacked diversity of habitat, with extensive areas of 'fast' flow over clean gravel.

Site 3 about 1.8km from source is located alongside a farm track just downstream of a culverted stream section. The incised ditch-like channel had a diverse topography with a deep scour pool downstream of the culvert and large silted and sandy gravel patches below. Macrophytes (*Apium/Berula* sp. and *Callitriche* sp.) were present and trailing brambles and other riparian plants bordered the channel.

Site 4 about 2.2km from the source and about 100m from the junction with the Tadnoll Brook was also situated in an incised ditch-like channel. Extensive beds of *Apium/Berula* sp. covered the substratum in spring, later in the year these were overlain by dense trailing riparian vegetation. Water velocity was impeded by the vegetation in all seasons.

Macroinvertebrate samples were collected on 2nd July and 5th November in 2018 and on 3rd March 2019, using a standard 3-minute kick/sweep technique (Wright *et al.* 1993) with a 900 µm mesh pond net. Samples were sorted live in the laboratory and preserved in 70% alcohol. The fauna was identified to species where keys and life-history stage allowed. Exceptions were Oligochaeta and *Pisidium* sp. (small bivalves) identified as such and Chironomidae identified to sub-family or tribe level.

Assessment of substratum conditions was carried out using the method described in Environment Agency (2003) which involves visual inspection and recording percentage cover of bedrock, boulders, pebbles and gravel, sand, silt and clay. The Environment Agency have no data on discharge or water chemistry for the Owermoinge Stream. We calculated spot measurements of discharge from velocity, depth and width data collected at the time of sampling. Physical features of the sites were recorded at each visit together with measurements of pH and conductivity taken with a portable meter (Hanna HI 98129). Estimates of nitrate concentration were obtained using "*Water Works*" Nitrate and Nitrite Test Strips (Table 1).

The River Invertebrate Classification Tool, (RICT) (Davy-Bowker *et al.* 2008) was used to determine the ecological status of the Owermoigne Stream and the Community Conservation Index (Chadd & Extence 2004) was used to help interpret our observations. Cluster analyses (Community Analysis Package Version 3.0, 2004, PISCES Conservation Ltd), were used to examine seasonal and spatial changes in the faunal composition of the Owermoigne sites. After standardisation for taxonomic level, cluster analysis was also used to compare the Owermoigne Stream

Table 1 Physical and chemical characteristics of four sites on the Owermoigne Stream based on mean values of three seasons' samples. (Site 1 was dry in the autumn).

	1	2	3	4
Grid Reference (SY)	768853	768863	774867	780869
Altitude (m OD)	49	37	30	29
Distance from source (km)	0.1	1	1.8	2.2
Water width (m)	2.95	1.68	2.10	1.73
Water depth (cm)	6.33	6.67	14.11	14.00
Surface Velocity Range ($cm\ s^{-1}$)	0–25	10–25	10–50	10–50
Substratum Cover (%)				
Boulders & Cobbles	26	2	1	0
Pebbles and Gravel	74	66	41	10
Sand	0	27	36	70
Silt & Clay	0	5	22	20
Macrophyte cover (%)	25	0	42	85
pH	7.7	7.5	7.5	7
Alkalinity ($mg\ l^{-1}\ CaCO_3$)	197.12	180.59	175.25	166.40
Conductivity (μScm^{-1})	641	589	573	545
Nitrate ($mg\ l^{-1}\ N$)	3	–	–	5

fauna with three other spring-fed watercourses in the area.

RESULTS

The Fauna

Based on collections in spring, summer and autumn, a total of 100 taxa in 51 families was found at the four sites (Appendix 1). Amongst major groups Diptera, Coleoptera and Trichoptera contributed 70% of total taxa (Table 2). No Red Data Book species occurred but the caddis fly *Synagapetus dubitans*, recorded for the first time in Britain in 2010 (Crofts 2011), was found at sites 1 and 2 in the Owermoigne Stream. Since its discovery there have been a number of records, mainly in the north of England, in woodland springs and this present record is the southernmost occurrence of the species to date. Apart from this find, the only other "Notable" or "Regionally Notable" species (*sensu* Chadd & Extence 2004) were the beetle *Gyrinus urinator*, the soldier fly *Oxycera morrisii* and the blackfly *Simulium angustitarse*. The infrequently recorded blackfly *Simulium costatum* found at sites 1 and 2 is closely associated with permanently flowing calcareous springs

Table 2 The distribution of taxa among major groups based on combined seasons' samples.

Taxa per group	1	2	3	4	Total
Tricladida	1	1	1	2	2
Mollusca	4	3	5	5	7
Oligochaeta	1	1	1	1	1
Hirudinea	0	3	2	2	3
Hydracarina	0	1	1	1	1
Crustacea	2	2	3	5	5
Plecoptera	0	1	3	2	3
Ephemeroptera	2	2	6	4	6
Odonata	0	0	0	1	1
Hemiptera	1	1	2	2	2
Coleoptera	5	4	11	11	21
Megaloptera	0	0	1	1	1
Trichoptera	2	6	9	11	19
Diptera	11	15	17	14	28
Total	29	40	62	62	100

The main interest lies in differences within the fauna between sites. Abundance and composition varied markedly between sites and seasons (Fig. 2). Based on combined seasons data the dominant taxa were the freshwater shrimp *Gammarus pulex* at sites 1 and 2 and a small gastropod *Potamopyrgus antipodarum* at

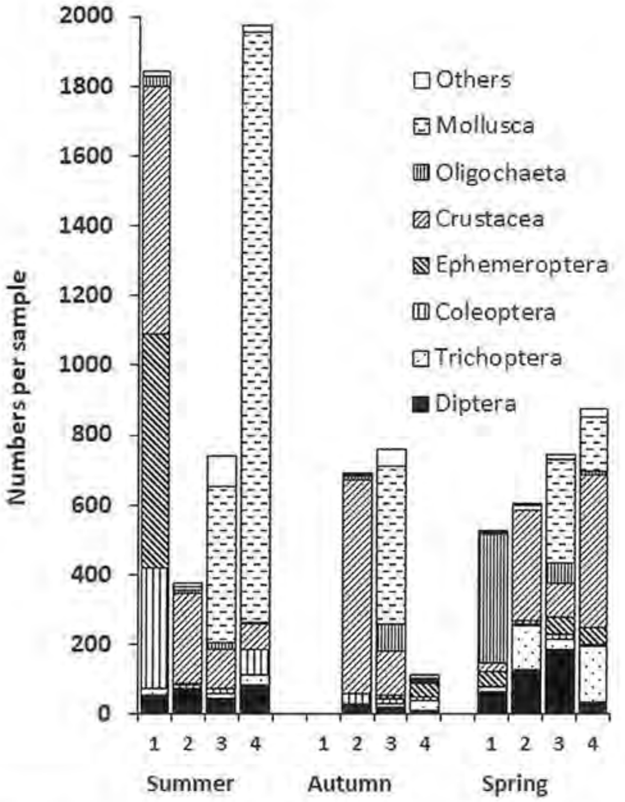

Figure 2 Seasonal differences in the faunal composition of major groups in four sites on the Owermoigne Stream.

sites 3 and 4. Site 1 which dried out in the autumn supported 29 taxa compared with 40 at site 2 with Diptera the main contributors at both sites. The highest taxon diversity was found at sites 3 and 4 (62 taxa) with Diptera, Coleoptera and Trichoptera the main contributors (Table 2). Cluster analysis of fauna from all samples from the stream showed four main groupings with sites 1 and 2 distinct from sites 3 and 4 (Fig. 3). Longitudinal position of sites along the stream was more important in determining these groups than seasonal differences. An exception was site 4 where the autumn sample was distinct, characterised by low abundance of all faunal groups.

Environmental Assessment

The national water quality assessment system, RICT (Davy-Bowker *et al.* 2008) was applied to sites on the Owermoigne Stream. The RICT methodology utilises a database of samples from reference sites considered to be the best available of their type in Britain. RICT makes a site-specific prediction of the fauna expected at a site and various indices derived from that fauna, based on environmental variables

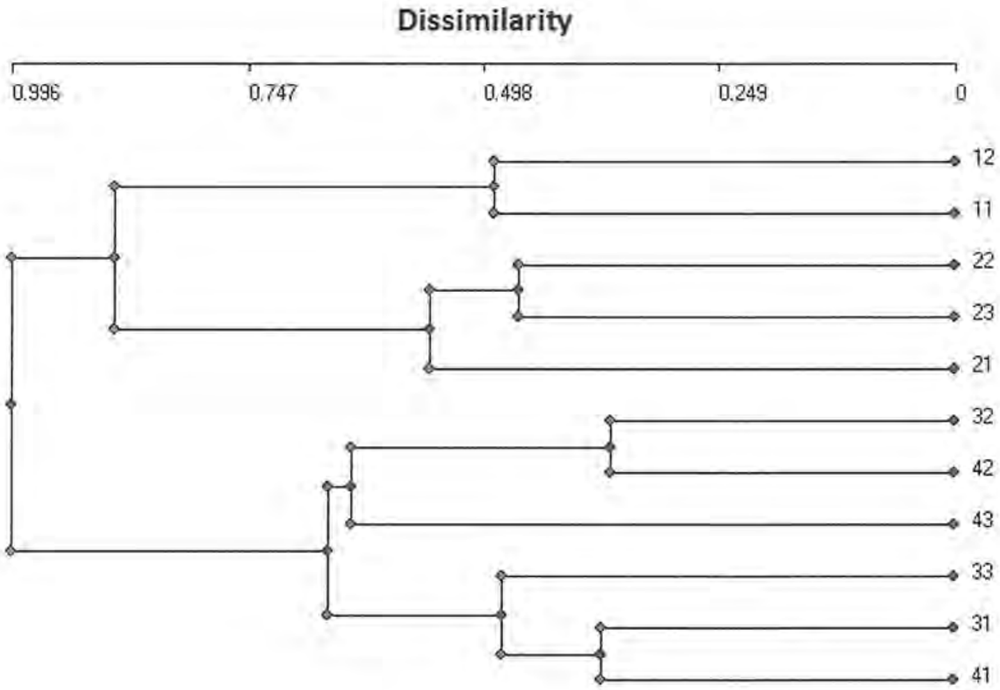

Figure 3 Dendrogram showing the seasonal relationship between samples on the Owermoigne Stream based on species presence/absence data.

Table 3 Observed and Expected values of ASPT and NTAXA for combined seasons' data at four sites on the Owermoigne Stream together with site suitability (S) and classification bands (B), for WHPT- ASPT and NTAXA and overall classification (CLASS) from RICT analyses (High 'H', Good 'G', Moderate 'M', and Poor 'P').

		ASPT			NTAXA			
	S	O	E	B	O	E	B	CLASS
1	5	5.12	6.09	M	17	19	H	M
2	1	5.00	5.93	M	16	22	G	M
3	1	5.46	5.46	H	24	25	H	H
4	1	5.18	5.47	G	24	26	H	G

recorded at a test 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 41, then the predictions and classifications arising should be carefully reviewed to consider if they are appropriate. In the Owermoigne Stream only Site 1 with a suitability code of 5, fell outside this range due mainly to its close proximity to the source.

The ratio of an 'observed to expected' index value, the ecological quality ratio (EQR), is classified by RICT into bands (High, Good, Moderate, Poor or Bad). The final overall classification of a site is based on the minimum EQR value from the Average Score Per Taxon (WHPT ASPT), an index of organic pollution impacts and the number of scoring taxa (NTAXA), an index of general degradation (Table 3). Quality classifications ranged from Moderate at sites 1 and 2 to High and Good at sites 3 and 4 respectively. The Community Conservation Index (Chadd & Extence 2004) which unlike RICT focuses on community richness and the relative rarity of the recorded species, was also applied to combined seasons data. Only Site 1 was classified as being of High conservation value with sites 2, 3, and 4 Low, Low, and Moderate respectively.

Comparison with other Streams

The faunal composition of three previously surveyed spring-fed streams (Armitage & Blackburn 2010) was compared with that of the Owermoigne Stream using cluster analysis on presence/absence data from combined seasons (Fig. 4). Sites show complete fidelity to each stream and the 20 sites fall into four groups representing the four streams. This indicates that despite similar source water chemistry and hydrology the local bankside and instream channel characteristics strongly determine the faunal community. Figure 5 compares the faunal composition of top and bottom sites in each stream and shows marked differences in the abundance of common families between sites and between streams. The Lulworth Stream is a short watercourse arising at low altitude and flowing alongside the road in a confined channel with no bankside vegetation. It is geographically isolated from other water courses and this is reflected in the relatively low number of taxa recorded. Only two taxa *Helophorus brevipalpis* and the Chironomidae sub-family Diamesinae were 'unique' to the site. This is in marked contrast to the Wool, Owermoigne, and Jordan streams which supported 31, 23, and 22 'unique' taxa respectively.

DISCUSSION

High alkalinity groundwater-fed streams generally provide a reliable source of water and the Wool, Lulworth, Jordan and Owermoigne Streams have had settlements along their course for at least 800 years (Royal Commission on Historical Monuments 1970). Such streams have experienced a range of anthropogenic impacts along their length including channelisation, cress production, water mills and abstraction for supply (Environment Agency 2004, Armitage and Blackburn 2010). These disturbances do not necessarily occur along the whole length of the stream but their effects (flow regulation and modification of riparian habitat) can influence faunal communities upstream and downstream. The Owermoigne Stream is heavily impacted by human activities. It is channelised through 'urbanised' areas and historically, leats from the stream fed a moat and four fishponds of the late 13th century house, Moigne Court. The occasionally observed autumn drying at site 1 may reflect impacts of local licensed small-scale borehole abstraction. Downstream the channelised course follows the road through a wooded area before entering farmland. Here the course of the

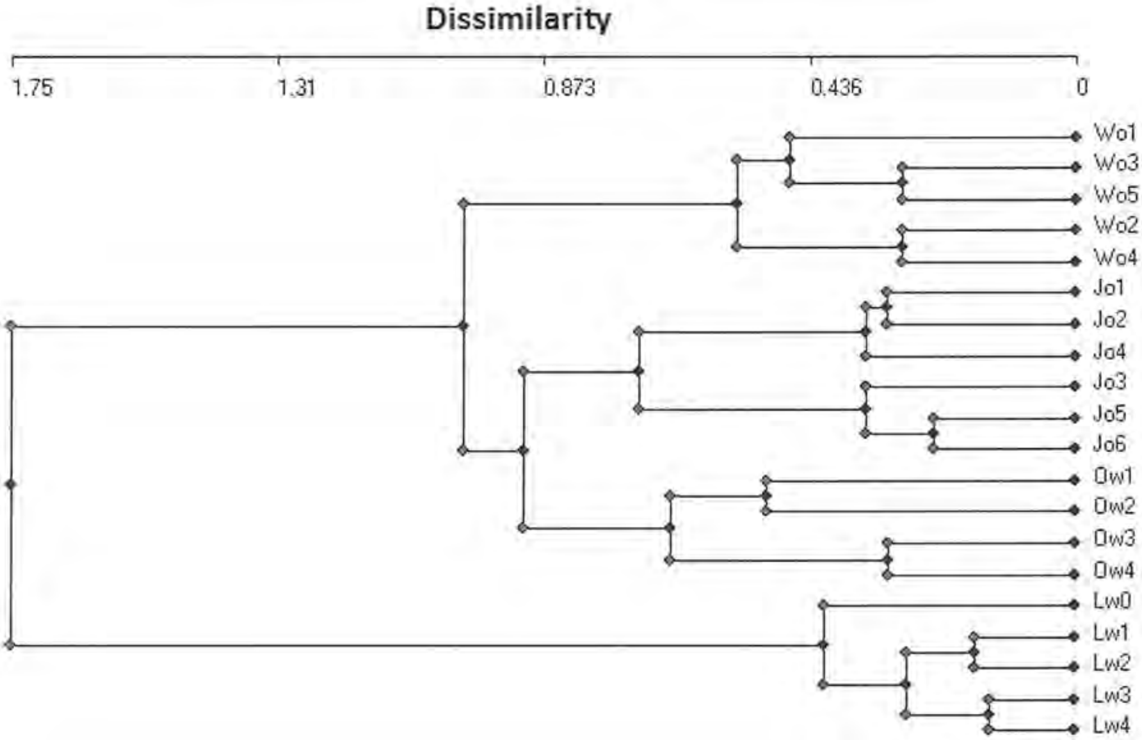

Figure 4 Dendrogram showing the relationship between sites on four spring-fed chalk streams based on species presence/absence data from combined seasons' samples. (Lw Lulworth, Ow Owermoigne, Jo Jordan, and Wo Wool).

stream is less straight and a glance at a sequence of old Ordnance Survey maps from 1888 to the present shows that the stream has been re-directed many times with associated channel deepening. Contrary to a consensus view that agricultural activity can reduce the quality (ecological and chemical) of streams flowing through farmland (Davey *et al.* 2008), we found that despite the proximity of an intensive dairy farm, macroinvertebrate diversity was greatest at the two lower sites where the environmental quality was classified as 'High' and 'Good'. There are two main contributing factors to this situation, firstly, the dairy farm effluent is not stored near the stream and the land is flat so the risks of increased nutrient loadings to the stream, known to be detrimental to faunal communities (Jarvie *et al.* 2018), are minimal. Secondly, most of the land adjacent to the stream is pasture (76%) or solar panels elevated over pasture (14%) with only 10% of the lower catchment arable. This reduces the risk of runoff from ploughed fields carrying excess sediment into the channel, a known stressor of faunal communities (Murphy *et al.* 2015, Armitage *et al.* 2018). A third factor is the channel morphology which in the lower reaches favours the growth of aquatic macrophytes and riparian vegetation which trails in the water providing physical structure, and an increase in habitat complexity and heterogeneity. These factors combine to increase the number of habitats available for colonising freshwater invertebrates which in turn support a richer assemblage of invertebrates. Total abundance varied little between sites, ranging from 1672 at site 2 to 2962 at site 4 whereas taxon richness ranged from 29 at site 1 to 62 at sites 3 and 4. Every site on the Owermoigne Stream is anthropogenically impacted but in the absence of polluting agents the sections running through farmland provided the most habitat diversity.

ACKNOWLEDGEMENTS

We are grateful to Max Frampton of Holly Farm for access to the lower sites and Wessex Water for access to the register of licensed water abstraction locations. We also thank our colleagues John Davy-Bowker and James Pretty, respectively for comments on the manuscript and advice on identification

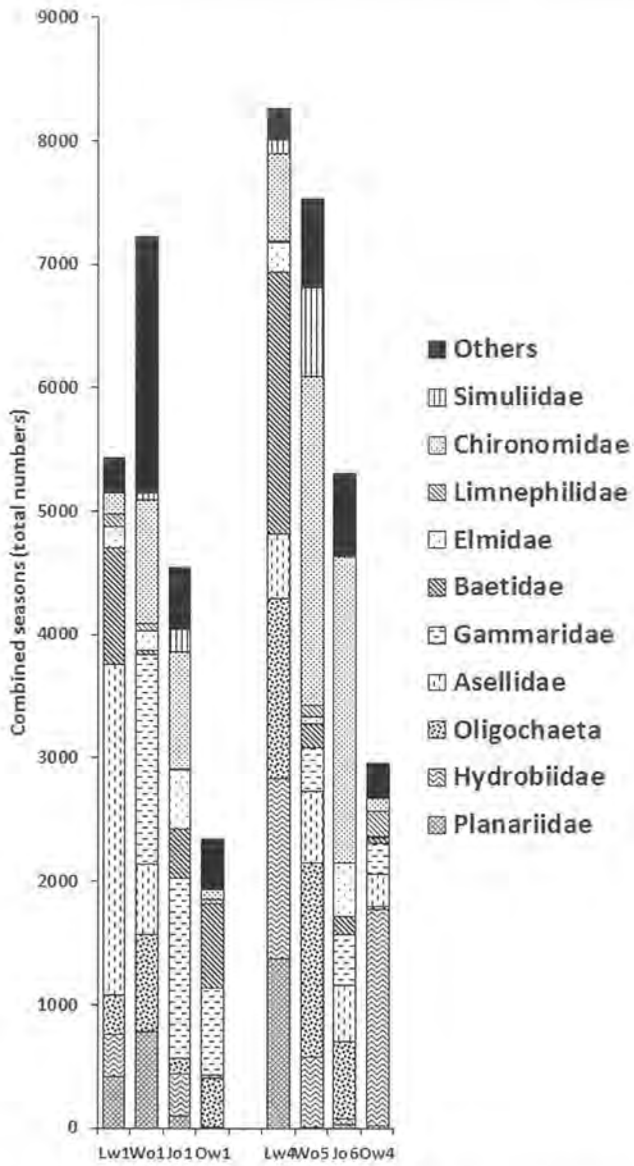

Figure 5 Comparison of faunal composition of top and bottom sites on four spring-fed chalk streams based on combined seasons' data (Spring, Summer and Autumn).

REFERENCES

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., 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.

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.

Crofts, S.M. 2011. 'Synagapetus dubitans, a caddisfly new to Britain'. London, UK, Riverfly Partnership, 15 pp.

Davey, A., Gardner, M., Johnson, I., Nixon, S., Payne, M. and Smith, H. 2008. '*Understanding the Impact of Farming on Aquatic Ecosystems*' Defra Project WQ0112 Final Report 31 January 2008, Swindon. 43 pp.

Davy-Bowker, J., Clarke, R., Corbin, T., Vincent, H., Pretty, J., Hawczak, A., Blackburn, J., Murphy, J. and Jones, I. 2008. '*River Invertebrate Classification Tool. Final Report*'. Edinburgh, UK, Scotland and Northern Ireland Forum for Environmental Research (SNIFFER), pp 268. Available from:-http://eprints.bournemouth.ac.uk/16550/2/SNIFFER_WFD72C_RICT_Final_Report_-_Davy-Bowker%2C_Clarke_et_al_2008.pdf [Accessed August 2019].

Environment Agency. 2003. '*River Habitat Survey in Britain and Ireland: Field Survey Guidance Manual River Habitat Survey Manual*', 2003 Version. Environment Agency, Bristol, UK, 136.

Environment Agency. 2004. '*The State of England's Chalk Rivers. A Report by the UK Biodiversity Action Plan Steering Group for Chalk Rivers*'. Environment Agency, Bristol. 78 pp.

Jarvie, H.P., Smith, D.R., Norton, L.R., Edwards, F.K., Bowes, M.J., King, S.M., Scarlett, P., Davies, S., Dils, R.M. and Bachiller-Jareno, N. 2018.'Phosphorus and nitrogen limitation and impairment of headwater streams relative to rivers in Great Britain: A national perspective on eutrophication', *Science of the Total Environment*, **621**, 849–862.

Murphy, J.F., Jones J.I., Pretty, J.L., Duerdoth, C.P., Hawczak, A., Arnold, A. Blackburn, J.H., Naden, P.S., Old, G., Sear, D.A., Hornby, D. and Collins A.L. 2015. 'Development of a biotic index using stream macroinvertebrates to assess stress from deposited fine sediment'. *Freshwater Biology*, **60**, 2019–36.

Royal Commission on Historical Monuments. 1970. '*An Inventory of the Historical Monuments in the County of Dorset. Vol. II Parts 1 and 2*, pp. 1–188, 189–417'. HMSO, London.

Wright, J.F., Furse, M.T. and Armitage, P.D. 1993. 'RIVPACS – a technique for evaluating the biological quality of rivers in the U.K'. *European Water Pollution Control*, **3(4)**, 15–25.

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Appendix 1. The total number of taxa recorded at four sites on the Owermoigne Stream based on summer and autumn samples taken in 2018 and spring samples in 2019. Note that there was no water in autumn at site 1.

	1	2	3	4
Polycelis felina (Dalyell)	2	5	0	18
Polycelis nigra/tenuis	0	0	1	5
Potamopyrgus antipodarum J.E.Gray	2	12	1172	1756
Radix balthica (Müller)	9	0	1	3
Galba truncatula (Müller)	3	0	1	0
Anisus vortex (L.)	0	0	0	12
Ancylus fluviatilis Müller	0	10	1	0
Succinea sp.	0	0	0	3
Pisidium sp.	3	4	22	75
Oligochaeta	399	24	156	19
Piscicola geometra (L.)	0	1	4	2
Glossiphonia complanata (L.)	0	6	9	8
Theromyzon tessulatum (Müller)	0	1	0	0
Hydracarina	0	3	117	9
Ostracoda	0	0	2	2
Asellus aquaticus (L.)	21	4	75	259
Asellus meridianus Racovitza	0	0	0	4
Gammarus pulex (L.)	712	1182	258	247
Crangonyx pseudogracilis Bousfield	0	0	0	1
Leuctra fusca(L.)	0	0	1	0
Nemoura avicularis Morton	0	0	2	1
Nemoura cinerea (Retzius)	0	2	1	1
Baetis rhodani (Pictet)	679	0	27	47
Centroptilum pennulatum Eaton	0	0	3	0
Ephemera danica Müller	0	0	4	10
Serratella ignita Poda)	32	11	3	24
Habrophlebia fusca (Curtis)	0	2	21	0
Paraleptophlebia submarginata (Stephens)	0	0	3	13
Calopteryx sp.	0	0	0	1
Velia sp.	2	1	14	2
Hydrometra stagnorum (L.)	0	0	1	2
Agabus bipustulatus (L.)	0	0	1	0
Agabus paludosus (Fabricius)	0	0	0	2
Agabus spp.	0	0	0	4
Nebrioporus elegans (Panzer)	0	0	1	0
Ilybius fuliginosus (Fabricius)	0	0	3	3
Ilybius sp.	0	0	3	0
Hydroporus pubescens (Gyllenhaal)	0	0	0	1
Hydroporus sp. larva	1	0	0	0
Platambus maculatus (L.)	0	0	2	0
Gyrinus urinator Illiger	0	0	0	1
Haliplus lineatocollis (Marsham)	0	0	2	2
Haliplus spp. larvae	0	0	0	3
Helophorus aequalis Thomson	2	0	0	0
Helophorus brevipalpis Bedel	306	2	5	51
Helophorus minutes Fabricius	0	0	0	3
Helophorus obscurus/flavipes	34	0	0	0
Hydraena riparia Kugelann	0	0	1	0
Anacaena lutescens (Stephens)	0	0	1	3
Elodes sp.	0	2	0	0
Limnius volckmari (Panzer)	0	17	3	0
Elmis aenea Müller	3	23	17	11
Sialis lutaria (L.)	0	0	2	4
Synagapetus dubitans McLachlan	2	120	0	0
Agapetus fuscipes Curtis	0	0	0	4
Rhyacophila dorsalis (Curtis)	0	0	2	2
Hydropsyche siltalai Döhler	0	0	0	1
Apatania muliebris McLachlan	35	0	0	0
Anabolia nervosa (Curtis)	0	0	0	1
Limnephilus lunatus Curtis	0	2	21	170
Limnephilus marmoratus Curtis	0	0	0	8
Potamophylax latipennis (Curtis)	0	1	0	0
Potamophylax cingulatus (Stephens)	0	0	5	0
Glyphotaelius pellucidus (Retzius)	0	0	0	8
Halesus radiatus (Curtis)	0	0	1	0
Halesus digitatus (Schrank)	0	2	4	4
Micropterna sequax McLachlan	0	3	0	0
Limnephilus sp.	0	0	1	0
Limnephilidae (early instars)	0	2	14	16
Silo nigricornis (Pictet)	0	0	0	3
Beraeodes minutus (L.)	0	0	2	0
Sericostoma personatum (Spence)	0	0	10	5
Tipula montium group	6	0	0	0
Tipula sp.*? maxima* Poda	0	1	0	0
Dicranota sp.	17	13	6	3
Eloeophila sp.	0	7	5	1
Pilaria sp.	0	0	3	5
Neolimnomyia sp.	0	1	0	0
Pericoma sp.	0	1	1	1

	1	2	3	4
Dixa maculata complex	1	0	0	0
Dixa nebulosa Meigen	0	0	1	2
Ceratopogonidae	0	0	14	8
Simulium angustitarse (Lundström)	0	11	0	1
Simulium costatum Friederichs	2	103	136	0
Simulium lundstroemi (Enderlein)	0	3	2	4
Simulium ornatum group	1	21	7	0
Simulium vernum group	0	7	5	1
Simulium angustipes/velutinum	0	1	0	0
Tanypodinae	3	0	15	21
Prodiamesa olivacea (Meigen)	0	0	9	7
Orthocladiinae	75	18	19	15
Tanytarsini	7	34	18	58
Chironomini	0	7	0	0
Chelifera	0	0	1	0
Clinocerinae	3	0	0	0
Oxycera rara (Scopoli)	0	0	0	1
Oxycera morrisii Curtis	2	0	1	0
Oxycera nigricornis Olivier	0	1	0	0
Pachygaster leachii Stephens	1	0	0	0
Chrysops caecutiens (L.)	0	0	4	0
Total	29	40	62	62

POOLE HARBOUR: CURRENT UNDERSTANDING OF THE LATER PREHISTORIC TO MEDIEVAL ARCHAEOLOGY AND FUTURE DIRECTIONS FOR RESEARCH

DEREK PITMAN, EILEEN WILKES, CLARE RANDALL, ANDREW BROWN, HARRY MANLEY and DANIEL CARTER

Poole Harbour and its hinterland comprises a significant area of Dorset both spatially and in terms of influence. It contains numerous archaeological sites of various dates and types. Whilst the area has attracted a considerable amount of research in the last 50 years, information regarding the archaeology of the Poole Harbour basin occurs in disparate locations. This paper summarises and provides a synthesis of the current state of knowledge of the later prehistoric, Romano-British and medieval period. It then identifies threats to the archaeological resource of the area, identifies further research potential which can address local regional and national questions, and suggests future research priorities.

INTRODUCTION

Poole Harbour and its hinterland comprises a significant proportion of the south-eastern part of the current County of Dorset. It contains numerous archaeological sites of various dates and types, which builds a picture of settlement, production and exchange from at least the earlier Iron Age to the present day. The Harbour environs have attracted considerable research, leading to important publications, and been identified as one of the most important areas for coastal archaeology in England (Guthrie 2011). However, the examination of the intertidal and sub-tidal archaeology has been more limited and information regarding the archaeology of the Poole Harbour basin is contained in disparate publications and sources. Previous attempts at synthesising the available data have been constrained by period or research theme. Broader and more integrated studies would be desirable. This paper summarises current knowledge, focussing on the later prehistoric, Romano-British and medieval periods. It then identifies threats to, and the potential of the resource, and suggests future research potential and priorities.

THE PHYSICAL LANDSCAPE

Poole Harbour lies on the north-eastern side of Purbeck; the Harbour itself comprises approximately 3500 hectares of lowland estuary (Fig. 1) which drains much of central and southern Dorset. The coastline within the Harbour measures *c.* 160 kilometres (May 2010). It forms the largest natural harbour in the UK, having broadly assumed its present form around 6000 years ago (May and A'Court 2010, 19).

Geology, topography and environment

The geology of Poole Harbour is complex. Most of the Harbour is occupied by Tertiary Eocene deposits belonging to the Poole Formation, laid down around 48 million years ago (BGS 2019). The formation comprises gravels, sands, clays, lignites and brickearths along with fine kaolinitic clays commonly termed 'ball clay' or 'pipeclay'. The basin was formed as part of the lower reaches of the ancient Solent River, and much of its area is below 20m aOD. In the more recent past, alluvium and tidal mudflat deposits have accumulated along the fringes of the estuaries and channels. On land, these buried geologies are overlain generally by naturally wet sandy and loamy soils that are relatively nutrient-poor and acidic, in places developing a peaty surface (CSAIS 2020). To the south, the basin is adjoined by the Purbeck ridge which comprises bands of chalk and greensand, which divide the basin from the Isle of Purbeck where the geology is composed of Wealden group mudstones and Purbeck group limestones and mudstones; this is broken to the south-west by the gap at Corfe Castle. To the west lie the valleys of the Rivers Frome and Piddle, and to the north the land opens out into the undulating terrain of chalk and the Stour catchment, with clay lowlands and heaths to the north-east. On its eastern side the Harbour mouth opens into Poole Bay.

The Harbour possesses a complex hydrological system comprising two main channels connected to several estuarine and river tributaries (Wilkes 2019). These channels comprise the northernmost (Wareham) channel, adjoining the Rivers Piddle, Frome and Sherford and a southern channel, termed the South Deep, which connects to the Corfe River along with several smaller streams (Fig. 1). Within the bay, which is enclosed by Studland on the south side and Sandbanks on the north, lie several small islands that from west to east comprise, Long Island, Round Island, Green Island and Furzey Island, with the eastern-most, Brownsea Island, being the largest. The meandering coastline also forms a number of promontories, notably Newton, Ower and Arne on the south side of the harbour and Hamworthy and Poole on the north. The interior of the Harbour is relatively shallow, with extensive areas of intertidal salt marsh and mudflats, which grade into poorly drained wet grassland; heathland lies further inland.

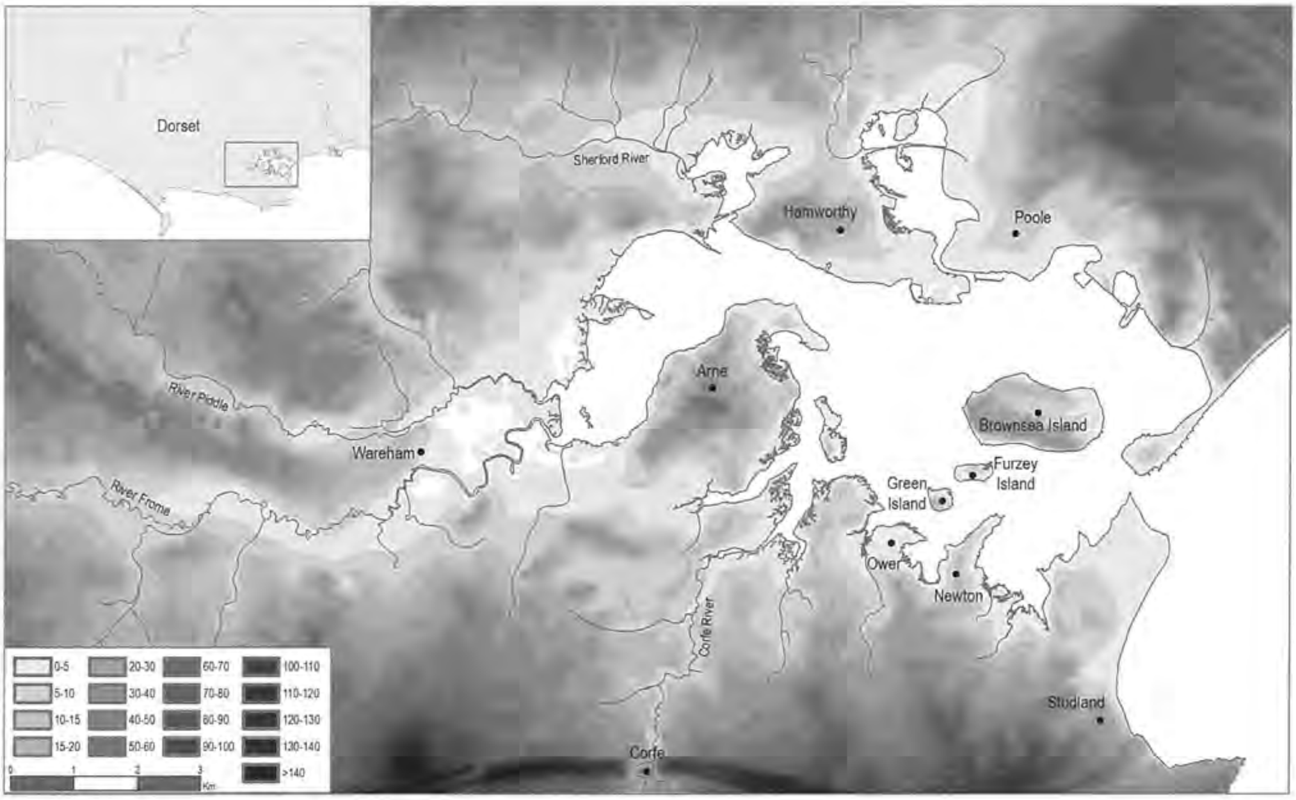

Figure 1 Location and topography of Poole Harbour.

Currently, the north-east of the Harbour is dominated by the conurbation of Poole and Bournemouth. This contrasts to the west and south, which comprises sparsely populated heathland with a largely pastoral agricultural economy; located within this lies the Wytch Farm Oilfield. The historic town of Wareham (with more recent development around Sandford) lies to the north-west, located strategically at, what was at the time of its establishment the lowest bridging point at the mouth of Frome and Piddle rivers which drain central Dorset. The castle and substantial village at Corfe is located on the major routeway south into the Isle of Purbeck at a break in the Purbeck Ridge.

The area is of both national and international importance with respect to its environmental value, forming part of the Dorset Area of Outstanding Natural Beauty (AONB). The entire area of the Harbour is designated as a Site of Special Scientific Interest (SSSI), comprising a wetland of international significance under the Ramsar Convention, and a European Special Protection Area (SPA). Areas within the Harbour fall under additional land designations such as Special Areas of Conservation (SACs) and National Nature Reserves (DEFRA 2019). Cumulatively, these highlight the importance of the numerous flora and fauna within this unique mixed wetland and heathland habitat.

A CHANGING RESOURCE

By its nature, Poole Harbour is a dynamic environment. It sees regular diurnal and seasonal changes relating to the tides, weather and run-off from the river valleys, as well as being subject to longer-term climate change and, in recent centuries, large scale anthropogenic intervention.

Environmental change

Present-day Poole Harbour is a product of postglacial sea-level change. While the pre-glacial topography of limestone and chalk ridges and river valleys are identifiable, the current form of the landscape is also due to modifications via sediment accretion and coastal erosion. The area has of course been subject to changing vegetation over time (Long *et al.* 2009), whilst sea levels have altered dramatically at times (Sutherland 1984).

Sea Level changes have been considered utilising foraminiferal data from multiple cores from Arne and Newton (Edwards 2001). During the last 5000 years there have been four broad phases:

1. A rising relative sea level between 4700BP and 2400BP (e.g. Later Neolithic- Middle Iron Age);
2. Stable to falling level from 2400BP until 1200BP (e.g. Middle Iron Age-Early Medieval);
3. A brief rise in from 1200BP to 900BP, followed by a period of stability (e.g. Early medieval-medieval). The mean tide level (MTL) was calculated to be *c*. -1.0 mOD;
4. A recent increase in the rate of rise from 400–200BP until the present day (e.g. Post-medieval) (after Edwards 2001).

It has been suggested that by the late Iron Age/ Romano-British period the highest astronomical tide (HAT) was 1m lower than that currently experienced (Jarvis 1992; Wilkes 2004). Further localised changes have been postulated from the middle Iron Age into the Romano-British periods. For example, Furzey Island and Green Island were separated, having previously formed a single 'South Island' (Wilkes 2004, 214; Trim 2018, 62–3); Round Island and Long Island adjoin at low tide suggesting that they were once one land mass, whilst Brownsea Island may always have been separate (Wilkes 2019, 5). Shoreline change and coastal erosion is an extensive phenomenon within Poole Harbour, and is of considerable current concern. May (1969, 147) showed that the coastal erosion rate measured between 1886 and 1952 could be averaged at 0.28m per annum for Hamworthy, and 0.35m at Arne. By 1980, 66% of the extent of salt marsh and coast which had been measured in 1952 had been lost from the southern shore of the Harbour between Fitzworth Point and a point south of Brownsea Island, while only 16% had been lost from the central part of the harbour (Long and Scaife 2009, 16). Coastal erosion has been most significant on the southern shore. However rapid sediment deposition is taking place on Sandbanks and Studland on the north and south sides of the harbour mouth (SCOPAC 2012). The colonisation of the mud flats with *Spartina* cord-grass in the 19th century trapped more silt, although the affected area is now much reduced compared with the 1920s (May and A'Court 2010). Several studies of saltmarsh and coastal erosion have shown that the causes are often unclear and potentially result from diverse actors. Accretion rates particularly in areas of salt marsh and are not uniform, and the extent of salt marsh may expand or see a net reduction (Wolters *et al.* 2005, 845–6).

Post-medieval industry and anthropogenic change

The greatest impact to the north-east has been urban and suburban development of the historic settlements of Poole and Hamworthy. This now covers a considerable portion of the northern shore, and there is continual pressure for development for housing, business and infrastructure. The impact of the expansion of Poole-Bournemouth from the 19th century was two-fold. The footprint of settlement expanded and also created increased clay extraction for bricks and other architectural ceramics, affecting the northern arc of the Harbour and Brownsea Island (Sheldrick 2010). Substantial residential development has also occurred around Wareham, particularly in the Sandford area. Large scale gravel extraction in the later 20th century enabled the extensive excavation at Bestwall Quarry (Ladle and Woodward 2009; Ladle 2012) but has created a re-configured landscape including new lakes. On the south side of the Harbour, extensive open cast ball clay mining from the end of the 18th century has radically altered the form of the land itself in areas around Norden and Newton (Buxton 2010). Consequently, considerable areas have been either removed or put beyond reach beneath spoil dumps, and this needs to be taken into account in any consideration of archaeological site distribution.

THE ARCHAEOLOGY

Occupation within the Poole Harbour basin appears to have shifted location several times in the last three and a half millennia. There is a growing body of data suggesting that these relocations may be linked to a combination of changing climatic and environmental (e.g. Wilkes 2004; Long and Scaife 2009), commercial (Hinton 2002, 94; 2018; Forrest 2017) and political factors (Jarvis and Bellamy 2010). There is extensive evidence for the use of the area of the Harbour from the Mesolithic onwards (e.g. Bellamy 2009; RCHME 1970, 511), with notable Neolithic monuments over-looking the basin from the south (e.g. Ailwood Down, RCHME 1970, 432), and within it at Bestwall Quarry (Bellamy 2009). There are numerous round barrows on Godlingston Heath, along the flanks of the Purbeck ridge, at Arne and the Frome valley (RCHME 1970, 443–4,452–3). Extensive and important Middle and Late Bronze Age settlement and field systems occur at Bestwall Quarry (Ladle and Woodward 2009) with the most easterly Dorset stone circle at Rempstone (Gale 2003, 76). However, it is from the Iron Age onwards that various strands of settlement, production and use of the place as a location for connectivity coalesce. A larger nodal network focussed on the harbour with extensive communication links from at least the Middle Iron Age onwards (Wilkes 2004; Forrest 2017; Hinton 2018; Trim 2018).

Conversely, the Poole Harbour basin also contains important evidence of post-medieval industry ranging from attempts to produce alum and copperas (Bellamy *et al.* 2014a), through the inception and burgeoning of the ball clay industry from the 16th century, to the establishment of the Cordite Factory at Sandford in the earlier 20th century (Street and Sheldrick 2010). The evidence from these post-medieval activities are however so extensive that they require separate consideration. This review therefore focuses on the period between the beginning of the Iron Age (*c.* 800BC) to the production of the Treswell map of the harbour in 1586 (Forrest *et al.* 2017), a convenient beginning to the post-medieval/modern period.

Datasets and reviews

Numerous sources record archaeological finds, site and investigations, including the Dorset Historic Environment Record. Detailed surveys were undertaken by the Royal Commission on the Historical Monuments of England (1970) and airborne laser scanning data has more recently been collated as part of the National Mapping Project (Royall 2014; 2016). Various research frameworks and policy documents

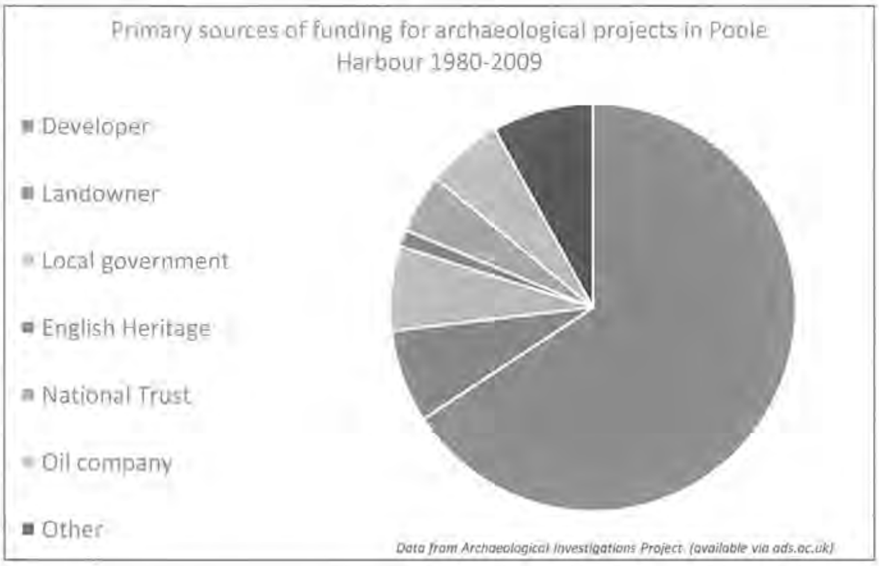

Figure 2 Primary funding sources for archaeological projects carried out in the Poole Harbour basin 1980–2009.

reference the archaeology (Champion *et al.* 2001; Webster 2008; Le Pard *et al.* 2011; Guthrie 2011; Johns *et al.* 2015). A substantial overview of the history of the Harbour has been provided in the *Book of Poole Harbour* (Dyer and Darvill 2010).

From the late 1980s onwards archaeological field investigations have largely been commercially driven (Fig. 2). This has included substantial and important work related to oil exploration and extraction at Wytch Farm (Sunter and Woodward 1987; Cox and Hearne 1991). The extensive and long-running examination of the landscape at Bestwall Quarry, Wareham (Ladle and Woodward 2009; Ladle 2012) related to large scale gravel extraction. Excavation, historic building survey and documentary research has been carried out partly as a research project but given impetus by the need to conserve the structures at Corfe Castle (Papworth in prep). On the north-eastern side of the basin, the ever-expanding Poole/Bournemouth conurbation has led to both significant and numerous small investigations within the old town of Poole (Horsey 1992; and Watkins 1994) and on the Hamworthy peninsula (e.g. Jarvis and Bellamy 2010).

Several reviews of the archaeological evidence have been focussed on a particular period or activity (e.g. Wilkes 2004; Trim 2018; Jones 2017; Hathaway 2013). Attention has been paid to craft activities such as Kimmeridge Shale working and particularly the Romano-British pottery industry (South East Dorset Black Burnished Ware 1 pottery hereafter termed BB1 – e.g. Calkin 1949; 1953; 1954; 1960; 1967; and Farrar 1969; 1976; 1981; 1982; 1983; 1984; Lyne 2002; 2012). This has led inevitably to some spatial bias towards the south and west sides of the Harbour where the archaeological resource has been located and is accessible. The principal archaeological investigations undertaken within the study area have been collated in Table 1 and are presented thematically.

This review of the archaeological evidence from the Poole Harbour basin will be in two strands. The first strand focuses on the available resources that have been exploited during the study time frame, with the second focusing on the chronology of the different archaeological sites identified. This duel stranded approach provides a far greater synopsis of the available data whilst providing an insight into possible research themes for the future.

The resources of the harbour and its hinterland

Apart from its physical and topographical characteristics which offer abundant beaching locations sheltered from the prevailing weather, the Poole Harbour basin also contains, or has access to a wide range of raw materials (Fig. 3).

Stone (Heathstone, Limestone, Chalk, Shale)

Poole Harbour and Purbeck provide access to a variety of bedrock geologies with a long history of extraction and product creation. The differing

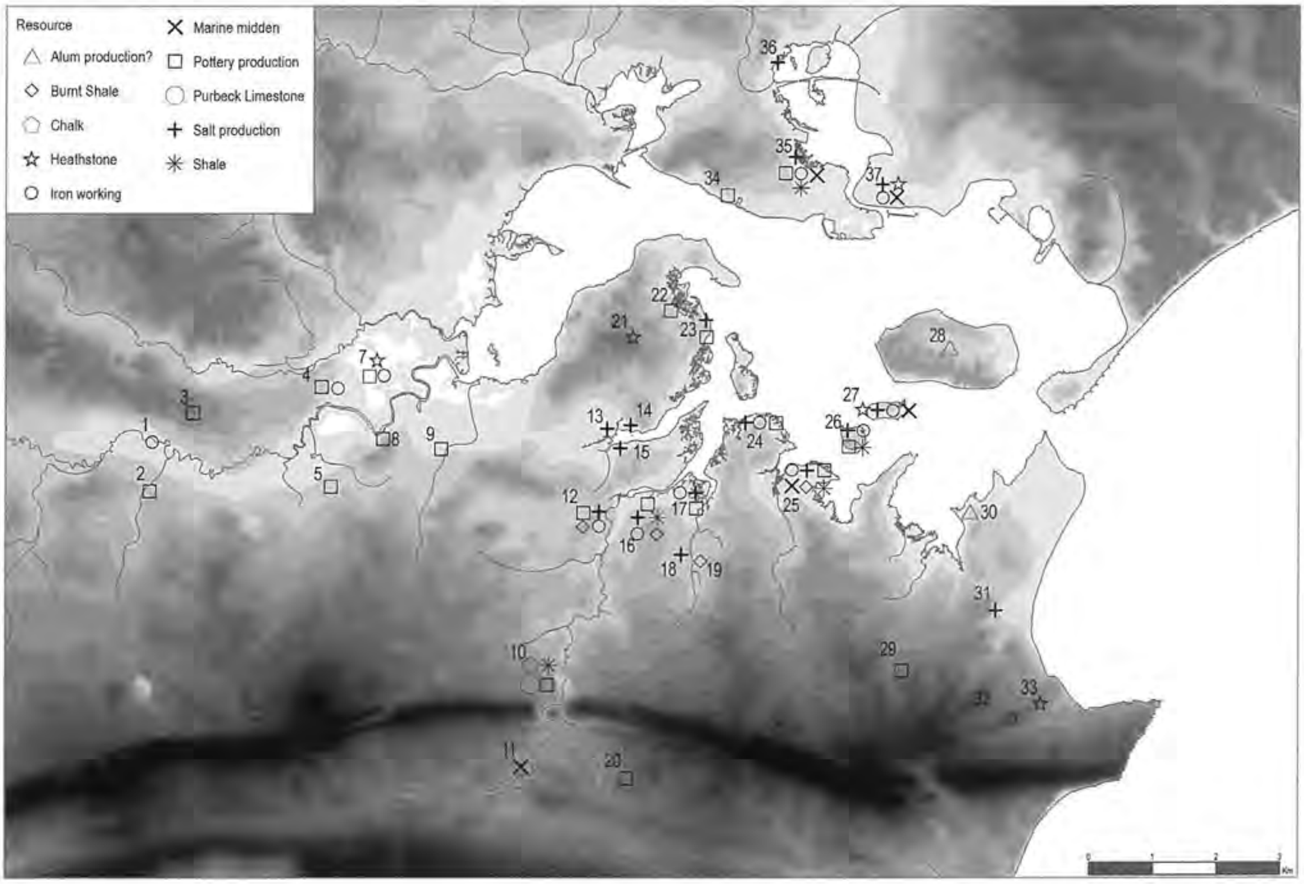

Figure 3 Principal sites of resource exploitation and production mentioned in the text. 1: River Frome at Worgret; 2: East Holme; 3: Worgret; 4: Pound Lane; 5: Stoborough; 6: Creech Grange; 7: Bestwall; 8: Redcliffe Farm; 9: Bank Gate Cottages; 10: Norden; 11: Bucknowle Farm; 12: West of Corfe River; 13; Salters Copse; 14: Salterns; 15: Middlebere; 16: East of Corfe River; 17: Point Ground; 18: Wytch Moor; 19: East of Wytch Moor; 20: Sandyhill Copse; 21: Arne; 22: Big Wood; 23: Shipstal Point; 24: Fitzworth Point; 25: Ower; 26: Green Island: 27: Furzy Island; 28: Brownsea Island; 29: Godslington Heath; 30: Studland Circles; 31: Studland Heath; 32: Woodhouse Hill; 33: Studland; 34: Lake; 35: Hamworthy; 36; Boat House Clump; 37: Poole.

nature, quality and potential uses of each stone coupled with changing tastes and distribution opportunities has influenced their use through time.

Heathstone is the only generally available stone within the basin itself. It is a highly ferruginous sandstone and derives from discrete pockets within local tertiary sand and clay formations across Purbeck and known colloquially as Carstone or Ironstone. The use of this material is known from the Neolithic period onwards (Mercer and Healey 2008, 633). The stone was used in the Romano-British period to make rotary querns (e.g. Furzey Island (Cox and Hearne 1991, 176), and Bestwall (Ladle 2012)), as well as for three stele (marker stones) at Studland (Cox 2012) and one from Bestwall Quarry (Ladle 2012, 174). Heathstone was used in the main construction of local buildings rather than decorative elements, such as the medieval Town Cellars of Poole, churches at Arne, Canford Magna and Corfe Mullen (Dorset Materials Survey 1992–4), Wimborne Minster (RCHME 1975, 82) and Wareham Castle (Renn 1960; RCHME 1970, 325). It was also commonly utilised locally for vernacular buildings. There are currently no known dedicated extraction sites, and due to the isolated nature of outcrops, such sites may be difficult to define. Thomas (2016, 129) hypothesises that heathstone was recovered from isolated clay and sand pits. However, the large volume used in the past implies a more focussed exploitation. Lytchett Matravers on the northern fringe of Poole Harbour may have provided one potential extraction site dating to the 15th century (Thomas 2016, 131).

The Purbeck Limestone beds run east to west from Swanage to Worbarrow Bay. They comprise various qualities of fossiliferous limestones of Cretaceous

Table 1 Site investigations in and around Poole Harbour.

	Site	Reference	Settlement	Funerary	Pottery	Salt	Stone	Shale	Metal Production / working	Other
Iron Age	Bestwall	Ladle 2012	X							
	East of Corfe	Cox and Hearne 1991	X		X	X		X	Iron	
	Furzey Island	Cox 1989; Cox and Hearne 1991; Wilkes 2004; Hathaway 2013	X			X		X	Iron	
	Green Island	Calkin 1955; Wilkes 2004, Wessex Arch 2003	X					X	Iron	
	Hamworthy	Smith 1931; Jarvis 1994	X		X	X		X	Iron	
	Ower	Sunter and Woodward 1987; Cox and Hearne 1991	X			X		X	Iron and Bronze	
	Rope Lake Hole	Sunter and Woodward 1987	X	X				X		
	Slepe	Cox and Hearne 1991	X							
	West of Corfe River	Cox and Hearne 1991	X		X	X		X	Iron	
	West Creech	Cox and Hearne 1991	X							
Romano-British	Arne (Shipstal Point and Redcliffe)	Smith 1934; Farrar 1952; 1963; 1978; 1981 Lyne 2002	X		X	X				
	Bestwall	Ladle 2014	X	X	X			X		
	Boathouse Clump, Upton	Jarvis 1986b								
	Brownsea Island	Jarvis 1993			X	X		X		
	East of Corfe River	Cox and Hearne 1991	X		X	X		X	Iron	
	Fitzworth	Calkin 1949	X		X?	X?				
	The Foundry, Poole; West Quay Road, Poole	Watkins 1994	X			X				
	Hamworthy	Smith 1931; Jarvis 1994; Terrain Archaeology 2001; 2003	X		X	X		X	Iron	
	Middlebere	Papworth 1992				X				
	Norden	Sunter and Woodward 1987; Cox and Hearne 1991	X				X			
	Ower	Sunter and Woodward 1987; Cox and Hearne 1991	X	X	X	X		X		
	Rope Lake Hole	Sunter and Woodward 1987	X			X		X		
	Stoborough	Hearne and Smith 1991; Field 1992; Lyne 2002	X		X					
	Woodhouse Hill, Studland	Field 1966; Beavis 1971	X				X			
	Worgret	Hearne and Smith 1991	X		X					
	Point Ground, Wytch	Pitman *et al.* forthcoming			X					

	Site	Reference	Settlement	Funerary	Pottery	Salt	Stone	Shale	Metal Production / working	Other
Early Medieval	Bestwall	Ladle 2012							Iron	Numerous charcoal pits possibly associated with metalworking
	Ulwell	Cox 1988		X						
	Worgret, Frome River	Maynard 1988; Hinton 1992a							Iron	Timber lined pit – evidence for watermill /with metalworking
Medieval	Arne	Numerous historic documentary sources	X							
	Bestwall	Ladle 2012	X							
	East Holton	Hewitt forthcoming	X							
	Newton	Cox and Hearne 1991	X							
	Ower and Ower Farm	Cox and Hearne 1991; Dodd 1994	X			X				X – Clay extraction for unknown purpose
	Salterns	Cox and Hearne 1991	X			X–Waste Only				
	Wytch	Pitman et al. forthcoming; Cox *et al.* 2009				X				

origin (Clements 1993). Purbeck limestone (or 'marble') was used from the Bronze Age onwards (Palmer, 2019), but most archaeological evidence relates to the Romano-British period (Beavis 1971) when it was worked on sites within the Harbour basin. The initial lack of suitable stone sources in southern Britain necessitated importation from the Mediterranean, incurring cost and suggesting wealth and power. Its occurrence at high-status sites across Britain (e.g. Fishbourne) indicates that Purbeck Limestone was on a par with Mediterranean imports (Williams 2002, 127–9). In time it came to be extensively used as a roofing material on several Dorset villas. Unworked stone awaiting use for building materials or to be turned into stone products was identified at Woodhouse Hill (Beavis 1971, 192). In addition, distinctive limestone mortars were produced at Norden (Sunter and Woodward 1987), and like heathstone it was also used to create stele or markerstones which were recycled in buildings at Ower (Woodward 1987, 105) and Worgret (Mills and Hearne 1991, 97). As expected the evidence for workshops and extraction sites increases nearer to the source, but limestone appears to have been a status symbol associated with authority, probably due to restricted availability.

This is echoed in the medieval period, when Purbeck marble occurred across southern Britain in monastic and parish church architecture (Leach 1978), including high profile buildings such as Salisbury Cathedral (Tatton-Brown 1991) and Wimborne Minster where it was used extensively in decorative elements (RCHME 1975). The occurrence and use of Purbeck marble during the medieval period has been charted by Drury (1949), with an overview of extraction for both the Romano-British and medieval periods provided by Williams (2002); a gazetteer has been compiled by Palmer (2019). Purbeck limestone was a highly sought-after material, prized for the creation of buildings, architectural details and mortars (Palmer 2014). Limestone was exported from Ower quay during the medieval period (Jarvis 2014), prior to the development of Swanage as the primary transhipment location for the industry in the 18th century (RCHME 1970, 290).

Chalk occurs across the southern part of Purbeck, forming the western end of a remnant which originally extended the Purbeck Ridge to the Isle of Wight (May and A'Court 2010). Chalk was also worked at Norden, where tesserae were being produced in the Romano-British period (Sunter and Woodward 1987). During the post-medieval period chalk was burned in limekilns scattered across the Purbeck hills; an early 18th century example was excavated on Wytch Heath (Cox and Hearne 1991, 104–5). More significant, at least in earlier periods, was the utilisation of shale. Kimmeridge Shales occur within the Jurassic deposits of Kimmeridge Clay. The beds lie between Chapman's Pool and Brandy Bay, roughly east to west across Purbeck. Deposits outcrop in a band less than 1km in width. Accessible near-surface exposures are likely to have existed at Horbarrow Bay and Clavel's Hard (Cox and Mills 1991, 170). This finely laminate argillaceous rock is soft, which facilitates splitting and working. It has a high mineral oil content, which contributes to its sheen but also enabling its use as a readily combustible fuel source.

Kimmeridge Shale first enters the archaeological record in the form of worked beads in the Mesolithic period (Denford 2000). However, industrial scale exploitation of the material does not appear to have been undertaken until the Iron Age, when it was worked by hand into armlets and rings, as evidenced at Rope Lake Hole (Sunter and Woodward 1987), Eldon's Seat (Cunliffe and Philipson 1968) and Football Field, Worth Matravers (Cullinane 2018). Waste shale quantities can be voluminous, as at Rope Lake Hole (Sunter and Woodward 1987, 165). Here, five shale working dumps were identified with random samples of *c.* 1% being taken from three of these. It was noted by Cox and Mills (1991, 170) that the 'evidence for shale working, in the form of waste core material has come from virtually every Iron Age site in Purbeck'; in the past such waste cores were referred to colloquially as 'coal money' (Calkin 1955).

