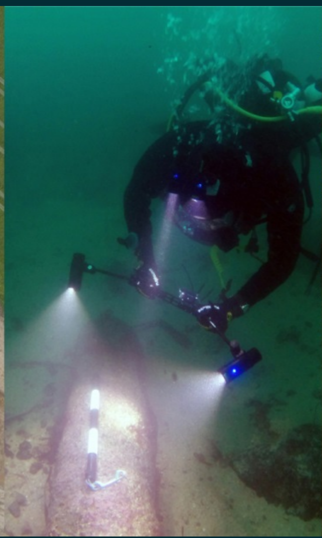
Cotswold Archaeology

Sherford New Town
Yealmpton
Devon

Archaeological Evaluation





for
AECOM

on behalf of
The Sherford Consortium

CA Project: 880198
CA Report: 17364

May 2018

Andover Cirencester Exeter Milton Keynes

Sherford New Town
Yealmpton
Devon

Archaeological Evaluation

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CONTENTS

LIST OF ILLUSTRATIONS

SUMMARY

Project Name:	Sherford New Town
Location:	Land north-west of Harestone Farm, Yealmpton, Devon
NGR:	256561 054998
Type:	Evaluation
Date:	31 May–21 June 2017
Planning Reference:	Plymouth City Council: 06/02036/OUT; South Hams District Council: 7_49/2426/06/O)
Site Code:	SHER 17

In May and June 2017, Cotswold Archaeology (CA) carried out an archaeological evaluation of part of the proposed site of the Sherford New Town development, Yealmpton, Devon. One of the primary aims of the evaluation was to further investigate a circular enclosure ditch detected previously by a geophysical survey.

The evaluation confirmed the presence of the enclosure ditch. There was evidence for a former internal ditch-side bank. There was no evidence for further internal features, although only a small part of the enclosure's interior was sampled by the evaluation.

The enclosure ditch had two openings: one on the ditch's north-eastern edge and one on its southern edge. Seven postholes and a shallow ditch were recorded within the northern opening.

Middle Bronze Age radiocarbon and optically stimulated luminescence dates were obtained from the fills of the circular enclosure ditch and two of the postholes. Early Bronze Age radiocarbon dates were obtained from the fills of one of the postholes and some probable root disturbance within the northern opening.

The almost complete absence of artefacts from the enclosure ditch and the associated features suggests that the enclosure was not a domestic feature. The true function of the enclosure is uncertain at this stage. The absence of an internal mound indicates that it was not a barrow. The presence of an internal (rather than external) bank and the Middle Bronze Age date suggest that the enclosure is not a henge.

1. INTRODUCTION

1.1 In May and June 2017, Cotswold Archaeology (CA) carried out an archaeological evaluation of part of the proposed site of the Sherford New Town development, Yealmpton, Devon (centred at NGR: 256561 054998; Fig. 1). This evaluation was undertaken for AECOM, on behalf of the Sherford Consortium.

1.2 Outline planning permission has been granted for the Sherford New Community development (Plymouth City Council ref: 06/02036/OUT; South Hams District Council ref: 7_49/2426/06/O). Conditions 52, 54, 56 and 93 of the outline planning permissions require a programme of archaeological work.

1.3 The present evaluation site is Field 87 of the wider scheme. The evaluation was carried out in accordance with both a specific method statement (AECOM 2017) and the wider project archaeological Written Scheme of Investigation (WSI; URS 2014). The fieldwork also followed *Specification for Archaeological Field Evaluation* (Devon County Council 2017) and *Standard and guidance for archaeological field evaluation* (CIfA 2014).

1.4 The evaluation fieldwork was monitored by Stephen Reed (Senior Historic Environment Officer, Devon County Council Historic Environment Team), including site visits on 14, 15 and 19 June 2017.

The site

1.5 The evaluation site forms a small area in the eastern part of the proposed Sherford New Town development. The site covers *c*. 0.36ha, of which *c*. 430m² was excavated. At the time of the evaluation, the site comprised a grass pasture field, bounded to the north and west by hedges and to the east and south by narrow lanes (Fig. 3). The site lies at approximately 62m AOD, with the ground dropping away to the east.

1.6 The underlying bedrock geology of the area is mapped as Middle Devonian Slates, which formed during the Devonian Period. No superficial deposits are recorded (BGS 2017).

2. ARCHAEOLOGICAL BACKGROUND

2.1 The project WSI (URS 2014) and the method statement (AECOM 2017) provide archaeological and historical backgrounds for the evaluation site and the wider scheme. This data is briefly summarised in the following text.

Prehistoric and Roman (500,000 BC–AD 410)

2.2 Evidence of significant prehistoric activity has been recorded near Elburton. This includes Neolithic, Bronze Age and Iron Age settlement.

2.3 To the west of Elburton, the site of a possible Bronze Age barrow has been identified. This is thought to be associated with a nearby Bronze Age cemetery. Two possible late Neolithic/Bronze Age barrows survive as earthworks within the wider development site, to the north-east of Elburton.

2.4 Evidence of an Iron Age settlement has been recorded at Hazel Grove, Elburton, immediately south-west of the wider development site. A scheduled multivallate Iron Age hillfort known as Wasteberry Camp lies to the east of the wider development site, approximately 600m east of Hareston.

2.5 A group of archaeological features, pottery sherds and iron-smithing slag recorded by the geophysical survey and trial trench evaluation in the south-western part of the wider site are possibly part of an Iron Age/Roman settlement. A number of Roman coins have been found within the same field as these features.

2.6 A previous geophysical survey of the present evaluation site (Bartlett-Clark Consultancy 2014) recorded a circular enclosure ditch of possible prehistoric or Roman date.

2.7 The remains of a possible Roman field system have been recorded by archaeological trial trenching in the north-central part of the wider development site, south of Butlas Farm.

Early medieval and medieval (AD 410–AD 1539)

2.8 Early medieval storage pits have been recorded at Hazel Grove, Elburton, to the immediate south-west of the wider development site.

2.9 Elburton itself was a medieval rural settlement, formerly surrounded by open strip-field systems. Several farmsteads or settlement sites within or adjacent to the wider development site are thought to have had early medieval or medieval origins.

3. AIMS AND OBJECTIVES

3.1 As defined in the evaluation method statement (AECOM 2017), the general objectives of the evaluation were:

- to evaluate the survival of archaeological deposits or features at the site, to gain information about the archaeological resource (including its presence or absence, character, extent, date, integrity, state of preservation, quality and significance);
- if archaeological remains are identified, to inform the preparation of a strategy to mitigate the impact of the proposed development.

3.2 The specific objectives were:

- to ground-test the geophysical survey results (Bartlett-Clark Consultancy 2014), specifically the circular enclosure ditch anomaly recorded in this area;
- to provide further information on the extent of modern disturbance.

4. METHODOLOGY

4.1 The evaluation fieldwork comprised the excavation of eight trenches, including three contingency trenches (T1–T5, CT1–CT3; Fig. 2).

4.2 The trenches were located primarily to investigate the large circular enclosure ditch identified by the previous geophysical survey (Bartlett-Clark Consultancy 2014). There was some variation in the layout of the trenches from that specified in the method statement (AECOM 2017); these variations were requested by Stephen Reed in order to provide further information about the circular ditch.

4.3 Trenches were set out on OS National Grid (NGR) co-ordinates using Leica GPS and surveyed in accordance with *CA Technical Manual 4: Survey Manual*.

4.4 All trenches were excavated by a mechanical excavator equipped with a toothless grading bucket. All machine excavation was undertaken under constant archaeological supervision to the top of the natural substrate. Where archaeological deposits were encountered, they were excavated by hand in accordance with *CA Technical Manual 1: Fieldwork Recording Manual*.

4.5 Deposits were assessed for their palaeoenvironmental potential and samples were taken in accordance with *CA Technical Manual 2: The Taking and Processing of Environmental and Other Samples from Archaeological Sites*. All recovered artefacts were processed in accordance with *CA Technical Manual 3: Treatment of Finds Immediately after Excavation*.

4.6 The archive and artefacts from the evaluation are currently held by CA. It is anticipated that the evaluation archive will be combined with the archives from the other archaeological works undertaken as part of the wider scheme, and that a single combined project archive will be deposited with the Plymouth City Museum & Art Gallery and the Archaeology Data Service (ADS).

4.7 A summary of information from this project, as set out in Appendix F, will be entered onto the OASIS online database of archaeological projects in Britain.

5. RESULTS

5.1 This section provides an overview of the evaluation results. Additionally:

- detailed summaries of the recorded contexts can be found in Appendix A;
- details of the artefacts recovered from the site can be found in Section 6;
- details of the environmental samples (palaeoenvironmental evidence) can be found in Section 7 and Appendix B;
- details of the geoarchaeological and pollen assessment can be found in Section 8 and Appendix C;
- details of the radiocarbon dates can be found in Section 9 and Appendix D;
- details of the Optically Stimulated Luminescence (OSL) dating can be found in Section 10 and Appendix E.

5.2 The natural underlying geology comprised firm yellow-brown silty clay with occasional stones, and was encountered in all trenches at a depth of 0.3m–0.6m below the present ground level. The natural was generally sealed by sandy clay subsoil, which was covered in turn by the topsoil. T3 featured a stony layer between the topsoil and the subsoil (Fig. 10, Sec. GG).

Trench 1 (Figs. 4, 6 & 7)

5.3 This trench exposed the south-eastern terminus of the circular ditch. Ditch terminus 107 was 2.8m wide and up to 1.69m deep. It contained seven fills (103, 104, 105, 106, 108, 111 and 112; Fig. 7, Secs. BB and CC). The lower fills (105, 106, 111 and 112) appeared to have formed through a low action gradual silting process, the deposits being predominantly of fine silty sands with only occasional small stone inclusions. A radiocarbon date of 1499–1383 cal BC (Middle Bronze Age) was obtained from fill 106.

5.4 The main central fill of ditch terminus 107 (context 104) consisted of large, angular stones, which appeared to have been deliberately backfilled into the ditch from the northern, internal side of the feature. An OSL date of 1720 BC–1250 BC (Early/Middle Bronze Age) was obtained for this fill.

5.5 To the north of the ditch terminus, two deposits were noted in section (109 and 110; Fig 6), both of which overlay the natural substrate. It is possible that upper layer 109 represents the heavily-truncated remains of a former bank within the interior of the circular enclosure ditch. Lower layer 110 may represent the former ground surface, which was sealed by the bank. The form and nature of layer 109 and the fills within ditch terminus 107 suggest that once the ditch had gone out of use and had partially silted up, the internal bank was deliberately backfilled into the ditch.

5.6 To the north-west side of ditch terminus 107, possible pit or posthole 116 was recorded. Although undated artefactually, this pit/posthole was cut into subsoil 101, indicating that it was post-medieval in date.

5.7 In the western part of the trench, the terminus of north/south aligned ditch 506 (T5; see below) was recorded as 114. This ditch was cut into subsoil 101, indicating that it was post-medieval in date.

Trench 2 (Figs. 4, 8 & 9)

5.8 Here, circular enclosure ditch 208 was 2.8m wide and 1.55m deep (Fig. 8, Sec. EE). It contained five fills (203, 204, 205, 206 and 209). The nature of these fills was similar to those seen in terminus 107 (T1) to the east. Lowest fill 209 appeared to have been formed through low action gradual silting. Second fill 206 may have formed through either erosion or deliberate backfilling.

5.9 Third fill 205 contained very frequent large angular stones and appeared to represent deliberate backfill. This fill may be material from a former internal bank. A thin layer of material (context 207; Fig. 8, Sec. DD) recorded in section to the north of ditch 208 may represent the remnants of this putative bank.

Trench 3 (Figs. 5, 10, 11, 12 & 13)

5.10 T3 exposed the northern opening the circular enclosure ditch. The two ditch terminals forming the opening were 7.5m apart. Within the opening were a number of isolated features, comprising postholes, pits and a narrow ditch.

5.11 North-eastern terminus 307 (Fig. 12, Sec. JJ) was 2.3m wide and 1.2m deep, with three distinctly separate fills. Basal fill 306 had apparently built up via a low action, gradual silting process, as with the other slots across this ditch. A radiocarbon date of 1501–1391 cal BC (Middle Bronze Age) was obtained from this fill; an OSL date of 2020 BC– 1480 BC (Early/Middle Bronze Age) was also obtained from this fill.

5.12 Fill 306 was covered by stone-rich deposit 305, which may have derived from a now-vanished ditch-side bank. Upper deposit 304 is likely to have accumulated over a period of time as the lower deposits settled.

5.13 North-western ditch terminus 339 was recorded mainly in plan, with only a very small intervention excavated to test the sequence of deposits. The eastern part of this feature featured a stone-rich upper fill (context 338), which may have originated as backfilled material from a former bank.

5.14 Further evidence for a bank was provided by layer 333, which was recorded in section to the south-west of north-eastern ditch terminus 307, and which may represent the remnant of a former interior bank (Fig 10, Section GG).

5.15 Seven postholes (311, 313, 315, 317, 320, 323 and 341; Fig. 13, Secs. KK–PP) were grouped together in the western side of the opening. These postholes varied in size from 0.27m diameter/0.11m depth (posthole 341) to 1.09m length/0.56m width/0.4m depth (posthole 320). Postholes 315/317 and 320/323 appeared to form two pairs, each pair featuring an oval, deep posthole (317 and 320) with a smaller circular posthole to the immediate north/north-west (315 and 323).

5.16 Radiocarbon dates were recovered from the following postholes:

- posthole 311: 1421–1272 cal BC (Middle Bronze Age)
- posthole 317: 1887–1739 cal BC (Early Bronze Age)
- posthole 323: 1404–1229 cal BC (Middle Bronze Age)

5.17 Two further features within the opening (309 and 336) were very irregular and are considered likely to be the results of bioturbation/root disturbance. A radiocarbon date of 2341–2189 cal BC (Early Bronze Age) was obtained from feature 336.

5.18 North-east/south-west aligned ditch 332 was also located within the opening, cutting across the edge of possible root disturbance 336. This ditch was 0.3m wide and only 0.08m deep. It appeared to terminate at both ends, although the very shallow nature of the ditch raises the possibility that its original extent had been truncated away by later activity such as ploughing. A small amount of subsoil 301 was left *in situ* adjacent to ditch 332, so that the relationship between the ditch and the subsoil could be confirmed; it was established that ditch 332 was sealed by the subsoil.

5.19 Shallow cut feature 343 was recorded in the south-western section of T3 (Fig 11, Section HH). This potential shallow pit was cut into subsoil 301, and is therefore likely to be post-medieval in date.

Trench 4 (Fig. 2)

5.20 The continuation of the circular enclosure ditch was recorded in T4 as ditch 406. It was not subject to full excavation in T4, although a small intervention was excavated. A single item of prehistoric worked flint was recovered from fill 403.

Trench 5 (Figs. 4 & 14)

5.21 This trench exposed the south-western terminus of the circular enclosure ditch (ditch 504). This terminus was not excavated. The trench section adjacent to ditch terminus 504 (Fig. 14, Sec. QQ) contained layer 509, which may have represented the remnants of a former ditch-side bank on the interior of the enclosure.

5.22 Shallow pit 508 (Fig. 14, Sec. SS) was 0.32m wide and 0.08m deep, with a single undated fill (507).

5.23 North/south-aligned ditch 506 (Fig. 14, Sec. RR) was exposed in the eastern part of T5; this ditch continued into T1 (ditch 114), where it terminated. Ditch 506 was cut into the subsoil layer and is therefore likely post-medieval in date.

Contingency Trench 1 (Fig. 15)

5.24 This trench exposed the western side of the circular enclosure ditch (ditch 1004), which measured 2.2m in width. The trench section (Fig. 15, Sec. TT) contained no clear evidence of a former bank.

Contingency Trench 2 (Fig. 16)

5.25 This trench exposed the eastern side of the circular enclosure ditch (ditch 2004), which measured 2.2m in width. The trench section (Fig. 16, Sec. UU) contained no clear evidence of a former bank.

Contingency Trench 3 (Fig. 17)

5.26 This trench exposed part of the north-western section of the circular enclosure ditch (ditch 3004), which measured 1.95m in width. The possible remnants of an internal ditch-side bank were recorded in the trench section (context 3007; Fig. 17, Sec. VV).

5.27 The subsoil within CT3 was cut by two treethrows (3006 and 3009), which were in the approximate locations of geophysical anomalies (Bartlett-Clark Consultancy, 2014).

6. THE FINDS

Pottery

6.1 Three sherds (63g total) of abraded pottery were recovered from two deposits. These sherds comprise the rim from a Trevisker ware jar (post-medieval treethrow 3006, CT3) and two plain Trevisker ware body sherds in a fabric with quartzite inclusions (topsoil, T1). The rim is externally expanded and internally bevelled, and decorated with horizontal cord impressions; it is of Early to Middle Bronze Age date. All three sherds are apparently residual in later deposits.

Flint

6.2 A single flake fragment of prehistoric worked flint was recovered from ditch 406 (fill 403). It cannot be closely dated.

Context	Class	Description	Ct.	Wt.(g)	Spot-date
100	Prehistoric pottery	Trevisker ware	2	3	E–M BA
403	Flint	Flake	1	3	
3005	Prehistoric pottery	Trevisker ware; jar	1	60	E–M BA

Table 1: finds concordance

7. THE BIOLOGICAL EVIDENCE

7.1 A series of 12 environmental samples (254 litres of soil) were selected for processing. These samples were taken from three slots through the circular enclosure ditch and from six features in the northern opening of this ditch. These samples were processed to evaluate the preservation of palaeoenvironmental remains and with the intention of recovering environmental evidence of domestic or industrial activity on the site. It was hoped that the environmental assemblages might also assist in determining the date and possible function of the circular enclosure ditch. The samples were processed by standard flotation procedures (*CA Technical Manual 2: The Taking and Processing of Environmental and Other Samples from Archaeological Sites*).

7.2 In addition, a sequence of 12 small samples through circular enclosure ditch slot 107 was processed for the recovery of mollusc remains following standard mollusc sample flotation procedures (Evans 1972). The aim was to see if molluscs were preserved and, if so, whether the mollusc assemblages would provide any detailed information on the nature of the local landscape and any changes in this over time. Unfortunately, mollusc shells were not preserved on the site. The mollusc samples (samples 91–102) were also assessed for charred remains to augment those recovered from the bulk samples.

7.3 Preliminary identifications of plant macrofossils are noted in Appendix B, following nomenclature of Stace (1997) for wild plants, and traditional nomenclature, as provided by Zohary *et al* (2012) for cereals.

7.4 The flots were generally rather small, with 10%–60% rooty material and modern seeds. The charred material was in varying levels of preservation.

Features in northern opening of circular ditch

7.5 A small quantity of indeterminate grain fragments, monocotyledon stem fragments and charcoal fragments greater than 2mm were noted within fill 318 (sample 10) of pit 320.

7.6 Fill 316 (sample 11) of pit/posthole 317 produced a seed of oat (*Avena sp*.) and a few charcoal fragments while the assemblage from fill 335 (sample 17) of pit/posthole only contained a small number of charcoal fragments.

7.7 Low numbers of charcoal fragments but no charred plant remains were noted from fill 310 (sample 8) of posthole 311 and fill 321 (sample 14) of posthole 323.

7.8 Fill 327 (sample 13) of ditch 328 (same as 332) produced a sparse amount of charcoal fragments and no charred plant remains.

7.9 All these assemblages are likely to be reflective of dispersed domestic hearth material.

Circular ditch

7.10 A few charcoal fragments were recovered from fill 209 (sample 42) of ditch section 208.

7.11 Fill 306 (sample 7) of ditch section 307 contained a small number of charred remains. These included indeterminate grain fragments, a tuber fragment and charcoal fragments.

7.12 Small to moderately small charred plant assemblages were recorded from fills 106 (sample 4), 108 (sample 3), 104 (sample 2) and 103 (sample 1) of ditch section 107. These included grain fragments of barley (*Hordeum vulgare*) and hulled wheat, emmer or spelt (*Triticum dicoccum*/*spelta*), and seeds of brassica (*Brassica sp*.). A moderate quantity of charcoal fragments was recovered from upper fill 103 (sample 1) and low numbers in the other three samples (2–4).

7.13 The small quantities of charred material noted within the mollusc samples (91–102) from ditch section 107 included fragments of barley grains, hulled wheat grains, hazelnut shell (*Corylus avellana*) and charcoal.

7.14 Again, these assemblages from the circular enclosure ditch appear to be representative of dispersed domestic settlement waste. The radiocarbon and OSL dates (see Sections 9 and 10) indicate an Early/Middle Bronze Age date for the circular enclosure ditch. The charred plant assemblages from the sequence of deposits in ditch section 107 would appear to be compatible with these dates rather than a Late Neolithic date, as the general trend in mainland Britain appears to be for cereal agriculture to have been rare or absent in the later Neolithic (Stevens and Fuller 2012). There is no indication from the environmental results alone of the likely date of the assemblages from the other ditch sections or the features within the northern opening of the circular enclosure ditch.

Summary

7.15 Although there is no clear evidence of the function of the circular enclosure ditch from the environmental remains, there appears to be an indication of some settlement activity in the wider vicinity during the Early/Middle Bronze Age period.

8. GEOARCHAEOLOGICAL AND POLLEN ASSESSMENT

8.1 The full geoarchaeological and pollen assessment report is presented as Appendix C. This section presents a brief summary of this data.

Geoarchaeology

8.2 Geoarchaeological recording was undertaken for samples taken from three sequences across the circular enclosure ditch:

- ditch terminus 107 (T1);
- ditch 208 (T2); and
- ditch terminus 307 (T3).

8.3 The two sequences across the ditch terminals demonstrated evidence of stocastic sedimentation, often consisting of the incorporation of stone-rich deposits that had probably slumped into the ditch and caused disturbance/erosion of earlier stabilisation surfaces within the ditch. The sequence located away from the ditch terminus contained a preserved stabilisation surface with evidence of *in situ* rooting, with the underlying sediments demonstrating a more gradual rate of sedimentation.

Pollen

8.4 Pollen assessment was undertaken on four samples from the sequence though ditch terminus 107 (T1). Pollen concentrations were extremely low, but sufficient pollen was extracted to enable a pollen assessment. This demonstrated the presence of an open grassy environment with evidence for local arable activity. This pollen contained within the circular ditch is consistent with the Early to Middle Bronze Age date for the circular ditch fills derived from radiocarbon and OSL dating (see Sections 9 and 10).

9. RADIOCARBON DATING

9.1 Radiocarbon dating was undertaken of samples from two terminals of the circular enclosure ditch (slots 107 and 307), three pits/postholes (311, 317 and 323) and possible bioturbation/root disturbance 336. The samples were analysed during March 2018 at Scottish Universities Environmental Research Centre (SUERC). The methodology employed is outlined in Dunbar *et al*. (2016). The radiocarbon dating certificates are included as Appendix D.

9.2 The uncalibrated dates are conventional radiocarbon ages. The radiocarbon ages were calibrated using the University of Oxford Radiocarbon Accelerator Unit calibration programme OxCal v4.3.2 (2017) (Bronk Ramsey 2009) using the IntCal13 curve (Reimer et al. 2013).

Feature	Lab No.	Material	δ 13C	δ 15 N	C/N ratio	Radiocarbon age	Calibrated radiocarbon age 95.4% probability	Calibrated radiocarbon age 68.2% probability
Context 106 Circular ditch 107	SUERC-78019	Charcoal: Hazel *(Corylus avellana)*	-25.3‰			3147±29 yr BP	1499–1383 cal BC (86.5%) 1340–1311 cal BC (8.9%)	1491–1484 cal BC (4.5%) 1452–1397 cal BC (63.7%)
Context 306 Circular ditch 307	SUERC-78020	Charcoal: Birch *(Betula)*	-27.1‰			3158±29 yr BP	1501–1391 cal BC (92.6%) 1336–1323 cal BC (2.8%)	1493–1481 cal BC (10.3%) 1454–1410 cal BC (57.9%)
Context 310 Posthole 311	SUERC-78022	Charcoal : Oak *(Quercus)*	-25.4‰			3086±29 yr BP	1421–1272 cal BC (95.4%)	1407–1374 cal BC (25.4%) 1355–1302 cal BC (42.8%)
Context 316 Pit/posthole 317	SUERC-78018	Charcoal: Alder/Hazel (Alnus glutinosa/Corylus avellana)	-26.8‰			3480±29 yr BP	1887–1739 cal BC (91.5%) 1713–1698 cal BC (3.9%)	1877–1841 cal BC (26.9%) 1822–1796 cal BC (18.9%) 1782–1752 cal BC (22.4%)
Context 321 Posthole 323	SUERC-78021	Charcoal: Oak *(Quercus)*	-26.8‰			3053±29 yr BP	1404–1229 cal BC (95.4%)	1385–1340 cal BC (32.5%) 1316–1266 cal BC (35.7%)
Context 335 Pit/posthole 336	SUERC-78026	Charcoal: Willow/Poplar *(Salix/Populus)*	-25.0‰ assumed			3805±29 yr BP	2341–2189 cal BC (83.0%) 2183–2141 cal BC (12.4%)	2289–2201 cal BC (68.2%)

Table 2: radiocarbon dating results

10. OPTICALLY STIMULATED LUMINESCENCE DATING

10.1 Optically Stimulated Luminescence (OSL) dating was undertaken for two samples from the circular enclosure ditch. The OSL report is included as Appendix E. In summary:

- fill 104 (ditch 107, T1; sample YEAL01): 1720 BC–1250 BC (Early/Middle Bronze Age);
- fill 306 (ditch 307, T3; sample YEAL02): 2020 BC–1480 BC (Early/Middle Bronze Age).

