Making a significant place: Excavations at the Late Mesolithic Site of Langley's Lane, Midsomer Norton, Bath and North-East Somerset

Jodie Lewis[a]*, Caroline Rosen[a], Rona Booth[a] and Paul Davies[b]

With contributions from Martyn Allen[c] and Matt Law[d]

[a]Institute of Science and the Environment, University of Worcester, Worcester, UK; [b] Pro Vice-Chancellor, Bath Spa University, Bath, UK; [c] Allen OsteoAnalysis, 350 Queens Road West, Beeston, Nottingham, NG9 1GW; [d] School of History, Archaeology and Religion, Cardiff University, Cardiff, UK

*University of Worcester, Henwick Road, Worcester, WR2 6AJ

jodie.lewis@worc.ac.uk

Excavations at the Late Mesolithic Site of Langley's Lane, Midsomer Norton, Bath and North-East Somerset

Excavations at the site of Langley's Lane, Bath and North-East Somerset, have revealed an important sequence of Late Mesolithic activity focused around an active tufa spring. The sequence of activity starts off as an aurochs kill and primary butchery site. Culturally appropriate depositional practices occur through the placement of a selection of bone in the wetland of the spring and the digging of pits around the spring margins. The spring at Langley's Lane continued to be visited and more animal bone and lithic material was placed in the wetland. Finally, visits to the site involved yet more formalized activity in the form of pit digging and the creation of a stone surface. Activities such as these are difficult to locate in the archaeological record and Mesolithic ritual activity rare, making this a site of some significance to studies of Mesolithic NW Europe.

Keywords: Mesolithic; tufa spring; aurochs; ritual; kill-site; pits

Introduction

Tufa springs, or petrifying springs, occur throughout the British Isles in limestone geology. Although many are still active today, the most extensive deposition took place during the early Holocene, with dates of c.7000-3800 cal. BC commonly cited as the period for optimum tufa deposition (Goudie 1990; Parker and Goudie 2007). The tufa deposits left by the calcium rich waters which issue from the springs promote favourable preservation conditions for organic materials including molluscs and, therefore, many have been studied to develop palaeoenvironmental sequences (e.g. Kerney 1959; Garnett et al. 2006).

Archaeologically, tufa springs have received less attention, despite prehistoric human activity being known from some sites since the early twentieth century (e.g. Clark 1938). In the context of the Mesolithic, the association of activity with tufa springs has long been known and include sites such as Prestatyn in north Wales (Clark 1938; Bell 2007), Blashenwell in Dorset (Clark 1938) and Cherhill in Wiltshire (Evans and Smith 1983). The most recent review of activity at tufa springs (and other springs with unusual properties) is by Davis (2012), who considers the particular significance these places may have had to Mesolithic communities. Further afield, Mesolithic archaeology has also been recovered from tufa springs in France and Germany (Limondin 1995).

It is this known association of Mesolithic activity with tufa spring sites that provided the impetus for the excavations at Langley's Lane. The site is located in the Wellow Valley near Midsomer Norton, Bath and North-East Somerset; the valley is marginal to the lower Mendip plateau in the west, and the lower lying Wessex chalk to the east and its location constitutes an important upland/lowland transect (Fig. 1). The valley is well known for its tufa deposits, having been previously subject to palaeoenvironmental mapping and study by Findlay (1965) and Willing (1985).

Figure 1 Topographic map showing the site location. Map produced by N. Johnson. (©Crown Copyright and Database Right (2018). Ordnance Survey (Digimap Licence)).

During field visits to the Wellow Valley by one of the authors (PD) in the early 2000s, fresh lithic artefacts of Mesolithic date were observed and collected from the site. These artefacts were associated with a low tufa mound, approximately 20m by 30m and up to 0.5m in height, evidenced by tufa material which had been revealed by ploughing. As such, the initial reasons for sampling and excavation were three-fold:

(1) To locate any *in situ* archaeological horizons.

(2) To establish the stratigraphy of the tufa deposits

(3) To tie the archaeology firmly to either the existing environmental sequence (Willing 1985), or to undertake new, more archaeologically related, primary environmental sampling.

Excavations at the site were conducted over two seasons in 2004 and 2005. An initial strategy of test-pit transects and an auger survey was conducted, to identify the depth and extent of the tufa deposits, and to locate any concentrations of archaeologically significant materials and deposits. Four test-pits, 1m by 1m in size (TP1-4), were opened at 10m intervals along a baseline that extended across the tufa mound and a further three 2m by 2m test-pits (TP5-7) were positioned perpendicular to this baseline. The auger survey also bisected the tufa mound from south-west to north-east (Fig. 2). The results of this initial phase of work were used to inform the position of the open-area excavation.

Figure 2 Location map showing Trench 1 and auger survey. Map produced by N. Johnson. (©Crown Copyright and Database Right (2018). Ordnance Survey (Digimap Licence)).

During the 2004 season, an L-shaped trench (Trench 1a, with each arm of the "L" measuring 10m by 2m) was laid out, joining up test-pits 2 and 3 and bisecting the tufa mound. During the second season of excavation, in 2005, this trench was extended to the north-west with a 10m by 5m trench, and a subsequent 1.5m extension to the south-east (Trench 1b), in order to expose and determine the edge of the tufa mound (Fig. 2). Trenches 1a and 1b are herein referred to as Trench 1. Contexts were numbered from '1000' during the 2004 season and from '3000' during the 2005 season. Where the same deposits were encountered during both seasons, these were given the appropriate season’s reference. In 2004, almost half of the trench was excavated to bedrock, with other areas sampled. In 2005 the entire tufa edge revealed within the trench was excavated to bedrock and the remaining areas appraised and sampled accordingly.

Given the high potential for recovering molluscan evidence, a rigorous programme of environmental sampling was carried out. This involved both vertical and lateral sampling of the archaeological deposits, with the aim of recovering a sequence through time as the tufa mound formed as well as a ‘snap-shot’ of the broader environmental conditions of the tufa spring.

The excavated deposits and features

The series of test-pits and auger survey established the depth of deposits and height of the limestone bedrock below and beyond the tufa mound. Although the position and depths of deposits varied across the site, a general sequence of silty-clay deposits (red-brown followed by dark brown) overlay the limestone bedrock followed by a series of tufa deposits, comprising pure tufa and clay with tufa, which was overlain by the ploughzone soil (Fig. 3).

Figure 3 Results of the auger survey, south-west to north-east across the tufa mound. Note, auger hole 6 could not be sampled due to overhead powerline. Digitized by N. Johnson.

This sequence broadly corresponds to the stratigraphy identified during open-area excavation: an open ground surface prior to the activation of the spring; activation of the spring under wetter conditions; a second drying out phase of the spring; and, finally, post-spring activity.

Five stratigraphic phases, of both cultural and natural origin, date to the Mesolithic. In addition, post-Mesolithic activity is attested to by a small number of Neolithic and Bronze Age lithics in the plough zone soil, a Bronze Age date on animal bone from a disturbed area of the site and a few sherds of post-medieval pottery in the plough zone soil. The Mesolithic phases are classified as Phase 1 and subdivided into a, b, c, d and e (Fig. 4), with the later post-Mesolithic archaeology assigned to Phase 2.

Figure 4 Overview of the Mesolithic phases

Phase 1a

The earliest activity on the site is represented by (1030), a compact reddish-brown silty clay with charcoal flecking, 0.3m thick (Fig. 5). This deposit overlies the limestone geology and was subsequently buried by the pure tufa deposit (1007) of Phase 1c. Three lithic items, including a Late Mesolithic narrow blade microlith, were recovered from this deposit, representing limited human activity at the site before the activation of the spring (Phase 1b).

Figure 5 Sections C-D and E-F. See Figure 2 for section locations. Digitized by N. Johnson.

Phase 1b

The second phase of activity is related to the activation of the tufa spring. A spring issue point (1037) was visible as an ovoid spread of naturally cemented oncoidal tufa, extending over an area measuring c.1m x 0.4m (Fig. 5 and 6). Leading from this was a spring channel [1042], with two fills, a thin basal fill of clay and onchoidal tufa (1050) and an upper fill of tufa rich silty clay (1043) (Fig. 5). Context (1050) contained three fragments of animal bone, identifiable only as “large mammal”. As the tufa in the spring spout and lower fill of the channel was onchoidal and laminar, it would suggest that it formed when the flow of water was fast and there was some turbulence, whereas the finer tufa of the upper fill may relate to when the spout height matched the water column height and was possibly deposited as groundwater.

The tufa-rich waters spread beyond the channel, leading to the first phase of deposition of a very pure, wet tufa deposit (1007) in the area surrounding the spring issue.

Phase 1c

Phase 1c represents the first extensive signs of Mesolithic activity at the tufa spring. The active tufa spring waters are represented by a creamy-white friable tufa deposit (1007) up to 0.45m thick (Fig. 5). The extent of this deposit seems to have been contained by a natural rise in the topography. This deposit contained twenty-nine animal bone fragments and twelve lithic artefacts and were recovered from the top few centimetres of this deposit, in a discrete area. A Late Mesolithic date was obtained on cut marked bone (see Dating).

The dryland deposits (3031) and (3017/3029), to the north-west of the spring waters, are alluvial in origin and are superficially the same deposit; separate context numbers were assigned to different areas as (3017/3029) was sealed by (1008/3002), a later phase of the tufa spring (Fig. 6). Both deposits were similar to (1030) and consisted of a compact reddish-brown silty clay with charcoal flecking, 0.3m thick and overlay the limestone geology.

Figure 6 Plan of Phase 1c activity. Digitized by N. Johnson.

Some individual animal bones and lithics were retrieved from deposits (3031) and (3017/3029). In addition, five discrete clusters (I-V) of animal bone and lithics were recovered from (3031). In total forty-one animal bones and 160 lithics were recovered.

Cutting deposits (3017/3029) and (3031) were nine pits; one pit is associated with the top of the (3017/3029), seven pits are associated with the top of (3031) and one pit cut both of these dryland deposits, demonstrating their contemporaneity (Fig. 6 and 7).

Figure 7 Sections of 7 pits. For pit [1048] see Figure 5. A section drawing was not produced for pit [3033]. Digitized by N. Johnson.

The form and fills of the pits are presented in Table 1. In summary, the pits are circular or oval in shape and generally have a rounded or flattish base. The size of the pits is not uniform, ranging from between 0.1 to 0.5 metres in diameter. However, all of the pits are shallow ranging from 0.05 to 0.13 metres deep. Eight of the nine pits contained artefactual material: all eight contained lithics; six contained colourful small stones and one contained two fossils. Two lithics from separate pits refitted (see lithics report). Of particular interest, one pit contained a hand-moulded tufa ball and a further pit contained a lump of tufa, assigned context (3007), which is likely to have been a second tufa ball (see Tufa Ball below).

Table 1 Characteristics of the nine pits cut into the dryland near the edge of the tufa spring waters

As the nine pits are all small and shallow, albeit exhibiting variety in form and dimension, a consideration of the preservation of these features is necessary, as there is a tendency to view shallow prehistoric features as plough damaged. The pits lay c. 0.2-0.3m below the current ground surface, a depth at the very limit of modern plough regimes, which might allow the possibility of some truncation. Pit [1048] was securely sealed and pit [3027] was partially sealed by (1008/3002), a clay with tufa deposit related to the active tufa spring during Phase 1d. As this deposit (1008/3002) was forming during the later Mesolithic, it shows the shallowness of the two pits sealed by this deposit to be a true reflection of their original form.

Given the shallowness of the pits, it is unlikely that they held postholes; and it is not possible to link them all into a single obvious layout, though each is no more than 2m from another (Fig. 6). Three pits [3010; 3020; 3027] are arranged in a closely spaced line, with [3010] and [3020] exhibiting a convincing uniformity in shape, depth and fill. The other pits occur either singly or possibly as pairs. Pits [3008] and [3033] are both circular, though of different sizes, and only 0.2m apart whereas pits [1031] and [1032] are 1m apart and are linked by form and fill, though the artefacts they contain are very different. Importantly, however, all of the nine pits cut the dryland deposits near to the edge of the tufa spring waters; the north-western part of the trench was archaeologically sterile, suggesting that activities were deliberately concentrated close to this tufa edge.

With one exception, all the pits have a single fill, likely the redeposited spoil, suggestive of single episodes of deposition, rapidly executed. This is supported by pit [1032], which contained the curious ball of tufa. This ball, formed of tufa with a clay component, is further discussed below but it is pertinent to mention here that if the spaces around and above the ball had not been quickly backfilled it would have lost its form and weathered into a layer of tufa, as is suspected for the lump of pure tufa, (3007), from pit [3008].

In addition to the nine deliberately dug shallow pits, a very irregular cut feature, [1039], was identified (Fig.6). This was filled by (1038), a firm brown clay, and contained no finds. The form and fill of this feature indicates it is most likely of natural origin.

At some point during Phase 1c, a new spring [1044] cut through the upper fill of the existing spring channel (see Phase 1b) and parts of tufa (1007), marking a further reactivation of the spring (Fig. 5 and 6). It resulted in a second spring channel, filled by a gritty, grey tufa and clay mix (1045), which later became sealed by the clay with tufa (1008/3002) of Phase 1d. Contained within this new channel were six large mammal bones and some occasional fragments of oak charcoal. The onchoidal spread of tufa (1037) continued to form and would likely have been visible during this phase.

A further spring issue point [1046] was also noted, this time cutting the top of the dryland deposits (3017/3029). This feature continued outside the excavated area but the exposed portion measured c. 0.8 x 0.4m in diameter and was filled by onchoidal tufa and silty clay (1047). It was sealed by (1008) of Phase 1d but a tufa rich pipe directly above the spring issue point suggests that it may have reactivated on at least one occasion.

Phase 1d

Phase 1d is represented by a clay with tufa deposit (1008/3002) also deposited by spring waters, though different to and later than (1007). Deposit (1008/3002) was comprized of an orangey-brown mixed clay with tufa up to 0.2m thick which extended 2.5 metres north of the limit of the pure tufa (1007) of Phase 1c (Fig. 5 and 6). Like the earlier pure tufa, the spread of this deposit seems to have been contained by a natural rise in topography. Its higher clay content represents a drying out phase, with slower and, perhaps, more intermittent water issuing from the spring. This is supported by the 120 lateral samples taken from this deposit for molluscan analysis (see Molluscan Analysis).

A total of eight animal bones and 159 lithic items were recovered from this phase of the tufa spring. A cut marked *Bos sp.* calcaneous was recovered from the base of this deposit and returned a Late Mesolithic radiocarbon date (see Dating). All other animal bone was recovered during the lateral molluscan sampling at the edge of this deposit, where it was at its thinnest. The lithics, however, were stratified throughout this deposit both vertically and horizontally.

The dryland north-west of this wet, spring deposited clay with tufa was a moderately compact, reddish-brown, silty clay (3034), up to 0.13m deep (Fig. 5). This directly overlays (3031) of Phase 1c and represents a continuation of alluvial deposition in the Wellow Valley during the earlier part of the Holocene. Deposit (3031) was defined based on its distinct artefact and cut feature horizon whereas by contrast, no archaeological material was recovered from (3034). This does not preclude the possibility of dryland activity at the tufa spring during Phase 1d; as the excavation focused on the northern and western limit of the clay with tufa (1008/3002), it is possible that anthropogenic activity may be preserved in the unexcavated areas to the south and east.

Phase 1e

During this phase, the springs stopped issuing and, correspondingly, tufa formation ceased. The tufa and clay deposited between Phases 1b and 1d now took the form of a dry, low mound. Adjacent to this mound was an alluvial deposit (1006/3003), a continuation of (3034), though with a distinct artefact horizon (Fig. 8). Deposit (1006/3003), comprized a moderately compact, reddish-brown, silty clay up to 0.08m deep, surrounding the low tufa mound, to the north and north-west. Superficially, this deposit represents a continuation of (3031) and (3034) but was assigned a separate context number as a distinct artefact horizon was observed. The finds recovered from this horizon included 161 lithics and eight pieces of animal bone.

Figure 8 Plan of Phase 1e activity. Digitized by N. Johnson.

Given the shallow depth of this artefact horizon (between 0.15-0.2m below the current ground surface), it is possible that it represents sorting resulting from ploughing, though three factors might suggest otherwise. Firstly, the microliths from this deposit contained a number of rod forms which are often associated with a fifth millennium date; secondly, one of these rods was broken in antiquity and the two refitting pieces were found in close proximity; and thirdly, the other archaeological features associated with this phase of activity and located at a similar height to this artefact horizon were undamaged by the plough. The presence of some lithic items in the unstratified plough soil (1000/3000) attest to some disturbance, though this appears to be minimal.

Cutting the tufa mound and adjacent ground surface (1006/3003) was a large pit [1024/3012]. The pit measured c.0.9m in diameter and was 0.2m deep, cutting through deposit (3031) of Phase 1c. The primary fill, a firm reddish-brown clay (1004/3011), was 0.13m thick and contained sixteen lithics, thirty-six small stones and one piece of sandstone with a flattened and smoothed surface. Some of the lithics and the utilized sandstone have tufa adhering to their surfaces, which must have become attached prior to deposition in the pit as the tufa spring was no longer active. It is possible that these materials were encountered during the digging of the pit as it cut through the cut feature and artefact horizon of Phase 1c. The homogeneity of the clay fill and lack of obvious lenses suggests that it represents a single episode of deposition. A layer of tufa, clay and stones, 0.08m thick, was then placed over this, filling the pit to the top and sealing the contents.

Later, this pit [1024/3012] was recut by two small, circular and straight sided cuts, [1055/3014] (Fig. 5) and [3030]. The first, [1055/3014], was filled by (1054/3013), a firm, brown, silty clay, 0.15m in diameter and 0.19m deep. It contained a single large stone, , twenty-two lithics and four small stones. At its base was a tufa rich lens (3015), 0.04m thick, containing five flints whilst at the top, overlying fill (1054/3013), was a lump of tufa (3023) and another of clay (3024), both 0.04m thick. Context (3024) also contained two flints and one small stone. The second, [3030], was slightly smaller at 0.14m diameter. The fill (3028) was a reddish-brown clay, with degraded limestone at its base, and contained 19 lithics and a single, small stone.

At the same level as pit [1024/3012] and 0.5m to the west of it, was a broadly rectangular area of irregularly laid stones (3004), forming a rough surface measuring c.1.25 x 0.8m. This was located on top of and at the very edge of the clay with tufa where it was at its thinnest. The stones, identified as White Lias (nearest source c. 350m), were sub-angular to rounded and measured up to 0.1m. They were a single layer deep, with lithics and animal bones recovered from between the stones. These comprized ten fragmented bones and thirty-four lithics.

Two other features [1025] and [1026] cut the top of the tufa mound. Cut [1025] was irregularly shaped, 0.5m long by 0.13m deep with a relatively flat base. It was filled by (1009), a purplish-brown clay containing a small fragment of burnt flint. Cut [1026] measured 0.6m by 0.5m, though the western boundary was indefinite. It was filled by (1010), which was identical in composition to (1009), and contained thirty-four lithics, a small, smooth black stone, a smoothed piece of sandstone and a belemnite fossil. Compared to the other deliberately cut pits across all phases of the site, these two features are more irregular in shape and contain an unusually coloured fill, not seen elsewhere. It is possibly that they are natural features, with the purplish-brown colour of the clay the result of decomposing organic material and/or standing water. The finds may be residual, though the large and diverse assemblage from [1026] might also indicate intentional deposition (in a natural or anthropogenic) cut feature. Ultimately however, the origin of and use of these features is uncertain, making further speculation difficult.

The southern surface of the clay with tufa was cut by six stake-holes [1017-1022]. These were circular, with straight sides and flat or rounded bases, and varied in diameter between 0.03-0.08m and in depth 0.02-0.06m. They contained no finds and were sealed by the soil [1001/3001] that formed after tufa deposition had ceased. There is no discernible pattern to their arrangement, though more may lie outside the excavated area.

Phase 2: Post-Mesolithic

The tufa mound and the archaeological features cut into it were eventually sealed by deposit (1001/3001), a firm, orangey-brown, silty clay. This deposit was restricted to the tufa mound and probably represents a plough soil, its different colour and composition attributable to the disturbance of the clay with tufa (context 1008/3002). (1001/3001) contained over one hundred unstratified lithic items, a single sherd of post-medieval pottery and one iron nail. Three natural features cut this deposit: a large tree throw [1023], an animal burrow [1034] (which also cut [1023]) and a further hollow [1053], representing either vegetation or burrowing animals. The tree throw cut all the deposits beneath it and was filled by (1005) a stony, orangey-brown silty clay.

The alluvial surface associated with Phase 1e, beyond the tufa mound, itself becomes sealed by the plough-zone soil horizon (1000/3000), a brown silty-clay up to 0.2m thick. Unstratified lithics and a small amount of animal bone and post-medieval pottery were recovered from this deposit.

Neolithic or Early Bronze Age activity is attested by a few flints in the lower levels of (1000/3000) and (1001/3001), a heavily abraded sherd of Bronze Age pottery and an Early Bronze Age radiocarbon date on an animal bone from a disturbed corner of the tufa mound (see Dating).

In addition, a single stake-hole [1002] was observed in deposit (1001/3001) and found to contain a single sherd of post-medieval pottery.

