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BATTEN HANGER, ELSTED & TREYFORD, WEST SUSSEX REPORT ON GEOPHYSICAL SURVEY, MAY 2008

Andrew Payne

ARCHAEOLOGICAL SCIENCE

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BATTEN HANGER, ELSTED & TREYFORD, WEST SUSSEX

REPORT ON GEOPHYSICAL SURVEY, MAY 2008

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SUMMARY

A geophysical survey was conducted in the vicinity of the partially excavated Roman villa at Batten Hanger, West Sussex, to inform the ongoing management of the site following an increased threat from ploughing to the previously stable remains. Magnetometer and earth resistance surveys were undertaken to help further define the extent of the archaeological activity. No obvious additional building remains were detected, but the magnetometer survey has defined an area of potentially significant magnetic disturbance extending for up to 160m to the north of the known villa. Earth resistance survey, targeted over the area of magnetic disturbance, was less informative although both survey techniques have identified the course of a roadway running into the villa complex from the south.

CONTRIBUTORS

The geophysical fieldwork at Batten Hanger was carried out by Louise Martin and Andrew Payne.

ACKNOWLEDGEMENTS

Bill Sillar (University College London) and James Kenny (Chichester District Council) are thanked for providing useful information on previous geophysical survey and excavation undertaken at Batten Hanger in 2006. The cover photograph shows a view looking south along the narrow valley containing the villa site in the middle distance.

ARCHIVE LOCATION

English Heritage, Research Department, Fort Cumberland, Portsmouth.

DATE OF FIELDWORK AND REPORT

The fieldwork was conducted between 19th May and 22nd May 2008 and the report was completed on 20th November 2008.

CONTACT DETAILS

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INTRODUCTION

Geophysical survey was undertaken at Batten Hanger to assist in defining the full extent of a partially excavated Roman villa after the site was ploughed after a lengthy period out of cultivation. The renewed ploughing resulted in considerable disturbance to the previously stable buried remains, necessitating a response to protect the site from further degradation (Linford 2008).

The villa (NGR SU 818153; NMR Monument number 246266) is situated in a sheltered and secluded location in the middle reaches of a long narrow dry valley running from north to south through steep wooded hangers. Excavations undertaken between 1988 and 1991 (Frere 1989; Frere 1990; Frere 1991; Magilton 1991) revealed the remains of a substantial complex of well preserved Roman buildings in the valley bottom, consisting of an aisled building of several phases incorporating a bath-house on the northern side of the complex (the north range) with an adjacent range of further buildings on the western side of the complex (the west range). The buildings appeared to be constrained to a ditched enclosure or "farmyard" defined on three sides of the villa complex by trial-trenching, but of unknown extent to the north and north-east of the north range. Subsequent limited geophysical survey and exploratory excavation by University College London (UCL) in 2006 confirmed the presence of further structural remains to the north of the aisled hall, but these were not fully defined (Sillar 2006).

At the time of the 1988-91 excavations the surviving masonry was in good condition with walls extending to a considerable depth and the collapsed east gable of the aisled building clearly visible in plan. The remains were vulnerable to further ploughing due to their proximity to the surface and were therefore taken out of cultivation and sealed beneath a permeable polythene geotextile membrane and backfilled. The recent episode of ploughing has now brought this protective material to the surface, suggesting the archaeological deposits are also under attrition. This has resulted in a renewed initiative to secure the site from additional disturbance by means of statutory protection. In order to inform this process a geophysical survey was requested to assist in defining the full extent of the villa and any associated archaeological activity, so that a suitable constraint area can be established to prevent further damage from ploughing.

The geological deposits in the valley floor consist of mixed fluvially derived head deposits of gravelly flinty clay fringed by deposits of purer Upper Cretaceous Seaford Chalk where the ground rises to form the valley sides (British Geological Survey 1996). The head deposits in the valley bottom are overlain by well-drained flinty fine silty soils of the Andover 2 association (Soil Survey of England and Wales 1983). The survey was undertaken during a prolonged period of warm and settled weather when ground conditions were very dry. The field was planted with a crop that was still low enough not to impede the survey despite the late spring programming, the ground surface was rutted and heavily furrowed in places due to the recent cultivation.

METHOD

i) Magnetometer survey

A fluxgate gradiometer survey was carried out over the entire length of the dry valley where it is bounded by the wooded hangers, but excluding the majority of the area where the main villa buildings had previously been exposed and recorded by excavation. Some overlap with the previously excavated area was included to confirm the current survey was correctly positioned with respect to the known archaeological remains.