11. DISCUSSION

Bronze Age (2400 BC–700 BC)

11.1 The evaluation confirmed the presence of the circular enclosure ditch detected previously by the geophysical survey (Bartlett-Clark Consultancy 2014). This ditch was very substantial, measuring 1.95m–2.8m in width and 1.2m–1.69m in depth. The enclosure had an internal diameter of approximately 50m. There were two openings: one on the ditch's north-eastern edge (*c*. 7.5m in width) and one on its southern edge (*c*. 4m in width).

11.2 The basal fills of the enclosure ditch had apparently accumulated over time via a low action, gradual silting process. Radiocarbon dates of 1499–1383 cal BC and 1501–1391 cal BC (both Middle Bronze Age) were obtained from these basal fills; an OSL date of 2020 BC–1480 BC (Early/Middle Bronze Age) was also obtained from the same context as the latter radiocarbon date. In combination, the overlap of these date ranges suggests that the basal fills accumulated over the period 1499 BC–1480 BC (Middle Bronze Age).

11.3 The basal fills of the enclosure ditch were sealed by a stone-rich layer which appeared to have been deliberately backfilled into the ditch from the interior of the enclosure. This is suggestive of an internal bank, which was deliberately slighted once the ditch had partially infilled. The trench sections also contained the remnants of this former internal bank and indicated that it was a localised bank adjacent to the ditch, rather than a more general mound occupying the entire interior of the enclosure. An OSL date of 1720 BC–1250 BC (Early/Middle Bronze Age) was obtained from the bank material backfilled within the ditch, which, in combination with the dates obtained for the underlying deposits, suggests that the bank was slighted in the period 1480 BC–1250 BC (Middle Bronze Age).

11.4 The fills overlying the backfilled bank material appear to have accumulated subsequently over time via gradual silting.

11.5 Other than the bank, there was no evidence for any internal features, although only a small area of the enclosure's interior was sampled by the evaluation.

11.6 There were no features within the enclosure's southern opening, but a cluster of seven postholes was recorded in the western side of the northern opening. Two of these postholes provided Middle Bronze Age radiocarbon dates (1421–1272 cal BC and 1404–1229 cal BC). It is notable that these dates are slightly later than those obtained from the basal fills of the enclosure ditch (1499 BC–1480 BC).

11.7 There was tentative evidence for earlier Bonze Age activity: one posthole within the northern opening provided an Early Bronze Age radiocarbon date (1887–1739 cal BC). Two areas of probable bioturbation/root disturbance were also recorded within the northern opening, and one of these also provided an Early Bronze Age radiocarbon date of (2341–2189 cal BC).

11.8 The postholes in the northern opening were edged by a very shallow north-east/south-west aligned ditch (ditch 332). This ditch appeared to terminate at both ends, although its very shallow nature raises the possibility that its original extent had been truncated away by later activity such as ploughing. This ditch was undated, but its spatial relationship to the enclosure ditch opening and the postholes suggests that it was probably contemporary with these features.

11.9 The palaeoenvironmental assemblage from the circular enclosure ditch and the postholes in the northern opening was probably reflective of dispersed domestic hearth material, and is therefore indicative of some settlement activity in the wider vicinity during the Bronze Age.

11.10 Artefactual material was almost entirely absent from the site, with the only apparently *in situ* artefact comprising a single prehistoric worked flint flake from the enclosure ditch. Three sherds of abraded Trevisker ware pottery (Early–Middle Bronze Age) were also recovered as residual in later deposits. The almost complete absence of artefacts from the enclosure ditch and the associated features suggests that the enclosure was not a domestic feature. The true function of the enclosure is uncertain at this stage. The absence of an internal mound indicates that it was not a barrow. The presence of an internal (rather than external) bank and the Middle Bronze Age date suggest that the enclosure is not a henge.

Post-medieval (1540–1800)

11.11 A small number of features (pit/posthole 116, ditch 506/114, feature 343) were cut into the subsoil layer and are therefore likely post-medieval in date.

12. CA PROJECT TEAM

12.1 Fieldwork was undertaken by Simon Sworn, assisted by Jerry Austin, George Gandam, Vicky Parsons, Parris Stubbings and Tina Tapply. This report was written by Simon Sworn.

12.2 The finds report was written by Grace Jones and Katie Marsden and the biological evidence report was written by Sarah F. Wyles. The report illustrations were prepared by Esther Escudero

12.3 The radiocarbon dating was undertaken by the Scottish Universities Environmental Research Centre. The OSL dating was undertaken by Dr P. S. Toms, University of Gloucestershire. The geoarchaeological and pollen assessment was undertaken by the University of Southampton.

12.4 The project was managed for CA by Derek Evans.

13. REFERENCES

AECOM 2017 *Trial Trench Evaluation Method Statement: Sherford, Field 87*

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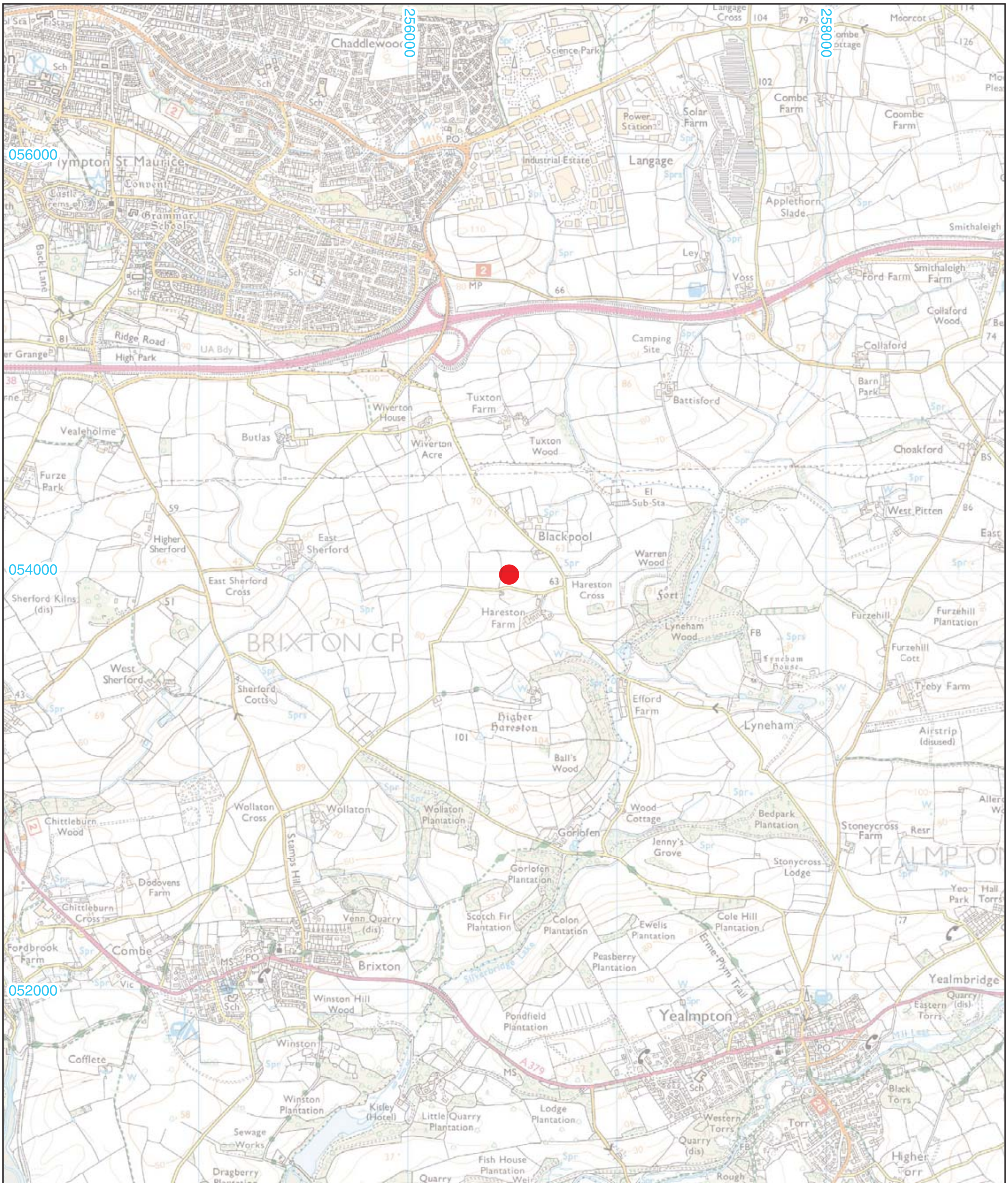

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PROJECT TITLE
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FIGURE TITLE
Site location plan

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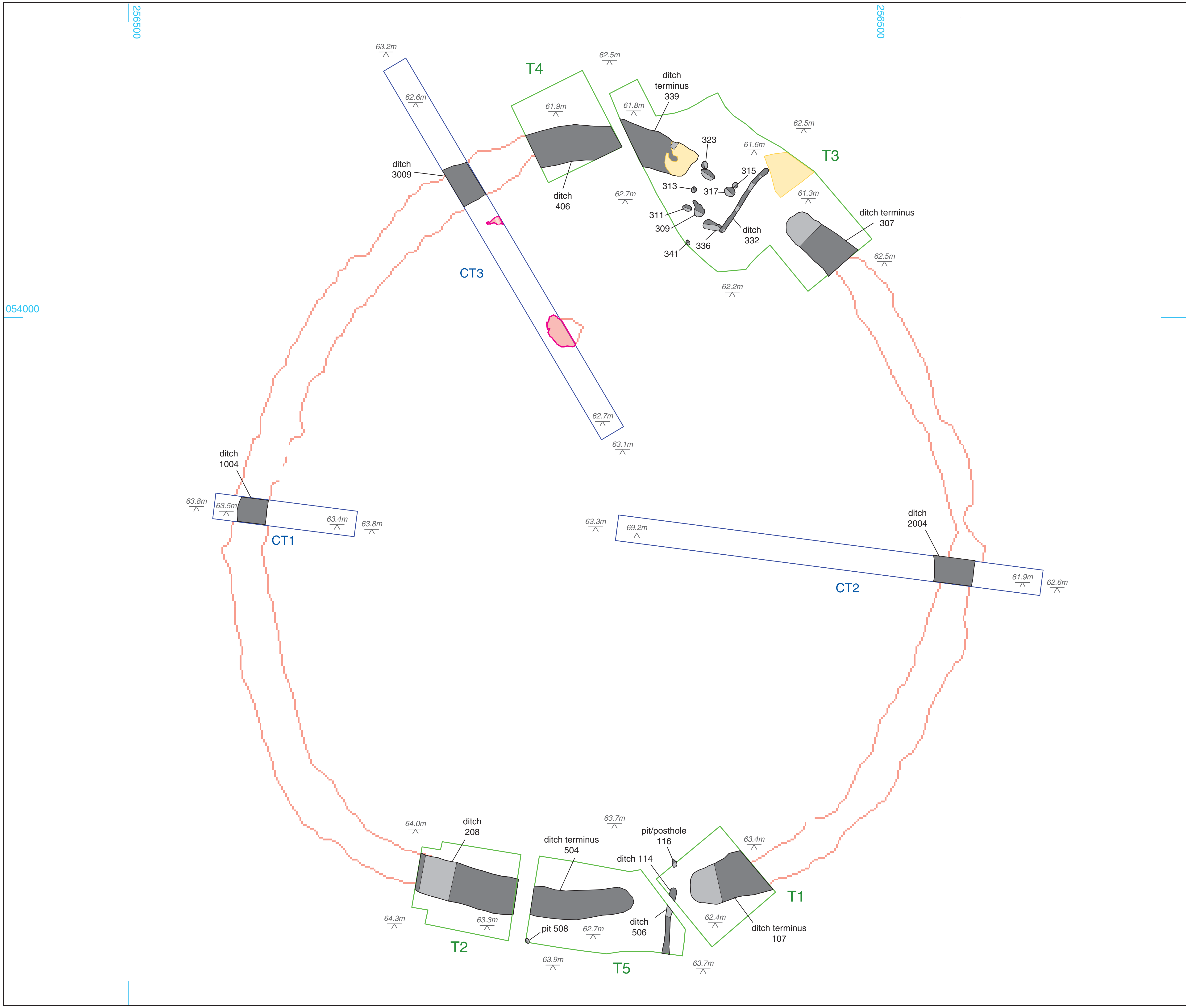
APPROVED BY	DE	SCALE@A4	1:25,000	



Evaluation trench

Contingency trench

Archaeological feature (excavated / unexcavated)

Tree-throw

Deposit

AECOM Geophysical Interpretations key:

Magnetic Anomalies - Archaeological

0 1:250 10m

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PROJECT TITLE
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FIGURE TITLE
Trench location plan, showing geophysical survey results

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CHECKED BY	DJB	DATE	08/08/2017	2
APPROVED BY	DE	SCALE@A3	1:250	

General view of the site, looking south.

General view of the site in the foreground with Harestone Cottages and Dartmoor in the background, looking north-east.

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FIGURE TITLE
Photographs

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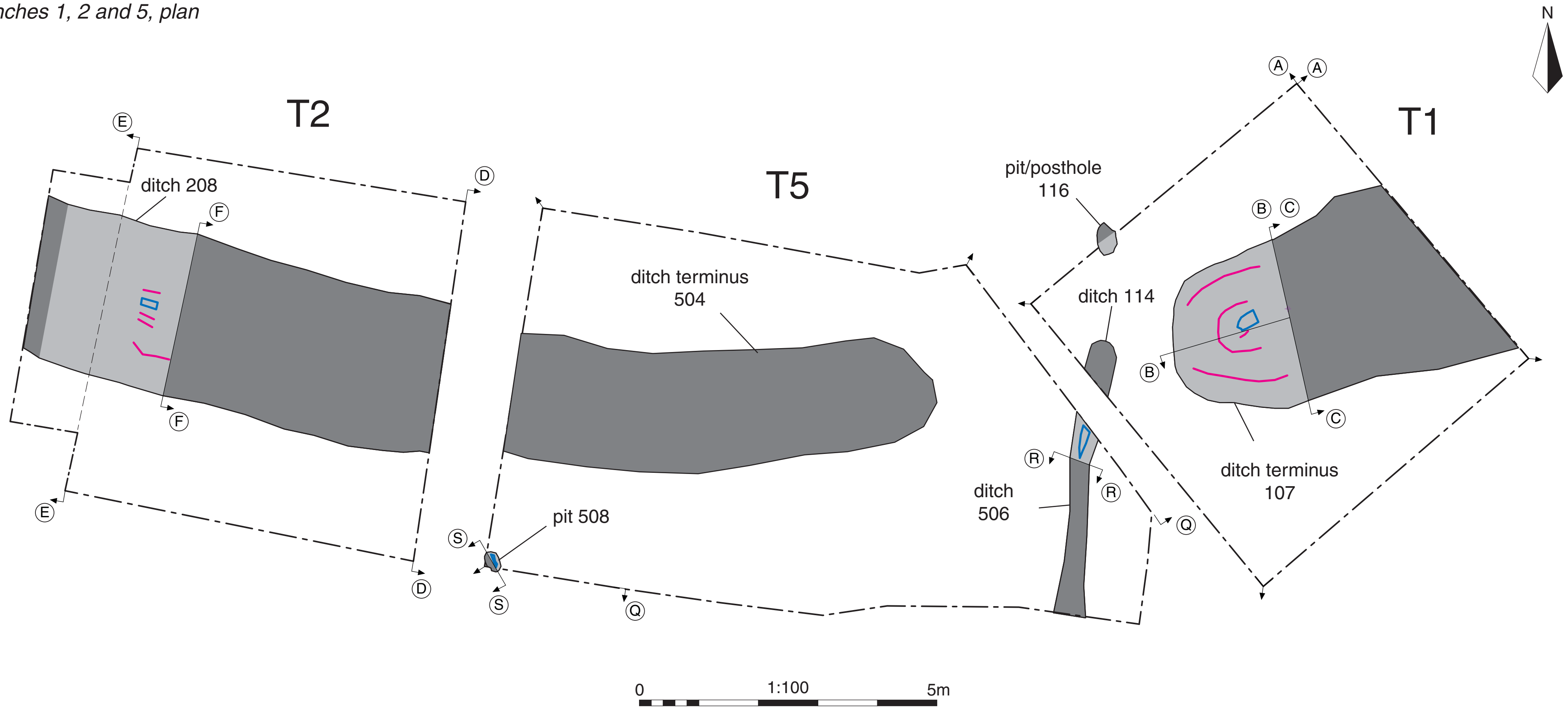
APPROVED BY	DE	SCALE@A4	NA	

Trenches 1, 2 and 5, plan



Trench 1 (left) with excavated terminus 107 and Trench 5 (right) showing unexcavated terminus 504 in plan, looking south (2 x 1m scales)

Evaluation trench

Archaeological feature (excavated / unexcavated)

Base of feature

Break of slope

Section location

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FIGURE TITLE
Southern entrance of enclosure ditch: plan and photograph

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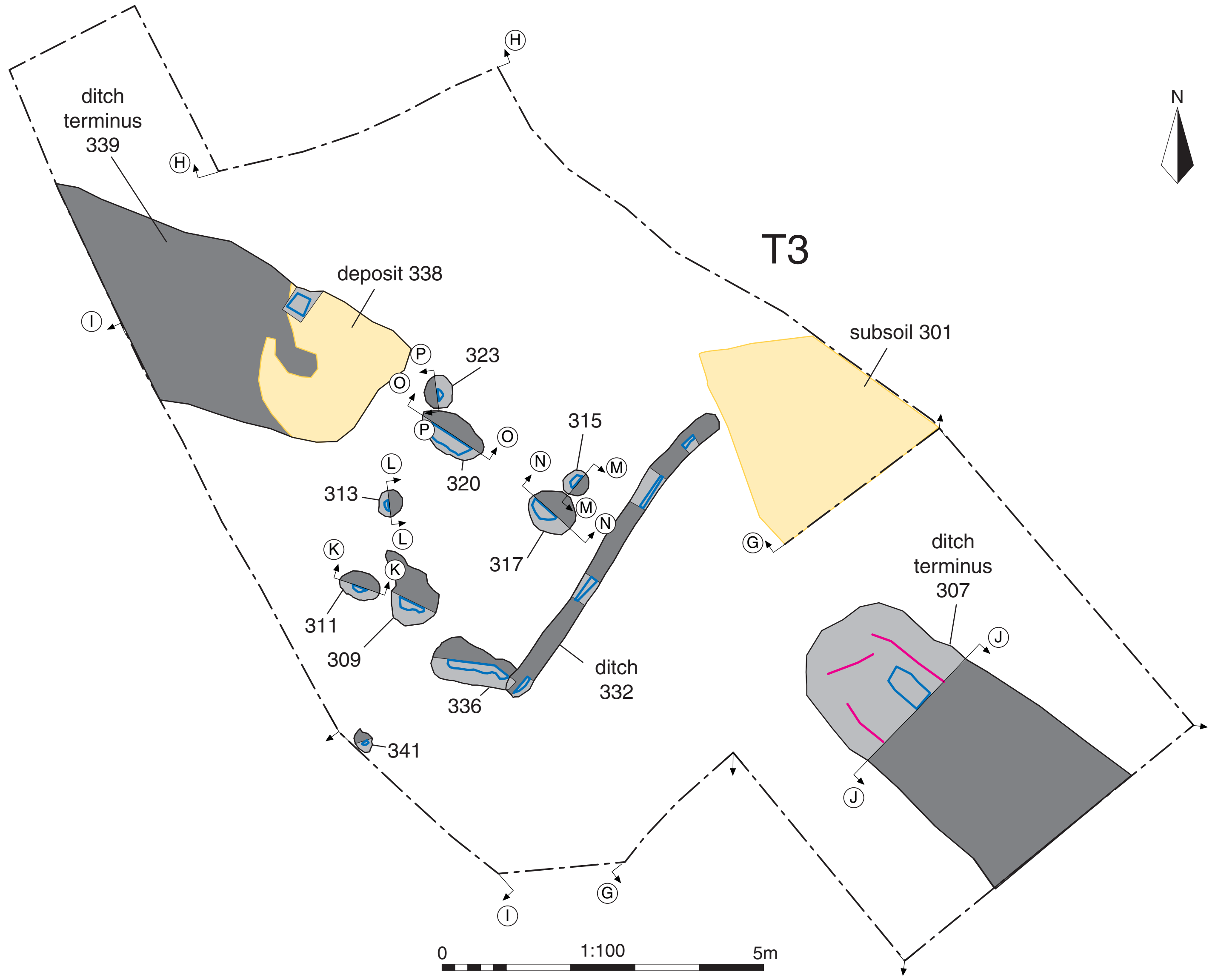

Excavated ditch terminus 307 shown on the top right and unexcavated, stone rich terminus 339 to the bottom left. Excavated pits/postholes and north-east/south-west aligned ditch to the centre, looking north-east (2 x 1m scales)

Excavated ditch terminus 307 shown on the top right and unexcavated, stone rich terminus 339 to the top left. Excavated pits/postholes and north-east/south-west aligned ditch in the centre, looking north (2 x 1m scales)

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FIGURE TITLE
Northern entrance of enclosure ditch: plans and photographs

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APPROVED BY	DE	SCALE@A3	1:100	

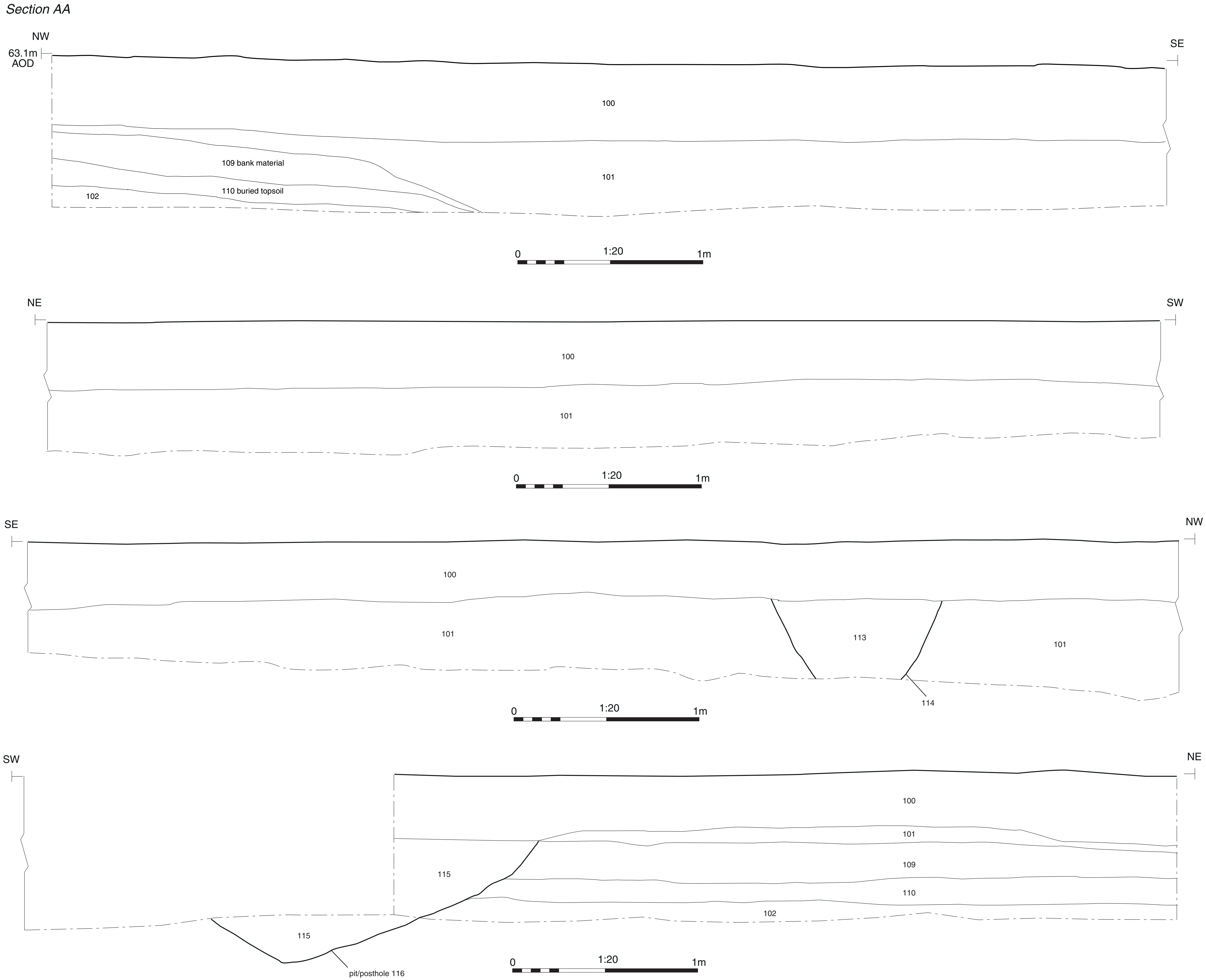

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FIGURE TITLE
Trench 1: section

