1938

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WANBOROUGH ROMAN TEMPLE, GREEN LANE, WANBOROUGH, GUILDFORD, SURREY, REPORT ON GEOPHYSICAL SURVEY, 1997

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Summary

A geophysical survey was carried out at the site of a Roman temple near Wanborough in Surrey in an attempt to establish the extent of the remains and its potential for scheduling. Whilst magnetic survey was unsuccessful, resistivity survey detected a number of anomalies of possible Roman origin in the field to the south of the temple remains. Whilst most of these cannot be interpreted unambiguously, a trackway was detected describing the shape of an arc, a small part of which had previously been excavated in 1985.

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WANBOROUGH ROMAN TEMPLE, GREEN LANE, WANBOROUGH, GUILDFORD, SURREY

Report on Geophysical Survey, October 1997.

Introduction

A geophysical survey was carried out in the vicinity of the Roman temple at Green Lane, Wanborough in Surrey at the request of the English Heritage Inspector of Ancient Monuments for the county, Mr. S. Trow. The site of the temple itself (SU 921 496) has been the subject of two previous geophysical surveys, the first by R. Poulton in 1980 using the resistivity technique (O'Connell 1980), and the second by A. J. Clark of the Ancient Monuments Laboratory in 1985 where the original survey was extended using both resistivity and magnetometry (O'Connell & Bird, 1987). Based, in part, on these results, an excavation was carried out over the temple in 1985-6 by the Surrey Archaeological Society, when the discovery of ritual items with no known parallels indicated that the site may be of unique importance (*ibid.*).

However, the immediate environs of the temple have suffered both before and since the excavation from the activities of treasure hunters seeking Roman coins and several large holes, over a metre deep, appeared overnight earlier this year, where soil had been carried away to be sifted for coins. Hence, the purpose of the present survey was to identify the extent of any Roman remains associated with the temple, so that the site might be considered for the statutory protection of scheduling under the 1979 Ancient Monuments and Archaeological Areas Act.

The area is situated on London Clay (Geological Survey of Great Britain, 1949) and the temple is located near the crest of a south facing slope which looks towards the Hogs Back. The temple itself now lies partially under Green Lane, a local byway leading from Wanborough to Ash Green, but also projects into a grass field to the south where it is covered by a visible mound caused by spoil from the 1985 excavation. Remains detected during this excavation suggested that other Roman buildings may have extended into the fields to the north of the lane but these are now heavily wooded rendering geophysical survey unfeasible. Hence, the present work concentrated on the field to the south.

Method

A grid of 30 metre squares was laid out in the field south of Green Lane around the area where the temple remains were excavated (Figure 1). The grid was orientated parallel to the field boundary separating the field from the lane, which ran approximately east-west at this point; it was subsequently located using an EDM.

The shaded squares in this figure were then surveyed with a fluxgate gradiometer according to the standard technique outlined in Annex 1, note 2 and trace and greyscale plots of the results at 1:1250 scale are depicted in figure 2. It should be noted that in this figure the data has been represented with east rather than north at the top of the page, for the convenience of the trace plot representation. For the trace plot no processing of the data has been carried out apart from zeroing the median value of each traverse to remove the effects of heading errors. Some further processing was carried out for the greyscale plot, first to remove high amplitude dipolar anomalies caused by near surface ferrous anomalies or "iron spikes", then each traverse was filtered in the fourier domain with a 1D Butterworth band-reject filter to remove a distracting low-amplitude periodic effect introduced into the data by the particular instruments being used.

It had been hoped that this magnetometer survey would detect areas of magnetically enhanced soil caused by Roman activity and thus pinpoint areas for more detailed investigation with the slower resistivity technique. However, it soon became apparent that the magnetometer was having little success at detecting anomalies so further investigation with this technique was abandoned in favour of a larger resistivity survey covering all the 30 metre squares depicted in Figure 1. This was carried out according to the standard technique outlined in Annex 1, note 1, and the remote probes were widely separated (about 20 metres apart) to allow the measured resistance values to be converted into apparent resistivities. The unprocessed results of this resistivity survey are shown in Figure 3 in greyscale format at 1:2500 scale, superimposed on the Ordnance Survey map, and again at 1:1250 scale in Figure 4 in both trace (4a) and greyscale (4b) format.

