Land at Mounton Road
Chepstow
Monmouthshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey, covering 12 hectares of land to the west of Chepstow, was carried out to inform the submission of a planning application. Although the site borders a Roman road to the east, and a second Roman road is thought to cross the southern tip of the site, no anomalies of definite archaeological origin have been identified. Two vague linear trends in the data may indicate flanking ditches either side of the Newnham to Caerleon Roman road in the south but no anomalies indicative of roadside activity have been located. Numerous linear anomalies caused by recent and post-medieval ploughing, field drains, 19th century field boundaries (now removed) and pipes have been located. On the basis of the geophysical survey, the archaeological potential of the site is considered to be low across the majority of the site and low to moderate along the eastern and southern site boundaries adjacent to the Roman roads.

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Report Information

Client:	Taylor Wimpey UK Ltd
Address:	
Report Type:	Geophysical Survey
Location:	Chepstow
County:	Monmouthshire
Grid Reference:	ST 525 932
Period(s) of activity represented:	Roman?
Report Number:	2459
Project Number:	4041
Site Code:	CHE13
Planning Application No.:	Pre-application
Museum Accession No.:	n/a
Date of fieldwork:	April 2013
Date of report:	April 2013
Project Management:	Sam Harrison BSc MSc AIfA
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Report:	Alistair Webb BA MIfA
Illustrations:	Sam Harrison
Photography:	Site Staff
Research:	n/a

Authorisation for distribution: ---

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1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by Andrew Crutchley of the Environmental Dimension Partnership (EDP), on behalf of Taylor Wimpey UK Ltd, to undertake a geophysical (magnetometer) survey of land on the western edge of Chepstow, Monmouthshire (see Fig. 1) to inform the submission of a planning application for a proposed housing development.

Site location, topography and land-use

The Proposed Development Area (PDA) comprises a roughly triangular block of agricultural land, centred at ST 525 193, that covers approximately 12 hectares. It is bounded to the east by the A446, which follows the line of a former Roman road (see below) and to the south by the A48, which is thought to possibly follow a second Roman road (see Fig. 2). Saint Lawrence Lane borders the site to the west, with a small stand of trees along the northern edge which borders onto Mounton Road. The survey area comprises six fields, situated at around 60m above Ordnance Datum (aOD), all of which are under permanent pasture (see Plates). The survey was carried out between April 8th and April 12th 2013.

Soils and geology

The underlying bedrock geology comprises Black Rock Limestone Subgroup – Dolostone. There are no superficial deposits. The soils in this area are classified in the Eardiston 1 soil association, characterised as well-drained, reddish, coarse loams over sandstone (Soil Survey of England and Wales 1983).

2 Archaeological and Historical Background

Whilst there is some evidence for prehistoric activity in the local area, especially to the north, the known archaeological potential of the site relates primarily to the Roman period, with the road from Monmouth to Chepstow (Margary Road no. 6d - now the A446) forming the eastern site boundary and the road from Newnham to Caerleon (Margary Road no. 60a) projected to cross the southern tip of the site (see Fig. 2). Given the possibility of roadside features contemporary with the roads, the PDA was considered to have a high potential for currently unknown archaeological features prior to the commencement of the fieldwork.

3 Aims, Methodology and Presentation

The general objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any magnetic anomalies identified;

- to therefore determine the presence/absence and extent of any buried archaeological features; and
- to prepare a report summarising the results of the survey.

Magnetometer survey

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble 5800 model). Bartington Grad601 magnetic gradiometers were used during the survey, taking readings at 0.25m intervals on zig-zag traverses 1m apart within 30m by 30m grids, so that 3600 readings were recorded in each grid. These readings were stored in the memory of the instrument and later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) software was used to process and present the data. Further details are given in Appendix 1.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 is a large scale (1:2000) location plan displaying the processed magnetic data and field numbers. Figure 3 is an overall data interpretation plot at the same scale. Detailed data plots (‘raw’ and processed) and full interpretative figures are presented at a scale of 1:1000 in Figures 4 to 12 inclusive.

Further technical information on the equipment used, data processing and survey methodologies are given in Appendix 1 and Appendix 2. Appendix 3 describes the composition and location of the site archive.

The survey methodology, report and any recommendations comply with the Project Design (Harrison 2013), and guidelines outlined by English Heritage (David *et al* 2008) and by the Institute for Archaeologists (IfA 2010). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty’s Stationery Office (© Crown copyright).

The figures in this report have been produced following analysis of the data in ‘raw’ and processed formats and over a range of different display levels. All figures are presented to most suitably display and interpret the data from this site based on the experience and knowledge of Archaeological Services staff.

4 Results (see Figs 4 – 12 inclusive)

Ferrous Anomalies

Individual iron ‘spike’ anomalies are ubiquitous across the whole of the site, as they are on most fields. These anomalies are caused by ferrous debris on the surface of the field or incorporated into the plough soil. Unless there is any other supporting evidence for an archaeological interpretation, or any obvious clustering that might imply an archaeological origin, they are not considered to be archaeologically significant.

A large dipolar linear anomaly, **A**, running along the boundaries between Fields 3, 4 and 5 locates a sub-surface pipe. Other linear bands of magnetic disturbance around the periphery of the site locate other services and/or the proximity of ferrous material in the boundary itself. A second linear anomaly, **B**, running broadly north/south through Field 2 and Field 3, and a third, **C**, crossing Field 6, also locate buried pipes.

Agricultural Anomalies

Linear trend anomalies on a variety of differing alignments have been identified across most parts of the site. All are interpreted as being due to post-medieval agricultural activity.