Dating

Radiocarbon dating

Seven samples from secure contexts were submitted for radiocarbon dating but four failed due to insufficient collagen. These comprized two samples from Phase 1c and one each from Phases 1d and 1e. Although stratigraphically the earliest bones from the site are the three large mammal bone fragments from the original spring channel (1050; Phase 1b), these may have been moved by water action and, therefore, could be residual or redeposited finds. The same reasoning applies to the six large mammal bones from the spring channel recut (1045) and because of this these bones were not submitted for radiocarbon dating.

Table 2 Radiocarbon determinations calibrated using OxCal v4.3.2 Bronk Ramsey 2017; r:5; IntCal13 atmospheric curve (Reimer et al. 2013)

Two of the successful dates are Late Mesolithic, in particular relating to the latter part of the Late Mesolithic (Table 2). Having only two radiocarbon determinations relating to the Mesolithic phases of the site makes dating discrete events problematic. The only successful date on a sample from the pure tufa (1007), was on a butchered *Bos* sp. proximal metacarpal, one of twenty-nine *Bos sp.*/large mammal bones thought to represent one animal (see Faunal Remains; Allen pers. comm.). This date, 6500-6260 cal. BC, accords well with the post-6500 cal. BC date suggested by the presence of *Discus rotundatus* (Preece and Bridgland 1999) from deposit (1030) sealed beneath (1007). The aurochs calcaneus found near the base of the clay with tufa (1008/3002) became tethered in place by successive episodes of calcium carbonate precipitation and provides a *terminus post quem* of 5990-5810 cal. BC for this deposit.

The stratigraphic relationship between deposits is supported by the radiocarbon dating, which shows that several hundred years (at least) separated the end of the pure tufa deposition and the early phases of clay with tufa formation, although we must be cautious in assuming uniformity across the site.

The third date of 1740-1530 cal. BC was derived from a large mammal bone fragment from the western corner of deposit (3029) (Table 2). This later, Bronze Age, date confirmed the excavators' opinion that this area had suffered disturbance. The date does not of course necessarily date this disturbance, but the discovery of a single body sherd of weathered Bronze Age pottery, together with a small number of unstratified Neolithic/Bronze Age lithics from the plough soil does indicate a later presence at the site.

Typo-chronological evidence

A total of eighteen microliths and eight microlith fragments of indeterminate type were recovered from stratified and unstratified contexts from the site (Fig. 9; Table 3). As a group, the microliths can be classified as belonging to the narrow blade tradition, having a mean width of 4mm, though 58 per cent ranged between 2 and 3mm. Only two microliths were complete and have a length of 18 and 20.5mm. The most common form represented is the micro-scalene triangle, representing 45 per cent of the identifiable forms; the majority of these are attributable to Jacobi's (1978) 7b with one more akin to 7a. Other forms present include one micro-isosceles triangle, one convex backed piece with additional retouch along the right-hand edge, two obliquely truncated pieces (one with additional retouch along the right-hand side), four rod microliths and two straight backed pieces.

Figure 9 Microliths – 1 (1030) Phase 1a; 2-4 (3031) 5 (3029) 6 (3007) Phase 1c; 7 (3004) 8-12 (1006/3003) Phase 1e; 13-15 unstratified Illustrated by C. Rosen.

Table 3 Microlith types by context and phase

The 'micro' nature of these narrow blade microliths, and the forms represented, places them in the latter part of the Late Mesolithic, post-*c*. 6500 cal. BC, when micro-geometric forms appear across southern Britain (Barton and Roberts 2004); this is also supported by the radiocarbon dates obtained from the site (see above). As such, the microliths from Langley's Lane can be added to other known sites with radiocarbon determinations from south-west Britain with microlith assemblages of this type. These include: Three Holes Cave in south Devon where micro-scalene triangles and rods are associated with a date range of 5475-5206 cal. BC (OxA-4491) and 5227-4843 cal. BC (OxA-4492) (Roberts 1996); at Madawg Rockshelter, Herefordshire, a date range of 5673-5480 cal. BC (OxA-6082) is associated with a micro-scalene triangle (Barton and Roberts 2004); at Goldcliff in the Severn Estuary, micro-scalene forms are associated with an earliest date of 5810-5525 cal. BC (OxA-6683) from context 1202 (Bell 2007); and at Totty Pot on the Mendip Hills, located approximately 17.5 km from Langley's Lane, micro-scalene triangles, micro-lunates and rod microliths are associated with a date of 5219-5016 cal. BC (OxA-9863) from an aurochs element (though here a direct relationship between the microliths and the faunal remains cannot be certain) (Murray 2010; Schulting et al. 2010).

Both dates from Langley's Lane (6500-6260 and 5990-5810 cal. BC) fall earlier than those from the sites mentioned above and, therefore, make an important contribution to understanding the inception of this change in microlith typology in south-west Britain. The dates from Langley's Lane are more akin to those from Broxbourne 105 in Hertfordshire, approximately 180km to the east, where dates of 6415-5835 cal. BC (OxA-593) are associated with these micro-geometric forms (Jacobi 1994).

The microlith evidence is not evenly distributed across the stratigraphic phases of the site; seven were recovered from Phase 1e, five from Phase 1c and one from Phase 1a (Table 3). Nevertheless, the dominance of micro-scalene triangles in phases 1c and 1e suggest a certain uniformity in microlith technology across time, probably representing several hundreds of years at least. The presence of two obliquely blunted points in Phase 1c (3031) and (3029) might be considered unusual as this type is also commonly associated with Early and Middle Mesolithic assemblages. However, the examples from Langley's Lane conform to those recovered at Goldcliff site J, whereby six micro-scalene triangles were found associated with two obliquely blunted points of the same width as those from Langley's Lane (8mm) (Barton in Bell 2007). Barton (p. 116) goes on to note that a defining feature of narrow blade assemblages is 'small geometric microlith shapes such as narrow micro-scalene triangles, curved backed pieces (including microlunates), straight backed and small oblique points'.

It may also be significant that the four rod microliths derived from Phase 1e and the unstratified topsoil deposit. These microlith types are often associated with the latest or terminal Mesolithic from about the early fifth millennium cal. BC (Griffiths 2014).

Attempts to date faunal remains from Phase 1e were unsuccessful (see above), however the presence of this microlith type in the later stratigraphic phases may point towards a fifth millennium date for the Phase 1e activity, though the limited number of rods necessitates some caution.

Rates of tufa deposition

Estimates for the rates of Holocene tufa deposition in England vary from 0.13mm to 0.7mm a year (Preece and Day 1994; Meyrick and Preece 2001; cited in Gradzinski 2010), though it should be noted that these are mean values. Tufa deposition is higher in fast flowing conditions and there can also be stand-still events and erosion; these factors together with other individual site-specific issues can make comparison between regions difficult. However, taking the extremes of these two estimates, the pure tufa could therefore have taken between 645 and 3,460 years to form and the clay with tufa between 290 and 1,540 years.

The presence of *Discus rotundatus* from the palaeosol beneath the pure tufa, coupled with the radiocarbon date from animal bone recovered from the top of the pure tufa, as well as the occodinal tufa observed in the spring channel, all point towards a relatively short episode of formation and, as such, a relatively shorter life to the wettest phase of the tufa spring.

The clay with tufa deposit represents a drying out phase, with the issuing of water being considerably slower/more intermittent, supported by the molluscan evidence (see below). Given this slower rate of tufa formation, it seems reasonable to suggest that the post-clay with tufa activity (Phase 1e) occurred at some point from the beginning of the fifth millennium cal. BC and supports the date suggested by the presence of rod microliths in this phase.

Molluscan analysis by Matt Law, Rona Booth and Paul Davies

Introduction

As already mentioned, the Wellow Valley has previously been subject to palaeoenvironmental study. Following Findlay's (1965) mapping of tufa deposits, Willing (1985) undertook some limited molluscan work on tufa deposits just to the north-east of Clapton. This was used to compare molluscan successions in Somerset during the Holocene with those already established from eastern England. The study suggested that the deposits were likely to span the early to mid-Holocene. Although no radiocarbon dating was undertaken as part of Willings' (1985) study, the molluscan faunas are, in this respect, good chronological markers.

The only substantial work carried out since then has been by the Quaternary Research Unit at Bath Spa University. Prompted by a study on modern tufa deposition on Mendip undertaken by Baker and Simms (1998), the Unit began exploring the stratigraphy and geographic extent of tufa deposits of the valley near Ston Easton. This work has shown that tufa deposits are up to 5 metres thick, and that there are occasionally intercalated organic and/or woody horizons. Often, too, there is very well developed underlying palaeosol, containing the snail species *Discus ruderatus*, indicating a pre-6500 cal. BC date (Preece and Bridgland 1999). An early preliminary report was issued (Davies et al. 2001), though since then more stratigraphic and molluscan work has been undertaken, largely as honours level projects and on-going staff research.

Methods

Sediment samples were taken from the tufa and associated deposits during both seasons of fieldwork at Langley's Lane. The main emphasis was on securing a vertical sequence through the deposits and a series of lateral samples from the base of the clay with tufa deposit (1008/3002).

A vertical column, 0.92m in length, was taken from the north facing, open section of Trench 1, capturing contexts (1001), (1008/3002), (1007), (1030) (Fig. 5). Fifteen samples were retrieved at 0.05m intervals. Sample weights were 0.5 kg.

In addition, 120 lateral samples were recovered across the base of the clay with tufa deposit (1008/3002) to establish whether there might have been any signs of lateral variation in vegetation, following Evans (1972), Rouse and Evans (1994) and Davies (1999). As an aid to interpretation, taxa were arranged into groups, broadly following those of Evans (1972) and Evans (1991). The groupings broadly represent a progression from woodland conditions through more open environments to gradually wetter conditions and eventually moving water.

For the lateral sampling, an area measuring 8m x 2.5m was divided into 0.2m squares and alternate squares sampled (Fig. 10). Photographs of the sampled areas *in situ* have previously been published by Davies (2008, fig. 1.4, p. 5). Sample weights were 0.5 kg, and the depth of each sample was 0.05m.

Figure 10 Molluscan lateral sampling plan. Digitized by N. Johnson.

All samples were processed using the standard method of wet sieving through graded mesh (Evans 1972). Shells were identified to species level where possible, although in some cases gross calcareous accretions obscured key details. Comparisons were made to reference collections and all identifications were carried out under a low power binocular microscope. Ecological information is taken from Evans (1972), Macan (1977), Kerney & Cameron (1979), Killeen et al. (2004), and Davies (2008). Nomenclature follows Anderson (2008).

For each gastropod taxon within a sample, the most commonly represented non-repetitive element (usually the shell apex, umbilicus, or body whorl with mouth) was counted to determine the minimum number of individuals (MNI) present. Left and right valves of bivalve species were counted, and then the highest number used as the MNI. The lateral sample diagram was plotted using C2 (https://www.staff.ncl.ac.uk/stephen.juggins/software.htm).

Results

The vertical sequence

Four ecologically determined zones can be identified. Two of these zones (Zones 1 and 2) correspond to the Mesolithic activity and are summarized in detail here. Zones 3 and 4 relate to the post-Mesolithic environment and are mentioned here only briefly. A fifth zone relating to the deepest 0.22 metres of palaeosol (context 1030) (referred to as Zone 0) was not conducive to shell preservation and is not further discussed. The total MNI are shown in Table 4. and the mollusc histogram for this sequence is shown in Fig. 11.

Table 4 MNI from molluscan vertical sequence

Figure 11 Mollusc histogram from vertical sequence Produced by R. Booth and digitized by C. Rosen.

Zone 1

This zone incorporates the top 0.05 metres of the palaeosol (context 1030) and with only twenty-two individuals, the environmental data must be considered tentative. *Discus rotundatus* and *Carychium tridentatum* dominate the assemblage; there are no obligatory hygrophiles and only a solitary specimen each of *Vallonia pulchella* and *Vertigo pusilla*. *Clausilia bidentata* and *Aegopinella pura* along with *Discus* are indicative of some woodland components. This suggests a dry, lightly shaded environment, perhaps provided by a thin tree canopy with some areas of low shrub. The presence of *Discus rotundatus* at this level indicates a post-6500 cal. BC date for the onset of tufa deposition at Langley's Lane (Preece and Bridgland 1999) although the Holarctic species, *Discus ruderatus*, that it replaces at that time is found in earlier tufa in the Wellow Valley approximately 100 metres away (Willing 1985).

Zone 2

This zone incorporates contexts (1008) (0.40-0.45m) and (1007) (0.45-0.65m). The zone is dominated by shade loving taxa *Discus rotundatus* and *Carychium tridentatum*. Shade demanding Gastrodontoidea are accompanied by shade tolerant *Acanthinula aculeata*, *Clausilia bidentata* and *Punctum pygmaeum*, indicating a wooded environment.

Wet ground fauna, *Lymnaea trunculata*, Succineidae and *Zonitoides nitidus,* in the absence of any other freshwater or amphibious taxa, suggest small areas of marshy or boggy ground rather than a large body of water. The ground is at its wettest at around 0.45-0.55 metres, when there is a peak in all the facultative hygrophiles.

Vallonia costata and *Vallonia pulchella* perhaps indicate the presence of some open herbaceous vegetation, but are tolerant of wetter conditions, whilst *Pupilla muscorum*, although usually a xerophyle, is found in sub fossil, wet ground contexts (Evans 1972). *Vallonia* are not present in sufficient numbers to suggest any significant ground clearance took place.

Zone 2 most likely comprizes woodland with some open structure and a mix of ecological niches, including pockets of wet and marshy ground.

Zone 3

This zone corresponds with the beginnings of the cessation of tufa deposition at 0.30-0.40m (context 1001). Shade loving taxa still dominate but the amphibious/freshwater G*alba truncula*ta and amphibious Succineidae disappear whilst *Vallonia costata* is joined by *Vallonia excentrica*, the most xerophilic of the British *Vallonia* species. *Pupilla muscorum* disappears and woodland species decline perhaps suggesting some ground disturbance or clearance.

Zone 4

This zone corresponds to the top of the subsoil (0.20-0.30m) and tufa is no longer a dominant feature of the soil morphology. Shade loving taxa decline dramatically and open country species dominate, including the appearance of *Helicella itala*. The taxa present indicate open conditions, probably grassland.

The lateral series

Due to the large dataset produced by the 120 lateral samples, only a summary of the results is presented here; a full account has been deposited with the site archive.

In general, the lateral sampling revealed fluctuations in the abundance of a few dominant taxa (especially *Discus rotundatus*) and the changing presence or absence of other species. Molluscan abundance was highly variable but, in general, higher numbers of snails were to be found towards the south of the sampled area. The dominant taxa include representatives of shaded, intermediate and open ground groups.

There are much higher levels of *Carychium tridentatum* and the Gastrodontoidea towards the south of the sampled area, especially in squares C20 and F12. This is suggestive of abundant leaf litter. *Acanthinula aculeata* and *Clausilia bidentata* are both rupestral species which prefer slightly drier conditions above ground level. Where they occur together, frequently in the southern most grid squares, and especially in A24, A34, B29, B35 and F12, the presence of fallen branches or possibly even standing tree trunks is suggested. There are no apparent signs of human disturbance.

The more northerly samples contained too few snails to draw meaningful conclusions about the local environment, with the notable exception of K11 (n=78), which is generally indicative of mixed shaded/open conditions, perhaps with fallen branches.

Discussion

The vertical sequence shows a similar environmental history to that at many other tufa sites such as Cherhill, Wiltshire and Holywell Combe, Kent (Davies 2008). The evidence from Zone 1, equivalent to the top of the palaesol, indicates a dry, lightly shaded environment, with *Discus rotundatus* supporting a post-6500 cal. BCdate for the start of tufa deposition. Zone 2 corresponds with both phases of tufa deposition and the main episodes of human activity and suggests the area was comprized of open woodland with pockets of boggy or marshy ground with some open vegetation, rather than constituting a large body of water. The paucity of freshwater and amphibious taxa indicate that the tufa formed slowly in thin surface layers from the underground springs. Following this, in Zones 3 and 4 (post-Mesolithic), freshwater and woodland species start to decline before becoming replaced by open country species.

Overall, the lateral sampling undertaken at the edge of clay with tufa (1008/3002) revealed that the dominant taxa include representatives of shaded, intermediate and open ground groups, with only very limited evidence for aquatic species. This supports the suggestion that the higher clay component in this tufa represents a gradual drying out phase.

Faunal remains by Martyn G. Allen

Introduction

An assemblage of animal bone totalling 115 specimens was excavated from the site. Whilst minimal in quantity, the remains represent a small window of opportunity for highlighting some aspects of mammal exploitation during the Later Mesolithic, a period during which faunal remains are generally rare.

Methods of analysis

The animal bone was analysed using the author's personal reference collection and some specimens were taken for further analysis using collections housed at the English Heritage Centre for Archaeology, Fort Cumberland. Each fragment has been counted individually and identified to species, where possible, or assigned a size category (e.g. large mammal). A number of specimens clearly fitted back together and, although these fragmentations may have taken place ante-excavation, they have been quantified as 'one'. Bone surface condition was assessed to examine preservation and limitations for recovery. This measure was based on the criteria set out by Behrensmeyer (1978) on an increasing scale from '0' to '5', where 0 is 'excellent condition' and 5 is 'highly fragmentary'. Measurements were taken from specimens according to the criteria of von den Driesch (1976). Dental ageing for *Bos* sp. was recorded using Grant's (1982) wear stages. Markers of butchery and burning were observed and described in specific detail, and though indications of sex, pathology and gnawing were looked for, none have been observed.

Preservation

The general surface preservation of the bone is marginally variable across the assemblage, though none of the material could be described as 'well preserved' and the mean condition value for the assemblage was 2.6. Many specimens had been subject to mild flaking of the external laminar bone, whilst a few had even suffered deep cracking. This level of preservation has contributed to an increased level of fragmentation and may well have precluded the observation of surface marks, such as butchery and gnawing.

Species representation

Red deer *Cervus elaphus*, wild boar *Sus scrofa* sp. and cattle *Bos* sp. were all identified from the assemblage (Table 5). Red deer is represented by a mandibular third molar from context 1008. The specimen is in an early stage of wear, indicating the presence of a young adult. Wild boar is also represented by tooth specimens from (3007), (3017/3029) and (3031). Two of these, (3007 and 3017/3029), are fragmented molars and, unfortunately, could not be measured, but both were unworn and root formation had not commenced at the time of death which suggests that these derived from quite a young individual, or individuals.

Table 5 Number of identified specimens by phase and context (Parentheses indicate possible aurochs *Bos primigenius*).

Table 6 Number of specimens according to element from cattle, red deer and wild boar (Parentheses as in Table 5)

Cattle are the best represented animal producing a total of thirty-eight specimens and are almost exclusively fragments of skull or foot/ankle bones, apart from a fragment of pelvis from context (3017/3029) (Table 6). Four of the cattle specimens, all from context (1007), are of particular interest. A number of these specimens derive from the skull of a large *Bos sp.* individual, of which three were identified as a fragmented part of an occipital bone (that which is sited on the ventral surface of the skull leading to the occipital condyles). The specimen is very large, raising the possibility that it could be derived from the wild form of cattle, aurochs *Bos primigenius*, subsequently confirmed by the radiocarbon dates. From the same context (1007), a *Bos sp.* proximal metacarpal was identified. Again, this specimen looked to be very large, and its greater completeness allowed for biometric analysis (see below).

From the non-identified specimens, shaft fragments from a femur (unstratified) and a radius (3017/3029) were identified as either cattle or red deer, as required diagnostic features were lacking. The femur looks to be rather slender and is possibly from a cervid, though the unstratified nature of the context does not rule out the presence of an intrusive modern cattle bone. The surface condition of this bone was relatively superior to the rest of the assemblage. All the remaining fragments derive from either large or medium-sized mammals, and all are conceivably from the three species already identified.

Ageing of cattle

All cattle specimens, where applicable, were fully fused at the epiphyseal junctions. The cattle M1/2 gave a Grant tooth wear score of E/F and, whilst it is difficult to give an estimate for age from this one specimen, it does indicate the presence of a young adult. Overall, there was no evidence of neonatal, infant or juvenile cattle in the assemblage. It is possible that the presence of such could have been lost through taphonomic processes post-discard.

Biometric analysis of the Bos metacarpal (context 1007)

A number of studies have previously used biometric analysis as a means for differentiating between early domesticated cattle *Bos taurus domesticus* and its wild progenitor, the aurochs *Bos primigenius* (Degerbøl and Fredskild 1970; Bökönyi 1995, 8-9; Kyselý 2008; Prummel and Niekus 2011, 1460). The completeness of the *Bos* sp. proximal metacarpal from (1007) enabled measurements to be taken and compared with other contemporary examples. The proximal breadth measured 68.5mm and the proximal depth 45.45mm. Against aurochs biometric data from material excavated at Star Carr, Yorkshire (Legge and Rowley-Conwy 1988), the Langley's Lane specimen thus sits neatly within the range of a group of smaller individuals (Fig. 12). This pattern is mirrored by comparison of the proximal breadth to measurements from female and male aurochs metacarpals excavated from sites in northern continental Europe (Degerbøl and Fredskild 1970). Here, the Langley's Lane bone specimen sits in the middle of the range for female aurochs (Fig. 13).

