Substrata

Archaeological Geophysical Surveyors

An archaeological gradiometer survey

Land at Berry Cliff Camp, Branscombe, Devon

Ordnance Survey E/N: 318840 88210 (point)

Report: 130110
Ross Dean BSc MSc MA MIfA
10 January 2013

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Accompanying CD-ROM

1 Survey description and summary

Type of survey: twin-sensor fluxgate gradiometer
Date of survey: between 16th and 22nd August 2012
Area surveyed: 16ha.
Lead surveyor: Ross Dean BSc MSc MA MIfA

Client
AC Archaeology Ltd, 4 Halthaies Workshops, Bradninch, Nr Exeter, Devon EX5 4QL

Location

Site:	Land at Berry Cliff Camp
Civil Parish:	Branscombe
District:	East Devon
County:	Devon
NGR:	SY 1884 8821(point)
OS E/N:	318840 88210 (point)
Scheduled Monument Numbers:	29637 & 33049
OASIS number:	substrat1-154747
Archive:	The archive of this survey will be held by Substrata.

Summary
This survey was part of a programme of archaeological investigations at Berry Cliff Camp commissioned as part of the Unlocking Our Costal Heritage project (Horner, 2010). At the time of writing, the Unlocking Our Costal Heritage project is led by the South West Coast Path Team (SWCPT) and is a three year series of investments to conserve, enhance and interpret some 40 nationally important historic and archaeological sites along the Coast Path which are currently at risk of being irreparably damaged or lost, or which could be made more accessible for wider audiences. Other bodies working in partnership with SWCPT include the relevant Areas of Outstanding Natural Beauty, Devon County Council, English Heritage, Natural England, the National Trust and the landowners.

The site comprises Berry Cliff Camp, an Iron Age hillfort, and an adjoining prehistoric field system which occupy a plateau of land at Littlecombe Hill, Branscombe; both are Scheduled Monuments. This section of East Devon Coast is part of the Jurassic Coast World Heritage Site, which is also a Site of Special Scientific Interest (SSSI). The South West Coast Path (SWCP) passes through the monument and field system running parallel with the cliff edge (James, 2012).

The magnetic contrast across the survey areas was sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses. A total of 39 magnetic anomaly groups were identified as pertaining to potential archaeology. Those in area 1 (figure 1) for the most part reflect a pattern of extant linear earthworks and extant cairns and/or possible barrows mapped by the RCHME as a field system thought to date from the Iron Age and later. Some of the anomaly patterns represent linear deposits that may also relate to this field system although other archaeological origins cannot be ruled out. Three areas of relatively high magnetic anomaly contrasts in area 1 point to deposits that may be archaeologically significant and associated with the field system and cairns or barrows.

No archaeologically significant magnetic anomaly groups were recorded in area 2 (figure 1). Anomaly groups likely to reflect the Berry Camp defences and two former post medieval field boundaries removed between 1959 and 1963 were recorded in areas 3 and 4 along with 9 linear anomaly groups that may represent former field boundaries or other enclosures. The

anomalies reflecting the former defences seem to show either a more complex structure than is now visible or more than one phase of construction.

Survey aims

- Identify and accurately record the location of any magnetic anomalies that may be related to archaeological deposits, structures or artefacts known to exist within the survey area;
- Within the limits of the techniques and dataset, archaeologically characterise any such anomalies or patterns of anomalies; and,
- Produce a summary based on the survey that is sufficiently detailed to inform any subsequent archaeological investigation about the location and possible archaeological character of the recorded anomalies

(James, 2012)

Standards

The standards used to complete this survey are defined by the Institute for Archaeologists (2011). The codes of approved practice that were followed are those of the Institute for Archaeologists (2008 and 2009) and Archaeology Data Service/Digital Antiquity Guides (undated). The document text was written using the house style of the Institute for Archaeologists (Institute for Archaeologists, undated).

2 Site description

Landscape and land use

The survey area lies between 123-127m OD. At the time of the survey it was under permanent pasture, with some scrub encroachment along the cliff edge, the earthwork banks of the hillfort and the barrow group to the west.

Geology and soils

The site is located on a solid geology of Cretaceous Upper Greensand under Clay-with-Flints (in part Eocene) (British Geological Survey, 1984). The Clay-with-Flints Formation is in this area a residual deposit formed from bedrock strata of the Upper Greensand Formation. It is unbedded and heterogenous. The deposit locally comprises sand and clayey sand containing angular, shattered blocks of chert (British Geological Survey, undated)

The soils are of two types; on the western half of the site they comprise variably flinty fine silty and fine loamy over clayey soils of the Batcombe Series which give way to the Clay-with-Flints Formation at a depth of approximately 1m. On the eastern half the soils are typical brown earths of the Bearstead Association which pass to stoneless sand within 0.8m depth (Soil Survey of England and Wales, 1983; Findlay et al, 1984)

Historic landscape characterisation

Western field of area 1 and area 4 (figure 1): modern enclosures from rough ground; These modern enclosures have been created out of earlier rough grazing ground, heathland or moorland in the twentieth century.

Enclosures of post-medieval date; fields laid out in the eighteenth and nineteenth century commonly have many surveyed dead-straight field boundaries

(Devon County Council, undated).

Archaeological and historical background

Berry Cliff Camp (DCCHER No. 10899 & SM no. 29637) is a rectangular-shaped Prehistoric Slight Univallate Hillfort, which encloses an area of some 3ha (area 3 in figure 1). The

landward side is defended by a single rampart fronted by a U-shaped ditch (4.5m wide x 1.1m deep) with a counterscarp bank, which is only visible on the northern and western sections of the defensive circuit. The earthwork rampart, which includes large flint nodules, survives on the northern and eastern sides to a maximum height of 1m and depth of 4m. The interior is known to have been ploughed (English Heritage, 2011). While the shape of the defensive circuit suggests that the monument was fully enclosed, with much of the southern rampart being lost through cliff erosion, it is possible that the cliff edge may have provided a natural defence, thereby negating the need for a southern section of rampart. Only one entrance, located on the northwest corner of the defensive circuit, was recorded during an earthwork survey carried out in 1989 (RCHME 1989). The northern part of the hillfort interior (the area defined by the post medieval field boundary) may have been once used as a garden (Butler, 2000, 122).

