Ancient Monuments Laboratory
Report No. 53/2000

FULLERTON ROMAN SITE, HAMPSHIRE. REPORT ON GEOPHYSICAL SURVEY, FEBRUARY 2000.

L. Martin & A. Payne

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Summary

A geophysical survey was carried out around a previously excavated Roman building situated in the valley of the River Ann near Fullerton, Hampshire. The purpose of the survey was to explore for additional associated features such as out-buildings and also to recover the position of previously recorded features interpreted as a water mill and leat. An extensive fluxgate magnetometer survey located a large rectangular enclosure surrounding the Roman building and containing possible additional structures. A linear anomaly may represent the supposed leat and a cluster of anomalies nearby might be the location of a mill. More limited resistivity survey added little further definite information.

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Introduction

A geophysical survey was conducted over approximately 3.3 hectares of arable farmland surrounding the remains of a Roman building at Fullerton, in the parish of Wherwell, Hampshire. The principal Roman building at Fullerton was unearthed in the 1960s (Cunliffe *pers comm*) and is now covered by a small copse of trees situated in the north-east corner of a large arable field. The excavated area lies on the floor of the valley of the River Ann and is flanked to the west by the steeply rising ground of the valley slopes.

The survey was requested by Professor Barry Cunliffe of the Institute of Archaeology, Oxford in advance of renewed excavations by the Danebury Environs Roman Programme. The survey was required to inform the detailed planning of the excavations and in particular to :

i) identify any further building remains in the vicinity of the previously excavated main villa structure

ii) recover the position of a suspected mill leat or canal and a number of adjacent timber buildings believed to be of Roman date recorded during the earlier excavations.

The artificial channel is shown on earlier plans extending south from the main villa structure on a course roughly parallel with the modern north-south field boundary. The previously recorded timber structures adjacent to it have been interpreted as the possible remains of a mill. The timber structures are located approximately 90m south of the main villa building.

The site (SU 374 400) lies on flinty and chalky soil of the Charity 2 association (Soil Survey of England and Wales 1983) developed over Upper Chalk (Institute of Geological Sciences 1949). At the time of the survey the site was ploughed and awaiting planting. The Roman remains at Fullerton currently do not have scheduled monument status.

Method

<u>Magnetometer survey</u>

Magnetometry was considered the most appropriate geophysical technique to use to evaluate the site so as to cover the largest area possible within the time available. The survey was conducted over all the numbered grid squares (Figure 1) using the standard method outlined in note 2 of Annex 1. Plots of the data-set are presented as both an X-Y traceplot and a linear greyscale, at a scale of 1:1250 on Plan A and as a linear greyscale superimposed on the base OS map (1:2500) in

Figure 2. The only corrections made to the measured values displayed in the plots were to zero-mean each instrument traverse to remove heading errors and to 'despike' the data through the application of a 2m by 2m thresholding median filter (Scollar *et al* 1990) to reduce the detrimental effects produced by surface iron objects. In addition the upper and lower values were trimmed for presentation as a trace-plot.

Earth resistance survey

A more limited earth resistance survey was conducted in the immediate vicinity of the villa in an attempt to clarify anomalies noted in the magnetometer data. Measurements were collected with a Geoscan RM15 resistance meter, MPX15 multiplexer and PA5 mobile probe array in the Twin-Electrode configuration. Readings were collected using the standard method outlined in note 1 of Annex 1, but with a sample interval of 0.5m x 0.5m. Plots of the data-set are presented as both an X-Y traceplot and a linear greyscale, at a scale of 1:500 in Plan C1 and C2. Plan C3 shows a plot of the data after a high-pass filter has been applied.

Results

Magnetometer survey

The magnetic response over the site is generally subdued (~ ± 1nT), except where modern ferrous material is present. The most intense of the archaeologically significant anomalies only produced a reading of ~13nT (nanotesla). A graphical summary of all significant anomalies discussed in the following text is provided on Plan B and Figure 3.

Anomalies from modern features

Ferrous fencing along the north-eastern edge of the field has caused extremely disturbed readings **[1]**. Various artefacts of cultivation have also been recorded: a linear anomaly parallel to the field edge at **[2]**, corresponding to the edge of recent ploughing; a similar, slightly stronger anomaly at **[3]** at the boundary of crop and ploughed soil; and an intermittent negative anomaly **[4]**, running parallel to the north-eastern fence and which most probably relates to a deep furrow visible on the surface of the field.

Archaeological anomalies

A series of linear positive magnetic anomalies **[5 – 7]** of variable signal strength have been mapped in the northern part of the surveyed area. These anomalies represent the ditches defining the boundary of an enclosure of roughly rectilinear form encompassing the main villa remains. The northern extent of the enclosure could not be traced beyond the eastern boundary of the field due to unsuitable terrain for geophysical survey (vehicle tracks and woodland fringing the course of the River Ann). It is therefore not possible to determine the exact dimensions of the enclosure. The variable magnetic response to the ditches may reflect differential erosion by ploughing or the selective incorporation of occupation material (such as pottery, daub and ash) from adjacent domestic or industrial activities. Interruptions in the response to the ditches are apparent in the southern and perhaps also the northern sides of the enclosure at roughly opposite points, probably indicating the sites of entrances.

In the northern field, at **[8]**, immediately inside the enclosure ditch, is a particularly pronounced magnetic anomaly with a maximum positive magnetic signal of around 13 nT. The anomaly is approximately rectangular in shape (5m x 3m) and is suggestive of a heated structure such as a corn-drying oven – similar to that at Grateley Roman Villa, Hampshire (Cunliffe 1999). Anomaly **[8]** lies adjacent to an area of raised magnetic response **[9]**, within which several discrete positive magnetic anomalies are evident. These possibly relate to further pits, ovens or hearths. The generally disturbed response around the concentration of these discrete anomalies may reflect the presence of a previously unrecorded outbuilding of the Roman villa.

The only other discernible anomalies within the confines of the enclosure are in the southern field. A slight area of increased magnetic response **[10]** may be significant. East of this are two linear magnetic anomalies **[11]** and **[12]**, running north-south. **[12]** is adjacent to strong positive magnetic readings at **[13]**, that may represent pits and burnt features. The anomalies at **[13]** are located in approximately the same area as the previously recorded timber structures interpreted as the remains of a possible mill. Immediately to the east and running almost parallel to the field edge is an area of positive magnetic readings **[14]** that could be evidence for the mill leat. This seems to cut through the line of the enclosure. A further weak linear positive anomaly **[15]** running north-south along the higher ground of the valley side is tentatively interpreted as a possible trackway. Because this feature is on approximately the same alignment as the enclosure around the villa it is potentially Roman.

