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BRADING ROMAN VILLA, ISLE OF WIGHT
REPORT ON GEOPHYSICAL SURVEYS, MARCH 1994, APRIL 1995 AND FEBRUARY 2009

Andrew Payne

ARCHAEOLOGICAL SCIENCE

ENGLISH HERITAGE

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NGR SZ 599 862

ISSN 1749-8775

SUMMARY

A caesium magnetometer survey was undertaken to investigate the wider setting of the Roman villa remains at Brading, Isle of Wight, to assist with an on-going programme of excavation. This work extends the previous fluxgate magnetometer surveys at the site conducted in 1994-5 and demonstrates a continuation of ditch-type anomalies, possibly defining field boundaries, enclosures and track-ways in the wider landscape around the villa. This activity may either be associated directly with the Roman buildings or, could possibly represent Iron Age settlement predating the development of the villa. The survey also located a previously unknown group of ring-ditches further to the west of the villa, suggestive of prehistoric funerary monuments or perhaps, a series of outlying Romano-British shrines.

CONTRIBUTORS

The caesium magnetometer survey was conducted by Neil Linford, Louise Martin and Andy Payne together with Sam Cheyney (Leicester University). Processing of the total field caesium magnetometer data to enable it to be combined with the previous fluxgate gradiometer survey was undertaken by Neil Linford. Mark Cole, Peter Cottrell and Tom Williams (Bradford University) are thanked for their contribution to the 1994 and 1995 fluxgate magnetometer surveys.

ACKNOWLEDGEMENTS

The author wishes to thank The Oglander Roman Trust for granting access to the site and for providing indoor work-space for processing the data on site during the course of the fieldwork.

ARCHIVE LOCATION

Fort Cumberland.

DATE OF FIELDWORK AND REPORT

The caesium magnetometer survey fieldwork was conducted between 23rd and 25th February 2009 following fluxgate magnetometer surveys originally undertaken during 7-11 March 1994 and 28 April 1995. The report combining the results of all three surveys was completed on 22 December 2009. The cover photograph shows the new visitor centre building erected over the main villa house in 2004 viewed from the east. The foundations of the previously excavated south wing of the villa are marked out in the foreground.

CONTACT DETAILS

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INTRODUCTION

Excavations of the Roman villa at Brading (Scheduled Monument 30278) from 1879 to 1885 first revealed the presence of a prosperous villa establishment consisting of three main ranges set around a central courtyard (Price and Price 1890). The farm containing the site was purchased by Lady Oglander, for whom the current charitable trust securing the future of the remains is named, and more extensive investigations subsequently revealed several spectacular mosaics in the west range that were then protected by cover buildings erected in 1885 and 1908 (Trow 1996). A number of more recent evaluations took place between 1994-1997 and 2002-5 linked to drainage work, the construction of new car-park facilities and the replacement of the original dilapidated cover buildings with a new visitor centre supported by a grant from the Heritage Lottery Fund (HLF) in 2004 (Busby 1994; Loader and Westmore 1995; Trott 1999; 2002; 2005).

The aim of the current geophysical survey was to assist the Oglander Roman Trust with a programme of research to better understand how the villa may have articulated with, and developed within, the surrounding landscape (Cunliffe 2008a; Payne 2009). This would build on evidence from the previous fluxgate magnetometer survey and excavations of a probable late Iron Age farmstead under the site of the current car-park (Trott 1999; 2002; 2005). Results reported here combine data from the original, hitherto unreported, fluxgate magnetometer surveys together with the initial phase of the new field work conducted with the caesium vapour instrumentation, expanding coverage mainly to the north and west of the visitor centre.

The site (NGR SZ 599862) is situated below the south-eastern end of the central chalk ridge that crosses the length of the Isle of Wight, overlooking the junction of the River Yar and Brading Haven on light sandy soils of the Fyfield 4 association developed over Ferruginous Sands of the Cretaceous Lower Greensand series (Geological Survey of Great Britain (England and Wales) 1976; Soil Survey of England and Wales 1983). The scheduled villa site currently lies towards the centre of a large area of former arable fields covering approximately 16 ha, now under permanent pasture to provide more protection to any outlying archaeological remains (Trow 1996). Weather conditions at the time of the caesium magnetometer survey (February 2009) were dry and mild.

Survey areas

The first stage of the survey in March 1994 (Figure1, Area 1) consisted of a 60m wide transect of fluxgate gradiometer coverage along the proposed route of new drainage conduits aligned on the access roadway as it approaches the villa. The survey was broadened-out around the known villa structure to investigate part of the re-buried south wing, test for the presence of further previously undiscovered Romano-British remains and any other archaeological activity in the locale associated with, or pre-dating the villa.

A second smaller fluxgate gradiometer survey (Figure 1, Area 2) was carried out in April 1995 at the request of the Isle of Wight Archaeological Unit in the area immediately east of the courtyard of the villa complex, known as the Middle Paddock. For practical reasons the grid was aligned differently in this area and there was a deliberate overlap with the previous survey coverage. The aim of the survey here was to detect the presence of any archaeological features potentially threatened by the construction of a new car park designed to accommodate coaches. Evaluation trenches were later excavated in this area that subsequently revealed several archaeological features corresponding to geophysical anomalies mapped in 1995 survey (Trott 1999).

The initial phase of the caesium magnetometer survey, undertaken for the current project in February 2009 (Figure 1, Area 3), covered a 6.1ha area of former arable land to the immediate north, west and south-west of the fenced compound around the current visitor facilities.

METHOD

The caesium magnetometer survey area was divided into 60m x 100m grids, located using a real-time kinematic Global Positioning System (GPS). The earlier magnetometer surveys undertaken in 1994-5 were conducted on a grid of 30m squares set out using a Nikon DTM01 total station theodolite in the two areas described above. Figure 1 shows the location of the survey areas.

The 1994-5 magnetometer surveys were carried out with Geoscan FM36 fluxgate gradiometers with a reading interval of 0.25m along traverses spaced 1.0m apart. Measurements were recorded on the 0.1 nanotesla (nT) instrument range. Subsequent processing was limited to truncating the range of the data set to exclude extreme values beyond -60 to 60 nT/m, followed by the correction of instrument drift and directional sensitivity effects by setting each line of readings to a local zero mean prior to creating a composite of the data from the individual 30m grid squares.