Figure 12 Comparison of Langley's Lane *Bos sp.* metacarpal proximal epiphysis measurement (breadth x depth) with data from Mesolithic Star Carr, Yorkshire (Star Carr data from Legge and Rowley-Conwy 1988). Produced by M. Allen.

Figure 13 Comparison of Langely's Lane *Bos sp.* metacarpal proximal epiphysis measurement (BP) with Mesolithic/Neolithic aurochs and Neolithic domestic cattle from northern continental Europe (Continental data from Degerbøl and Fredskild 1970, 92-97). Produced by M. Allen.

Butchery and Burning

A small number of specimens showed evidence of butchery. The complete metacarpal from (1007) had been deliberately and transversely broken mid-shaft. This breakage had caused an obviously related flake scar to occur on the proximal surface of the diaphysis at the breakage, indicating the direction of the percussion blow to the posterior surface (Fig. 14). On the articulating surface of the proximal end, cut marks are observable running transversely along the anterior side, and a large hole has been worked into the surface which projects into the marrow cavity of the shaft. This may have been for pushing the marrow out of the bone after breakage (Fig. 15).

Figure 14 *Bos sp.* metacarpal antetiror showing flake scar. Photograph by M. Allen.

Figure 15 *Bos sp.* metacarpal dorsal showing cut marks and marrow extraction hole. Photograph by M. Allen.

A second proximal *Bos sp.* metacarpal from (3017/3029) had also been fractured transversely through the diaphysis and showed signs of cutting on the proximal surface, very similar to that seen on the specimen in Fig. 14. The bone had, however, been further fractured into a number of smaller pieces – some which fitted quite well back together – and it may have been that the element had been continually struck to break open the proximal end in order to remove the marrow, rather than push it through a hole. Unfortunately, this meant that the specimen could not be measured.

A *Bos sp.* calcaneus from (1008) had been chopped, dissecting the articulating surface in half and causing quite a straight-edged break. There is evidence that the bone suffered a little extra breakage around the point of impact, and a large flake scar can be observed on the posterior surface. The *Bos sp.* mandible from (1007) showed signs of cutting around the posterior surface of the main articulation, presumably to remove the jaw from the skull, possibly to extract the tongue.

The *Bos sp.* calcaneus from context 1008 and *Bos sp./Cervus* radius from (3017/3029) both exhibited slight brown staining of their surfaces which may be indicative of heat-related activity, though the poorer surface condition of these specimens made identification difficult. However, some other fragments of large mammal bone from (3017/3029) showed better evidence for burning, with one specimen including a small blackened parch-mark.

Discussion

The biometric analysis and radiocarbon dating support the identification of a female aurochs. There is a suggestion that female aurochs may be under-represented in the European record due to an eagerness to identify early domestic cattle (Prummel pers. com.).

The butchery marks and body part evidence are somewhat revealing about the ways the animals were being exploited after death and may shed light on the function of the site. The cut marks seen on the *Bos sp.* metacarpal (1007) are suggestive of cutting through the cartilage to remove the bone from the front leg at the ‘wrist’, as well as exposing the proximal surface. The bone would thus be available to be held on a stable surface and struck in order to break off the distal end (which was not found amongst the assemblage). The hole in the proximal end could then be cut through the thick cortical bone on the articulating surface, presumably to push out the remainder of the bone marrow from within the cavity. Similar butchery techniques were also observed on aurochs metapodials excavated from Jardinga and Balkweg in the Netherlands, both of which are late Mesolithic in date (the former also producing quantities of red deer remains) and have been interpreted as kill and primary butchery sites (Prummel et al. 2002, 418; Prummel and Niekus 2011, 1461-1462). The Langley’s Lane material primarily includes evidence for head and foot elements and, although diminutive in sample size, would thus lend support for a similar interpretation.

Lithics by Rona Booth and Caroline Rosen

Introduction and methods

The lithic assemblage recovered from the excavations at Langley’s Lane totals 681 items from stratified contexts. Generally, the lithics were recovered by hand and no dry or wet sieving was employed. However, the programme of lateral sampling for molluscan evidence associated with (1008/3002), the Phase 1d tufa, did employ wet sieving and it is notable that very few lithics were recovered through this process. The stratified assemblage is composed of diagnostic Late Mesolithic lithics (tools and debitage), with no evidence of cultural mixing evident. Within the unstratified plough-zone soil, a small quantity of Neolithic and Bronze Age lithic material was observed. Also, the disturbed area of (3029), which also evidenced Neolithic and Bronze Age lithics (Fig. 6), did not contain any diagnostic Mesolithic lithic material. The lithics were analysed at the macro-scale, using a 10x magnification aid where necessary. Flakes with a ratio of 2:1 are classified as blades and blades with a width of 12mm or less are classified as bladelets.

Generally, the lithic material is in good condition, with the majority of items exhibiting fresh edges. However, a number of flakes and blades exhibited varying degrees of wear/damage on their edges, visible macroscopically. These pieces are otherwise fresh in appearance (e.g. unworn edges and dorsal ridges are undamaged) and, as such, rather than post-depositional damage the wear is suggestive of utilisation. When this use-wear was observed it was classified using three broad categories: light, moderate and heavy.

Raw material

The lithic assemblage is primarily comprized of flint items (96 per cent) with a small quantity of chert. The flint varies in colour from mottled grey to brown and black with no apparent preference for any particular raw material. For flint items with cortex present, it would appear that secondary sources were utilized, though some items were derived from primary chalk sources. Interestingly, flint recovered from the wetland deposit (1007) of Phase 1c comprizes only primary chalk flint. The chalk flint may in part originate from the Wiltshire Downs, some 30 km to the east of Langley's Lane, whereas secondary deposits of flints and cherts have been recorded in the Bath environs (see Davis 2012 pp.130-133), around 16kms north-east of the site.

The most common chert present is Greensand Chert which occurs as outcrops in the Blackdown Hills (c. 60 km to the south-west), although local non- extant sources may have been utilized. A single flake of Portland Chert perhaps came from one of the few known sources in Wiltshire rather than being derived from the Portland Beds in Dorset.

Retouched items

The retouched assemblage comprises a total of 52 items deriving from all stratigraphic phases (Table 7 and Fig. 16). The formally retouched tools include microliths, scrapers, notched pieces, denticulates, piercers, piercer-like flakes and miscellaneously retouched pieces.

Table 7 Quantity of retouched items by phase and context *probable. Parentheses indicates additional microlith fragments.

Figure 16 scrapers 1 (3002) 2-3 (3004); notched pieces 4-6 (1008); denticulates 7 (3003) 8 (3002);piercers and piercer-like flakes 9-10 (1006/3003) 11 (3029); cores 12 (3029) 13-14 (1008); microburins 15 (1008) 16-17 (3031); flake 18 (3029); blades 19-20 (1007) 21-22 (1006/3003) 23 (3002); bladelets 24-25 (3002); 26-31 lithics from pit [1031]; 32-39 lithics from pit [1048]; 40-43 lithics from pit [3006]; 44-46 lithics from pit [3010]; 47-54 lithics from pit [3008]; 55-70 lithics from pit [3012]; 71-76 lithics from pit [3020]; 77-84 lithics from pit [3027]; refit between nos. 40 and 71. Grey scale indicates tufa adherence. Lithics illustrated by C. Rosen.

Microliths: A total of thirteen microliths, one probable microlith and six microlith fragments of indeterminate types were recovered from stratified contexts, related to phases 1a, c and e; though the quantity varies between phases, with microliths from Phase 1e constituting just under half of all microliths (six identifiable forms and six fragments) (Table 7). Of the thirteen microliths, two represent complete pieces, six have either their proximal or distal tips broken and five are broken at either the proximal or distal end. The breaks are not modern as the same level of patination covers the broken surface in all cases. For the typological characteristic of the microliths see 'Typo-chronological evidence' above.

Scrapers: A total of four scrapers were recovered, one each from contexts (3017) (Phase 1c) and (1008/3002) (Phase 1d) and two from context (3004) (Phase 1e). The scrapers have all been made on flakes, with one flake being broken, and the raw material used in each case is different, though all are flint. Cortex is present on two of the scrapers, whilst two scrapers have tufa adhering to them. The scraper from (3017) was produced on the end of a small flake and resembles a thumbnail type. The tufa adhering to the dorsal surface is obscuring key detail, however some semi-abrupt retouch is visible. The scraper from (3002) is broken but would have been fashioned on a large flake (Fig. 16.1). Semi-abrupt retouch is present at the distal end and additional fine retouch is present along the left-hand side, though the extent of this is unknown as this fine retouch continues into the break. The two scrapers from (3004) were both produced on medium sized flakes. One is an end scraper with abrupt retouch (Fig. 16.2), whilst the other has abrupt and semi-abrupt retouch along all edges (Fig. 16.3). The retouch on all four scrapers is more irregular than systematic which suggests expediency.

Notched pieces: Eight notched pieces were recovered: one each for contexts (1007) (Phase 1c) and (1010) (Phase 1e) and six from (1008/3002) (Phase 1d). The notched pieces were all produced on flakes of different shapes and sizes and differing raw material (though all are made on flint), apart from one which was produced on a bladelet (Fig. 16.4). For the latter, the bladelet is broken, though unlikely to have been much longer then the extant piece and is quite thick (10mm wide and 9mm thick), therefore precluding this piece being an attempt at microlith production using the microburin technique. The single notches on all of the pieces have been produced by abrupt blows struck from the ventral surface and are located along one of the lateral edges of the piece.

Denticulates: A total of three denticulates were recovered: one each from contexts (3031) (Phase1c), (1008/3002) (Phase1d) and (3003) (Phase1e). All three were produced on flakes: two of the flakes are quite thick (10mm and 12mm) with one representing a primary flake with 90 per cent cortex. The denticulate from (3031) has been modified by irregular retouch along the left-hand lateral edge, with additional edge damage along this edge. The piece from (1008/3002) is modified along the left-hand side lateral edge with irregular semi-abrupt retouch and edge damage (Fig. 16.8). Irregular semi-abrupt retouch and edge damage also characterized the piece from

(3003), though here the distal end of the flake was modified (Fig. 16.7). The irregular character of the retouch on all three denticulates suggest expediency.

Piercers and piercer-like flakes: Two formally retouched piercers were recovered from context (1006/3003) (Phase 1e) and three piercer-like flakes were recovered from (3017/3029), (1049) and (3026) (all Phase 1c). The two formally retouched piercers were produced on thinner flakes (3mm and 4mm). One piercer has semi-abrupt retouch along both lateral edges of the flake at the distal end to form a point; the point is slightly rounded showing signs of use (Fig. 16.10). The second piercer has only been retouched (semi-abrupt) along one lateral edge with the cortex present along all of the opposing edge (Fig. 16.9). Again, the tip is slightly rounded showing signs of use.

The three piercer-like flakes evidence no retouch, however their form is strikingly similar to formally retouched pieces. One of these, from context (1049), has a slightly rounded tip demonstrating that this item, at least, was used as an expedient piercer. The other two piercer-like flakes have very small chips broken from their tips which may have occurred during use as a piercer (Fig 16.11).

Miscellaneously retouched pieces: A total of twelve miscellaneously retouched pieces were identified from eight contexts associated with phases 1c, d and e (Table 7). All examples are on broken flakes or debitage fragments, with fine, semi-abrupt and abrupt retouch observed. All of the pieces are too fragmentary to suggest that they are fragments of more formal tool types. However, given the expedient character of the other retouched tools from the assemblage, it is likely that these pieces represent expediently applied retouch.

Debitage

Cores: The assemblage contains sixteen cores and nine core fragments (Table 8). All of the cores are flint, apart from one which is chert. As a group, all of the cores are of a similar type, though there is variety in the raw material suggesting they all derived from different sources. Ten of the cores can be classified as being irregular in shape with multiple platforms at irregular angles (Fig. 16.12-14 and 44). In all but one case, the negative scars show bladelet and small flake removals; one irregular core evidences flake removals. All but three of the ten cores show that step and hinge fractures were common. These, as well as the small size of the cores, indicate that they were worked to exhaustion.

Table 8 Quantity and character of debitage by phase and context. Parenthesis notes additional broken examples.

Three of the cores are opposed platform cores, two from (3031) and one from (3005) (Fig. 16.40), both contexts are associated with Phase 1c. The three cores evidence bladelet and small flake removals. The small size of these three cores indicate that they have been exhausted. Significantly, the core from (3005) refitted with a core rejuvenation flake from (3019) (Fig. 16.85).

Only two cores can be described as single platform conical. One is chert, from (3031) (Phase 1c), with clear evidence of bladelet removals and its small size indicates it is exhausted. The other is from context (1008/3002) (Phase 1d), again, with clear evidence of bladelet removal and can be considered exhausted due to its small size.

The nine core fragments all evidence bladelet and small flake removals, some with step and hinge fractures. Like the cores, they occur in a variety of raw materials, though they are all flint.

Core rejuvenation flakes: A total of thirty-one core rejuvenation flakes were recovered from contexts associated with phases 1c, d and e (Table 8). These pieces primarily comprize larger plunging flakes, many of which have cortex present, as well as a couple of larger crested blades and one core tablet. There are three contexts where quantities are greater: the dryland of Phase 1c (3031 and 3017/3029) (ten pieces), the alluvial deposit (1006/3003) (five pieces) and stony surface (3004) (five pieces) of Phase 1e. The larger size of these pieces and the presence of cortex on many of them would suggest that initial core working was occurring, though was not extensive.

Microburins: Five microburins are present in the assemblage, three from contexts (3031) (Phase 1c) (Fig. 16.16-17) and one each from contexts (1008/3002) (Phase 1d) (Fig. 16.15) and (1054/3013) (Phase 1e) (Table 8).

Flakes: Flakes and broken flakes constitute a large proportion of the debitage assemblage, totalling 133 and seventy-two items respectively (Table 8). They occur in phases 1c, d and e and occur in the deposits relating to these phases, as well as most of the features. As a group the flakes vary in size from quite small to larger pieces. However, the flakes demonstrate some differences between the phases/contexts and are best described in relation to these.

The flakes from the dryland deposits associated with Phase 1c, (3031) and (3017/3029), are dominated by smaller flakes (inc. broken flakes) (<240x200mm) with lesser quantities of larger pieces which include a few larger primary and secondary flakes. The raw materials used are varied, though all are flint; similarities in raw material between some flakes suggests that they derived from the same core, however no refits were found. Some of the larger flakes show moderate to heavy edge-damage.

Only five flakes and one broken flake was recovered from the wetland of the tufa spring (1007). Like those from the dryland contexts, there is evidence of utilisation on some of the pieces. A few flakes, fifteen complete and six broken, were recovered from five of the Phase 1c pits [1048, 3027, 1031, 3020, 3008]. These are all small in size with no evidence of edge-damage.

The flakes from the clay with tufa deposit (1008/3002) of Phase 1d are dominated by medium to larger sized pieces (> 20x18mm) with the largest piece measuring 52x37mm. Some small flakes are present, but the smaller items are dominated by debitage fragments (see below). There is also a small quantity of secondary flakes present. The raw material is represented by a variety of flint types as well as two large chert flakes with heavy edge-damage. A large proportion of the flakes have light, moderate and/or heavy edge-damage indicating that they were used expediently on a range of materials.

Flakes from the alluvial deposit (1006/3003) of Phase 1e are dominated by small flakes (<23x12mm). There is some light to moderate edge-damage on some of the pieces, however the majority of these items appear to be knapping debris rather than expediently used pieces.

The flakes from the stony surface (3004) of Phase 1e are dominated by medium sized flakes (average size 20x15mm) with a distinct lack of smaller flakes which are characteristic of (1006/3003). Some of these flakes evidence light to moderate edge-damage.

Only three complete and two broken flakes were recovered from pit [3012], all of which are small in size. The two recuts [1055/3014] and [3030] which cut this pit also contained some complete and broken flakes, again of a small size. Finally, ten complete and ten broken small flakes were recovered from the natural feature [1026].

Blades: In total nineteen complete and seventeen broken blades from contexts relating to phases 1c, d and e (Table 8). Six blades and one broken blade were recovered from the dryland (3031) and (3017/3029) associated with Phase 1c. These items derive from different sources of flint and some show evidence of light to moderate edge-damage. From the wetland of the tufa spring (1007), one complete blade of chalk flint was recovered showing moderate edge-damage (Fig. 16.20).

There is one blade and twelve broken blades from the clay with tufa (1008/3002) of Phase 1d (Fig. 16.23). The blade shows heavy to moderate edge-damage along both lateral edges.

The alluvial deposit of Phase 1e (1006/3003) had five complete blades associated with it (Fig. 16. 21-22). Two of these show heavy edge-damage. Three complete and two broken blades were recovered from the stony surface (3004), with one of the complete blades (chert) evidencing heavy edge-damage.

Bladelets: A total of thirty-eight complete and forty-nine broken bladelets were recovered from deposits and features from phases 1c, d and e (Table 8). Notable quantities derive from three particular contexts. Twelve complete and nine broken bladelets were recovered from the dryland (3031) and (3017/3029) associated with Phase 1c. One piece shows evidence of moderate edge-damage. From Phase 1d, three complete and eighteen broken bladelets were recovered from the clay with tufa (1008/3002) (Fig. 16.24-25). In all cases the broken bladelets are represented by both proximal and distal fragments.

Debitage fragments: A large proportion, 240 items, of the assemblage, from all phases, has been classified as debitage fragments (Table 8). These pieces are characterized by smaller broken pieces of debitage which cannot be attributed to a formal debitage classification. It is likely that the majority of these are related to knapping activity and microlith production.

Tufa adhering to flint

It is worthy of note that a number of lithics had tufa adhering to them (Table 9). It is unsurprising that tufa adheres to the lithics from the pure tufa deposit (1007) of Phase 1c and the clay with tufa deposit (1008/3002) of Phase 1d, as these deposits were formed from an active tufa spring. However, tufa was also observed adhering to lithic items from dryland deposits (3017/29) and (3031) and two of the pits of Phase 1c and some of the features associated with Phase 1e.

Table 9 Quantification of lithics with tufa adherence

Burnt pieces

A total of fifty-six pieces of flint were burnt. These derive from contexts associated with Phases 1c, d and e (Table 10). Quantities by context are generally small apart from two which evidence slightly higher occurrences. The dryland, (3031) and (3017/3029), of Phase 1c evidences twelve burnt pieces, 12 per cent of items from this context. The other notable quantity is from (1006/3003) of Phase 1e where twenty-three items, representing 14.5 per cent of items from this context, exhibited burning.

Table 10 Quantification of burnt lithics

Discussion

The lithic assemblage recovered from the site is relatively small, particularly when compared to other Mesolithic spring sites such as Hawkcombe Head, Somerset (Gardiner 2007) and Blick Mead, Wiltshire (Jacques and Phillips 2014). This small size, however, may reflect the size of the excavation trenches. Nevertheless, the assemblage is important as it derives from sealed deposits and features and shows no evidence of cultural mixing. The date of the assemblage is Late Mesolithic based on the microliths (see Typo-chronology above), though substantially supported by the presence of bladelets, microburins and bladelet cores.

The formal tools from all phases are few in quantity and are represented by a small range of types. When considered by phase, excluding Phase 1a, the retouched component constitutes 7 per cent for phases 1c and 1d and 8 per cent for Phase 1e. These totals are a little higher than those recorded from other Mesolithic knapping sites, for example Blick Mead, Wiltshire records 3 per cent (Jacques and Phillips 2014) and Streat, Sussex records 2 per cent (Butler 2007). This higher frequency of retouched items may be a result of the hand-collection methods employed during the excavation.

Microliths are the most common tool in the retouched assemblage and it is notable that nearly all examples are broken to some extent. The presence of complete and broken bladelets from phases 1c (n=26), d (n=21) and e (n=38) suggests that microliths were being produced on site, perhaps to repair hunting equipment. Only five microburins were observed in the assemblage, three from the dryland (3031) of Phase 1c and one each from the clay with tufa (1002/3002) of Phase 1d and the large pit [1055/3014] of Phase 1e. The presence of these items in each of the three main phases of activity support microlith production on site; however, their low numbers may reflect either a technological strategy (Finlay 2000), or the biases involved in hand collection of lithic material. The presence of notched flakes, albeit in small quantities, may also support an interpretation that hunting equipment was being repaired; use-wear and residue analysis on notched pieces from Mesolithic sites in France has demonstrated that they were used as scraping tools on a variety of materials, which included tasks such as the shaping of arrow shafts but could also involve basket making, thread/string making and possibly bone working (Gassin et al. 2013).

The remaining retouched items include scrapers, denticulates, piercers (and piercer-like flakes) and miscellaneously retouched pieces. Apart from the miscellaneously retouched pieces, these items occur in low quantities, particularly when quantified by phase. The irregular retouch observed on the scrapers and the denticulates may suggest that these items were expediently produced. The function of these tools at Langley's Lane is difficult to interpret as no use-wear or residue analysis was carried out. For phases 1c, d and e, it is possible that the scrapers and denticulates may have been employed in animal processing tasks, given their spatial association with the butchered faunal remains. The recent micro-wear analysis on the scrapers from Star Carr has demonstrated that scrapers were most commonly used on hides, though bone, plant and wood materials were also scraped (Conneller et al. 2018). One of the denticulates/notches from Star Carr was used for butchery and two were used to scrape/shave bone, though more commonly plant-based materials were scraped or planed (ibid.).

