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Home Farm
Kirkby Fleetham
North Yorkshire

Geophysical Survey

January 2010

Report No. 2019

CLIENT

Field Archaeology Specialists Ltd.

Home Farm
Kirkby Fleetham
North Yorkshire

Geophysical Survey

Summary

A sample geophysical (magnetometer) survey covering 15 hectares in 30m wide transects was carried out at the proposed site of a gravel quarry near Kirkby Fleetham. Numerous anomalies have been identified in all of the survey transects. However, the overwhelming majority can be attributed directly or indirectly to features such as field boundaries, trackways, a plantation and river defences shown on the first edition Ordnance Survey map of 1857. In addition others are due to ploughing or to land drainage. Given the nature of the superficial geology many of the discrete anomalies that have been identified are considered likely to be due to variation in the soils and drift. Whilst no anomalies have been identified as having a definite archaeological potential several have been identified that could be caused by underlying archaeological features. However, on balance, taking account of the location of the site, it is considered likely that a non-archaeological cause for the majority of these anomalies is probable. Therefore, on the basis of the geophysical survey undertaken to date the site is considered as having a low archaeological potential.

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Report Information

Client:	Field Archaeology Specialists Ltd
Address:	Unit 8, Fulford Business Centre, 35 Hospital Fields Road, York YO10 4DZ
Report Type:	Geophysical survey
Location:	Kirkby Fleetham
County:	North Yorkshire
Grid Reference:	SE 2815 9605
Period(s) of activity represented:	n/a
Report Number:	2019
Project Number:	3498
Site Code:	KIR09
Planning Application No.:	pre-determination
Museum Accession No.:	-
Date of fieldwork:	November 2009
Date of report:	January 2010
Project Management:	Sam Harrison BSc MSc AIfA
Fieldwork:	Sam Harrison Alex Harrison BSc Ian Wilkins BSc MSc
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Illustrations:	Sam Harrison
Photography:	n/a
Research:	n/a
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1 Introduction

Archaeological Services WYAS was commissioned by Cecily Spall of Field Archaeology Specialists Ltd (FAS) to undertake a geophysical (magnetometer) survey at Home Farm, Kirkby Fleetham in North Yorkshire (see Fig. 1).

The geophysical survey is the first element of a staged programme of archaeological evaluation that will inform the Environmental Impact Assessment and allow North Yorkshire County Council to make an informed decision on any planning application. The aim of the evaluation is to determine the nature, extent and significance of the archaeological resource and provide sufficient detail to allow the scope of mitigation to be designed with confidence.

Site location, topography and land use

The site covers an area of approximately 140 hectares site with Home Farm (SE 280 960) lying to the centre of the site, just north of Kirkby Fleetham Hall. The survey covered approximately 15 hectares in seven 30m wide transects, whose location was determined by the client. The transects were aligned north/south from David's Wood and Kirkby Wood on the southern boundary to the River Swale on the northern edge. Hookcar Hill lies to the west of the site with Lowfield Lane and North Lowfield Farm to the east. Kirkby Lane bisects the area.

At the time of survey most of the site consisted of large, newly sown, arable fields. A few small pasture fields lie to the south and east of Home Farm and two plantations (Park and Low Birch) are located to the east of the farm. The site is generally flat forming part of the river Swale flood plain, with Fiddale Beck cutting through the north-west corner of the site and feeding into the river. The topography varies from 34m above Ordnance Datum in the south-east to 40m aOD in the west. The river defences run along the northern edge of the site forming a significant embankment with a scarp slope marking the southern extent of the flood plain.

Geology and soils

The geology comprises Upper Permian Marl (Roxby Formation) to the west and Triassic Sherwood Sandstones to the east. This is overlain by alluvial gravel deposits from the river Swale. The soils are classified in the Alun association being described as deep, stoneless, permeable coarse loams over gravel.

2 Archaeological background

A review of the known archaeological resource of the site and the surrounding area has been undertaken by the client. This information suggests little evidence of Palaeolithic to Neolithic activity within the survey area although locally a number of ritual monuments including cursus monuments, henges and burial enclosures have been identified. Again, although

Bronze and Iron age sites are known within the region, no monuments or finds have been recorded in the survey area. The Roman town of Catterick (*Caractonium*) lies 7km to the north-west of the site and Roman finds have been numerous in the area with spot finds of coins from Low Kiplin and Great Langton just to the north of the site, on the opposite bank of the river Swale.

The village of Kirkby is documented in the Domesday Book suggesting a pre-existing settlement with associated agricultural system. Ridge and furrow has been identified to the east of Kirkby Fleetham Hall within the survey area. The 1857 Ordnance Survey map depicts a number of tracks, field boundaries and river defences which have subsequently been removed with the introduction of large scale and intensive farming techniques (see Fig. 2).

3 Aims, Methodology and Presentation

The general aim of the geophysical survey was to obtain information that would help evaluate the archaeological potential of the site. This information would be included as part of an Environmental Impact Assessment which may be submitted in support of any future planning application. This information will then enable further evaluation, possibly including additional geophysical survey, and/or mitigation measures to be designed as appropriate.

Specifically the aims were:

- To interpret any magnetic anomalies identified by the survey and thereby
- To determine (so far as is possible) the presence or absence of buried archaeological remains in the survey transects and thereby assess the archaeological potential of the site.

These aims were to be achieved by undertaking detailed magnetometer survey along seven 30m wide transects, spaced equidistantly and aligned north/south across the application area. Trees had been planted at the northern end of T1 and around the southern end of T6 precluding survey at these locations (see Fig. 2). The southern half of T5 was next to a metal fence so the transect was shifted eastwards, following discussion with the client, to minimise the magnetic disturbance.

The survey areas were set out using a Trimble RTK dGPS system or a Trimble 5500 Total Station and tied into permanent landscape features which were then superimposed onto a digital Ordnance Survey map base supplied by the client. Survey station positions (wooden stakes) were left along field boundaries to facilitate any future investigations.

Magnetometer survey

Bartington Grad601 instruments were used to take 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. Detailed survey allows the visualisation of weaker anomalies that may not have been readily identifiable by magnetometer (magnetic) scanning.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey mapping is shown in Figure 1. Figure 2 is a more detailed site location showing the magnetometer data and boundaries and features from the 1857, first edition, Ordnance Survey map. The processed greyscale data, the 'raw' XY trace plot data and interpretation figures are presented at a scale of 1:1000 in Figures 3 to 38 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 Methodology (Archaeological Services 2009) and guidelines outlined by English Heritage (David *et al* 2008) and by the IfA (Gaffney, Gater and Ovenden 2002). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright – OS Licence No. 100023320).

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 and Discussion

Magnetometer Survey

Where obvious and confident interpretations can be made or anomalies are deemed possibly significant they have been annotated on the interpretation figures for ease of discussion. Otherwise generic typological interpretations apply as described below.

Ferrous, dipolar anomalies/areas of magnetic disturbance

Ferrous anomalies either as individual "spikes" or more extensive areas of magnetic disturbance are typically caused by ferrous (magnetic) material, either on the ground surface or in the topsoil. Little importance is normally given to such anomalies unless there is any supporting evidence for an archaeological interpretation, as modern ferrous objects or material are common on rural sites, often being present as a consequence of manuring, deliberate infilling or fly tipping. Iron spike anomalies are present in all of the survey transects and for most there is no obvious pattern or clustering to their distribution (other than along former boundaries or adjacent to Fiddale Beck) to suggest anything other than random ferrous debris in the plough-soil. One possible exception is in T2, north, where five spikes (Fig 5 - **A**) aligned north-west/south-east have been identified. On balance it is considered likely that this is a chance alignment of ferrous debris and therefore not of any archaeological significance.

Two large ferrous responses in T6, centre (Fig. 32 - **C1**) and T7 (Fig. 38 - **C2**), are due to the metal cladding around the base of electricity poles.

A linear band of spikes (Fig. 29 - **B**) has been identified in T6, north. This correlates with the edge of a former plantation (see Fig. 2) and is probably due to ferrous debris buried in a former boundary.

At the southern edge of T6, south, another broadly linear band of magnetic disturbance (Fig. 35 - **D**) correlates with the position of a track shown on the first edition mapping (see Fig. 2). However, no anomalies are apparent at the other locations where the transects cross the route of former trackways.

Linear anomalies and trends

Linear anomalies are commonly caused by agricultural activity such as ridge and furrow or later ploughing regimes, former (ploughed out) field boundaries or field drains.

The more closely spaced, parallel linear trend anomalies, such as those identified in T5, north (see Fig. 20) are probably indicative of recent ploughing regimes. The stronger, slightly further apart anomalies such as those in T6, centre, and T6, south, are probably due to ridge and furrow ploughing. Here the anomalies are due to the magnetic contrast between the infilled furrows and former ridges.

Many of the field boundaries mapped on the 1857 Ordnance Survey map (see Fig. 2) which are no longer extant also either manifest as magnetic anomalies (for example T1, south – **F** or in T6, south - **P**), can be inferred either by the extent or change in direction of ploughing anomalies, the presence of other non-linear anomalies (for example **Q** – see Fig. 38) or the disturbance on the edge of the former plantation (see Fig. 29 - **B**).

Other linear anomalies (for example **E** – see Fig. 5) could also be a former boundary although it does not correspond with any mapped boundary.

Perhaps the most complex arrangement of linear trends is at the southern end of T2 (see Fig. 8) where numerous trend anomalies on varying alignments are identified. It is likely that some of these anomalies are due to ploughing while others may be due to field drains.

Areas of magnetic enhancement

Numerous discrete anomalies/small areas of magnetic enhancement and short linear anomalies have been identified in all of the transects. It is impossible to give a confident interpretation for many of these anomalies – given the nature of the superficial geology, it is considered likely that many of these discrete anomalies will be due to natural variations in the composition of the soils and the effects of the underlying superficial deposits, although an archaeological cause cannot be discounted. Similarly many of the short linear enhancements could be due to former agricultural activity but could also be caused by infilled archaeological features.

In T3 (see Fig. 14 - **H**), the responses are weak and disjointed, although it may be due to past ploughing trends a geological origin should also be considered. At the southern end of T3 two linear responses, perpendicular to each other have been identified (see Fig. 17 - **I**). Without further information it isn't possible to give a definite interpretation but they are probably of agricultural origin although an archaeological origin cannot be dismissed.

Anomaly **J1** (see Fig. 11), in T4, has no obvious surface origin but as the enhanced response correlates with the mapped location of the 1857 river defence boundary (see Fig. 2) it is assumed that the anomaly is likely to be due to ground disturbance associated with the flood defence. The response from anomaly **J2** in T6, north (see Fig. 29) is more redolent of a pit, but it is also on the line of the 1857 river defence boundary so on balance is also considered to be due to relatively recent activity.

A cluster of discrete anomalies (see Fig. 20 - **L**) in T5, north, correspond with the extent of the former plantation (see Fig. 2). This exact correlation would suggest that the responses are possibly caused by the infilled tree boles following felling. However, no similar anomalies are noted in T6 where the transect also extends across the site of the plantation.

In T5, south, anomalies (**M** & **N**) form distinct linear responses. The ploughing responses to the south of anomaly (**N**) suggest that they may be former field boundaries although an archaeological cause cannot be discounted.

5 Conclusions

Numerous anomalies have been identified in all of the survey transects. However, the overwhelming majority can be attributed directly or indirectly to features such as field boundaries, trackways, a plantation and river defences shown on the first edition Ordnance Survey map of 1857. In addition others are due to ploughing or to land drainage.

Given the nature of the superficial geology many of the discrete anomalies that have been identified are considered likely to be due to variation in the soils and drift.

Whilst no anomalies have been identified as having a definite archaeological potential several have been identified that could be caused by underlying archaeological features. However, on balance, taking account of the location of the site, it is considered likely that a non-archaeological cause for the majority of these anomalies is probable. Therefore, on the basis of the geophysical survey undertaken to date the site is considered as having a low archaeological potential.

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.