The caesium magnetometer survey was conducted using an array of four specially modified high sensitivity Scintrex SM4 caesium vapour magnetometer sensors mounted on a non-magnetic cart system (Linford *et al.* 2007). Readings were collected at intervals of 0.125m along 100m parallel traverses separated by 0.5m and orientated north-south. The caesium data was processed in the following steps:

i) to correct for diurnal variation and the offset and directional sensitivity of the individual sensors, the data from each 100m instrument traverse was initially reduced to a local zero mean.

ii) range truncation was then applied to the data set to suppress responses to near surface ferrous detritus and disturbance from service pipes, reducing the range of the data to -60 to 60 nT to exclude extreme outlying values.

iii) to enable the total field caesium and fluxgate gradiometer surveys to be presented as a unified data set, the total field measurements were transformed to the equivalent vertical gradiometer response for two sensors separated by 1.0m. The total field data were upward continued by 1m and converted to a pseudo-gradient by subtracting the vertical component of the upward continued version from the vertical component calculated from the original data (Gunn 1975; Blakely 1995; Tabbagh *et al.* 1997).

The combined pseudo-gradient caesium magnetometer and fluxgate gradiometer data are presented as linear greyscale images overlain on the 1:2500 scale Ordnance Survey (OS) mapping in Figure 2. In addition larger scale (1:1250 or 1:1000) plots of the data sets from each of the separate survey areas are presented in Figures 3-5. Linear greyscale images and traceplots of the fluxgate gradiometer data from Areas 1 and 2 are presented in Figures 3 and 4 respectively. The initial total field caesium magnetometer data (processed according to steps (i) and (ii) above) are presented as a linear greyscale image and a traceplot in Figures 5(A) and 5(B) and the pseudo-gradient transform of the caesium data (processed according to step (iii) above) are presented as a linear greyscale image in Figure 5(C).

The combined pseudo-gradient transform of the total field caesium and fluxgate gradiometer data are presented in units of nT/m, with the appropriate correction for the vertical separation of the sensors used (see Annex 1, Section 2).

RESULTS

A graphical summary of the anomalies discussed in the following text, superimposed on the base Ordnance Survey map data is provided in Figure 6.

1994-95 magnetometer data (Areas 1 and 2)

The area around the villa buildings contains a complex pattern of positive linear magnetic anomalies [m1-10]. The most obvious of these appear as parallel pairs of linear anomalies which in places merge together to form single, broader responses. One of these broad anomalies [m1; continuing as m14 in Area 3] runs on an east-west alignment directly north of the villa. To the east of the villa buildings this is joined by a similar anomaly [m2], approaching from the south that intersects with [m3], consisting of two parallel linear components, merging from the east to form a sub-rectangular enclosure [m4] bounded on three sides by [m1-3]. A series of parallel pairs of positive linear anomalies [m5] can be seen branching off from [m1] on a different alignment towards the north-west where they extend into Area 3 as [m13]. To the west of the villa buildings, a series of three parallel and closely set narrower linear anomalies are visible [m6], terminating at [m1] to the north (also mapped as [m30] in the overlapping caesium coverage). Other parallel north-south alignments are visible at [m7] and [m8]. A further parallel pair of linear positive anomalies [m9], similar to [m1-m3], are present in the southern-most part of Area 1 through which a further single positive linear response [m10] passes on a SSW-NNE orientation.

Together this complex of anomalies suggests a series of boundary and enclosure ditches, probably of more than one phase rather than a contemporary multi-ditched rectangular enclosure constructed to house the villa ranges. The broader anomalies [m1 and m2] were initially thought to represent track-ways (in the form of in-filled hollow-ways worn into the ground by extended use), but sections cut through them in 1995 and 1997 have indicated the presence of broad, shallow ditches (Loader and Westmore 1995, Trench 6; Trott 1999, Feature 8301) forming a rectangular enclosure [m4] with no obvious indication of significant internal activity. However, more pronounced magnetic enhancement of sections of the ditch-fills at [m11] is evident around the south-west and east sides of the enclosure and is, perhaps, suggestive of semi-industrial activity.

A zone of intense magnetic disturbance [m12] coincides with the expected position of a detached bath-house building forming part of the southern range, known from excavation in 1881. There is no trace in the geophysical data of any of the rammed chalk wall-foundations of the other structures of the south range known from excavation, although such features would be unlikely to be detectable by magnetic means (cf Payne *et al.* 2008).

A limited number of probable pits, defined by localised positive magnetic anomalies, are interspersed among the ditch systems identified in Areas 1 and 2. The effect of modern ploughing can be seen as a series of parallel lines in the data running WSW-NNE in the field south of the villa and from north to south in Area 2.

2009 caesium magnetometer data (Area 3)

To the north and north-west of the villa the continuation of two boundaries or track-ways found in the fluxgate data can be followed; [m13] (a continuation of [m5]) branching off towards the chalk escarpment edge and [m14] (a continuation of [m1]) running from the north range (aisled building) of the villa to the western limit of the 2009 survey area. Several less substantial, linear positive anomalies [m15-16] possibly represent boundary ditches partitioning the area directly north of the north range accompanied by weaker linear trends [m17] that may be suggestive of a field system. A large ditched enclosure [m18] is present in the north of Area 3 defined on three sides by positive linear magnetic anomalies, but apparently open to the west. A narrow break in the enclosure ditch at [m19] may indicate an entrance providing access to the possible track-way [m14] flanking the enclosure to the south. The open side of the enclosure may be related to an adjacent rectangular positive magnetic response at [m20] and a large ring-ditch [m21], approximately 29m in diameter, with further (probably superimposed) rectilinear boundaries at [m22]. An alignment of four substantial pit-type anomalies [m23] are present immediately south of [m21] and contained within the rectilinear boundaries of [m22]. The magnetic response of the south-western segment of [m21] is weaker and less distinct which may indicate increased magnetic enhancement of the ditch fill to the north due to the influence of adjacent settlement, perhaps associated with the scatter of pit-type anomalies found at [m24]. A similar group of pit-type anomalies at [m25], clustered in a rectangular pattern and tentatively bounded by a weak negative magnetic response, may be indicative of a previously unrecognised small outlying building of the villa complex.

