



Barrowed Time

Archaeological Evaluation

Interim Assessment Report

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Interim Assessment Report for a Community-Based Archaeological Investigation at Bolton le Sands

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Heritage Lottery Fund

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Purpose of document

This document has been prepared as an Interim Assessment Report for the Heritage Lottery Fund (Client), and DigVentures' global crowdfunding community (Stakeholder Sponsors). The purpose of this document is to provide a comprehensive account of the 2016 field season at Bolton le Sands, with specialist assessment of finds and samples, and recommendations for further investigation and analysis. It is supported by an easily accessible online database of all written, drawn, photographic and digital data. An Updated Project Design detailing full recommendations for the 2017 field season will be produced in April 2017. DigVentures accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared. DigVentures has no liability regarding the use of this report except to Heritage Lottery Fund.

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Executive summary

DigVentures, in partnership with Durham University, was commissioned by the Heritage Lottery Fund (HLF) to undertake a crowdfunded community-based archaeological research project at a recently discovered Bronze Age Burial monument at Bolton le Sands, Lancashire (hereafter 'the Site'). The 'Barrowed Time' project was structured as a year long community engagement project, with fieldwork designed to help contextualise the unexpected discovery of a Late Bronze Age tanged chisel and knife blade by a local metal detectorist.

Following the initial discovery of the Bronze Age artefacts in 2013, a small-scale archaeological assessment was undertaken by University of Central Lancashire (UCLAN) in conjunction with the Portable Antiquities Scheme (PAS). This included a resistivity survey and a small archaeological test trench which identified the possibility that the site was the location of an early prehistoric burial cairn. The current project was established in 2016 to further investigate the site. On 28 March 2016, the first execution stage of the 'Barrowed Time' Project was completed, comprising a magnetometry survey of the find spot and area immediately adjacent. Based on the results of this work, the Project Design planned for the excavation of three trenches at the main site at Bolton le Sands, which is defined by an enclosure, platform and earthen mound burial monument on the summit of a hill, located in a commanding position overlooking Morecambe Bay, aiming to understand the chronological development of the Site and understand the Site's archaeological and palaeoenvironmental conditions.

Fieldwork took place between the 4th and 17th July 2016 (Project Number: BLS 16). It was designed to define and characterise the physical extent of the site through a programme of non-intrusive investigations and intrusive excavation, obtaining baseline data that will facilitate its future management, increase awareness of the local historic landscape, build local skills capacity and assemble a committed group of advocates to help support the local heritage scene over the long term.

The results presented in this report comprise those of the third execution stage of the project, and have been circulated for peer review and consultation with the wider specialist team (Review Point 4). The potential of these results to achieve the Aims and Objectives of the project are discussed in the final section of this report, followed by an Updated Project Design (bound separately) detailing recommendations for further work, analysis and publication (Review Point 5).

Results summary

Three small-scale evaluation trenches were excavated over the course of two weeks across the Bronze Age burial monument at Bolton le Sands, located to address specific questions. All data has been recorded by community participants and DigVentures staff using a web accessible relational database. This can be explored by following the links throughout the report (and in Appendix 1). In addition, excavated features are also navigable through a series of nested 3D models, from the landscape level, down to individual trenches, features and small finds.

Trenches 1 and 2 comprised two hand dug trenches laid out in a north to south and east to west orientation. They intersected in a cruciform pattern and measured 2m x 35m (N-S) and 2m x 25m (E-W) respectively. Remains of a Bronze Age ring cairn enclosing the upper contour of the hill were exposed in the eastern, western and southern part of the trenches. The northern part of the cairn has potentially been damaged by later ploughing. Further features comprised



a post-medieval field boundary with well stratified post-medieval pottery in the overlying deposit in Trench 1, and in Trench 2 a Bronze Age pit filled with cobbles as well as an early modern backfilled clay pit.

Trench 3 was a hand dug trench measuring 4m x 4m and located to target the evaluation trench excavated by UCLAN in 2013. It was designed to further investigate the original deposition of the Treasure and to complete the excavation of a possible cremation burial. Excavation unearthed features such as the former UCLAN trench, a Bronze Age pit and a second pit with an inverted cremation urn that contained the remains of possibly one young male adult. Additional finds comprised abraded pot fragments, worked lithic material, burnt stone and cremated bone fragments.

The magnetometry survey revealed a long linear anomaly characteristic of a former field boundary, as well as two large amorphous and magnetically strong anomalies suggestive of quarrying or excavation. Additionally, several smaller scale ferrous anomalies were present throughout the data, which were probably modern. Low level aerial survey of the site was successful, with a completed UAV mounted photogrammetry survey that will produce a full metrically accurate 3D digital terrain model of the site to place the monument and interventions into a landscape context.

As the project moves into the fourth execution stage an Updated Project Design will be produced distilling these results into proposals for extending the trenches across the top of the mound at Bolton le Sands to investigate probable further cremation urns, and potential funerary activity. Additional fieldwork proposals include a landscape survey and targeted excavation of a second recently discovered hoard site at Scotforth. Building on the success of the 2016 field season's public engagement strategy, the Heritage Lottery Fund have been approached to support a 12-month activity plan alongside fieldwork proposals for 2017. This will include the creation of a pop-up museum at Lancaster City Museum designed to help revitalise interest and engagement with the heritage of the area.

Acknowledgements

Thanks to our project partner, Durham University, and in particular to Matthew Hepworth and David Kierzek, the metal detectorists who discovered the site in the first place. Also thanks to Stuart Noon, for introducing us to the site, to Christine Stebbing and the group of Morecambe Heritage Centre who supported us throughout the project, to Sue and Alan Tyldesley from Yealand Old School, to Joe and Barbara Whitaker, the landowners of the excavation site, to Andrew Brown of the Lancaster and District Heritage Group, to Jason Wood from Beyond the Castle, as well as to Peter Isle from Lancashire County Council.

The project was managed and directed for DigVentures by Brendon Wilkins and co-directed by Stuart Noon and Benjamin Roberts, with Lisa Westcott Wilkins in the role of Project Executive. The project field team included Raksha Dave, Maiya Pina-Dacier, Rosanna Ring, Nigel Steel, Anna van Nostrand. The geophysical survey was led by Jennifer Peacock using equipment kindly loaned from Durham Archaeological Services, and Duncan Hale of Durham Archaeological Services processed the geophysical results. Aerial photography and photogrammetry was managed by Adam Stanford from Aerial-Cam Ltd and Hugh Fiske. Post excavation analysis and reporting was undertaken by Johanna Ungemach, with Manda Forster, Brendon Wilkins, Stuart Noon and Benjamin Roberts. Specialist advice and assistance was also provided by Rosalind McKenna, Alex Whitlock, Neil Wilkin, and Sam Walsh.



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Table of contents

<u>1</u>	<u>INTRODUCTION AND SCOPE</u>	<u>11</u>
1.1	Project background	11
1.2	Project scope	11
1.3	Public impact	12
1.4	Site description	13
<u>2</u>	<u>ARCHAEOLOGICAL AND HISTORICAL BACKGROUND</u>	<u>14</u>
2.1	Introduction	14
2.2	Summary of previous work	17
<u>3</u>	<u>PROJECT AIMS AND OBJECTIVES.....</u>	<u>17</u>
3.1	Background.....	17
3.2	Aim 1: Define and establish the precise physical extent and condition of the Site with a programme of remote sensing and metric survey.	18
3.3	Aim 2: Understand the chronological development of the burial monument refining its chronology, phasing and character with three targeted trenches.	18
3.4	Aim 3: Understand the Site's archaeological and palaeoenvironmental conditions.....	18
3.5	Aim 4: Making recommendations, analysis and publication.	19
<u>4</u>	<u>METHODOLOGY.....</u>	<u>19</u>
4.1	Introduction	19
4.2	Remote sensing and metric survey.....	19
4.3	Excavation methodology	20
4.4	Health and safety	21
<u>5</u>	<u>REMOTE SENSING RESULTS</u>	<u>21</u>
5.1	Introduction	21
5.2	Methodology	21
5.3	Results	21
5.4	Conclusions.....	21
<u>6</u>	<u>EXCAVATION RESULTS.....</u>	<u>22</u>
6.1	Introduction	22
6.2	Stratigraphic sequence	22
6.3	The burial monument	22
6.4	Trench 1 (Figure 4) https://goo.gl/Q6MI22	23
6.5	Trench 2 (Figure 5) https://goo.gl/ab7QW0	23
6.6	Trench 3 (Figure 6) https://goo.gl/2og8rU	24
<u>7</u>	<u>THE FINDS</u>	<u>25</u>
7.1	Introduction	25
7.2	Assemblage summary	25
7.3	Recommendations	27
<u>8</u>	<u>LITHICS – CHIPPED AND WORKED STONE.....</u>	<u>28</u>

8.1	Introduction	28
8.2	Chronology, distribution and use	29
8.3	Recommendations	29
9	<u>URN ASSESSMENT.....</u>	<u>30</u>
9.1	Introduction	30
9.2	Methods	30
9.3	Excavating the urn	30
9.4	The burial urn	31
9.5	Recommendations	31
10	<u>HUMAN REMAINS</u>	<u>31</u>
10.1	Introduction	31
10.2	Results of analysis: cremated remains within urn (3015).....	31
10.3	Conclusion	33
10.4	Recommendations	33
11	<u>PALAEOENVIRONMENTAL RESULTS</u>	<u>34</u>
11.1	Introduction	34
11.2	Methods	34
11.3	Results	35
11.4	Conclusion	35
11.5	Recommendations and archive	36
12	<u>BOLTON LE SANDS: DISCUSSION.....</u>	<u>37</u>
12.1	Introduction	37
12.2	Project Aim 1	37
12.3	Project Aim 2	38
13	<u>CONCLUSIONS.....</u>	<u>39</u>
14	<u>BIBLIOGRAPHY.....</u>	<u>40</u>
15	<u>APPENDIX 1 – TRENCH AND CONTEXT DESCRIPTIONS.....</u>	<u>51</u>
17	<u>APPENDIX 2 – FINDS CATALOGUES</u>	<u>55</u>
19	<u>APPENDIX 3 – PALAEOENVIRONMENTAL DATA.....</u>	<u>78</u>
20	<u>APPENDIX 4 – ENVIRONMENTAL SAMPLE CATALOGUE</u>	<u>81</u>
21	<u>APPENDIX 5 – MEDIA AND EVENTS – AUDIENCE FIGURES.....</u>	<u>82</u>
22	<u>APPENDIX 6 – AERIAL SURVEY PROCESSING REPORT</u>	<u>83</u>

List of tables

Table 1	Assemblage summary for Bolton le Sands	27
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Table 2	Weight of bone from sieve fractions	32
Table 3	Spread of elements from different thirds of the urn (g)	33
Table 4	The coins	55
Table 5	Copper alloy and lead objects	56
Table 6	Iron objects	56
Table 7	Metal working debris	57
Table 8	Lithic assemblage, type and date	59
Table 9	Lithic assemblage, significant finds	60
Table 10	Lithic assemblage, distribution by context	62
Table 11	Flint and chert catalogue	62
Table 13	Stone – other worked stone, manuports and heat shattered stone	70
Table 14	Quartzite	71
Table 14	Glass fragments	72
Table 15	Prehistoric pottery	72
Table 16	Post medieval pottery	74
Table 17	Clay pipe	76
Table 18	Building materials – CBM and daub	77
Table 19	Plant Macrofossils - Complete list of taxa recovered	78
Table 20	Charcoal - Complete list of taxa recovered	78
Table 21	Components of the samples from excavations	79

List of figures

Figure 1	Barrowed Time, Site location: Main site at Bolton le Sands
Figure 2	Barrowed Time: Archaeological background of northwest Lancashire
Figure 3	Barrowed Time: Location of remote sensing with excavated trenches overlaid
Figure 4	Barrowed Time: Trench 1 excavation results
Figure 5	Barrowed Time: Trench 2 excavation results
Figure 6	Barrowed Time: Trench 3 excavation results
Figure 7	Barrowed Time: Landscape photogrammetry, main Site at Bolton le Sands
Figure 8	Distribution of small finds
Figure 9	Barrowed Time: Urn Assessment photostory
Figure 10	Aerial view of the burial monument at Bolton le Sands, looking south west across Morecambe bay
Figure 11	Aerial view of the burial monument at Bolton le Sands, looking north east towards the Yorkshire Dales and Howgill Fells
Figure 12	Aerial view of the burial monument at Bolton le Sands, under excavation by community volunteers

List of plates

Plate 4.1	Trench 1: Pre-excavation facing south, northern part of the trench
Plate 4.2	Trench 1: Mid-excavation facing south, post medieval field boundary F102
Plate 4.3	Trench 1: Mid-excavation facing northwest, southern part of Bronze Age ring cairn F101
Plate 4.4	Trench 1: Extension of the southern part of the trench, level with ring cairn
Plate 5.1	Trench 2: Pre-excavation facing east, western part of the trench
Plate 5.2	Trench 2: Mid-excavation facing north, western part of Bronze Age ring cairn F204



Plate 5.3	Trench 2: Mid-excavation facing east, cobbled filled pit F203
Plate 5.4	Trench 2: Mid-excavation facing northwest, Early Modern backfilled clay pit F201
Plate 8.1	Trench 6: Pre-excavation facing north
Plate 8.2	Trench 6: Mid-excavation facing north, sondage exposing limit of 2013 UCLAN evaluation trench F301
Plate 8.3	Trench 6: Mid-excavation facing north, urn F302 still in place
Plate 8.4	The cremation urn F302 mid-excavation
Plate 8.5	The cremation urn F302 mid-excavation
Plate 11.1	Landscape orthophoto
Plate 11.2	Landscape shaded orthophoto
Plate 11.3	Trenches orthophoto
Plate 11.4	Trenches shaded orthophoto
Plate 13.1	X-ray photo of urn revealing large density of bone (bone nest) and the possibility of two or more objects within the urn
Plate 13.2	Photo of Urn with clay cap (3014) as removed from site prior to excavation in the lab
Plate 13.3	Photo of layer immediately below clay capping featuring lens of material (3013) that was probably used to cover the cremated material to act as a barrier between the clay cap and bone
Plate 13.4	Inside the urn was a large density of bone (bone nest) with surrounding soil (3015) indicating the presence of multiple individuals.
Plate 13.5	Close up photo of two pot fragments inserted in the urn that appear to be of a different construction and walling to the urn, suggesting that they are from a secondary vessel
Plate 13.6	Photo of Late Neolithic to Early Bronze Age secondary grey flint heat effected damaged 'D' scraper 'thumbnail scraper' inserted in the urn. The scraper is heat affected on one face and not vitrified
Plate 13.7	The Early Bronze Age Food Vessel urn (c.2100-1900BC) recovered from Bolton le Sands and excavated stratigraphically in the lab as a separate feature F302
Plate 13.8	Close-up photo of urn fabric (3011), containing inclusions of very small grey/blue chert chippings and possibly small burnt pottery fragments (grog), extremely small shell and potentially cremated bone inclusions
Plate 13.9	Close-up photo of urn fabric (3011); the base contains a frequent concentration of mid greyish blue chert trituration grits that are in extreme density in the base with moderate and then occasional occurrence progressing up the body to the rim
Plate 13.10	Post-excavation photo of the urn; the vessel is narrow at the base and widens significantly to the top
Plate 13.11	Post-excavation photo of the urn; the thickness of the vessel's wall gradually thins as it progresses from the base to the top

1 INTRODUCTION AND SCOPE

1.1 Project background

- 1.1.1 This project was designed in response to the unexpected discovery of a Late Bronze Age bronze tanged chisel and knife blade by two local metal detectorists (Matthew Hepworth and David Kierzek) at Bolton le Sands (hereafter 'the Site' – Figure 1), lawfully reported to the Portable Antiquities Team (PAS) and subsequently declared Treasure under the provisions of the Treasure Act (1996; 2002 amendment covering prehistoric base-metal hoards – (PAS - Lancum-0788A0). The community and outreach aspects have been distilled into a separate activity plan (DigVentures 2015), falling under the auspices of 'Barrowed Time', an HLF supported digital archiving, education and outreach initiative.
- 1.1.2 In July/August 2013, immediately following the discovery, a small-scale archaeological assessment was undertaken by University of Central Lancashire (UCLAN) students in conjunction with the PAS, including a resistivity survey and a small trench towards the periphery of the site (Batey 2014). The results of the archaeological assessment were presented in an unpublished MA Dissertation (Batey 2014); this contains summary descriptions of the finds and no further post-excavation analysis was conducted by the UCLAN team.
- 1.1.3 PAS Finds Liaison Officer for Lancashire and Cumbria, Stuart Noon, introduced the Site to DigVentures, which was subsequently commissioned by the Heritage Lottery Fund (HLF) to undertake a crowdfunded community-based archaeological research project. Following consultation with HLF and Durham University, a project model was devised according to the MoRPHE framework (Management of Research Projects in the Historic Environment - 2006). This approach has been used to design a four-staged field research project for the year 2016, encompassing two weeks of fieldwork during July 2016 and completion of post excavation analysis and reporting by January 2017.
- 1.1.4 The information contained in this report provides an assessment of the results from the Site. The results presented include an evaluation of the recorded archaeology with reference to the original project aims, including specialist assessment of appropriate finds and environmental material. The report has been circulated for peer review and consultation with the wider specialist team (Review Point 4).

1.2 Project scope

- 1.2.1 The Bronze Age burial monument at Bolton le Sands lies approximately 0.5 miles from the west coast in Lancashire and was discovered in 2013 by metal detectorists. DigVentures submitted a successful grant application to the HLF in January 2016 and the first execution stage of the project was completed on 28 March 2016, comprising magnetometry survey of the find spot and area immediately adjacent (Figure 3). The overarching aim of the 2016 project was to define and characterise the physical extent of the site through a programme of non-intrusive investigations and intrusive excavation, obtaining baseline data that will facilitate its future management as detailed in the Project Design (Wilkins et al 2016, Section 2).
- 1.2.2 There is no overarching national research agenda or framework specific to Bronze Age funerary sites. An assessment of the wider regional research themes identified in the

regional research agenda *The Archaeology of North West England. An Archaeological Research Framework for the North West Region* (Brennand 2006) during the Project Design stage defined a number of questions warranting further archaeological research. These included, among others, investigating features and structures of the burial monument, as well as probable funerary activities and establishing chronological phasing for the Site. The trenches were designed to characterise specific topographic and geophysical anomalies (see Research Aims and Objectives below).

- 1.2.3 This report is one of a number of archive and dissemination products to have been generated by the project, including the digital archive, the paper archive and the artefact and environmental material recovered, recorded and processed. The project archive is currently held by DigVentures and will be prepared in accordance with standards and guidance for archaeological archives (ClfA 2014, Brown 2011). All project reports will be openly and freely distributed to Lancashire County Council Historic Environment Record, Archaeological Data Service, OASIS portal and the Project website. Copyright on all reports submitted will reside with DigVentures, although a third party in-perpetuity license will automatically be given for reproduction of the works by the originator, subject to agreement in writing with DigVentures.

1.3 Public impact

- 1.3.1 The project represents the first major excavation of an Early Bronze Age funerary monument in north Lancashire since 1982 (Oliver et al. 1987) – a rare opportunity to build a community around the first scientific excavation of this type of site for a generation. This is particularly significant in an area where there is little funding for heritage, evidenced by the closure of five museums in Lancashire during 2016 (see <http://council.lancashire.gov.uk/ieDecisionDetails.aspx?ID=9161> – and see Wilkins et al 2016, Section 6.2, for a description of strategy relating to public engagement, following Historic England SHAPE sub-programme numbers 12212.110; 51311.110 and 51332.110).
- 1.3.2 The Sites immediate communities (North Lancaster, Morecambe and Heysham) fall within the 25% most deprived areas in England, with much lower levels of educational achievement than the national average (source: Lancaster District Core Strategy). A key ambition of the project was therefore to engage non-traditional audiences in archaeology, stimulating surrounding communities to become more involved with and enthused about the stewardship of their local heritage. In showcasing such new and important finds (including both the archaeological materials recovered and the sites themselves), the project has engaged both local and global audiences, in order to ensure the future preservation and management of the Site.
- 1.3.3 At the same time, the location of the Site needed to be protected from illegal treasure hunting and the location of the burial monument itself remained secret to the general public. In order to maximise engagement away from the excavation, an off-site incident room was set up, providing a pop-up shop, welcome center and post-excavation lab at the Morecambe Heritage Center. This central position in the town allowed more people to see and experience the archaeology, and learn about the sites. The pop-up shop was open to the public throughout the excavation, with three members of DigVentures staff on hand to answer questions about the project. Activities included live-streamed digital content from the excavation; a temporary exhibition containing artefacts from the hoard; and primary school education sessions



with five local schools involving a total of 337 students. Visitor numbers to the pop-up-shop averaged 50 people daily on week days, and 70-80 people each day during weekends totalling approximately 700 people.

- 1.3.4 To further expand audience reach into the digital realm, a dedicated project microsite hosted on the DigVentures website was developed (<https://goo.gl/B1qcRR>). It includes all related site records, documentation and artefacts, and utilises the Digital Dig Team recording system which facilitates the presentation and archive of data relating to the archaeological excavation and the recording of previously recovered artefacts. Additionally, all community and social engagement aspects of the project directed through DigVentures' various social media channels were promoted through the microsite and are available to view on the project timeline (<https://goo.gl/ITalQn>).
- 1.3.5 Daily updates were published throughout the excavation on several social channels including Facebook, Instagram and Twitter, with the live tweets during the project reaching an audience of 286,000. Video broadcasts from site had a total reach of 110,000 people; presented by dig volunteers as well as seasoned professionals, the most popular video update (describing the joy of finding the Bronze Age layer) received 4000 views (<https://goo.gl/I1BxKq>). Additionally, a graphic artist created a site diary in the form of daily comics adding variety to the media posts and providing a new type of media for people to engage with (<https://goo.gl/QORr5n>). The comics averaged 130 post clicks each, with an absolute reach of 2,200 people. Press coverage was extensive throughout the project, with articles featured in the Observer and the Times, and broadcasts by BBC News and BBC North West Tonight, reaching an audience of several million people (for a complete list of media and events, see Appendix 5).
- 1.3.6 The project was funded 77% with a grant from the HLF and 23% with public crowdfunded contributions, with the professional excavation team assisted throughout by crowdsourced voluntary public participation (Figure 12). The project's crowdfunding community comprised 138 individuals from six countries, including 71 on-site participants and 67 online supporters. Participants included local residents, visitors from across the UK and international people, of all ages, walks of life, and different levels of archaeological experience and knowledge. Details of all of the contributors to the campaign and their reasons for supporting the project can be found on the microsite's team page (<https://goo.gl/5ZeKpH>).
- 1.3.7 Following fieldwork, engagement with the online audience was maintained by posting post-excavation specialist reports in an accessible form (<https://goo.gl/mkJjnG>). Furthermore, the micro-excavation of the Bronze Age urn (see Section 9) was live broadcast on Facebook with seven separate videos documenting the process (<https://goo.gl/RO3nrN>). The live videos allowed people to interact in real-time, asking questions to the experts and receiving replies in real time. The post-excavation videos reached a total of 47,500 viewers, 1838 reactions, comments and shares and 5287 post clicks.
- 1.4 **Site description**
 - 1.4.1 Bolton le Sands (NGR SD4828567877) is a small town located some 5km (3 miles) north of Lancaster, along the A6. The town borders the extensive sands of Morecambe



Bay, and the parish takes in a large area of coastal salt marsh (LCC 2000, 5). Bolton le Sands sits above an area of marine alluvium on top of loam and boulder clay of glacial origin. It is surrounded by hills composed of sandstone, gritstone and carboniferous limestone, and so is close to sources of good building stone (LCC, 13). The landscape character is defined as Low Coastal Drumlins around 40m high (LCC 2000, 78), where the last retreating Ice sheets left a series of rounded boulder clay hills in their paths (LCC 2000, 79). The hills, which have broad rounded tops and frequently steep sides, were created as a result of erosional and depositional processes of the glacial ice sheets moving through the area. Outwash sands and gravels, or boulder clays were moulded to form oval whaleback hills. These are isolated and generally more subdued than drumlins of the Drumlin Field landscape type. The alignment of the Low Coastal Drumlins gives a distinctive grain to the landscape and provides important evidence of the movement of the glacial ice sheets in the quaternary period.

- 1.4.2 Whilst it is likely that these drumlins have been farmed and settled since the earliest period, medieval and later ploughing appears to have destroyed much of the physical evidence. The agriculture of the area is primarily pasture with a predominance of dairy farming. The Low Coastal Drumlins have proved attractive sites through which to locate communication routes such as Roman roads, canals, railways and modern main roads. These weave between the higher drumlins and link large villages to the main urban areas (LCC 2000, 78).
- 1.4.3 A small field located near the town is a hill that was the location of the archaeological excavation following on from the discovery of a treasure hoard consisting of a tanged chisel, knife blade and metal working waste. The prehistoric burial monument at Bolton le Sands appears to have been in use for a great deal of time. The lifecycle of this monument appears to have begun in the Mesolithic/Neolithic period and is likely to have ended around the Early Iron Age. The material culture from the site suggests that it was revisited and reused throughout this expansive time period. The site at Bolton le Sands is privately owned by John and Barbara Whitaker, and defined by an enclosure and a platform and earthen mound on the summit of a hill, located in a commanding position overlooking Morecambe bay, approximately 0.5 miles east of the coast (GR: 54.102504, -2.778825) (Figure 10 and 11).