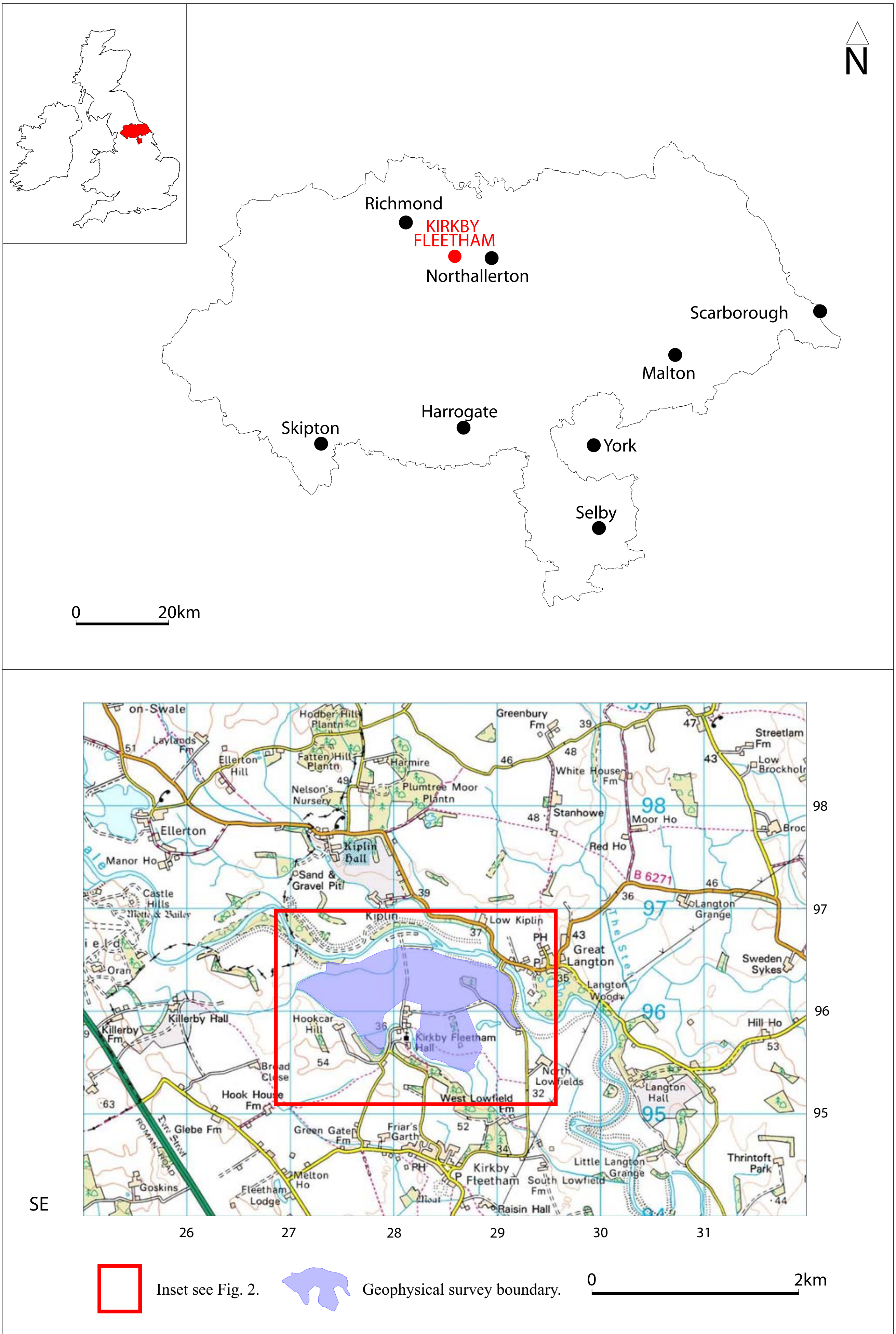

Fig. 1. Site location

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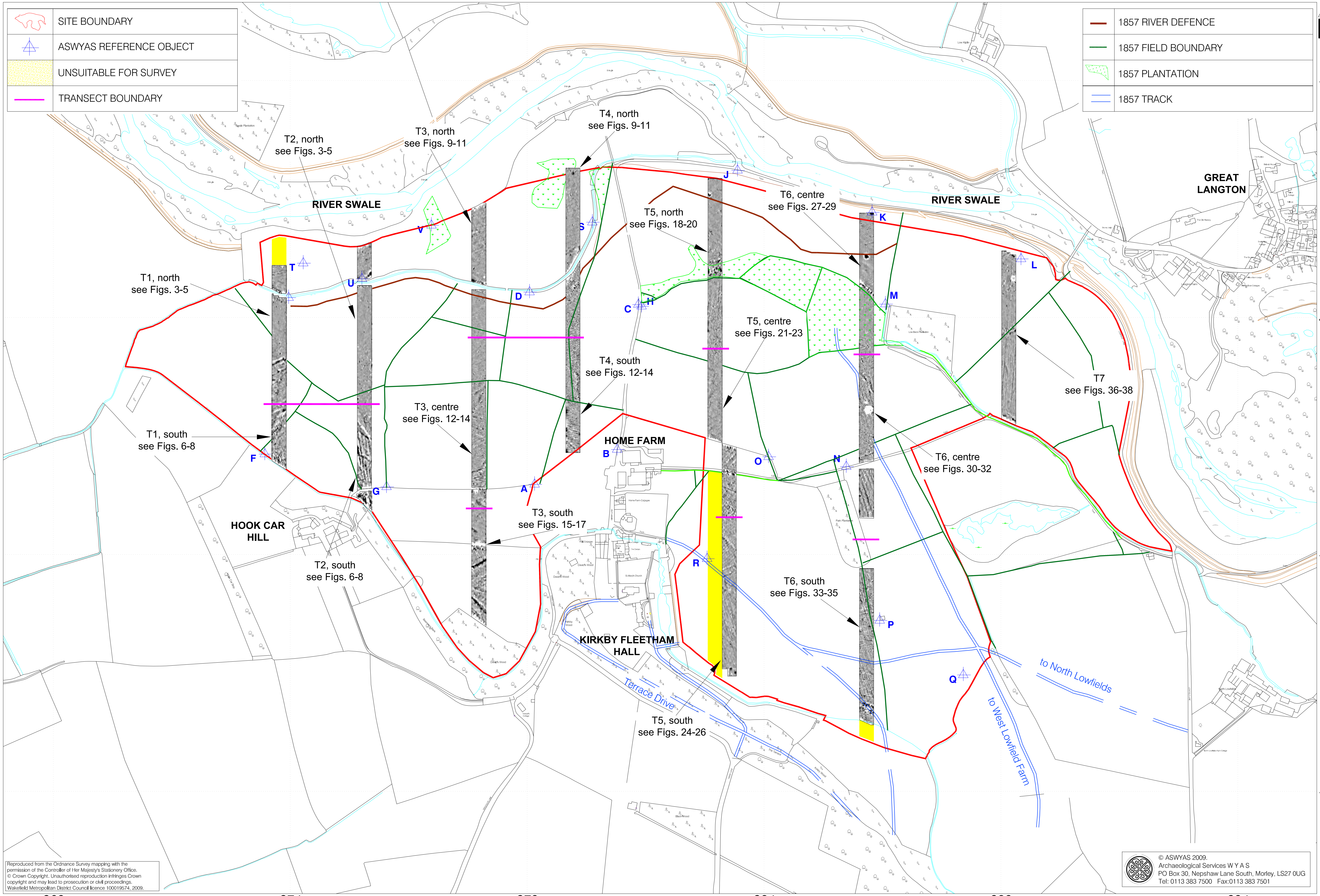


Fig. 2. Site location showing greyscale magnetometer data (1:7500 @ A3)

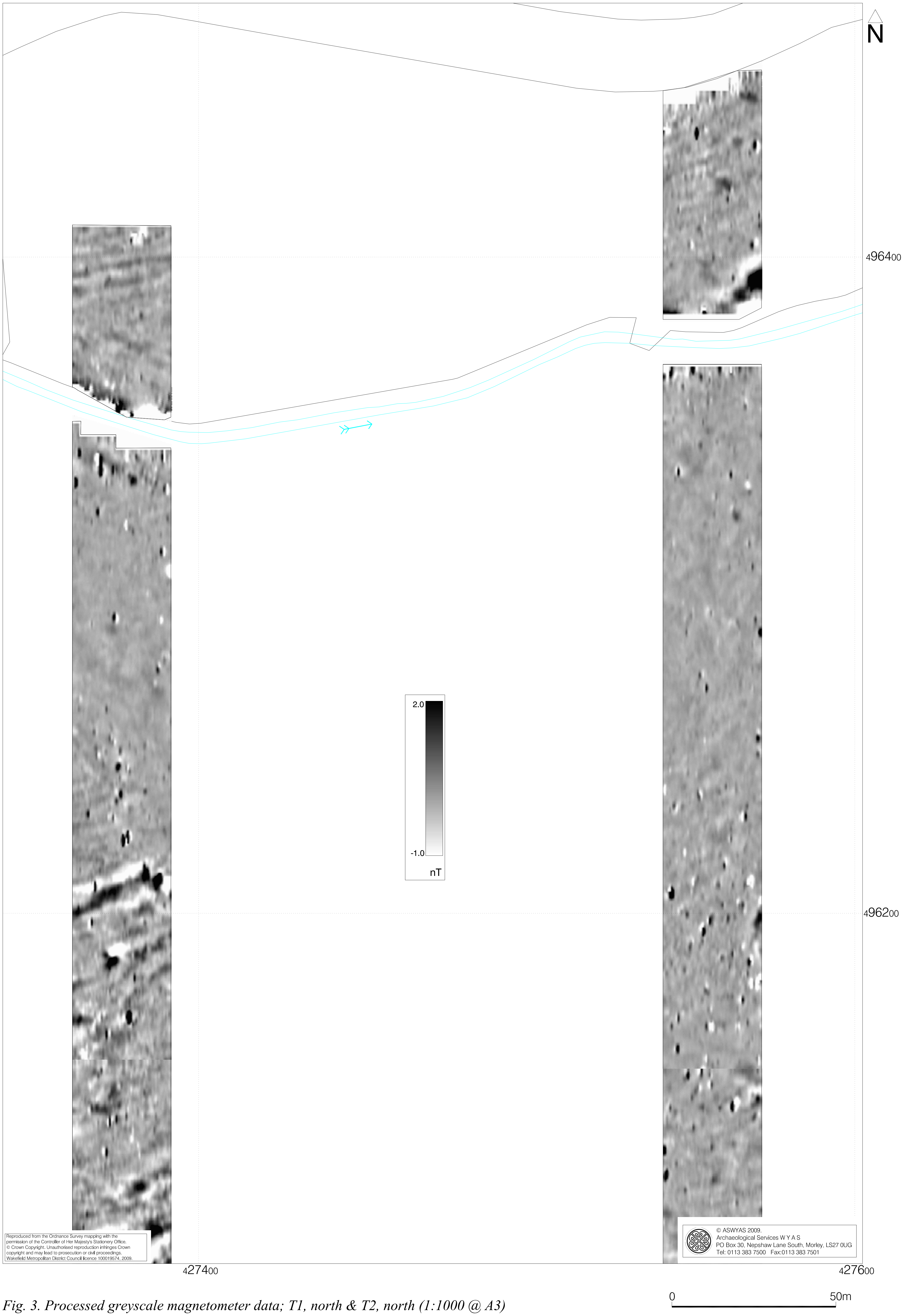


Fig. 3. Processed greyscale magnetometer data; T1, north & T2, north (1:1000 @ A3)