The western section of [m14] also demonstrates an enhanced magnetic response, possibly related to significant semi-industrial activity and burning in the area, or perhaps to the more recent deliberate introduction of magnetic detritus. Two further ring-ditches [m26-27] are present to the south, both on the route of a well used modern footpath, visible as a weak narrow linear anomaly [m28]. The larger of the two ring-ditches [m26] is approximately 18m in diameter and appears to contain a central positive magnetic anomaly [m29], which may represent burial deposits (possibly at risk from footpath erosion). The smaller ring-ditch [m27] to the south is only about 10m in diameter and not so well defined, suggesting a relatively insubstantial feature which may have been more susceptible to plough damage in the past.

A set of triple ditches [m30] appears to define the western boundary of the villa "compound" with little magnetic activity immediately beyond this towards the ring-ditches other than a small number of scattered pit-type anomalies. To the south of the villa [m31-

32] appear to represent a continuation of the ditch-type anomalies found in the previous fluxgate coverage. The superimposed linear anomalies of varying alignment here are strongly suggestive of different phases or re-cutting of ditches.

To the west, a further parallel linear anomaly [m33] is found, possibly with a continuation to the north at [m34]. Whilst these may be of archaeological significance a more recent origin associated with the farm buildings to the south cannot be discounted. A large ferrous pipe defined by an intense linear magnetic response [m35] is also found to pass through the far north-western corner of the survey area. Additional positive linear anomalies, most notably at [m36] and [m37], are likely to relate to relatively recent former field boundaries and land allotment based on an examination of historical OS mapping (Ordnance Survey 1882). The parallel linear anomalies at [m38] are also likely to be related to relatively recent cultivation patterns.

DISCUSSION

The original fluxgate survey results correspond remarkably well with the results of limited excavation in the Middle Paddock area carried out in two stages in 1995 and 1997 (Loader and Westmore 1995; Trott 1999). Here, during construction work for the new visitor centre car-park, a late Iron Age and early Roman ditch pre-dating the villa construction was discovered together with a possible circular, sunken potter's clamp. The magnetic response to both of these features is very pronounced in the fluxgate data, specifically at [m11], and the associated semi-industrial activity seems to be a likely source of the strong magnetic enhancement of the anomalies in this area. Other less substantial features recorded by the excavation included three possible late Iron Age buildings, a pre-Flavian oven and an early Anglo-Saxon post-hole alignment. However, these features were not resolved by the fluxgate survey, presumably on account of their limited size and poor preservation due to the effects of ploughing.

It is now known (following the results of excavation in August 2009) that the intense magnetic response recorded in the fluxgate magnetometer survey over the detached Roman bath-house at [m12] is the product of large amounts of ferrous debris deposited in the back-fill of the earlier Victorian excavations. Underneath the Victorian back-fill deposits, the bath house structure was found still preserved remarkably intact (Figures 7(A) and 7(B)).

Although the ring-ditch anomalies [m21, m26 and m27] would generally be interpreted as the remnants of ploughed-out Bronze Age barrows the location of these close to a major Romano-British villa complex would not preclude their interpretation as a complex of small shrines or temples forming part of the villa landscape, possibly adapted from earlier prehistoric funerary monuments (Cunliffe, pers. comm.; Dark 1993).

CONCLUSION

The 1994-5 fluxgate gradiometer results indicated that the villa ranges are situated in an area criss-crossed by several ditch systems. Their arrangement suggests a complex evolution over time and it is likely that several phases of construction and modification are represented. This would suggest, together with the available excavation data, that the villa probably developed from an earlier late Iron Age settlement focus in common with other excavated villa sites in Hampshire, such as Grateley, Houghton Down, Dunkirt Barn and Meonstoke (King 1996; Linford *et al.* 2005; Cunliffe 2008b). The known location of the building remains of the south range failed to produce a detectable magnetic response in the fluxgate data with the exception of the previously excavated detached bath-house. However, following subsequent excavation in August 2009 the surviving features of the south range are now known to be sealed by up to ~0.75m of soil (Figure 7(C)).

The more recent caesium magnetometer coverage has revealed the wider extent of significant activity extending beyond the villa, but also includes a linear group of ring-ditches suggestive of the ploughed out remains of a small Bronze Age barrow cemetery or, perhaps, a complex of Romano-British shrines related to the villa. The activity mapped by the caesium survey is particularly concentrated to the north of the site and contains several clusters of pit-type anomalies suggestive of further occupation. The probable western boundary of the villa complex itself appears as a triple alignment of parallel linear anomalies linking the two major east-west aligned boundaries or track-ways to the north and south.

LIST OF ENCLOSED FIGURES

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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).

3) Resistivity Profiling

This technique measures the electrical resistivity of the subsurface in a similar manner to the standard resistivity mapping method outlined in note 1. However, instead of mapping changes in the near surface resistivity over an area, it produces a vertical section, illustrating how resistivity varies with increasing depth. This is possible because the resistivity meter becomes sensitive to more deeply buried anomalies as the separation between the measurement electrodes is increased. Hence, instead of using a single, fixed electrode separation as in resistivity mapping, readings are repeated over the same point with increasing separations to investigate the resistivity at greater depths. It should be noted that the relationship between electrode separation and depth sensitivity is complex so the vertical scale quoted for the section is only approximate. Furthermore, as depth of investigation increases the size of the smallest anomaly that can be resolved also increases.

Typically a line of 25 electrodes is laid out separated by 1 or 0.5 metre intervals. The resistivity of a vertical section is measured by selecting successive four electrode subsets at increasing separations and making a resistivity measurement with each. Several different schemes may be employed to determine which electrode subsets to use, of which the Wenner and Dipole-Dipole are typical examples. A Campus Geopulse earth resistance meter, with built in multiplexer, is used to make the measurements and the Campus Imager software is used to automate reading collection and construct a resistivity section from the results.