A major innovation in the Late Iron Age, probably in the 1st century BC, was the introduction of the lathe. The typology of waste cores demonstrates changes in technology over time (Calkin 1955). Working tools were still flint, supporting a limited but significant flint-working tradition. Pre-Roman lathe turned shale objects, trimmed using flint tools, occur within the Harbour on Green Island, as well as Gallows Gore, and sites at Worth Matravers (Calkin 1955; Cullinane 2018). The hand working of shale objects continued alongside those worked on the lathe (Cox and Mills 1991, 173), and this is evidenced at sites such as that East of Corfe River, West Creech and at Ower. These sites also speak to a change in focus of production in the later Iron Age from locations close to source, to locations within the Poole Harbour basin. The evidence for burnt shale is mixed. Cox and Hearne (1991) noted that it could relate to either domestic or industrial processes, with occurrences at East and West of Corfe River, at Ower and East of Wytch Moor, likely deriving from accidental burning (Cox and Mills 1991, 174). In contrast, where shale occurs on medieval sites across Dorset, it is burnt rather than worked (e.g. Shaftesbury, (Richards *et al.* in prep)), suggesting a conscious shift from its use for manufactured products to use purely as a fuel.

The intensity and specialisation of the Romano-British shale industry is notable. Examination of the incidence of over 3000 artefacts from nearly 700 British sites showed that armlets, spindlewhorls and waste cores all dramatically increased in number from the late Iron Age into the Romano-British period (Denford 2000).The number of lathes per workshop identified at Gallows Gore, Worth Matravers, could be inferred where a shale working floor produced debris patterns and stone settings showing the locations of lathes (RCHME 1970, 621). Diversity of products increased over time but vessels and other items were a more specialised product than armlets (Cox and Hearne 1991, 174). Furniture elements and vessels were made at Norden from the 2nd century onwards, and bead and tray fragments were identified at 3rd–4th century Ower (Sunter and Woodward 1987). Ower, followed by Hamworthy, had the most occurrences of shale objects within Poole Harbour (Denford 2000).

Aggregates

The entire Poole Harbour basin is a complex series of beds of stones, clays, sands and gravels. Having been used from the Bronze Age onward in a variety of fabrics (Woodward (2009) sands were used extensively from the late Iron Age as a temper in ceramics (Jones 2017, 10–17), and were most likely obtained from the same area as the clays within which lenses of sand occur (see below). In recent centuries, sand and gravel have been extracted deliberately as aggregates for the construction industry, and this remains a potential area for impact on the archaeological resource.

Clay

Poole Harbour possesses a wealth of clays suitable for potting. These have been utilised since at least the earlier Bronze Age (Jones 2017, 73), with firing features and dumps of clay identified at Bestwall Quarry (Ladle and Woodward 2009, 66,68). However, more abundant evidence of pottery production dates to the Late Iron Age with clay filled pits and burnishers found at Bestwall (Ladle 2012), along with a probable Late Iron Age trench kiln (kiln 2914), identified at the site East of Corfe River (Cox and Hearne 1991, 38–9). A further probable kiln of similar date was identified West of the Corfe River (feature 3040; Cox and Hearne 1991, 69). A defined range of styles in sandy or quartz tempered reduced and/or oxidised wares, often termed Durotrigian ware after the supposed tribal area in which they occur (and which somewhat problematically, they have also been used to define), spread across Dorset and into Somerset during the 1st century BC. These included jars with everted rims, bowls and jars with bead rims and less common forms such as tankards and lids. These were first defined as a limited suite of styles (Brailsford 1958), but the picture has subsequently been recognised to be more complex (Brown 1997; Jones 2017). The standardisation in forms and fabric seems consistent with organisation of production and apparent commercialisation (Williams 1977, 168).

The term 'Black-burnished ware' (BB1) was first coined by Gillam (1963, 126). The pottery forms drew upon the Iron Age tradition and the vessels are arguably Dorset's most prolific ceramic product. The industry has an extended history of study (Farrar 1969; Williams 1977; Grant 1982; Coulson 1989). During the early Romano-British period, BB1 was distributed across the south west, but during the 2nd–4th centuries AD it spread across the entire province of Britain. The potential Roman Army supply base at Hamworthy may have influenced the survival and development of the industry (Williams 1977, 170). The BB1 industry is characterised by a wide range of vessels, handmade in a quartz-rich fabric, burnished and fired in reducing conditions to a black colour. However, 84% of the 1st/2nd century AD BB1 assemblage from Hamworthy was oxidised which rarely occurs in quantity anywhere other than kiln sites (Jarvis 1994). A similar percentage occurred at Bestwall Quarry (Lyne 2012), where BB1 was produced in huge quantities (Ladle 2012). Recent finds at Point Ground, Wytch also contained oxidised pottery of an orange hue (Pitman in prep). It appears therefore that this is a common phenomenon for Roman Poole Harbour, and it has been linked to salt production (Farrar 1963, 140). Jones (2017, 39–41) has shown that there are numerous potential production sites known (Table 2) with 13 sites of this type lying within the immediate confines of Poole Harbour, and others further afield.

South East Dorset Orange Wiped Ware (SEDOWW) was a late derivative of the BB1 industry (Gerrard 2010; 2012). This comprises a fabric very similar to that of BB1, oxidised rather than reduced with a striking range of forms. These include peculiar large jars with pie-crust rims, small perforations at numerous heights up the body and around the neck and often, a very large pre-firing hole in the base. Their function remains obscure (Gerrard 2010; Ladle 2012, fig. 154.8). The dateable contexts in which these occur indicate that they were produced (alongside some other late forms of Black Burnished Ware) from the mid-4th to mid-5th centuries AD (Gerrard 2010; 2012) and when found on sites across Dorset are potentially an important marker of activity continuing into the 5th century (Randall 2020).

The earlier medieval period has been regarded as largely aceramic. However locally produced pottery occurred at Bestwall Quarry with vessels dated to the 6th through to the 10th century (Brown 2012, 258). Whilst pottery was being produced in the area of the Harbour during the medieval period, the location for this is unclear. The recent find of a 13th–14th century pottery kiln at Pound Lane, Wareham (Milward 2017) is helpful. This kiln was producing both glazed fineware jugs alongside more utilitarian coarsewares. Further kilns were probably situated around Poole (Spoery and Hart 1988). A group of kiln waste dating to the early post-medieval period was identified at East Holme, west of Wareham (Terry 1987), although no kiln structure

Table 2 Late Iron Age and BB1 pottery production sites, suspected and confirmed (After Jones 2017, Table 3.1).

Location	Date Range	Reference
Shipstal Point	AD C1–2nd	RCHME 1970, 593, no. 54; Swan 1984, 261
N. of Bank Gate Cottages	ERB–LRB	Farrar 1963, 140; RCHME 1970, 593, no. 52; Swan 1984, 260
Nutcrack Lane and Stickland's Gardens, Stoborough	LIA–RB	Lyne 2003; RCHME 1970, 592, no. 50; Swan 1984, 259
Worgret, west of The Purbeck School	LIA–LRB	Farrar 1953; Hearne and Smith 1992; RCHME 1970, 592, no. 49; Swan 1984, 259
Redcliff Farm, Ridge	AD C1–4th	Lyne 2003; Swan 1984, 260
Big Wood, near Shipstal	AD C1–2nd	RCHME 1970, 593, no. 53; Swan 1984, 261
Fitzworth Point	AD C1–4th	Calkin 1949; RCHME 1970, 597, no. 226; Swan 1984, 262–3
Cleavel Point, Ower	LIA to RB (C3rd–4th)	Farrar 1952; Farrar 1962b; RCHME Dorset 1970, 597–8, 227; Sunter and Woodward 1978; Swan 1984, 261–2
Old Landing Stage, Green Island	LIA	RCHME 1970, 597, no. 224; Wessex Archaeology 2003; Swan 1984, 262
Lake, Hamworthy	LIA	Smith 1931, 126–7; RCHME 1970, 603
Hamworthy	RB	Smith 1931; RCHME 1970, 603, no. 402; Lyne 1994
Bestwall Quarry	LIA and AD C3–5th	Ladle 2012
Point Ground, Wytch	RB	Montieth, Milward and Pitman in prep.
West of Corfe River	LIA	Cox and Hearne 1991
East of Corfe River	LIA	Cox and Hearne 1991
Norden	RB	Farrar 1952; RCHME 1970, 598, no. 230; Sunter and Woodward 1987; Cox and Hearne 1991; Swan 1984, 263
Sandyhill Copse	LIA/ERB	Farrar 1962b; RCHME 1970, 599, no. 233
East Holme	AD C2nd	Beavis 1972
Creech Grange	AD C2–3rd	Unknown
Godlingston Heath, Studland	AD C2–3rd	Farrar 1962b, 141–142; RCHME 1970, 609, no. 45; Swan 1984, 264

was identified. Further waste pottery was recovered in the Stoborough area (Ladle pers comm.) and the fabric relates directly to redwares that commonly occur in Corfe Castle and its environs.

Salt

Salt was an essential element in food preservation before the advent of refrigeration in the post-medieval period. In Poole Harbour, salt was produced by the evaporation of seawater (Hathaway 2005; 2013) as opposed to extraction from the extensive Triassic saltfields that underlie much of south-east Dorset. The topography of the Harbour and direct access to salt water makes it an ideal location. Seawater is *c.* 3.5% salt (Hathaway 2013, 106), so whilst excess water can be evaporated naturally, in the British climate this is more effectively achieved via the application of heat. For the Iron Age and Romano-British periods, salt production is therefore indicated by the presence of briquetage, a term which includes ceramic evaporation containers and associated hearth furniture.

Late Iron Age briquetage has been identified from Green Island (Wilkes 2004) and Furzey Island (Cox 1989; Cleal 1991), mainland sites such as Ower (Sunter and Woodward 1987; Cox and Hearne 1991), and East of the Corfe River (Cleal 1991). The Foundry, Poole (Watkins 1994) and West of Corfe River (Cox and Hearne 1991) provided evidence indicating continuation of salt production into the early Romano-British period. Production evidence is more extensive, including at Ower in the 3rd–4th century AD, Middlebere (Papworth 1992), Fitzworth (Calkin 1949), and at two sites on the Arne peninsula, Shipstal Point (Smith 1933; Farrar 1952) and Salterns Copse (Farrar 1963). On the north-eastern side of the Harbour briquetage has been identified at Boathouse Clump (Jarvis 1986b) and Hamworthy (Smith 1931; Jarvis 1994).

During the late Romano-British period there was a distinct decrease in the amount of briquetage, which has been attributed to the adoption of lead vats (Hathaway 2013, 475). This seems to presage the methods used in the medieval period. At Point Ground, Wytch, workshops of Saxo-Norman date with boiling hearths also yielded numerous vesicular droplets of lead (Pitman in prep). Thick deposits of burnt sand and fuel ash slag were identified across the site at Point Ground, which is similar to deposits at Salterns on the adjacent Arne peninsula and Wytch Moor (Cox and Hearne 1991, 93–95, 97–100). Thirteen salt workers were listed in Domesday at Ower (Thorn and Thorn 1983). Documentary sources (Keen 1988) indicate that salt production was widespread across Poole Harbour during the medieval period. It was largely a monastic undertaking, with rents often being paid in salt. Locations including Middlebere, are indicated on Treswell's Survey in AD 1586 as being further potential production locations (Forrest *et al.* 2017; Keen 1988). Place name evidence (*Salterns*), supports this with places including this on the Arne peninsula, between Canford and Poole and at Studland.

Iron and other minerals

Ironworking took place within the Harbour area. Local outcrops of ironstone at Studland, Woodhouse Hill, and Godlingston Heath may be potential extraction locations (Thomas 2016, 132), providing the raw material for early iron production. In comparison, ironstone was extracted at Hengistbury Head for iron production during the late post-medieval period. Between 1848 and 1872 the Hengistbury Mining Company extracted ironstone boulders (Cross 1963). During the Late Iron Age, ironworking waste was deposited at Ower (Cox and Hearne 1991, 159), Fitzworth Point (Calkin 1949, 42) and West Creech (Cox and Hearne 1991, 159). Further evidence for iron working within the Harbour basin was identified on Green Island during test pitting (Wilkes 2004, 201). Two hearth bottoms were identified in excavations at Furzey Island (Cox and Hearne 1991, 159). Romano-British ironworking evidence has been identified on the north side of the Harbour at Hamworthy (Smith 1931), and at 'Cottage B' at Woodhouse Hill, Studland with a probable forge attached to domestic rooms. This was dated to the 4th century AD (Field 1966, 159). Remnants of non-diagnostic hearth lining at East and West of the Corfe River (Cox and Hearne 1991, 159) also indicate iron working.

Two sites present evidence of ironworking during the early medieval period. At Bestwall, two phases of iron working were evident, one spanning the late 5th to early 6th century and the second from the 8th to early 10th century (Ladle 2012, 319). At Worgret on the banks of the River Frome, a timber lined pit was identified. Originally a quenching tank or tanning trough it had been later backfilled with large amounts of iron slag and abraded Romano-British pottery sherds (Maynard 1988, 96–7). One of the timbers provided a radiocarbon date of the late 5th to mid-7th century. Subsequently, the timber lining was dendrochrologically dated to the 7th century (Hinton 1992b), after which the ironworking waste must have been dumped. Evidence of ironworking also occurred in Wareham in the 11th century (Hinton and Hodges 1977, 58), whilst metalworking waste was identified within the backfill of salt boiling workshops at Point Ground, Wytch, dating from at least the 11th century (Pitman in prep). Iron smithing evidence of the 14th century was also identified at Thames Street Poole (Horsey 1992, 28–9).

During the 16th century Poole Harbour became the location for activity which potentially represents England's earliest chemical industry, serving increasing demand from the textile industry. Aluminium silicate and pyrites could be found in local clays and manufactured into soluble aluminium sulphate. Ammonium alum could then be produced by the addition of urine, and potash alum by adding burnt seaweed or wood. Alum was utilised as a fixative in cloth dyeing, as well as a softener for leather. Copperas, ferrous sulphate, was used as a black dye or ink colourant and also possessed fixative qualities. It was derived either from its naturally occurring mineral form, melanterite or weathered pyrites which both occur in the local clays (Broadbent and Hawkins 2010, 109–110). Extraction locations were identified on Treswell's Survey as '*the mynes*' (Forrest *et al.* 2017). Demand increased during the 16th century as the supply from the main source in Papal controlled Italy was disrupted. Suggested production locations on Brownsea Island (Broadbent and Hawkins 2010, 111) have proved inconclusive (Bellamy *et al.* 2014a), as has exploration of the Studland Circles, complexes of low circular earthworks with dish-like interiors (Bellamy *et al.* 2014b).

Agricultural, wild and woodland products (arable, livestock husbandry, fish, shellfish, and timber)

From the Neolithic onwards woodland in the Harbour area consisted of lime oak and hazel, with elements of beech and ash (Haskins 1978). The earliest woodland around Bestwall Quarry appears to have been oak dominated deciduous woodland. Clearance of woodland initially commenced during the Bronze Age, continuing throughout the Iron Age (Gale 2009, 334; 2012, 287), and occurred similarly at other sites in the Harbour (Scaife 1991, 197). Pollen indicates that heathland expanded during the earlier Bronze Age, whilst alder carr vegetation developed in wet valleys. Pine stands remained on some islands into the Iron Age (Allen and Scaife 1991, 217). Development of heaths are of course indicative of degraded soils, but this does not mean that areas were rendered agriculturally unusable. Heathland has to be grazed, cut and otherwise utilised to prevent woodland succession, so persistence of heaths throughout the later prehistoric and historic period indicates constant use for grazing and fuel cutting (Allen and Scaife 1991, 217). The lack of fields on the heaths is therefore not an indication of lack of use but of extensive grazing activities, rather than enclosed agricultural practices.

Woodland exploitation would have occurred from the earliest times, and a common factor in many of the other industrial processes seen within the Poole Harbour basin is that they required fuel, particularly for potting, salt production and ironworking. Iron Age evidence at Bestwall included the use of oak, alder and hazel, but also hawthorn, blackthorn, gorse and heather (Gale 2012, 285) reflecting use of more shrubs and heathland species than the present of woodland *per se*. Oak, gorse and heathers remained important in Romano-British pottery kilns at Bestwall (Gale 2012, 285). Specific exploitation of the woodland in the later 1st millennium AD has been seen at Bestwall, with numerous pits dated to *c*.600–900 AD containing large amounts of oak with a small element of holly charcoal, suggesting not only charcoal production but also reflecting the composition of the woodlands from which it came (Gale 2012, 286). Whilst building in timber is implicit in many of the structures of all periods, in some cases wood has been preserved and the species identified. At Worgret, an oak lined tank or tanning trough was dated by dendrochronology to the 7th century AD (Hinton 1992b).

Arable agriculture was apparently confined to inland areas, especially during the Iron Age and Romano-British periods. There is limited evidence of Late Iron Age crops from Bestwall Quarry, being restricted to a few barley and spelt wheat parts (Carruthers 2012, 290). Chaff however was used as a fuel in the Bestwall kilns. Bread wheat, spelt, emmer, hulled barley, possibly oats and flax were all represented. Bread wheat, hulled barley oats and rye all occurred in post-Roman and early medieval features (Carruthers 2012, 299). Rye was also more abundantly present at Wytch Farm. As it tolerates poor conditions this may reflect soil degradation and podzilisation (Allen and Scaife 1991, 219). Plant macrofossils from Bucknowle Villa included a wide range of weeds of arable production. These reflected local habitats including wet and potentially saline environments, heathland as well as limestone areas (Green 2009, 171), so it seems possible that some crops were sourced from north of the ridge. A single fragment of fig and two olive stones (Green 2009, 168) were evidently not local products. The Romano-British pollen evidence from Bestwall, from a single buried soil and a Late Roman kiln, showed a localised lack of tree cover (excepting low levels of ash and lime) and a preponderance of grass pollen. The arable element had reduced from previous Iron Age samples, although it was still present (Scaife 2012, 274–5). This mirrors other contemporary sites in the Harbour (Scaife 1991, 197). As industrial activity increased, pastoral production may have provided a better fit with land use and seasonal labour demands.

Animal bone has only been recovered from a few sites due to poor preservation on the acid soils (Higbee 2012, 270; Hamilton-Dyer 1991). Where present they typically comprise the main livestock species. However, there are important assemblages from later Iron Age Ower, where, pig is far more abundant than expected (Coy 1987; Hamilton-Dyer 1991). This has been linked to salt production and the suitability of pig meat for preserving (Maltby 2006). Other nearby sites have produced assemblages which provide an impression of the broader animal economy of the region. At Football Field, Worth Matravers there was a more typical Iron Age emphasis on sheep/goat in the Early and later Iron Age assemblages (Randall 2018b). At Bucknowle villa the modest Iron Age assemblage was dominated by domestic species. This was similar in the Romano-British assemblage, although deer increased, and chicken was added (Rixson and Rixson 2009). Field systems can relate to both arable agriculture and livestock husbandry. The best understood land boundaries were at Bestwall Quarry, where Middle and Late Bronze Age systems (the former including stock handling features such as sorting gates (Ladle and Woodward 2009, 85, 106–108) were superseded by those of later Iron Age, Romano-British and medieval period (Ladle 2012, 101–110). These have features associated with livestock husbandry (cf. Randall in press). Later prehistoric fields survive as earthworks at Creech and Povington Hill, to the south around Corfe, and on Ballard Down (RCHME 1970, 629–32).

Fishing and use of other marine resources were limited until the Romano-British period. In keeping with almost all Iron Age sites, including those coastally located, there is limited evidence of marine species exploitation. However, the Middle Iron Age midden on Furzey Island produced bones of eel, flatfish and garfish which would have been locally available. Late Iron Age deposits on the Ower peninsula also produced eel and flatfish vertebrae (Hamilton-Dyer 1991, 210). Small amounts of marine molluscs were recovered from both sites (Winder 1991). At Football Field, Worth Matravers very small amounts of fish bone were present from Iron Age and Romano-British contexts, mainly seabream, whilst there was some exploitation of shellfish particularly limpets throughout the later prehistoric and Romano-British periods (Randall 2018c; Ladle and Ladle 2018). At Bucknowle villa a range of species was recovered. These included ling, bass, wrasse and scad, which prefer rocky shores (Hamilton-Dyer 2009, 164), and therefore may have been procured from the southern Purbeck coast. However, eels and salmonids could have come from the Corfe River, whilst flatfish and mullet as estuarine species, along with conger eel, are common in Poole Harbour (Hamilton-Dyer 2009, 164). Fishing became an increasingly important part of medieval subsistence within Poole Harbour and the wider Purbeck area (Hinton 2002, 93–95). There were extensive oyster shell middens of 9th–12th century AD date on the foreshore at both Hamworthy and Poole and which represent deliberate large scale exploitation (Winder 1992, 199).

At Ower Farm a substantial midden of marine mollusc shells accumulated, dating to the 12th–13th centuries. The structure of this midden, of which only a small part was sampled, indicated targeted acquisition of particular species (Winder 1991). It also contained bones of eel, bass, gurnard and ray, all of which would be available in the Harbour (Hamilton Dyer 1991, 211). It was suggested that the scale of exploitation may have related to the manor being in the possession of Milton Abbey and seafood being particularly appropriate to the monastic diet (Winder 1991, 212–3). Later medieval fish bones from Poole include both local coastal species and those such as cod, ling, haddock and hake which are deep water fish (Coy 1992), and attest to the development of the fishing industry.

Boat Building

The Poole Harbour logboat was identified during dredging works in the Harbour in 1964. The ten-metre-long vessel radiocarbon dated to 397–176 cal BC was carved from a single locally sourced oak trunk (Wilkes 2019, 8–9). No evidence for Roman boat production has been identified, although extensive oyster exploitation (Winder 1991; 1992) suggests the building of fishing boats was likely to be undertaken, if not larger vessels. Evidence for 14th century boat production was identified at The Foundry (Watkins 1994). Here, 53 timbers including support 'knees' and clinker planking were identified. They were situated on the medieval western shoreline adjacent to St James' Church (Sutton 2010, 147).

Distribution of activity over time

From the inception of the Iron Age onwards, locations of settlement, agriculture and industrial and other activities shifted throughout the Poole Harbour basin (Fig. 4).

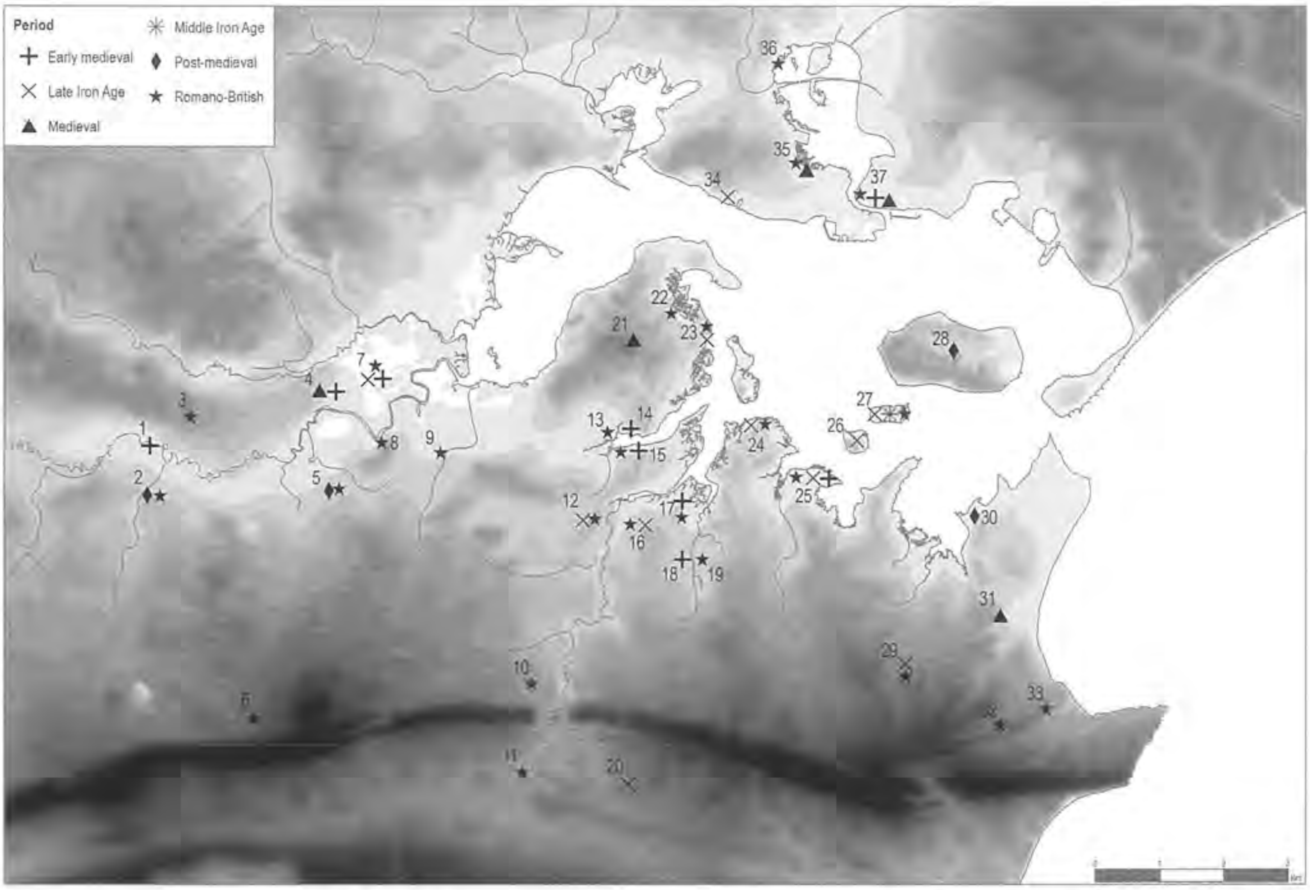

Figure 4 Principal sites mentioned in the text by period, numbers as Figure 3.

The Iron Age

Evidence for the Early Iron Age use of the immediate harbour area is hard to come by, contrasting with that on the southern Purbeck coast (cf. Cunliffe 1984, fig. 2.3). Cunliffe noted the potential for bias resulting from researchers such as J.B. Calkin (Cunliffe 1987, 338), who focussed his efforts on the Isle of Purbeck. However, there was even a hiatus at Bestwall Quarry between the Late Bronze Age (Ladle and Woodward 2009) and the later Iron Age (Ladle 2012). Nevertheless, Wilkes (2019, 9) suggests that Green Island was occupied from the Early Iron Age. Early Iron Age pottery was also recovered at West Creech (Cox and Hearne 1991, 135). The evidence is therefore currently ambiguous as to whether there was a significant use of the Poole Harbour basin in the Early Iron Age. However, if there were, a reorientation of activity from the middle of the 1st millennium BC onward, creating greater focus on the Harbour basin, it needs to be considered whether changing climatic conditions may have played a role in this. Middle to Late Iron Age activity is known from both Furzey Island and Green Island, Fitzworth, Shipstal point, and Slepe, on the southern littoral, with further sites at the base of the Purbeck ridge at West and East Creech (Cox and Hearne 1991, 7–8).

The earliest evidence for substantial activity are two opposing stone and timber jetties facing each other from Ower Peninsula and Green Island dated to the Middle Iron Age (Bugler 1964; Markey 2003; Wilkes 2004, 187). These substantial structures demonstrate contemporaneous occupation on Green Island and the mainland from at least the Middle Iron Age (Markey 2003; Wilkes 2004; 2007). Ower, Hamworthy and Green Island may have acted as potential connecting trade points to export items via Hengistbury Head (Woodward 1987, 6). However, Wilkes (2004, 205–6) has pointed out that similar quantities of imported pottery occurred at Ower, Green Island and Furzey Island. The port may have been an amalgam of locations in Poole Harbour forming a coastal node for exchange (Wilkes 2004). Occupation has also been identified along various river valleys, exemplified by sites at East and West of the Corfe River (Cox and Hearne 1991) and Worgret and Stoborough on the River Frome (Hearne and Smith 1991). Iron Age activity on the Bestwall peninsula (Ladle 2012), at the confluence of the Rivers Piddle and Frome, highlights the importance of access to fresh water. Nodes have previously been shown to act as gateway exchange points in a larger communication network (Burghardt 1971; Hirth 1978) and probably acted similarly along inland waterways whilst at Poole Harbour the sea provided external links to an extensive network of coastal nodes along the south coast (Wilkes 2004; 2007).

Activity on Furzey Island ceased *c.* AD 20 and there was apparent decline on the sites either side of the Corfe River (Cox 1989; Cox and Hearne 1991). This has been attributed to a rise in sea levels which is evidenced by the separation of 'South Island' into Furzey and Green Islands (Wilkes 2004, 214). At the same time there were changes in activity and formal planning at Ower, with activities previously undertaken on Furzey Island being located here (Cox and Hearne 1991, 79). There was a marked increase in imported pottery at Ower from this time (Cox and Hearne 1991, 78). The role of Ower as a port can be attested via the amount of both regional and continental pottery that has been recovered. The proportion of imported wares to local products within Poole Harbour including Furzey Island and Ower (Cox 1985) are comparable to that recovered from Hengistbury Head for the Later Iron Age (Wilkes 2004, 381) despite the limited nature of the investigations at Ower (Sunter and Woodward 1987; Cox and Hearne 1991) versus the extensive investigations at Hengistbury Head (Cunliffe 1987).

Dressel 1 amphora from Italy were used principally as wine containers. Dressel 1A date to before 50 BC, and 1B appear before the middle of the 1st century BC. The distribution of Dressel 1 Amphora in Britain currently comprises two main clusters, to the east, around Colchester, and at Hamworthy, Green Island and Hengistbury Head. A similar distribution is mirrored in the locations of Pascual 1 amphorae, which came from eastern Spain and southern France (Tyers 1996). Amphora fragments have been recovered from Ower, Cleavel Point and Worgret. This distribution of pre-invasion amphora has suggested a lack of hostility to Rome (Williams 1981). Alongside this there is evidence of several craft activities including shale working, pottery and salt production. Poole Harbour as a port might be considered in parallel with Hengistbury Head, a renowned centre for inter-continental trade (Cunliffe 1987).

The Romano-British period

Following the Roman invasion, the apparent focus of maritime infrastructure shifted to the northern side of the Harbour and to the Hamworthy peninsula. The Roman road from Hamworthy to Badbury Rings provided a link to the legionary fortress at Lake Farm, Wimborne (RCHME 1970, 528–531; Russell and Cheetham this volume), some 6km to the north. Evidence from Hamworthy indicates it may have been a military supply base (Smith 1931; RCHM 1970, 603–4; Jarvis and Bellamy 2010). The evolution of Hamworthy into a civilian port is suggested by longevity of use of the peninsula including a 4th century cemetery (Jarvis 1993; Jarvis and Bellamy 2010, 73). Complete BB1 pots have been recovered from the tidal mudflats adjacent to Hamworthy, and may derive from the loading or unloading of vessels. A significant proportion of imported pottery was recovered including *terra rubra* and *terra nigra* (Smith 1934, 14–15), indicating early 1st century activity. *Terra sigillata* of Claudian date was also recovered from Hamworthy (Jarvis 1993). Local copies in BB1 fabric of imported forms of pottery were also present (Smith 1934), presumably meeting a demand for imported styles. In addition, salt manufacture in the area may have been for export (Jarvis 1994).

BB1 was eventually distributed throughout England and northwards beyond the Antonine Wall (Tyers 2014) and produced in such quantity (Ladle 2012) that substantial transhipment facilities within and beyond the Harbour were necessary. BB1 pottery was also exported to the continent, evidenced by occurrences in Belgium at Liberchies, Northern France at Boulogne-sur-Mer and Dieppe, plus further west in Brittany at both Kervennenec and Quimper; Aardenburg in the Netherlands, may also be included (Fulford 1977). BB1 was distributed via a three-tier system of inland, coastal, and intercontinental trade, placing the Harbour at the heart of an extensive network of communication links (Allen and Fulford 1996, Fig. 13). Hamworthy, may have played a key role.

Elsewhere around the Harbour, much of the Romano-British evidence has related to the various industrial products discussed above. This is particularly the case for BB1 with one of the most extensively explored sites at Bestwall Quarry (Ladle 2012). Wareham itself may have been a site of Roman occupation (Buxton 2010, 86; Bellows 1892; Hinton and Hodges 1977, 81; Keen 1984, 205; Penn 1980, 106), although the evidence is somewhat scant. On the south side of the Harbour there was some continuity of the later Iron Age sites and activity around the Corfe River. Norden became a particular focus for manufacture. The Isle of Purbeck also has plenty of settlement evidence, with excavated habitation sites at Worth Matravers (Graham *et al.* 2002); Ladle 2018), and Rope Lake Hole (Woodward 1986b). The Woodhouse Hill rural settlement with its important stone built and apsidal ended buildings was situated on the south side of the Harbour basin (Field 1966).

A few villas were located in this area. It has been suggested that, because of this low density, Purbeck was an Imperial estate (Woodward 1987, 69). However, this is now in doubt due to the presence of Bucknowle Villa, Corfe Castle and two villas located at the base of the Purbeck ridge. The Brenscombe villa *c.* 1.5km to the east of the Corfe gap has been identified only by the prescence of a mosaic floor (Farrar 1962, 113–114; Farrar 1963, 103), whilst that at East Creech, *c.* 2km to the west of the Corfe gap is only known from a selection of architectural fragments (Farrar 1962, 113–4). Further Romano-British remains have been noted *c.* 2km to the east of Brenscombe and at Corfe itself (Farrar 1963, 103–4). The Bucknowle Villa to the south of the Purbeck ridge is better understood having been extensively excavated. It was occupied from the 1st to the 4th century AD (Light and Ellis 2009). The presence of these villas suggests that east Purbeck was divided into several estates, but we do not currently have distribution or chronological data to understand how this was articulated.

The earlier medieval period

In keeping with elsewhere in Dorset, there is much reduced evidence for activity in the immediate post-Roman centuries. However, the apparent survival of an element of the Black Burnished Ware industry into the 5th century (Gerrard 2010) is particularly interesting. Excavation at Bestwall Quarry demonstrated that pottery production continued into the post-Roman period, with a single organic tempered vessel dated by radiocarbon to the 6th century (Brown 2012, 258). At Bestwall one phase of ironworking was of 5th–6th century date (Ladle 2012, 319). Furthermore, the presence of inscribed stones at Wareham now in Lady St Mary church (RCHME 1970, 308, 310–2) is significant. These have been subject to much discussion as to their origin and date but are now thought to range between the 5th and 7th centuries (Cramp 2006, 31, 116–18; Charles-Edwards 2013; Hinton 1992c; Hinton 2019). As these stones have an exclusively western British distribution, with the Wareham inscriptions representing extreme eastern outliers (Hinton 1998, 25), they potentially attest to a lingering Christian presence into the 7th century and may also suggest continued maritime links to the west.

Burial evidence from the Isle of Purbeck, particularly from Ulwell, Swanage (Cox 1988) and Football Field, Worth Matravers (Ladle 2018) indicates populations in the 7th–8th centuries who were burying their dead in manner akin to late Roman practice and referencing Roman buildings in the reuse of building materials in graves. The practices place them firmly in a western British tradition which is seen elsewhere in Dorset and beyond (Randall 2018a). This accords with the stalling of Germanic cultural influence spreading into the area until the formation of the Kingdom of Wessex around this time (Eagles 2001).

Settlement at Wareham was established during this period (Keen 1984, 213; RCHME 1970, 304). Wareham is mentioned in the Anglo-Saxon Chronicle (Ingram 1912) in the early 9th century as the place of burial of King Brihtric, which suggests it was a minster site (Hall 2000,14–15; Hinton 2012,123), which appears to have had a profound effect on the development of the estate boundaries in the entire area in the later Saxon period. Wareham was clearly a fortified *burh* by *c.*AD 876 when it was occupied by the Great Army led by Guthrum (Hinton 1998, 54), the location both enabling penetration inland (a route up the Frome Valley and through south Dorset to Exeter), but access by sea. Its origins however appear to be earlier. The distribution of coinage of the 7th and 8th century along the Frome valley suggests that Wareham retained an international trading function (Costen and Costen 2016, 11). A sherd of 8th century pottery found in Lady St Mary's churchyard was probably manufactured in or around Hamwih (Southampton) (Hodges 1977). The *burh* was re-fortified by AD 914 and its role in the system of burhs underlines its strategic importance to Wessex. Corfe was a royal estate from the 9th century and by AD 978/9 the connection was strong enough for King Edward to be murdered there (Hinton 1994, 11; 2002, 87). This strategic role of Wareham and the Frome Valley was reinforced over the centuries with Wareham being the location of Canute's invasion of Wessex in 1015, and a landing point of Matilda's Angevin forces during the Anarchy in 1139 (Davis 1977). A number of large, north-south aligned long rectangular land units which in some cases incorporated land both south and north of the Purbeck Ridge apparently preserve the arrangement of late Saxon estates (Taylor 1970, 62).

Elsewhere in the Harbour area, direct evidence of the later first millennium AD has been scant. Iron working evidence from the Frome River site was of 7th century date (Maynard 1988). At Bestwall (Ladle 2012), a second episode of charcoal burning returned a radiocarbon date of 8th to early 10th century. Locally produced pottery from Bestwall spanned the 7th to 10th centuries (Brown 2012, 258). At Point Ground, Wytch, salt production evidence has returned dates of the 9th–11th century AD (Pitman in prep). Substantial marine shell middens at Poole and Hamworthy dating from the 9th century onwards attest to a fishery which may be indicative of settlement (Horsey and Winder 1992; Winder 1992, 194). Other settlement within the Poole Old Town area is attested by a 10th century sherd (Jarvis 1992, 62) and an imported pottery sherd from The Foundry site (Watkins 1994).

The later medieval period

The Domesday survey of 1086 included the Harbour-side settlements of Wareham, Corfe, Stoborough and Studland was well as East Holton and Ower. Of particular interest are the thirteen salt workers listed at Ower (Thorn and Thorn, 1983). Wareham Castle may have been originally constructed around this time, although there is confusion in records with Corfe Castle. Both defences had a role to play in the wars of Stephen and Matilda in the early 12th century (RCHME 1970, 304,325). Purbeck was demonstrably an area of dispersed settlement rather than nucleated organisation (Hinton 2012, 126). Dispersed settlement was a general feature of the east and central Dorset heaths where several holdings are likely to have been referred to together. Expansion into these areas is known to have increased in the 13th century (Taylor 1970). However, place-name evidence indicates a lack of newly enclosed areas around the Harbour during the later medieval period (Hinton 2002, 93). Settlement evidence at Ower Farm dating to the 12–14th centuries indicates continuity from Domesday (Cox and Hearne 1991; Dodd 1995). Salt working continued at Point Ground, Wytch into the 12th–13th centuries (Pitman in prep). At East Holton buildings of 12th century date were identified during trial trenching on land at Holton Lee (Hewitt in prep). Some associations and patterns of land holding apparently persisted from the late Saxon period (Taylor 1970). Swanage, although mentioned in Domesday, only developed as the main port for export of Purbeck marble from the 18th century (RCHME 1970, 290). One element of its associated land block was Godlingston, situated to the south of the Purbeck Ridge, but with a connection to the Harbour via Godlingston Heath (which remained part of Swanage parish into the 19th century). The Manor was constructed in around AD 1300. The main building was built on a rectangular plan, but with the addition of a round tower at one end, presumably for defensive purposes (RCHME 1970, 294–295). Part of the large Langton manor also stretched to the shores of the Harbour. During the mid 14th century this included two salterns at Middlebere (Calendar of Inquisitions Post Mortem Vol 15, 1 Richard II).

In contrast, the north eastern coast of the Harbour had limited settlement excepting the manor of Canford. By 1252 a charter was granted for the town of Poole (Sydenham 1986, 22), which was likely a small community by the 12th century (Penn 1980, 78). The growth of the town is charted in detail elsewhere and is outside of the scope of this paper (RCHME 1970, 189; Hinton 1992, 4–5). Late first millennium evidence of exploitation as an oyster fishery (Winder 1992) suggests an origin as a fishing port. However cross channel trade was an important factor. Norman wine importation was significant (Hodges 1981, 251) and associated French fineware pottery appeared across England (e.g. Fox and Radford 1933, 118). In Poole these imports include 13th century Rouen wares, 13th and 14th century Saintonge, Normandy gritty wares and stonewares datable to the 14th and 15th centuries, with continuity into the early post-medieval with Beauvais pottery (Horsey 1992, 116–8).

Poole grew rapidly from the 13th century onwards (Horsey 1992), which may in part have related to silting of the western extent of the Harbour, around Wareham (Smith 1931, 125; RCHME 1970,189), where Normandy gritty ware sherds occurred in the 12th century (Renn 1960; Hinton and Hodges 1977). Wareham was still in use as a port in the late Medieval period (Hinton 2002, 94; Forrest 2017, 25), although it may not have been practical for deeper draught shipping. There was a marked decline in Wareham's maritime trade following the Black Death (Forrest 2017, 19–22) and into the 16th century (Hinton 2018, 71). From this point on Poole was engaged in international trade. It was a key transit point in the important pilgrim route to Santiago de Compostela, signified to this day in the town's arms with symbolic scallop shells. From at least the 15th century onwards, trade with Iberia is evidenced by finds of olive jars, dishes and tin-glazed wares of Spanish origin (Barton *et al.* 1992, 126). Poole was the busiest port in Dorset, and serviced the largest ships (Hinton 2018, 70–1); larger sea-going vessels appeared from the 14th century onwards, preferring the deeper water port. Wareham only harboured ships up to 7 tonnes (medievalandtudorships.org). Whilst 87% of the ships leaving Poole in the 15th–16th centuries were engaged in English coastal journeys, 9% of all listed journey destinations were to France, with both Spain and Portugal comprising 1% each (Jarvis 1992b). A possible attempt to cash in on established trade routes occurred with the attempted foundation in 1286 of the planned settlement of *Gotowre super mare*, in the area now known as Newton, on the south side of the Harbour. This had apparently failed by 1288 (Beresford and Hurst 1971; Viner 2002; Le Pard *et al.* 2011). Attempts to locate any physical remains have not been successful (Cox and Hearne 1991, 91–2; Dodd 1995). However, the re-establishment of coastal and cross channel links provided a ready market for new products which could be won from the Harbour's resources, leading to the appearance in the 16th century of the alum and copperas industries and the commencement of ball clay extraction.

THE POTENTIAL OF THE RESOURCE, THREATS, QUESTIONS AND FUTURE DIRECTIONS

Whilst the archaeological resource afforded by Poole Harbour is as rich as its natural resources, there are various lacunae in the evidence. We are not in a position to determine at this point whether some of these are genuine absences or an accident of the history of investigation. The archaeology of the area has the potential to offer much in future with respect to understanding settlement, production and connectivity locally, regionally and internationally stretching from the later prehistoric period through to recent centuries. However, there are also a number of on-going threats both from climate change (IPPC 2013) and direct human action (e.g. Monteith and Craig-Atkins 2012).

A number of actions could be taken to address these issues. Detailed mapping of the intertidal and sub-tidal zone would benchmark the current position, potentially recording previously unknown archaeological assets and providing condition information to assess and prioritise projects in the intertidal zone before such information is permanently lost. Enhancing the content of the Historic Environment Record in this regard would be valuable. The non-terrestrial zones of Poole Harbour offer considerable potential for better understanding the use of the harbour as a resource for seafood, shellfish, and salt production. Furthermore, the use of the intertidal zone as a focal point for trading resources should also be explored. Quays and jetties enabled the loading and unloading of goods and people, but also acted as portals to the wider world. Understanding the development of these in relation to social interaction and cultural exchange will shift the focus from them being seen in purely functional terms of transport or logistics. However, we need to better understand the chronology and distribution of such intertidal and sub-tidal features before they are lost.

Coastal erosion rates are concerning, and coupled with potential sea level rise, highlights the need for recording schemes such as the CITiZAN initiative (https://www.citizan.org.uk). Wilkes (2019, 8) notes that prehistoric artefacts regularly erode from cliff faces at Ower. Erosion on the southern side of the Harbour around locations which contain valuable archaeological deposits may need proactive examination. The current coastal management approach is one of *No Active Intervention* (Guthrie and Ridgewell 2011), meaning these areas will be allowed to continue to erode, with the potential for valuable archaeological deposits being lost unless they are recorded. Given the 1.8m of cliff per year being lost in the more residential areas around Canford Cliffs, the policy of holding the existing line is understandable (Guthrie and Ridgewell 2011, 4.4.16) where it threatens people's homes and livelihoods, in contrast to uninhabited areas. However, we should start to think in a more pro-active fashion about how to manage the process of change in relation to the historic and archaeological resource.

In addition, because the Poole Harbour basin is so rich in aggregates and the particularly valuable ball clay, the area of the Harbour and its archaeologically related riverine hinterland will inevitably be affected by future aggregate extraction. Locations have been identified as possible extraction sites within the local authority Minerals Strategy (Dorset County Council 2014). This includes areas for potential future open cast sand and gravel extraction through the Frome and Piddle Valleys. A number of them will involve impact on the archaeological resource. Ball clay extraction, given its international importance and scarcity, will also continue to affect the southern Poole Harbour basin, and there may in the future be increased pressure on this resource. Other pressures also exist from settlement expansion, commercial repurposing of some areas and traffic – vehicular and on foot – which potentially impact the condition and setting of a wide range of heritage assets. However, in many of these cases, better understanding of the archaeological resource and the stories it can tell could prove valuable for local people and visitors alike in management and interpretation initiatives.

In considering gaps in our knowledge, there has been limited evidence identified of activity in the Poole Harbour basin during the earlier Iron Age. This is particularly intriguing given the extensive evidence, often coastally located, on the Purbeck peninsula (e.g. Cunliffe and Phillipson 1968; Woodward 1986b; Ladle 2018). There is also currently no physical archaeological evidence for either Early or Middle Iron Age pottery production. It would be helpful to establish whether this is a genuine lack of potting activity in this period or an artefact of the sites examined thus far or limitations in dating. More could be learned about individual sites, for example clarifying the full extent of activity at Ower and the relationship of the later Iron Age pottery (and shale) industry to sites in the inland hinterland. Given the increased volume and reach of Late Iron Age wares, to say nothing of BB1 during the Romano-British period, there is still plenty we do not know about the distribution of production throughout the Harbour area, how that was managed, articulated and the products transhipped. The Iron Age settlement pattern is particularly poorly understood on the northern side of Poole Harbour, for example along the River Sherford.

Considering the wider use of the landscape in the Romano-British period, we are very far from understanding patterns of land use, tenure and settlement. The two villas north of the Purbeck ridge are only known from minimal finds. Ideas of an imperial estate have been challenged but it is only by considering the role of villa estates and other non-industrial settlement, in conjunction with a more rounded understanding of areas of production of salt, shale, pottery and stone objects, that this can be demonstrated or rejected. In addition, each of these industrial processes still has areas in which increased clarity would not only aid understanding of the locale, but of artefactual studies and thereby more broadly applicable chronology. Making use of remotely sensed data (for example LiDAR data) and processing it appropriately at a landscape scale may provide further insights into land use, which can be combined with information from environmental proxies, as well as identifying hitherto "lost" sites.

Particular attention to very late Romano-British pottery production would be of significant benefit. With the potential for pottery production having continued into the 5th century AD (Gerrard 2010), the identification of this material has not only implications for understanding continuity of activity within in the Harbour basin into the post-Roman period, but for understanding contemporary occupation and connectivity throughout Dorset. The tantalising indications of pottery production in a new tradition from the 6th century onward at Bestwall Quarry suggest that we should be mindful of the likely existence of other production locations within the Poole Harbour basin in the post-Roman and early medieval period, given the increasing number of sites in the Harbour area which have been yielding evidence of the latter half of the first millennium AD. This has considerable potential to feed into thinking around the 'frontier' of Germanic influence as evidenced increasingly by metal detected finds (Eagles 2018), and which have Poole Harbour as the southern point of the zone of contact with incoming influences to the east. Notably, some of the chronological gaps have been filled in recent years by what may have appeared unprepossessing features but provided opportunities for radiocarbon dating (e.g. Worgret; Bestwall). Further use of scientific dating should be a priority.

Moving into the medieval period, there are similar lacunae. Consideration has been given to the late Saxon development of estates on Purbeck, which also involves the southern side of the harbour. It is clear that multiple land holdings, and probably farms and small settlements were associated with named units of land attested by charters and Domesday, but it is far from clear where the subdivisions lay and where the loci of agricultural and settlement activity were. There is much to learn about the role the southern Harbour area played in the agricultural structure of the wider hinterland and the way in which different areas within named land units provided different productive components to the economy of the whole.

We are beginning to have glimpses of the later prehistoric, Romano-British, medieval and later industrial use of Poole Harbour and the way in which contact and shipping was managed. However, viewing the Harbour basin as a series of overlapping resources and tracing their exploitation in a spatio-temporal framework may provide a different understanding of how the area was utilised from the Iron Age onwards. Moving away from a site specific micro analysis to a wider landscape-based and ecologically integrated approach could provide fresh insights. For example, it would be possible to understand what differing affordances were offered in the various zones within the Harbour basin (e.g. intertidal, heathland, clay with flints etc.) and how these were, or were not, utilised at different times. Other important issues which could and should be explored lie in how and why ecological change occurred, and how the contemporary archaeological evidence changed, or did not, within these zones. Aside from further exploration of salt, iron and pottery production sites, the confirmation of the location of *Gotowre* and understanding the reasons for its failure would be of use. If this was related to the silting up of the Harbour it has wider implications for further understanding the development of Wareham, Poole and Swanage. Within Poole town in particular, there may still be opportunities to examine the remnants of earlier foreshores where boat building locations are likely. The Foundry site highlights the importance of these former intertidal zones both within the built-up area and outside of it, whilst understanding the boat building industry may provide insights as to the balance of deep water, coastal and riverine interactions. Meanwhile there has been limited investigation of the earliest origins of the ball clay industry in the later 16th century, and awareness of early post-medieval chemical industries should also be raised.

Whilst some areas of the Poole Harbour basin have proved better than others in preservational terms for animal bone and shell, there are opportunities to invest more attention in the residues of agriculture (both arable and pastoral), woodland management and fisheries. Where sites are excavated, some weight should be given to prioritising sampling strategies which address these concerns. Additionally, the topographical and environmental nature of the Harbour affords both considerable opportunity. For a wetland environment, there has been in the past limited exploration of waterlogged deposits which could provide valuable environmental proxies over the last several thousand years. These delicate potential resources however are substantially threatened. Peat accumulations in the Harbour remain to be mapped in detail (Wilkes 2019), but have potential to provide more sample locations for pollen, diatoms, foraminifera and other materials. The low-lying topography with a high water table as well as open water offers further opportunity for wood and other organic materials to be preserved. These proxies have the potential to tell us about both the immediate locale and broader vegetation change in south-eastern Dorset. This deserves to be considered in some detail in relation to past climate change and the response of people living within the Poole Harbour basin to the new challenges and opportunities which those alterations would have produced.

CONCLUSION

Poole Harbour and its hinterland is a rich, diverse archaeological resource. It not only occupies an important part of Dorset, but its raw materials and industries, coupled with its inland and maritime connectivity, means that it has both local interest and has wider regional and indeed international importance. It is an ideal study area where a broad archaeological dataset can be reviewed and assessed, allowing the consequences of environmental, political and commercial change to be examined, alongside exploring how past communities occupying the fragile liminal littoral zone have responded. It has provided much, but with appropriate attention, has considerably more to offer.

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REFERENCES

Allen, J.R.L. and Fulford, M.G. 1996. 'The Distribution of South-East Dorset Black Burnished Category I Pottery in South-West Britain', *Britannia*, **27**, 223–281.

Allen, M.J. and Scaife, R.G. 1991. 'The exploitation of the flora and fauna and its impact on the natural and derived landscape', in P., Cox, and C.M., Hearne, *Redeemed from the heath. The Archaeology of the Wytch Farm Oilfield (1987 - 90)*. DNHAS Monograph **9**, DNHAS, Dorchester, 216–220.

Barton, K.J., Cartwright., L. Jarvis, K.S. and Thomson, R.G. 1992. 'Catalogue of the pottery', in I. Horsey, *Excavations in Poole 1973-1983*. DNHAS Monograph **10**, DNHAS, Dorchester, 65–128.

Beavis, J. 1971. 'Some Aspects of the Use of Purbeck Marble in Roman Britain', *PDNHAS*, **92**, 181–204.

Beavis, J. 1972. 'Interim Report on Roman and Medieval sites at East Holme, Wareham', *PDNHAS*, **93**, 161.

Bellamy, P.S. 2009. 'The Mesolithic, Neolithic and Early Bronze Age periods', in L. Ladle and A. Woodward, *Excavations at Bestwall Quarry, Wareham 1992-2005. Volume 1: The Prehistoric Landscape*. DNHAS Monograph **19**, DNHAS, Dorchester, 37–56.

Bellamy, P.S., Corney, M., and Wilson, C. 2014a. 'Investigations on the south shore of Brownsea Island by the Dorset Alum and Copperas Industries Project', *PDNHAS*. **135**, 272–283.

Bellamy, P.S., Corney, M., and Wilson, C. 2014b. 'Investigations on the Studland Circles by the Dorset Alum and Copperas Industries Project', *PDNHAS*, **135**, 297–310.

Bellows, J. 1892. 'Roman Wareham and the Claudian Invasion', *PDNHAS*, **13**, 115–129.

Beresford, M.W. and Hurst, J.G. 1971. *Deserted medieval villages*. Lutterworth Press, London.

Brailsford, J. 1958. 'Early Iron Age C in Wessex', *Proceedings of the Prehistoric Society*, **24**, 101–119.

British Geological Survey (BGS), 2019. *The Geology of Britain Viewer*. Available from: https://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html.

Broadbent, G. and Hawkins, A. 2010. 'Alum and Copperas', in B., Dyer, and T., Darvill, *The Book of Poole Harbour*. The Dovecote Press, Wimborne Minster, 109–112.

Brown, L. 1997. 'Marketing and commerce in Late Iron Age Dorset: the Wareham/Poole Harbour pottery industry', in A. Gwilt and C. Haselgrove (eds), *Reconstructing Iron Age Societies* Oxbow Monograph 71, Oxford.

Brown, D. 2012. 'Post-Roman and Saxon pottery' in L. Ladle, *Excavations at Bestwall Quarry, Wareham 1992-2005. Volume 2: The Iron Age and Later Landscape*. DNHAS Monograph **20**, DNHAS, Dorchester, 257–260.

Bugler, J. 1964. 'The Poole Harbour "Causeway"', *PDNHAS*, **88**, 158–160.

Burghardt, A. 1971. 'A hypothesis about gateway cities', *Annals Association of American Geographers*, **61**, 269–85.

Buxton, B. 2010. 'Wareham', in B., Dyer, and T., Darvill, *The Book of Poole Harbour*. Dovecote Press, Wimborne Minster, 86–88.

Calkin, J.B. 1949. 'The Isle of Purbeck in the Iron Age', *PDNHAS*, **70**, 29–59.

Calkin, J.B., 1953. 'Some archaeological discoveries in the Isle of Purbeck', *PDNHAS*, **74**, 48–54.

Calkin, J.B. 1954. '"Kimmeridge Coal Money"', the Romano-British Shale Armlet Industry, *PDNHAS*, **75**, 45–7.

Calkin, J.B. 1960. 'Some Archaeological Discoveries in the Isle of Purbeck: Part 2', *PDNHAS*, **81**, 114–123.

Calkin, J.B. 1967. 'Some Archaeological finds in East Dorset and Purbeck', *PDNHAS*, **88**, 113–115.

Carruthers, W. 2012. 'The charred plant remains', in L. Ladle, *Excavations at Bestwall Quarry, Wareham 1992–2005. Volume 2: The Iron Age and Later Landscape.* DNHAS Monograph **20**, DNHAS, Dorchester, 289–301.

Champion, T.C., Haselgrove, C., Armit, I., Creighton, J. and Gwilt, A. 2001. *Understanding the British Iron Age: an agenda for action. A Report for the Iron Age Research Seminar and the Council of the Prehistoric Society.* Trust for Wessex Archaeology, Salisbury.

Charles-Edwards, T.M. 2013. *Wales and the Britons 350–1064.* OUP, Oxford.

Cleal, R. 1991. 'Briquetage', In P. Cox, and C.M. Hearne, *Redeemed from the heath. The Archaeology of the Wytch Farm Oilfield (1987–90).* DNHAS Monograph **9**, DNHAS, Dorchester, 143–9.

Clements, R.G. 1993. 'Type-section of the Purbeck Limestone Group, Durlston Bay, Swanage, Dorset', *PDNHAS*, **114**, 181–206.

Costen, M. and Costen, N. 2016. 'Trade and exchange in Anglo-Saxon Wessex, c AD 600–780', *Medieval Archaeology*, **60/1**, 1–26.

Coulston, B.J. 1989. *Multi-disciplinary Methodologies applied to ancient ceramics.* Unpublished PhD Thesis, University of Manchester.

Cox, P.W. 1988. 'A Seventh Century Inhumation Cemetery at Shepherd's Farm, Ulwell near Swanage, Dorset', *PDNHAS*, **110**: 37–47.

Cox, P. W. 1989. 'Excavation and Survey on Furzey Island, Poole Harbour Dorset', *PDNHAS*, **110**, 49–72.

Cox, P. W. 2012. 'Three Romano-British Stele from Studland', *PDNHAS*, **133**, 75.

Cox, P. W., Firth, E., Scaife, R., and Whelan, J. 2009. *Further Investigations at Two Medieval Saltworking Sites at the Wytch Farm Oilfield.* AC Archaeology, unpublished client report.

Cox, P. and Hearne, C.M. 1991. *Redeemed from the heath. The Archaeology of the Wytch Farm Oilfield (1987–90).* DNHAS Monograph **9**, DNHAS, Dorchester.

Cox, P.W. and Mills, J.M. 1991. 'Kimmeridge Shale', in P. Cox, and C.M. Hearne, *Redeemed from the heath. The Archaeology of the Wytch Farm Oilfield (1987–90).* DNHAS Monograph **9**, DNHAS: Dorchester, 170–6.

Coy, J. 1987. 'The animal bones', in N., Sunter, and P.J. Woodward, *Romano-British Industries in Purbeck: Excavations at Norden, Ower and Rope Lake Hole*, DNHAS Monograph **6**, DNHAS, Dorchester, 114–118.

Coy, J. 1992. 'The animal bone', in I. Horsey, *Excavations in Poole 1973–1983.* DNHAS Monograph **10**, DNHAS, Dorchester, 186–194.

Cramp, R. 2006. *Corpus of Anglo-Saxon stone sculpture Vol VII: South-West England.* OUP/British Academy, London.

Cranfield Soils and Agrifood Institute (CSAIS), 2020. *Soilscapes.* Available at: http://www.landis.org.uk/soilscapes/# Accessed 3/02/2020.

Cross, D.A.E. 1963. *Man and the Christchurch Avon. The story of Navigation on the River Avon and in Christchurch Harbour.* Available from: http://www.royhodges.co.uk/Man%20and%20the%20Christchurch%20Avon%201963.pdf.

Cullinane, S. 2018. 'The Kimmeridge Shale', in L. Ladle *Multi-period occupation at Football Field, Worth Matravers, Dorset Excavations 2006–201.1* BAR British Series 643 BAR Publishing Oxford, 110–116.

Cunliffe, B. 1984. 'Iron Age Wessex: continuity and change', in B. Cunliffe and D. Miles (eds), *Aspects of the Iron Age in Central Southern Britain.* OUCA, Oxford, 12–45.

Cunliffe, B. 1987. *Hengistbury Head, Dorset: the Prehistoric and Roman Settlement, 3500 BC – AD 500.* Vol. 1, Oxford University Committee for Archaeology, Monograph No. **13**. Oxford University Press, Oxford.

Cunliffe, B. and Phillipson, D.W. 1968. 'Excavations at Eldon's Seat, Encombe, Dorset', *Proceedings of the Prehistoric Society* **34**, 191–237.

Davis, R. 1977. *King Stephen.* Longman, London.

Department of the Environment, Fisheries and Rural Affairs (DEFRA) 2019. *MAGIC Mapping Data Service.* Accessed from: https://magic.defra.gov.uk.

Denford, G. 2000. *Prehistoric and Romano-British Kimmeridge Shale.* Archaeology Data Service. Available from: https://archaeologydataservice.ac.uk/archives/view/denford_na_2000/index.cfm.

Dodd, J. 1995. 'The excavation of a medieval building at Ower Farm, Corfe Castle, and other archaeological observations during the construction of a new wellsite and pipeline at the Wytch Farm Oilfield, 1994', *PDNHAS*, **116**, 55–60.

Dorset County Council 2014. *Bournemouth Dorset and Poole Minerals Strategy.* Available at https://www.dorsetcouncil.gov.uk/planning-buildings-land/planning-policy/dorset-county-council/minerals-planning-policy/mineral-strategy/minerals-strategy.aspx.

Drury, G.D. 1949. 'The Use of Purbeck Marble in Medieval Times', *PDNHAS*, **70**, 74–98.

Dyer, B. and Darvill. T. 2010. *The Book of Poole Harbour.* Dovecote Press, Wimborne Minster.

Eagles, B. 2001. 'Anglo-Saxon presence and culture in Wiltshire c. AD450–c.675', In P.D. Ellis (ed.), *Roman Wiltshire and After. Papers in Honour of Ken Annable.* Wiltshire Archaeological and Natural History Society, Devizes, 199–233.

