Historic England

Remote Sensing

Sea Lane End, Dunster Beach, Carhampton, Somerset.

Report on Geophysical Survey, April 2016

Cara Pearce

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SEA LANE END, DUNSTER BEACH, CARHAMPTON, SOMERSET

REPORT ON GEOPHYSICAL SURVEY, APRIL 2016

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SUMMARY
Magnetometer and earth resistance surveys were carried out at Sea Lane End, Dunster Beach, Carhampton, Somerset, after members of Dunster Museum Archaeological Group identified numerous sherds of Romano-British pottery eroding from the field edge bordering the beach. It was later determined that these sherds were contained within a cut feature identified from the exposure, further investigated by a monitoring and recording training project organised by the Coastal and Intertidal Zone Archaeological Network (CITiZAN) in conjunction with the geophysical survey. The aim of the geophysical survey was to investigate the field adjacent to the pottery finds to help establish the extent and nature of the site at Dunster, and provide further information regarding the feature and its possible wider context. Both magnetic (1.5ha) and earth resistance (0.7ha) surveys identified a number of linear anomalies, morphologically representative of field boundaries, enclosures and trackways potentially Roman in date. Likely anomalies related to medieval ridge and furrow were also identified.

CONTRIBUTORS
The survey was supervised by Andrew Payne (Historic England) and Cara Pearce (Historic England Placement), together with Alex Bellisario (CITiZAN) with assistance from Rachel Quick (Nautical Archaeological Society). The data was collected by volunteers from the Dunster Museum Archaeological Group: Doug Challenor, Martin Harborne, Isabella Pietrzak, Len Pietrzak, Jeni Fender, Lee Webber, Vanessa Wolf, Alan Wolf, Philip Webber, Ruth Webber, Lynn Perry, Paul Sheldon, Biddy Bale, Chris Lovell, Tony Chambers, Penny Lock, Kieron Creech. Data processing was conducted by Andrew Payne and the report prepared by Cara Pearce.

ACKNOWLEDGEMENTS
The author would like to thank The Crown Estate for granting permission for the survey to be carried out and to the tenant farmers Mr and Mrs Parker for allowing access to the field(s). The cover image shows volunteers being trained in the use of Geoscan FM36 fluxgate gradiometer overlooking the beach at Dunster.

ARCHIVE LOCATION
Fort Cumberland, Portsmouth

DATE OF SURVEY
The survey was carried out over a week from 5th-9th April 2016. The report was completed on 27th May 2016

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INTRODUCTION

A geophysical survey was carried out over an area adjacent to Dunster Beach, Carhampton, Somerset (centred at ST00573 44330), where a significant number of large pieces of Romano-British pottery (both greyware and Black-burnished ware) had been recovered by members of Dunster Museum Archaeological Group (Bellisario 2015). The finds were eroding out of a 'u' profiled cut feature identified in an exposure along the edge of the beach. Since then a number of similar features have been identified along the profile and the area has now been recorded as a Roman settlement by Somerset HER (32999). Whilst there is some evidence for a Roman military presence in the area through a number of forts, for example Rainsbury fort, Upton (MSO8387), some 15km south of Dunster, there is a lack of archaeological evidence for settlement from this period in Exmoor and its immediate environs (Riley and Wilson-North 2001).

The survey used both magnetometer and earth resistance techniques in an attempt to identify the extent and nature of the site to enhance the interpretation reached from the finds evidence. It is hoped that the results of the survey will be used to inform further work at the site. In addition, this project provided training for members of the Dunster Museum Archaeological Group in geophysical survey techniques.

Previous evaluation of aerial photographic evidence did not identify any significant activity at the site (Crowther *et al.* 2008). Surrounding known archaeology is mainly medieval – post medieval in date, comprising field boundaries, ridge and furrow, and extensive fish weirs out at sea. Comprehensive military defences also survive along this stretch of coastline, including a Cold War Royal Observer Corps (ROC) monitoring post located in the corner of the field (ST 0052 4440; 35624) and fragments of World War II pill boxes on the beach, that were once situated along the field edge, but have subsequently collapsed due to aggressive coastal erosion (Council for British Archaeology 2006).

