Castle Neroche Geophysical Survey
May 2017

GeoFlo

Southwest Geophysical and Flotation Services

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Castle Neroche Geophysical Survey,
May, 2017

1.0 Introduction

The survey took place at Castle Neroche (fig 1), a Norman mott-and-bailey castle on the site of an Iron Age Hillfort (OS grid ref 327100 115850), on behalf of the South West Heritage Trust. The purpose of the survey was to locate a Second World War Auxiliary Unit Special Duties radio station and associated services (Somerset HER ref 2802) beneath the earthworks to the southeast of the mott (fig 2). Although the radio station's general location had been deduced from the remains of aerial wires in nearby trees (fig 3), the aim of the survey was to determine its precise location. Ref: (Ward, W. & Perry, C. 2014. *British Resistance Archive Special Duties Branch. Chirnside 0 - Special Duties Radio Zero IN Station at Buckland St Mary.* (Online). (Accessed 19th May 2017). Available from: http://www.coleshillhouse.com/specialdutiesbranch/chirnside-zero-special-duties-radio-zero-in-station-at-buckland-st.mary.php

Both gradiometry and resistivity were carried out over a small area between the ramparts and quarry pits (figs 2 & 3). The survey area included trees where the remains of wires from aerials had been identified and where the remains of a ceramic ventilation pipe had been spotted (Webster, C. 2017. *Email to Liz Caldwell*, 5th May). The total survey area was approximately 0.2ha.

Castle Neroche is situated approximately 2km north of the village of Buckland St Mary in Somerset, and is approximately 10km southeast of the county town of Taunton. The geology of the site is Clay with Chert Gravel Formation over Upper Greensand Formation Sandstone bedrock.

The work was carried out by GeoFlo – Southwest Geophysical and Flotation services

1.1 Equipment

Fluxgate gradiometer – Bartington Grad 601-2

The Bartington Grad 601-2 is a dual system gradiometer, a form of magnetometer. It comprises two sensor rods carried on a rigid frame, each sensor including two fluxgates aligned at 90° to each other, one set 1m above the other. It measures variations in the magnetic field between the two fluxgates, recorded in *nanoTesla* (nT) at each sampling point within a grid. The manufacturer claims a depth range of approximately three metres. The instrument is most effective when carried at a consistent height, not exceeding 0.3m above the ground.

Magnetometers are especially effective for discovering thoroughly decayed organic materials, such as those which accumulate in ditches and pits, and matter exposed to intensive firing, including industrial areas, hearths and larger ceramics. All of these are likely to give a positive magnetic response, sometimes with a negative halo, giving a dipolar effect. Non-igneous stone features, such as walls and banks, are usually perceived as negative anomalies against a background enhanced by decayed organics.

Resistivity meter – TR/CIA Resistance Meter

A twin probe array was used, with mobile probes at a fixed separation of 500mm and two remote probes of variable spacing. The meter range was 200 Ohm, and minimal filtration was employed to remove any effects of mains electrical earth currents.

Resistivity meters work by measuring the resistance to the passing of an electrical current through the ground from one probe to another. Different buried components in the ground have different degrees of conductivity or resistance. Water is the best conductor in the soil so in effect the method is also dependent on the amount of moisture present. As a consequence it can be susceptible to geological and seasonal variations. It is effective in the identification of stone structural remains, organically rich deposits and cut linear features or large pits, where there is sufficient contrast between features and the surrounding buried environment.

Software – Geoscan Geoplot 3.00v

Geoplot 3.00v allows the presentation of data in four graphical forms: dot-density, grey scale, pattern and X-Y (or *trace*) plots. The latter are particularly effective when used in conjunction with other graphical modes to emphasise ferrous magnetic anomalies or other distortions which show as accentuated peaks or troughs. The programme supports statistical analysis and filtering of data.

1.2 Field method

The survey area was divided into 10m squares orientated according to existing earthworks and tied into the OS grid post survey (figs 2 & 3).

For gradiometry, readings were logged at 0.25m intervals along northeast to southwest traverses set 1m apart, in a zig zag pattern. For resistivity, readings were logged at 1m intervals along southeast to northwest traverses set 1m apart, in a zig zag pattern.

1.3 Gradiometer processing method

Preliminary processing revealed considerable impact from ferrous magnetic features, characterised by sharp dipolar fluctuations ranging from approximately 30nT to over 3000nT. The normal processing sequence would require these replacing with null (dummy) entries to avoid problems with subsequent processing functions designed to accentuate weaker archaeological responses. However in this survey it is the ferrous anomaly which is of interest as it could represent the location of the radio base, requiring much broader parameters be used (see also ***3.1*** below).

1. Readings exceeding 100nT either side of 0 were replaced by null (dummy) entries.
2. Any anomalous isolated readings were similarly replaced.
3. Typical regular error due to the zig zag operation of the gradiometer was removed.
4. The mean reading for every traverse was reset to 0.
5. The asymmetric data collection pattern was mitigated by the positive interpolation of data points along the Y axis using the calculation of sin(x)/x.