FIGURE 1

BRADING ROMAN VILLA, ISLE OF WIGHT Location of magnetometer surveys, 1994, 1995 and 2009

SZ 5986

1:2500

0 50 100 150m

1994 fluxgate gradiometer survey area
1995 fluxgate gradiometer survey area
2009 caesium magnetometer survey area

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FIGURE 2

BRADING ROMAN VILLA, ISLE OF WIGHT Combined magnetometer surveys, 1994, 1995 and 2009

SZ 5986

1:2500

0 50 100 150m

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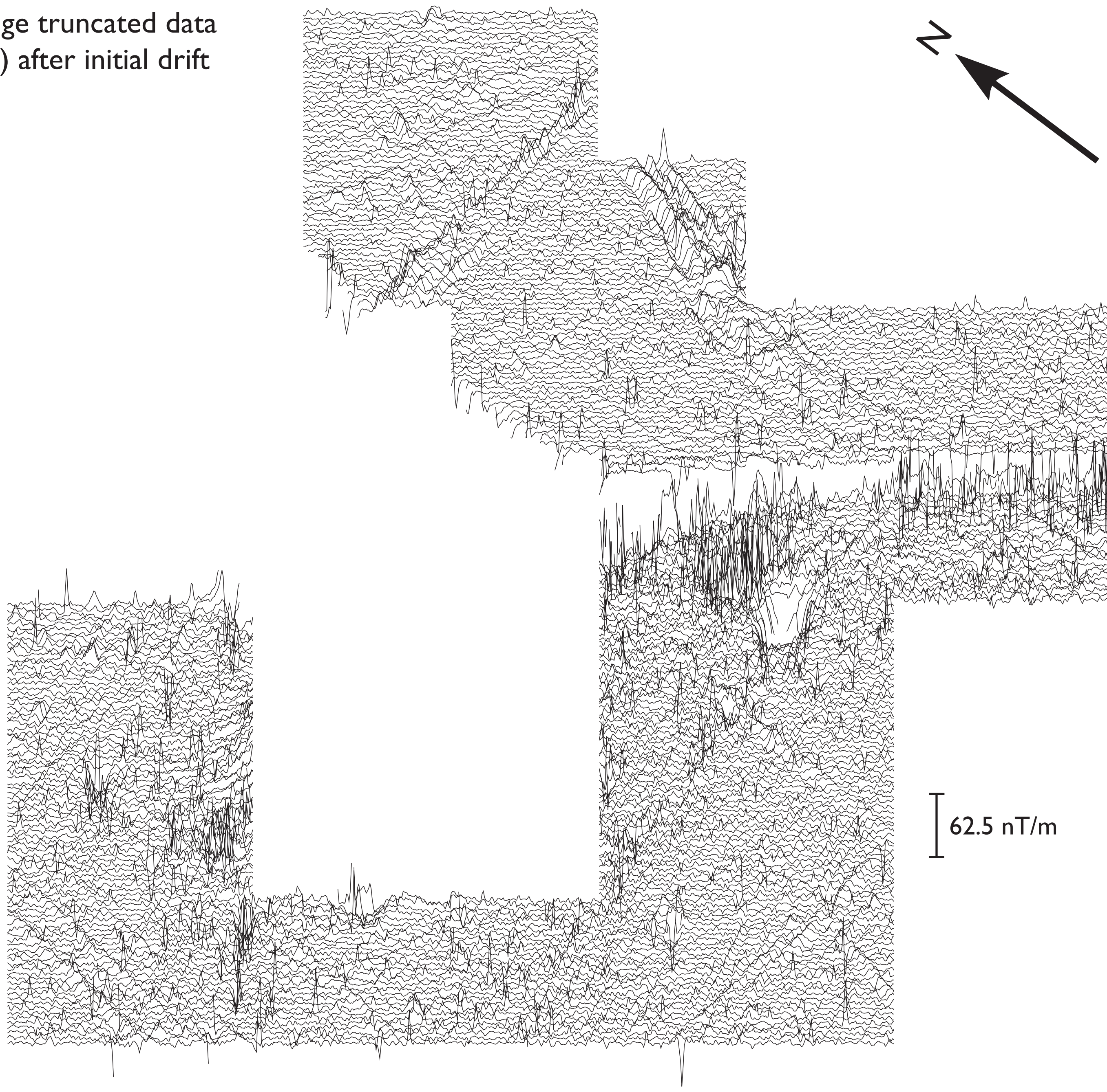
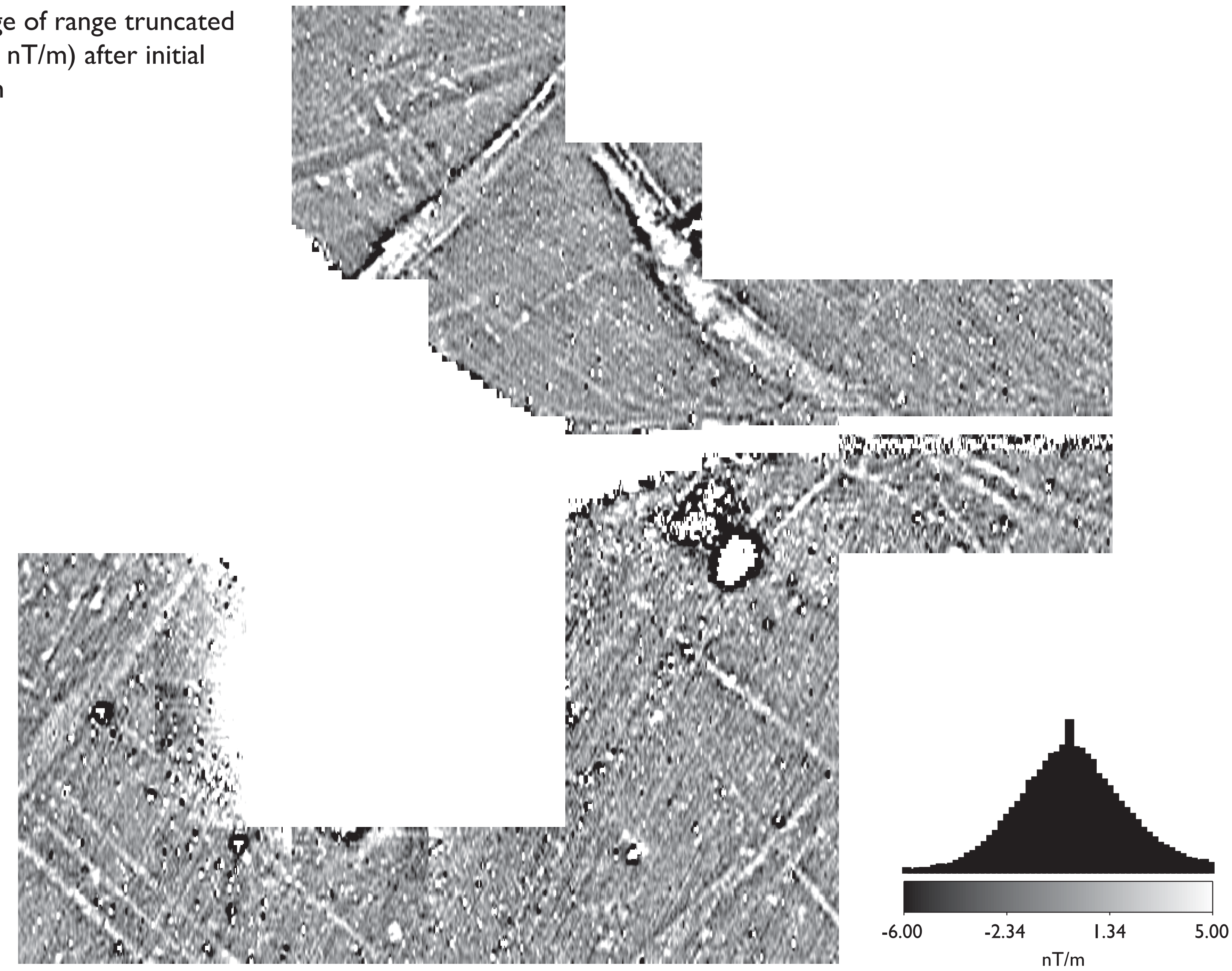
BRADING ROMAN VILLA, ISLE OF WIGHT
Fluxgate gradiometer survey of Area 1, March 1994