The site lies over Mercia mudstone with drift deposits of river terrace gravels and sands (British Geological Survey 1997), over which soils of the Newnham association have developed (Soil Survey of England and Wales 1983). The very flat field is currently in arable production and at the time of the survey was fallow following a previous maize crop. Weather conditions were very windy and cold yet dry throughout the field work.

METHODS

A survey grid of 30m squares was established using a differential Trimble R8 Global Navigation Satellite System (GNSS) using a local base station established using the Ordnance Survey VRS Now real time correction service and the OSNT02 coordinate transformation (Figure 1). Partial grids were laid out using tapes and ranging poles from the established points.

Magnetometer survey

Readings were recorded using Geoscan FM36 and FM256 fluxgate gradiometers at 0.25m intervals along parallel NE-SW traverses spaced 1.0m apart, walked in a zig-zag mode. A limited sample area of two 30m grids was conducted at the same sample resolution using a Bartington Grad601-2 dual sensor fluxgate gradiometer in order to assess the potential continuation of archaeological activity further to the east in Field 2 (Figure 1).

Subsequent data processing involved reducing the effects caused by directional sensitivity and instrument drift by setting each traverse to a zero median and truncating extreme values lying outside a range of ±50nT. A small number of grids were additionally corrected to reduce positioning errors by applying a destaggering algorithm. For comparability, data collected with the 1m sensor separation Bartington magnetometers were additionally transformed to the equivalent 0.5m separation measurements using the Fourier domain filters (see Tabbagh *et al.* 1997). A linear greyscale image of the magnetometer survey is presented overlain on Ordnance Survey mapping in Figure 2, together with trace plot and greyscale images of minimally processed data shown on Figure 4.

Earth resistance survey

Measurements were collected in Field 1 (Figure 1) using a Geoscan RM15 resistance meter and a PA5 electrode frame in the twin electrode configuration with readings taken at 1.0m intervals along parallel traverses separated by 1.0m using a 0.5m mobile probe separation. The post-acquisition processing included the application of a 2m by 2m thresholding median filter to remove isolated high readings caused poor probe contact due to the stoney surface material. Discontinuities between grid edges were reduced by modifying the statistical distribution of adjacent data sets, or by applying a edge matching routine based on a 1D high-pass median filter of window width 10m to columns of data parallel or in close proximity to the mismatched grid edge, and replacing the original values with a linearly weighted combination of these and the edge matched version. This was especially important in areas of the site where coastal inundation significantly altered the moisture content and soil conductivity

overnight. A linear greyscale image of the survey is shown superimposed over Ordnance Survey mapping in Figure 3, with a trace plot of the minimally processed data and linear and equal area greyscale images shown on Figure 5. A further linear greyscale plot of high pass filtered data is supplied in Figure 5(D). This removes regional trends to emphasise local variations of comparable width to a radius of 4m.

RESULTS

Magnetometer Survey

A graphical summary of significant magnetic [m1-10] anomalies discussed in the following text, are shown superimposed on the Ordnance Survey mapping, on Figure 6.

General Response

The magnetic response across the site was good, with the magnitude of significant anomalies measuring up to 15nT/m. The ROC monitoring post [m1] generated a degree of interference extending for approximately 3.5m, and the negative anomaly [m2] is likely to be a service line for the monitoring post. A number of high magnitude responses, measuring up to 67nT/m, were recorded at [m3] and are likely to represent near surface ferrous material.

Field 1

Two parallel, linear positive anomalies [m4] which run east-west into the survey area from the East seem most likely to represent some form of trackway. These intersect with a series of rectilinear ditch-type responses [m5], possibly a large rectangular enclosure, part of a field system or small paddock with internal subdivisions. The pottery, which provided the impetus for the survey, was recovered from the easternmost segment of [m5] which also generated the highest magnitude of response (15.15nT/m) across the survey. It is evident that a proportion of [m5] has been lost to erosion however the extent of the loss is impossible to determine.