1.4 Resistivity processing method

1. Isolated high or low readings (noise spikes) were replaced by the mean reading.
2. The impact of geological variation was reduced by the application of a uniform high pass filter with a radius of 8 readings in the X and Y directions.
3. Data were smoothed and weak anomalies highlighted by the application of a low pass filter with a radius of 1 reading in the X and Y directions.
4. Further smoothing was achieved by the positive interpolation of data points along the Y and X axes, using the calculation of sin(x)/x.

2.0 The survey area

2.1 Gradiometry *(figs 2 & 10)*

The grid comprises 16 contiguous whole and partial 10m squares covering a grassy area with sparse mature oak and beech trees. It was bounded by quarry pits to the north and east and earthwork banks to the south and west.

2.2 Resistivity *(figs 2 & 11)*

The resistivity grid comprises 12 whole and partial 10m squares covering most of the area of the gradiometry survey plus two additional grids to the southeast.

3.0 The survey results

3.1 Gradiometry results *(figs 4, 5, 6 & 10)*

The unprocessed data reveals a very strong dipolar response towards the eastern side of the survey area. Fig 4 presents the data using standard deviation plotting parameters which highlight the strength of the ferrous response.

In figs 5 & 6 absolute plotting parameters have been used (recommended for gradiometry data) and readings exceeding 100nT either side of 0 have been replaced by dummy entries in order to negate the effect of the ferrous response and so reveal any surrounding weaker archaeological anomalies.

Although the results are dominated by the major dipolar anomaly (**A**, fig 10), the survey has also detected a small number of other linear anomalies which could be indicative of buried archaeology. These are discussed in ***3.1(i)*** below.

There is also a scatter of non-linear anomalies across the survey area, generally within a range of 10 to 30nT. A clipped colour plot (fig 6) shows the nature of the spread of this material, where readings higher than 10nT are included in the maximum red colour band. These could indicate ferrous material possibly associated with anomaly **A** (fig 10) or possibly past quarrying activity. It is worth noting that the area is also regularly visited by members of the public and some of the anomalies could possibly be due to lost or discarded items with some ferrous content.

3.1(i) Positive magnetic anomalies *(fig 10)*

A Major ferrous magnetic anomaly with readings exceeding 3000nT. Readings are consistent with a large ferrous object/structure, suggesting this is the location of the radio station. The proximity of this anomaly to the surviving tree aerials and ceramic ventilation pipe supports this interpretation. Corresponds with low resistance anomaly **a** (see figs 10 & 11).

B Dipolar magnetic response associated with anomaly **A**. Readings are within a range of -3000 to 3000nT.

C Discrete area of ferrous magnetic anomalies with readings exceeding 3000nT. Possibly material associated with anomaly **A** or past quarrying activity.

D Amorphous area of thermo remanent/ferrous magnetic anomalies, generally within a range of 20 to 3000nT. Proximity to anomaly **A** could suggest a possible association.

3.1(ii) Negative magnetic anomalies *(fig 10)*

E Irregular linear anomaly, generally within a range of -4 to -6nT. Within normal range for non-magnetic stone.

F Linear anomaly within a range of -1 to -2.8nT. Location suggested possible association with the nearby quarry pit.

3.2 Resistivity results *(figs 7, 8, 9 & 11)*

The resistivity survey results show a low resistance anomaly (**a**, fig 11) in the same location and of a similar size and shape to ferrous magnetic anomaly **A** (fig 10). This strengthens the probability of anomaly **A** representing the location of the radio base. Fig 7 shows the unprocessed resistivity data and fig 8 after processing.

There are a number of other amorphous high and low resistance anomalies across the survey area. It is possibly that some of these might be geological rather than archaeological, and could relate to gravel deposits. Areas of high and low resistance are highlighted in fig 9, particularly demonstrating the disturbance around the edges of the two adjacent quarry pits. Fig 11 highlights anomalies where the degree of confidence in them relating to archaeological features is higher (see ***3.2(i)*** and ***3.2(ii)*** below).

Note: The readings below are after the use of a high pass filter enabling high and low resistance data to be expressed in a bipolar form.

3.2(i) Lower resistivity anomalies

a Irregular anomaly with readings from -32 to -41 ohms. Corresponds with the location of ferrous magnetic anomaly **A** (see ***3.1(i)*** above).

b Linear anomaly with readings from -12 to -36 ohms. Within normal range for a ditch. Aligns with anomaly **a** but its proximity to the nearby quarry pit and scarp makes interpretation uncertain.

c Oval anomaly with readings from -30 to -78 ohms. Within normal range for a pit. Possibly associated with quarrying activity.

d - f Irregular linear anomalies with readings from -20 to -25 ohms. Within the normal range for ditches. Anomaly **d** could possible intersect with **a**. It is possible that **d**, **e** and **f** could be part of the same intermittent linear, possibly associated with aerial wires in nearby trees. However, tree roots can affect moisture levels and therefore the electrical conductivity of the soil, which could limit confidence in the interpretation of **e**. Although **f** is less than 10m from aerial 2 (fig 3), the change in alignment might suggest it is not associated with the radio station.