Various areas of increased magnetic noise are visible outside the confines of the enclosure, the largest of which can be seen at **[16]**. Smaller regions of similar response can be seen at **[17]** and **[18]**. The cause of the magnetic disturbance in these areas is uncertain but could be due to the presence of pockets of variable geology, natural hollows silted up with hill-wash or quarrying and other man-made ground disturbance. North of **[18]** is a positive magnetic curvilinear anomaly **[19]**, which has produced a much stronger response on its eastern side. The weakness of the response on the western edge precludes a definite interpretation although it could represent a partial segment of an irregular ditched enclosure.

<u>Earth resistance survey</u>

A graphical summary of the significant anomalies discussed in the following text is provided on Plan C4.

The resistivity data is dominated by the effects of modern cultivation. The large area of low resistance **[R1]** in grid square 12 correlates with a strip of crop growing along the northern edge of the field. The lower resistance readings seen here probably derive from the crop retaining moisture in the soil, as compared to the open ground on the rest of the ploughed surface. Three linear low resistance anomalies **[R2]** run east-west across **[R1]**, perpendicular to the direction of the instrument traverses. These probably result from ploughing or tractor tracks incised into the surface of the field. Similar responses can be seen in the uncultivated part of the field at **[R3]**. Parallel and to the south of these anomalies is a very low resistance linear response **[R4]** that corresponds to a deep furrow in the field. Very weak low resistance anomalies **[R5]**, possibly resulting from plough action, can be seen to the south of these modern responses. Although it is not possible to date these features, they do not represent artefacts of the current agricultural regime.

Two amorphous areas of weak high resistance values [**R6**] and [**R7**] may represent the rubble of former buildings but this interpretation is only very tentative.

A broad but weak linear low resistance anomaly [**R8**] cuts in at the western edge of grid square 16. This corresponds to the position of the enclosure ditch [**7**] noted in the magnetometer data.

Conclusion

The magnetometer survey, although revealing only a generally subdued response has successfully located a rectilinear enclosure surrounding the villa. This enclosure presumably extended eastwards, but was outside the surveyable area. The broad positive anomaly [**14**] could be a trace of the mill leat; however, little other information has been gleaned about this structure.

Within the enclosure the main evidence for activity comes from anomalies to the north of the villa where a possible corn drier and a tentative out-building have been located.

The resistivity survey has mainly identified agricultural activities such as crop coverage and ploughing. A weak low resistance anomaly has been interpreted as part of the enclosure ditch, but the anomaly is not as distinguishable as in the magnetometer data. Possible former buildings may also have been located as areas of high resistance.

Surveyed by: A Payne
L Martin

Date of survey: 21-25/2/2000

Reported by: L Martin and A Payne

Date of report: 26/7/2000

Archaeometry Branch,
Ancient Monuments Laboratory,
English Heritage.

References

British Geological Survey, 1949, Winchester, England and Wales, Sheet 299, Drift Geology, 1:50,000.

Cunliffe, B., 1999, *The Danebury Environs Roman Project: 3. Grateley South Excavation 1999, Interim Report.* The Danebury Trust & Institute of Archaeology, Oxford 1999.

Scollar, I. Tabbagh, A. Hesse, A. and Herzog, I. (eds.), 1990, *Archaeological Prospecting and Remote Sensing*. Cambridge.

Soil Survey of England and Wales, 1983, Soils of England and Wales, Sheet 6, South East England.

List of enclosed figures.

Annex 1: Notes on standard procedures

1) **Resistivity 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 resistivity 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 the Ancient Monuments Laboratory 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 North. 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. However, the magnetometer is always kept facing in the same direction, regardless of the direction of travel, to minimise heading error.

   Unless otherwise stated the measurements are made with a Geoscan FM36 fluxgate gradiometer which incorporates two vertically aligned fluxgates, one situated 0.5 metres above the other; the bottom fluxgate is carried at a height of approximately 0.2 metres above the ground surface. The FM36 incorporates 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 the Ancient Monuments Laboratory 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.