The linear anomalies [m6] are suggestive of some form of trackway or field boundary, with a series of small appended enclosures [m7] and [m8], possibly with internal subdivisions found to the north. There appears to be a possible entrance along the eastern edge of [m8], although the weaker magnitude of response in this area of the survey makes it difficult to discern relationships and breaks in the ditches with any certainty.

An irregular, sub-rectangular anomaly [m9] may represent a possible enclosure distinct from the rectilinear east-west aligned possible field system [m5] and enclosures [m7] and [m8].

Field 2

A linear ditch-type anomaly [m10], with a slight return, suggests that further survey would be worthwhile.

Earth Resistance Survey

A graphical summary of significant earth resistance [r1-5] anomalies discussed in the following text are shown superimposed on the Ordnance Survey mapping in Figure 7.

General Response

The background response varies across the site with much lower readings recorded along the coast, most likely due to the regular inundation of saltwater at high tide. A number of broad and irregular low resistance anomalies [r1], approximately 5-10m apart, oriented northwest-southeast are indicative of medieval to post medieval ridge and furrow. It is likely that the low resistance anomaly at [r2] is associated with the ROC post and is replicated in the magnetometer data at [m2].

Field 1

Two narrow, roughly parallel, low resistance ditch type anomalies [r3] truncated by coastal erosion run broadly northeast-southwest. Whilst their orientation and character may be similar to the enclosures and field systems [m4, 6 and 7], they appear too heavily masked by the ridge and furrow to identify any relationship with the surrounding archaeology. A further short stretch of ditch-type anomaly [r4] correlates with [m4].

The character of the possible enclosure at [r5] is much broader and more diffuse in the earth resistance data than [m8] although it is still distinctly visible, characterised by its northern corner and slightly curved edges. In the high pass filtered version of the data it appears marginally less diffuse and more in line with the magnetometer response, possibly suggesting that the anomaly is more likely to be archaeological than geological in origin.

CONCLUSIONS

The geophysical survey suggests that the pottery recovered from the exposed ditch profile at Dunster Beach is associated a much larger complex of enclosures, field boundaries and possible trackways indicative of a combination of agricultural and settlement practices. Whilst the rectilinear ditched boundaries seem likely to be associated with Roman settlement at the site, a tentative suggestion of a further phase of activity may be indicated by the presence of a sub-rectangular enclosure on a differing alignment. The maximum extents of the site have yet to be determined and it is evident that further survey in the adjacent fields would be a worthwhile exercise.

