SUTTON COURTENAY, Oxfordshire.

Report on geophysical surveys, October 2001 – March 2003.

Introduction

Geophysical surveys of approximately 15.8 hectares were conducted over part of the site of a high status Anglo-Saxon settlement, a presumed market place, sunken-feature buildings (SFBs) and a cemetery, previously identified through aerial photography (Benson and Miles 1974a and 1974b) and metal detector finds (Hamerow 1999) at Sutton Courtenay, Oxfordshire. This is the only Anglo-Saxon settlement complex where such features have been identified in direct association (Mayes 2003, 3). The survey area lies directly south of a series of 33 SFBs excavated by E. T. Leeds in the 1920s and 1930s and east of the Drayton South Cursus, part of which was previously subject to an archaeological investigation by the Oxford Archaeological Unit in 1994 (Mayes 2003, 2). Drop Short Roman Villa lies to the north-east and was excavated in the 1950's by Berkshire Archaeological Society but never published (*ibid*, 6).

Aerial photographs (APs) indicate several zones of activity in neighbouring areas. To the west of the north-south Milton Road, the southern end of the Drayton South Cursus and various other prehistoric features precede a series of what are interpreted as Anglo-Saxon timber halls laid out in an 'L' shape (Benson and Miles 1974b). This area now holds Scheduled Ancient Monument status (OX 248). Just east of Milton Road an extension to the Saxon structures has been recorded (NMR No. SU 49 SE 5). To the north-east of this a gravel quarry was identified (NMR No. SU 49 SE 130) and to the south a single ditched oval enclosure containing two smaller sub-circular enclosures, a separate circular enclosure, possible SFBs, part of a rectangular enclosure and other linear features (Benson and Miles 1974a, 62; NMR No.s SU 49 SE 5, SU 49 SE 89, SU 49 SE 93). Further east, near the location of the metal detected finds, numerous trackways, polygonal enclosures, field boundaries and pits have also been recorded (Benson and Miles 1974a, 62; NMR No.s SU 49 SE 19, SU 49 SE 95, SU 49 SE 132).

The aim of this survey was to attempt to confirm and enhance the cropmark evidence and the relationship of the various zones, potentially locating any further features related to these and to the metal detected finds. Due to access limitations only land to the east of Milton Road was available for survey. A preliminary survey was conducted over the eastern set of cropmarks to test the response at the site and included the area from which various metal artefacts had been recovered. These results informed a proposal for an English Heritage Commissions funded research project jointly run by Oxford Archaeology and Oxford University into the Saxon settlement at Sutton Courtenay. As part of this, and following the successful initial results, the survey area was extended twice more to the west. A research evaluation was subsequently conducted by Oxford Archaeology with four trenches measuring 20x10m and eight associated 1m^2 test pits targeting specific geophysical anomalies.

The site (SU 491 936) lies on well drained fine and coarse loamy soils of the Sutton 1 association (Soil Survey of England and Wales 1983) developed over the Second (Summertown-Radley) Gravel Terrace of the River Thames (Mayes 2003, 1) and possibly Head and Younger Combe Deposits to the east (British Geological Survey 1971). At the time of the surveys the field was under light cultivation of winter wheat.

Method

Magnetometry has proven to be successful on similar sites in the region, such as at Barrow Hills, Radley (Bartlett, A in Barclay and Halpin 2002, 11-14) where a combination of prehistoric monuments and SFBs was recorded on second terrace river gravels. Therefore this technique was chosen in an attempt to locate the ditches and settlement features known to exist from the cropmark evidence. The survey was conducted with Geoscan FM36 fluxgate gradiometers over all the shaded grid-squares on 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 1:2500 in Plan A. A plot of the data-set is superimposed over the OS base map (1:2500) in Figure 2 and as a false colour plot in Figure 3. In Figure 5 the approximate location of the excavation trenches are overlaid on the false colour plot at a scale of 1:500.

The main corrections made to the measured values displayed in the plots were to zero-mean each instrument traverse to correct for instrument heading errors and to 'despike' the data through the application of a 2m by 2m thresholding median filter (Scollar *et al* 1990; 492). This latter operation reduces the distracting, localised, high-magnitude effects produced by surface iron objects. Some of the data was 'destaggered' to correct for slight positional offsets in the recorded data caused by the different heading directions. Furthermore, for the traceplot representation of the data (Plan A1), the magnitudes of extreme values were truncated to ±15nT to improve the visual intelligibility of the plot.