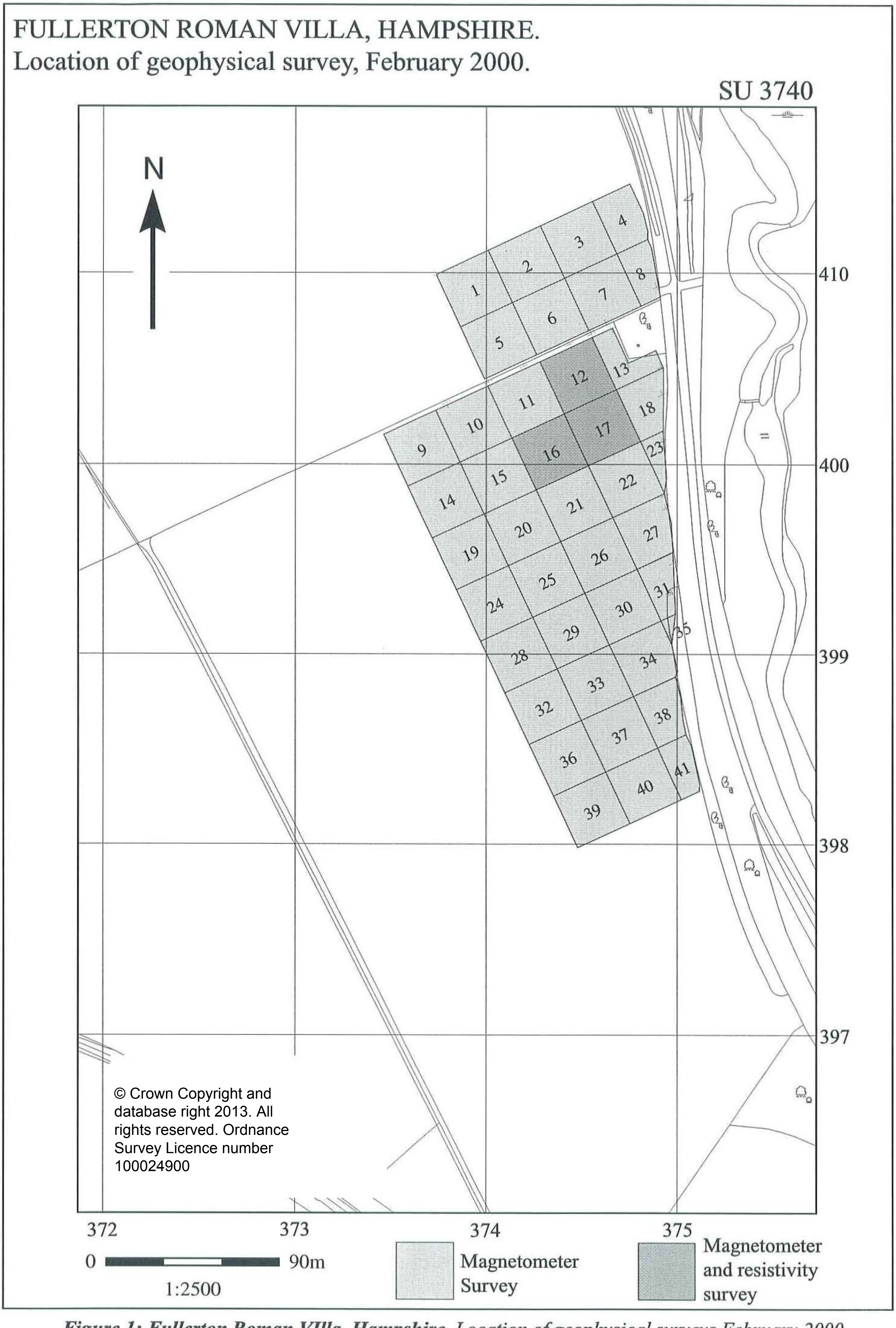


Figure 1; ***Fullerton Roman VIlla, Hampshire,*** *Location of geophysical surveys February 2000.*

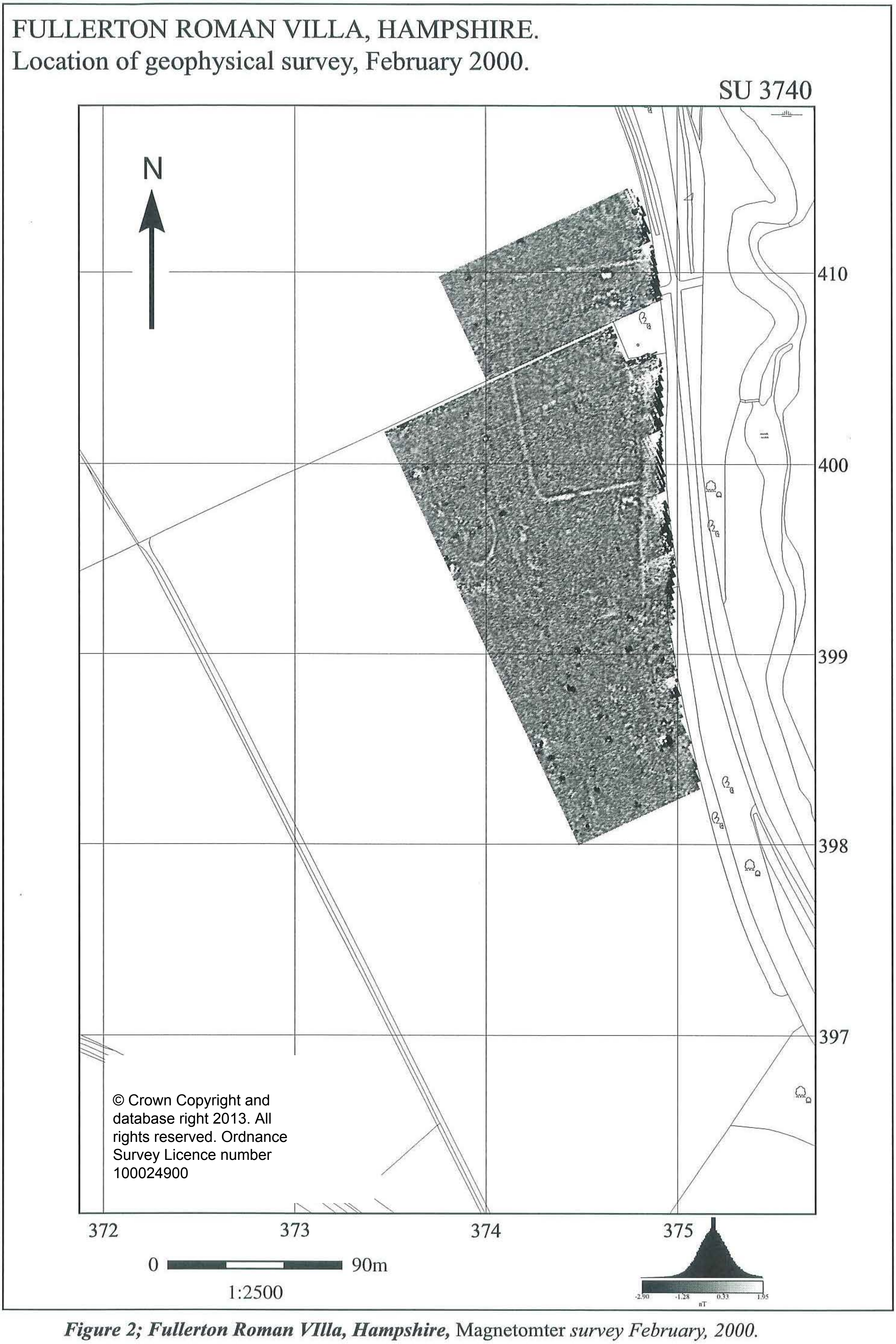


Figure 2; Fullerton Roman VIlla, Hampshire, Magnetomter *survey February, 2000.*

FULLERTON ROMAN VILLA, HAMPSHIRE.
Magnetometer Survey, February 2000.