LIST OF ENCLOSED FIGURES

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Figure 1

SEA LANE END, DUNSTER BEACH, CARHAMPTON, SOMERSET

Location of geophysical surveys, April 2016

0 90m

1:1250

magnetometer survey

earth resistance survey

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Figure 2

SEA LANE END, DUNSTER BEACH, CARHAMPTON, SOMERSET

Location of fluxgate magnetometer survey, April 2016

0 90m

1:1250

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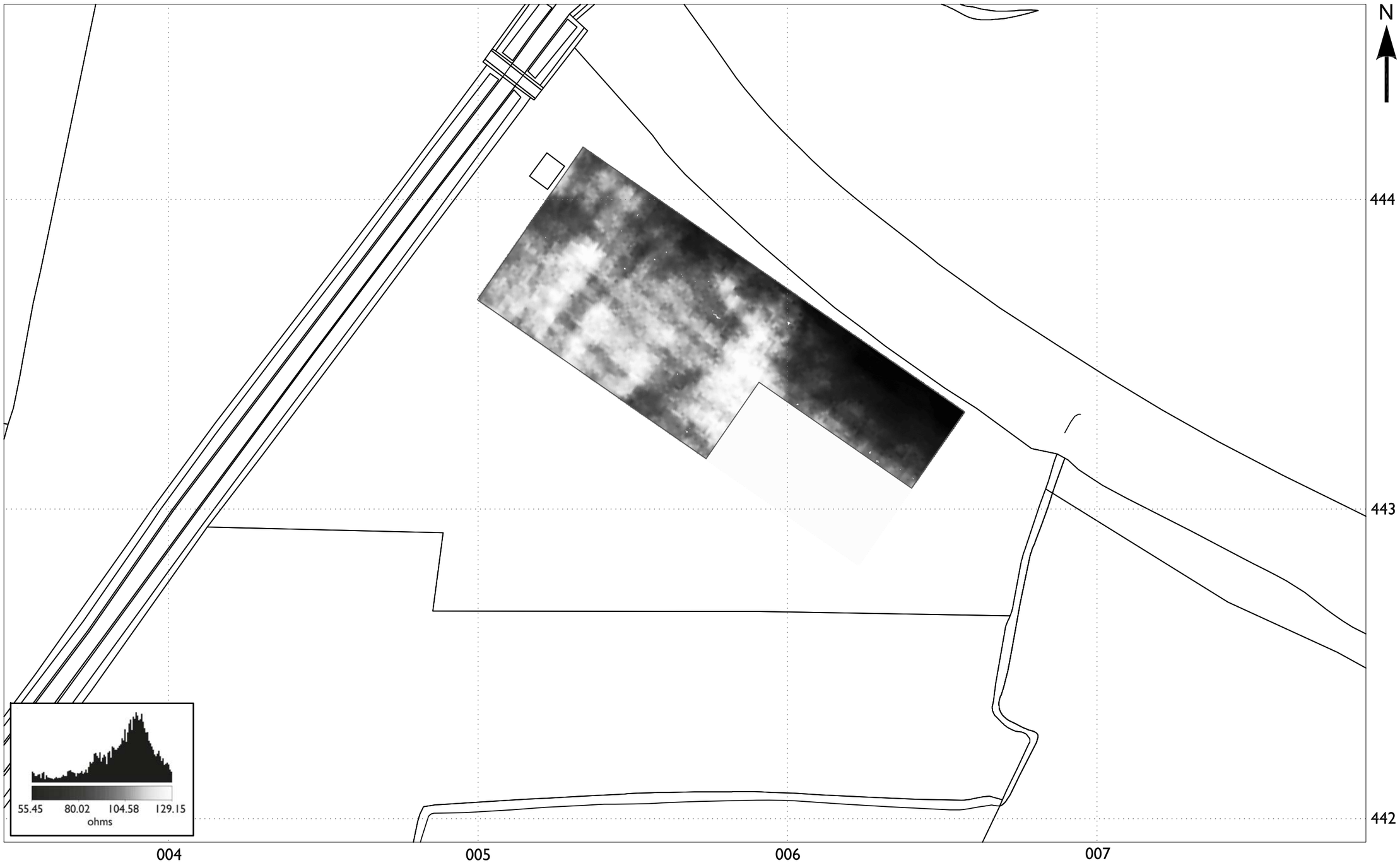
Figure 3