Data was collected over a grid of 30m squares set out using a differential global positioning system (GPS) over the recently ploughed area (Figure 1). Readings were recorded using the standard method (Annex 1, note 2) at intervals of 0.25m along successive north-south orientated traverses spaced 1.0m apart using the 100 nanotesla per metre (nT/m) range setting of the magnetometer. Subsequent processing of the data involved initial truncation of the recorded data-range to remove extreme readings (values outside the range of +/-100 nT/m, caused by ferrous disturbance from the fences along the edges of the survey area) and subsequent setting of each traverse to a zero mean, to remove directional sensitivity and instrument drift. A linear greyscale plot of the resulting data is displayed superimposed over the Ordnance Survey (OS) base map on Figure 2. Additional representations of the data as a linear greyscale plot and an X-Y traceplot are presented on Figures 4(a) and 4(c). The data shown in Figures 4(a) and (c) were further processed to remove localised strongly magnetic responses from near surface ferrous material (iron "spikes") by the use of a 2m by 2m thresholding median filter (Scollar *et al.* 1990, 190-1) to improve the definition of weaker anomalies.

ii) Earth resistance survey

A more limited earth resistance survey was carried out over selective areas to test for the continuation of masonry footings outside the known limits of the villa remains, encompassing a zone of potentially significant magnetic disturbance. Unfortunately, the dry and flinty soil conditions in the field resulted in poor probe contact with the uneven ground surface, which curtailed the use of a multiplexed 0.5m and 1.0m mobile probe spacing survey following an initial trial attempt to the south of the excavated villa.

Measurements were recorded with a Geoscan RM15 resistance meter, MPX15 multiplexer and an adjustable PA20 electrode frame in the Twin-Electrode configuration, using the standard method outlined in Annex 1, note 1. North of the villa readings were recorded with a 0.5m mobile probe spacing at a 1.0m sample interval and a finer 0.5 x 1.0m sample interval was employed to the south.

Figure 3 displays a greyscale plot of the earth resistance data superimposed over the Ordnance Survey base map. The data has been processed through the application of a 1.0m by 1.0m thresholding median filter, to remove isolated noise spikes caused by poor contact with the ground surface, and a 1.0m radius Gaussian low-pass filter to reduce the distracting effect of localised noise (Scollar *et al.* 1990, 190, 513). The same data is presented as a greyscale plot at a larger scale in Figure 4(b) and as a traceplot, without low-pass filtering, in Figure 4 (d).

RESULTS

Graphical summaries of significant geophysical anomalies discussed in the text are identified by the prefixes [M] for the magnetic and [R] for the earth resistance data sets on Figures 5 and 6 respectively.

i) Magnetometer survey

The area immediately north of the excavated aisled hall contains two adjacent, but discrete, mixed positive and negative magnetic responses [M1and M2] that correlate with similar anomalies recorded by the previous UCL magnetometer survey. Whilst anomalies [M1and M2] could well be associated with thermoremanent material from an additional Roman building, they also lie within a zone of more generalised magnetic disturbance (shown stippled in red on Figure 5) that may indicate an extension of the activity associated with the villa to the north, although the precise nature of this response is unclear. A very weakly defined linear positive magnetic anomaly [M3] running along the western side of the disturbed area may indicate part of an enclosure system, possibly also represented by a further ditch-type response [M4] on a perpendicular alignment. The significance of the narrow linear negative anomaly [M5] is difficult to ascertain, although it is unlikely to be related to the current plough pattern and may, perhaps, indicate the location of a previous excavation trench.

A second area of possible archaeological activity has been located further to the north of the known villa remains [M10-16]. The anomalies here are suggestive of intermittent sections of enclosure ditch [M10 to M12], scattered pits [M13 to M15] and a possible larger amorphous in-filled pit, scoop or quarry at [M16].

To the south of the excavated area the magnetometer survey has revealed far less activity, but may indicate a possible roadway visible as a broad weak positive magnetic anomaly [M17] running south-east from the enclosure ditch [M18] around the villa buildings becoming fainter as it heads away from the main area of occupation. The trajectory of the roadway suggests that it connects with the nearby route of the main Roman road running north from Chichester (Margary 1973, 78-80). The recovery of the location of the enclosure ditch [M18] should enable the plan of the features recorded by the 1988-91 excavations to be fixed more precisely in relation to the modern Ordnance Survey mapping (J Kenny *pers. comm.*). The area close to the southernmost extent of the previously exposed villa buildings shows an intensely disturbed magnetic response [M19] that would be expected over a previous archaeological excavation. Two further ditch type responses [M20] and [M21] are found to the south of the survey area, although the significance of these anomalies is difficult to fully ascertain. Further weaker linear responses prevalent throughout the survey area are a response to the rutted and furrowed ground surface resulting from agricultural activity.