3.2(ii) Higher resistivity anomalies

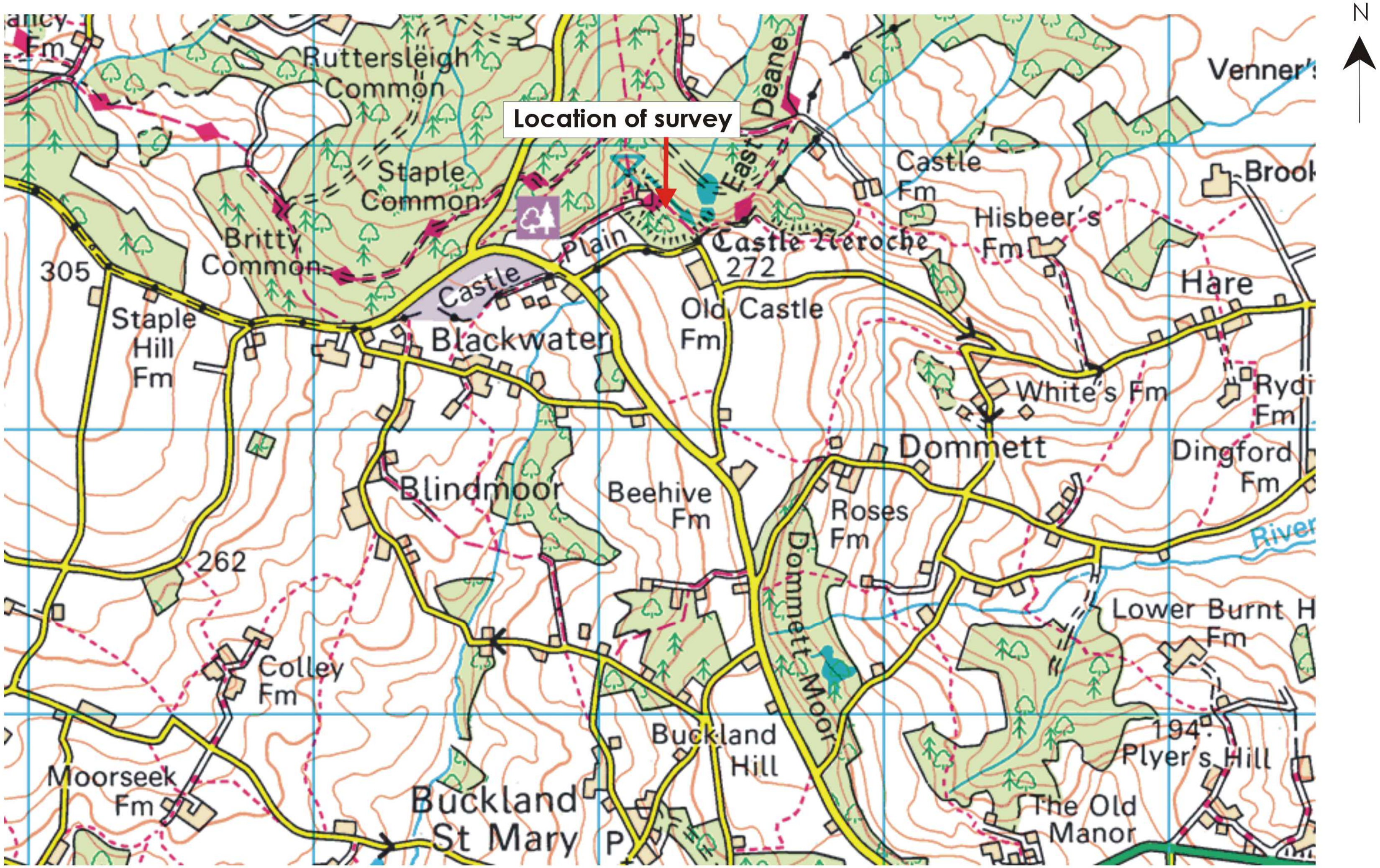
e Amorphous area of high resistance with readings from 30 to 50 ohms. Adjacent to Aerial 2 (fig 3) but its location on the crest of a bank with high stone content suggests it could possibly be a geological response.

f Irregular linear anomaly with readings from 60 to 85 ohms. Its proximity to the quarry pit suggests a possible geological response. However a recent visit to the site by members of the Coleshill Auxiliary Research Team reported the remains of a ceramic ventilation pipe running north-south 0.6m from the edge of this quarry pit (Webster, C. 2017. *Email to Liz Caldwell*, 5th May).