Earthworks to the east of the monument (area 4, figure 1) are considered to be post medieval field boundaries (English Heritage, 2011). To the north of the hillfort (area 2, figure 1), additional earthworks on the steep slopes running down to the stream are likely to be the result the result of extensive quarrying associated with the limekiln to the east (DCCHER Nos. 39174 & 39175).

The multi-period field system to the north of Littlecombe Shoot covers an area of some 3.5ha (DCCHER No. 49237, 20101, 20097 & SM 33049) and comprises a number of low earthwork banks and lynchets with associated clearance cairns (area 1, figure 1). The morphology of the field system (small and roughly square) suggests an Iron Age origin with usage perhaps continuing into the Roman period. The monument was surveyed in 1989 by the Royal Commission on the Historical Monuments of England (RCHME), where the banks were found to be between 2m-4.5m long and 0.5m-2m wide defining five or six small fields (English Heritage 2011).

Associated with the fields are a number of stone cairns several of which lie on the field banks (DCCHER Nos. 20105, 49227-49233 & 49236). These cairns are considered to be the result of field clearance and are likely to be contemporaneous with the prehistoric working of the fields; and they survive as low earth covered piles of flint and stone (English Heritage, 2011). Several patches of surface flint showing signs of deliberate breaking have also been identified (DCCHER No. 49234 & 49235). The DCCHER records eight probable barrows (DCCHER Nos. 10914, 10915, 10922, 10923, 10924, 20102, 20103 & 20104) on northern and eastern fringes of the field system; it is possible that several (if not all) are in fact clearance cairns.

After James (2012).

3. Results, discussion and conclusions

This survey was designed to record magnetic anomalies. The anomalies themselves cannot be regarded as actual archaeological features and the dimensions of the anomalies shown do not represent the dimensions of any associated archaeological features. The analysis presented below attempts to identify and characterise anomalies and anomaly groups that may pertain to archaeological deposits and structures.

The reader is referred to section 4.

3.1 Results

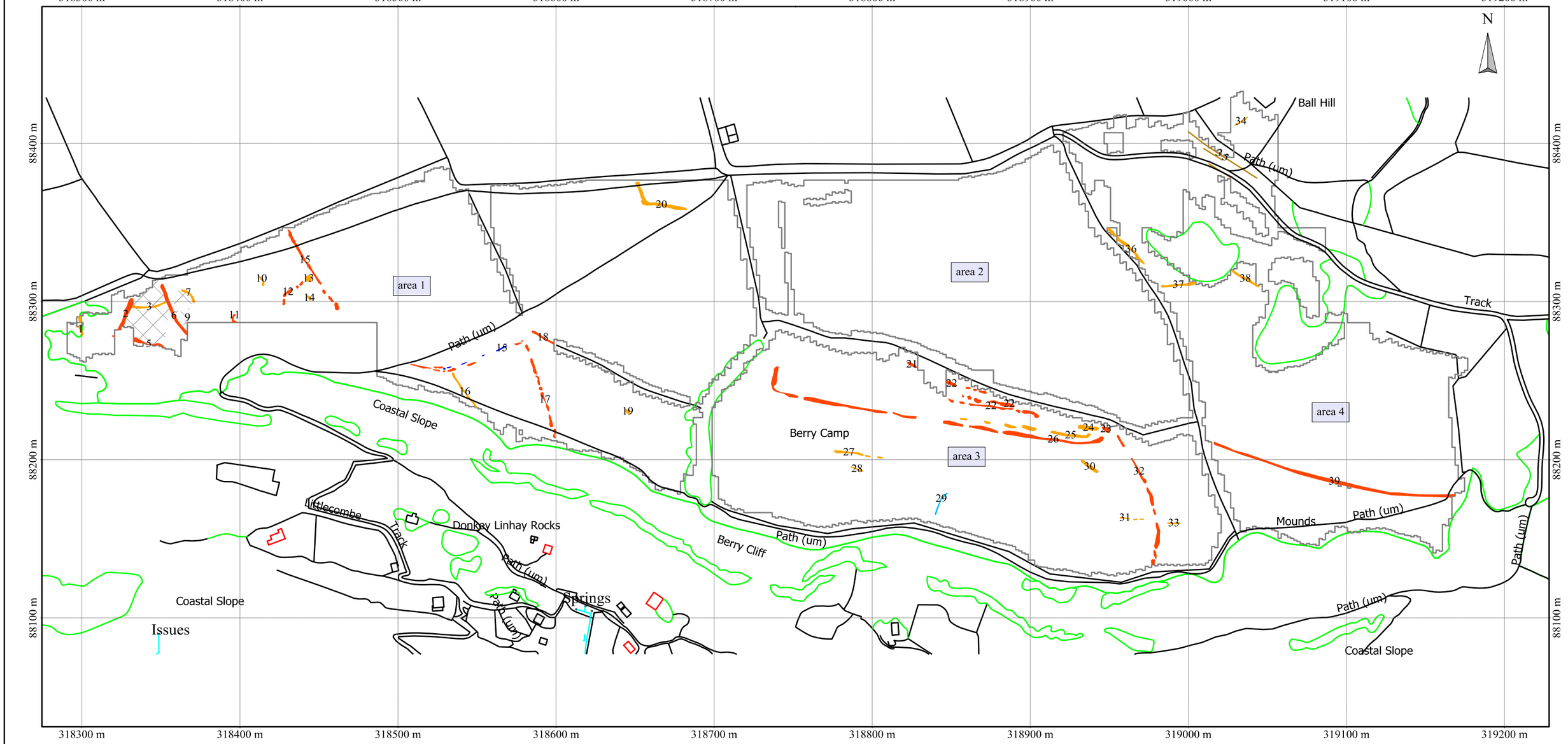
For ease of discussion, the survey area was divided into four areas as shown in figure 1 (this section) which also shows a summary of the survey interpretation across the entire survey area.

Figures 2 and 3 (this section) show the interpretation of the survey across areas 1 and 2 to 4 respectively. The accompanying tables 1 and 2 are extracts from a detailed analysis of the survey data provided in the attribute tables of the GIS project on the accompanying CD-ROM.

Figures 2 and 3 along with tables 1 and 2 comprise the analysis and interpretation of the survey data.

Figure 4 (appendix 1) shown the survey interpretation superimposed on earthworks mapped by the Ordnance Survey.

The processed gradiometer data is presented in figures 5 to 8, appendix 1.