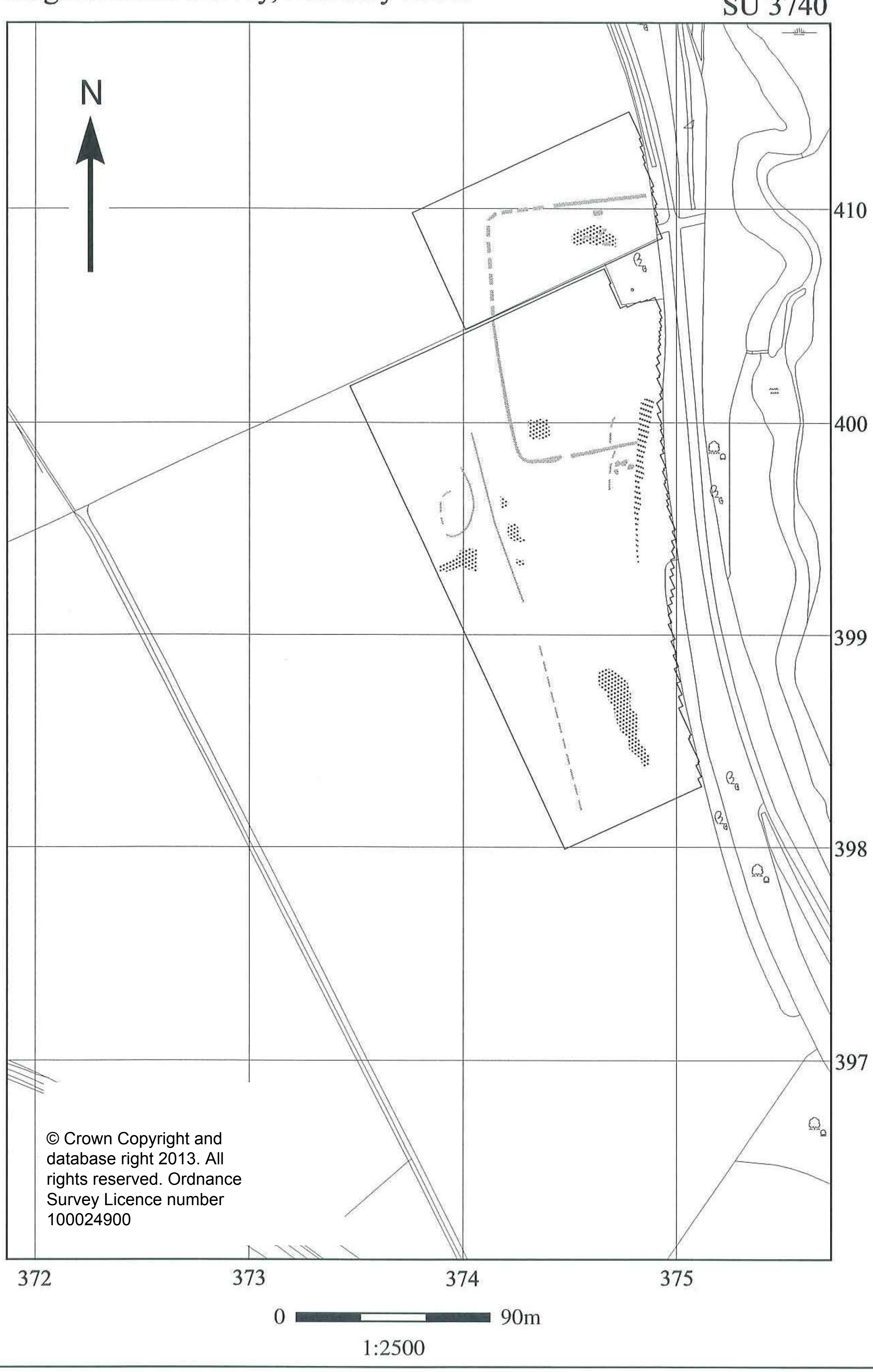


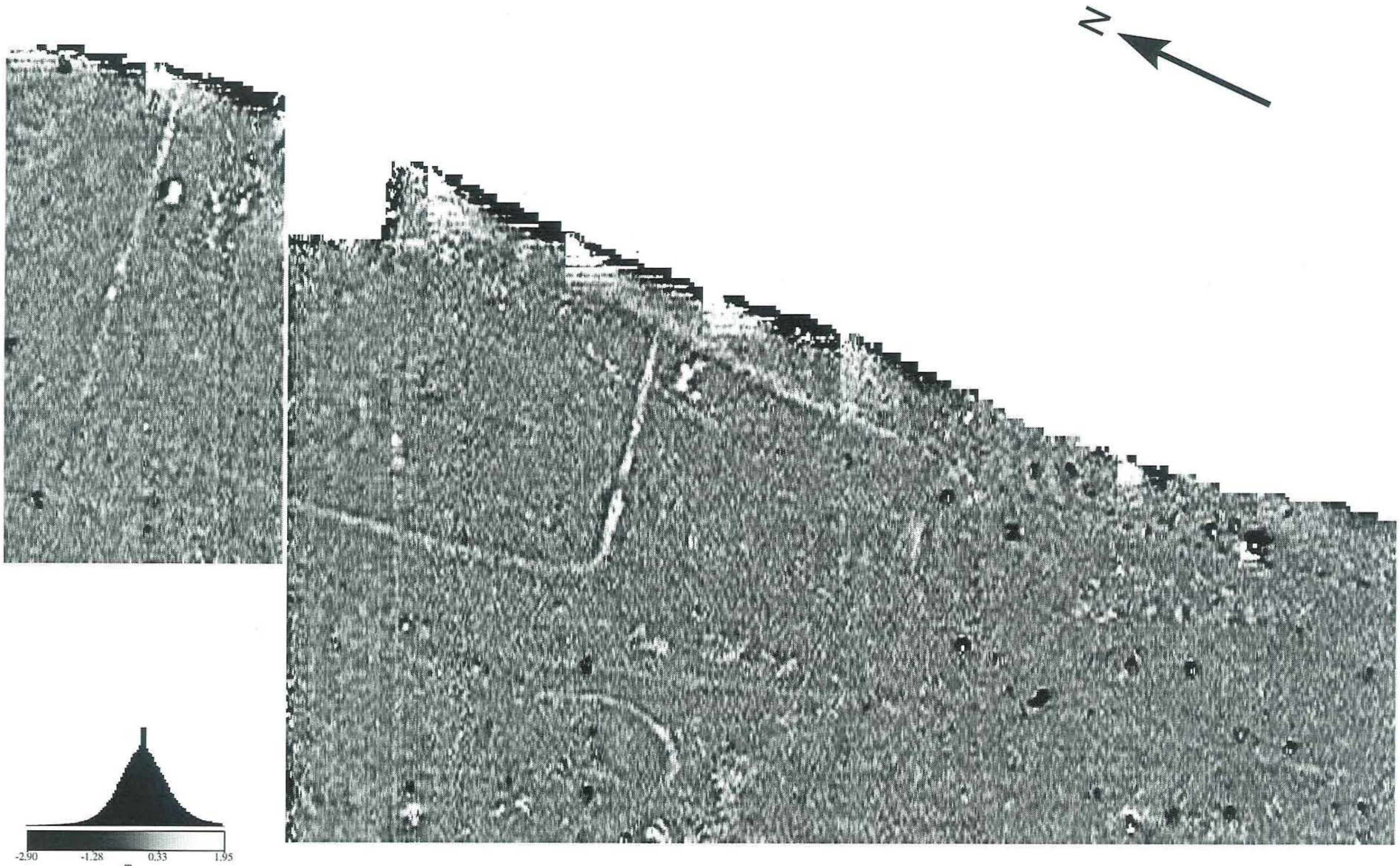
Figure 3; Fullerton Roman VIlla, Hampshire : *Summary of significant magnetic anomalies.*