ii) Earth resistance survey

North of the villa two localised areas of high resistance [R1and R2] may represent further fragments of the main villa complex, but are not sufficiently well described in the survey data to suggest a more definitive interpretation. A broad linear low resistance anomaly [R3] runs along the western edge of the survey that appears to correspond with [M3] and may represent the response to a ditch or a similar in-filled feature. In addition, a very weakly defined circular high resistance anomaly [R4] is partially coincident with an area of magnetic disturbance [M1]. Again, it is difficult to fully interpret this anomaly, although an archaeological origin cannot be ignored.

South of the villa a section of the possible roadway mapped by the magnetometer has been detected as a diagonal band of lower resistance [R5] cutting across an area of higher background resistance, perhaps corresponding to stonier deposits.

CONCLUSIONS

Exploratory excavation conducted 40m to the north of the previously excavated villa in 2006 has already revealed evidence for a small (approximately 2.0m by 2.0m) square building with rammed chalk foundations and a number of enclosure ditches (Sillar 2006). The current magnetometer survey now suggests the archaeological activity extends even further, for some 160m north of the excavated villa, but not continuing as far as the closed-off narrow end of the valley. The area of magnetic disturbance immediately to the north of the villa does not suggest an easily comprehensible layout of ditches and enclosures, although it still seems likely to be associated with significant occupation activity. To the south of the villa remains, the magnetic survey has confirmed the location of an enclosure ditch and revealed the course of a possible track or road-way. The results of the earth resistance survey were comparatively disappointing and failed to detect the building remains discovered during the 2006 excavation, possibly due to the dry, stony site conditions at the time of the survey.

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FIGURE LISTING

ANNEX 1: NOTES ON STANDARD PROCEDURES

1) Earth Resistance Survey: Each 30 metre grid square is surveyed by making repeated parallel traverses across it, all aligned parallel to one pair of the grid square's edges, and each separated by a distance of 1 metre from the last; the first and last traverses being 0.5 metres from the nearest parallel grid square edge. Readings are taken along each traverse at 1 metre intervals, the first and last readings being 0.5 metres from the nearest grid square edge.

   Unless otherwise stated the measurements are made with a Geoscan RM15 earth resistance meter incorporating a built-in data logger, using the twin electrode configuration with a 0.5 metre mobile electrode separation. As it is usually only relative changes in earth resistance that are of interest in archaeological prospecting, no attempt is made to correct these measurements for the geometry of the twin electrode array to produce an estimate of the true apparent resistivity. Thus, the readings presented in plots will be the actual values of earth resistance recorded by the meter, measured in Ohms (Ω). Where correction to apparent resistivity has been made, for comparison with other electrical prospecting techniques, the results are quoted in the units of apparent resistivity, Ohm-m (Ωm).

   Measurements are recorded digitally by the RM15 meter and subsequently transferred to a portable laptop computer for permanent storage and preliminary processing. Additional processing is performed on return to Fort Cumberland using desktop workstations.

2) Magnetometer Survey: Each 30 metre grid square is surveyed by making repeated parallel traverses across it, all parallel to that pair of grid square edges most closely aligned with the direction of magnetic N. Each traverse is separated by a distance of 1 metre from the last; the first and last traverses being 0.5 metre from the nearest parallel grid square edge. Readings are taken along each traverse at 0.25 metre intervals, the first and last readings being 0.125 metre from the nearest grid square edge.

   These traverses are walked in so called 'zig-zag' fashion, in which the direction of travel alternates between adjacent traverses to maximise survey speed. Where possible, the magnetometer is always kept facing in the same direction, regardless of the direction of travel, to minimise heading error. However, this may be dependent on the instrument design in use.

   Unless otherwise stated the measurements are made with either a Bartington *Grad601* or a Geoscan FM36 fluxgate gradiometer which incorporate two vertically aligned fluxgates, one situated either 1.0m or 0.5 metres above the other; the bottom fluxgate is carried at a height of approximately 0.2 metres above the ground surface. Both instruments incorporate a built-in data logger that records measurements digitally; these are subsequently transferred to a portable laptop computer for permanent storage and preliminary processing. Additional processing is performed on return to Fort Cumberland using desktop workstations.