British Grid
centre X: 318751.50 m, centre Y: 88258.84 m

Scale: 1:2500 @ A3. Spatial Units: Meter. Do not scale off this drawing

possible archaeology

- likely archaeology, positive anomaly (2)
- likely archaeology, negative anomaly (2)
- possible archaeology, positive anomaly
- possible archaeology, negative anomaly
- possible archaeology, mixed anomaly spread
- possible archaeology, trend in anomaly patterns (3)

Notes:

1. All interpretations are provisional and represent potential archaeological deposits.
2. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
3. Representative; not all examples included.
4. Anomalies likely to represent geological or other natural deposits are not mapped.

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Figure 1: survey interpretation

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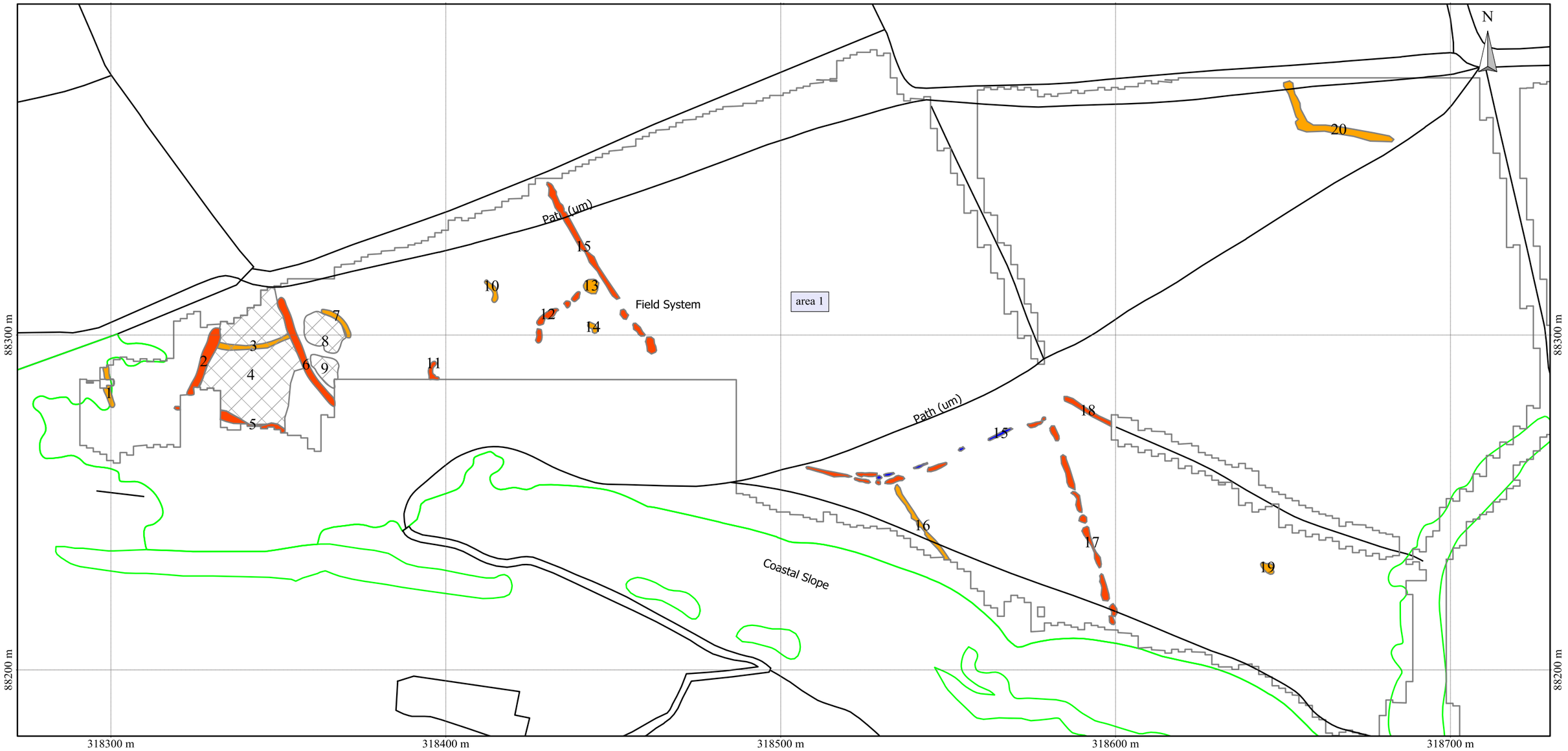
area	group	associated	class	form	archaeological characterisation	comments	period	supporting evidence
1	1		possible positive	linear				
1	2		likely positive	linear	extant earthwork	earthwork mapped on current OS map - part of a multi-period field system		DCCHER 49237, 20101, 20097, & SM33049 & current Ordnance Survey map
1	3		possible positive	curvilinear				
1	4		possible mixed spread	irregular	archaeological deposit, recent rubble or near-surface bedrock	anomaly pattern confined to area within extant earthworks		
1	5		likely positive	linear	extant earthwork	anomaly group probably associated with an earthwork mapped on current OS map		DCCHER 49237, 20101, 20097, & SM33049 & current Ordnance Survey map
1	6		likely positive	linear	partially extant earthwork	part mapped as earthwork on current OS map - part of a multi-period field system		DCCHER 49237, 20101, 20097, & SM33049 & current Ordnance Survey map
1	7	8	possible positive	curvilinear	barrow or cairn	anomalies in proximity of earthwork mapped on current OS map		DCCHER 10915 & current Ordnance Survey map
1	8	7	possible mixed spread	oval	barrow or cairn	anomalies in proximity of earthwork mapped on current OS map		DCCHER 10915 & current Ordnance Survey map
1	9		possible mixed spread	irregular	archaeological deposit, recent rubble or near-surface bedrock			
1	10		possible positive	curvilinear		anomaly group may be associated with an earthwork mapped as a barrow or cairn on current OS map		DCCHER 10914 & current Ordnance Survey map
1	11		likely positive	curvilinear	barrow or cairn	anomalies in proximity of earthwork mapped on current OS map		DCCHER 10914, 10915, 10922, 10923, 10924, 20102, 20103, 20104 & current Ordnance Survey map
1	12		likely positive	disrupted linear	extant earthwork	earthwork mapped on current OS map - part of a multi-period field system		DCCHER 49237, 20101, 20097, & SM33049 & current Ordnance Survey map
1	13		possible positive	oval	barrow or cairn	earthwork mapped on current OS map - part of a multi-period field system		DCCHER 49237, 20101, 20097, & SM33049 & current Ordnance Survey map
1	14		possible positive		barrow or cairn	anomalies could represent natural deposits or possibly a barrow		
1	15		likely positive/negative	curvilinear	partially extant earthwork	part mapped as earthwork on current OS map - part of a multi-period field system		DCCHER 49237, 20101, 20097, & SM33049 & current Ordnance Survey map
1	16		possible positive	linear				
1	17		likely positive	linear	extant earthwork	anomaly group may extend to the north-west but masked by those representing natural deposits		Current Ordnance Survey map
1	18		likely positive	linear	extension of an extant field boundary			current Ordnance Survey map
1	19		possible positive		barrow or cairn	anomalies in proximity of earthwork mapped on current OS map		
1	20		possible positive	multilinear				