PLAN A

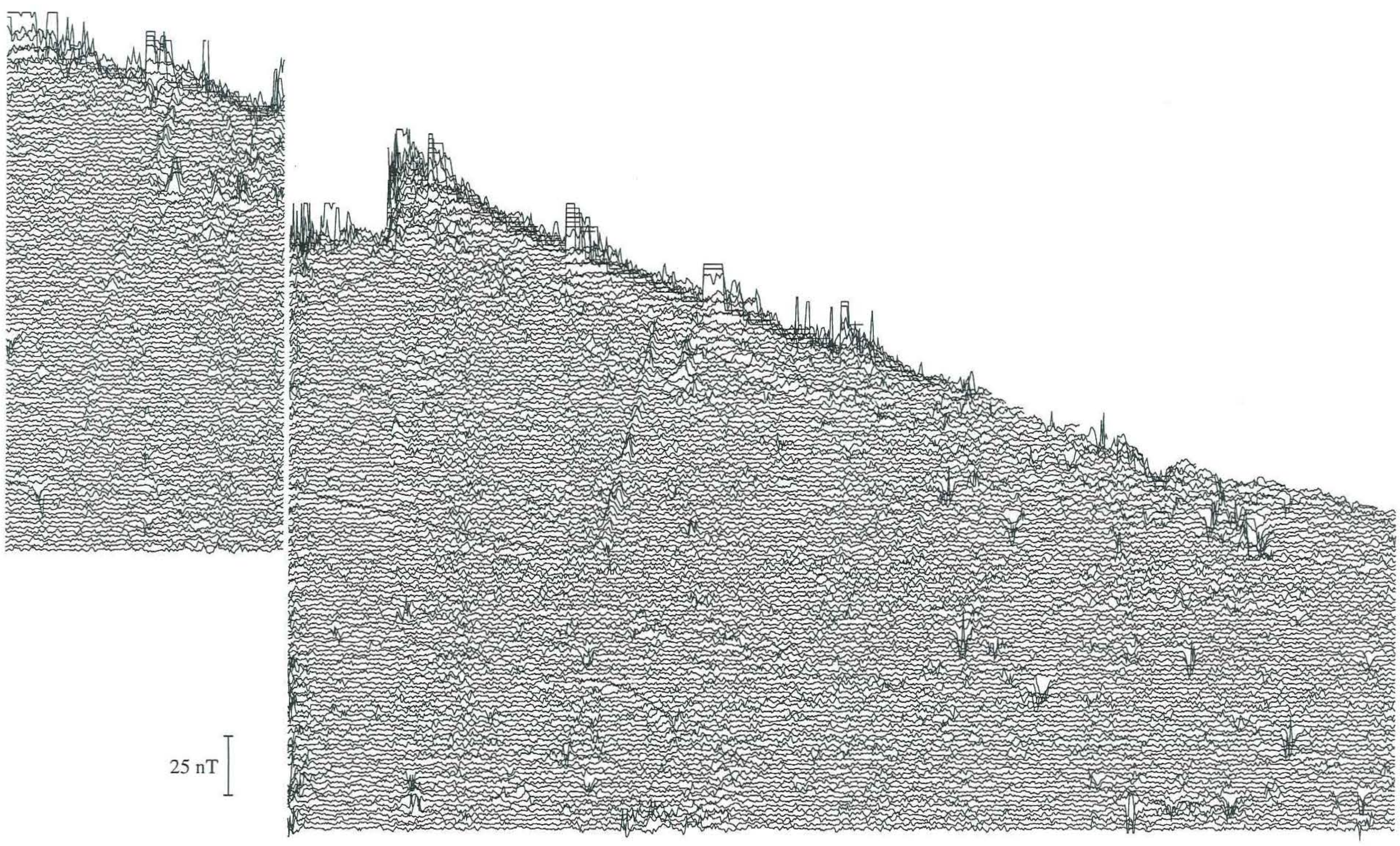
FULLERTON, HAMPSHIRE

Fluxgate gradiometer survey, February 2000.

a) Linear greyscale of despiked magnetometer data.



b) Traceplot of despiked magnetometer data.