4.0 Conclusion

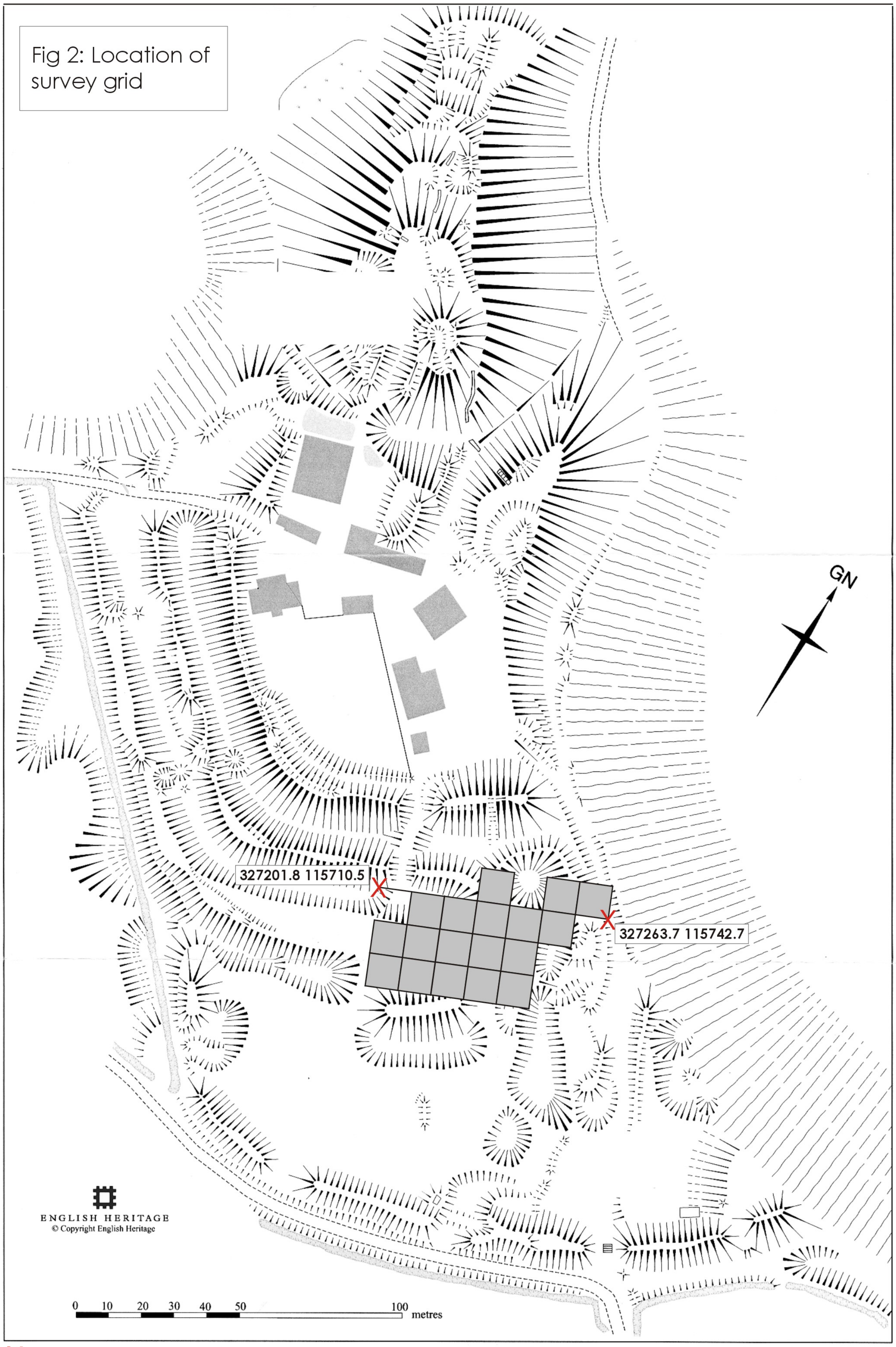
The degree of confidence in identified anomalies is high with regards to the location of the radio station, but varies from low to moderately high for other anomalies. Both surveys have detected a substantial anomaly, the location and appearance of which is strongly suggestive of the radio station. The very strong dipolar response in the gradiometry survey is particularly convincing, corroborated by the corresponding low resistance anomaly. The proximity of this anomaly to the surviving tree aerials and ceramic ventilation pipe strengthens the degree of confidence in identifying this as the radio station.