It was notable that a number of flakes and blades from the dryland (3031 and 3017/3029) and wetland (1007) deposits associated with Phase 1c evidence moderate to heavy edge-damage, suggesting these pieces were expediently utilized on a harder material. The lithics from the tufa spring waters (1007), in particular, show heavy edge-damage. Both the dryland and wetland lithics were closely associated with butchered aurochs remains.

Edge-damage was also observed on some of the larger flakes from the clay with tufa (1008/3002) of Phase 1d, though for these the edge-damage ranged from light to heavy and suggests expedient use on a range of materials, both soft and hard. Some light to moderate edge-damage was observed on some of the larger items from the contexts associated with Phase 1e, however in comparison to the earlier phases there would seem to be less focus on the expedient use of flakes.

The two piercers from (1006/3003) of Phase 1e point towards a greater diversity of tasks in comparison to the earlier phases. However, three piercer-like flakes were recovered from Phase 1c, with one of these showing signs of use.

The large quantities of debitage fragments as well as cores, core fragments and core rejuvenation pieces from phases 1c, d and e attests to the knapping of flint on site. For the dryland deposits of Phase 1c (3031 and 3017/3029), the cores are all exhausted, this coupled with the high occurrence of smaller flakes and debitage fragments, suggests that flint was brought to the site predressed; some primary core rejuvenation flakes, however, are present. This also seems to be the case for the lithics from Phase 1d.

It is worthy of note that the lithics from the stony surface (3004) associated with Phase 1e are dominated by larger primary flakes and larger core rejuvenation pieces with a distinct lack of smaller flakes and only a small number of debitage fragments. This signature is different from that observed for the alluvial deposit (1006/3003) of the same phase, which evidences a large quantity of smaller flakes and debitage fragments and a small quantity of primary flakes and may indicate a certain amount of ‘zoning’ or separation in activity, with initial core reduction being carried out on the stony surface (3004).

During all phases, the lithic evidence suggests microlith production and possibly hunting equipment maintenance. Given the spatial association of the lithics to butchered aurochs remains, it is possible that animal processing tasks are represented by the expedient use of flakes and blades and the presence of expediently produced denticulates and scrapers, though these items could also have been used on a variety of materials. Throughout all phases, there is a distinct lack of ‘formally’ produced tools (apart from the microliths) and a high utilisation of flakes and blades, which points towards expedience. The absence of other formal tool types often associated with Mesolithic settlement sites, such as core tools and burins, as well as a technological strategy which favoured expediency, point towards Langley’s Lane being a place which was not occupied for long periods, though undoubtedly the evidence represents multiple visits.

Stones and fossils by Rona Booth

In total, 196 stones and two fossils were recovered from a variety of contexts associated with phases 1c, d and e. The stones comprize a variety of geologies and were visually examined and classified in relation to their broad geological type. The range of geologies represented include limestones, sandstones, ironstones, quartz, mudstone and coal; all of these geologies are not immediately local to the tufa spring, with sources ranging from between 400m and 10km from the site. However, it is also possible that some of the stones derived from the Wellow Brook which runs adjacent to the site. The two fossils are belemnites and derived from context (1049), the fill of pit [1048].

Generally, the stones were small in size, ranging from 5mm to 40mm in length. What is striking about these stones is the variety of colours which are represented, various shades of reds, browns and yellows as well as white and black. Some of the stones show evidence of having been burnt.

A few notable larger items were present and include: a piece of micaceous sandstone from (3017/3029) measuring 40 x 25 x 4 mm with possible cutmarks on one surface; a tufa-coated Blue lias stone from (1007) measuring 25 x15 x 40 mm in size, with a small patch of a black substance adhering to it; a larger piece of onchoidal tufa and a piece of ironstone measuring 45 x 35 x 11 mm from (1008/3002); a piece of sandstone from pit [1024/3012] measuring 90 x 40 mm with a flattened smooth surface, perhaps for grinding or polishing, with tufa adhering to all surfaces apart from the smooth one; and a piece of White lias from [1055/3014] measuring 125 x 85 x 40 mm with tufa spots adhering to one side.

It is worthy of mention that the stone from the dryland deposits (3017/3029) and (3031) of Phase 1c were all found in groups on the surface of these deposits. In the case of context (3031) the stones were found in association with a cluster of lithics and bones.

Finally, some of the stones had tufa adhering to them: six of the stones and one of the fossils from pit [1048]; the larger piece of sandstone from pit [1024/3012]; and three pieces of red sandstone and a piece of Lias from pit [1055/3014].

Tufa ball by Jodie Lewis

Within pit [1032] a hand-moulded tufa ball was recovered (Fig. 17). The ball was roughly spherical with a diameter of 70 mm in diameter and appeared to be formed by moulding a lump of tufa and clay between two hands: a replica was easily made during the excavation. The ball failed to retain its shape post-excavation and was subject to molluscan analysis but the sample size proved too small for meaningful conclusions to be drawn. A small amount of magnetic ferrous material was also found in the ball, though this could have been a natural inclusion in the tufa or clay.

Figure 17 *In situ* hand-moulded tufa ball within pit [1032] alongside a replica. Photograph by Jodie Lewis.

A second tufa ball may have been present in pit [3008]. As discussed above, this took the form of an indeterminate lump but contained within it were eight lithics, nine small stones and eight animal (*Sus* and medium sized mammal) bone fragments.

Discussion

A memorable event (Phase 1c)

The lithics and faunal remains recovered from the tufa spring and the contemporary dryland deposits, as well as the digging of pits near the edge of the spring waters, represents the most intensive phase of activity at the site. A date from one of the aurochs elements from the tufa spring waters indicates that this activity commenced during the earlier part of the second half of the seventh millennium cal. BC. During this phase the tufa spring waters would have formed a boggy and marshy area, rather than a large body of water; the shade loving and shade tolerant molluscs also indicate a wooded environment with some open structure. During Phase 1c, the spring was at its wettest and the calcium carbonate rich waters would have been visible as a murky white wetland.

The overwhelming dominance of aurochs head and feet bones which show butchery and marrow extraction marks point towards a kill and primary butchery site. One metacarpal from the tufa spring waters evidenced cut marks, indicative of cutting through cartilage to remove the bone from the leg, and a large hole, probably for marrow extraction. Cut marks on the mandible are also likely the result of removing the jaw from the skull to extract the tongue. From the dryland deposits, it seems that the butchery marks on the *Bos sp.* metacarpal represent repeated striking of the element to break open the proximal end to remove the marrow. Additionally, some of the dryland bones evidenced burning. It is likely that the aurochs remains from this phase of activity represent one animal, probably a young female.

The lithic material recovered from the dry and wetland deposits accord well with butchery activity, though those from the dryland possibly represent multiple visits rather than a single activity episode. However, all the lithics from the tufa spring, which were recovered in close proximity to the aurochs remains, were of chalk flint and are more convincing evidence of a single episode of activity.

The dryland assemblage is dominated by flakes, with some blades, and many items exhibit moderate to heavy edge-damage, suggestive of use on a hard material such as bone. The presence of microliths, a notched piece and bladelets suggest the production of projectiles, perhaps to repair hunting equipment. Interestingly, twelve pieces of flint from the dryland contexts are burnt; this, as well as the burnt *Bos sp.* remains, suggest the presence of hearths and the cooking of meat, though no hearths were observed during excavation.

Within a European context, faunal assemblages of this type are rare, with Prummel and Niekus (2011) noting that only a few sites are certain – three from the River Tonger in the Netherlands (Jardinga-1, Jardinga-2 and Balkweg) (Prummel et al. 2002; Prummel and Niekus 2011), one from Schlaatz in Germany (Benecke 1999) and, possibly, one from Sassenberg-Hildenbrink (Auler 1995). The aurochs elements from the River Tonger sites comprize feet and lower leg bones as well as ribs, vertebra and cranial bones; at all three sites cut and chop marks, as well as some burning, are present (Prummel et al. 2002; Prummel and Niekus 2011). Like the evidence from Langley's Lane, it would seem that bone marrow was extracted and consumed on the spot (ibid.). Some lithic evidence was associated with these sites: at Balkweg a single flint blade, broken in two parts, with a small notch near the proximal end was found and at Jardinga-1 and Jardinga-2 five blade fragments, a piece of flint with some traces of hammering and a scraper were recovered.

Within Britain, faunal assemblages of Mesolithic date are generally rare (Blinkhorn and Milner 2013) and, to the authors' knowledge, few other confirmed aurochs kill and primary butchery sites are known. Rowley-Conwy (2017) has argued that hunting and butchery took place at several of the Early Mesolithic sites around prehistoric Lake Flixton in Yorkshire, based on skeletal element frequency which suggested meatier parts of the animals had been removed. Of particular note is a group of aurochs bones from Seamer Carr site B, found associated with a small assemblage of flint artefacts, which may be indicative of butchery in preparation for meat transport (Rowley-Conwy 2017). Bones represented include include pelvis, ribs, vertebrae, a hyoid and right mandible and maxilla.

At King Arthur's Cave, in Herefordshire, a preponderance of dentition and foot bones, from red and roe deer as well as aurochs, have been interpreted by ApSimon et al. (1992) as evidence for 'intensive butchery'. The faunal remains from this site have not been subject to radiometric dating, though are believed to be Mesolithic based on their association with diagnostic Late Mesolithic microliths. The aurochs elements include twenty-three teeth, one carpal, two acetabulum, three phalanges, one sesamoids and one vertebrae (ibid.).

At Blick Mead, in Wiltshire, aurochs foot and ankle bones comprize the majority of the assemblage; Rogers et al. (in Jacques et al. 2018) briefly consider the possibility of a kill-site, however as the preservation in the chalky deposits was poor, they suggest that this may account for the dominance of harder foot bones. In addition, they propose that the high proportion of proximal hind limb bones are indicative of Blick Mead being a base camp.

At Langley's Lane, the butchered faunal remains were recovered from both the dryland area of the site as well as from the boggy and marshy area of the active tufa spring. Assuming that the animal was not butchered within this marshy area, it would seem that some (twenty-nine elements) of the non-meat bearing elements, as well as some of the lithics used during butchery, were selected for deposition within the watery context.

The practice of disposing of animal remains in a culturally appropriate manner has been observed at the Early Mesolithic site of Star Carr in North Yorkshire. Recent excavations at the site have demonstrated that animal remains (antler points and skeletal elements) as well as the flint tools used in animal butchery were being collected and then deposited within the waters of palaeolake Flixton (Taylor et al. 2017; Conneller et al. 2018). Also, at Flixton School House Farm, on the southern shore of Lake Flixton, aurochs remains were placed in a shallow pool of water, the act representing a single episode of deposition (Conneller and Overton 2018). Ribs, vertebrae and pelvis were present but were not articulated, suggesting that bones were selected from a larger assemblage and deliberately deposited together, perhaps in a bag (Conneller and

Overton 2018; Overton and Taylor 2018).

At the Late Mesolithic spring site of Blick Mead in Wiltshire, just over 50kms east of Langley's Lane and of a similar date, a range of skeletal elements from different animals were placed in the spring waters (Jacques and Phillips 2014; Jacques et al. 2018). Jacques et al. (2018) consider the possibility that these remains represent refuse discard but go on to note the presence of intact microliths amongst these remains. These artefacts were not at the end of their use-life which could suggest deposition at Blick Mead was influenced by factors other than simple refuse disposal (ibid.).

Taylor et al. (2017, 38), after Conneller (2003), have argued that practices of this nature should not necessarily be taken to indicate a 'purely' ritual site. Rather, the deliberate deposition of animal bones and material culture into wetland environments should be considered as 'culturally appropriate modes of treating this material'. Often, as at Star Carr and Blick Mead, these culturally appropriate depositional practices are occurring alongside more prosaic activities (Taylor et al. 2017). At Langley's Lane, the deposition of animal bone and the lithics used to butcher the animal together with primary butchery activities, the removal of the meat-bearing elements for consumption elsewhere, the production of microliths and the maintenance of equipment may reflect this pattern.

In addition to the butchered aurochs remains, a limited quantity of wild boar remains (some of which are identified as medium mammal but suspected to be boar) were also recovered from the dryland context (three teeth) and from one of the pits which respect the wetland edge (one tooth and seven bone fragments). The wild boar remains from the pit were found within a lump of pure tufa which possibly represent another hand-moulded tufa ball. Also incorporated into this lump of tufa were a microlith and seven items of debitage as well as nine stones. Of particular interest is the different depositional context in which the wild boar remains were found. The presence of these bone fragments within a probable tufa ball which was placed in a pit suggests that the remains of this animal were subject to a different set of cultural practices.

The digging of the nine pits near to the wetland edge is a practice as yet unparalleled in the British Mesolithic. As has been noted earlier, they do not seem to be structural in nature and their small size and single fills suggest they were rapidly executed and quickly backfilled. The lithic material contained within them which is generally unremarkable, is dominated by debitage fragments with some flakes and bladelets and one microlith; had they not been recovered from the pits they would not warrant further discussion. The range and size of material is similar to that recovered from the dryland deposits the pits cut, leading to the possibility of residuality. However, two items of flint from two separate pits refitted, which may suggest purposive selection and deposition; and tufa coated lithics were observed from two of the pits, items which must had been in contact with the tufa rich waters. In addition, lithics were incorporated into the possible 'dissolved' tufa ball in pit [3008], which constitutes a deliberate act; the small stones within the pits is also suggestive of a structured deposit. The range of colours represented by these stones is striking – white, yellow, grey, brown, black and red – with a few small pieces of quartz and others with quartzitic inclusions. All of these materials can be found between 400 metres and 10 kilometres of the site, although we have discussed the possibility of their presence in the Wellow Brook: either way their selection indicates purposeful acquisition. Yet undoubtedly, the most convincing – and striking – evidence for purposeful, structured deposition within the pits is shown by the placement of a hand-formed tufa ball in one of them.

Blinkhorn et al. (2016) have recently reviewed the evidence for the presence of pits on

Mesolithic sites in Britain and Ireland. They have noted that the evidence from the pit-fills indicate a variety of functions which may include refuse disposal, deposition, possible caching and burial. They considered the difficulty in interpreting purposive depositional practices and distinguishing this from refuse disposal based on the information available from site reports. At Langley's Lane, although it is possible that some of the lithic items are residual, the pits show incontrovertible evidence for structured depositional activities.

Although the pits, the dryland and wetland flint and the faunal assemblage are archaeologically assigned to the same phase, it is possible that they represent a series of visits to the site. The radiocarbon dates suggest that this wetter phase of the tufa spring lasted between 270 to 690 years, based on the date of the cut marked *Bos sp.* element from the pure tufa deposits, the presence of *Discus rotundatus* in the deposits associated with Phase 1a and the radiocarbon date on the cut marked *Bos sp.* element from the base of the clay with tufa associated with Phase 1d. Whether the activity associated with Phase 1c occurred intermittently throughout this period or whether it represents more intensive periods of activity at a particular time is not possible to infer.

A persistent place (Phase 1d)

As time passed the micro-environment of the tufa spring began to change. The spring wetland environment characteristic of Phase 1c started to dry out, evidenced by the higher clay content of the tufa. The molluscan evidence continues to indicate a wooded environment with some open structure. During this drying out phase, Mesolithic communities continued to visit the spring and deposit aurochs remains and flint into the surviving spring waters. This drying out phase commenced at some point shortly after the beginning of the sixth millennium cal. BC.

Deposited into the slower and, perhaps, more intermittent spring waters were both faunal remains and struck lithics. The faunal remains are represented by eight bones (some fragmented), including a chopped aurochs calcaneous with brown staining, possibly heat related. Apart from the chopped aurochs calcaneous, the faunal remains were found during the lateral mollusc sampling at the very edge of the clay with tufa.

The lithic material was found stratified through the clay with tufa and their horizontal and vertical distribution suggests that they probably represent more than one depositional episode. The character of the assemblage is similar to the lithics from Phase 1c: the retouched component is dominated by notched pieces accompanied by one probable microlith, one scraper and one denticulate. The debitage component is dominated by larger sized flakes (broken and complete), which evidence light, moderate and heavy edge-damage, broken blades and broken bladelets as well as a high quantity of debitage fragments. As such, this assemblage represents a variety of tasks probably including flint knapping, microlith production and the expedient use of larger flakes on a range of materials – tasks which also reflect the activities associated with Phase 1c.

What seems striking is that the emphasis of activity now appears to be focused on the spring waters, rather than the dryland adjacent to the spring. During Phase 1c, the deposition of lithics and faunal remains into the spring waters was comparatively restricted, probably representing material associated with the aurochs butchery. In contrast, the activity associated with the dryland is rich, represented by clusters of lithics and faunal remains and pits. During Phase 1d, this situation seems to be inverted, with activity focusing on depositional practices in the spring waters. The contemporary dryland deposit (3034) was devoid of archaeological material culture. However, as noted, this does not necessarily preclude the possibility of dryland activity to the south and east of the spring waters as these areas were not excavated. Nevertheless, the lithic assemblage recovered from the spring waters, during Phase 1d, is large in quantity (n.159) compared to Phase 1c (n. twelve) and is represented by a range of tools and debitage, some of which show evidence of use. As such, during Phase 1d, there appears to be a shift in attitude towards depositional activities, with the emphasis now focused on the spring waters and placing items within it.

Remembering and marking the former spring (Phase 1e)

This final Mesolithic phase comes after the spring had dried up and clay with tufa formation ceased. The site of the spring was now marked by a low, dry white tufa mound which continued to attract human activity. A large pit, later cut by two postholes, was dug here and a small stony surface created; six stakes were erected; flint knapping took place and aurochs were consumed. Although attempts to date this phase through radiocarbon dating were unsuccessful, the calculated rates of tufa formation coupled with the presence of rod microliths indicates that it is likely to have occurred at some point during the fifth millennium cal. BC.

Although it should not be assumed that the activities associated with Phase 1e are all contemporary, there is a common theme that links them: they are all focused on the dry tufa mound or the boundary of the mound and the surrounding deposits. It is important to note, however, that once the tufa spring had dried out, vegetation would have soon colonized the mound. That the activities associated with this phase focused on or respect the edge of the tufa mound suggests that they were taking place whilst it was still visible.

The large pit was dug at the junction of the dry tufa mound and the adjacent alluvial surface; whilst digging this pit the contrasting deposits of the white tufa and the brown alluvial material surrounding the mound would have been visibly apparent. The pit contained a small collection of lithics, including an unfinished microlith, and colourful small stones. Interestingly, the pit was recut by what are believed to be two postholes approximately 0.15 m in diameter, both recuts were circular and had straight sides with one containing a large stone thought to be post packing. This is a phenomenon observed at a number of other Mesolithic pits in Britain and Ireland; Lawton-Matthews and Warren (2015, 145) term such postholes pit markers and suggest that they indicate a concern with marking points in the landscape, though some may also have had a structural function.

The presence of two features potentially of natural origin within 1m of this pit may be important. One of these contained lithics, stones and a belemnite fossil and although these could be residual, the presence of the colourful stones and the belemnite may also suggest a structured deposit. Lawton-Matthews and Warren (2015, 147) noted the similarities between the treatment of some tree throws and pits in the Irish Mesolithic and suggest that these classes of evidence should be treated together. The deliberately laid stone surface at the edge of the tufa mound, close to the large pit, suggests the creation of bounded spaces. Significantly, the lithic material recovered from this stony surface is different in character to the lithics found on the adjacent contemporary ground surface. The assemblage is dominated by larger lithics such as cores, core fragments, larger primary flakes and core rejuvenation pieces; little in the way of small debitage was present. This may suggest a certain amount of 'zoning' or separation in lithic working, with the initial reduction of cores taking place on the stony surface.

The contemporary ground surface adjacent to the dry tufa mound contained a number of lithic items, including formally retouched items and debitage, though lacking the larger core preparation and rejuvenation flakes associated with the stone surface. The assemblage suggests that flint knapping to produce microliths and other expedient items were the focus here.

In addition to the lithics, aurochs and large mammal bone fragments were recovered from both the stony surface and the adjacent ground surface, suggesting that processing and/or consumption featured in the activities taking place.

This continued interest in the site, particularly at a time when the spring had dried out and transformed into a low white mound, attests to the continuing significance of this place. Like Phase 1c, and probably Phase 1d, more prosaic activities (food consumption, flint knapping) appear to be occurring alongside practices which do not exhibit a utilitarian function. The digging of a large pit and the subsequent marking of this with two posts, as well as the marking of the tufa mound by six stakes suggests the need to physically augment and make visible visits to the site.

The presence of a small quantity of tufa coated lithics in the large pit and one of the postholes cutting it, as well as on the stony surface and in one of the natural features, probably derived from the deposits which make up the tufa mound, as during Phase 1e the tufa spring had completely dried out. These lithics (and perhaps other material) are likely to have been encountered during the digging activities of Phase 1e.