To reduce the dynamic range of the data and bring out some of the additional detail visible on the computer screen, the resistivity survey was processed using the Wallis statistical differencing algorithm (Pratt 1978, 326) computed over a 21 reading square window and using an edge to background ratio of 0.85. The results of these operations are depicted as a greyscale plot at 1:1250 scale in Figure 4c.

Results

The magnetometer survey

As mentioned above, it was hoped that the magnetometer would respond to magnetically enhanced soils caused by anthropogenic activity associated with the temple, thus providing a rapid means of locating areas of archaeological interest. However, it is clear from Figure 2 that the area surveyed is almost devoid of significant anomalies and that the site is magnetically quiet. Indeed the standard deviation of the data after the removal of high amplitude "iron spikes" (which distort the distribution) is only 0.49nT.

One possible linear anomaly has been detected towards the east of the survey and this is indicated in Figure 4b. It is associated with a number of high amplitude dipolar responses likely to be caused by near surface iron objects and is close to the estimated position of trench T.3 in the 1985 excavation. It is thus likely that the magnetometer is responding to disturbance caused by this event, the dipolar responses perhaps representing nails.

The resistivity survey

To aid the interpretation of geophysical anomalies, Figure 4d shows an interpretation plan derived from an examination of the results of the resistivity survey, at 1:1250 scale. In the discussion below, bold numbers in square brackets refer to the feature numbers depicted on this plan.

The mean background resistivity was low (14.00Ωm) over most of the site including the area where the temple was situated **[1]**, as might be expected over a clay subsoil. However, downslope, towards the south, a distinct boundary may be discerned between this and an area of higher mean resistivity (21.54Ωm); the approximate location of this boundary is marked on Figure 4d. It is quite possible that this is caused by a change in the underlying geology not marked on the geological map (Geological Survey of Great Britain, 1949) at this position. However, it might also represent the boundary of deliberate landscaping at some time in the past, as the general south-trending slope appears to be flattened in the vicinity of the temple.

Close to the site of the temple itself **[1]**, the outline of the 1985 excavation trench T.2 (O'Connell and Bird 1987) is visible as an approximately rectangular area of slightly raised resistivity, marked in Figure 4d. Overlapping this and extending to the east is an amorphous region of high resistivity, the outline of which does not exactly correspond with the topography of the mound of excavation spoil covering this area. During the excavation, evidence was found for the deliberate levelling of the temple structure after it went out of use. It is thus conceivable that this area represents a spread of Roman masonry rubble.

Further south, in the vicinity of Surrey Archaeological Society's trench T.3, **[2]**, the eastern terminal of a large arc-shaped linear anomaly may be discerned. The anomaly is some 7 metres wide and over 60 metres long with a mean resistivity (26.47Ωm) significantly higher than the general background level (14.00Ωm). O'Connell and Bird (1987, 29) report that a trackway of uncertain antiquity was discovered in trench T.3:

> "...consisting of a linear spread of flints, interspersed with small pebbles to form a metalled surface. The trackway or road was aligned in a north-easterly/south-westerly direction but must presumably have turned further to the east, if it indeed continued northwards, because no trace of it was evident in Trench 4."

Geophysical evidence now suggests that, not only did this trackway not continue further to the north, but also that it did not head far in the south-westerly direction detected in the trench but gradually turned northwards in an arc, suggesting that it might have had a decorative rather than practical function.

Near the western terminal of this trackway, **[3]**, is a discrete anomaly of extremely high resistivity (51.54Ωm) compared to the regional background, measuring about 5 metres by 7 metres and apparently forming part of a less distinct linear high resistivity anomaly running approximately north-south. The anomaly is likely to be caused by non-porous stone buried near the surface, however, owing to the non-diagnostic shape of the anomaly it is not possible to determine whether it represents a Roman feature associated with the temple.