Results

A graphical summary of the significant anomalies discussed below is provided on Figure 4. Numbers in [ ] refer to annotations in this figure. A comparison of the magnetometer plot with the excavation plan is provided on Figure 5.

Modern disturbance at the site can be seen in the form of a highly magnetic service pipe running through the north-west of the area [1]. Former fence lines can be seen at [2] and [3] and a new fence line (erected during the first survey visit) produced a response at [4]. The path, also perhaps a former fence line, has been recorded at [5]. A negative magnetic linear response [6] runs between two ferrous disturbances [7-8] and is most likely a plastic pipe servicing two water troughs. The direction of modern ploughing can be seen over much of the survey area and is specifically illustrated on two different alignments at [9] and [10].

A large amorphous magnetic response [11] correlates with a bowl-like depression visible on the ground. It has also been recorded from AP evidence (NMR No. SU 49 SE 130) and is suggestive of quarrying activity. Similar smaller anomalies have been recorded at [12] and [13]. The latter response appears truncated to the north (along the line of ploughing) and to the south is bordered by at least four apparently adjoining sub-rectangular anomalies of over 10m in length.

A small rectilinear response [14] correlates with the location of a timber hall visible on an aerial photograph (SU 4993/5/34 July 1970 NMR). Excavation Trench 4 was sited over the eastern end of this anomaly and revealed the footings of a timber building. The foundation trench for this was substantial: ~1m wide and 1m deep (Chris Hayden *pers comm.*) and the large volume of magnetically enhanced soil filling it has generated a strong magnetic anomaly, discernable even in close proximity to the steep magnetic gradient generated by the modern pipe at [1]. Similarly strong magnetic anomalies caused by deep foundation trenches were detected at Cowage Farm, but not at Barrow Hills where the foundation trenches were not of such a size (David 1994, 9).

In the excavation trench a ditch was observed running east from the building and it is interesting to note that despite being quite shallow (~15cm) relative to the depth of overburden (~40cm), it was also detected as a positive magnetic anomaly.

A broad band of raised magnetic readings [15] runs northwest-southeast to the south of [1] and is broadly parallel to the cursus. It may be of geological origin, but could also be the ploughed out remnants of a more archaeologically significant feature.

A large circular anomaly [16], ~23m in diameter has been interpreted from AP evidence as a barrow ditch (NMR No. SU 49 SE 89), possibly associated with those also recorded to the north and west of here.

At [17] an intriguing group of anomalies has been recorded. A ditched oval enclosure measuring ~33x21m surrounds a smaller circular anomaly (~11.5m in diameter). Within the latter at least two pit-type anomalies have been recorded and various other discrete responses are evident to the south, still within the bounds of the larger oval ditch. This ditch feature appears to be more or less complete along its length: the most obvious interruptions are attributable to ploughing. The responses here are broadly comparable with the AP evidence (NMR No. SU 49 SE 89), although only one inner circular anomaly has been recorded in the magnetometer survey. A larger pit-type anomaly overlaps the course of the outer ditch to the east and, just outside to the south-east, either a group of pits or a small enclosure has been recorded.

Various sub-rectangular anomalies [28] can be seen to the east of [17] and these are of a similar size to the anomalies typically caused by SFBs. One was targeted for excavation with Trench 3 but the recorded anomaly was revealed to be a probable waterhole rather than an SFB. Several inter-cutting pits of Anglo-Saxon date overlay the upper fills of this feature. Adjacent to the waterhole numerous pits, some visible as positive magnetic anomalies, were also excavated and found to be Neolithic in date (Mayes 2003, 14-15).

Throughout this western area of the survey numerous pit-type anomalies have been recorded of various sizes and intensities. It is not possible to draw attention to them all, either graphically or in text, however, they suggest a focus of archaeological activity in this area.

At the eastern end of the survey around [19] a large area appears to be enclosed by a series of linear and curvilinear ditches and possible trackways. To the south in particular, several of these latter anomalies are apparent as paired parallel lines (e.g. [20]) for at least some of their course. Though some of these may relate to ditched trackways, others could be evidence of re-cutting and movement of the enclosure ditches over time; the strength of response to one of the parallel anomalies is often of a different magnitude to the other. There is evidence for numerous internal divisions within the larger enclosures and a dense patterning of pit-type anomalies, some forming linear alignments and some clusters e.g. [21] and [22] respectively.