(A) Traceplot of range truncated data (-60 to 60 nT/m) after initial drift correction



(B) Greyscale image of range truncated data (-60 to 60 nT/m) after initial drift correction



1:1250

0 30 60 90m

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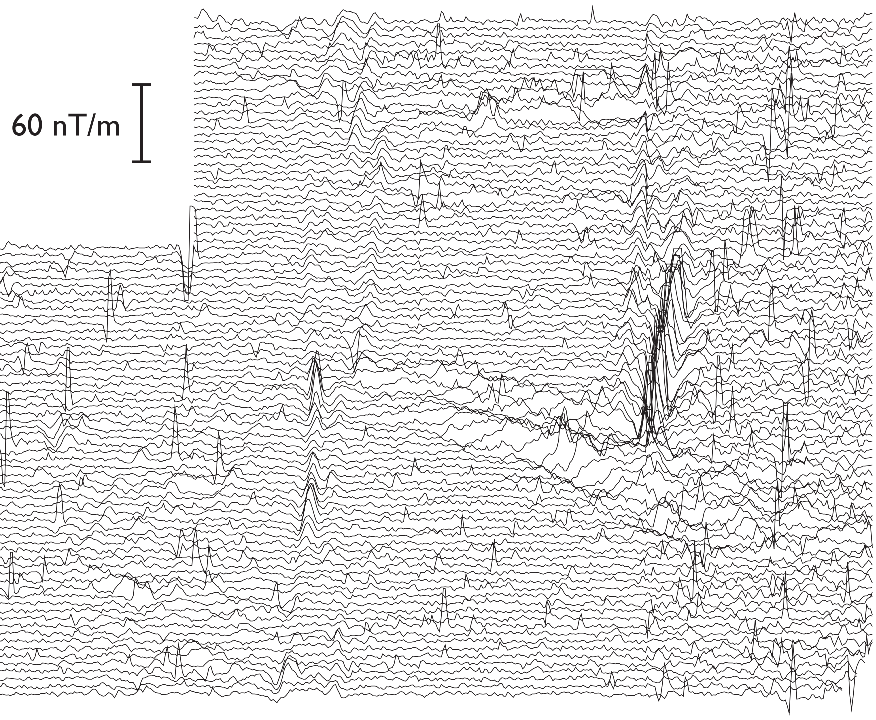
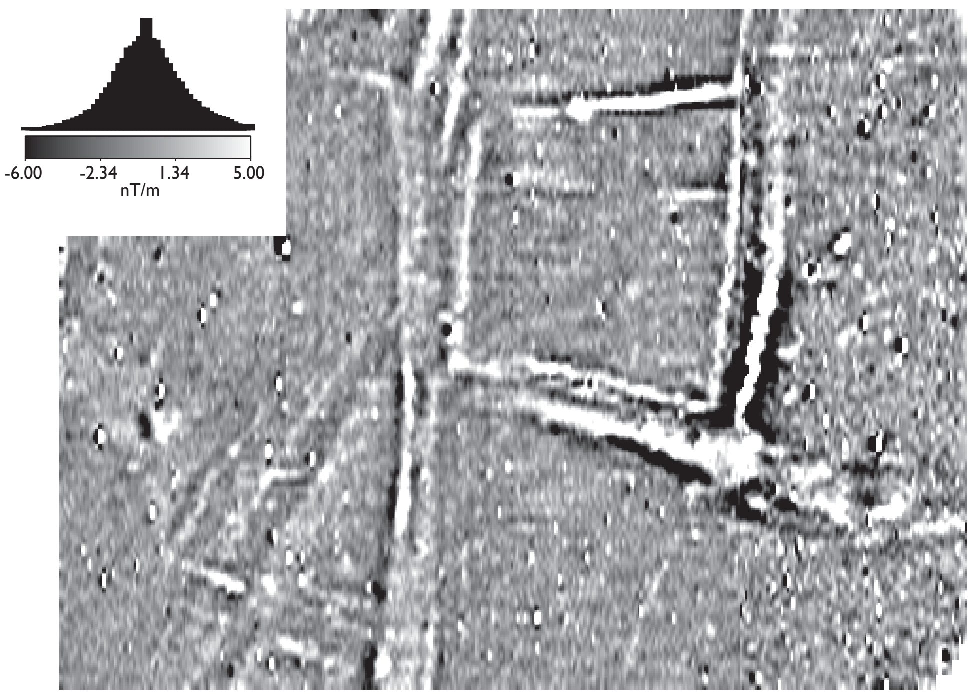
BRADING ROMAN VILLA, ISLE OF WIGHT
Fluxgate gradiometer survey of Area 2, April 1995

A) Traceplot of range truncated (-60 to 60 nT/m) data following initial drift correction



