1527

Ancient Monuments Laboratory
Report 46/95

CAESAR'S CAMP, WINDSOR FOREST, BERKS., REPORT ON GEOPHYSICAL SURVEY, 1995

N Linford

Ancient Monuments Laboratory Report 46/95

CAESAR'S CAMP, WINDSOR FOREST, BERKS., REPORT ON GEOPHYSICAL SURVEY, 1995

N Linford

Summary

A survey of about 2ha of this Iron Age hillfort was conducted after the removal of dense pine needle litter and surface vegetation from a trial area within its interior. The aim of this clearence was to facilitate the reinstatement of the original heathland environment that thrived on the site prior to its utilisation for commercial afforestaion during the 1950s. An archaeological evaluation, through both geophysical survey (reported upon here) and subsequent hand excavated test-pits, was requested to aid the interpretation of the monument and to amplify the results of a topograhic survey conducted in 1989 by RCHME. Despite the particularly quiet response encountered, the magnetometer survey has successfully indicated the presence of a number of potentially significant anomalies. The most obvious of these, a ditch-type anomaly inside the W ramparts, concurs with the location of linear earthworks identified during the topographic survey. The significance of a scatter of discrete pit-type anomalies is difficult to ascertain and the interpretation of these results will, no doubt, be clarified by the availability of subsequent test-pit evaluation data.

Author's address :-

Mr N Linford
ENGLISH HERITAGE
23 Savile Row
London
W1X 1AB

CAESAR'S CAMP, Windsor Forest, Berkshire.

Report on geophysical survey, October 1995

Introduction

Caesar's Camp is an Iron Age hillfort built on a natural spur of land around whose contours banks and ditches were constructed to provide defensive earthwork ramparts (Royal Commission on the Historic Monuments of England (RCHME) survey 1989). The hillfort is scheduled as an ancient monument of national importance (Easthampstead No. 32) and together with the surrounding woodland it forms part of the Crown Estate known as Windsor Forest. In March 1994 the area of land containing the hillfort became the subject of a countryside stewardship scheme that devolved the management of the site from the Crown Estate to Berkshire County Council and Bracknell Forest Borough Council for a duration of 30 years. The aim of this scheme is to protect the monument from further decay by thinning the over mature deciduous trees currently established on the ramparts and re-introducing a heathland mix of grass, heather and bilberry to stabilise the earthworks. The interior of the monument was previously utilised for commercial forestation with a conifer crop planted in 1955 producing a thick layer of pine litter throughout the interior of the hillfort. Re-vegetation trials have demonstrated that the removal of this pine litter to expose the mineral soil is essential for the successful re-establishment of the heathland mix.

The aim of this survey was to investigate the presence of any significant archaeological anomalies within a ~2ha area of the hillfort interior that was cleared of pine litter as part of a pilot project during August/September 1995. The survey was immediately followed by a test-pit evaluation of the same area conducted by the Central Archaeological Service (CAS) of English Heritage.

The site (NGR SU 864 657) lies on a spur of plateau gravel overlying sands of the Barton Beds.

Method

The success of magnetometer surveys when applied to similar monuments deemed it to be the most suitable technique for the initial investigation of this site (Payne 1995 *forthcoming*). Twin electrode earth resistance survey (involving a trailing wire between mobile/remote electrodes) was considered but dismissed due to the highly uneven nature of the terrain and the character of archaeological features likely to be encountered. **Figure 1** depicts the grid of 30m squares superimposed upon the 1:2500 RCHME earthwork plan[1] subsequently surveyed with the magnetometer following the standard method outlined in Annex 1, note 2. The results of the magnetometer survey are illustrated both as a traceplot of the raw field data **Plan A1** (corrected

[1] A more accurate version of this plan will be available in the near future following the location of the on-site CAS coordinate system to the NGR by use of a portable GPS receiver. All coordinates cited within this report relate to the site reference grid.

for drift between individual grid squares/instruments) and as a greytone image of this data after processing with a 3m by 3m thresholding median filter to diminish the response from near surface ferrous litter (**Plan A2**).

A transect of soil samples were collected at 15m intervals EW along the CAS 90N grid line (Figure 1). The magnetic susceptibility of these samples was subsequently measured using a Bartington MS1 susceptibility meter and 100cc laboratory sensor; the results are recorded in **Table 1**.