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

2.1 Introduction

- 2.1.1 Early Bronze Age funerary architecture in Lancashire/Cumbria can encompass barrows, cairns, ring cairns, flat cairns, ring works, stone circles and timber circles in addition to multiple phases of construction (cf. Hodgson and Brennand 2006; Quatermaine and Leech 2012; see Figure 2 for the location of Bronze Age sites in northwest Lancashire, described in this section in numerical order). On the basis of visible landscape features, the site at Bolton le Sands has been assigned a generalised terminology of 'burial monument', though this classification will be refined as the project recovers increasing characterisation evidence. Few Early Bronze Age funerary sites have been excavated, analysed and published to modern standards, and those that have been excavated frequently demonstrate multiple phases of architectural and funerary activity spanning the Neolithic-Bronze Age periods. A further complication with local typology is that many sites have suffered damage due to modern industry

and agriculture (cf. Annable 1987; Middleton 1996; Barrowclough 2007, 95f; Barrowclough 2008; Evans 2008, 100f), making any initial system of classification necessarily provisional.

- 2.1.2 The last Early Bronze Age funerary monument to be excavated in north Lancashire took place in 1982 (the rescue excavation of a damaged Early Bronze Age cairn at Manor Farm, Borwick in advance of gravel extraction (Oliver et al. 1987; see Figure 2, Site 1). Early Bronze Age funerary structures have been (hastily) excavated by antiquarians in Lancashire and south Cumbria since 1778 with the excavation of a barrow on 'Barrow Hill' near Yealand Conyers (see Figure 2, Site 2). Whilst many have been intrusively investigated since then, very few sites have been systematically excavated, scientifically analysed and fully published. These sites are: Manor Farm, Borwick, Lancashire (excavated 1982, full report - Oliver 1987); Ewanrigg, Maryport, Cumbria (excavated 1982-6, full report - Bewley et. al. 1992; see Figure 2, Site 3), Hardendale Nab, Shap, Cumbria (excavated in 1986, full report - Howard-Davis and Williams 2005; see Figure 2, Site 4), Oddendale Nab, Shap, Cumbria (excavated 1990, full report – Turnbull and Walsh 1997) and Allithwaite, Cumbria (excavated in 2001, full report Wild 2003; see Figure 2, Site 5). Although an unurned cremation dating to the Early Bronze Age was found in recent excavations at Dallam School, Milnthorpe, Cumbria, there was no evidence for an associated funerary structure (excavated in 2005, full report - Platell 2013; see Figure 2, Site 6). To the south, in central Lancashire, a possible Bronze Age cairn was excavated at Jepson's Gate as part of the Anglezarke uplands Survey (excavated 1983, full report - Howard-Davis 1996).
- 2.1.3 It is far more typical that Early Bronze Age funerary structures were excavated fairly badly by local antiquarians in the 19th—early 20th century and frequently re-analysed and re-dated in recent decades. These include: Bleasdale timber circle (Varley 1938; see Figure 2, Site 7), Hades Hill (Sutcliffe 1898-1900; see Figure 3, Site 8) and Sizergh Fell (excavated 1903, interim - Hughes 1904a; 1904b; reassessment - Fell 1953; re-excavated 2002-5; published Edmonds and Evans 2007; see Figure 2, Site 9).
- 2.1.4 There are subsequently much more systematic excavations by local archaeologists and community groups in the mid-late 20th century but have invariably yet to be fully analysed or published. There are exceptions, especially in central and south Lancashire. The sites include Winter Hill cairn (excavated 1958, full report Bu'lock et al 1960; see Figure 2, Site 10), Levens Park (excavated 1968-71, interim - Sturdy 1973; Turnbull and Walsh 1996; see Figure 2, Site 11), Whitelow cairn, Ramsbottom (excavated 1960-2, interim - Tyson 1994; see Figure 2, Site 12), Wind Hill cairn (interim Tyson 1980), Shaw cairn (excavated 1976-1988, interim - Mellor 2000), Noon Hill (excavated 1958 and 1963-4 – 4 - interim - Booth 1963; see Figure 2, Site 13), Pendleton (excavated 1972, summary - Barrowclough 2014; see Figure 2, Site 14) and Moseley Height (Bennett 1951; currently being re-investigated by UCLAN with excavations in 2009-10 – in prep – Rick Peterson pers. comm). Although beyond the political boundaries of northwest England, the recent, extensive publication of the excavations from 1932-50 at Hare Hill ring cairn are of particular importance (Boughey 2015).
- 2.1.5 The Northwest Wetland surveys of south Cumbria (Hodgkinson et al. 2000) and north Lancashire (Middleton et al. 1995) provide the closest analysed environmental sequences to the Bolton le Sands monument that encompass the Early Bronze Age. Together they represent an invaluable context for understanding Early Bronze Age

landscape activity. An HLF funded community survey and excavation project on Brackenber Moor, Cumbria, which included the investigation of Early Bronze Age cremations, is also relevant (interim unpublished reports - Railton 2011; Slater and Railton 2013). The palaeogeographical analysis of sea level change in Morecambe Bay throughout the Holocene (Zong 1993) and the analysis of palaeoenvironmental influences on human activity in the Furness Peninsula, south Cumbria during the Neolithic-Bronze Age (Appleby 2013) both further enhance the understanding of the environmental context.

- 2.1.6 The excavated Early Bronze Age funerary sites in Lancashire have yet to be (re-) dated or reassessed on the scale of those in Northumberland (eg Fowler 2013), Yorkshire (see Manby et al 2003; Boughey 2015), Derbyshire (eg Barnatt 1990; Barnatt 1994; Barnatt and Collis 1996), Dumfries and Galloway (Yates 1984) or even mainland Scotland (eg Sheridan 2007a; 2007b). The Early Bronze Age funerary sites in Cumbria have been far more intensively surveyed (see Hoaen and Loney 2007; Evans 2005; Evans 2008; Sharpe 2007; Barrowclough 2010a; Quartermaine and Leech 2012) and more frequently excavated, extensively analysed and fully published to modern standards as at Ewanrigg (Bewley et al 1992), Hardendale Nab (Howard-Davis and Williams 2005), Oddendale Nab (Turnbull and Walsh 1997) and Allithwaite (Wild 2003). The relative lack of well excavated, radiocarbon dated and fully published Early Bronze Age sites in Lancashire is also highlighted by two recent surveys of Early Bronze Age human remains (Walsh 2013) and Food Vessels (Wilkin 2014) in northern England.
- 2.1.7 Beyond the exemplary publication of the rescue excavation of the cairn at Manor Farm, Borwick (Oliver 1987) and the earlier excavation and full publication of the cairn at Winter Hill (Bu'lock et al. 1960), amongst several interim reports at other sites (see 2.1.2) Early Bronze Age funerary activity in Lancashire remains poorly understood – as has been noted in recent county-wide assessments (Middleton 1996; Barrowclough 2007; 2008). Within northwest England, this is most comparable to the current state of knowledge and understanding in Cheshire, where beyond notable exceptions such as Church Lawton on the Cheshire/Staffordshire border (Reid et al. 2014) and to a lesser extent Gallowsclough Hill, Delamere Forest (Forde-Johnstone 1960), Winwick (Freke and Holgate 1990) and Woodhouse End, Gawsworth (Rowley 1977), few Early Bronze Age funerary sites are well understood (Mullin 2003; 2007).
- 2.1.8 The available radiocarbon dates for Early Bronze Age Lancashire have been enhanced by several new dates from research projects led by David Barrowclough (see Barrowclough 2007; 2008; 2010b; Walsh 2013). The old and new radiocarbon dates have enabled a basic chronological framework but one that is in definite need of further refinement. This is especially pertinent given the complexities of Early Bronze Age funerary construction sequences and re-use as recently highlighted using Bayesian modelling at Over, Cambridgeshire (Garrow et al. 2014) and the re-use of earlier objects in later funerary deposits as at Pendleton, Lancashire (Barrowclough 2014).
- 2.1.9 Many of the key artefacts and types found in Early Bronze Age funerary structures in Lancashire are subject to recent re-analyses as part of regional and national projects. These include ceramic vessels such as Food Vessels (Wilkin 2014) and Collared Urns (Longworth 1984; Barrowclough 2010b); bronze and flint daggers (Frieman 2014; Needham in Hunter and Woodward 2015); and jet beads and necklaces (Sheridan and Davis 1998; 2002; Sheridan in Hunter and Woodward 2015).

2.1.10 The accessible and surviving human bones from excavated Early Bronze Age sites in Lancashire have also been recently re-assessed (Walsh 2013). In addition, a synthesis of cremated human remains dating to the Middle Bronze Age in Britain has been accepted for publication (Caswell and Roberts forthcoming). Current understanding of the treatment of the dead in prehistory, and in particular the construction, dating, organisation and location of funerary structures during the Early Bronze Age (c. 2200-1600 BC) remains poor, especially relative to neighbouring regions. There are very few well-excavated, scientifically analysed and fully published sites. The diversity of funerary practices evidenced in all excavations, from antiquarian to the present day, indicates a rich archaeological record.

2.2 Summary of previous work

2.2.1 An evaluation and geophysical survey was undertaken by the University of Central Lancashire in partnership with the PAS between the 29th July and 2nd August 2013 (Batey 2014). The evaluation was centred on the summit of the hill incorporating the original treasure findspot of a tanged chisel, knife blade and metal working waste. A trench (6m x 2m) was excavated and a silty clay topsoil layer (context A1) revealed two fragments of jet, and fragments of chert and flint. The sub-soil layer (A2) again of silty clay revealed numerous small pieces of worked burnt flint, one in particular (031) appeared to be the remains of a flint scraper, probably dating to the Early Bronze Age.

2.2.2 A trench extension was then opened (2.5m x 2.5m) to incorporate new readings from metal detectors in the main trench in the south-east corner. Due to time limitations, it was deemed more suitable to open two sondages, the first of which was at the base of the south facing section wall in the main trench. It was rectangular in shape, measuring 0.45m x 0.45m, and revealing a copper-alloy ring likely to be a part of a Bronze Age horse harness. The second sondage (also 0.45m x 0.45m) was opened in the trench extension and uncovered a copper-alloy fragment of a Late Bronze Age razor.

2.2.3 Further excavation of the main trench uncovered a feature [A3] that ran almost the entire length of the northern section of the trench (4m east to west). It measured 0.3m wide from the edge of the south facing section wall and was oval in shape. At the eastern edge of this feature a cluster of flat stones was identified that appeared to be deliberately arranged in a circular pattern. The deposit of sandy/silty clay (A4) within the circular arrangement of stones was visibly different in colour and composition to that of the rest of the trench. The slope-top of the cut [A3] was at a depth of 0.2m below ground surface, with the base of the feature recorded at a depth of 0.4m. The feature was excavated with care so as not to disturb or remove the flat stones which uncovered burnt remains including deposits of charcoal, burnt wood and a substantial deposit of cremated bone.

3 PROJECT AIMS AND OBJECTIVES

3.1 Background

3.1.1 The following is based on the project aims detailed in the Borrowed Time Project Design for a Community Archaeology Project (Wilkins et al 2016, Section 2), designed to address the evaluation and assessment stage of the project (third execution stage).



The project has been designed in accordance with priorities articulated in Historic England's Action Plan 2015-18 (informing Heritage 2020, the successor to the National Heritage Protection Plan) and detailing how heritage organisations will work together to benefit the historic environment. The business case for this work has been designed in accordance with the fundamental principles of SHAPE (Strategic framework for the Historic Environment: Activities and Programmes in English Heritage, 2008).

- 3.1.2 The overarching aim of the project was to define and characterise the physical extent of the site through a programme of non-intrusive investigations and intrusive excavation, obtaining baseline data that will facilitate its future management.

- 3.2 **Aim 1:** Define and establish the precise physical extent and condition of the Site with a programme of remote sensing and metric survey.

Q1: Can the layout of the burial monument and any associated subsurface archaeology be determined and refined by remote survey?

Q2: What are the topographic anomalies visible in top of the burial monument, and is this evidence for anthropogenic activity?

Q3: Can we identify any phasing in the topographic or remote sensing anomalies indicative of an extended period of use?

- 3.3 **Aim 2:** Understand the chronological development of the burial monument refining its chronology, phasing and character with three targeted trenches.

Q4: Can we corroborate chronological phasing for the Site, including the presence of earlier and later features and structures, as defined in Aim1?

Q5: What are the typical and atypical features of the burial monument and did this influence the functions and activities that took place?

Q6: What is the landscape setting and character surrounding the burial monument, and how did this shape its location, design and development?

- 3.4 **Aim 3:** Understand the Site's archaeological and palaeoenvironmental conditions

Q7: What is the current state of the archaeological and palaeoenvironmental material across the site?

Q8: How well do deposits and artefacts survive, and how deeply are they buried?

Q9: Can the palaeoenvironmental data recovered from sampling in the trenches inform us about burial or broader settlement activities that may have taken place at or near to the site?

Q10: What is the range and spatial patterning of artefacts recovered from the burial monument, and can this inform our understanding of the use of the upland Pennine landscape and utilisation of wider resources?

Q11: Can we increase our understanding of the local environment in the Bronze Age period in terms of the environmental manipulation and differential exploitation of natural resources?

3.5 **Aim 4: Making recommendations, analysis and publication.**

Q12: What can an integrated synthesis of the results of this work with previous interventions tell us about the Site and it's setting?

Q13: What recommendations can be made to protect, conserve and enhance the heritage asset, in the light of the issues and opportunities identified under Aims 1 - 3?

4 **METHODOLOGY**

4.1 **Introduction**

4.1.1 The archaeological fieldwork was carried out in accordance with the methodology defined in the *Barrowed Time Project Design for a Community Archaeology Project* (Wilkins et al 2015, Section 10). All work was undertaken in conjunction with best practice, national guidelines and published standards (ibid). Methodological summaries are presented below, following detailed descriptions in the Project Design linking specific techniques to aims and objectives (ibid, Section 10).

4.2 **Remote sensing and metric survey**

4.2.1 Remote sensing work (taking place on 28 March 2016) was designed to address the research questions associated with Aim 1 (Wilkins 2016, Appendix 2). This entailed a combination of non-intrusive geophysical survey (magnetometry) with a low-level aerial survey to determine likely features for targeted trenching.

4.2.2 Geophysical survey (magnetometer) was completed on the burial monument at Bolton le Sands with survey grids geo-referenced relative to the Ordnance Survey National Grid using a Trimble Geo XR GPS. This was used to collect reference points within the survey area, as well as local detail, and subsequently corrected to the Bolton le Sands site plan. The magnetic survey was carried out using a Bartington Grad 601-2 dual magnetic gradiometer. Geoplot 3 (Geoscan Research) software was used to process and present the data.

4.2.3 A UAV mounted photographic survey was undertaken on the landscape surrounding the burial monument at Bolton le Sands, producing a metrically accurate 3D digital surface model (DSM, see Appendix 6 for processing information). The resulting DSM is intended to provide an accurate and versatile record of the form and condition of the earthwork feature and as such to provide a baseline dataset for comparison with future surveys to place the burial monument and interventions into a landscape context to facilitate more detailed invasive and non-invasive work at the Site (Figure 7).



4.3 Excavation methodology

- 4.3.1 Excavation took place over the course of a first field season (4th to 17th July 2016) addressing the research questions associated with Aims 1 and 2. This entailed a programme of targeted interventions designed to ground-truth the results of remote sensing and metric survey, identifying and investigating any archaeological features encountered, and obtaining appropriate samples for archaeological, artefactual and palaeoenvironmental assessment.
- 4.3.2 During 2016, the burial monument at Bolton le Sands was investigated with three hand dug trenches (T1, T2 and T3), measuring 35m x 2m, 25m x 2m and 4m x 4m. All trenches were marked out on the ground using a dGPS prior to the commencement of work, and initially scanned for surface finds with a metal detector prior to excavation. Excavation trenches were located across the top of the burial monument which is situated on a prominent hilltop. They were positioned to assess the character of the burial monument and any associated archaeology, as well as to assess, characterise and date a probable modern linear feature to the north of the burial monument and to further investigate the original deposition of a previously discovered treasure find spot.
- 4.3.3 Trenches were subsequently hand-cleaned, planned and photographed prior to hand-excavation. Any archaeological features and deposits exposed in the evaluation trenches were hand cleaned and excavated to determine their nature, character and date. Carefully chosen cross-sections were then excavated through features to enable sufficient information about form, development, date and stratigraphic relationships to be recorded. All excavated features were 100% dry-sieved for artefacts using a 5mm gauge, and/or wet-sieved and processed using a standard archaeological floatation device.
- 4.3.4 A complete drawn record of the evaluation trenches comprises both plans and sections, drawn to appropriate scales and annotated with coordinates and AOD heights. A single context recording system was used to record the deposits, and a full list of all records is presented in Appendix 1. Layers and fills are recorded with curved brackets (001), whilst the cut of the feature is shown [001]. Each context is prefixed with the relevant Trench number (ie Trench 1, 1001+, Trench 2, 2001+). Features have been specified in a similar manner, pre-fixed with the letter F (ie Trench 1, F101+, Trench 2, F201+).
- 4.3.5 All interventions were surveyed using a dGPS tied into the Ordnance Survey grid. During 2016 all recording was undertaken using the DigVentures Digital Dig Team recording system. Digital Dig Team is DigVentures' bespoke, cloud-based, open data recording platform, designed to enable researchers to publish data directly from the field using any web-enabled device (such as a smartphone or tablet) into a live relational database. Once recorded, the born-digital archive is instantly accessible via open-access on a dedicated website, and published to social profiles of all project participants (community, professional and specialist). Links to all individual trench, feature and context records are provided in Appendix 1, from where all associated finds, samples, plans, sections, photographic records and 3D models can also be explored.

4.4 Health and safety

- 4.4.1 All work was carried out in accordance with its company Health and Safety Policy, to standards defined in The Health and Safety at Work etc. Act 1974, and The Management of Health and Safety Regulations 1992, and in accordance with the SCAUM (Standing Conference of Archaeological Unit Managers) health and safety manual Health and Safety in Field Archaeology (1996), and DigVentures Health and Safety Policy.

5 REMOTE SENSING RESULTS

By Brendon Wilkins, Jennifer Peacock and Duncan Hale

5.1 Introduction

- 5.1.1 This section presents the results of a geophysical survey at the Site undertaken by the project team, led by Jennifer Peacock, using equipment kindly loaned from Durham Archaeological Services. Duncan Hale of Durham Archaeological Services processed the geophysical results. The principle purpose of the work was to 'define and establish the precise physical extent and condition of the Site' (Aim 1) with each survey area designed to address a specific research objective (see Section 3.2 and 4.1.1 and 4.1.2 above). Figure 3 shows the overall location of each targeted area.

5.2 Methodology

- 5.2.1 All survey work was carried out in accordance with the current Historic England guidelines (HE 2008) and following the method outlined in Section 4.2 above. The magnetic survey equipment used was a Bartington Grad-601 (fluxgate magnetometer). When interpreting the results several factors were taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies were categorised by their potential origin. A physical and digital archive is stored in a suitable format at DigVentures office, and will be accessioned with the project archive.

5.3 Results

- 5.3.1 A long, linear anomaly which transects the northern part of the site is of a form and magnetic response characteristic of a former field boundary. Two large, amorphous and magnetically-strong anomalies, visually suggestive of previous excavation, were detected in the middle of the survey area. The ferrous response on the southern edge of the survey area is caused by a post and wire fence. Several smaller scale ferrous anomalies are present throughout the data; these are characteristic of small pieces of ferrous debris in the topsoil and are often modern.

5.4 Conclusions

- 5.4.1 It was not possible to precisely define the physical extent of the burial monument in the results of the magnetometry survey (see Aim 1). However, given the presence of upstanding remains and the use of complementary remote techniques (such as low-level aerial survey), this was not viewed as problematic in determining the location of the proposed trenches. A cruciform trench pattern was determined on the basis of



remote sensing results (Trench 1 and 2) with anomalies suggestive of former excavation used to position Trench 3 above former UCLAN trench and find spot.

6 EXCAVATION RESULTS

By Johanna Ungemach, Stuart Noon and Brendon Wilkins

All digital context and feature records have been archived on the Digital Dig Team system and can be reviewed here: <https://goo.gl/xJiMwP>

6.1 Introduction

- 6.1.1 During 2016, three small-scale evaluation trenches were investigated. The Project Design planned for the excavation of three trenches across the burial monument at Bolton le Sands (Trench 1—3, Figure 3). The principle purpose of the excavation was primarily to understand the chronological development of the Site (see Aim 2, above) and to understand the Site's archaeological and palaeoenvironmental conditions (Aim 3). Each trench was located to address a specific research objective, and these are discussed with the excavation results below. Figure 1 shows the overall location of the targeted area, and Figures 4-6 provide illustration of individual trenches containing archaeological features. Detailed descriptions of each and every context are included in Appendix 1, organised by trench number.

6.2 Stratigraphic sequence

- 6.2.1 A common stratigraphic sequence was recognised across the site. All three trenches comprised firm mid brown silty sand (1001, 2001, 3001) overlying sandy clay subsoil of the same colour and compaction (1002, 2002, 3002). Lithic tools, cremated bone and Prehistoric pot sherds were identified immediately below the subsoil, potentially representing a relict landscape surface dating from the Late Neolithic to the Early Bronze Age. This is supported by the fact that the large stones covering the inverted Food Vessel urn (3011) was already visible in the subsoil. The glacial till natural (1007, 1008, 2006, 3012) was a hard mid reddish brown sandy clay, with occasional inclusions of small sub-rounded pebbles. The stratigraphic sequence fluctuated in depth across the site predominantly due to natural height variation with the underlying sloping topography.

6.3 The burial monument

- 6.3.1 Three trenches (Trench 1, 2 and 3) were located across the top of the burial monument, which is situated on a prominent hilltop. Trenches 1 and 2 were laid out to cross the mound in a north to south and east to west orientation. They were located over the metal detector find spot and geophysical anomaly, and intersected in a cruciform pattern. Trench 1 was positioned to assess, characterise and date the mound, and to investigate a probable modern linear feature to the north of the burial monument. The initial purpose of Trench 2 was to assess the character of the burial monument and any associated archaeology and Trench 3 was positioned over a large geophysical anomaly, and also coincided with the evaluation trench previously excavated by UCLAN, which had investigated the original Treasure find spot. This facilitated the further investigation of the original deposition of the Treasure and complete

excavation of a possible cremation burial, which included worked lithic material, jet and cremated bone.

- 6.3.2 Several distinct phases of Bronze Age activity were determined at Bolton le Sands, commencing with the construction and use of a burial monument and closing with the deposition of hoard material around 1500 years later. This sequence of activity is outlined further below as it pertains to each individual trench.

6.4 Trench 1 (Figure 4) <https://goo.gl/Q6MI22>

- 6.4.1 Trench 1 was hand dug with a north—south orientation and measured initially 35m x 2m with a later extension of 2m x 3m to the east in the southern end of the trench. It was excavated down to a hard mid reddish brown sandy clay natural (1008) with 15% small sub angular stone inclusions. A small variation in compaction and inclusions was observed in the natural (1007) in the 2m² area where Trench 1 intersected with Trench 2.

- 6.4.2 Once the topsoil and subsoil had been removed, the remnants of a ring cairn F101 enclosing the upper contour of the hill, were visible in the southern part of the trench (Plate 6.3). The ring cairn was constructed on a base of buried soil (1009) that was only visible beneath the southern part of the structure. The comparatively high amount of stone in this area can be explained by the slumping topography, with material having accumulated towards the lower end of the feature. In order to investigate the structure of the ring cairn further, the trench was extended by a further 2m x 3m to the east (Plate 6.4). The extension picked up a curving return joining up with a similar deposit in the east of Trench 2. A sondage was excavated in the northern part of Trench 1 in order to locate the northern part of the cairn. Unfortunately, this could not be located, and may have been damaged by later ploughing.

- 6.4.3 The linear geophysical anomaly situated in the north of the trench was identified as a post-medieval field boundary F102 with well-stratified post-medieval pottery found in the deposit (1003) overlying the bank (Plate 6.2). It proceeded beyond the limits of excavation towards the temporary car park in the north east of the site.

6.5 Trench 2 (Figure 5) <https://goo.gl/ab7QW0>

- 6.5.1 Trench 2 was hand dug with an east—west orientation, measuring 25m x 2m, and was excavated down to the natural (2006). Underlying the subsoil (2002) and interfacing with natural (2006), a layer (2003) was recorded in the western part of the trench. Apart from five flint and chert artefacts (Section 9), no diagnostic material was recovered. Therefore, the nature of the layer remains undetermined.

- 6.5.2 Following identification of the ring cairn F101 in the south of Trench 1, two sondages were excavated in the east and west of the trench to investigate the potential continuation of the feature into this area. Parts of the cairn were found on both sides: the eastern part F202 and the western part F204. The latter was sat on an upcast bank (2009) and a cut [2008], dug to assist the construction of the bank (2009), was visible in section (Plate 7.2). A cobble filled pit F203 was recorded in the west of the trench, probably dating to the Bronze Age. The pit, which was defined by a sub-circular cut [2004] into the deposit (2003), was filled with cobbles (2007) and soft mid reddish

brown silty clay (2005), and was interpreted as being packing for a probable large posthole F203 (Plate 7.3).