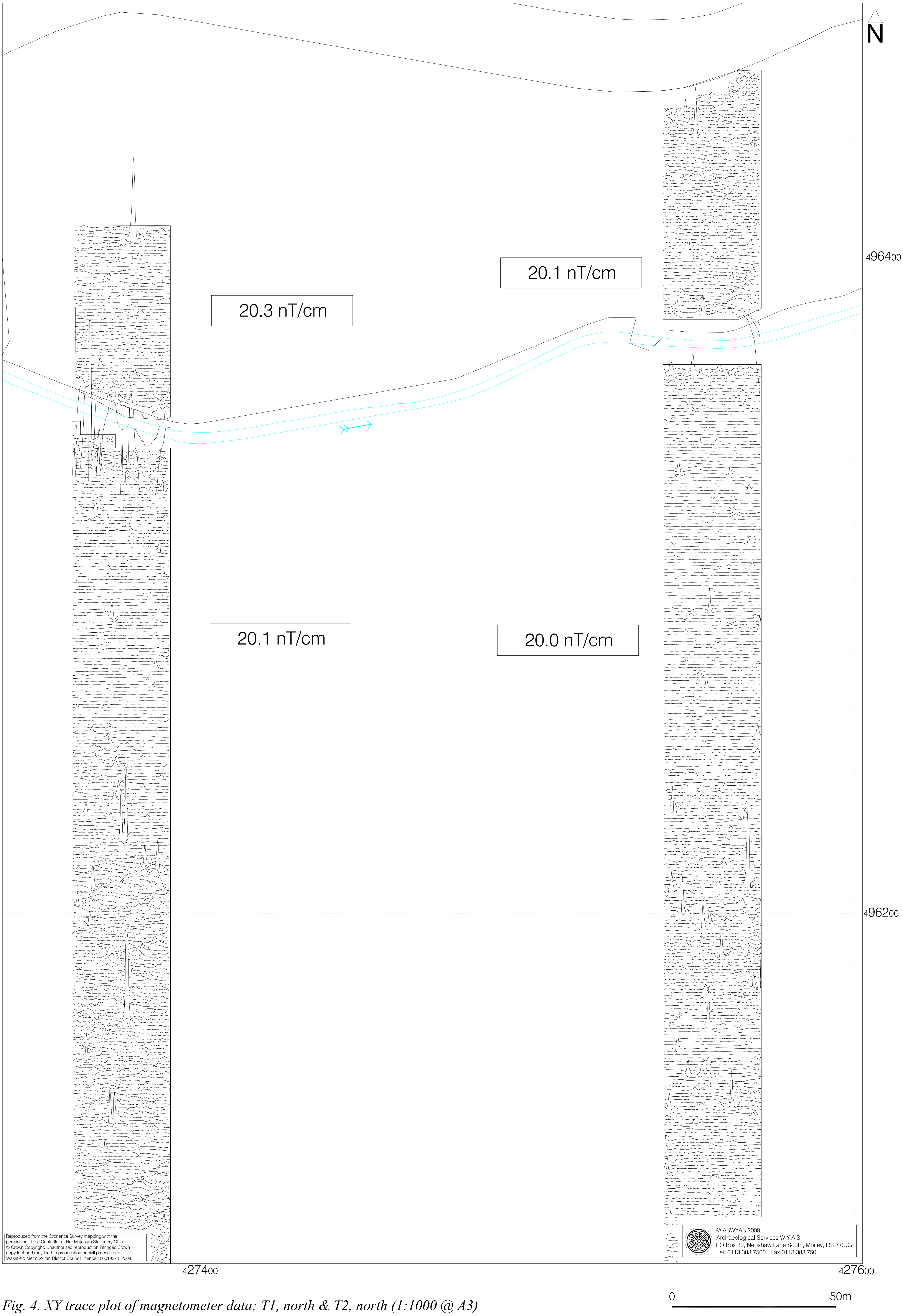
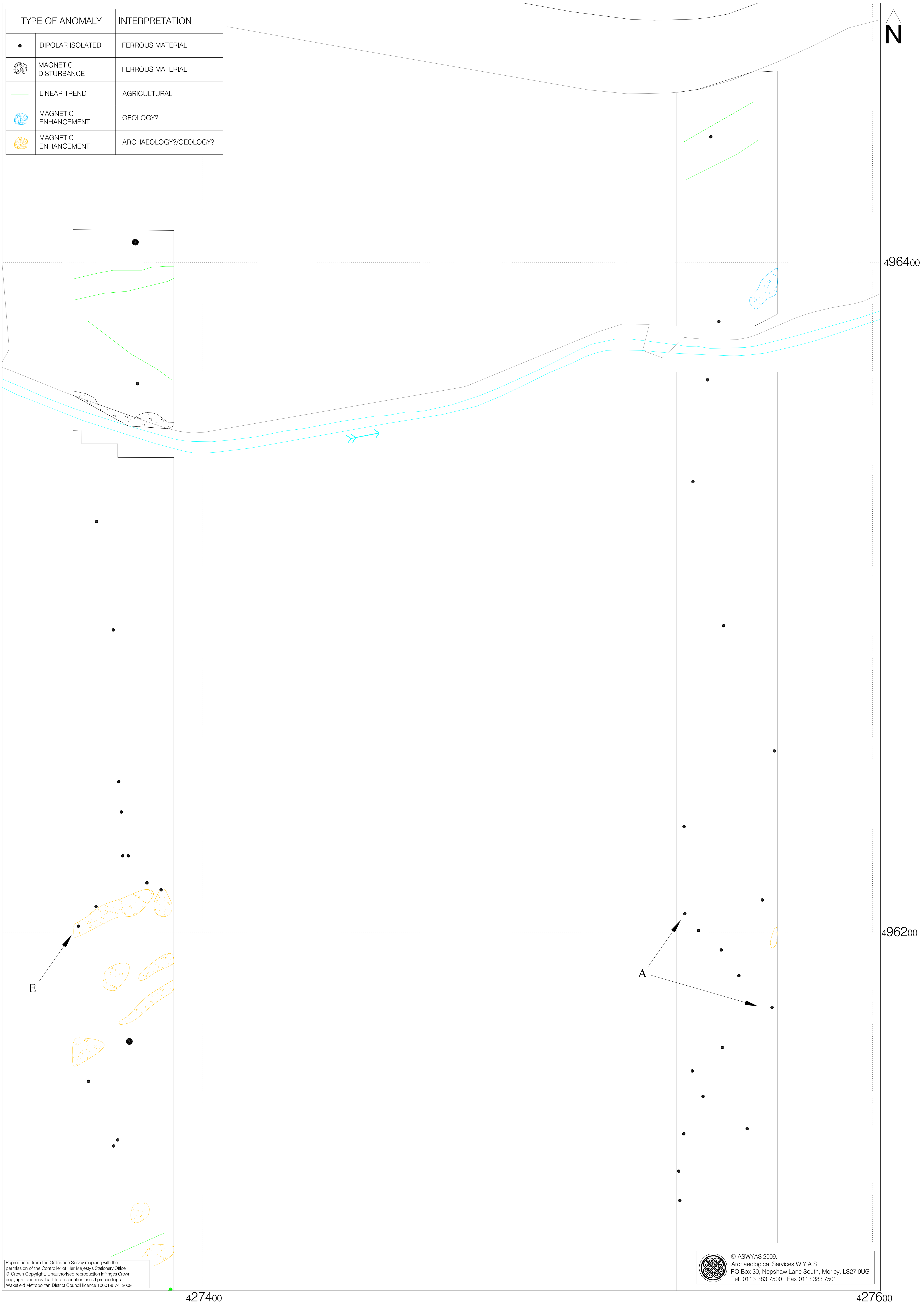


Fig. 4. XY trace plot of magnetometer data; T1, north & T2, north (1:1000 @ A3)



0 50m

Fig. 5. Interpretation of magnetometer data; T1, north & T2, north (1:1000 @ A3)

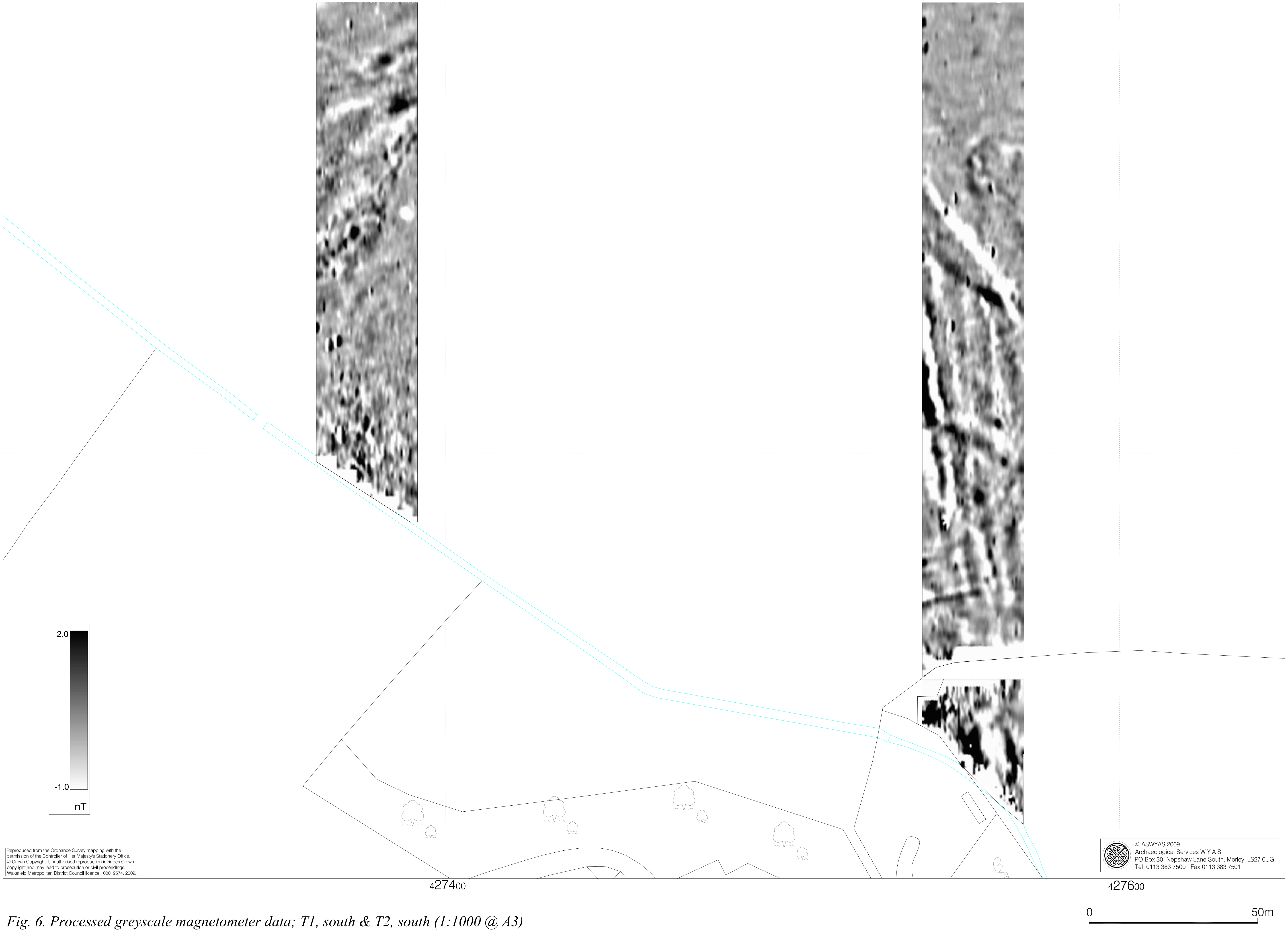


Fig. 6. Processed greyscale magnetometer data; T1, south & T2, south (1:1000 @ A3)