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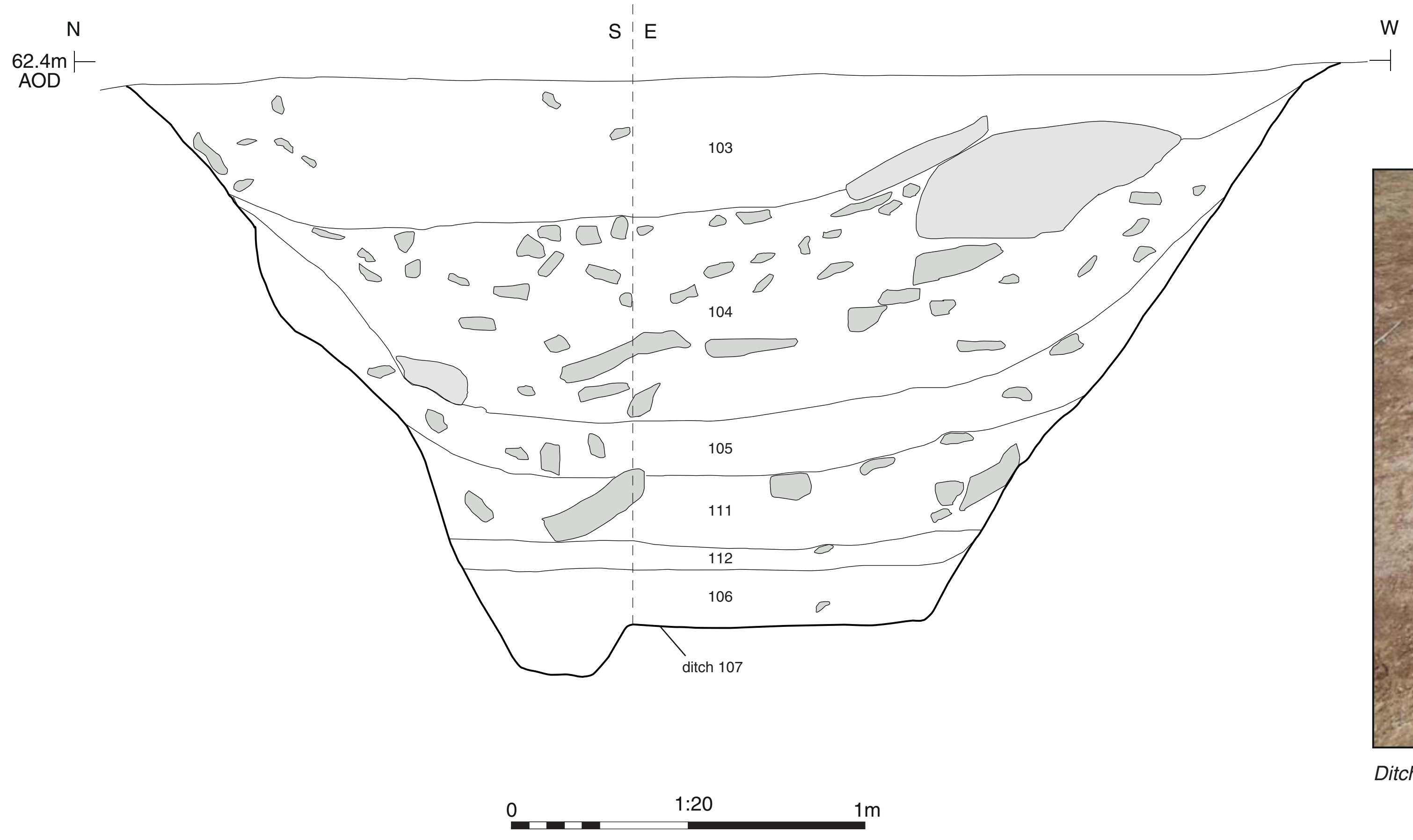
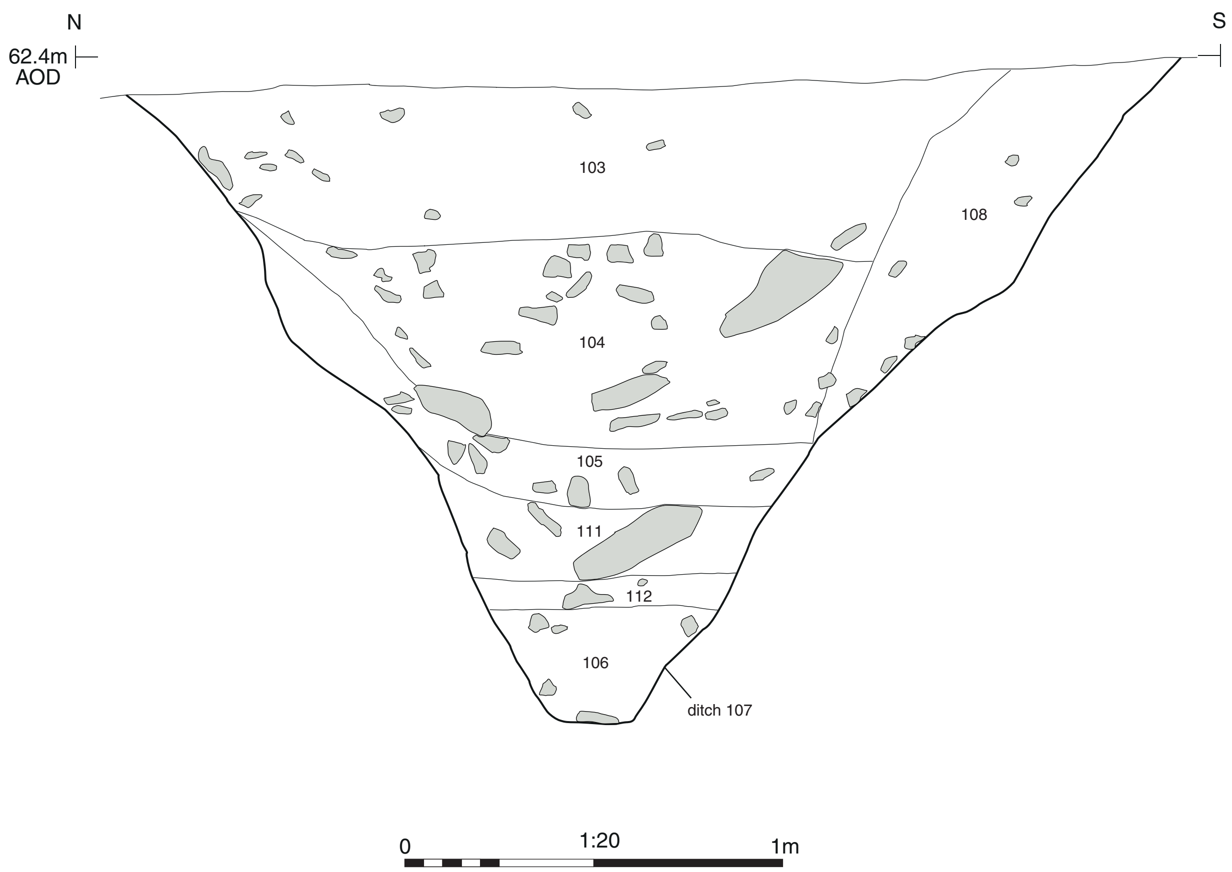
Section BB



Ditch terminus 107 (partly excavated), showing stone rich context 104, looking south (1m scale)

Section CC



Ditch terminus 107, looking north-east (1m scale)

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FIGURE TITLE
Trench 1: ditch terminus 107, sections and photographs

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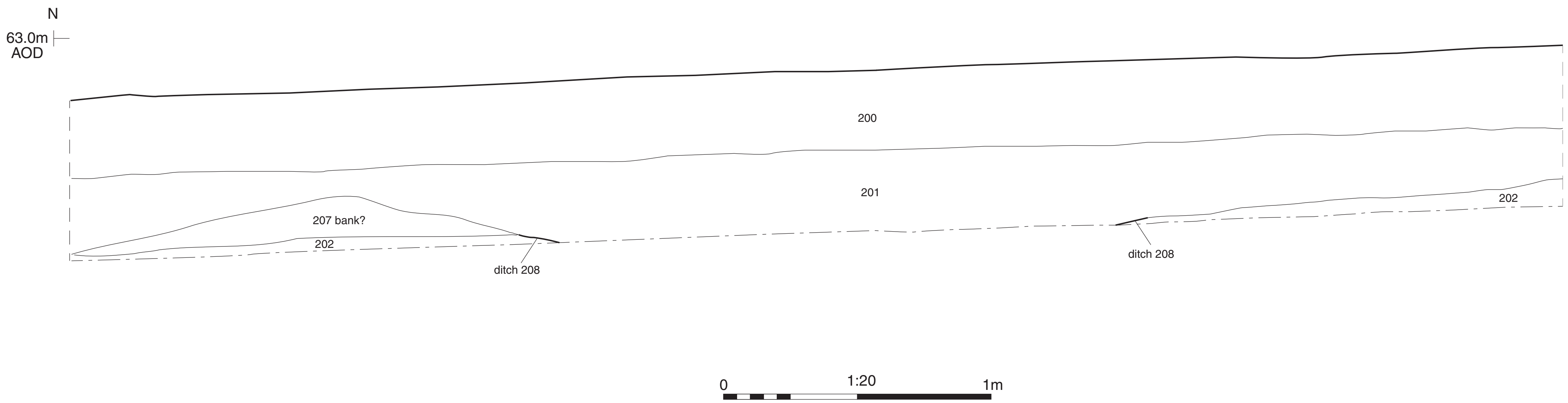
APPROVED BY	DE	SCALE@A3	1:20	

Section DD



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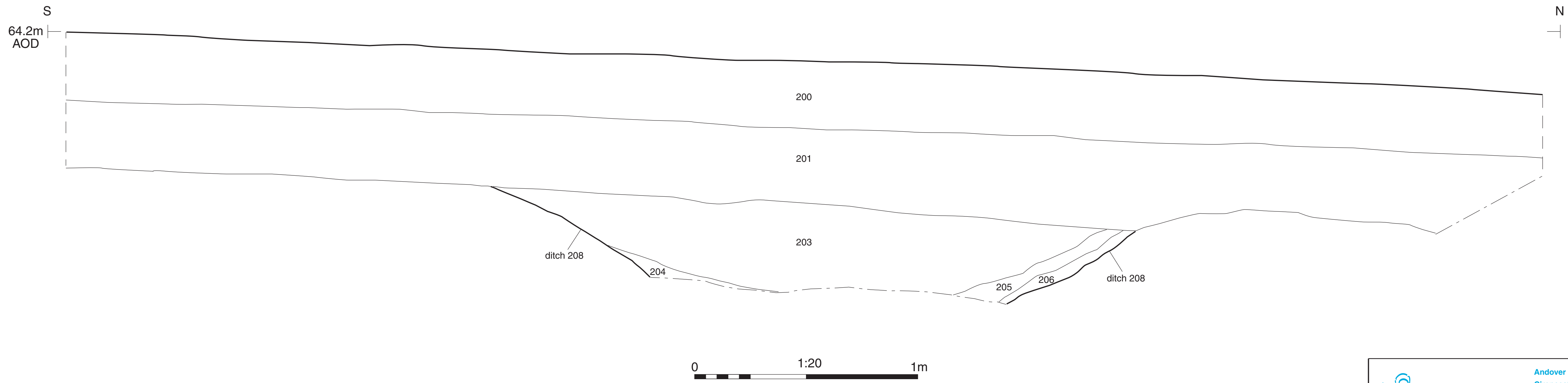

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FIGURE TITLE
Trench 2: sections

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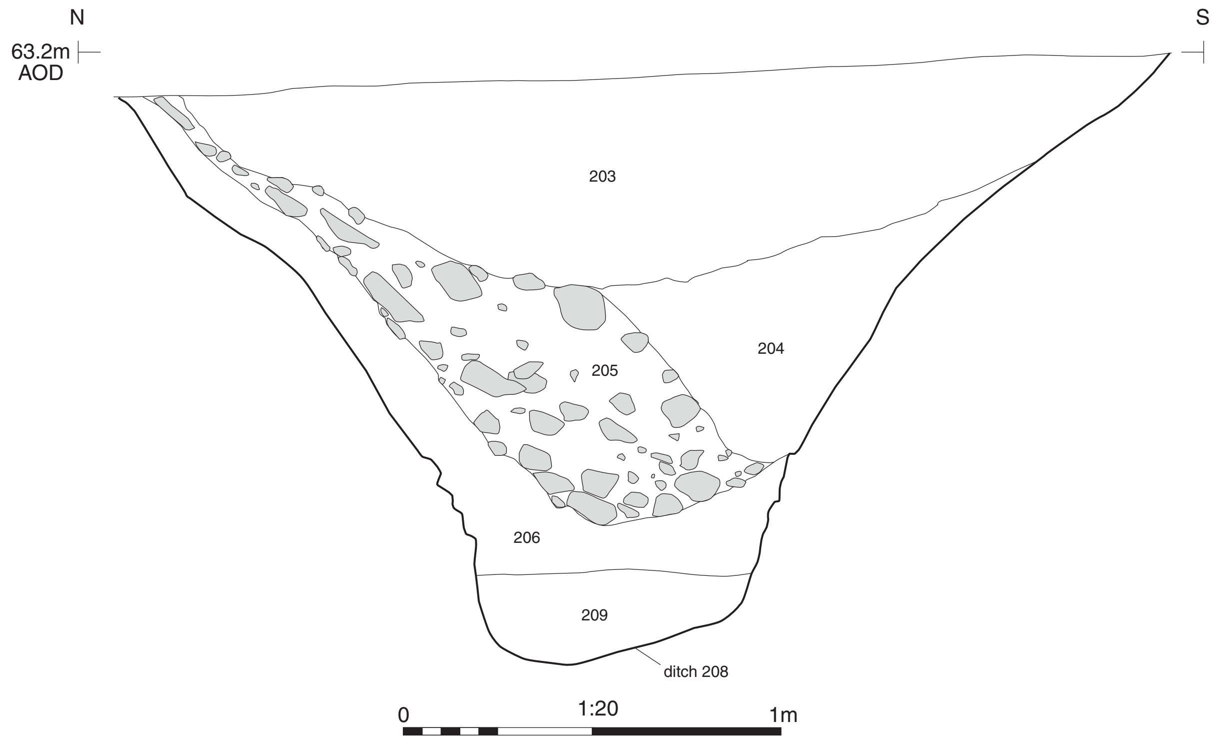
APPROVED BY	DE	SCALE@A3	1:20	

Section FF



Ditch 208, looking east (1m scale)

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FIGURE TITLE
Trench 2: section and photograph

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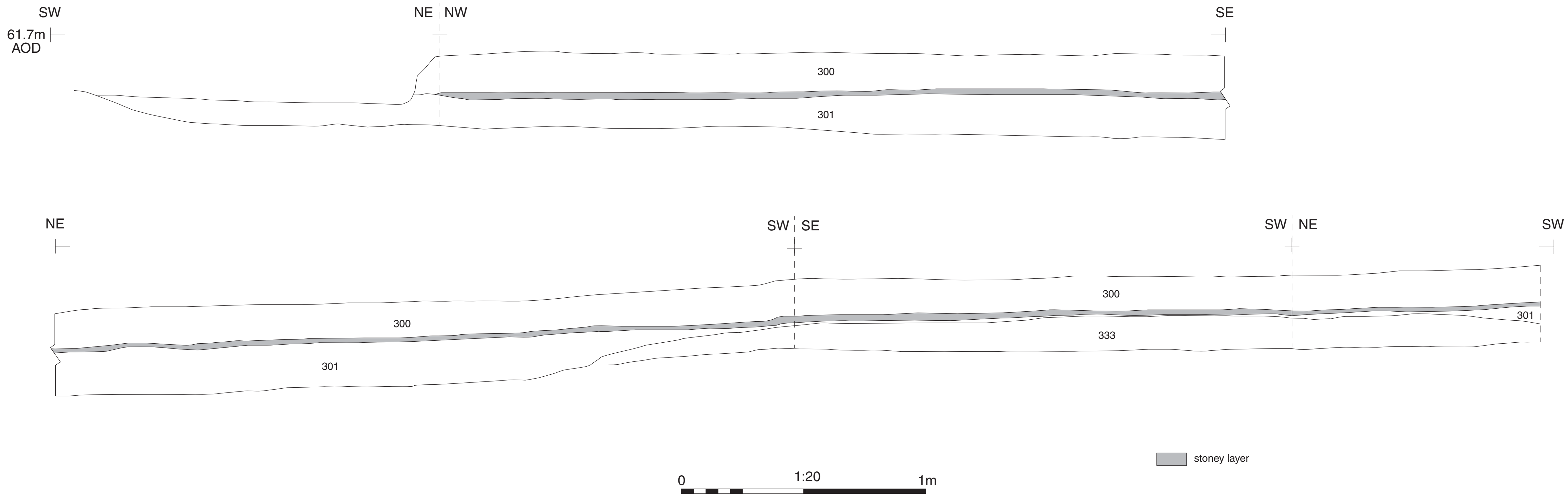
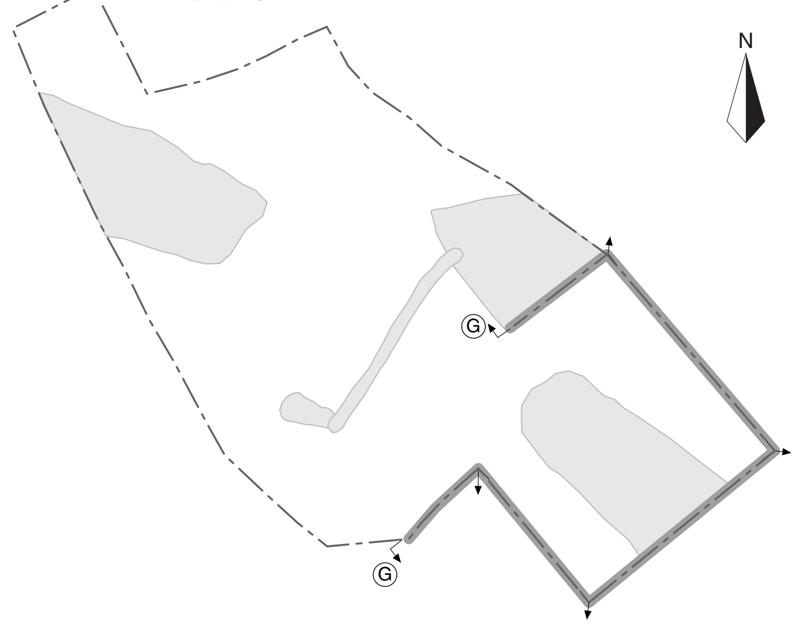
Section GG





(Trench 3 sketch plan, see Figure 5)

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FIGURE TITLE
Trench 3: section and plan

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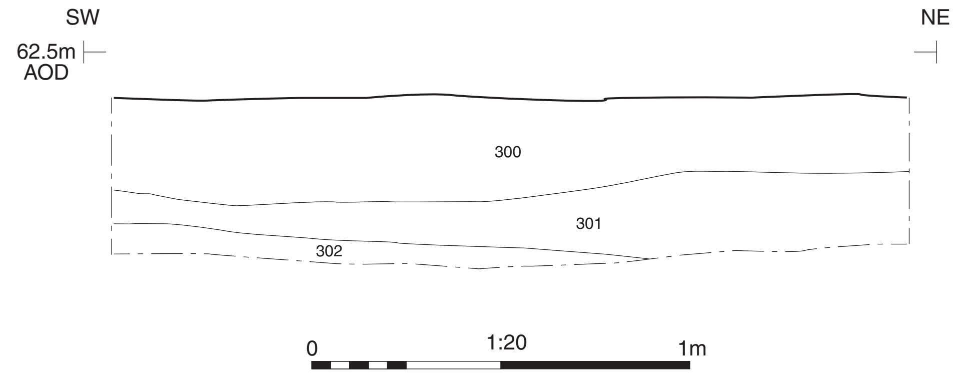

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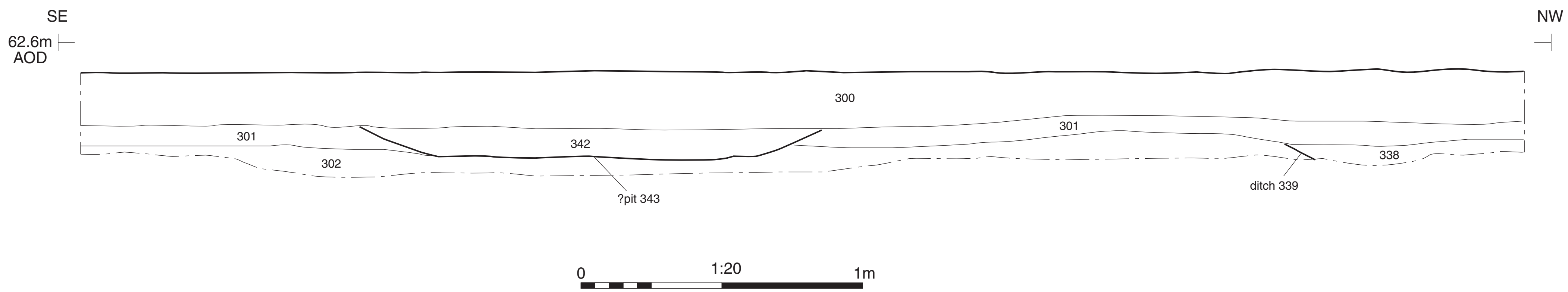

Trench 3, general view of the northern entrance and associated features, looking north-east (1m scales)

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FIGURE TITLE
Trench 3: sections and photograph

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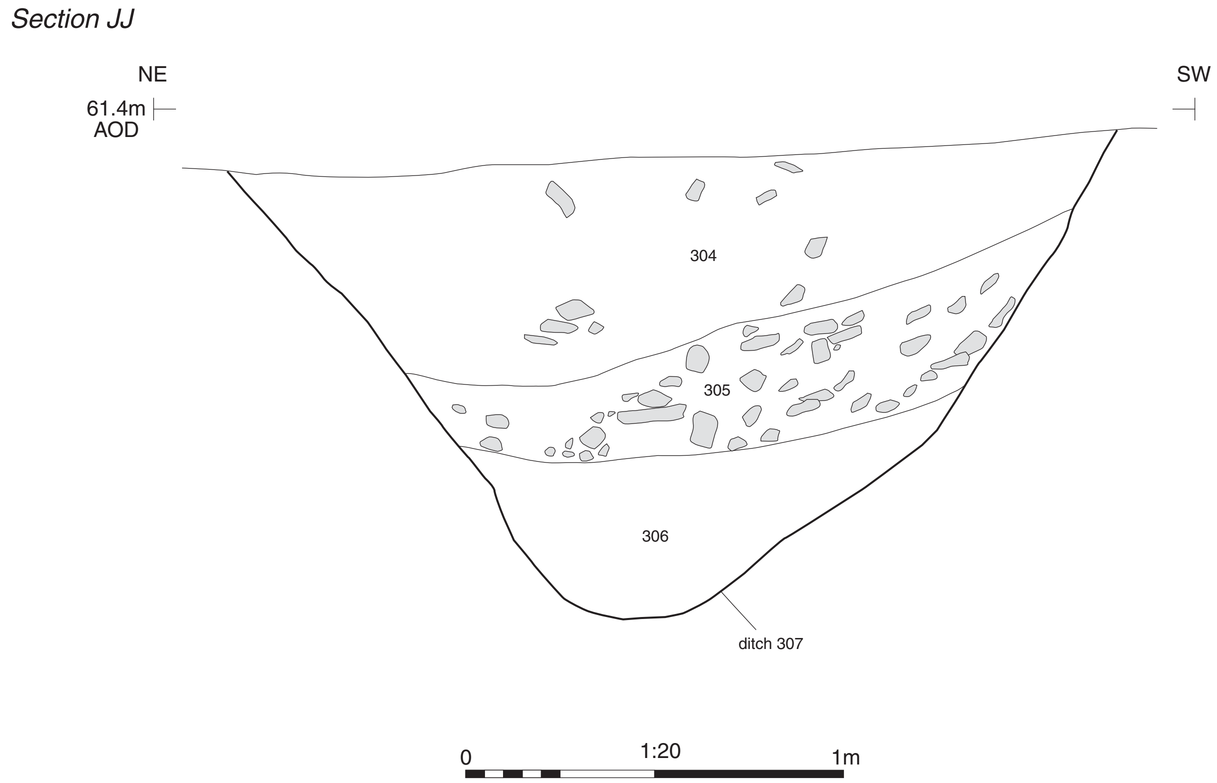
APPROVED BY	DE	SCALE@A3	1:20	