table 1: survey data analysis, area 1



British Grid
centre X: 318500.92 m, centre Y: 88289.54 m

Scale: 1:1200 @ A3. Spatial Units: Meter. Do not scale off this drawing

possible archaeology
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Notes:
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Figure 2: survey interpretation, area 1

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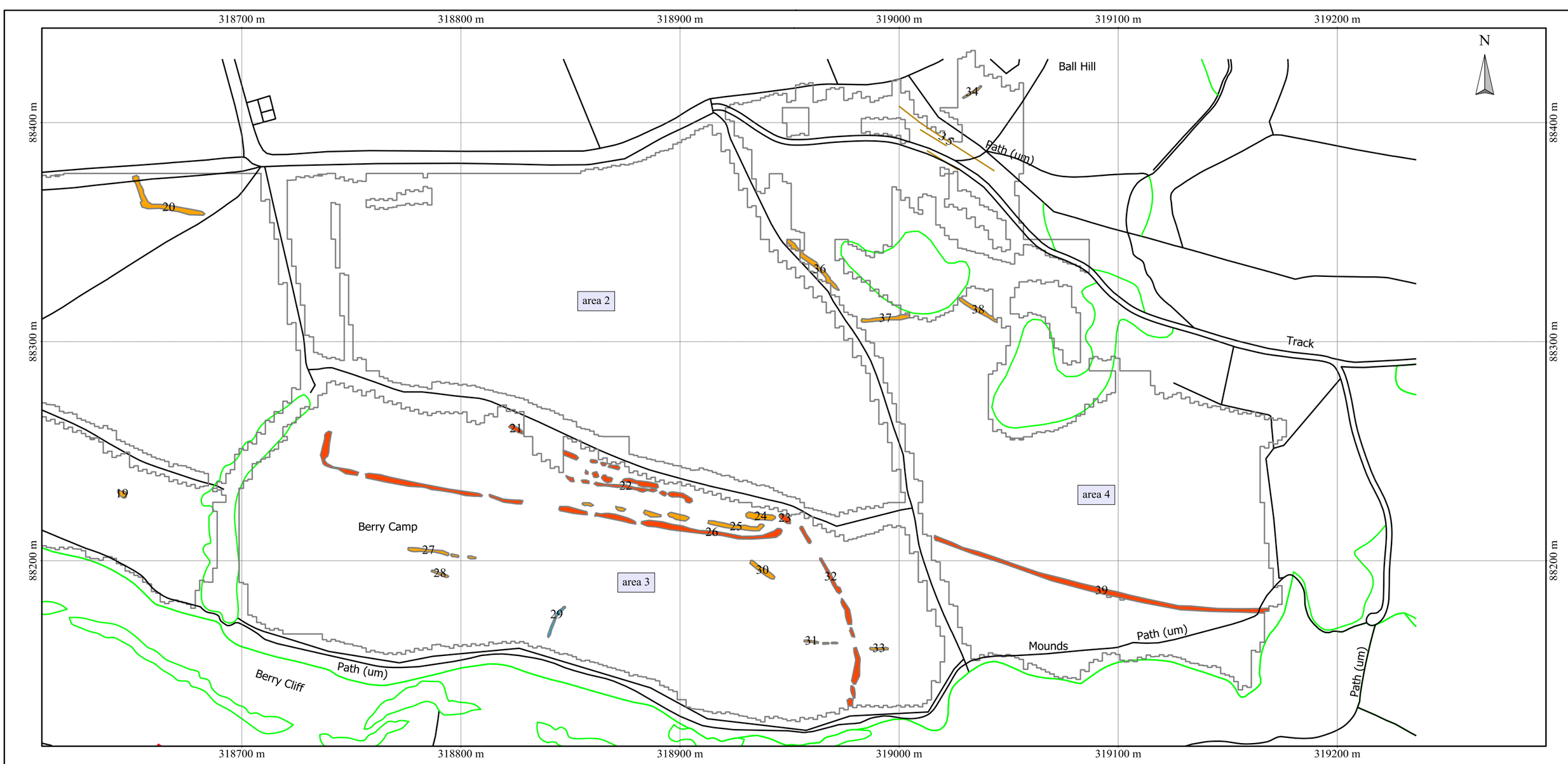
area	group	associated	class	form	archaeological chara	comments	period	supporting evidence
3	21	22 23 24	likely positive	linear		anomaly group probably associated with earthworks forming the landward defences of Berry Camp and mapped on current OS map		DCCHER 10899 & SM 29637
3	22	21 23 24	likely positive	disrupted linear		anomaly group probably associated with earthworks forming the landward defences of Berry Camp and mapped on current OS map		DCCHER 10899 & SM 29637
3	23	21 22 24	likely positive	linear		anomaly group probably associated with earthworks forming the landward defences of Berry Camp and mapped on current OS map		DCCHER 10899 & SM 29637
3	24	21 22 23	possible positive	linear				
3	25	26	possible positive	disrupted linear				
3	26	25	likely positive	multilinear		anomaly groups directly correspond to earthworks and a public footpath recorded on the 1840 tithe map and all OS maps between 1889 and 1959 but not subsequently - may have associated negative anomalies indicating an earthen bank with stone revetments on each side	Post-medieval	1840 Brandscombe tithe map, Ordnance Survey maps 1889 to present, RCHME survey (1989)
3	27		possible positive	linear				
3	28		possible positive	linear		tenuous - may be cultivation traces		
3	29		possible negative	linear				
3	30		possible positive	linear				
3	31		possible positive	linear		tenuous - may be cultivation traces		
3	32		likely positive	curvilinear	extant earthwork	anomaly group probably associated with an earthwork mapped on current OS map		DCCHER 49237, 20101, 20097, & SM33049 & current Ordnance Survey map
3	33		possible positive	linear				
4	34		possible positive	linear				
4	35		possible trend			uncertain provenance - may be associated with quarry		
4	36		possible positive	linear				
4	37		possible positive	linear				
4	38		possible positive	linear				
4	39		likely positive	curvilinear		anomaly groups directly correspond to earthworks and a public footpath recorded on the 1840 tithe map and all OS maps between 1889 and 1959 but not subsequently - may have associated negative anomalies indicating an earthen bank with stone revetments on each side	Post-medieval	1840 Brandscombe tithe map, Ordnance Survey maps 1889 to present, RCHME survey (1989)