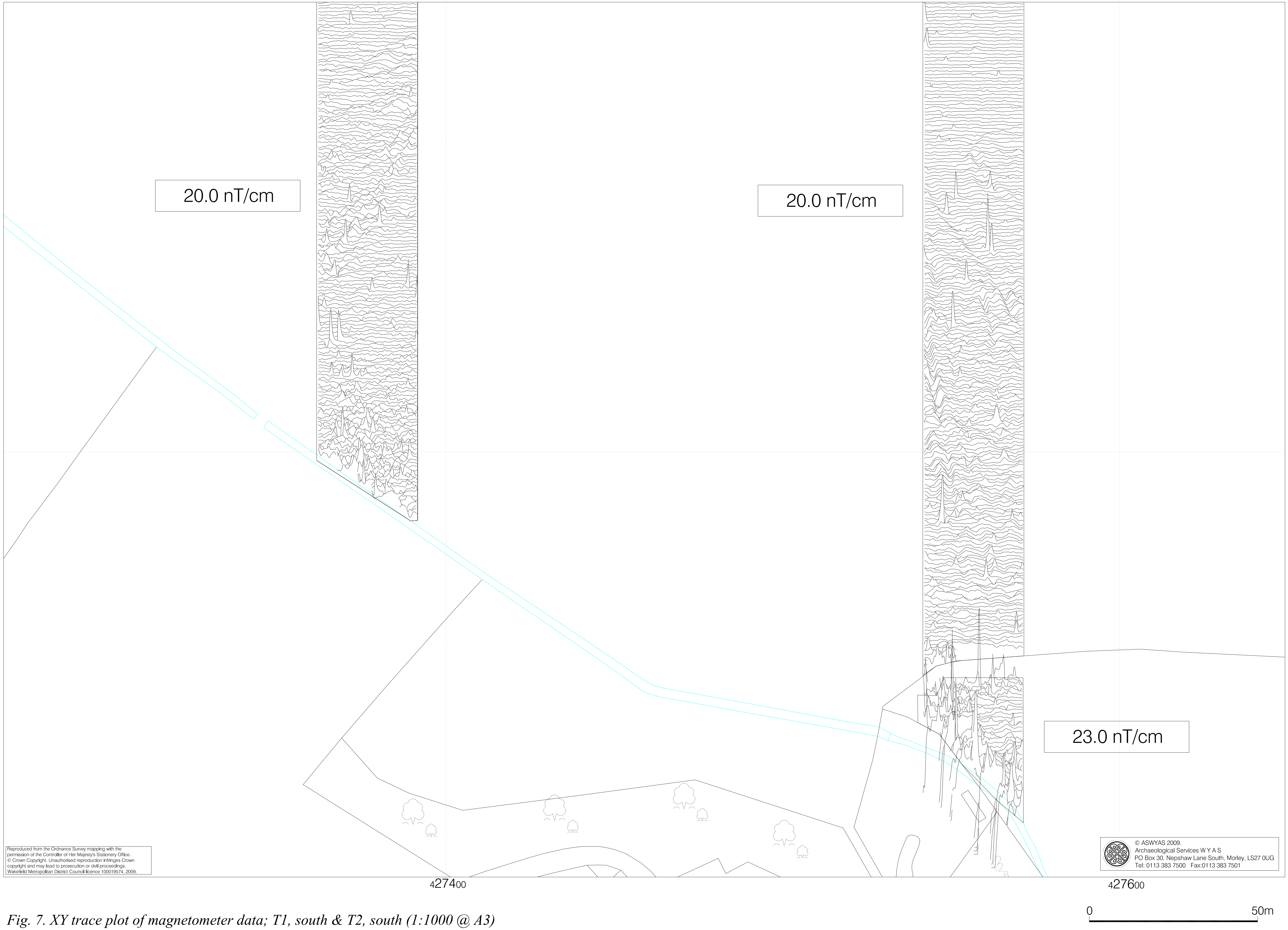


Fig. 7. XY trace plot of magnetometer data; T1, south & T2, south (1:1000 @ A3)

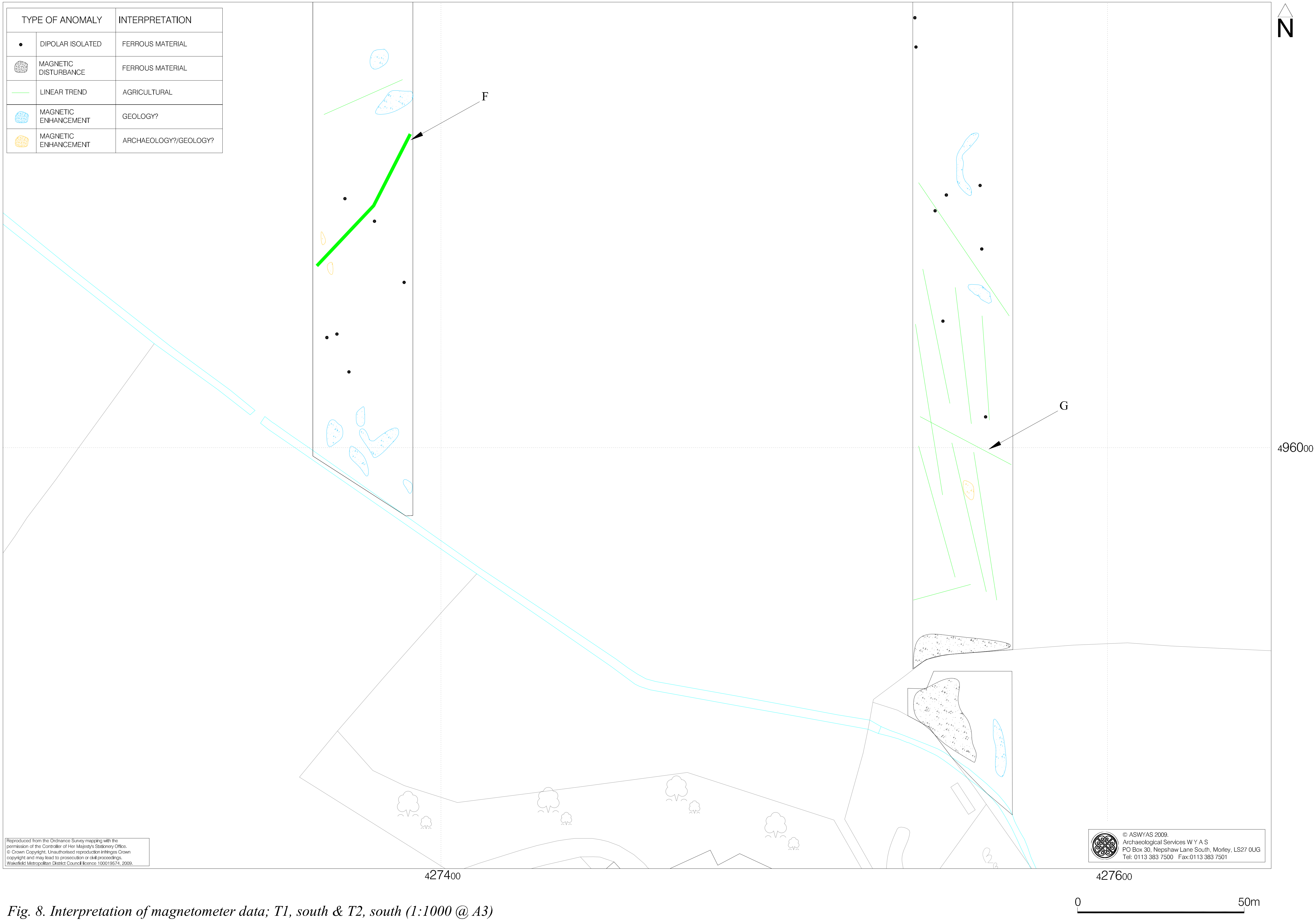


Fig. 8. Interpretation of magnetometer data; T1, south & T2, south (1:1000 @ A3)

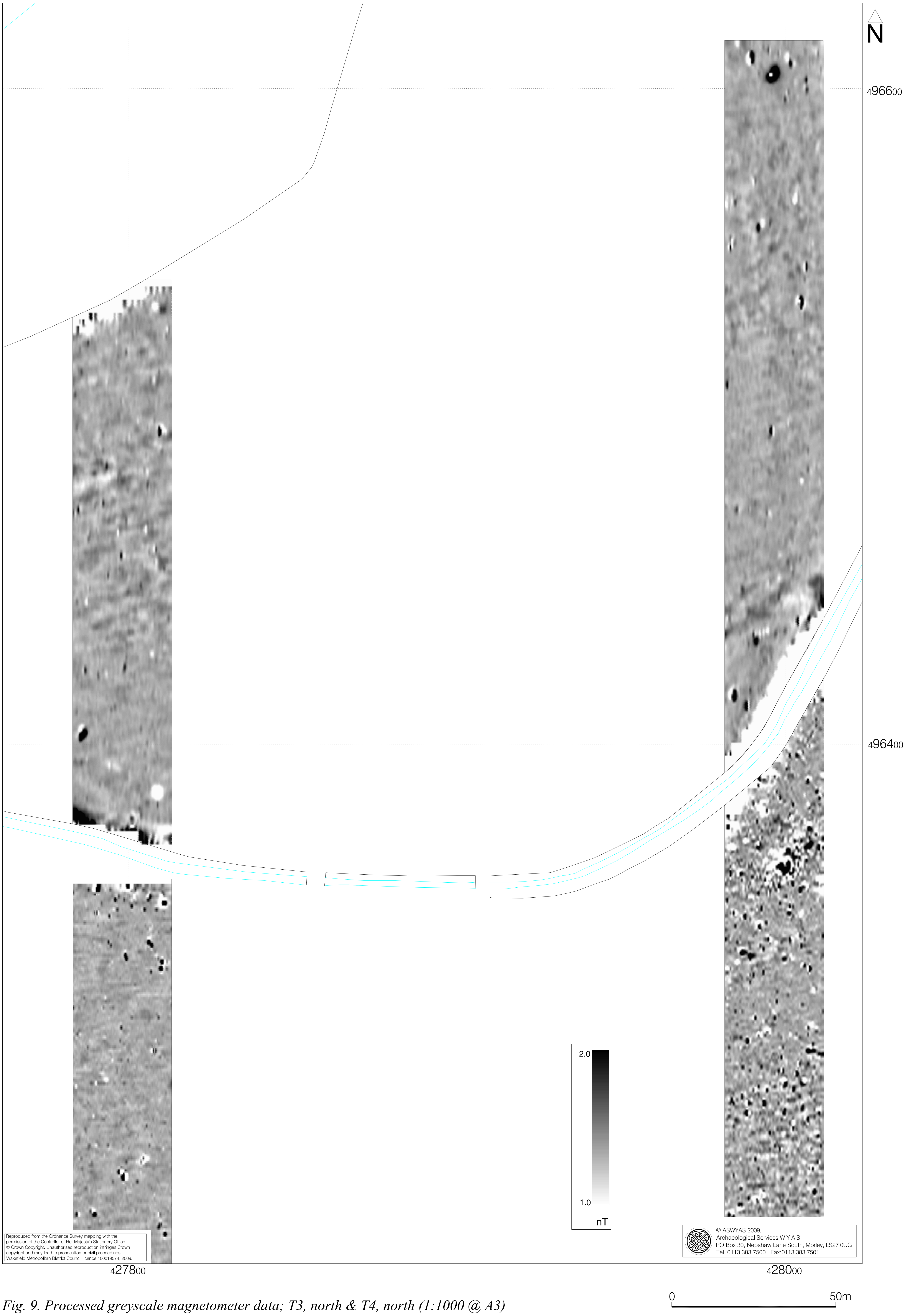


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Fig. 9. Processed greyscale magnetometer data; T3, north & T4, north (1:1000 @ A3)

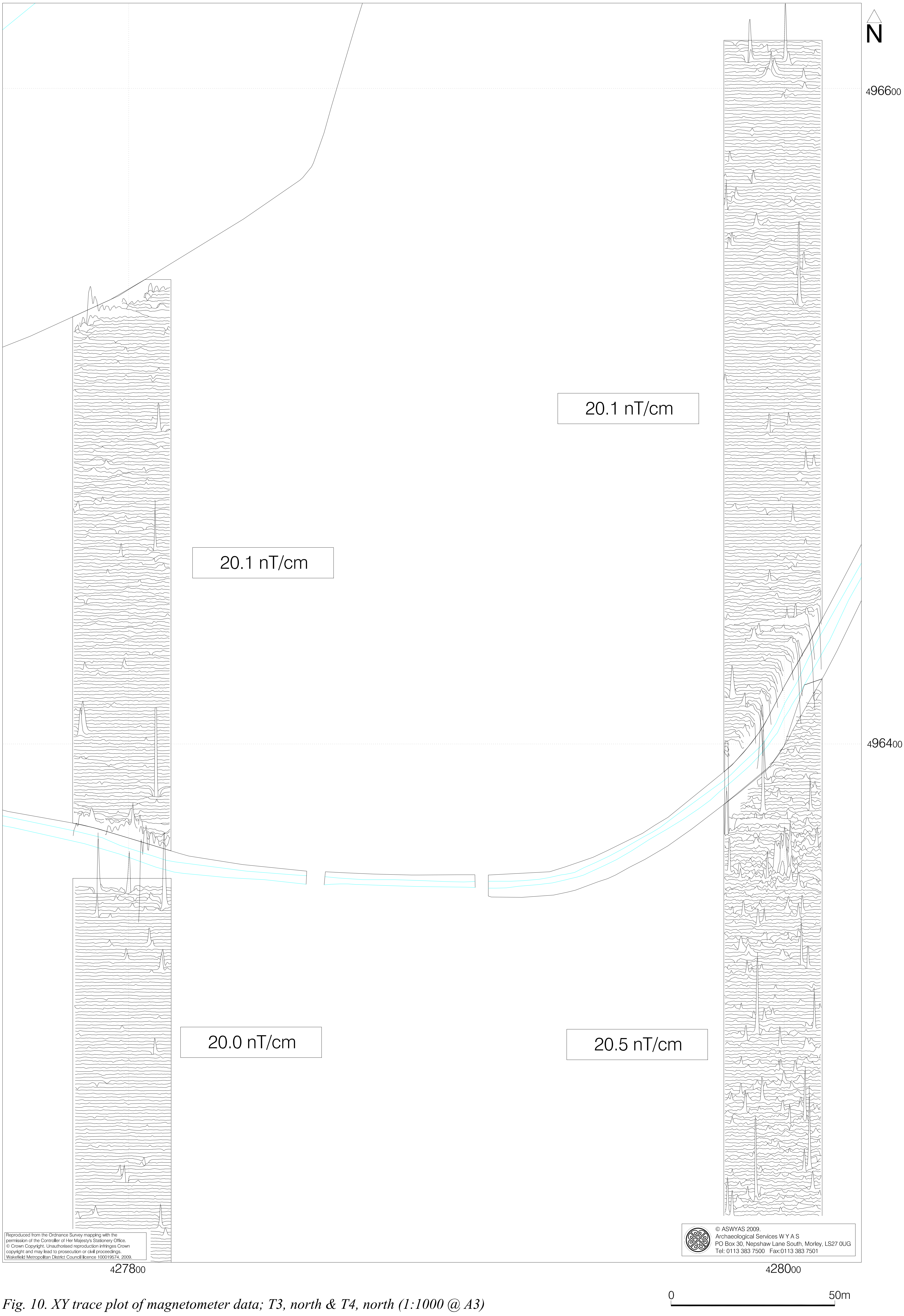

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Fig. 10. XY trace plot of magnetometer data; T3, north & T4, north (1:1000 @ A3)