Fig 1: Location of survey



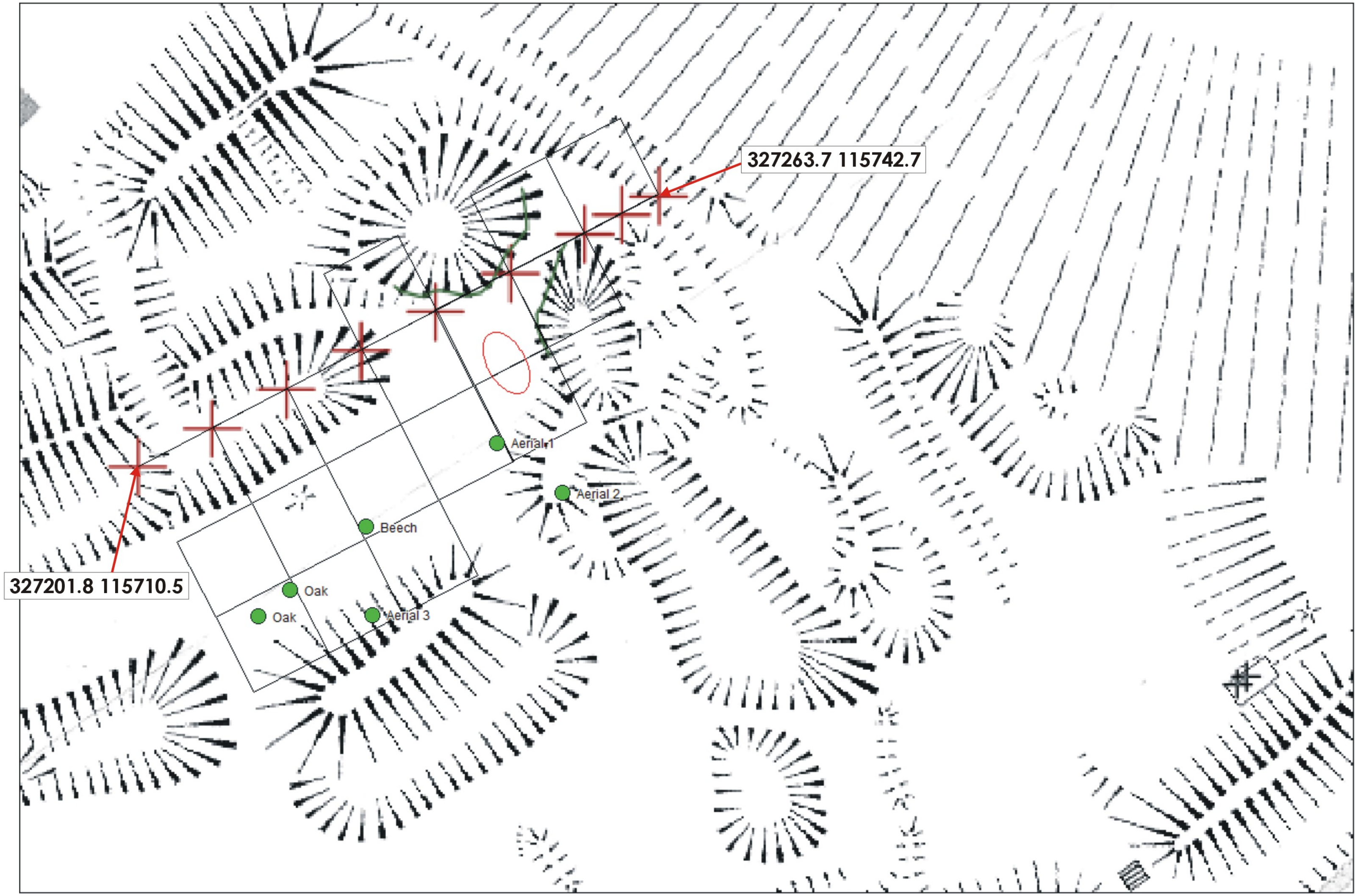
Ordnance Survey Map Copying Licence Number: 100048647

0 250 metres 1000



X Baseline coordinates

Fig 3: Location of baseline points, aerials and potential site of radio station



Graphic courtesy of the South West Heritage Trust and Context One Archaeological Services