Trench 3, ditch terminus 307 fully excavated, looking south-east (1m scale)

Trench 3, ditch terminus 307 partly excavated, showing stone deposit 305, looking east (1m scale)

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FIGURE TITLE
Trench 3: section and photographs

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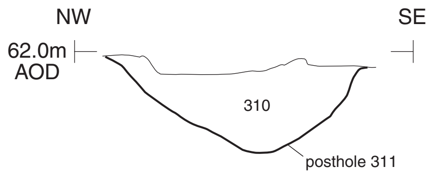
Section KK



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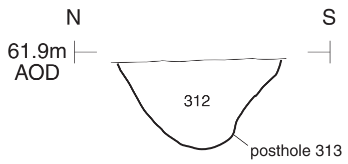

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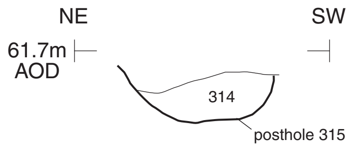

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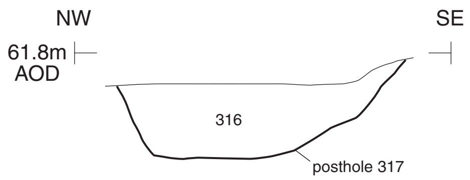

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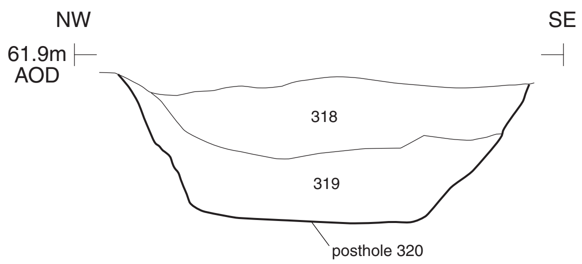

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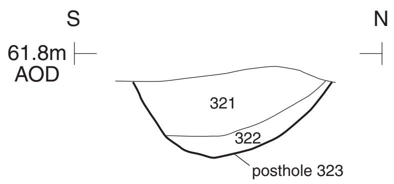

Trench 3: posthole 320 and 323, looking north (0.5m scale)

Trench 3: postholes 315 and 317, looking north (0.5m scale)

Trench 3: posthole 313 in foreground, with 309, 311 and 336 to the right and 315, 317, 320, 323, ditch 326 and ditch terminus 307 behind, looking north-east (0.5m scale)

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FIGURE TITLE
Trench 3: sections and photographs

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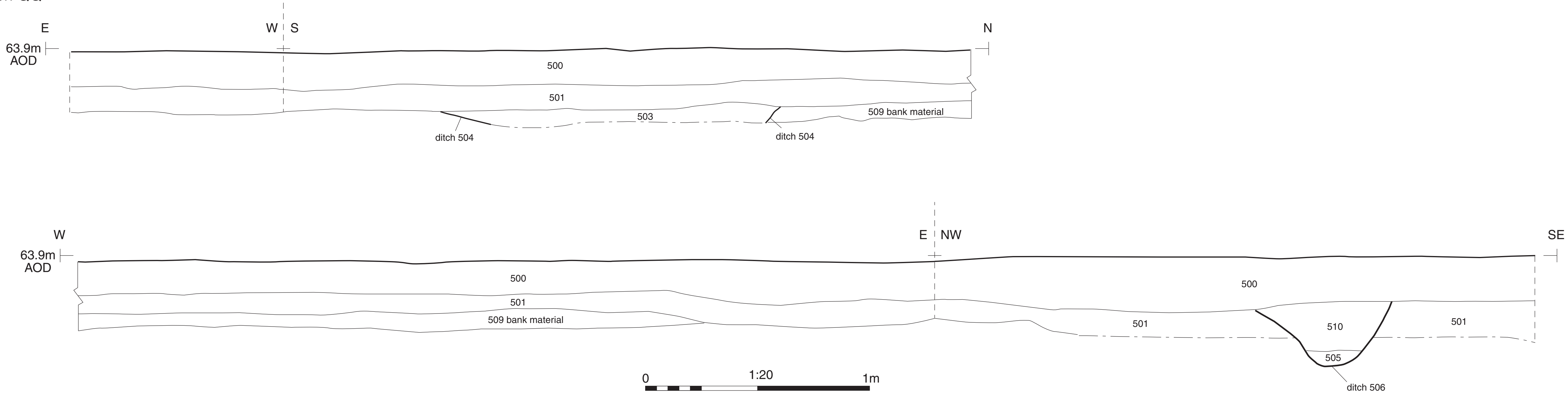
CHECKED BY	DJB	DATE	29/08/2017	13
APPROVED BY	DE	SCALE@A3	1:20	

Section QQ



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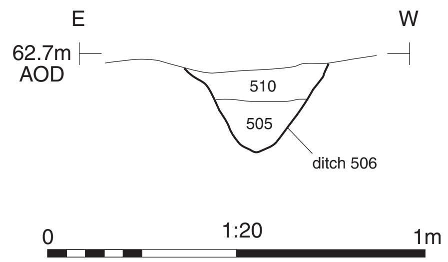

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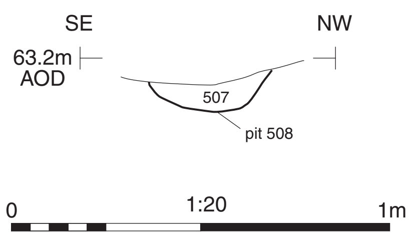

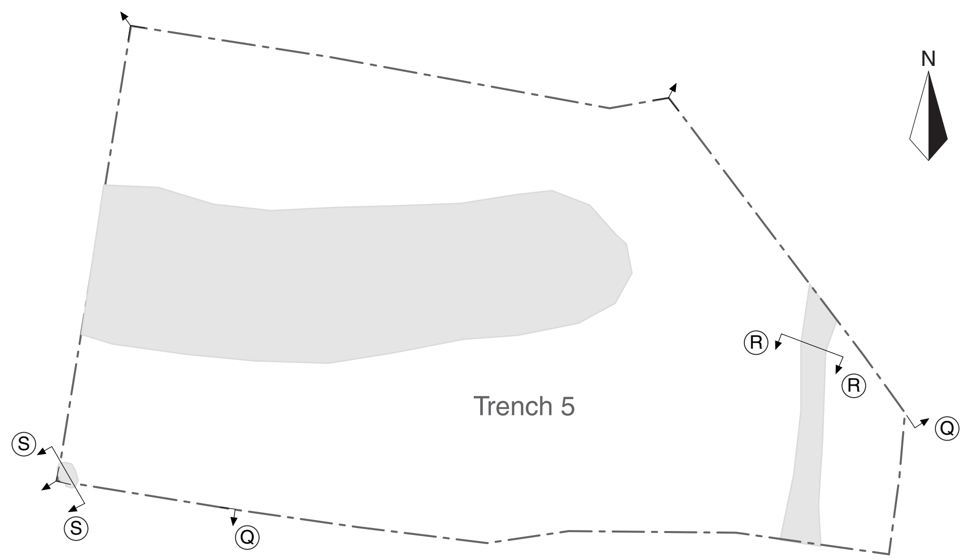

(Trench 5 sketch plan, see Figure 4)

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FIGURE TITLE
Trench 5: sections and plan

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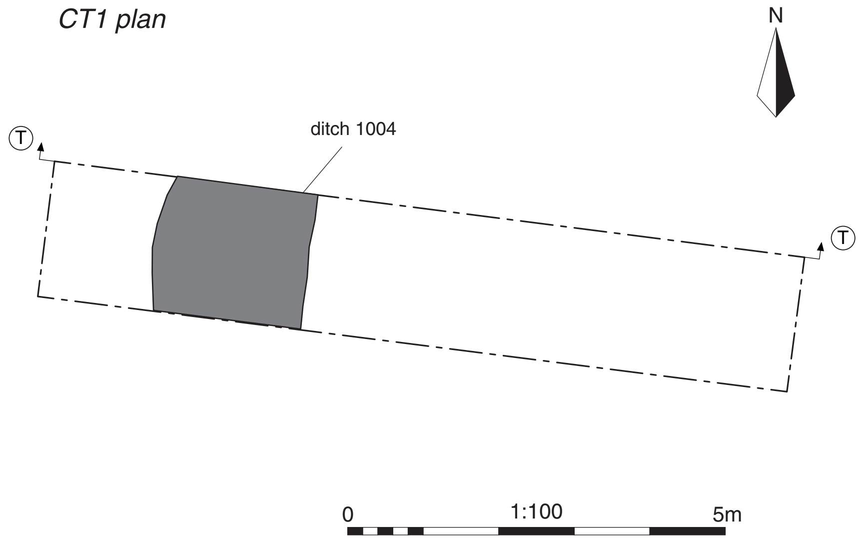
CT1 plan



Contingency trench

Archaeological feature

Trench CT1, showing ditch 1004 clearly visible as a dark feature aligned north/south, looking north-west (1m scale)

Section TT

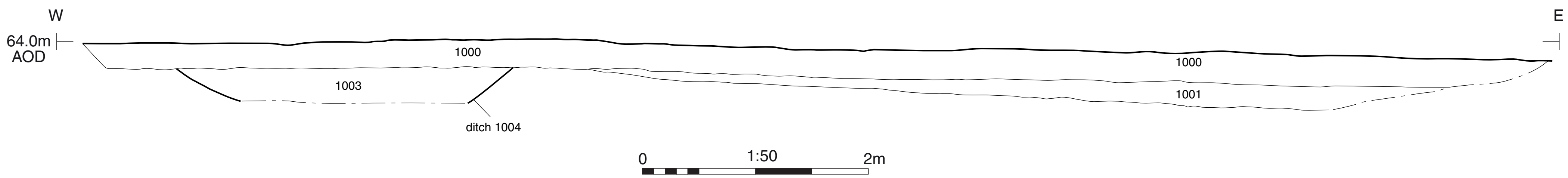


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FIGURE TITLE
Contingency Trench 1: plan, section and photograph

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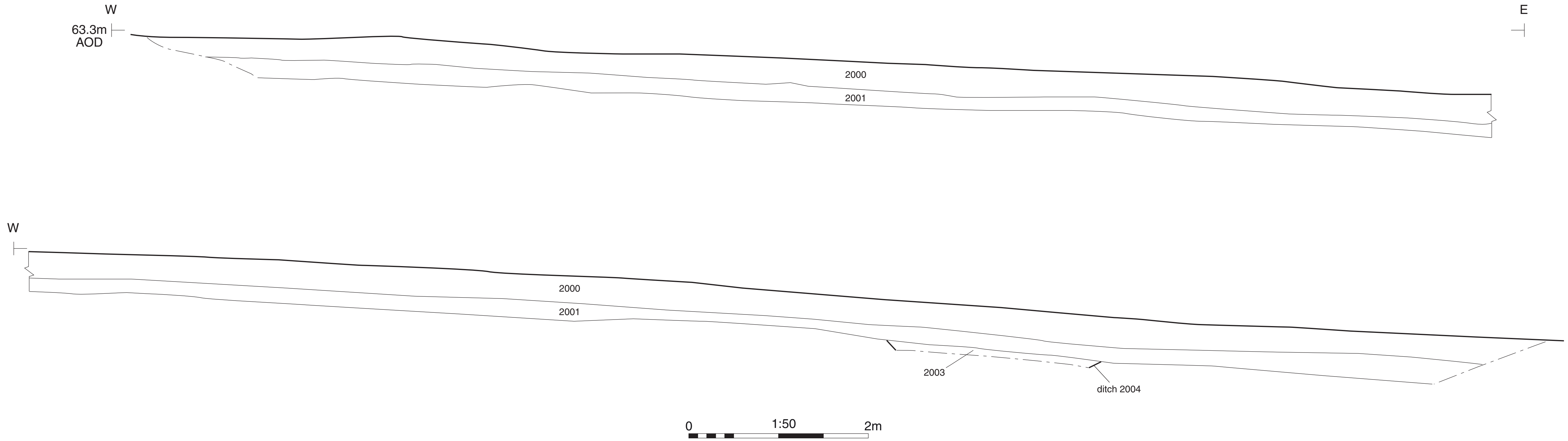
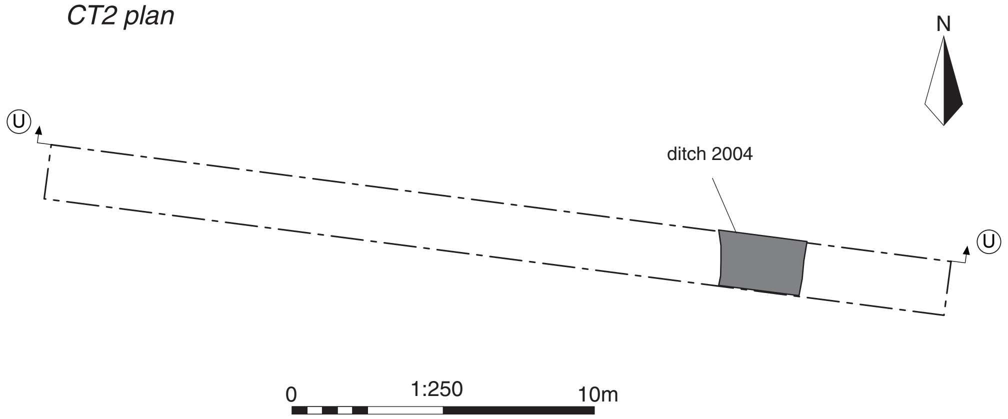
Section UU



CT2 plan



Contingency trench

Archaeological feature

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FIGURE TITLE
Contingency Trench 2: plan and section

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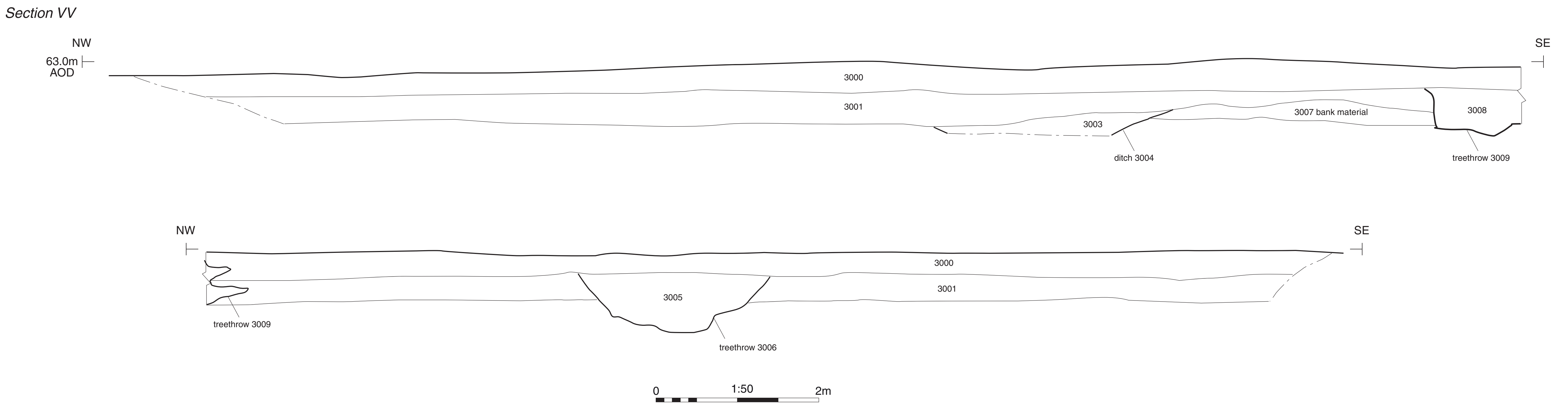

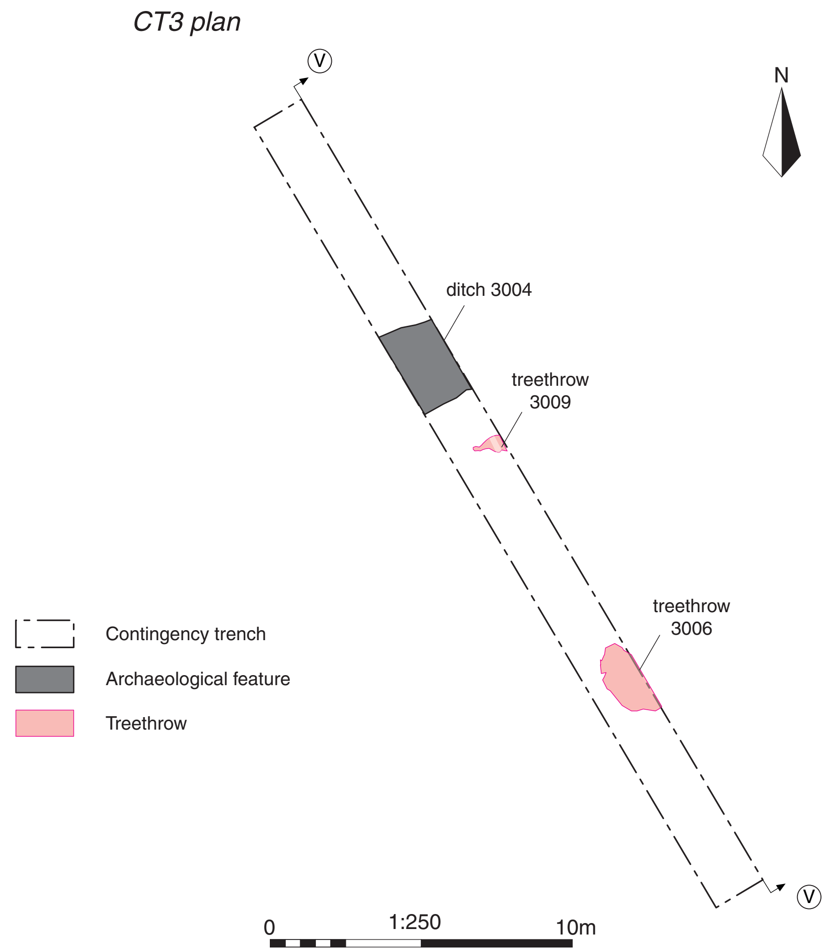

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FIGURE TITLE
Contingency Trench 3: plan and section

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APPENDIX A: CONTEXT DESCRIPTIONS

Trench	Context	Type	Fill of	Interpretation	Context Description	Length (m)	Width (m)	Depth/ thickness (m)
CT1	1000	Layer		Topsoil	Mid brown sandy clay, occasional small stones			0.25
CT1	1001	Layer		Subsoil	Mid red-brown sand clay. Frequent stone.			0.2
CT1	1002	Layer		Natural	Firm yellow- brown silty clay with occasional stones			
CT1	1003	Fill	1004	Upper fill	Mid red-brown silty clay with occasional small subangular stones. Not excavated			
CT1	1004	Cut		Ditch	Curvilinear, enclosure. Not excavated		2.2	
CT2	2000	Layer		Topsoil	Mid Brown, sandy clay occasional small stones			0.3
CT2	2001	Layer		Subsoil	Mid red-brown sand clay. Frequent stone			0.2
CT2	2002	Layer		Natural	Firm yellow-brown silty clay with occasional stones			
CT2	2003	Fill	2004	Upper fill	Mid red-brown silty clay with occasional small subangular stones. Not excavated			
CT2	2004	Cut		Ditch	Curvilinear, enclosure. Not excavated		2.2	
CT3	3000	Layer		Topsoil	Mid brown, sandy clay occasional small stones			0.3
CT3	3001	Layer		Subsoil	Mid red-brown sand clay. Frequent stone			0.3
CT3`	3002	Layer		Natural	Firm yellow-brown silty clay with occasional stones			
CT3	3003	Fill	3004	Upper fill	Mid red-brown silty clay with occasional small subangular stones. Not excavated			
CT3	3004	Cut		Ditch	Curvilinear, enclosure. Not excavated		1.95	
CT3	3005	Fill	3006	Primary fill	Mid orange-brown silty clay with rare stone and occasional charcoal	2.3	>1	0.7?
CT3	3006	Cut		Treethrow?	Irregular oval, gentle to moderate slope with undulating base, root disturbance	2.3	>1	0.7?
CT3	3007	Deposit		Bank	Light reddish brown silty clay. Compact. Occasional small to medium sub-angular stone. Inside edge of [3004]	4	18	0.3
CT3	3008	Fill	3009	Primary fill	Mid orange-brown silty clay with rare stone and occasional charcoal	1	>0.8	0.12
CT3	3009	Cut		Treethrow?	Irregular oval, gentle to moderate slope with irregular rounded base, root disturbance	1	>0.8	0.12
1	100	Layer		Topsoil	Mid brown, sandy clay occasional small stones			0.3
1	101	Layer		Subsoil	Mid red-brown sandy clay. Frequent stone			0.3
1	102	Layer		Natural	Firm yellow-brown silty clay with occasional stones			
1	103	Fill	107	Seventh fill	Mid brown, loose silty clay with occasional subangular stone and rare charcoal	>2	1.41 exposed	0.44

Trench	Context	Type	Fill of	Interpretation	Context Description	Length (m)	Width (m)	Depth/ thickness (m)
1	104	Fill	107	Sixth fill	Mid brown, very firm silty clay. Abundant subangular and subrounded stone, some very large. rare charcoal	>1.8	0.85	1
1	105	Fill	107	Fourth fill	Yellow-brown, firm silty clay. Occasional/frequent subangular stones, some large	>0.75	>1.5m	0.22
1	106	Fill	107	Primary fill	Light grey-blue film silty clay. Occasional subangular stones, rare charcoal and manganese	<0.5	0.63	0.27
1	107	Cut		Ditch	Curvilinear, terminus end enclosure. Steep near vertical sloping sides. Flat bottom.	>2	2.77	1.72
1	108	Fill	107	Fifth fill	Mid brown-grey and yellow mottled clay. Firm. Occasional subangular and subrounded stone, rare charcoal	>2	0.45	0.46
1	109	Deposit		Bank? For 107	Mid reddish brown silty clay. Firm. Occasional stones	>4.2	>2.3	0.18
1	110	Deposit		Sealed soil? Below 109	Mid brownish grey, silty clay. Rare stone inclusions	>3.4	>2.2	0.11
1	111	Fill	107	Third fill	Mid grey-brown firm/very firm silty clay. Abundant subangular and subrounded stone, some very large. Occasional charcoal	>0.75	0.92	0.2
1	112	Fill	107	Second fill	Mid grey with brown mottling. Firm silty clay. Occasional subangular stones and rare charcoal	>0.5	0.68	0.1
1	113	Fill	114	Upper fill	Mixed dark brown grey silty clay with abundant charcoal and occasional/rare stones	>0.9	0.34	>0.42
1	114	Cut		Ditch terminus	Linear, rounded end. Steep sides, near vertical sides. Not excavated	>0.9	0.34	>0.42
1	115	Fill	116	Primary fill	Mid grey-brown firm silty clay. Rare charcoal and subrounded stones.	>0.56	1.2	0.44
1	116	Cut		Pit	Oval. Steep sloping sides, pointed bottom.	>056	1.2	0.44
2	200	Layer		Topsoil	Mid brown, sandy clay occasional small stones			0.3
2	201	Layer		Subsoil	Mid red-brown sand clay. Frequent stone.			0.3
2	202	Layer		Natural	Firm yellow-brown silty clay with occasional stones			
2	203	Fill	208	Fifth fill	Mid brown, friable sandy clay. Occasional subangular stones		3.1	0.55
2	204	Fill	208	Fourth fill	Light grey, loose silty clay. Very rare stones		1.15	0.8
2	205	Fill	208	Third fill	Mid brown silty clay. Abundant subangular and subrounded stones, some very large		1.6	0.7
2	206	Fill	208	Second fill	Light grey brown soft silty clay. Very occasional small subangular stones.		1.77	1.24
2	207	Deposit		Bank? For 208	Yellow-brown, firm silty clay. Rare stones. Redeposited.		1.3	0.2
2	208	Cut		Ditch	Linear enclosure. Steep sloping sides, becoming more vertical. Flat bottom.	>6	3.1	1.6