Results

Magnetometer survey *Plans A1, A2 and B1.*

General response

The majority of readings recorded during this survey fall within 0.5nT of the mean zero reading (A2; greytone mapping histogram) illustrating the extremely quiet response encountered over the interior of the monument. Although conditions such as these do not preclude the identification of archaeological anomalies, extreme care must be taken in the interpretation of the more subtle instrument responses. Plan B presents a graphical summary of significant anomalies identified by the author and discussed in the following text.

Modern interference

The intrusion of modern interference is most graphically illustrated by the traceplot of raw data (A1) in grid squares 1, 2 and 18 where it appears as a plethora of intense, sharply peaked anomalies. This response is, without doubt, related to a scatter of near-surface ferrous litter which extends throughout the majority of the pilot survey area. The ferrous water main buried beneath the central NS trackway bisecting the monument also appears as alternate positive (white) and negative (black) fringes of magnetic field distortion along the edges of all the survey squares adjacent to this feature. Furthermore, the lobe of negative readings detected in grid squares 2/3 (centred on CAS 150E/130N) suggests that a spur to this pipeline runs along the E branch of the trackway immediately N of squares 1-4.

Archaeological anomalies

The most obvious of these occurs as a positive ditch-type anomaly following the course of the ramparts along the W edge of the survey area (squares 13, 22 and 26). The location of this anomaly concurs with the earthwork features identified during the 1989 RCHME survey and suggests the presence of an internal ditch running inside defences. Closer examination of the magnetometer data reveals two tentative pit-type anomalies (Plan B; squares 22 and 26) abutting the ramparts and apparently incorporated within the internal defensive ditch. There is little evidence for the existence of a similar feature against the E ramparts beyond the identification of a far more tentative, positive anomaly in the SE corner of square 20 - although this is partially obscured by a near surface "iron spike".

A thin scatter of pit-type discrete positive anomalies is evident within the survey area, illustrated by the two most convincing examples, found in squares 15 and 16. There is no indication of any spatial relationship between the individual anomalies and there is a considerable variation in the size and magnitude of their response. The positive anomaly identified within square 10 is of particular interest as its response suggests a causative feature, or aggregate of features, with dimensions greater than those anticipated for a single pit.

Soil magnetic susceptibility

The values of topsoil magnetic susceptibility from the transect of soil samples collected across the survey area (Figure 1; location plan) are recorded in table 1. An additional sample of sediment from a subtle linear feature discovered during the CAS evaluation (from a 1m x 1m test pit in the centre of square 25; CAS 75E/45N) was also measured to provide a further comparison with the magnetometer results. The extremely low values of magnetic susceptibility encountered over the site reflect the apparent absence of iron bearing minerals within the topsoil developed over this site. Only sample -45E/90N, collected from inside the W rampart, demonstrated a significant increase in magnetic susceptibility - possibly influenced by the presence of enhanced sediment from the linear ditch feature in the vicinity of this sample.

Table 1; Magnetic susceptibility results.

Sample Location	κ_{100cc}	χ [$m^3kg^{-1} \times 10^{-8}$]	Sample Location	κ_{100cc}	χ [$m^3kg^{-1} \times 10^{-8}$]
195E/90N	1	0.4	60E/90N	4	1.9
180E/90N	1	0.5	45E/90N	8	4.3
165E/90N	1	0.4	30E/90N	6	3.2
150E/90N	2	1.2	15E/90N	6	2.7
135E/90N	1	0.4	0E/90N	3	1.6
120E/90N	1	0.5	-15E/90N	0	0
105E/90N	6	3.1	-30E/90N	4	2.2
90E/90N	2	1.3	-45E/90N	45	19.7
75E/90N	3	1.7	linear feature	1	0.3

Conclusion

Given that the current survey has covered only two of the seven hectares comprising the interior of this hillfort any archaeological interpretation of the results must be viewed in the context of this sub-sample and may not necessarily apply to the entirety of the monument. However, the magnetometer results suggest a relatively sparse degree of activity within the survey area and provide little evidence for sustained occupation or a wealth of interior structures. Obviously, the level of confidence that can be applied to this conclusion depends upon the identification of magnetic anomalies associated with surviving archaeological features. In this case, one must question both the survival of such features following the mechanical damage from the commercial conifer plantation and also the ability of the iron deficient environment to produce consistently detectable magnetic anomalies. The latter may well have been adversely affected by the leaching of iron rich minerals in the acid conditions formed by the pine needle litter (M. Canti *pers comm*; Bloomfield 1953). Certainly, the identification of subtle magnetic anomalies, for example those associated with post-hole features, would be unlikely on a site with such extremely low topsoil and subsoil magnetic susceptibility values. The comparison of these results with test-pit data will therefore prove an essential adjunct to any conclusions drawn from this survey concerning contemporary activity within the hillfort.