Eagles, B. 2018. *From Roman civitas to Anglo-Saxon shire Topographical studies on the formation of Wessex.* Oxbow Books, Oxford.

Edwards, R.J. 2001. 'Mid- to late Holocene relative sea-level change in Poole Harbour, southern England', *Journal of Quaternary Science*, **16**, 221–235.

Farrar, R.A.H. 1953. 'Archaeological Fieldwork in Dorset in 1952', *PDNHAS*, **74**, 85–110.

Farrar, R.A.H. 1962a. 'A probable Roman villa at Brenscombe Farm, Corfe Castle', *PDNHAS*, **84**,113–4.

Farrar, R.A.H. 1962b. 'A note on the prehistoric and Roman salt industry in relation to the Wyke Regis Site, Dorset', *PDNHAS*, **84**, 137–144.

Farrar, R.A.H. 1963. 'Archaeological Fieldwork in Dorset', *PDNHAS*, **85**, 103.

Farrar, R.A.H. 1969. 'A late Roman Black-Burnished Pottery Industry in Dorset and its affinities', *PDNHAS*, **90**, 174–180.

Farrar, R.A.H. 1976. 'Interim Report on excavations at the Romano-British Potteries at Redcliff, near Wareham', *PDNHAS*, **97**, 49–51.

Farrar, R.A.H. 1981. 'Arne, Redcliff Farm', *PDNHAS*, **102**, 88.

Farrar, R.A.H. 1982. 'Redcliff, Arne', *PDNHAS*, **103**, 123.

Farrar, R.A.H. 1983. 'The Black Burnished Ware Factory at Redcliff, Arne', PDNHAS, **104**, 186–7.

Farrar, R.A.H. 1984. 'The final season of excavation at Redcliff, Arne', PDNHAS, **105**, 148.

Field, N. 1966. 'Romano-British Settlement at Studland, Dorset. Final Report on the Excavation, 1952–58', *PDNHAS*, **87**, 142–207.

Forrest, M. 2017. 'The development of Dorset's harbours in the fourteenth and fifteenth centuries', *PDNHAS*, **138**, 17–33.

Forrest, M., Halling Barnard, J., Mitchell, R., and Papworth, M. (eds) 2017. *Treswell's Survey of Purbeck 1585-6*. Dorset Record Society Volume **19**, Dorset Record Society, Dorchester.

Fox, C. and Radford, C.R. 1933. 'Kidwelly Castle, Carmarthenshire; including a Survey of the Polychrome Pottery found there and elsewhere in Britain', *Archaeologia*, **83**, 93–138.

Fulford, M. 1977. 'Pottery and Britain's Foreign Trade in the Later Roman Period', in D.P.S. Peacock (ed), *Pottery and Early Commerce: Characterisation and Later Ceramics*. Academic Press, London.

Gale, J. 2003. *Prehistoric Dorset*. Tempus, Stroud.

Gale, R. 2009. 'Charcoal', in L. Ladle, and A. Woodward, *Excavations at Bestwall Quarry, Wareham 1992-2005. Volume 1: The Prehistoric Landscape*. DNHAS Monograph **19**, 12–16, DNHAS, Dorchester, 326–8 .

Gale, R. 2012. 'The Charcoal', in L., Ladle, *Excavations at Bestwall Quarry, Wareham 1992-2005. Volume 2: The Iron Age and Later Landscape*. DNHAS Monograph **20**, DNHAS Dorchester, 275–289.

Gerrard, J. 2010. 'Finding the Fifth Century: a late fourth and early fifth century pottery fabric from South-East Dorset', *Britannia*, **41**, 293–312.

Gerrard, J. 2012. 'Some thoughts on Black Burnished ware and its variants in the late 4th and early 5th centuries', in L. Ladle2012. *Excavations at Bestwall Quarry, Wareham 1992-2005. Volume 2: The Iron Age and Later Landscape*. DNHAS Monograph **20**, DNHAS, Dorchester, 242–3.

Gillam, J.P. 1963. 'The coarse pottery', in K.A. Steer, 'Excavations at Mumrills Roman Fort, 1958–60', *Proceedings of the Society of Antiquaries of Scotland*, **94**, 113–129.

Graham, A.H., Hinton, D.A., and Peacock, D.P.S. 2002. 'The excavation of an Iron Age and Romano-British settlement at Quarry Field, south of Compact Farm, Worth Matravers Dorset', in D.A. Hinton (ed), *Purbeck Papers*. University of Southampton Department of Archaeology Monograph **4**, 1–83.

Grant, J. A. 1982. *An analytical study of quartz-tempered pottery from Hengistbury Head*. Unpublished Master of Research dissertation, University of Bradford.

Green, F. 2009. 'The plant remains', in T. Light and P. Ellis, *Bucknowle A Romano-British villa and its antecedents: excavation 1976-1991*, DNHAS Monograph **18**, DNHAS, Dorchester, 166–171.

Guthrie, J.G.L. 2011. *Poole and Christchurch Bays Shoreline Management Plan Review Sub-cell f; Section 4. Policy Development Zone 3*. Policy Document created by Royal Haskoning on behalf of Bournemouth Borough Council. Available from: https://twobays.net/smp2.htm.

Hall, T. 2000. *Minster churches in the Dorset landscape*. BAR British Series **204**, BAR, Oxford.

Hamilton-Dyer, S. 1991. 'Animal bone', in P. Cox, and C.M. Hearne, *Redeemed from the heath. The Archaeology of the Wytch Farm Oilfield (1987-90)*. DNHAS Monograph **9**, DNHAS, Dorchester, 209–212.

Hamilton-Dyer, S. 2009. 'Fish Remains', in T. Light and P. Ellis, *Bucknowle A Romano-British villa and its antecedents: excavation 1976-1991*. DNHAS Monograph **18**, DNHAS, Dorchester, 163–165.

Haskins, L.E. 1978. *The Vegetational History of South East Dorset*. PhD thesis, University of Southampton.

Hathaway, S.E. 2005. 'Poole Harbour: a review of early and more recent investigations with evidence for Iron Age and Romano-British salt production', *PDNHAS*, **127**, 53–7.

Hathaway, S.E. 2010. 'Salt Production', in B., Dyer and T. Darvill, *The Book of Poole Harbour*. Dovecote Press, Wimborne Minster, 106–8.

Hathaway, S.E. 2013. *Making the Invisible, Visible. Iron Age and Roman Salt Production in Southern Britain*. PhD Thesis, Bournemouth University

Hearne, C. M. and Smith, R. J. C. 1991. 'A late Iron Age settlement and Black Burnished ware (BB1) production site at Worgret, near Wareham, Dorset 1986–7', PDNHAS, 113, 55–105.

Higbee, L. 2012. 'The animal bone', in L. Ladle, *Excavations at Bestwall Quarry, Wareham 1992-2005. Volume 2: The Iron Age and Later Landscape*. DNHAS Monograph **20**, DNHAS, Dorchester, 270–272.

Hinton, D. 1992a. 'Introduction', in I. Horsey, *Excavations in Poole 1973-1983*. DNHAS Monograph **10**, DNHAS, Dorchester, 3–10.

Hinton, D. 1992b. 'Revised Dating of the Worgret Structure', *PDNHAS*, **114**, 258–9.

Hinton, D. 1992c. 'The inscribed stones in Lady St Mary Church Wareham', *PDNHAS*, **114**, 260.

Hinton, D. 1995. 'Some Anglo-Saxon Charters and estates in south-east Dorset', *PDNHAS*, **116**, 11–20.

Hinton, D. 1998. *Saxons and Vikings*. Dovecote Press, Dorchester.

Hinton, D. 2002. 'A "Marginal Economy"? The Isle of

Purbeck from the Norman Conquest to the Black Death', in D. Hinton (ed.), *Purbeck Papers.* University of Southampton Monograph No. 4. Oxbow Books, Oxford, 84–117.

Hinton, D. 2012. 'Central southern England: "Chalk and Cheese"', in N. Christies and P. Stamper (eds) *Medieval Rural Settlement: Britain and Ireland, AD 800–1600.* Windgather Press, Oxford.

Hinton, D. 2018. 'Dorset's Harbours in the sixteenth century', *PDNHAS*, **139**, 70–1.

Hinton, D. 2019. 'Post-Roman Purbeck and a further consideration of St Aldhelm's Chapel', *PDNHAS*, 140, 75–80.

Hinton, D. and Hodges, R. 1977. 'Excavations in Wareham', 1974–5, *PDNHAS*, **99**, 42–83.

Hirth, K.G. 1978. 'Interregional trade and the formation of prehistoric gateway communities', *American Antiquity*, **43**, 35–45.

Hodges, R. 1977 'The pottery from Lady St Mary's churchyard', in D. Hinton, and R. Hodges Excavations in Wareham, 1974–5, *PDNHAS*, **99**, 79.

Hodges, R. 1981. 'Some Early Medieval French Wares in the British Isles: An Archaeological Assessment of the Early French Wine Trade with Britain', in H., Howard, and E.L. Morris (eds), *Production and Distribution: a Ceramic Viewpoint.* BAR International Series **120**, 239–255.

Horsey, I. 1992. *Excavations in Poole 1973–1983.* DNHAS Monograph **10**, DNHAS, Dorchester.

Horsey, I. and Winder J. 1992. 'The Late Saxon and Conquest period oyster middens', in I. Horsey, *Excavations in Poole 1973–1983.* DNHAS Monograph **10**, DNHAS, Dorchester, 60–61.

Ingram, J. 1912. *The Anglo-Saxon Chronicle.* Everyman Press, London.

International Panel on Climate Change (IPCC) 2013. *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* The Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge.

Jarvis, K.S. 1986a. 'Observations for Sea-Level Changes on the South-East Side of Furzey Island, Poole Harbour', *PDNHAS*, **107**, 153–4.

Jarvis, K.S. 1986b. 'Boat-House Clump, Upton – A Romano-British Saltworking Site', *PDNHAS*, **107**, 159–162.

Jarvis, K.S. 1992a. 'An Intertidal zone Romano-British Site on Brownsea Island', *PDNHAS*, **114**, 89–95.

Jarvis K.S. 1992b. 'Introduction to the pottery', in I. Horsey, *Excavations in Poole 1973–1983.* DNHAS Monograph **10**, DNHAS, Dorchester, 62–64.

Jarvis, K.S. 1994. 'Excavations at Hamworthy in 1974', *PDNHAS*, **115**, 107–108.

Jarvis, K.S. 2014. 'Ower Quay', *PDNHAS*, **135**, 212–216.

Jarvis, K. and Bellamy, P. 2010. 'The Roman Occupation of Hamworthy', in B. Dyer and T. Darvill, *The Book of Poole Harbour.* Dovecote Press: Wimborne Minster, 71–3.

Johns, C. Kirkham, G. Cousins, T. and Parham, D. 2015. *Rapid Coastal Zone Assessment for South-West England (South coast Dorset) Historic England Project No. 6673.* Report no.2014R043 undertaken by Cornwall Archaeology Unit and Bournemouth University. Available from: https://research.historicengland.org.uk/

Jones, G.P. 2017. *Sourcing the Clay: Iron Age pottery production around Poole Harbour and the Isle of Purbeck, Dorset, UK.* PhD Thesis, Bournemouth University.

Keen, L. 1984. 'The Towns of Dorset', in J. Haslam (ed.), *Anglo-Saxon Towns in Southern England.* Phillimore and Co. Ltd, Chichester.

Keen, L. 1988. 'Medieval Salt Working', *PDNHAS*, **109**, 25–28.

Ladle, L. 2012. *Excavations at Bestwall Quarry, Wareham 1992–2005. Volume 2: The Iron Age and Later Landscape.* DNHAS Monograph **20**, DNHAS, Dorchester.

Ladle, L. 2018. *Multi-period occupation at Football Field, Worth Matravers, Dorset Excavations 2006–2011.* BAR British Series 643 BAR Publishing Oxford.

Ladle, M. and Ladle, L. 2018. 'The marine molluscs', in L. Ladle, *Multi-period occupation at Football Field, Worth Matravers, Dorset Excavations 2006–2011.* BAR British Series **643**, BAR Publishing, Oxford, 281–283.

Ladle, L. and Woodward, A. 2009. *Excavations at Bestwall Quarry, Wareham 1992–2005. Volume 1: The Prehistoric Landscape.* DNHAS Monograph **19**, DNHAS, Dorchester.

Leach, R. 1978. *An Investigation into the use of Purbeck Marble in Medieval England.* Harrison and Sons, Hartlepool.

Le Pard, G. Bellamy, P. and Pinder, C. 2011. *Newton, Studland. Historic Urban Characterisation. Report for the Dorset Historic Towns Project by Dorset County Council.* Available from: https://www.dorsetcouncil.gov.uk/libraries-history-culture/local-history-heritage/historic-towns/historic-towns.

Light, T. and Ellis, P. 2009. *Bucknowle A Romano-British villa and its antecedents: excavation 1976–1991.* DNHAS Monograph **18**, DNHAS, Dorchester.

Long, A.J. and Scaife, R.G. 2009. 'Environment and Environmental Change', in L. Ladle, and A. Woodward, 2009. *Excavations at Bestwall Quarry, Wareham 1992–2005. Volume 1: The Prehistoric Landscape.* Dorset DNHAS Monograph **19**, DNHAS, Dorchester, 12–16.

Long, A.J., Scaife, R.G. and Edwards, R.J. 1999. 'Pine Pollen in intertidal sediments from Poole Harbour, UK; implications for late-Holocene sediment accretion rates and sea-level rise', *Quaternary International*, **55**, 3–16.

Lyne, M.A.B. 2002. 'The Late Iron Age and Romano-British Pottery Production Sites at Redcliff, Arne and Stoborough', *PDNHAS*, **124**, 45–99.

Lyne, M.A.B. 2012. 'The Utilisation of Resources and the Technology Employed by the Bestwall Black Burnished Ware (BB1) Industry', in L., Ladle, *Excavations at Bestwall Quarry, Wareham 1992–2005. Volume 2: The Iron Age and Later Landscape.* DNHAS Monograph **20**, DNHAS, Dorchester, 244–255.

Maltby, M. 2006. 'Salt and animal products: linking production and use in Iron Age Britain', In M. Maltby *Integrating Zooarchaeology Proceedings of the 9th ICAZ Conference Durham 2002.* Oxford, 119–124.

Markey, M. 2003. *South Deep jetties, Poole Harbour. 2003 fieldwork.* Unpublished fieldwork report of the Poole Bay Archaeological Research Group.

May, V. 1969. 'Reclamation and Shoreline Change in Poole Harbour, Dorset', *PDNHAS*, **90**, 141–154.

May, V. 2010. 'Introduction', in B. Dyer and T. Darvill, *The Book of Poole Harbour.* Dovecote Press, Wimborne Minster, 16.

May, V. and A'Court, M. 2010. 'The formation of the Harbour', in B. Dyer and T. Darvill, *The Book of Poole Harbour.* Dovecote Press, Wimborne Minster, 17–21.

Maynard, D. 1988. 'Excavations on a Pipeline near the River Frome, Worgret, Dorset', *PDNHAS*, **110**, 77–98.

Mercer, R. and Healey, F. 2008. *Hambledon Hill, Dorset, England. Excavation and survey of a Neolithic monument complex and its surrounding landscape, Volume 1.* English Heritage, London.

Milward, J. 2017. 'Results of and archaeological excavation at Pound Lane, Wareham', *PDNHAS*, **138**, 96–101.

Mills J.M. and Hearne, C. M., 1991 'Stone objects and architectural fragments', In C. M. Hearne and R. J. C. Smith 'A late Iron Age settlement and Black Burnished ware (BB1) production site at Worgret, near Wareham, Dorset 1986–7', PDNHAS, 113, 95–97.

Montieth, J. and Craig-Atkins, E. 2012. 'Ower, Corfe Castle', *PDNHAS*, **133**, 104–5.

Palmer, J. 2014. 'Roman Purbeck Limestone Mortars', *PDNHAS*, **135**, 222–234.

Palmer, J. 2008. *Database of the Roman Purbeck limestone industry.* Available from: http://www.palmyra.me.uk/pur-preface.html.

Papworth, M. 1992. *Middlebere, Corfe Castle Estate, Dorset, Wessex Region.* Unpublished Survey Report for the National Trust.

Penn, K.J. 1980. *Historic Towns in Dorset.* DNHAS Monograph **1**, DNHAS, Dorchester.

Randall, C.E. 2018a. 'The Human remains', In L. Ladle, *Multi-period occupation at Football Field, Worth Matravers, Dorset Excavations 2006–2011* BAR British Series **643**, BAR Publishing, Oxford, 221–233.

Randall, C.E. 2018b. 'The faunal remains', In L. Ladle, *Multi-period occupation at Football Field, Worth Matravers, Dorset Excavations 2006–2011* BAR British Series **643**, BAR Publishing, Oxford, 234–266.

Randall, C.E. 2018c. 'Fish', In L. Ladle, *Multi-period occupation at Football Field, Worth Matravers, Dorset Excavations 2006–2011* BAR British Series **643**, BAR Publishing, Oxford, 283–4.

Randall, C.E. 2020. 'Later prehistoric and Romano-British occupation at Townsend Farm, Poyntington. Geophysical survey and evaluation 2010–11', *PDNHAS* **141**, 171–81.

Randall, C.E. in prep. 'A sheep's eye view: Land division, livestock and people in later prehistoric Somerset, UK', In S. Arnoldussen, M. Løvschal, R. Johnston and D. McOmish (eds) *Cropland Shaping.* European Association of Archaeologists' (EAA) Themes Series.

Renn, D.F. 1960. 'The Keep of Wareham Castle', *Medieval Archaeology* **4**, 56–68.

Rixson, D. and Rixson, P. 2009. 'Animal bone', In T. Light and P. Ellis *Bucknowle A Romano-British villa and its antecedents: excavation 1976–1991*, DNHAS Monograph **18**, DNHAS, Dorchester, 158–163.

Royal Commission on Historical Monuments (England) (RCHME), 1970. *An Inventory of the Historical Monuments in the County of Dorset, Volume 2 - South East. Parts 1-3.* Royal Commission on Historical Monuments (England), HMSO, London.

Royal Commission on Historical Monuments (England) (RCHME), 1975. *An Inventory of the Historical Monuments in the County of Dorset, Volume 5 -East.* Royal Commission on Historical Monuments (England), HMSO, London.

Royall, C. 2014. *Rapid Coastal Zone Assessment Survey for South-West England - South Coast Dorset. Component One: National Mapping Programme.* Historic England Project No. 6673. Report No. 2014R003 completed by the Cornwall Archaeology Unit. Available from: https://research.historicengland.org.uk/.

Royall, C. 2016. *National Mapping Programme Mapping of Wild Purbeck: Historic England Project No. 6600.* Report No. 2015R070 completed by the Cornwall Archaeology Unit. Available from: https://research.historicengland.org.uk/.

Scaife, R.G. 1991. 'Pollen Investigation and Vegetational History', in P. Cox, and C.M. Hearne, *Redeemed from the heath. The Archaeology of the Wytch Farm Oilfield (1987 - 90).* DNHAS Monograph **9**, DNHAS, Dorchester, 180–197.

Scaife, R.G. 2012. 'Pollen Analysis', in L. Ladle *Excavations at Bestwall Quarry, Wareham 1992–2005. Volume 2: The Iron Age and Later Landscape.* DNHAS Monograph **20**, DNHAS, Dorchester, 272–5.

Standing Conference on Problems Associated with the Coastline (SCOPAC), 2012. *Sediment Transport Database: Poole Harbour.* Available from: http://www.scopac.org.uk/sts/poole-harbour.

Smith, H.P. 1931. 'The Occupation of the Hamworthy Peninsula in the late Celtic and Romano-British times', *PDNHAS*, **52**, 96–130.

Smith, H.P. 1933. 'Local Historical Research and the School Curriculum', *PDNHAS*, **56**. 11–21.

Spoery, P. and Hart, V. 1988. 'Documentary and Other Evidence for Medieval and Post-medieval Ceramic Production in Dorset', *PDNHAS*, **110**, 29–35.

Street, E. and Sheldrick, W. 2010. 'Other Chemicals', in B. Dyer and T. Darvill, *The Book of Poole Harbour.* The Dovecote Press, Wimborne Minster, 113–117.

Sunter, N. and Woodward, P.J. 1987. *Romano-British Industries in Purbeck: Excavations at Norden, Ower and Rope Lake Hole.* DNHAS Monograph **6**, DNHAS, Dorchester.

Sutherland, F.M.J. 1984. *Flandrian Sea Level-level Changes on the South Coast of England.* MSc Thesis, University of Durham.

Sutton, J. 2010. 'Ship and Boatbuilding', in B. Dyer and T.

Darvill, *The Book of Poole Harbour*. The Dovecote Press, Wimborne Minster, 146–157.

Swan, V. G. 1984. *The Pottery Kilns of Roman Britain*. Royal Commission on Historical Monuments (England). Supplementary Series Volume 5. HMSO, London.

Sydenham, J. 1986. *The history of the Town and County of Poole*. 2nd Edition. Poole Historical Trust: Poole.

Tatton-Brown, T. 1991. 'Building the tower and spire of Salisbury Cathedral', *Antiquity*, **65**, 74–96.

Taylor, C. 1970. *The Making of the English Landscape*. Hodder and Stoughton, London.

Terrain Archaeology, 2001. *The Interim Report on archaeological excavaton and obxervations during phase 2 drainage works: Shapwick Road, Hamworthy (TA 5050)*. Unpublished Client Report by Terrain Archaeology Ref. 5050.4.

Terrain Archaeology, 2003. *Archaeological Evaluation: Shapwick Road, Hamworthy (TA 5050)*. Unpublished Client Report by Terrain Archaeology Ref. 5050.5.

Terry, J. A. 1987. 'East Holme pottery', *PDNHAS*, **109**, 39–46.

Thomas, J. 2016. 'Note on the Use of Tertiary 'Heathstone' in Buildings Over the Area of Outcrop of the Palaeogene in the Isle of Purbeck, South-Central and East Dorset', *PDNHAS*, **137**, 129–136.

Thorn, C. and Thorn, F. 1983. *Domesday Book Dorset*. Phillimore, Chichester.

Trim, P. 2018. *Pooled Resources: An Experimental Investigation of Salt Production and Pottery Manufacture within the LIA and Romano-British Landscape of Poole Harbour, Dorset*. Master of Research Thesis, Bournemouth University.

Tyers, P. 1996. 'Roman amphoras in Britain', *Internet Archaeology*, **1**. Available from: https://intarch.ac.uk/journal/issue1/tyers_index.html.

Tyers, P. 2014. 'Potsherd: Atlas of Roman Pottery', Available from: http://potsherd.net/atlas/potsherd.

Viner, L. 2002. *Lost villages*. The Dovecote Press, Wimborne.

Watkins, D.R. 1994. *The Foundry: Excavations on Poole Waterfront 1986-7*. DNHAS Monograph **14**, DNHAS, Dorchester.

Webster, C.J. (ed.) 2008. *The Archaeology of South West England. South West Archaeological Research Framework: Resource Assessment and Research Agenda*. Somerset County Council, Taunton.

Wessex Archaeology, 2003. *Green Island, Poole Harbour, Dorset. An archaeological evaluation and an assessment of the results*. Salisbury, unpublished client report for Videotext Communications Ltd.

Wessex Archaeology, 2007. *Portland Gas Pipeline, Dorset, archaeological evaluation*. Salisbury, unpublished client report No. 60715.13.

Wilkes, E. 2004. *Iron Age Maritime Nodes on the English Channel Coast: An Investigation into the Location, Nature and Context of Early Ports and Harbours*. PhD Thesis, Bournemouth University.

Wilkes, E. 2007. 'Prehistoric sea journeys and port approaches: the south coast and Poole Harbour', in V. Cummings and R. Johnstone (eds), *Prehistoric Journeys*. Oxbow Books, Oxford, 121–130.

Wilkes, E. 2019. 'Chapter 2: Environmental and archaeological background to prehistoric Poole Harbour', in J.Berry, D. Parham, and C. Appleby (eds.). *The Poole Iron Age Logboat*. Archaeopress, Oxford, 5–10.

Williams, D. F. 1977. 'The Romano-British black-burnished industry: an essay on characterization by heavy-mineral analysis', in D.P.S. Peacock (ed.), Pottery and early commerce. Characterization and trade in Roman and later ceramics, Academic Press, London, 163–220.

Williams, D. F. 1981. 'Roman Amphora Trade with Late Iron Age Britain', in H. Howard and E.L. Morris *Production and Distribution: a Ceramic Viewpoint*. BAR International Series **120**, 123–132.

Williams, D. F. 2002. 'Purbeck Marble in Roman and Medieval Britain', in D.A. Hinton, *Purbeck Papers*. Oxbow, Oxford, 127–131.

Winder, J.M. 1991. 'Marine Mollusca', in P. Cox, and C.M. Hearne, *Redeemed from the heath. The Archaeology of the Wytch Farm Oilfield (1987-90)*. DNHAS Monograph **9**, DNHAS, Dorchester, 212–216.

Winder, J.M. 1992. 'The Oysters', in I. Horsey, *Excavations in Poole 1973–1983*. DNHAS Monograph **10**, DNHAS, Dorchester, 194–200.

Wolters, M., Bakker, J.P., Bertness, M.D., Jefferies, R.L. and Möller, I. 2005. 'Saltmarsh Erosion and Restoration in South-East England: Squeezing the Evidence Requires Realignment', *Journal of Applied Ecology*, **42(5)**, 844–851.

Woodward, A. 2009 'The pottery', in L. Ladle and A. Woodward, *Excavations at Bestwall Quarry, Wareham 1992–2005. Volume 1: The Prehistoric Landscape*. DNHAS Monograph **19**, DNHAS, Dorchester, 200–271

Woodward, P.J. 1986a. 'Ower' in N. Sunter, and P.J. Woodward, *Romano-British Industries in Purbeck: Excavations at Norden, Ower and Rope Lake Hole*. DNHAS Monograph **6**, DNHAS, Dorchester, 44–122.

Woodward, P.J. 1986b 'Rope Lake Hole' in N. Sunter, and P.J. Woodward, *Romano-British Industries in Purbeck: Excavations at Norden, Ower and Rope Lake Hole*. DNHAS Monograph **6**, DNHAS, Dorchester, 125–180.

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THE SEATOWN BURNT MOUND, CHIDEOCK

MARTIN PAPWORTH

WITH CONTRIBUTIONS BY MIKE ALLEN, PETER BELLAMY, DANA CHALLINOR, ALISON FERRIS, CYNTHIA POOLE, HENRIETTA QUINNELL, ROGER TAYLOR AND SUSAN WATTS

The investigation of a burnt mound revealed that it had been created between 2400–2100 BC. It is an isolated example of this type of site and the earliest found in Dorset. The site is unusual being on a hillslope terrace away from a stream or river. Therefore the usual explanation for this type of site; i.e. debris derived from heating stones to boil water, does not seem applicable. The feature was buried by 0.7m of colluvial soils, above which were found two Latest Iron Age (170 BC to AD 20) ovens, part of an occupation site confirmed by other finds collected from the undercliff. The ovens were buried by a further 1.0m of agriculturally derived colluvial soils, increasingly mixed with aeolian deposits as coastal erosion brought the coastal cliff closer to the site.

INTRODUCTION

2015 was the National Trust year of the Coast. This was a celebration of Enterprise Neptune, the Trust's campaign to acquire and conserve key coastal properties. 2015 was an opportunity to promote coastal archaeology and to carry out work to conserve by record sites threatened by coastal erosion.

The Golden Cap Estate of west Dorset is composed of Upper Greensand and Lias geology characterised by deposits of soft sands and clays. These geological outcrops are particularly susceptible to cliff falls and archaeological loss and therefore an excavation here, where Enterprise Neptune began, was felt to be particularly appropriate.

Since the 19th century, a number of eroding archaeological sites had been recognised by people walking the coastal footpath. These archaeological records were collected and included within the National Trust Historic Landscape and Archaeological Survey of the Golden Cap Estate (Papworth 2000). This report recommended that evaluation excavations should be carried out at each of the identified sites to understand the context of the finds that had been collected.

The Golden Cap report resulted in three excavations: Thorncombe Beacon in Symondsbury parish, 2003; Doghouse Hill in Chideock, 2009 and Golden Cap in Stanton St Gabriel, 2011. This work provided significant new information for an area of Dorset where previously very little archaeological research had taken place (Papworth 2013).

The 2000 report also identified a site at Ridge Cliff, Stanton St Gabriel (SY 3910 9235) where a local archaeologist, Anthony Pasmore, had found Romano British pottery eroding from the cliff on the east side of the stream known as Ridge Water (Fig. 1). This was to be the site of the July 2015 excavation but

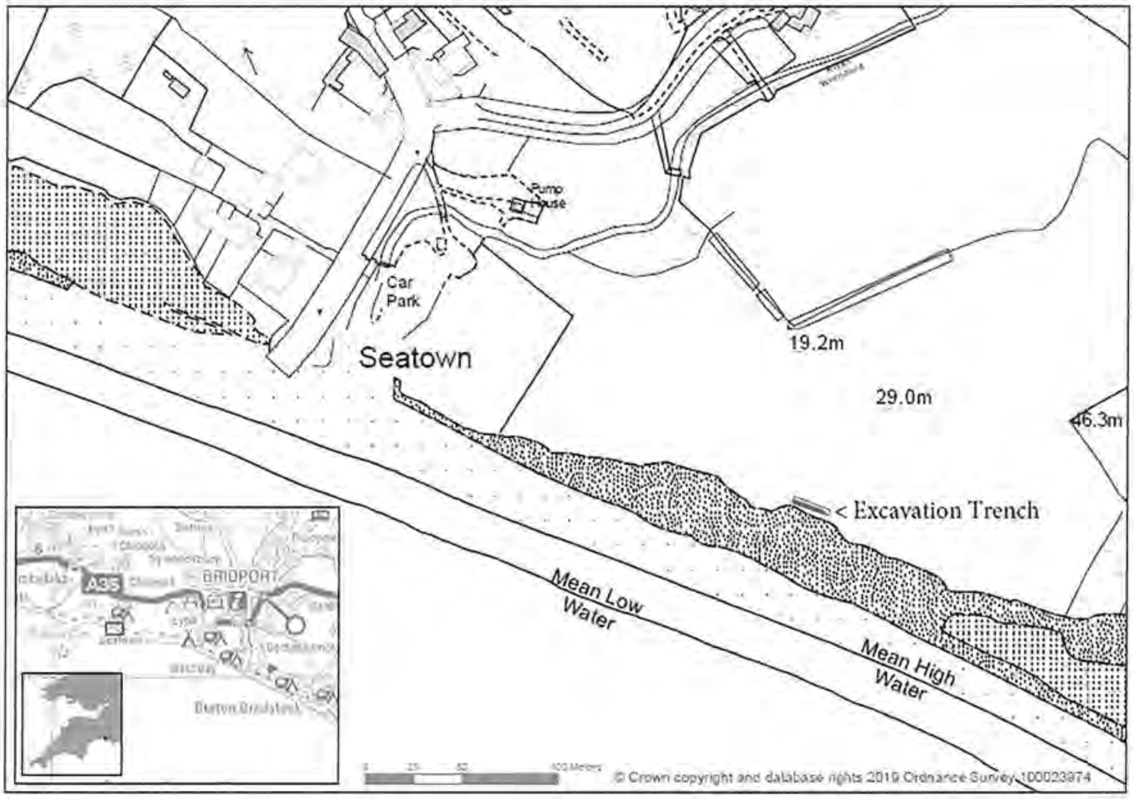

Figure 1 Location map.

visits during the preceding winter suggested that the eroding cliff was now barren of finds. If nothing remained there, it created a situation in which a Golden Cap Estate excavation was funded but lacked a site to excavate. A phone call to Anthony Pasmore confirmed that he had found nothing there in recent years and he suspected that the site had now been lost to the sea.

However, he recommended an alternative. He mentioned his recent discovery of eroding burnt material (SY 42242 91646), near Seatown in the parish of Chideock, which he believed would be a good candidate for the excavation. From his experience of work carried out in the New Forest, he thought that these remains were typical of the type of site known as a 'burnt mound', though nothing of this sort had previously been recorded in west Dorset. The site (Fig. 2) was found to occupy a slight terrace on a moderate west facing slope. It lay between the coastal hamlet of Seatown and the 100m high Ridge Cliff hill. Seatown is at the mouth of the River Winneford and the burnt mound was found 220m east and 30m above where the river meets the sea.

The position of the seam of burnt material, where it outcropped at the cliff edge, made it difficult to reach safely (Fig. 3). However, it could be viewed from below by taking a narrow path down from the cliff top and scrambling over fallen coastal erosion debris. At the site, the cliff face was sheer down to the undercliff, 10–15m below. Here, the sloping surface was found to be strewn with collapsed blocks of burnt gravel fragments mixed with ash. Scattered amongst this material were occasional struck and worked flints, which, it was thought, were likely to be prehistoric in date.

THE EXCAVATION

It was clear that this was an unusual and potentially significant site which was rapidly being lost to the sea. Two weeks in 2015, July 6th–17th, were set aside to make an archaeological record of the burnt mound and the associated stratified contexts above it.

Geophysical Survey

Before the excavation, a geophysical survey was

Figure 2 Site of excavation looking west towards Seatown with Golden Cap in the background.

Figure 3 Site of excavation trench looking north east. Burnt mound can be seen as a layer of dark material in the cliff face 1.5m–2.0m below the digger.

carried out. A 40m long base line was fixed along the ESE–WSW cliff face with the position of the burnt mound at its centre. From the base line, right-angled offsets were created to enable two 20m grids to be surveyed using a Geoscan FM36 Fluxgate Gradiometer. Readings were taken at 0.25m intervals along parallel traverses aligned NNE–SSW. This was to try to determine the surviving extent of the burnt mound under the rough pasture ground near the cliff edge.

The results were disappointing. The plot only showed a mottled and scattered pattern of readings and no anomaly could be discerned to indicate the extent of the buried mound below the turf. The archaeology was perhaps too deep to be detected using this method.

Plotting the Mound in the Cliff Face (Fig. 4)

On the west side of the site, the cliff edge jutted a little further south. From this position, an oblique view of the burnt mound could be obtained. An observer standing here could shout out when a plumb-bob measuring tape reached the top and bottom of the mound section exposed in the cliff face.

Therefore, a 20m long tape was run along the cliff face and both ends were plotted with a GPS device. At 0m, the east end was at SY 42256 91630 and at 20m it was SY 42239 91638

The exposed seam of burnt material began at 2.8m and faded away at 18.15m which made the mound at the cliff face 15.35m long. From 11m–12.5m, that is slightly west of its centre, the mound was 0.35m thick though generally it measured between 0.28–0.30m thick.

At the cliff edge, the east edge of the mound was 1.7m deep below the ground surface and the west edge was 1.2m deep. At 16.1m there was a 0.9m gap in the burnt material and this was later found to coincide with the position of a ditch [29] recorded during the excavation. The depth of soil that had accumulated above the burnt mound indicated its considerable antiquity. This had been demonstrated in 2009, at a site 700m south-east of the burnt mound (SY 4223 9165), where 1.2m deep deposits proved to cover the remains of a Middle Bronze Age settlement site (Papworth 2013).

Topsoil Removal

The depth of soil above the burnt mound required a mechanical excavator to be used. A flat edged bucket was requested to enable each level to be closely observed as the excavation proceeded. However, the sandy soil proved to be extremely resilient and the contractor had to switch to a toothed bucket. Throughout the excavation, the hardness of the soil made progress slow and much of the excavation was carried out by pecking the ground surface with a mattock blade because using a trowel made little impact.

The original size of the trench was to be 20m long, parallel with and on average about 1.0m from the cliff face. The irregular line of the cliff meant that this distance varied between 0.5m and 1.3m. The original width of the trench was to be 3m, though at a depth of 0.25m, because of time constraints and the hardness of the soil, the trench was reduced to 15m long and 1.5m wide. The long reference trench section was maintained along the south side of the trench. The 0m point was at the east end and the deep trench extended from 2.5m to 17.5m. The four corners of the original trench were GPS plotted at 0m/0m (SY 42253 91642); 0m/20m (SY 42233 91649); 0m/3m (SY 42256 91644); 20m/3m (SY 42238 91652).

From 0m to 2.5m, the machine was used to excavate 0.8m depth of soil and from 2.5m–6.0m it removed 1.2m of soil. This revealed a series of windblown and colluvial deposits and the mechanical excavation halted where burnt red soil indicated that *in situ* material started to be revealed at the Iron Age buried soil horizon.

The machine excavated the whole length of the 1.5m wide trench from 2.5m to 16.5m to the bottom of context (3) at 0.8m deep from the ground surface. Hand excavation concentrated on three areas which were dug to the bottom of the burnt mound. The east trench **A** was from 2.5m to 6.0m, the middle trench **B** was from 9.8m to 11.7m and trench **C** was initially from 14.6m to 16.5m and on the last day extended by machine to 19.5m to pick up the western edge of the

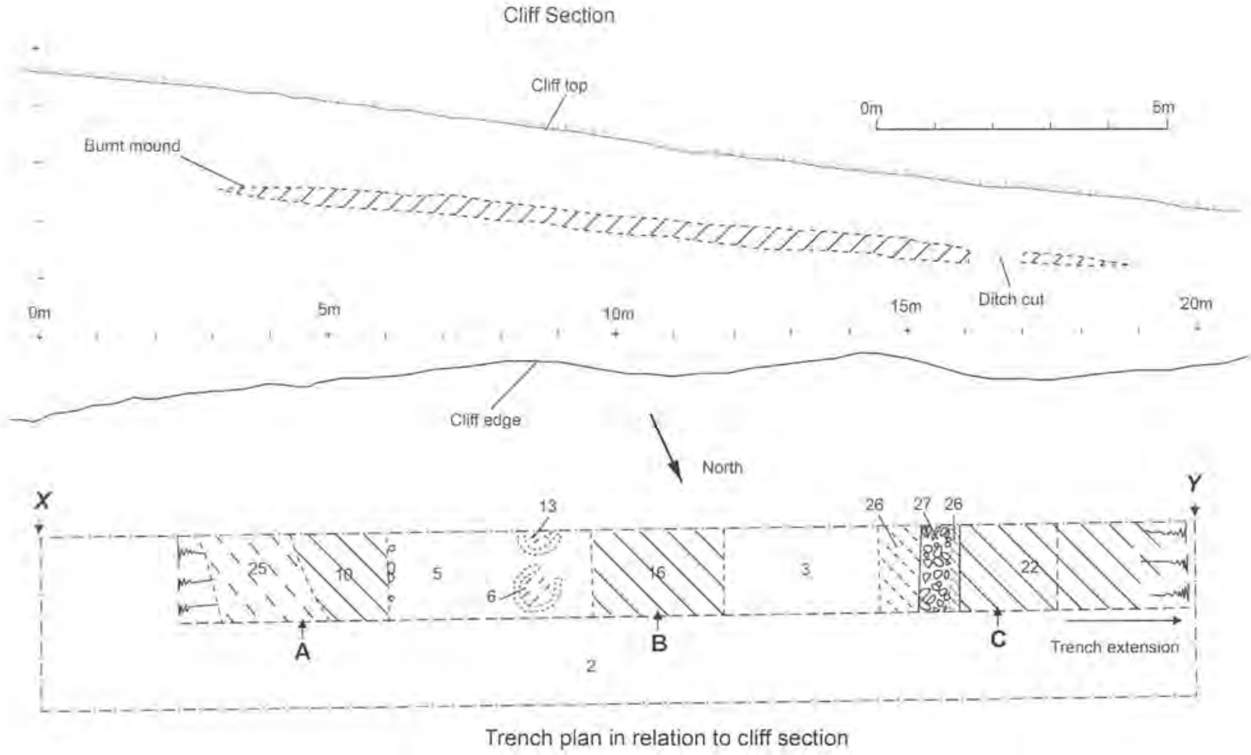

Figure 4 Upper drawing: section of burnt mound plotted in the cliff section. Lower drawing: excavation trench plan in relation to the cliff face. The cliff section drawing has been inverted to enable it to relate to the plan and therefore the viewer is looking south through the cliff towards the sea. West on right hand side.

burnt mound. Between 6.0m to 9.8m was the area of the Late Iron Age ovens which were left in position 0.4m higher than the upper level of the burnt mound.

THE STRATIGRAPHIC DESCRIPTION (FIGS 4 & 5)

The top 0.35m of the trench was layer (1). This was a yellow to ochre fine compacted sand with few inclusions apart from occasional small greensand chert fragments. There were occasional finds of Welsh slate and one or two brick fragments near the base of this layer.

From 0.35m to 0.70m was layer (2) which was a stonier harder layer. An ochre fine compacted sand with moderate to numerous chert and sandstone fragments 30–100mm3 and moderate pebbles. Fragments of Welsh slate and Verwood type green glazed earthenware were found in the upper part of this context mixed with occasional struck flint and prehistoric pottery fragments.

Layer (3) was 0.70–0.9m below the surface. This was a darker yellow-red brown fine silty sand with moderate chert fragments and charcoal flecks and chert fragments average size 20–50m3. Finds in this layer were flint flakes and pottery including Poole Harbour wares and occasionally other Iron Age and Bronze Age fragments. At the deeper east end of the trench, (3) overlay layer (7) which was similar but with fewer stones and was essentially part of (3). The base of (7) was from 1.5–1.0m below the ground surface.

The contexts (3) and (7) were found to overlay (4) in trench **A** and west of this, the burnt area and ovens (5); (9); [6] & [13], layer (11) in trench **B** and layer (14) in trench **C**

THE OVENS AREA (SEE PLAN PART OF FIGS 4 & 5)

Beneath (3) from 8m–9.5m was (9), an area of dark red-brown silty sand mixed with very numerous

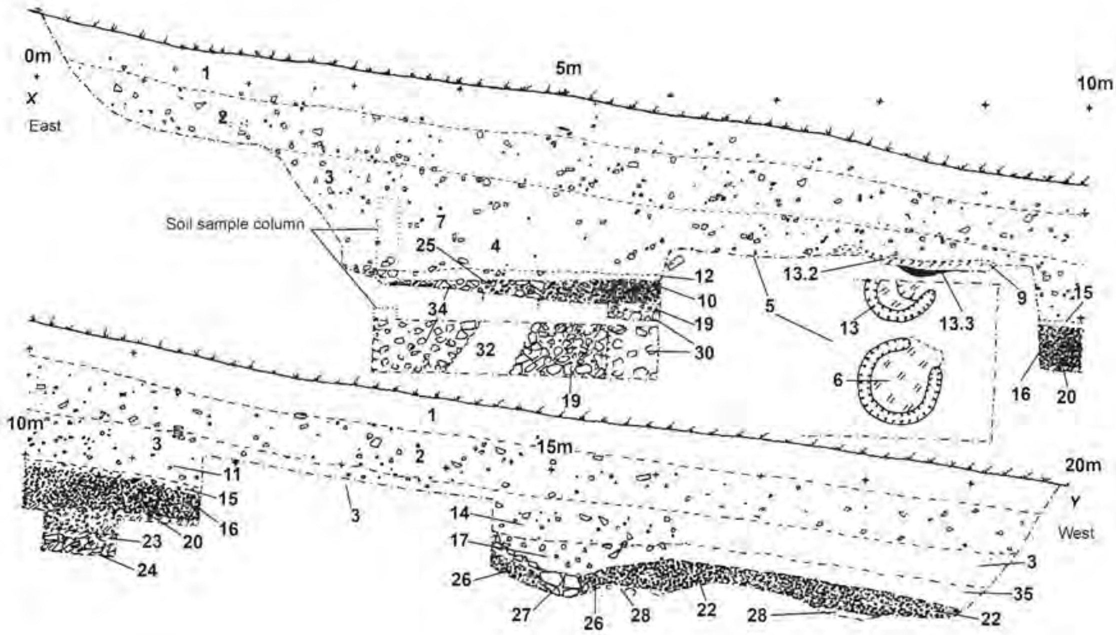

Figure 5 Drawing of north facing excavation section. Inset plans of ovens 6 & 13 and the east edge of the burnt mound are positioned to relate to the correct part of the section drawing above.

flecks and patches of charcoal, red burnt sand and yellow sand flecks created a mottled effect. This was up to 0.06m deep and covered the western sides of two baked earth hearths or ovens [6] and [13]. They were constructed out of context (5) and were almost circular in plan and spaced only 0.15m apart. The larger oven [6] (Fig. 6) measured 0.8m in diameter and was defined by a 0.12m wide ridge of the yellow-ochre compacted sand which was burnt red around the inner edge. The wall of the oven was 0.06m high externally and the interior was dished so that the centre was 0.10m below the ridge top. On the south-west side was an opening 0.3m wide. The base of [6] was covered in a layer of charcoal 0.02m thick (6.3) and above this was a ruby red sand/clay mix up to 0.08m deep (6.2) which was overlapped by (9) on the west side. This layer and (9) included fragments of Iron Age pottery.

Oven/hearth [13] continued into the south section and only 60% of the feature was excavated. It was 0.65m in diameter and like [6] was defined by a ridge/wall 0.05m high and 0.10m thick with an entrance on the south-west side. The dished interior was burnt red and 0.05m deep to the east but stepped down and was 0.12 deep towards the entrance. Its filling was very similar to [6]. The deeper part of the oven was filled with black silty ash and charcoal (13.3) up to 0.06m deep and above this and across the interior of the oven was a ruby red baked sand/clay (13.2). This was overlain by mottled charcoal layer (9).

Layer (5) was the layer the ovens were constructed into and was seen in plan but not excavated. Layer (5) was 1.2m below the ground surface, a dark yellow brown loamy sand with patches of red burnt soil mixed with a moderate number of large stones up to 300mm3, mainly chert and sandstone but with one block of mudstone. At 6m, there was a 0.3m wide concentration of these stones aligned north to south but nothing clearly related to a structure was observed apart from the ovens [6] and [9].

To the east of (5) and equivalent to it was the 0.1m deep layer (4) in trench **A** (Fig. 7). This was a reddish grey silty sand with numerous charcoal flecks and occasional struck and worked flints and small chert fragments up to 30mm3.

(4) overlay (8) a red brown silty sand flecked with grey up to 0.2m deep containing very numerous charcoal flecks and occasional chert and sandstone lumps 20–50mm3 and struck and worked flint.

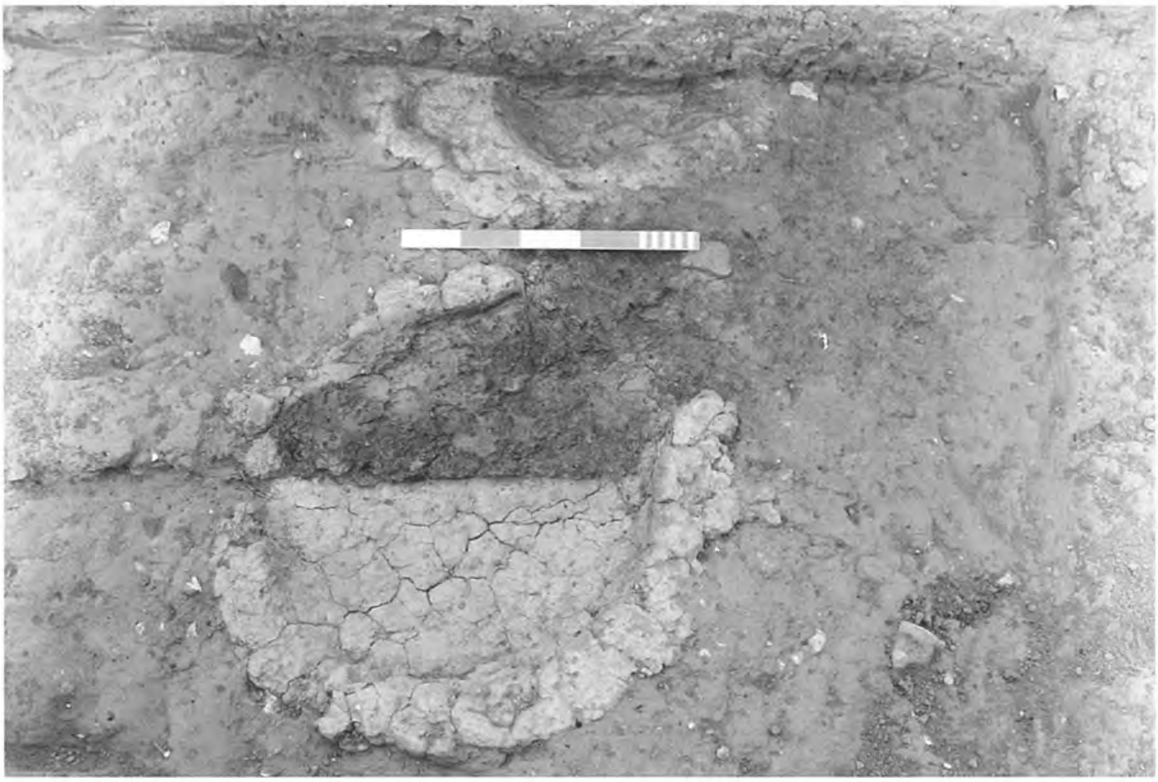

Figure 6 The Late Iron Age ovens [6] half sectioned charcoal and clay deposit from last firing *in situ* from which C^{14} samples taken. Oven [13] can be seen above [6] continuing into the trench south section. Scale has 0.1m divisions. The right end of the scale rests on a sherd of Poole Harbour ware.

Figure 7 Looking south east. The top of the burnt mound visible in trenches A and B divided by the raised area containing the ovens. Scale divisions 0.1m.

Figure 8 Trench B looking east showing Early Bronze Age burnt mound section and accumulation of soil above with Late Iron Age ovens top centre.

The equivalent layers for (4) and (8) were (11) in trench **B** (Fig. 8) and (14) in **C**. Both were 0.18–0.2m deep. In **B**, (11) overlay (15) which was the equivalent to (12) in **A** (which will be described below) but in trench **C** context (14) was found to overlay the upper filling (17) of the ditch [31]. A distinctive element of both contexts 14 and 15 were occasional fragments of green glauconite flint (see note in lithics report below).

THE WEST DITCH

The evidence for this ditch was first seen as a 1m wide break in the burnt mound at the cliff section. Trench C found this ditch at 14.5m–15.5m whereas the cliff-edge gap was recorded from 16m–17m. By plotting a line between these two observations it indicates that the ditch was aligned NNE–SSW.

There had been three ditch cuttings, the primary ditch [29], the narrower recut [21] and a later, broader shallower cut [31]. Layer (17) filled ditch [31] which measured 2.2m wide and 0.3m deep. It consisted of a yellow brown softer silty sand mixed with numerous charcoal flecks and a moderate number of sandstone and chert fragments 20–60mm3.

[31] cut the top of layer (27) which was the filling of a steep-sided rounded bottom ditch [21] which measured 0.55m wide and 0.25m deep. (27) was filled with large lumps of sandstone up to 200mm3 mixed with plastic yellow clay.

[21] was a recut of the original ditch [29] which was 0.28m deep and measured over 1.1m wide. [29] was filled with (26), a very dark grey brown silty ashy clay with very numerous charcoal patches and numerous chert fragments 20–40mm3.

The primary ditch [29] cut through (22), the context number for the burnt mound in **C** and the nature of its filling (26) indicated that it was likely to derive from the weathering of the burnt mound material into the ditch.

THE BURNT MOUND

In **A**, layer (8) covered (12) which was 0.06–0.10m deep and like (15) in **B** lay directly above the burnt mound. In the extension of **C** to the equivalent of (15) was (35). (12) became deeper towards the east where the lower 0.5m of this layer, from 2.9–4.0m, was given the context number (18). (12)/(18) was a light grey to grey brown softer and moister sand than (4). It was mixed with very numerous charcoal and orange brown sand flecks, occasional chert fragments and struck and worked flint becoming more stony in (18) towards the western edge. (15), in **B**, was similar but the soil was darker and a harder yellow brown silty sand.

The removal of layers (12)/(18) and (15) released a mildly acrid tar-like smell as the burnt mound was revealed. In **A**, the upper burnt mound was context [10] and in **B** it was [16]. The top was gritty hard and dry becoming moister with more clay towards the bottom of the layer. It consisted of a black to very dark grey brown silty sand with compacted very numerous fragments of burnt rounded sandstone mixed with chert fragments, stone size average 15–20mm3, mixed with silty ash and charcoal. Within (10)/(16) and particularly in **B**, were thin 3–6mm thick lenses of black ashy silt with few stones and other lenses, generally at a lower level, of moister plastic yellow clay.

In **A**, the west edge of (10) was at 3.8m, where it abutted context (25), thickening to 0.22m deep at 6m. In **B**, at 10m, the upper mound (16) was 0.38m thick and at 11.5m it decreased to 0.32m thick. In trench **C** the mound was 0.28m thick at 16.5m and by 19.5m had thinned to 0.18m. Although the trench was extended by machine on the last day, the full diameter of the mound was not revealed although its western edge is likely to lie between 21m–23m based on the observation at the cliff edge and the rate of decrease in the thickness of the mound.

In both **A** and **B**, the bottom part of the mound was distinct from the upper deposit. In **A**, below (10) was (19) a 0.05–0.08m thick dark red brown loamy clay mixed with very numerous charcoal flecks and patches and numerous lumps of burnt red sandstone up to 60mm3. Distinctive inclusions within this layer were lumps of chocolate brown friable clay. Below (16), in **B**, was (20) an 0.1m deep yellow brown plastic clay mixed with very numerous lumps of burnt sandstone 10–20mm3 and ash which was concentrated at the surface and faded towards the base of this layer.

At the mound's eastern edge, layer (10) continued beyond (19) in **A** and overlay (25) which was a yellow brown silty sand with numerous larger and angular lumps of sandstone 50–100mm3, possibly evidence of a kerb or rough retaining structure built around the mound. In **C**, the burnt mound deposit (22) was the same as (10) in **B**. No distinctive lower burnt mound layer was observed at this west end of the trench.

The lower burnt mound layer (20), in **B**, covered a 0.05m deep light grey fine clay with no inclusions (23) which was sampled for its potential as a buried soil (see Allen this report). In **C**, a similar layer was recorded as (28) below burnt mound layer (22) but was thinner and mixed with occasional sandstone lumps with flecks of charcoal. Context (28) was observed at 16m and 18m where the bottom of the burnt mound was excavated.

Where observed, that is at 10.5m, layer (23) in **B** and at 16m, layer (28) in **C**, these lowest archaeological deposits overlay a packed jumbled layer of sandstone and chert set in a plastic clay. This context (24) was thought to be the natural bedrock as observed in the cliff section.

At the east end, in **A**, an 0.4m wide *sondage* at 5.5m revealed that the lower burnt mound (19) did not cover a stone-free grey clay layer and here directly overlay (30) which, like (24), was a yellow plastic clay mixed with lumps of chert and upper greensand sandstone average 50–100mm3 with no other inclusions. Therefore, this deposit was also thought to be geological.

On the last day of the excavation, another 0.8m wide *sondage* trench was excavated in the bottom

Table 1 The deposit sequence.

0–34cm	Topsoil Ah and A: high level of wind-blown sand from the cliff face context (1)
34–56cm	B horizon, colluvial B (and Aeolian): both wind-blown and arable / hill wash (2)
56–78cm	Upper silty stone-free colluvium: downslope movement of soil through cultivation (3)
78–125cm	Stony colluvium: downslope: more intensive cultivation?, disturbance of subsoil upslope (7)
125–148cm	Stone-free colluvium: downslope movement of soil through cultivation (4)
148–154cm	Stone-free colluvium, buried soil (= hearth/kiln): occupation level Late Iron Age (5)
154–171cm	Largely stone-free colluvium: movement of soil downslope probably through cultivation (8)
171–186cm	Silty colluvium: Less bare soil, gradual accumulation of fine soil (12)
186–205cm	Buried soil and charcoal: Occupation level Early Bronze Age (18)
205–210cm	Burnt mound: Occupation level Early Bronze Age (10)
210–215cm	Pre burnt mound deposit, geological: (34)

of A to investigate the junction of (10) with the supposed kerb deposit (25). It showed that against the south section between 4.4m–4.9m, the edge of (10) and (25) overlay a linear band of yellow hard clay mottled with blue and grey flecks which contained no stones (32). This linear feature followed a clear diagonal path across the trench with a NE to SW alignment. The lower mound deposit (19) on its NW side continued deeper as did the deposit on the SE side. This was (34) below 'kerb' (25) which was a yellow brown sandy clay mixed with numerous lumps of sandstone 50–100mm3. (32) is tentatively interpreted as the filling of a narrow 0.5m wide ditch [33] which here followed the edge of the mound and had cut (19) and (34) but there was insufficient time to investigate this feature further.

FINDS REPORTS

Environmental Summary

A column of soil was analysed at the east edge of the burnt mound i.e. 3.5m from the baseline zero point. The following observations (Table 1) were made with measurements taken from the ground surface to the lowest level of excavation beneath the burnt mound.

The soil had accumulated over at least 4000 years. The upper soil deposits contained more wind-blown sand as coastal erosion brought the cliff face closer to the site and the prevailing south west winds carried sand from the cliff face onto the ground surface. From below 56cm–148m, the soils derived predominantly from soil movement downslope suggesting prolonged periods of bare earth caused by regular cultivation with occasional accelerated soil movement during heavy rainfall. A more stable grassland environment coincided with the creation of the Late Iron Age ovens. Below this, from 154–186cm, were more colluvial deposits indicating earlier periods of prolonged cultivation above the earlier occupation deposit created when the burnt mound was being created.

Environmental Report by Mike Allen

The excavation at Chideock produced a stratified burnt mound, and oven feature (Allen 2015). The radiocarbon programme set to define the period and duration of the burnt mound, and chronological relationship of the burnt mound with the oven 6.3.

Stratigraphy

The burnt mound (16) was clearly stratified (weakly banded) and comprised a greyish brown to dark greyish brown (10YR 4–5/2) moist silty clay loam with many small and medium stones (many burnt), common fine distinct strong brown (7.5YR 5/6) Fe mottles with a greyish hue. It contained many charcoal fragments and pieces of burnt reddened soil indicated that much of the material was re-worked. Limited examination of the base of the

Table 2 Charcoal: species identified (Dana Challinor).

Feature	Context	Sample	*Alnus glutinosa* (Alder)	*Fraxinus excelsior* (Ash)	*Prunus spinosa* (Blackthorn)	*Prunus* spp	Maloideae (Apple/Pear type)	*Salix/Populus* (Willow type)	*Corylus* spp (Hazel)	cf. *Rubus* & *Prunus*
Ditch	17	6					✓			
Burnt mound	16	1		✓		✓	✓			
Burnt mound	16	3	✓	✓						
Burnt mound	23	4		✓			✓	✓	✓	
Oven	6.3	5	✓			✓				✓
Above east edge of Burnt Mound	18	2		✓	✓		✓	✓	✓	

burnt mound did not see obvious reddened or altered soils, suggesting that much of the debris examined consisted of moved and re-deposited material rather than being burnt *in situ*.

The burnt mount lay on greyish brown massive silt with a few fine reddened fragments (burning), and charcoal pieces (23=20) being the weathered base above the greensand and yellow clay (24). The mound was cut by a ditch [31] with a charcoal-rich fill (17), and thus it is assumed that the charcoal in this feature is coeval with that and provides a *terminus post quem* for the burnt mound. Oven 6.3 was undated and isolated from the burnt mound and not stratigraphically related to it.

Taphonomy

Bulk samples of 5–15 litres were processed from the buried mound, and hand collected as were charcoal found within oven (6.3) (Allen 2016). Samples of short-lived identified charcoal (Table 2) were carefully selected and in particular their taphonomy considered with care.

Oven 6.3: hand-collected charcoal from the oven was considered to be fuel from this and provide a reliable date for the last burning. Alder (*Alnus glutinosa*) Roundwood charcoal was selected.

Burnt mound: the weakly banded nature of the buried mound suggest some stratification and accumulation indicating a chronological development in its construction. Although the mound seems to have been deposited in sequence, we cannot, however, be entirely sure that the deposits forming the mound have a similar chronological integrity; they could have originated from a single-event deposit, and been moved to create the mound. Nevertheless, we assume the mound has chronological stratification. The base of the mound (20) is in part the weathered basal horizons beneath the mound.

The mound was cut by ditch [31] with a charcoal-rich fill (17) which should provide a *terminus post quem* for the burnt mound accumulation, providing that the charcoal does not originate from the burnt mound.

Charcoal: Sample selection

Charcoal was identified by Dana Challinor from a number of contexts (Table 2), proving a range of species in the burnt mound (alder, ash, hazel, buckthorn/sloe, willow, apple/pear etc.), and oven 6.3 contained species of alder, buckthorn/sloe/blackberry (Table 2). Short-lived identified roundwood charcoal was selected (Table 3). Only charcoal potentially suitable for radiocarbon dating was identified rather than the full assemblages.