The more closely spaced parallel anomalies, such as those in Field 2 and Field 3, which are aligned north-west/south-east, reflect the direction of cultivation. To the south of Field 2, more widely spaced and slightly sinuous anomalies, aligned south-west/north-east are considered more likely to be caused by the post-medieval agricultural practice of ridge and furrow ploughing. The characteristic striped appearance to the data is a result of the magnetic contrast between the now soil-filled furrows and the former ridges. The much straighter and more regularly (and widely) spaced linear trends, such as those in Field 1 (aligned south-east/north-west) and Field 4 (on the same alignment), are interpreted as field drains.

Linear and curvilinear anomalies **D**, **E** and **F**, locate former field boundaries which have been removed since the publication of the first edition Ordnance Survey map. These former boundaries and some of the ploughing trends described above are still clearly visible on current GoogleEarth images of the site.

Geological Anomalies

Numerous discrete anomalies (areas of magnetic enhancement) have been identified throughout the site. These are particularly prominent at the northern end, particularly in Field 6 and to a lesser extent in Field 5. Field 6 is shown on the first edition mapping as an area of woodland or perhaps an orchard and Field 5 is also shown with partial tree cover. It is considered possible that these anomalies may be due to tree root action that has eroded depressions in the sedimentary bedrock, which, when the roots have rotted away, become filled with soil thus causing a discrete anomaly. Elsewhere across the site, similar anomalies may also be due to soil filling other cavities and depressions in the bedrock. There are noticeably fewer of these anomalies in Field 1, where the magnetic background is much more uniform relative to the rest of the site.

Archaeological? Anomalies

The remaining anomalies do not obviously fall into one of the above categories and have therefore been ascribed a possible archaeological origin.

At the southern end of the site, in Field 1, two vague linear trends, **G** and **H**, have been identified. These anomalies are on the same south-west/north-east alignment, and in the presumed location, as a Roman road (see Fig. 3); the anomalies are considered to be caused by the soil-filled roadside ditches, rather than the former road surface.

A cluster of short linear and discrete anomalies, **I**, have been noted very close to the eastern site boundary. Due to their proximity to the line of a former Roman road, these anomalies have been interpreted as being potentially archaeological. However, this interpretation is considered to be tentative and a more prosaic cause is considered equally plausible.

5 Discussion and Conclusions

Anomalies of agricultural origin have been clearly identified across the whole of the survey area, suggesting that if there had been archaeological features present they too would most probably have been located. However, no anomalies of unambiguous archaeological origin have been identified by the geophysical survey. The possible line of a Roman road has tentatively been located, in the far south, but the anomalies are extremely weak. The magnetic background in this (southern) part of the site is comparatively uniform here (Field 1) and it is considered likely that any major archaeological activity adjacent to the Roman road, if present, would have been identified. However, as ever, there is always a chance that there may be small isolated features, such as pits, that may be too small to be identified.

Similarly, no anomalies of obvious archaeological potential are identified close to the eastern site boundary, where the modern road (A446) also follows the route of a Roman road. Even so a cluster of anomalies of unknown origin have been highlighted as being of possible interest. However, non-archaeological causes are considered equally likely.

Overall, on the basis of the geophysical survey, the archaeological potential of the site is assessed as being ‘low’ and ‘low to moderate’ adjacent to the lines of the former Roman roads.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-

archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.

Appendix 1: Magnetic survey - technical information

Magnetic Susceptibility and Soil Magnetism

Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. The magnetic susceptibility of a soil can also be enhanced by the application of heat and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough. An advantage of magnetic susceptibility over magnetometry is that a certain amount of occupational activity will cause the same proportional change in susceptibility, however weakly magnetic is the soil, and so does not depend on the magnetic contrast between the topsoil and deeper layers. Susceptibility survey is therefore able to detect areas of occupation even in the absence of cut features. On the other hand susceptibility survey is more vulnerable to the masking effects of layers of colluvium and alluvium as the technique, using the Bartington system, can generally only measure variation in the first 0.15m of ploughsoil.

Types of Magnetic Anomaly

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes)

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend

This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

Methodology: Magnetic Susceptibility Survey

There are two methods of measuring the magnetic susceptibility of a soil sample. The first involves the measurement of a given volume of soil, which will include any air and moisture that lies within the sample, and is termed volume specific susceptibility. This method results in a bulk value that it not necessarily fully representative of the constituent components of the sample. For field surveys a Bartington MS2 meter with MS2D field loop is used due to its speed and simplicity. The second technique overcomes this potential problem by taking into account both the volume and mass of a sample and is termed mass specific susceptibility. However, mass specific readings cannot be taken in the field where the bulk properties of a soil are usually unknown and so volume specific readings must be taken. Whilst these values are not fully representative they do allow general comparisons across a site and give a broad indication of susceptibility changes. This is usually enough to assess the susceptibility of a site and evaluate whether enhancement has occurred.

Methodology: Gradiometer Survey

There are two main methods of using the fluxgate gradiometer for commercial evaluations. The first of these is referred to as ***magnetic scanning*** and requires the operator to visually identify anomalous responses on the instrument display panel whilst covering the site in widely spaced traverses, typically 10m apart. The instrument logger is not used and there is therefore no data collection. Once anomalous responses are identified they are marked in the field with bamboo canes and approximately located on a base plan. This method is usually employed as a means of selecting areas for detailed survey when only a percentage sample of the whole site is to be subject to detailed survey.

The disadvantages of magnetic scanning are that features that produce weak anomalies (less than 2nT) are unlikely to stand out from the magnetic background and so will be difficult to detect. The coarse sampling interval means that discrete features or linear features that are parallel or broadly oblique to the direction of traverse may not be detected. If linear features are suspected in a site then the traverse direction should be perpendicular (or as close as is possible within the physical constraints of the site) to the orientation of the suspected features. The possible drawbacks mentioned above mean that a ‘negative’ scanning result should be validated by sample detailed magnetic survey (see below).