It is the opinion of the manufacturer of the Geoscan instrument that two sensors placed 0.5 metres apart cannot produce a true estimate of vertical magnetic gradient unless the bottom sensor is far removed from the ground surface. Hence, when results are presented, the difference between the field intensity measured by the top and bottom sensors is quoted in units of nano-Tesla (nT) rather than in the units of magnetic gradient, nano-Tesla per metre (nT/m).

FIGURE 1

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Location of Geophysical Surveys, May 2008

SU 8115

1 : 2500
0 50 100 150m

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FIGURE 2

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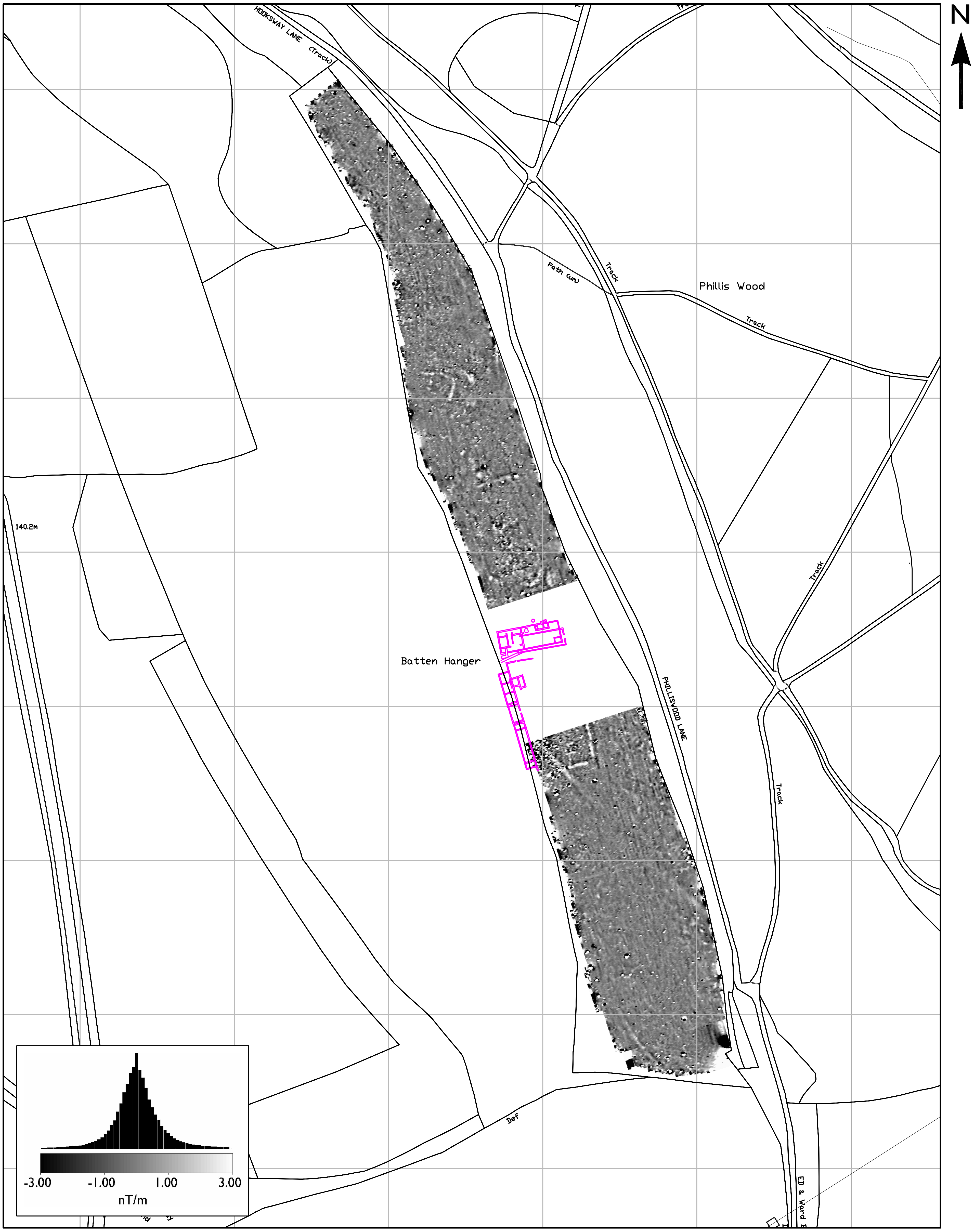
Location of Fluxgate Magnetometer Survey, May 2008