Overview

Langley's Lane offers us a rare intimate glimpse into the development of a persistent place in Late Mesolithic Britain. In the middle of the seventh millennium cal. BC, a young female aurochs was killed and butchered at the tufa spring; some of the non-meat bearing elements of this animal and probably some of the tools used during butchery were deposited in the murky, white spring waters. Wild boar teeth and bones as well as small colourful stones were brought to the site for deposition in pits near the edge of the spring. Engaging with the material properties of the tufa became an important component of these visits. Visits to the spring continued into the sixth millennium cal. BC and although activity appears to have become more ephemeral as the site gradually (perhaps seasonally) became drier, the tufa spring continued to be a significant place, one where lithic and animal bone could be deposited. At some point during the fifth millennium cal. BC, the tufa spring completely dried out and transformed into a low, white tufa mound. The formalized activity now focused on the boundary between this tufa mound and the adjacent land surface; a pit was dug and marked, stakes were set through the mound and a small stone surface was laid. Flint was brought to the site for knapping and again, aurochs were consumed.

The Wellow Brook and the numerous tufa springs within the valley would have provided a seasonally constant and reliable source of water as well as promoting lusher and more diverse vegetation, attractive to both humans and animals. Aurochs were present in this valley, which links the uplands of the Mendip plateau with the valley of the (Bristol) River Avon and the Cotswolds and Wessex chalk beyond, throughout the Later Mesolithic. It may have been a migratory or favoured route for these animals, well-known to Mesolithic communities, who exploited or deliberately targeted aurochs encounters. It has been suggested that Mesolithic aurochs may have preferentially occupied wet and open landscapes (Noe-Nygaard et al. 2005) though they could adapt to woodland conditions (Vuure 2005). The Wellow Valley offered both.

Overton (2014) has argued for animals in the Mesolithic to be viewed as sentient beings and suggested that encounters with these non-human agents were memorable and part of the tempo of daily life. At Langley's Lane, the initial encounter with an aurochs during Phase 1c, whether by strategy or chance, and the successful kill of this large and dangerous animal was an event which occurred at a spring with unusual material properties. This memorable event became entangled with the material properties of the tufa spring, producing effects which engendered this place with a special significance.

It may have been this event that set-in motion the need to return to the spring site. Initially to carry out commemorative activities at the waters' edge, in the form of pit digging, flint knapping, equipment repair and maintenance and the consumption of meat; and later to deposit both lithic and faunal material into the spring waters. The differences in the character of the activity taking place between phases 1c and 1d, clearly shows that attitudes towards the tufa depositing spring were not fixed. Later, after the spring waters had dried out, activity continues, new features are created which mark the location and the boundary of the tufa deposits and older material is being physically engaged with through digging activities.

Despite differences in activity between the phases, there are also important reoccurring themes – the processing and consumption of aurochs, microlith production and the repair of hunting equipment. It would appear that visits to Langley's Lane became focused around these tasks which together constitute embodied performances which helped to maintain the memory of the site. Langley's Lane may have been a storied place which existed both physically and conceptually.

The transformative and unusual properties of the tufa material offer a rare opportunity to think about how Mesolithic communities may have perceived and engaged with their world. Tufa does not only cover and coat objects as it forms, it is literally water that becomes stone. This phenomenon of 'stone growing' was a geological event happening in human time. Mesolithic communities were not only depositing bone and flint into the spring, but physically engaging with its material properties. Lithic material was retrieved from the tufa spring waters during Phase 1c, evidenced by tufa adhering to lithics from the dryland scatter and from some of the lithics in the pits. Tufa adhering to flint is not dissimilar to cortex that coats flint nodules: perhaps then a tufa coating was seen as the stone re-growing its ‘skin’.

The most intriguing evidence, however, is in the creation of one certain and one probable hand-moulded tufa balls and their subsequent deposition in two of the pits. No other examples of deliberately fashioned tufa balls are known. Spherical flint nodules and fossil sponges are known to occur naturally and occasionally appear in archaeological contexts of various dates; it is possible that the tufa balls were an attempt to replicate such an item. Another analogy for a white ball shape is the full moon, recalling Gaffney et al.’s (2013) discussion of lunar observation and “time reckoning” at the Early Mesolithic pit alignment at Warren Field in Aberdeenshire, Scotland. However, the tufa ball may not be a representation of something else, instead what may be significant is the material itself, its manipulation and its subsequent containment within a small pit.

Conclusion

The small-scale excavations at the Langley’s Lane tufa spring revealed an unexpected rich sequence of activities, spanning the later Mesolithic. Stratified sites with associated faunal remains and an environmental sequence are rare in the British Mesolithic. As such, Langley’s Lane is an important addition to our corpus of Mesolithic sites, not just regionally, but nationally.

The nature of the activities taking place are extraordinary. The successful kill of an aurochs at the tufa spring was an event that sparked a chain of actions, including pit digging and the manipulation and deposition of tufa, animal bones and lithics. Such practices suggest an enmeshing of butchery rituals with the properties of the place where they were carried out and an adherence to rules governing culturally appropriate deposition.

This initial kill seems also to have acted as a long-term catalyst for activities at the tufa spring. Repeated visits were made to the site during the later Mesolithic, further aurochs were killed and/or consumed here, more flint was knapped and deposition and digging continued. Though similarities exist between the different phases of the site there are also differences, as would be expected over the extended time period involved. What links them however is that the material traces of animals, people, things and actions were captured and contained by the wet/dry tufa and could be reencountered. The tufa deposits became a repository for histories and stories which could be remembered, re-made and re-imagined at this significant place.

Acknowledgements

We are grateful to the landowners (Ken) Osborne and Partners of Whitchurch Farm, who allowed our excavations to take place. Excavations were directed by Jodie Lewis, Paul Davies and David Mullin and supervized by Abby Bryant, ably assisted by a team of students from the University of Worcester and other volunteers. The University of Worcester granted Jodie Lewis research leave to write this article and together with Bath Spa University provided funding for post-excavation analyses. Mark Evans, Jodie Lewis' research assistant, helped organize post-excavation logistics. Site plans were digitized by Neal Johnson. Alan Clapham kindly identified the oak charcoal and Tom Higham offered advice on the radiocarbon failures. Ed Blinkhorn shared unpublished information for which we are most grateful. Thanks also to Vanessa Straker, Julie Jones and Heather Tinsley who advised on the environmental strategy; and Bob Sydes and Chris Webster for HER data. David Mullin and Neal Johnson have commented on numerous versions of this article and we have also benefitted from conversations about the site with Richard Bradley. We are most grateful to the anonymous reviewers for their helpful comments; any errors are our own.

References

Anderson, R. 2008. *Annotated list of the non-marine Mollusca of Britain and Ireland*, London: Conchological Society of Great Britain and Ireland

ApSimon, A. M. Smart, P. L. Macphail, R. Scott, K. and Taylor, H. 1992. King Arthur's Cave, Whitchurch: a re-assessment of a Middle and Upper Palaeolithic, Mesolithic and Beaker site, *Proceedings of the University of Bristol Spelaeological Society,* **19**, part 2, 183-239

Auler, J. 1995. Ein borealzeitliches Auerochsen-Skelett vom Niederrhein (Stadt Dormagen, Kreis Neuß, Reg.-Bez. Düsseldorf), *Prähistorische Zeitschrift,* **70**, 159-174

Baker, A. and Simms, M. J. 1998. Active deposition of calcareous tufa in Wessex, UK, and its implications for the late-Holocene tufa decline *The Holocene* **8** part **3**, 359-65

Barton, N. and Roberts, A. 2004. The Mesolithic period in England, in A, Saville, (ed.) *Mesolithic Scotland and its Neighbours*, 339-358, Edinburgh: Society of Antiquaries of Scotland

Behrensmeyer A. K. 1978. Taphonomic and ecologic information from bone weathering, *Palaeobiology,* **4**, 150-62

Bell, M. 2007. *Prehistoric Coastal Communities: The Mesolithic in Western Britain,* York: Council for British Archaeology, CBA Research Report **149**

Benecke, N. 1999. *Die jungpleistozäne und holozäne Tierwelt Mecklenburg-Vorpommerense Faunenhistorische und kulturgeschichtliche Befunde*, Olching: Gregor, Documenta Naturae **124**

Blinkhorn, E. Lawton-Matthews, E. and Warren, G. 2016. Digging and filling pits in the Mesolithic of England and Ireland: comparative perspectives on a widespread practice, in N. Achard-Corompt, E. Ghesquiére and V. Riquier (eds.*), Creuser au Mésolithique/Digging in the Mesolithic: Actes de la séance de la Société Préhistorique Française de Châlons-en-Champagne (29-30 mars 2016)*, 211-24, Paris: Société Préhistorique Française

Blinkhorn, E. and Milner, N. 2013. *Developing a Mesolithic Research and Conservation Framework, resource assessment*, York: University of York

Bökönyi, S. 1995. Problems with using osteological materials of wild animals for comparisons in archaeozoology, *Anthop Közl*, **37**, 3-11

Butler, C. (2007) A Mesolithic site at Streat Lane, Streat, East Sussex, *Sussex Archaeological Collections*, **145**, 7-31

Clark, J. G. D. 1938. Mesolithic industries from tufa deposits at Prestatyn, Flintshire and Blashenwell, Dorset, *Proceedings of the Prehistoric Society*, **4**, 330–4

Conneller, C. 2003. Star Carr recontextualised. In J. Moore & L. Bevan (eds), Peopling the Mesolithic in a Northern Environment, 81–6. Oxford: British Archaeological Report S1157

Conneller, C. Little, A. and Birchenall, J. (2018) Making Space Through Stone, in N. Milner, C. Conneller and B. Taylor (eds.) *Star Carr Volume 1: A Persistent Place in a Changing World*, 157–221 York: White Rose University Press

Conneller, C. Little, A. Garcia-Diaz, V. and Croft, S. 2018. The worked flint. In N. Milner, C. Conneller and B. Taylor (eds.) *Star Carr Volume 2: Studies in Technology, Subsistence and Environment*, 493–534 York: White Rose University Press

Conneller, C. and Overton, N. 2018. The British Mesolithic Context, in N. Milner, C. Conneller and B. Taylor (eds.) *Star Carr Volume 1: A Persistent Place in a Changing World*, 275–303 York: White Rose University Press

Davies, P. 1999. Molluscan total assemblages across a woodland-grassland boundary and their palaeo-environmental relevance, *Environmental Archaeology*, **4**, 57–66

Davies, P. 2008. *Snails: archaeology and landscape change* Oxford: Oxbow

Davies, P. Haslett, S.K. Davies, C.F.C. and Thomas, L. 2001. Reconstructing Holocene landscape change on Mendip: the potential of tufa deposits, *Proceedings of the Cotswold Naturalists' Field Club,* **62**, 42-7

Davis, R. 2012**.** The Nature of Mesolithic Activity at Selected Spring sites in SW England*,* unpublished PhD thesis, University of Worcester

Degerbøl, M. and Fredskild, B. 1970, The urus (*Bos primigenius Bojanus*) and Neolithic domesticated cattle (*Bos taurus domesticus* Linné) in Denmark, *Det Kongelige Danske Videnskabernes Selskab, Biologiske Skrifter*, **17,** part 1, 1-234

Evans, J. G. 1991. The land and freshwater Mollusca, in S. P. Needham (ed.), *Excavation and Salvage at Runnymede Bridge 1978*, 263-74, London: British Museum Press.

Evans, J. G. 1972. *Land Snails in Archaeology*, London: Seminar Press

Evans, J. G. and Smith, I. F. 1983. Excavations at Cherhill, North Wiltshire, 1967, *Proceedings of the Prehistoric Society*, **49**, 43-117

Findlay, D. C. 1965 *The Soils of the Mendip District of Somerset,* London: HMSO

Finlay, N. 2000. Microliths in the making, in R. Young (ed.), *Mesolithic lifeways: current research from Britain and Ireland*, Leicester, 23-31 Leicester Archaeology Monographs 7

Gaffney, V. Fitch, S. Ramsey, E. Yorston, R. Ch'ng, E. Baldwin, E. Bates, C. R. Gaffney, C. Ruggles, C. Sparrow, T. McMillan, A. Cowley, D. Fraser, S. Murray, C. Murray, H. Hopla, E. and Howard, A. 2013. Time and a place: a luni-solar 'time-reckoner' from 8th millennium BC Scotland, *Internet Archaeology*, **34**, https://doi.org/10.11141/ia.34.1

Gardiner, P. (2007) Mesolithic activity at Hawkcombe Head, Somerset: an interim report on the 2002-3 excavations, in C. Waddington and K. Pedersen (eds.) *Mesolithic Studies in the North Sea Basin and Beyond,* 81-95, Oxford: Oxbow

Garnett, E. R. Andrews, J. E. Preece, R. E. and Dennis, P. F. 2006. Late glacial and early Holocene climate and environment from stable isotopes in tufa, *Quaternaire,* **15**, 31-42

Gassin, B, Marchand, G. Binder, D. Claud, E. Gueret, C. and Philibert, S. 2013. Late Mesolithic notched blades: tools for plant working? *Bulletin de la Société préhistorique française* **110,** 25-46

Goudie, A. 1990. *The Landforms of England and Wales*, Oxford: Blackwell Publishing

Gradzinski, M. 2010. Factors controlling growth of modern tufa: results of a field experiment, in H. M. Pedley and M. Rogerson (eds.) *Tufas and Speleothems: Unravelling the Microbial and Physical Controls*, 143-92, London: The Geological Society, Geological Society Special Publication **336**

Grant A. 1982. The use of tooth wear as a guide to the age of domestic ungulates, in B. Wilson, C. Grigson and S. Payne (eds.), *Ageing and Sexing Animal Bones from Archaeological Sites*, 91-108, Oxford: British Archaeological Reports, British Series **109**

Griffiths, S. 2014. Points in time: the Mesolithic–Neolithic transition and the chronology of late rod microliths in Britain, *Oxford Journal of Archaeology*, **33**, 221-43

Jacobi, R. 1978. The Mesolithic of Sussex, in P. Drewett (ed) *Archaeology in Sussex to AD1500* York: Council for British Archaeology. Research Report **29**

Jacobi, R. 1994. Mesolithic radiocarbon dates: a first review of some recent dates, in N. Ashton A. and David (eds.), *Stories in Stone*, 192-198, London: Lithic Studies Society, Occasional Paper **4**

Jacques, D. and Phillips, T. 2014. Mesolithic settlement near Stonehenge: excavations at Blick Mead, Vespasian's Camp, Amesbury, *Wiltshire Archaeological and Natural History Magazine*, **107**, 7-27

Jacques, D. Phillips, T. and Lyons, T. 2018. *Blick Mead. Exploring the 'first place' in the Stonehenge landscape*, Oxford: Peter Lang

Kerney, M. P. 1959. An interglacial tufa near Hitchin, Hertfordshire, *The Proceedings of The Geological Association*, **70**, part 4, 322-37

Kerney, M. P. and Cameron, R. A. D. 1979. *A Field Guide to the Land Snails of Britain and Ireland*, London: Collins

Killeen, I. J. Aldridge, D. and Oliver, P. G. 2004. *Freshwater Bivalves of Britain and Ireland*, Shrewsbury: Field Studies Council

Kyselý, R. 2008. Aurochs and potential crossbreeding with domestic cattle in Central Europe in the Eneolithic period: a metric analysis of bones from the archaeological site of Kutná Hora-Denemark (Czech Republic), *Anthropozoologica,* **43,** part 2, 7-37

Lawton-Matthews, E. and Warren, G. M. 2015. Pits in the Irish Mesolithic, in N. Bicho, C. Detry, T. D. Price and E. Cunha (eds.), *Muge 150th: The 150th Anniversary of the*

Discovery of Mesolithic Shell Middens Volume 2, 139-52, Newcastle: Cambridge Scholars Publishing

Legge, A. J. and Rowley-Conwy, P. A. 1988. *Star Carr Revisited,* London: Centre for Extra-Mural Studies, Birkbeck College, University of London

Legge A. J. 2010. The aurochs and domestic cattle, in T. P. O'Connor and N. J. Sykes (eds.), *Extinctions and Invasions: A Social History of British Fauna,* 26-35, Oxford: Windgather

Limondin, N. 1995. Late-Glacial and Holocene malacofaunas from archaeological sites in the Somme Valley (North France), *Journal of Archaeological Science,* **22**, 683-98

Macan, T. T. 1977. A Key to the British Fresh- and Brackish-water Gastropods (4th Edition), Ambleside, UK: Freshwater Biological Association.

Meyrick, R. A. and Preece, R. C. 2001. Molluscan successions from two Holocene tufas near Northampton, English Midlands, *Journal of Biogeography*, **28**, 77–93

Murray, E. 2010. Totty Pot, Cheddar, Somerset. The faunal remains, *Proceedings of the University of Bristol Spelaeological Society*, **25**, part 1, 97-104

Noe-Nygaard, N. Price, T. D. and Hede, S. U. 2005. Diet of aurochs and early cattle in southern Scandinavia: evidence from 15N and 13C stable isotopes, *Journal of Archaeological Science*, **32**, part 6, 855-71

Overton, N. 2014. Memorable Meetings in the Mesolithic: Tracing the Biography of Human-Nonhuman Relationships in the Kennett and Colne Valleys with Social Zooarchaeology, unpublished PhD Thesis, University of Manchester

Overton, N. and Taylor, B. 2018. Humans in the Environment: Plant, Animals and Landscapes in Mesolithic Britain and Ireland, *Journal of Wold Prehistory*, **31**, part 3, 385-402

Pandolfi, L. Petronio, C. and Salari, L. 2011. Bos primigenius Bojanus, 1827 from the Early Late Pleistocene Deposit of Avetrana (Southern Italy) and the Variation in Size of the Species in Southern Europe: Preliminary Report, *Journal of Geological Research*, **2011**, 1-11

Parker, A. and Goudie, A. 2007. Late Quaternary Environmental change in the Limestone regions of Britain, in A. Goudie and J. Kalvoda (eds.), *Geomorphological Variations,* 157-182, Prague: P3K

Preece R.C. and Bridgland D.R. 1999. Holywell Coombe, Folkestone: a 13,000 year history of an English Chalkland Valley, *Quaternary Science Reviews*, **18**, 1075-1125

Preece, R.C. and Day, S. 1994. Special Paper: Comparison of Post-Glacial Molluscan and Vegetational Successions from a Radiocarbon-Dated Tufa Sequence in Oxfordshire, *Journal of Biogeography,* **21**, part 5, 463-78

Prummel, W. and Niekus, M. L. J. 2011. Late Mesolithic hunting of a small female aurochs in the valley of the River Tjonger (the Netherlands) in the light of Mesolithic aurochs hunting in NW Europe, *Journal of Archaeological Science,* **38**, 1456-67

Prummel, W. Niekus, M. L. J. van Gijn, A. L. and Cappers, R. T. J. 2002. A late Mesolithic kill site of aurochs at Jardinga, Netherlands, *Antiquity,* **76**, 413-424

Reimer, P. J. Bard, E. Bayliss, A. Beck, J. W. Blackwell, P. Bronk Ramsey, C. Buck, C. E. Cheng, H. Edwards, R. L. Friedrich, M. Grootes, P. M. Guilderson, T. P. Haflidason, H. Hajdas, I. Hatté, C. Heaton, T. J. Hoffmann, D. L. Hogg, A. G. Hughen, K. A. Kaiser, K. F. Kromer, B. Manning, S.W. Niu, M. Reimer, R. W. Richards, D. A. Scott, E. M. Southon, J. R. Staff, R. A. Turney, C. S. M. and van der Plicht, J. 2013. Intcal13 and Marine13 radiocarbon age calibration curves 0-50,000 years cal. BP, *Radiocarbon*, **55,** part 4, 1869-87

Roberts, A. 1996. Evidence for late Pleistocene and early Holocene human activity and environmental change from the Torbryan Valley, south Devon, in D. J. Charman, R. M. Newnham and D. G. Croot (eds.), *Devon and East Cornwall Field Guide*. 168-204, London: Quaternary Research Association

Rouse, A. J. & Evans, J. G. 1994. Modern land Mollusca from Maiden Castle, Dorset, and their relevance to the interpretation of subfossil archaeological assemblages, *Journal of Molluscan Studies*, **60**, 315–29

Rowley-Conwy, P. 2017. To the Upper Lake: Star Carr Revisted by Birchbark Canoe, in P. Rowley-Conwy, Serjeantson, D. and Halstead, P. *Economic Zooarchaeology, Studies in Hunting, Herding and Early Agriculture*. Oxford: Oxbow

Schulting, R. J. Gardiner, P. Hawkes, C. and Murray, E. 2010. A Mesolithic and Neolithic human bone assemblage from Totty Pot, Mendips, Somerset, *Proceedings of the University of Bristol Spelaeological Society*, **25**, 73-95

Taylor, B. Elliott, B. Conneller, C. Millner, N. Bayliss, A. Knight, B. and Bamforth, M. 2017. Resolving the Issue of Artefact Deposition at Star Carr, *Proceedings of the Prehistoric Society*, **83**, 23-42 van Vuure, S. 2005. *Retracing the Aurochs: History, Morphology and Ecology of an Extinct Wild Ox,* Sofia (Bulgaria): Pensoft Publishers

von den Driesch, A. 1976. *A Guide to the Measurement of Animal Bones from Archaeological Sites.* Harvard: Harvard University, Peabody Museum of Archaeology and Ethnology, Peabody Museum Bulletin **1**

Willing, M. 1985. The Biostratigraphy of Flandrian Tufa deposits in the Cotswold and Mendip Districts, unpublished PhD Thesis, University of Sussex

Table 1 Characteristics of the nine pits cut into the dryland at the edge of the tufa spring.