SEA LANE END, DUNSTER BEACH, CARHAMPTON, SOMERSET

Location of earth resistance survey, April 2016



0 90m

1:1250

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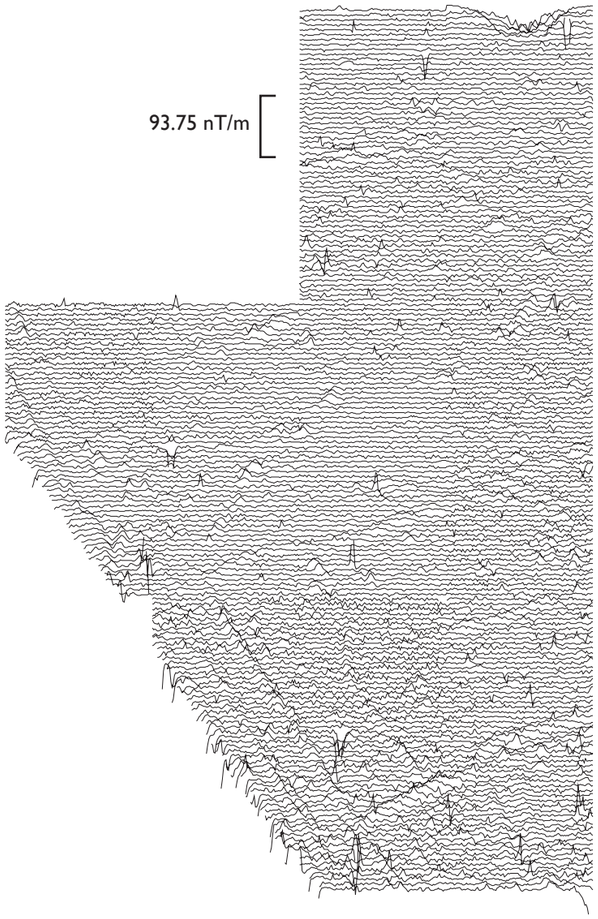
Fluxgate magnetometer data, April 2016

Figure 4

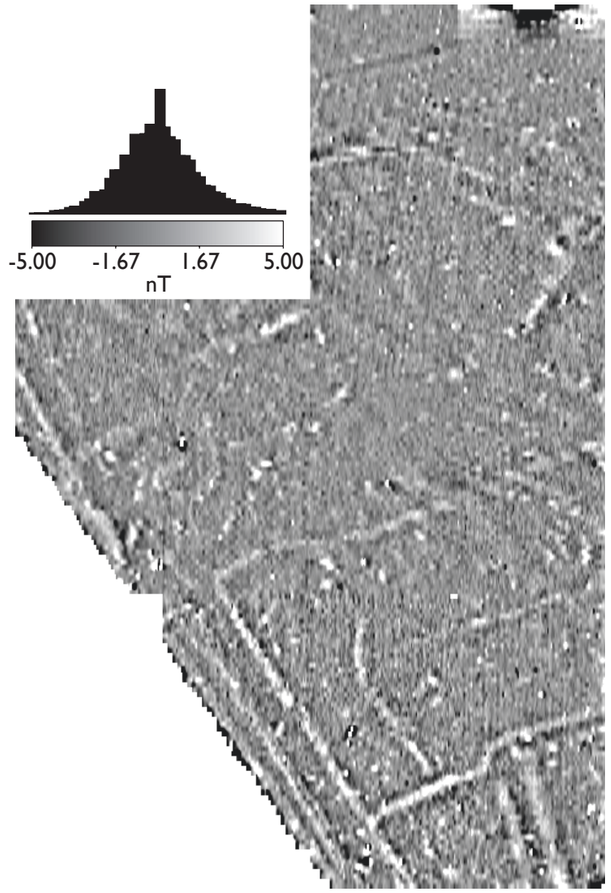
N

Field 1

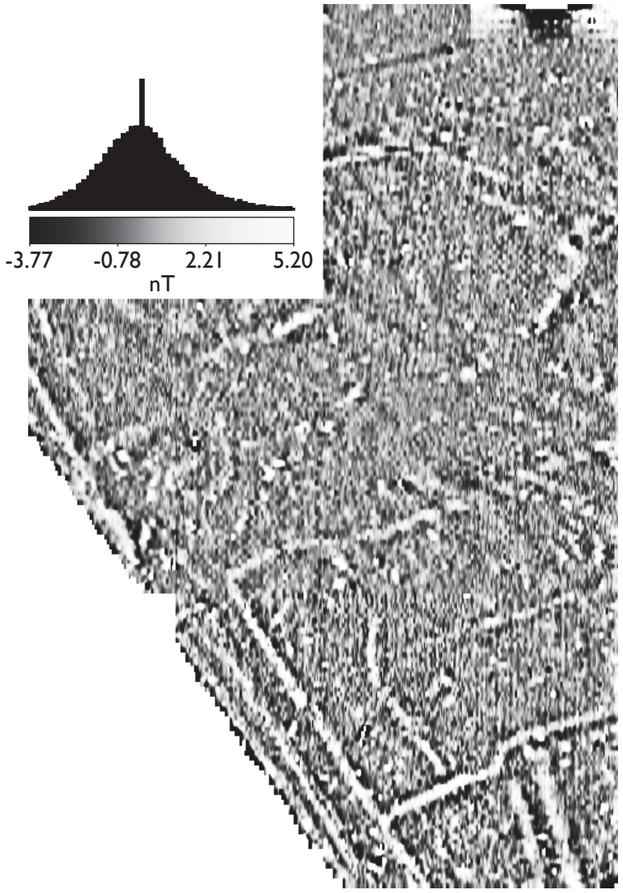
(A) Trace plot of minimally processed magnetometer data