Table 3 Charcoal selected for radiocarbon dating (identifications by Dana Challinor).

Feature	Context	Sample	C^{14} sample	Notes	Selected
Ditch	17	6	Maloideae	Moderate ring curvature	Maloideae
Burnt mound	16	1	*Fraxinus excelsior* rw *Prunus* sp	*Fraxinus* <1 growth ring	*Fraxinus*
Burnt mound	16	3	*Fraxinus excelsior* rw	No pith or bark, but strong ring curvature and no tyloses; 4+yrs	*Fraxinus*
Burnt mound	23	4	*Fraxinus excelsior* rw	No pith or bark, but strong ring curvature and no tyloses; 3+yrs	*Fraxinus*
Oven	6.3	5	*Alnus glutinosa*	Faint ring curve	*Alnus*

Table 4 Radiocarbon determinations from Chideock.

Feature	Context	Sample	Charcoal	Lab no	Result BP	δC^{13} ‰	Cal BC
Oven	6.3	5	*Alnus glutinosa*	SUERC-66454	2053±29	-27.0	170BC–AD20
Ditch	17	6	Maloideae	SUERC-66696	3793±27	-25.1	2300–2130
Burnt mound	16 top	1	*Fraxinus excelsior*	SUERC-66451	3836±25	-27.2	2460–2200
Burnt mound	16 base	3	*Fraxinus excelsior*	SUERC-66452	3788±29	-24.0	2340–2130
Burnt mound	23 lowest	4	*Fraxinus excelsior*	SUERC-66453	3815±29	-24.8	2430–2190

Nevertheless, Maloideae roundwood charcoal was specifically selected from the ditch (17) as this was a species not identified from the samples of the mound, and thus is considered more likely to be related to activity associated with the ditch, rather than derived from the mound through which the ditch was cut. Ash (*Fraxinus excelsior*) Roundwood charcoal was selected throughout the burnt mound.

RADIOCARBON RESULTS

The samples were submitted for AMS radiocarbon dating at the Scottish Universities Environmental Research Centre. They were was processed at SUERC following a modified version of the pre-treatment method outlined by Longin (1971), graphitisation as described in Slota *et al.* (1987), and measurement by AMS as described by Xu *et al.* (2004).

The AMS radiocarbon dates and the results are given in table 3 and are quoted in accordance with the international standard known as the Trondheim convention (Stuiver & Kra 1986). They are conventional radiocarbon ages (Stuiver & Polach 1977). Calibration of the results has been performed using the data set published by Riemer *et al.* (2004) and performed using the programme OxCal v4.2.3 (www.flaha.ox.ac.uk/). Details of the algorithms employed by this program are available from the on-line manual or in Bronk Ramsey (1995; 1998; 2001). The calibrated date ranges (Table 3) cited in the text are those with 95% confidence and have been rounded out to the nearest 10 years (Mook 1986). The certificates are presented separately. The results are presented in Table 4 and as a histogram of probability distribution (Figs 9 and 10).

The three results from the burnt mound (two within the body of the mound (16) and one immediately below (23)) are similar and all within the date range *c.* 2460–2130 cal BC, i.e. the Early Bronze Age or Beaker period (Fig. 10), with the sample from (17) the final ditch cutting [31] of the mound *c.* 2300–2130 cal BC (SUERC-66454) not being statistically different. The results indicate the burning event associated with the mound was *c.* 2300 ±200 cal BC, with no clear chronological stratigraphic development *within* the mound indicated by the C^{14} dates. This suggests that either the ditch was cut very soon after the burnt mound was deposited, or that the charcoal dated was derived from the mound. The radiocarbon results provide a date for the burning events, and not strictly for the burnt mound accumulation. We can suggest that the events relating to the burning, the

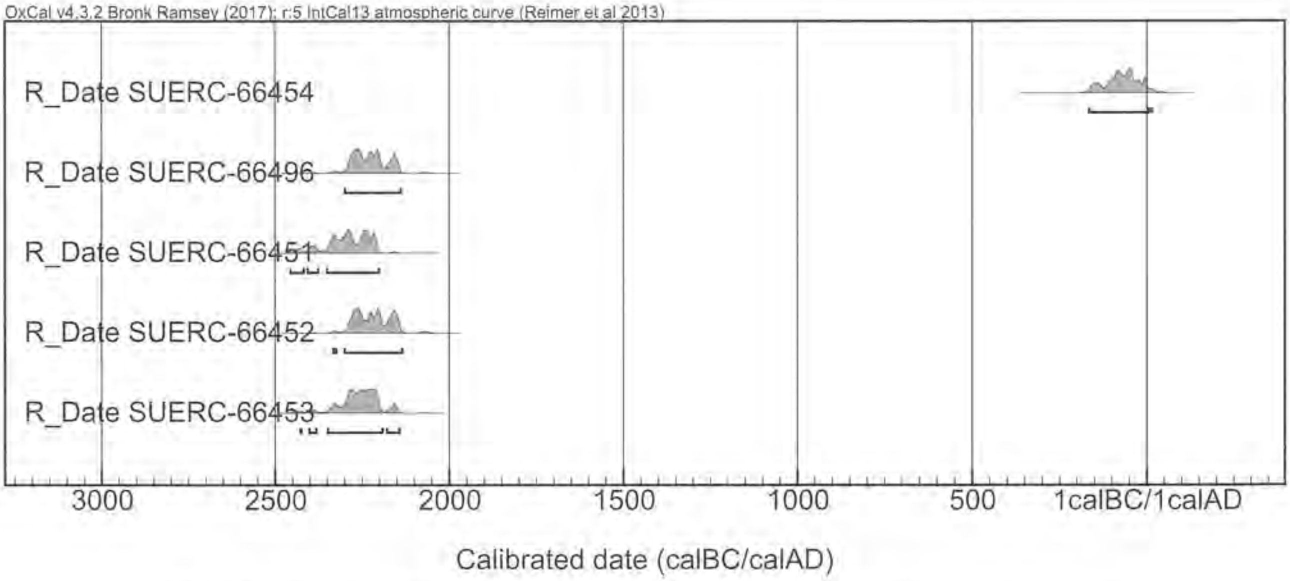

Figure 9 Radiocarbon probability distributions of the results from the burnt mound and oven 6.3.

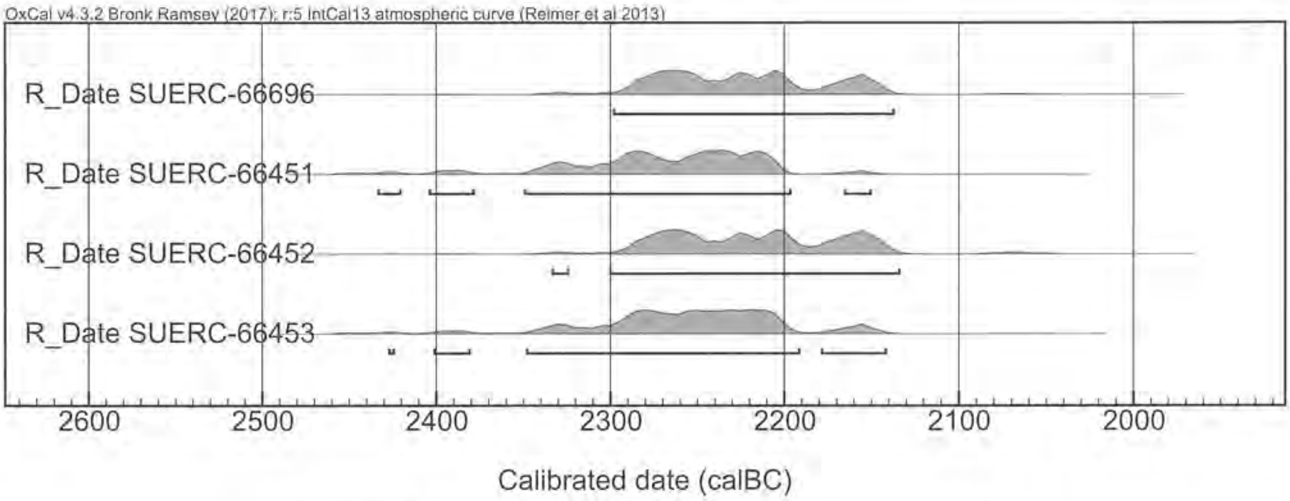

Figure 10 Radiocarbon probability distributions from the burnt mound.

creation of the burnt mound, and the ditch [21/29] cutting the mound occurred within a relatively short period time.

The oven 6.3 clearly dates to 170 cal BC – 20 cal AD, and post-dates the burnt mound by two millennia, and relates to Late Iron Age activity.

FLAKED STONE BY PETER S. BELLAMY

Introduction

A total of 338 pieces of worked flint and chert were recovered from thirteen contexts, together with fourteen unstratified pieces. The whole assemblage was examined and catalogued (Table 5). Very little flint and chert was recovered from secure contexts, so it was not possible to undertake any meaningful metrical or quantitative analysis.

Methods

All material was counted by context and classified into a series of broad general categories, commonly employed in flint analysis, to produce an overall catalogue. The definitions of the main lithic categories follow Andrefsky (2005), Ballin (2000), and Inizan *et al.* (1999). In addition, a number of technological and other attributes that may have chronological or diagnostic significance (see Harding 1991, table 16, for example) were noted but not quantified. Conditional factors, such as burning, patination, or damage were also recorded.

Following the initial cataloguing by context, the material was grouped into five broad stratigraphic units (Table 5) to assess the potential for more detailed metrical analysis, but this showed there was not a sufficiently large sample of material from stratigraphically secure contexts to enable any meaningful quantitative analysis. The stratigraphic units were used as the basis for the qualitative assessment of the assemblage. The unstratified pieces were not included in the analysis, but are included in the overall quantifications.

Raw Material

The raw materials consist of 86% flint and 14% chert. The flint ranges in colour from dark brown glossy to mid grey opaque flint. 108 pieces (37%) retain some traces of the external surface of the nodule, of which 75% are beach pebble flint and 25% have traces of thin smooth eroded cortex, probably from derived nodules rather than chalk flint. The chert is primarily greensand chert pebble nodules with a small number of coarse greyish-brown coarse chert pieces and a single chip of Portland Chert (from context 14). The precise sources of the raw materials are not known but the material is all likely to have been derived from the local area.

GLAUCONITE FLINT BY ALISON FERRIS

Fragments of distinctive green flint were found in the lower colluvial lower deposits on the west side of the burnt mound. Four small chunks in (14) above ditch filling (17) in C and another six in (15) directly overlying the mound. The fragments were unworked and averaged 10–30mm3.

The green colour of the flint is caused by a coating of Glauconite which is iron potassium phyllosilicate. This material is likely to be a remnant of eroded chalk geology and has been found locally on Charmouth beach further to the west.

Table 5 Stratigraphic units used for flint analysis.

Stratigraphic Unit	Spot dating	Contexts
Upper overburden	Post-medieval	1, 2
Lower overburden	Iron Age-Post medieval	3, 4, 5, 8, 11, 14
Above burnt mound	Early Bronze Age	12, 15, 18
Ditch 29	2460–2130 cal BC	17
Burnt mound	2460–2130 cal BC	10

The examples from (14) and (15) are likely to have been selected for a specific purpose during a particular period as they only occur at this level within the Seatown excavation stratigraphy.

Assemblage Description

The assemblage consists of knapping debris from the reduction of mainly pebble cores to produce a range of flakes, blades and blade-like flakes. A small quantity of tools and utilised pieces are present. All are flake and blade tools with no evidence for the production of core tools. The assemblage is composed of 59.76% flakes (of which 49.5% are broken), 8.58% blades (of which 79.3% are broken), 1.76% cores, 3.85% tools, 14.79% chips and 11.24% miscellaneous debitage. The majority of the flint and chert is in an edge-damaged condition, with a small quantity in a slightly fresher condition and a small number of rolled pieces. Eleven pieces (3%) have been burnt.

The whole assemblage is presented in Table 6 by stratigraphic unit (see Table 5). The bulk of the material came from the lower overburden contexts, with relatively little associated with the burnt mound. Overall, the assemblage is broadly similar for all stratigraphic units. The flint and chert from each unit is described separately below.

Burnt Mound

Only four pieces of flint and chert were recovered from the burnt mound. All are edge-damaged and one is heavily burnt. All are undiagnostic flakes and include one primary flake of pebble flint and a long thick flake of greensand chert.

Table 6 Assemblage composition by stratigraphic unit.

Context	Raw Mat.	flakes	Broken flakes	blades	Broken blades	cores	tools	chips	Indeter-minate	total	tool type
Upper overburden	Flint	4	2						1	7	
Upper overburden	Chert	3	1							4	
Lower overburden	Flint	65	58	3	18		8	40	32	224	4 scrapers, 1 piercer, 1 denticulate, 2 edge trimmed
Lower overburden	Chert	12	12	2	1	2	1	1	1	32	1 utilised flake
Above burnt mound	Flint	10	9		2	2	2	4	2	31	1 scraper, 1 truncated blade
Above burnt mound	Chert		3					3		6	
Ditch 29	Flint	2	4	1	2		2	1	1	13	1 fabricator, 1 retouched flake
Ditch 29	Chert	1	1			1				3	
Burnt mound	Flint	2	1							3	
Burnt mound	Chert	1								1	
Unstratified	Flint	2	8			1		1	1	13	
Unstratified	Chert		1							1	
Total	Flint	85	82	4	22	3	12	46	37	291	
Total	Chert	17	18	2	1	3	1	4	1	47	
Total	Total	102	100	6	23	6	13	50	38	338	

Ditch 31

Sixteen pieces of flint and chert were recovered from the fill of Ditch 31, which cut the burnt mound deposit. This small assemblage includes some larger core trimming flakes and three blades (one small secondary trimming blade and two broken blades or blade-like flakes). A single multi-platform core on a greensand chert pebble was recovered. This has evidence for small blade-like flake removals. Two tools were identified: a flint fabricator (context 17, SF600, see Fig. 11) with a rounded, worn, slightly polished end and a squat flake (context 17, SF598) with some semi-abrupt retouch on left proximal end. This assemblage has few diagnostic features, but would fit within a Late Neolithic/Early Bronze Age industry.

Layer above Burnt Mound

A total of thirty-seven pieces of flint and chert were recovered from the layers immediately overlying the burnt mound. This consisted mainly of flakes, together with two blade fragments, two cores, two tools (Fig. 11) and a small number of chips and indeterminate miscellaneous debitage. These pieces are in a slightly edge-damaged condition and a single piece of flint was burnt. The flakes include a number of primary and secondary flakes from beach pebble flint, together with broken tertiary flakes. The flakes are generally irregularly-shaped, but with the occasional long flake present. The tertiary flakes are mainly broken and appear to derive from core trimming, rather than blank production.

The two flint cores consist of a multi-directional core on a small beach pebble, with evidence for a number of blade-like flake removals, and a burnt pebble flint multi-platform core fragment with more irregular flake removals evident. Two tools were recovered – a scraper and a truncated blade. The scraper (context 15, SF586) was formed by fine semi-abrupt retouch

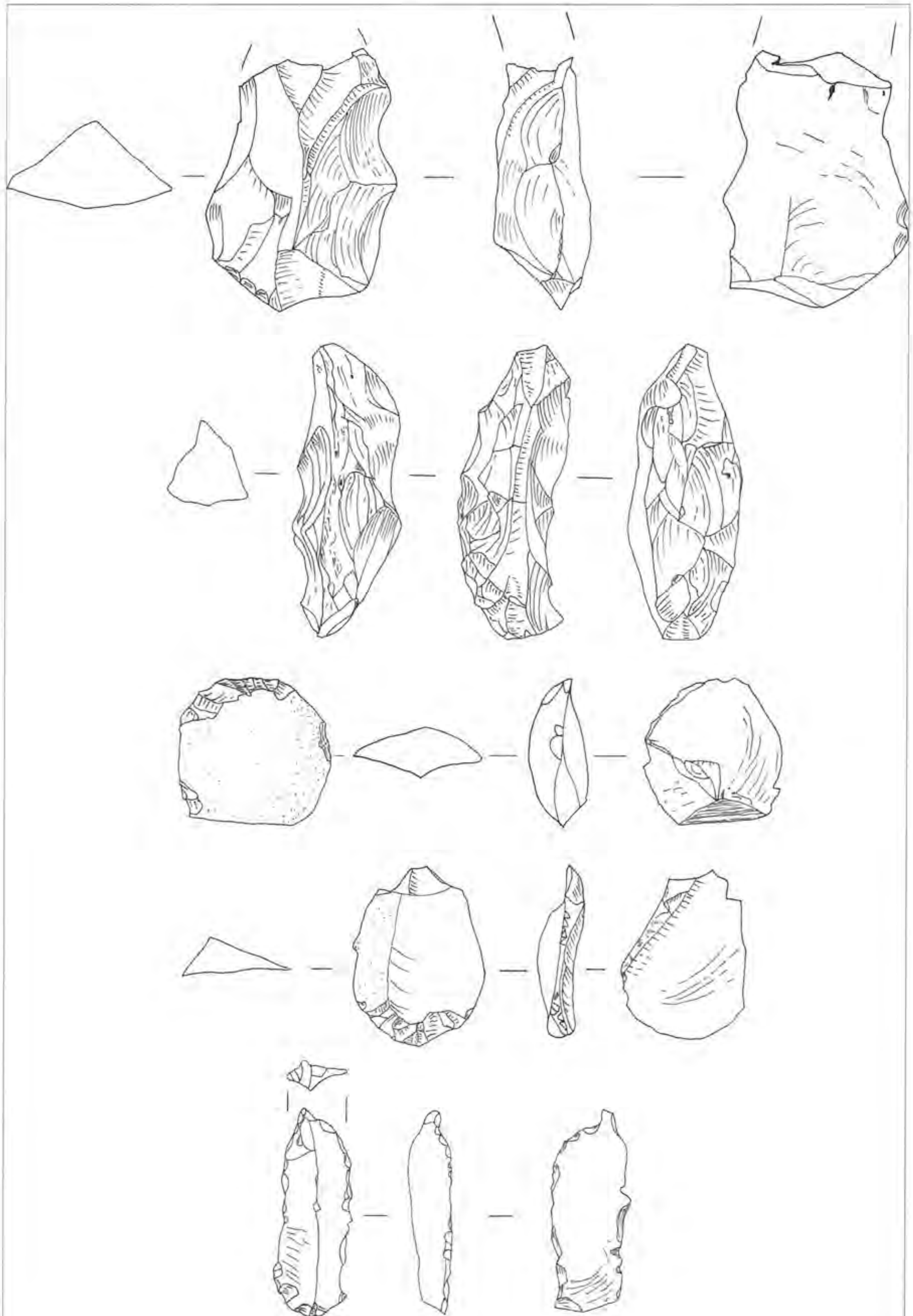

Figure 11 Flint small finds.

around the distal end of a primary flake of thin cortex flint. It measures 28mm by 27mm by 10mm thick and is of a form often associated with Beaker assemblages (Bellamy and Montague 2009, 177–182). The truncated blade (context 15, SF581) is of brown glossy flint measuring 36mm by 16mm by 5mm thick with abrupt retouch truncating the distal end. Again, the flint and chert is largely undiagnostic, but contains some evidence for the production of broad blades or blade-like flakes, which together with the scraper may suggest a Late Neolithic/ Beaker assemblage. The presence of a significant proportion of primary and secondary flakes together with a number of small chips suggests that some knapping was taking place in the vicinity of the site.

Lower Overburden

The majority of the flint was recovered from the lower overburden that sealed the burnt mound and incorporated the Iron Age ovens. The flint from each context in this stratigraphic unit was analysed separately, but, as there was little difference in the character of the flint from each layer, it is treated as a single assemblage.

A total of 256 pieces of flint and chert were recovered from the lower overburden (Table 6). This assemblage consists of 57.42% flakes and broken flakes, 9.38% blades and broken blades, 0.78% cores, 3.52% tools, 16.01% chips and 12.89% miscellaneous debitage. Generally the pieces are in an edge-damaged condition with a small number of more rolled pieces and seven were burnt.

The flakes (of which 48% are broken) include a mixture of broad thick primary and secondary trimming flakes, irregular broad squat flakes and broad blade-like flakes with roughly parallel sides and parallel dorsal ridges.

The blades are small broad blades between 27–39mm long and 10–17mm wide with slightly irregular, but broadly parallel, sides. Almost all the blades are made from a dark brown glossy flint with thin cortex, together with a small number in greensand chert. Both secondary and tertiary blades are present. There is some evidence for platform preparation. The majority of the blades (79%) are broken.

The two cores are multi-platform flake cores on greensand chert pebbles. One core has evidence for hard hammer broad flake and longer more irregular flake removals.

The eight tools present consist of four scrapers, one piercer, one denticulated retouched flake, two edge-trimmed flakes and one utilised flake (Table 6). The scrapers include one example with regular semi-abrupt retouch around the distal end of a broad flake with thin eroded cortex (context 11, SF553, see Fig. 11), measuring 32mm by 24mm by 6mm thick. It is similar in character to another scraper found in the layer above the burnt mound (context 15, SF586, see Fig. 11) and is of a type found with Beaker assemblages. The other scrapers are less chronologically diagnostic but include a heavily burnt end scraper (context 14 SF591) on a broad thick blank 44mm by 37mm by 16mm, with abrupt retouch on distal end, which would fit within an Early Bronze Age industry, together with a rough scraper with irregular abrupt retouch on the proximal end of primary flake (context 3) and one possible scraper, or other flake tool fragment, with abrupt retouch along right side of broken flake (context 3). The piercer (context 11 SF569, see Fig. 11) has a short point formed by abrupt retouch on the left distal end of a blade blank measuring 38mm by 12mm by 5mm thick. The denticulated retouched flake (context 14 SF573, see Fig. 11) is broken and has large semi-abrupt lunate retouch on the left and right sides of a thick hard hammer flake measuring 36mm wide and 19mm thick. This is a type more often associated with Middle/Late Bronze Age industries (Harding 1991). The remaining three pieces are less formal tool types with two broken edge-trimmed pieces with irregular edge modification (context 3 SF504 and SF511) and a utilised flake (context 3, SF525) with irregular semi-invasive retouch on the left distal edge, perhaps the result of use.

Upper Overburden

Only eleven pieces of flint and chert were recovered from the topsoil and upper part of the overburden. This largely comprises thick squat primary and secondary flakes from flint and chert pebbles. None of the pieces are diagnostic.

Discussion

The character of the flint and chert from each of the stratigraphic units is very similar and can be considered together as a single assemblage. Very little, if any, of the flint is in a primary context and the whole assemblage can be considered residual, perhaps deriving from activity further upslope. The condition of the material suggests that it was transported a relatively short distance to the site.

There are few chronologically diagnostic pieces present, though the character of the material with its broad blade and blade-like flake component could suggest a Late Neolithic/Early Bronze Age date and would fit comfortably within the *c.* 2460–2130 cal BC radiocarbon dates for the burnt mound.

The composition of the assemblage with primary and secondary flakes, some tertiary core trimming flakes and cores, together with a small amount of miscellaneous debitage fragments and chips, suggest that some knapping was undertaken nearby, primarily using flint and chert beach pebbles. There is no apparent deliberate selection of flint or chert for the production of flakes, but for blade production, a dark brown glossy flint with thin cortex was clearly preferentially chosen. The flint and chert pebbles were undoubtedly locally sourced, but the precise source of the blade raw material is not known, but may have also been local.

There is a restricted range of tools present with eight tool types (scraper, piercer, fabricator, denticulate, truncated blade, retouched flake, edge-trimmed and utilised flakes), most represented by a single example. From such a small sample it is difficult to determine the range of activities represented by the tool assemblage. Of the five scrapers, two were small end scrapers with semi-abrupt retouch of a type associated with Beaker assemblages (Bellamy and Montague 2009). These scrapers, together with the fabricator and perhaps the piercer would fit comfortably within a late third millennium BC date, contemporaneous with the burnt mound. The denticulate is more usually associated with a Middle/Late Bronze Age flint industry (cf. Harding 1991) and may hint at a later period of activity, but there was no other evidence for M/LBA or later flint identified within the assemblage. No flint or chert could be identified as belonging to the Iron Age activity on the site.

In conclusion, the flint assemblage most likely belongs to the late third millennium BC activity on site represented by the burnt mound deposits, but is residual indicating the focus of the activity lies a short distance away from the location of the present excavation trench. The assemblage contains evidence for both production of flint artefacts and for their use, though the precise details of the range of activities represented cannot be determined from the restricted size of this assemblage.

Pre-medieval pottery by Henrietta Quinnell with petrographic analysis by Roger Taylor

The assemblage, 63 sherds 404 grams, contained both Middle Bronze Age and Later Iron Age material, all except that from the Poole Harbour area, deriving from sources to the west of the site, including some from Devon and even Cornwall.

Fabrics

Nine sherds were examined under the petrological microscope. Abbreviations used in Table 7 in brackets after description e.g. *gabbroic* (gab)

(11) /549\ *Gabbroic.* (gab) Moderate very coarse inclusions, oxidised 5YR 5/6 yellowish red with discontinuous reduced core 4/1 very dark grey. *Feldspar* – soft white altered angular to sub-angular grains, 0.05–2.5mm: *amphibole* – light brown fibrous aggregates and cleaved grains, 0.5–5.0mm: *quartz* – sparse white translucent angular grains, 0.2–0.5mm and rounded translucent colourless grains, 0.2mm: *magnetite* – rare black sub-angular glossy magnetic grains, 0.1– 0.2mm: *matrix* – finely micaceous clay with grains of the main tempering minerals less than 0.05mm. *Comment.* A gabbroic fabric from the Lizard.

(11) /579\ *Granite derived.* (Gd) Moderate coarse inclusions, oxidised surfaces 5 YR 5/6 yellowish red, reduced core 3/1 very dark grey. *Quartz* – translucent colourless sub-angular grains, 0.1–3.0mm, many grains show thermal cracking: *mica* – biotite, brown cleavage flakes, commonly with abraded margins but some showing traces of hexagonal crystal form, 0.05–1.5mm, muscovite, colourless silvery cleavage flakes,

Table 7 Sherds by context, sherd number/grams, and fabric.

Context	Description	VQ	Gab	Gd	FtL	UGD	LV	PH	Totals
2	Layer				1/10				1/10
3	Layer below 2				3/6 ? Lias	12/23		8/38	23/67
5	Layer into which ovens 6 and 13 set				1/4 ?Lias		2/4	12/91	15/99
6	Oven/kiln					1/14			1/14
6.2	Upper fill 6					1/18		6/28	7/46
8	Layer beneath 4 A				1/1 ?Lias	1/1			2/2
9	Layer over oven 6 and 13							7/142	7/142
11	Layer west of 6 B	1/3	1/5	1/3					3/11
12	Layer over burnt mound 10/19 A				1/3 ?Lias				1/3
15	Layer below 11 above burnt mound 10/19				3/10				3/10
Totals		1/3	1/5	1/3	10/34	15/56	2/4	33/299	63/404

0.05–0.5mm: *feldspar* – altered white, sometimes buff stained, angular to sub-angular grains, 0.05–2.0mm: *matrix* – silty clay with fine quartz and mica and feldspar. *Comment.* A granite derived fabric, possibly from South Dartmoor.

(5) /531\ *Ludwell valley.* (LV) Moderate generally coarse inclusions, reduced 5 YR 4/6 very dark grey. *Quartz* – angular transparent to translucent colourless appearing dark because of reduction, angular to sub-rounded grains, 0.05–1.0mm: *rock fragments* – micaceous slate, a scatter of silvery grey tabular fragments, 0.5–4.0mm, sandstone, fine-grained, 0.5mm: *mica* – biotite, sparse dark brown cleavage flakes, 0.1–0.2mm, muscovite, rare cleavage flakes, 0.2mm: *feldspar* – colourless translucent sub-angular cleaved grain, 0.5 and 0.8mm: *tourmaline* – a black vitreous angular grain, 1.0mm: *matrix* – silty clay with some very fine mica. *Comment.* A Ludwell Valley, Exeter, sherd.

(11) *Vein quartz.* Sparse very coarse inclusions, oxidised outer surface 5YR 6/6 reddish yellow, reduced core and inner surface 4/6 very dark grey. *Quartz* – white to translucent vein quartz, angular grains, 0.5–5.0mm, a translucent rounded grain 2.0mm: *flint/chert* – a brownish grey slightly translucent sub-rounded slightly glossy fragment, 4.5mm: *matrix* – smooth clay with some very fine mica. Comment. A vein quartz tempered fabric. The local geology would not yield vein quartz. It is likely that vein quartz pebbles and cobbles derived from westerly sources by eastward tidal drift could be obtained from local beaches. The flint fragment also suggests a westerly source.

(2) *Flint tempered ?Lias.* (FtL)Sparse very coarse inclusions, irregular firing oxidised 5YR 4/1 dark grey to reduced 6/3 light reddish brown. *Flint* – medium to dark grey, grey-white mottled and brownish stained and tending to translucent angular to sub-rounded fragments, 0.3–2.5mm; some fragments polished; one rounded large >5mm grey fragment shows chatter marking; two white fragments probably cortex: *quartz* – sparse colourless transparent sub-angular to rounded polished grains, 0.2–1.1mm: *matrix* – micaceous clay with some muscovite cleavage flakes up to 0.1mm. *Comment.* The source of the tempering flint is likely to be a beach such as Beer to the west largely composed of flint. The clay could be from part of the Lias succession.

(3) /520\ *Lias ?* (L) Surfaces oxidised 5YR 5/4 reddish brown, core reduced 4/1 dark grey. *Comment.* Micaceous clay with some muscovite cleavage flakes up to 0.1mm. essentially the same as the matrix of sherd (2). No visible hard inclusions. Some charcoal fragments and number of irregular cavities, some of which may have contained charcoal.

(3) /513\ *Upper Greensand Derived.* (UGD) Common coarse inclusions, surfaces oxidised interior 5YR 5/6 yellowish red, core reduced 3/1 very dark grey. *Quartz* – translucent to transparent, occasionally white, angular to rounded grains, some showing polish, 0.05–1.5mm: *chert* – sparse white, angular fragments, 0.4–1mm: *tourmaline* – sparse black rounded polished grains, 0.05–0.1mm: shell – white silicified fragments, 0.5 & 1.0mm: *matrix* – smooth clay. *Comment.* An Upper Greensand Derived fabric.

(3) /520\ A *Upper Greensand Derived variant.* (UGDv) Sparse very coarse inclusions, irregular firing surfaces oxidised 5YR 5/4 reddish brown, core reduced 4/1 dark grey. *Quartz* – transparent to translucent colourless angular to rounded grains, some polished, 0.05–0.5mm, rarely 1.5mm: *chert* – a grey mottled sub-angular fragment 2.0mm: *rock fragments* – silicified sandstone, off-white angular fragments, 1 & 2.2mm: *silicified shell* – white tabular fragment >1.5mm: *mica* – sparse muscovite cleavage flakes up to 0.1mm: *brown pellets* – large numbers of soft, light brown slightly translucent to dark brown rounded glossy pellets, some compound or intergrown, 0.05–0.4mm, light brown colouration associated with the oxidised parts of the sherd; pellets are probably altered glauconite and an original component of the clay: *matrix* – silty clay with some fine quartz visible. *Comment.* An Upper Greensand Derived fabric with a glauconitic marine clay. The Lias a likely source.

(5) /535\ *Poole Harbour variant.* (PH v) abundant coarse inclusions, reduced outer surface 5YR 5/1 grey, otherwise oxidised 5/4 reddish brown. *Quartz* – abundant, colourless transparent to translucent and some dark grey and reddish coloured grains, predominantly angular to sub-rounded, some polished; some well-rounded grains of which some are polished, 0.1–0.5mm: *mica* –sparse muscovite cleavage flakes up to 0.05mm in the matrix: *tourmaline* – rare black rounded and polished grains, 0.1mm. *Comment.* Poole Harbour variant.

Poole Harbour. Term used for fabric of South-East Dorset black-burnished/Durotrigian type following D. F. Williams in Holbrook and Bidwell 1991, 100 and references therein.

General comment on fabrics. A very variable group of sherds with implications of coastal contact, none are immediately local to Seatown. The vein quartz and Upper Greensand Derived fabrics are likely to have come from a little distance westwards.

Comment

These sherds are generally small, mean sherd size 6.4g, variably abraded, except for some of the Poole Harbour type, and most lack useful characteristics of form.

The Vein Quartz sherd from (11) almost certainly comes from Devon, where vein quartz is a regular component of Early Neolithic fabrics (Quinnell and Taylor 2016) but may be found on occasion as late as the Early Bronze Age in the Exeter area (Quinnell and Farnell forthcoming). The general character of the sherd would support a Bronze Age date.

Other sherds suggested as Middle Bronze Age come from (2), (3), (5), (11) and (15). These are of flint tempered, ?Lias, granite derived and gabbroic fabrics. The limited pieces with form, the rims from (2), (5) and (8) and the partial lug from (3), are appropriate for this period. All this material is coming in from the west, the ?Lias and flint tempered from East Devon, the granite derived sherd from the Dartmoor area, and the gabbroic of Cornish clay from the Lizard. The last is only the second gabbroic sherd/vessel of this date to be recognised in Dorset, the first being a Trevisker style vessel from a burial at Sturminster Newton (Parker Pearson 1990, 20). The nearest Bronze Age gabbroic material otherwise comes from Colaton Raleigh in the Otter Valley in Devon (Farnell and Quinnell 2015). Here sherds of a biconical gabbroic vessel were associated with a date bridging the Early and Middle Bronze Ages: the gabbroic clay was mixed with gabbroic grog: grog is not known at this date in Cornwall, and it is possible that the clay was brought to, and potted in, Devon, a practice demonstrated in different ways on a number of sites in that county. It is a reminder that the source of the main fabric component may not be the source of the pot making (Quinnell 2012, 163–4), and that the sherd from Seaton could indicate movement of clay, not a finished vessel.

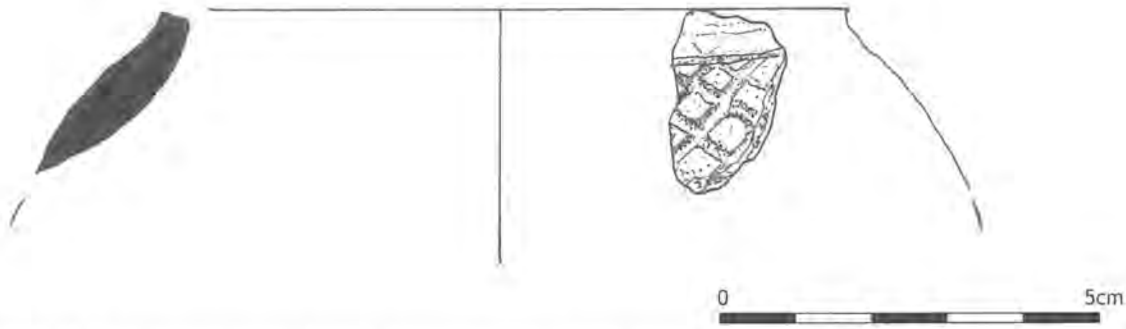

Figure 12 Small find 531 South Western Decorated Ware Ludwell Valley sherd from layer (5) beside oven (6).

A small probable Middle Bronze Age assemblage from Doghouse Hill a km to the east contained sherds assigned to a mix of probable Trevisker and Deverel-Rimbury traditions but in generally grogged and calcined flint fabrics (L. Mepham in Papworth 2013, 219; M. Leivers idem, 220). These fabrics reflect those found further to the east in Dorset, rather than reflecting the western derived fabrics of Seatown. The ceramics of west Dorset are poorly understood for this period with influences from western Trevisker and eastern Deverel-Rimbury predominating in the few sites known (Quinnell 2012, 164–5). More widely Trevisker ceramics can have much the same forms and decoration in the Early and in the Middle Bronze Ages, but in the former period are generally confined to burial and ritual related sites, in the latter to broadly domestic related contexts (Quinnell 2012). While the material at Seatown cannot be definitely ascribed to the Trevisker tradition, the lug from (3) would be appropriate and such affinities would fit with the western sourcing of the fabrics. Overall these Bronze Age sherds suggest domestic activity in the vicinity of the site and as such are likely to belong to the Middle Bronze Age had not the C^{14} dates and lithic reports provided strong evidence for the Early Bronze Age occupation of the site.

The remaining material belongs to the later Iron Age or Roman period. SF531 (see Fig. 12) from (5) has decoration of Middle Iron Age type South Western Decorated (Glastonbury). Its Ludwell Valley fabric sources within Exeter and is defined by Roger Taylor in Quinnell and Farnell (forthcoming). Some 29 sherds of this fabric were found at Maiden Castle (Brown 1991, 188). The fabric is broadly that of Peacock's (1969) Group 5 of Glastonbury Ware. The sherd is reduced and burnished with criss cross incised lines, typical of South Western Decorated material which in Devon is generally dated to the 3rd to 1st centuries BC (Quinnell and Farnell forthcoming).

Contexts (3) (5) (6.2) and (8) all contain Upper Greensand Derived sherds likely to come from East Devon. The general character of these sherds suggest the later Iron Age, certainly as it is known in Devon: much of the material of this date from Blackbury hillfort has been identified as of this fabric (information Roger Taylor) as is that from features at the Donkey Sanctuary, Salcombe Regis (Quinnell and Taylor 2012) That from SF513 (3) shows the start of a lug which would best explained as similar to the lugs of Late Iron Age Durotrigan ceramics.

About three quarters of the assemblage on weight appears to be of Poole Harbour/Durotrigan fabric. The fabric varies in quality of manufacture and amount of inclusions. No formal or decorative pieces are present. It seems probable that this belongs broadly with the Late Iron Age of Dorset, with pottery made in the Poole Harbour area being gradually exchanged and used well outside its place of manufacture. There seems no reason to assume that any of this need be of Roman date. A Late Iron Age date fits well with SUERC-66454 170 cal BC – 20 cal AD which comes from oven context 6.3. There is increasing evidence for this fabric occurring in West Dorset and East Devon in the Late Iron Age. A small assemblage in Poole Harbour fabric, either of Late Iron Age or early Roman date was identified in excavations at Thorncombe Beacon, less than two km to the east (L Mepham in Papworth 2013, 207). A pre-Roman assemblage has long been known from a context at the Honeyditches, Seaton, Roman villa site (Bidwell 1981) and scattered sherds are now being recognised with increasing frequency in East Devon and the Exeter area (Quinnell and Farnell forthcoming).

Pottery by context

A copy of the finds spreadsheet has been annotated with the details for each SF number.

(2) Layer includes post-medieval material. Flat-topped slightly everted rim sherd with finger modelling, flint tempered fabric, probably Middle Bronze Age.

(3) Layer below (2) SF507 SF514 SF517 Poole Harbour probably later Iron Age body sherds

SF513 SF528 Upper Greensand Derived, SF513 with base of handle or lug. Sherds of broadly Iron Age type.

SF520 Lias? Sherds possibly part of simple boss type lug and probably Middle Bronze Age. Sherds Upper Greensand Derived of broadly Iron Age type.

(5) Sandy layer in which ovens [6] and [13] set

SF502 ?Lias simple pointed rim probably Middle Bronze Age.

SF529 SF535 broadly Poole Harbour type probably Later Iron Age, body sherd Poole Harbour variant; sherds without SF number include rounded rim with incised line beneath likely to be Middle Iron Age.

SF531 2 sherds 4 g Ludwell Valley, Exeter, fabric, incised decoration from shoulder just below neck, Middle Iron Age South Western Decorated (see Fig. 12).

(6) oven or kiln Upper Greensand Derived body sherd of broadly Iron Age type.

(6.2) upper oven fill: SF592 body sherd Upper Greensand Derived body sherd of broadly Iron Age type. SF594 SF595 Poole Harbour type fabric

(8) layer beneath (4): SF540 Small sherds of Upper Greensand Derived body sherd of broadly Iron Age type and one of ? Lias, the latter abraded but possibly part of a rim as SF502 in (5).

(9) layer over ovens (6) and (13): SF596 SF597 Poole Harbour sherds include joining base angle.

(11) layer west of oven (6): SF549 Gabbroic body sherd; SF579 Granite derived thin body sherd; no SF number Vein quartz body sherd.

(12) layer over burnt mound [10]: SF546 ?Lias body sherd

(15) layer below (11) and above burnt mound [15]: SF585 Body sherds ?Lias fabric; despite small size of inclusions these sherds appear of general Bronze Age character.

FINDS REPORTS FROM ITEMS RECOVERED FROM THE UNDERCLIFF IN THE VICINITY OF THE BURNT MOUND

In September 2016, a local man, Humphrey Bickford, who had visited the excavation in July 2015 found fragments of a rotary quern and three chunks of baked clay while walking along the beach below the burnt mound. He contacted the National Trust and the finds were then examined by specialists. Mr Bickford took National Trust archaeologist Nancy Grace to the site of the discovery. It appeared that they had fallen from the projecting block of cliff 20–30m west of the 2015 excavation. The finds are most likely to be associated with the Late Iron Age settlement activity indicated by the two ovens found above the burnt mound.

Rotary Quern by Susan Watts with geological identification by Roger Taylor

Four joining fragments from the lower stone of a rotary quern and a single fragment from a matching upper stone were recovered from a cliff fall at Ridge Cliff, Seatown.

The pieces of lower stone make up about half of the quernstone, although the central portion with the spindle hole is missing. The stone was originally *c.* 32.5cm diameter across the top, the side curving

Figure 13 Assembled fragments of lower rotary quern in profile.

towards the underside which was about 28.0cm diameter. It stood *c.* 9.5cm high at the edge rising to *c.* 13.3cm towards the centre. The upper, grinding surface is convex in shape and is noticeably worn at the periphery with evidence of glazing.

The fragment of upper stone comprises about one fifth of the stone with the remains of a handle hole and the central hole or eye, but the top of it is missing. The surviving fragment is *c.* 22.3cm by 17.7cm by 9.4cm thick (maximum dimensions). The grinding surface is concave to match that of the lower stone and, like the latter, is worn with evidence of glazing at the periphery. The side of the stone is curved.

The stone has broken across one side of a flat oval, wedge-shaped handle hole. This is *c.* 6.0cm wide, 5.0cm deep and 2.4cm high narrowing to *c.* 0.5cm and is worn smooth inside. It is now *c.* 4.3cm from the base of the stone but would have originally been more, the stone having gradually become thinner with wear. The eye was sub-circular, about 8.5cm diameter.

The wide eye, concave-convex grinding surfaces and handle hole in the side are typical characteristics of the form of rotary quern found on Iron Age sites in the south and south-west of England (Curwen's Wessex type) (Curwen 1937, 142; Watts 2002, 31). The quern is loosely associated with the remains of two clay ovens, excavated on the cliff top above. Charcoal from the base of one of the ovens (6.3) produced a calibrated radiocarbon date of 170 BC – AD 20 (Allen 2016). The form of the quern is in keeping with this date.

What makes the quern particularly interesting is that it is of non-local origin. The stone is identified as elvan micro granite, an intrusive igneous rock which occurs in dykes around the granite areas of Cornwall and also Dartmoor. Evidence suggests that Iron Age communities tended to source their querns within a *c.* 40km radius, closer if suitable rock was available more locally. However, as the Seatown quern demonstrates, they were also acquired on occasion from more distant sources (Peacock 2013, 145–161; Watts 2014, 33; Watts and Watts forthcoming).

The presence of such 'exotic' stones may be indicative of trading networks and exchange mechanisms and/ or of contacts and movements between particular communities or individuals (Watts 2014, 33). The fact that sherds of both Bronze Age and Iron Age pottery with origins in Devon and Cornwall have also been found at Seatown (Quinnell this report) points to long term associations between this area and the south-west peninsula. Further evidence

Figure 14 Clay triangular object from above. Scale in centimetres.

for this association comes from Portesham, Dorset where a saddle quern of igneous rock, also possibly quartz porphyry from Devon or Cornwall, was found in a pit on a settlement dated to the Late Bronze Age/Early Iron Age (Laidlaw and Knowles 2003, 31).

However, micro granite is also found in northern France. Links between Dorset and France in the prehistoric period are well known with sites such as Hengistbury Head (where quern fragments of Normandy Puddingstone were found) and Poole Harbour acting as 'coastal nodes' (Laws 1987, 176; Wilkes 2004). Pottery deriving from the Poole Harbour area was also found at Seatown (Quinnell this report). Further petrological analysis of the Seatown quern is suggested, therefore, in order to identify more precisely the area from which the stone originated.

The choice of quartz porphyry for quernstones lies in its composition with quartz grains projecting from a fine-grained matrix which produces a natural cutting surface. As the stone wears so the quartz grains gradually fall out exposing new surfaces (Watts and Quinnell 2004, 147). One presumes, therefore, that the stones would have been regularly maintained to remove any loose quartz grains prior to milling or that the ground product would have been sieved in order to remove any such grains that may have dropped out during a milling session. That the Seatown quern had been used for grinding is witnessed by the wear around the periphery of the grinding surfaces, mentioned above, and also by the smoothing of the handle hole from a wooden handle.

As the pieces of quern at Seatown were recovered from a cliff fall it is not known what context the

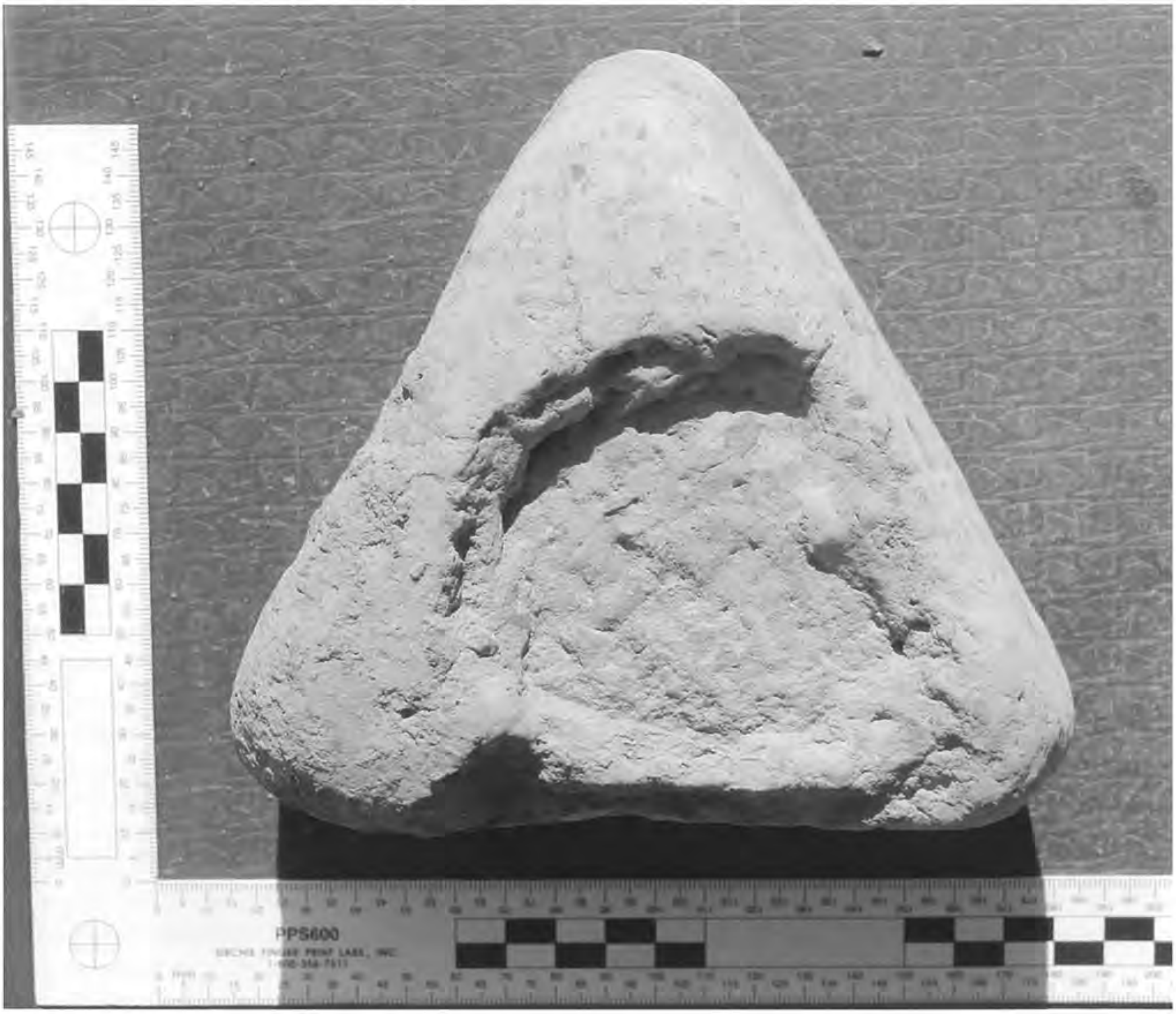

Figure 15 Baked clay triangular object in profile. Scale in centimetres.

fragments originally came from, if they comprise the whole of the deposit or if the missing pieces were once also present. Although the quernstones may have broken as a result of the cliff fall, it is also possible that the stones were in a fragmentary condition prior to this. There is evidence of burning on the fragments and it is possible that the stones were heated in order to make them more easily breakable. If so, the fragments may have formed part of a structured deposit (Watts 2014). In other words, rather than being randomly discarded, pieces of this quern were placed in a particular context for a reason that had purpose and meaning to those who left them there.

Fired Clay Report by Cynthia Poole

Following a cliff fall three triangular perforated bricks were recovered by a member of the general public, two of which have been made available for recording and analysis together with a sample of fired clay from a nearby oven structure. The artefacts were found at the base of the cliff below the site of the excavation where two Iron Age oven bases (contexts 6 & 13) had previously been discovered in July 2015. The fired clay is fully recorded in the appendix at the end of this report.

Both fired clay bricks available for analysis are of the well-known triangular form found on Iron Age sites throughout lowland southern and eastern England.

These are hand made in the form of an equilateral triangle with smooth flat triangular faces, flat but slightly less even side surfaces, rounded corners and arrises and with a perforation across each of the three corners. The third brick was reportedly of the same form and similar in character.

Both bricks are made in a fine silty clay containing red ferruginous clay pellets, angular - sub-angular, up to 6mm in size. This is likely to derive from local clay sources, though it has not been compared to any geological deposits in the area.

Both bricks are of near identical size measuring 152–154mm along the sides, 140–142mm high and 97mm thick. These are of standard size though at the higher end of the thickness range, which more commonly averages 70–80mm. The perforations across each corner measured 12–13mm and 14–16mm in diameter, widening slightly at the surface. Both bricks are very neatly made and well finished. The corners are rounded and plain without any external grooves, a feature that tends to be more common in the eastern half of their distribution. Both show evidence of being more heavily fired on one triangular face compared to the other, which is a characteristic commonly observed on these objects. Each has one triangular face that has been fully fired to a reduced grey colour, which partly extends over the edges and one corner, whilst the opposite face is only lightly fired or heated. The core of the broken brick is effectively unfired.

Both have marks present on the surface. On the complete brick, there are three finger marks forming indents along one of the angles between the side surface and triangular face, which result from handling the brick while the clay was still sufficiently soft to deform from the pressure. Such features are rarely found on triangular bricks in contrast to Roman and later brick and tile, suggesting that normally the bricks were left to dry until at least leather hard before moving them. The half brick has a deep finger or thumb print in the centre of the triangular face swiping up to the broken section. From the surviving imprint, it is difficult to judge whether this is also the effect of handling or a deliberate mark. Deliberate markings on the triangular face have been observed on a small number of triangular bricks. They are probably decorative though some other function such as ownership or maker's marks cannot be excluded. Examples found in an early Iron Age oven at St Martha's Hill, Guildford (Lowther 1935) had been decorated on the triangular faces with a four-petal rosette ornament formed by the thumb. Further examples of deliberate marks on triangular bricks were found at south Thanet (Poole 2015, 304 and Fig. 12.6), where one had a triskele pattern marked on it and another two lines forming a cross, both made with the fingers. One from Glastonbury Lake Village was pitted on both sides with fingertip depressions and holes apparently made with a stick (Bulleid and Grey, 1917, 571, No. 22). The example from Seatown could be a further addition to the corpus of decorated triangular bricks.

Triangular perforated bricks are a common artefact found on Iron Age sites across lowland England (as well parts of Germany, the Low Countries and northern France) from about 500 BC continuing in use certainly into the early Roman period and possibly later on some native settlements. These artefacts have been traditionally interpreted as loomweights in spite of some early instances linking them to other activities. In addition to the examples from an oven at St Martha's Hill noted above other instances were recorded suggestive of use as oven or hearth furniture. At Malmesbury, Wiltshire considerable quantities of triangular bricks were associated with an extensive area of red burnt clay and burnt stones suggestive of demolished ovens or kilns (recorded in the Gentleman's Magazine of 1831, p. 500 and Gomme 1887, 422). At Bigbury, Kent, they appeared to form the kerb or floor of a hearth (Journ. Brit. Arch. Assoc., XVIII, 1862, 272) and were associated with metal artefacts possibly cauldron fittings. The function of triangular bricks as loomweights was not questioned until an association with burnt debris and oven structure was observed during the analysis of fired clay from Danebury, Hampshire (Poole 1995), where one example had been found within the base of an oven below the collapsed superstructure and numerous examples were discarded in pits in dumps of oven structure and burnt debris. Subsequently corroborative evidence has come to light in more recent fieldwork. Examples have been found discarded with kiln furniture at

Dagenham, Essex (Poole 2010) and associated with pottery kilns at Bricket Wood, Hertfordshire (Poole forthcoming). The most significant discovery in terms of establishing function was a number of triangular bricks from south Thanet which had clear wear and salt discolouration on one apex and adjacent surfaces, indicative of use as a pedestal support for evaporation troughs used in salt production (Poole 2015, 304). Such a specialised activity cannot account for all examples, but provides clear evidence that these objects functioned as pedestals in some circumstances and were probably used in a similar manner in a more general domestic setting as oven and hearth furniture. The differential firing between the two faces that has been noted on so many examples suggests that they may also have been used as kerbs, hearth floor or baffles for vents or flues, where only one face would be fully exposed to the heat source.

The presence of two oven bases at Seatown close to the find spot of the triangular bricks may be no coincidence. They are dated to the Late Iron Age and neither oven had been heavily fired and it is likely they were used in a domestic capacity or for crop processing. The triangular bricks could have been used in conjunction with the ovens though there is no actual evidence to confirm such a hypothesis. If this were the case they may have served as some sort of support within the oven, or, in view of the differential firing between the faces, used in some manner where only one face was exposed directly to the fire possibly covering any openings or vents in the structures. Whether the triangular bricks and the ovens were directly associated or not, their presence in fairly close proximity suggests settlement remains may survive in the vicinity masked by the thick layer of soil blanketing the area.

DISCUSSION AND CONCLUSION

Burnt mounds are found across the United Kingdom and Ireland and although similar in form, they seem to represent the residue from a number of potential activities and functions over a broad span of time. Many date to the Middle to Late Bronze Age, but another cluster of sites, including the Seatown mound, date to the earliest Bronze Age.

The English Heritage asset description for Burnt Mounds (2011, 2) introduces them as sites beside streams in various landscape settings ranging from the fens of East Anglia, to the chalklands of Hampshire and the uplands of Northumbria and Cumberland. Few finds are associated with them and they are generally, though not always, isolated from settlement. The mound is usually associated with a pit or trough and this is thought to have held water.

Sometimes known as 'boiling mounds', stones were heated on a fire and then placed in the water filled pit causing the temperature of the water to be raised to boiling point. The process of hot stones entering cold water caused the stones to shatter. The shattered stones were taken out of the trough at the end of each cycle and placed to one side of the pit. Regular repetitions of this process caused a low spread mound of hearth rakings and shattered stones to accumulate near the pit.

In October 1988, a conference was held in Dublin, organised by the International Burnt Mound Study Group. Researchers from across the British Isles and North-West Europe read papers on a range of sites (Buckley 1988). The Irish mounds had traditionally been thought to be for cooking, though an alternative proposal was now being considered. It was thought that they could have been used as saunas and have had a spiritual purpose, similar to the way sweat lodges are still used in some cultures today e.g. by the Nisga'a people of British Colombia.

There are many published examples of burnt mounds but a particularly well preserved site was excavated in 1996 beside the River Soar in Birstall, Leicestershire. The waterlogged conditions meant that the pit lining survived; consisting of a ring of stakes infilled with woven wattle and daub above a floor made of timber planks. There were two hearths, one lay to the north-east and the other to the south-west of the trough. These were matched by two burnt mounds one to the north-west and the other to the south-west.

The site's waterlogged condition meant that plant remains were preserved and detailed environmental sampling was able to be carried out. This quality of evidence allowed various ideas to be set aside. In the discussion, Ripper & Beamish (2011, 199–202) suggested that it was unlikely that the trough functioned as a food cooking pit as there were no food remains, despite the excellent conditions which would enable organic material to survive. The pit was less than a metre in diameter and awkward to use as a bath and the lack of structural evidence around the trough indicated that a sauna hut or chamber had not been erected over it.

Heated water has a number of other practical uses including tanning leather which can be assisted by preparing animal hides in a vat of warm water mixed with urine or potash to loosen hair fibres, followed by soaking the skin in water mixed with oak bark.

Another process is fulling which crushes the fibres of woollen cloth to felt them and prevents shrinkage of the fabric. The reconstruction illustration used in the report (ibid. 202) was of stones heated on one of the Early Bronze Age hearths, hides being soaked in the tank and then dried on a rack placed over the other fire.

This Birstall burnt mound matches the date of the Seatown burnt mound but the differences are clear. Seatown lies high above the closest water source and no water pit or trough or hearth was found in association. Bringing water to this site would have been difficult work as we discovered in 2015 when carrying containers uphill from the stream in the valley bottom.

Dorset burnt mounds are infrequent. Examples have been found at Hambledon Hill (Mercer and Healy 2008, 438–40; 583–4) Bestwall, Poole Harbour (Ladle and Woodward 2004, 371) and South Lodge on Cranborne Chase (Barrett, Bradley & Green 1991, 161). All of these were dated to the Middle to Late Bronze Age and South Lodge and Bestwall were closely associated with settlement. Both were thought to have been used for food preparation and unusually, Bestwall included fragments of large Deverel-Rimbury vessels. These were interpreted as debris from feasting following the 'closing down' of a nearby house. At South Lodge, an elongated pit nearby was thought to be evidence of a water 'trough' for cooking. A wooden trough placed in the pit was filled with water and heated stones boiled the water to enable whole animal carcasses to be cooked (Green 2000, 105). A site at Reap Lane, Southwell on the Isle of Portland was also associated with a Bronze Age settlement though this too was also dated to the later Bronze Age (Bellamy 2000)

The Dorset Historic Environment Record includes four other sites, discovered during evaluations and watching briefs. They appear to be prehistoric but are not closely dated. These include discrete spreads of burnt flint and ash: at Stafford Farm, West Stafford (Wessex Archaeology 2007); at Milton Road, Milborne St Andrew (1992, 234) and at Sturminster Marshall (Havard & Nicholl 2013, 8–9). The closest comparable site to Seatown was found during the construction of the Blandford By-Pass in 1985. It was a 15m long and 0.2m high spread of burnt flint and charcoal but was also undated (Green 1986, 153).

Further east, within the New Forest, there are many examples beside water courses associated with pits (Pasmore & Pallister 1967, 14–19) and the dated examples are later Bronze Age.

Therefore, the known Dorset and Hampshire examples are not closely comparable with the Seatown mound which is 800 to 1000 years earlier and at least 35km west of the nearest known site at West Stafford near Dorchester.

Excavations at Golden Cap in 2011 (Papworth 2013), dated three of the linear group of four cairns on the summit from charcoal mixed with burnt flint found beneath the chert mounds. The dates of the cairns fell within the range 2100–1900 BC. The closest comparisons to this type of site were to the west from excavations of cairns on Farway Hill near Honiton in Devon. Though not quite as old as the Seatown burnt mound, the experience of Golden Cap together with the pottery analysis (Quinnell this report) would suggest that comparative sites should be found to the west of Seatown.

Recent excavations at Jacob's Well near Woodbury (Tilley & Pauknerova 2017) and Town Farm Quarry near Burlescombe (Best & Gent 2007) have revealed details of burnt mounds in east Devon However, both sites are over 55km from Seatown and both are sites near springs associated with water troughs and date to the period 1700–1300 BC. The Burlescombe example contained remains of the timber lining of the trough and at Jacob's Well the burnt mound was linked to designed pebble floor patterns which were thought to have a ritual significance.

Therefore these comparisons leave the Seatown mound isolated both chronologically and geographically. It has the earliest proven date for a burnt mound in Dorset and Devon and the closest known burnt mound sites lie over 35km away. It is located 30m above the nearest water source on a hillslope terrace with no contemporary trough or hearth found during the excavation. However, the excavation covered only a small part of this deeply buried site and evidence of associated features may exist nearby or may already have been lost through cliff erosion.