B) Greyscale image of range truncated (-60 to 60 nT/m) data following initial drift correction

N



1:1000

0 30 60 90m

BRADING ROMAN VILLA, ISLE OF WIGHT Caesium magnetometer survey of Area 3, February 2009

FIGURE 5(A)

Traceplot of range truncated (-60 to +60 nT) total field data

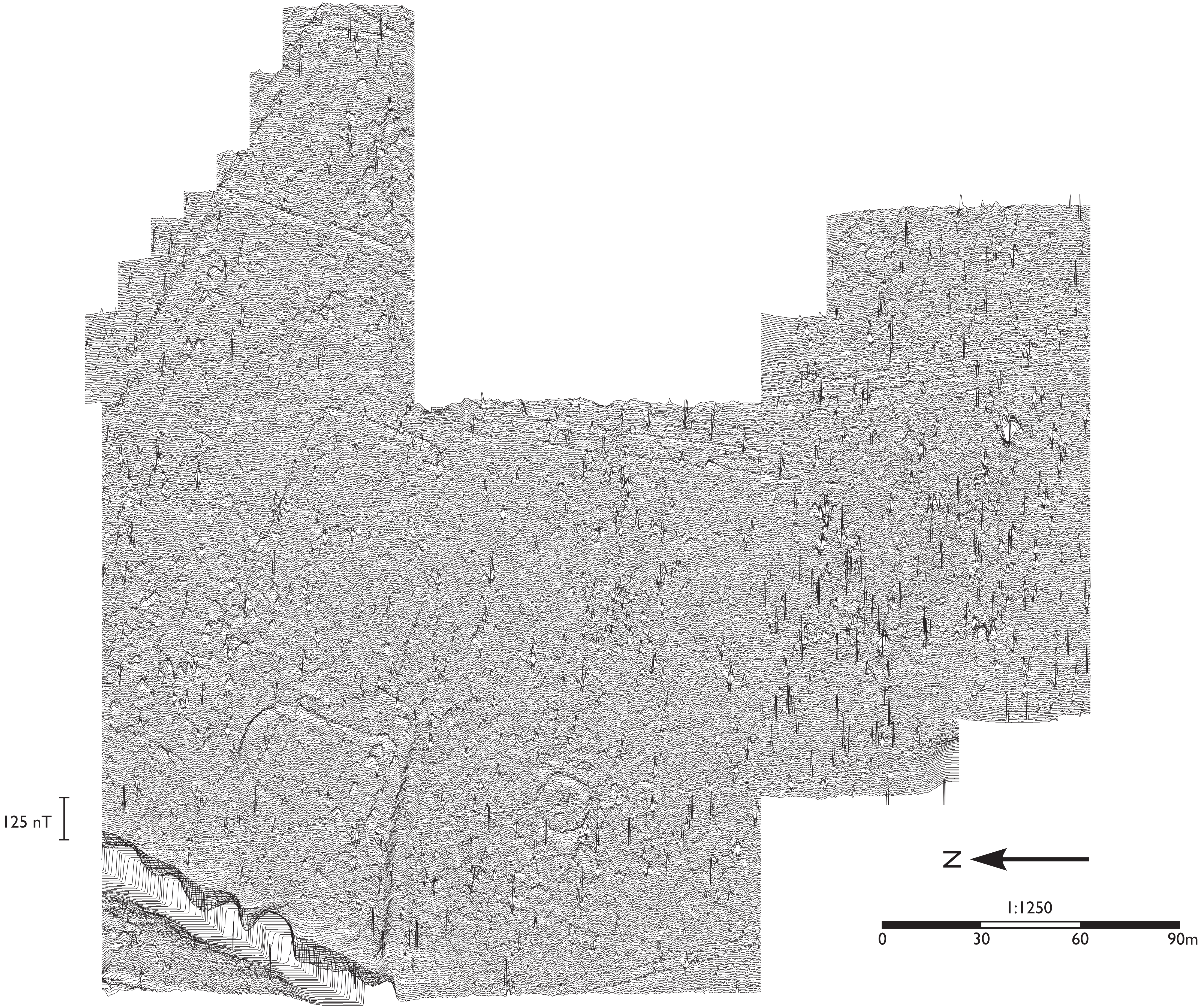


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FIGURE 5(B)

BRADING ROMAN VILLA, ISLE OF WIGHT Caesium magnetometer survey of Area 3, February 2009