- 6.5.3 In the eastern end of the trench, a visible geophysical anomaly was identified on historic mapping as a backfilled clay extraction pit F201 (Plate 7.4). Similar to the extant clay pit immediately to the south of the Site, the pit was assigned to the early Modern period, and was not related to any prehistoric activity identified on site.

6.6 Trench 3 (Figure 6) <https://goo.gl/2og8rU>

- 6.6.1 Trench 3 was hand dug with dimensions of 4m x 4m, situated slightly downslope to the south of the mound to target a geophysical anomaly in the area of the former UCLAN trench and metal detector finds. Overlying the natural (3012), firm light reddish brown silty sand (3004) represented an Early Bronze Age floor surface covering the entirety of the trench dimensions. Its firm compaction, as well as inclusions of abraded pot fragments, worked lithic material and cremated fragments, indicate that it was exposed for a significant period. A third of the area was covered by the deposition of cremation interment in the mound F303. It comprised a lens of mid reddish brown sandy silt (3003) with inclusions of moderately occurring small sub-angular and sub-rounded stones, a Bronze Age pot fragment, worked lithic tools and burnt stone fragments.
- 6.6.2 The Bronze Age layer (3004) was cut by a Bronze Age pit F304 comprising a circular cut [3007] with shallow sides and a gradual break of slope to the concave base that was heat affected and exhibited charcoal staining. It was originally dug from a south—east direction and filled with a loose mid reddish brown sandy clay (3008), with inclusions of large sub-rounded stones, frequent charcoal, medium and small sub-angular heat affected fractured stones and heat affected clay. The charcoal and heat affected clay were concentrated at the base, the large-sub-angular stones, on the other hand, appear to have been delineating a circular structure with the heat affected sub-angular stones used as packing.
- 6.6.3 A second pit feature F302 cut into the Bronze Age layer (3004) defined by a circular cut [3005] with rounded corners, steep sides and a sharp break of slope to the base. This was the most significant feature in the trench, containing an inverted cremation urn (3011) (Plate 6.3 and 6.5; Figure 9). The cut [3005] was filled with a soft light greyish brown silty clay (3006) with moderate sub-rounded stone used as packing material from the surrounding surface soil (3004) and mixed with natural clay for the purpose of keeping the urn upright. The urn base projected approximately 0.04m - 0.06m above the top of the pit, with a deliberately placed stone cap (3014) along with two large stones placed in a protective arrangement (Plate 8.4). The urn was lifted as a whole and subsequently wrapped in gauze and cling film to ensure its integrity (Plate 13.2). It was then x-rayed and excavated under controlled conditions at the Lancashire Conservation Studios (Section 9).
- 6.6.4 The edge of the UCLAN evaluation trench was located in the north west corner of the trench. The previous excavation revealed a finds rich feature, likely to be a cremation pit. Re-excavation of the trench revealed a natural tree throw under the corner of the previous trench F301 (Plate 8.2). It consisted of a shallow sub-angular cut [3009] into the Bronze Age layer (3004), with rounded corners, steep sides, a sharp slope and flat base. The fill comprised a loose mottled reddish brown sandy clay (3010), is likely to

have been decayed root material mixing with the surrounding surface soil (3004). The angular nature of the cut [3009] suggests that it was a natural tree throw underneath the re-deposited material from the UCLAN trench. The probable cremation pit was originally at the north east end of the UCLAN trench and therefore located beyond the extent of the current excavation trench.

7 THE FINDS

By Manda Forster

All digital records relating to small finds from the Site can be reviewed on the Digital Dig Team system here: <https://goo.gl/oTjw3d>

7.1 Introduction

- 7.1.1 The finds assemblage recovered includes a range of materials reflecting the use and chronology of the sites at Bolton le Sands. The artefactual record provides an additional means to understand how the site has developed over time (Aim 2, Q4), as well highlighting the nature of preservation and survival of different materials at the site (Aim 3, Q7 and Q8) and, through detailed recording and analysis, understanding of the use of the upland Pennine landscape and utilisation of wider resources (Aim 3, Q11). The location of all small finds were geographically recorded onsite locations of finds (see Figure 8), providing data with which to understand the use of space and help areas of key activities or significance (Aim 3, Q10).
- 7.1.2 Assessment of the full assemblage has been undertaken, including specialist analysis of priority materials (the burial urn and cremation, lithics and palaeoenvironmental material, see below), and recommendations provided will inform future research strategy and publication (Aim 4).

7.2 Assemblage summary

- 7.2.1 The largest material group within the assemblage by weight are the ceramics (see Table 7.1) from which the greater proportion (post medieval pottery and clay pipe) relate to later activity on and around the site. Whilst these finds (and other post medieval material) are not going to inform our understanding of the Bronze Age burial monument *per se*, the later finds do provide some indication of the later land-use and activities at the site, as well as a sound chronological indicator. More significant to research aims and objectives is the recovery of a complete burial urn with cremated human remains, as well as a number of prehistoric pottery fragments from across the site (see Figure 12 and 13). Both the cremated remains and the urn have huge potential to shed light on the treatment of death and burial during the Bronze Age and a rare opportunity to understand this monument type, and the people who used it, more fully (see Section 2.1, also Aim 2, Q4 and Q5).
- 7.2.2 Excavation of the urn under laboratory conditions has provided a detailed record of how the deposits within the vessel were structured. A dense group of cremated bone material was situated at the base of the vessel, with two fragments from another ceramic vessel and a flint scraper included in the deposit. A layer of sandy silt sealed these deposits, and may have acted to prevent the vessel's contents spilling out (see

Section 9 below). The burial urn itself is of Late Neolithic to Early Bronze Age date (c. 2100-1900BC). The urn was found to contain the well-preserved cremated remains of a young adult, possibly a male (see Section 10, below). A group of 35 fragments of prehistoric pottery (Appendix 2.8) were found in addition to the urn, often very abraded and poorly preserved. Further analysis of these fragments alongside the urn with answer specific questions relating to this phase of activity, such as whether or not these sherds relate to another single vessel, or represent a number of different objects. Are they associated directly with the funerary assemblage and act of burial, perhaps deposited as sherds with some other meaning (see, for example, Woodward 2002). The finds distribution (Figure 8) highlights the grouping of prehistoric ceramics around the urn burial and the pit feature in Trench 2 west (F203), which would suggest a relationship between the two.

- 7.2.3 The worked stone assemblage recovered includes a range of artefact types which provide great potential in understanding the chronological and spatial patterning at the site (see Figure 12), addressing key objectives within the research aims (Aim 3, Q10 and Q11). The manufacture of worked flint, chert and quartzite were clearly significant, with large numbers of debitage and cores, as well as some tools identified within the flint assemblage (see Section 8, Appendix 2.3). The dating of the worked flint (n=149) extends from the Mesolithic through to the Early Iron Age, with concentrations from the Mesolithic to Neolithic (31% of the assemblage) and the Neolithic to Bronze Age (26%). The distribution of the flint objects around the site suggests a concentration of working within the bounds of the ring cairn itself (see Figure 8). A separate report on the flint and chert chipped stone artefacts can be found below (Section 8).
- 7.2.4 As well as a large assemblage of flint and chert tools, the potential use of quartzite as a tool (reflected in the mixed assemblage of chipped quartz and pebbles (n=87), see Appendix 2.6) is also significant. Quartz is not an easy material to study with regards to its alteration and use and its collection from archaeological contexts is certainly worthwhile (see Warren and Neighbour 2004). Although not yet positively identified as worked artefacts or working debris, the material collected represents a further potential strand of investigation into use and working of lithics at the site. In addition, the presence of a number of small quartz pebbles may be suggestive of something more symbolic, a possibility noted due to its occurrence in funerary contexts (Warren 2006).
- 7.2.5 Another interesting group of stone is the small assemblage of 'black lithic' (n=19), a term used in this report as an umbrella term for jet, cannel coal and lignite (see Appendix 2.4). None of the items recorded are worked objects *per se*, although some do indicate working to some extent. The presence of conchoidal fractures which appear on many not only provide an indication that the material was being brought to the site and worked, but may also suggest the material is most likely to be cannel coal, rather than jet or lignite. Cannel coal and lignite would certainly be more likely to be available locally to the people living in this area, jet having a very limited provenance UK (the only source being Whitby). Objects manufactured from black lithic, especially jet, are often associated with exotic and valuable items, and occasionally included as grave goods in Bronze Age burials (such as from the cist cemetery at West Water Reservoir, Hunter and Davis 1994). Little is known about the manufacture and distribution of goods during early prehistory, although much of the jet which has been analysed and positively identified is likely to have been manufactured in Whitby (see

Sheridan et al 2002). The use of jet-like materials in their own right (such as cannel coal) is less well understood.

- 7.2.6 Further work into the provenance of all the worked stone artefacts and manuports recorded (such as haematite and calcite Appendix 2.5 within the assemblage will provide an excellent picture of the utilisation of materials from local and more distant sources (addressing Aim 3, Q10 and Q11).

Type	Number	Weight (g)
Metal - Coins	4	14
Metal - Cu alloy	17	91
Metal - Lead	1	8
Metal - Iron	6	221
Metalworking debris - Cu alloy slag	4	134
Stone - black lithic	18	50.5
Stone - general	7	308
Stone - quartzite	87	569.5
Stone - chert / flint	145	
Glass - modern	7	27
Ceramic - prehistoric pottery	35	
Ceramic - med/post med pottery	338	1490
Ceramic - clay pipe	20	35
CBM (inc daub)	6	85

Table 1 Assemblage summary for Bolton le Sands

7.3 Recommendations

- 7.3.1 Recommendations for further work relating to the chipped stone, burial urn, cremated bone and palaeoenvironmental material are provided in specialist reports below (Sections 8, 9, 10 and 11). The recommendations in this section describe potential further work for metal, stone (other than flint) and ceramics not including the burial urn.
- 7.3.2 As the majority of coins recovered were not found in stratified contexts, no further work is required. The exception is the silver penny (BLS_10, 2001), which provides an intrinsically dated object from which the dating of later activity of the site can be better defined. A specialist identification to confirm the date of the coin would contribute to an understanding of the overall chronology of the site (Aim 2, Q4), as well as aiding understanding of the nature, in terms of dates and extent of potential mixing, of the buried deposits (Aim 3, Q8 and Q9).
- 7.3.3 All metal finds recovered from secure contexts which would benefit from further analysis. This includes the copper alloy objects (BLS_2, 7, 40 and 120), the iron (BLS_4, 8 and 9). Although unstratified, analysis of the metalworking debris should be considered. Further identification has the potential to inform understanding of the chronology and use of the site (Aim 2, Q4), and identify any activities which may relate to the site (Aim 3, Q10).

- 7.3.4 The quartzite would benefit from being assessed alongside other chipped stone, with consideration of the distribution of both chipped material and the frequency of natural and unworked pebbles at the site. Broader consideration of the quartz, with regards to its provenance and comparison with use at other contemporaneous sites, would aim to explore the utilisation of materials (addressing Aim 3, Q10 and Q11).
- 7.3.5 This group of black lithic material is particularly interesting and would certainly benefit from closer examination. The specialist identification of the material would not only help present a more accurate picture, but will provide key evidence in understanding more about the exploitation of natural resources, either near to the site, or imported to the site from some distance (Aim 3, Q10 and Q11). Once the type of stone has been fully identified, broader comparisons will be possible both within assemblage (as part of the material culture at the site) and with other sites. Geological provenance of the possible manuports recorded (haematite and calcite) would also provide an opportunity to explore the utilisation of materials from local and more distant sources (addressing Aim 3, Q10 and Q11).
- 7.3.6 Further analysis of the prehistoric pottery recovered should be undertaken alongside that of the burial urn with a close examination of the complete assemblage to designed understand the chronology of the site, the nature of the activity relating to the site and the people who visited and use it (Aim 2, Q4, Aim 3, Q10 and Q11). Scientific analysis should also be considered to hold potential to shed light on these areas – in particular lipid analysis to assess the contents of vessels used and scientific provenance to explore the use of local and distant resources. Analysis of the assemblage should establish the relationship between the burial urn, the fragments recovered from within the urn and the fragments recovered from the contexts within the ring cairn itself.
- 7.3.7 With regards to later ceramic materials, a simple typological identification and dating of the post medieval pottery and clay pipe would provide a useful indication of the main periods of later activity, providing a full chronological framework for the site (Aim 2, Q4). Although limited in both size and number the possible presence of daub at the site is interesting, and has connotations for understanding the use and possible make-up of more structural elements at the site (Aim 2, Q4).

8 LITHICS – CHIPPED AND WORKED STONE

By Alex Whitlock

8.1 Introduction

- 8.1.1 All data relating to the chipped stone assemblage can be found in Appendix 2.5, along with an extended report. In total, 145 struck stones (including five probably natural) and four pieces of burnt unworked flint or chert were recovered in total from Trenches 1, 2 and 3 (see Appendix 2.5). The objective of this assessment was to evaluate the assemblage in relation to the site, and compare with results from previous investigations (in 2013). Specific aims are to understand the chronological development of the burial monument (Aim 2), assess the current state of the chipped stone assemblage (Aim 3, Q7), understand spatial patterning (Aim 3, Q10) and exploitation of resources (Aim 3, Q11).



8.2 Chronology, distribution and use

- 8.2.1 With regards to Aim 2, the majority of the assemblage dates to two periods – the Mesolithic to Neolithic (31%) and Neolithic to Bronze Age (26%). Other periods represented in the lithic record are Prehistoric (27%), Mesolithic (1.5%), Neolithic (6%), Bronze Age (0.5%), Bronze Age to Early Iron Age (4.5%). The presence of Mesolithic through to Neolithic material within deposits is not unusual and could be a result of the shallow depth of deposits and later land-use combined with the small size of many of the artefacts, or potentially a sign that earlier examples were being used as a source of lithic material in later periods. A concentration of finds of this period can be seen within subsoil deposits across the site (1002, 2002 and 3002), which suggests that these strata may have been exposed in the Late Mesolithic to Early Neolithic, when stone was being worked.
- 8.2.2 With regards to the distribution of the lithics at the site (Aim 3, Q10), the majority (59%) of the Neolithic to Bronze Age lithics are also found within the subsoil contexts (1002) (2002) (3002). This lends further support to the idea of continuity of use at the site. The presence Bronze Age to Early Iron Age material is so sparse that it is difficult to draw any conclusion about it, although the majority is also found within subsoil deposits. The spatial distribution of the finds does suggest that working of lithics – or at least the debris of that activity – were being ‘contained’ within the inner boundary of the ring cairn itself (see Figure 12). This area of investigation certainly merits further research, especially in consideration of the date the cairn was constructed, the date that the lithic material was worked, and the relationship between the two. The predominance of debitage within the assemblage and general lack of high status finds (with the exception of BLS_41) could be indicative that the activity of working stone was being undertaken on a very utilitarian level.
- 8.2.3 The presence of the Late Mesolithic finds suggests that the site may have been the location of a knapping area during this period, located here for strategic reasons, perhaps in relation to food gathering and hunting. Further investigation will help elucidate the earliest use of the site and, if related to knapping, one would expect the recovery of more projectile points. Late Mesolithic use may have given the site a significance in later periods, and could perhaps be the reason for this focus of activity into the Bronze Age. The lithic assemblage indicates that the site has been returned repeatedly from the Late Mesolithic until the Bronze Age, and probably into the Early Iron Age.

8.3 Recommendations

- 8.3.1 The lithic assemblage has potential for further analysis and the tasks outlined below will provide greater understanding of the assemblage and the use of the area during the early prehistoric periods. Specific recommendations, designed to inform the research objectives include further detailed analysis of the distribution of the finds against sub-classifications of the material (eg by type and date), consideration of the source of the material and a detailed comparison with other regional assemblages to provide a more in depth understanding of upland Pennine landscape and utilisation of wider resources (Aim3, Q 10).

9 URN ASSESSMENT

By Stuart Noon

9.1 Introduction

- 9.1.1 An inverted urn BLS_112 (3011) was recovered from Trench 3 on top of the burial mound at the main site at Bolton le Sands (Figure 13). It was kept inverted and removed from site with excess natural clay (3012) around the pot, protecting its fabric (Plate 13.2). A strategy was determined to undertake a micro-excavation under lab conditions to provide greater clarification of the chronology of the urn, the burial and this phase of activity at the site (Aim 2, Q4), as well as increasing knowledge surrounding the use of the site and the landscape (Aim 3, Q10).

9.2 Methods

- 9.2.1 The urn was kept inverted and under controlled conditions in the Lancashire Museums Archaeology Store. X-rays at the Westmorland General Hospital conducted by Chris Whiteside and David Tonks of the Radiography Department, revealed indications of a large density of bone and the possibility of two or more objects within the urn (Plate 13.1).
- 9.2.2 Subsequently, the urn was righted and excavated under controlled conditions in Lancashire Museums Service Conservation Studios in Preston by Stuart Noon, Jenny Truran, Sam Walsh, Maiya Pina-Dacier and Matthew Hepworth. It was treated as an archaeological feature and excavated stratigraphically, with contents and fabric assigned context numbers, providing rigorous control with which to ascertain the deposition of bone and objects within. The urn collapsed after the excavation, and has been carefully packaged for further scientific analysis prior to consolidation.

9.3 Excavating the urn

- 9.3.1 Inside the urn and surrounded by soil (2015), two pot fragments and a flint scraper, as well as a large density of bone (bone nest) was found (Plate 13.3). The flint scraper is of a whitish grey colour, heat affected on one side, but not vitrified (Plate 13.6). The two pot fragments appear to be of a different construction to the urn, suggesting they originate from a different vessel (Plate 13.5). Both pot and flint may have been deliberately inserted into the urn, or could be residual and scooped up with the bones immediately prior to deposition. The pot fragments are not abraded (unlike other prehistoric pottery fragments from the site), which might suggest they were either fresh or from a different deposition close by.
- 9.3.2 Covering the dense bone 'nest' was a lens of material comprised of a firm light brownish-grey sandy silt with occasional <5% charcoal inclusions (3013). This may have been used to act as a barrier between the cremated material and a stiff clay cap (3014) on top of the urn, which appears to have been packed down and left to dry before the urn's inversion. Such a seal prior to deposition would prevent the contents from spilling out.

9.4 The burial urn

- 9.4.1 The urn is 381mm in length and 420mm in width, with a diameter of 360mm at the top and 190mm at the base (Plate 13.7 and 13.10). At the base the wall is 2.75mm thick and, moving back from the base into the side walling, slims down to 1.75mm (Plate 13.11). At the rim, the thickness of the wall is 1.2mm. The fabric is a light brown sandy clay (3011) with moderate inclusions of extremely small shell fragment, as well as possible occasional inclusions of cremated bone and small burnt pottery fragments (grog). Additionally, there are very small mid greyish blue chert trituration grit inclusions with occasional to moderate occurrence moving from the rim down the body of the urn (Plate 13.8). The base contains an extreme density and the grits vary in dimensions between 2mm in length to 10mm in width to 12mm in length and 8mm in width (Plate 13.9).
- 9.4.2 Heavy burning of the inside walling to a depth of 5mm at the base to 10mm at the top suggests that the bones were deposited in the urn whilst still hot from the cremation. Decoration on the outside comprise one row of even oval and three rows of uneven circular indentations. The latter measure 7mm in diameter to a depth of 1.5mm (Plate 13.7).

9.5 Recommendations

- 9.5.1 Despite the lack of identified identical parallels for the urn, it would appear to date from the Late Neolithic to Early Bronze Age c. 2100-1900BC. Its form seems to be to some extent similar to Pennines Urns that are indicative of a distinct Pennine culture with strong influences from Scotland. Additionally, there is a parallel from Northumberland detailed in Gibson (2002, Fig.48.1). The urn itself provides insight into a number of areas, all important to understanding more about the period and context within which it was deposited, and about the people and their attitudes to death and burial. Reconstruction of a profile of the collapsed urn would facilitate comparison with other similar vessels, allowing detailed examination of its form. In order to establish whether the urn was re-used or specially made for that occasion, lipid analysis of the fabric would be beneficial, whilst thin section analysis and radiocarbon dating would help establish the urn's construction date.

10 HUMAN REMAINS

By Sam Walsh

10.1 Introduction

- 10.1.1 Excavation at the Bolton le Sands burial monument resulted in the discovery of an inverted urn BLS_112 containing cremated remains, in addition small fragments of cremated bone were found in Trench 3 (2016) and in the earlier UCLAN assessment (2013). This assessment is focused on the urned remains.

10.2 Results of analysis: cremated remains within urn (3015)

- 10.2.1 From duplication of bones the MNI (Minimum Number of Individuals) is one individual. This seems strange given the high weight of bone. The weight of the bone may



indicate that there are two individuals (see discussion). From the development and size of the remains these are the bones of an adult. The cranial suture fusion and the tooth roots indicate this was a young adult. The partially surviving pubic symphyses give a slightly older age but due to being partially destroyed these are less reliable.

- 10.2.2 The morphology of the cranium is not strongly suggestive of a male or female, however the mandible and sciatic notch are more suggestive of a possible male individual (M?). The long bones appear to have been large but not particularly robust, the muscle attachments are not very large. This adds to the impression of a younger adult.
- 10.2.3 There were no significant pathological alterations to the bones (although this is always difficult to assess with cremated remains). There was some porosity on fragments of cranium potentially indicating malnutrition, and some bone formation on the phalanges caused by activities. These alterations alone are not definitive of any particular condition and require further analysis.
- 10.2.4 The cremated remains from the urn are unusual in the volume of the deposit (see Table 2) at over 3500g (including residue). Without the residue the bone weight still stands at 2808.11g. The bones are also extremely well preserved; bones that are usually destroyed by the cremation process such as the epiphyses, pelvis, and vertebral bodies are surviving in large, identifiable fragments. The bone preservation and survival is a large factor in the high weight of this deposit.

Sieve fractions	Weight (g)	Spread of deposit within urn		
	Total	Top	Mid	Base
10mm+	1740.32	640.34	594	505.98
5mm+	451.88	131.24	65.72	254.92
2mm+	615.91	186.39	71	358.52
<2mm	732	150	69	513
Total bone weight	3540.11	1107.97	799.72	1632.42
Total identified	1755.11	623.97	553.72	577.42
Total unidentified	1785	484	246	1055

Table 2 Weight of bone from sieve fractions

- 10.2.5 The fractions of the cremated bone from the base, middle, and top portions of the urn were weighed separately to check for differences in preservation and spread of elements (see Table 11.1). While most bones are represented in each portion, the cranium, mandible, and vertebrae (which were predominantly lumbar) have a greater distribution in the upper third of the urn. Long bones are more widely spread, the humerus and femur being predominantly in the top and middle thirds, and the tibia in the mid and base. The scapula is predominantly from the mid portion, and the hand bones the base (see Table 3).

Element	Top	Mid	Base
Cranium	124.2	79	71
Mandible	23	5	1.52
Teeth	3.92	0.59	4.7
Clavicle	9	7	0

Element	Top	Mid	Base
Scapula	5	22	7
Vertbrae	98.75	22.25	27.46
Ribs	40	20	76
Sternum	0	1	0.13
Humerus	57	54	17
Radius and ulna	22	32	36
Hand	10.97	6	16
Pelvis	26	64	4
Femur	64	60	9
Patella	1.16	0	0
Tibia	22	45	48
Fibula	8	11	15
Foot	3	47	5.1

Table 3 Spread of elements from different thirds of the urn (g)

10.2.6 The cremated remains were predominantly tan to white in colour indicating that most of the remains were fully cremated at around 600°C. Some small fragments were a darker brown to black in colour which indicates a temperature of around 300°C+. These different coloured fragments were charred and incompletely oxidized. These fragments may have fallen to the outskirts of the pyre. Fracture patterns are linear, transverse, curved, and spiral, with some smaller spalled fragments. These may give some indication as to whether cremated remains were fleshed or de-fleshed prior to cremation (Ubelaker 2009).

10.3 Conclusion

10.3.1 In summary the cremated remains from the urn have an MNI of one individual, a possible male of young adult age. The bones are most unusual in the level of preservation, and the weight of the deposit. Out of 109 Early Bronze Age cremation deposits analysed by Walsh (2013) there were only 19 with multiple individuals, and of these only nine weighed above 1000g. Only one of these weighed over 2000g; this was Cowlam 2, weighing 2955g (two adults). It has been suggested that weights from 2141-2500g are indicative of multiple individuals. However, greater weights have been recorded from modern cremations (McKinley 2000, 408).

10.4 Recommendations

10.4.1 The recovery of this cremated material offers a rare opportunity to examine in detail the life and death of individuals associated with the burial. As a rare and well preserved example, this not only has the potential to inform our knowledge of the date, use and significance of the burial monument itself (Aim 2, Q4, Aim 3), but to add significantly to the corpus of data relating to burials in this period. More in-depth osteological analysis, AMS dating and isotope analysis, will provide further insight into the health of the individuals associated with the burial, as well as detailed understanding of the burial process itself. Osteological analysis is still to be carried out on small amounts of scatter cremated bone from the site.