Trench	Context	Type	Fill of	Interpretation	Context Description	Length (m)	Width (m)	Depth/ thickness (m)
2	209	Fill	208	Primary fill	Light blue-grey soft clay. Rare subangular stones, rare charcoal.		0.7	0.24
3	300	Layer		Topsoil	Mid brown, sandy clay occasional small stones			
3	301	Layer		Subsoil	Mid red-brown sandy clay. Frequent stone.			0.3
3	302	Layer		Natural	Firm yellow-brown silty clay with occasional stones			0.3
3	303	Void	Void	Void	Void	Void	Void	Void
3	304	Fill	307	Third fill	Mid grey-brown, friable sandy clayey silt. Occasional stone.	>5	2.4	0.5
3	305	Fill	307	Second fill	Mid brown clayey silt. Compact. Frequent unsorted stones.	>2	1.7	0.35
3	306	Fill	307	Primary fill	Mid brown-grey. Firm silty clay. Occasional stone	>1.5	1.4	0.4
3	307	Cut		Ditch terminus	Linear, enclosure. Steep sloping sides, rounded bottom.	>5	2.4	1.2
3	308	Fill	309	Primary fill	Light brownish-yellow, firm silty clay. Abundant small subangular stones/	1.3	0.76	0.07
3	309	Cut		Natural depression?	Circular, gentle sloping sides, concave base.	1.3	0.76	0.07
3	310	Fill	311	Primary fill	Dark grey brown, friable silty clay. Occasional sub-rounded stones	0.68	0.39	0.25
3	311	Cut		Posthole	Sub-oval, rounded corners. Steep concave sides, V-shaped base.	0.68	0.39	0.25
3	312	Fill	313	Primary fill	Mid brown, firm silty clay. Occasional medium sized subangular stones.	0.44	0.38	0.24
3	313	Cut		Posthole	Circular. Steep sided, concave base.	0.44	0.38	0.24
3	314	Fill	315	Primary fill	Mid/dark brown, friable silty clay. Occasional medium sized subangular stones. Occasional charcoal.	0.41	0.41	0.15
3	315	Cut		Posthole	Circular. Concave sides. Flat bottom	0.41	0.41	0.15
3	316	Fill	317	Primary fill	Mid yellowish brown, friable silty clay. Abundant large and medium stones.	0.76	0.7	0.27
3	317	Cut		Posthole/pit	Subcircular, subrounded corners. Steep sloping sides, flat bottom	0.76	0.7	0.27
3	318	Fill	320	Second fill	Dark grey-brown, friable silty clay. Occasional medium subangular stones.	1.09	0.56	0.2
3	319	Fill	320	Primary fill	Dark grey-yellow, firm silty clay. Occasional subangular stones.	1.09	0.56	0.2
3	320	Cut		Pit	Oval, subrounded corners. Steep sloping sides, flat bottom.	1.09	0.56	0.4
3	321	Fill	323	Second fill	Dark yellowish brown, friable silty clay. Frequent charcoal, occasional small and medium subangular stone.	0.54	0.45	0.18
3	322	Fill	323	Primary fill	Mid Greyish yellow, firm silty clay. Occasional small subangular stones.	0.43		0.06
3	323	Cut		Posthole	Circular, gentle sloping sides, concave base.	0.54	0.45	0.23

Trench	Context	Type	Fill of	Interpretation	Context Description	Length (m)	Width (m)	Depth/ thickness (m)
3	324	Layer		Remnant subsoil. Same as 301	Mid grey-brown, friable silty clay. Occasional small subangular stones.	2.8	2.8	0.3
3	325	Fill	326	Primary fill	Dark brown, friable silty clay. Occasional gravels and charcoal.	5.2	0.24	0.05
3	326	Cut		Ditch	Linear, gentle concave sides. Concave base.	5.2	0.24	0.05
3	327	Fill	328	Primary fill. Same as 325	Dark brown, friable silty clay. Occasional gravels and charcoal.	5.2	0.32	0.08
3	328	Cut		Ditch. Same as 326	Linear, gentle concave sides. Concave base.	5.2	0.32	0.8
3	329	Fill	330	Primary fill. Same as 325	Dark brown, friable silty clay. Occasional gravels and charcoal.	5.2	0.29	0.04
3	330	Cut		Ditch. Same as 326	Linear, gentle concave sides. Concave base.	5.2	0.29	0.04
3	331	Fill	332	Primary fill. Same as 325	Dark brown, friable silty clay. Occasional gravels and charcoal.	5.2	0.25	0.02
3	332	Cut		Ditch. Southern terminus	Linear, gentle concave sides. Concave base.	5.2	0.25	0.02
3	333	Deposit		Bank? For 307	Dark red-brown, friable sandy clayey silt. Occasional small stones.	>4.2	>3.2	0.2
3	334	Fill	336	Second fill	Dark reddish brown, friable silty clay. Occasional medium stones, frequent charcoal.	1.56	0.66	0.12
3	335	Fill	336	Primary fill	Light brownish yellow, firm silty clay. Occasional subangular stones and charcoal.	1.56	0.33	0.14
3	336	Cut		Pit/posthole	Oval, subrounded corners. Steep irregular sloping sides. Flat with dip to the east.	1.56	0.66	0.25
3	337	Deposit	339	Upper fill. Same as 338	Mid brown grey, firm clayey silt. Abundant stone inclusions. Not fully excavated	3.5	2.2	>0.25
3	338	Deposit	339	Upper fill. Same as 337	Abundant stones within a mid brown-grey, firm clayey silt.	2.2	1.9	<0.25
3	339	Cut		Ditch terminus	Linear, rounded end. Enclosure. Not excavated	>5	2.2	
3	340	Fill	341	Primary fill	Mid grey, firm silty clay. Rare subrounded stones, some large	0.4	0.32	0.1
3	341	Cut		Posthole	Oval, steep concave sides. Rounded bottom	0.4	0.32	0.1
3	342	Deposit	343	Stoney deposit. Natural depression?	Mid/dark brown-grey, firm silty clay. Frequent subangular and subrounded stones, some large.		3.2	0.2
3	343	Cut		Natural depression? Linear?	Possible cut, filled by stone deposit. Very shallow, concave slope with flat irregular base.		3.2	0.2
4	400	Layer		Topsoil	Mid brown sandy clay occasional small stones			
4	401	Layer		Subsoil	Mid red-brown sandy clay. Frequent stone.			
4	402	Layer		Natural	Firm yellow-brown silty clay with occasional stones			

Trench	Context	Type	Fill of	Interpretation	Context Description	Length (m)	Width (m)	Depth/ thickness (m)
4	403	Fill	406	Third fill	Light brownish grey, very firm clay. Occasional large stones and gravels. Rare charcoal. Not fully excavated	>2	>1.52	0.5
4	404	Fill	406	First fill	Mid brownish yellow, quite mixed. Firm clay. Occasional subangular stones and rare charcoal. Not fully excavated	>2	0.26	>0.23
4	405	Fill	406	Second fill	Mid brownish grey, firm silty clay. Frequent medium subangular stones, rare charcoal. Not fully excavated	>2	>0.7	
4	406	Cut		Ditch	Curvilinear enclosure. Steep concave slope. Not fully excavated.	>2	>1.61	
5	500	Layer		Topsoil	Mid Brown, sandy clay occasional small stones			0.16
5	501	Layer		Subsoil	Varied, some places mid red-brown sandy clay, others more yellow brown and siltier. Frequent subangular and subrounded stones. Rare charcoal.			0.12
5	502	Layer		Natural	Firm yellow- brown silty clay with occasional stones			
5	503	Fill	504	Upper fill	Mid yellowish brown silty clay, with most rare large subangular stones, increasing at the terminus. Not excavated		3	
5	504	Cut		Ditch terminus	Curvilinear, enclosure terminus. Not excavated		3	
5	505	Fill	506	Primary fill	Mid brown-grey, firm silty clay. Occasional subangular stones.	>0.7	0.46	0.14
5	506	Cut		Ditch. Same as 114	Linear, steep sloping, V-shaped varied base, pointed and flatter in places.	>0.7	1.2	0.58
5	507	Fill	508	Primary fill	Mottled, brown grey, firm silty clay with rare subrounded stones.	0.32	0.32	0.08
5	508	Cut		Pit	Subcircular, gentle slope with a flat bottom.	0.32	0.32	0.08
5	509	Deposit		Bank? For 504	Mid/dark yellowish brown, firm silty clay with rare subangular stones.	<5.6	>1.8	0.16
5	510	Fill	506	Second fill. Same as 113	Mixed dark brown grey silty clay with abundant charcoal and occasional/rare stones	>0.7	1.2	0.44

APPENDIX B: THE PALAEOENVIRONMENTAL EVIDENCE

Feature	Context	Sample	Vol (L)	Flot size (ml)	Roots %	Grain	Chaff	Cereal Notes	Charred Other	Notes for Table	Charcoal > 4/2mm	Other
Pit												
320	318	10	7	10	50	*	-	Indet. grain frag	*	Stem frag	-/*	-
Pit/Postholes												
317	316	11	6	5	60	-	-	-	*	*Avena*	*/*	-
336	335	17	5	3	50	-	-	-	-	-	*/*	-
Postholes												
311	310	8	7	10	50	-	-	-	-	-	*/*	-
323	321	14	2	5	40	-	-	-	-	-	*/**	-
Ditch												
328	327	13	3	5	50	-	-	-	-	-	-/*	-
Circular Ditch												
208	209	42	24	5	30	-	-	-	-	-	*/*	-
307	306	7	55	20	10	*	-	Indet. grain frags	*	Tuber frag	**/**	-
107	106	4	41	50	20	**	-	Barley + hulled wheat + indet. grain frags	-	-	*/*	-
	108	3	30	5	50	*	-	Hulled wheat grain + indet. frag	-	-	*/*	-
	104	2	35	25	15	**	-	Barley + indet. grain frags	*	*Brassica*	*/**	-
	103	1	39	80	25	**	-	Barley + wheat + indet. grain frags	-	-	**/***	-
107	106	91	889g	1		-	-	-	-	-	-/*	-
	106	92	569g	1		-	-	-	-	-	-/*	-
	106	93	904g	1		-	-	-	-	-	-	-
	112	94	865g	2		-	-	-	-	-	-/*	-
	111	95	960g	2		-	-	-	-	-	*/*	-
	104	96	983g	1		*	-	Indet. grain frag	*	Stem frag	-/*	-
	104	97	1487g	5		*	-	Indet. grain frag	-	-	*/*	-
	104	98	1210g	2		-	-	-	-	-	*/*	-
	104	99	1256g	3		*	-	Barley + ?wheat grains	-	-	*/*	-
	103	100	1221g	2		*	-	Indet. grain frag	-	-	*/*	-
	103	101	1057g	5		*	-	Indet. grain frag	*	*Corylus avellana* shell frag	-/*	-
	103	102	1380g	5		*	-	Hulled wheat grain	-	-	*/*	-

Key: * = 1–4 items; ** = 5–19 items; *** = 20–49 items; **** = 50–99 items; ***** = >100 items

APPENDIX C: GEOARCHAEOLOGICAL AND POLLEN ASESSMENT REPORT

Follows

Sherford New Town, Yealmpton, Devon
Site Code: SHER 17
Project No. 880198
Geoarchaeological and Pollen Assessment

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September 2017

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Sherford New Town, Yealmpton, Devon
Site Code: SHER 17
Project No. 880198
Geoarchaeological and Pollen Assessment

September 2017

Executive Summary

Geoarchaeological recording of monolith and spot samples from three trenches was undertaken from a ring ditch encountered during the Sherford New Town development, Yealmpton, Devon. Two of the trenches from the ditch terminus' demonstrated evidence of stocastic sedimentation, often consisting of the incorporation of stone-rich deposits that had probably slumped into the ditch and caused disturbance / erosion of earlier stablisation surfaces within the ditch. A third trench located away from the ditch terminus contained a preserved stabilisation surface with evidence of preserved in situ rooting, with the underlying sediments demonstrating a more gradual rate of sedimentation.

Pollen assessment was undertaken on four samples from Trench 1. Pollen concentrations were extremely low but sufficient pollen was extracted to enable a pollen assessment. This demonstrated the presence of an open grassy environment with evidence for local arable activity. This pollen contained within the ring ditch is consistent with the Early to Middle Bronze Age date for the ring ditch fills derived from OSL dating.

Recommendations are made for an additional pollen assessment of the monolith sequence from trench 2, as well as full pollen analysis on three of the samples assessed in this study.

Sherford New Town, Yealmpton, Devon
Site Code: SHER 17
Project No. 880198
Geoarchaeological and Pollen Assessment

September 2017

Acknowledgements

The pollen assessment and geoarchaeological recording was undertaken by Dr Michael Grant (COARS), who also compiled the report. Pollen extraction was undertaken using the facilities at PLUS, University of Southampton. The pollen assessment was commissioned by Sarah Wyles on behalf of Cotswold Archaeology.

Sherford New Town, Yealmpton, Devon
Site Code: SHER 17
Project No. 880198
Geoarchaeological and Pollen Assessment

September 2017

Contents

Sherford New Town, Yealmpton, Devon
Site Code: SHER 17
Project No. 880198
Geoarchaeological and Pollen Assessment

September 2017

Tables

Sherford New Town, Yealmpton, Devon
Site Code: SHER 17
Project No. 880198
Geoarchaeological and Pollen Assessment

1 Introduction

The Sherford New Town development, covering c. 490 ha, is located c. 6.5km east of Plymouth city centre, bounded by the A38 to the north, adjacent to the Deep Lane junction, and with the A379 located to the south. The Site occupies a shallow basin dissected by a number of minor valleys, creating a rolling topographic landform of ridges and troughs. The underlying geology is predominantly Devonian Slates. Upper Devonian Slate with grit interbeds are concentrated within the north of the Site, while Middle Devonian Slate, containing intrusive and extrusive Igneous tuffs and dolerite (diabase), are present within the central and southern portion of the site. Middle Devonian Limestone outcrop to the west of the Site. The superficial deposits at the site include Pleistocene river gravels and head deposits, located on the west and northwestern side of the site, and Holocene alluvium associated with watercourses originating from springs beneath the Site. In the west of the Site the southwest draining watercourse is associated with Billacombe Brook, while in the centre of the site the southward draining watercourse feeds into Cofflete Creek.

During an archaeological geophysical survey of the Site a ring ditch, measuring c. 56m in diameter, was identified centred on NGR 256480 053985. The form of the ring ditch was thought to be reminiscent of a henge monument and therefore subject to an evaluation excavation. The excavation was focused predominantly on the ditch terminus' adjacent to the northern and southern entrances revealed a ditch up to 1.7m deep. Monolith samples, along with bulk sediment samples, were taken from the trench sections associated with both of the terminus', along with the main ditch itself. The high content of large stones in some of the trench sections made monolith sampling difficult, and in trench 1 (Section CC) it was only possible to obtain a column of sediment samples. Dating of the ring ditch was provided by two OSL dates, indicating an Early to Middle Bronze Age date.

2 Assessment Aims

The geoarchaeological assessment has been undertaken with the following aims:

1. Record the sediments sampled within the ring ditch trenches; and
2. Identify samples that may be suitable for pollen assessment.

The pollen assessment has been undertaken with the following aims:

1. Ascertain whether pollen is preserved within the sample submitted for assessment; and
2. Provide an interpretation of the local environment based upon the pollen assemblage

3 Methodology

3.1 Geoarchaeological Recording

Sequences from three trenches cut into the ring ditch were selected for geoarchaeological recording:

- West facing Section CC, Ditch Terminus [107], Trench 1. Pollen samples <44> to <63>
- West facing Section FF, Ditch [208], Trench 2. Monolith <43>
- Northwest facing Section JJ, Ditch Terminus [307], Trench 3. Monoliths <18> and <29>

The high stone content in Section CC of Trench 1 meant that it was not possible to obtain a monolith sample. Instead a series of twenty sediment samples, each of 20mm vertical thickness, were taken from the ditch fill and assessed individually. The geoarchaeological assessment followed the guidelines given in Historic England (2015), with descriptions according to Hodgson (1997) including sediment type, depositional structure, texture and colour. Interpretations regarding mode of deposition, formation processes, likely environments represented and potential for palaeoenvironmental analysis were also noted. The results have been tabulated and are given below. A photographic record of the samples, including key stratigraphic features, has been made to supplement the sedimentary descriptions. Dating of Trench 1 and 3 have been undertaken using OSL (see Table 1).

Table 1: OSL dating from Trenches 1 and 3

Context and elevation	Lab Code	Total D_r (Gy ka^{-1})	D_e (Gy)	Age (ka)	Date
(104) 61.63m OD	GL16166	3.31 ± 0.22	11.5 ± 0.4	3.48 ± 0.26	1720– 1250 BC
(306) 60.20 m OD	GL16167	3.43 ± 0.24	12.9 ± 0.5	3.74 ± 0.30	2020– 1480 BC

3.2 Pollen Assessment

Standard preparation procedures were used (Moore *et al*. 1991). A total of four samples were selected for preparation (see Table 2). An initial pollen preparation was undertaken using 2cm^3 from each sample, but this failed to extract sufficient material for an assessment. Consequently, each sample was re-prepared using 5cm^3 of sediment. To each sample a *Lycopodium* spike added (two tablets from batch 3862) to allow the calculation of pollen concentrations (Stockmarr 1971). All samples received the following treatment: 20 mls of 10% KOH (80°C for 30 minutes); 20mls of 60% HF (80°C for 120 minutes); 15 mls of acetolysis mix (80°C for 3 minutes); stained in 0.2% aqueous solution of safranin and mounted in silicone oil following dehydration with tert-butyl alcohol. Due to the highly minerogenic nature of these samples additional sieving and decanting was undertaken between the KOH and HF stages.

Table 2: List of pollen samples assessed

Sample Number	Sample Number	Context Number
Pol_1	<52>	(105)
Pol_2	<57>	(111)
Pol_3	<59>	(112)
Pol_4	<61>	(106)

Pollen counting was undertaken at a magnification of x400 using a Nikon SE transmitted light microscope. Determinable pollen and spore types were identified to the lowest possible taxonomic level with the aid of a reference collection kept at COARS, University of Southampton. The pollen and spore types used are those defined by Bennett (1994; Bennett *et al*. 1994), with the exception of Poaceae which follow the classification given by Küster (1988), with *Cerealia*-type grains further classified using Andersen (1979) with plant nomenclature ordered according to Stace (2010). A total land pollen (TLP) sum of 100 grains was sought for the pollen assessment, but this was not achieved for the basal sample <61> due to the low pollen concentrations. The results from the four samples are provided in Table 7 and illustrated in Figure 1.

4 Results

4.1 Geoarchaeological Recording

A description of the monoliths and sediment samples taken from the ring ditch are porivided in Table 3, Table 4, Table 5 and Table 6. The sediment sequences are dominated by silty clays / clays with frequent inclusions of locally-derived Middle to Late Devonian stone, consisting of both the metamorphic slates and igneous dolerite and marble. The former are typically broken into small fragments <10mm showing evidence of rounding, though in some contexts these are clearly horizontally bedded (e.g. context (209)) suggesting a gradual infilling of the trench, though in most contexts there was no such structure with slate randomly orientated (e.g. context (306)) indicating more rapid infilling from processes such as slides or slumping. The larger dolerite stones showed some evidence of rolling (rounded edges) but had retained their sub-angular blocky shape and were typically horizontally bedded.

Organics were rare in most samples with the exception of fine roots and, in context (104), small charcoal fragments. Rooting was most prevalent in the top of context (206) from monolith <43> (Trench 2) where a buried soil appeared to be present, represented by a think bAh horizon. This suggests a period of stabilisation and vegetation colonisation of the base of the ring ditch prior to the deposition of the stone rich fill (205). By contrast, in (306) (monolith <18>, trench 2), roots were not always preserved but instead the root casts were retained within an eluviated slightly stoney slightly sandy clay.

4.1.1 Trench 3

The basal context (306) of Trench 3 shows evidence of post-depositional rooting without any stabilisation surfaces visible within the sequence. Stone content tends to be limited, restricted to small fragments of slate and dolerite, but there is no evidence of bedding structures. Rooting is notably throughout this context and there is clear evidence of some restructuring and nutrient exchange within this deposit. Stone content notably increases in the overlying context (305), suggesting more rapid and / or higher energy sediment accumulation through dumping or slumping. Stone orientation is random at both top and bottom of this context, but within the centre there is more structure. The absence of rooting structures suggests that the roots present within the underlying context (306) were present prior to the deposition of (305) and may indicate that a former land surface (base of the ditch) was eroded during the deposition of (306). OSL dating of context (306) provided an age of 2020– 1480 BC (GL16167).

4.1.2 Trench 2

The structure of the basal trench 2 sediments is very different to those observed in trench 3. Here there appears to be a retained buried land surface (base of the ditch) beneath the main deposition of larger stones within context (305). Vertical root structures are retained *in situ* at the top of (206), while deeper in (209) there are clearly defined bedding structures within the slate stones to indicate gradual sediment accumulation. The upper clays in (209) represent the oxidised zone above the water table, while the base of (209) contains clear evidence of mottling where water levels have fluctuated,

Table 3: Monolith <29>, Northwest facing Section JJ, Ditch Terminus [307], Trench 3

Description	Context
0.00 to 0.50m. 10YR 8/3 Brown silty clay, massive, no mottles. Very slightly stoney, small angular to sub-angular platy slate stone. No organics. Clear boundary to:	(304)
0.50 to 0.235m 10YR 5/4 Yellowish Brown silty clay, massive, no mottles. Slightly stoney, small angular to sub-angular platy slate stone, aligned at 45° with some bedding visible, plus very large (100x60x50mm) angular dolerite at 0.05-0.10m. Rare fine roots (<20mm length with no vertical orientation). Clear boundary to:	(305)
0.235 to 0.42m 10YR 6/4 Light Yellowish Brown silty clay, massive, no mottles. Slightly stoney, small angular to sub-angular platy slate stone, horizontally bedded, plus very large (30x30x30mm) angular dolerite at 0.25m. Small (<3mm) black flecks (c. 1%) visible below 0.28m. No organics present. Abrupt boundary to:	(305)
0.42 to 0.50m 10YR 6/4 Light Yellowish Brown silty clay, massive, no mottles. Very slightly stoney, small angular to sub-angular platy slate stone, with random orientation. No organics present.	(306)

Table 4: Monolith <18>, Northwest facing Section JJ, Ditch Terminus [307], Trench 3

Description	Context
0.00 to 0.09m 10YR 5/2 Greyish Brown silty clay, massive, no mottles. Moderately stoney small angular (2%), sub-angular to sub-rounded (20%) small angular platy slate stone. No organics. Abrupt boundary to:	(305)
0.09 to 0.22m. 10YR 5/4 Yellowish Brown silty clay, massive, no mottles. Very slightly stoney small sub-angular platy slate stone, with rare fine roots. Horizontal bands of stoneless 10YR 7/4 Very Pale Brown clay at 0.13-0.14m and 0.21-0.22m, with occasional horizontal fine roots. Sharp boundary to:	(306)
0.22 to 0.31m 10YR 5/3 Brown clay, massive, no mottles. Very slightly stoney, small angular platy slate stone, with medium-sized angular platy slate and blocky dolerite (up to 40mm diameter), with random orientation. No organics. Clear boundary to:	(306)
0.31 to 0.50m 10YR 5/4 Yellowish Brown clay, massive. Very slightly stoney, small angular platy slate stone, becoming slightly stoney towards the base, including medium-sized angular platy slate and blocky dolerite (up to 40mm diameter) and small (10mm diameter) rounded marble stone. Rare (1%) small black flecks (not charcoal). Coarse mottling (40%) relating to a pocket of 10YR 7/4 Very Pale Brown slightly stoney slightly sandy clay between 0.385-0.43m, containing fine (<1mm) perforations indicating former root channels. No organic material (including roots) present. Slightly stoney small angular to sub-angular platy slate stone present within clay, with highest concentrations around the edges of the clay deposit.	(306)

Table 5: Monolith <43>, West facing Section FF, Ditch [208], Trench 2

Description	Context
0.00 to 0.12m No sample recovery	
0.12 to 0.14m. 10YR 6/2 Light Brownish Grey slightly sandy silty clay, blocky structure, with 10YR 7/6 yellow medium mottles (10%). Fine vertical roots (>40mm length). Stoneless. Clear boundary to:	(206) bAh horizon
0.14 to 0.28m 10YR 7/2 Light Grey slightly sandy silty clay, massive, no mottles. Very stoney, comprising mainly very large angular blocky dolerite (up to 150mm) aligned at 45° (note angle of monolith sampling) with moderately stoney small rounded to sub-rounded platy slate stones within clay matrix around larger angular stones. Roots do not penetrate below large stones. Clear boundary to:	(206)
0.28 to 0.39m 5Y 7/1 Light Grey silty clay, massive, medium (2%) 10YR 7/6 yellow mottles. Very slightly stoney, small rounded and angular stones, coupled with both horizontal and angular bedded small platy slate stones. Angular blocky dolerite stone present at 0.36-0.38m. No organics. Abrupt boundary to:	(209)
0.39 to 0.50m 10YR 6/2 Light Brownish Grey silty clay, massive, with medium (50%) 10YR 5/6 yellowish brown mottles. Slightly stoney, small sub-angular to sub-rounded platy slate stone with increase in stone associated with mottles making some mottles crumbly in texture. Rare small angular dolerite stone, with small rounded marble stone also present. No organics.	(209)

Table 6: Sediment descriptions for pollen samples <44> to <63> from West facing Section CC, Ditch Terminus [107], Trench 1. * denotes sample assessed for pollen content

Sample	Context	Description
<44>, <45> and <46>	(103)	10YR 5/3 Brown clay, no mottles, very slightly stoney, small angular to sub-angular platy slate stone. Rare fine roots (<20mm length) visible in sample <46>
<47>	(104)	10YR 4/4 Dark Yellowish Brown silty clay, no mottles, very slightly stoney, small angular platy slate stone. Small (<3mm) black flecks of charcoal, coupled with rare small 2.5YR 6/6 light red oxidised sandy clay inclusions
<48> and <49>	(104)	10YR 4/4 Dark Yellowish Brown silty clay, no mottles, very slightly stoney, small angular platy slate stone. No organics
<50> and <51>	(105)	10YR 4/4 Dark Yellowish Brown silty clay, no mottles, very slightly stoney, small angular platy slate stone. No organics
<52>*	(105)	10YR 5/6 Yellowish Brown clay. No mottles, very slightly stoney, small angular platy slate stone. Rare (1%) fine roots
<53> and <54>	(108)	10YR 5/4 Yellowish Brown silty clay. No mottles, stoneless, no organics.
<55>, <56> and <57>*	(111)	10YR 5/4 Yellowish Brown silty clay, no mottles. Very slightly stoney (slightly stoney in <57>), small sub-angular platy slate stone. No organics
<58> and <59>*	(112)	10YR 5/3 Brown clay, no mottles, stoneless. Rare (2%) small black flecks and small organic (<2mm) fragments.
<60>, <61>*, <62> and <63>	(106)	10YR 6/4 Light Yellowish Brown clay with medium (15%) 10YR 5/6 Yellowish Brown mottles. Very slightly stoney (increasing to moderately stoney in <63>), small angular to sub-angular platy slate stone. Rare (1%) small organic (<2mm) fragments, increasing to 3% in sample <62>

4.1.3 Trench 1

Only spot samples were taken from trench 1 due to the high stoney content of the sequence inhibiting monolith sampling. While only limited information can be obtained about the structure of the deposits, the sediment colours, grain size and inclusions show a stronger similarity to the sequence from Trench 3 than Trench 2. Organic remains were rare and where present were either roots or material too small for identification. Within context (104) small charcoal fragments were present. OSL dating of context (104) has provided an age of 1720– 1250 BC (GL16166).