No contemporary settlement evidence was recovered during the excavation but finds of earlier Bronze Age flint tools demonstrate that there was occupation in the vicinity.

There were long periods of cultivation across the site until the Late Iron Age when the site was occupied once again and two ovens were constructed.

The positioning of these ovens with their flues facing the prevailing south-west wind is evidence that the burnt mound activity was also located here to enable high temperatures from the natural draught of air.

The finds from these 0.8m diameter baked earth features suggests that they were domestic ovens complete with the burnt alder fuel from their last firing. They lay under a heap of burnt clay which is likely to represent the collapsed roofs of these structures. There was no kiln furniture to indicate that they might have been used for pottery production. Similarly, there were no warped or partially fired vessels of the type found on kiln sites such as those found on the Romano-British kiln sites in Purbeck (Ladle 2012, 40–43). However, evidence for pottery production in the Iron Age is likely to be seen as bonfire kilns and clamps (Jones 2017, 63). The mix of pottery associated with the ovens (Quinnell this report) is an indication of the range of vessels used in the settlement to cook, store or serve food and they include locally manufactured items from Upper Greensand fabrics as well as pottery from more distant sources including South West Decorated Ware from Lugwell Valley in the Exeter area. The Poole Harbour sherds were found to account for 75% of the pottery assemblage associated with the ovens.

The expansion of Poole Harbour pottery distribution in the Latest Iron Age is an indicator of the growing influence of the Dorset centred alliance of peoples known as the *Durotriges*. The scant evidence for closely dated pottery assemblages from west Dorset indicated that, at the time of the Roman Conquest, this area lay outside strong *Durotrigan* influence (Papworth 2008, 161–3) but the discovery of these closely dated ovens (170 BC to AD 20) and increasing numbers of finds in east Devon (Quinnell this report) seem now to confirm the traditional furthest extent of the *Durotrigan* zone as far as the River Axe by the end of the Latest Iron Age. An example of *Durotrigan* settlement west of Lyme Regis was found during the excavations at Holcombe Farm, Uplyme which uncovered a Late Iron Age settlement associated with Poole Harbour pottery below a Roman Villa (Pollard 1974).

The ovens of Seatown would have been associated with settlement and the finds of the granite rotary quern fragments and the triangular clay objects are supporting evidence for this, but, as with the burnt mound, only a small sample of the whole site was seen in 2015.

There is much more to be discovered along this stretch of the coast as the sea makes its relentless assault on the land. The National Trust will continue to monitor the cliff face to see what else might be revealed at Ridge Cliff Hill, east of Seatown.

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REFERENCES

Allen, M.J. 2015. *Seatown burnt mound, Chideock, Dorset (AEA288); geoarchaeology and land-use history.* Unpubl. report for The National Trust.

Allen, M.J. 2016. *113104-14: Seatown Burnt Mound, Chideock, Dorset: Palaeo-environmental (charcoal, charred plant remains) and radiocarbon assessment.* Unpubl. report for The National Trust, report AEA 288.01.02.

Andrefsky, W. 2005. *Lithics. Macroscopic approaches to analysis.* Cambridge Manuals in Archaeology, Cambridge.

Anon, 1993. 'Possible Burnt Mound, Milton Road, Milborne St Andrew, *Proceedings of the Dorset Natural History and Archaeological Society* **114**, 234.

Ballin, T. B. 2000. 'Classification and description of lithic artefacts: A discussion of the basic lithic terminology' *Lithics* **21**, 9–15.

Barrett, J. Bradley, R. and Green, M. 1991. *Landscape, monuments and society. The prehistory of Cranborne Chase,* Cambridge University Press, Cambridge.

Bellamy, P.S. 2000. *Land off Reap Lane, Southwell, Portland, Dorset: Interim Report of the Excavation of Area 1.* Terrain Archaeology Report SWX8558

Bellamy, P. S. and Montague, R. 2009. 'The Flaked Stone' in L. Ladle and A. Woodward *Excavations at Bestwall Quarry, Wareham 1992–2005. Volume 1: The Prehistoric Landscape.* Dorset Natural History and Archaeology Society Monograph **19**, 154–199.

Best, J. and Gent, T. 2007. 'Bronze Age Burnt Mounds and Early Medieval Timber Structures at Town Farm Quarry, Burlescombe, Devon', *Proceedings of the Devon Archaeological Society* **65**, 35–46.

Bronk Ramsey, C. 1995. 'Radiocarbon calibration and analysis of stratigraphy: The OxCal program', *Radiocarbon* **37**, 425–430 .

Bronk Ramsey, C. 1998. 'Probability and dating', *Radiocarbon* **40**, 461–474.

Bronk Ramsey, C. 2001. 'Development of the radiocarbon calibration program OxCal', *Radiocarbon* **43**, 355–363.

Brown, L. 1991. 'Later Prehistoric Pottery', in N. Sharples, *Maiden Castle. Excavation and Field Survey 1985-6,* English Heritage Archaeological Report **19**, 185–203.

Buckley, V. 1988. *Burnt Offerings, International Contributions to Burnt Mound Archaeology,* Historic Buildings and Monuments, Scotland.

Bulleid, A. and St George Grey, H. 1917. *The Glastonbury Lake Village A Full Description of the Excavations and the Relics Discovered 1892–1907 Vol. II,* The Glastonbury Antiquarian Society.

Curwen, E.C. 1937. 'Querns', *Antiquity* **11**, 133–150.

English Heritage, 2011, *Introduction to Heritage Assets: Burnt Mounds,* English Heritage.

Farnell, A. and Quinnell, H. 2015. 'A Bronze Age Hilltop Enclosure at Otter Farm, Colaton Raleigh, Rast, Devon', *Proceedings of the Devon Archaeological Society* **73**, 67–74.

Gomme, G.L. 1887. 'The History of Malmesbury as a Village Community' *Archaeologia* **50** pt 2, 421–38.

Gould, N. 1862. *Journal of the British Archaeological Association* **XVIII**, 272–3.

Green, M. 1986. 'Blandford By-pass, Blandford Forum', *Proceedings of the Dorset Natural History and Archaeological Society* **107**, 153.

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

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 Archaeology Society Monograph **8**.

Havard, T. and Nicholl, M. 2013. 'Corfe Mullen to Salisbury Transfer Scheme, Wessex Water, Dorset and Wiltshire', *Cotswold Archaeology Report* 12376, 8–9.

Holbrook, N. and Bidwell, P. T. 1991. *Roman Finds from Exeter,* Exeter City Council/Exeter University, Exeter.

Inizan, M.-L., Reduron-Ballinger, M., Roche, H. and Tixier, J. 1999. *Technology and Terminology of Knapped Stone.* Préhistoire de la Pierre Taillée 5. CREP, Nanterre.

Jones, G.P. 2017. *Sourcing the Clay: Iron Age pottery production around Poole Harbour and the Isle of Purbeck, Dorset, UK,* PhD Thesis Bournemouth University.

Ladle, L. 2012. *Excavations at Bestwall Quarry, Wareham 1992–2005 Volume 2: The Iron Age and Later Landscape,* Dorset Natural History and Archaeological Society Monograph **20**, DNHAS, Dorchester.

Ladle, L. and Woodward A. 2009. *Excavations at Bestwall Quarry, Wareham 1992–2005 Volume 1: The Prehistoric Landscape,* Dorset Natural History and Archaeological Society Monograph **19**, DNHAS, Dorchester.

Laidlaw, M. and Knowles, K. 2003. 'Quernstones'. in J.Valentin, '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.

Laws, K. 1987. 'Quernstones' in B. Cunliffe, *Hengistbury Head Dorset 1: The prehistoric and Roman settlement, 3500 BC–AD 500*, Oxford.

Longin, R. 1971. 'New method of collagen extraction for radiocarbon dating', *Nature* **230**, 241–2.

Lowther, A.W.G. 1935. 'An Early Iron Age Oven at St Martha's Hill, near Guildford, Surrey' *Archaeological Collections* **XLIII**, 113–5, Pl. XIII .

Mercer, R. and Healy F. 2008. *Hambledon Hill, Dorset, England. Excavation and survey of a Neolithic monument complex and its surrounding landscape*, English Heritage.

Mook, W.G. 1986. 'Recommendations/resolutions adopted by the twelfth International Radiocarbon Conference', *Radiocarbon* **28**, 799.

Papworth, M. 2000. *Golden Cap Estate Archaeological & Historic Landscape Survey*, unpublished report for National Trust.

Papworth, M. 2008. 'Deconstructing the Durotriges, a definition of Iron Age communities within the Dorset environs', *BAR British Series* **462** BAR, Oxford.

Papworth, M. 2013. Excavations at Thorncombe Beacon, Doghouse Hill and Golden Cap on the Golden Cap Estate, West Dorset, *Proceedings of the Dorset Natural History and Archaeological Society* **134**, 205–247.

Parker Pearson, M. 1990. 'The production and distribution of Bronze Age pottery in south-west Britain', *Cornish Archaeology* **29**, 5–32.

Pasmore, A.H. and Pallister, J. 1967. 'Boiling Mounds in the New Forest' *Proceedings of the Hampshire Field Club and Archaeological Society* **24**, 14–19.

Peacock, D. 2013. 'The Stone of Life. Querns, Mills and Flour Production in Europe up to c. AD 500', *Southampton Monographs in Archaeology New Series* **1** University of Southampton, Southampton.

Pollard, S. 1974. 'A Late Iron Age Settlement and a Romano-British Villa at Holcombe near Uplyme, Devon', *Proceedings of the Devon Archaeological Society* **32**, 59–161.

Poole, C. 1995. 'Loomweights versus oven bricks' in B. Cunliffe, 1995, *Danebury: an Iron Age hillfort in Hampshire Volume* 6, Council for British Archaeology Research Report **102**, 285–6.

Poole, C. 2010. 'The fired clay' in E. Biddulph, K. Brady, B.M. Ford and P. Murray, 'Roman settlement, pottery production, and a cemetery in the Beam valley, Dagenham' in *Essex Archaeology and History Vol.* **1**, 129–37.

Poole, C. 2015. 'Fired Clay and Briquetage' in P. Andrews, P. Booth, A.P. Fitzpatrick, and K. Welsh, 'Digging at the Gateway: Archaeological landscapes of south Thanet. The Archaeology of East Kent Access Phase II Volume 2: The Finds and Environmental Reports, Oxford' *Wessex Archaeology Monograph* **8**, 289–323.

Poole, C. forthcoming. 'The structural fired clay and kiln furniture from Bricket Wood Bund' in C. Poole, K. Brady, E. Biddulph and S. Lawrence 'Prehistoric, Roman and medieval activity along the M25 motorway between Maple Cross and South Mimms'

Quinnell, H. 2012. 'Trevisker Pottery: Some Recent Studies', in W. J. Britnell and R.J. Silvester, *Reflections on the Past: Essays in Honour of Frances Lynch*, Cambrian Archaeological Association, Welshpool, 146–171.

Quinnell, H. and Farnell, A. forthcoming. 'Prehistoric sites in the Digby area of Exeter', *Proceedings of the Devon Archaeological Society*.

Quinnell, H. and Taylor, R. 2012. 'Prehistoric Pottery and Fired Clay', in M. Gillard and H. Quinnell, 'Prehistoric Activity and Artefacts at the Donkey Sanctuary, Trow Farm, Salcombe Regis', *Proceedings of the Devon Archaeological Society* **70**, 52–57.

Quinnell, H. and Taylor, R. 2016. 'Revealing Complexity: The Sourcing of Early Neolithic Ceramics in South-West Britain', in E. Sibbesson, B. Jerrvis and S. Coxon, *Insight from Innovation: New Light on Archaeological Ceramics*, Highfield Press, St Andrew's, 42–56.

Reimer, P.J., Baillie, M.G.L., Bard, E., Bayliss, A., Beck, J.W., Bertrand, C.J.H., Blackwell, P.G., Buck, C.E., Burr, G.S., Cutler, K.B., Damon, P.E., Edwards, R.L., Fairbanks, R.G., Friedrich, M., Guilderson, T.P., Hogg, A.G., Hughen, K.A., Kromer, B., McCormac, G., Manning, S., Bronk Ramsey, C., Reimer, R.W., Remmele, S., Southon, J.R., Stuiver, M., Talamo, S., Taylor, F.W., van der Plicht J. and Weyhenmeyer, C.E. 2004. 'IntCal04 terrestrial radiocarbon age calibration, 0–26 cal kyr BP', *Radiocarbon*, **46** (3), 1029–1058,

Ripper, S. and Beamish, M. 2011. 'Bogs, Bodies and Burnt Mounds: Visits to Soar Wetlands in the Neolithic and Bronze Age', *Proceedings of the Prehistoric Society* **78**, 173–206.

Slota Jr, P.J., Jull A.J.T., Linick, T.W. and Toolin, L.J. 1987. 'Preparation of small samples for 14C accelerator targets by catalytic reduction of CO', *Radiocarbon* **29**(2), 303–6.

Stuiver, M. and Kra, R.S. 1986. 'Editorial comment', *Radiocarbon* **28**(2B), ii.

Stuiver, M. and Polach, H.A. 1977. 'Reporting of 14C data', *Radiocarbon* **19**, 355–63.

Tilley, C. and Pauknerova, K. 2017. 'Burnt Mounds and Pebble Structures' in C. Tilley *Landscape in the Longue Durée*, UCL Press, London.

Watts, M. 2002. *The Archaeology of Mills & Milling*, Stroud.

Watts, M. and Watts, S. 2014. 'Rotary Querns and Millstones in South-West England', *Proceedings of the Millstone Colloquium, Almeria.*

Watts, S.R. 2014, 'The Life and Death of Querns. The Deposition and Use-Contexts of Querns in South-

Western England from the Neolithic to the Iron Age', *Southampton Monographs in Archaeology New Series* **3** University of Southampton, Southampton.

Watts, S. and Quinnell, H. 2004. 'Rotary Querns' in, Quinnell, H., *Trethurgy. Excavations at Trethurgy Round, St. Austell. Community and Status in Roman and Post-Roman Cornwall*, Cornwall County Council, Truro.

Wessex Archaeology, 2007. *Portland Gas Pipeline: Archaeological Evaluation*, Wessex Archaeology Report 60715.03.

Xu, S., Anderson, R., Bryant, C., Cook, G.T., Dougans, A., Freeman, S., Naysmith, P., Schnabel, C. and Scott, E.M. 2004. 'Capabilities of the new SUERC 5MV AMS facility for 14C dating', *Radiocarbon* **46**, 59–64.

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STRUCTURE AND CHANGE IN BRONZE AGE BURIAL MOUNDS: AN ANTIQUARIAN EXCAVATION RE-EXAMINED USING AN INTEGRATED GEOPHYSICAL AND TOPOGRAPHICAL SURVEY AT CLANDON BARROW, DORSET

JOHN GALE, PAUL CHEETHAM AND HARRY MANLEY

The excavation of Clandon Barrow by the antiquarian Edward Cunnington in 1882 is most notable for a rich assemblage of artefacts recovered from within it. The artefacts have been described by Stuart Needham and Ann Woodward as ….." the bringing together of the most cosmologically-charged materials of contemporary culture"…. by a local elite (Needham and Woodward, 2008, 44). The excavation itself and subsequently its interpretation has been at least partially compromised by the lack of clarity in the structural and contextual detail of the barrow mound recorded by Cunnington, made more difficult in the knowledge that the primary deposits of the monument were never reached. In an attempt to provide greater clarity upon the structural deposits through non-intrusive techniques the authors conducted a series of detailed topographic and geophysical surveys at the site in 2009 and 2011. The results provide additional data on the mounds composition including some clarity of the presence of a primary mound that was later 'aggrandised' by a secondary mound constructed above it. This secondary mound was slightly off-set to the original and the results of the survey confirms that its construction consists of layered strata (as implied in the excavation archive) although the time scale of such layering and its purpose remains speculative. The presence of a flint cairn lying atop the primary mound is further considered in the light of data recovered from the surveys which provides further insight into the continuing use and re-use of funerary monuments in the late 3rd millennium BC.

INTRODUCTION

In the late summer of 1882 the antiquarian Edward Cunnington undertook the excavation of a large and well preserved round barrow on the outskirts of Dorchester, Dorset, in the south of England. The barrow, known as the Clandon Barrow (Fig. 1), occupies a relatively isolated position on a knoll of an outlying ridge on the north side of the South Dorset Ridgeway – an area notable for its extremely dense concentration of round barrows (Woodward, P. 1991, 143–6; Needham and Woodward 2008, 1–6).

The findings from the excavation were not made public in Cunnington's lifetime, but were

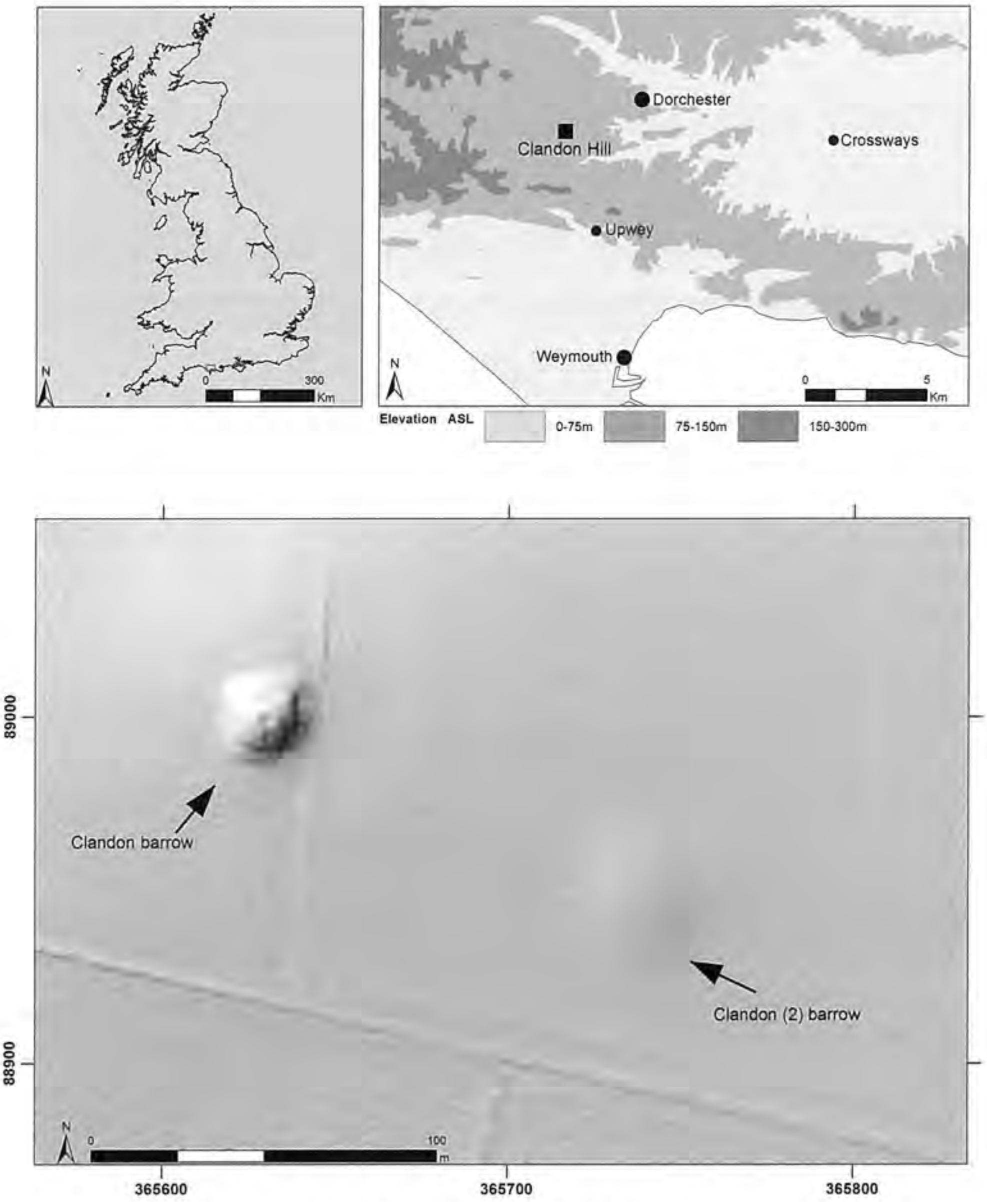

Figure 1 Location of Clandon Barrow.

subsequently published in 1936, alongside the results from a second barrow to the south (Drew and Piggott 1936, 18–25). Both as a result of that paper and work undertaken in association with it, the barrow at Clandon has become notable for the artefacts found within it rather than the burial mound itself. These included high status gold, jet and amber objects that were paralleled with artefacts recovered from Bush Barrow near Stonehenge, excavated by Cunnington's Great Grandfather, William, in 1808. The finery of the objects recovered from the mound were described by Piggott in the 1936 report and were included within a corpus of sites that led to his conceptualisation of a 'Wessex Culture' in 1938 (Piggott 1938). Although the assemblage recovered from the barrow and its identification as a definable cultural package has been recently challenged (Needham and Woodward 2008) it nonetheless remains an important exemplar of contemporary Bronze Age material culture with regard to aspects of wealth, exchange and status in the late second millennium BC.

For our purposes the most intriguing aspect of the barrow which was described by Cunnington in his excavation notebook and in the subsequent publications that were eventually to follow, was

Figure 2 Contemporary watercolour from the Cunnington archive showing a sectional view of Clandon Barrow and the location of features and finds documented during the excavation. Reproduced courtesy of Dorset County Museum.

the structure of the barrow itself. Cunnington had entered the barrow from the apex of the mound, as was the standard approach at the time and proceeded to excavate a vertical shaft down towards the presumed goal of a central primary deposit, either on the pre-barrow ground surface or within a pit cut into it. Unfortunately he never reached the primary deposits having decided to curtail his diggings prematurely at a depth of approximately 9 feet 6 inches (2.95m). The combination of the discovery of a spectacular group of artefacts from within the body of the mound combined with what was clearly an unstable excavation shaft almost certainly led to his decision to stop, whilst safe in the knowledge that he had already made a significant discovery.

His contemporary account of the barrow's construction, which included a water colour sketch (Fig. 2) in addition to details of the excavation made in a manuscript notebook, suggest a layered structure of sands, clays and gravels; this was made more complex with the discovery of archaeological features that were not fully understood at the time, most notably a flint cairn (Cunnington layer 9) 7 feet (2.13m) below the top of the mound. Slight discrepancies between the notes and the water colour sketch regarding the deposits encountered further complicate the sequence of deposits, and subsequently interpretation particularly in the formation and function of the flint cairn is compromised. Drew's published section drawing of the excavation (1936, 19) although based upon the contemporary watercolour defers to the narrative from Cunnington's manuscript notebook when the two accounts differ (Fig. 3). The difference between Cunnington's records largely concerns the artefacts associated with the cairn and their placement. It is unclear as to when the notebook was completed as it is undated, but Woodward suggests it may have been 20–25 years later and possibly drawn up with reference to now lost field notes (2008, 3).

Subsequent to the publication of the Clandon material by Drew and Piggott in 1936, speculative interpretation of the context and form of the barrow has been somewhat surprisingly absent from the archaeological literature, with the notable exceptions of Woodward (2000, 40–1) and Needham & Woodward (2008, 1–52). Although the latter study was focussed primarily upon the material assemblage

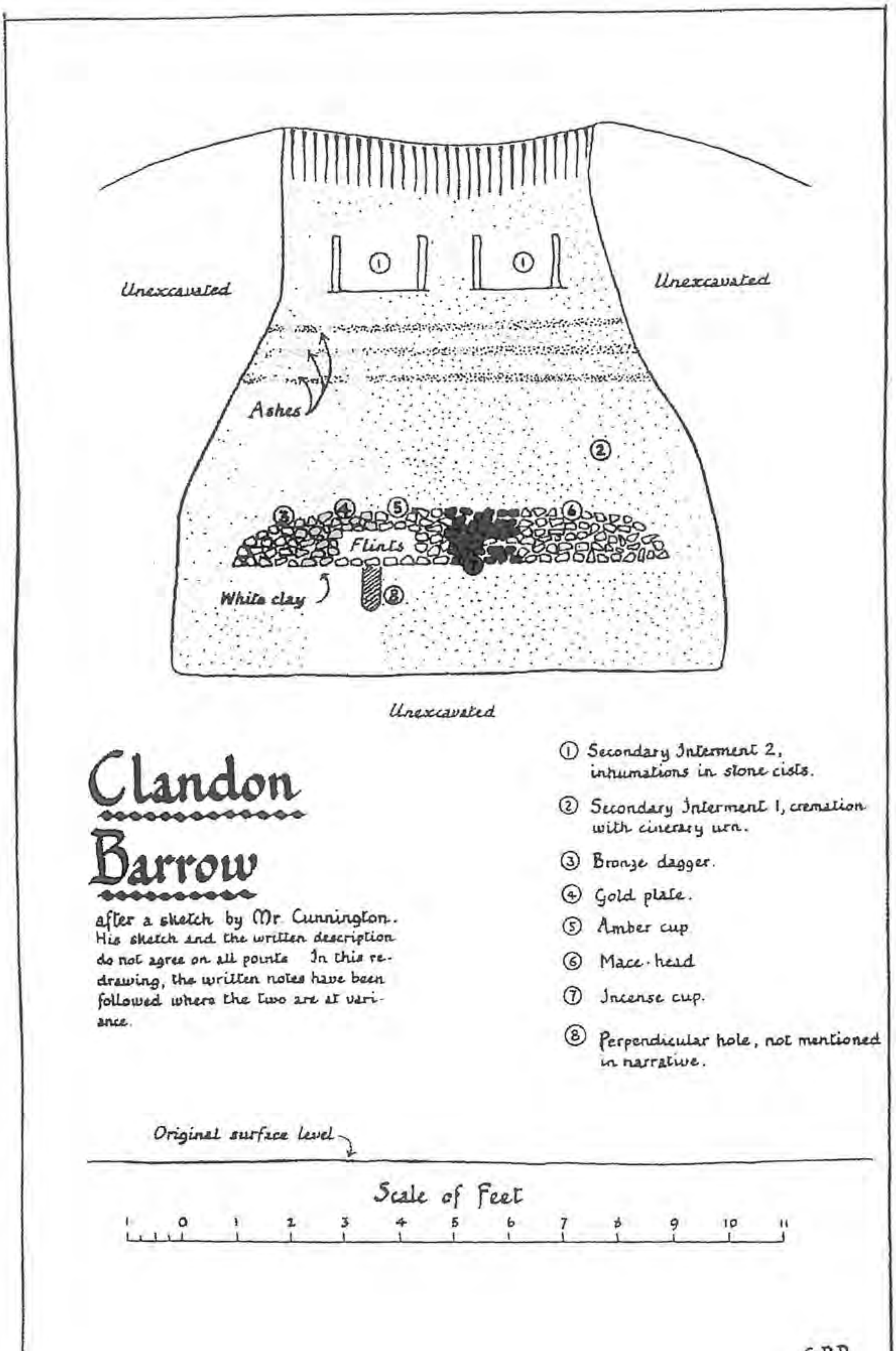

Figure 3 Charles Drew's published section of Clandon Barrow based upon Cunnington's original sketch and manuscript notebook. © Dorset Natural History and Archaeological Society.

and its social and economic context, it additionally revisited the morphological and structural evidence of the barrow itself, with a view to drawing more effective comparators both regionally and nationally. In the former we see aired the idea implicit in the section published in 1936 that the barrow had been enlarged or aggrandised from a more modest precursor. The intersection between these two phases of mound construction likely being the flint cairn discovered and recorded by Cunnington (Figs 2 and 3) with which all of the high status artefacts were somewhat associated. Interestingly at Clandon no burial is directly associated with the artefacts or the flint cairn (or at least none were recorded) which brings into question the otherwise implicit funerary association of the deposit. Similarly, it raises the question as to the potential wider purpose of such round mounds beyond their perceived functionality as simply receptacles or 'houses' for the dead. Such a view on the wider use of barrow mounds for social rituals linked to traditional belief systems, ancestor cults and contemporary perceptions of a cosmological order is not new (Barrett 1988, 30–41; Barrett 1990, 179–89), but archaeological evidence to support such ideas is still fairly limited.

For the most part evidence for structural change and variability in barrow architecture has been best viewed directly through archaeological excavation. Amongst numerous examples, probably the one that best illustrates enlargement that is likely to be broadly contemporaneous with Clandon, is that of Amesbury G71 in Wiltshire (Christie 1967; Barrett 1988). Here it was possible to define four phases of construction, of which two involved the erection of mounds – one on top of the other that seemed to represent activity, perhaps over several generations.

None of this was of course apparent prior to excavation taking place and our understanding of such monuments (both individually and collectively), which still dominate many prehistoric landscapes today, is consequently compromised. Whilst the answer may be to excavate more examples, current strategies and policies that concentrate on plough damaged and therefore incomplete sites are much less likely to further develop our understanding – a point first raised by John Barrett over a quarter of a century ago (1990, 184).

Alternative strategies for the investigation of extant archaeological earthworks using non-intrusive methods have been around for some time and the combination of topographic and geophysical techniques has been both commonplace and revelatory, providing data on previously unrecorded archaeological sites but also adding additional detail on known sites. For the most part such surveys and techniques provide information that enhances the two dimensional spatial content of sites rather than looking at phasing via the identification of stratified deposits. More recently however, the availability of such techniques as electrical resistivity imaging (ERI) and ground penetrating radar (GPR) that in particular has the ability to examine the geophysical properties of deposits via depth profiling, are making inroads into field archaeological investigations.

Investigations looking at the profiling of earth mounds through the application of ERI and GPR have been generally successful across a wide range of pedologies in various countries. The investigation of a mounded tomb in Ogaki, Japan with GPR revealed a burial pit and a stone chamber within the body of the mound (Kamei *et al* 2000, 225–30). Similarly the application of ERI was undertaken in the USA to examine the structure of Platform Mounds in Mississippi and was able to detect surfaces, middens and pits within the body of the mounds examined (Kassabaum *et al.* 2014, 27–37). In the UK ERI was successfully applied to a group of Roman Barrows at Bartlow in Cambridgeshire where it was particularly effective in the detection of antiquarian diggings in all four of the barrows but also identified the presence of revetments to the mounds construction previously unknown (Astin *et al.* 2007, 24–37). Furthermore, the collection of high resolution three dimensional spatial data through the application of Terrestrial Laser Scanning (TLS), survey grade Global Navigation Satellite Systems (GNSS), and more recently Airborne Laser Scanning (ALS; often referred to as LiDAR) has enabled archaeologists to identify and examine the micro-topography of earthworks.

With these factors in mind an integrated programme of topographical and geophysical survey was planned that was undertaken periodically between May 2009 and July 2011 with the overarching goal to better determine the constructional features of the Clandon barrow mound and to correlate results with the observations made in the 1882 excavation. In turn, the applicability of the resultant methodology could be tested to examine the potential for the determination of variation in barrow structure more generally.

METHOD AND RESULTS

A total of three non-intrusive techniques were employed during the field investigation of Clandon Barrow: Topographic survey – Global Navigation Satellite Systems (GNSS), Geophysical survey – Resistivity (Twin probe array and Earth Reisistivity Imaging (ERI)) and Ground Penetrating Radar (GPR), with each method and associated results described in turn below:

Topographic survey

High resolution Terrestrial Laser Scanning was initially considered as the primary method to collect the topographic data. However, the quantity and height of vegetation covering the barrow would have necessitated in a large amount of data filtering to reveal the "bare earth" barrow surface required for this research. Therefore topographic points were collected using a Leica GNSS Smart Rover together with a base station positioned over a Leica Smart Net-derived British National Grid control point. This system enabled a rapid process of acquiring topographic points in real-time corrected British National Grid coordinates with a three dimensional positional accuracy of ±0.03m. The GNSS antenna was mounted on a 2.0m detail pole to penetrate the vegetation growing on the barrow surface. Measurements were recorded automatically every 0.25m, although where sharp changes in gradient were identified, a finer sample resolution was triggered manually by the surveyor.

During two periods of surveying, over 6000 individual 3D points were collected within an area of approximately 0.35 hectares. The resultant data was subsequently processed into a Digital Terrain Model via Surfer v8 and ArcGIS v10.1.

Results

The results of the topographic survey are displayed in Figure 4 (A–E) and reveal a number of noticeable features. Overall, this round barrow is surprisingly roughly square in plan form with gently rounded corners. The northern edge curves slightly outwards, but the eastern, southern and western sides are fairly straight and are at right-angles to each other. The barrow footprint covers an area approximately 25m × 25m and rises to a height of 5m above the surrounding ground surface. On the southern edge of the barrow a shallow ditch-like depression is evident. Its widest point, in the SE corner of the barrow, is 5m but then tapers down to a width of 1.5m in the SW corner. The depth of the ditch is fairly uniform at around 0.25m but appears to gently fade out towards the SW corner. In the SE corner, the ditch ends abruptly at the modern fence line. There is no evidence of a ditch on the other sides of the barrow. The origin of this feature is unclear although it is apparently un-related to a quarry ditch identified in the geophysical data (see below) and probably post-dates the mound's construction.

Another noticeable topographic feature is a "C" shaped ridge located on the apex of the barrow. The ridge itself is approximately 1.7m wide and 6.0m in diameter, although a 2m opening can be seen around the southern side. The centre of the depression forming this feature is approximately 0.5m lower than the top of this ridge, and this level is maintained though this opening until it meets the sloping side the barrow. This hollow on the apex of the barrow is the vestigial remains of Cunnington's excavation trench from 1882.

On the eastern side of the barrow a large, 5.5m wide rectangular depression can be observed stretching from the ground surface to a height of approximately 2.5m and extends 2.5m horizontally into the barrow itself. The base of the depression gently slopes upwards, and two small ridges run parallel along the top of each side of the depression. The feature appears to be intrusive to the original form of the barrow and subsequently almost certainly post-dates the prehistoric use of the barrow mound. Its function is unclear although it is likely to be a singular episode, possibly the result of quarrying for gravel from what would have been an easily accessible source.

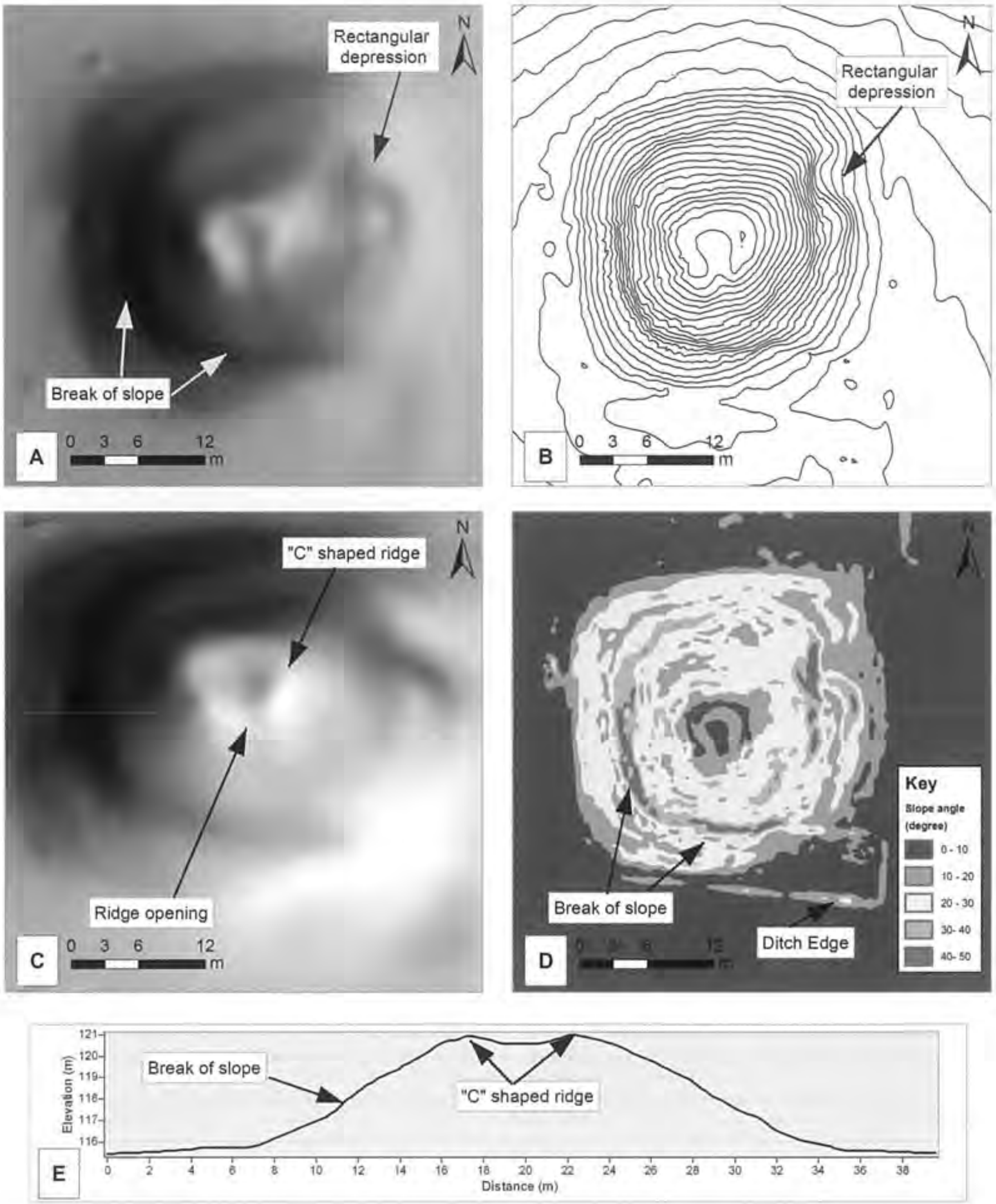

Figure 4 Results of topographic survey. A: Plan view of digital terrain model; B: Contour plot of digital terrain model (contour interval = 0.25m); C: Perspective view of digital terrain model; D: Slope angle change derived from digital terrain model; E: Elevation profile across Clandon Barrow (West to East).

On the southern and western sides of the barrow a sharp break in slope can be observed approximately 2.5m above the ground surface (Fig. 4D). Here, the slope angle of the barrow side increases from approximately 26° to approximately 45°. This change in slope angle continues for 2m horizontally, before the slope angle decreases to 30°– 35° and continues to the top of the barrow. Although this break in slope is most prominent on the western and southern sides of the barrow, it can also be seen to a lesser extent on the northern side. There appears to be limited evidence of it on the eastern side of the barrow. The break of slope revealed by the topographic survey is partially visible to the naked eye when the flora on the mound is low (Fig. 5). It appears as a step in the profile of the mound, most noticeable on the western flank of the mound. This feature would appear to represent the exposed interface between the primary mound and the 'aggrandised' mound raised above it. It is not visible on all flanks of the mound as the upper mound would appear to be slightly off-set from the primary mound probably obscuring it in places.

Figure 5 Photograph of the profile of Clandon barrow 2009 (viewed from the south) © John Gale.

Geophysical survey

Resistivity - Area Survey

Initial assessment at the site for the application of both area magnetometry and earth resistivity techniques indicated that earth resistivity was the more responsive of the two techniques, and subsequently the immediate environs of the mound were surveyed with the intent to identify the presence of an otherwise undetected ring ditch and any other related features.

A Geoscan RM15 Earth Resistivity Meter was used to survey approximately 3200sq metres around the base of the barrow mound. A twin probe array was chosen with a survey reading interval of 0.5m × 0.5m. Data was collected via 20m grids and processed in Terrasurveyor processing software, the results of which are presented in Figure 6C and described below:

Results

Area A (Fig. 6C) - Immediately to the north of the barrow mound a large area of high resistance was recorded. The form of this area is irregular and appears to be diminishing both north and west. Such a large irregular area of high resistivity is likely to be a response to a significant change in the underlying pedology/geology but it is unclear if this is a result of cultural or natural processes. It could represent the outcropping of the underlying chalk sub-strata where the topography of the hill begins to fall away quite steeply.

Anomaly B - Two curvilinear areas of low resistance running south and south east from the south-eastern foot of the barrow mound. The origin of these anomalies is unclear but both appear to inter-relate to Anomaly D (see below).

Anomaly C - Parallel banding of high and low resistance particularly noticeable on the southern extent of the plot but which extend two thirds up the surveyed area and conform to the articulation of the current field boundaries. Such effects are

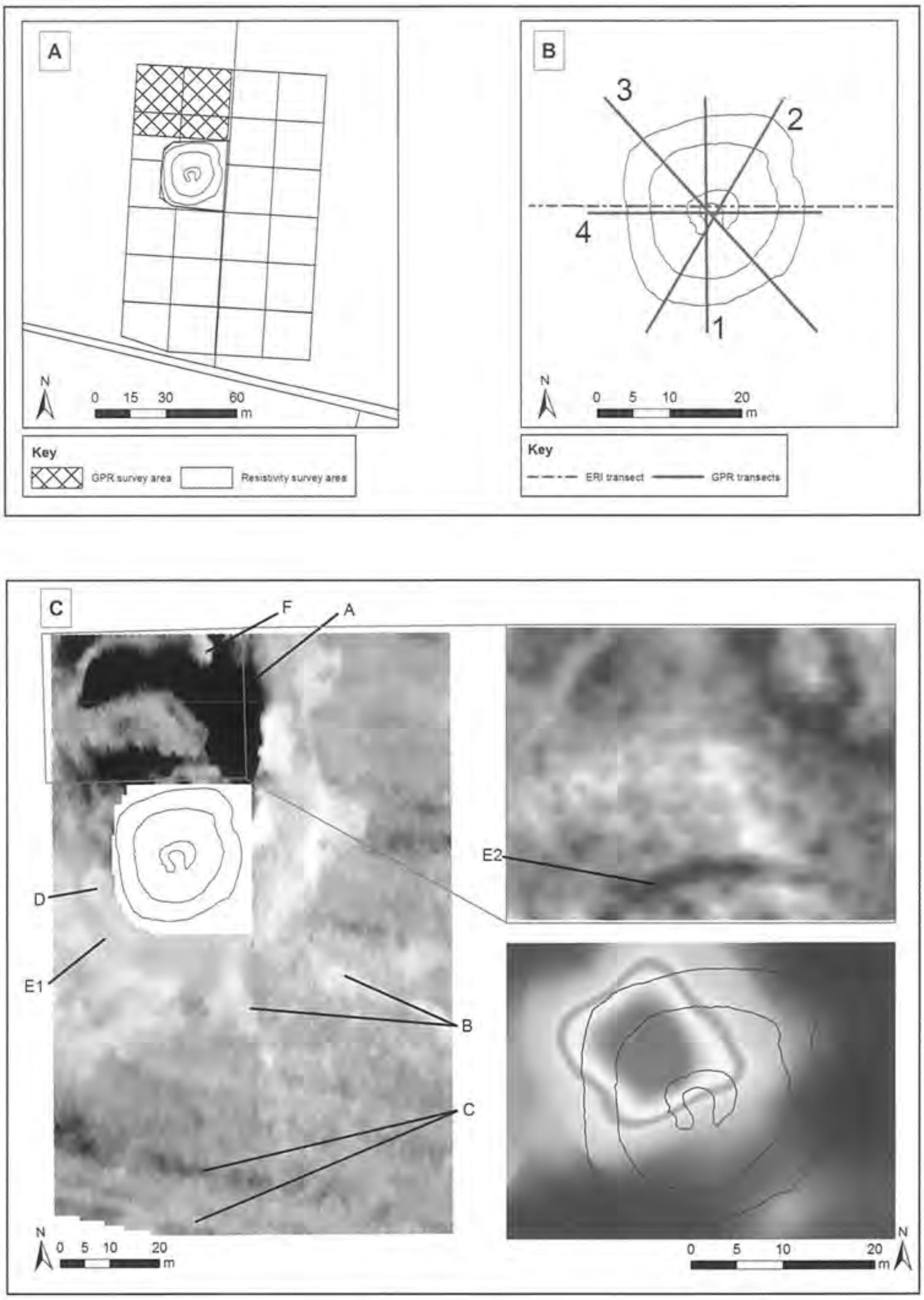

Figure 6 A = Location plan of geophysical area surveys. B = Location plan of ERI and GPR transects over the mound at Clandon. C = Plots of geophysical area surveys: left – Twin probe array resistivity survey with highlighted areas and anomalies (A–F) discussed in text, upper right GPR area survey showing the arc of the barrow ditch (E2) and the possible pit or quarry (F) in the top right of the image; lower right – GPR time slice interpolated plot from transects 1–4 showing highly reflective deposits in north west quadrant.

a common feature resulting from plough activity which appears to be the case here.

Anomaly D and E 1 – At the foot of the barrow mound and extending around most of its circumference (and generally concentric to it) is a circular anomaly of low resistance varying in width that appears to be related to the mound. This anomaly is likely to be a highly localised effect with moisture draining through and off the barrow into a slight hollow in which the mound sits. Within this anomaly to the western side of the mound and approximately 6–10m from it, there is a curvilinear feature of higher resistance which appears to be ditch-like

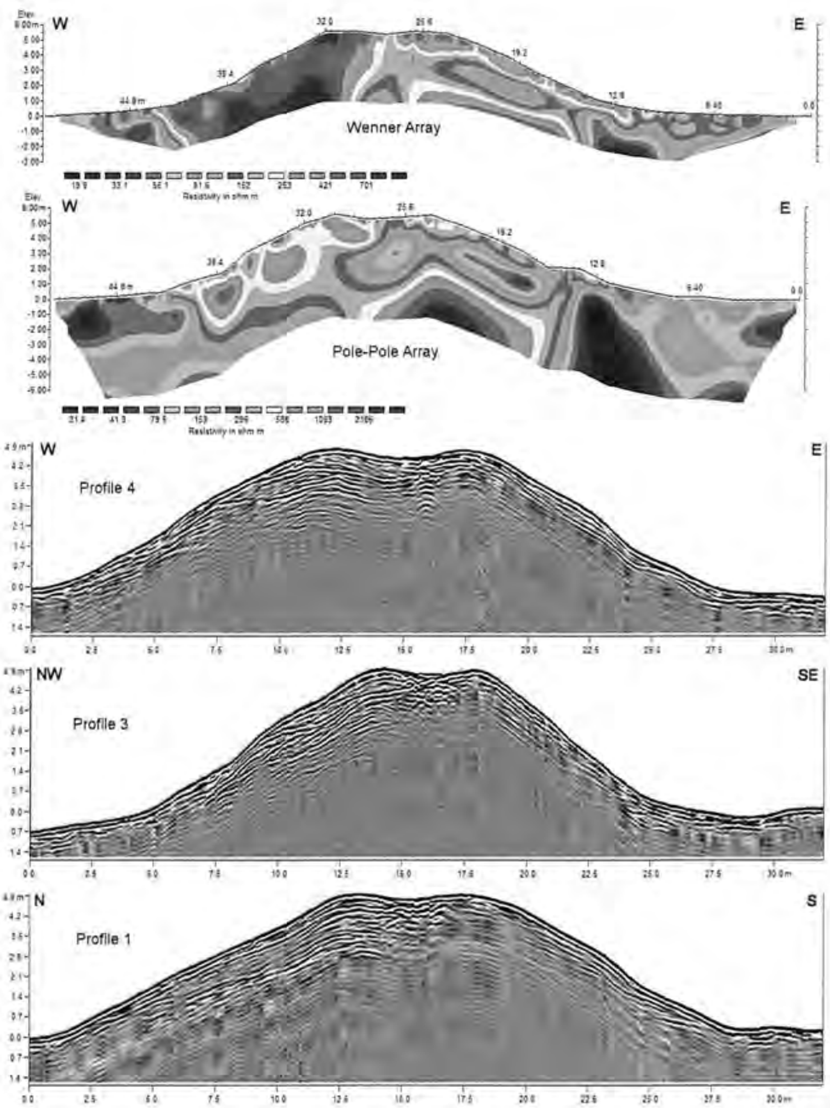

Figure 7 Electrical resistivity imaging (ERI) and 250 MHz ground penetrating radar (GPR) profiles. Both the Wenner and pole-pole array W-E profiles clearly demonstrate the heterogeneous nature of the mound structure, with higher resistivity deposits within the west of the mound, the latter array suggesting the higher resistance material is located fully within the up-cast mound structure. The comparable W-E GPR profile 4 also indicates more interfaces and layering of mound in the west suggesting a series of stony deposits and stratigraphic interfaces. Whilst this inhomogeneity is also visible in the N-S GPR profile 1, it is most clearly demonstrated in the NW-SE profile 3 which corresponds to the high reflectivity zone shown in figure 6. Whilst there are hints in the GPR profiles of an interface between the proposed upper part mound and original mound, most strongly evident in profile 1, signal attenuation has not allowed the depth of penetration to confirm clearly such an interface.

(E1). Further traces of this can also be traced at the northern foot of the mound (E2) also visible in the GPR data (Fig. 6C upper right). Combined the evidence would strongly suggest the presence of a quarry ditch concentric to the mound.

Electrical Resistivity Imaging (ERI)

A single transect (Fig. 7) 50 metres long was located across the barrow (east-west) and electrodes were placed at 80cm intervals across the length of the transect. Readings were taken using Wenner, and pole to pole configurations and the results are presented in Fig. 7.

Both of the arrays present a clear indication that the construction of the mound is not uniform throughout, and that the eastern and western halves of the mound present a different resistivity response. The interface between these differing responses was severely compromised by the access shaft dug by

Cunnington's team which is visible in the data, in the centre of both profiles. For the most part the data would seem to represent a resistivity response to the variant nature of the construction material used in the mound most likely in the upper or aggrandised mound. This lack of homogeneity across two sides of the barrow mound is perhaps surprising and suggests that construction material is drawn from at least two sources.

Ground Penetrating Radar

A total of 7 transects in 4 alignments were placed directly across the barrow (Fig. 6B) covering the footprint of the barrow mound with one transect (north-south) extended to explore the profile across a possible berm and ring ditch. All four transects were surveyed using both 250 MHz and 500 MHz antennae, with a sampling interval 0.05m. The result of these surveys is presented in the profiles for transects 1, 3 and 4 on the 250 MHz wave length (Fig. 7) and an interpolated data set from all of the 250 MHz traverses of the mound was compiled. The profiles all show a more complex stratigraphic composition to the north and west of the mound compared to the south and east. An interpolated time slice from this data set is superimposed over the plan of the barrow within Figure 6C bottom right, this further defines a highly reflective deposit or surfaces in the superstructure of the mound that is approximately 12m wide restricted to the north western quadrant. Unfortunately although there is some evidence to suggest the presence of deposits that may sit on top of an earlier mound the signal attenuation is weak and GPR alone cannot confirm this.

Additionally an area 500 MHz survey immediately north of the barrow mound was undertaken with traverses at 0.5m separation to further explore the anomalies highlighted in the earth resistivity survey. The resultant GPR grey scale image (Fig. 6C top right - E2) clearly shows the arc of the ditch around the northern foot of the barrow which is concentric with that evidenced on the area earth resistivity plot to the west and south of the mound (Fig. 6C left). The 'O' shaped feature also seen on the image appears (F) to be a pit or steep hollow consistent with a quarry or possibly a doline (sinkhole), a geological feature commonly found in the area and in association with round barrows (Gale, 2009, 199-205).

DISCUSSION AND CONCLUSIONS

Archaeological survey and excavation have frequently revealed that barrow mounds, especially round barrows, are both morphologically and structurally highly variable. Such differences are ultimately due a range of factors both natural and cultural which makes the on-going study of them continually necessary and worthwhile, but these inherent differences also make barrows difficult to interpret. The debate on barrow mounds being something more than simply places to inter the dead is now generally accepted in academia (Woodward, 2000, 16), but interpretation of *how* they continued to serve contemporary society *after* their initial construction requires consideration on a case by case basis. The excavation undertaken by Cunnington at Clandon suggested a constructional complexity compromised by an excavation technique not equipped to provide answers to questions that archaeologists might wish to address today:

- Is Clandon simply one barrow on top of another?
- Why was there no sign of a 'primary' deposit in the 'upper' mound/barrow if this was the case?
- Are the layers of ash, gravel and sand mentioned by Cunnington simply construction elements or do they hold greater significance to the mounds development and use?
- What was the flint cairn that was closely associated with the Clandon 'finery', and was it a discrete deposit on the apex on the then surface of the mound, or was it an integral part of either mounds construction?
- Was the funerary urn found above the flint cairn a secondary interment inserted into the mound or could its position be otherwise explained?

The results of the non-intrusive topographic and geophysical surveys described above provide some further insight into, and contextualisation of, the observations made by Cunnington, leading to the production of a more coherent narrative of the barrow's construction and subsequent use.

The topographic survey clearly indicates that the upper levels of the mound have a distinctive break in slope approximately 3m below the current apex (Fig. 4). This break of slope is most notable on the southern and western flanks of the barrow but can also be seen on parts of the eastern flank. The angular footprint of the barrow mound may have been accentuated by ploughing attrition over the years but this cannot be true of the upper parts of the mound. Therefore, it is apparent that the overall mound at Clandon would have had at least two distinct phases of construction.

Confirmation of the interface between an original lower mound and later mounded components can be referenced on the ground (Fig. 5), where a break of slope is very visible in the photograph on the left flank (west) of the photograph. However, the geophysical evidence from the surveys is not so clear cut. The presence of layering can be seen in the multiple reflections from the GPR profiles, particular for the north-western quadrant of the mound but it has not been possible to demonstrably identify if any of these are specifically indicative of the expected interface. Both the GPR and ERI profiles do however clearly indicate marked differences in the barrow's material composition which may be a product of a complex multiple phase construction.

The excavation archive is unclear as to whether or not the entirety of the flint cairn identified in 1882 was removed, although both Drew's section and Cunnington's water colour seem to imply that it was. Its presence cannot be definitively confirmed in the geophysical data which may suggest that it was completely removed at the time of the excavation. That this cairn functioned as an elevated platform atop the primary is an idea postulated previously by Woodward (2000, 140). Insight into the use of flint cairns as platforms used for funerary rituals in this period may be further evidenced by the nearby site of Litton Cheney (Catherall 1976, 81–100). Here on the summit of a low hill, a badly plough damaged site consisted of a circular ditched enclosure approximately 35 metres in diameter that contained an oval structure (9.8m × 9.0m) and a low flint cairn (3.2m × 3.9m). The flint cairn was 0.10–0.15m thick (although some material may have been removed by subsequent ploughing) and contained on it, within it and underneath it cremation deposits and the shattered remains of Collared Urn type vessels. The second phase of the adjacent oval structure also contained a cremation within a Collared Urn. Although the excavator considered the structure to be possibly domestic in origin it is possible that the whole complex could be funerary in character with the oval structure representing a mortuary structure. The similarity between the Litton Cheney flint cairn and its deposits and the Clandon flint cairn is striking and may suggest a common origin in elevated platforms forming part of contemporary funerary practice. It is also increasingly possible that the heightening of the mound was an on-going process with the formulation of successive deposits some of which were noted by Cunnington and for which the GPR profiles seems to further support (Fig. 7).

The geophysical surveys at Clandon have also provided some insight into the possible source of construction materials for the mound/s. The apparent lack of prior evidence for a quarry ditch for the mound can now be seen to be incorrect as the combined evidence from the earth resistivity and GPR surveys show a clear ditch surrounding the mound and concentric to it. The ditch would appear to be approximately 3m wide with a berm between its inner rim and the base of the mound of around 8–10m wide. The depth of this ditch is unknown. The material for the construction of the mound is therefore most likely to be comprised of the sands and gravels that cap the chalk on Clandon Hill, materials which are referred to in Cunnington's notes. One of the most unusual observations made in the excavation archive is the reference to a white clay layer underneath the flint cairn. This is unlikely to be a true clay deposit which is not to be found locally, but rather a layer of excavated and weathered chalk that may have been the final surface of the primary mound before the mound had the flint cairn erected on top of it. The source of this material is of course abundant in the area but it may have been exposed in the quarry ditch or alternatively found in the area immediately adjacent to the mound on its northern flank. The earth resistivity survey reveals an area of high resistance which may indicate an near surface deposit of the underlying chalk.

In conclusion, these non-intrusive surveys were designed to elucidate the observations made at the time of the 1882 excavation and enhance a narrative which began with Drew and Piggott's summation in 1936 and more recently by Woodward (2000) and Needham and Woodward (2008). The results generally confirm that the barrow is seemingly comprised of two mounds: one mound on top of another.

Of the primary mound there is still little that can be revealed beyond its basic dimensions and type. This mound was approximately 28m in diameter 2.2m high and was almost certainly constructed of sands and gravels from the immediate area. It is as yet unclear if this material was scraped up from the immediate vicinity or if it was extracted from a quarry ditch that is concentric to the barrow. It is likely however that a deposit of chalk lined this primary mound as a concluding action to the mound's construction, completing its initial design. One might assume that this mound was a funerary monument and is likely to contain a primary interment at its centre.

The construction of a platform (or cairn) of flint stones was the beginning of a new phase of the monument's use – no doubt related to rites and ceremonies already imbued into the monument. Using a combination of Cunnington's excavation archive and recent non-intrusive surveys, a more detailed picture of the construction and use of the secondary mound begins to emerge. There is no evidence for the formation of a soil over the top of the chalk lining of the primary mound, a detail unlikely to have been missed by Cunnington, suggesting that the flint cairn began to be laid down relatively quickly after the initial construction of the burial mound. The expression of 'finery' through the objects offered and placed on and within this cairn is made at this time, a gesture no doubt of great significance to the community that made it and one might assume this was associated with the interment of cremations. Following this a series of deposits are made consisting of sands and gravels sometimes interleaved with deposits of ash. It remains unclear if such deposits were made successively or over a more prolonged period. Certainly whilst the geophysics broadly concurs with the likely presence of layering it cannot address the composition or frequency of deposits. Perhaps the best clue to this process is found in the original archive where a crushed Collared Urn was found on a thin layer of ash and flints and in association with a cremation. This deposit was recorded as being "some way above the flint cairn". It is possible that this deposit was inserted into the mound as a secondary interment and that the hole for it was missed by Cunnington. It is of course equally possible for the interment to have been placed on the then surface of the mound which was then covered by further deposits of mound material. That three layers of ash were recorded in the rising levels of the mound may, as Woodward (2000, 140) has suggested, be related to ceremonies enacted on a platform possibly involving fire and smoke.

It is clear that the upper mound at Clandon was not simply one barrow on top of another. The aggrandisement of the original monument was almost certainly progressive, undertaken as a series of steps marking events in which the rites and ceremonies of a group or community were played out, presumably as part of a well-established set of cosmological beliefs.

Although these surveys have provided some confirmation and a rationale for further illumination as to the construction and development of this fascinating monument, particularly with reference to the original observations made or inferred from the 1882 excavation, it is clear that further advancement will require some level of intrusive investigation.

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Barrows on the South Dorset Ridgeway lies with Dr Ann Woodward and the late Peter Woodward and is here gratefully acknowledged.

For permission to access the Edward Cunnington archive at the Dorset County Museum we are indebted to the museum's Director Dr Jon Murden and his staff, and for kindly granting permission to reproduce Figure 2.

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REFERENCES

Astin, T., Eckardt, H. and Hay, S. 2007. 'Resistivity Imaging Survey of the Roman Barrows at Bartlow, Cambridgeshire, U.K'. *Archaeological Prospection* **14**, 24–37.

Barrett, J.C. 1988. 'The Living and the Dead and the Ancestors: Neolithic and Early Bronze Age Mortuary Practices', in J.C. Barrett and I.A. Kinnes (eds), *The Archaeology of Context in the Neolithic and Bronze Age: Recent Trends.* University of Sheffield, 30–41

Barrett, J.C. 1990. 'The Monumentality of Death: The Character of Early Bronze Age Mortuary Mounds in Southern Britain'. *World Archaeology*, **22(2)**, 179–189.

Catherall, P.D. 1976. 'Excavations at Litton Cheney, Dorset 1974', in C. Burgess and R. Miket (eds) *Settlement and Economy in the Third and Second Millennia B.C.* British Archaeological Reports 33, 81–100.

Christie, P.M. 1967. 'A barrow cemetery of the second millennium BC in Wiltshire, England'. *Proceedings of the Prehistoric Society* **33**, 336–66.

Drew, C.D. and Piggott, S. 1936. 'Two Bronze Age Barrows, excavated by Mr Edward Cunnington'. *Proceedings of the Dorset Natural History and Archaeological Society* **58**, 18–25

Gale, J. 2003. *Prehistoric Dorset.* Tempus, Stroud.

Gale, J. 2009. 'A Geophysical examination of Round Barrow cemeteries on the South Dorset Ridgeway'. *Proceedings of the Dorset Natural History and Archaeological Society* **130**, 199–205.