(B) Linear greyscale image of magnetometer data

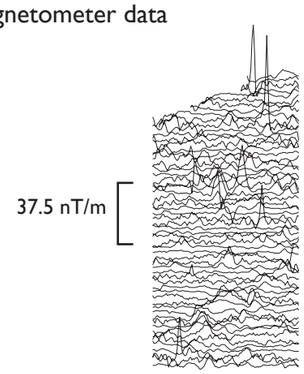


(C) Equal arear greyscale image of minimally processed magnetometer data

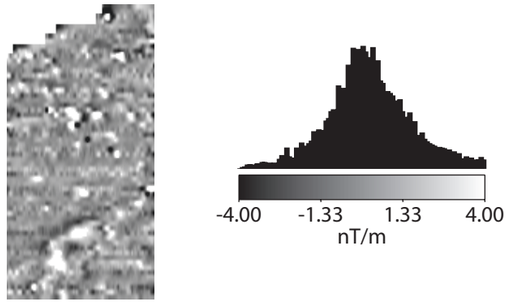


Field 2

(D) Trace plot of minimally processed magnetometer data



(E) Linear greyscale plot of minimally processed magnetometer data



0 90m

1:1250

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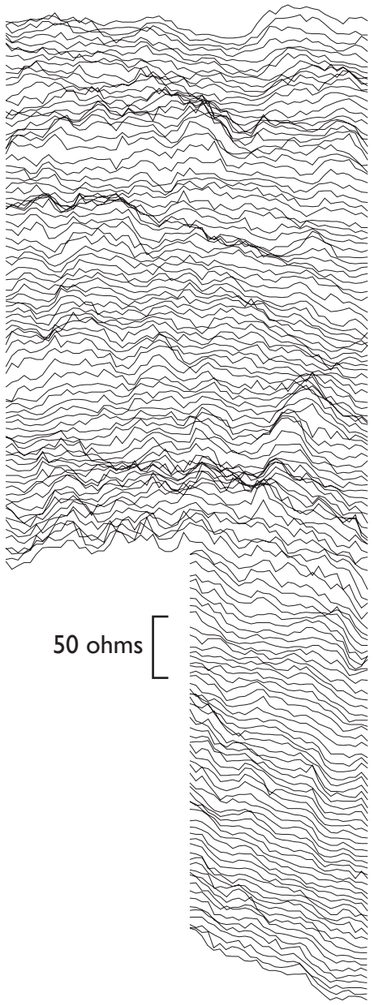
SEA LANE END, DUNSTER BEACH, CARHAMPTON, SOMERSET
Earth resistance data, April 2016

Figure 5

(A) Trace plot of minimally processed data



(B) Linear greyscale plot of minimally processed data

(C) Equal area plot of minimally processed data

(D) Linear greyscale plot of 4m radius high-pass filtered data

0 60m

1:1000

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Figure 6

SEA LANE END, DUNSTER BEACH, CARHAMPTON, SOMERSET

Graphical summary of significant magnetometer anomalies, April 2016

0 90m

1:1250

raised magnetic

positive magnetic

negative magnetic

magnetic noise

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Figure 7

SEA LANE END, DUNSTER BEACH, CARHAMPTON, SOMERSET

Graphical summary of significant earth resistance anomalies, April 2016

0 90m

1:1250

low resistance

high resistance

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