0 90m

1:1250

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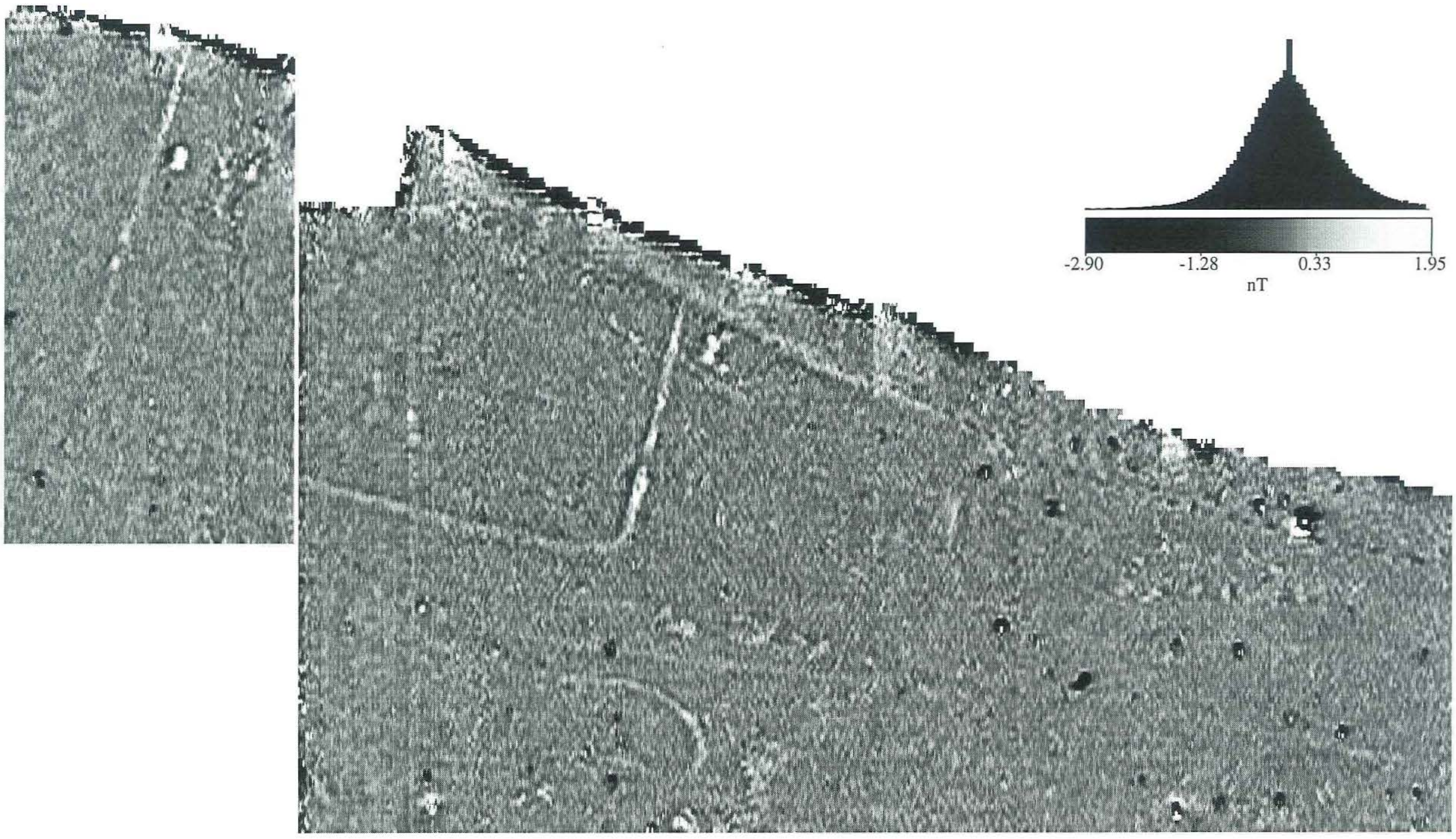
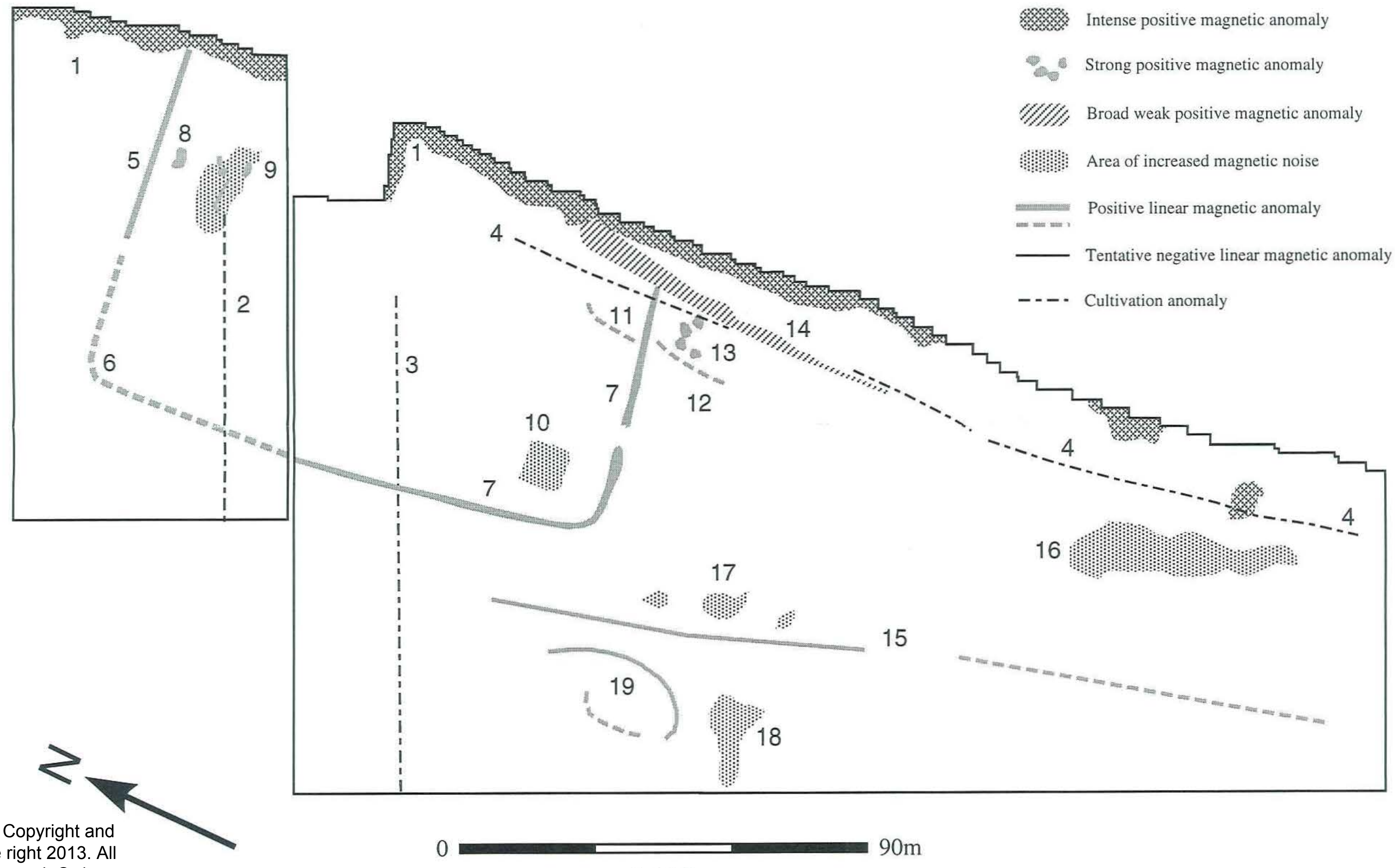
PLAN B