Surveyed by: M Cole
N Linford

Date of survey: 25-28/9/95

Reported by: N Linford

Date of report: 12/10/95

Archaeometry Branch,
Ancient Monuments Laboratory,
English Heritage.

References

Bloomfield, C. (1954). A study of podzolization. Part I. the mobilization of iron and aluminium by Scots Pine needles. *Journal of Soil Science*, **v4**, p 5-16.

Payne, A. W. (*forthcoming*). Responding to the management and interpretation needs of Wessex hillforts: the role of geophysical survey. *Proceedings of the Archaeological Prospection Conference 1995; Archaeological Prospection special issue.*

List of 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 metre 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 0.5m apart do not produce a true measure of vertical magnetic gradient. 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.

CAESAR'S CAMP, WINDSOR FOREST, BERKS.
Location of geophysical survey, October 1995.

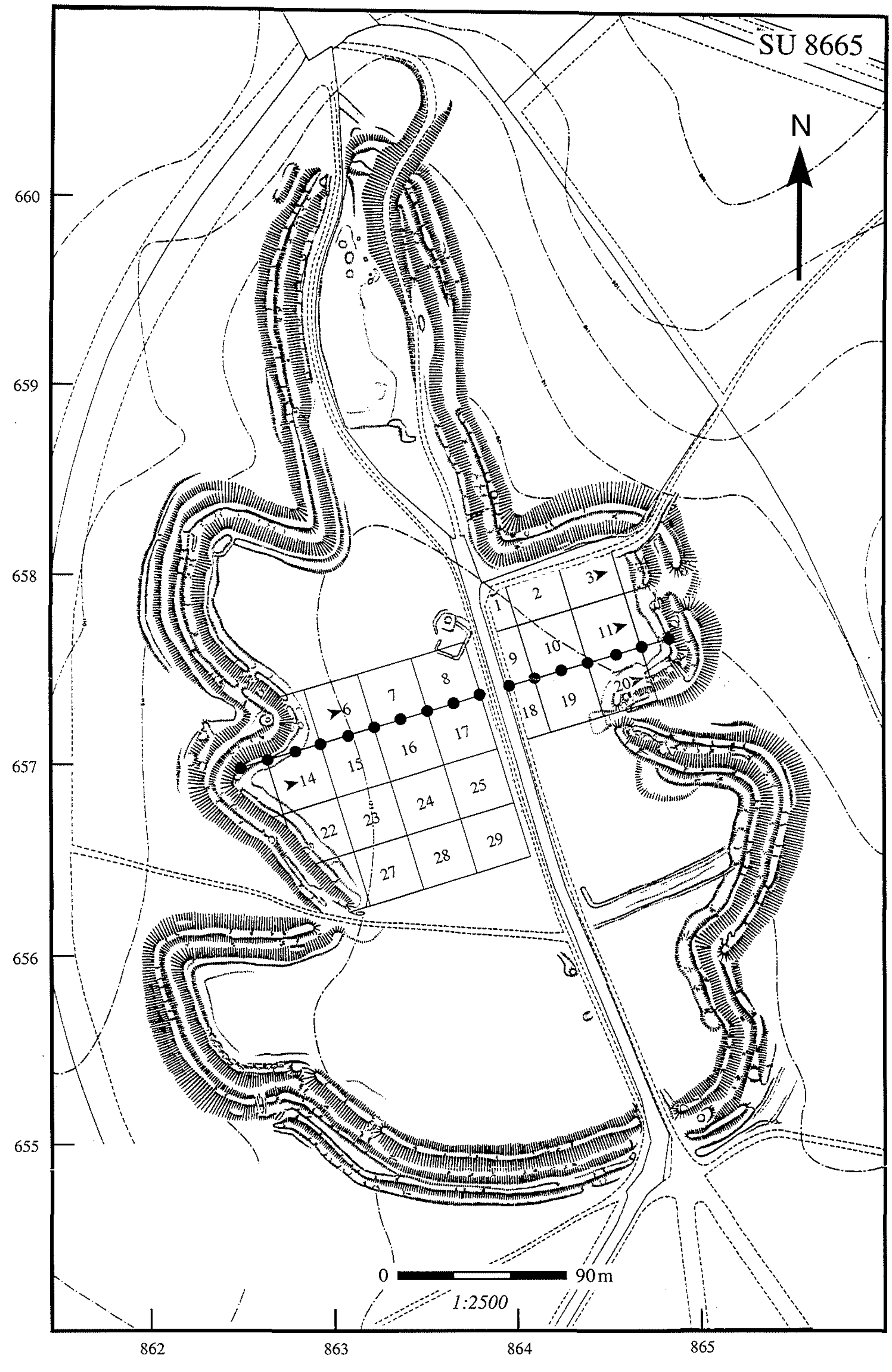


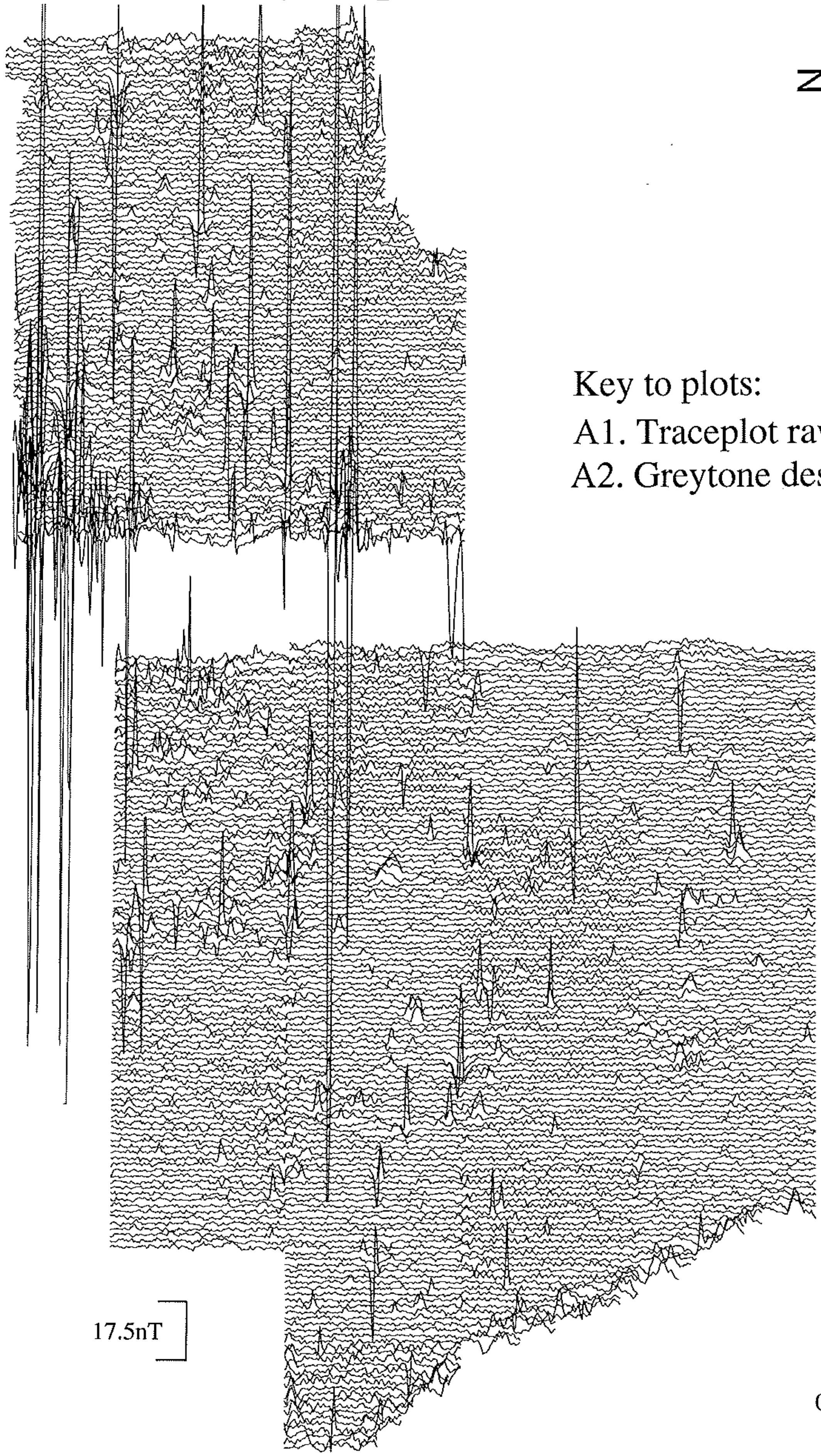
Figure 1, Caesar's Camp, Windsor Forest, Berks.; Location of geophysical survey squares 1995.
--●---●-- *indicates position of topsoil magnetic susceptibility transect.*

CAESAR'S CAMP, WINDSOR FOREST, BERKS.