11 PALAEOENVIRONMENTAL RESULTS

By Rosalind McKenna

All digital records relating to palaeoenvironmental samples from the Site can be reviewed on the Digital Dig Team system here: <https://goo.gl/7s19c9>

11.1 Introduction

11.1.1 A programme of soil sampling was implemented during the excavation, which included the collection of soil samples from sealed contexts. A list of samples can be found in Appendix 4. The aim of the sampling was to:

- assess the type of preservation and the potential of the biological remains (Aim 3, Q7 and Q8)
- inform understanding of the local environment in the Bronze Age period in terms of the environmental manipulation and differential exploitation of natural resources (Aim 3, Q11)
- assess the state in which the palaeoenvironmental remains are being successfully preserved in-situ and the level of impact from agriculture and bioturbation (Aim 3, Q7).

11.2 Methods

11.2.1 Following selection, subsamples of raw sediment from the selected samples were processed. The samples were examined in the laboratory, where they were described using a pro forma. The subsamples were processed by staff at DigVentures using standard water flotation methods. The flot (the sum of the material from each sample that floats) was sieved to 0.5mm and air dried. The heavy residue (the material which does not float) was not examined, and therefore the results presented here are based entirely on the material from the flot. The flot was examined under a low-power binocular microscope at magnifications between x12 and x40.

11.2.2 A four-point semi quantitative scale was used, from '1' – one or a few specimens (less than an estimated six per kg of raw sediment) to '4' – abundant remains (many specimens per kg or a major component of the matrix). Data were recorded on paper and subsequently on a personal computer using a Microsoft Access database. The results of this can be seen in Appendix 4, Table 21 at the end of this report.

11.2.3 Identification was carried out using published keys (Jacomet 2006, Biejerinkc 1976, Jones – unpublished and Zohary & Hopf 2000), online resources (<http://www.plantatlas.eu/za.php>) the authors own reference collection. Taxonomy and nomenclature follow Stace (1997). The full species list appears at Appendix 4, Table 19 at the end of this report.

11.2.4 The flot was then sieved into convenient fractions (4, 2, 1 and 0.3mm) for sorting and identification of charcoal fragments. Identifiable material was only present within the 4 and 2mm fractions. A random selection of ideally 100 fragments of charcoal of varying sizes was made, which were then identified. Where samples did not contain 100 identifiable fragments, all fragments were studied and recorded. Identification was made using the wood identification guides of Schweingruber (1978) and Hather



(2000). The full species list appears in Appendix 4, Table 21 at the end of this report. Taxa identified only to genus cannot be identified more closely due to a lack of defining characteristics in charcoal material.

11.3 Results

- 11.3.1 Eight samples and numerous sub-samples are the basis of this investigation. Charred plant macrofossils were present within two of the samples in the form of single indeterminate cereal grains. These were identified based on their overall size and morphological characteristics, which may suggest a high degree of surface abrasion on the grains, indicative of mechanical disturbances. Other than to state their presence in the samples, nothing of further interpretable value can be gained. The results of this analysis can be seen in Appendix 4, Table 19 below.
- 11.3.2 The presence of root / rootlet fragments within most of the samples indicates disturbance of the archaeological features, and it may be due to the nature of some features being relatively close to the surface, as well as deep root action from vegetation that covered the site. The presence of earthworm egg capsules, together with the remains of insect fragments within some of the samples, further confirms this.
- 11.3.3 Charcoal fragments were present within the majority of the samples, scoring between a '1' and '4' on the semi quantitative scale. The preservation of the charcoal fragments was fair to poor. The majority of the fragments were too small to enable successful fracturing that reveals identifying morphological characteristics. Where fragments were large enough, the fragments were very brittle, and the material crumbled or broke in uneven patterns making the identifying characteristics difficult to distinguish and interpret, and so only a limited amount of environmental data can be gained from the samples. Identifiable remains were however present in four of the samples, and the results of this analysis can be seen in Appendix 4, Table 19 below.
- 11.3.4 The total range of taxa comprises oak (*Quercus*), willow / poplar (*Salix* / *Populus*), hazel / alder (*Corylus avellana* / *Alnus glutinosa*). These taxa belong to the groups of species represented in the native British flora. As seen in Table 2, alder / hazel was present in two of the samples, willow/poplar was present in one of the samples and oak was present in a three of the samples. The most recorded species was alder / hazel. It is possible that this was the preferred fuel wood obtained from a local environment containing a broader choice of species. The compositions of the samples are all very similar.
- 11.3.5 Generally, there are various, largely unquantifiable, factors that affect the representation of species in charcoal samples including bias in contemporary collection, inclusive of social and economic factors, and various factors of taphonomy and conservation (Thiery-Parisot 2002). On account of these considerations, the identified taxa are not considered to be proportionately representative of the availability of wood resources in the environment in a definitive sense, and are possibly reflective of particular choice of fire making fuel from these resources.

11.4 Conclusion

- 11.4.1 The samples produced some environmental material of interpretable value, with the charred plant macrofossils from two of the samples, and the charcoal remains from



four of the samples. The charred remains recovered were only single occurrences and were of poor quality - charred material that was within the samples appears to have been subjected to high temperatures of combustion, as the grains were severely puffed and distorted.

- 11.4.2 The charcoal remains showed the exploitation of a several species native to Britain, with the prevalence of oak being selected and used as fire wood. Hazel is recorded as a good fuel wood and was widely available within oak woodlands, particularly on the fringes of cleared areas (Grogan *et al.* 2007, 30). Alder is a poor fuel as it burns quickly and gives off little heat, but has been found suitable for charcoal production, but given that it was only recorded in small numbers, it may merely represent a selection of available firewood. Oak has good burning properties and would have made a fire suitable for most purposes (Edlin 1949). Oak is a particularly useful fire fuel as well as being a commonly used structural/artefactual wood that may have had subsequent use as a fire fuel (Rossen and Olsen 1985). Willow/Poplar are species that are ideal to use for kindling. They are anatomically less dense than for example, oak and ash and burn quickly at relatively high temperatures (Gale & Cutler 2000, 34, 236, Grogan *et al.* 2007, 29-31). This property makes them good to use as kindling, as the high temperatures produced would encourage the oak to ignite and start to burn.
- 11.4.3 The evidence of carr fen woodland indicates a damp environment close to the site. This type of woodland would have consisted of willow and poplar, and alder which are all trees that thrive in waterlogged and damp soils, particularly in areas close to streams or with a high water table (Stuijts 2005, 143; Gale and Cutler 2000). Dryland wood species indicates the presence of an oak-ash woodland close to the site. This would have consisted of oak, which would be the dominant large tree species (Gale and Cutler 2000, 120, 205), and hazel would thrive at the edges and in clearings.
- 11.4.4 As asserted by Scholtz (1986) cited in Prins and Shackleton (1992, 632), the "Principle of Least Effort" suggests that communities of the past collected firewood from the closest possible available wooded area, and in particular the collection of economically less important kindling fuel wood (which was most likely obtained from the area close to the site), the charcoal assemblage does suggest that the local vegetation would have consisted of an oak woodland close to the site.
- 11.4.5 It is thought to be problematic using charcoal and plant macrofossil records from archaeological sites, as they do not accurately reflect the surrounding environment. Wood was gathered before burning or was used for building which introduces an element of bias. Plant remains were also gathered foods, and were generally only burnt by accident. Despite this, plant and charcoal remains can provide good information about the landscapes surrounding the sites presuming that people did not travel too far to gather food and fuel.

11.5 Recommendations and archive

- 11.5.1 The samples have been assessed, and all interpretable data has been retrieved. No further work is required on any of the samples.

12 BOLTON LE SANDS: DISCUSSION

12.1 Introduction

- 12.1.1 The project was designed to undertake an evaluation and post-excavation assessment of a potentially substantial Early Bronze Age funerary monument which, until very recently, had remained undetected (see Wilkins et al. 2016). The project sought to expand upon the initial discovery of a Late Bronze Age bronze tanged chisel and knife blade (PAS - LANCUM-0788A0) and the features, including a cremation burial, revealed in the UCLAN geophysical survey and sondage (Batey 2014).
- 12.1.2 The project design identified the strong likelihood of encountering potential complexities in the excavation of the monument when reviewing current understandings of Late Neolithic-Early Bronze Age funerary architecture in the region. The broadest and most accurate term for the Site as initially encountered – that of ‘barrow’ – was deliberately chosen as this could encompass the potential discovery of a barrow, cairn, ring cairn, flat cairn, ringwork, stone circle and timber circle in addition to multiple phases of monument construction as found elsewhere in South Cumbria and North Lancashire (cf. Evans 2005; Hodgson and Brennand in Brennand 2006; Quatermaine and Leech 2012; Wilkins et al. 2016).
- 12.1.3 This evaluation has established that the site is defined by a ring cairn enclosing a central platform and earthen mound on the summit of a hill, located in a commanding position overlooking Morecambe bay. The results from the 2016 excavation of the Site and post-excavation specialist analyses are discussed below in relation to: Project Aims 1-3 and associated Research Questions 1-13; the project design (Wilkins et al. 2016); and further research by the authors.

12.2 Project Aim 1

- 12.2.1 Aim 1 focused on the non-intrusive remote sensing and geophysical survey of the Site in order to define the physical extent and assess the condition of the Site. This comprised integrating the earlier resistivity results obtained by UCLAN team (whose spatial co-ordinates were sadly unrecorded, see Batey 2014) with pre-existing aerial photographs from the SMR and the current project’s magnetometry, low-level aerial photography and photogrammetry surveys. The most productive results were achieved through magnetometer survey which identified two major sub-surface sub-circular anomalies on the summit of the hill which provided two of the foci for intrusive excavation.
- 12.2.2 The magnetometer survey, together with pre-existing and new aerial photography and photogrammetry, also identified a linear feature running to the north of the burial monument. This was investigated with the working hypothesis, later confirmed by excavation, that the feature was a post-medieval to modern field boundary. None of the remote sensing or geophysical surveys provided a clear indication of the boundaries of the Site, beyond what could be observed on the ground.
- 12.2.3 Research question 1 related to the determination of the layout of the Site and any associated sub-surface archaeology. Research questions 2 and 3 relate to the identification of phasing through topographic and/or remote sensing anomalies to identify extended periods of use. Only two major periods of landscape use could be

tentatively identified at the site from the non-intrusive survey; a potential later prehistoric phase and a post-medieval/modern phase. This is despite artefactual evidence for activity at the site during the intervening periods.

12.3 Project Aim 2

- 12.3.1 Aim 2 focused on understanding the chronological development of the burial monument refining its chronology, phasing and character of the Site through hand-dug intrusive excavations based upon the results of the non-intrusive Site surveys. Trenches 1 and 2 were deliberately placed in a cruciform pattern across the visible enclosure, platform and earthen mound burial monument in order to identify the extent and, where possible, the chronological phasing of the Site. Trench 3 was placed to locate, re-investigate and contextualise the earlier UCLAN excavations as well as one of the sub-circular geophysical anomalies.
- 12.3.2 The excavations in Trench 1 and Trench 2 revealed an Early Bronze Age ring cairn, dated by associated ceramic fragments and lithics, enclosing the upper contour of the hill. The northern part of the cairn has potentially been damaged by later ploughing. They also revealed a Post-Medieval field boundary with well stratified Post-Medieval pottery in the overlying deposit in Trench 1, and in Trench 2 an Early Modern backfilled clay pit.
- 12.3.3 Trench 3 revealed a posthole, a shallow prepared platform, possibly indicating the construction of a mortuary enclosure and an inverted Early Bronze Age Food Vessel urn containing the remains of at least two cremated adults and a flint blade. Additional finds comprise abraded pot fragments, worked lithic material, burnt stone and cremated bone fragments.
- 12.3.4 Research question 4 relates to the corroboration of the chronological phasing for the Site. Whilst further investigations remain imperative, several phases can already be identified through archaeological features. The excavations revealed the construction of the ring cairn (F101) probably during the Early Bronze Age (c. 2200-1600 BC) and the deposition of the cremated adults during this period. The presence of scattered human cremated remains elsewhere on the ring cairn together with the presence of multiple funerary internments (inhumations and cremations) at comparable sites (see below) strongly implies that there will be multiple phasing within this period.
- 12.3.5 There are no excavated features which could be dated to the Late Bronze Age (c. 1100-800 BC) and thus contemporary with the Late Bronze Age metalwork. However, it was not possible to re-locate precisely the findspots of the bronze tanged chisel and knife blade. The subsequent excavated features, a field boundary and a clay pit, date to the Post Medieval to Modern periods respectively.
- 12.3.6 Research question 5 relates to the typical and atypical features of the Site. The label 'ring cairn', as correctly applied to the Early Bronze Age monumental feature revealed in Trenches 1 and 2, encompasses a very broad range of later prehistoric monuments found in Britain from southwest England to northwest Scotland which have consistently defied any straightforward feature-orientated definition (see Lynch 1972; 1979; 1993; Barnatt 1990; Evans 2005). Whilst many ring cairns have been identified and even investigated across Lancashire and Cumbria, the poor quality of the (early) excavations, the infrequency their publication, and the frequent complexity of the

architectural embellishment and phasing and long-term (re-)use means that they are still poorly understood. This point was specifically highlighted in a major survey of the Neolithic-Early Bronze Age in Cumbria (Evans 2005, 330-1), where the evidence is more substantial quality and quantity than in north Lancashire. This monumental diversity within the term 'ring cairn' means that it is possible to identify regional parallels for those excavated features and artefacts that are broadly contemporary to, and associated with, the ring cairn.

- 12.3.7 The inclusion of two cremated adults within the inverted Food Vessel urn is comparable in vessel form, decoration and context to the Food Vessel deposited inverted with cremated human remains within a stone cist and excavated at cairn at Noon Hill, Lancashire (Booth 1963). The presence of scattered human bone fragments, ceramic vessel fragments and lithics within the body of the ring cairn is paralleled at other cairn monuments such as Manor Farm, Borwick, Lancashire (Olivier 1987), Oddendale, Shap, Cumbria (Turnbull and Walsh 1996), Hardendale Nab, Shap, Cumbria (Williams and Howard-Davis 2004) and Levens Park, Cumbria (Turnbull and Walsh 1997).
- 12.3.8 The use of quartz pebbles and other white stones is found at several Late Neolithic-Early Bronze Age cairn and other funerary and monumental sites in the region such as at Birkrigg 1, Cumbria (Gelderd et al. 1914), Mecklin Park, Cumbria (Spence 1937) and Ewanrigg, Cumbria (Bewley et al. 1992). The presence of later artefactual evidence beyond the prehistoric period scattered across the upper soil levels of the Site is comparable to the similar multi-period varied assemblage from the excavations at the cairns at Manor Farm, Borwick, Lancashire (Olivier 1987) and to a lesser extent at Hardendale Nab, Shap, Cumbria (Williams and Howard-Davis 2004).
- 12.3.9 Research question 6 relates to the landscape setting and character and its relationship the monument and its developments. Ring cairns are typically placed on relatively higher ground, such as an enhancement to the summits of hills as at the Site, as well as in locations which are visible from the surrounding landscape below (see Lynch 1972; 1979; 1993; Quatermaine and Leach 2012). The location of the ring cairn on a relatively high hill but on lower ground close to the coastline and with striking views over Morecambe Bay to the west and to the Cumbrian uplands to the north, is paralleled by the location of Manor Farm, Borwick, Lancashire (Olivier 1987) and Birkrigg, Cumbria (Gelderd et al. 1914). The coastal siting and concentration of Early Bronze Age monuments can be observed in both Lancashire (Barrowclough 2007) and south Cumbria (Evans 2005).

13 CONCLUSIONS

- 13.1.1 This report has present an assessment of the archaeological investigation and findings form the burial monument site at Bolton le Sands. The site includes rare and exciting archaeology which would benefit from further investigation and which provide new knowledge to a group of monuments which are not well understood. In addition, the value of these sites to the local community and wider audiences has been well demonstrated through the engagement with a number of opportunities provided by the project.



- 13.1.2 The recommendations made within the report will be considered fully by the project team, and an updated project design will bring together plans for the next steps to be taken. This will inform any further work at the site and outline the work which will be undertaken. The digital, paper and material archive is currently held by DigVentures and stored securely in the northern office.

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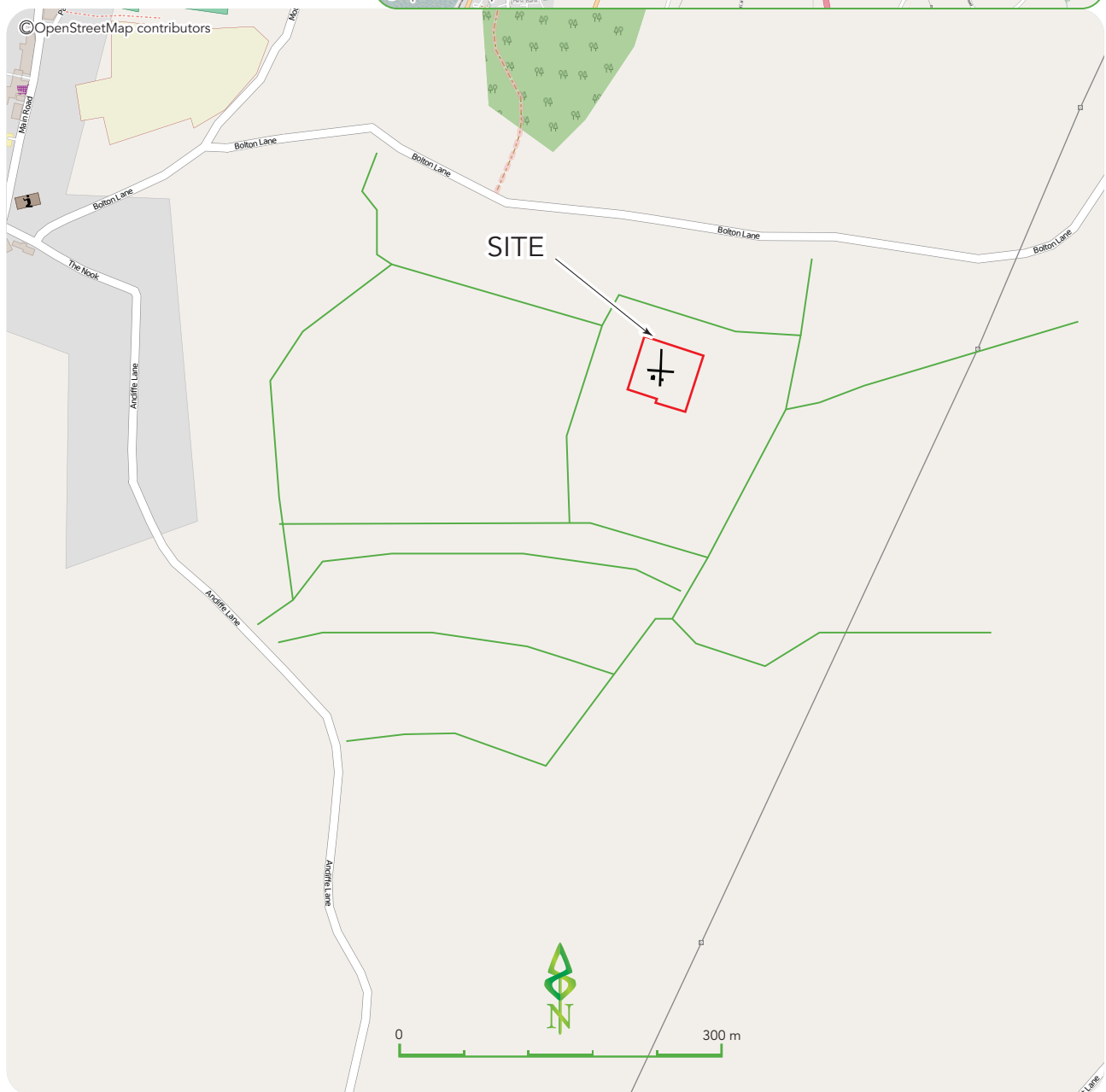
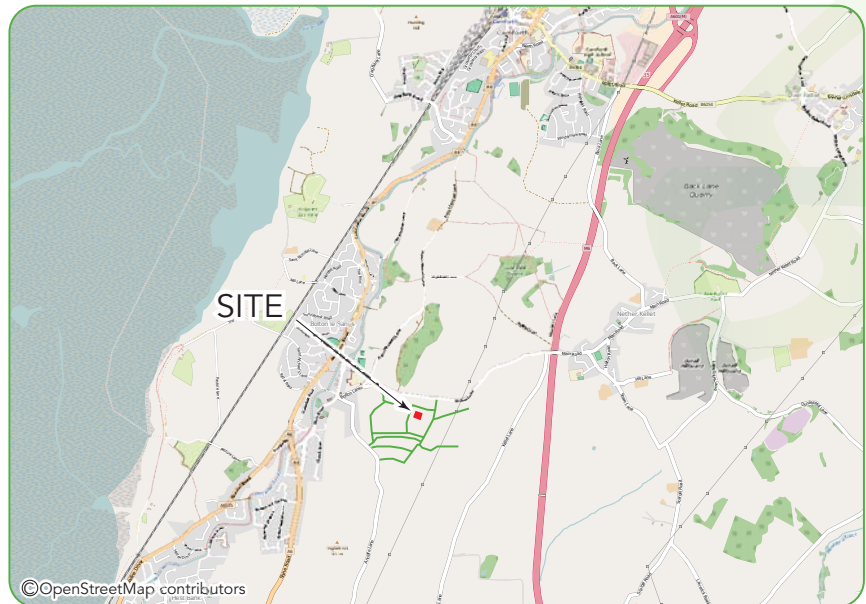
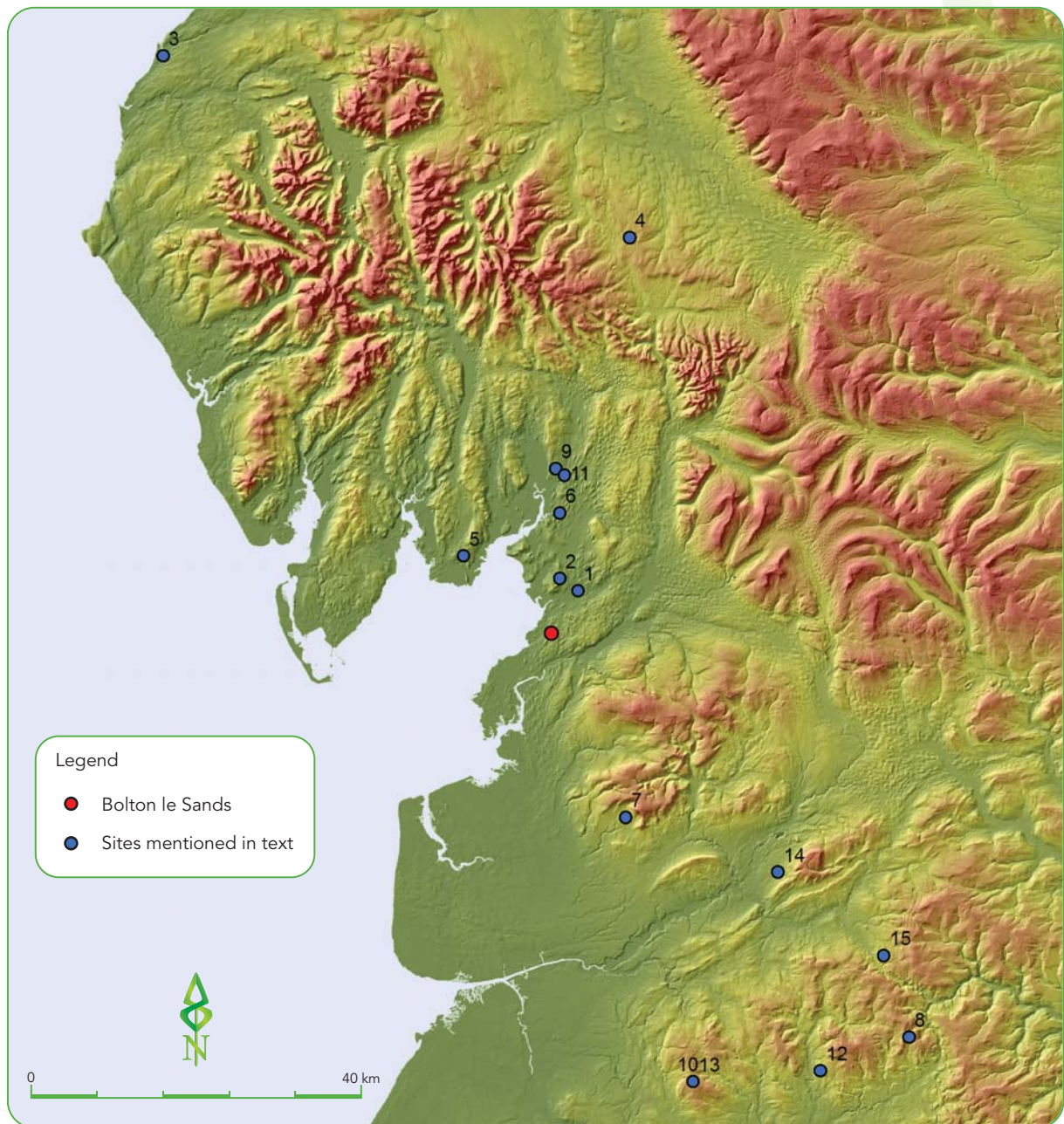


Figure 1 - Barrowed Time, Site location: Bolton le Sands.