The second method is referred to as ***detailed survey*** and employs the use of a sample trigger to automatically take readings at predetermined points, typically at 0.25m intervals, on zig-zag traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation. Detailed survey allows the visualisation of weaker anomalies that may not have been detected by magnetic scanning.

During this survey a Bartington Grad601 magnetic gradiometer was used taking readings on the 0.1nT range, at 0.25m intervals on zig-zag traverses 1m apart within 30m by 30m square grids. The instrument was checked for electronic and mechanical drift at a common point and calibrated as necessary. The drift from zero was not logged.

Data Processing and Presentation

The detailed gradiometer data has been presented in this report in XY trace and greyscale formats. In the former format the data shown is 'raw' with no processing other than grid biasing having been done. The data in the greyscale images has been interpolated and selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

An XY plot presents the data logged on each traverse as a single line with each successive traverse incremented on the Y-axis to produce a 'stacked' plot. A hidden line algorithm has been employed to block out lines behind major 'spikes' and the data has been clipped. The main advantage of this display option is that the full range of data can be viewed, dependent on the clip, so that the 'shape' of individual anomalies can be discerned and potentially archaeological anomalies differentiated from 'iron spikes'. Geoplot 3 software was used to create the XY trace plots.

Geoplot 3 software was used to interpolate the data so that 3600 readings were obtained for each 30m by 30m grid. The same program was used to produce the greyscale images. All greyscale plots are displayed using a linear incremental scale.

Appendix 2: Survey location information

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble 5800 model). The accuracy of this equipment is better then 0.01m. The locations of the survey grid and anomalies are available as a DXF file. The internal accuracy of these markers is better than 0.01m.

Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

Appendix 3: Geophysical archive

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS2 and AutoCAD 2008) files; and

- a full copy of the report.

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the Monmouthshire Historic Environment Record).

Bibliography

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Institute for Archaeologists, 2010. *Standard and Guidance for archaeological geophysical survey.* IfA

Soil Survey of England and Wales, 1983. *Soil Survey of England and Wales: Soils of Eastern England*, Sheet 4

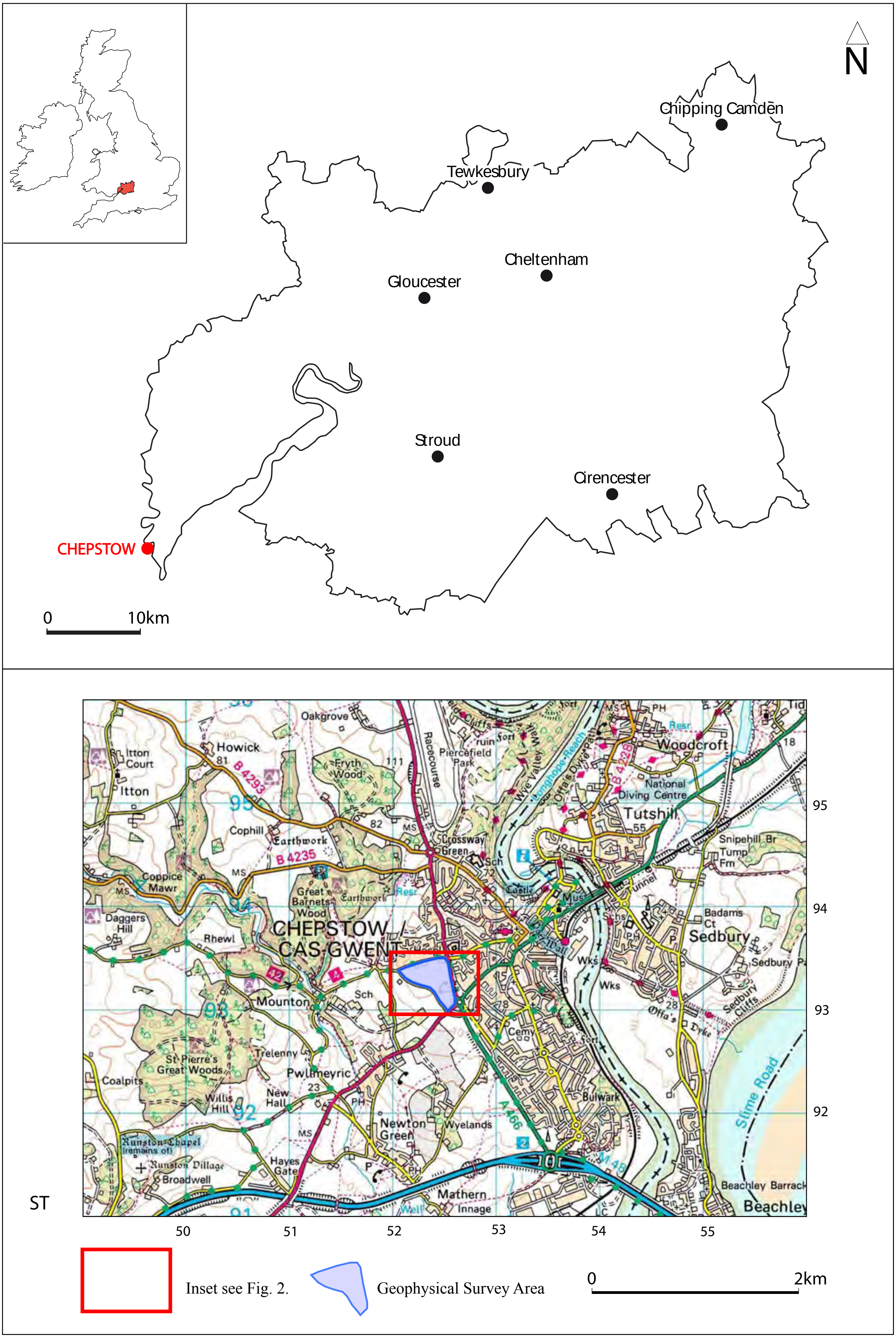

Fig. 1. Site location

Fig. 2. Site location showing greyscale magnetometer data (1:2000 @ A3)