Greyscale image of total field data

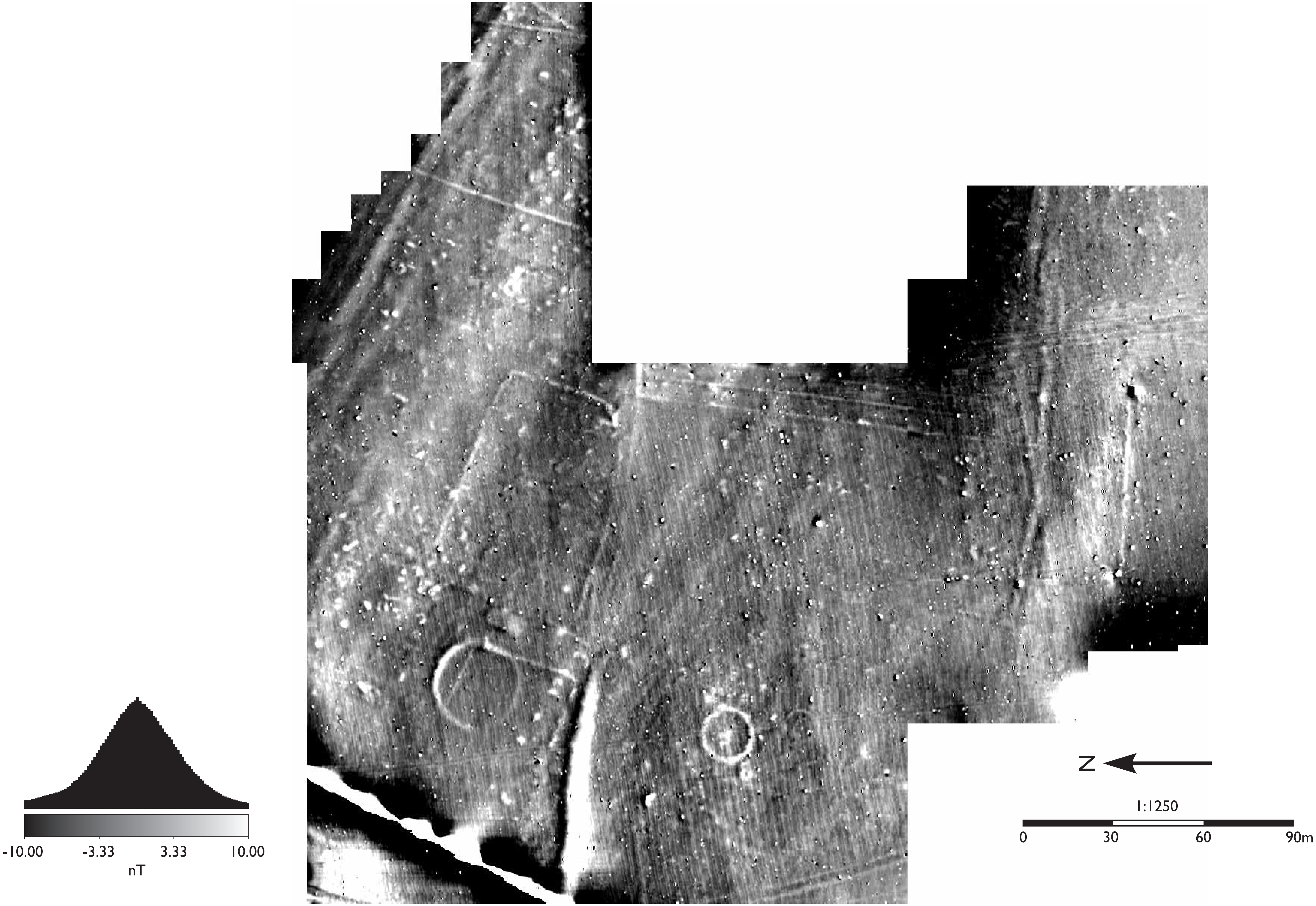

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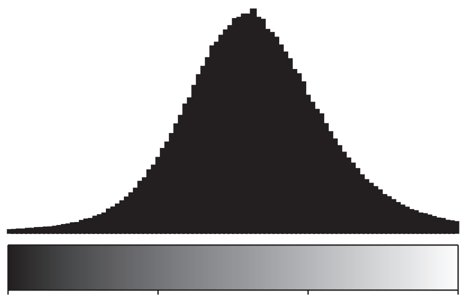
FIGURE 5(C)

BRADING ROMAN VILLA, ISLE OF WIGHT Caesium magnetometer survey of Area 3, February 2009