SU 8115



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0 50 100 150m

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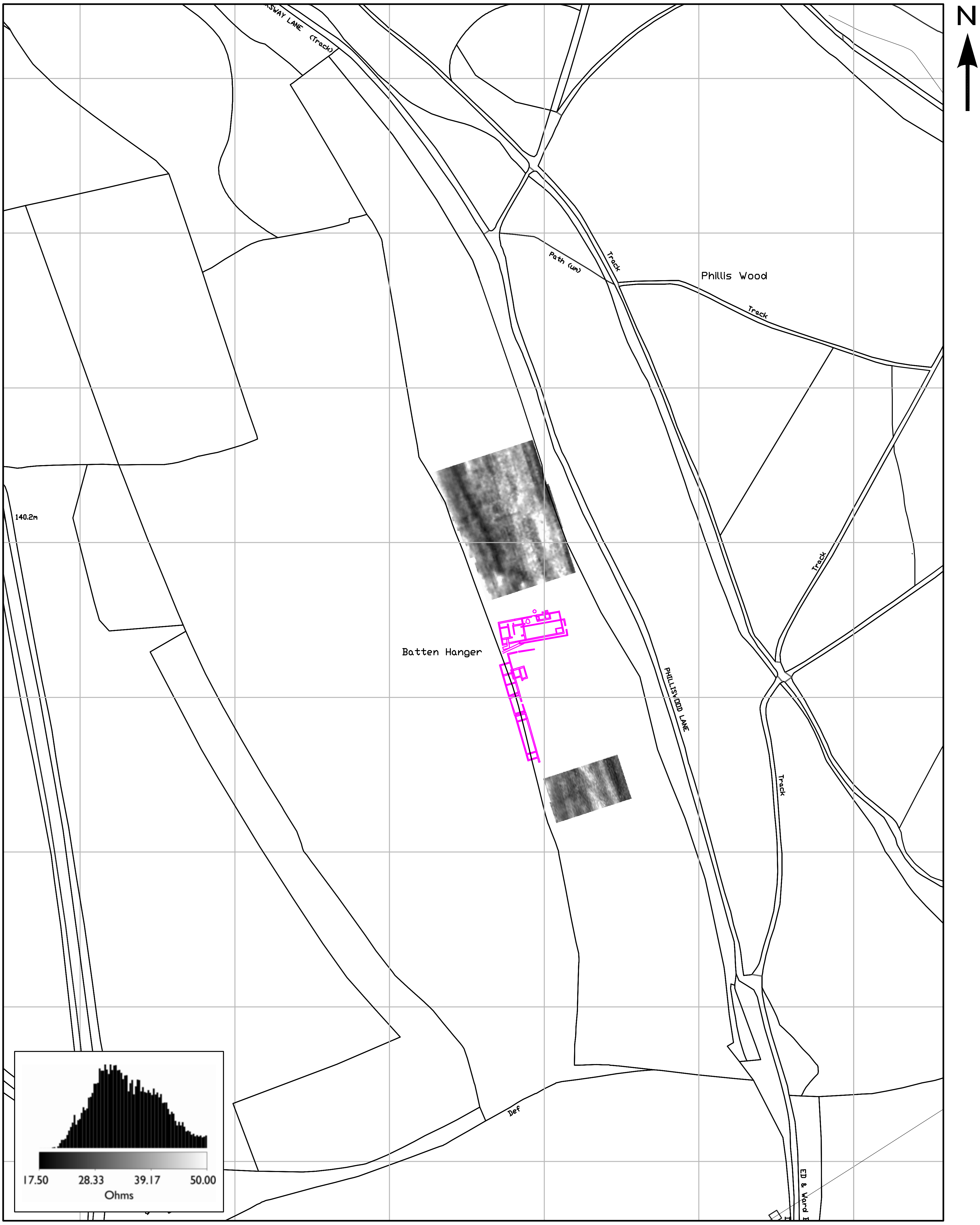
Location of Earth Resistance Survey, May 2008