Cut No.	Fill	Shape	Dimensions	Base	Finds
1031	1028 Moderately compact reddish-brown silty clay	Circular	0.25m x 0.1m deep	Rounded	6 lithics; 1 small stone
1032	1029 Moderately compact reddish-brown silty clay	Circular	0.2m x 0.13m deep	Rounded	Tufa ball (1033)
1048	1049 Moderately compact brown clay	Not fully excavated so unknown	0.5m x 0.25m x 0.1m deep (exposed)	Not revealed	17 lithics; 33 small stones; 2 belemnite fossils
3006	3005 Firm reddish-brown silty clay	Not fully excavated so unknown	0.15m x 0.06m deep (exposed)	Slightly tapered	5 lithics
3008	3025 clay rich tufa Upper fill 3007 lump of tufa (?ball)	Circular	0.25m x 0.08m deep	Rounded	(3007) 8 lithics; 9 small stones; 8 animal bone frags.
3010	3009 Stiff mid-brown clay	Sub-circular	0.4 x 0.3 x 0.05m deep	Flattish	3 lithics; 15 small stones
3020	3019 Stiff mid-brown clay	Sub-circular	0.5m x 0.4 x 0.06m	Flattish	6 lithics; 8 small stones
3027	3026 Soft dark-brown clay	Circular	0.4m x 0.1m deep	Flattish	8 lithics; 12 small stones
3033	3032 Soft mid-brown clay	Circular	0.1m x 0.08m deep	Rounded	None

Table 2 Radiocarbon determinations calibrated using OxCal v4.3.2 Bronk Ramsey 2017; r:5; IntCal13 atmospheric curve (Reimer et al. 2013).

Lab. code	**Specimen**	**Uncalibrated date BP**	**Calibrated date BC**	**Probability**	**δ13C**
UBA-20293	Butchered *Bos* sp. proximal metacarpal, context (1007)	7558±49 BP	6500-6260 cal. BC	95.4%	-24.02
UBA-20199	Chop marked *Bos* sp. calcaneous, context (1008)	7003±32 BP	5990-5810 cal. BC	95.4%	-24.01
UBA-20295	Large mammal bone fragment, disturbed part of context (3029)	3345±37 BP	1740-1530 cal. BC	95.4%	-22.65

Table 3 Microlith types by context and phase.

Context	**Phase**	**Micro-scalene triangle**	**Micro-isosceles triangle**	**Rod microlith**	**Obliquely blunted**	**Convex backed**	**Straight backed**	**Total**
(1030)	1a					1		1
(3031)	1c	2			1			3
[3008]		1						1
(3029)					1			1
(1006/3003)	1e	2	1	3				6
(3004)		1						1
Unstratified	n/a	2		1			2	5

Table 4 MNI from molluscan vertical sequence.

Species/depth (m)	**0.2-0.25**	**0.25-0.3**	**0.3-0.35**	**0.35-0.4**	**0.4-0.45**	**0.45-0.5**	**0.5-0.55**	**0.55-0.6**	**0.6-0.65**	**0.65-0.7**
Galba truncatula					1	1	2	4	2	
Succineidae						1				
Carychium minimum			4	3	4	9	5	7	4	
Cochlicopa lubrica		3	9	8	21	11	15	19	5	1
Vertigo pusilla	1		2	2	3	2	11	5	1	1
Vertigo pygmaea	3		1	2	2	1				
Pupilla muscorum					8	3	5	2	6	
Euconulus alderi			1					2		
Trochulus striolata				1						
Trochulus hispida	5	7	3	3	10	3	10	7	6	
Vitrina pellucida		1	1				2			
Vitrea sp.		3	10	3	3	17	17	11	6	1
Cepaea sp.			5	3	5	3	2	1	1	
Vallonia pulchella	23	14	4	5	2	9	14		1	1
Carychium tridentatum	2	11	132	112	158	252	131	99	49	12
Discus rotundatus	3	11	49	35	77	71	41	40	13	4
Lauria cylindricaea										
Acanthinula aculeata			6	6	18	19	19	8	3	
Ena obscura							1			
Punctum pygmaeum			1	5	8	21	13	8	3	
Nesovitrea hammonis			1	1					1	
Aegopinella pura				10	8	14	7	11	2	1
Aegopinella nitidula			13	7	13	4	9	7		
Oxychilus sp.			6	5		16	13	13	11	
Zonitoides nitidus			7	3	4	11	8		4	
Clausillia bidentata		2	6	2	8	3	7	3	1	1
Vallonia costata		2	5	3	4	6	4	1	2	
Vallonia excentrica	2	1	1	1						
Helicella itala	5									
Total individuals	44	55	267	220	357	477	336	248	121	22

Table 5 Number of identified specimens by phase and context (Parentheses indicate possible aurochs Bos primigenius).

Phase	**Context**	***Bos* sp.**	***Cervus elaphus***	***Bos/ Cervus***	***Sus scrofa***	**large mammal**	**medium mammal**	**mammal**	**Total**
1b	1050					3			3
1c	1007	21(4)				4			29
	1045					6			6
	3007				1		7		8

	3017/ 3029	3		1	1	14		5	24
	3031	3			2	9		3	17
1d	1008	2	1					5	8
1e	1006/3003	3						5	8
	3004	1				9			10
Unstratified		1		1					2
	Total	38	1	2	4	45	7	18	115

Table 6 Number of specimens according to element from cattle, red deer and pig (Parentheses as in Table 5).

Element	***Bos* sp.**	***Bos/Cervus***	***Cervus elaphus***	***Sus scrofa***
Skull	21(3)			
Mandible	1			
Teeth	3		1	4
Radius		1		
Pelvis	1			
Femur		1		
Metacarpal	1(1)			
Metatarsal	1			
Metapodial	1			
Calcaneus	2			
Tarsal	1			
2nd phalanx	2			
Total	38	2	1	4

Table 7 Quantity of retouched items by phase and context *probable. Parentheses indicates additional microlith fragments.

Phase	1a	1c							1d	1e				
Context	1030	1007	3017/3029	3031	1049 [1048]	3026 [3027]	3019 [3020]	3007 [3008]	1008/3002	1006/3003	3004	1010 [1026]	3013 [3014]	3028 [3030]
Microlith	1		1	3				1	1*	6 (6)	1			
Scraper			1						1		2			
Notched pieces		1							6			1		
Denticulates				1					1	1				
Piercers										2				
Piercer-like flakes			1		1	1								
Misc. retouch		1	3				1		2	2		1	1	1

Table 8 Quantity and character of debitage by phase and context. Parenthesis notes additional broken examples.

Phase	Context	Cores	Core frags.	Core rejuvenation	Microburins	Flakes	Blades	Bladelets	Debitage frags.
1a	(1030)					(1)			1
1c	(1007)			1		5 (1)	1	(2)	
	(3017/29)	3		3		22 (5)	3 (1)	7 (6)	24
	(3031)	4	1	7	3	12 (7)	3	5 (3)	31
	Pit [1048]					8 (3)	2 (1)		2
	Pit [3027]					3			4
	Pit [1031]					3 (2)			1
	Pit [3010]	1						1	1
	Pit [3020]			1		1 (1)			2
	Pit [3006]	1						1	3
	Pit [3008]			1		(1)		1	4
1d	(1008/3002)	6	6	2	1	24 (13)	1 (12)	3 (18)	62
1e	(1006/3003)			5		27 (15)	5	11 (13)	68
	(3004)			5		6 (3)	3 (2)	2 (3)	7
	[3012]					3 (2)		1 (1)	9
	[1025]								1
	[1026]		1	1		10 (10)	(1)	4 (1)	4
	[1055/3014]		1	2	1	3 (2)			12
	[3030]	1		3		5 (5)	1	(1)	2
	(3015)					(1)		2 (1)	1
	(3024)					1			1

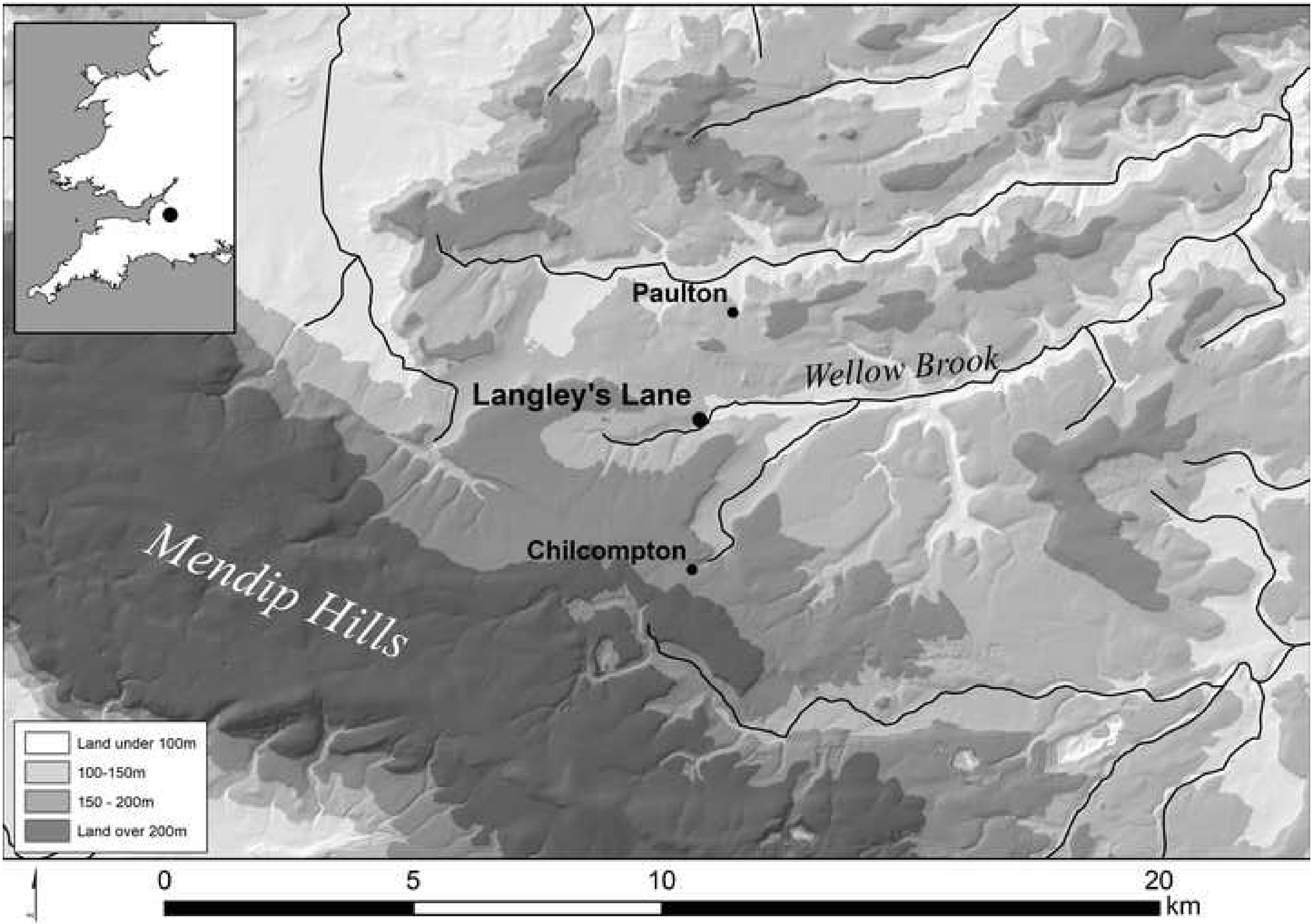
Table 9 Quantification of lithics with tufa adherence.

Phase	Context	No. of pieces with tufa adhering
Phase 1c	(1007)	11
	(3017/3029)	17
	(3031)	15
	[1048] (1049)	9
	[1031] (1028)	1
Phase 1d	(1008/3002)	35
Phase 1e	(3004)	7
	[1024/3012] (1004/3011)	2
	[1055/3014] (1054/3013)	1
	[1026] (1010)	1

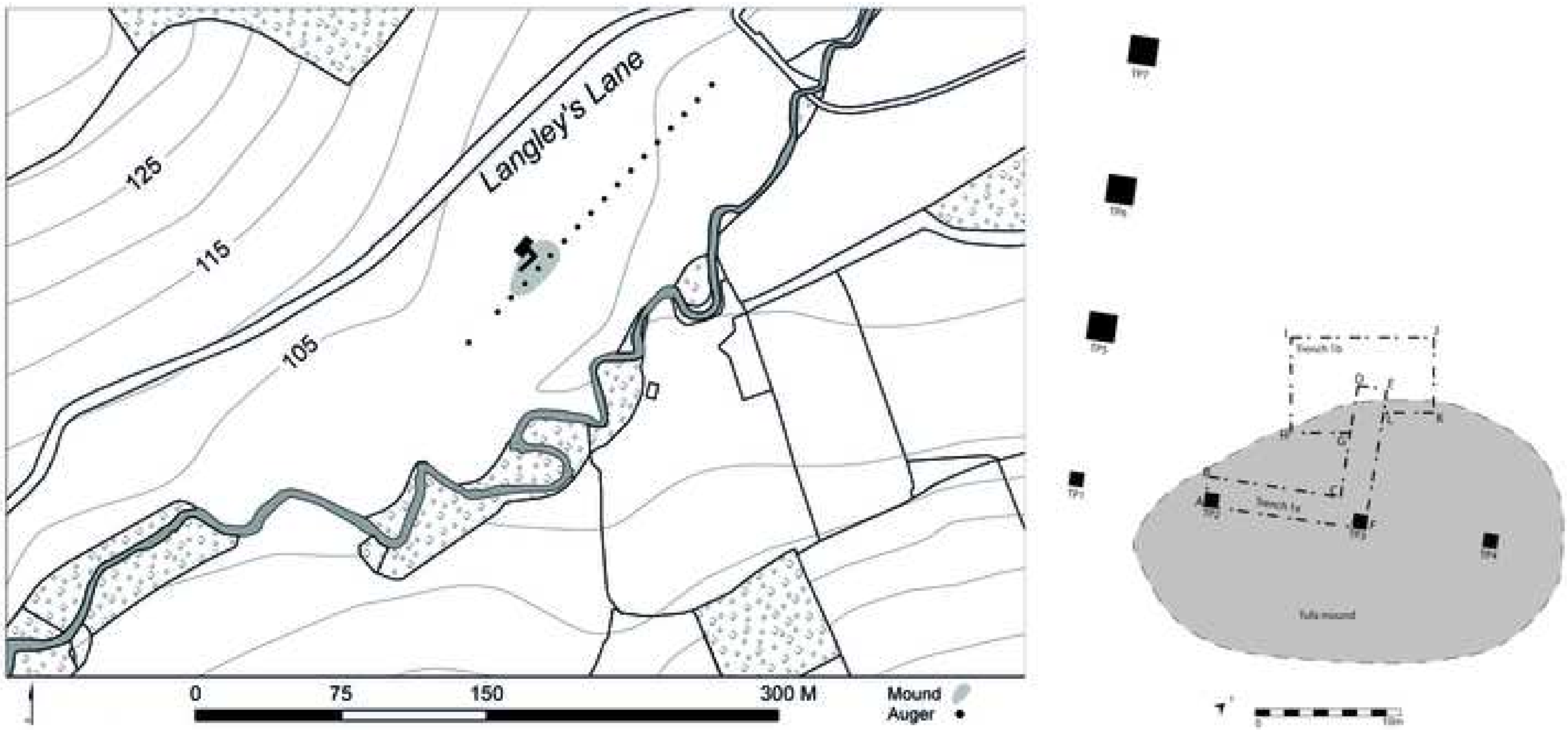
Table 10 Quantification of burnt lithics

Phase	Context	Burnt pieces
Phase 1c	(1007)	1
	(3017/3029)	10
	(3031)	2
	[1048] (1049)	1
Phase 1d	(1008/3002)	6
Phase 1e	(1006/3003)	23
	(3004)	3
	[1024/3012] (1004/3011)	3
	[1055/3014] (3015)	2
	[1025] (1009)	1
	[3030] (3028)	1
	[1026] (1010)	3

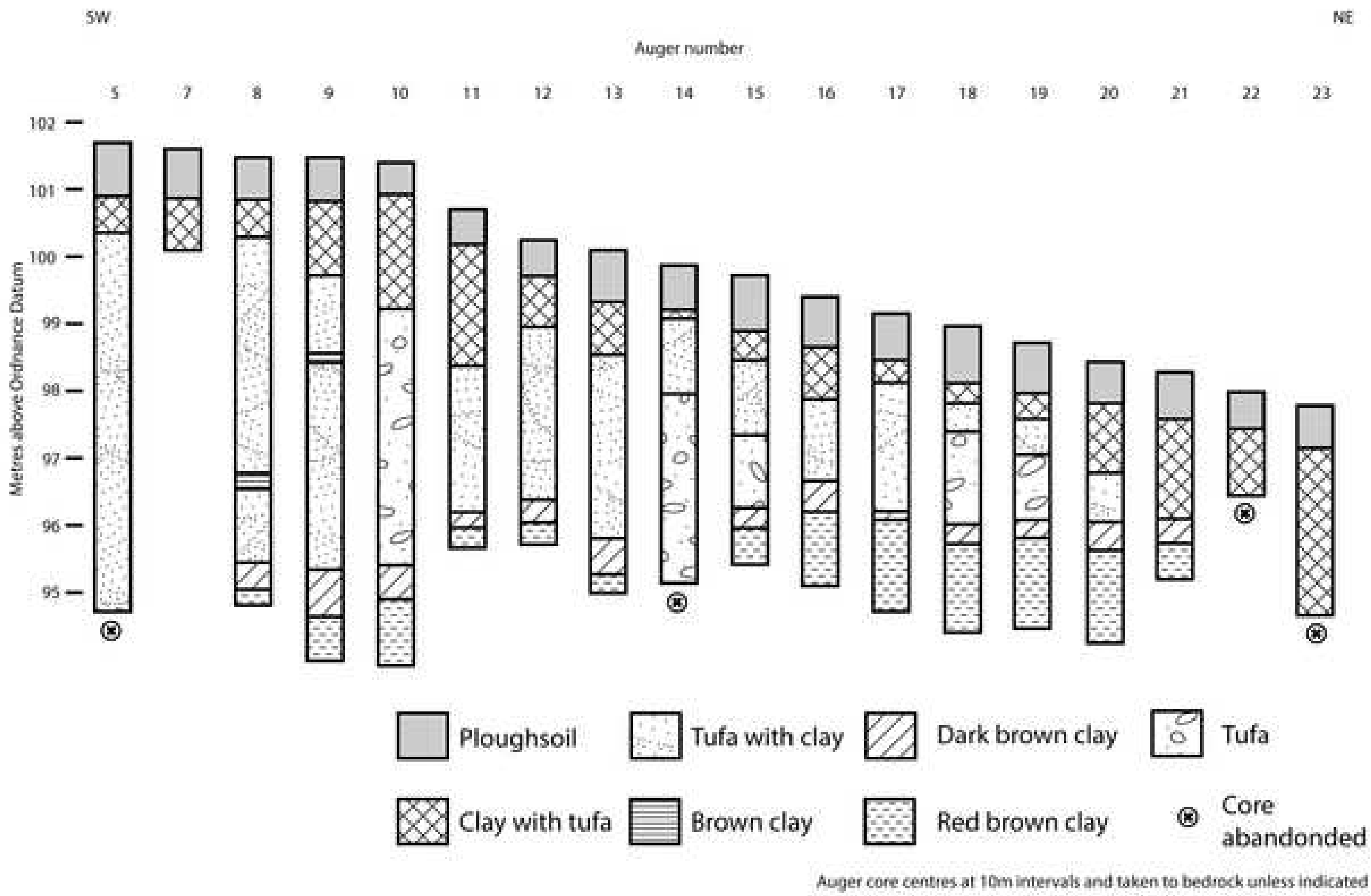
Figure


Paulton
Wellow Brook
Langley's Lane
Chilcompton
Mendip Hills
Land under 100m
100-150m
150 - 200m
Land over 200m
0
5
10
20
km