Towards the north-west corner of the survey at **[4]**, another amorphous region of high-resistivity similar to that at **[1]**, extends south into the field from the northern field boundary. Given the proximity of this boundary, and that the field has been cultivated for arable crops in the recent past, such a feature would normally be dismissed as being due to an accumulation of agricultural debris. However, the similarity in character and extent between this region and that at **[1]**, suggest that an explanation as a second rubble spread should also be borne in mind. A very indistinct linear anomaly of slightly raised resistivity is just visible running south-west from here into the field to the west. It is possible that this represents a former trackway across the area of similar construction to that at **[2]**, although its cause might also be attributed to modern agricultural practice on the field.

A third region of raised resistivity is apparent to the south at **[5]**. Here the average resistivity rises to 36.80Ωm compared to a background value in the vicinity of 21.54Ωm. Two broad linear anomaly appear to radiate outwards, north and north-west from this region crossing the linear anomaly associated with **[3]**, described above. Such anomalies are typically found at gates in the field boundary, the raised resistivity being caused by compression of the soil at the bottleneck where livestock congregate when being driven out of the field. This seems unlikely the be the explanation in the present instance, as the southern field boundary is formed by the edge of Wanborough Woods which appear overgrown and impenetrable with no evidence of a path at this point.

Hence, as with the anomalies at **[1]** and **[4]**, an explanation in terms of buried rubble could be considered. After contrast enhancement (Figure 4c) three narrow linear high resistivity anomalies can be identified within the general area of raised resistivity at **[5]** and these are also indicated in Figure 4d. It is possible that these represent wall footings but some caution must be expressed, as they appear to run either parallel with or perpendicular to the linear ridges and depressions caused by the modern cultivation regime.

Finally, two longer, linear high resistivity anomalies also run through this area parallel to each other and to the southern field boundary **[6]**. Once again they are parallel to the topographic trends caused by modern cultivation and it is possible that drainage effects at this, lower end of the field have simply enhanced the electrical contrast of two such ridges. However, since it is established that Roman remains are present at the site, it might also be considered that these represent some form of southern boundary to the occupation.

Conclusions

The magnetic survey of the site was unsuccessful at detecting archaeological anomalies and the general magnetic response was particularly quiet. This suggests that, whilst the remains of Roman buildings may be present under the field, they were not centres of habitation and little enhancement of the magnetic mineralogy of the soil occurred. The resistivity survey was more successful, detecting a number of interesting anomalies of possible Roman origin. The most convincing of these is the arcing linear feature at **[2]** which appears to coincide with trench T.3 of the 1985-6 excavations, where a metalled trackway was discovered. Other anomalies **[3, 4 and 5]** might represent buried rubble spreads indicating the position of further Roman buildings. However, in each case the interpretation is far from unambiguous owing to their amorphous shape, the proximity of field boundaries and the modern agricultural regime. Without limited test excavation of one or more of these features it is impossible to determine conclusively whether they represent Roman remains or have a more mundane, recent origin.

Surveyed by: N. Linford
P. Linford

Dates: 6-8th October 1997

Report by: P. Linford
N. Linford

Date: 17th October 1997

References

Geological Survey of Great Britain, 1949, 1:63360 Solid and Drift Edition, Sheet 285, Aldershot.

O'Connell, M. G., 1980, Green Lane, Wanborough (SU 920 495). *Surrey Archaeological Collections* **75**, 185-93.

O'Connell, M. G. & J. Bird, 1987, The Roman temple at Wanborough, excavation 1985-6. *Surrey Archaeological Collections* **82**, 1-168.

Pratt, W. K., 1978, Digital Image Processing. Wiley Interscience: New York.

Enclosed figures and plans

Annex 1: Notes on standard procedures

1) **Resistivity Survey:** Each 30 metre square is surveyed by making repeated parallel traverses across it, all aligned parallel to one pair of the 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 square edge. Readings are taken along each traverse at 1 metre intervals, the first and last readings being 0.5 metres from the nearest 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 square is surveyed by making repeated parallel traverses across it, all parallel to that pair of 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 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 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.