Various circular and curvilinear magnetic anomalies e.g. [23-25] have also been recorded within and adjacent to the enclosure system. Many of these either abut, or overlap the enclosure ditches so it is not possible to decipher the chronological relationship between the two. That at [25] surrounds five pit-type anomalies which may possibly pertain to vertical post settings.

Two trenches were excavated within this area. Trench 1 revealed an east-west ditch, provisionally given an Iron Age-Romano British date, as well as several early Iron Age pits to the south of this and post holes to the north (Chris Hayden *pers comm*.). A second ditch recorded in the south-east corner of the trench did not prove to be dateable. In Test Pit A to the north-east of the trench a crouched burial was discovered in a shallow pit. All of these features, apart from the postholes and burial, were evident in the magnetometer plot. Trench 2 exposed three substantial ditches and a large pit, most probably of Iron Age – Roman date (Chris Hayden *pers comm.*). These were all recorded by the magnetometer survey but a number of smaller pits and postholes were not.

Two broadly parallel linear anomalies [26] that may form part of a wide track or boundary around the south end of the main enclosure system extend to the west, though the signal becomes weak around [27]. It is unclear what the final destinations of these ditches are. The northern of the two anomalies takes a sharp turn to the north at [28], possibly respecting the barrow [16] before becoming obscured by the pipe [1] and quarry [11]. Part of the north-south course of [28] was excavated in Trench 3 and the upper fills of this ditch date it to the Roman period (Chris Hayden *pers comm.*).

Overall many fewer anomalies have been recorded across the middle section of the survey and those that are evident have a generally more subdued magnetic response than elsewhere on the site. A similar lack of response is reflected by the AP evidence. It is possible that less activity occurred here in antiquity. However, [26-27] crosses this area and exhibits a much weaker magnetic response here than in the eastern and western areas. This suggests that geomorphology might be involved: either an increased depth of overburden or a less magnetically responsive soil mineralogy.

Conclusion

A complex pattern of occupation has been recorded across the survey area. Correlation with AP transcription is good, and significantly more detail has been recorded in many places. The 'dead' zone in the middle of the survey area has produced potential archaeological anomalies, although they are much weaker than elsewhere, indicating a probable localised increase in overburden.

The intensity and extent of activity at the eastern end of the survey area suggests considerable settlement in antiquity. The palimpsest of responses precludes clear phasing, which at best would only be based on the morphology of anomalies, however, limited excavation has demonstrated the use of various features from the Iron Age to the Anglo-Saxon period. Elsewhere pits of Neolithic date have been recorded suggesting a prolonged focus in this overall area.

Possible parallels to the oval enclosure, recorded by both magnetometry and APs can be found at the nearby site of Barrow Hills, Radley (Andrew David and Jonathan Last *pers comm*.). Here two oval cropmarks were observed by Crawford (Barclay and Halpin 2002, 2-3). One was destroyed before attention was drawn to it, but the second was surveyed then excavated and shown to be a Neolithic oval barrow later re-used when an Anglo-Saxon SFB was established in its centre (Bradley 1992). However, also at Barrow Hills, an early Bronze Age round barrow (4A) together with a second later (unditched) burial mound were subsequently enclosed by a collared oval ditch to create a twin barrow (4) (Barclay and Halpin 2002, 153-4). Without excavation, neither the phasing nor dating of the feature is possible. Thus it cannot be determined with any certainty which of the two parallels the features at Sutton Courtenay may conform to: either a burial mound placed within the bounds of a still visible oval ditch, or two barrows encircled by one larger ditch.

Surveyed by:	L Martin A Payne	Date of survey:	15-19/10/2001
	P Cottrell L Martin		11-15/02/2002
	L Martin A Payne		03-07/03/2003
Reported by:	L Martin	Date of report:	13/10/2004

Archaeometry Branch,
English Heritage,
Centre for Archaeology.

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National Monument Records cited:
NMR Number: SU 49 SE 5
NMR Number: SU 49 SE 19
NMR Number: SU 49 SE 89
NMR Number: SU 49 SE 93
NMR Number: SU 49 SE 95
NMR Number: SU 49 SE 130
NMR Number: SU 49 SE 132
NMR Number: SU 49 SE 131

List of enclosed figures.