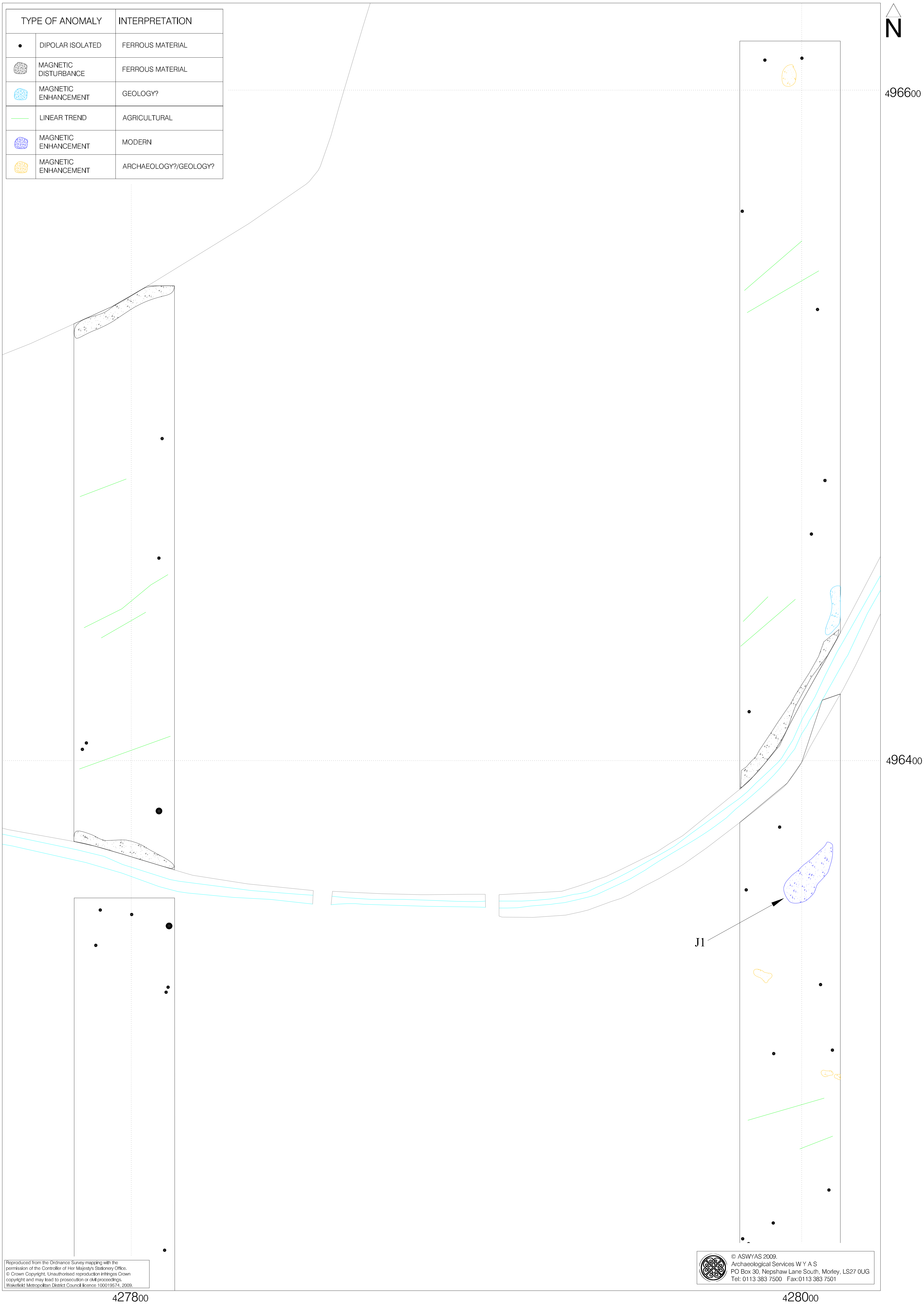

Fig. 11. Interpretation of magnetometer data; T3, north & T4, north (1:1000 @ A3)

0 50m

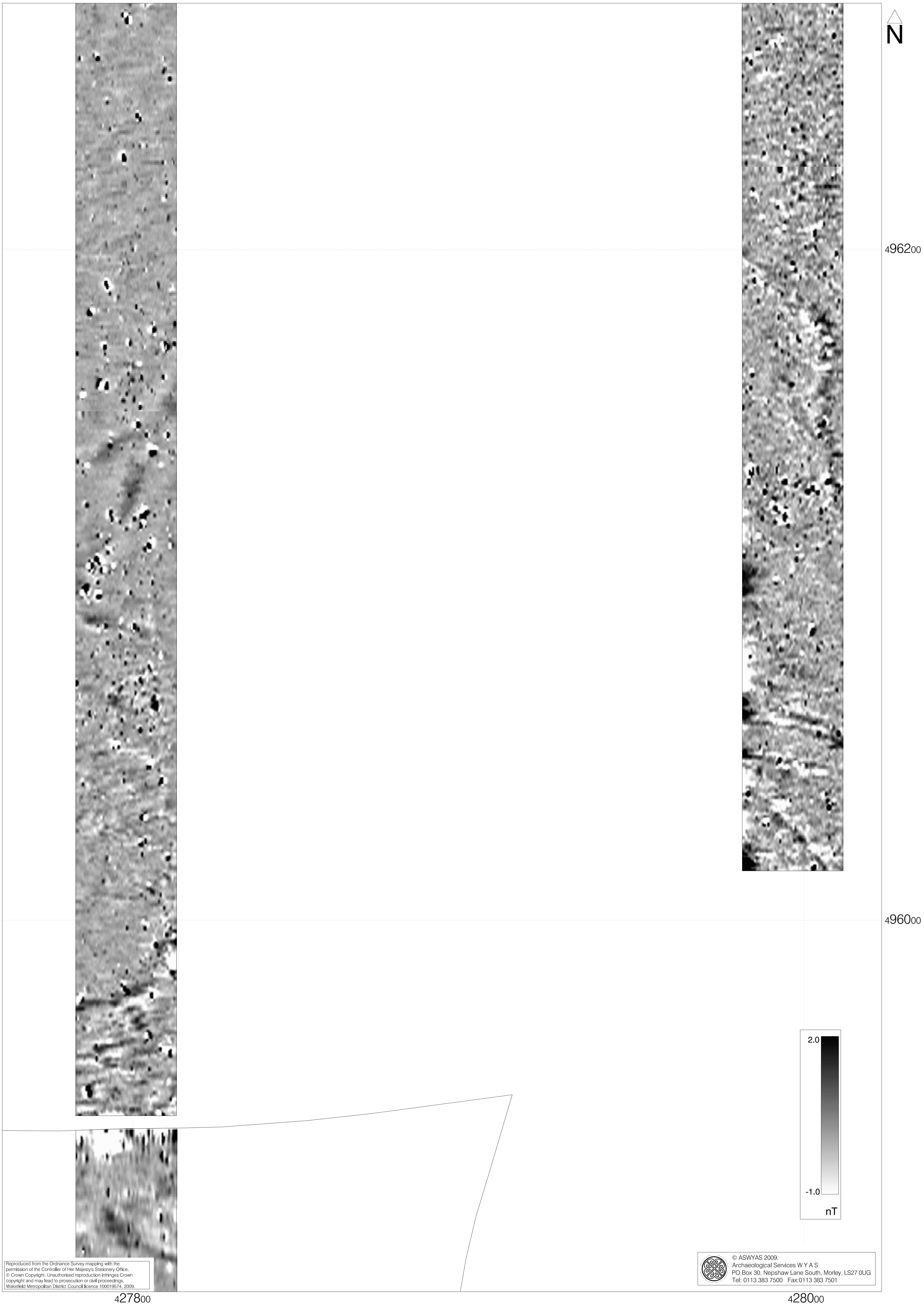

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Fig. 12. Processed greyscale magnetometer data; T3, centre & T4, south (1:1000 @ A3)

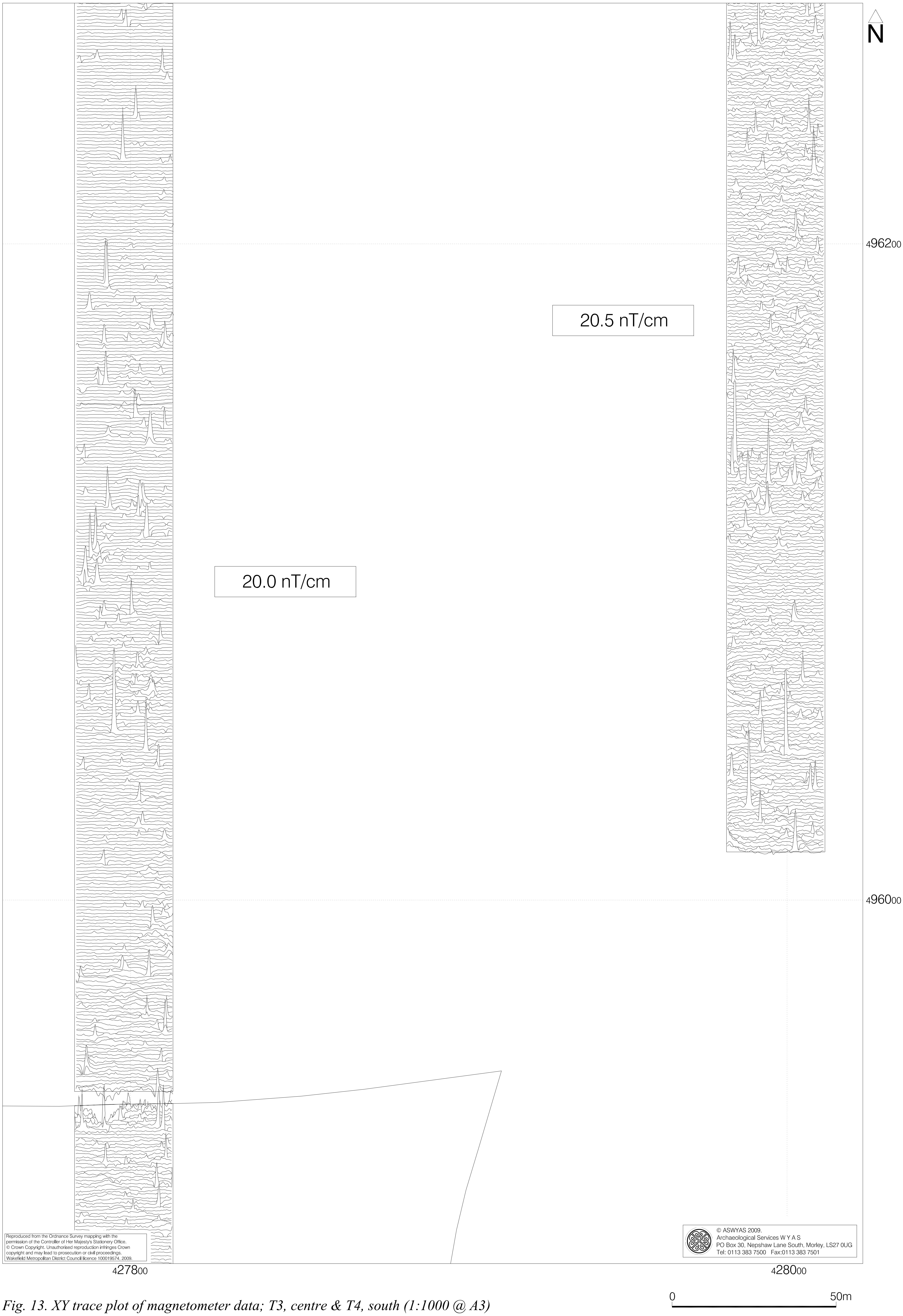

Fig. 13. XY trace plot of magnetometer data; T3, centre & T4, south (1:1000 @ A3)