4.1.4 Summary

The sampled sequences from Trenches 1, 2 and 3 show notable differences in their sedimentation record. Both Trenches 1 and 3 appear to have undergone stochastic sedimentation events with the inclusion of slumped material and, notably with Trench 1, inclusion of large locally-derived stone. OSL dating from these two trenches indicate an Early to Middle Bronze Age for the sediment fills, with the earliest date associated with the basal primary fill, whereas the later date is from sediment above the main stone layer. The sediments, supported by the OSL dating, therefore suggests the potential that periods of stabilisation and land surface development occurred prior to subsequent burial by the stone-rich contexts. Both trenches 1 and 3 are located at the ring-ditch terminus and therefore situated within areas of likely highest disturbance. By contrast the sequence from trench 2 shows more gradual initial sedimentation and the preservation of a buried land surface that can be attributed to stabilisation and vegetation colonisation of the base of the ditch prior to the incorporation of the stone-rich context (205).

4.2 Pollen Assessment

The pollen identified and their respective counts are shown in Table 7 and illustrated in Figure 1. Pollen concentrations were very low in all four samples with only sample, from context (2067), exceeding 670 grains cm^{-3}. The lowest pollen concentrations were found in the basal sample <62> from context (106) where a pollen count of only 28 grains was achieved, with pollen concentration of 220 grains cm^{-3}. Even though pollen concentrations were very low, pollen preservation was good in most samples and there were no apparent biases in the pollen assemblage because of differential preservation.

The pollen were dominated by Poaceae (grasses), accounting for 81-83% of the pollen assemblage, indicating an open grassland environmental around the site. Cereal pollen was also present in the samples, most prevalent in the uppermost contexts where it accounts for 6% of the pollen assemblage. The grains were all well preserved, each having a mean pollen size >40µm (typically 42-45µm), mean annulus diameter >10µm (typically 11-13µm), a protruding annulus whose diameter was greater than double the pore diameter with sharp outer annulus boundary, and a verrucate surface pattern. These characteristics satisfy the cerealia-type criteria of Küster (1988) and can be categorised as *Avena-Triticum* (oat-wheat) under the criteria of Andersen (1979). The presence of these grains indicates the local proximity of arable agriculture through the cultivation of cereals and / or on-site processing of the crop.

UNIVERSITY OF Southampton

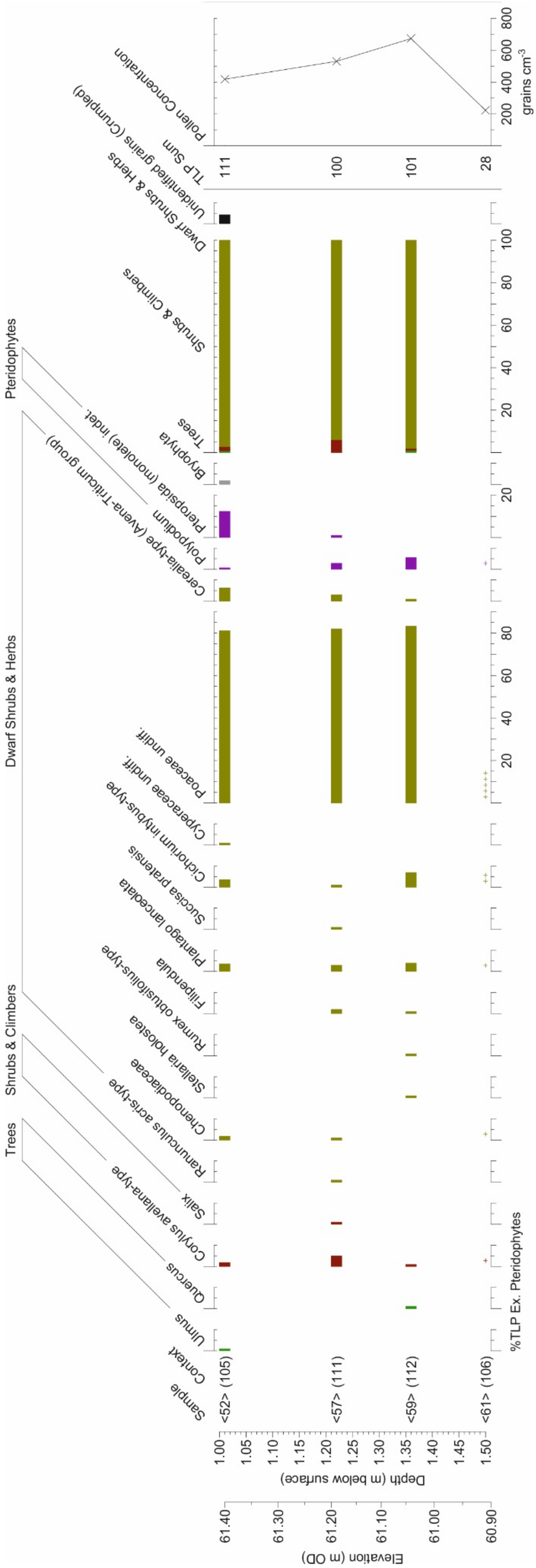

Figure 1: Pollen assessment results from Trench 2

The remainder of the pollen assemblage contains other taxa commonly associated with areas of grassland (e.g. *Succisa pratensis* (devil's-bit scabious)) along with indicators of ground disturbance and / or nutrient enrichment (e.g. *Plantago lanceolata* (ribwort plantain) and *Cichorium intybus*-type (including dandelion and chicory). Also present are taxa most commonly associated with areas of damp ground such as *Ranunculus acris*-type (buttercups), *Filipendula* (meadowsweet) and Cyperaceae (sedges). These could originate from areas of damp grassland, vegetation within the ditch itself, or areas associated with the nearby streams. The presence of Pteropsida (monolete) indet. (fern spores) and *Polypodium* (polypody) may indicate growth within the ditch itself, especially where there is exposed rock in the ditch wall or piles of rock excavated during the ditch construction.

Woodland is poorly represented within the pollen assemblage with *Corylus avellana*-type (hazel) the only taxon represented in all four samples. The low abundance of woodland taxa (<19% TLP) suggests that the few trees present around the site are likely to be associated with isolated stands or small areas of scrub. The presence of *Stellaria holostea* (greater stitchwort) also suggests some areas of shade in the wider area.

The limited pollen diversity within the Trench 1 pollen samples suggests either little change in the local vegetation during the period when the ditch was infilling, or else that there has been some vertical translocation of material caused by processes such as bioturbation through root activity. The only notable change in the pollen is the increase in cereals towards the top of the sequence which may indicate increased local arable activity after the construction of the ring ditch. The pollen signal of a predominantly open grassland environment with little tree cover is consistent with the Bronze Age date derived from the OSL dating.

5 Potential

Pollen concentrations were low from the site but it was possible to obtain sufficient counts from samples within Trench 1 to permit a pollen assessment. These provide an environmental context for the site, placing it within an open grassland-dominated setting. The restricted pollen assemblage encountered within these samples, due to the dominance of Poaceae in the assemblage, has limited the ability to infer the likely local environment beyond just grassland-dominated with potential elements of damp grassland and ground disturbance. Extended pollen-counting (analysis), up to 300-400 TLP, could help to expand the number of taxa encountered and strengthen the environmental interpretation of this sequence.

Comparison of the sediments recorded between the three trenches suggests that the deepest contexts from trench 2 (206 and 209) may contain a sedimentary sequence laid with a more gradual sedimentation rate, compared to the more stochastic (and erosive) record that is associated with the ditch terminus' in Trenches 1 and 3. Trench 2 also contains an intact buried soil horizon that is absent from the other two trenches. Investigation of the pollen contained within monolith <43> could therefore provide an understanding of the environment around the site prior to the infilling of the ditch with the layer of stone-rich sediments that is prevalent in contexts (205), (305) and constitutes most of ditch terminus [107].

Pollen assessment, and any subsequent analysis, of the sediments within monolith <43> could allow a direct comparison to be made with the pollen sequence assessed in this report from Trench 1. Most notably it would help to establish if the cereal-pollen signal was as prevalent away from the ditch terminus, as well as providing any indication of the local vegetation associated with the buried surface at the top of the monolith. No short-lived organic material was encountered within the sediment samples that could suitable for radiocarbon dating to help further constrain the age of the ring ditch.

Table 7: Pollen counts for samples from West facing Section CC, Ditch Terminus [107], Trench 1

Sample	<52>	<57>	<59>	<61>
Context	(105)	(111)	(112)	(106)
Ulmus	1			
Quercus			1	
Corylus avellana-type	2	5	1	1
Salix		1		
Ranunculus acris-type		1		
Chenopodiaceae	2	1		1
Stellaria holostea			1	
Rumex obtusifolius-type			1	
Filipendula		2	1	
Plantago lanceolata	4	3	4	1
Succisa pratensis		1		
Cichorium intybus-type	4	1	7	2
Cyperaceae undiff.	1			
Poaceae undiff.	90	82	84	23
Cerealia-type (*Avena-Triticum* group)	7	3	1	
Polypodium	1	3	6	1
Pteropsida (monolete) indet.	16	1		
Bryophyta	2			
Unidentified grains (crumpled)	5			
Exotic (*Lycopodium*) counted	601	379	307	252
TLP Sum	111	100	101	28
Pollen concentration (grains cm^{-3})	420	530	670	220

6 Recommendations

Pollen concentrations are low but full analysis counts are achievable from most of the samples assessed. Full analysis counts from samples <52>, <57> and <59> are recommended, but no further samples from Trench 1 are recommended for pollen analysis from this sequence. Pollen assessment, potentially leading into analysis, is also recommended for monolith <43> from Trench 2. Four samples should be selected from this monolith for pollen assessment, with sediment amounts processed ≥5cm^3. This could provisionally lead to up to eight samples from this sequence being subject to pollen analysis. No further dating of the ditch sequences is deemed necessary as the OSL dating has firmly placed the sequence within the Early to Middle Bronze Age, and there was no short-lived organic material that would be suitable for radiocarbon dating to further constrain the age of the ring ditch.

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APPENDIX D: RADIOCARBON CERTIFICATES

Follow

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RADIOCARBON DATING CERTIFICATE
26 March 2018

Laboratory Code SUERC-78018 (GU47307)

Submitter Emma Aitken
Cotswold Archaeology
Unit 8 The IO Centre
Fingle Drive
Stonebridge
Milton Keynes MK13 0AT

Site Reference Sherford New Town, Yealmpton, Devon
Context Reference 316
Sample Reference SHER17-316

Material Charcoal : Alder/hazel (Alnus glutinosa/Corylus avellana)

$\delta^{13}C$ relative to VPDB -26.8 ‰

Radiocarbon Age BP 3480 ± 29

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

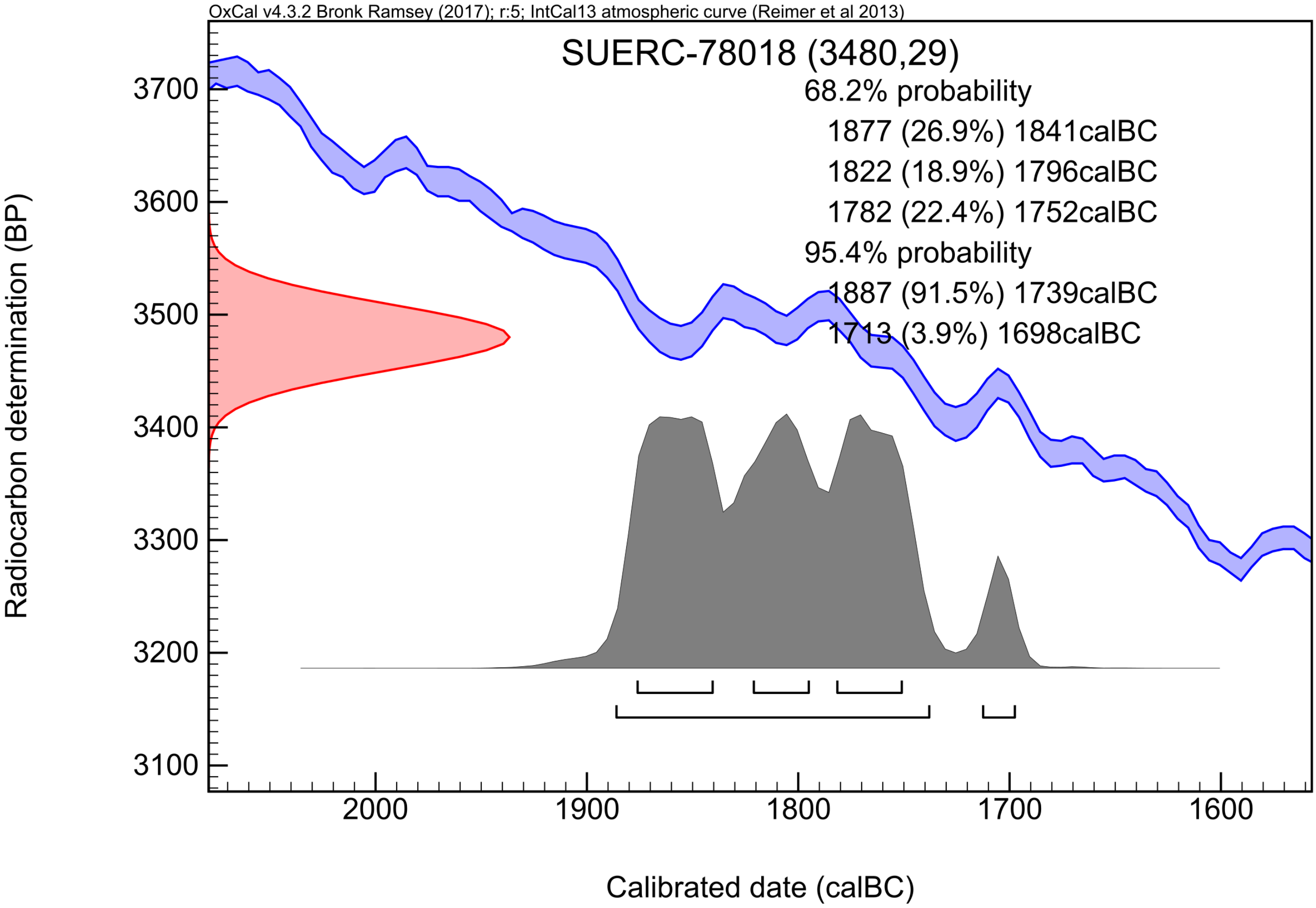
Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by : E. Dunbar

Checked and signed off by : P. Naysmith



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*

† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
26 March 2018

Laboratory Code	SUERC-78019 (GU47308)
Submitter	Emma Aitken Cotswold Archaeology Unit 8 The IO Centre Fingle Drive Stonebridge Milton Keynes MK13 0AT
Site Reference	Sherford New Town, Yealmpton, Devon
Context Reference	106
Sample Reference	SHER17-106
Material	Charcoal : Hazel (Corylus avellana)
$\delta^{13}C$ relative to VPDB	-25.3 ‰
Radiocarbon Age BP	3147 ± 29

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

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Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

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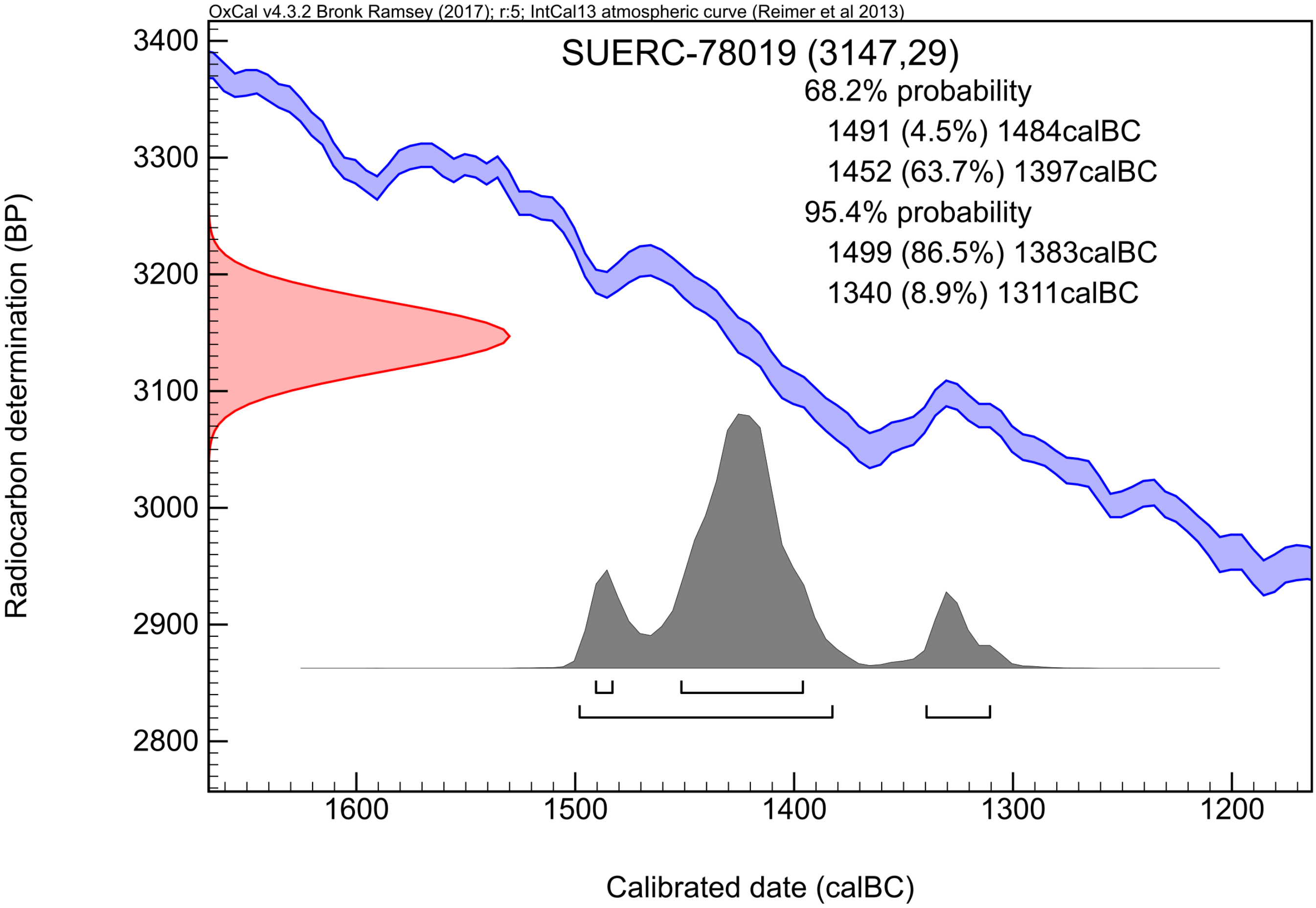
Conventional age and calibration age ranges calculated by : E. Dunbar

Checked and signed off by : P. Naysmith



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

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† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
26 March 2018

Laboratory Code	SUERC-78020 (GU47309)
Submitter	Emma Aitken Cotswold Archaeology Unit 8 The IO Centre Fingle Drive Stonebridge Milton Keynes MK13 0AT
Site Reference	Sherford New Town, Yealmpton, Devon
Context Reference	306
Sample Reference	SHER17-306
Material	Charcoal : Birch (Betula)
$\delta^{13}C$ relative to VPDB	-27.1 ‰
Radiocarbon Age BP	3158 ± 29

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

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Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

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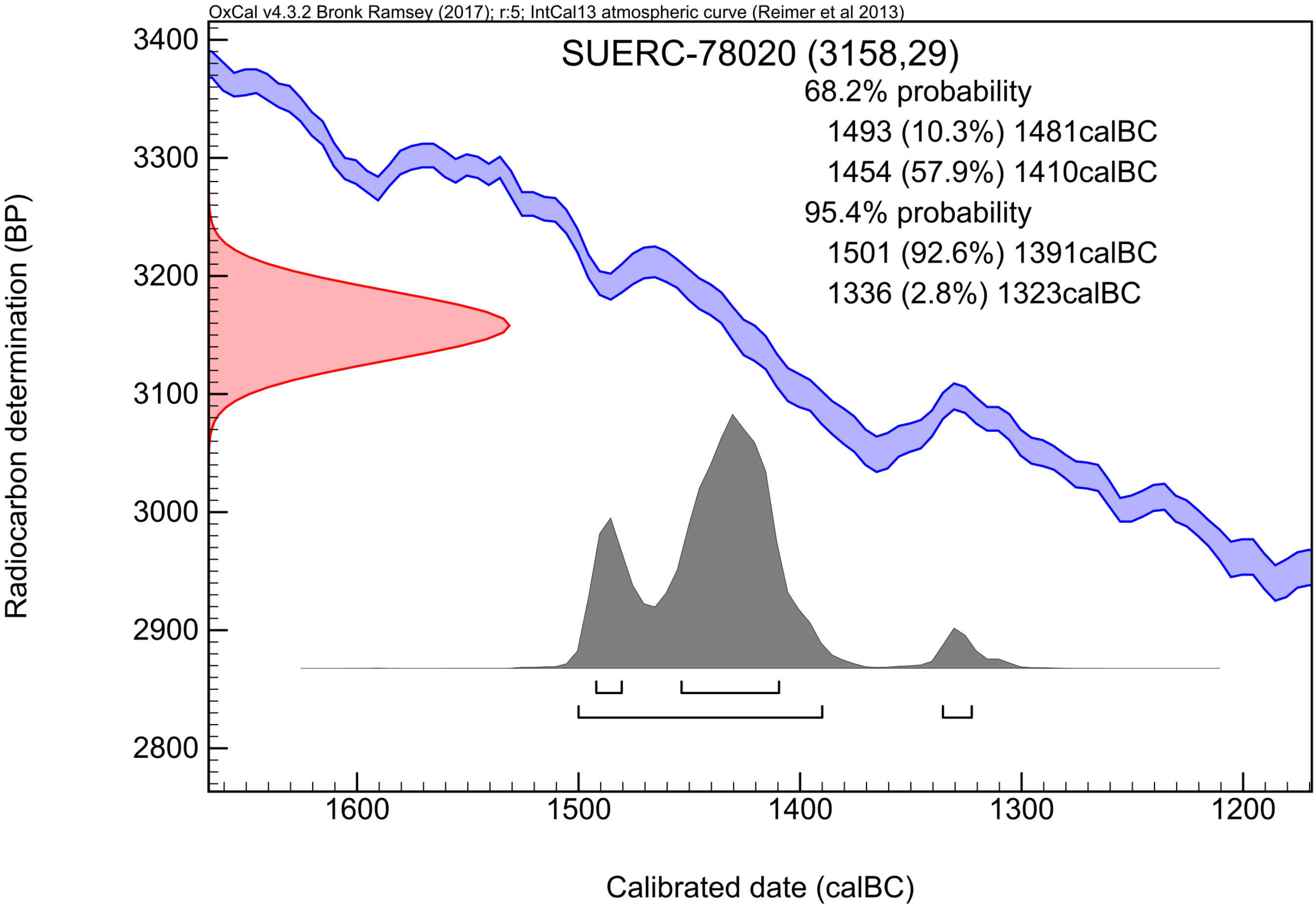
Conventional age and calibration age ranges calculated by : E. Dunbar