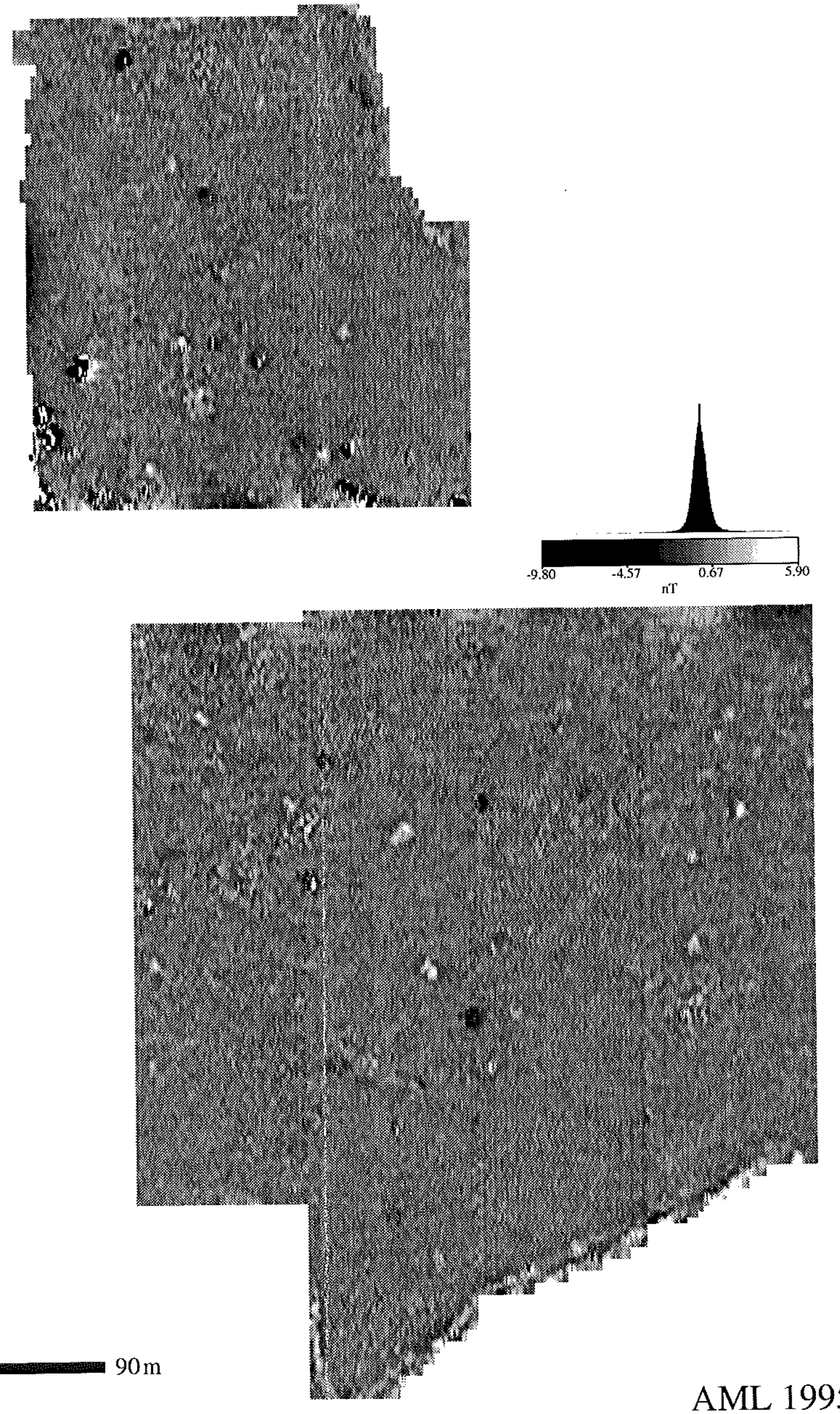
PLAN A

Magnetometer survey, September 1995.

A1.



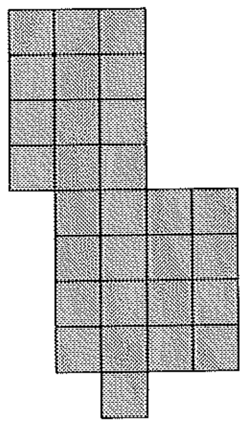
A2.