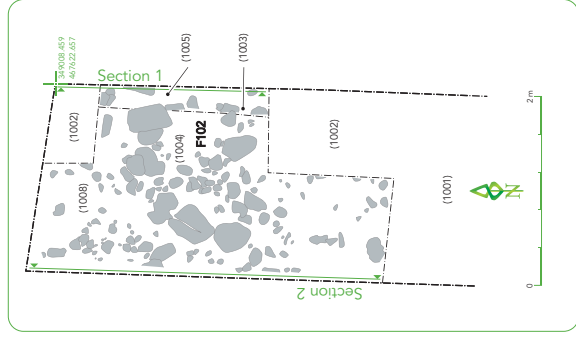


- | | | | |
|-----------------------------------|----------------------------|-----------------------|--------------------|
| 1. Manor farm site | 5. Allithwaite | 9.Sizergh Fell | 13. Noon hill |
| 2. Barrow hill | 6. Dallam school | 10. Winter hill cairn | 14. Pendleton |
| 3. Ewanrigg | 7. Bleasdale timber circle | 11. Levens Park | 15. Moseley height |
| 4. Hardendale Nab
Shap Cumbria | 8. Hades Hill | 12. Whitelow cairn | |

Figure 2 - Barrowed Time: Archaeological background of northwest Lancashire.



Figure 3 - Barrowed Time: Location of remote sensing with excavated trenches overlaid.



Trench 1

Section 1



Post-excavation west-facing section, northern part of Trench 1

Section 3



Post-excavation west-facing section, southern part of Trench 1

Trench 2
(see Figure 5)



Trench 3
(see Figure 6)

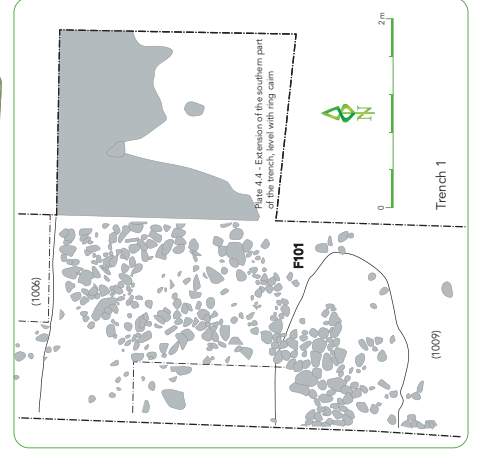


Plate 4.1 - Pre-excavation facing S, northern part of this trench.



Plate 4.2 - Mid-excavation facing S, Post Medieval field boundary F102.



Plate 4.3 - Mid-excavation facing NW, southern part of Bronze Age ring cam F101.



Trench 1 plates

Figure 4 - Barrowed Time: Trench 1 excavation results (Best viewed at A2 in hard copy).

Figure 5 - Barrowed Time: Trench 2 excavation results.

Trench 3 plates



Plate 6.1 - Pre-excavation facing N.



Plate 6.2 - Mid-excavation facing N, sondage exposing limit of 2013 UCLAN evaluation trench F301.



Plate 6.3 - Mid-excavation facing N, urn F302 still in place.



Plate 6.4 - The cremation urn F302 mid-excavation.



Plate 6.5 - The cremation urn F302 mid-excavation, 2.

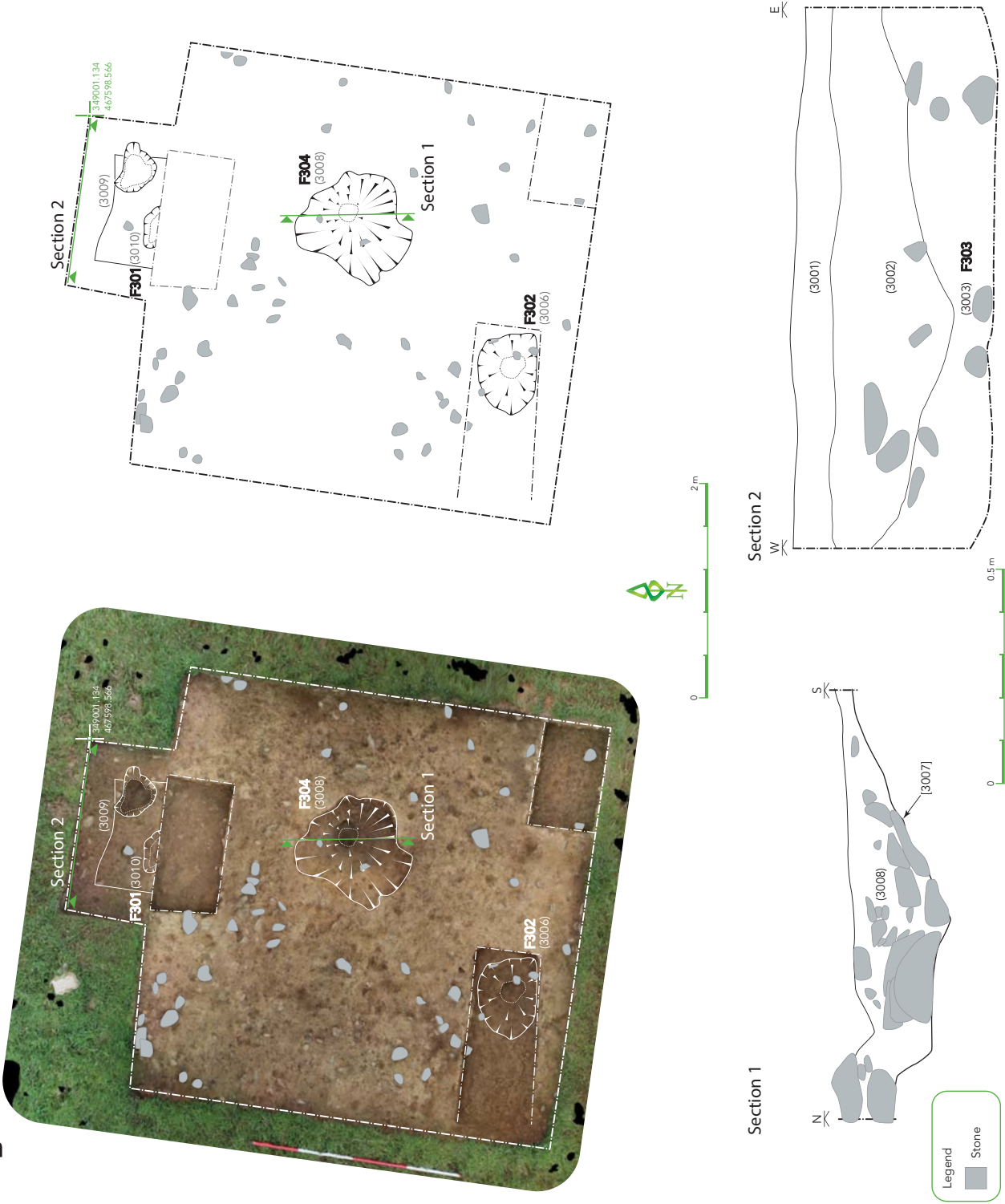




Figure 7.1 - Landscape orthophoto.

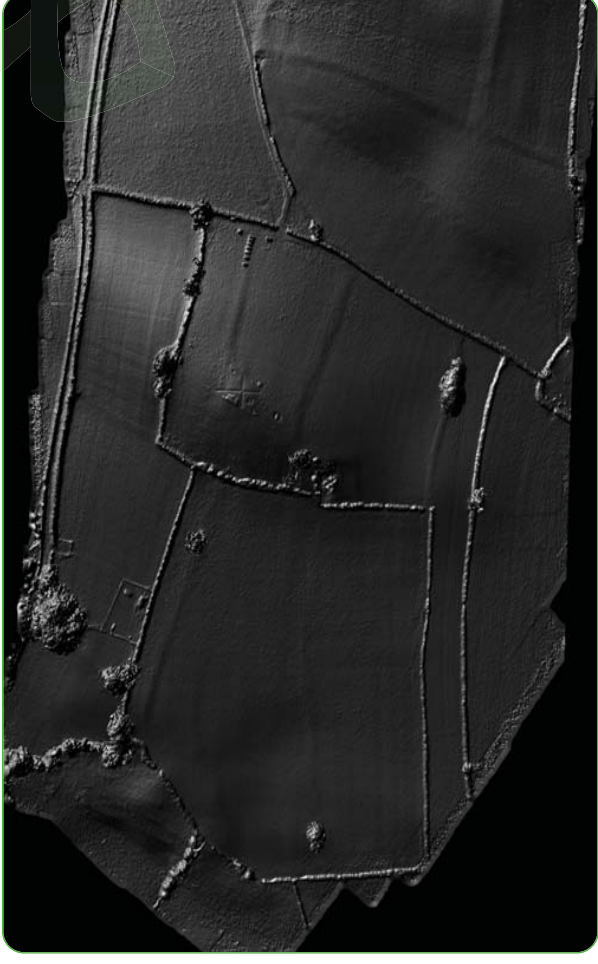


Figure 7.2 - Landscape shaded orthophoto.



Figure 7.3 - Trenches orthophoto.

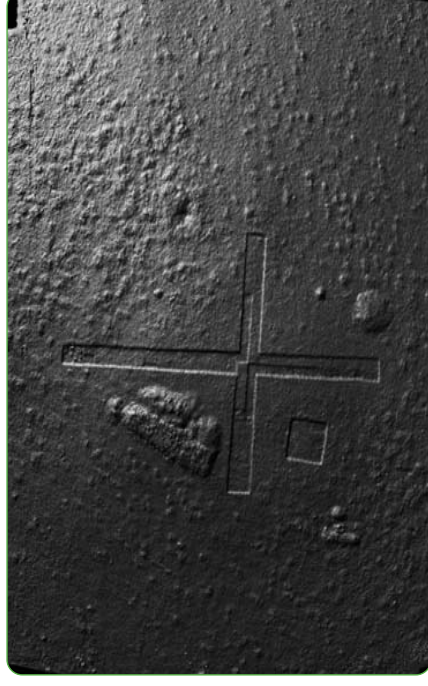


Figure 7.4 - Trenches shaded orthophoto.

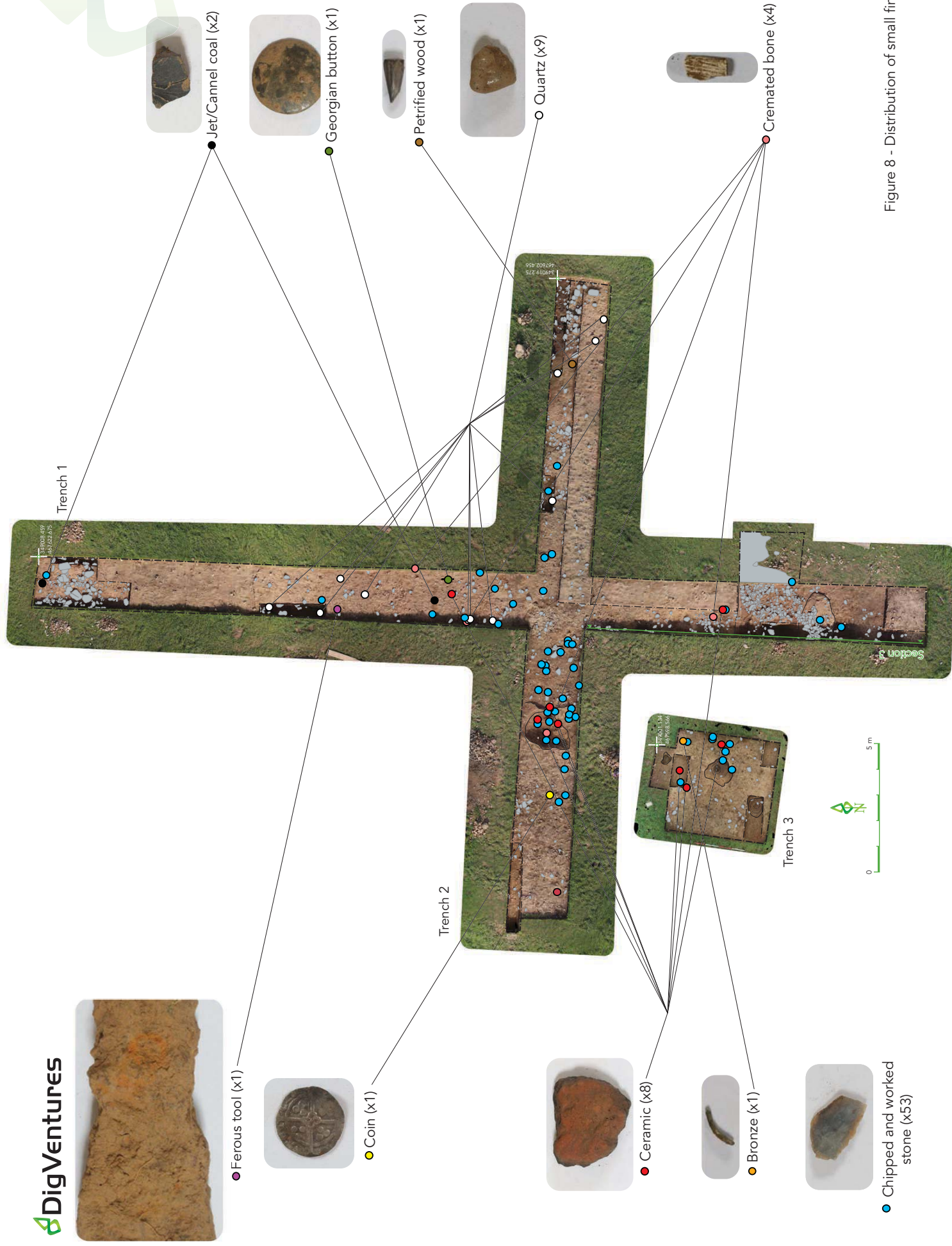


Figure 8 - Distribution of small finds.

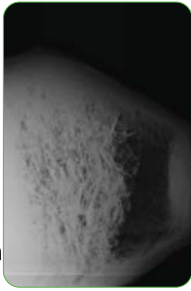


Plate 9.1 - X-ray photo of um revealing large density of bone (bone head) and the possibility of two or more objects within the um.



Plate 9.2 - Photo of um with clay cap (9014) as removed from site prior to excavation in the lab.



Plate 9.3 - Photo of layer immediately below clay capping featuring a large density of bone (bone head) and the possibility of two or more objects within the um.



Plate 9.4 - Inside the um was a large density of bone (bone head) and the possibility of two or more objects within the um.



Plate 9.5 - Close up photo of two pot fragments inserted in the um, suggesting that they are from a secondary vessel.



Plate 9.6 - Photo of Late Neolithic to Early Bronze Age 'humidified scraper' inserted in the um. The scraper is heat affected on one face and not vitrified.



Close-up photo of um fabric (9011), illustrating evidence of burning on the inside surface, likely to be a consequence of firing.



Close-up photo of um decoration, featuring one row of indentations and three rows of uneven circular indentations.



Close-up photo of um fabric (9011), with possible indications of grog temper.



Close-up photo of oval indentation patterning.



Close-up photo of um fabric (9011) containing inclusions of very small grey/blue chert chipping, and possibly small burnt pottery fragments (grog), extremely small shell and potentially cremated bone inclusions.



Close-up photo of um fabric (9011), the base contains a frequent concentration of mid grey/blue chert trinitration; grits that are in extremes density in the base with moderate and then occasional occurrence progressing up the body to the rim.



Plate 9.7 - The Early Bronze Age (EBA) vessel um (c.2100-1900BC) recovered from Bolton-le-Sands and excavated stratigraphically in the lab as a separate feature E20.



Plate 9.10 - Post-excavation photo of the um, the vessel is narrow at the base and widens significantly to the top.



Plate 9.11 - Post-excavation photo of the um, the thickness of the vessel's wall gradually thins as it progresses from the base to the top.

Figure 9 - Barrowed Time: Um Assessment photostory

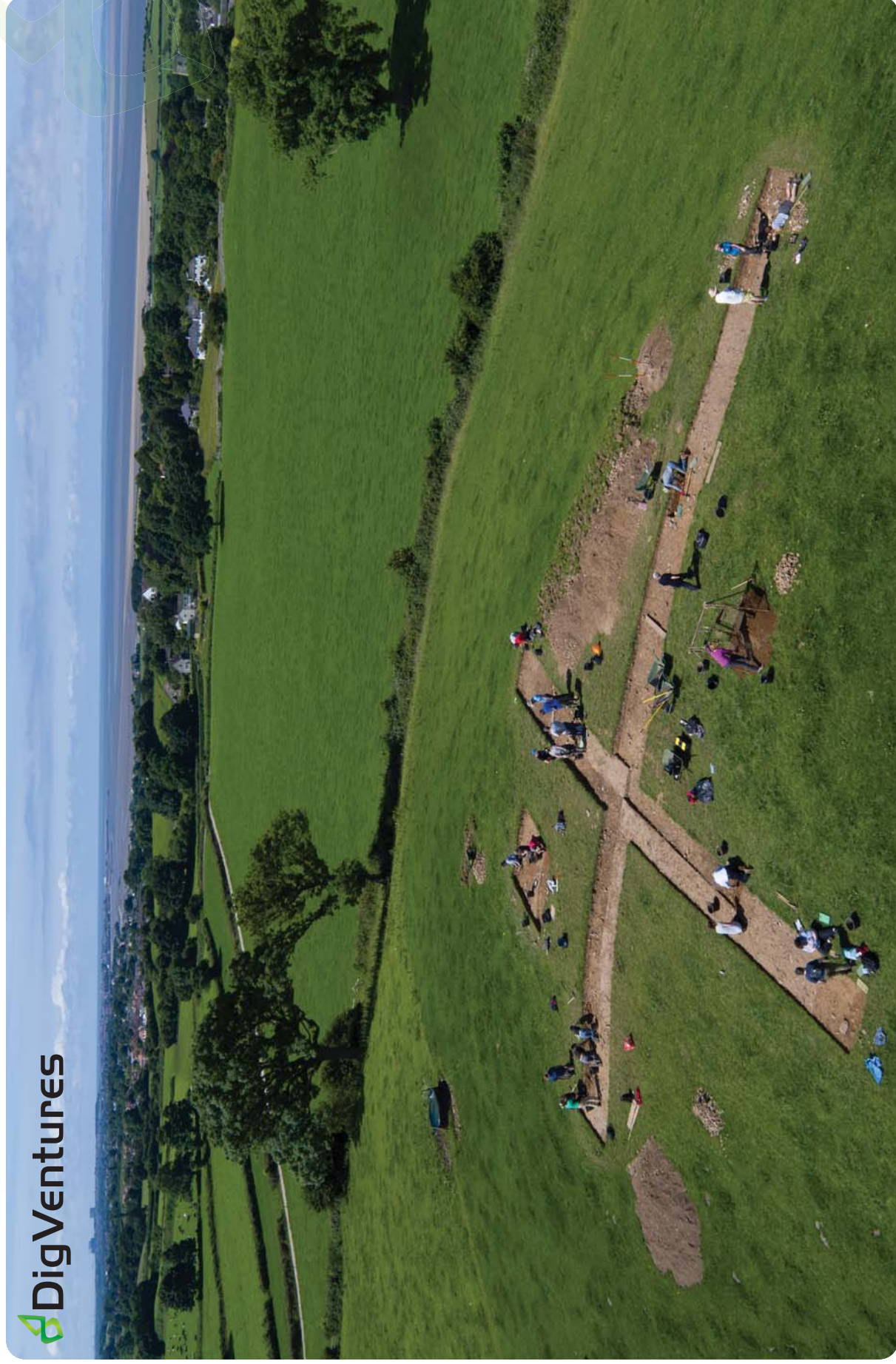


Figure 10 - Barrowed Time: Aerial view of the barrow at Bolton-le-Sands, looking south west across Morecambe bay.



Figure 11 - Barrowed Time: Aerial view of the barrow at Bolton-le-Sands, looking north east towards the Yorkshire Dales and Howgill Fells.



Figure 12 - Barrowed Time: Aerial view of the barrow at Bolton-le-Sands, under excavation by community volunteers.

Appendices

15 APPENDIX 1 – TRENCH AND CONTEXT DESCRIPTIONS

Trench 1	Dimensions: 2m x 35m (Extension of approx. 2m x 3m above the enclosing cairn bank)			
	Orientation: North-south			
	Reason for Trench: To assess, characterise and date the burial monument and a probable modern linear feature to the north of the monument			
Context	Description	Interpretation/ Process of deposition	Dimensions (m)	Feature
1001	Mid brown firm sandy silt with inclusions of sub-rounded pebbles, charcoal and coal fragments. Link: https://goo.gl/ws645g	Deposit – Topsoil	Length – 35.00m Width – 2.00m Depth – 0.05m	
1002	Mid brown firm silty sand with inclusions of charcoal and sub-rounded to sub-angular pebbles. Link: https://goo.gl/ZtUHpb	Deposit – Subsoil	Length – 35.00m Width – 2.00m Depth – 0.07m-0.12m estimated	-
1003	Mid orangey brown firm silty-clay with 50 % inclusions of sub-angular and sub-rounded stones, as well as occasional larger stone blocks up to 0.3m long Link: https://goo.gl/mYG6BW	Deposit – Overlying post medieval field boundary	Length – extends beyond LOE Width – extends beyond LOE Depth – 0.10 - 0.20m	BLS_10 2
1004	Mid greyish brown firm silty clay with inclusions of 10% rounded and sub-angular pebbles and cobbles, as well as regular occurrences of larger stone blocks up to 0.5m long Link: https://goo.gl/UDWPj9	Deposit – Post medieval field boundary	Length – 1.95m Width – 1.90 m Depth – Unknown	BLS_10 2
1005	Mid greyish brown firm silty-clay with 5% rounded stone inclusions up to 0.15m long Link: https://goo.gl/TQNNN6	Deposit – Base of post medieval field boundary	Length – 0.28m to LOE Width – 1.80m Depth – Unknown	BLS_10 2
1006	Mid orangey brown compact sandy clay with 80% sub-angular to rounded inclusions of medium sized stones up to 0.3m Link: https://goo.gl/10G5PE	Fill– Southern part of Bronze Age ring cairn	Length – 1.25m Width – 0.70m Depth – Unknown	BLS_10 1
1007	Mid orangey brown firm sandy clay with 20% inclusions of sub-angular small stones. Link: https://goo.gl/nHwWih	Deposit – Layer below subsoil	Length – 1.96m Width – 2.00m Depth – 0.20m - 0.35m	-
1008	Mid orangey brown hard sandy clay with 15% inclusions of sub-angular to rounded stones Link: https://goo.gl/eHX6Nc	Deposit – Natural	Length – 35.00m Width – 2.00m Depth – Unknown	-

1009	Mid orangey grey firm silty clay with inclusions of small angular pebbles Link: https://goo.gl/SU3LN5	Deposit – Buried soil beneath southern part of Bronze Age ring cairn	Length – 2.00m Width – 0.90m Depth – 0.05m	BLS_10 1
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Trench 2	Dimensions: 2m x 25m			
	Orientation: East-west			
	Reason for Trench: To assess the character of the burial monument and any associated archaeology			
Context	Description	Interpretation/ Process of deposition	Dimensions (m)	Feature
2001	Mid brown firm silty sand with inclusions of coal, charcoal, limestone and sandstone, as well as orange flecks and sub-rounded stone Link: https://goo.gl/QnTpQF	Deposit – Topsoil	Length – 25.00m Width – 2.00m Depth – 0.04m	-
2002	Mid brown firm sandy clay with occasional inclusions of sandstone, charcoal, coal and sub-angular to sub-rounded stones Link: https://goo.gl/0DvsAV	Deposit – Subsoil	Length – 25.00m Width – 2.00m Depth – 0.08-0.18m	-
2003	Mid orangey brown compact silty clay with 30% inclusions of sub-rounded to sub-angular small stones with occasional larger stone up to 0.25m long Link: https://goo.gl/mXr7T2	Deposit – Layer below subsoil	Length – Width – Depth – 0.03-0.26m	BLS_203
2004	Sub-oval pit feature, with gradually concaved sides and rounded base. Link: https://goo.gl/D14cjF	Cut – Cut of cobble filled pit	Length – 1.60m Width – 1.30m Depth – 0.10-0.30m	BLS_203
2005	Mid orangey brown soft silty clay with 50% inclusions of medium to large stones ranging from 0.1 to 0.3m Link: https://goo.gl/GJV3h1	Fill – Fill of cobble filled pit	Length – 1.60m Width – 1.30m Depth – 0.10-0.30m	BLS_203
2006	Mid orangey brown hard sandy clay with inclusions of 5% small stones Link: https://goo.gl/LrQDbs	Deposit – Natural	Length – 25.00m Width – 2.00m Depth – Unknown	-
2007	Mid greyish brown firm sandy silt with 10% inclusions of rounded small stone Link: https://goo.gl/zDMFyV	Fill – Cobble fill of cobble filled pit	Length – 1.40m Width – 1.30m Depth – 0.10-0.30m	BLS_203
2008	Predominantly cairn material – angular to sub-rounded pebbles and stones, with mid Greyish sandy silt Link: https://goo.gl/FwW2br	Layer – Western part of Bronze Age ring cairn.	Length – 1.75m Width – 2.00m+ Depth – 0.06-0.25m	BLS_204