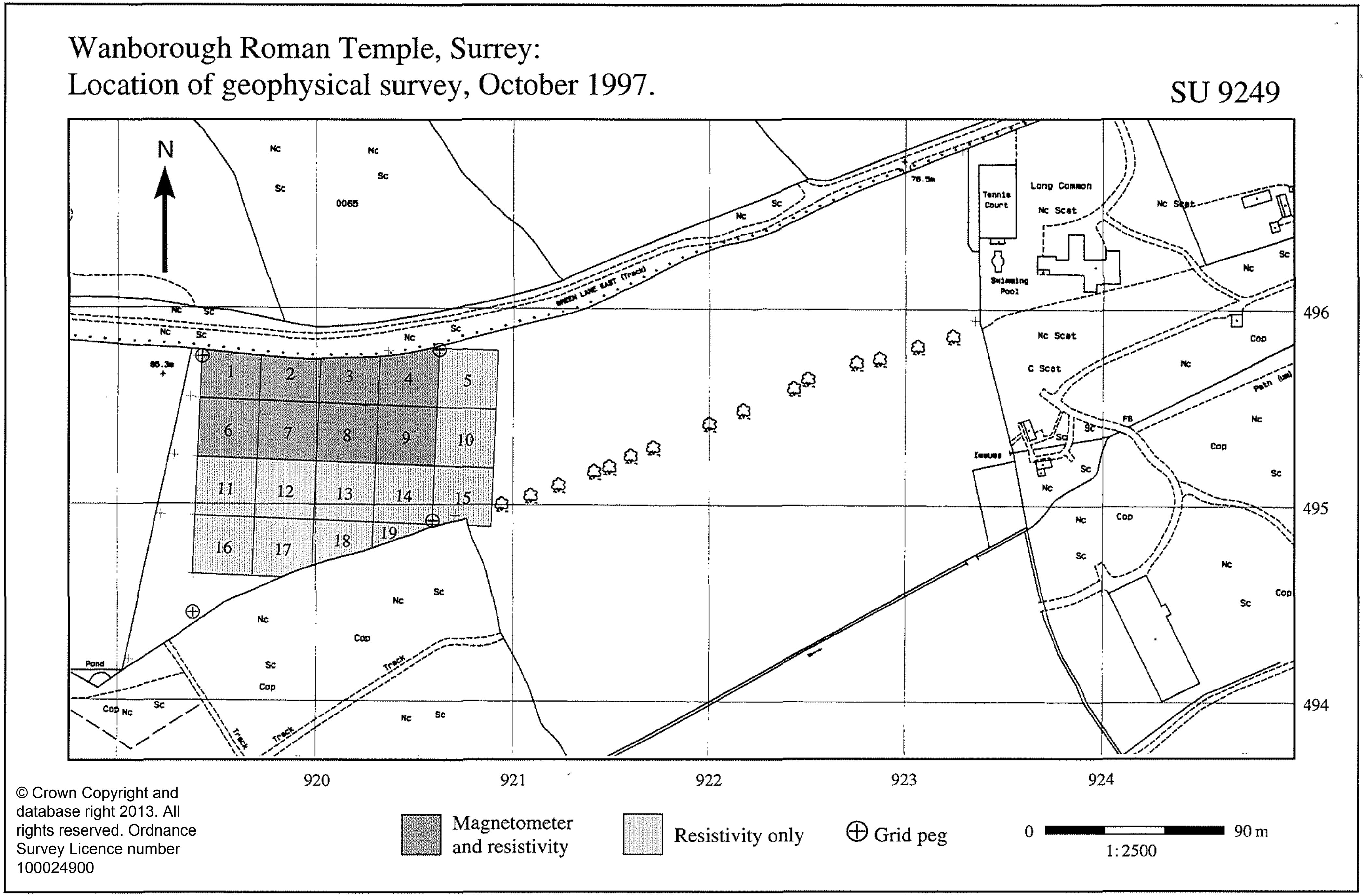