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 the Centre for Archaeology 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. 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 the Centre for Archaeology 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).

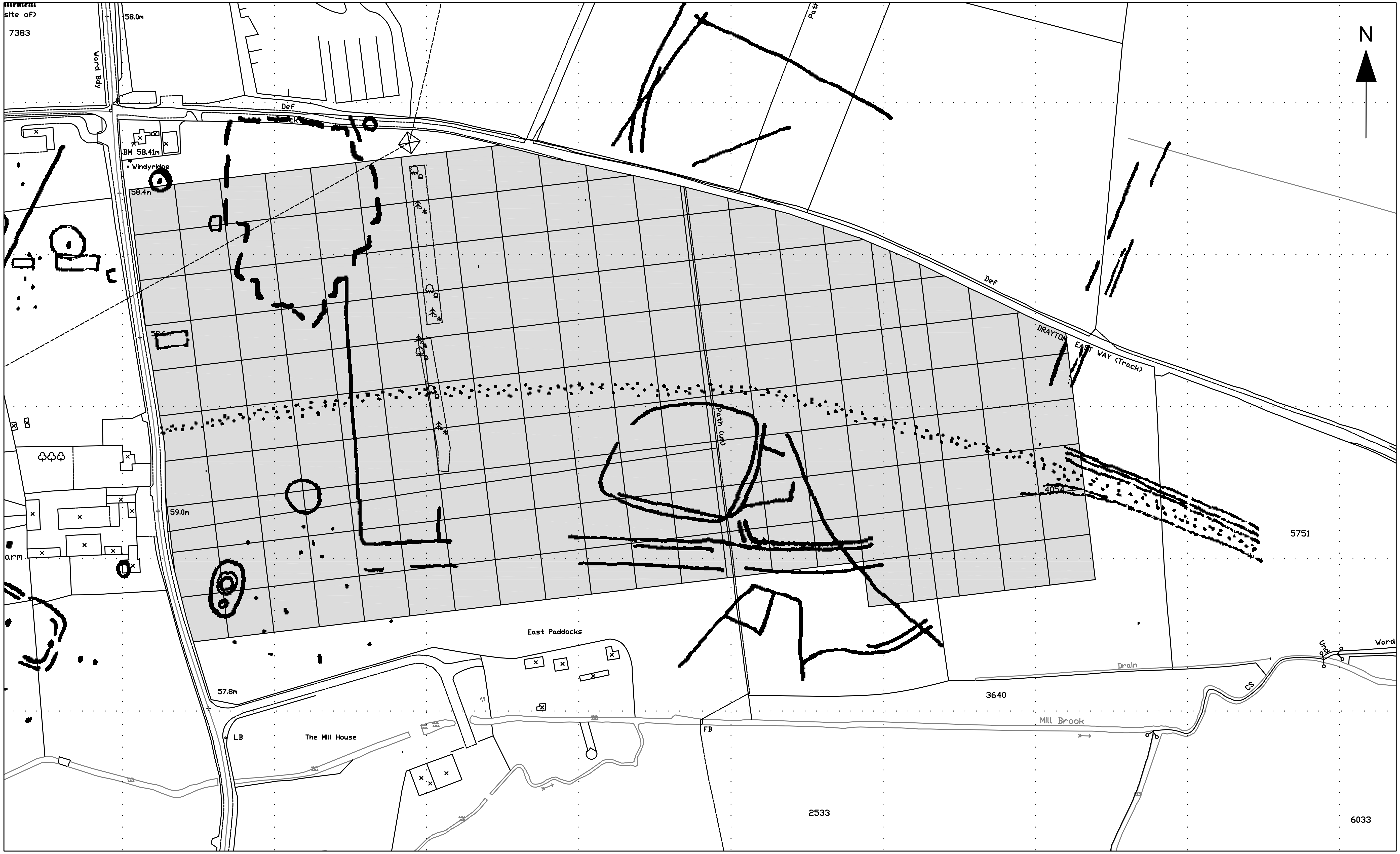
3) **Resistivity Profiling:** This technique measures the electrical resistivity of the subsurface in a similar manner to the standard resistivity mapping method outlined in note 1. However, instead of mapping changes in the near surface resistivity over an area, it produces a vertical section, illustrating 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

SUTTON COURTENAY, OXFORDSHIRE.
Magnetometer survey, October 2001, February 2002 and March 2003.