table 2: survey data analysis, areas 2, 3 and 4



British Grid
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Scale: 1:1800 @ A3. Spatial Units: Meter. Do not scale off this drawing

possible archaeology
- likely archaeology, positive anomaly (2)
- likely archaeology, negative anomaly (2)
- possible archaeology, positive anomaly
- possible archaeology, negative anomaly
- possible archaeology, mixed anomaly spread
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Notes:
1. All interpretations are provisional and represent potential archaeological deposits.
2. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
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Figure 3: survey interpretation, areas 2 to 4

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3.2 Discussion

Refer to figures 2 and 3 (this section) and 6 and 7 (appendix 1).

Not all anomalies or anomaly groups identified in the survey dataset are discussed below. All identified anomaly groups are recorded in the GIS project on the accompanying CD-ROM. Those anomaly groups possibly representing archaeological deposits are included in data analysis tables 1 and 2.

Numerous relatively large, positive anomaly groups with relatively indistinct edges can be seen across the survey area. These are likely the result of deposits filling natural fissures in the underlying superficial and bed rock geology and are unlikely to be the result of archaeological depositional processes although some of the deposits may have been affected by ploughing at various times. The fissures are possibly the result of land slippage close to the coast and possibly other geological processes such as faulting. In the author's experience, these anomaly patterns are not common across similar superficial and solid geology inland of the this coast.

The RCHME survey mapped a number of possible barrows and field clearance cairns likely to be contemporary with the field system discussed above, some previously recorded, which comprise low earth covered piles of flint and stone (section 2). These do not show directly in the gradiometer survey data but a number of anomalies lying close to the mapped monuments are highlighted in the survey analysis as likely to be associated with them. It is possible that these anomalies represent the disturbance of deposits around the individual monuments by later activities such as ploughing although some may relate to the monuments themselves.

Data related to historical maps and other records

Area 1 (figure 2)
Anomaly groups **2**, **5**, **6** **12**, **15** and **17** relate to the Iron Age and later earthworks that form a field system which was mapped by the Royal Commission on the Historical Monuments of England (RCHME) in 1989 (figure 4 shows the Ordnance Survey summary mapping of these monuments).

Anomaly group **18** is likely to be an extension of an existing field boundary.

Anomaly group **3** is an area of higher contrasting data confined by the earthworks represented by groups 2, 5 and 6 and may represent deposits of material and/or ground disturbance with an archaeological origin.

Groups **7**, **8**, **9**, **10**, **11**, **13** and **19** are spatially associated with mapped earthworks thought to be field clearance cairns and possibly some barrows as discussed in section 2 and shown in figure 4.

Areas 2 to 4 (figure 3)
Groups **21**, **22** and **23** and possibly **25** relate to the extant northern defences of Berry Camp hillfort. This boundary is described as a single rampart fronted by a U-shaped ditch (4.5m wide by 1.1m deep) with a counterscarp bank (section 2). Archaeological recording carried out in 2012 where the South West Coast Path passes through Berry Camp hillfort describe the defences at that location as composed of an inner (eastern) and outer (western) ramparts separated by a silted up ditch with no evidence for a second ditch on the outside of the outer rampart (AC Archaeology 2012: Devon County Council Historic Environment Record, forthcoming). The anomaly groups suggest that

the northern bank may have a more complex construction than a single bank and outer ditch or that there was more than one phase of construction of the northern defences.

Group **26** directly correspond to the traces of a redundant post medieval field boundary and former public footpath surviving as a low earthwork in area 3. Group **39** corresponds to a similar boundary in area 4. Both were recorded on the 1840 tithe map and on Ordnance Survey maps to 1959 but not beyond. In both cases, the anomalies point to a stony structure, possibly a revetment wall or area cleared of surface soil, flanking both sides of a central linear earthen bank.

Group **32** is likely to reflect an extant earthwork mapped by the RCHME and the Ordnance Survey.

Data with no previous provenance

Area 1 (figure 2)

Anomaly group **14** has very similar characteristics to the anomaly groups associated with cairns and may represent such a monument.

Groups **1** and **16** are linear patterns of anomalies that typically relate to archaeological features such as field boundaries and other enclosures. They may relate to archaeological features associated with the prehistoric field system discussed above.

Group **20** may also be related to the field system but it may be a fortuitous alignment of naturally occurring deposits.

Areas 2 to 4 (figure 3)

No anomalies pertaining to possible archaeology were recorded in area 2.

All the remaining anomaly groups in areas 3 and 4 are linear patterns of anomalies that typically relate to archaeological features such as field boundaries and other enclosures.

3.3 Conclusions

The magnetic contrast across the survey areas was sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses. A total of 39 magnetic anomaly groups were identified as pertaining to potential archaeology. Those in area 1 (figure 1) for the most part reflect a pattern of extant linear earthworks and extant cairns and/or possible barrows mapped by the RCHME as a field system thought to date from the Iron Age and later. Some of the anomaly patterns represent linear deposits that may also relate to this field system although other archaeological origins cannot be ruled out. Three areas of relatively high magnetic anomaly contrasts in area 1 point to deposits that may be archaeologically significant and associated with the field system and cairns or barrows.