0 80m

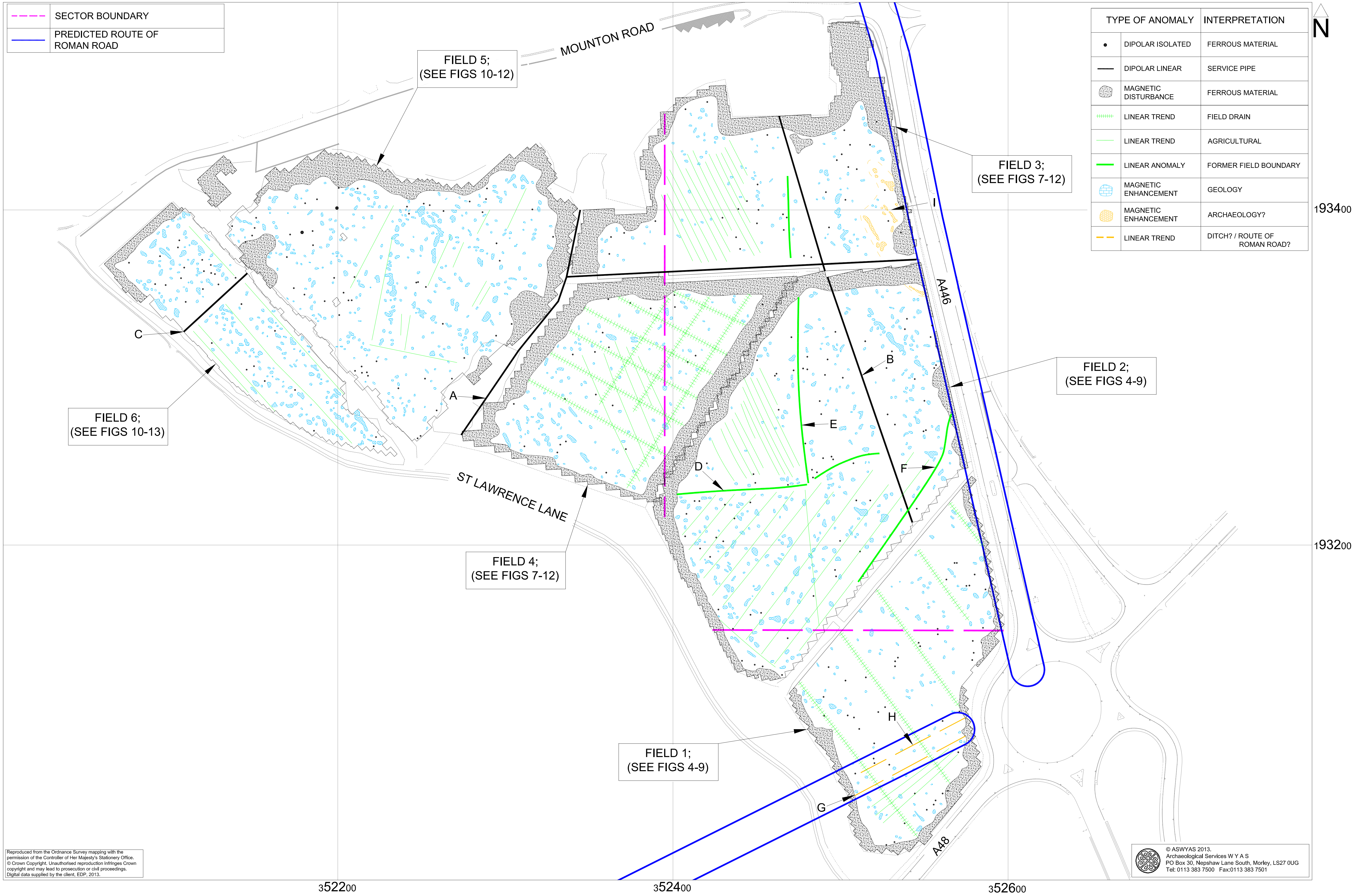

Fig. 3. Overall interpretation of magnetometer data (1:2000 @ A3)

0 80m

Fig. 4. Processed greyscale magnetometer data; Fields 1 and 2 (1:1000 @ A4)

Fig. 5. XY trace plot of minimally processed magnetometer data; Fields 1 and 2 (1:1000 @ A4)