FULLERTON, HAMPSHIRE
Fluxgate gradiometer survey, February 2000.

a) Linear greyscale of despiked magnetometer data.



b) Graphical summary of significant magnetic anomalies



0 90m

1:1250

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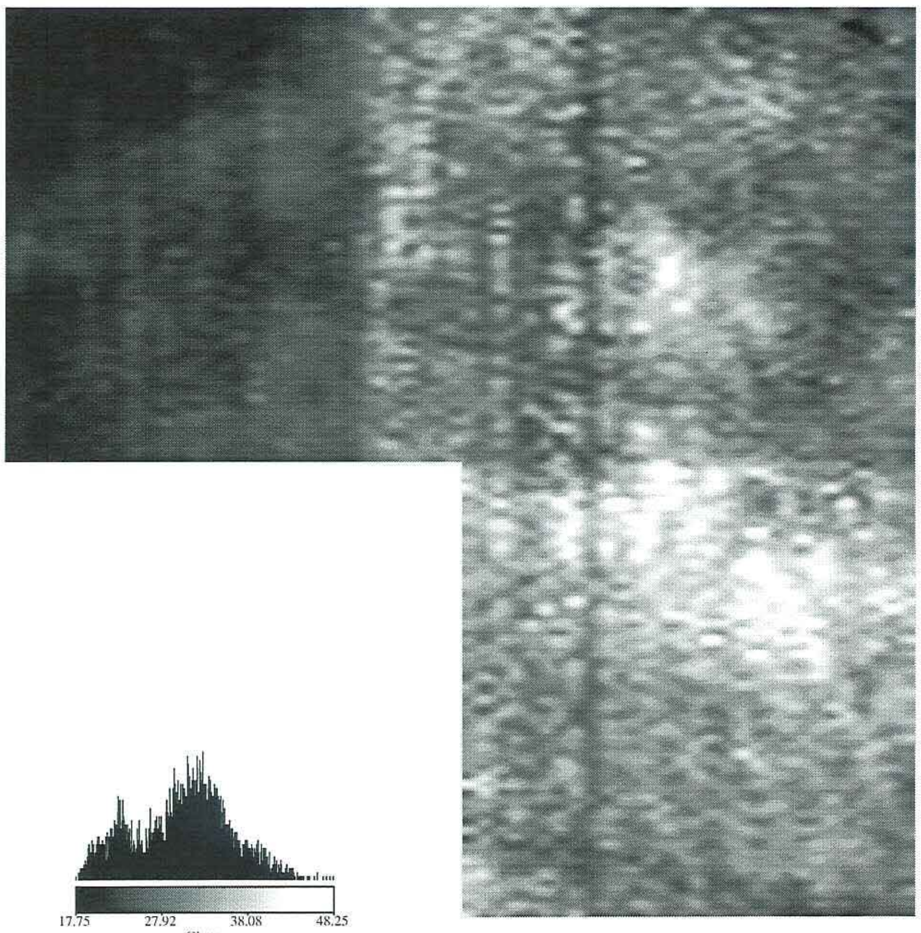
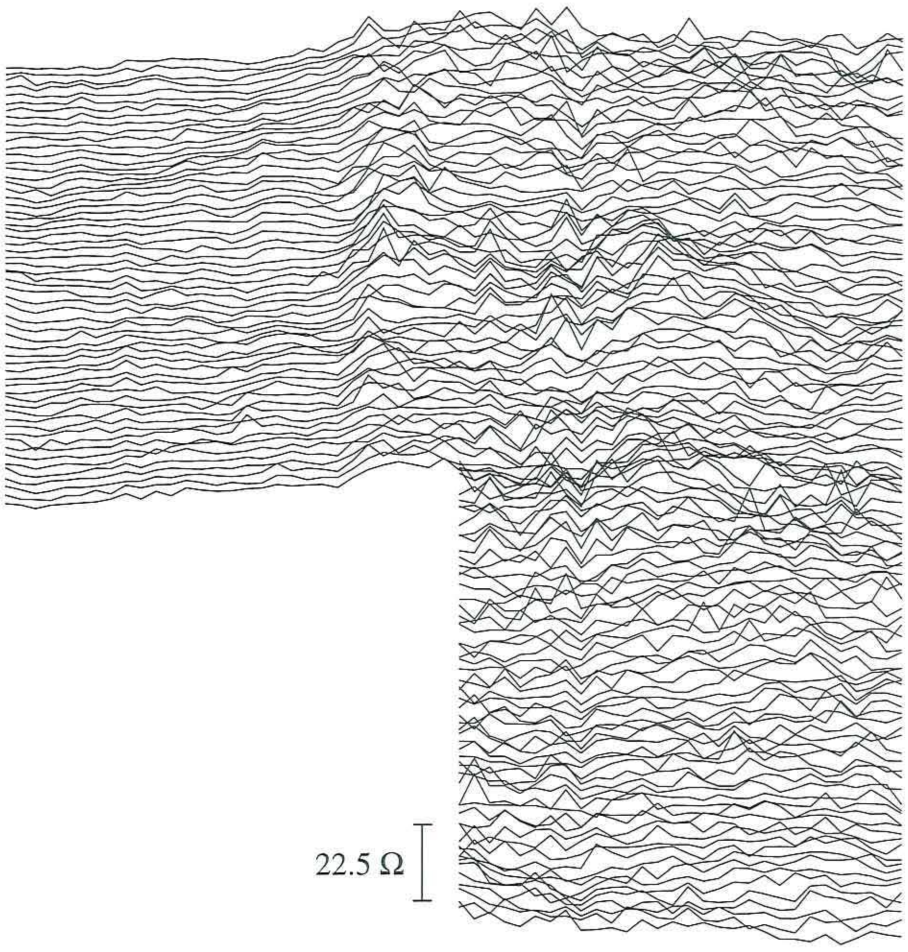
PLAN C

FULLERTON ROMAN VILLA, HAMPSHIRE
Resistivity survey, February 2000.