Checked and signed off by : P. Naysmith



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve.†

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* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
26 March 2018

Laboratory Code	SUERC-78021 (GU47310)
Submitter	Emma Aitken Cotswold Archaeology Unit 8 The IO Centre Fingle Drive Stonebridge Milton Keynes MK13 0AT
Site Reference	Sherford New Town, Yealmpton, Devon
Context Reference	321
Sample Reference	SHER17-321
Material	Charcoal : Oak (Quercus)
$\delta^{13}C$ relative to VPDB	-26.8 ‰
Radiocarbon Age BP	3053 ± 29

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

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Conventional age and calibration age ranges calculated by : E. Dunbar

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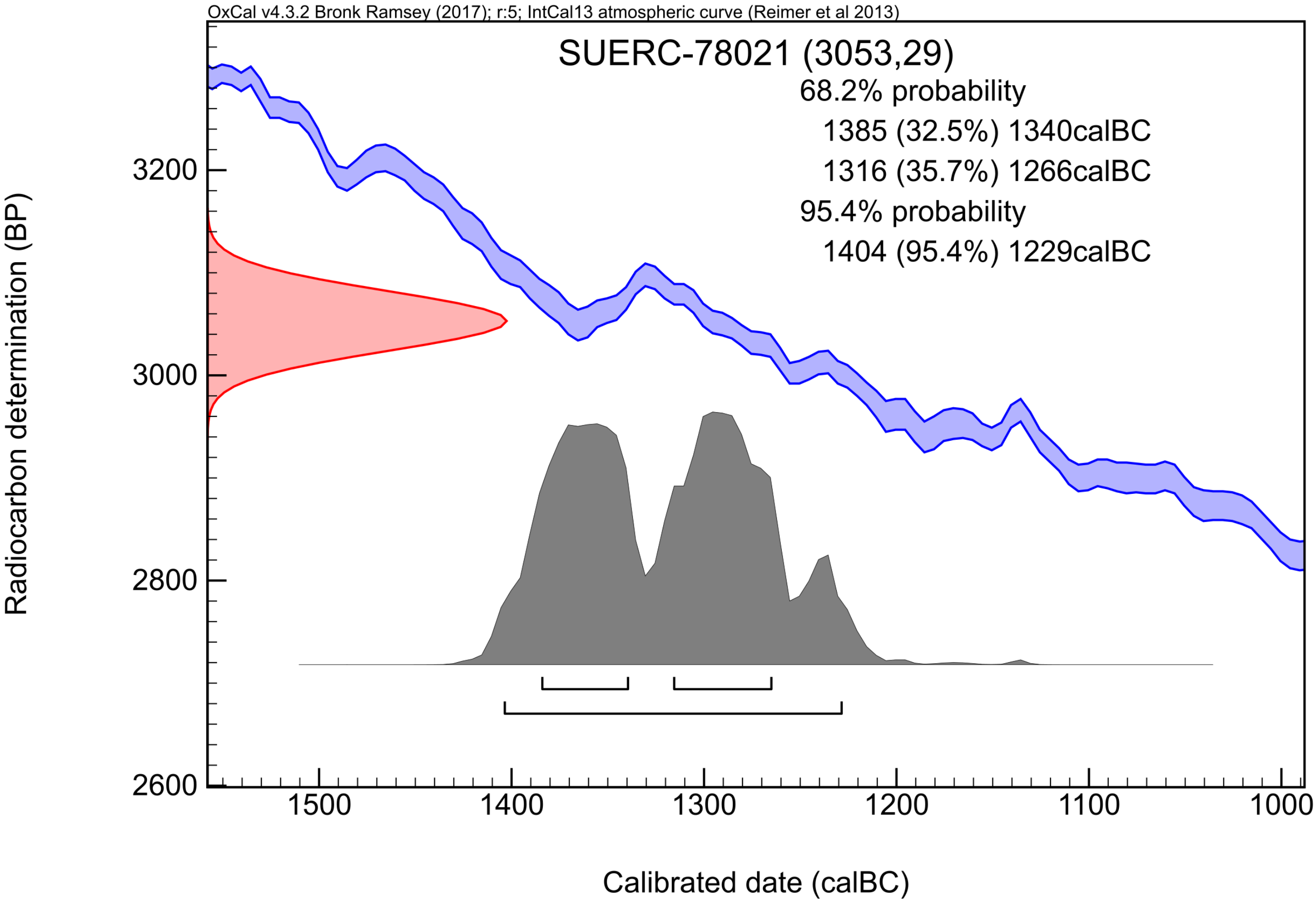

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The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve.†

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* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

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RADIOCARBON DATING CERTIFICATE
26 March 2018

Laboratory Code	SUERC-78022 (GU47311)
Submitter	Emma Aitken Cotswold Archaeology Unit 8 The IO Centre Fingle Drive Stonebridge Milton Keynes MK13 0AT
Site Reference	Sherford New Town, Yealmpton, Devon
Context Reference	310
Sample Reference	SHER17-310
Material	Charcoal : Oak (Quercus)
$\delta^{13}C$ relative to VPDB	-25.4 ‰
Radiocarbon Age BP	3086 ± 29

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

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Conventional age and calibration age ranges calculated by : E. Dunbar

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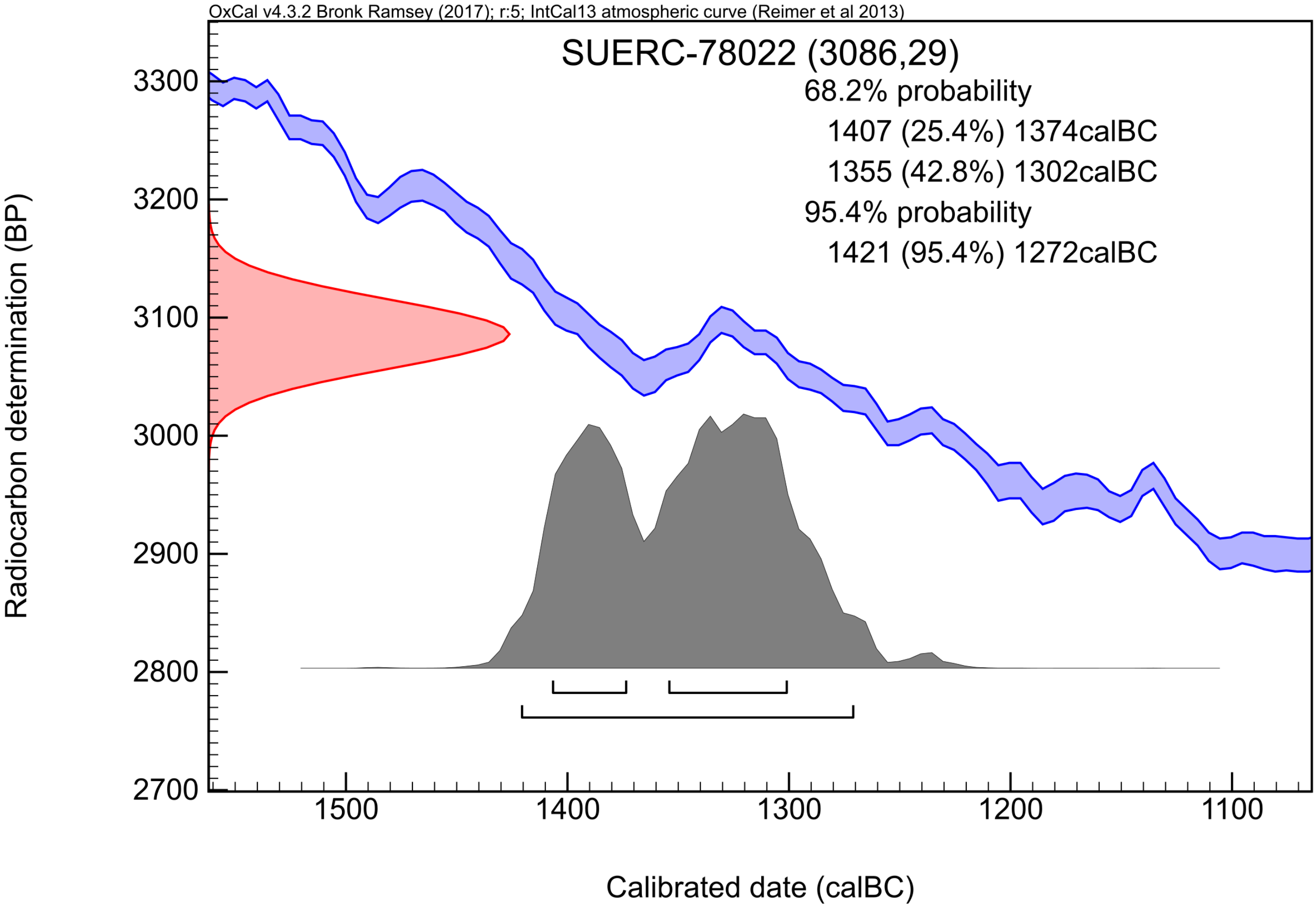

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The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

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RADIOCARBON DATING CERTIFICATE
26 March 2018

Laboratory Code	SUERC-78026 (GU47312)
Submitter	Emma Aitken Cotswold Archaeology Unit 8 The IO Centre Fingle Drive Stonebridge Milton Keynes MK13 0AT
Site Reference	Sherford New Town, Yealmpton, Devon
Context Reference	335
Sample Reference	SHER17-335
Material	Charcoal : Willow/poplar (Salix/Populus)
$\delta^{13}C$ relative to VPDB	-25.0 ‰ assumed
Radiocarbon Age BP	3805 ± 29

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

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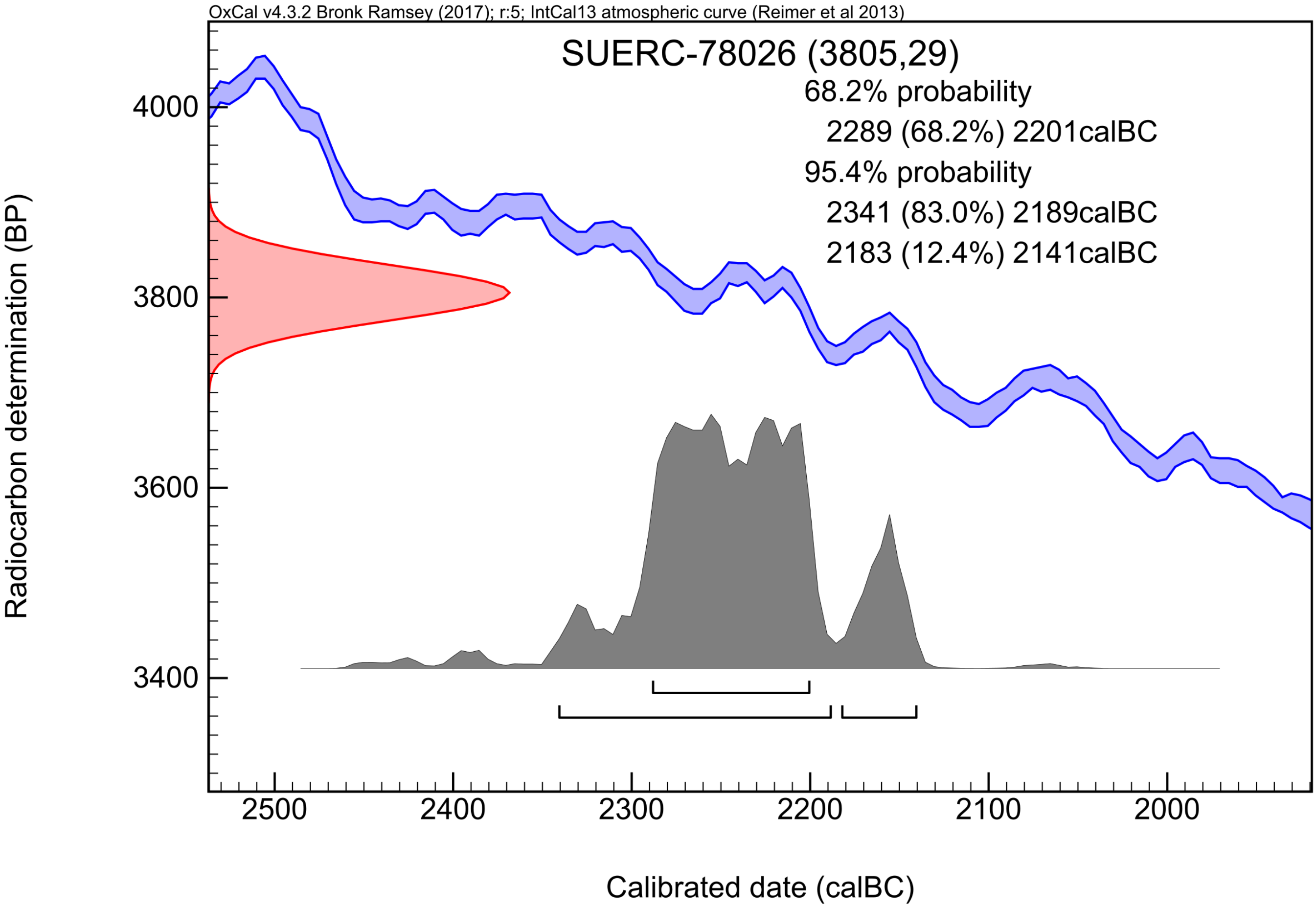
Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by : E. Dunbar

Checked and signed off by : P. Naysmith



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APPENDIX E: OPTICALLY STIMULATED LUMINESCENCE DATING REPORT

Follows

University of Gloucestershire

Luminescence dating laboratory

Optical dating of sediments: Sherford excavations, UK

to

S. Cobain

Cotswold Archaeology

Prepared by Dr P.S. Toms, 03 August 2017

Contents

Scope of Report

This is a standard report of the Luminescence dating laboratory, University of Gloucestershire. In large part, the document summarises the processes, diagnostics and data drawn upon to deliver Table 1. A conclusion on the analytical validity of each sample's optical age estimate is expressed in Table 2; where there are caveats, the reader is directed to the relevant section of the report that explains the issue further in general terms.

Field Code	Lab Code	Overburden (m)	Grain size (μm)	Moisture content (%)	NaI γ-spectrometry (*in situ*) γ D_r (Gy.ka^{-1})	Ge γ-spectrometry (*ex situ*)			α D_r (Gy.ka^{-1})	β D_r (Gy.ka^{-1})	Cosmic D_r (Gy.ka^{-1})	Preheat (°C for 10s)	Low Dose Repeat Ratio	Interpolated:Applied Low Regenerative-dose D_e	High Dose Repeat Ratio	Interpolated:Applied High Regenerative-dose D_e	Post-IR OSL Ratio
						K (%)	Th (ppm)	U (ppm)									
YEAL01	GL16166	1.50	5-15	21 ± 5	0.97 ± 0.09	2.35 ± 0.14	10.10 ± 0.61	1.90 ± 0.14	0.37 ± 0.04	1.80 ± 0.19	0.16 ± 0.02	200	0.97 ± 0.02	0.97 ± 0.02	1.03 ± 0.02	1.04 ± 0.03	0.98 ± 0.03
YEAL02	GL16167	1.65	5-15	23 ± 6	1.01 ± 0.10	2.59 ± 0.15	10.51 ± 0.63	2.01 ± 0.14	0.37 ± 0.05	1.89 ± 0.22	0.16 ± 0.02	220	1.00 ± 0.03	1.00 ± 0.03	1.05 ± 0.03	1.07 ± 0.03	0.99 ± 0.03

Field Code	Lab Code	Total D_r (Gy.ka^{-1})	D_e (Gy)	Age (ka)	Date
YEAL01	GL16166	3.31 ± 0.22	11.5 ± 0.4	3.48 ± 0.26 (0.21)	1720 B.C. – 1250 B.C
YEAL02	GL16167	3.43 ± 0.24	12.9 ± 0.5	3.74 ± 0.30 (0.25)	2020 B.C. – 1480 B.C.

Table 1 D_r, D_e and Age data of submitted samples located at c. 50°N, 4°W, 64m. Age estimates expressed relative to year of sampling. Uncertainties in age are quoted at 1σ confidence, are based on analytical errors and reflect combined systematic and experimental variability and (in parenthesis) experimental variability alone (see 6.0). Blue indicates samples with accepted age estimates, red, age estimates with caveats (see Table 2).

Generic considerations	Field Code	Lab Code	Sample specific considerations
None	YEAL01	GL16166	None
	YEAL02	GL16167	None

Table 2 Analytical validity of sample suite age estimates and caveats for consideration

1.0 Mechanisms and principles

Upon exposure to ionising radiation, electrons within the crystal lattice of insulating minerals are displaced from their atomic orbits. Whilst this dislocation is momentary for most electrons, a portion of charge is redistributed to meta-stable sites (traps) within the crystal lattice. In the absence of significant optical and thermal stimuli, this charge can be stored for extensive periods. The quantity of charge relocation and storage relates to the magnitude and period of irradiation. When the lattice is optically or thermally stimulated, charge is evicted from traps and may return to a vacant orbit position (hole). Upon recombination with a hole, an electron's energy can be dissipated in the form of light generating crystal luminescence providing a measure of dose absorption.

Herein, quartz is segregated for dating. The utility of this minerogenic dosimeter lies in the stability of its datable signal over the mid to late Quaternary period, predicted through isothermal decay studies (e.g. Smith *et al*., 1990; retention lifetime 630 Ma at 20°C) and evidenced by optical age estimates concordant with independent chronological controls (e.g. Murray and Olley, 2002). This stability is in contrast to the anomalous fading of comparable signals commonly observed for other ubiquitous sedimentary minerals such as feldspar and zircon (Wintle, 1973; Templer, 1985; Spooner, 1993)

Optical age estimates of sedimentation (Huntley *et al*., 1985) are premised upon reduction of the minerogenic time dependent signal (Optically Stimulated Luminescence, OSL) to zero through exposure to sunlight and, once buried, signal reformulation by absorption of litho- and cosmogenic radiation. The signal accumulated post burial acts as a dosimeter recording total dose absorption, converting to a chronometer by estimating the rate of dose absorption quantified through the assay of radioactivity in the surrounding lithology and streaming from the cosmos.

$$\text{Age} = \frac{\text{Mean Equivalent Dose } (D_e\text{, Gy})}{\text{Mean Dose Rate } (D_{r,}\text{ Gy.ka}^{-1})}$$

Aitken (1998) and Bøtter-Jensen *et al*. (2003) offer a detailed review of optical dating.

2.0 Sample Collection and Preparation

Two sediment samples were collected within opaque tubing and submitted for Optical dating. To preclude optical erosion of the datable signal prior to measurement, all samples were opened and prepared under controlled laboratory illumination provided by Encapsulite RB-10 (red) filters. To isolate that material potentially exposed to daylight during sampling, sediment located within 20 mm of each tube-end was removed.

The remaining sample was dried and then sieved. The fine silt fraction was segregated and subjected to acid and alkaline digestion (10% HCl, 15% H_2O_2) to attain removal of carbonate and organic components respectively. Fine silt sized quartz, along with other mineral grains of varying density and size, was extracted by sample sedimentation in acetone (<15 μm in 2 min 20 s, >5 μm in 21 mins at 20ºC). Feldspars and amorphous silica were then removed from this fraction through acid digestion (35% H_2SiF_6 for 2 weeks, Jackson *et al*., 1976; Berger *et al*., 1980). Following addition of 10% HCl to remove acid soluble fluorides, grains degraded to <5 μm as a result of acid treatment were removed by acetone sedimentation. Twelve multi-grain aliquots (ca. 1.5 mg) were then mounted on aluminium discs for D_e evaluation.

All drying was conducted at 40°C to prevent thermal erosion of the signal. All acids and alkalis were Analar grade. All dilutions (removing toxic-corrosive and non-minerogenic luminescence-bearing substances) were conducted with distilled water to prevent signal contamination by extraneous particles.

3.0 Acquisition and accuracy of D_e value

All minerals naturally exhibit marked inter-sample variability in luminescence per unit dose (sensitivity). Therefore, the estimation of D_e acquired since burial requires calibration of the natural signal using known amounts of laboratory dose. D_e values were quantified using a single-aliquot regenerative-dose (SAR) protocol (Murray and Wintle 2000; 2003) facilitated by a Risø TL-DA-15 irradiation-stimulation-detection system (Markey *et al*., 1997; Bøtter-Jensen *et al*., 1999). Within this apparatus, optical signal stimulation is provided by an assembly of blue diodes (5 packs of 6 Nichia NSPB500S), filtered to 470$\pm$80 nm conveying 15 mW.cm^{-2} using a 3 mm Schott GG420 positioned in front of each diode pack. Infrared (IR) stimulation, provided by 6 IR diodes (Telefunken TSHA 6203) stimulating at 875$\pm$80nm delivering ~5 mW.cm^{-2}, was used to indicate the presence of contaminant feldspars (Hütt *et al*., 1988). Stimulated photon emissions from quartz aliquots are in the ultraviolet (UV) range and were filtered from stimulating photons by 7.5 mm HOYA U-340 glass and detected by an EMI 9235QA photomultiplier fitted with a blue-green sensitive bialkali photocathode. Aliquot irradiation was conducted using a 1.48 GBq ^{90}Sr/^{90}Y β source calibrated for multi-grain aliquots of 5-15 μm quartz against the 'Hotspot 800' ^{60}Co γ source located at the National Physical Laboratory (NPL), UK.

SAR by definition evaluates D_e through measuring the natural signal (Fig. 1) of a single aliquot and then regenerating that aliquot's signal by using known laboratory doses to enable calibration. For each aliquot, five different regenerative-doses were administered so as to image dose response. D_e values for each aliquot were then interpolated, and associated counting and fitting errors calculated, by way of exponential plus linear regression (Fig. 1). Weighted (geometric) mean D_e values were calculated, given sufficient mass, from 12 aliquots using the central age model outlined by Galbraith *et al*. (1999) and are quoted at 1σ confidence (Table 1). The accuracy with which D_e equates to total absorbed dose and that dose absorbed since burial was assessed. The former can be considered a function of laboratory factors, the latter, one of environmental issues. Diagnostics were deployed to estimate the influence of these factors and criteria instituted to optimise the accuracy of D_e values.

3.1 Laboratory Factors

3.1.1 Feldspar contamination

The propensity of feldspar signals to fade and underestimate age, coupled with their higher sensitivity relative to quartz makes it imperative to quantify feldspar contamination. At room temperature, feldspars generate a signal (IRSL; Fig. 1) upon exposure to IR whereas quartz does not. The signal from feldspars contributing to OSL can be depleted by prior exposure to IR. For all aliquots the contribution of any remaining feldspars was estimated from the OSL IR depletion ratio (Duller, 2003). The influence of IR depletion on the OSL signal can be illustrated by comparing the regenerated post-IR OSL D_e with the applied regenerative-dose. If the addition to OSL by feldspars is insignificant, then the repeat dose ratio of OSL to post-IR OSL should be statistically consistent with unity (Table 1). If any aliquots do not fulfil this criterion, then the sample age estimate should be accepted tentatively. The source of feldspar contamination is rarely rooted in sample preparation; it predominantly results from the occurrence of feldspars as inclusions within quartz.

3.1.2 Preheating

Preheating aliquots between irradiation and optical stimulation is necessary to ensure comparability between natural and laboratory-induced signals. However, the multiple irradiation and preheating steps that are required to define single-aliquot regenerative-dose response leads to signal sensitisation, rendering calibration of the natural signal inaccurate. The SAR protocol (Murray and Wintle, 2000; 2003) enables this sensitisation to be monitored and corrected using a test dose, here set at 5 Gy preheated to 220°C for 10s, to track signal sensitivity between irradiation-preheat steps. However, the accuracy of sensitisation correction for both natural and laboratory signals can be preheat dependent.

The Dose Recovery test was used to assess the optimal preheat temperature for accurate correction and calibration of the time dependent signal. Dose Recovery (Fig. 2) attempts to quantify the combined effects of thermal transfer and sensitisation on the natural signal, using a precise lab dose to simulate natural dose. The ratio between the applied dose and recovered D_e value should be statistically concordant with unity. For this diagnostic, 6 aliquots were each assigned a 10 s preheat between 180°C and 280°C.