No archaeologically significant magnetic anomaly groups were recorded in area 2 (figure 1). Anomaly groups likely to reflect the Berry Camp defences and two former post medieval field boundaries removed between 1959 and 1963 were recorded in areas 3 and 4 along with 9 linear anomaly groups that may represent former field boundaries or other enclosures. The anomalies reflecting the former defences seem to show either a more complex structure than is now visible or more than one phase of construction.

4 Disclaimer and copyright

The description and discussion of the results presented in this report are the authors, based on his interpretation of the survey data. Every effort has been made to provide accurate descriptions and interpretations of the geophysical data set. The nature of archaeological geophysical surveying is such that interpretations based on geophysical data, while informative, can only be provisional. Geophysical surveys are a cost-effective early step in the multi-phase process that is archaeology.

5 Acknowledgements

Substrata would like to thank John Valentin of AC Archaeology Ltd for commissioning us to complete this survey.

6 References

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RCHME (1989) Survey of Berry Cliff Camp

Soil Survey of England and Wales (1983) *Soils of South West England Sheet 5* 1:250 000, Southampton: Ordnance Survey

Appendix 1 Supporting plots

General Guidance

The anomalies represented in the survey plots provided in this appendix are magnetic anomalies. The apparent size of such anomalies and anomaly patterns are unlikely to correspond exactly with the dimensions of any associated archaeological features.

A rough rule for interpreting magnetic anomalies is that the width of an anomaly at half its maximum reading is equal to the width of the buried feature, or its depth if this is greater (Clark, 2000: 83). Caution must be applied when using this rule as it depends on the anomalies being clearly identifiable and distinct from adjacent anomalies. In northern latitudes the position of the maximum of a magnetic anomaly will be displaced slightly to the south of any associated physical feature.

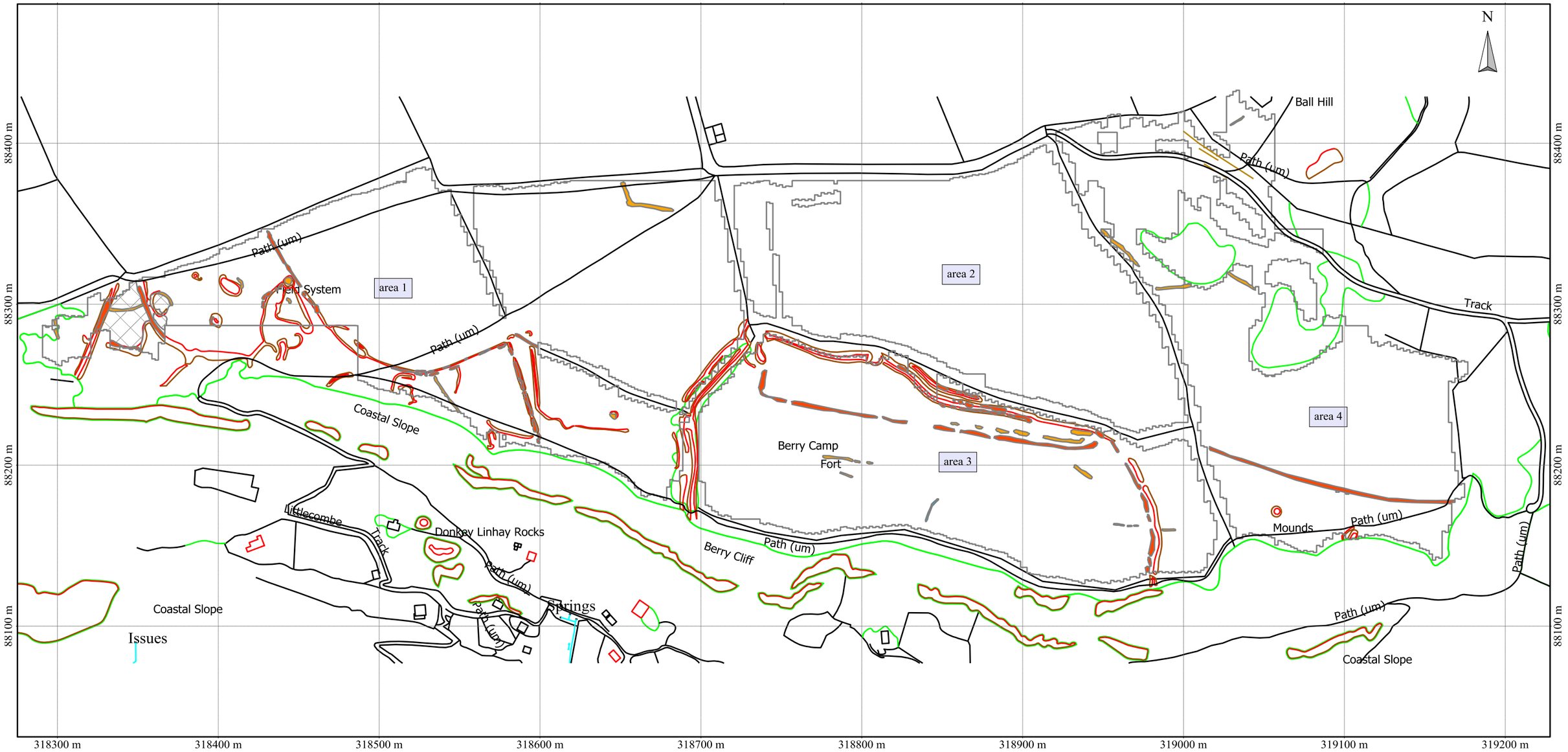

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Figure 4: survey interpretation with earthworks mapped by the Ordnance Survey

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Tel: 07788627822
Email: geophysics@substrata.co.uk
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British Grid
centre X: 318751.50 m, centre Y: 88258.84 m

Scale: 1:2500 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer survey
Land at Berry Cliff Camp, Branscombe, Devon
Ordnance Survey E/N: 318840 88210 (point)
Report: 130110

Figure 5: processed gradiometer data

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318300 m 318400 m 318500 m 318600 m 318700 m

88300 m

88200 m

N

nT
2
-2

Coastal Slope

British Grid
centre X: 318500.92 m, centre Y: 88289.54 m

Scale: 1:1200 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer survey
Land at Berry Cliff Camp, Branscombe, Devon
Ordnance Survey E/N: 318840 88210 (point)
Report: 130110

Figure 6: processed gradiometer data, area 1

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British Grid
centre X: 318951.98 m, centre Y: 88279.21 m