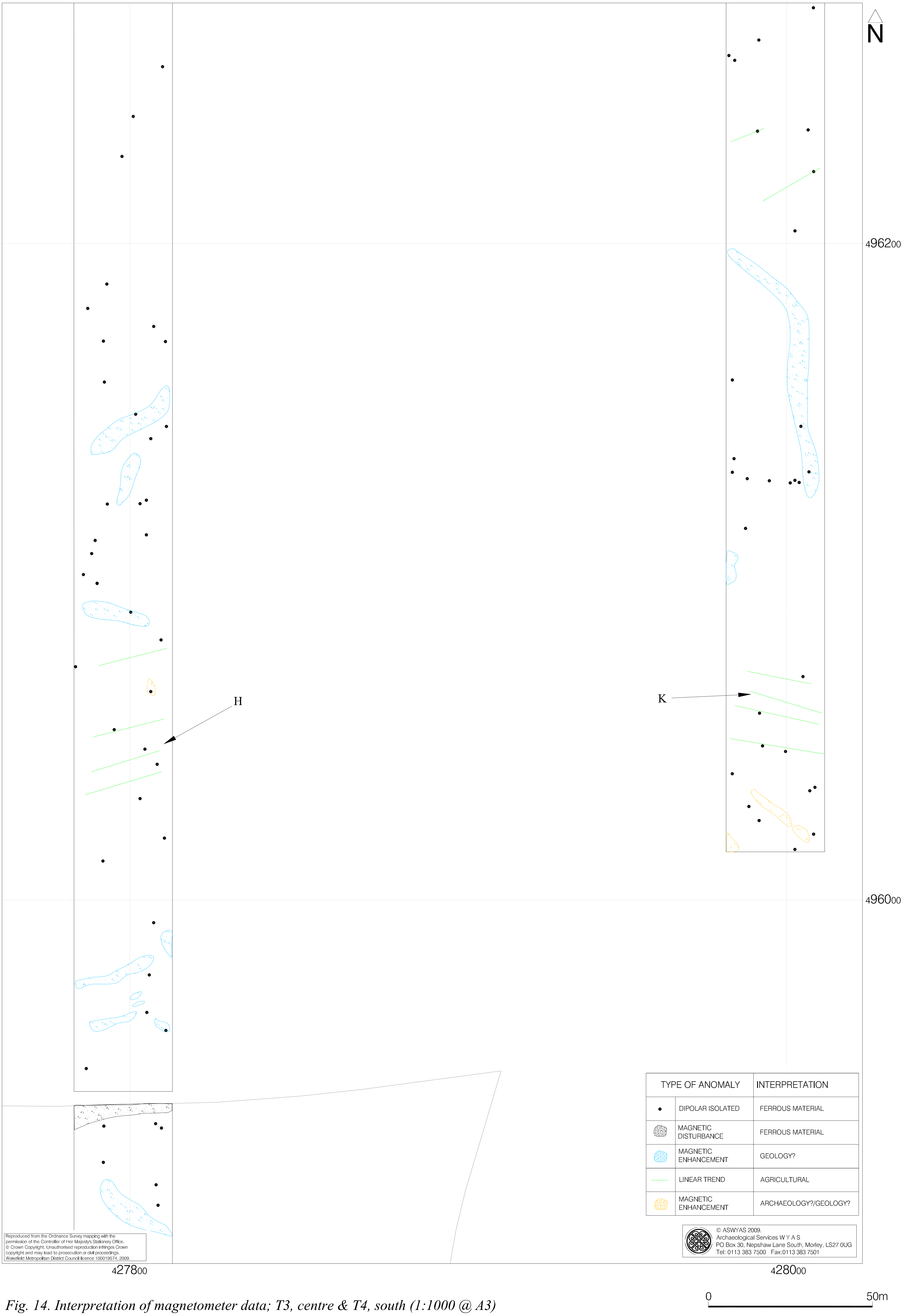

Fig. 14. Interpretation of magnetometer data; T3, centre & T4, south (1:1000 @ A3)

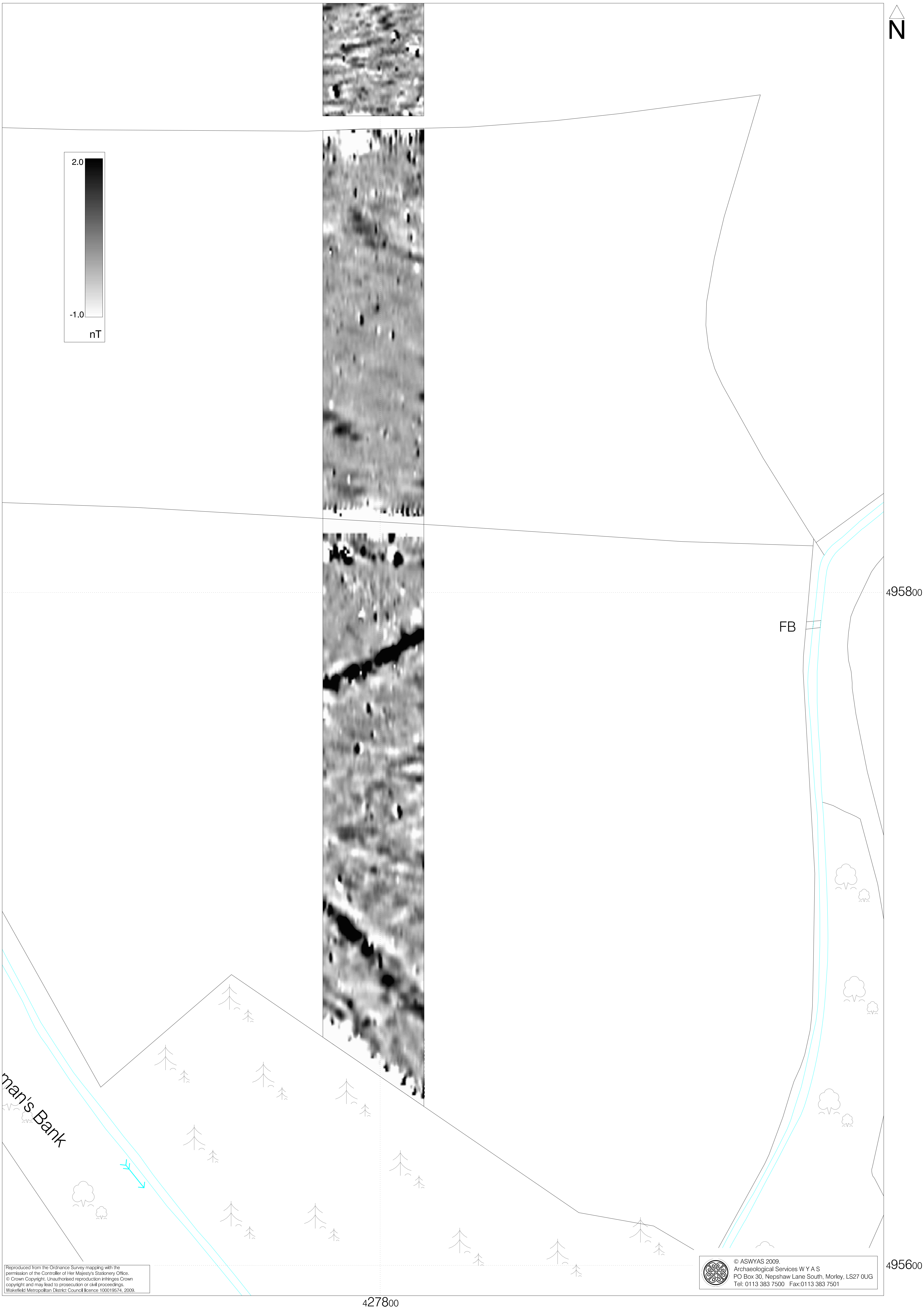

Fig. 15. Processed greyscale magnetometer data; T3, south (1:1000 @ A3)

Fig. 16. XY trace plot of magnetometer data; T3, south (1:1000 @ A3)

Fig. 17. Interpretation of magnetometer data; T3, south (1:1000 @ A3)

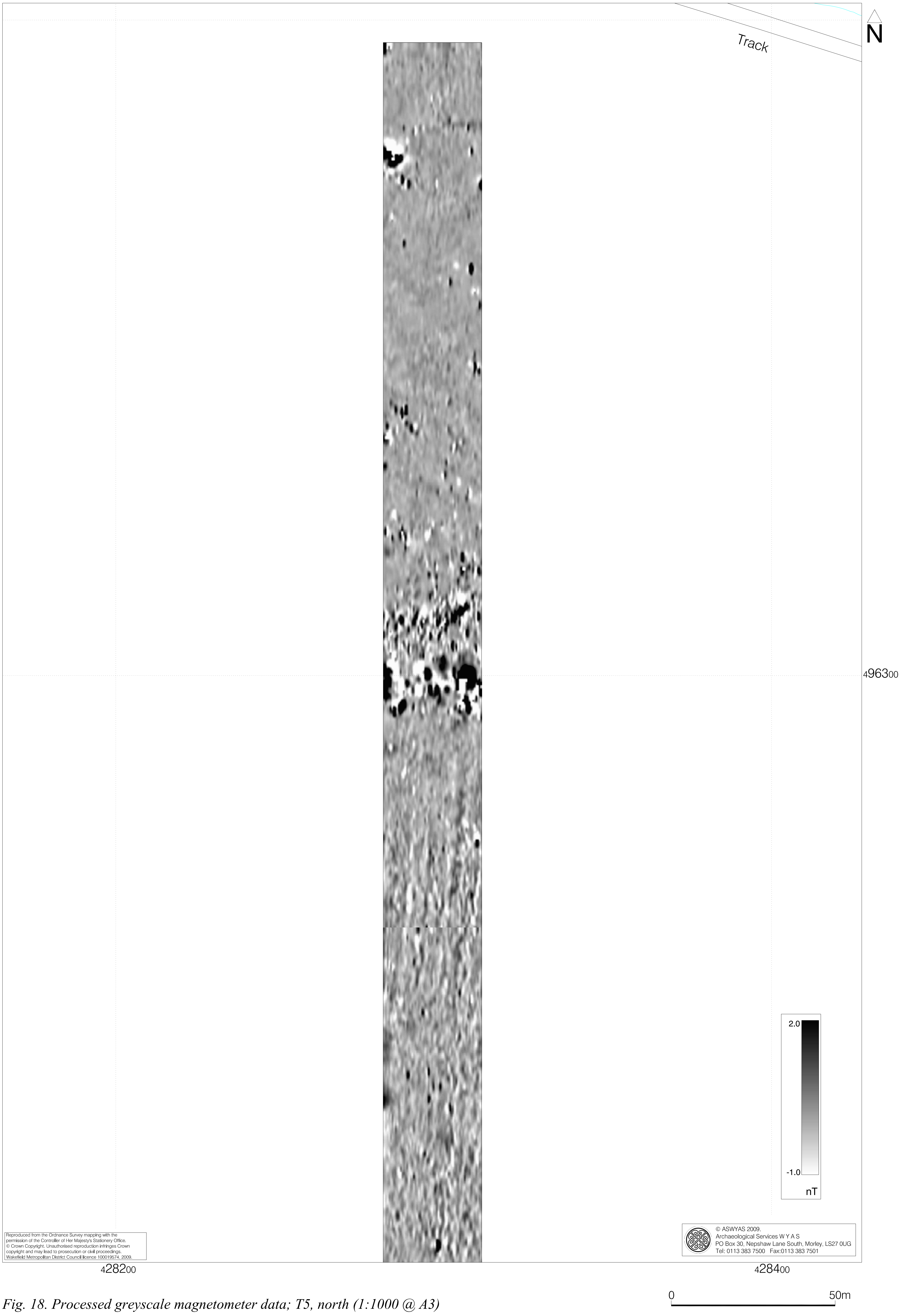

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Fig. 18. Processed greyscale magnetometer data; T5, north (1:1000 @ A3)