Kamei, H., Marukawa, Y., Kudo, H., Nishimura, Y. and Nakai, M. 2000. 'Geophysical Survey of Hiri-Otsuka Mounded Tomb in Ogaki, Japan'. *Archaeological Prospection* **7**, 225–230

Kassabaum, M., Henry, E.R., Steponatis, V.P. and O'Hear, J.W. 2014. 'Between Surface and Summit: The Process of Mound Construction at Feltus'. *Archaeological Prospection* **21**, 27–37.

Needham, S. and Woodward, A. 2008. 'The Clandon Barrow Finery: a Synopsis of Success in an Early Bronze Age World'. *Proceedings of the Prehistoric Society* **74**, 1–52

Piggott, S. 1938. 'The Early Bronze Age in Wessex'. *Proceedings of the Prehistoric Society* **4**, 52–106.

Robinson, G.M. 1976. *A Reassessment of the Barrow Excavations of Edward Cunnington in Dorset 1878–1908.* Unpublished B.A. Dissertation. Department of Archaeology. University of Cardiff.

Warne, C. 1866. *Celtic Tumuli of Dorset.* London: James Russell Smith

Woodward, A. 2000. *British Barrows: A Matter of Life and Death.* Tempus, Stroud.

Woodward, P. 1991. *The South Dorset Ridgeway: survey and excavation 1977–84.* Dorchester: Dorset Natural History & Archaeological Society Monograph 8

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ADDITIONAL LINES OF ENQUIRY: PRELIMINARY INVESTIGATIONS OF SOME MORE ROUND BARROW CEMETERY ARRANGEMENTS

RICHARD MILWAIN

This study acts as a follow-up to Bennett and Gale's article 'Lines of enquiry: Linear organisation of the High Lea Farm Bronze Age barrow cemetery' article which appeared in the 2017 volume of the Proceedings. Bennett and Gale considered the potential influence of solstice alignments, particularly the winter solstice sunset and the Badbury Rings-High Wood double hill on the layout of the High Lea Farm cemetery. The present study considers the potential influence of such factors elsewhere, following the suggestion that the analysis of other cemetery layouts might help provide a wider context. This study investigates seven round barrow cemeteries on or near the heathland in the south-east of Dorset: Canford Heath, Seven Barrows, Coombe Beacon, Five Barrow Hill, Horton Common, Foxbury Hill and Quomp Close. The results suggest that winter solstice sunsets and/or summer solstice sunrises may have influenced the layout of each of these except the Canford Heath and Five Barrow Hill groups, which were influenced by prominent hills. The strong apparent effects of solsticial alignments suggests that the conclusions reached in Bennett and Gale's study do not lie in isolation.

AN INTRODUCTION AND BACKGROUND TO THE STUDY

Following Bennett and Gale's investigation into the organisation of the High Lea Farm Bronze Age barrow cemetery, Hinton Martell (Bennett and Gale 2017), the present study investigates the arrangements of some other round barrow cemeteries in the south-east of Dorset, with all but one (the Badbury Rings group) lying on heathland (Fig. 1). It is generally easier to examine the basic layout of round barrow cemetery layouts here, particularly when compared with the large cemeteries found in other areas of the county. This is largely thanks to them forming small, coherent groups that are frequently separated in the landscape from their neighbours. Despite this, the investigation of their setting is not without problems. The first comes when considering the results in the field; the heathland has undergone significant change in the past 200 years, particularly with the introduction of conifer plantations and the development of Poole, Bournemouth and the surrounding area. Dating evidence is also frequently lacking as well as information pertaining to the alignment of internal features such as burial pits. With these shortcomings in mind, the study focuses on barrow cemeteries with clearer linear alignments in the arrangement of the monuments (Fig. 2).

At a wider scale, Garwood has highlighted the lack of evidence for linear barrow groups prior to 1900

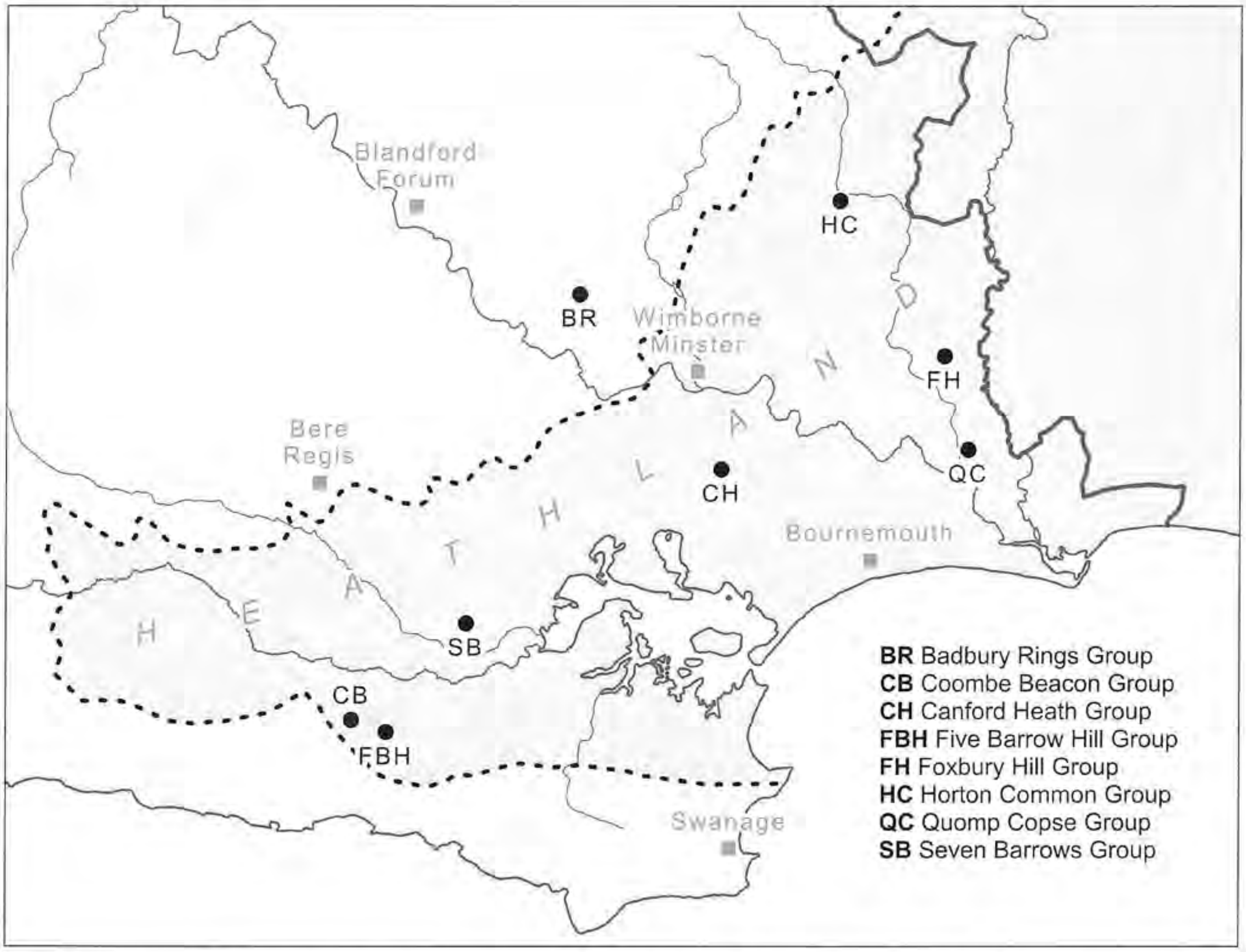

Figure 1 Locations of the round barrow cemeteries considered in the study (© Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right 2019).

BC, with those in close set lines (particularly where the spacing between mounds is less than 40m) appearing to have been constructed between *c.* 1800–1600 BC (Garwood 2007, 39, 44). This chronological framework, when coupled with work carried out by Bradley and Fraser (2000; discussed below), allows the groups considered here to be placed within the first half of the 2nd millennium BC.

It is likely that many of the groups considered here were constructed in fairly open landscapes, raising the possibility that visual factors, perhaps over long distances, influenced the spatial organisation of these cemeteries. The heathland of eastern Dorset was well on the path towards development by the Bronze Age, as initially highlighted by Professor G. W. Dimbleby, who analysed pollen from round barrows in Wallisdown (Dimbleby 1952) and Chick's Hill near Wareham (Dimbleby 1962, 66–8). More recent work by Rob Scaife on Bronze Age round barrows near East Holme (Scaife 1991) and at Binnegar Quarry (Scaife 2011) has provided evidence for heathland vegetation with areas of surviving woodland. Beyond the heathland, the Badbury landscape at this time was likely to have included large areas of open grassland, as suggested by work undertaken on a round barrow at Barford Farm (Howard 1989), located 2km to the south of the Badbury Rings group.

In terms of absolute dating evidence, charcoal recovered from the upper fills of the round barrow ditch at Binnegar Quarry returned Late Bronze Age/Early Iron Age and Middle Iron Age radiocarbon dates (Mason and Hawtin 2011), while a round barrow on Canford Heath (fully excavated and thought to represent a disc barrow) returned a Middle Bronze

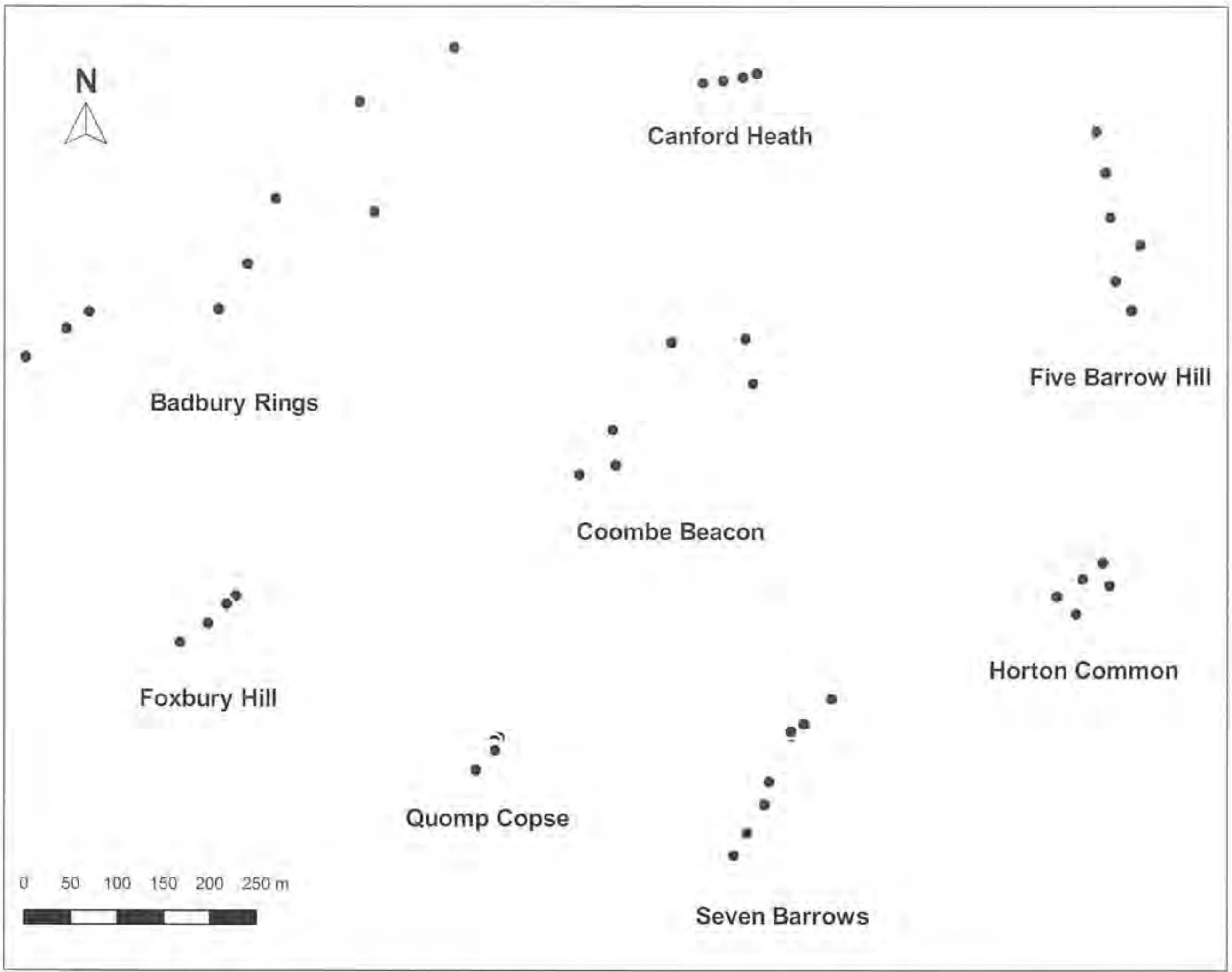

Figure 2 Simplified plans of the round barrow cemeteries considered in the study.

Age date (Horsey and Shackley 1980). Such dating evidence appears to tie in with the work of Bradley and Fraser (2010, 20) on the heathland barrows of southern England, who suggest that these round barrows developed later than in other areas. Many of the monuments, which were commonly isolated or found in small groups, were built in a single phase of construction, on newly opened ground and often away from earlier monuments and areas of long-established settlement (ibid. 21–3). A chronology is provided in which a general date of 1850–1500 BC is given for the construction of the first heathland barrows, with their use continuing into the late 2nd millennium BC (ibid. Table 1). At a county-wide scale in Dorset, and particularly on the heathland, there is evidence for the re-use of round barrows during the Middle Bronze Age, with urnfields often found close to, if not inserted into, older monuments such as the one at Simon's Ground, near Ferndown. These became more common during the later stages of the Bronze Age (Bradley and Fraser 2010, 26; Gale 2003, 83–87; Woodward 2000, 43).

Study has found evidence supporting an alignment with the summer solstice sunrise and/or winter solstice sunset locations at a number of round barrow cemeteries. In some instances these alignments may also have also focussed on prominent landscape features, as appears to have been the case at High Lea Farm with respect to the double hill at Badbury (Bennett and Gale 2017, 130–2). Additional examples, located in topographically prominent locations, may have focussed on the same landscape features on alignments which do not appear to hold any obvious cosmological significance. Such findings are not without precedent. Beyond Dorset, both the Devil's

Jumps and Heyshott Down linear round barrow cemeteries on the South Downs of West Sussex are oriented towards a position on the horizon where the summer solstice sun sets (Garwood 2003, 60–61). In the case of the Devil's Jumps, the alignment towards Harting Beacon is particularly striking.

This fits a wider picture in which the layout of some linear barrow cemeteries from the early 2nd millennium BC onwards suggests a "shift to mound groups as the principal context for the referencing of solar alignments" (Garwood 2007, 41). In such examples, linear groups appear to have been oriented towards "things of the past, and towards natural or celestial phenomenon redolent of permanence and timelessness, while at the same time emphasising lineality and sequence to invoke a sense of history and succession" (ibid. 44). As such, the presence of earlier monuments often proved a factor influencing round barrow placement. Some linear groups appear to have been aligned on the long axis of Neolithic barrows (Woodward 2000, 78), while round barrows within the Stonehenge landscape were frequently constructed in locations offering views towards a wide range of earlier monuments. Movement between barrow groups may have been guided by routes that brought monuments and prominent features in and out of view, including not only Stonehenge itself but also numerous barrow groups and conspicuous hills. Some round barrows, such as the one situated above the entrance to Lake Bottom, *c.* 3.5km to the south of Stonehenge, offered wide ranging views from pivotal locations in the landscape (Exon *et al.* 2000, 82–91).

The present study also suggests that Bronze Age round barrow cemeteries found in fairly close proximity to one another do not necessarily focus on the same feature, or hold the same alignment, suggesting that a range of factors were at play at their time construction and during their subsequent development. Additionally, there are a number of barrow cemeteries which do not display any obvious alignment with topographic features or astronomical events at all; these often lie on ridges, where their alignment appears to be largely dictated by topography with little room for their orientation towards notable landscape features, earlier monuments or cosmological events. As with Bennett and Gale's work, the study made use of the *Horizon* software (version 0.12a; Smith 2019) to investigate potential alignments and azimuths using Ordnance Survey Terrain 50 elevation data. QGIS was used to produce viewsheds from the round barrow cemeteries. For consistency, and due to meagre dating evidence, the Bronze Age winter and summer solstice locations referred to here, reflect a date of 2000 BC.

ROUND BARROW CEMETERY INVESTIGATIONS

Canford Heath

A small, approximately east-west aligned linear cemetery comprising four bowl barrows lies on the south-western edge of the Canford Heath plateau (SZ 023 954). This is situated in a prominent location where the terrain drops steeply both to the south and west and offers expansive views southwards particularly across Poole Harbour (Fig. 3). When viewed approximately westwards along the axis of the cemetery, an observer from the easternmost barrow would have looked towards the now tree-lined Beacon Hill (or Lytchett Beacon), some 5km distant (SY 975 948) (Fig. 4). The view from the cemetery is today broken by a loose covering of pine trees on the western edge of the plateau, although it is quite clear that Beacon Hill forms the next prominent feature along the sightline of the cemetery.

Hutchins described Beacon Hill as "a hill in shape of a tumulus, which commands a very extensive prospect of Poole Bay" (Hutchins 1868, 360), and so it is suggested that the hill, possibly due to its barrow-like appearance, may have influenced the alignment of the Canford Heath group. Its apparent use as a beacon over several centuries also helps to highlight its topographic prominence; it is marked on Caxton's 1575 ('Lechiot Becon') and Taylor's 1765 ('Lytchett Beacon') county maps, and is number 3 in White's list of Dorset beacons (Russell 1959). Despite the prominence of the hill in the Poole Harbour basin landscape, evidence of prehistoric activity in its immediate surroundings is scarce, with a round barrow 1km to the north-east of the hill (north of Naked Cross, SY 980 957) providing a rare example.

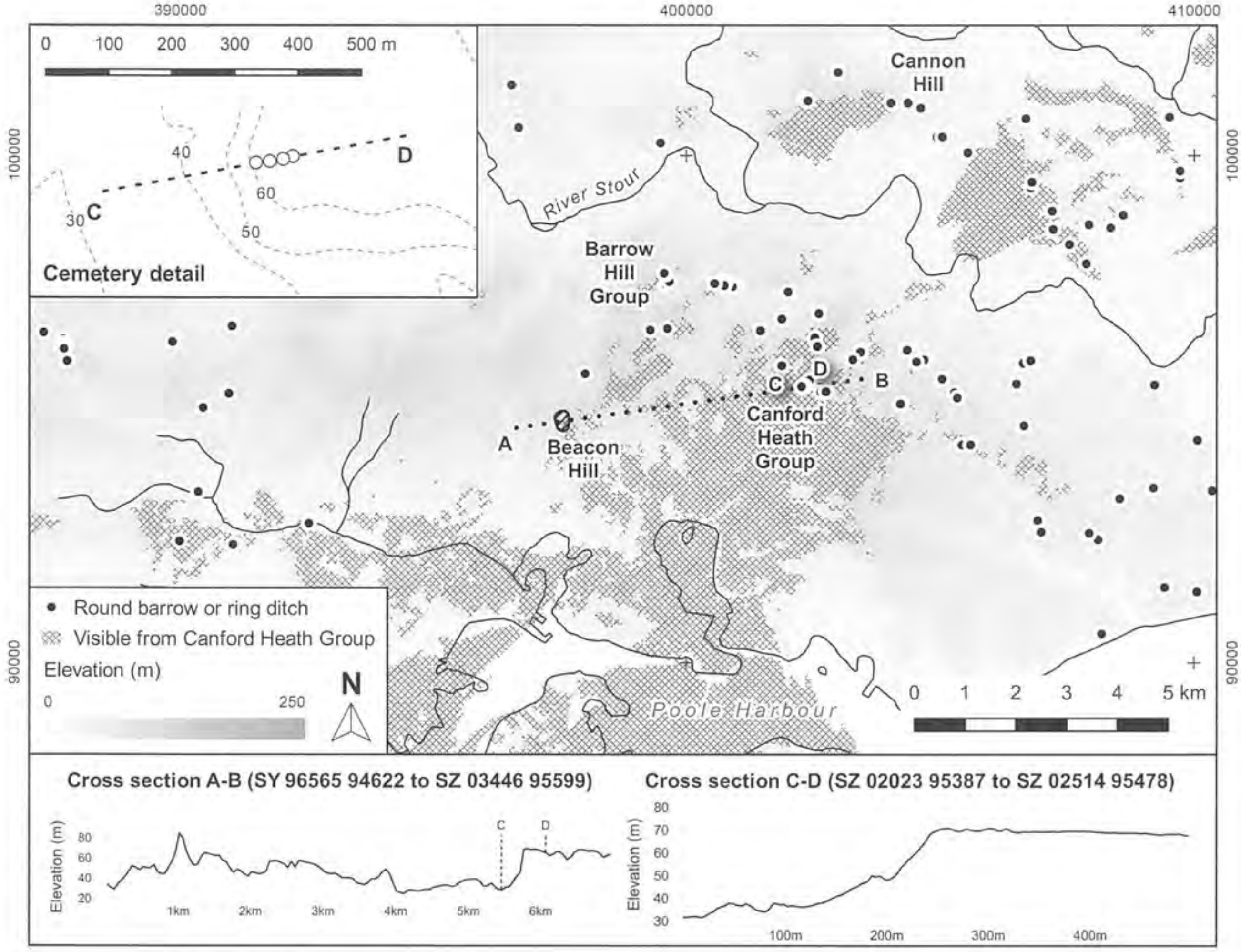

Figure 3 Overview of the Canford Heath Group and topographic profiles along investigated lines of sight (Contains Ordnance Survey data © Crown copyright and database right 2019. © Environment Agency copyright and/or database right 2019).

Figure 4 View towards the 'tumulus-shaped' Beacon Hill, as viewed a short distance from the western barrow in the Canford Heath Group. The horizon has been accentuated.

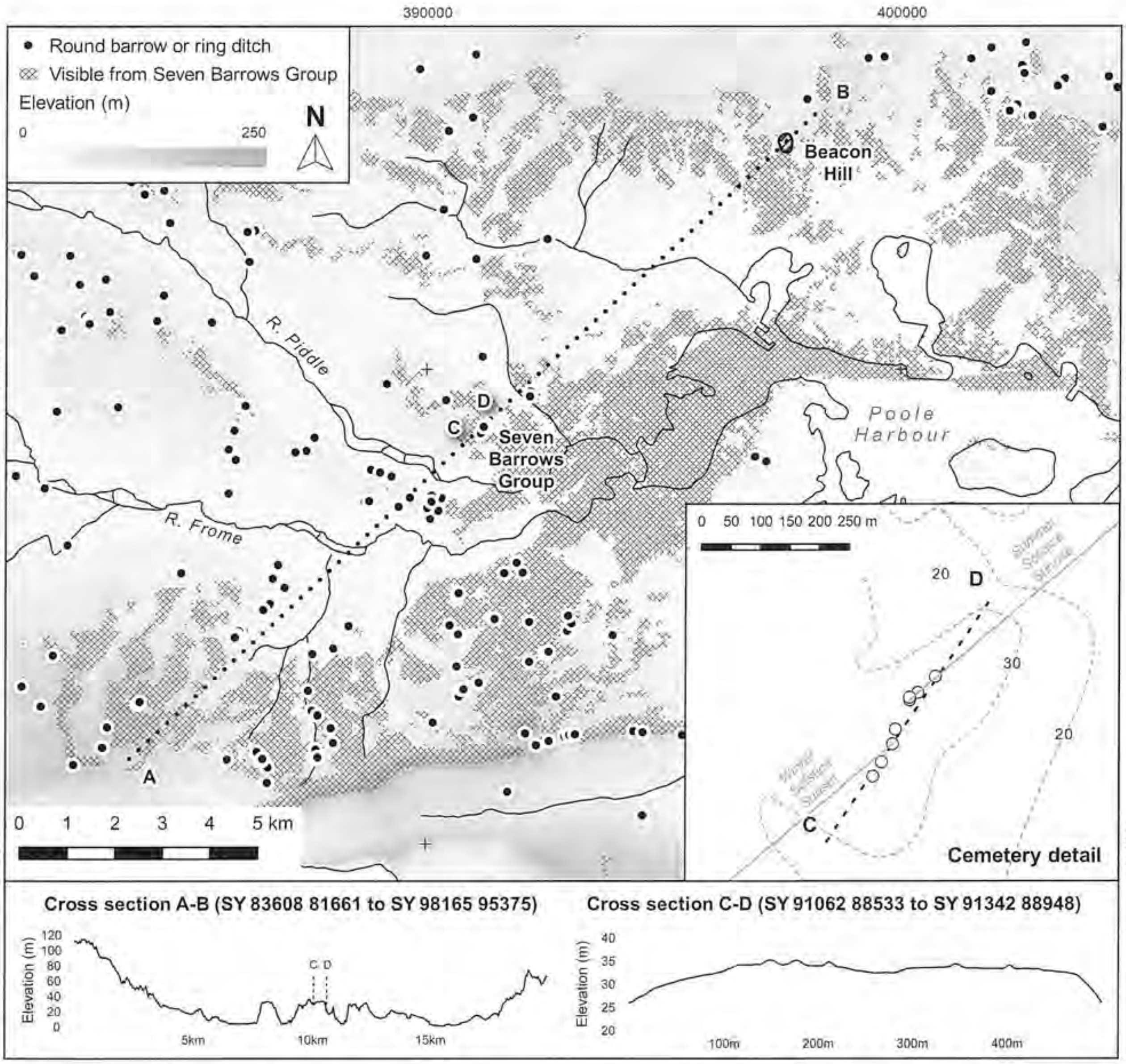

Figure 5. Overview of the Seven Barrows Group and topographic profiles along investigated lines of sight (Contains Ordnance Survey data © Crown copyright and database right 2019. © Environment Agency copyright and/or database right 2019).

This should be compared with the rich archaeological landscape of the Badbury-High Wood double hill area highlighted in Bennett and Gale's study (2017). It is possible that extensive sand and gravel extraction in the past has destroyed evidence, but as it stands there is simply not the evidence to suggest a later prehistoric focus at Beacon Hill in the same way as at Badbury.

It should be noted that a number of other round barrows lie on Canford Heath, although none form any clear groups. Some appear to afford views towards Beacon Hill while others do not. The small barrow cemetery on Barrow Hill, Corfe Mullen (ST 996 975), located approximately 3.5km to the north-west of the Canford Heath group, includes another small linear group of two bowl barrows and two bell barrows. The cemetery offers views to the north instead, rather than to Beacon Hill, and appears to be aligned with the Bronze Age summer solstice sunrise. This would have occurred behind Cannon Hill near Colehill (SU 043 010) as seen from the group.

Seven Barrows

The Seven Barrows group (SY 912 887), located 1.5km to the north-west of Wareham and comprising eight bowl barrows (a monument no longer visible has been assigned to the group), affords views across the heathland to the north and east, as well as southwards towards the Purbeck Hills (Fig. 5). The cemetery, while clearly linear in form, is slightly dog-legged in its overall plan. The four northern barrows lie on an axis more in keeping with the angle of the Bronze Age summer solstice sunrise, which would have occurred in the general direction of Beacon Hill, 9km away. The sun would have risen slightly to the east of Beacon Hill as seen from the Seven Barrows group, at approximately SY 986 950.

The open nature of the cemetery's situation means that the Bronze Age winter solstice sunset would also have been visible from the group. An observer sited at or behind the northernmost barrow could have looked south-westwards across the Piddle and Frome valleys and viewed the sun setting behind the Purbeck Hills, in an area close to East Lulworth (SY 826 817), 11km distant. Evidently, a number of alignments of potential interest in visual terms are offered by the Seven Barrows group. Understanding the cemetery in the present landscape is made problematic by a number of factors, including a) it lying on private land, b) being split by the road to Bere Regis and c) the presence of plantations on Northport Heath obscuring the views towards Beacon Hill. Despite this, the intervening land is generally low-lying and a direct line-of-sight is theoretically possible. The cemetery saw partial excavations by Shipp and Durden in the mid-19th century, without result (RCHME 1970, 455). Understanding the development of the cemetery would help to understand better the possible visual influences behind the arrangement of the group.

Coombe Beacon

Moving south-west from Seven Barrows to Coombe Heath, the small barrow cemetery on Coombe Beacon (SY 860 844) lies on the edge and bottom of a north-east facing spur (Fig. 6). The group, comprising six bowl barrows, does not form a straight linear alignment, instead falling somewhere between a nucleated and linear cemetery as defined by Fleming (1971, 141) (a similar arrangement occurs on Horton Common; see Fig. 2). In their present form, the northern barrows in the group are considerably larger than those located in a more elevated position to the south-west. There appear to be no documented excavations to aid with interpretation. Other round barrows can be found on the heath to the north-east, and these appear to fall on the same alignment.

The southernmost barrow of the group, located just off of the elevated spur of Coombe Beacon, overlooks the larger northern barrow in the direction of the Bronze Age summer solstice sunrise, and this axis again coincides with views towards Beacon Hill. This is in a very similar location to Seven Barrows, but at a more distant 15km. In practice, however, attempts to verify the alignment have been met with mist or haze over the wider Poole Harbour area, and the distance to Beacon Hill from Coombe Beacon is likely to significantly lessen the prominence of the hill when compared to the Canford Heath or Seven Barrows groups.

The layout of the cemetery, with the barrow best suited to act as a viewpoint towards the Bronze Age summer solstice sunrise overlooking the group from the edge of the spur, also means that there are no prominent markers within the group through which the Bronze Age summer solstice could be observed. This would lessen the visual impact, in contrast to the example of HLF1 at High Lea Farm (Bennett and Gale 2017, 132). Conversely, the Bronze Age winter solstice sunset as seen from the north-eastern barrow would have taken place behind the elevated spur of Coombe Beacon and, approximately, the south-western barrow in the group. Although only a very short distance away (225m from the larger, easternmost barrow), this alignment would have offered a more visually prominent display, with the barrow on the spur silhouetted against the setting sun (Fig. 7).

Where wider visibility from the barrow group is concerned, the views are open both to the north, towards the Frome and Piddle valleys and the Poole Harbour area, and east towards the Purbeck Hills, with Creech Barrow Hill, Povington Hill and Whiteway Hill all prominent from the cemetery. This may further suggest that the general south-west to north-east trend of the cemetery was a purposeful one. If a visually prominent feature was the preferred

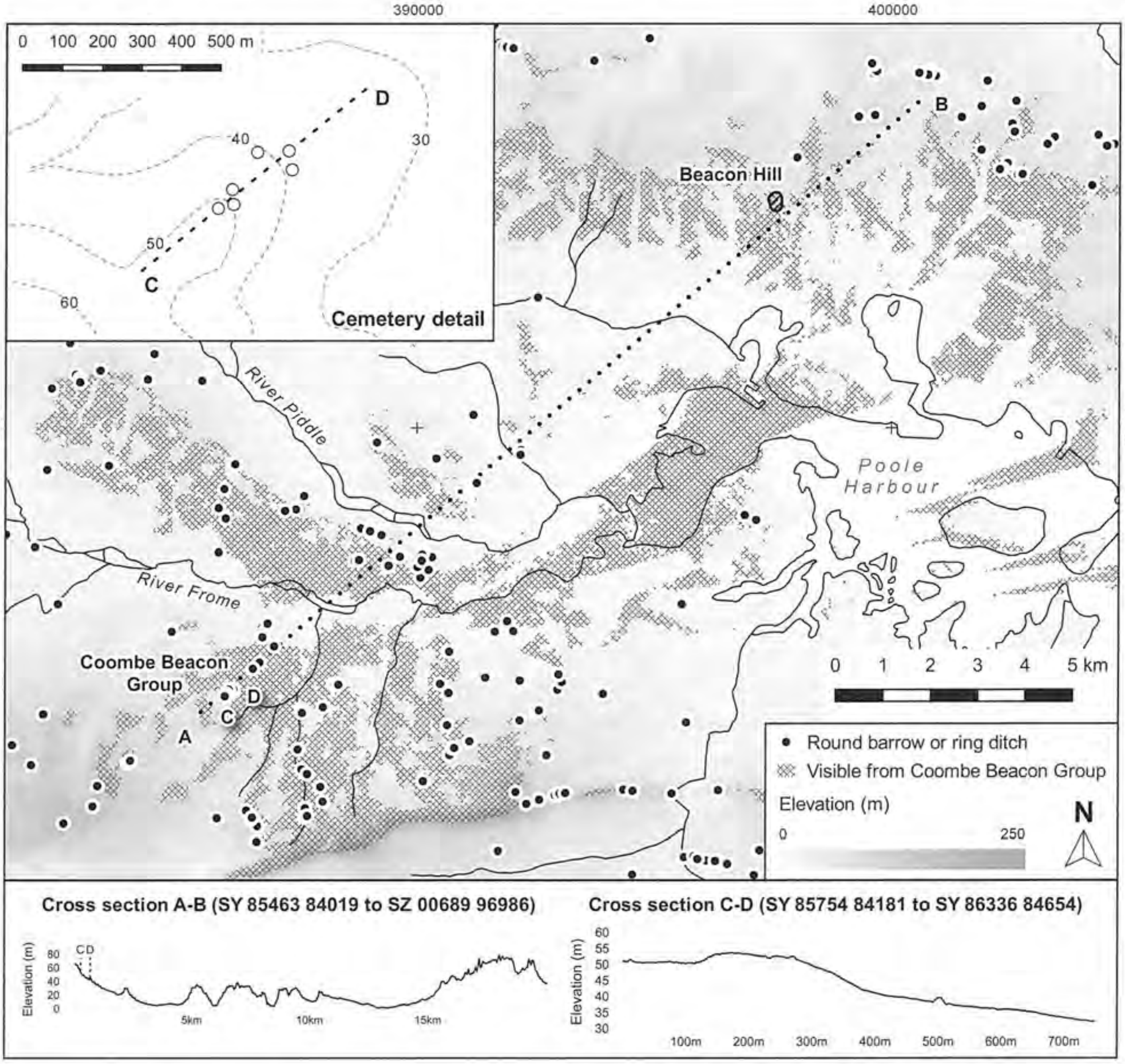

Figure 6 Overview of the Coombe Beacon Group and topographic profiles along investigated lines of sight (Contains Ordnance Survey data © Crown copyright and database right 2019. © Environment Agency copyright and/or database right 2019).

Figure 7 View towards the western barrows in the Coombe Beacon Group. The Bronze Age winter solstice sunset would have taken place behind the central barrow when viewed from the group's north-eastern monument.

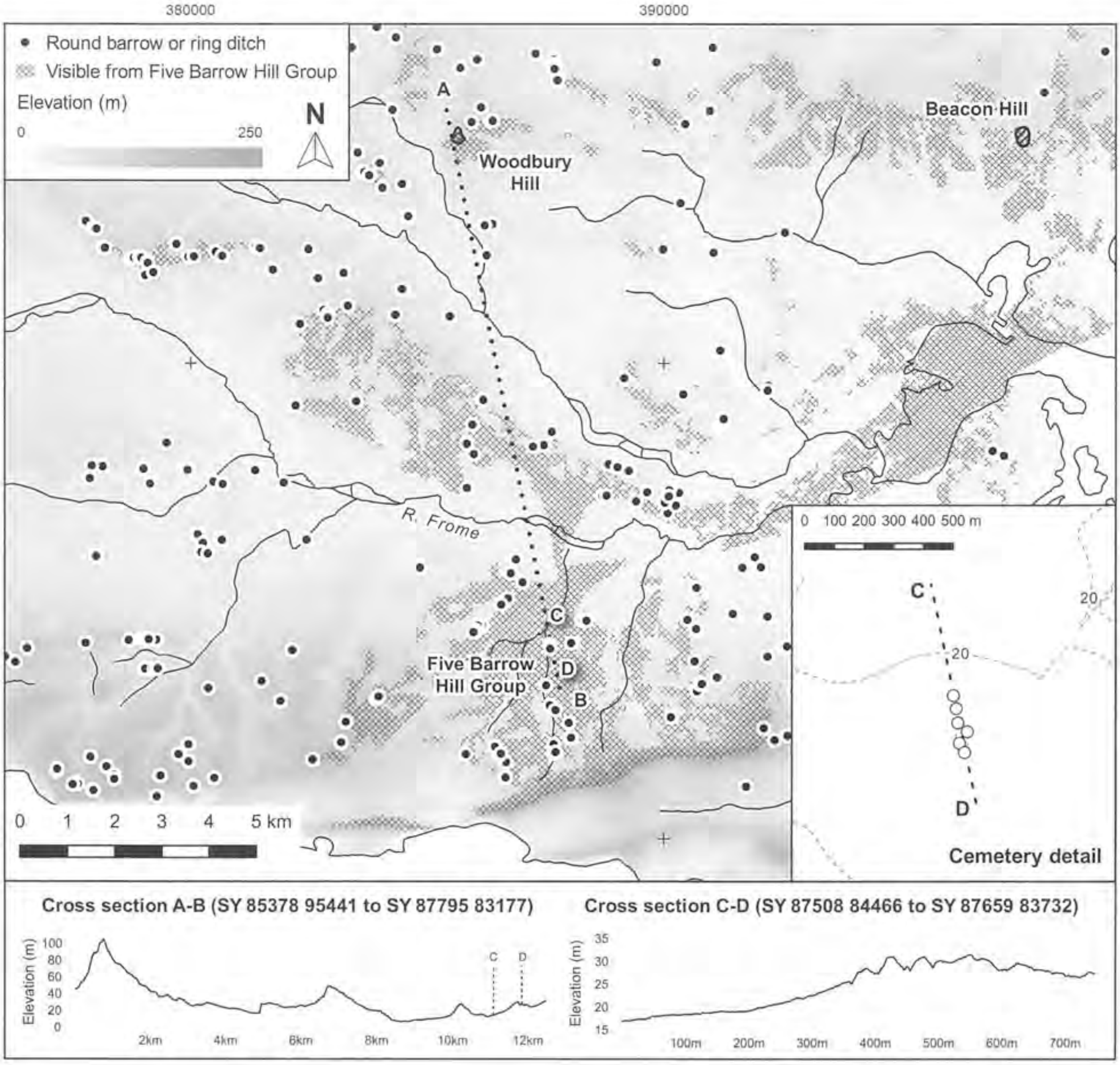

Figure 8 Overview of the Five Barrow Hill Group and topographic profiles along investigated lines of sight (Contains Ordnance Survey data © Crown copyright and database right 2019. © Environment Agency copyright and/or database right 2019).

target of the cemetery axis, then other alignments would be better suited.

Five Barrow Hill

A short distance to the east of Coombe Heath lies the linear barrow cemetery on Five Barrow Hill (SY 875 840), situated on the northern edge of a spur overlooking the Luckford Lake valley (Fig. 8). Views to Beacon Hill are theoretically available from this location, but the cemetery instead appears to point towards Woodbury Hill near Bere Regis (SY 856 948, 11km from the cemetery). As with the Canford Heath group, this axis does not appear to align with an astronomically significant event, but with a prominent landscape feature instead. Woodbury Hill is another significant feature in the Poole Harbour basin landscape, lying on the western edge of the heathland's extent. As with Beacon Hill, Woodbury Hill is listed in White's list of Dorset beacons (number 20 in Russell [1959]), and its significance from later prehistory onwards is attested by it being the site of a small univallate hillfort, medieval chapel and holy well (RCHME 1970, 484). Bronze Age evidence in the surrounding landscape comes in the form of a number of neighbouring round barrows.

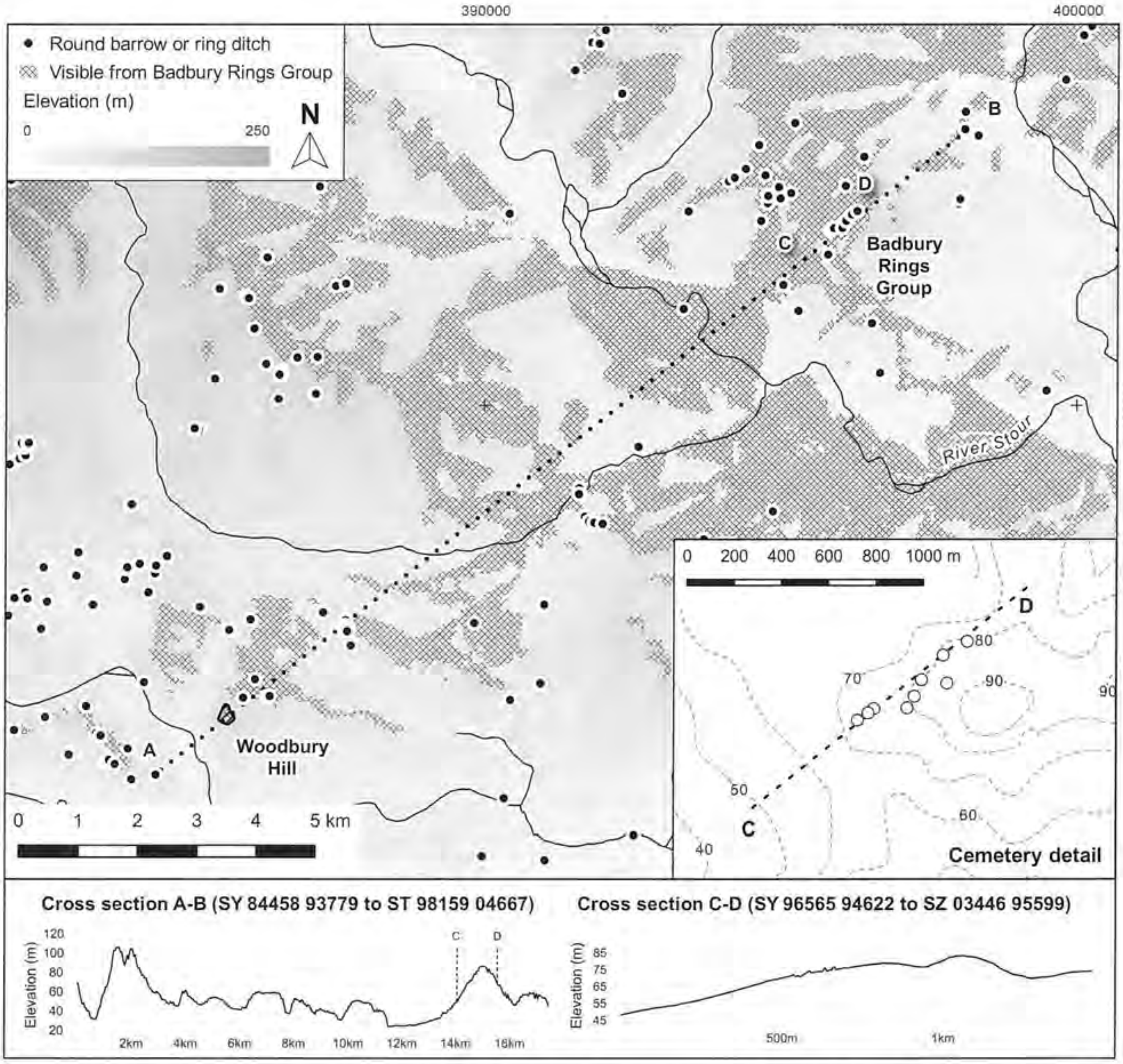

Figure 9 Overview of the Badbury Rings Group and topographic profiles along investigated lines of sight (Contains Ordnance Survey data © Crown copyright and database right 2019. © Environment Agency copyright and/or database right 2019).

The landscape in which the Five Barrow Hill cemetery currently finds itself in, notably within the Lulworth Heath firing range, makes study of the group and its relationship with Woodbury Hill difficult to verify on the ground. Despite this, the intervening landscape is generally low-lying, except for a ridge between the Frome and Piddle at Stokeford Heath (SY 868 883), beyond which Woodbury Hill is theoretically visible. Small, nearby cemeteries provide a means of investigating other possible alignments in the immediate surroundings. The West Holme linear cemetery (SY 883 846) was also constructed on a slight ridge but instead lies on an approximately east-west alignment, while a smaller group of three round barrows near Pool Pond on Povington Heath (SY 885 837) appears to be approximately aligned with Beacon Hill, although at a distance of 14km this might be coincidental.

Badbury Rings

Another barrow cemetery aligned with Woodbury Hill (13km distant), although this time coinciding with the location of the Bronze Age winter solstice sunset, is the group located to the north-west of Badbury Rings (ST 96 03; Fig. 9). The cemetery lies almost entirely on the south-west facing slope of the side of the Stour valley. Northern outliers sharing the same apparent axis lie beyond a slight ridge that switches views towards the north. There appear to be no records of excavation at this cemetery.

The views alter as you move along axis of the cemetery, with monuments emerging as others fall out of view. The north-eastern barrow (ST 9629 0328) might have acted as a marker towards the Bronze Age summer solstice sunrise, as the view through the cemetery from this point is towards the north-east; more generally though, the focus of the cemetery appears to be towards the south-west. It is possible that the Badbury Rings group was in part organised to provide shifting views. The emergence and disappearance of round barrows when walking along a linear group has been highlighted at a number of round barrow cemeteries, such as at Bronkham Hill on the South Dorset Ridgeway (Woodward 2000, 125), while the Winterbourne Stoke Crossroads group to the west of Stonehenge affords views towards a range of monuments and hills as one moves along the cemetery (Exon *et al.* 2000, 96–101).

The view towards Woodbury Hill is today interrupted by the beech avenue lining the B3082 Wimborne to Blandford road, although a combination of visibility analysis and inspection in the field from adjacent parts of the hill suggests that a clear line of site between the cemetery and Woodbury Hill is possible. This is also highlighted by the fact that a beacon on Badbury (White's list number 21 in Russell, 1959) was to be lit during the Napoleonic Wars, should the beacon on either Beacon Hill/Lytchett Beacon or Woodbury Hill have been fired (Bankes 1853, 278–9).

Foxbury Hill

A number of small round barrow cemeteries on the eastern heathlands of the county also provide evidence for some potentially interesting alignments. The Foxbury Hill group comprises four closely-spaced bowl barrows and lies on Barnsfield Heath, near Matchams (SU 121 005), overlooking the Moors River to the south-west and the Stour valley beyond (Fig. 10). There appear to be no recorded investigations at the cemetery. The location of the group affords views to the south and west, and when viewed from the north-eastern barrow its axis is aligned with the Bronze Age winter solstice sunset. The location and axis of the cemetery does not appear to offer an alignment with any prominent landscape features, with the Bronze Age winter solstice sunset occurring behind the elevated plateau around Wallisdown, to the north of the Bourne valley (SZ 06 95). An observer from the north-eastern barrow could use the south-western barrow–the largest of the group today–as a marker for the winter solstice sunset, thanks to the cemetery lying on a slight east-to-west incline.

Horton Common

The round barrow cemetery on Horton Common (SU 075 073) is a further example of an approximately north-east to south-west aligned cemetery, similar in form to the Coombe Beacon group. It comprises five bowl barrows and lies on the eastern edge of Redman's Hill, some 25m lower than the elevated area immediately to the west (Fig. 11). The group is associated with a cross dyke which shares the same alignment. Field investigation of the setting of the cemetery is today made difficult due to vegetation. There are no recorded excavations of the barrows. Its location offers fairly limited views when compared with the other cemeteries considered in the study. The views to the north-east, towards the Bronze Age summer solstice sunrise, overlook the River Crane, located 350m away. Another parallel with the Coombe Beacon group lies in the siting of the south-western barrow as a convenient marker to an observer viewing the Bronze Age winter solstice sunset 'through' the cemetery from north-east.

Quomp Copse

A further round barrow cemetery with potential interest in terms of its alignment can be found in Quomp Copse (SZ 130 962), located on the edge of the Moors River overlooking the Moors-Stour valley 5km to the north-west of Christchurch town centre (Fig. 12). The cemetery currently lies within woodland near Hurn and comprises five bowl barrows lying on an approximately south-west to north-east axis. There are no recorded excavations of any of the barrows within the group.

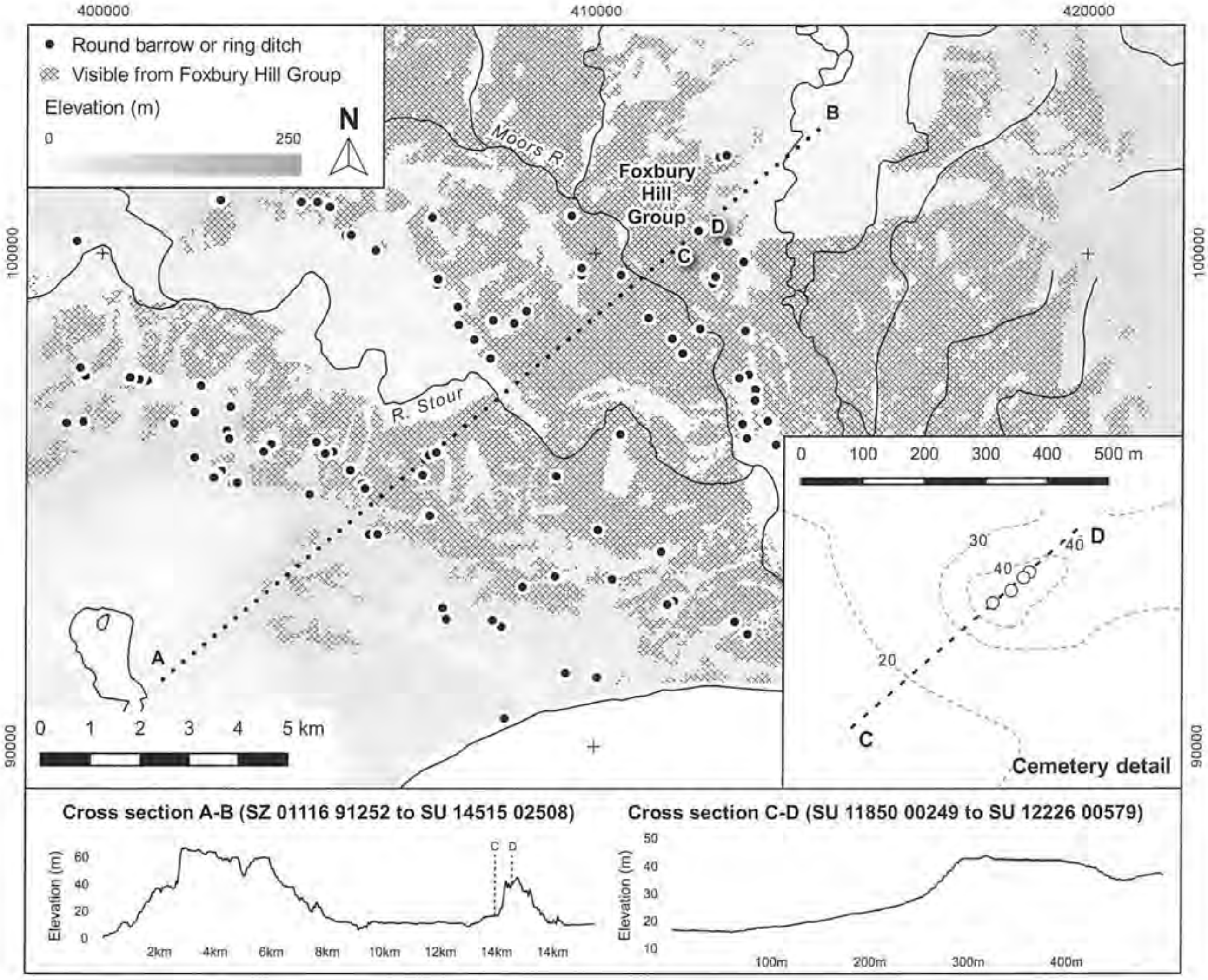

Figure 10 Overview of the Foxbury Hill Group and topographic profiles along investigated lines of sight (Contains Ordnance Survey data © Crown copyright and database right 2019. © Environment Agency copyright and/or database right 2019).

Visibility analysis suggests that the dominant views lie along the Stour valley, both to the west and south-east, and along the Moors valley and adjacent heathland to the north-west, an area now largely covered by Bournemouth Airport and Hurn Forest. However, the alignment of the round barrows within the group suggests a focus towards the south-west and in particular the Purbeck Hills. The Bronze Age winter solstice sunset occurs 10° west of a gap in the hills at Ulwell (SZ 0179 8128) when viewed from the group.The Ulwell gap provides a visually prominent notch in the east-west aligned range when viewed across a wide area (Fig. 13) and could have provided a useful natural marker in the landscape from which a significant event in the year could be gauged. It is possible, therefore, that the alignment of the Quomp Copse group was influenced by this pronounced feature of the Purbeck Hills.

'NEGATIVE' EVIDENCE

It is important to note that a number of round barrow cemeteries within the area considered here do not appear to possess alignments with landscape features or potentially significant astronomical events. To provide some examples, the cemeteries on Nine Barrow Hill on the Purbeck ridge (SY 996 815) and at Simon's Ground, Ferndown (SU 063 999) both appear to be sited in topographically prominent locations but are not oriented on significant landscape features or aligned with clear astronomical events.

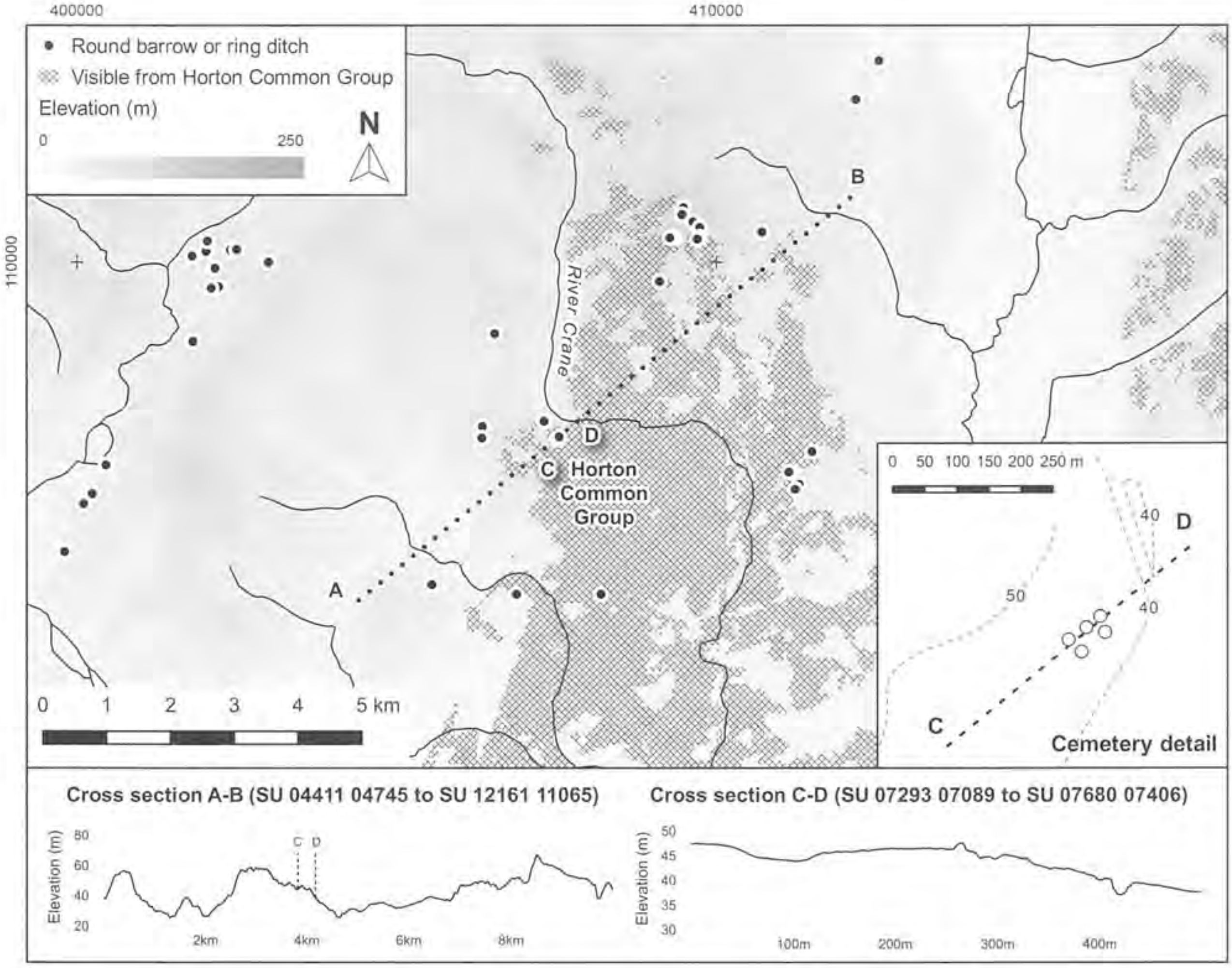

Figure 11 Overview of the Horton Common Group and topographic profiles along investigated lines of sight (Contains Ordnance Survey data © Crown copyright and database right 2019. © Environment Agency copyright and/or database right 2019).

The cemetery on Nine Barrow Hill, which includes an earlier long barrow located immediately to the south of the main group of round barrows (RCHME 1970, 443–4), lies on, or just off of, the Purbeck ridge, while the monuments at Simon's Ground are located on the edge of a plateau, with open views across the Stour Valley to the south.

At St Catherine's Hill near Christchurch (SZ 14 95), located between the lower reaches of the Rivers Avon and Stour only a short distance to the south of the Quomp Copse group, there is, at a glance, no obvious evidence for alignments, or for well-defined cemetery groups, despite a number of round barrows having been constructed on the 2km long hill.

CONCLUSIONS

It appears that a number of different factors may have influenced the arrangement of Bronze Age round barrow cemeteries on the heathlands and neighbouring areas of eastern Dorset, with the examples hinting at the potential importance of solstice sunrises and/or sunsets, and prominent landscape features, as summarised in Table 1. It is clear from the study that a number of issues require addressing before a greater understanding of organisation across these cemeteries can be gained. At the individual cemetery level, shortcomings focus on the development of each group through time: how did they develop in the short-term and/or longer-term? Were they planned prior to the

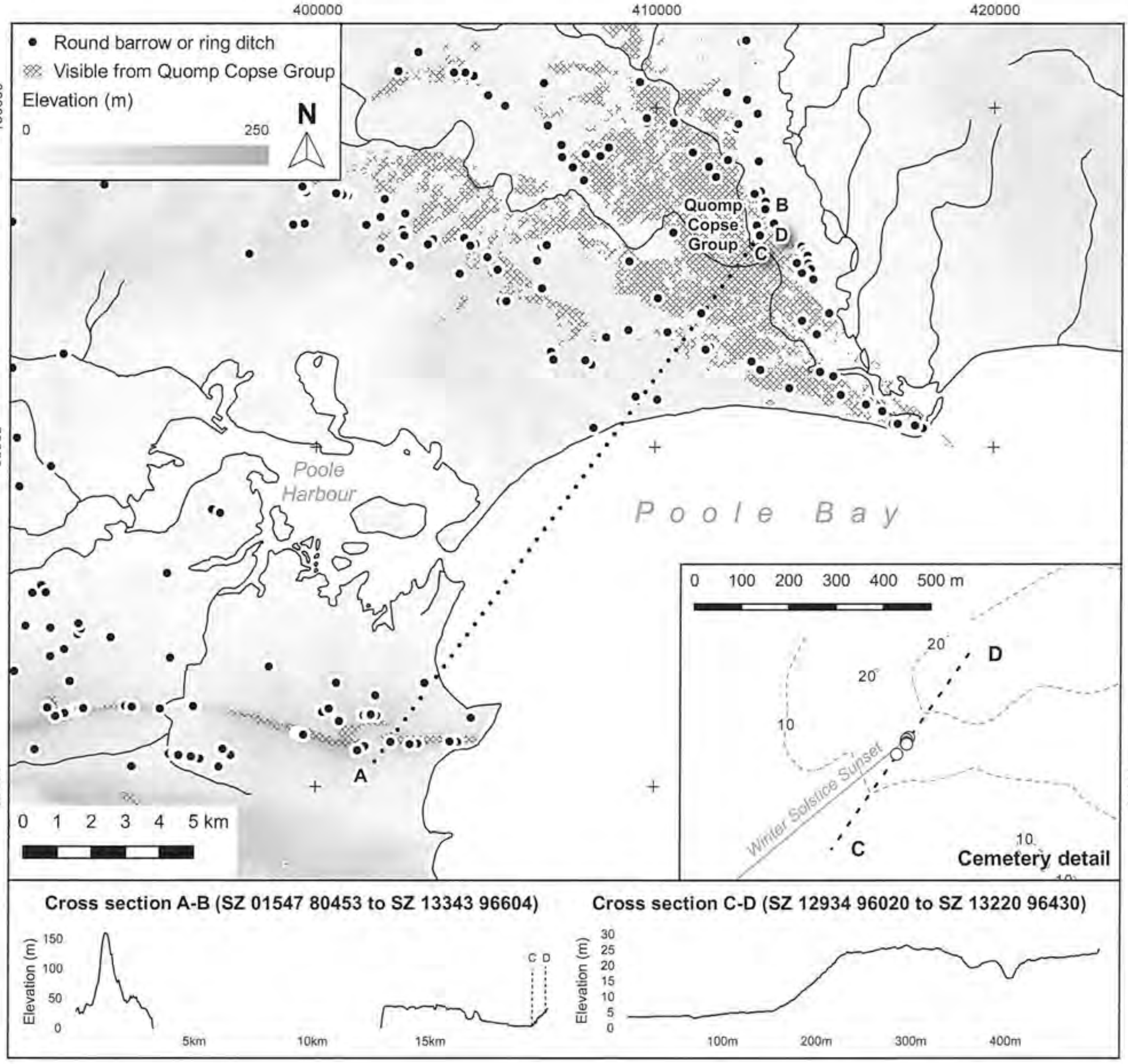

Figure 12 Overview of the Quomp Copse Group and topographic profiles along investigated lines of sight (Contains Ordnance Survey data © Crown copyright and database right 2019. © Environment Agency copyright and/or database right 2019).