0 40m

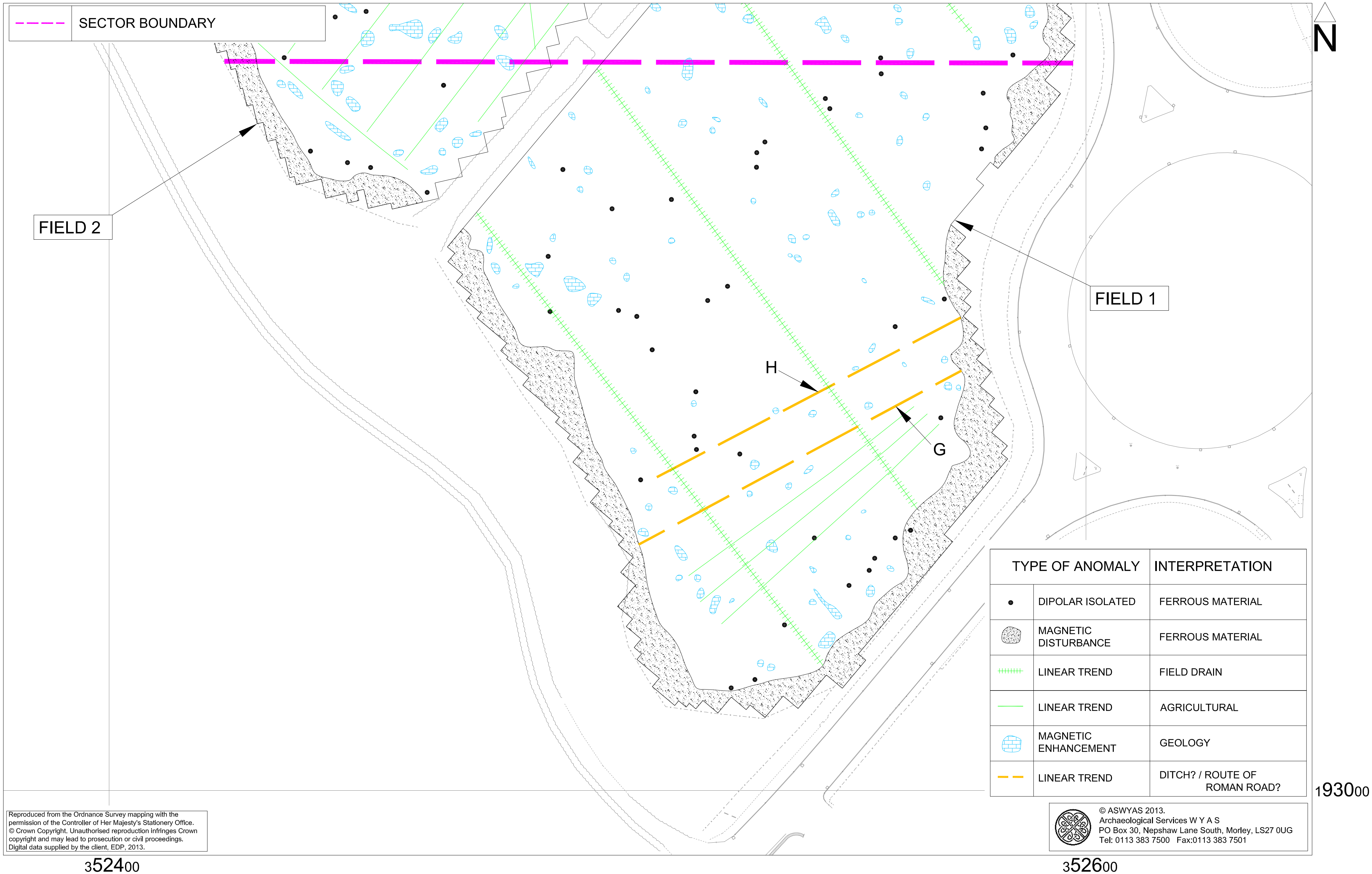

Fig. 6. Interpretation of magnetometer data; Fields 1 and 2 (1:1000 @ A4)