Key to plots:

A1. Traceplot raw magnetometer data.

A2. Greytone despiked magnetometer data.



0 90m

1:1000

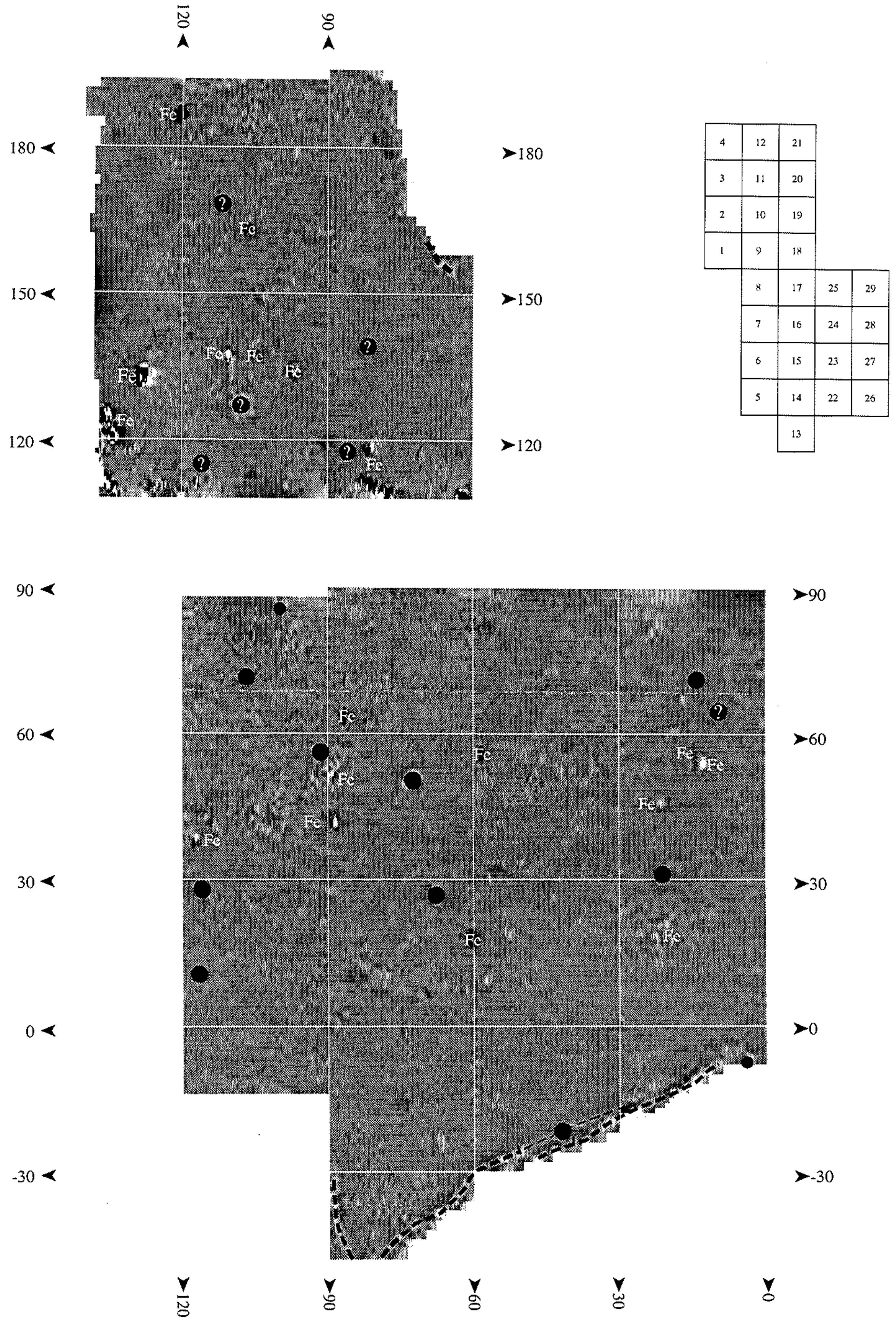
AML 1995

CAESAR'S CAMP, WINDSOR FOREST, BERKS.
Magnetometer survey, September 1995.

PLAN B

B1. Summary of geophysical anomalies.

N



➤ 120 CAS site grid coordinate

● Pit type anomaly

? Tentative pit type anomaly

Ditch type anomaly

Fe Near surface ferrous material

0 ——— 90m

1:1000

Ancient Monuments Laboratory 1995