SU 8115



1 : 2500

0 50 100 150m

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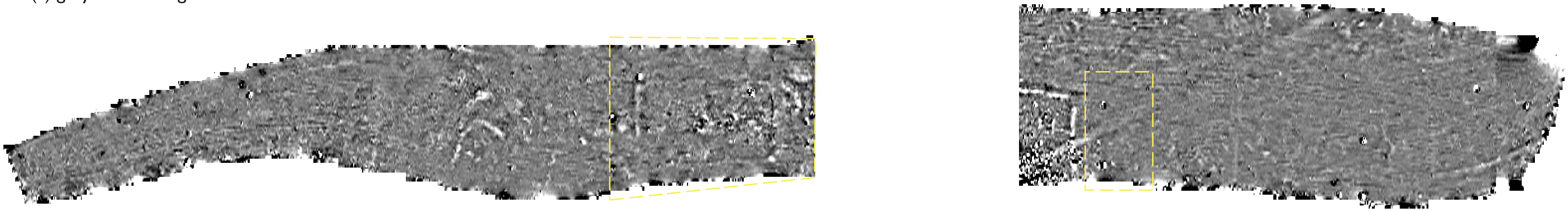
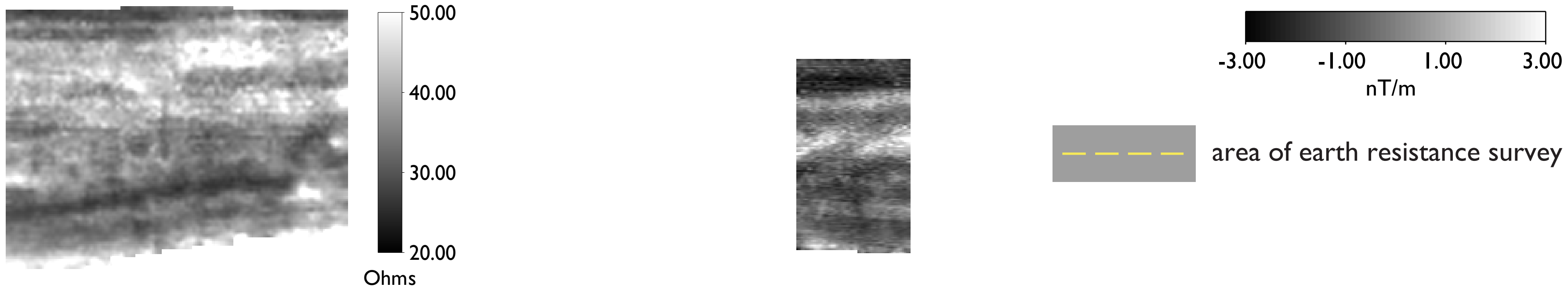
BATTEN HANGER, ELSTED & TREYFORD, WEST SUSSEX Geophysical Surveys, May 2008