That preheat treatment fulfilling the criterion of accuracy within the Dose Recovery test was selected to generate the final D_e value from a further 12 aliquots. Further thermal treatments, prescribed by Murray and Wintle (2000; 2003), were applied to optimise accuracy and precision. Optical stimulation occurred at 125ºC in order to minimise effects associated with photo-transferred thermoluminescence and maximise signal to noise ratios. Inter-cycle optical stimulation was conducted at 280ºC to minimise recuperation.

3.1.3 Irradiation

For all samples having D_e values in excess of 100 Gy, matters of signal saturation and laboratory irradiation effects are of concern. With regards the former, the rate of signal accumulation generally adheres to a saturating exponential form and it is this that limits the precision and accuracy of D_e values for samples having absorbed large doses. For such samples, the functional range of D_e interpolation by SAR has been verified up to 600 Gy by Pawley *et al*. (2010). Age estimates based on D_e values exceeding this value should be accepted tentatively.

3.1.4 Internal consistency

Abanico plots (Dietze *et al*., 2016) are used to illustrate inter-aliquot D_e variability (Fig. 3). D_e values are standardised relative to the central D_e value for natural signals and are described as overdispersed when >5% lie beyond $\pm 2\sigma$ of the standardising value; resulting from a heterogeneous absorption of burial dose and/or response to the SAR protocol. For multi-grain aliquots, overdispersion of natural signals does not necessarily imply inaccuracy. However where overdispersion is observed for regenerated signals, the efficacy of sensitivity correction may be problematic. Murray and Wintle (2000; 2003) suggest repeat dose ratios (Table 1) offer a measure of SAR protocol success, whereby ratios ranging across 0.9-1.1 are acceptable. However, this variation of repeat dose ratios in the high-dose region can have a significant impact on D_e interpolation. The influence of this effect can be outlined by quantifying the ratio of interpolated to applied regenerative-dose ratio (Table 1). In this study, where both the repeat dose ratios and interpolated to applied regenerative-dose ratios range across 0.9-1.1, sensitivity-correction is considered effective.

3.2 Environmental factors

3.2.1 Incomplete zeroing

Post-burial OSL signals residual of pre-burial dose absorption can result where pre-burial sunlight exposure is limited in spectrum, intensity and/or period, leading to age overestimation. This effect is particularly acute for material eroded and redeposited sub-aqueously (Olley *et al*., 1998, 1999; Wallinga, 2002) and exposed to a burial dose of <20 Gy (e.g. Olley *et al*., 2004), has some influence in sub-aerial contexts but is rarely of consequence where aerial transport has occurred. Within single-aliquot regenerative-dose optical dating there are two diagnostics of partial resetting (or bleaching); signal analysis (Agersnap-Larsen *et al*., 2000; Bailey *et al*., 2003) and inter-aliquot D_e distribution studies (Murray *et al*., 1995).

Within this study, signal analysis was used to quantify the change in D_e value with respect to optical stimulation time for multi-grain aliquots. This exploits the existence of traps within minerogenic dosimeters that bleach with different efficiency for a given wavelength of light to verify partial bleaching. D_e (t) plots (Fig. 4; Bailey *et al*., 2003) are constructed from separate integrals of signal decay as laboratory optical stimulation progresses. A statistically significant increase in natural D_e (t) is indicative of partial bleaching assuming three conditions are fulfilled. Firstly, that a statistically significant increase in D_e (t) is observed when partial bleaching is simulated within the laboratory. Secondly, that there is no significant rise in D_e (t) when full bleaching is simulated. Finally, there should be no significant augmentation in D_e (t) when zero dose is simulated. Where partial bleaching is detected, the age derived from the sample should be considered a maximum estimate only. However, the utility of signal analysis is strongly dependent upon a samples pre-burial experience of sunlight's spectrum and its residual to post-burial signal ratio. Given in the majority of cases, the spectral exposure history of a deposit is uncertain, the absence of an increase in natural D_e (t) does not necessarily testify to the absence of partial bleaching.

Where requested and feasible, the insensitivities of multi-grain single-aliquot signal analysis may be circumvented by inter-aliquot D_e distribution studies. This analysis uses aliquots of single sand grains to quantify inter-grain D_e distribution. At present, it is contended that asymmetric inter-grain D_e distributions are symptomatic of partial bleaching and/or pedoturbation (Murray *et al*., 1995; Olley *et al*., 1999; Olley *et al*., 2004; Bateman *et al*., 2003). For partial bleaching at least, it is further contended that the D_e acquired during burial is located in the minimum region of such ranges. The mean and breadth of this minimum region is the subject of current debate, as it is additionally influenced by heterogeneity in microdosimetry, variable inter-grain response to SAR and residual to post-burial signal ratios.

3.2.2 Turbation

As noted in section 3.1.1, the accuracy of sedimentation ages can further be controlled by post-burial trans-strata grain movements forced by pedo- or cryoturbation. Berger (2003) contends pedogenesis prompts a reduction in the apparent sedimentation age of parent material through bioturbation and illuviation of younger material from above and/or by biological recycling and resetting of the datable signal of surface material. Berger (2003) proposes that the chronological products of this remobilisation are A-horizon age estimates reflecting the cessation of pedogenic activity, Bc/C-horizon ages delimiting the maximum age for the initiation of pedogenesis with estimates obtained from Bt-horizons providing an intermediate age 'close to the age of cessation of soil development'. Singhvi et al. (2001), in contrast, suggest that B and C-horizons closely approximate the age of the parent material, the A-horizon, that of the 'soil forming episode'. Recent analyses of inter-aliquot D_e distributions have reinforced this complexity of interpreting burial age from pedoturbated deposits (Lombard *et al*., 2011; Gliganic *et al*., 2015; Jacobs *et al*., 2008; Bateman *et al*., 2007; Gliganic *et al*., 2016). At present there is no definitive post-sampling mechanism for the direct detection of and correction for post-burial sediment remobilisation. However, intervals of palaeosol evolution can be delimited by a maximum age derived from parent material and a minimum age obtained from a unit overlying the palaeosol. Inaccuracy forced by cryoturbation may be bidirectional, heaving older material upwards or drawing younger material downwards into the level to be dated. Cryogenic deformation of matrix-supported material is, typically, visible; sampling of such cryogenically-disturbed sediments can be avoided.

4.0 Acquisition and accuracy of D_r value

Lithogenic D_r values were defined through measurement of U, Th and K radionuclide concentration and conversion of these quantities into α, β and γ D_r values (Table 1). α and β contributions were estimated from sub-samples by laboratory-based γ spectrometry using an Ortec GEM-S high purity Ge coaxial detector system, calibrated using certified reference materials supplied by CANMET. γ dose rates were estimated from *in situ* NaI gamma spectrometry. *In situ* measurements were conducted using an EG&G μNomad portable NaI gamma spectrometer (calibrated using the block standards at RLAHA, University of Oxford); these reduce uncertainty relating to potential heterogeneity in the γ dose field surrounding each sample. The level of U disequilibrium was estimated by laboratory-based Ge γ spectrometry. Estimates of radionuclide concentration were converted into D_r values (Adamiec and Aitken, 1998), accounting for D_r modulation forced by grain size (Mejdahl, 1979), present moisture content (Zimmerman, 1971) and, where D_e values were generated from 5-15 μm quartz, reduced signal sensitivity to α radiation (a-value 0.050 $\pm$ 0.002). Cosmogenic D_r values were calculated on the basis of sample depth, geographical position and matrix density (Prescott and Hutton, 1994).

The spatiotemporal validity of D_r values can be considered a function of five variables. Firstly, age estimates devoid of *in situ* γ spectrometry data should be accepted tentatively if the sampled unit is heterogeneous in texture or if the sample is located within 300 mm of strata consisting of differing texture and/or mineralogy. However, where samples are obtained throughout a vertical profile, consistent values of γ D_r based solely on laboratory measurements may evidence the homogeneity of the γ field and hence accuracy of γ D_r values. Secondly, disequilibrium can force temporal instability in U and Th emissions. The impact of this infrequent phenomenon (Olley *et al.*, 1996) upon age estimates is usually insignificant given their associated margins of error. However, for samples where this effect is pronounced (>50% disequilibrium between ^{238}U and ^{226}Ra; Fig. 5), the resulting age estimates should be accepted tentatively. Thirdly, pedogenically-induced variations in matrix composition of B and C-horizons, such as radionuclide and/or mineral remobilisation, may alter the rate of energy emission and/or absorption. If D_r is invariant through a dated profile and samples encompass primary parent material, then element mobility is likely limited in effect. Fourthly, spatiotemporal detractions from present moisture content are difficult to assess directly, requiring knowledge of the magnitude and timing of differing contents. However, the maximum influence of moisture content variations can be delimited by recalculating D_r for minimum (zero) and maximum (saturation) content. Finally, temporal alteration in the thickness of overburden alters cosmic D_r values. Cosmic D_r often forms a negligible portion of total D_r. It is possible to quantify the maximum influence of overburden flux by recalculating D_r for minimum (zero) and maximum (surface sample) cosmic D_r.

5.0 Estimation of Age

Ages reported in Table 1 provide an estimate of sediment burial period based on mean D_e and D_r values and their associated analytical uncertainties. Uncertainty in age estimates is reported as a product of systematic and experimental errors, with the magnitude of experimental errors alone shown in parenthesis (Table 1). Cumulative frequency plots indicate the inter-aliquot variability in age (Fig. 6). The maximum influence of temporal variations in D_r forced by minima-maxima in moisture content and overburden thickness is also illustrated in Fig. 6. Where uncertainty in these parameters exists this age range may prove instructive, however the combined extremes represented should not be construed as preferred age estimates. The analytical validity of each sample is presented in Table 2.

6.0 Analytical uncertainty

All errors are based upon analytical uncertainty and quoted at 1σ confidence. Error calculations account for the propagation of systematic and/or experimental (random) errors associated with D_e and D_r values.

For D_e values, systematic errors are confined to laboratory β source calibration. Uncertainty in this respect is that combined from the delivery of the calibrating γ dose (1.2%; NPL, pers. comm.), the conversion of this dose for SiO_2 using the respective mass energy-absorption coefficient (2%; Hubbell, 1982) and experimental error, totalling 3.5%. Mass attenuation and bremsstrahlung losses during γ dose delivery are considered negligible. Experimental errors relate to D_e interpolation using sensitisation corrected dose responses. Natural and regenerated sensitisation corrected dose points (S_i) were quantified by,

$$S_i = (D_i - x.L_i) / (d_i - x.L_i) \qquad \textbf{Eq.1}$$

where D_i = Natural or regenerated OSL, initial 0.2 s

L_i = Background natural or regenerated OSL, final 5 s

d_i = Test dose OSL, initial 0.2 s

x = Scaling factor, 0.08

The error on each signal parameter is based on counting statistics, reflected by the square-root of measured values. The propagation of these errors within Eq. 1 generating σS_i follows the general formula given in Eq. 2. σS_i were then used to define fitting and interpolation errors within exponential plus linear regressions.

For D_r values, systematic errors accommodate uncertainty in radionuclide conversion factors (5%), β attenuation coefficients (5%), a-value (4%; derived from a systematic α source uncertainty of 3.5% and experimental error), matrix density (0.20 $g.cm^{-3}$), vertical thickness of sampled section (specific to sample collection device), saturation moisture content (3%), moisture content attenuation (2%), burial moisture content (25% relative, unless direct evidence exists of the magnitude and period of differing content) and NaI gamma spectrometer calibration (3%). Experimental errors are associated with radionuclide quantification for each sample by NaI and Ge gamma spectrometry.

The propagation of these errors through to age calculation was quantified using the expression,

$$\sigma y\ (\delta y/\delta x) = (\Sigma\ ((\delta y/\delta x_n).\sigma x_n)^2)^{1/2} \qquad \textbf{Eq. 2}$$

where y is a value equivalent to that function comprising terms x_n and where σy and σx_n are associated uncertainties.

Errors on age estimates are presented as combined systematic and experimental errors and experimental errors alone. The former (combined) error should be considered when comparing luminescence ages herein with independent chronometric controls. The latter assumes systematic errors are common to luminescence age estimates generated by means identical to those detailed herein and enable direct comparison with those estimates.

Fig. 1 Signal Calibration

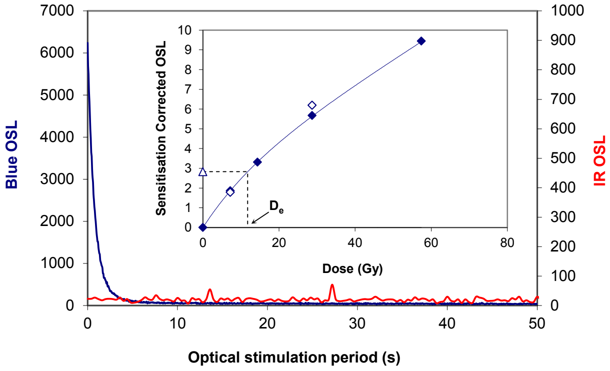

Fig. 2 Dose Recovery

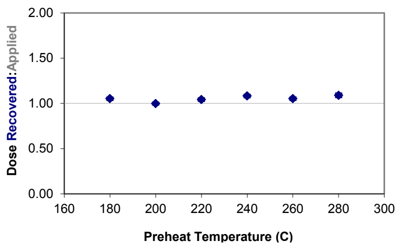

Fig. 3 Inter-aliquot D_e distribution

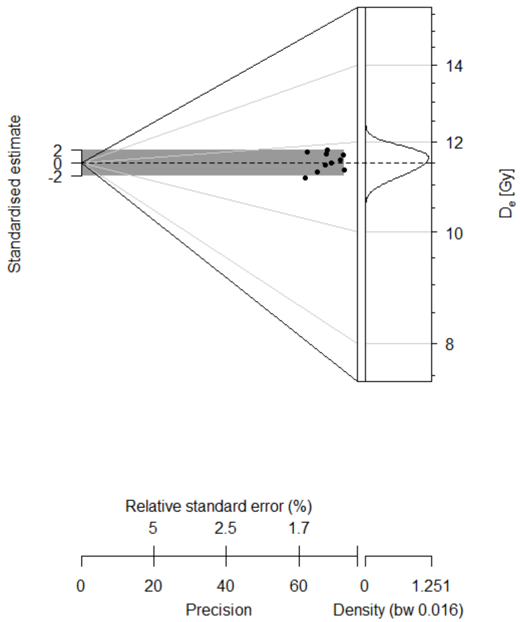

Fig. 4 Signal Analysis

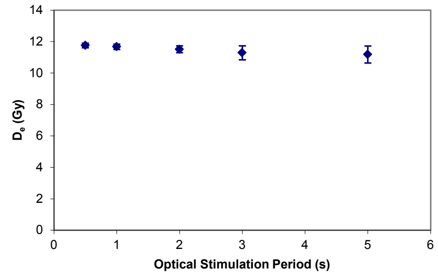

Fig. 5 U Decay Activity

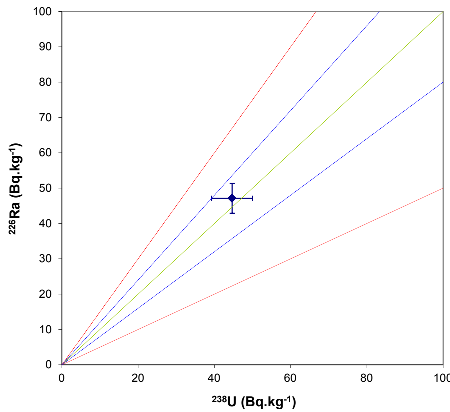

Fig. 6 Age Range

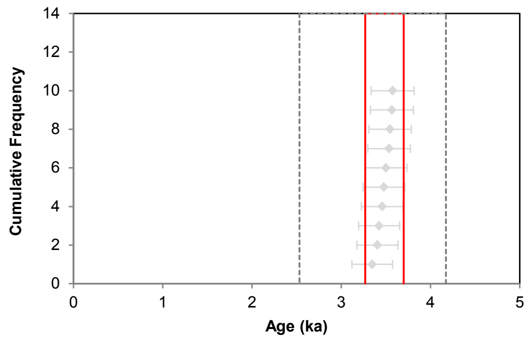

Fig. 1 Signal Calibration Natural blue and laboratory-induced infrared (IR) OSL signals. Detectable IR signal decays are diagnostic of feldspar contamination. Inset, the natural blue OSL signal (open triangle) of each aliquot is calibrated against known laboratory doses to yield equivalent dose (D_e) values. Repeats of low and high doses (open diamonds) illustrate the success of sensitivity correction.

Fig. 2 Dose Recovery The acquisition of D_e values is necessarily predicated upon thermal treatment of aliquots succeeding environmental and laboratory irradiation. The Dose Recovery test quantifies the combined effects of thermal transfer and sensitisation on the natural signal using a precise lab dose to simulate natural dose. Based on this an appropriate thermal treatment is selected to generate the final D_e value.

Fig. 3 Inter-aliquot D_e distribution Abanico plot of inter-aliquot statistical concordance in D_e values derived from **natural** irradiation. Discordant data (those points lying beyond ±2 standardised ln D_e) reflect heterogeneous dose absorption and/or inaccuracies in calibration.

Fig. 4 Signal Analysis Statistically significant increase in **natural** D_e value with signal stimulation period is indicative of a partially-bleached signal, provided a significant increase in D_e results from **simulated partial bleaching** followed by insignificant adjustment in D_e for simulated **zero** and **full bleach** conditions. Ages from such samples are considered maximum estimates. In the absence of a significant rise in D_e with stimulation time, simulated partial bleaching and zero/full bleach tests are not assessed.

Fig. 5 U Activity Statistical concordance (equilibrium) in the activities of the daughter radioisotope ^{226}Ra with its parent ^{238}U may signify the temporal stability of D_r emissions from these chains. Significant differences (disequilibrium; >50%) in activity indicate addition or removal of isotopes creating a time-dependent shift in D_r values and increased uncertainty in the accuracy of age estimates. A 20% disequilibrium marker is also shown.

Fig. 6 Age Range The Cumulative frequency plot indicates the inter-aliquot variability in age. It also shows the **mean age range**; an estimate of sediment burial period based on mean D_e and D_r values with associated analytical uncertainties. The **maximum influence** of temporal variations in D_r forced by minima-maxima variation in moisture content and overburden thickness is outlined and may prove instructive where there is uncertainty in these parameters. However the combined extremes represented should not be construed as preferred age estimates.

Sample: GL16166

Fig. 1 Signal Calibration

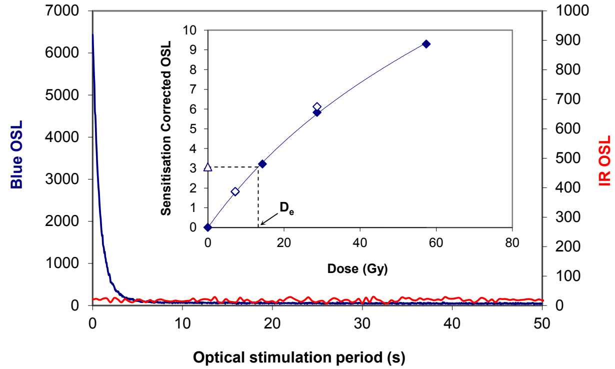

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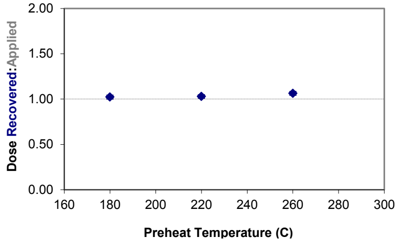
Fig. 2 Dose Recovery



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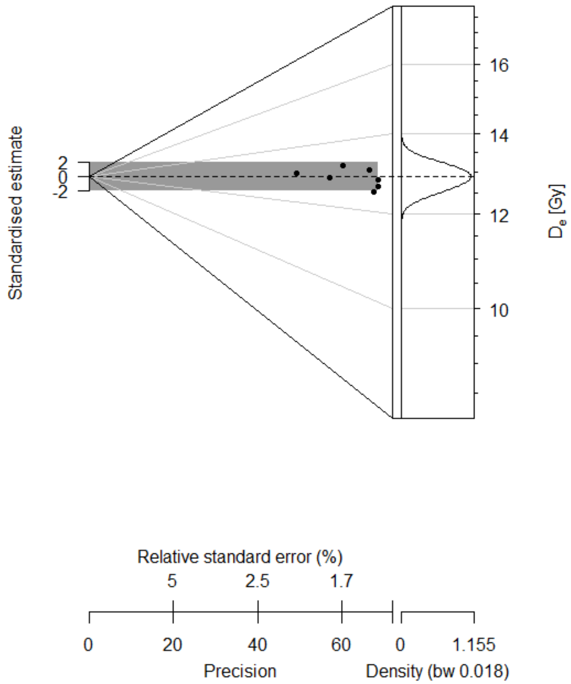


Sample: GL16167

Fig. 4 Signal Analysis

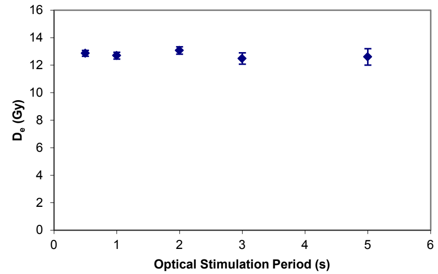


Fig. 5 U Decay Activity

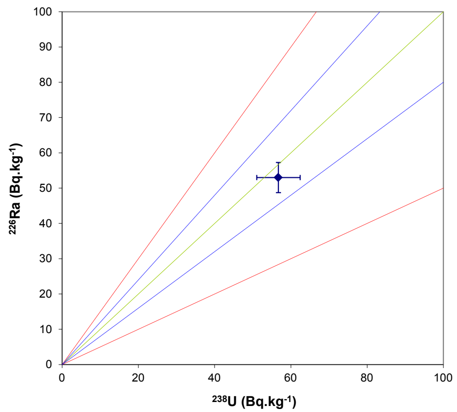
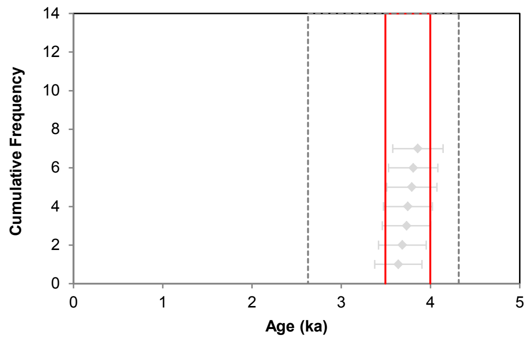


Fig. 6 Age Range



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APPENDIX F: OASIS REPORT FORM

PROJECT DETAILS		
Project name	Sherford New Town, Yealmpton, Devon	
Short description	In May and June 2017, Cotswold Archaeology (CA) carried out an archaeological evaluation of part of the proposed site of the Sherford New Town development, Yealmpton, Devon. One of the primary aims of the evaluation was to further investigate a circular enclosure ditch detected previously by a geophysical survey. The evaluation confirmed the presence of the enclosure ditch. There was evidence for a former internal ditch-side bank. There was no evidence for further internal features, although only a small part of the enclosure's interior was sampled by the evaluation. The enclosure ditch had two openings: one on the ditch's north-eastern edge and one on its southern edge. Seven postholes and a shallow ditch were recorded within the northern opening. Middle Bronze Age radiocarbon and optically stimulated luminescence dates were obtained from the fills of the circular enclosure ditch and two of the postholes. Early Bronze Age radiocarbon dates were obtained from the fills of one of the postholes and some probable root disturbance within the northern opening. The almost complete absence of artefacts from the enclosure ditch and the associated features suggests that the enclosure was not a domestic feature. The true function of the enclosure is uncertain at this stage. The absence of an internal mound indicates that it was not a barrow. The presence of an internal (rather than external) bank and the Middle Bronze Age date suggest that the enclosure is not a henge.	
Project dates	31 May–21 June 2017	
Project type	Field evaluation	
Previous work	Geophysical survey (Bartlett Clark Consultancy, 2014)	
Future work	Unknown	
PROJECT LOCATION		
Site location	Field 87, Sherford New Town, Yealmpton, Devon	
Study area (m^2/ha)	*c*. 430m²	
Site co-ordinates	256561 054998	
PROJECT CREATORS		
Name of organisation	Cotswold Archaeology	
Project brief originator	N/A	
Project design (WSI) originator	AECOM & URS	
Project Manager	Derek Evans	
Project Supervisor	Simon Sworn	
MONUMENT TYPE	Middle Bronze Age enclosure	
SIGNIFICANT FINDS	None	
PROJECT ARCHIVES	**Intended final location of archive**	**Content**
Physical	Plymouth City Museum & Art Gallery	Two pottery sherds and a single flint flake
Paper	N/A	N/A
Digital	Archaeology Data Service (ADS)	Database, digital photos, scans of site records
BIBLIOGRAPHY		
Cotswold Archaeology 2018 Sherford New Town, Yealmpton, Devon*: Archaeological Evaluation* CA typescript report **17364**		

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