Fig 4: Unprocessed gradiometry data

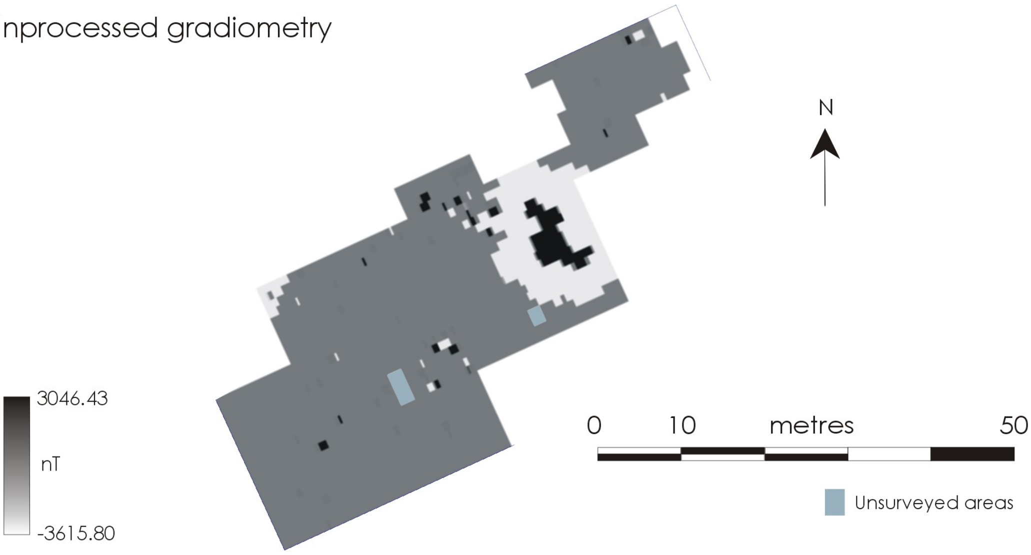


Fig 5: Processed gradiometry survey results

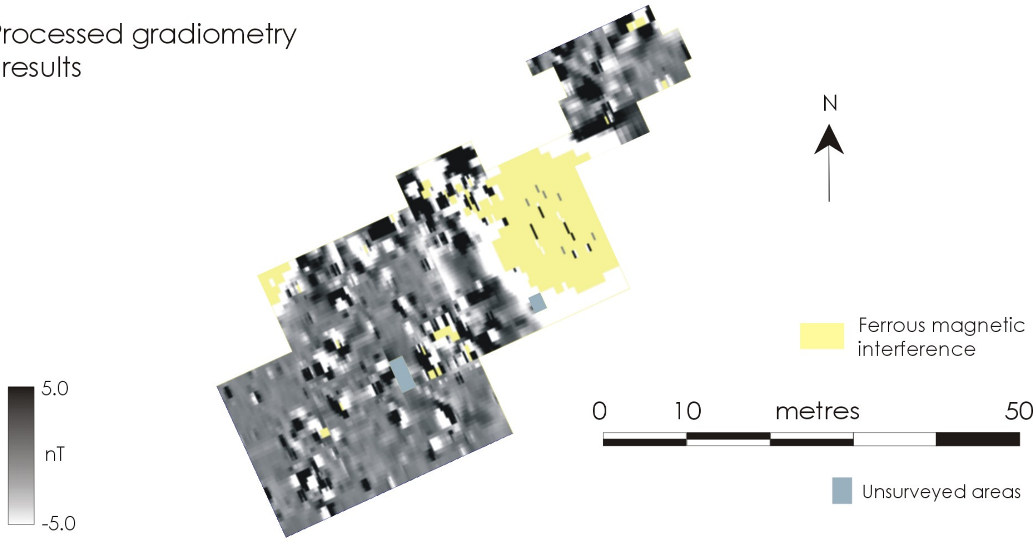


Fig 6: Highlighted gradiometry results

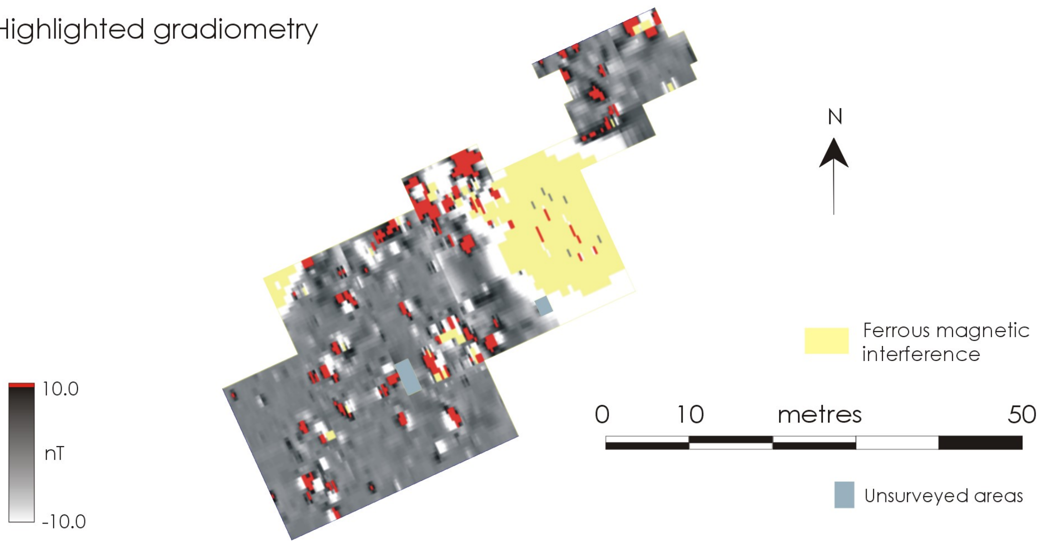