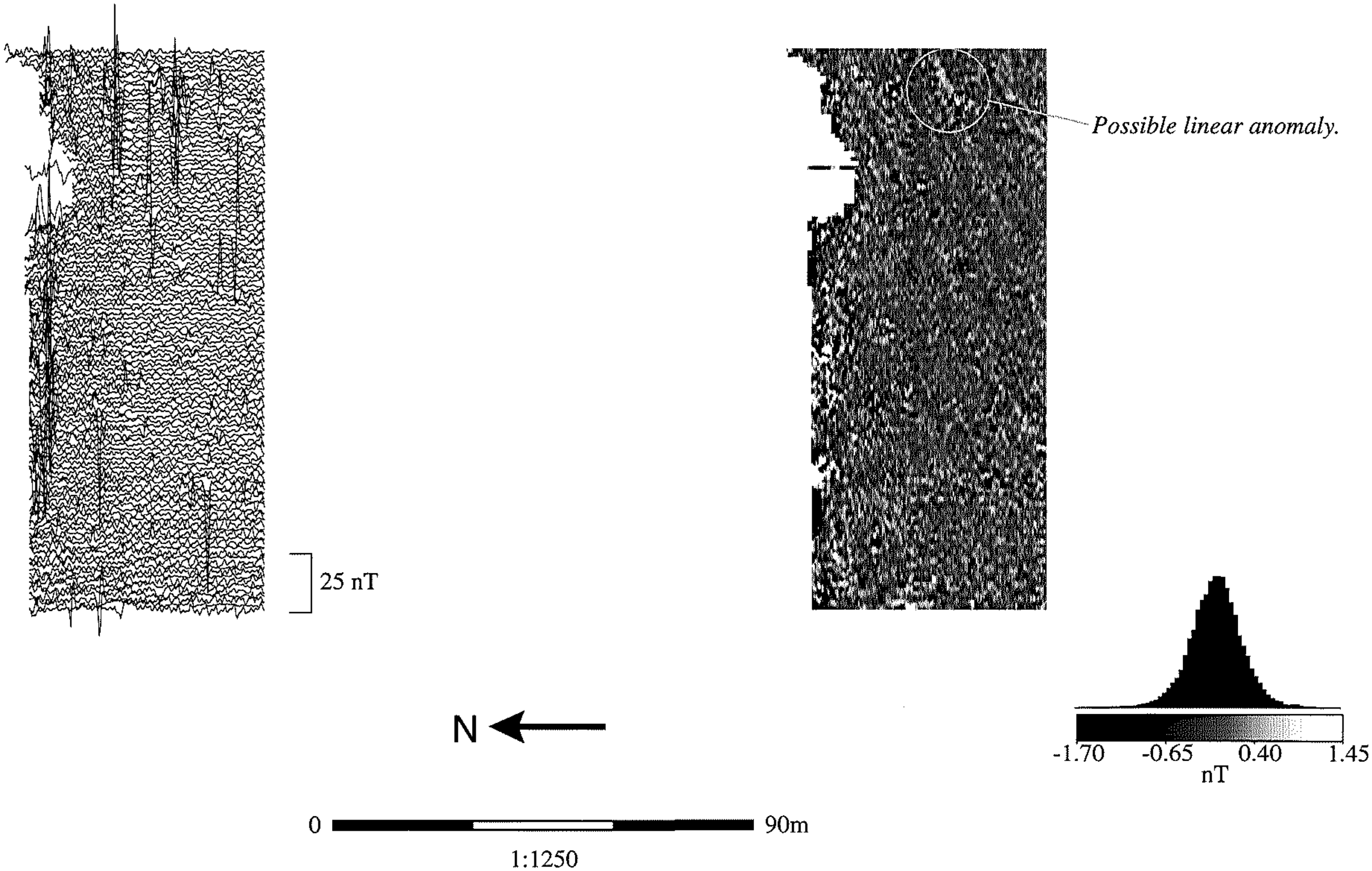