Scale: 1:1800 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer survey
Land at Berry Cliff Camp, Branscombe, Devon
Ordnance Survey E/N: 318840 88210 (point)
Report: 130110

Figure 7: processed gradiometer data, areas 2 to 4

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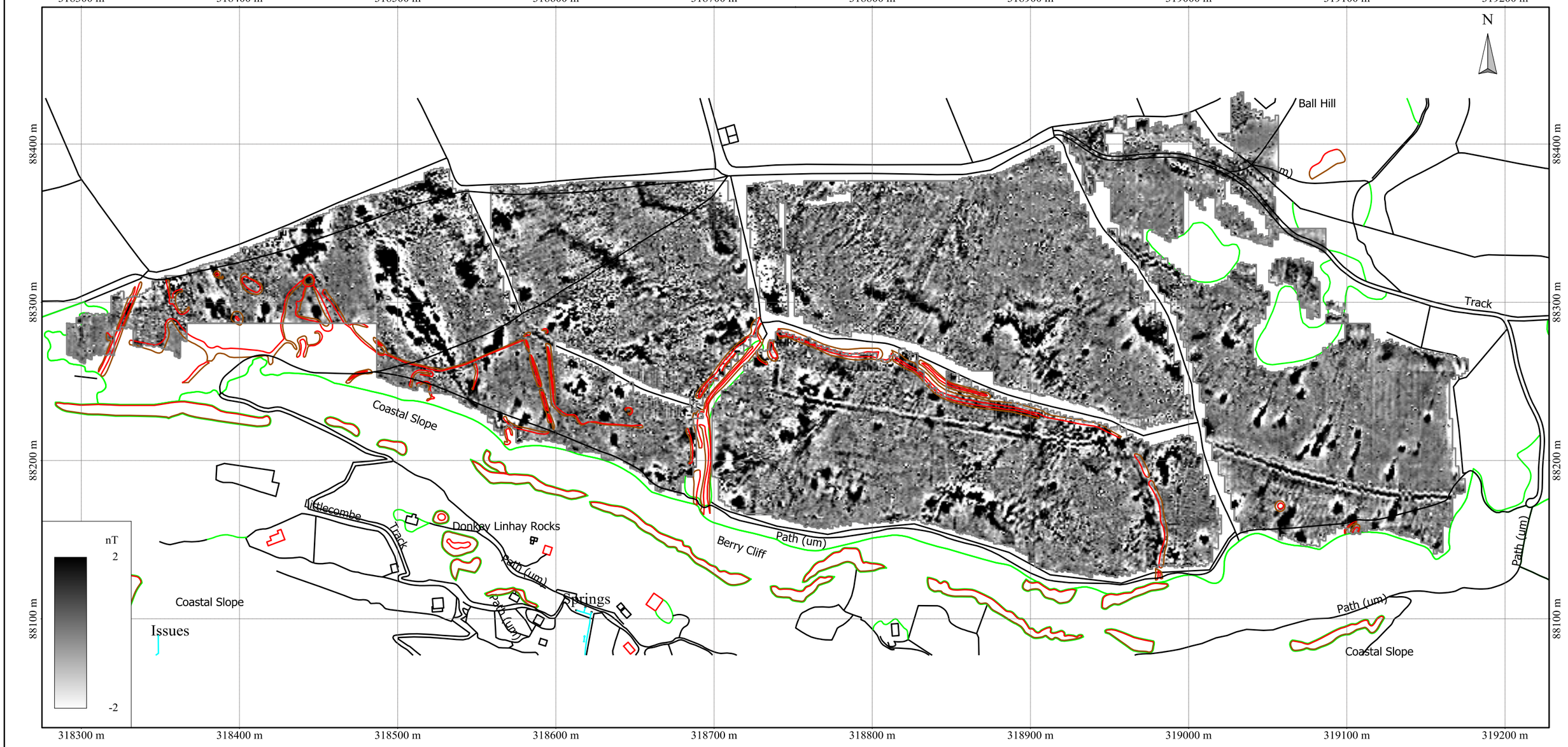

British Grid
centre X: 318751.50 m, centre Y: 88258.84 m

Scale: 1:2500 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer survey
Land at Berry Cliff Camp, Branscombe, Devon
Ordnance Survey E/N: 318840 88210 (point)
Report: 130110

Figure 8: processed gradiometer data with earthworks mapped by the Ordnance Survey

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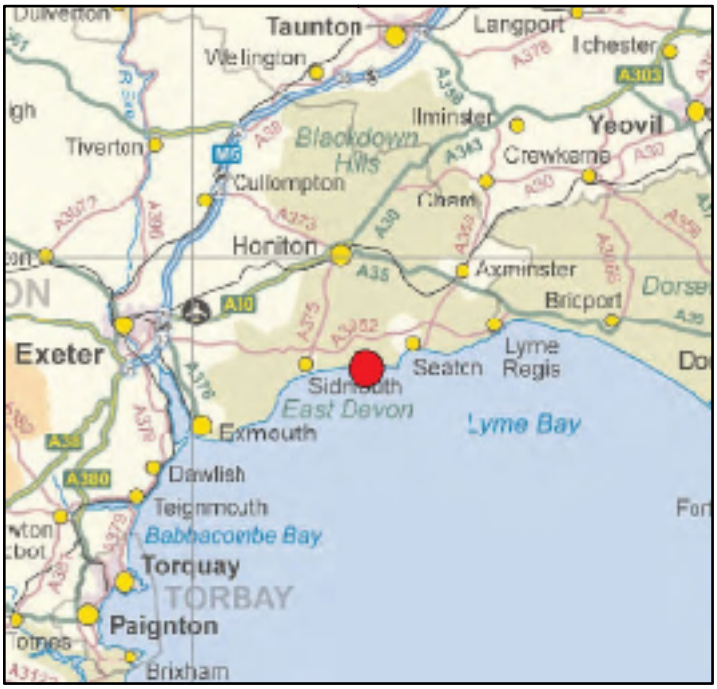

An archaeological gradiometer survey
Land at Berry Cliff Camp, Branscombe, Devon
Ordnance Survey E/N: 318840 88210 (point)
Report: 130110

Figure 9: location map

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Appendix 2 Methodology

Table 2: methodology
Documents Project Design: James (2012) Written Scheme of Investigation (WSI): Dean (2012)
Methodology 1. The work was undertaken in accordance with the project design and WSI. The geophysical (gradiometer) survey was undertaken with reference to standard guidance provided by the Institute for Archaeologists (2011), the Archaeology Data Service/Digital Antiquity Guides (undated) and as outlined in the Section 42 licence. 2. The temporary survey grid location information and grid plan was recorded as part of the project in a suitable GIS system. 3. Data processing was undertaken using appropriate software, with all anomalies being digitised and geo-referenced. The final report included a graphical and textual account of the techniques undertaken, the data obtained and an archaeological interpretation of that data and conclusions about any likely archaeology.
Grid *Method of Fixing:* DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates. *Composition:* 30m by 30m grids *Recording:* Geo-referenced and recorded using digital map tiles.
Data Processing, Analysis and Presentation Software DW Consulting TerraSurveyor3 Manifold System 8.0 Universal Edition Microsoft Corp. Office Publisher 2003.