SU4993



0 90m
1:2500

AP transcription
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Magnetometer survey

Centre for Archaeology 2004

Figure 2

SUTTON COURTENAY, OXFORDSHIRE.
Linear greyscale of magnetometer survey, October 2001, February 2002 and March 2003.

SU4993

0 90m
1:2500

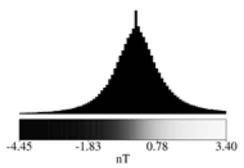

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Figure 3

SUTTON COURTENAY, OXFORDSHIRE.
False colour plot of magnetometer survey, October 2001, February 2002 and March 2003.

SU4993

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Figure 4

SUTTON COURTENAY, OXFORDSHIRE.
Graphical representation of significant geophysical anomalies, October 2001 - March 2003.

SU4993

Positive magnetic anomaly

Raised magnetic anomaly

Negative magnetic anomaly

Area of magnetic disturbance

0 90m

1:2500

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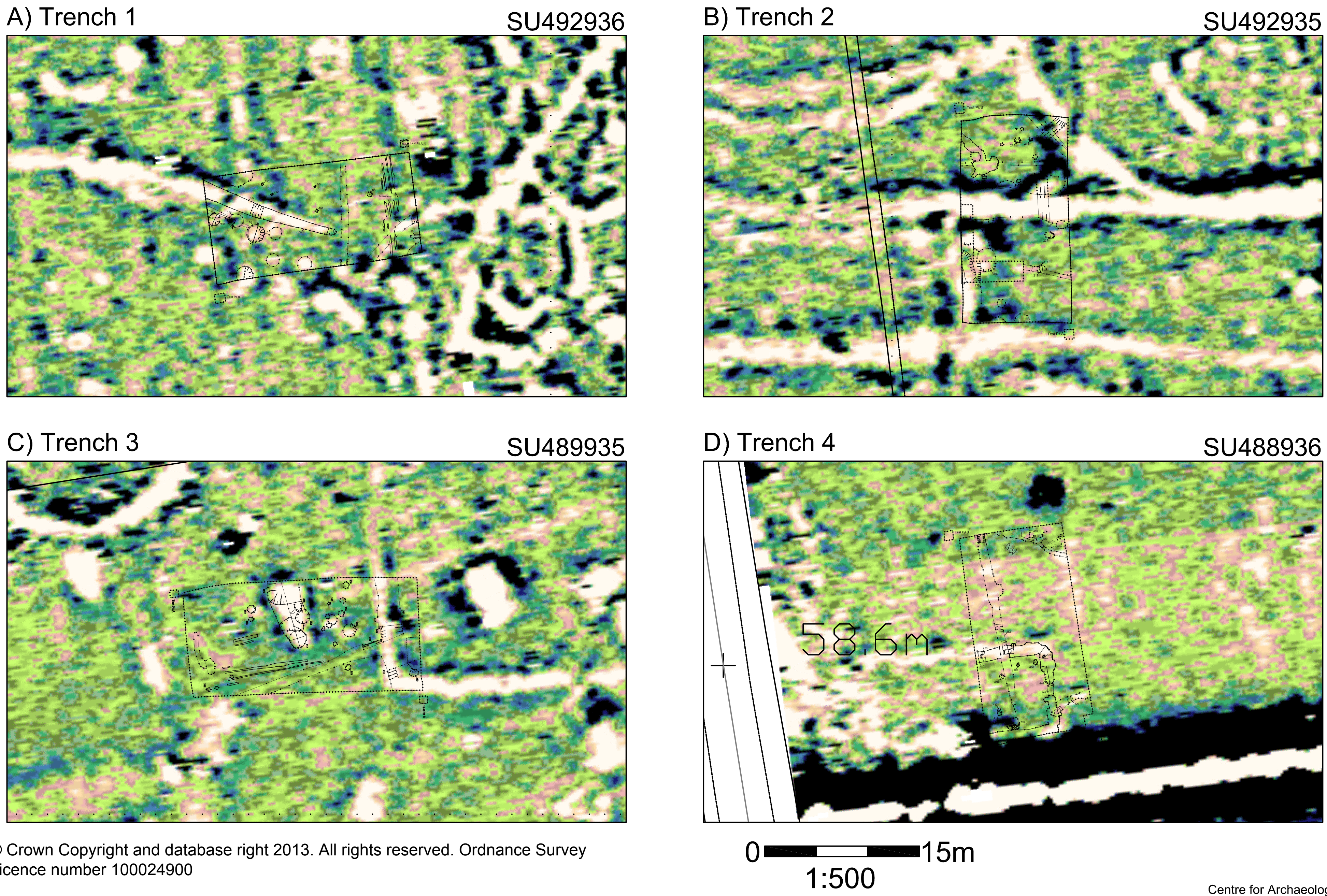
SUTTON COURTENAY, OXFORDSHIRE.