Figure



Figure

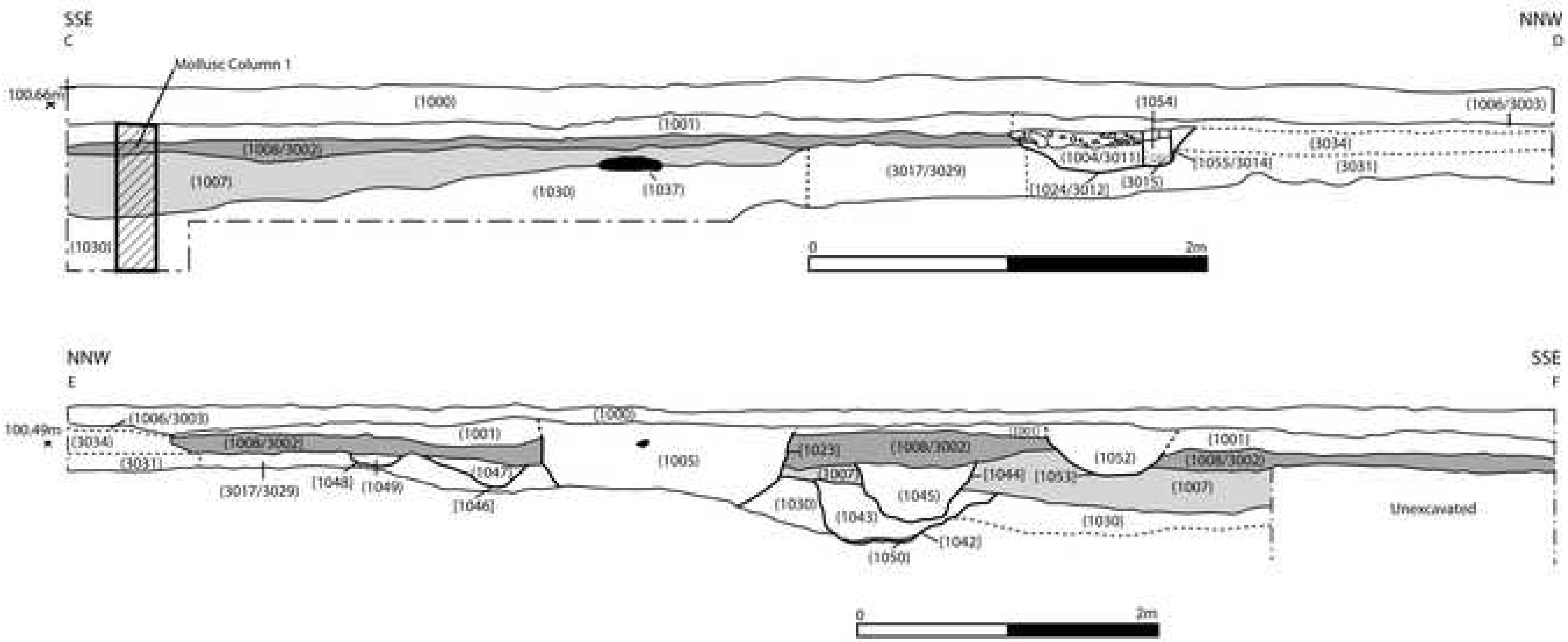


SW
NE
Auger number
5
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
102
101
100
99
98
97
96
95
Metres above Ordnance Datum
Ploughsoil
Tufa with clay
Dark brown clay
Tufa
Clay with tufa
Brown clay
Red brown clay
Core abandonded
Auger core centres at 10m intervals and taken to bedrock unless indicated

Figure

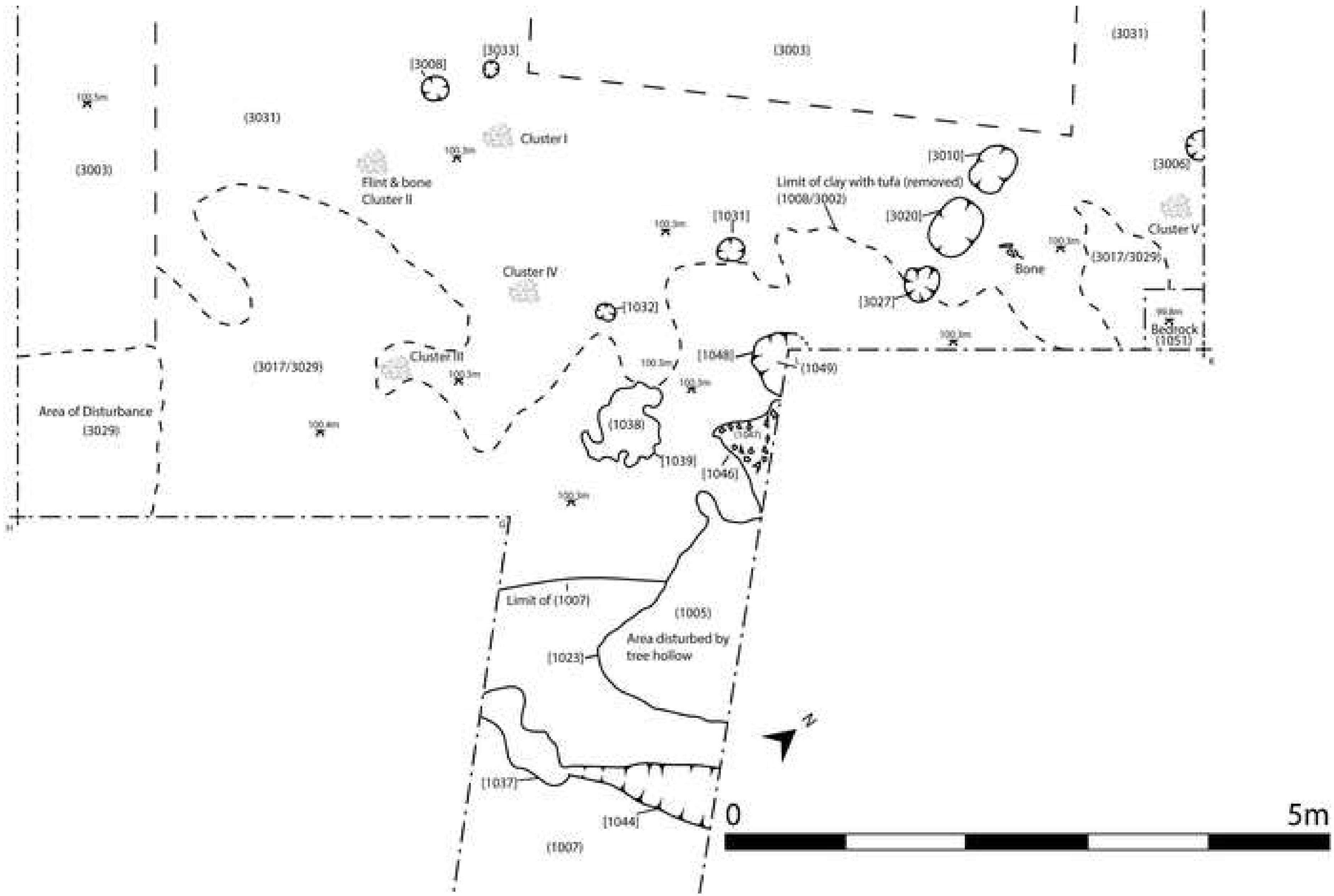
		Palaeoenvironmental	Archaeology
7500 cal. BC			
	Phase 1a	Dry slightly shaded environment, perhaps provided by a thin tree canopy with some areas of low shrub.	Limited Mesolithic presence: three lithic items, inc. one narrow blade microlith
7000 cal. BC			
6500 cal. BC	Phase 1b	Activation of the tufa depositing spring	No archaeology
	Phase 1c	Spring established creating small areas of boggy/ marshy ground which would have been visible as a murky, white wetland. Wooded environment.	Aurochs kill and primary butchery. Nine pits cut into the dryland. Animal bone and lithic clusters.
6000 cal. BC	Phase 1d	Gradual drying out of spring, water issuing from the spring slower or more intermittent. Woodland with some open structure.	Animal bone and lithic items deposited within the spring waters. Dryland devoid of archaeological material.
5500 cal. BC			
5000 cal. BC	Phase 1e	Cessation of tufa deposition and spring activity. The tufa deposits now take the form a low white mound. Woodland with some evidence for clearance.	A large pit marked by two posts. A stony platform was created. Lithic material from deposit surrounding tufa mound. Six stakes cutting the top of the tufa mound.
4500 cal. BC			
4000 cal. BC			

Figure



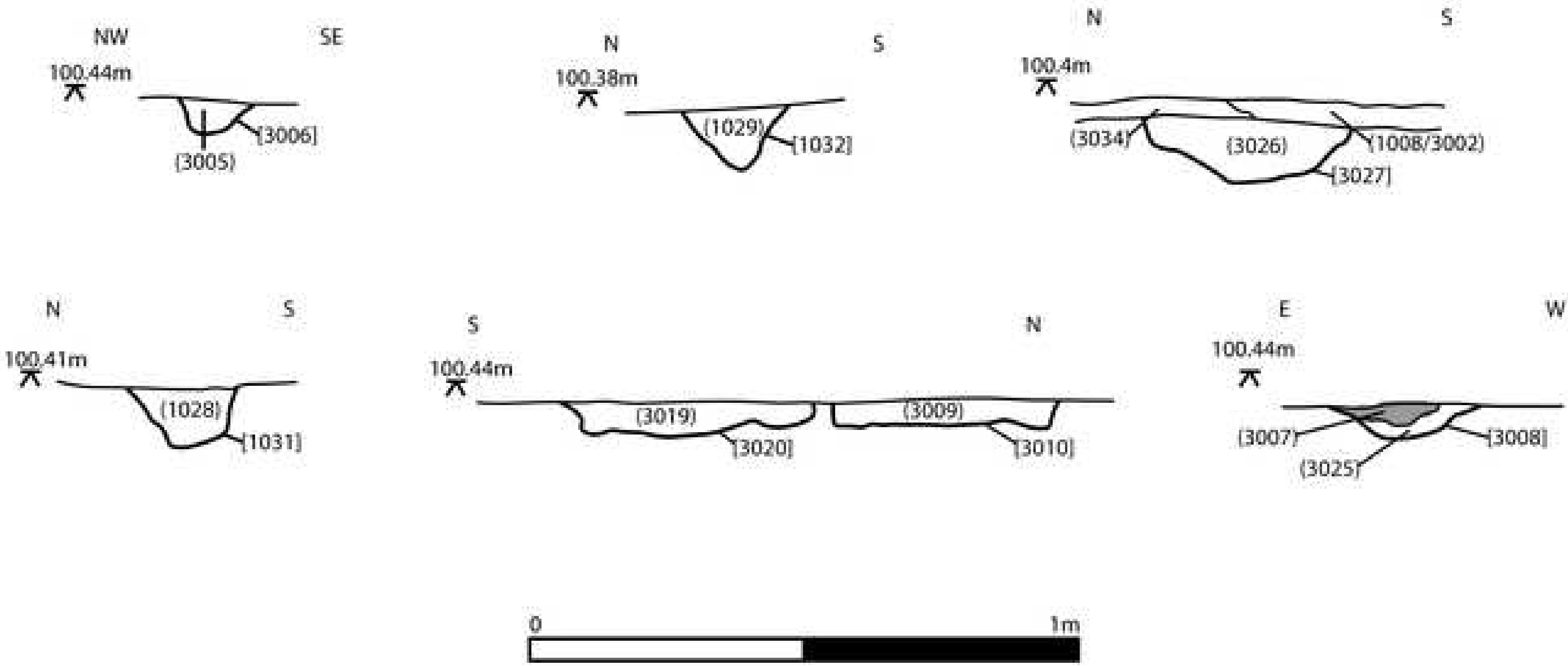
SSE
C
NNW
D
Mollusc Column 1
100.66m
(1000)
(1001)
(1054)
(1006/3003)
(1008/3002)
(1007)
(1030)
(1037)
(3017/3029)
(1004/3011)
(1055/3014)
(3034)
(3031)
(1024/3012)
(3015)
(1030)
0
2m
NNW
E
SSE
F
100.49m
(1006/3003)
(3034)
(3031)
(1008/3002)
(3017/3029)
(1048)
(1049)
(1001)
(1047)
(1046)
(1000)
(1005)
(1023)
(1008/3002)
(1007)
(1030)
(1043)
(1045)
(1044)
(1053)
(1052)
(1001)
(1008/3002)
(1007)
(1030)
(1042)
(1050)
Unexcavated
0
2m

Figure

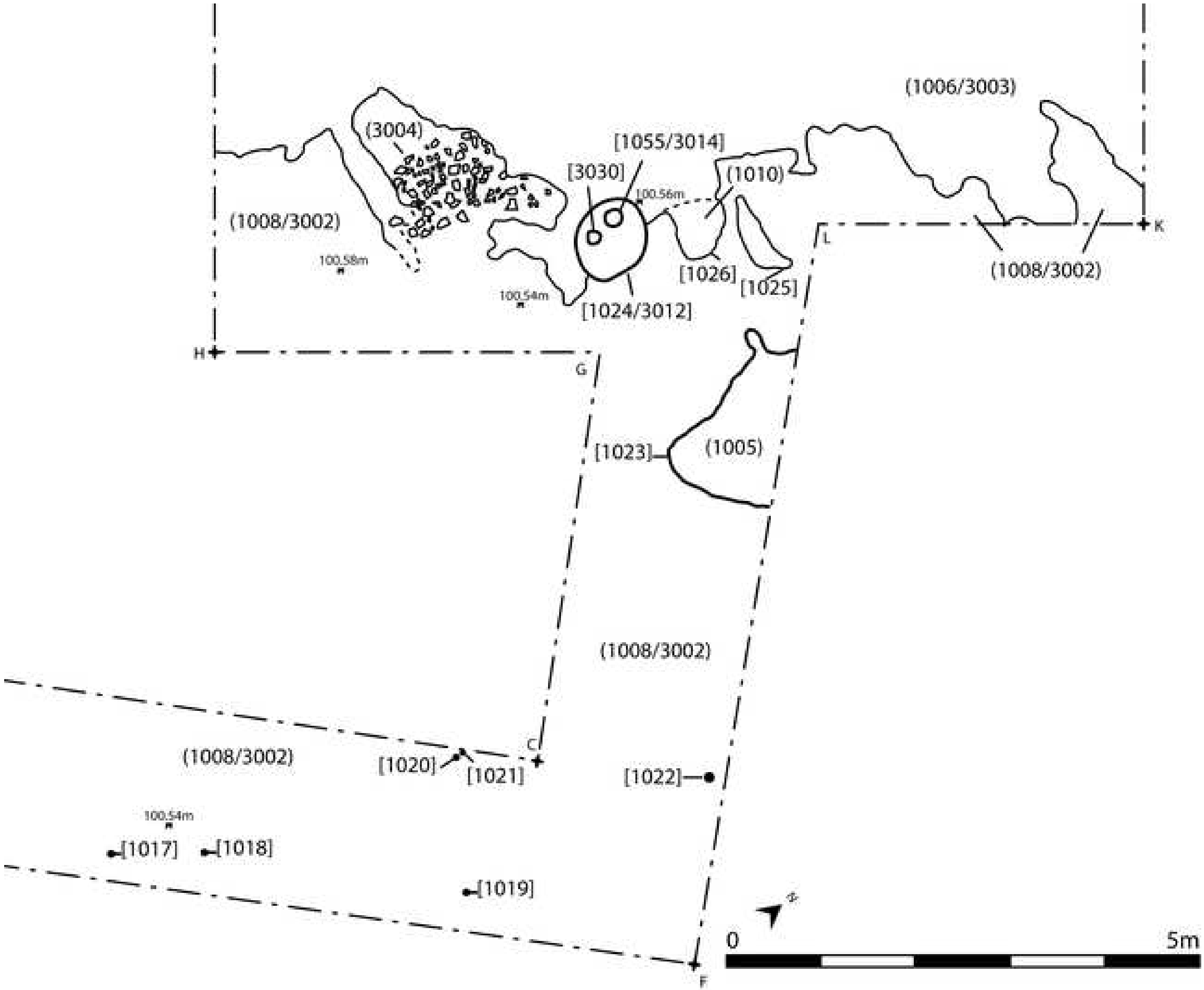


[3008]
[3033]
(3003)
(3031)
(3031)
(3003)
Cluster I
Flint & bone
Cluster II
[3010]
(3006)
Limit of clay with tufa (removed)
(1008/3002)
[1031]
[3020]
Cluster V
Cluster IV
Bone
(3017/3029)
[1032]
[3027]
Bedrock
(1051)
[1048]
(1049)
(3017/3029)
Cluster III
Area of Disturbance
(3029)
(1038)
[1039]
[1046]
Limit of (1007)
(1005)
Area disturbed by
tree hollow
[1023]
N
[1037]
[1044]
(1007)
0
5m

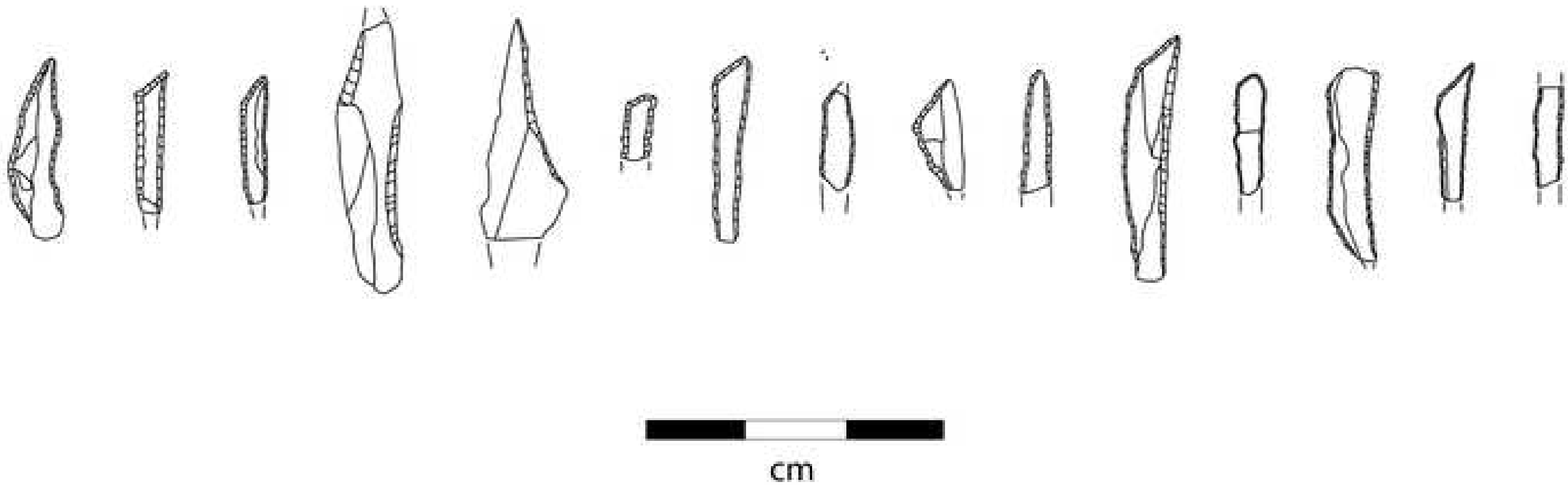
Figure


NW
SE
100.44m
[3006]
(3005)
N
S
100.38m
(1029)
[1032]
N
S
100.4m
(3034)
(3026)
(1008/3002)
[3027]
N
S
100.41m
(1028)
[1031]
S
N
100.44m
(3019)
(3009)
[3020]
[3010]
E
W
100.44m
(3007)
[3008]
(3025)
0
1m

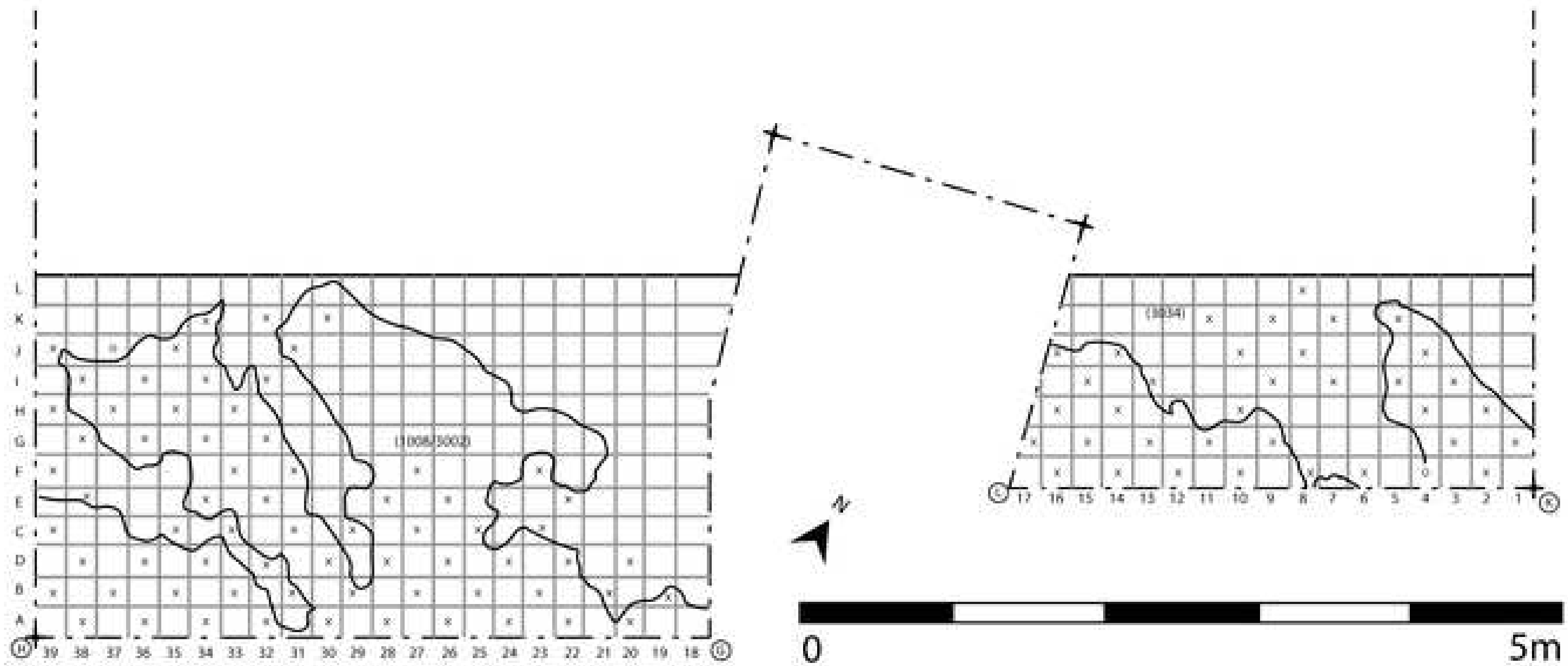
Figure


(1006/3003)
(3004)
[1055/3014]
[3030]
(1010)
100.56m
(1008/3002)
100.58m
100.54m
[1026]
[1025]
[1024/3012]
L
K
(1008/3002)
H
G
[1023]
(1005)
(1008/3002)
C
(1008/3002)
[1020]
[1021]
[1022]
100.54m
[1017]
[1018]
[1019]
N
0
5m
F