0 40m

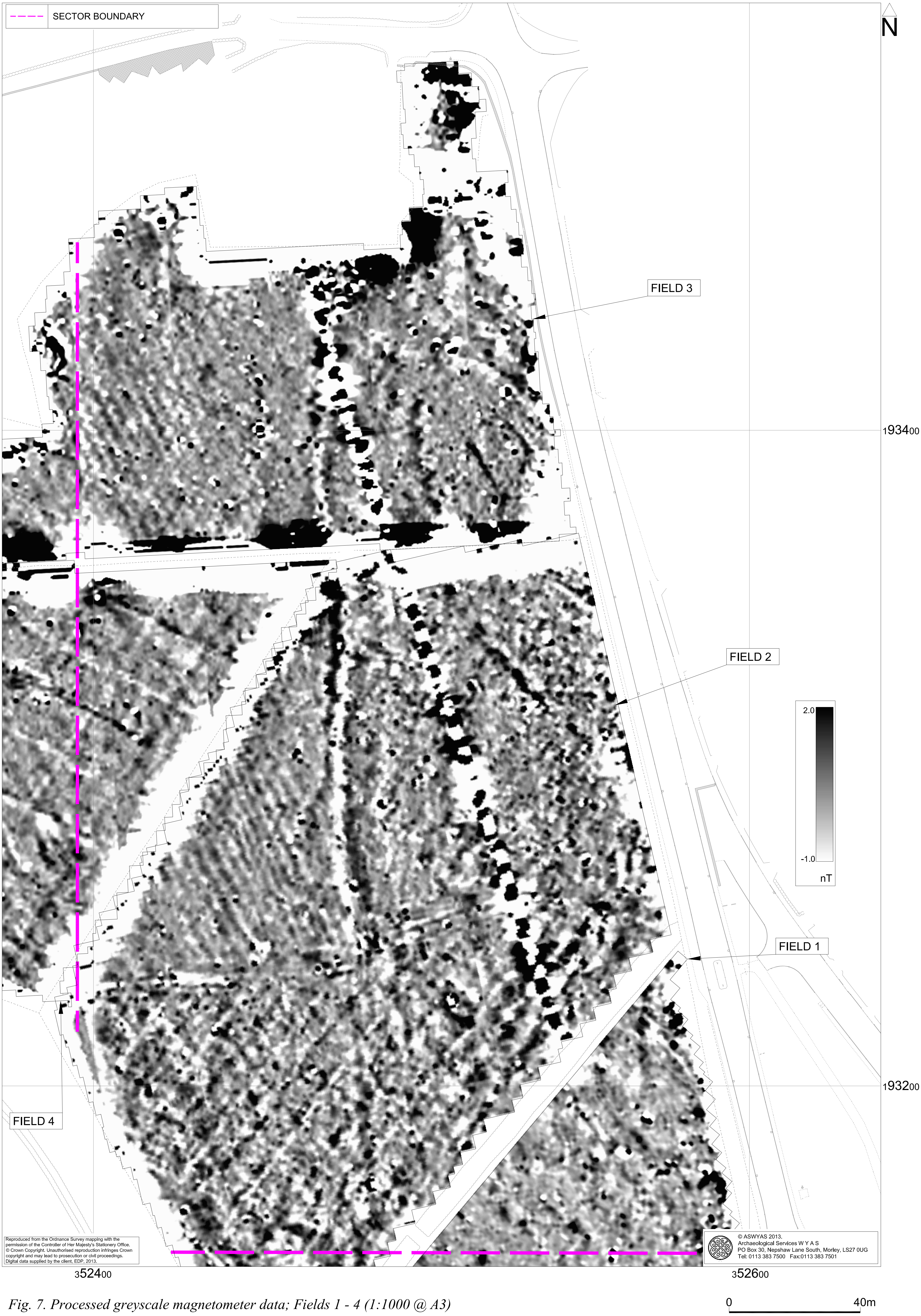

Fig. 7. Processed greyscale magnetometer data; Fields 1 - 4 (1:1000 @ A3)

Fig. 8. XY trace plot of minimally processed magnetometer data; Fields 1 - 4 (1:1000 @ A3)

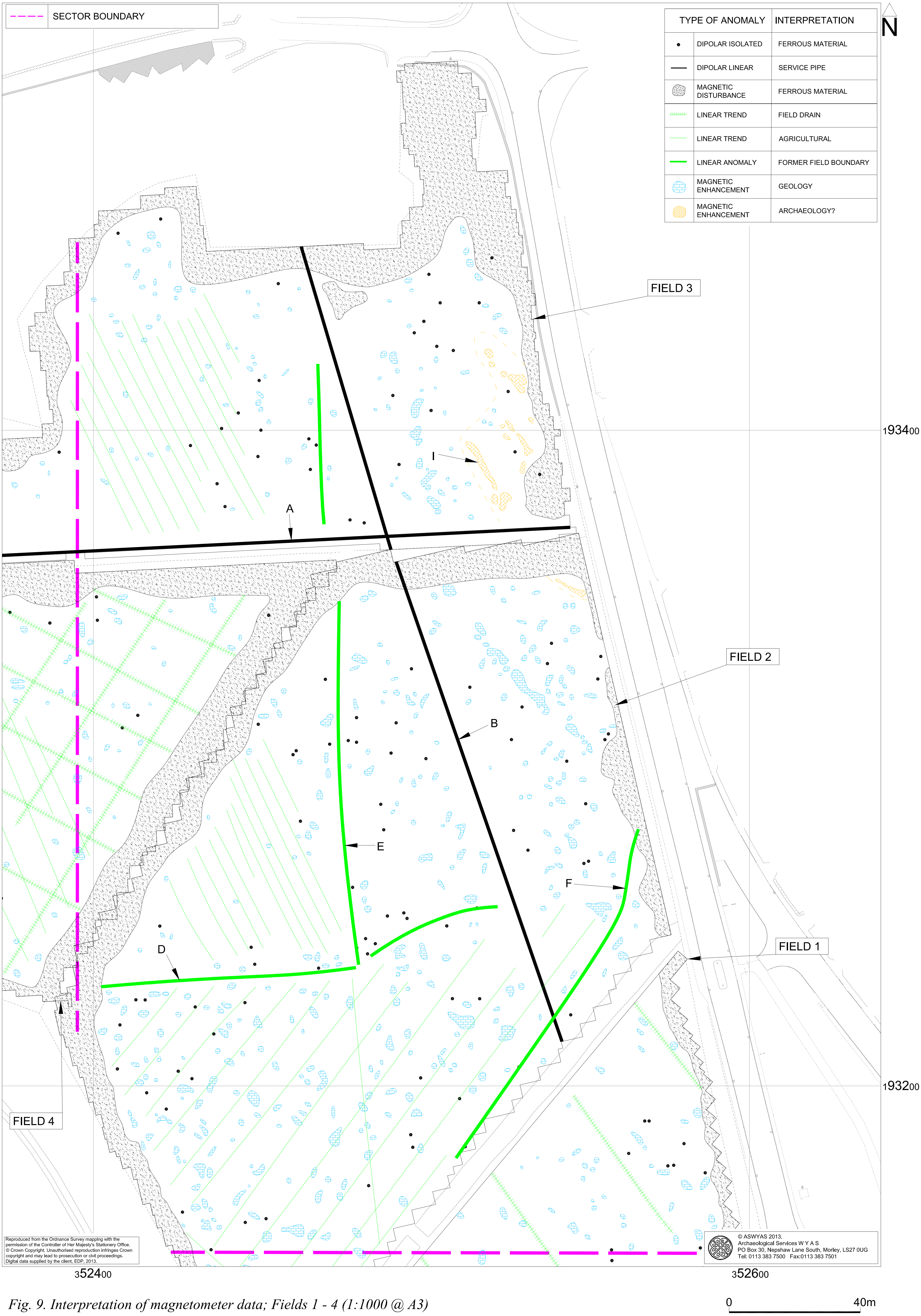

Fig. 9. Interpretation of magnetometer data; Fields 1 - 4 (1:1000 @ A3)