Figure 1; Wanborough Roman Temple, Surrey: Location of geophysical survey October 1997.

Figure 2) WANBOROUGH, ROMAN TEMPLE, SURREY:
Magnetometer Survey, October 1997.

a) Trace plot or unprocessd results

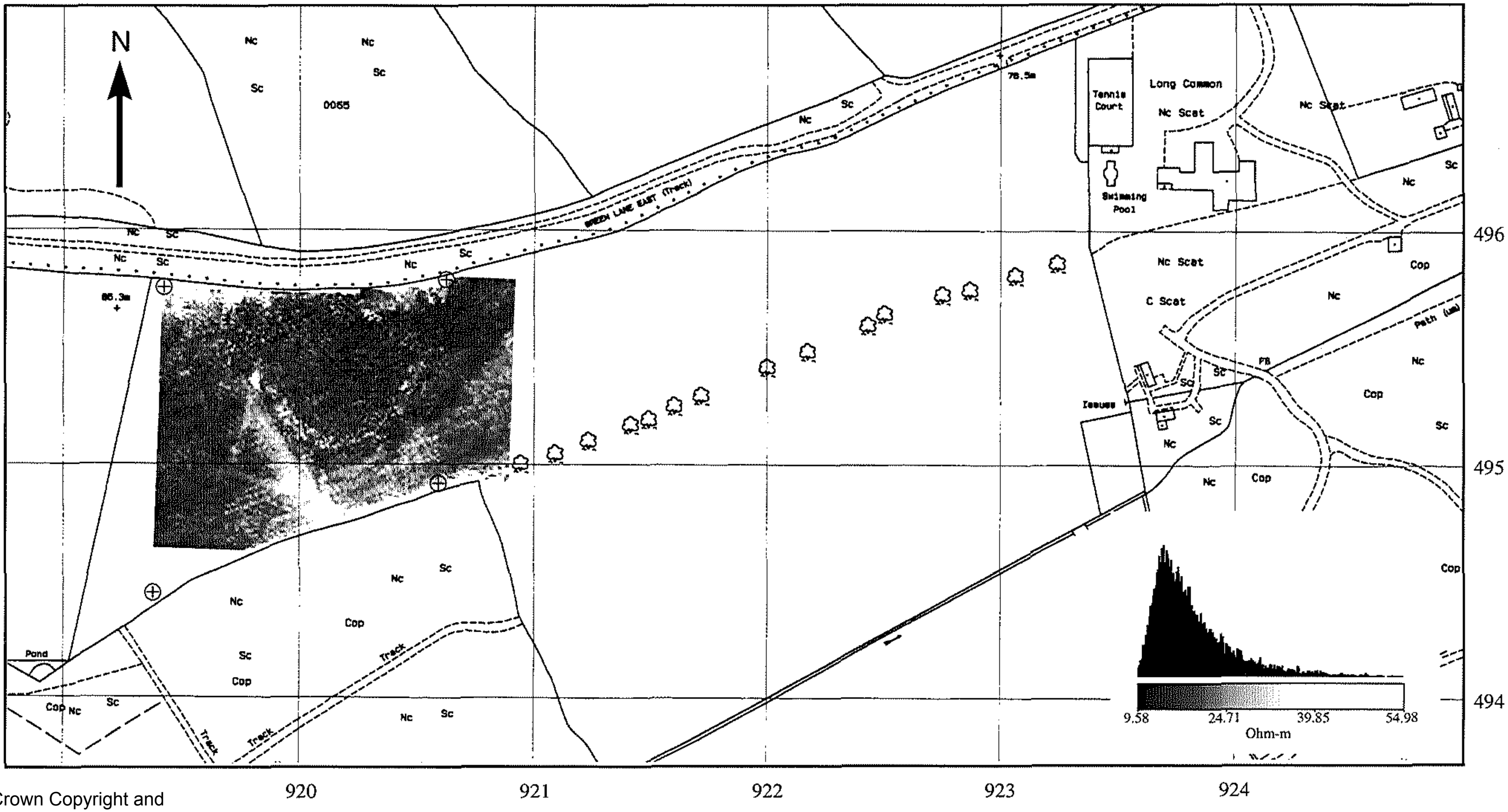
b) Linear greyscale plot indicating possible anomaly



Ancient Monuments Laboratory, 1997

Wanborough Roman Temple, Surrey:
Location of resistivity survey, October 1997.

SU 9249



0 90 m
1: 2500

Figure 3; Wanborough Roman Temple, Surrey: Resistivity data superimposed over OS map..

Figure 4) WANBOROUGH, ROMAN TEMPLE, SURREY: Resistivity Survey, October 1997.