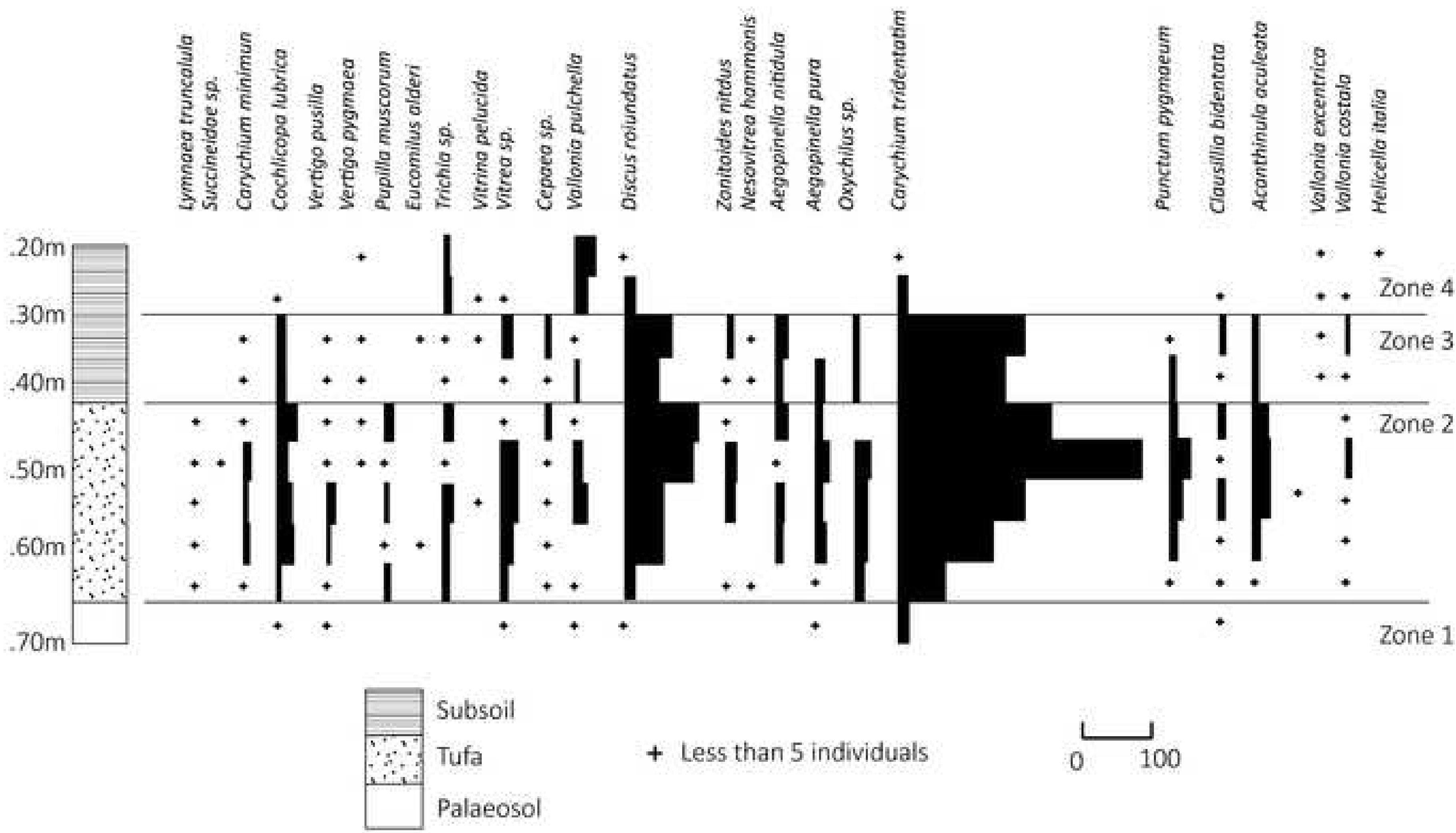
Figure



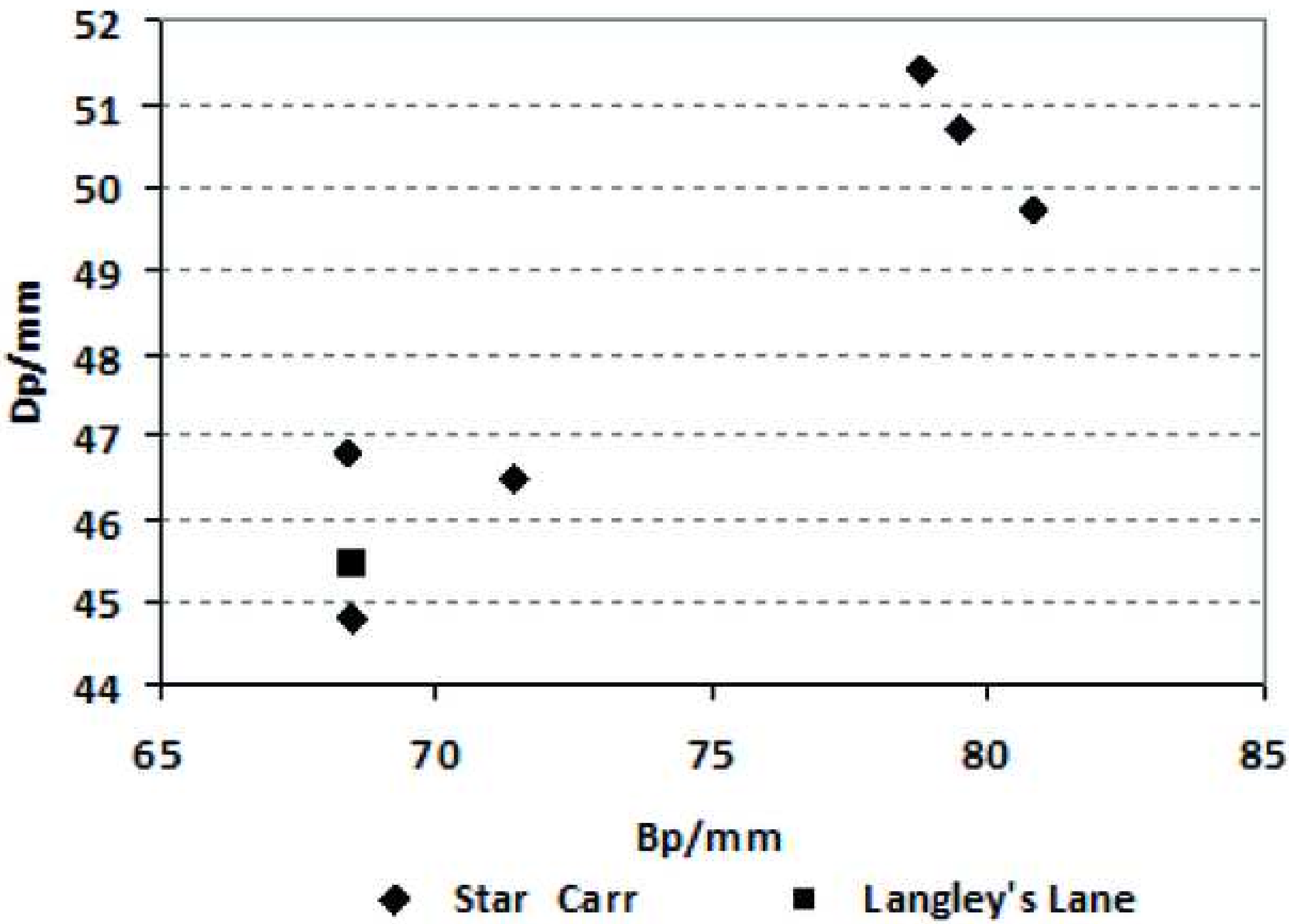
Figure


(1008/3002)
(3034)
L
K
J
I
H
G
F
E
C
D
B
A
39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18
17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
N
0
5m

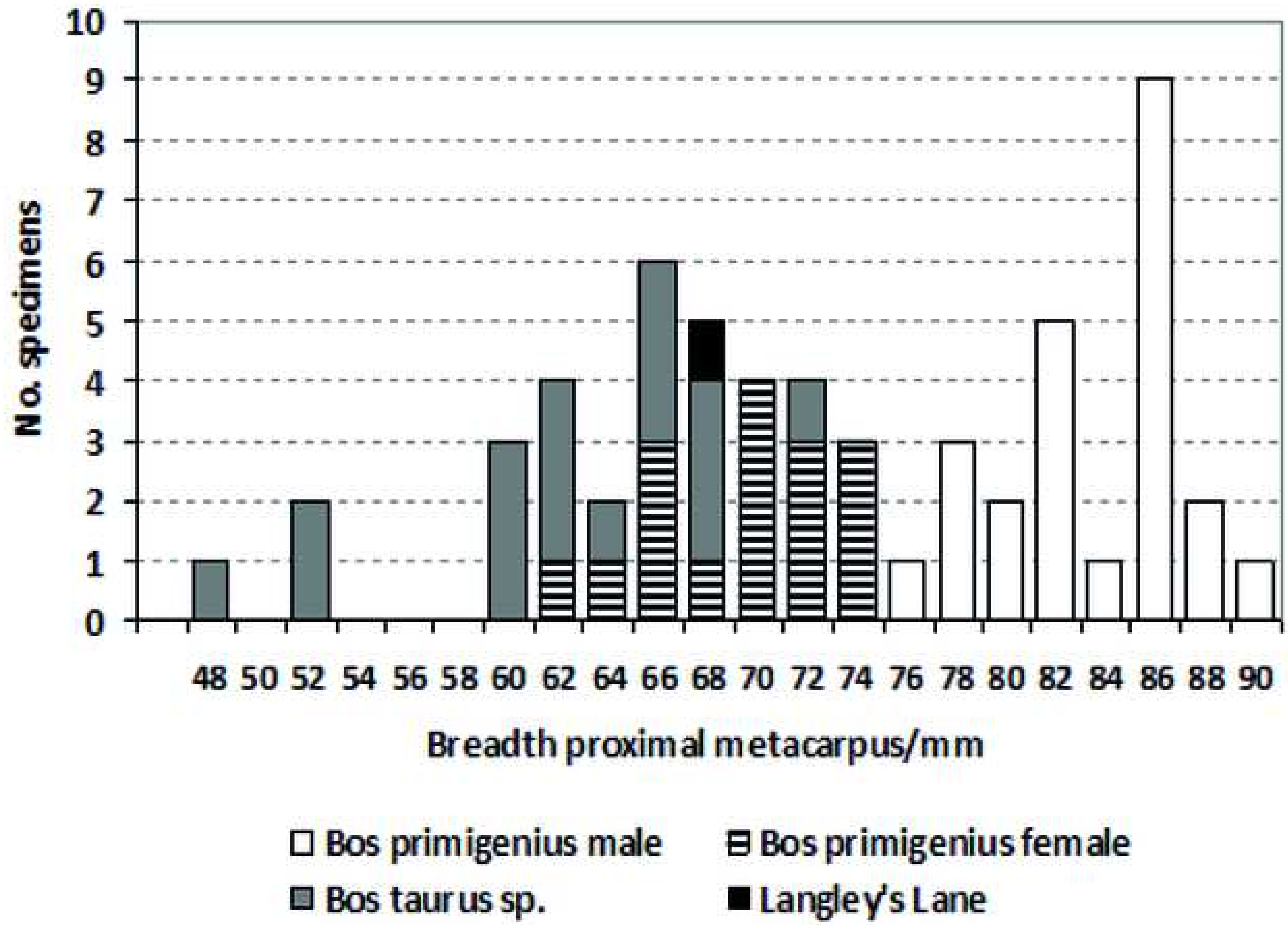
Figure


Lymnaea truncatula
Succineidae sp.
Carychium minimum
Cochlicopa lubrica
Vertigo pusilla
Vertigo pygmaea
Pupilla muscorum
Eucomilus alderi
Trichia sp.
Vitrina pelucida
Vitrea sp.
Cepaea sp.
Vallonia pulchella
Discus rotundatus
Zonitoides nitdus
Nesovitrea hammonis
Aegopinella nitidula
Aegopinella pura
Oxychilus sp.
Carychium tridentatim
Punctum pygmaeum
Clausillia bidentata
Acanthinula aculeata
Vallonia excentrica
Vallonia costata
Helicella italia
.20m
.30m
.40m
.50m
.60m
.70m
Zone 4
Zone 3
Zone 2
Zone 1
Subsoil
Tufa
Palaeosol
+ Less than 5 individuals
0
100

Figure

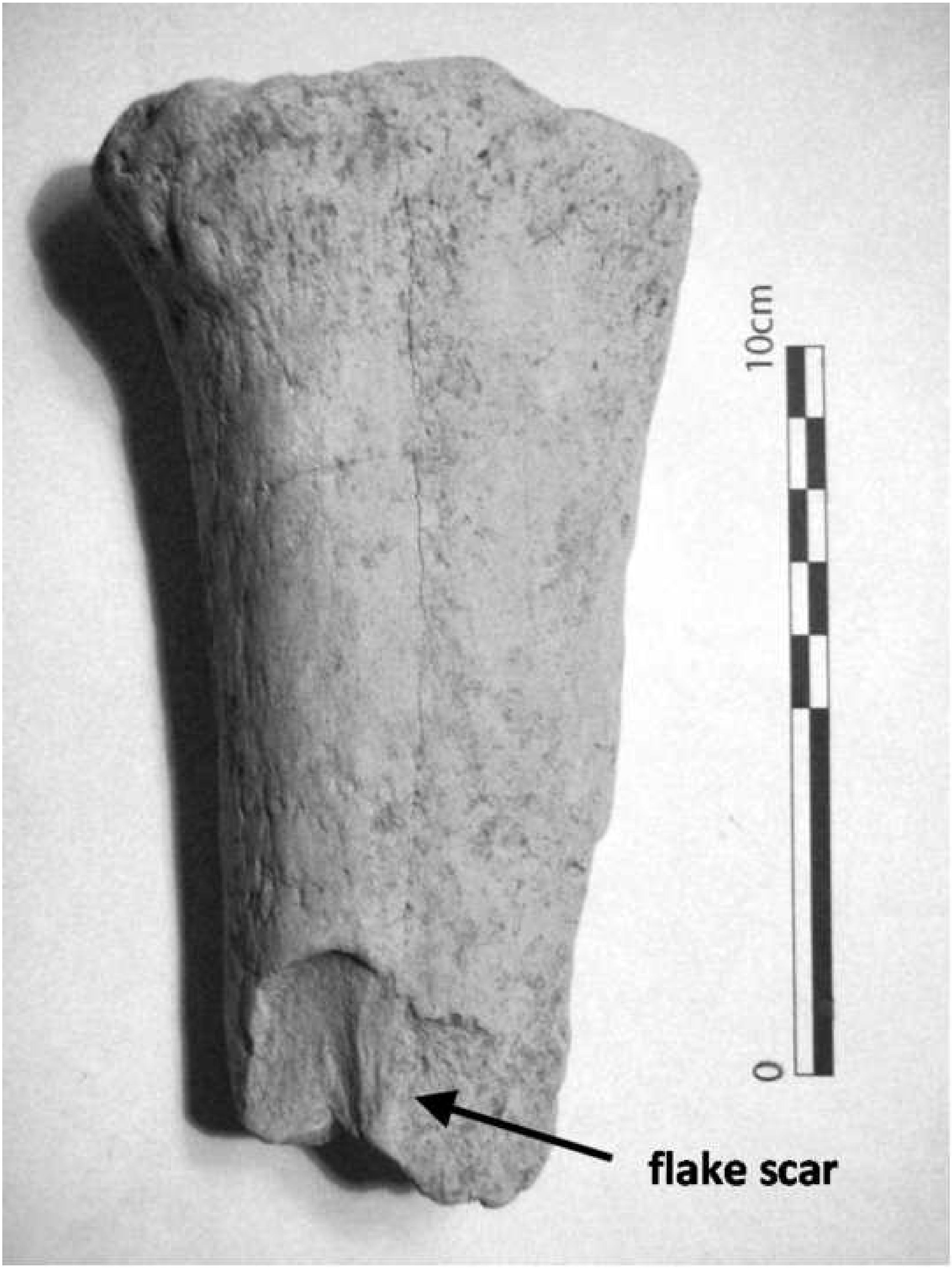

52
51
50
49
48
47
46
45
44
Dp/mm
65
70
75
80
85
Bp/mm
Star Carr
Langley's Lane

Figure

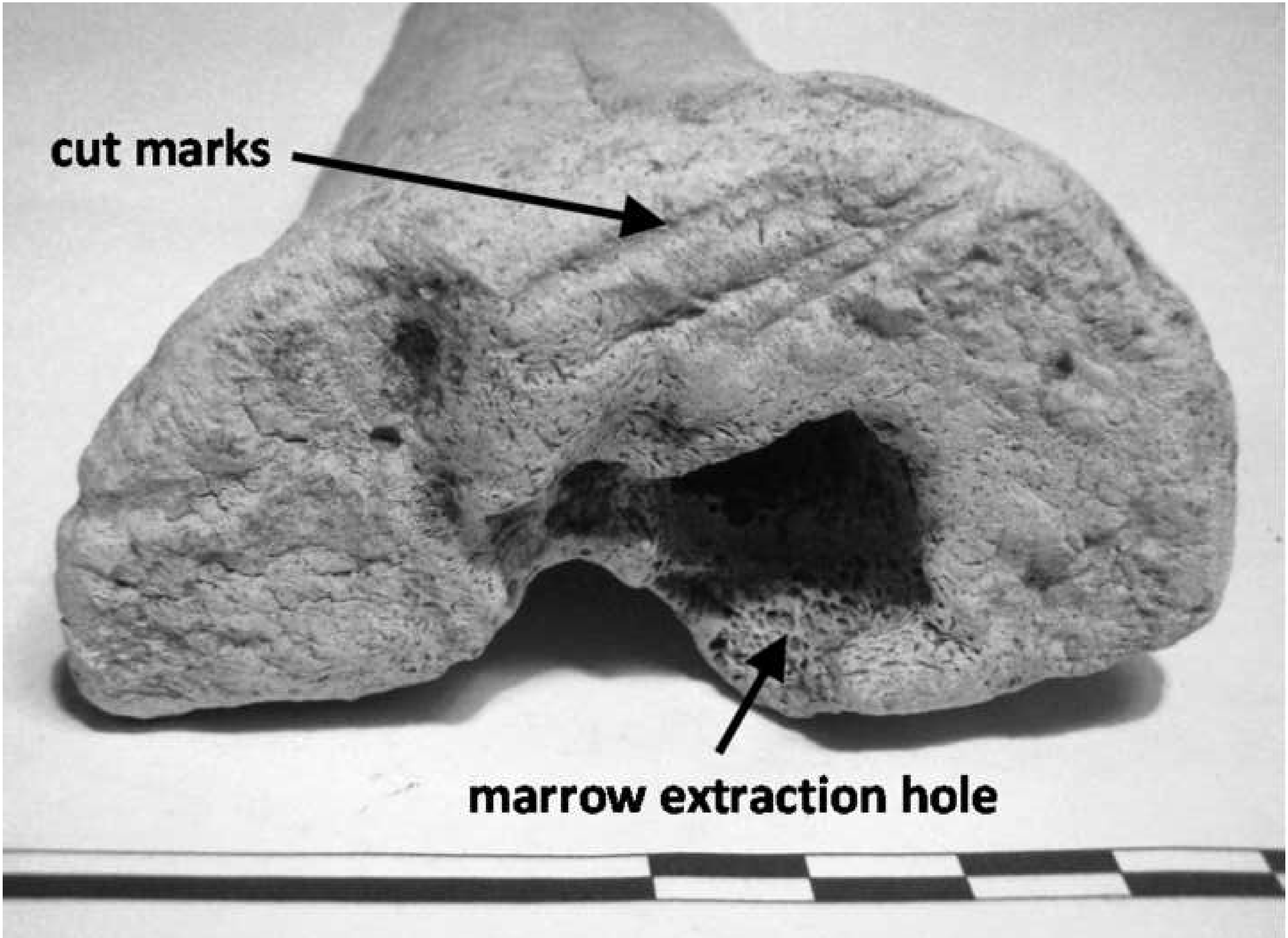


10
9
8
7
6
5
4
3
2
1
0
No. specimens
48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90
Breadth proximal metacarpus/mm
Bos primigenius male
Bos primigenius female
Bos taurus sp.
Langley's Lane

Figure



Figure



Figure