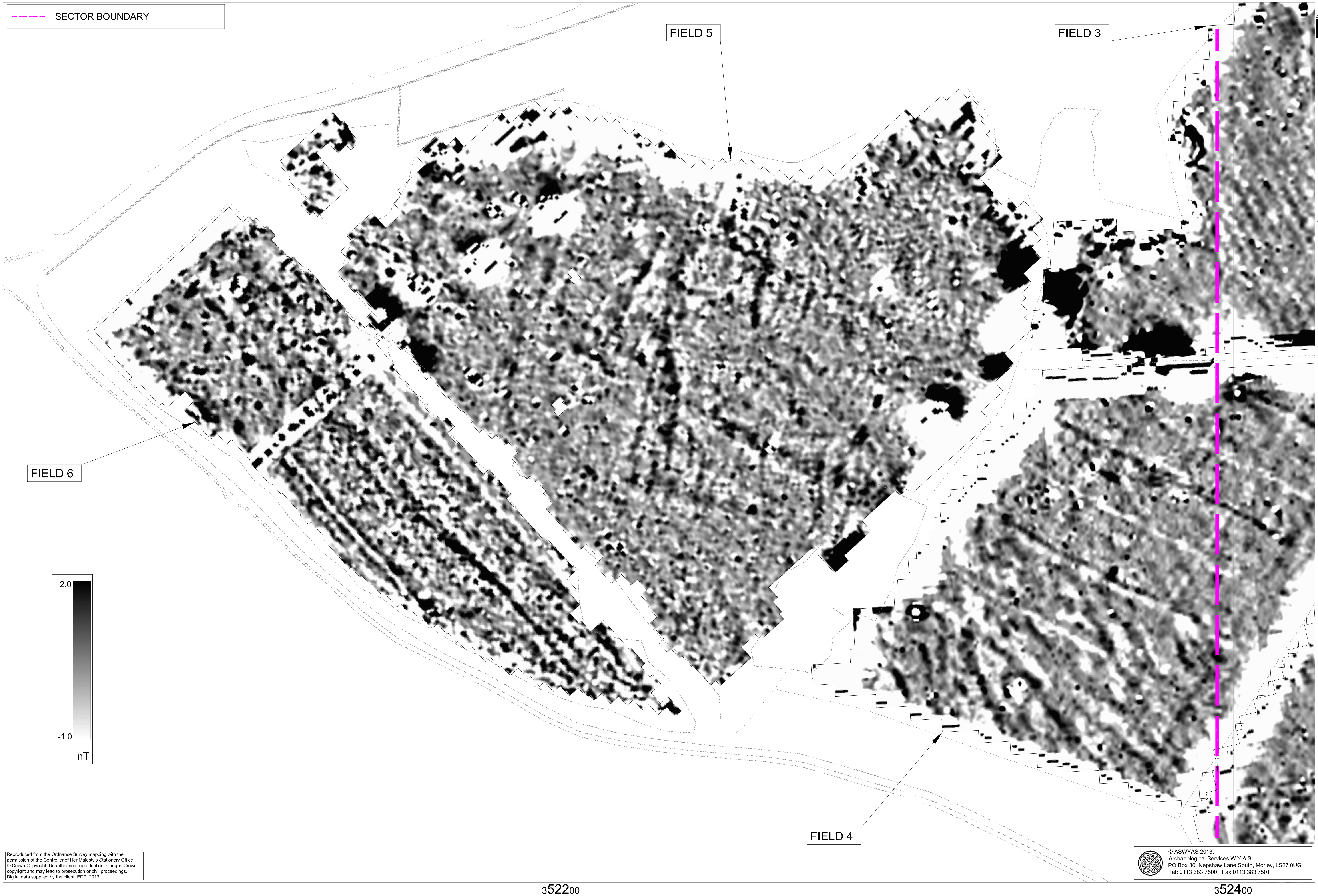

Fig. 10. Processed greyscale magnetometer data; Fields 3 - 6 (1:1000 @ A3)