FIGURE 4

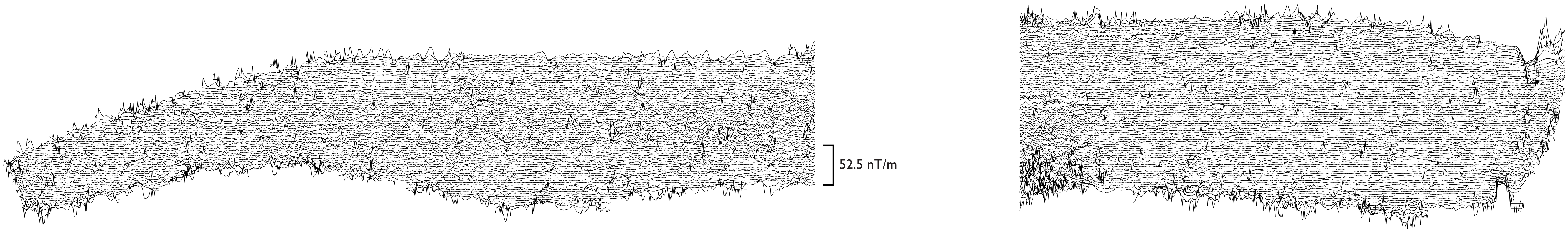
4(a) greytone of magnetometer data



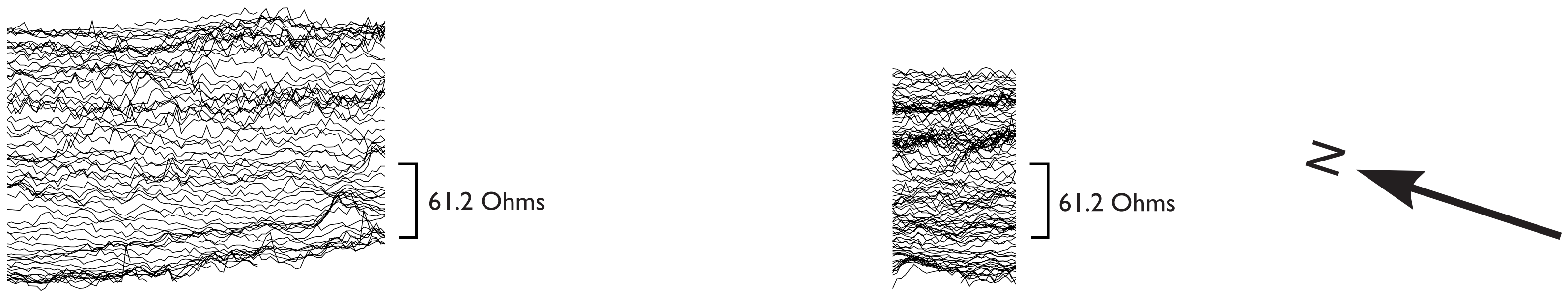
4(b) greytone of earth resistance data



4(c) traceplot of magnetometer data



4(d) traceplot of earth resistance data



0 90m
1 : 1750

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Graphical summary of significant magnetic anomalies, May 2008