Fig 7: Unprocessed resistivity data

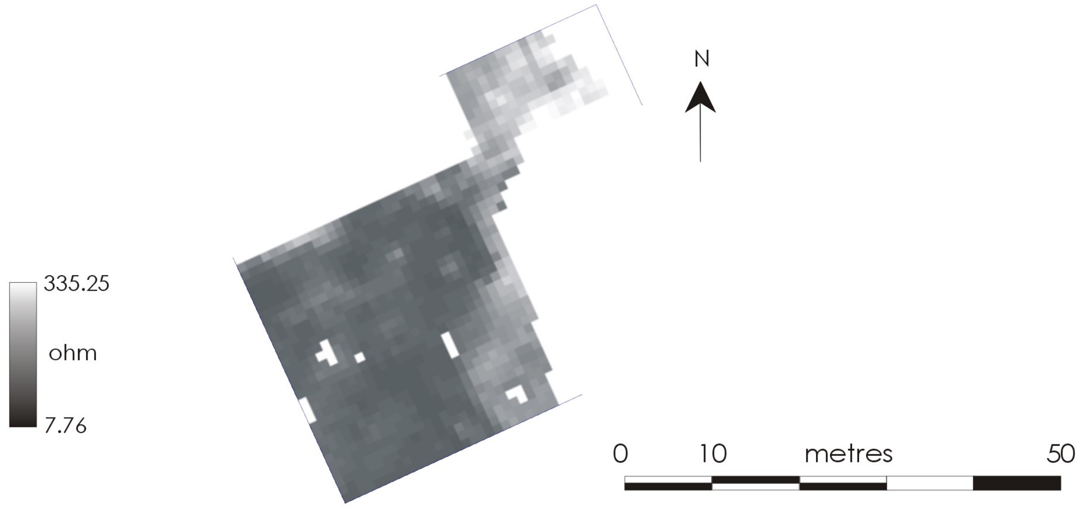


Fig 8: Resistivity survey results

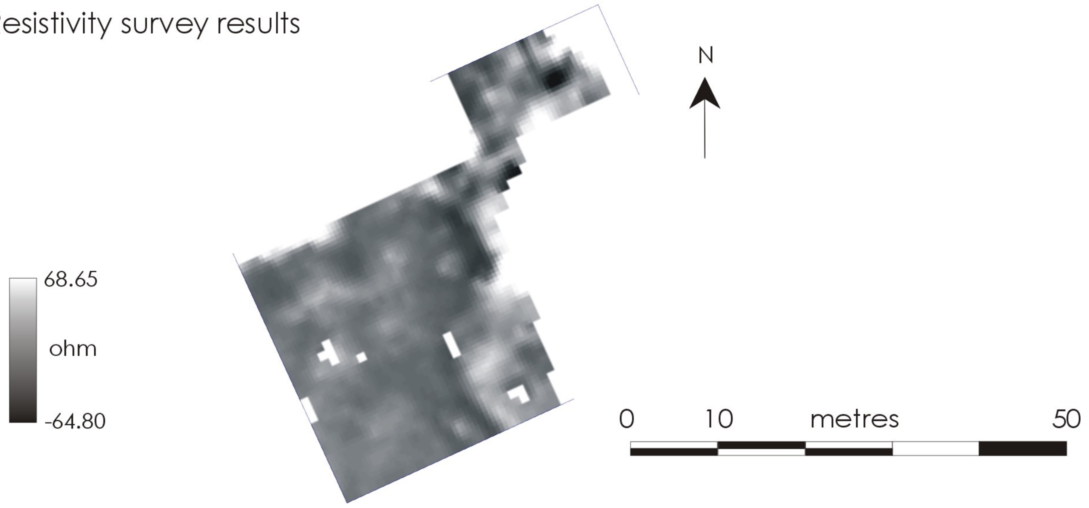


Fig 9: Highlighted resistivity results

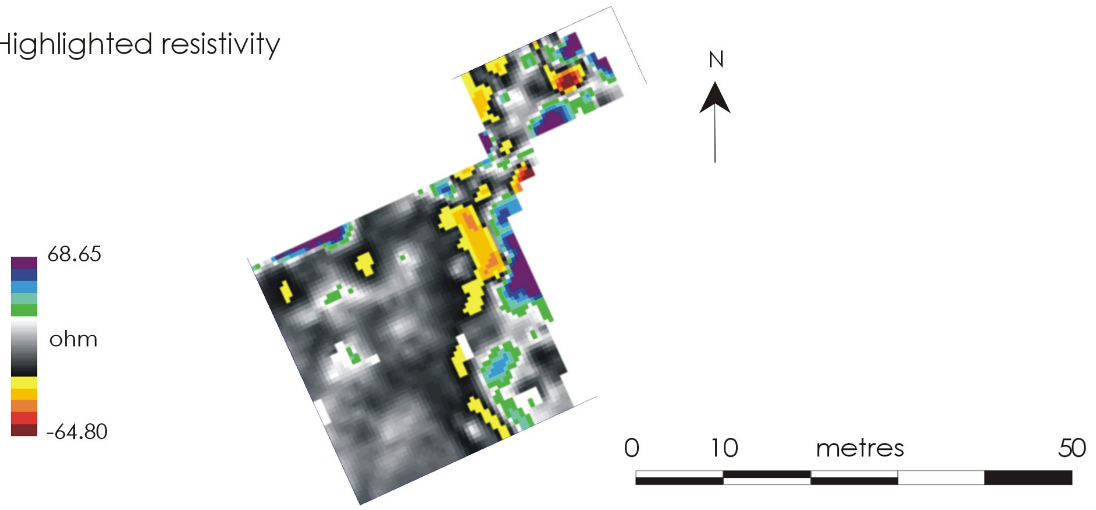