2011	Predominantly cairn material – angular to sub-rounded pebbles and stones, with mid Greyish sandy silt Link: https://goo.gl/BdeqqA	Layer – Eastern part of Bronze Age ring cairn	Length – 1.75 Width – 2.00m+ Depth – 0.06-0.25m	BLS_202
2013	Disturbed and poorly sorted context indicative of recent backfill of modern clay pit, confirmed by farmer to have taken place in recent memory. Link: https://goo.gl/1VM5fc	Fill – Fill of Early Modern clay pit	Length – 3.0m+ Width – 2.0m+ Depth – unknown	BLS_201

Trench 3	Dimensions: 4m x 4m			
	Reason for Trench: To further investigate the original deposition of the treasure and complete excavation of a possible cremation burial			
Context	Description	Interpretation/ Process of deposition	Dimensions (m)	Feature
3001	Mid brown firm silty sand with inclusions of cremated bone fragments, flint and jet Link: https://goo.gl/QIOHG0	Deposit – Topsoil	Length – 4.00m Width – 4.00m Depth – 0.10m	-
3002	Mid brown firm sandy clay with inclusions of stones of varying sizes Link: https://goo.gl/DFAlid	Deposit – Subsoil	Length – 4.00m Width – 4.00m Depth – 0.05m	-
3003	Mid reddish brown moderate sandy silt with inclusions of small to medium sub-rounded to sub-angular stones, fractured sandstone, natural limestone pebbles and small flecks of charcoal Link: https://goo.gl/zSLE3b	Layer – Cremated material	Length – 4.00m Width – 4.00m Depth – 0.05m	BLS_303
3004	Light reddish brown firm silt sand with inclusions of small sub-angular stones, localised within single area, though potentially extending beyond limit of excavation Link: https://goo.gl/mht6z7	Layer – Bronze Age layer below cremation	Length – 1.0m+ Width – 1.0m+ Depth – 0.05m	-
3005	Circular shape in plan with rounded corners, a sharp break of slope-top and break of slope base, and steep almost vertical sides to a flat base. Link: https://goo.gl/OGi5AV	Cut – Cut of pit for inverted urn	Length – 0.55m Width – 0.65m Depth – 0.40m	BLS_302
3006	Light greyish brown moderately soft fine silty clay with inclusions of moderate rounded stones. Link: https://goo.gl/Wh1wHh	Fill – Fill of pit for inverted urn	Length – 0.55m Width – 0.65m Depth – 0.40m	BLS_302
3007	Circular shape in plan with rounded corners and gradual break of slope –top and gradual rounded break of slope –base,	Cut – Cut of Bronze Age pit filled	Length – 1.10m Width – 1.00m Depth – 0.50m	BLS_304

	concave and irregular sides to a gradual rounded base. Link: https://goo.gl/ih4Z3e			
3008	Mid reddish brown loose sandy clay with inclusions of charcoal fragments, large sub-rounded stones and numerous heat affected fractured stones Link: https://goo.gl/UTINcl	Fill – Fill of Bronze Age pit filled	Length – 1.10m Width – 1.00m Depth – 0.50m	BLS_304
3009	Sub-angular shape in plan with rounded corners and sharp break of slope-top, flat break of slope base, steep almost vertical sides to a flat base. Link: https://goo.gl/br7919	Cut – Cut of previously excavated UCLAN evaluation trench	Length – 0.36m Width – 0.30m Depth – 0.17m	BLS_301
3010	Mottled reddish brown loose sandy clay with no inclusions. Link: https://goo.gl/Hd0lh4	Fill – Fill of previously excavated UCLAN evaluation trench	Length – 0.36m Width – 0.30m Depth – 0.17m	BLS_301
3011	Light brown sandy clay with inclusions of chert chippings and possibly cremated bone Link: https://goo.gl/PfbGO1	Artefact – Fabric of inverted urn	Length – 0.381m Width – 0.420m Depth – 0.012 – 0.0275m	BLS_302
3012	Mid reddish brown stiff sandy clay with occasional inclusions of small and very small sub-rounded stones Link: https://goo.gl/E57gCL	Layer – Natural	Length – 0.381m Width – 0.420m	-
3013	Light brownish grey firm sandy silt with 5% inclusions of occasional charcoal Link: https://goo.gl/uEZXsi	Layer – Lens containing organic material	Length – 0.381m Width – 0.420m	-
3014	Mid reddish brown very compact sandy silt with moderate inclusions of small sub-angular stones and occasional small sub-rounded stone, as well as occasional cremated bone Link: https://goo.gl/BndxwV	Artefact – Clay cap of inverted urn	Length – 0.381m Width – 0.420m	BLS_302
3015	Light brownish grey very firm sandy silt with 90% inclusions of bone Link: https://goo.gl/ogCheB	Fill – Fill of inverted urn	Length – 0.381m Width – 0.420m	BLS_302

Appendix 2.1 Coins

Four coins were recovered during the excavations at Bolton le Sands, three of which are unstratified and one was recovered from topsoil in Trench 2. Three silver coins are in good condition; an Edward IV silver penny, BLS_10 (2001), dated to 1480-3, and two Elizabeth I shillings, BLS_114 and BLS_115 (both unstrat), dated to 1560-1 and 1591-5. The fourth, BLS_113 (unstrat), appears to be the copper alloy core of a coin, possibly a silver penny.

A specialist identification of the silver penny (BLS_10), would inform the dating of later activity of the site from a stratified and intrinsically dated find. This would contribute to an understanding of the overall chronology of the site (Aim 2, Q4), as well as aiding understanding of the nature, in terms of dates and extent of potential mixing, of the buried deposits (Aim 3, Q8 and Q9).

No further work is recommended for the other coins, which will be stored under appropriate conditions with the rest of the site archive.

Table 4 The coins

SF	Context	Material	Type	Description	Quantity	Weight (g)
10	2001	Silver	Silver penny	Edward IV, 1480-83	1	1
113	u/s	Cu alloy	?Penny	Cu alloy core from possible silver penny	1	1
114	u/s	Silver	Shilling	Elizabeth I Shilling, 1560-1	1	6
115	u/s	Silver	Shilling	Elizabeth I Shilling, 1591-5	1	6
				Total	4	14

Appendix 2.2 Cu Alloy, lead, iron and metalworking debris

The copper alloy assemblage recovered from Bolton le Sands comprises a number of small objects (n=15), including a fragment from a possible finger ring, small fragments from unidentifiable objects, a possible horse harness ring, and a modern assemblage of fragments from brass gun cartridges (n=3).

Other metal finds are less numerous, including a small group of iron (n=6) and one fragment of lead. One item of metalworking debris was recovered, a small lump of cu alloy slag, weighing 134g.

The finds recovered from secure contexts which would benefit from further analysis include the copper alloy objects, the iron and metalworking debris. Further identification has the potential to inform understanding of the chronology and use of the site (Aim 2, Q4), and identify any activities which may relate to the site (Aim 3, Q10).

Table 5 Copper alloy and lead objects

SF	Context	Material	Type	Description	Quantity	Weight (g)	Dimensions
2	1001	Cu Alloy	Button	Plain circular disc, upper side of button, possibly Georgian	1	3	21mm diam, 1mm thick
7	2001	Cu Alloy	Strap end	Possible strap end	1		
40	3002	Cu Alloy	Ring	Small fragment from annular ring, possible finger ring, semi-circular in section	1	1	14 x 3 x 1mm
116	u/s	Cu Alloy	Object	Part of tool or utensil, square in section, pointed at one end, straight and then curving at other end	1	13	56 x 5 x 6mm
117	u/s	Cu Alloy	Strip	Plain strip, rectangular in section, possible perforation edge at one end	1	3	23 x 10 x 2mm
118	u/s	Cu Alloy	Ring	Plain annular ring, possible harness ring, circular in section	1	13	33mm diam, 4mm thick
119	u/s	Cu Alloy	Object	Oval object with flat face, faint decoration visible, and two studs on back. Possible brooch fitting or button	1	2	14x 11 x 2mm
120	2001	Cu Alloy	Object	Curved strip with semi circular section. Possibly from an oval or D-shaped frame buckle	1	2	20 x 8 x 2mm
121	u/s	Cu Alloy	Object	Two objects, both partial. One, flat and curved with perforations. The other elongated with possible loop at one end.	2	13	18 x 18 x 3mm; 31 x 10 x 5mm
	1001	Cu Alloy	Cartridge	Shell fragment, brass, tubular with no markings	1	5	13 diam x 26 x 1mm
	1002	Cu Alloy	Cartridge	Shell fragments, very small, from wall of shell	2	1	12 x 6 x 1mm; 7 x 3 x 1mm
	2002	Cu Alloy	Cartridge	Shell fragment, brass, markings on base of shell	1	5	22 diam x 11mm
	u/s	Lead	Object	Triangular shaped lead object, unknown	1	8	37 x 29 x 2mm
				Total	15	66	

Table 6 Iron objects

SF	Context	Material	Type	Description	Quantity	Weight (g)	Dimensions
4	1001	Fe	Object	Iron wedge shaped tool	1	164	82 x 38 x 22mm
8	2001	Fe	Object	Ferrous object			
9	2001	Fe	Object	Ferrous object			

	1001	Fe	Object	Fe strip with rectangular section	1	3	34 x 7 x 5mm
	1002	Fe	Object	Two fragments, possibly both from same object, possible nail with large flattened head	2	29	57 x 18 x 9mm
	2001	Fe	Object	Fe strip with rectangular section, slightly curved	1	21	48 x 14 x 7mm
	2005	Fe	Object	Fe strip with rectangular section	1	4	42 x 6 x 4mm
				<i>Total</i>	6	221	

Table 7 Metal working debris

SF	Context	Material	Type	Description	Quantity	Weight (g)	Dimensions
	u/s	Slag	Slag	Smelting waste from cu alloy smelting	4	134	41 x 28 x 10mm
				<i>Total</i>	4	134	

Appendix 2.3 Stone; the flint and chert chipped stone assemblage

Introduction

One hundred and forty-five struck stones (including five probably natural) and four pieces of burnt unworked flint or chert were recovered in total from Trenches 1, 2 and 3 (see Appendix 2.5). The objective of the assessment was to evaluate the assemblage in relation to the site, and compare with results from previous investigations (in 2013). Specific aims are to understand the chronological development of the burial monument (Aim 2), assess the current state of the chipped stone assemblage (Aim 3, Q7), understand spatial patterning (Aim 3, Q10) and exploitation of resources (Aim 3, Q11)

Methodology

The lithics were catalogued according to broad artefact/debitage type and retouched pieces were classified following standard morphological descriptions (Bamford 1985, 72-77; Healy 1988, 48-49; Bradley 1999, 211-227; Butler 2005). A blade is defined as a flake over twice as long as it is wide and a bladelet is a blade under 40mm in length. Debitage is defined as the waste material from the manufacture of lithic implements. Prehistoric is defined as being Mesolithic to Early Iron Age and is used when it has not been possible to provide a more accurate date. Additional information was recorded on the condition of the artefacts including, burning, breakage, etc.

The 2013 lithic assemblage

The University of Central Lancashire (UCLAN) evaluation undertaken in 2013 produced a number of finds which have been the subject of post excavation assessment. Initial assessment was by necessity quite cursory and period of manufacture in particular given as a general

guide. The 2013 assemblage included cremated bone, copper alloy objects dating from the Bronze Age to the Post Medieval, unidentified burnt material, partly burnt wood, heat effected stone, jet, and an amount of lithic material. The majority of the worked stone has been given a broad date of Neolithic to Bronze Age, with a smaller percentage being Mesolithic to Neolithic. The 2013 lithics (mostly chert and flint), includes tool fragments, debitage, heat effected struck stone, and quartz chippings, some of which could be worked. Of note are fragments of red ochre like material and fine grained pale buff daub found during the excavation. The latter has also found adhering to one of the 2016 pieces of struck flint (BLS16_101).

Although the 2013 material requires further evaluation, it is possible to make some broad statements. Generally, the assemblage conforms in part with the dating of the 2016 finds, and the lithics are similarly lightly abraded.

The 2016 lithic (including chipped stone) assemblage

The chipped stone assemblage includes 19 cores or possible cores, 60 pieces of debitage including retouched, 24 tools on debitage, four blade based tools, four blade fragments, eight other tools, two other tool fragments, one scraper rough out, ten pieces of micro core fragments and debitage, six microliths including tools on micro debitage, one bladelet, one bladelet fragment, four unworked pieces of heated stone, and five pieces of stone that are probably natural.

With regards to lithic type, the assemblage comprises 60% chert, 25% flint, 13% probable chert but possible flint, 2% other stone types. Only six pieces show any significant abrasion, the rest have minimal or no damage. This strongly suggests that they are at or near the original deposition sites. The burnt unworked chert may have been burnt at any time in the past and is therefore not realistically dateable. The degree of cortex remaining on the stone is as follows; primary (more than 50%) cortification - 7%, secondary cortification (less than 50%) – 37%, tertiary (0%) cortification – 56%.

The majority of the assemblage dates to two periods – the Mesolithic to Neolithic (31%) and Neolithic to Bronze Age (26%). Other periods represented in the lithic record are Prehistoric (27%), Mesolithic (1.5%), Neolithic (6%), Bronze Age (0.5%), Bronze Age to Early Iron Age (4.5%), and the stone that is probably natural (3.5%).

Discussion

Abraded Stone – Noticeably abraded finds represented approximately 5% (7 items) of the assemblage. Five of these had been worked and two appeared to have no artificial removals but a couple could possibly have been used as hammer stones. All are black chert with one exception, being a piece of metamorphic or igneous black stone. At least one of the pieces has been water rolled, either in the sea or other fast flowing body of water. The only piece that can be firmly dated comes from the Neolithic to Bronze Age. Generally the lithics recovered from site showed only slight abrasion in the form light edge damage. The presence of more heavily abraded material suggests it was either artificially brought to site, to be knapped or for some more ritual use, or by some natural agency (e.g. glaciation), then utilised when the site was in use.

Orange Chert/Flint – The opaque orange stone found on site requires further analysis and investigation of other lithic assemblages in the North West. It does look like an orange version



of the caramel flint found on chalk downlands. However, there are two things that suggest it is an iron rich chert rather than flint. The first is cultural: it is generally thought that caramel flint was poorly regarded as a material for making lithic implements and would therefore seem unlikely to have been imported into the area in any great quantity. The second point is to do with the material itself, which occasionally includes are shiny silver grey in colour giving it the appearance of a polished and very fine grained limestone grading to chert. A similar graded interface between the chert and limestone is commonly observed in chert but rarely with such a high gloss.

The origin of the raw material requires further research, but may be Scottish. Pebbles of the same material have been found in the shingle at the Point of Ayre on the Isle of Man. The orange stone found on site seems to have been from a similar, but probably more local source. The supporting evidence for this is the Late Neolithic to Bronze Age core (pebble with removals) recovered from (2002)E. However, this may be the form in which the stone was imported from further afield. Six orange stone artefacts were recovered during the 2016 excavation. Of these, one dates from the Late Mesolithic to Early Neolithic, three Neolithic to Bronze Age, one probably Late Bronze Age to Early Iron Age, and a last piece that requires more detailed analysis to determine a more precise date. There were three scrapers, a microlith that could serve as both scraper and cutting edge, a core and a piece of debitage. Based on the recovered samples, it may be suggested that the orange stone may have had some importance in the transitional period between the Late Neolithic and the Early Bronze Age.

Heat Effected Stone – Heat effected chert and flint represent approximately 6% (9 items) of the assemblage. Five of these had been worked and four appear to have no artificial removals. Half of the worked pieces date from the Late Mesolithic to Early Neolithic, and the other half from the Neolithic to Bronze Age. Late Mesolithic to Early Neolithic lithics are present across the site so it would unwise to restrict the period in which they may have been burnt. Neither of the LM/EN burnt pieces are complete implements. There were no pieces with post heating removals. This indicates that the burning was probably accidental but does suggest the use of fire on the site. It should be noted that a number of the unheated lithics have spots of apparently burnt iron rich material adhering to them.

Table 8 *Lithic assemblage, type and date*

Date	Artefact type and quantity	
Probably natural		5
Prehistoric (i.e. Mesolithic to Early Iron Age)		40
	Cores and probable cores	7
	Debitage	20
	Retouched debitage	7
	Scraper on debitage	1
	Borer or awl	1
	Heated, probably unworked	4
Mesolithic		2
	Cores and probable core	1
	Retouched debitage	1
Mesolithic to Neolithic		46
	Cores and probable cores	1

Date	Artefact type and quantity	
	Debitage	17
	Retoucheddebitage	2
	Scraper ondebitage	3
	Burin/gouge ondebitage	4
	Tool ondebitage	1
	Micro core fragments	6
	Microdebitage	4
	Scraper on microdebitage	1
	Scraper and burin/gouge on bladelet fragment	1
	Bladelet fragment	1
	Micro barb or tip	1
	Microliths	3
	Bladelet	1
Neolithic		9
	Scraper ondebitage	1
	Blade fragments	4
	Scraper on blade	3
	Multi tool on blade	1
Neolithic to Bronze Age		39
	Cores and probable cores	7
	Retouched core	1
	Debitage	3
	Retoucheddebitage	9
	Scraper ondebitage	9
	Burin ondebitage	1
	Scraper and burin ondebitage	1
	Tool fragments	2
	Scraper	3
	Scraper and burin	1
	Borer or drill	1
	'D' scraper rough out	1
Bronze Age		1
	Cores and probable cores	1
Bronze Age to Early Iron Age		7
	Retouched core	1
	Retoucheddebitage	1
	Tool ondebitage	1
	Scraper ondebitage	2
	Scraper	1
	Scraper and burin	1

Table 9 *Lithic assemblage, significant finds*

Context	Amount	Description
(2001) West	1	Late Bronze Age to Early Iron Age south east Cumbrian chert, possibly flint, double end scraper. The use of material is similar to that of the knapped assemblage found during the Crosby Garret helmet site excavation, as is the style of working, which is similar to that found on grey and black cherts in the central Pennines.

Context	Amount	Description
(1002) North	1	Late Bronze Age to Early Iron Age blue grey chert scraper, probably on debitage – origins elsewhere and unlikely to be brought in contemporary to knapping so therefore probably knapped on material brought on site in a previous era. Typical of Late Bronze Age to Early Iron Age utilitarian approach to knapping of lithics and their low status comparative to copper alloy tools.
(1002) North (3003) (3004)	> 4	Late Mesolithic to Early Neolithic black chert micro core frags with micro removals. This group, & the micro debitage found, indicates that in the Late Mesolithic to Early Neolithic there was knapping on the site.
(2002) East (1002)	2	(2002)E.1 + (1002) - Neolithic to Bronze Age south east Cumbrian chert sub cuboid cores with Late Mesolithic to Early Neolithic looking removal scars. These two cores have a distinctive appearance suggesting they might be part of a localised lithic culture. The anomalous looking removal scars may be a result of the knapper checking the quality of the chert or to see if it was chert or flint. This behaviour is comparatively common in assemblies in the central Pennines, especially on chert. A single small long thin removal would tell the knapper what the quality of the chert was without compromising its ability to be knapped if found to be suitable.
(1002)	1	Prehistoric, i.e. Mesolithic to Early Iron Age, coterminous Black to dark grey chert /limestone artificially fractured. The fact that they were found so close together suggests it is more likely to be the result of Bronze Age to Early Iron Age working because if they were earlier it is likely the individual fragments would have been more widely dispersed. If this is the case then it indicates that the area was still being used as a knapping site at this late period.
(2003) West SF 89	1	Neolithic grey flint serrated blade, burin, with two fine scrapers - probably beach flint judging from the remaining cortex. This is quite a complex multi tool. The form of knapping is typical of the Neolithic but the knapping isn't as controlled as you would see on tools of the same period from flint rich areas.
(2003) West SF 101	1	Late Neolithic to Early Bronze Age grey flint retouched deb with adhering daub or ochre like material. This adhering material indicates that the flint has been incorporated into a built feature on the site. The material is similar in colour to the pale buff daub found during the 2013 UCLAN excavation. Taken as a whole, these factors, along with some of the excavated features, suggests the possible presence of a built structure on the excavation site.
(3015) SF 104	1	Late Neolithic to Early Bronze Age secondary grey flint heat effected damaged 'D' scraper. It has been subjected to heating and is thermally fractured. The scraper is incomplete with an estimated 50% apparently lost. The heating has been variable and the heated areas have grained slightly and turned white. The remaining outer surface of this artefact shows very few signs of heating. Over the more heavily heat effected surface there are signs of surface vitrification but on this face the flint retains its original grey colour immediately below the cortex. An early estimate of the temperature of the cremation is approximately 600 °C. Flint tends to calcine and show thermal decomposition after heating to temperatures of about 1000 °C. Initial assessment suggests that the scraper may have been at the periphery of an area subjected to intense heating. This could have been a cremation, but probably not the one with which it was found as there was soil adhering to all its surfaces and the flint was found in a void with 2 vessel fragments. In addition, the temperature of the bone when moved to the vessel would not have been sufficient to cause the type of heat damage that is present on the flint.

Context	Amount	Description
		Further study is required to determine this artefacts manner and circumstances of its heating and its relationship to the inhumation with which it is was found. The scraper is currently in 2 pieces but is likely to break further if the remaining adhering material is removed. The unburnt area has been lightly cleaned to determine working and degree of cortification.