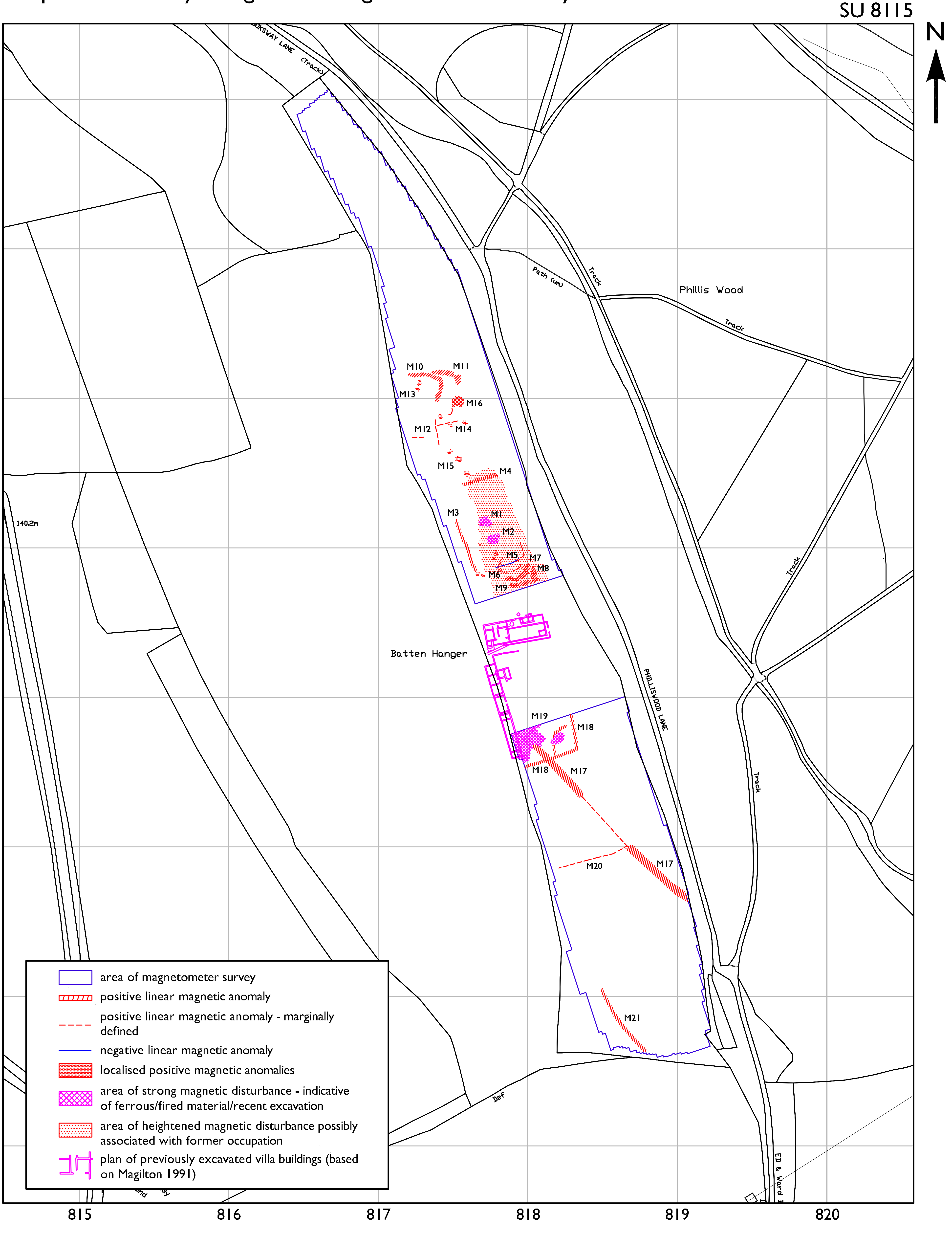

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FIGURE 6

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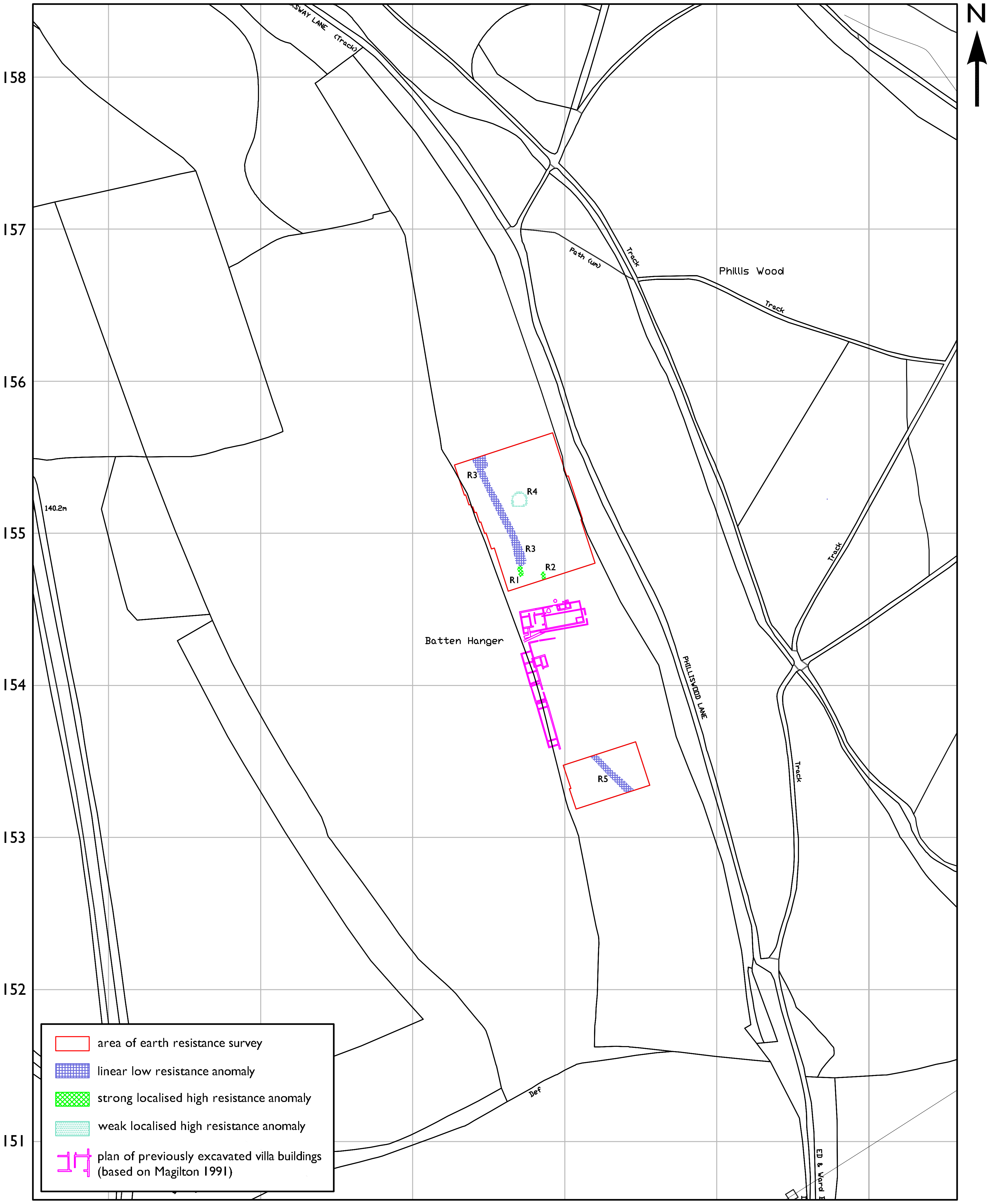
Graphical summary of significant earth resistance anomalies, May 2008

SU 8115



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0 50 100 150m

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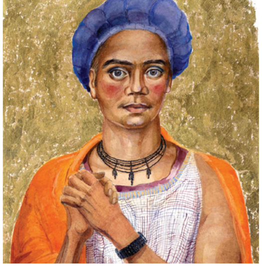



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- *Archaeological Projects (excavation)*
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