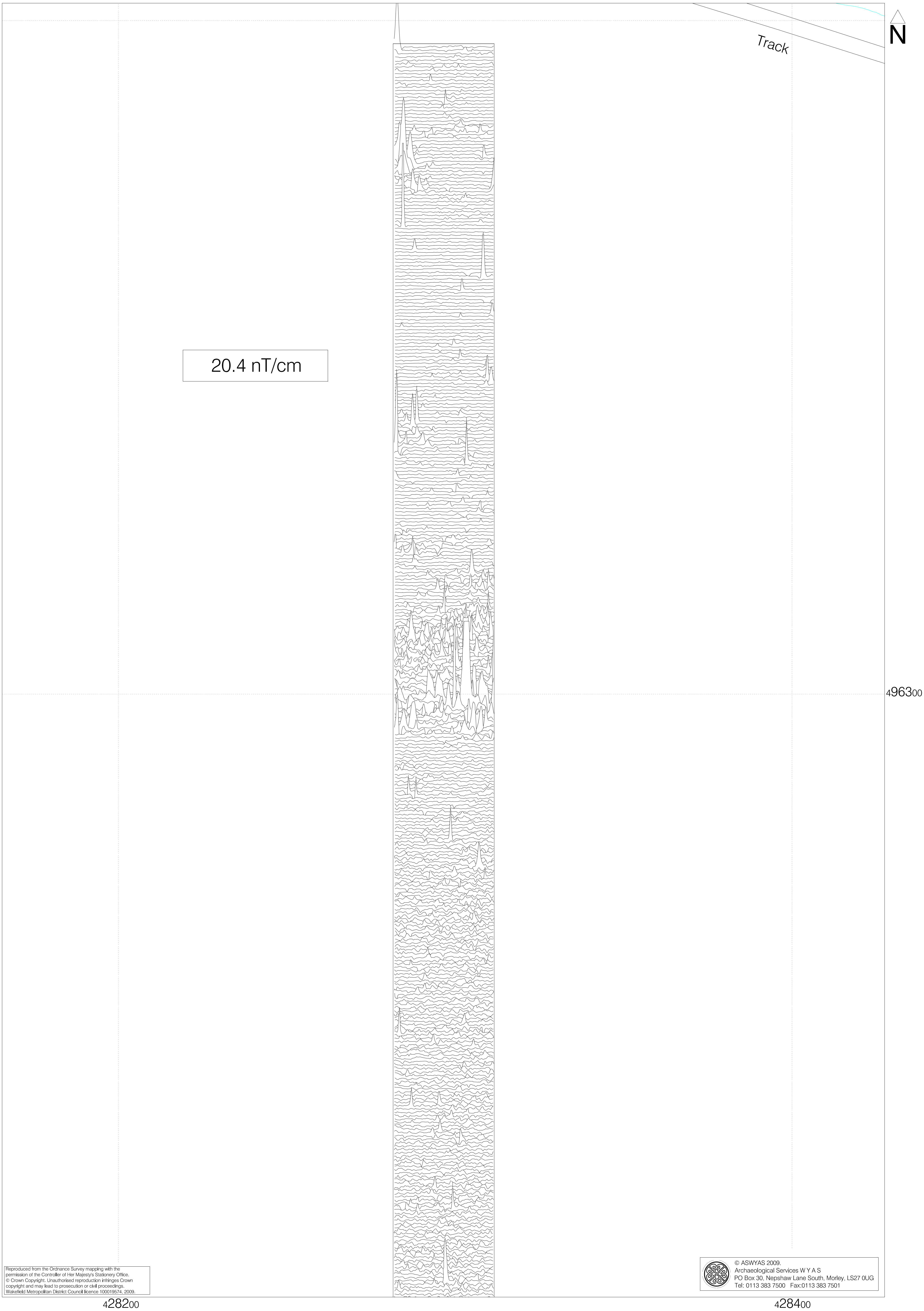

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Fig. 19. XY trace plot of magnetometer data; T5, north (1:1000 @ A3)

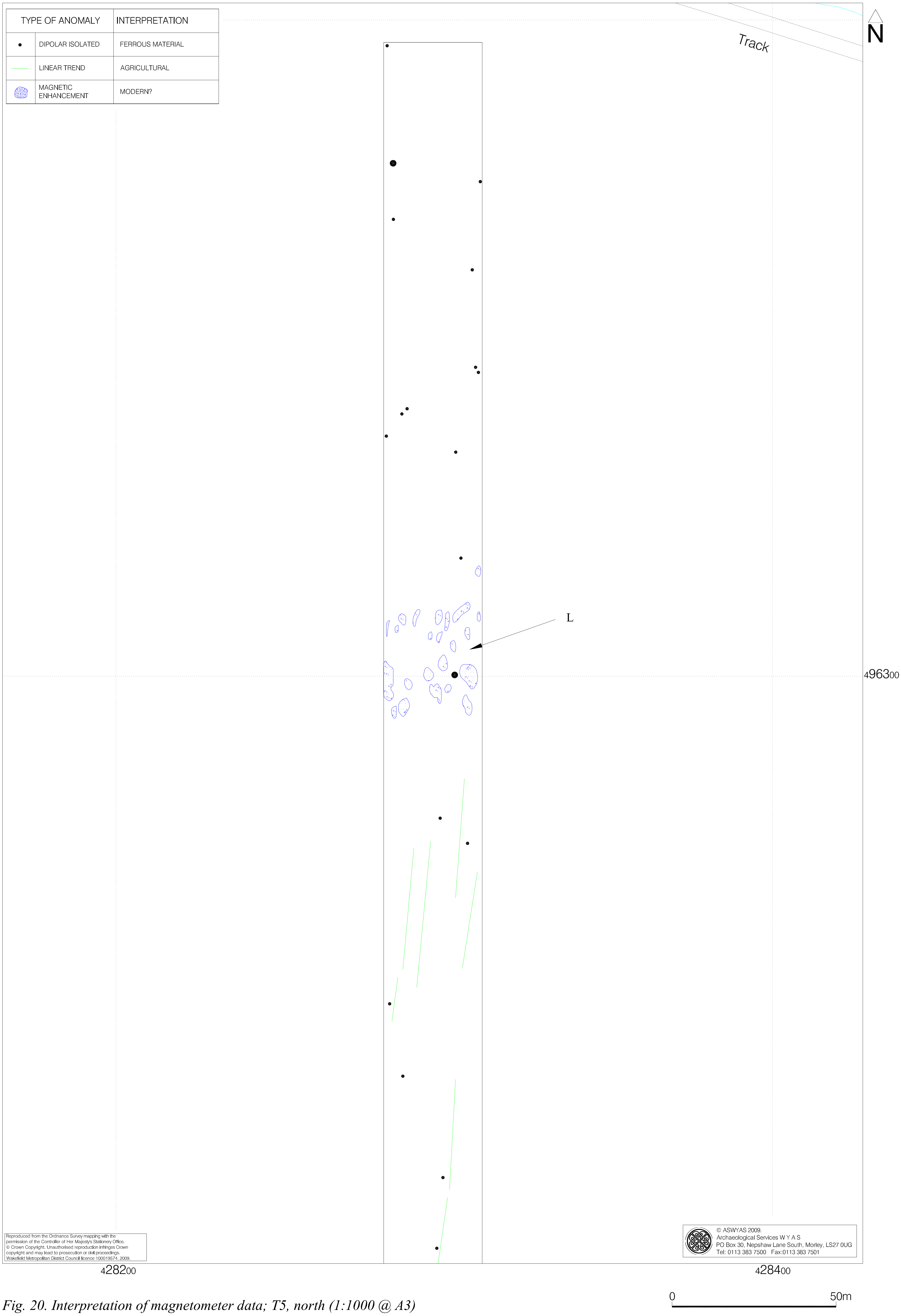

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Fig. 20. Interpretation of magnetometer data; T5, north (1:1000 @ A3)

Fig. 21. Processed greyscale magnetometer data; T5, centre (1:1000 @ A3)

Fig. 22. XY trace plot of magnetometer data; T5, centre (1:1000 @ A3)

Fig. 23. Interpretation of magnetometer data; T5, centre (1:1000 @ A3)

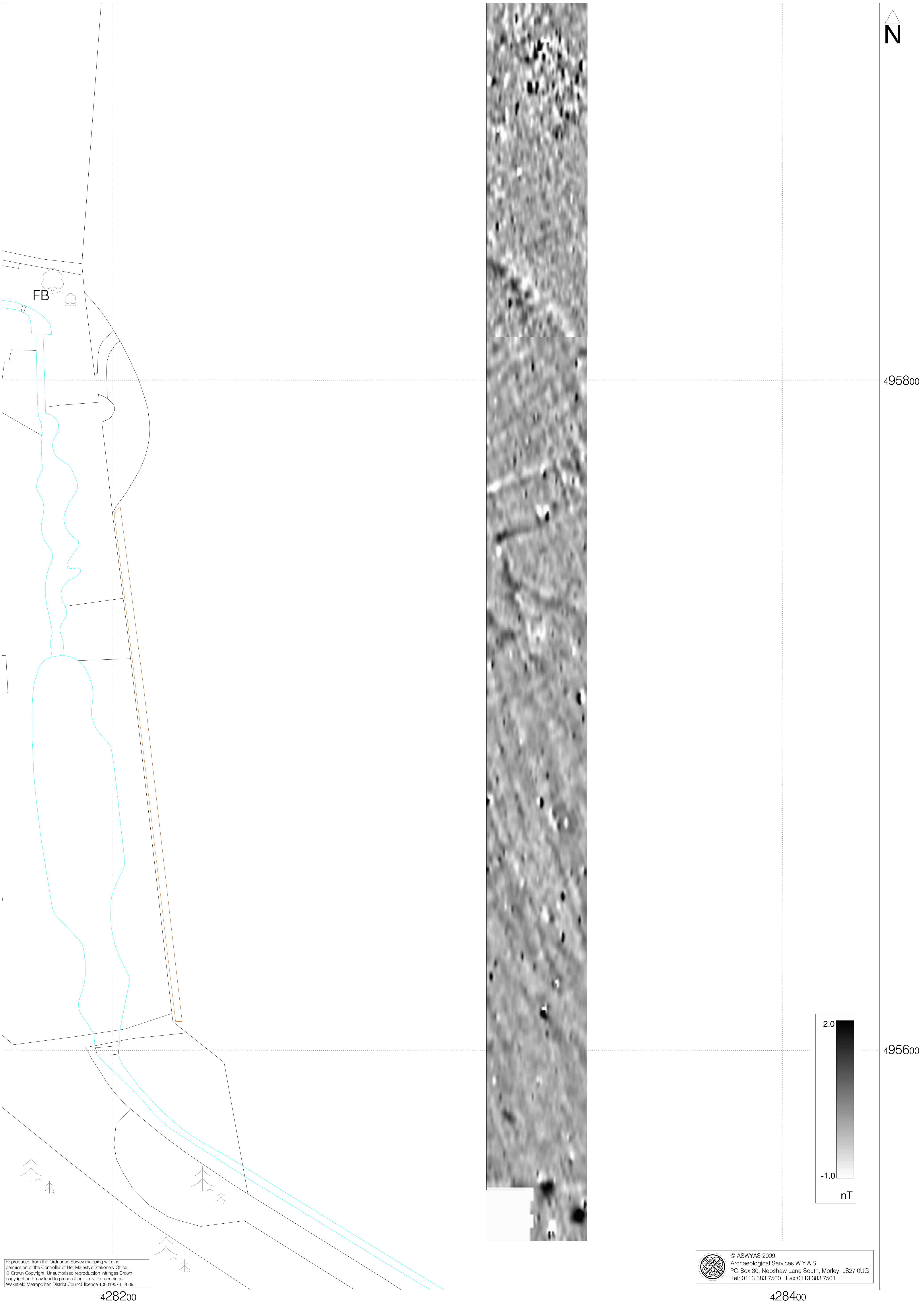

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Fig. 24. Processed greyscale magnetometer data; T5, south (1:1000 @ A3)