Figure 13 The Ulwell gap as viewed on the same axis, but 10km north-east of, the Quomp Copse Group. The gap has been blocked somewhat by buildings in the Lansdowne area of Bournemouth. The horizon has been accentuated.

Table 1 Suggested cemetery focus by group.

Cemetery	Suggested cemetery focus
Canford Heath	Beacon Hill (Lytchett Beacon)
Seven Barrows	Summer solstice sunrise and winter solstice sunset, possibly using Beacon Hill (Lytchett Beacon) as an approximate marker for the summer solstice sunrise
Coombe Beacon	Summer solstice sunrise and winter solstice sunset, possibly using Beacon Hill (Lytchett Beacon) as an approximate marker for the summer solstice sunrise. Winter solstice sunset marked using round barrow on spur
Five Barrow Hill	Woodbury Hill
Badbury Rings	Winter solstice sunset, using Woodbury Hill as a marker
Foxbury Hill	Winter solstice sunset
Horton Common	Winter solstice sunset
Quomp Copse	Winter solstice sunset, possibly using the Ulwell gap in the Purbeck Hills as an approximate marker

construction of the first monument? Did the focus, if one ever existed, only manifest itself following the construction of an initial monument, and if so, how might this have affected the subsequent organisation of the cemetery?

When considering the evidence across the cemeteries it is only possible to speculate as to whether any variations in the conclusions reached here are the result of changes through time, or are a product of a variety of influences amongst a series of contemporaneous monuments. As Garwood (2003, 58) states with reference to the South Downs, but equally applicable here, "there is no reason to believe that one model can be applied to the whole period in question". Detailed exploration of more complex Bronze Age round barrow cemeteries in the county may also help to provide further evidence one way or another, although as highlighted by the work of Ann and Peter Woodward with respect to the South Dorset Ridgeway (Woodward and Woodward 1996, 276–9), the organisation of round barrow cemeteries may have particular local influences, such as earlier monuments. Despite the shortcomings raised above, these preliminary investigations do suggest that further, more detailed research into the organisation of linear Bronze Age round barrow cemeteries in south-east Dorset may yield some interesting results.

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REFERENCES

Bankes, G. 1853. *The Story of Corfe Castle, and of Many Who Have Lived There*. John Murray, London.

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**, 127–36.

Bradley R. and Fraser, E. 2010. 'Bronze Age Barrows on the Heathlands of Southern England: Construction, Forms and Interpretations', *Oxford Journal of Archaeology* **29(1)**, 15–33.

Case, H. 1952. 'The Excavation of Two Round Barrows at Poole, Dorset', *Proceedings of the Prehistoric Society* **18**, 148–59.

Dimbleby, G.W. 1952. 'Pollen analysis of samples from Barrow', in H. Case 'The Excavation of Two Round Barrows at Poole, Dorset', *Proceedings of the Prehistoric Society* **18**, 158–9.

Dimbleby, G.W. 1962. *The Development of British Heathlands and their Soils*. Oxford Forestry Memoirs **23**, Clarendon Press, Oxford.

Exon, S., Gaffney, V., Woodward, A. and Yorston, R. 2000. *Stonehenge Landscapes. Journeys Through Real and Imagined Worlds*. Archaeopress, Oxford.

Fleming, A. 1971. 'Territorial Patterns in Bronze Age Wessex', *Proceedings of the Prehistoric Society* **37**, 138–66.

Gale, J. 2003. *Prehistoric Dorset*. Tempus, Stroud.

Garwood, P. 2003. 'Round Barrows and Funerary Traditions in Late Neolithic and Bronze Age Sussex', in D. Rudling (ed.), *The Archaeology of Sussex to AD2000*. University of Sussex, Brighton, 47–68.

Garwood, P. 2007. 'Before the Hills in Order Stood: Time and History in the Interpretation of Bronze Age Barrows', in J. Last (ed.) *Beyond the Grave. New Perspectives on Barrows*. Oxbow Books, Oxford, 30–52.

Horsey, I. and Shackley, M. 1980. 'The excavation of a

Bronze Age Round Barrow at Canford Heath, Poole, Dorset', *Proceedings of the Dorset Natural History and Archaeological Society* **102**, 33–42.

Howard, S. 1989. 'A double ring ditched, Bronze Age barrow at Barford Farm, Pamphill', *Proceedings of the Dorset Natural History and Archaeological Society* **111**, 31–55.

Hutchins, J. 1868. *The History and Antiquities of the County of Dorset. Third Edition.* John Bowyer Nichols and Sons, Westminster.

Mason, C. and Hawtin, T. 2011. 'Excavation of a Bronze Age Round Barrow at Binnegar Quarry', *Proceedings of the Dorset Natural History and Archaeological Society* **132**, 93–106.

RCHME. 1970. *An Inventory of the Historical Monuments in the County of Dorset, Volume 2, South-East.* Her Majesty's Stationery Office, London.

Russell, P. 1959. 'White's Schedule of the Dorset Beacons', *Proceedings of the Dorset Natural History and Archaeological Society* **81**, 103–6.

Scaife, R. 1991. 'Pollen', in Wessex Archaeology, *Round Barrows at Squirrel's Cottages, East Holme, Dorset. Archaeological Evaluation*, 22–5.

Scaife, R. 2011. 'Pollen analysis', in C. Mason and T. Hawtin, 'Excavation of a Bronze Age Round Barrow at Binnegar Quarry', *Proceedings of the Dorset Natural History and Archaeological Society* **132**, 96–104.

Smith, A.G.K. 2019. 'Horizon (Version 0.12a)', http://www.agksmith.net/horizon/ [accessed July 2019].

Wessex Archaeology. 1991. *Round Barrows at Squirrel's Cottages, East Holme, Dorset. Archaeological Evaluation.* Unpublished client report.

Woodward, A. 2000. *British Barrows. A Matter of Life and Death.* Tempus, Stroud.

Woodward, A.B. and Woodward, P.J. 1996. 'The Topography of some Barrow Cemeteries in Bronze Age Wessex', *Proceedings of the Prehistoric Society* **62**, 275–91.

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IN THE FOOTSTEPS OF VESPASIAN: RETHINKING THE ROMAN LEGIONARY FORTRESS AT LAKE FARM, WIMBORNE MINSTER

MILES RUSSELL, PAUL CHEETHAM, DAVE STEWART and DAVID JOHN

A recent geophysical survey of the Roman fortress at Lake Farm, near Wimborne Minster, first discovered in 1959, has clarified the nature and extent of the site, a major base of the Legio II Augusta during the conquest of the Durotriges and other tribes of South-West Britain in the mid-40s AD. A reconsideration of the social context and landscape setting of the legionary fortress is presented here and the suggestion is made that it was quite probably the site of Isca, as noted by the Roman geographer Ptolemy.

INTRODUCTION

The Roman fort at Lake Farm, to the immediate south-east of Wimborne Minster, was first recognised by Norman Field in 1959 (Field and Butler 1965; 1966). Subsequent excavations conducted, first by Field, from 1959 to 71 (Field 1967; 1968a; 1969; 1970; 1971; 1992, 34–8) and later by Graham Webster, from 1972–3 (Webster 1972; 1974), together with a series of early resistivity and magnetometry surveys, conducted by Andrew David, Alastair Bartlett and Tony Clark of the Ancient Monuments Laboratory (David 1977; David and Thomas 1980; David, Clark and Bolton 1982; David and Bolton 1983), defined the establishment as legionary fortress covering an area of at least 16 hectares with a possible civilian settlement (*vicus*), at its north-eastern corner (Field 1992, 38–9). More extensive excavations were undertaken in 1979–81, under the direction of Ian Horsey and Keith Jarvis of Poole Museums Archaeological Unit, during the construction of the Wimborne bypass (Horsey 1980; Horsey and Jarvis 1979; 1981). Further archaeological monitoring was conducted around the fringes of the site in 1989, 2002 and 2009 (Watkins 1989; Adam and Valentin 2002; Milward 2009).

Unlike other legionary centres identified from Southern Britain, Lake Farm did not develop into either a more permanent base or a town, ensuring that the ground plan of this early fortress has remained relatively intact and largely undisturbed. The importance of the fortress lies in the observation that it was almost certainly the headquarters of the II Augusta legion during its conquest of Dorset and the South-West, in the mid-40s AD, when it was under the command of general, and later emperor, Titus Flavius Vespasianus (Branigan 1973, 54; Field 1992, 32).

THE SURVEY

The legionary fortress of Lake Farm is today a Scheduled Ancient Monument, the area of protection straddling either side of the administrative boundary between Dorset and the newly formed unitary local government district of Bournemouth, Christchurch and Poole (BCP). It lies on the relatively level, low-lying floodplain of the river Stour at a height of 24m above Ordnance Datum. The underlying geology consists of tertiary sands and gravels of the Poole

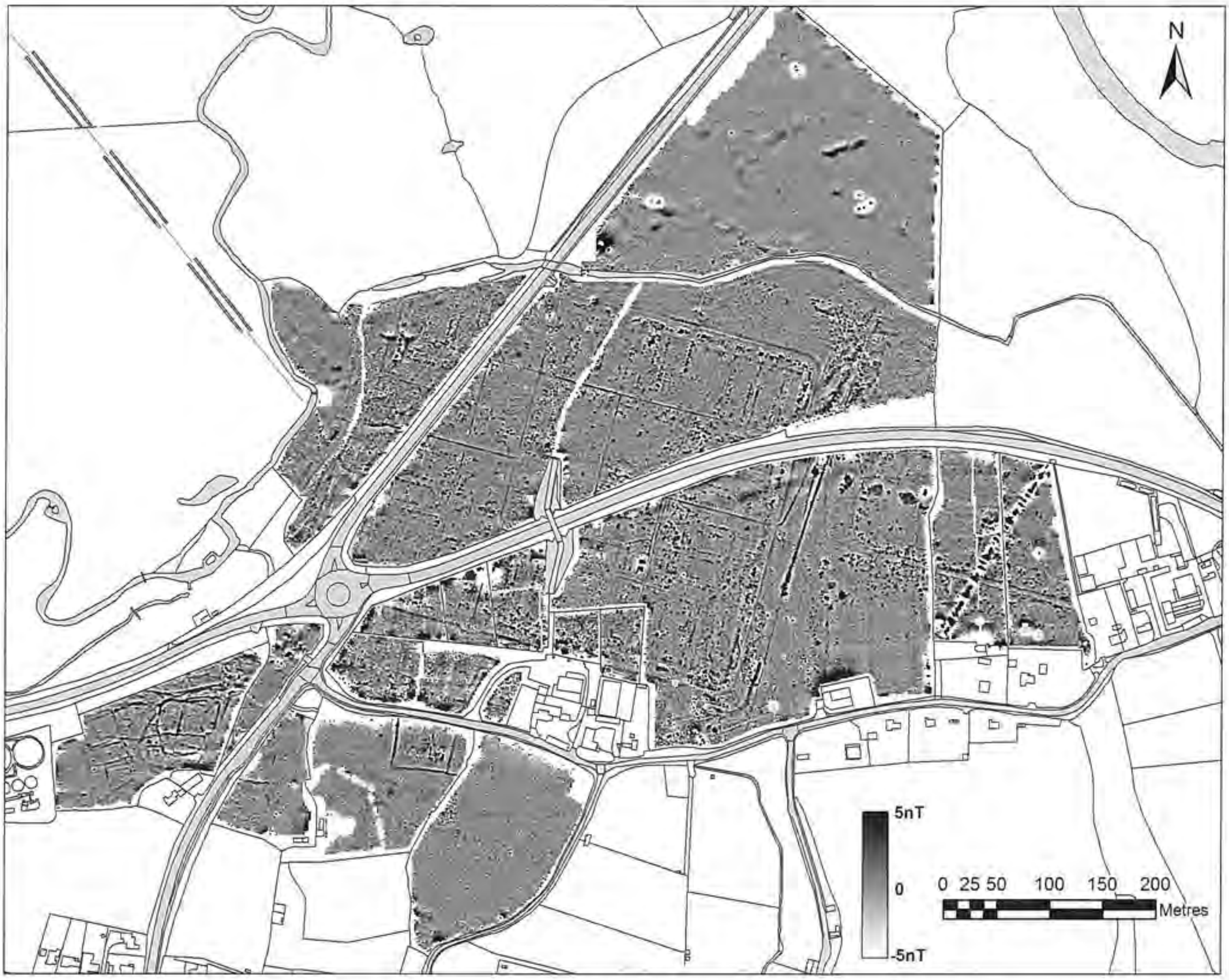

Figure 1 Lake Farm – the geophysical survey plot of the legionary fortress partially overlain by the modern A31 Wimborne bypass and B3078 Wimborne Road (Dave Stewart and Paul Cheetham, Bournemouth University).

Formation, part of the Hampshire basin complex. Two channels of the river Stour run to the north and west of the fort while a tributary stream runs 100m to the south. The fort itself is today divided into three unequally sized pieces of land by the B3078 Wimborne Road and the A31 Wimborne bypass.

In 2016, Bournemouth University conducted a full geophysical survey of the Lake Farm legionary fortress in the hope of better defining areas of Roman archaeology. The results of this survey are published elsewhere (Stewart, Cheetham and Russell 2020), but it is worth noting a few of the key observations here for the discussion that follows. The major feature identified during the survey was the external ditch of the fortress, which defines a rectangular enclosure with rounded corners, measuring 400m east – west and 320m north – south (Fig. 1). The internal layout, as defined in the survey, indicates that the main gate of the fortress, the *porta praetoria*, was orientated to face west-north-west. Further gates appear in the rampart circuit on the west, south and east.

The interior layout of the legionary fortress is marked by linear features, which are apparently drains, running in the centre of internal roadways forming a connected grid, splitting the fort into a number of well-defined insulae or islands. Narrow buildings, representing barrack blocks grouped in sixes, are in evidence around each side of the fortress, as well as a line of four rectangular areas that would conventionally represent the individual houses of military tribunes (Fig. 2).

Figure 2 Lake Farm – aerial reconstruction looking south, showing the possible appearance of the legionary fortress based on the geophysical survey results. To the left is the eastern supply road passing between workshops and entering the fortress's rear gateway (*porta decumana*), whilst on the right is the road from the main gateway (*porta pretoria*) heading towards Badbury Rings (David John, Bournemouth University).

A second ditch was observed, running outside, and roughly parallel to, the main fortress ditch on its southernmost side whilst another can be seen connecting to the curve of the southern side, gradually diverging from the eastern edge of the fortress line as it progresses north. Further aligned anomalies in the field north of the fortress provide an overall minimum length for this linear feature of between 500 and 550m, extending at least 150m to the north of the legionary fortress. This ditch appears to represent the remains of an earlier phase of military construction, probably a marching camp.

To the east of the fort, two roughly parallel linear anomalies may be interpreted as the ditches flanking a 5m wide roadway. Numerous strong anomalies, representing pits or hearths can be seen in this area, apparently respecting the road, which may indicate workshops or part of a civilian *vicus* settlement. The road, which continues east beyond the area of the 2016 survey, may have been the original supply route for the fortress the line of which, although obscured by modern farm buildings, appears to have been to a possible landing place on the Stour, near to the medieval fording point where Canford Bridge now stands.

A legionary fortress would certainly have had an external bathhouse and a possible candidate for this was found in fields below the southern gate where a ditched annexe, filled with highly magnetic material, was identified. However, limited evaluation excavation demonstrated this to result from iron-smithing activities and so the exact location of a bathing establishment remains to be identified (Cheetham *et al.* forthcoming).

DATING AND CONTEXT

The 2016 geophysical survey strongly indicates that there were at least two discrete periods of military occupation at Lake Farm (something first suggested by Field: 1992, 40–1), namely a large marching camp, superseded by a campaign fortress of sufficient size to accommodate a whole legion (totalling around 5280 men). The precise nature of dating sequences for both these establishments depends upon the results of a detailed post excavation analysis of artefacts deriving from over half a century's worth of intermittent archaeological examination. This work is currently ongoing, but a few tentative observations concerning dates and chronology are worth noting here.

The presence of a marching camp, tied with what little datable finds were recovered from examination of the ditch sequences (Field 1992, 32–44) suggests that the Legio II Augusta arrived in eastern Dorset

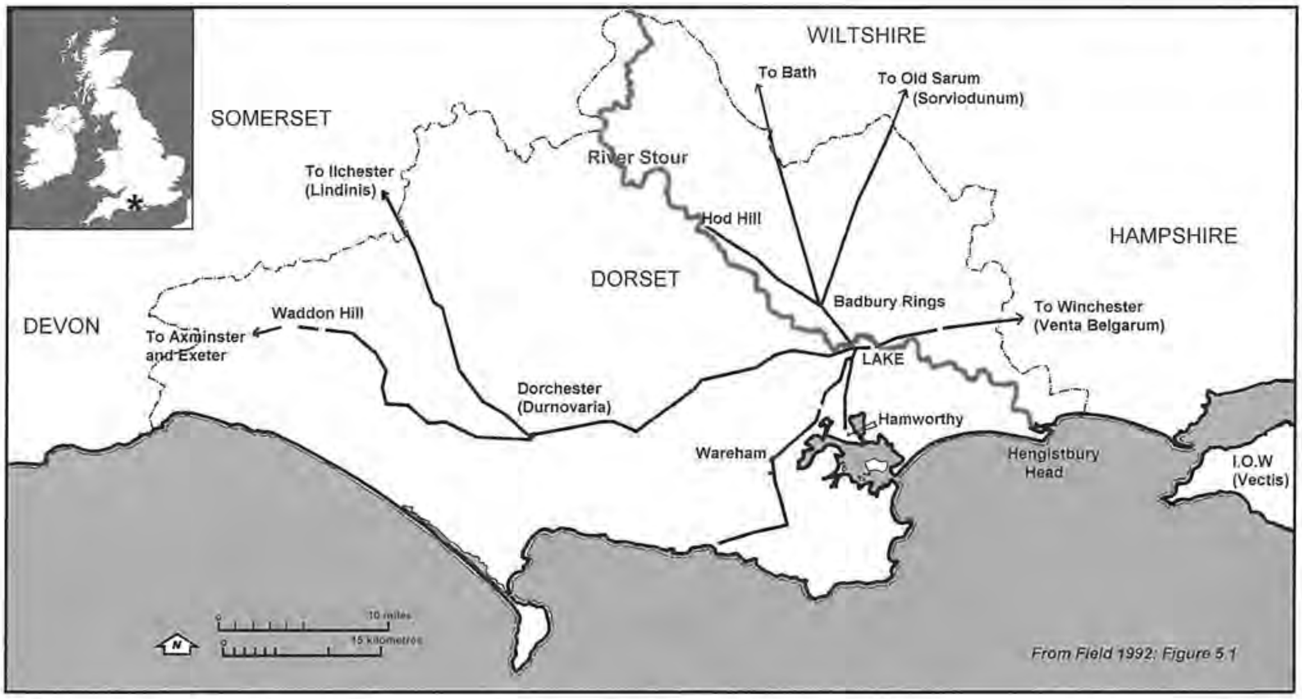

Figure 3 Lake Farm – the location of the fortress in relation to other key Roman sites mentioned in the text.

sometime in late AD 43 or early 44, a date which also appears to apply to the establishment of a fort inside the ramparts of the Dorset Iron Age hillfort at Hod Hill (Richmond 1968, 119; Manning 2002, 28). The Legion was, up until perhaps as late as AD 47, under the command of Titus Flavius Vespasianus whom, we must assume, had been given orders from the emperor Claudius, via campaign commander Aulus Plautius, to fully "subjugate the remaining districts" of Britain (Dio Cassius LX, 21). The precise operational objectives of this campaign are unclear, although presumably Vespasian was tasked with pacifying the western native tribal groups, in particular the Atrebates, Regini / Regnenses, Belgae, Durotriges and Dobunni.

Part of the problem in attempting to interpret Rome's military strategy in Dorset (Fig. 3) is the much-stated belief that the II legion fought a protracted campaign, attacking all the hillforts in the region, one after another (Frere 1974, 89–90; Branigan 1973, 52–4; Bugler and Drew 1973, 58; Harding 1974, 124–5; Alcock 1975, 170; Cunliffe 1978, 279–80, 339 Branigan 1980, 32; Webster 1980, 108–10; Salway 1981, 92–3; Peddie 1987, 146; Field 1992, 26–9; Manning 2002, 32; Mattingly 2006, 98–9; Sparey-Green 2015, 119). In fact, it has often been claimed that the native Durotriges, in particular, having "put up so stout a resistance" to the Roman army, had their territory extensively garrisoned (Frere 1974, 90).

The picture, of continuous conflict, is influenced by a short section in Suetonius' *Lives of the Twelve Caesars*, in which the general Vespasian is noted as having "fought the enemy on thirty occasions" reducing to submission "two powerful tribes, more than twenty towns, and the island of Vectis" (Suetonius *Vespasian* 4). This decidedly vague account concerning the activities of the II Augusta was first provided with a geographical anchor by the archaeologist Mortimer Wheeler who observed that, of the two anonymous tribes mentioned by Suetonius, "it is a good guess to affirm that one was the Durotriges" adding it was "an unthinkable insult to our most famous earthwork to exclude Maiden Castle" from the list of Vespasian's conquered twenty towns (Wheeler 1956, 104). Excavations conducted by Wheeler inside the area of the east gate of Maiden Castle hillfort in 1937 revealed an Iron Age cemetery, providing him with dramatic confirmation of a battle (Wheeler 1943, 61–2). Later fieldwork conducted by Ian Richmond at Hod Hill between 1951 and 58, added more apparent evidence for Roman action, in this case a short siege terminated with judicious use of artillery (*ballistae:* Richmond 1968, 33).

More recently, a renewed period of archaeological fieldwork across the hillforts of Dorset, coupled with a reanalysis of the primary excavation dataset, has indicated that the evidence for hillfort warfare, so persuasively argued by Wheeler and Richmond, may actually be nothing of the sort (Sharples 1991a 91–101; 1991b, 118–25; Stewart and Russell 2017, 158–62; Russell 2019). None of the individuals found by Wheeler within the East Gate cemetery of Maiden Castle can be shown to have died in defence of the hillfort, only that they were laid to rest from the mid first century BC (to the late first century AD) within a well-established burial ground set within a long-abandoned hilltop enclosure. Likewise, the 'artillery barrage' recorded from Hod Hill may more simply indicate the residue of practice fire within a defunct hillfort rather than representing the residue of a siege (Sharples 1991b, 125; Maxfield 1989, 25; Stewart and Russell 2017, 158–62, 166–69).

To date, there is unfortunately no evidence that any of the hillforts of Dorset were militarily active during the first century AD. Within the Durotrigian zone, settlement apparently comprised relatively dispersed communities living in individual, lightly enclosed farmsteads of a kind excavated at Woodcutts (Pitt Rivers 1887), Rotherley (Pitt Rivers 1888), Tollard Royal (Wainwright 1968), Gussage All Saints (Wainwright 1979), Tolpuddle Ball (Hearne and Birbeck 1999) and Winterborne Kingston (Russell *et al.* 2017). The arrival of the Roman army into this landscape undoubtedly disrupted the social order, and there may well have been a prolonged period of armed resistance, but it was probably nothing like the campaign of hillfort-related conflict that has usually been suggested. Additionally, if the relatively small size of the Lake Farm fortress is considered indicatory of the potentially transient nature of legionary forces in Dorset, this could in turn argue against any sustained degree of native resistance.

Since the completion of archaeological work at Maiden Castle (Wheeler 1943) and Hod Hill (Richmond 1968), the view has been that the II Augusta operated from a base at Chichester in West Sussex, before moving, at some point in the mid-40s AD, to Lake Farm (Branigan 1973, 52, 55; Frere 1974, 90). Sauer has, however, recently argued that Alchester, in Oxfordshire, was the primary base of the II Augusta under Vespasian's command, between AD 43 and *c.* AD 47, and that Lake Farm was occupied only after AD 50, following the pacification of the Durotriges but prior to the legion's transfer to Exeter in the mid to late 50s (Sauer 2005, 122–3). Timbers in the gateway to the annexe of the fortress at Alchester have been dendro-dated to having been felled at some point between October AD 44 and March AD 45. Given that the fortress here presumably predated the timber annexe, and assuming the timbers in question had not been reused, Sauer has argued that Alchester must have been constructed at the end of a campaign season, arguably in the autumn of AD 43 (Sauer 2005, 118). If Alchester was the main base of the II Augusta, as Sauer has suggested, then it may conceivably mark the first stage in its western campaign, being established close to the tribal border of the Catuvellauni and Dobunni.

A key element in the argument that Alchester was originally the campaign headquarters of the II Augusta was the discovery of a military tombstone, set up to one Lucius Valerius Geminus. Geminus was a veteran of the Legio II Augusta, originally from North-West Italy, who retired from active service at some point in the late AD 40s or early 50s and died close to his 50th year (Sauer 2005, 108–10). The importance of the stone found re-used in the foundations of the town wall of Alchester (Sauer 2005, 105), apart from being one of the earliest named Roman burials in Britain, is that it potentially provides unit affiliation for the fortress. Sauer has observed that "all tombstones of legionary veterans found in Britain derive from the site or immediate vicinity of a legionary fortress or a colony" there being no known examples, found close to a fort or town "where there had been no legionary base during the lifetime of the soldier" (Sauer 2005, 113). By itself, therefore, the tombstone of Geminus provides indirect, albeit perhaps rather compelling, evidence that Alchester was the main fortress of the II Augusta in the early years of the Roman campaign in Britain.

An additional tombstone from Dorset, first identified in 2016, however, casts some doubt on this hypothesis.

This stone grave-marker, found reused as a house step from a property in High East Street, Dorchester (Mike Trevarthen pers comm 2016), commemorated Lucius Didius Bassus, a veteran of the II Augusta, originally from Macedonia who died around the age of 55, having been discharged a decade or so earlier (Tomlin 2018, 427–8). The Bassus monument, as far as can be determined, appears to predate that of Gemminus from Alchester, an observation which Roger Tomlin believes helps to confirm that Dorchester was in fact "the legions early (if not only) base" (Tomlin 2018, 427). The absence of a fortress identified to date from beneath, or within the immediate vicinity of, the town of Dorchester, however, is problematic, as indeed is the relative proximity (37km) of Lake Farm to this later urban centre.

Three interpretational possibilities present themselves with regard to understanding the nature and significance of the Bassus tombstone. First, it is possible a Roman fortress lies somewhere close to, or underneath, Dorchester, despite the town being only a relatively short distance from the confirmed fortress of Lake Farm. Second, it could be that the stone found in High East Street was not originally from Dorchester, having been brought to the town from a site originally much closer to Lake Farm or Wimborne Minster. Third, it is possible that Bassus originally served in the fortress at Lake Farm, but chose after his retirement to live at, or close to, the new town of Dorchester, and was later buried there. Given that the new geophysical survey of Lake Farm confirms that the fortress was of sufficient size to house an entire legion, the excavation dataset suggesting abandonment and demolition in the early AD 50s, the site never being reoccupied, it would perhaps seem strange that Bassus would have been buried there. More likely, perhaps, his heirs chose to lay the veteran to rest in the nearest large civilian centre to the abandoned legionary fortress. If the findspot, at the eastern margins of Dorchester reflects the original location of Bassus' grave, then he would at least have been laid to rest in a cemetery set on the line of the road that ran from town towards the site of his former base.

Whether Lake Farm was, as suggested here, the main base of the II Augusta as it campaigned westwards, being contemporary with, or occupied at a different time to, Alchester, is something that is ultimately unproveable until the post-excavation analysis of the Lake Farm archive has been completed and a full constructional sequence developed. Certainly, the finds evidence recovered does seem to indicate a degree of military activity on site from late AD 43 or early 44, possibly related to the establishment of a primary phase marching camp, but the nature of this must at present remain unclear. Any interpretation of Roman military strategy in the years immediately following the invasion is not helped by the realisation that the accepted view of a full-scale assault upon the hillforts of Dorset (Wheeler 1943; Richmond 1968) is, as noted above, unsustainable (Stewart and Russell 2017, 169–70; Russell 2019). Other, alternative strategic centres of native Durotrigian power may well have been targeted by the legion, or more simply won over through economic or political means, but, with the hillforts out of the equation, it is clear that the nature of Roman conquest in the South-West needs to be rethought.

The identification of at least three major bases of the II Augusta, all apparently dating to the mid to late 40s AD, at Chichester, West Sussex (Down 1981, 119–28; 1988, 14), Alchester, Oxfordshire (Sauer 2005) and Cirencester in Gloucestershire (McWhirr 1988, 74–80), certainly does not help matters, suggesting that the legion was operating, presumably with considerable auxiliary support, on multiple fronts during this period. On a basic level, it can be said with some confidence that Chichester and quite possibly Alchester predate the main fortress phase at Lake Farm, which appears to have been constructed close to the river Stour, within the southern half of an earlier marching camp, sometime around AD 45, the fortress itself being deserted by the early AD 50s, as the legion moved west. The small fort at Hod Hill also appears to have been abandoned at this time after an extensive fire, attributed by Richmond to a cook-house accident (Richmond 1968, 121; Bugler and Drew 1973, 58), but more likely resulting from an act of slighting. The date for the establishment of Exeter is unresolved, although the evidence, such as it is, suggests that construction was underway at least by the mid-50s (Bidwell 1979, 13; Henderson 1988, 91; Manning 2002, 35). Dating evidence for the fort at Waddon Hill, in western Dorset, seems to broadly correspond with this, the site being built sometime after AD 50 and lasting at least until the early 60s (Webster 1979, 55). The fort set within the ramparts of Hembury hillfort, in North-West Devon appears to have been occupied from around AD 55 to the late 60s (Todd 2007, 117).

THE PROBLEM OF NOMENCLATURE

If, as now seems likely, Lake Farm was a major facility of the Legio II Augusta in its campaigns across South-Western Britain, why does its name not feature in surviving records? As long ago as 1968, Norman Field suggested that the fortress could plausibly be identified with *Isca*, a site named in a number of Roman sources (Field 1968b, 309). In Ptolemy's *Geography*, of the second century AD, *Isca Legio II Augusta* is named as a polis of the Dumnonii, together with *Voliba*, *Uxella* and *Tamara* (*Geography* II.3.13). Association of *Isca*, as Exeter, with the II Legion, is, by the mid-second century (when Ptolemy was writing), anachronistic however, unless remembrance of the unit was particularly strong, for the legion had by then been established at Caerleon in South-East Wales for some time. The third century *Antonine Itinerary* records the more complete, and presumably more accurate, name-form for the civitas at Exeter as *Isca Dumnoniorum* (Antonine Itinerary XV). If this was the real name for the town of Exeter, Ptolemy's mix-up may have derived from the fact that the legionary fortress at Caerleon also appears to have been called *Isca* (*Isca Leg II Augusta*: Antonine Itinerary XII). If, as seems likely, this name-form itself derived from a British term for water (Rivet and Smith 1979, 376), being the origin for river names Exe (Exeter) and Usk (at Caerleon) as well as Esk and Axe, then confusion could have come from both the obvious duplication and evident association with the II Augusta. Presumably the indigenous river-name established within the land of the Dumnonii was transferred, first to the army base at Exeter and eventually to the tribal centre that followed. A similar process later occurred at Caerleon, the fortress here being established on the tidal reach of the river Usk.

Ptolemy placed *Isca Legio II Augusta* in the territory of the Dumnonii, its nearest neighbour to the east being *Dunium*, a polis of the Durotriges (Ptolemy *Geography* II.3.13). Identification of *Dunium* has proved problematic, especially as it is both a name unrecorded in any other source for the area, but also as it evidently does not relate to the tribal civitas of *Durnovaria* (Dorchester), as established in the *Antonine Itinerary* (Antonine Itinerary XV). Rivet and Smith suggested that *Dunum* was a more likely name than *Dunium*, the 'i' being intrusive (Rivet and Smith 1979, 344), the name-form ultimately deriving perhaps from *dunos* or *dunon* meaning a hill or hillfort (hence *dinas* in Welsh or *dun* in Irish: Rivet and Smith 1979, 274). Thought to refer to a fortified place of the Late Iron Age, *Dunum* or *Dunium* (hereafter simply referred to as *Dunium*) being "one of the most important aspects of Celto-Latin toponymy" with at least sixteen Romano British placenames having derived from it (Rivet and Smith 1979, 274), the Durotrigian *Dunium* has traditionally been identified as Maiden Castle, something that Wheeler thought was borne out by both the impressive size of the hillfort together with the later establishment of the civitas *Durnovaria* (Dorchester) nearby (Wheeler 1943, 61; 1956, 104). The possible presence of early Roman timber buildings within the ramparts of Iron Age Maiden Castle has also been alluded to (Todd 1984; Manning 2002, 32), something which, if true, could further strengthen the hillfort's credentials as *Dunium*. It is worth pointing out, however, that no definite evidence for Roman military structures, least of all barrack blocks, was identified during the most recent geophysical survey of the site (Stewart and Russell 2017, 106–13).

Rivet and Smith noted that the distance from *Londinium* to *Dunium*, as recorded by Ptolemy, appeared to better suit Hod Hill, rather than Maiden Castle, where the establishment of a Roman fort within the north-western circuit of the Iron Age hillfort could conveniently explain the origins of the name (Rivet and Smith 1979, 145). Unfortunately, with regard to the theory that *Dunium* was Hod Hill, or even Maiden Castle for that matter, archaeological examination has shown that no Dorset hillfort was politically or economically active at the time of the Roman invasion and it is likely that another, less archaeologically obvious (and perhaps as yet undiscovered) settlement focus may originally have served as the Durotrigian polis (Papworth 2008, 86–91; Stewart and Russell 2017, 169–70).

A third possibility presents itself: that *Dunium* was actually the port of Hengistbury Head. As a key harbour with extensive cross-channel connections, Hengistbury was an important prehistoric trade hub on the confluence of the rivers Avon and Stour which, unlike the hillforts of Dorset, Hampshire and Southern Wiltshire, appears to have broadly remained in use into the second century AD (Cunliffe 1987, 67 and 141). Ptolemy, of course, does not state unequivocally that *Dunium* was the political centre of the Durotriges, merely that it was a polis or town within their territory. It should be noted that the distance from *Londinium* to *Dunium*, as recorded by Ptolemy, appears to accord well with *Dunium* being Hengistbury Head whilst the distance from Hengistbury to the fortress of Lake Farm (19km) is, as Norman Field noted "very close indeed to where *Isca Legio II Augusta* was placed by Ptolemy's figures" (Field 1968b, 309). In fact, Ptolemy's identification of *Isca Legio II Augusta* as a polis of the Dumnonii (presumably Exeter), does not fit the landscape of the *Geography* at all well, being "far more displaced from its putative Roman equivalent than any other town shown" (Field 1968b, 309).

Neither do the distances quoted in the Antonine Itinerary (XV) accord with the distances from *Durnovaria* (Dorchester) to *Isca* (assumed to be Exeter) even with the inclusion of the unknown intermediary location of *Muriduno*. Since *murus* is the Latin word city wall or rampart, the placename *Muriduno* could simply be translated as 'the Walls of *Dunium*', the distance from Dorchester to the cross-dykes of Hengistbury, 36 Roman miles (53km) being a close match with the distance from Hengistbury to *Isca*, 15 Roman miles (22km), also fits the suggestion that *Isca* was Lake Farm. If the II Augusta legion were somewhat conservative in fortress nomenclature, it is perfectly possible that *Isca* was the designation that they gave not only to Exeter and Caerleon, but also to Lake Farm before. Certainly, a military base sited perilously close to the lower reaches of the river Stour (with Stour like *Isca* possibly meaning 'lower water' as in the Welsh term *is dŵr*: Rowland Jones 1764), where it could directly be accessed from Hengistbury Head and the sea, at the very fringes of the river's floodplain, would perhaps more than justify the designation *Isca*, supporting Norman Field's theory and helping to significantly re-write the Roman geography of Southern Britain.

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REFERENCES

Adam, N. and Valentin, J. 2002. *Archaeological evaluation at Lake Farm, Wimborne, Dorset*. Unpublished AC Archaeology document ref: 2802/2/1, Chicklade.

Alcock, L. 1975. *By South Cadbury is that Camelot: the excavation at Cadbury castle 1966–70*. Thames and Hudson, London.

Bidwell, P. 1979. *The legionary bath-house and basilica and forum at Exeter, with a summary account of the legionary fortress*. Exeter Archaeological Report 1, Exeter.

Branigan, K. 1973. 'Vespasian and the South-West'. *Proceedings of the Dorset Natural History and Archaeological Society* **95**, 50–57.

Branigan, K. 1980. *Roman Britain: Life in an Imperial Province*. Reader's Digest, London.

Bugler, J. and Drew, G. 1973. 'Roman Dorset'. *Proceedings of the Dorset Natural History and Archaeological Society* **95**, 57–70.

Cheetham, P., Stewart, D. and Russell, M. Forthcoming. 'Evaluation Excavation of the Southern Annex of Lake Farm Legionary Fortress'

Cunliffe, B. 1978. *Iron Age communities in Britain: an account of England, Scotland and Wales from the Seventh Century BC until the Roman Conquest* (second edition). Book Club Associates, London.

Cunliffe, B. 1987. *Hengistbury Head Dorset Volume 1. The prehistoric and Roman settlement 3500BC – AD500*. Oxford Committee for Archaeology, Oxford.

David, A. 1977. *Lake Farm*. London: Unpublished Ancient Monuments Laboratory Geophysical Survey Report no 76/11.

David, A. and Thomas, B. 1980. *Lake Farm – report on magnetometer survey*. London: Unpublished Ancient Monuments Laboratory Geophysics Section Report no 21/80.

David, A., Clark, J. and Bolton, D. 1982. *Lake Farm – report on magnetometer survey*. London: Unpublished Ancient Monuments Laboratory Geophysics Section Report no 18/82.

David, A. and Bolton, D. 1983. *Lake Farm – report on magnetometer survey*. London: Unpublished Ancient Monuments Laboratory Geophysics Section Report no 21/83.

Down, A. 1981. *Chichester Excavations* 5. Phillimore, Chichester.

Down, A. 1988. *Roman Chichester*. Phillimore, Chichester.

Field, N. 1967. 'Excavations on the Roman military site at Lake Farm, near Wimborne'. *Proceedings of the Dorset Natural History and Archaeological Society* **88**, 143.

Field, N. 1968a. 'Excavations on the Roman military site at Lake near Wimborne, 1968'. *Proceedings of the Dorset Natural History and Archaeological Society* **89**, 171.

Field, N. 1968b. 'Ptolemy's Isca'. *Antiquity* **42**, 309–11.

Field, N. 1969. 'Excavations on the Roman military station at Lake Farm near Wimborne, 1969'. *Proceedings of the Dorset Natural History and Archaeological Society* **90**, 188–9.

Field, N. 1970. 'Excavations on the Roman military station at Lake near Wimborne, 1970'. *Proceedings of the Dorset Natural History and Archaeological Society* **91**, 151.

Field, N. 1971. 'Excavations on the Roman military station at Lake near Wimborne, 1971'. *Proceedings of the Dorset Natural History and Archaeological Society* **92**, 161.

Field, N. 1992. *Dorset and the Second Legion: new light on a Roman campaign*. Dorset Books, Exeter.

Field, N. and Butler, R. 1965. 'Excavations at Lake Gates, Pamphill, near Wimborne, Dorset'. *Proceedings of the Dorset Natural History and Archaeological Society* **86**, 99–101.

Field, N. and Butler, R. 1966. 'Excavations at Lake near Wimborne, 1966'. *Proceedings of the Dorset Natural History and Archaeological Society* **87**, 115.

Frere, S. 1974. *Britannia: a history of Roman Britain*. Pimlico, London.

Harding, D. 1974. *The Iron Age in Lowland Britain*. Routledge, London.

Henderson, C. 1988. 'Exeter (Isca Dumnoniorum)', in G. Webster (ed.) *Fortress into City. The Consolidation of Roman Britain first century AD, 91-119*. Batsford, London.

Hearne, C. and Birbeck, A. 1999. *A35 Tolpuddle to Puddletown Bypass, Dorset, 1996–8*. Wessex Archaeology Report 15, Salisbury.

Horsey, I. 1980. 'Lake Roman Fortress'. *Proceedings of the Dorset Natural History and Archaeological Society* **102**, 88.

Horsey, I. and Jarvis, K. 1979. 'Poole'. *Proceedings of the Dorset Natural History and Archaeological Society* **101**, 139.

Horsey, I. and Jarvis, K. 1981. 'Lake fortress, Poole'. *Proceedings of the Dorset Natural History and Archaeological Society* **103**, 123.

Jones, R. 1764. *The Origin of Language and Nations: Hieroglyphically, Etymologically and Topographically Defined and Fixed*. Privately Printed, London.

Manning, W. 2002. 'Early Roman campaigns in the South-West of Britain', in R. Brewer (ed), *The Second Augustan Legion and the Roman Military Machine*. National Museum of Wales, Cardiff, 27–44.

Mattingly, D. 2006. *An Imperial Possession: Britain in the Roman Empire*. Penguin, London.

Maxfield, V. 1989. 'Conquest and aftermath', in M. Todd (ed) *Research on Roman Britain, 1960–89*. Britannia Monograph 11, London, 19–30.

McWhirr, A. 1988. 'Cirencester', G. Webster (ed) *Fortress into city. The consolidation of Roman Britain, first century AD*. Batsford, London, 74–90.

Milward, J. 2009. *Lake Farm, Wimborne, Dorset. Archaeological Evaluation and Watching Brief Report (Scheduled monument no. 736)*. Unpublished Wessex Archaeology Report Ref: 72110.02, Salisbury.

Papworth, M. 2008. *Deconstructing the Durotriges: a definition of Iron Age communities within the Dorset environs*. British Archaeological Report 462, Oxford.

Peddie, J. 1987. *Invasion: the Roman Conquest of Britain*. Sutton, Gloucester.

Pitt-Rivers, A. 1887. *Excavations in Cranborne Chase near Rushmore on the borders of Dorset and Wiltshire. Volume I*. Privately Published, Rushmore.

Pitt-Rivers, A. 1888. *Excavations in Cranborne Chase near Rushmore on the borders of Dorset and Wiltshire. Volume II 1880–1888*. Privately Published, Rushmore.

Richmond, I. 1968. *Hod Hill volume 2: excavations carried out between 1951 and 1958*. Society of Antiquaries of London, London.

Rivet, A. and Smith, C. 1979 *The place-names of Roman Britain*. Batsford, London.

Russell, M. 2019. 'Mythmakers of Maiden Castle: breaking the siege mentality of an Iron Age hillfort'. *Oxford Journal of Archaeology* **138**, 325–42.

Russell, M., Cheetham, P., Barrass, K., Evans, D., Hambleton, E., Manley, H., Pitman, D. and Stewart, D. 2017. 'The Durotriges Project 2017: an interim statement'. *Proceedings of the Dorset Natural History and Archaeological Society* **139**, 106–111.

Salway, P. 1981. *Roman Britain*. Oxford University Press Oxford.

Sauer, E. 2005. 'Inscriptions from Alchester: Vespasian's base of the Second Augustan Legion?'. *Britannia* **36**, 101–33.

Sharples, N. 1991a. *Maiden Castle: excavations and field survey 1985–6*. English Heritage, London.

Sharples, N. 1991b. *Maiden Castle*. Batsford, London.

Sparey-Green, C. 2015. 'Inungi delectus – the Recruitment of Britons in the Roman Army during the Conquest: the evidence from Dorset' in Roselaaer, S. (ed.) *Processes of Cultural Change and Integration in the Roman World*. Brill, Leiden, 106–135.

Stewart, D. and Russell, M. 2017. *Hillforts and the Durotriges: a geophysical survey of Iron Age Dorset*. Archaeopress, Oxford.

Stewart, D., Cheetham, P. and Russell, M. 2020 'A Magnetometry Survey of the Second Augustan legionary fortress at Lake Farm, Dorset'. *Britannia* **51**, 223–6.

Todd, M. 1984. 'The Early Roman phase at Maiden Castle'. *Britannia* **15**, 254–5.

Todd, M. 2007. 'Roman military occupation at Hembury (Devon)'. *Britannia* **38**, 107–23.

Tomlin, R. 2018. *Britannia Romana, Roman Inscriptions and Roman Britain*. Oxbow, Oxford.

Wainwright, G. 1968. 'The excavation of a Durotrigian farmstead near Tollard Royal in Cranborne Chase, Southern England'. *Proceedings of the Prehistoric Society* **34**, 102–47.

Wainwright, G. 1979. *Gussage All Saints: an Iron Age Settlement in Dorset*. Her Majesty's Stationary Office, London.

Watkins, D. 1989. 'Observations during the construction of a pipe trench at Lake Farm – an interim note'. *Proceedings of the Dorset Natural History and Archaeological Society* **110**, 145.

Webster, G. 1972. 'Interim report on excavations at Lake Farm near Wimborne, 1972'. *Proceedings of the Dorset Natural History and Archaeological Society* **93**, 76–7.

Webster, G. 1974. 'Interim report on excavations at Lake Farm, Wimborne, 1973'. *Proceedings of the Dorset Natural History and Archaeological Society* **95**, 86–87.

Webster, G. 1979. 'Final report on the excavations of the Roman fort at Waddon Hill, Stoke Abbott, 1963–69'. *Proceedings of the Dorset Natural History and Archaeological Society* **101**, 51–90.

Webster, G. 1980. *The Roman Invasion of Britain*. Book Club Associates, London.

Wheeler, M. 1943. *Maiden Castle, Dorset*. Society of Antiquaries, London.

Wheeler, M. 1956. *Still Digging: Interleaves from an Antiquaries Notebook*. Dutton, London.

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LATER PREHISTORIC AND ROMANO-BRITISH OCCUPATION AT TOWNSEND FARM, POYNTINGTON. GEOPHYSICAL SURVEY AND EVALUATION 2010–11

CLARE RANDALL

Geophysical survey and trial excavations were carried out on two fields, Hanglands and Fairmile, at Townsend Farm, Poyntington, Dorset. Gradiometry was carried out across the entirety of Hanglands. Despite having been seriously affected by ploughing it produced evidence of linear cut features and included curvilinear anomalies possibly representing roundhouses. Three evaluation trenches were positioned with the aim of characterising the geophysical anomalies, understanding the quality, preservation, and gaining some chronological understanding. Despite considerable truncation by ploughing, an enclosure ditch and a curvilinear gully of later prehistoric date were identified as well as an undated terrace along the break in slope on the eastern side of the field, which could be Romano-British or medieval. Gradiometry over a small area at the north end of Fairmile, identified anomalies on a rectilinear alignment where Romano-British pottery had been recovered from the surface, including a South East Dorset Orange Wiped Ware sherd of the late 4th–early 5th century AD. The anomalies are suggestive of a substantial Romano-British building and associated features. The limited investigations have demonstrated an area of later Iron Age occupation adjacent to what appears to be a previously unrecorded villa.

INTRODUCTION

The work at Townsend Farm, Poyntington, was prompted by the discovery of a selection of pottery and burned stone by Mr Lewis whilst metal detecting. The South Somerset Archaeological Research Group (SSARG) was invited to carry out a geophysical survey and exploratory excavation, which took place over the summer, autumn and winter of 2010–2011.

BACKGROUND

The current parish of Poyntington has had a complex history, having been part of the Horethorne Hundred from before Domesday, and remaining part of Somerset until 1888. The current parish and county boundary runs along the top of Poyntington Hill immediately to the east of the site, and follows the route of a Late Saxon herepath (Davey 2005, 102). The village of Poyntington, recorded in Domesday and located c. 1km to the south of the site, is situated around the water courses. The church is of 12th century origin (RCHME 1974, 186) although earlier origins have been suggested. The Manor House and Court House, close to the church both have late medieval origins and there are medieval lynchets in the south-east part of the parish (RCHME 1974, 188–189). An unexplored promontory hillfort is known to the east at Milborne Wick. The site is immediately to the south of Poyntington Down, which had extensive gradiometry and some excavation as part of the South Cadbury Environs Project (SCEP). Most features examined as part of that work were Late Bronze Age and Iron Age in origin, although scattered Romano-British pottery was noted in the topsoil in test pits (Tabor 2008). There are also a number of recorded find spots of Romano-British pottery within Poyntington parish largely clustering around the outskirts of the modern village.

The site is centred on NGR ST 649 210 and covers two fields known as Hanglands and Fairmile (Fig. 1) situated to the north of the village of Poyntington. The bedrock geology in Hanglands is Fuller's Earth Rock Member – Limestone, which forms the promontory of which it consists, whilst Fairmile is Fuller's Earth Formation – Mudstone (BGS 2016). The soils are shallow loamy lime-rich and free draining. A source of one of the many tributaries of the Yeo rises c. 800m to the north-west and runs at the base of the hill on the west side of Hanglands through Poyntington village situated to the south.

The western field, Hanglands, covers the apex of a promontory c. 125m above Ordnance Datum (aOD) at the north end with the eastern field boundary slightly down slope (c. 110–115m-aOD). There is a steep drop to the west with the Yeo at the base and the land slopes away to the south (c. 100m aOD). This field was in grass at the time of investigation but clearly had been previously ploughed given the quantity of broken stone visible on the surface. The eastern field, Fairmile, comprises the western side of a dry valley, at the southern end of which is the source of a stream which runs north-south down towards Poyntington village. It slopes over its length from c. 125m to c. 95m aOD, north to south and generally from c. 115m – c. 100m aOD west to east, creating a south-east facing slope. Fairmile was in an arable rotation and had spring barley sown in late 2010.

Geophysical survey was carried out over a small area of Fairmile, but could not be extended due to the timing and crop rotation. A small surface sampling exercise examined the same area. Geophysical survey was also carried out in the adjacent field, Hanglands along with targeted excavation of three trial trenches. Full details are included in the HER report (Randall 2019). It had been intended to carry out additional geophysical survey and evaluation, but it was subsequently not possible to arrange further access to the site.

THE GEOPHYSICAL SURVEY, *LIZ CALDWELL*

Fairmile

A small test survey in Fairmile, revealed a series of contiguous linear positive and negative magnetic anomalies on a north-east to south-west alignment forming a clearly rectilinear arrangement (Figs 2 and 3). The anomalies indicate some subdivision of the rectilinear area. Readings are suggestive of a stone structure with possible associated structures/enclosures.

Hanglands

The results are dominated by an extensive network of linear anomalies suggesting multi-phase activity (Fig. 3). At least four major systems are distinguishable by their orientation. The readings are generally within the range for ditches with thermo remnant or high organic content and are consistent with those for field boundaries and enclosures. There is also a small grouping of curvilinear anomalies suggestive of circular structures south-east of the centre of the field. A weak but significant linear trend on an east-west alignment crosses the eastern side of the field, with readings and appearance consistent with those for plough marks. The results also reveal a number of other linear anomalies which are of differing alignment to each other and to the dominant linear systems.

There is a general scatter of non-linear anomalies across the survey area. These are within the range

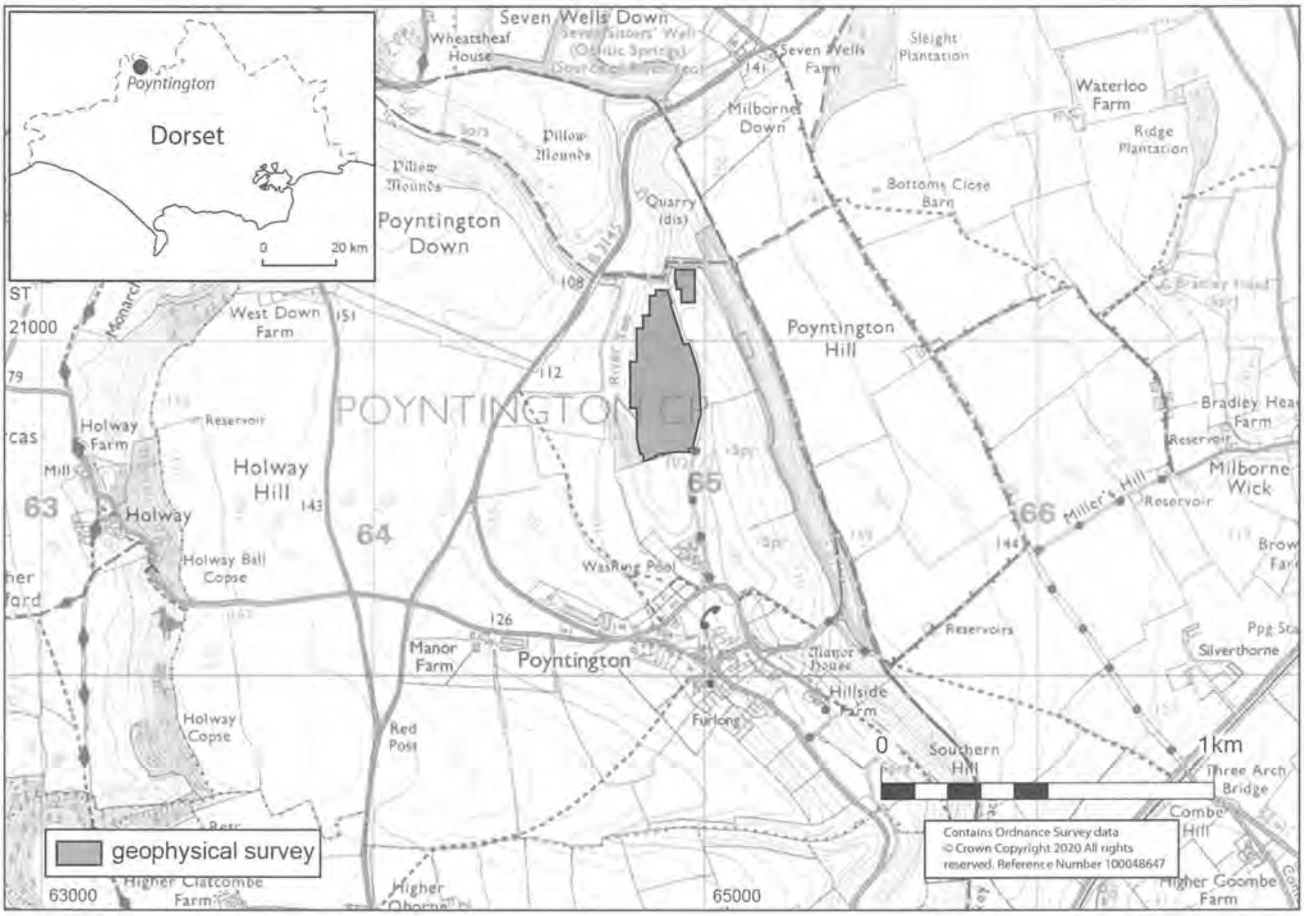

Figure 1 Location of Hanglands and Fairmile, Townsend Farm, with location of evaluation trenches 1–3.

for pits/cut features containing thermo-remnant/organic material. Some of these apparent features appear concentrated in and around specific linear and curvilinear anomalies, suggesting an association. Some of these anomalies have a strong magnetic signature exceeding 20nT which is within the range for significant thermo-remnant features, e.g. hearths or features with a fired or ferrous magnetic content. These appear to be concentrated around the central area of the field at the highest topographical point. The major ferrous magnetic anomaly to the west of the field is due to a former quarry.

SURFACE COLLECTION

Surface collection in Fairmile

Metal detecting in Hanglands (around NGR 364834 120975) had previously produced two Roman coins. Whilst detecting in the north-western corner of Fairmile, Mr Lewis noticed further material, largely burned stone and pottery, and gathered a sample. On further examination by SSARG, two concentrations of material were noted, largely on the upslope side adjacent to the north-west hedge boundary, presumably where the plough was cutting into the thinner soils. There was a notable scatter of limestone on the surface at NGR 364963 121042, and some pieces appeared dressed. Additionally there were burnt stones present and most of the Romano-British pottery came from this area. Materials recovered included hand-made ceramic building materials, animal bone, flint, and Romano-British pottery, including Black Burnished Ware (BB1) and Savernake ware (from NGR 364923 121166) as well as another three Roman coins.

Ploughzone sampling in Fairmile

A limited programme of ploughzone sampling by shovel pitting was undertaken, covering the same

Figure 2 Fluxgate gradiometer survey. Hanglands, with location of evaluation trenches.

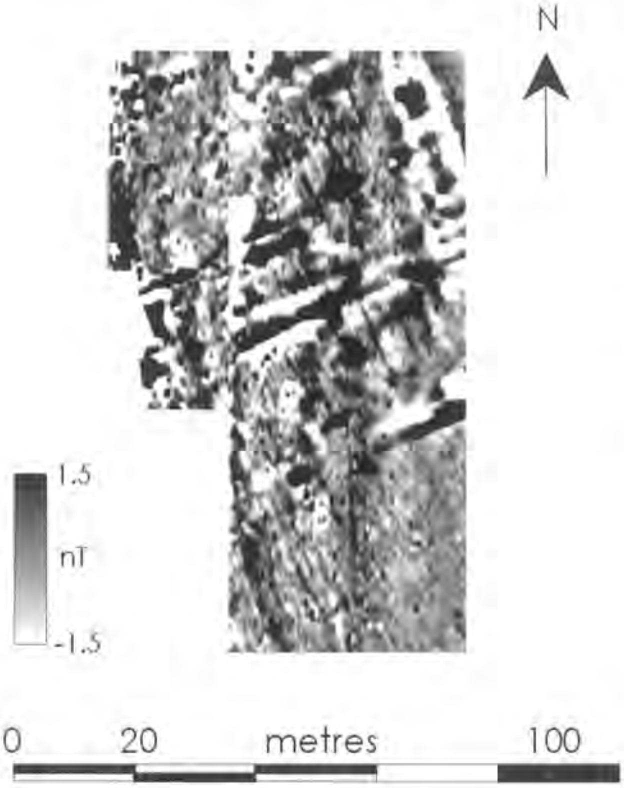

Figure 3 Fluxgate gradiometer survey. Detail of Fairmile

area and grid as the gradiometery survey. At each grid point (every 20m 40 litres of soil was screened through a 10mm mesh sieve to retrieve and note all finds. This produced a small selection of post-medieval and Romano-British material, but at low levels which did not produce any noticeable concentrations of material. It is suspected that the material retrieved from the area over the geophysical anomalies is likely to be derived from upslope as more substantial pieces of surface collected material retrieved from near the hedge may be from deposits which have been disturbed by ploughing.

THE EXPLORATORY EXCAVATION IN HANGLANDS

Three test trenches, 5m × 1m were excavated by hand in Hanglands (Fig. 2), positioned to examine anomalies noted on the geophysical survey. Hanglands was laid to pasture, but was known to have been previously ploughed. In Trenches 1 and 2, on the plateau, the topsoil (contexts (1001) and (2001)) was a yellowish/reddish brown sandy silt with a large number of angular and sub-angular small to medium limestones, clearly resulting from ploughing. In Trench 3, the soil matrix of the topsoil (3001) was similar, but contained fewer, smaller and less angular limestone fragments. The topsoil in Trench 1 overlay a subsoil (1002) with a similar matrix, also containing large numbers of limestones as well as burnt and cultural material, which overlay the natural limestone (1003). In Trench 2 the topsoil directly overlay the natural limestone (2004). In Trench 3, the limestone natural (3004) was overlain by a possible buried soil (3003) and hillwashes (3002) and (3005). Features which corresponded with anomalies on the gradiometry were identified in all three trenches, with an additional feature in Trench 2.

Trench 1 had been located to examine a linear anomaly which appeared to be a north-south aligned element of a sub-rectilinear enclosure. A ditch, F1001 (Fig. 4) corresponded completely with this anomaly. The entire feature was 2.20m wide and almost 0.60m deep, with a gently sloping concave side on the west. This cut was filled with a largely stone free silt (1005). F1001 had apparently then been re-cut on the same alignment, but with a moderately steep concave western side, which more closely mirrored the steep cut into the natural limestone on the eastern side. This re-cut was 1.40m wide and 0.58m deep and filled with a similar yellow-brown silt, but which contained a considerably greater quantity of limestones, burned and unburned. A single sherd of Romano-British pottery and handful of post-medieval pottery was recovered from the topsoil and sub-soil in Trench 1, but not from F1001.