Greyscale image of pseudo-gradient data



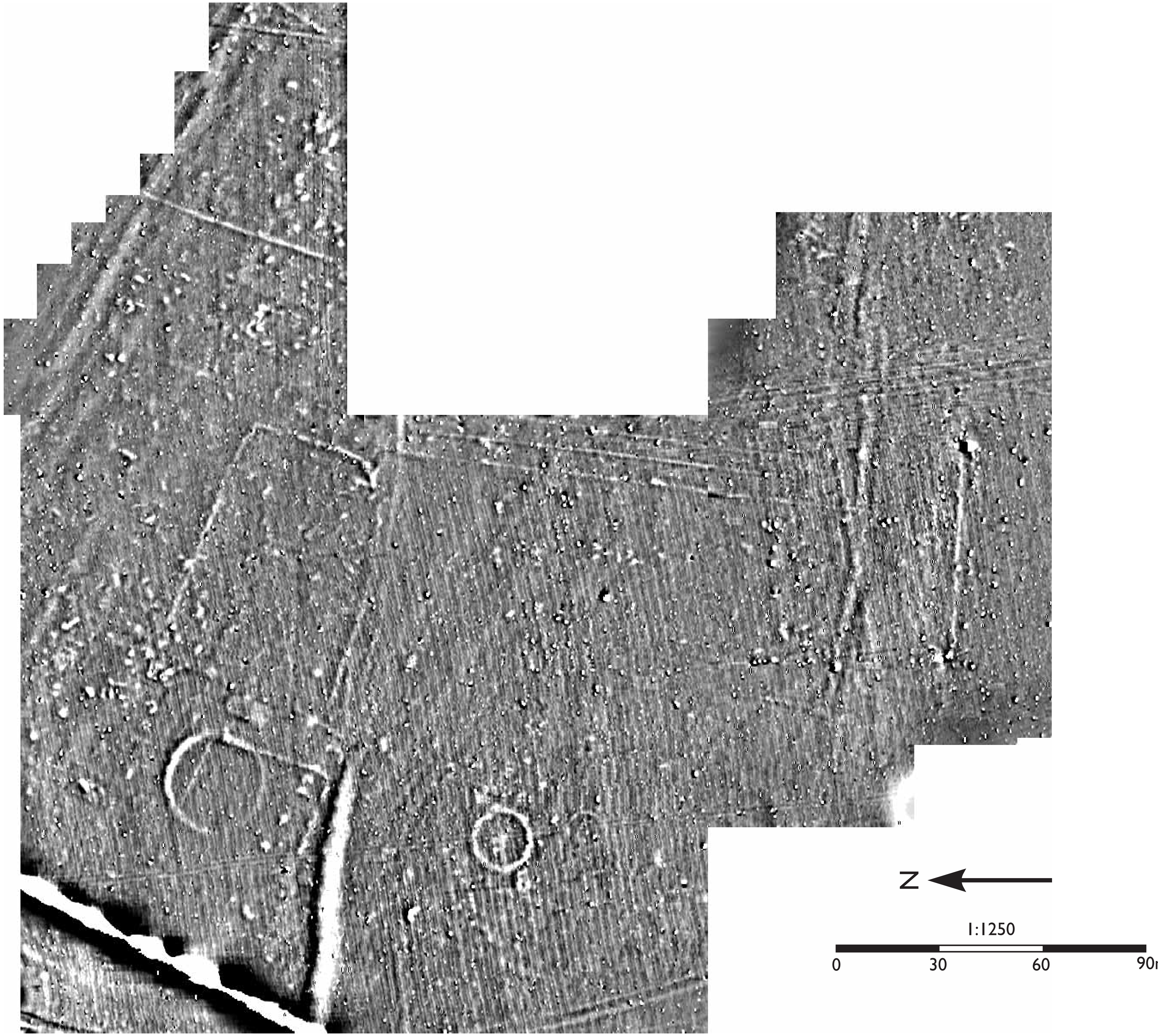


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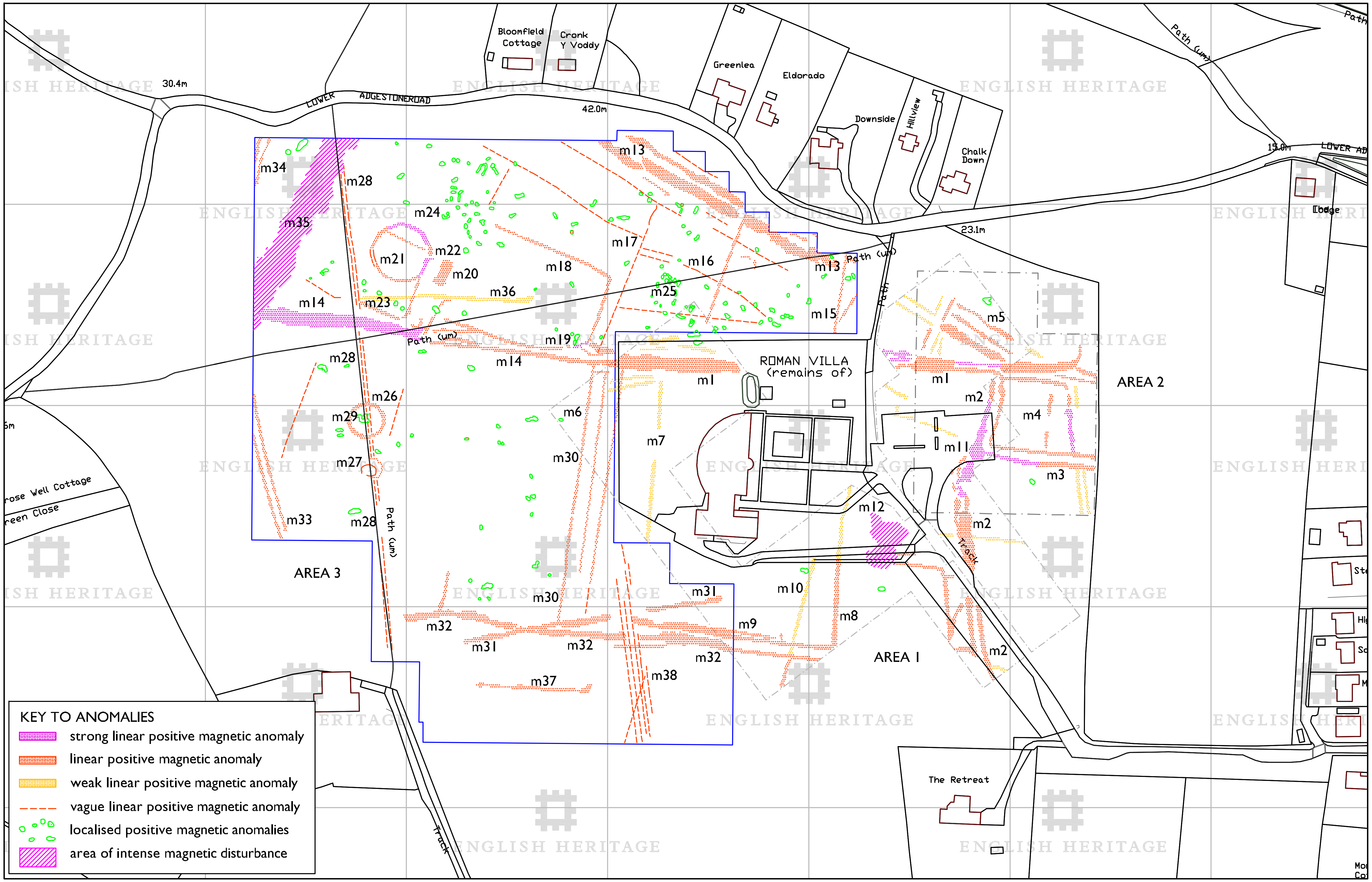
FIGURE 6

BRADING ROMAN VILLA, ISLE OF WIGHT Graphical summary of significant magnetic anomalies, 1994, 1995 and 2009



1:2000

0 50 100 150m

1994 fluxgate gradiometer survey area

1995 fluxgate gradiometer survey area

2009 caesium magnetometer survey area

Geophysics Team 2009

ENGLISH HERITAGE

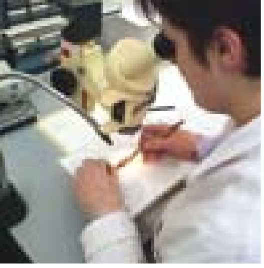
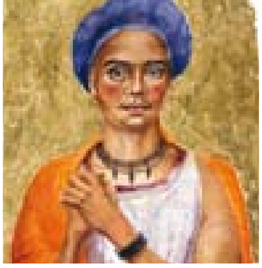
BRADING ROMAN VILLA, ISLE OF WIGHT

Photographs of excavation, August 2009

(A)

(B)

(C)



ENGLISH HERITAGE RESEARCH DEPARTMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for sustainable management, and to promote the widest access, appreciation and enjoyment of our heritage.

The Research Department provides English Heritage with this capacity in the fields of buildings history, archaeology, and landscape history. It brings together seven teams with complementary investigative and analytical skills to provide integrated research expertise across the range of the historic environment. These are:

- *Aerial Survey and Investigation*
- *Archaeological Projects (excavation)*
- *Archaeological Science*
- *Archaeological Survey and Investigation (landscape analysis)*
- *Architectural Investigation*
- *Imaging, Graphics and Survey (including measured and metric survey, and photography)*
- *Survey of London*

The Research Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support outreach and education activities and build these in to our projects and programmes wherever possible.

We make the results of our work available through the Research Department Report Series, and through journal publications and monographs. Our publication Research News, which appears three times a year, aims to keep our partners within and outside English Heritage up-to-date with our projects and activities. A full list of Research Department Reports, with abstracts and information on how to obtain copies, may be found on www.english-heritage.org.uk/researchreports

For further information visit www.english-heritage.org.uk

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