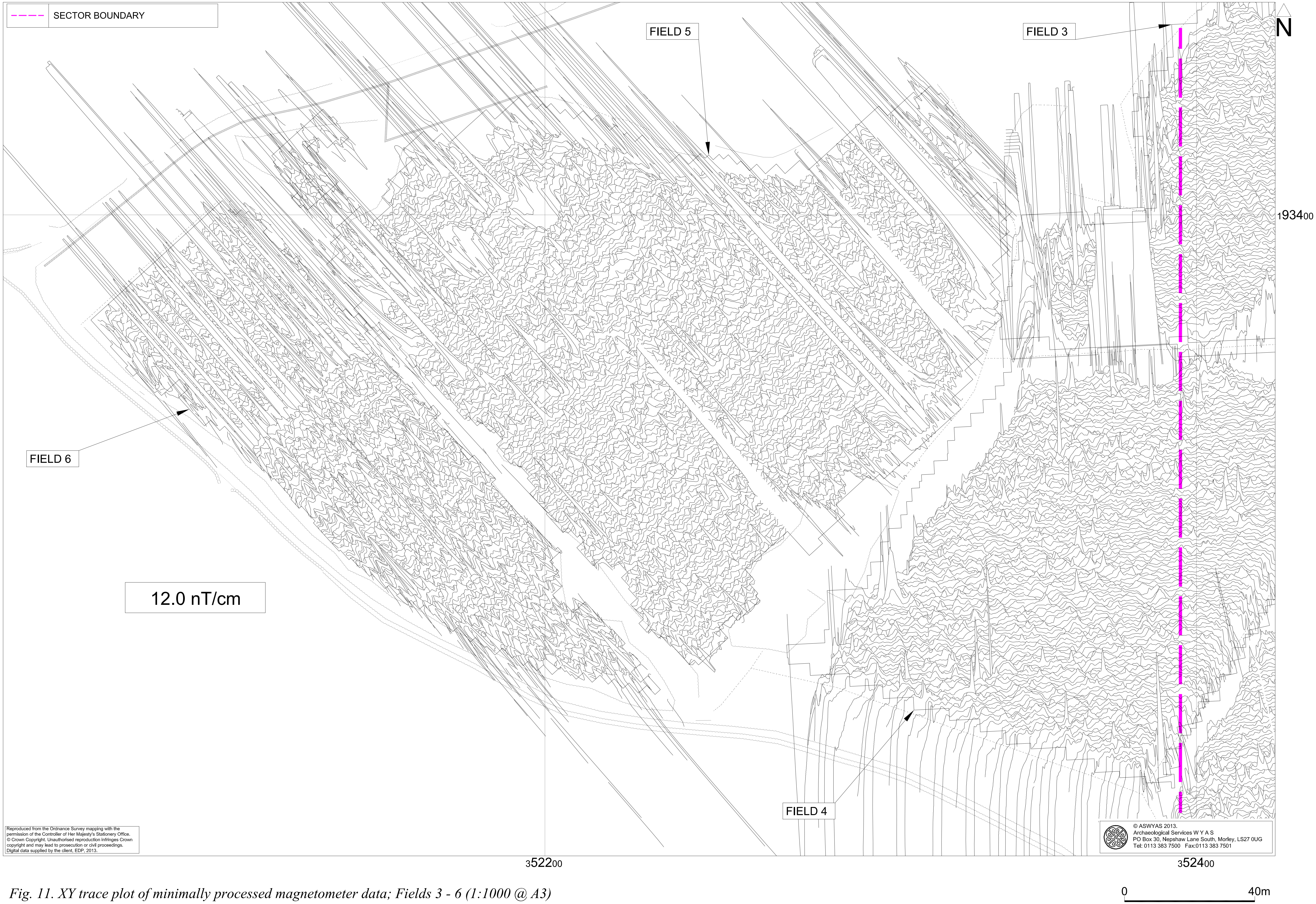

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Fig. 11. XY trace plot of minimally processed magnetometer data; Fields 3 - 6 (1:1000 @ A3)

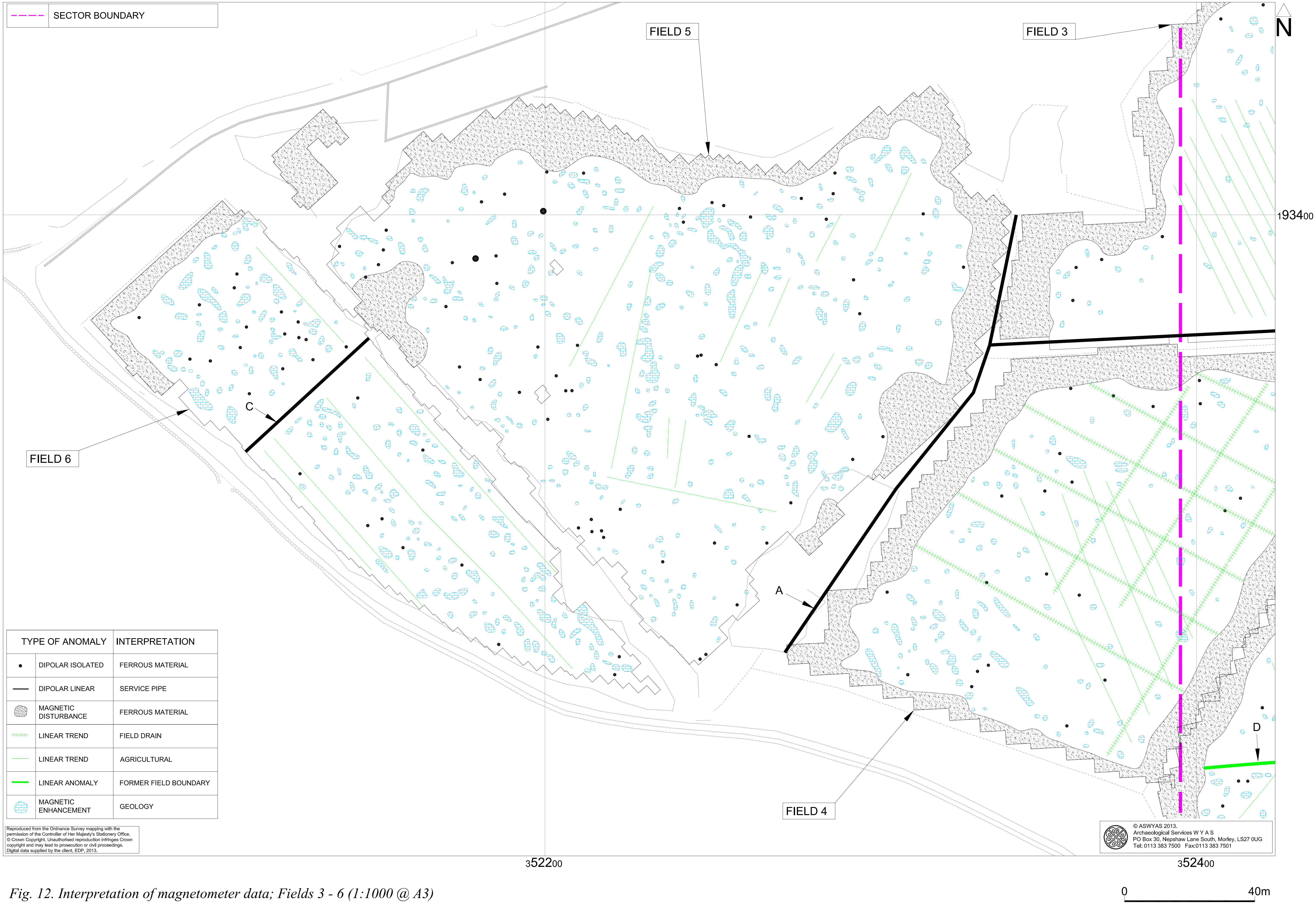

Fig. 12. Interpretation of magnetometer data; Fields 3 - 6 (1:1000 @ A3)