Fig 10: Composite interpretation of gradiometry results

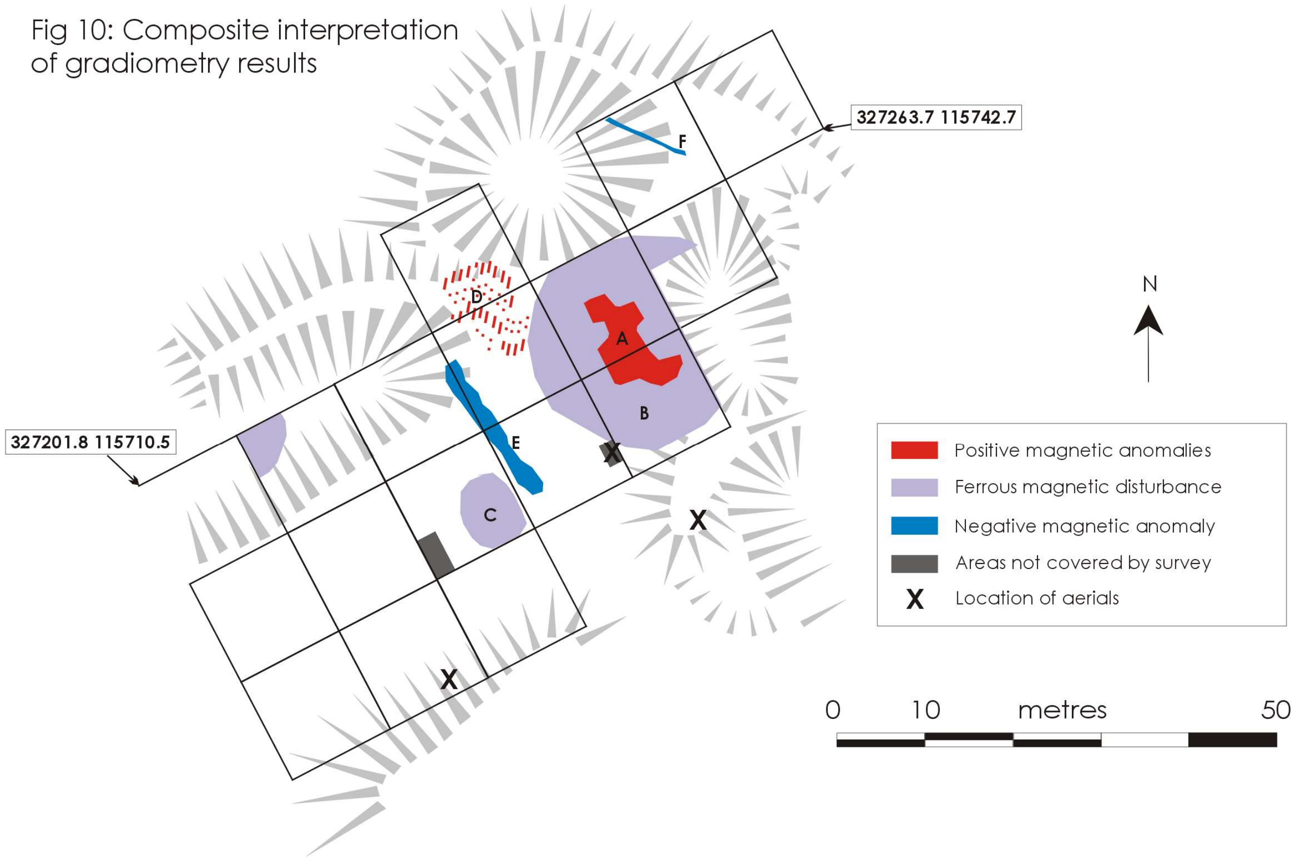


Fig 11: Resistivity interpretation

Report prepared by Liz Caldwell of GeoFlo for the Southwest Heritage Trust.
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