Table 10 *Lithic assemblage, distribution by context*

Trench	Context	Total finds	Finds %	Trench totals	Trench %
1	1001	13	9		
	1002	42	28		
	1003	1	1	56	38
2	2001	8	5		
	2002	41	28		
	2003	12	9		
	2005	3	2	64	44
3	3001	4	3		
	3002	8	5		
	3003	9	6		
	3004	5	3		
	3015	1	1	27	20
Unstrat		2	1	2	1

Table 11 *Flint and chert catalogue*

Context	Trench	Description	Chert	Flint	Other	Ch or Fl	sub total	% per context
1001	North	LM/EN GF patinated core frag		1				
1001	North	PH SEC deb	1					
1001	South	B SEC core or deb	1					
1001	South	PH SEC deb	1					
1001	South	PH BC retouched deb	2					
1001	South	N/B black stone deb/core with abraded removals. Abraded.			1			
1001	South	LM/EN BC deb	1					
1001	Centre	N rhyolite (probably), scraper on blade			1			
1001		PH BC abraded deb	1					
1001		PH BC deb	1					
1001		LN/B GF scraper on deb		1				

Context	Trench	Description	Chert	Flint	Other	Ch or Fl	sub total	% per context
1001		LM/EN BC deb	1				13	9%
1002	South	LB/EI BC tool on deb	1					
1002	South	PH SEC deb	1					
1002	South	PH BC deb	1					
1002	South	PH BC retouched deb	1					
1002	South	LM/EN BC core	1					
1002	South	LM/EN BC deb	1					
1002	North	LM/EN BC deb	2					
1002	North	LM/EN SEC deb	2					
1002	North	LM/EN BGC deb	1					
1002	North	LM/EN GC deb	1					
1002	North	PH BC abraded, probably natural	2					
1002	North	PH SEC/F heat effected, probably unworked, heat effected				1		
1002	North	N/B SEC/F heat effected, scraper on deb, heat effected				1		
1002	North	(1002)N.1 LB/EI BGC scraper, probably on deb. Find of note.	1					
1002	North	(1002)N.2&.3 LM/EN BC micro core frags with micro removals. Find of note.	2					
1002	North	PH SEC probably natural but with a possible burin	1					
1002	North	PH BC retouched deb	1					
1002	North	LN/EB BC core	1					
1002	North	PH BC probably natural	1					
1002	North	N BC scraper on blade	1					
1002	North	N/B GF burin on deb (waste flake)		1				
1002	North	N/B GF retouched deb		1				
1002	North	PH GF deb		1				
1002	North	EN GF broken blade butt		1				
1002	North	LN/EB SEC/F sub 'D' scraper				1		
1002	North	LM/EN OBF scraper on deb		1				
1002		PH SEC deb	1					

Context	Trench	Description	Chert	Flint	Other	Ch or Fl	sub total	% per context
1002		EM BC core, possible reuse in B	1					
1002		LM/EN OBF bladelet frag retouched to burin/gouge & scraper		1				
1002		LN/B GF notched scraper on deb		1				
1002		N/B GF retouched deb		1				
1002		N/B SEC sub cuboid core [possible LM/EN scars] see (2002)E.1. Find of note.	1					
1002		PH coterminous BC/limestone artificially fractured. Find of note.	4					
1002		LN/EB GF scraper on deb		1				
1002		LN/B SEC/F damaged tool				1	42	28%
1003	South	84 N/B GF deb		1			1	1%
2001	East	PH SEC deb	1					
2001	East	LM/EN SEC deb	1					
2001	East	LN/B SEC/F deb				1		
2001	East	LM/EN BC deb	1					
2001	East	PH rhyolite (probably), deb			1			
2001	East	N/B OC 'D' scraper. Organe chert or flint.				1		
2001	West	(2001W).1 LB/EI SEC/F double end scraper. Find of note.				1		
2001	West	N/B OBF sub 'D' scraper + burin		1			8	5%
2002	East	M BC retouched deb	1					
2002	East	PH SEC heat effected, probably unworked. Heat effected.	1					
2002	East	LN/B OC core/pebble with removals. Orange chert or flint.				1		
2002	East	PH GC core or deb	1					
2002	East	PH GC deb, possible core prep	1					
2002	East	PH BC abraded deb. Abraded.	1					
2002	East	LN/EB BC retouched deb	1					
2002	East	PH BC deb	4					

Context	Trench	Description	Chert	Flint	Other	Ch or Fl	sub total	% per context
2002	East	LM/EN BC deb	1					
2002	East	LM/EN BC burin on deb	1					
2002	East	N/B GF retouched deb		1				
2002	East	LM/EN SEC/F heat effected deb. Heat effected.				1		
2002	East	(2002)E.1 N/B SEC sub cuboid core [possible LM/EN scars]. Find of note.	1					
2002	East	70 LM/EN GF micro deb		1				
2002		71 LM/EN GF deb retouched to tool		1				
2002		LM/EN BC burin on deb	1					
2002		LM/EN BGC deb	1					
2002		LM/EN GC deb	1					
2002		PH BC probably natural	1					
2002		32 LM/EN BC scraper on deb	1					
2002		87 88 LM/EN F micro deb, possibly tool frags		2				
2002		22 LM/EN SEC microlith or broken bladelet	1					
2002		30 N GF blade frag		1				
2002		37 LM/EN OC sub square microliths. Orange chert or flint.				1		
2002		44 LB/EI SEC scraper on deb	1					
2002		46 LN/EB BC scraper on deb	1					
2002		50 PH BC retouched deb	1					
2002		59 LN/EB BC retouched deb	1					
2002		62 N GC scraper on blade	1					
2002		65 N/B OBF scraper on deb		1				
2002		66 LB/EI OC scraper & broken burin [some LM/EN like scars]. Organge chert or flint.				1		
2002		72 LM/EN F heat effected bladelet frag		1				

Context	Trench	Description	Chert	Flint	Other	Ch or Fl	sub total	% per context
2002		73 EN GF broken blade butt		1				
2002		75 LN/EB GF broken blade possibly retouched to a scraper		1				
2002		82 N/B GF retouched deb		1				
2002		69 PH BC core/pebble with removals, water rolled. Abraded.	1					
2002		86 LN/B OC deb. Orange chert or flint.				1	41	28%
2003	West	PH SEC/F core/deb				1		
2003	West	93 LN/EB GF retouched deb		1				
2003	West	94 PH OC scraper on deb. Orange chert or flint.				1		
2003	West	95 LM/EN BC fine end scraper on deb	1					
2003	West	96 LN/EB BC core	1					
2003	West	98 LM/EN GF bladelet		1				
2003	West	89 N GF serrated blade, burin, fine scrapers - probably beach flint. Find of note.		1				
2003	West	100 LM/EN BGC retouched deb	1					
2003	West	100 LM/EN BGC deb	1					
2003	West	100 LM/EN GF side scraper on micro deb		1				
2003	West	101 LN/EB GF scraper on broken/abandoned tool		1				
2003	West	101 LN/EB GF retouched deb with adhering daub or ochre. Find of note.		1			12	8%
2005	West	?? PH SEC heat effected, probably unworked	1					
2005		90 N/B BC core	1					
2005		85 LN/B GF damage borer/drill retouched to possible burin		1			3	2%
3001		PH SEC/F retouched deb				2		
3001		N BC scraper on deb	1					

Context	Trench	Description	Chert	Flint	Other	Ch or Fl	sub total	% per context
3001		N/EB GF heat effected, probable tool frag		1			4	3%
3002		17 LN/EB GF scraper on broken/abandoned tool		1				
3002		24 N SEC/F blade frag				1		
3002		26 PH BC borer or awl	1					
3002		25 LN/EB GF 'D' scraper rough out		1				
3002		38 LM/EN OBF micro deb		1				
3002		41 LM/EN SEC micro tip or barb	1					
3002		56 LN/EB BC retouched deb	1					
3002		57 LM/EN OBF probable microlith, possible micro deb		1			8	5%
3003		LM/EN BC micro core frags with micro removals see(1002)N.2&.3 Find of note.	2					
3003		PH BC abraded deb. Abraded.	1					
3003		PH SEC lightly heat effected, probably unworked	1					
3003		76 N/B SEC retouched core	1					
3003		78 PH BC deb	1					
3003		79 B/EI BC retouched core/deb	1					
3003		80 LM/EN GC burin on deb	1					
3003		81 B/EI SEC/F retouched deb				1	9	6%
3004		PH SEC deb	1					
3004		LM/EN BC micro core frags with micro removals see(1002)N.2&.3. Find of note.	1					
3004		53 M/N SEC/F retouched blade frag/deb				1		
3004		55 LM/EN BC two burin/gouges on deb	1					
3004		60 N/B BC scraper & possible burin on deb	1				5	3%

3015		104 LN/EB GF heat effected damaged 'D' scraper		1			1	1%
Unstrat		PH BC deb	1					
Unstrat		LM/EN BGC deb	1				2	1%
		Grand Totals (material)	90	37	3	19	149	100%
		% material	60%	25%	2%	13%		

Key

Material

BC – Black to dark grey chert
GC – Light to pale grey chert
GF – Grey flint
F – Flint colour uncertain
BGC – Blue grey chert
OBF – Olive brown flint
OC- Orange chert or flint
Other – Probably an igneous or metamorphic rock such as rhyolite
SEC – South east Cumbrian chert
SEC/F – South east Cumbrian chert, possibly flint

Period

PH – Prehistoric i.e. Mesolithic to Early Iron Age
M – Mesolithic
LM/EN – Late Mesolithic to Early Neolithic
M/N - Mesolithic to Neolithic
EN – Early Neolithic
N –Neolithic
LN/EB – Late Neolithic to Early Bronze Age
N/B –Neolithic to Bronze Age
B – Bronze Age
B/EI –Bronze Age to Early Iron Age
LB/EI – Late Bronze Age to Early Iron Age

Appendix 2.4 Stone - black lithic (cannel coal/ jet)

A group of 18 fragments (weighing 50g) of unworked jet, lignite or cannel coal were recovered from the site at Bolton le Sands, and only one from Scotforth (Trench 5). The finds were recovered from topsoil and subsoil deposits (1001, 1002, 1003, 2001, 2002, 5003). Identification of black lithic materials can be undertaken using X-ray fluorescence (see Davis 1993; Hunter et al 1993), which will help distinguish jet from cannel coal. Prior to further analysis, this is assumed to be largely made up of fragments of cannel coal, rather than jet, due to the nature of the fragments (unworked, or working debris) and the likely proximity to more local sources. The finds are mainly small fragments with conchoidal fractures and, although there are no finished objects, the assemblage could represent working debris and therefore suggest production of artefacts on or around the site.

Objects manufactured from black lithic, especially jet, are often associated with exotic and valuable items, and occasionally included as grave goods in Bronze Age burials (such as from the cist cemetery at West Water Reservoir, Hunter and Davis 1994). Little is known about the manufacture and distribution of goods during early prehistory, although much of the jet which has been analysed and positively identified is likely to have been manufactured in Whitby (see Sheridan et al 2002). The use of jet-like materials in their own right (such as cannel coal) is less well understood.

This group of material is really interesting, and would benefit from closer examination. The specialist identification of the material would not only help present a more accurate picture, but will provide key evidence in understanding more about the exploitation of natural resources, either near to the site, or imported to the site from some distance (Aim 3, Q10 and Q11). Once the type of stone has been fully identified, broader comparisons will be possible both within assemblage (as part of the material culture at the site) and with other sites.

Table 12 Black lithic assemblage

SF	Context	Trench	Material	Type	Description	Quantity	Weight	Dimensions
5	1001		Black lithic	Jet or cancell coal	Fragment, conchoidal fractures	1	7	33 x 30 x 13mm
	1001	North	Black lithic	Jet or cancell coal	Two fragments	1	5	22 x 11 x 11mm
	1001	South	Black lithic	Jet or cancell coal	Small fragment, conchoidal fractures	1	0.5	17 x 7 x 6mm
	1001	Centre	Black lithic	Jet or cancell coal	Small fragment, conchoidal fractures	1	1	25 x 12 x 7mm
58	1002		Black lithic	Jet or cancell coal	Fragment, conchoidal fractures	1	5	39 x 19 x 14mm
42	1002		Black lithic	Jet or cancell coal	Fragment, conchoidal fractures	1	1	16 x 10 x 6mm
	1002	South	Black lithic	Jet or cancell coal	Small fragment, and small cuboid frag	2	1	4 x 3 x 3mm
	1002	Ext	Black lithic	Jet or cancell coal	Small fragments x 3	3	2	8 x 5 x 3mm
	1003	North	Black lithic	Jet or cancell coal	Small fragment, conchoidal fractures	1	1	27 x 16 x 6mm
	2001	East	Black lithic	Jet or cancell coal	Small fragment, conchoidal fractures	1	1	20 x 19 x 6mm
21	2002		Black lithic	Jet or cancell coal	Small fragment, petrified wood	1	1	13 x 4 x 3mm
	2002	West	Black lithic	Jet or cancell coal	Small fragment, petrified wood	1	3	24 x 10 x 8mm
	2002	East	Black lithic	Jet or cancell coal	Small fragment, conchoidal fractures	1	4	31 x 22 x 12mm
	Unstrat		Black lithic	Jet or cancell coal	Fragment, conchoidal fractures	2	18	27 x 28 x 22mm
					<i>Total</i>	18	50.5	

Appendix 2.5 Stone - general

Only one fragment of stone displayed evidence of possible use wear – a fragment of haematite with wear on one end, potentially used as a hammerstone (2002). Two further finds of possible haematite (1001, 1002) were much smaller and display no signs of use. Other stone finds recovered included heat shattered stone (1001, 1002, 2001), and a possible fragment of calcite (2002).

In order to understand more fully the significance of this group of fragments, especially in relation to utilisation of wider resources available to the people using the site (Aim 3, Q10), the geological identification of stone type and probable source is recommended.

Table 13 Stone – other worked stone, manuports and heat shattered stone

SF	Context	Trench	Material	Type	Description	Quantity	Weight	Dimensions
	1001	North	Stone	Haematite	Unworked – manuport?	1	5	13 x 8 x 6mm
	1002	South	Stone	Haematite	Unworked – manuport?	1	51	33 x 33 x 27mm
	2002	East	Stone	Haematite	Possible hammerstone	1	130	50 x 32 x 30mm
	1003	North	Stone	Calcite	Possible calcite seam – manuport?	1	12	47 x 28 x 7mm
	1001	North	Stone	Unknown	Heat shattered stone	1	8	34 x 30 x 8mm
	1002	North	Stone	Unknown	Heat shattered stone	1	43	42 x 37 x 22mm
	2001	West	Stone	Unknown	Heat shattered stone	1	59	48 x 45 x 34mm
					<i>Total</i>	7	308	

Appendix 2.6 Stone: Quartzite

A large number of quartzite fragments, in the form of both chips and small pebbles, was recovered during excavation (n=87, 570g). The quartz material was recovered from topsoil and subsoil deposits in Trench 1 (52 frags), Trench 2 (27 frags) and Trench 3 (7 fragments). The single exception is a group of five small chips and one larger pebble from fill (2005), associated with pit F203. Quartz is not an easy material to study with regards to its alteration and use and its collection from archaeological contexts is certainly worthwhile (see Warren and Neighbour 2004). Although not yet positively identified as worked artefacts or working debris, the material collected represents a further potential strand of investigation into use and working of lithics at the site. In addition, the presence of a number of small quartz pebbles may be suggestive of something more symbolic, a possibility noted due to its occurrence in funerary contexts (Warren 2006).

The material would benefit from being assessed alongside other chipped stone, with consideration of the distribution of both chipped material and the frequency of natural and

unworked pebbles at the site. Broader consideration of the quartz, with regards to its provenance and comparison with use at other contemporaneous sites, would aim to explore the utilisation of materials (addressing Aim 3, Q10 and Q11).

Table 14 Quartzite

SF	Context	Trench	Material	Type	Description	Quantity	Weight	Dimensions
	1001	South	Stone	Quartzite	Small quartz pebbles x 2, small chip	3	10	
	1001	North	Stone	Quartzite	Small pebbles x 2	2	4	
14	1002		Stone	Quartzite	Quartz pebble	1	87	50 x 44 x 30mm
16	1002		Stone	Quartzite	Quartz pebble	1	6	22 x 19 x 15mm
13	1002		Stone	Quartzite	Quartz pebble/ chip	1	0.5	14 x 8 x 8mm
15	1002		Stone	Quartzite	Rose quartz pebble/ chip	1	0.5	3 x 2 x 2mm
39	1002		Stone	Quartzite	Quartz chip	1	1	13 x 12 x 8mm
	1002	South	Stone	Quartzite	Quartz pebbles and chips (x 14)	14	140	32 x 27 x 22mm
	1002	North	Stone	Quartzite	Quartz pebbles and chips (x 14)	14	64	
	1002	Ext	Stone	Quartzite	Quartz pebbles x 2	2	3	
	1003		Stone	Quartzite	Small pebbles x 10	10	19	
	1003	South	Stone	Quartzite	Small pebbles x 2	2	4	
	2001	East	Stone	Quartzite	Small pebbles x 3	3	3	
19	2002		Stone	Quartzite	Small fragment, ?rock crystal	1	1	3 x 2 x 2mm
74	2002		Stone	Quartzite	Small fragment, chip of quartz	1	1	2 x 2 x 2mm
20	2002		Stone	Quartzite	Rose quartz pebble/ chip	1	0.5	5 x 4 x 2mm
47	2002		Stone	Quartzite	Quartz chip	1	0.5	8 x 7 x 3mm
	2002	East	Stone	Quartzite	Small chip x 1	1	0.5	
	2002	West	Stone	Quartzite	Small pebbles x 8	8	28	
	2002	South	Stone	Quartzite	Small chips x 2	2	1	
	2002		Stone	Quartzite	Small pebbles x 4	4	13	
	2005		Stone	Quartzite	One large quartz pebble and 5 smaller chips	5	170	56 x 49 x 40mm

SF	Context	Trench	Material	Type	Description	Quantity	Weight	Dimensions
	3003		Stone	Quartzite	Small pebbles and chips x 2	7	10	
	Unstrat		Stone	Quartzite	Small chip	1	2	
					<i>Total</i>	87	569.5	

Appendix 2.7 Glass

A small assemblage of glass was recovered from the excavations (n=4, 27g), all modern green glass. The fragments were recovered from topsoil and subsoil in Trenches 1 and 2. No further work is recommended.

Table 14 Glass fragments

SF	Context	Trench	Material	Type	Description	Quantity	Weight	Dimensions
	1001	North	Glass	Modern	Green, modern glass fragments	2	5	31 x 15 x 3mm
	1002	North	Glass	Modern	Green, modern glass fragments	2	12	31 x 20 x 3mm
	1002	Central	Glass	Modern	Green, modern glass fragments	2	5	35 x 18 x 2mm
	2001	West	Glass	Modern	Green, modern glass fragments	1	5	22 x 21 x 3mm
					<i>Total</i>	7	27	

Appendix 2.8 Ceramics - prehistoric pottery

In addition to the cremation urn (BLS_112) a small number of sherds (n=35) were recovered during the excavations. The vessel sherds are all body sherds, poorly preserved with very abraded fractures. No rim or base sherds are present in this group and further work is recommended once a detailed assessment of the fabric and typology of the cremation urn (currently with the conservation lab) has been completed. Four fragments were recovered from Trench 1, all from subsoil (1002), and a further four from Trench 2. The latter group includes two fragments recovered from the fill (2005) of pit feature F203.

This group of prehistoric pottery should be analysed alongside the burial urn, with a close examination of the complete assemblage to designed understand the chronology of the site, the nature of the activity relating to the site and the people who visited and use it (Aim 2, Q4, Aim 3, Q10 and Q11). Scientific analysis should also be considered to hold potential to shed light on these areas – in particular lipid analysis to assess the contents of vessels used and scientific provenance to explore the use of local and distant resources.

Table 15 Prehistoric pottery

SF	Context	Trench	Material	Type	Description	Quantity
31	1002		Ceramic	Prehistoric pottery	Body sherd	1
48	1002		Ceramic	Prehistoric pottery	Body sherd	1



SF	Context	Trench	Material	Type	Description	Quantity
52	1002		Ceramic	Prehistoric pottery	Body sherd, burnt	1
NFS	1002		Ceramic	Prehistoric pottery	Possible prehistoric pot fragment, no extant surfaces	1
122	2002		Ceramic	Prehistoric pottery	Two fragments, one larger body sherd, one small frag	2
102	2003		Ceramic	Prehistoric pottery	7 small and very worn pot fragments found in close association with charcoal	7
91	2005		Ceramic	Prehistoric pottery	Body sherd	1
97	2005		Ceramic	Prehistoric pottery	Body sherd	1
54	3002		Ceramic	Prehistoric pottery	Vessel sherds	6
110	3002		Ceramic	Prehistoric pottery	Vessel, 1 fragment, no find spot	1
77	3003		Ceramic	Prehistoric pottery	Body sherd, poorly preserved	1
61	3004		Ceramic	Prehistoric pottery	Possible vessel fragment, no extant surfaces	1
123	3006		Ceramic	Prehistoric pottery	Four fragments, no extant surfaces, from fill around urn	4
111	3008		Ceramic	Prehistoric pottery	Vessel, 6 fragments, no find spot	6
112	3011		Ceramic	Prehistoric pottery	Burial urn (and associated fragments)	1 (urn)
105	3015		Ceramic	Prehistoric pottery	Vessel sherd	1

Appendix 2.9 Ceramics - post-medieval pottery and clay pipe

A total of 340 fragments of medieval/post medieval pottery were recovered during excavations, with a total weight of 1.5kg. The assemblage is made up of small fragments (an average weight of 4.5g per sherd) including rim, body and base sherds of very mixed type. The majority of finds appear to be post medieval and include Victorian blue and white, glazed brown and red earthenwares, transfer printed wares, slipwares, stoneware and salt-glazed fabrics. Fragments from Trench 1 (n=200, 885g) and Trench 2 (n=128, 561g) were recovered



from topsoil and subsoil deposits. The range of types and level of abrasion across the trenches is comparable. Trench 3 finds included one group of eight fragments recovered from topsoil (3001), and two fragments from layer (3004), presumably intrusive finds.

Clay pipe fragments (n=23, 40g) were recovered from Trenches 1, 2 and 4, all from topsoil or subsoil deposits. Apart from one small example of a bowl fragment with the beginnings of a heel, all the fragments are from broken stems with no mouthpieces noted. No stamps or other visible markings were present within the group.

A simple typological identification and dating of the post medieval pottery and clay pipe would provide a useful indication of the main periods of later activity, providing a full chronological framework for the site (Aim 2, Q4).

Table 16 Post medieval pottery

SF	Context	Trench	Material	Type	Description	Quantity	Weight
	1001	North	Ceramic	Med/Post - medieval	Mixed body, base and rim sherds including Victorian blue and white, brown glazed earthenwares, transfer printed wares and salt-glazed fabrics. Generally fragmented and abraded.	49	253
	1001	Centre	Ceramic	Med/Post - medieval	Brown glazed earthenware, 1 vessel fragment	1	7
	1001	South	Ceramic	Med/Post - medieval	Mixed body, base and rim sherds including Victorian blue and white, brown glazed earthenwares, transfer printed wares and salt-glazed fabrics. Generally fragmented and abraded.	28	147
	1002	North	Ceramic	Med/Post - medieval	Mixed body, base and rim sherds including Victorian blue and white, brown glazed earthenwares, slipware, transfer printed wares and salt-glazed fabrics. Generally fragmented and abraded.	71	361
	1002	North	Ceramic	Med/Post - medieval	Two fragments of red earthenware, possibly medieval	2	8
	1002	South	Ceramic	Med/Post - medieval	Mixed body, base and rim sherds including Victorian blue and white, brown glazed earthenwares, transfer printed wares and salt-	21	57

SF	Context	Trench	Material	Type	Description	Quantity	Weight
					glazed fabrics. Generally fragmented and abraded.		
	1002	Central	Ceramic	Med/Post - medieval	Mixed body, base and rim sherds including Victorian blue and white, brown glazed earthenwares, transfer printed wares and salt-glazed fabrics. Generally fragmented and abraded.	24	42
	1002	Central	Ceramic	Med/Post - medieval	Fragments of red earthenware, possibly medieval	1	3
	1003	North	Ceramic	Med/Post - medieval	Two fragments brown glazed earthenware, one porcelain	3	7
	2001	East	Ceramic	Med/Post - medieval	Mixed body, base and rim sherds including Victorian blue and white, brown glazed earthenwares, transfer printed wares and salt-glazed fabrics. Generally fragmented and abraded.	13	43
	2001	West	Ceramic	Med/Post - medieval	Mixed body, base and rim sherds, and a handle. Includes Victorian blue and white, stoneware, brown glazed earthenwares, transfer printed wares and salt-glazed fabrics. Generally fragmented and abraded.	61	269
	2002		Ceramic	Med/Post - medieval	Three small fragments of probably Victorian wares	3	2
	2002		Ceramic	Med/Post - medieval	Mixed body, base and rim sherds including Victorian blue and white, brown glazed earthenwares, transfer printed wares and salt-glazed fabrics. Generally fragmented and abraded.	2	6
	2002	West	Ceramic	Med/Post - medieval	One fragment, red earthenware, poss Roman	1	25

SF	Context	Trench	Material	Type	Description	Quantity	Weight
	2002	West	Ceramic	Med/Post - medieval	Mixed body, base and rim sherds including Victorian blue and white, brown glazed earthenwares, transfer printed wares and salt-glazed fabrics. Generally fragmented and abraded.	31	102
	2002	East	Ceramic	Med/Post - medieval	Base, body and rim fragments from three vessels, including glazed red earthenware, salt glazed and possible creamware rim	10	95
	2002	South	Ceramic	Med/Post - medieval	Body and rim fragments from mixed wares including glazed brown earthenware, Victorian blue and white	7	19
	3001		Ceramic	Med/Post - medieval	Body and rim fragments from various vessels including Victorian blue and white, glazed brown and red earthenwares	8	29
	3004		Ceramic	Med/Post - medieval	Base, body and rim fragments from two vessels, including glazed red earthenware	2	15
					Total	338	1490

Table 17 Clay pipe

SF	Context	Trench	Material	Type	Description	Quantity	Weight	Dimensions
	1001	South	Ceramic	Clay pipe	Stem fragment, 7mm diameter with 2mm hole	1	2	17 x 7mm
	1001	North	Ceramic	Clay pipe	Stem fragments, 6mm diameter with 2mm hole; one fragment has no perforation and is burnt on the surface	4	9	37 x 6mm
	1002	North	Ceramic	Clay pipe	Stem fragment, 8mm diameter with 2mm hole, smaller	2	3	23 x 8mm

SF	Context	Trench	Material	Type	Description	Quantity	Weight	Dimensions
					fragment is very burnt			
	1002	South	Ceramic	Clay pipe	Stem fragment, 7mm diameter with 2mm hole	1	2	25 x 8mm
	2001	West	Ceramic	Clay pipe	Stem fragments, 6mm diameter with 2mm hole	6	12	36 x 6mm
	2002	East	Ceramic	Clay pipe	Stem fragment, 6mm diameter with 2mm hole, burnt	1	1	19 x 6mm
	2002	West	Ceramic	Clay pipe	Stem fragments, 6mm diameter with 2mm hole	5	6	27 x 6mm
					<i>Total</i>	20	35	

Appendix 2.13 Building materials - CBM and daub

Only one small group (n=4, 43g) of very abraded brick was recovered during excavations, from subsoil deposits in Trench 1 (1002). Perhaps of more significance are the two fragments of possible daub recovered in Trench 3 deposits (3001) (3003). Although relatively small in both size and number, the presence of daub at the site may provide limited evidence of a structure.

Although limited in both size and number the possible presence of daub at the site is interesting, and has connotations for understanding the use and possible make-up of more structural elements at the site. For this reason (Aim 2, Q4), further analysis on this material might be beneficial.

Table 18 Building materials – CBM and daub

SF	Context	Trench	Material	Type	Description	Quantity	Weight	Dimensions
	3001		CBM	Daub	Possible daub	1	21	27 x 28 x 20mm
	3003		CBM	Daub	Possible daub	1	21	45 x 29 x 25mm
	1002	North	CBM	Brick	Four worn fragments of brick or tile	4	43	39 x 23 x 18mm
					<i>Total</i>	6	85	

19 APPENDIX 3 – PALAEOENVIRONMENTAL DATA

Table 19 Plant Macrofossils - Complete list of taxa recovered

Taxonomy and nomenclature follow Stace (1997)

Sample Number	2	9	
Context Number	3600	2009	
Feature Number			
Feature Type		Deposit	
Notes		Bank deposit of monument	
Latin Binomial			Vernacular
Indeterminate Cereal	1	1	Indeterminate Cereal

Table 20 Charcoal - Complete list of taxa recovered

Taxonomy and nomenclature follow Schweingruber (1978). Numbers are identified charcoal fragment for each sample.