Appendix 3 Data processing

Table 3: gradiometer survey - processed data metadata
SITE Land at Berry Cliff Camp, Branscombe, Devon Ordnance Survey E/N: 318840 88210 (point) Report: 130110
COMPOSITE Instrument Type: Grad 601 (Gradiometer) Units: nT Surveyed by: 22/08/2012 Assembled by: 01/10/2012 Direction of 1st Traverse: 0 deg Collection Method: ZigZag Sensors: 2 @ 1.00 m spacing. Dummy Value: 32702 Dimensions Composite Size (readings): 2640 x 900 Survey Size (meters): 330 m x 900 m Grid Size: 30 m x 30 m X Interval: 0.125 m Y Interval: 1 m Stats Max: 246.75 Min: -745.18 Std Dev: 7.36 Mean: 0.18 Median: 0.00 Composite Area: 29.7 ha Surveyed Area: 13.15 ha
Processes: 11 1 Base Layer 2 Clip at 4.00 SD 3 DeStripe Median Sensors: All 4 De Stagger: Grids: All Mode: Both By: -6 intervals 5 DeStripe Median Traverse: Grids: bc67+bc157.xgd bc68+bc158.xgd bc69+bc159.xgd 6 DeStripe Median Traverse: Grids: bc59+bc163.xgd 7 DeStripe Median Traverse: Grids: bc151+bc54.xgd bc53+bc164.xgd 8 De Stagger: Grids: bc16.xgd Mode: Both By: -3 intervals 9 DeStripe Median Traverse: Grids: bc117+bc216.xgd 10 DeStripe Median Traverse: Grids: bc106+bc223.xgd 11 De Stagger: Grids: bc186.xgd Mode: Outbound By: 3 intervals Note: interpolation match x & y doubled is completed automatically during export from TerraSurveyor to ERSI format

Appendix 4 Geophysical surveying techniques

1 Introduction

Substrata offers magnetometer and earth resistance surveying. We also provide other archaeology-specific geophysical surveys such as ground penetrating radar and resistivity. The particular method or combination of methods used depends on local soil conditions and the survey requirements. These methods are capable of delivering fast and accurate assessments of the archaeology of both large and small sites.

Further details can be found on our website at www.substrata.co.uk

2 Magnetometer surveying

Standard magnetometer surveys are the workhorse of archaeological surveying when speed and cost-effectiveness are important. Identifiable archaeological features include areas of occupation, hearths, kilns, furnaces, ditches, pits, post-holes, ridge-and-furrow, timber structures, wall footings, roads, tracks and similar buried features.

Magnetometer surveying is used to detect and map small changes in the earth's magnetic field caused by concentrations of ferrous-based minerals within the soil and subsoil, and by magnetised materials buried beneath the surface. While most of these changes are too small to affect a compass needle, they can be detected and mapped by sensitive field equipment. During surveys the different magnetic properties of top-soils, sub-soils, rock formations and archaeological features are recorded as variations against a background value. Subsequently magnetic anomalies resulting from potential archaeology can be identified and interpreted.

Bartington grad601-2 gradiometers

A gradiometer is a type of magnetometer and is sensitive to relatively small changes in the earth's magnetic field. Our primary surveying instruments are Bartington Grad601-2 (dual sensor) fluxgate gradiometers with automatic data loggers. They are specifically designed for field use by archaeologists. The Bartington gradiometers provide proven technology in archaeological magnetic surveying and offer fast, accurate set-up and survey rates. They are sensitive to depths of between 0 and 1.5m below ground level, with optimum sensitivity at depths of 1m or less.

Multiple sensor arrays

A technique relatively new to commercial archaeological surveying but well understood in academic circles involves the use of multiple magnetometer sensors towed behind a quad bike or similar vehicle. With multiple sensors and the use of on-board GPS units, it is possible to achieve faster survey rates at competitive commercial rates when compared to the use of multiple instruments and the techniques discussed above provided the ground is suitable for the vehicle and array. Substrata is pleased to announce that we now offer this service on suitable larger sites

3 Earth resistance surveying

Earth resistance surveying is an excellent tool for detecting buried archaeology. Its relatively slow rate of survey compared to magnetometer surveys means that it usually employed in commercial surveys when a detailed understanding of buried building remains is required. This technique measures changes in the electrical resistance of the ground being surveyed. In practice, the recording of differences in the electrical resistance of near-surface deposits and structures allows the detection and interpretation of masonry and brick foundations, paving and floors, drains and other cavities, large pits, building platforms, robber trenches, ditches, graves and similar buried features.

Resistance to electrical current flow in the ground depends on the moisture content and

structure of the soil and other materials buried beneath the surface. For example, the higher the moisture content of a soil, the less resistant it is to electrical current flow. A ditch completely buried beneath the present ground surface is likely to have an infill soil different to that surrounding the ditch in terms of compactness and composition. As a result, the soil filling the buried ditch will retain moisture in a different way to the surrounding soil which means it will have an electrical resistance at variance with the surrounding environment. By passing a small current through the ground it is possible to detect, record, plot and interpret such changes in electrical resistance.

For earth resistance surveying Substrata uses the Geoscan Research RM15 series multi-probe resistance meters and purpose-built automatic data-loggers. The Geoscan MPX15 multiplexer is an integral part to the instrument configuration and facilitates multi-probe arrays which speed up survey area coverage rates and, if required, facilitate simultaneous multiple-depth data collection.