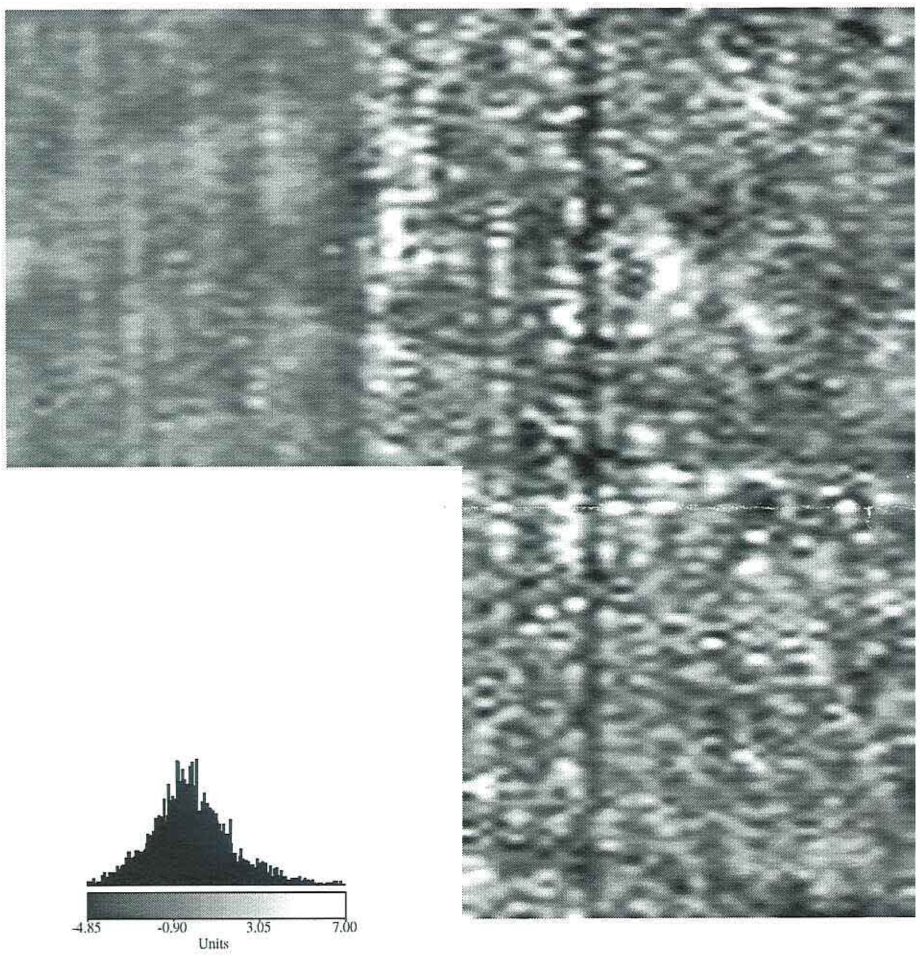
1) Linear greyscale of raw resistivity data.



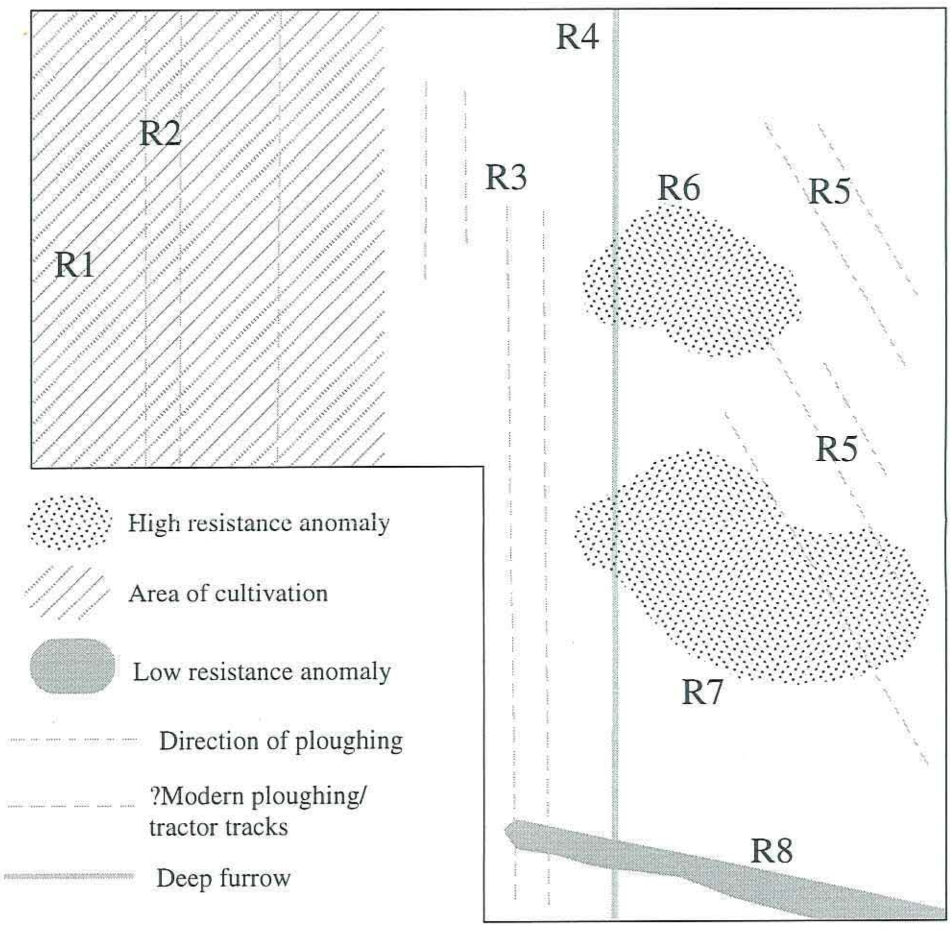
2) Traceplot of raw resistivity data.

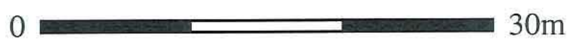


3) Linear greyscale of high-pass filtered resistivity data.



4) Graphical summary of significant resistance anomalies





1:500

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