Excavation plans overlaid on magnetometer survey.

Figure 5



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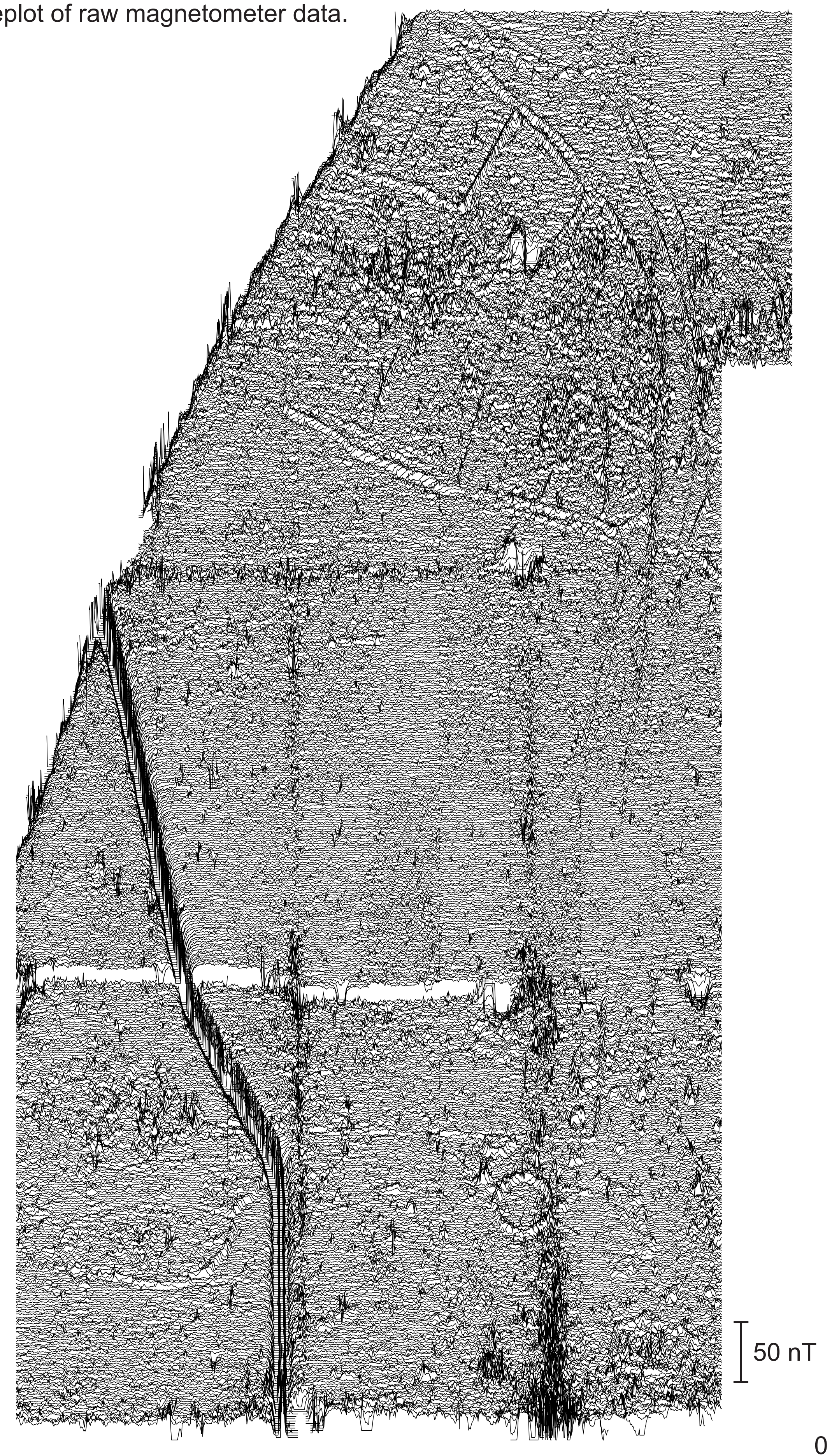
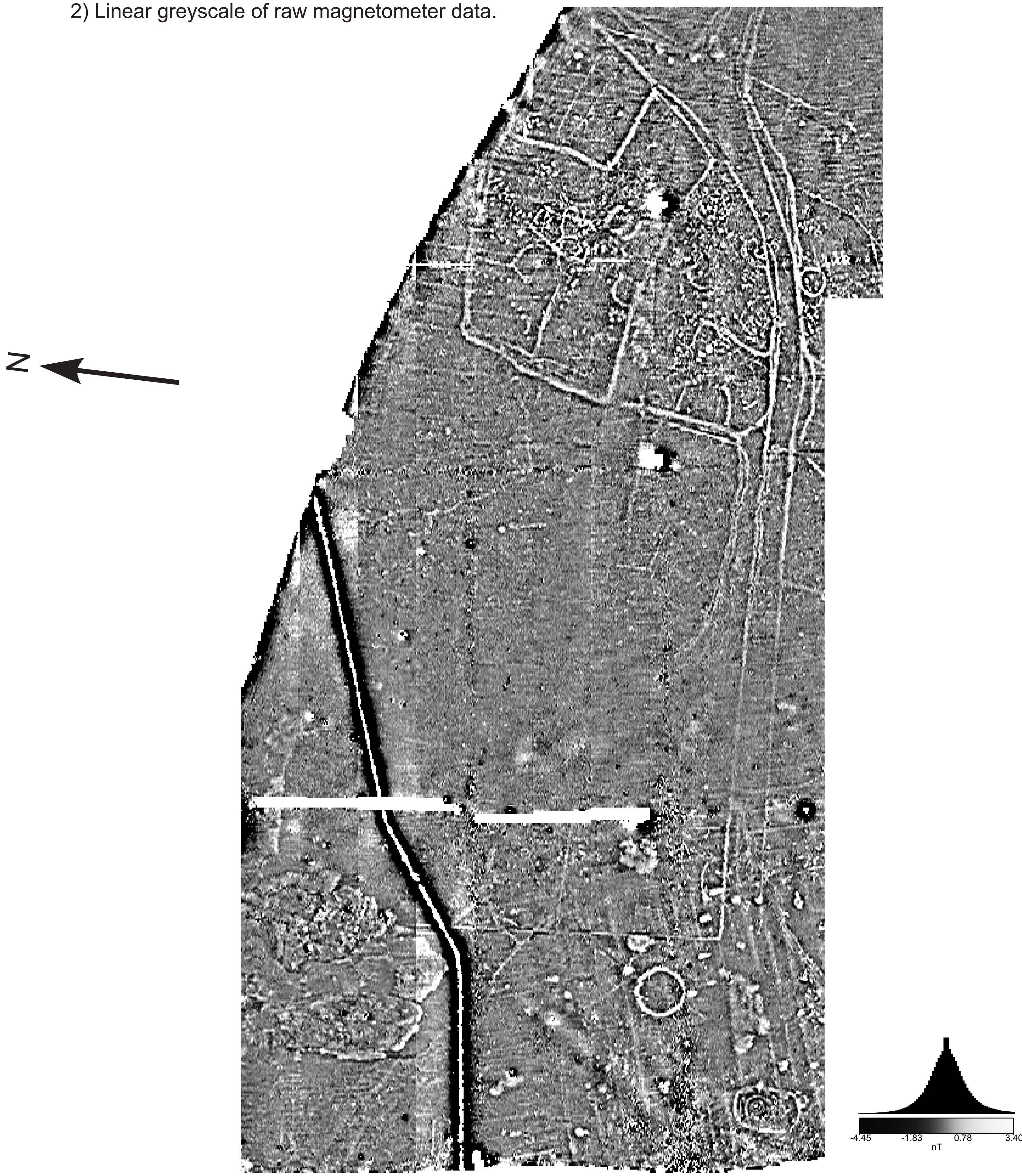
SUTTON COURTENAY, OXFORDSHIRE.
Magnetometer surveys, October 2001, February 2002 and March 2003.

PLAN A

1) Traceplot of raw magnetometer data.



2) Linear greyscale of raw magnetometer data.



0 90m
1:2500

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