Sample Number		3	3	3	3	4	11	11
Context Number		3008	3008	3008	3008	3003	3006	3006
Feature Number		3007	3007	3007	3007		3005	3005
Feature Type		Heat affected pit	Heat affected pit	Heat affected pit	Heat affected pit	Layer - ?ritual funerary surface	Cremation burial fill	Cremation burial fill
Notes		Sub sample 1	Sub sample 3	Sub sample 4	Sub sample 6	Sub sample 4	Sub sample 1	Sub sample 2
No. fgts.		500+	400+	500+	700+	36	14	11
Max. size (mm)		19	17	15	18	8	11	14
Latin	Vernacular							
<i>Salix</i> / <i>Populus</i>	Willow / Poplar			26				
<i>Alnus glutinosa</i> / <i>Corylus avellana</i>	Alder / Hazel	100	98	73	100			2
<i>Quercus</i>	Oak		2	1		3	6	
Indeterminate	Indeterminate					33	8	9

Sample Number		Unknown	
Context Number			
Feature Number			
Feature Type			
Notes			
No. fgts.		250+	
Max. size (mm)		13	
Latin	Vernacular		
Quercus	Oak	41	
Indeterminate	Indeterminate	59	

Table 21 Components of the samples from excavations

Semi quantitative scale: '1' – one or a few specimens (less than an estimated six per kg of raw sediment) to '4' – abundant remains (many specimens per kg or a major component of the matrix).

Sample Number	1	1	2	3	3	3	3
Context Number	3003	3003	3600	3008	3008	3008	3008
Feature Number				3007	3007	3007	3007
Feature type	Layer	Layer		Heat affected pit	Heat affected pit	Heat affected pit	Heat affected pit
Notes	Layer - ?ritual funerary surface	Layer - ?ritual funerary surface					
Sub sample	1	2		1	2	3	4
Charcoal	1	1	2	3	3	3	3
Earthworm egg capsules	1	1	1	1	1	1	1
Insect fragments	1			1	1		
Plant macrofossils – charred			1				
Plant macrofossils - modern	1						
Root / rootlet fragments	4	4	4	4	4	4	4
Sand	3	3	3	2	2	2	1
Shell fragments			1				

Sample Number	3	3	4	4	4	4	5
Context Number	3008	3008	3003	3003	3003	3003	2005
Feature Number	3007	3007					2004
Feature type	Heat affected pit	Heat affected pit	Layer	Layer	Layer	Layer	Fill

Sample Number	3	3	4	4	4	4	5
Notes			?ritual funerary surface	?ritual funerary surface	?ritual funerary surface	?ritual funerary surface	
Sub sample	5	6	1	2	3	4	1
Bone fragments			3	3			
Charcoal	1	4	1	1	2	1	1
Earthworm egg capsules		2		1			1
Insect fragments				1			
Root / rootlet fragments		3	4	3	4	4	4
Sand			3	4	3	3	2
Stones	4						

Sample Number	5	8	9	9	11	11	Unkn own
Context Number	2005	2008	2009	2009	3006	3006	
Feature Number	2004				3005	3005	
Feature type	Fill	Deposit	Deposit	Deposit	Cremation burial fill	Cremation burial fill	
Notes		Bank of monument	Bank of monument	Bank of monument			
Sub sample	1		1	2	1	2	
Bone fragments			4				
Charcoal	1	1		1	1	2	4
Earthworm egg capsules	1	1		1	1	1	1
Insect fragments					1		
Plant macrofossils – charred				1			
Root / rootlet fragments	4	4		4	2	4	
Sand	2	2		3	4	2	

20 APPENDIX 4 – ENVIRONMENTAL SAMPLE CATALOGUE

Sample Number	Context Number	Sample Type	Reason for sample	Sample volume
2	3006	Ecofact recovery Pollen General bulk	Is there any evidence of past environmental conditions? Are there any artefacts related to the deposition of the pot	10l
3	3008	Ecofact recovery Pollen General bulk	Is there enough charcoal for radiocarbon dating? Are there any ecofacts are artefacts relating to the purpose of the pit?	10l
4	3003	Cremation	Can the cremated bone fragments be identified. Can the charcoal be radiocarbon dated	10l
5	2005	General bulk	Category A – sediment likely to inform of particular use of feature	10l
6	3006	General bulk Pollen Ecofact recovery	Is there any evidence of past environmental conditions? Are there any artefacts related to the deposition of the pot	10l
7	2002	General bulk	Category C – deposits containing material not necessarily related to the function of a feature, but characterising deposits from different parts of the site.	10l
8	2008	General bulk	Category B – identified as containing material that could yield information regarding the deposit's origin or the process that produced it.	10l
9	2009	General bulk	Category B – identified as containing material that could yield information regarding the deposit's origin or the process that produced it.	10l
10	1009	General bulk	Because it was from a special feature	20l
11	3006	Ecofact recovery Pollen General bulk	Is there any evidence of past environmental conditions? Are there any artefacts related to the deposition of the pot	10l
12	3012	General bulk	To investigate organic matter in the natural immediately below the urn	100gr

21 APPENDIX 5 – MEDIA AND EVENTS – AUDIENCE FIGURES

Event/Publication	Date	Attended/Impressions
<i>The Observer</i>	13/03/2016	6.2 million
<i>The Times</i>	14/03/2016	2.8 million
<i>The Sun</i>	14/03/2016	9.1 million
The Bay (Broadcast)	14/03/2016	1,000
BBC Radio 5Live	14/03/2016	5,774
BBC News	14/03/2016	6.4 million
BT News	14/03/2016	Unknown
Culture24	14/03/2016	50,000
<i>Daily Mail</i>	14/03/2016	10.9 million
ITV News Online	14/03/2016	Unknown
<i>Lancashire Telegraph</i>	14/03/2016	Unknown
<i>Longridge & Ribble Valley News & Advertiser</i>	14/03/2016	Unknown
Tech Times	14/03/2016	Unknown
<i>Telegraph</i>	14/03/2016	5.3 million
<i>The Independent</i>	14/03/2016	2.9 million
<i>Westmorland Gazette</i>	21/03/2016	385
Reddit (linked to Observer article)	14/03/2016	30,462
<i>The Arts Newspaper</i>	15/03/2016	6,250
Heritage Trust	14/03/2016	100
New Historian	15/03/2016	125
Press Association	13/03/2016	Unknown
BBC North West Tonight	15/03/2016	Unknown
<i>Chorley & Leyland Guardian</i>	14/03/2016	Unknown
<i>Lancaster Guardian</i>	14/03/2016	Unknown
<i>Lancashire Evening Post</i>	14/03/2016	Unknown
<i>Clitheroe Advertiser</i>	14/03/2016	Unknown
School Group Sessions	6/07/2016 – 15/07/2016	350
BBC News	09/07/2016	6.4 million
<i>The Visitor</i>	05/07/2016	9,300
<i>The Lancaster Guardian</i>	05/07/2016	Unknown
<i>The Archaeology & Metal Detecting magazine website</i>	06/07/2016	Unknown
<i>The Guardian</i>	30/09/16	9.0 million
<i>The Daily Mail</i>	1/10/16	10.9 million
DigVentures Facebook Live Broadcast	03/10/16	47,500
<i>The Visitor</i>	14/10/16	9,300

BLS

Processing Report
25 November 2016



Survey Data

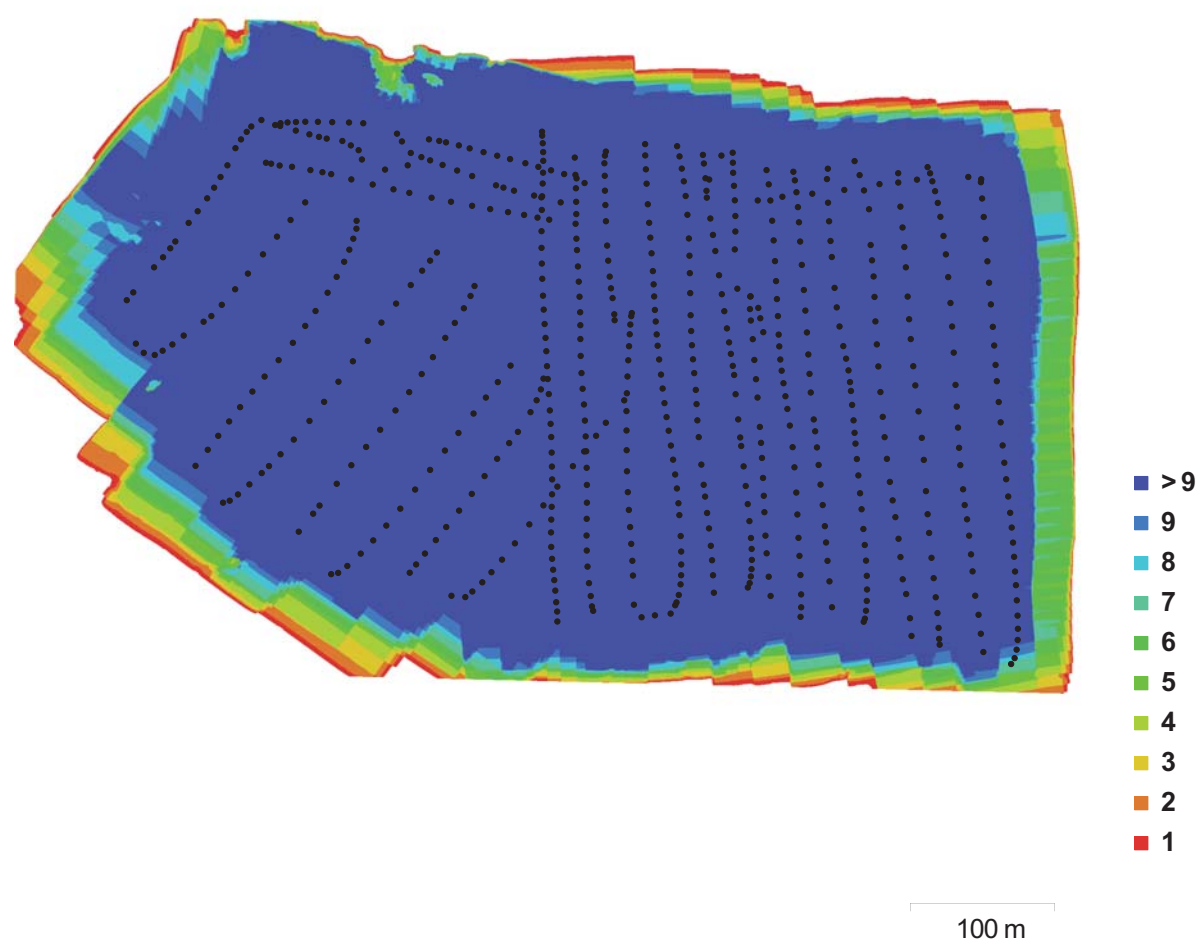


Fig. 1. Camera locations and image overlap.

Number of images:	625	Camera stations:	625
Flying altitude:	79.1 m	Tie points:	188,248
Ground resolution:	2.89 cm/pix	Projections:	2,439,539
Coverage area:	0.283 km ²	Reprojection error:	1.74 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
FC350 (3.61 mm)	3992 x 2992	3.61 mm	1.57 x 1.57 μm	No

Table 1. Cameras.

Camera Calibration

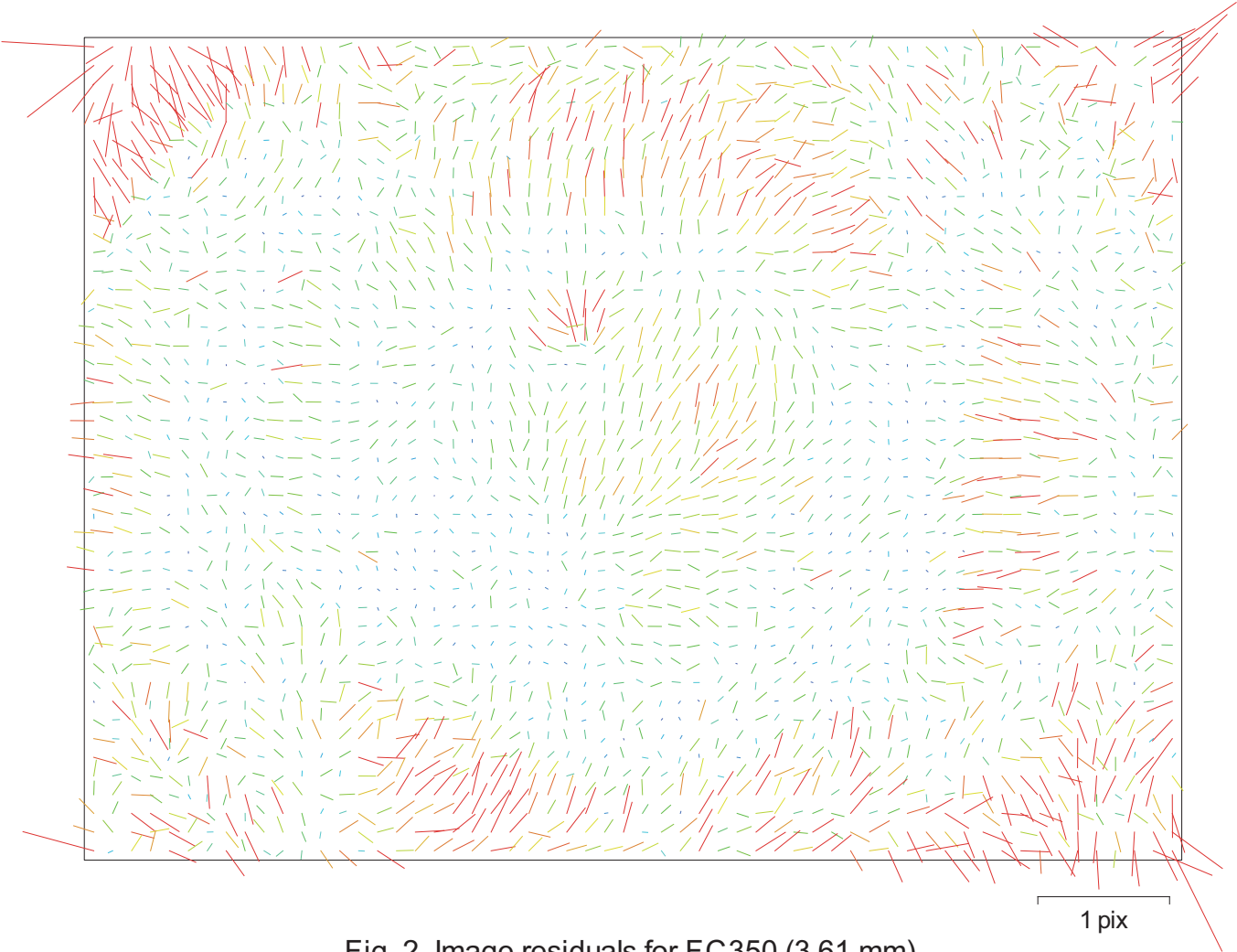


Fig. 2. Image residuals for FC350 (3.61 mm).

FC350 (3.61 mm)

625 images

Resolution	Focal Length	Pixel Size	Precalibrated
3992 x 2992	3.61 mm	1.57 x 1.57 µm	No
Type:	Frame	F:	2378.1
Cx:	-15.7934	B1:	-0.35
Cy:	-19.2211	B2:	-0.269593
K1:	-0.144136	P1:	5.36004e-05
K2:	0.143667	P2:	0.000624867
K3:	-0.0543344	P3:	0
K4:	0.0165859	P4:	0

Camera Locations

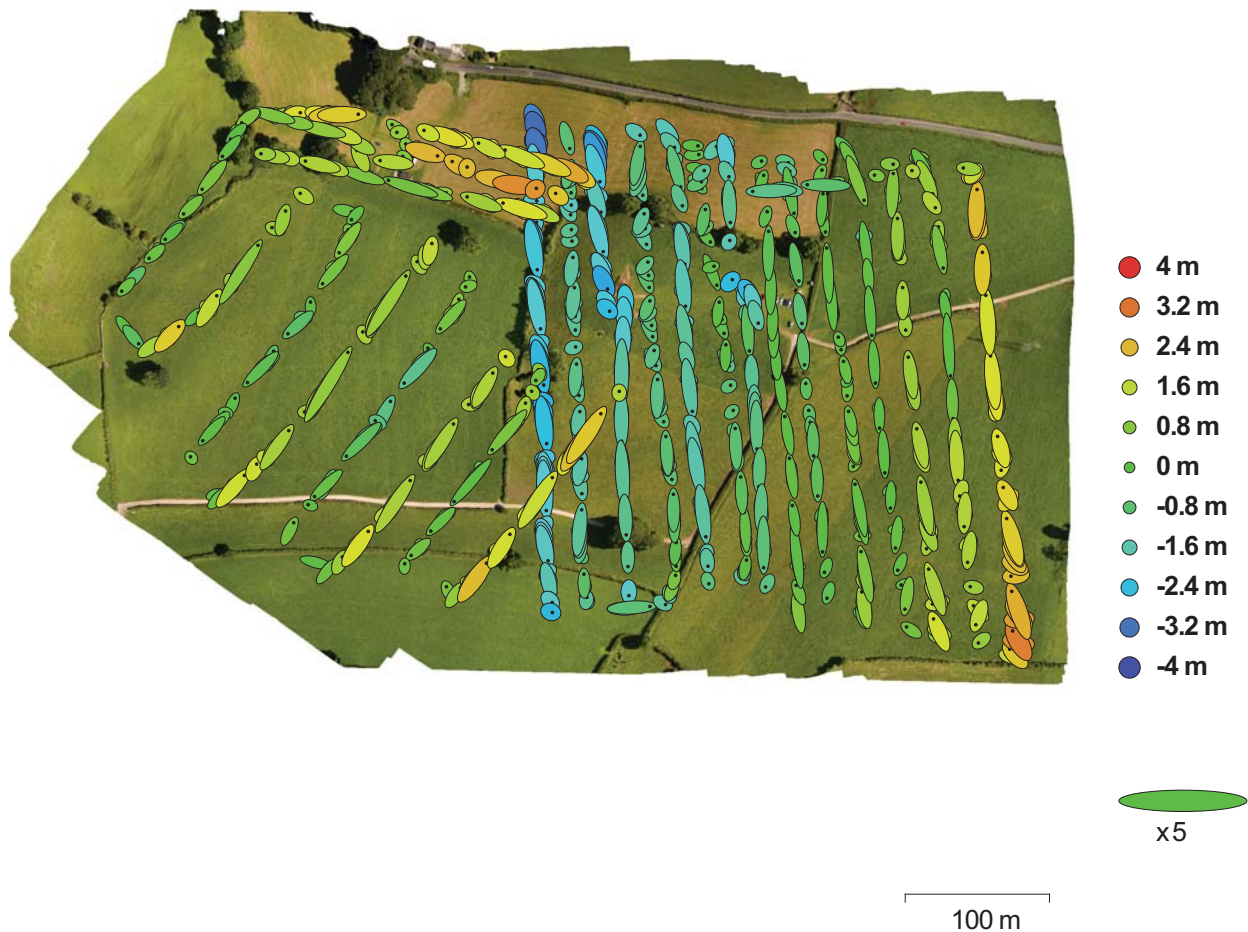


Fig. 3. Camera locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.

Estimated camera locations are marked with a black dot.

X error (m)	Y error (m)	Z error (m)	XY error (m)	Total error (m)
1.42271	2.70527	1.34728	3.05657	3.34032

Table 2. Average camera location error.

Digital Elevation Model

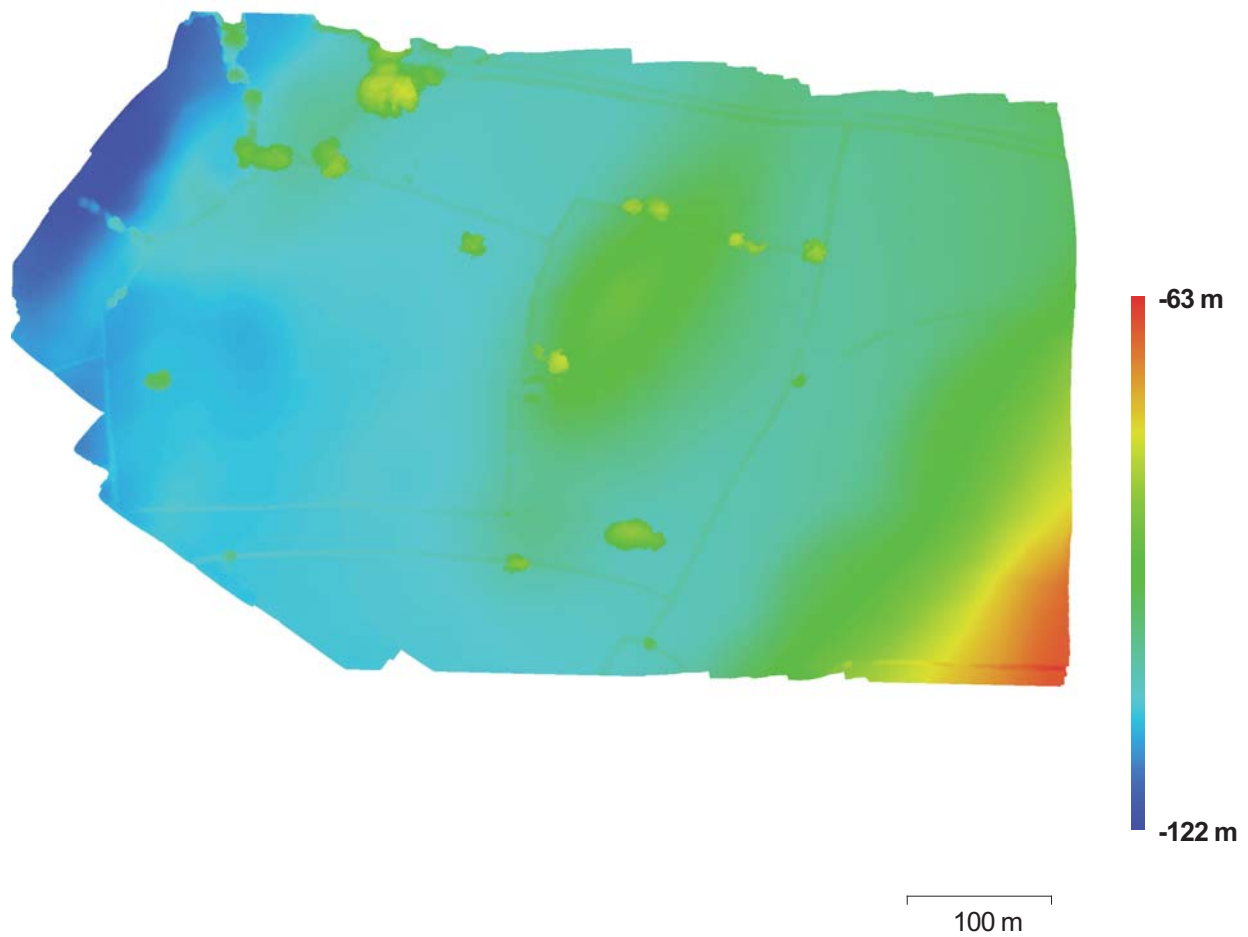


Fig. 4. Reconstructed digital elevation model.

Resolution: 11.5 cm/pix
Point density: 75.1 points/m²

Processing Parameters

General

Cameras	625
Aligned cameras	625
Coordinate system	OSGB 1936 / British National Grid (EPSG::27700)

Point Cloud

Points	188,248 of 203,342
RMS reprojection error	0.688053 (1.74182 pix)
Max reprojection error	2.0775 (58.3401 pix)
Mean key point size	2.7171 pix
Effective overlap	13.6157

Alignment parameters

Accuracy	High
Pair preselection	Reference
Key point limit	40,000
Tie point limit	4,000
Constrain features by mask	No
Matching time	57 minutes 26 seconds
Alignment time	9 minutes 1 seconds

Depth Maps

Count	625
-------	-----

Reconstruction parameters

Quality	Medium
Filtering mode	Aggressive
Processing time	1 hours 32 minutes

Dense Point Cloud

Points	25,202,032
--------	------------

Reconstruction parameters

Quality	Medium
Depth filtering	Aggressive
Dense cloud generation time	28 minutes 11 seconds

Model

Faces	5,040,390
Vertices	2,523,286
Texture	8,192 x 8,192, uint8

Reconstruction parameters

Surface type	Arbitrary
Source data	Dense
Interpolation	Enabled
Quality	Medium
Depth filtering	Aggressive
Face count	5,040,391
Processing time	17 minutes 40 seconds

Texturing parameters

Mapping mode	Generic
Blending mode	Mosaic
Texture size	8,192 x 8,192
UV mapping time	2 minutes 20 seconds
Blending time	23 minutes 42 seconds

Orthomosaic

Size	25,620 x 16,208
Coordinate system	OSGB 1936 / British National Grid (EPSG::27700)
Channels	3, uint8
Blending mode	Mosaic

Reconstruction parameters

Surface	Mesh
Enable color correction	No

Processing time	9 minutes 13 seconds
Software	
Version	1.2.6 build 2834
Platform	Windows 64 bit