In Trench 2 (Fig. 5) a gully or shallow linear (F2002) was located which corresponded with one geophysical anomaly. This was on a broadly east-north-east to west-south-west alignment. It had straight sides and a flat base and was 0.48m wide and 0.22m deep. A single fill (2002) of sandy clay silt contained some medium-large angular limestones as well as burnt stone and charcoal flecks. This fill contained a number of sherds of late Iron Age/ Romano-British pottery, animal bone and a single small fragment of vessel glass. A posthole or small pit (F2001) was also located in this trench, comprising a sub-circular shallow cut with near vertical sides,

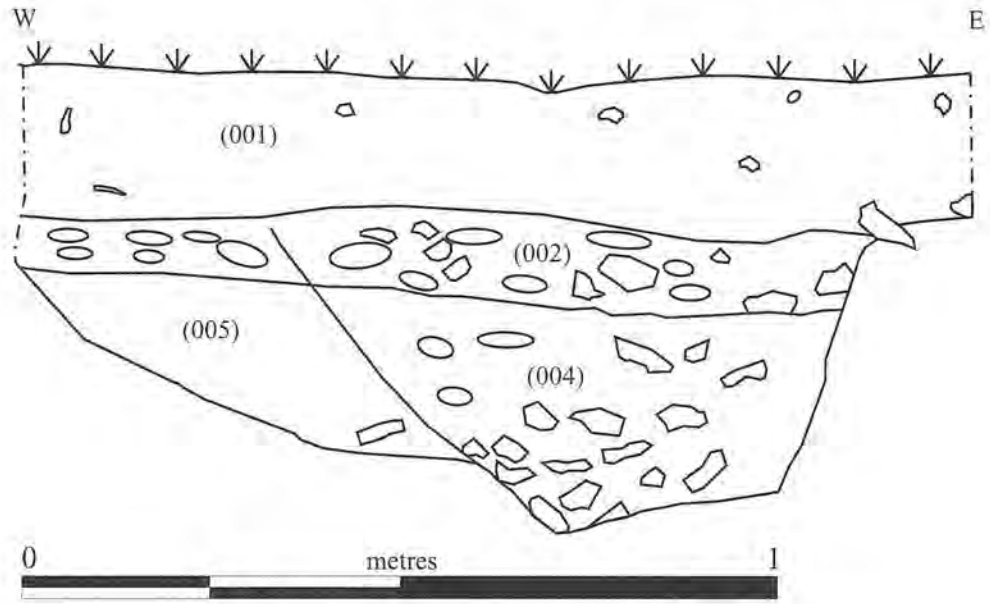

Figure 4 Trench 1, Ditch F1001, (facing N; 2m scales).

0.48m in diameter, and contained a similar fill to F2002, including burnt stones. The exact nature of both of these features was difficult to appraise as they both appeared to be heavily truncated.

Trench 3 was situated on the east facing slope to examine a diffuse linear geophysical anomaly. This trench contained a subsoil (3002) of reddish yellowish-brown sandy silt with moderate fine and medium sub-angular limestones which was 0.30m thick, interpreted as a colluvial layer. This sealed a similar layer (3003), which had built up on the natural limestone (3004). The natural limestone was exposed in a strip across the centre of the trench, with another silty build up to the east of it. The location where it was exposed corresponded to the anomaly on the geophysics, and it seems likely that as it followed the contour of the hill this represented a cultivation terrace and slight lynchet.

FINDS

The Pottery from the Hanglands evaluation excavations, Clare Randall

A total of 42 fragments of pottery were recovered from the three trenches, almost half of it 18th century or later in date, and the majority of the material from the topsoil. A total of 16 sherds of post-medieval pottery were recovered, 15 from topsoil contexts and one small fragment of bone china in posthole (2003). This selection of material included probably locally produced glazed coarsewares, as well as 19th century transfer print table ware, white china, and imported glazed stoneware.

Seven sherds in different fabrics, were identified as broadly prehistoric, variously including calcite, flint, limestone and platy shell. Almost all of these sherds were small and very heavily abraded, potentially representing manuring or related to the degree of stone in the topsoil. They may be Iron Age in date, with some conceivably earlier. All but one sherd was from Trench 2, with five fragments coming from the fill of F2002. Their condition implies that they may have been redeposited. A single sherd came from the colluvium (3002) in Trench 3. Trench 2 also produced six sherds of shell tempered pottery which can be more firmly assigned a Middle Iron Age–Late Iron Age date. Three sherds came from the topsoil and three from the fill of F2002, with the largest and freshest prehistoric sherd, albeit a wall fragment, from this feature.

A single very small and abraded sherd of probably Romano-British pottery came from layer (1002). A total of twelve undiagnostic, probably wall, sherds

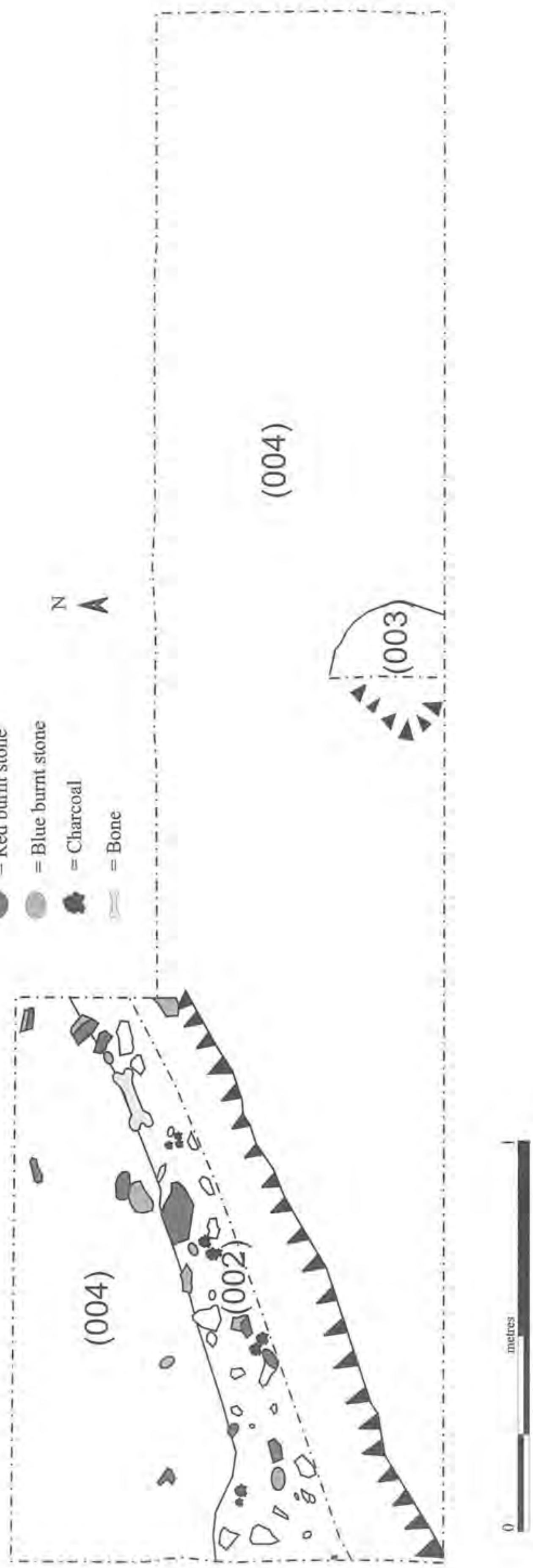

Figure 5 Plan, Trench 2 gully F2001.

Table 1 Coins.

Ruler	Description	Mint	Reference	Reece Period	Date (AD)
Claudius II	Obverse: illegible – Bust, right radiate Reverse: [IOVI VICTO]RI – Jupiter standing left holding sceptre in left and thunderbolt in right Diameter: 18.1mm Weight: 1.75 g Die axis: 6 o'clock	Rome	Cunetio cf. no. 1997	13	268–270
Theodora	Obverse: illegible – female portrait facing right, braided hair Reverse: [PIETAS ROMANA] – Pietas standing facing, holding infants Diameter: 14.5mm Weight: 0.74 g Die axis: 6 o'clock	-	-	17	337–340
Constans	Obverse: CONST[ANS ---] – Bust facing right, laureate, cuirassed Reverse: VICTORIAE DD [AVG Q NN] – Two Victories holding wreaths Mint mark: NR ligated/--- Diameter: 12.8mm Weight: 1.52 g Die axis: 6 o'clock	Arles	LRBC Pt I, No. 454	17	341–346

were identified as Late Iron Age/Romano-British sandy fabric. All but one of these came from Trench 2, with seven sherds from the topsoil and four from the fill of F2002. The sherds from the topsoil were small and abraded, those from F2002 less so. One sherd was recovered from the colluvial deposit in Trench 3.

Surface collected Romano-British pottery from Fairmile, James Gerrard

A single rim from an everted rim pie-crust decorated jar probably of Wessex Archaeology Type 12 was one of the initial surface collected finds from the site. The fresh sherd weighs 51g and has a single pre-firing perforation. The fabric appears consistent with South- East Dorset Orange Wiped Ware. These vessels have been discussed by Gerrard (2010) where they are argued to be one of the latest components of the Roman period Poole Harbour pottery industries. A date in the range of *c.* AD 350–450 is appropriate for the sherd. Its appearance at Poyntington is of some interest as this is beyond its current known distribution in southern and eastern Dorset.

The surface collected coins from Fairmile, Ciorstaidh Hayward Trevarthen

Three coins were recovered from the topsoil in Fairmile and are identified in Table 1. These are all 3rd and 4th century in date.

Stone, flint and other finds from Hanglands, Clare Randall

Two small pieces of a micaceous red sandstone were recovered from the topsoil (2001) in Trench 2. A larger old red sandstone fragment with one flat face came from the topsoil (3001) of Trench 3. A total of three pieces of flint were also found in topsoil contexts. One very small chip came from Trench 2. A small unworked flake came from (3001) and another piece may be a plough damaged fragment of core. None of this material is inherently dateable, but it is likely that the flint and Old Red Sandstone fragment are later prehistoric in origin.

A small selection of other finds came largely from topsoil contexts. A total of six fragments of ceramic building material were recovered from Trench 2 and Trench 3. Most of this was of a clearly handmade appearance, but all was small and abraded. Five small fragments of fired clay were recovered from (1001). A possible Romano-British hobnail came from the buried soil (3003).

The human remains from Hanglands, Clare Randall

A single fragment of human bone was recovered from the topsoil of Trench 1. This comprised part of the proximal shaft of a left third metacarpal. The proximal end was fairly abraded, and the breaks at the distal end of the fragment (about mid-shaft) have a slightly ragged appearance indicating that the breakage occurred when the bone was no longer fresh. The bone condition is however good. It would seem that this element has been displaced by ploughing. Comment can only be limited, but it is worth noting that human remains are a not infrequent inclusion in later prehistoric features in this area (Randall 2010).

Faunal remains from Hanglands, Clare Randall

A total of 22 fragments of animal bone were recovered, 21 from Trench 2 and one from Trench 3. All of the material was fragmented and poor-average in condition. Cattle and sheep/goat were identified as well as cattle-sized and sheep-sized mammal bone, but more than half of the material came from topsoil contexts. The rest of the material came from the fill of F2002, the later Iron Age gully, including cattle and sheep/goat. Little can be said about this limited assemblage, but the presence of livestock is to be expected in this period. A range of body parts was present, as well as evidence for gnawing (indicating the presence of dogs); aging information was limited.

DISCUSSION

The geophysical survey, surface collection and excavation of Hanglands and Fairmile have demonstrated that there is a nucleus of both prehistoric and Romano-British activity situated on the hilltop and at the head of the dry valley above the village of Poyntington.

The enclosure ditch in Hanglands Trench 1 remains undated, but the gully in Trench 2 produced clearly prehistoric pottery. This feature probably dates to the end of the Iron Age or early Romano-British period, but was evidently located close to earlier Iron Age activity, with probably residual Middle to Late Iron Age sherds also present. The greatest concentration of prehistoric and LIA/RB pottery occurred in the topsoil of Trench 2, which suggests that ploughing has affected the area truncating archaeological features. The only find from a very shallow posthole was an extremely small fragment of 19th century pottery, but this may well be intrusive, and it is more likely that this was a largely ploughed out feature associated with the gully. It is possible that this represents part of a roundhouse or other settlement structure. It would seem to support the possibility that there was an area of later prehistoric settlement on the top of the rise, possibly associated with a number of boundaries which may represent associated field systems. The work carried out by the South Cadbury Environs Project immediately to the north on Poyntington Down and Milborne Down identified linear and other features of later prehistoric date, although most of these related to the Sheep Slait ringwork and associated field system dating to the Late Bronze Age/Early Iron Age transition (Tabor 2008, 94). The Hanglands occupation may represent shifting settlement around the locality during the later prehistoric period.

The small area of geophysical survey which could be undertaken in Fairmile has provided a tantalising glimpse of apparently regular, rectilinear anomalies. Although no further work was possible due to the agricultural regime, the clear geophysical anomalies indicate that features are likely to be better preserved than those in the adjacent field where ploughing has caused truncation. The anomalies may represent an arrangement of structures at least 40m long by 60m wide. At the eastern extent of the survey, a series of linear anomalies characterised by a very low magnetic response appear consistent with a stone-built structure in the region of 40m long and more than 10m wide. The anomalies suggest a cellular arrangement of internal divisions, each measuring *c.* 5–6m by *c.* 3–4m. The rest of the survey area contains further linear anomalies aligned at right angles to this potential building. These positive and negative anomalies demarcate an area at least 60m across and may represent either wall foundations or ditched boundaries. The surface collected finds from Fairmile, from immediately above some of these structures, were probably generated by the plough cutting into archaeological deposits along the upslope/north-west headland. They are almost exclusively of Romano-British date, with some indications of occupation very late in the Romano-British period. Metal detected material reported from Hanglands indicates that Romano-British activity extended upslope, although none of the features examined could be dated to this period.

The indications are therefore of a substantial Romano-British building and associated archaeological features situated on a sheltered but elevated south-facing slope on fertile agricultural land. The admittedly limited and untested ground plan of potential structures indicated by the gradiometry is highly suggestive of the types of buildings and their arrangement seen in excavated examples of villas in the region such as Halstock and Tarrant Hinton (cf. Lucas 1993, 12; Graham 2006, 53). The overall scale, organisation and similar dimensions of the visible subdivisions support the comparison. This apparently substantial Roman building falls into the group of villas and other contemporary settlements within the orbit of *Lindinis* (cf. Putnam 2007, 94–6), but away from the core distribution. Villas in this area appear in general to be associated with river valleys. The Fairmile building, whilst more distant from an urban centre or known road is situated close to the head of one of the Yeo tributaries. Several other known findspots of Romano-British material in the area occur in similar settings although this pattern has probably been reinforced by the later settlement pattern leading to greater likelihood of discovery. The identification of this site however indicates that we still have an incomplete understanding of the distribution of settlements and estates, and the way in which the productive landscape of the Romano-British period in this area was articulated.

The presence at Fairmile, albeit in the form of a single sherd, of South East Dorset Orange Wiped Ware, extends the documented distribution (Gerrard 2010). That this Poole Harbour product dating from the late 4th or early 5th century AD was reaching the furthest northern reaches of Dorset and into Somerset is significant. A further sherd is present in the South Cadbury Environs Project archive from Sigwells, Charlton Horethorne, *c.* 3km to the north-west of Fairmile. Coins from Sigwells in the SCEP archive suggest activity late into the 4th century AD. As the potential date range for SEDOWW may take us into the first part of the 5th century AD, it is important to note it as an indication that connections could have potentially been maintained with south-eastern Dorset into the immediate post-Roman period and we should be alert to its potential presence in later Romano-British contexts across this region.

Trench 3 in Hanglands examined an undated terrace which corresponded with a long north-south linear indicated on the geophysical survey and situated along the break in the slope. This is most likely an agricultural feature and may be medieval, or indeed earlier in origin. A broadly rectilinear field system on a north-west to south-east alignment has been identified in the surrounding landscape which covers most of the Horethorne Hundred (Davey 2005, 67; fig. 5.3). It is identifiable in the south-west, south and along the western boundary of the parish of Poyntington (which is also the county boundary). It appears that the overall system predates 1086, as the county boundary which was established at this time appears to respect the general alignment (Davey, 2005, 70). In the area of the site, the pattern appears to have been obliterated, with few remnants identifiable in the current land boundaries. However, consideration of the geophysical survey of Hanglands indicates that there are the remnants of a rectilinear arrangement of boundaries on the same general alignment as that identified by Davey. The Trench 3 linear is on this orientation, but the feature remains undated, and its alignment may have been influenced by the local topography. Nevertheless, the field immediately to the north of Fairmile and Hanglands has a 'ham' name, indicative of habitation. It has been identified as part of a dispersed pattern of early medieval settlement within Poyntington parish (Davey 2005, 52, 59). If some of the boundaries seen in Hanglands are part of this broader later 1st millennium AD system of landscape organisation, and the adjacent field provides a hint of early medieval occupation, it is perhaps significant that it occurs immediately adjacent to what may be a substantial Roman building with indications that it may have lingered in use into the 5th century AD.

CONCLUSION

Geophysical survey, supported by ground-truthing excavation, has demonstrated that there are extensive archaeological features and deposits in Hanglands and Fairmile dating to the later prehistoric and Romano-British period. It seems likely that the extent of the archaeology in Fairmile is greater than that covered by the area which was available for geophysical survey, but there are indications of a substantial Romano-British building. The character, arrangement and scale of the anomalies would suggest that this may represent a previously unrecognised villa. Trial excavation has indicated that ploughing has already affected the archaeology in Hanglands, leading to truncation of features and re-deposition of soils on the slopes. It is likely however that the features and deposits in Fairmile are more deeply stratified and protected. If Fairmile represents another villa site, it underlines the density of sites in this area and posits again questions around the differences between the hinterland of Ilchester, and that of Dorchester. In addition, some of the linear anomalies seen may fit within an early medieval organisation of the landscape which is of particular interest if accompanied by a building which was in use at the very end of the Roman period.

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REFERENCES

Davey, J. 2005. *The Roman to Medieval transition in the region of South Cadbury Castle, Somerset.* BAR British Series 399 Archaeopress, Oxford.

Gerrard, J. 2010. 'Finding the Fifth Century: a late fourth and early fifth century pottery fabric from South-East Dorset', *Britannia* **41**, 293–312.

Graham, A. 2006. *Barton Field, Tarrant Hinton, Dorset Excavations 1968–1984.* Dorset Natural History and Archaeological Society Monograph **13**, DNHAS, Dorchester.

Lucas, R. 1993. *The Romano-British villa at Halstock, Dorset Excavations 1967–1985.* Dorset Natural History and Archaeological Society Monograph **17**, DNHAS, Dorchester.

Putnam, W. 2007. *Roman Dorset.* Tempus, Stroud.

Randall, C.E. 2010. 'More ritual rubbish? Exploring the taphonomic history, context formation processes and 'specialness' of deposits including human and animal bone in Iron Age pits', in J. Morris and M. Maltby (eds) *Integrating social and environmental archaeologies: reconsidering deposition.* BAR International Series 2077, Archaeopress, Oxford, 83–102.

Royal Commission on Historical Monuments England (RCHME) 1974. *An inventory of the Historical Monuments in the County of Dorset Vol. 1 West Dorset.* RCHME, London.

Tabor, R. 2008. *Cadbury Castle The Hillfort and landscapes.* The History Press, Stroud.

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A LATER BRONZE AGE GLOBULAR URN FROM WOODSFORD, DORCHESTER

RICHARD TABOR

During a recent phase of long term investigations in advance of gravel extraction at Woodsford Farm Quarry a type IIa Globular Urn was found in a ditch (ST 75738 90004) forming part of an extensive field system (Weale and Tabor 2018, 10–2, 26, fig. 4). The vessel is significant as an unusually late representative of Ann Woodward's Dorset Downs style component of the wider southern British Deverel-Rimbury tradition. It was in a soft, fine to medium grog-tempered fabric. The profile was intact from base to shoulder and reconstruction demonstrated that it had an upright, tapering rim over a straight neck. Decoration comprised a horizontal row of upright fingertip impressions below the rim above a minimum of five, probably more, 10mm wide shallow furrows bounded by a second row of upright fingertip impressions on the shoulder (Fig. 1). The bases of two small horizontally perforated lugs spanned the lower fingertip impressions and the lowest furrow. The wall thickness varied from 9mm to 12mm.

A sample from a residue on the lower interior wall yielded a date range of 1008–831 cal BC at 95.4% confidence, probability 1.0 (UBA-36537; Weale and Tabor 2018, appendix 7). At Bestwall Quarry, Wareham, Deverel-Rimbury style pottery had a long currency within the range 1545–1425 cal BC to 1100–900 BC and it is noteworthy that grog remained an important component in the Late Bronze Age assemblage in contrast to contemporary Somerset and other Dorset sites (Woodward 2009, 265, 270, 253). There is no close correspondence between the Woodsford urn and those from the nearby Knighton Heath cremation cemetery where radiocarbon dates were all several centuries earlier (Petersen 1981, 100–9). However, the Simons Ground cemeteries, east of Wimborne, included several vessels with Dorset Downs style affinities and a significant number of dates implied active use well into the 1st millennium BC (White 1982, 41).

REFERENCES

Ladle, L. and Woodward, A. 2009. *Excavations at Bestwall Quarry, Wareham 1992–2005, volume 1: The prehistoric landscape*, Dorset Natural History and Archaeological Society monograph **18**, Dorchester.

Petersen, F. 1981. *The Excavation of a Bronze Age Cemetery on Knighton Heath, Dorset*, BAR 98, Oxford

Weale, A. and Tabor, R. 2018. 'Woodsford Farm Quarry, Woodsford, Dorset, Area 4: An archaeological

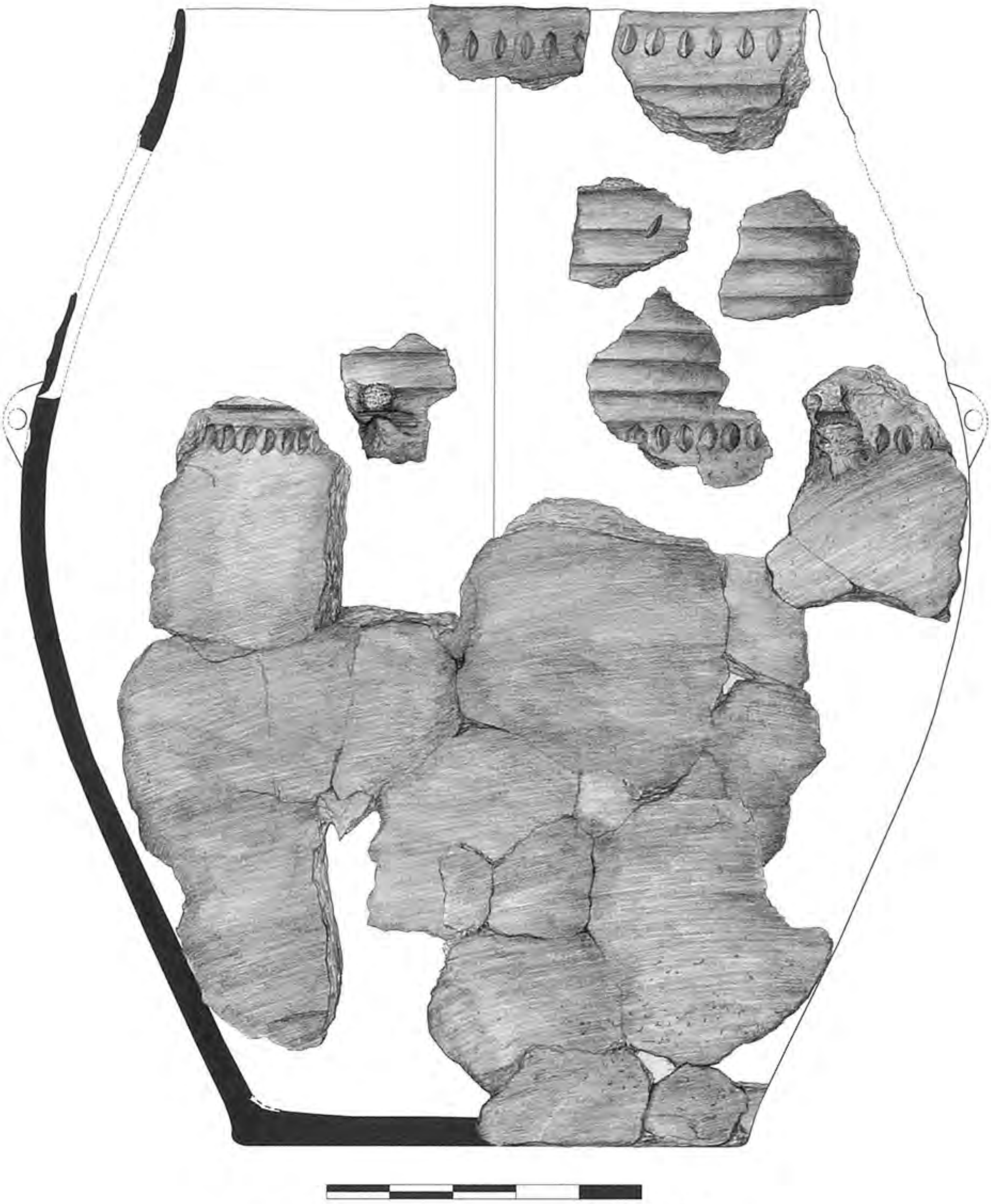

Figure 1 Late Globular Urn, Woodsford (Drawn by Amanda Tabor).

excavation post-excavation assessment', unpublished report, Thames Valley Archaeological Services report 08/129c.

White, D. 1982. *The Bronze Age Cremation Cemeteries at Simons Ground, Dorset*, Dorset Natural History and Archaeological Society monograph **3**, Dorchester.

Woodward, A. 2009. 'The Pottery', in Ladle and Woodward 2009, 200–71.

The author: Dr Richard Tabor, Thames Valley Archaeological Services. Illustration by Amanda Tabor

DORSET ARCHAEOLOGY IN 2019

Manor House Abbotsbury, SY 57663 85201

Context One Heritage and Archaeology carried out an archaeological field evaluation relating to the installation of a below ground oil tank and creation of a patio area. The site is located within the Scheduled Monument of St Peter's Abbey. Two trenches measuring 3.50m × 2.50m and 4m × 1.50m were excavated as part of the evaluation. Despite the archaeological potential, no features or deposits were observed relating to the ecclesiastical remains.

Clare Randall,
Context One Heritage and Archaeology

A338 Wessex Way, Bournemouth, SZ 12975 94965

In October 2019, Wessex Archaeology undertook an archaeological watching brief during the construction of a junction and related works on the A338 Wessex Way, Bournemouth. Four ditches were identified and recorded during the watching brief. The features are thought to represent field boundaries and dated to the medieval period by pottery recovered; a flint flake and burnt flint came from one of the trenches. A single sherd of residual Roman pottery was also recovered.

Finn Cresswell,
Wessex Archaeology

Poundbury B2 Site Poundbury, Dorchester, SY 67330 89972

In July 2019, Wessex Archaeology undertook an archaeological evaluation of land located at Parkway Farm Business Park. The evaluation comprised the excavation, investigation and recording of five trial trenches. A colluvial deposit, overlaying a paleochannel was recorded, and four modern features and a tree-throw hole were identified. No archaeological features pre-dating the modern period were identified or present.

Finn Cresswell,
Wessex Archaeology

Car park to the west of Roman Town House, Dorchester, SY 68915 90963

Context One Heritage and Archaeology carried out an archaeological field evaluation as a preliminary investigation of the preferred location for a new pedestrian ramp between The Grove and the Town House. The investigation area is located between the Roman Town House which is a Scheduled Monument and Grade I listed building, and the Roman Walls and Town Walks which are a Scheduled Monument and listed Park and Garden. The archaeological evaluation consisted of one 'L'-shaped trench positioned to determine at what depth the upper material of the Roman rampart might be encountered and provide information on any more recent disturbance to it. A series of deposits were observed which relate to a former modern cinder pathway which extended eastwards from a blocked opening in the wall onto Colliton Walk. It was constructed to a depth of c. 1m below the tarmac of the current car park surface and is probably a remnant of a later 19th century path or promenade. The pathway had been constructed above and against a series of varying silty clays, with chalk as a frequent component. With the exception of a fragment of post-medieval or modern brick immediately below the car park hogging, no finds were recovered or observed. These deposits are consistent with the known make-up of the upper layer of the Romano-British bank/rampart, although a more recent origin relating to 18th and 19th century landscaping is also likely.

Clare Randall,
Context One Heritage and Archaeology

Land South of Blandford Hill, Milborne St Andrew, SY 80511 97486

An evaluation recovered a moderate assemblage of Late Neolithic or Bronze Age worked flint, primarily as residual material in later features and the topsoil. A Bronze Age funerary landscape was represented an alignment of three barrows along a north-east/south-west alignment. These survived as ring-ditches, one of which was found with an undated inhumation grave, and another with a Bronze Age cremation deposit within a biconical beaker. A smaller ring-ditch was found to the south of the alignment. East of the central barrow in the alignment, a grave contained a child inhumation found with Early to Middle Bronze Age pottery, worked flints and flint nodules. A further possible inhumation grave was located to the north-east. Numerous pits were found across the site, at least some of which may represent further burials. A probable L-shaped ditch which yielded a single sherd of late prehistoric pottery may represent a field boundary and seemed to respect the barrows. Several post-medieval field boundary ditches and undated ditches were also present.

Steven Bush,
Cotswold Archaeology

Church Road, Pimperne, ST 90293 09589

In September 2019, Wessex Archaeology undertook an archaeological evaluation of a 1.05ha parcel of land located at Church Road, Pimperne. No archaeological features were revealed in any of the four trenches excavated, with colluvium uncovered in several. No archaeological features relating to the possible Iron Age enclosure (MDO4566) were encountered, despite it being present approximately 200m west of the site's boundary and within the same agricultural field. Several flint artefacts were recovered during the evaluation indication low-level prehistoric activity within the general environs of the site.

Finn Cresswell,
Wessex Archaeology

Land off High Street, Puddletown, SY 75624 94309

A watching brief recorded residual worked flints and a sherd of prehistoric pottery from the topsoil. An undated ditch, potentially a medieval or post-medieval boundary running south from the High Street, was identified.

Joe Whelan,
Cotswold Archaeology

DORSET RAINFALL 2019

Rainfall totals across Dorset in 2019 were the highest for five years. The average fall of 1163.1mm was 238mm (26%) above the 1981–2010 mean. It was the eighth wettest year in a continuous record back to 1856, the wettest being 2012 with 1314.9mm and 1960 with 1311.6mm. The rainfall of the first seven months of the year was not exceptional, the first widespread heavy rainfall event occurred on August 16th. Further heavy rainfalls produced some high daily totals over the next four months, most noteworthy being that of September 23rd when every station reported more than 25mm.Snowfall in 2019 was limited to one event that produced a general cover of a few centimetres during the evening of January 31st before slowly melting away over the next two or three days.

There were a few lengthy dry periods during the year, in fact most places recorded no rain at all until the third week of January. It was also generally dry across the county from June 25th through to July 16th and for periods of about one week in late August and mid-September. The wettest station in 2019 was Cerne Abbas with 1525.7mm and the driest was Portland with 745.0mm. The highest daily rainfall total was 76.2mm, recorded at Puddletown on September 23rd and this was the most registered in a single day since 86.8mm at Charminster on July 7th 2012.

HIGH 24-HOUR RAINFALL EVENTS IN 2019

Rainfall data analysed from 52 stations showed falls of more than 25mm were recorded somewhere across the county on 21 days. This compares similarly with 19 days in 2018 and 22 days the previous year. There were ten days when five or fewer stations met the 25mm criteria and four days when more than twenty qualified. The most widespread of these high rainfall events are described below.

16 August

A complex frontal system crossed southern England during the day and spread rain across all of Dorset through the morning. Much of the rain

Table 1 Monthly Rainfall and Thunder days in 2019

	Rain days >0.2mm	Rainfall (mm)	1981–2010 av. (mm)	% of av.	Thunder days
Month					
January	11	55.9	97.2	58	0
February	12	69.6	71.3	98	0
March	17	87.4	72.2	121	0
April	11	65.7	62.3	105	2
May	8	28.8	57.6	50	1
June	13	76.8	52.7	146	1
July	7	34.9	51.8	67	4
August	12	74.9	62.8	119	2
September	15	160.6	71.3	225	2
October	23	175.1	109.2	160	3
November	20	144.9	109.3	133	1
December	23	188.5	107.2	176	5
Year	172	1163	924.9	126	21

was quite light initially but became heavier in the afternoon and evening with a strengthening wind. This was also the coolest day of the month with maximum temperatures close to 17C. Over much of the north and east of the county and close to the coast, falls of 15–25mm were recorded while west of a line from Blandford and Wool across to Broadwindsor and Bridport falls of more than 35mm were measured.

(Charminster 50.0mm; Stratton 48.2mm; Bradford Peverell 46.1mm)

23 September

Early sunshine was soon replaced by cloud and rain from the west as another complex series of fronts crossed the county during the rain-day period of the 23rd. A band of rain reached most places by midday or soon after and was followed during the evening by showers. Renewed rain spread east overnight and was heavy at times and did not clear until well after dawn on 24th. In Dorchester 33mm of rain fell in the 3 hours ending 0500hrs GMT. Within this weather system was some tropical air linked to the remnants of ex-hurricane 'Humberto'.

All stations collected more than 30mm of rain in the 24-hour period except for Portland (26.2mm) and for all but two, it was the wettest day of the year. Much of the northwest of the county, extreme east and Purbeck areas along with much of the coastal strip received 35–45mm with 55–65mm across a large area of central Dorset. A small area just to the north of Dorchester recorded in excess of 70mm.

(Puddletown 76.2mm; Charminster 73.1mm; Melbury Sampford 67.0mm)

12 October

A very slow-moving frontal system produced almost continuous light to moderate rain throughout the day and evening and into the small hours of the 13th. The surface wind was virtually calm for much of this period. Most of the county apart from the extreme southwest and southeast received more than 25mm of rain, the result of its longevity rather than intensity. Much of central Dorset from Owermoigne in the south to East Stour in the north and west to east from Evershot to Blandford collected more than 30mm of rain.

(East Stour 36.4mm; Milton Abbas 35.0mm; Cerne Abbas 33.9mm)

Also worthy of note was the exceptionally heavy rainfall that affected much of west Dorset on *9 September*. For two stations, namely Rampisham and Thornford, it was the wettest day of the year with 63.0mm and 45.7mm respectively. A fall of 57mm was reported from Evershot with 49mm at Melbury Sampford. Falls of over 25mm were limited to an arc west of a line from Sherborne through Longburton to Cerne Abbas and Bridport. All of the county recorded rainfall, amounting to 15–22mm across central areas but closer to 10mm in the extreme north and south.

SNOWFALLS

A rather cold north-westerly airstream brought showers to much of Dorset on **January 22nd** and these turned to sleet or wet snow in places towards nightfall and produced a temporary covering at Shaftesbury. As skies cleared during the evening untreated roads and surfaces quickly became icy. There were further snow showers over high ground on the **23rd.**

On the **29th** frontal rain crossed the county and on its back edge, in falling temperatures, it turned sleety before dying out. Showers during the small hours of the **30th** were by now mainly of snow and with temperatures around -2C preserved the covering of about a centimetre until after dawn. Long sunny periods followed the earlier showers and skies remained clear overnight allowing a severe frost to develop with rural temperatures as low as -8C.

A frontal system initially spread rain and sleet into the south-west during the **31st** but this fairly readily turned to snow as it engaged with the cold air already in place. Snow fell quite steadily for about six hours after dusk and was followed by occasional snow flurries.

By dawn on **February 1st** most places had a covering of 4–10 centimetres and more in some exposed areas.

Many roads were impassable, schools closed and no flights were arriving at, or leaving Bournemouth Airport for several hours. Much of north and east Dorset continued to have snow at times until the evening, with further light accumulations. Snow cover gradually diminished over the next couple of days, the remainder disappeared overnight into the **4th** amid rain and an increasingly mild south-westerly wind. Sleet and snow showers were reported quite widely on **March 10th** and **12th**.

THUNDERSTORMS

Thunder was reported as heard on 21 days during 2019 compared with 14 days the previous year and the 30-year average (1986–2015) of 32 days.Much of the thunder was localised, of short duration and associated with passing showers. Most stations reported a 'quiet' year with no more than four thunder days although eight were recorded at West Moors and Gillingham. Five days with thunder in December was the most recorded across the county in a winter month since January 2014 with six. Several separate but short-lived outbreaks of thunder were reported for the morning, afternoon and evening of the 15th.

The most widespread event of the year occurred during the evening of July 23rd into the 24th. The day began with fog in some areas but this quickly 'burned off' to leave cloudless skies until late afternoon. Temperatures soared in the light east or south-easterly airflow, in association with an anticyclone centred to the south-east of the UK. Mid-afternoon 'highs' peaked over 31C well inland with sea breezes keeping it a little cooler close to the coast. For many places this was the hottest day of the year.

Isolated sferics were detected in the Channel in the mid-evening period and storms became widespread very quickly as they approached the coast from Devon to Hampshire. These high-level storms continued north during the late evening with almost continuous lightning and long and low rumbles of thunder for up to two hours. Most stations recorded little (<3mm) or no associated rainfall, although a total of 7.0mm was measured at Gillingham and 6.5mm at West Moors.

GENERAL WEATHER SUMMARY 2019

The mean temperature across the county in 2019 was about 0.5C above the 1981–2010 average with only the months of January, May and November producing a negative anomaly. The year was the wettest since 2014 and eighth wettest in Dorset records back to 1856.

January (The driest since 2012)

The New Year began with two weeks of dry weather, under the influence of high pressure. Temperatures were quite variable during this period depending upon the positioning of the 'high'. The wind was generally light and from the 4th–6th was totally calm.

The second half of the month was rather unsettled with rain at times and it was particularly wet on the 18th. The weather became progressively colder during the last week with widespread frost and some wintry precipitation. The mercury dropped as low as -8C on the morning of 31st and increasing cloud eventually brought a period of snow during the evening.

(HiMax 13.6C Hurn 25th; LoMax 2.8C Blandford St Mary 4th; HiMin 8.6C Blandford St Mary 13th;

LoMin -8.2C Hurn 31st; HiRain 31.8mm Winterbourne Steepleton 18th; Sun 61hrs 98% Hurn)

February

Most of the county was under a few centimetres of snow on the morning of the 1st and the temperature barely rose above freezing level all day. A diminishing snow cover remained in many inland areas until the evening of the 3rd and the onset of steady rain and much milder air. The period up to the 19th remained mild with rain or showers alternating with periods of sunshine. It was windy initially with gusts associated with storm 'Eric' of 50mph on the 8th. Dry weather returned for several days from the 20th, courtesy of high pressure and it became increasingly mild by day with unbroken sunshine. Under clear skies the nights were cold and frosty. Showery rain returned on the last day.

DORSET RAINFALL 2019

Stations marked * are sites incorporating tipping-bucket auto gauges and have not been included in the compilation of the county averages.

STATION	OBSERVER	Greatest 24hr fall Depth (mm)	Date	Days with rain 0.2mm	25mm	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR (mm)
STOUR BASIN																		
Blandford St Mary	Mr D Vincent	65.1	23/9	189	3	53.9	68.2	85.9	63.3	26.6	80.9	33.9	62.6	166.8	179.8	121.3	180.8	1124.0
Compton Abbas *	Environ Agency	65.2	23/9	224	3	48.4	59.4	89.4	65.4	30.2	86.0	43.2	62.8	167.2	146.4	119.4	165.4	1083.2
East Stour	Mr R Brown	37.5	23/9	169	2	44.3	48.1	75.8	45.9	29.2	70.2	40.7	52.7	121.0	143.4	112.6	148.8	932.7
Fontmell Magna	Mrs J Westgate	59.4	23/9	182	4	48.8	46.5	78.5	61.9	22.9	79.7	35.2	51.2	152.9	135.0	117.9	157.7	988.2
Gillingham	Mr T Yorke	36.1	23/9	201	5	60.5	68.5	110.8	61.5	35.3	85.6	68.7	75.5	147.9	197.2	138.2	201.7	1251.4
Iwerne Minster	Mr R Benfield	65.3	23/9	171	5	49.7	57.3	93.5	63.4	30.5	84.2	39.9	57.5	177.5	161.6	131.6	186.7	1133.4
King Stag *	Environ Agency	31.7	23/9	200	3	51.8	59.6	95.0	58.8	18.6	62.2	32.2	56.6	126.4	146.4	110.4	163.0	981.0
Shaftesbury (Hilltop)	Mr M Yorke	43.1	23/9	203	6	60.0	70.0	85.6	61.6	33.2	99.8	50.1	77.6	157.6	168.3	129.5	178.7	1172.0
Stourpaine	Environ Agency	64.4	23/9	176	2	48.7	63.3	95.6	63.3	25.7	71.4	36.6	53.7	161.4	167.8	123.6	185.7	1096.8
West Moors	Mr M Rowley	39.4	23/9	167	2	38.4	64.9	79.4	43.6	36.9	68.4	33.2	45.5	138.2	148.7	116.7	162.5	976.4
Wimborne (Merley)	Mr B Bush	46.4	23/9	177	6	44.4	77.9	87.7	58.9	39.4	79.4	39.1	61.4	138.6	178.5	137.5	193.5	1136.3
Winterborne Zelstone	Miss B Hooper	53.0	23/9	142	4	53.7	69.0	77.5	59.9	25.0	85.9	24.6	65.1	153.3	207.6	134.7	187.3	1143.6
Witchampton	Mr A Mitchell	44.6	23/9	161	2	49.3	67.7	78.6	51.2	23.7	67.5	29.5	45.3	136.6	170.0	123.1	160.7	1003.2
PARRETT BASIN																		
Melbury Sampford	Mr G Jones	67.0	23/9	179	11	56.1	66.8	100.8	79.5	30.4	81.8	28.6	94.8	201.3	173.4	144.4	189.1	1247.0
Stalbridge	Mrs M Paul	38.3	23/9	192	3	55.9	55.3	91.7	52.6	17.8	66.9	28.3	49.3	121.8	128.8	111.9	161.4	941.7
Thornford	Mrs W Morris	45.7	9/9	163	7	46.1	55.2	91.1	71.4	18.1	74.3	21.6	65.6	154.1	142.8	110.7	216.3	1067.3

DORSET RAINFALL 2019

STATION	OBSERVER	Greatest Depth (mm)	24hr fall Date	Days with rain 0.2mm	Days with rain 25mm	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR (mm)
FROME BASIN																		
Bere Regis	Environ Agency	52.2	23/9	171	5	46.8	85.2	82.2	56.3	25.9	73.7	36.3	63.6	147.6	178.7	132.9	186.0	1115.2
Bradford Peverell	Mr D Oliver	59.1	23/9	186	5	73.9	77.7	90.6	68.4	28.7	65.7	32.1	108.2	175.7	193.0	178.4	217.2	1309.6
Broadmayne	Mr M Ching	50.0	23/9	157	7	66.5	88.0	69.0	81.5	34.5	85.5	44.0	76.0	148.5	197.0	179.0	213.5	1283.0
Cerne Abbas	Mr P Spray	61.2	23/9	182	13	82.7	82.9	118.2	82.2	31.5	101.3	44.0	115.7	211.2	212.7	203.1	240.2	1525.7
Charminster	Mr G Eveleigh	73.1	23/9	174	5	67.4	90.2	100.0	67.5	28.9	71.9	38.7	113.1	194.6	206.2	183.2	228.7	1390.4
Dewlish (Parsonage Farm)	Mr C Britton	58.1	23/9	153	7	61.7	83.2	105.7	79.8	30.2	80.2	39.1	90.8	182.8	197.3	159.9	192.7	1303.4
Dorchester	Mr J Oliver	66.0	23/9	181	5	70.5	78.7	85.6	65.7	38.6	70.6	34.2	89.8	180.1	195.1	179.2	202.5	1290.6
Evershot *	Environ Agency	59.5	23/9	213	10	56.8	87.2	106.2	87.8	30.4	84.6	30.2	94.8	210.4	175.6	143.4	186.2	1293.6
Milborne St Andrew	Mr A Maitland	66.4	23/9	177	6	58.6	84.9	97.7	71.0	29.2	72.2	37.3	85.2	180.4	196.1	149.6	197.7	1259.9
(Coles Farm)	Environ Agency	47.4	23/9	214	7	66.0	82.0	108.2	67.0	25.0	84.8	38.4	98.6	162.8	166.0	146.2	192.8	1237.8
Minterne Magna *	Mr K Battrick	60.0	23/9	155	9	70.0	90.5	114.0	81.0	34.5	91.0	44.0	101.0	185.5	222.5	169.0	235.0	1438.0
Milton Abbas	Mr A Hodge	64.4	23/9	168	5	67.8	68.2	75.5	72.0	32.8	88.5	40.5	80.4	167.0	202.0	174.5	200.8	1270.0
Owermoigne	Mr H Wood-																	
Puddletown (Bardolf Manor)	Homer	76.2	23/9	175	5	69.8	79.6	96.9	73.2	38.8	74.1	35.2	84.8	166.2	205.6	162.8	202.3	1289.3
Rampisham	Mrs C Parry	63.0	9/9	180	10	61.8	82.5	102.1	84.6	30.4	86.0	34.0	102.8	212.6	182.7	150.3	201.8	1331.6
Stratton	Mr A Keep	65.0	23/9	143	8	60.6	79.6	93.9	77.8	29.9	67.0	31.7	113.7	185.2	191.5	174.2	203.2	1308.3
Sydling St Nicholas	Mr C Legg	56.1	23/9	155	12	48.1	79.8	108.5	61.2	22.1	89.1	33.0	101.1	195.1	164.2	181.1	209.6	1292.9
Wareham (Trigon)	Mr R Sturdy	38.6	23/9	152	1	44.8	54.6	70.7	39.1	31.1	57.4	27.5	35.6	110.7	156.1	110.6	142.7	880.9
AXE BASIN																		
Forde Abbey	Mr M Roper	42.8	23/9	161	6	42.2	76.0	96.6	80.5	29.9	106.0	25.4	79.1	145.3	161.3	141.6	199.6	1183.5
COASTAL STREAMS																		
Bothenhampton	Environ Agency	64.5	23/9	169	3	46.9	44.8	60.9	60.2	32.2	51.7	23.1	65.4	154.9	127.0	134.8	135.4	937.3
Friar Waddon *	Environ Agency	48.4	23/9	191	2	55.2	67.8	71.8	61.2	22.8	60.0	22.8	68.4	147.4	156.8	143.6	165.2	1043.0
Portland Bill (Old Higher	Mrs F Lockyer	26.2	23/9	174	1	38.6	42.6	49.6	60.6	28.4	62.4	18.8	38.0	81.4	127.2	95.6	101.8	745.0
Light)	Environ Agency	42.7	23/9	164	3	44.8	52.2	57.0	59.4	21.2	66.8	25.7	51.8	124.1	158.0	143.3	170.5	974.8
Preston	Environ Agency	32.6	23/9	182	2	52.6	60.0	69.8	50.8	16.4	55.2	26.1	49.1	117.8	132.4	117.0	154.6	901.8
Swanage *	Environ Agency	43.6	23/9	199	2	44.6	47.8	63.0	64.6	29.4	52.6	21.6	60.4	130.2	121.0	130.0	133.4	898.6
Swyre *	Mr R Poots	50.6	23/9	162	3	54.8	52.4	47.6	47.5	18.5	35.6	23.1	52.2	132.3	159.3	134.1	170.5	927.9
Weymouth																		
COUNTY AVERAGES				172		55.9	69.6	87.4	65.7	28.8	76.8	34.9	74.9	160.6	175.1	144.9	188.5	1163.1

(HiMax 17.8C Blandford St Mary 27th; LoMax 1.5C East Stour / Dorchester 1st; HiMin 8.7C Thornford 21st;

LoMin -7.6C Hurn 3rd; HiRain 25.4mm Toller Down 3rd; Sun 106hrs 135% Hurn)

March

The period up to the 18th was very unsettled and often breezy with rain falling every day. More than 25mm was recorded at a few sites in the west of the county on the 5th. Inland wind gusts exceeded 40mph on the 3rd, 10th and 16th. The last 13 days were mainly dry and temperatures remained close to average until the last week when it became rather warm and sunny after the clearance of any early morning fog.

(HiMax 19.3C Wimborne 30th; LoMax 9.0C East Stour 10th; HiMin 10.9C Blandford St Mary 15th;

LoMin -2.6C Hurn 26th; HiRain 37.8mm Forde Abbey 5th; Sun 117hrs 104% Hurn)

April

After a dry, sunny and rather warm day on the 1st, falling pressure heralded a period of cloudier skies with outbreaks of rain or showers, some heavy with hail until the 5th. Much of the month was dry with variable amounts of cloud and sunny periods. From the 18th–22nd the weather was particularly spring-like with a light easterly airflow and temperatures above 21C daily. Temperatures returned to normal during the last week with some persistent rain on the 24th and showers on the 26th. Storm 'Hannah' produced wind gusts inland of over 40mph on the 27th.

(HiMax 25.9C Blandford St Mary 21st; LoMax 7.9C Blandford St Mary 4th; HiMin 12.3C Thornford 24th;

LoMin -4.0C Hurn 3rd; HiRain 31.3mm Evershot 4th; Sun 198hrs 117% Hurn)

May (Driest since 2010)

There were a few showers early and late in the month and a general area of rain crossed the county overnight into the 8th. Some places caught showers on the 17th and 19th and on the latter date Dorchester received 10.6mm of rain in 40 minutes in the early afternoon. Having said that, it was a largely dry month across the county with rainfall averaging out at 50% of the norm. Temperatures were mostly close to average with no extremes, although a slight rather late air frost was recorded on the 5th and 6th.

(HiMax 25.3C Thornford 24th; LoMax 12.9C Dorchester 5th; HiMin 14.6C Thornford 31st;

LoMin -1.6C Hurn 5th; HiRain 22.9mm Forde Abbey 7th; Sun 210hrs 108% Hurn)

June (Wettest since 2012)

The first three weeks were rather unsettled with outbreaks of rain or showers and some quite high rainfall totals locally on the 7th and more generally on the 10th. Temperatures were close to average for much this period but it was rather cool on the 11th and 13th with maxima in the low teens. The last week became progressively warmer and increasingly sunny. Temperatures were generally in the high 20s Celsius from the 27th–29th before a cold front arrived and dropped the maximum by as much as 10 degrees on the 30th.

(HiMax 33.1C Thornford 29th; LoMax 13.0C East Stour 11th; HiMin 18.1C Thornford 29th;

LoMin 3.6C Hurn 6th; HiRain 36.5mm Forde Abbey 10th; Sun 174hrs 86% Hurn)

July

The first half of the month was completely dry and pleasantly warm with temperatures in the mid-20s, gentle breezes and a good deal of sunshine. Many places had showers early on the 18th and general rain into the 19th – the first rain in most places since June 24th. The 19th was the only sub-20C day of the month and temperatures soon began to soar again. Early patchy fog on the 23rd soon cleared and the day quickly became hot with temperatures above 30C. Thunderstorms broke out in the evening but with little rain. The 25th was another very hot day that ended with some thundery showers. Dorset was just outside of the area of exceptional heat that affected much of the south-east quadrant of England on this date. Cambridge University Botanic Garden measured the highest temperature ever recorded in the UK at 38.7C. Temperatures returned to average for the last four days with showers or longer spells of rain.

(HiMax 32.5C Blandford St Mary 25th; LoMax 17.8 Wimborne 19th; HiMin 19.1C Blandford St Mary 24th;

LoMin 7.0C Dorchester 4th; HiRain 34.0mm Gillingham 30th; Sun 239hrs 117% Hurn)

August

This was a rather warm and fairly sunny month with the highest temperatures recorded in the first and last week. Most of the rain fell between the 8th and 18th with some high totals on the 8th and 16th especially. Barometric pressure fell to about 997 millibars during the late evening of the 9th and in the steadily rising pressure behind the 'low' the wind gusts strengthened to 47mph in Dorchester around midday on the 10th. This was the highest reading recorded in August in 25 years.

(HiMax 30.3C Wimborne 25th; LoMax 17.0C Thornford 16th; HiMin 17.4C Blandford St Mary 9th;

LoMin 6.2C Hurn 21st; HiRain 50.0mm Charminster 16th; Sun 207hrs 109% Hurn)

September (Wettest since 1976)

Apart from overnight rain on the 3rd and a cool and wet day on the 9th the first three weeks were mainly dry.

The mid-month period was dominated by high pressure with a good deal of sunshine and mainly light breezes. Temperatures climbed into the mid-20s at times but where the sky remained clear overnight it became quite cool.With low pressure very much in control, the last ten days were exceptionally wet. It was a rare event on the 23rd when all observers across the county recorded more than 25mm of rain. During this period day temperatures returned to normal values but a near constant cloud cover ensured the nights were very mild.

(HiMax 26.1C Wimborne 15th; LoMax 14.0C East Stour 9th; HiMin 16.2C Wimborne 26th;

(LoMin 3.4C Hurn 8th; HiRain 76.2mm Puddletown 23rd; Sun 155hrs 108% Hurn)

October (Wettest since 1976)

A very unsettled and exceptionally dull month with periods of rain or showers and only a few brief dry interludes, notably the 19th to 23rd. Rainfall was almost continuous from the evening of the 11th to noon on the 13th with aggregates of 40–50mm in most places. Temperatures were close to average for much of the month but it was briefly rather cold with maxima of around 10C from 27th–30th. The first rural frost of the season was recorded on the 28th.

(HiMax 19.4C Hurn 1st; LoMax 9.5C Dorchester 28th; HiMin 15.6C Wimborne 16th;

LoMin -1.5C Hurn 28th; HiRain 36.4mm East Stour 12th. Sun 68hrs 64% Hurn)

November

The jet stream was well south of its usual position for most of the month, steering depressions directly over or close to southern England. The mean sea-level pressure of 1000 millibars was about 15 millibars below the 1981–2010 average for November and the third lowest of any month in forty years. It was mild early and late in the month but temperatures were generally a little below average, especially by day. The 2nd was the windiest day of the year with inland gusts reaching 55mph and more than 70mph along the coast during the morning. There were a few calm interludes allowing night frosts, notably the 9th when temperatures locally dropped down below -3C. Rain or showers fell on about twenty days in most places and was heavy and prolonged at times and with saturated ground some local flooding occurred.

(HiMax 15.5C Hurn 1st; LoMax 5.0C Dorchester 14th; HiMin 10.3C Wimborne 2nd;

LoMin -4.0C Hurn 9th; HiRain 33.7mm Preston 21st; Sun 56hrs 75% Hurn)

December (Wettest since 2013)

Most places were dry and rather cold for the first few days before unsettled and milder conditions arrived on the 6th and persisted throughout the month. The rain or showers were heavy at times with localised hail and thunder. Falls of more than 25mm were measured on four days during the month, the most widespread of these being on the 18th. The Christmas period was rather mixed – Christmas Eve was largely dry, mild and breezy with sunny intervals while Christmas Day was sunny and calm but a little cooler. Boxing Day was windy with morning rain followed by a brief sunny interlude and further rain by evening. After four months of well above average rainfall large areas of low-lying farm and meadow land were under water at the close of the year.

(HiMax 13.1C Hurn 6th; LoMax 5.2C Dorchester 2nd; HiMin 9.2C Wimborne 8th;

LoMin -4.7C Hurn 5th; HiRain 29.5mm Iwerne Minster 26th; Sun 60hrs 105% Hurn)

From the Rainfall Editor, John Oliver. Contact: johnr.oliver@yahoo.co.uk

OBITUARIES

NOELLE MARY (PENNY) COPLAND-GRIFFITHS (1944–2019)

Although born just north of London towards the end of the Second World War, after a post war family move to Ferndown, and then to Horton, it was to Dorset and to some extent to the wider Wessex, to which Penny was loyal and most passionate about for all her life.

History was always a family interest. Penny's Father (my Grandfather) Herbert was always interested in the past and was almost certainly the stimulus for our curiosity of what had gone before. Penny had so many interests but perhaps there are two very closely interlinked, for which she was known; archaeology and pottery.

The early part of Penny's first marriage actually meant living on an archaeological site. Simons Ground near Wimborne was not only her first married home but was also the site of a Bronze Age Cremation Cemetery, excavated between 1967 and 1969 (White 1982). After the end of her first marriage, and a return to the parental home at

Horton, Penny added to her archaeology CV by becoming involved in the excavation at Rockbourne Roman villa. It was at Rockbourne where she met many people who would become not only lifelong friends but also colleagues and co-authors in much of her later work on the pottery industry based around Verwood.

Penny's interest in and knowledge of the Verwood Potteries, are best encapsulated in some of her published works but her legacy lives on in more than the printed word. In 1985, Penny and her then husband Michael, founded the Verwood and District Potteries Trust. Their initial aim was to buy and preserve the pottery site at Prairie Farm in Verwood. Although the site was not purchased by the trust, their work did lead to it being Scheduled as an ancient monument. Much of the trust's work after 1986, involved further research into the Verwood Pottery industry and its promotion around Wessex.

Between 1976 and 1991 Penny was heavily involved at the excavations at Bucknowle Farm (where she is pictured here) (Light and Ellis 2009), where she was known as the matriarchal figure to many of the young diggers, working and living on site. When my parent's marriage broke down in 1977, Penny took me to Bucknowle and I dug there intermittently from that year until the end in 1991. Penny shared not only her knowledge but also her enthusiasm for history, archaeology and the potteries. I was not the only youngster to be taken under her wing, there were many others. We who are left are museum curators, historians, archivists and university lecturers to describe but a few. She also became a valued member of the Dorset Archaeological Committee, doing turns as a judge of the Dorset Archaeological Awards. Always engaged and supportive, she flew the flag for early modern archaeology, which is so often overlooked.

Over the years Penny accumulated a large collection of Verwood pottery, many found and purchased under unusual circumstances; night time window shopping in Corfe and returning from court in Devon being my most memorable. Penny's Verwood and studio pottery collection was given to the Priest House Museum in Wimborne. In the last years of her life Penny had been funding doctoral research in to the Verwood Potteries at Bournemouth University and she left funds for that to be completed.

Penny's legacy will continue in the printed word, the three dimensional and in the archaeological. She lies buried near her parents, accompanied by a Verwood pot.

William Spencer, Cumbria, 2020

REFERENCES

Light, T. and Ellis P. 2009. *Bucknowle, a Romano-British villa and its antecedents 1976-1991.* Dorset Natural History and Archaeological Society Monograph 18, DNHAS, Dorchester.

White, D.A. 1982. *The Bronze Age Cremation Cemeteries at Simons Ground, Dorset.* Dorset Natural History and Archaeological Society Monograph 3, DNHAS, Dorchester.

PENNY'S PUBLICATIONS

The Verwood and District Potteries: A Dorset Industry, in collaboration with David Algar and Tony Light was first published by CJ Newsome in 1979. Updated and republished in 1987.

Discover Dorset Pottery, The Dovecote Press, 1998

Dorset County Pottery, with Jo Draper Crowood Press 2002

LES AMES (1919–2019)

Les Ames was a man devoted to his community on Portland. He devoted more than 40 years of his life to local politics as an independent, being at various times a town, borough and county councillor. He served as mayor of the Weymouth and Portland Borough twice and was mayor of Portland three times. He was made an MBE in 2006, for serving the community of Dorset, and an Honorary Freeman of Portland in 2014. In 2013, at the age of 94 Les became the oldest town mayor in the world, a testament to his dedication.

Les served with the RAF in the late 1940s, including a period in India during partition. He came from Croydon where he met his wife Jean, to whom he was to be married for more than 75 years, and they moved to Portland in the early 1950s. Les worked for the Admiralty, but soon became involved in the local community. He was keen on sport, and particularly in supporting and encouraging young people. He supported sports clubs on the Island and became a governor of local schools.

Les's love of his adopted home included its history and heritage. He was always interested in preserving the sense of place whilst championing local business. When redevelopment of the art deco Portland Town Council offices was proposed in the mid 2000's, Les spoke up for the building in the face of some people's dislike of it. He defended it as significant

Photo provided by The Dorset Echo.

for the local history of Portland. It was Les's role as a county councillor, and his interest in local history which led him to become a member of the Dorset Archaeological Committee. He served for many years, including as Vice Chair, and brought his long experience to chairing meetings when called upon. He was a font of knowledge on the inner workings of local government and always interested whatever the topic. He was always particularly engaged in the involvement of young people in heritage and archaeology.

Les also served as a judge for the Dorset Archaeological Awards on more than one occasion, most recently in 2015, alongside Penny Copland-Griffiths. He remained a member of the committee to the end of his life. Even after having to give up attending, Les insisted on receiving committee papers and minutes and remained in contact with other committee members.

Les Ames MBE died peacefully, on Portland on 4th November 2019, aged 100 years.