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Fig. 25. XY trace plot of magnetometer data; T5, south (1:1000 @ A3)

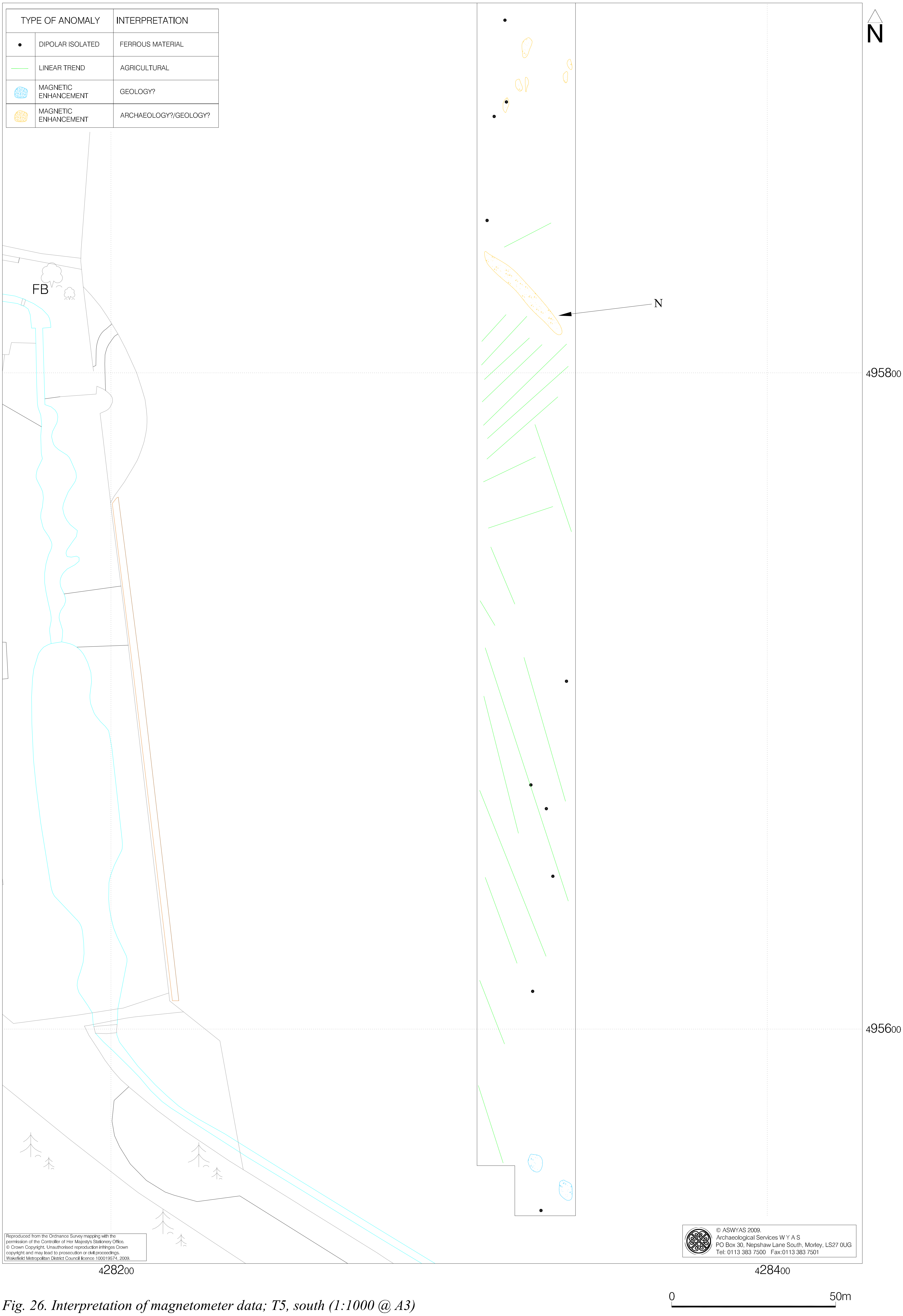

Fig. 26. Interpretation of magnetometer data; T5, south (1:1000 @ A3)

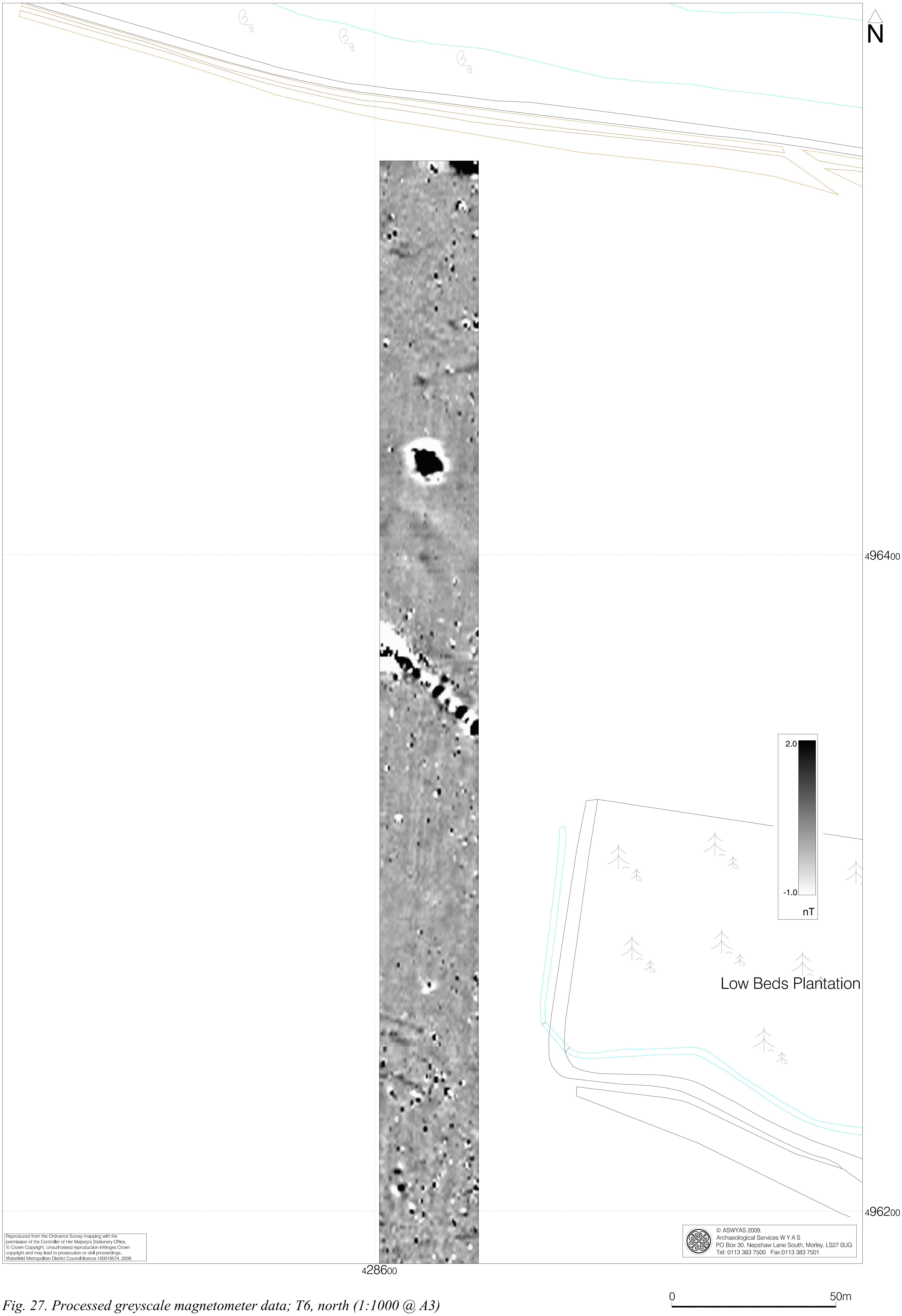

Fig. 27. Processed greyscale magnetometer data; T6, north (1:1000 @ A3)

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Fig. 28. XY trace plot of magnetometer data; T6, north (1:1000 @ A3)

Fig. 29. Interpretation of magnetometer data; T6, north (1:1000 @ A3)

Fig. 30. Processed greyscale magnetometer data; T6, centre (1:1000 @ A3)

Fig. 31. XY trace plot of magnetometer data; T6, centre (1:1000 @ A3)

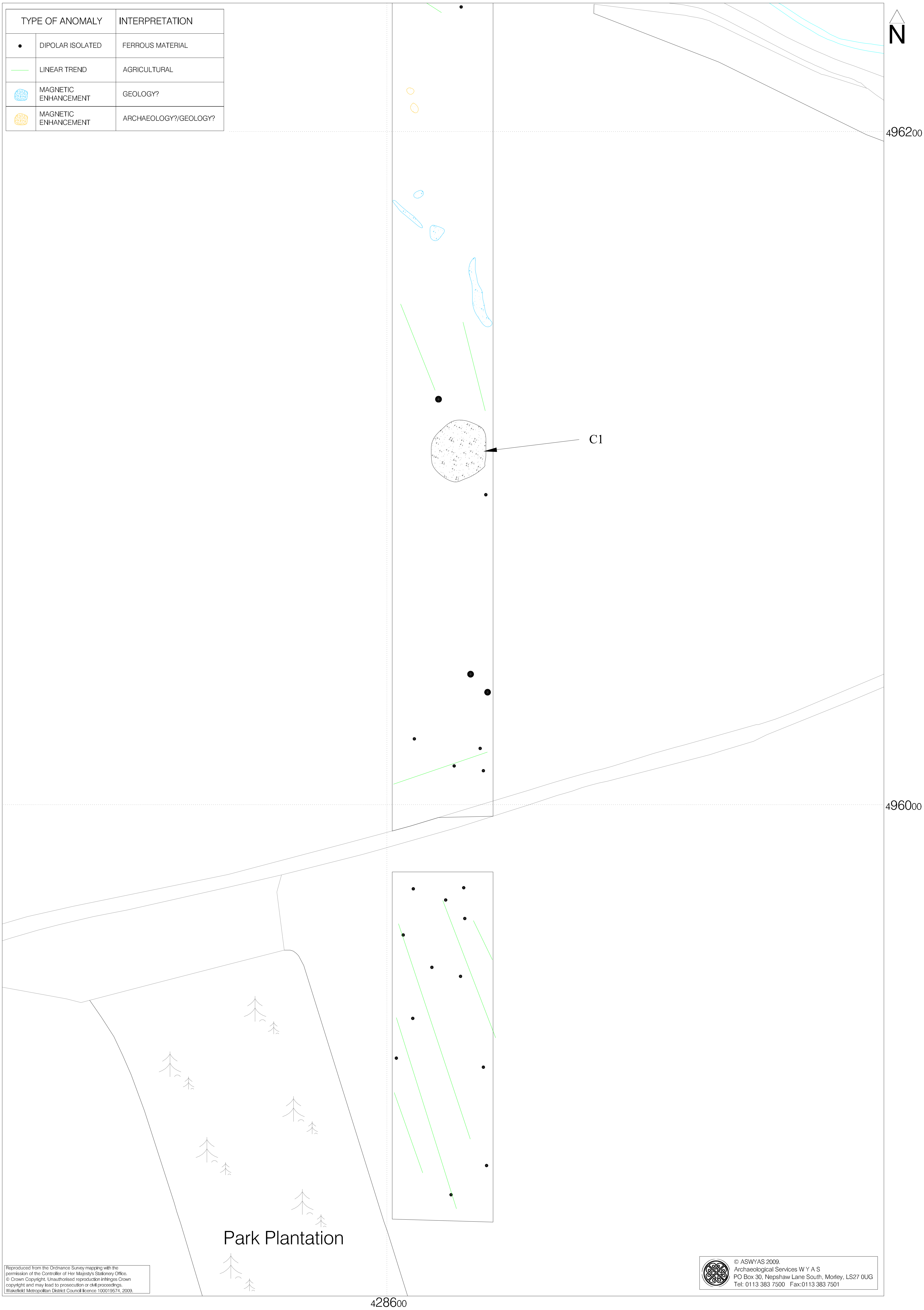

Fig. 32. Interpretation of magnetometer data; T6, centre (1:1000 @ A3)

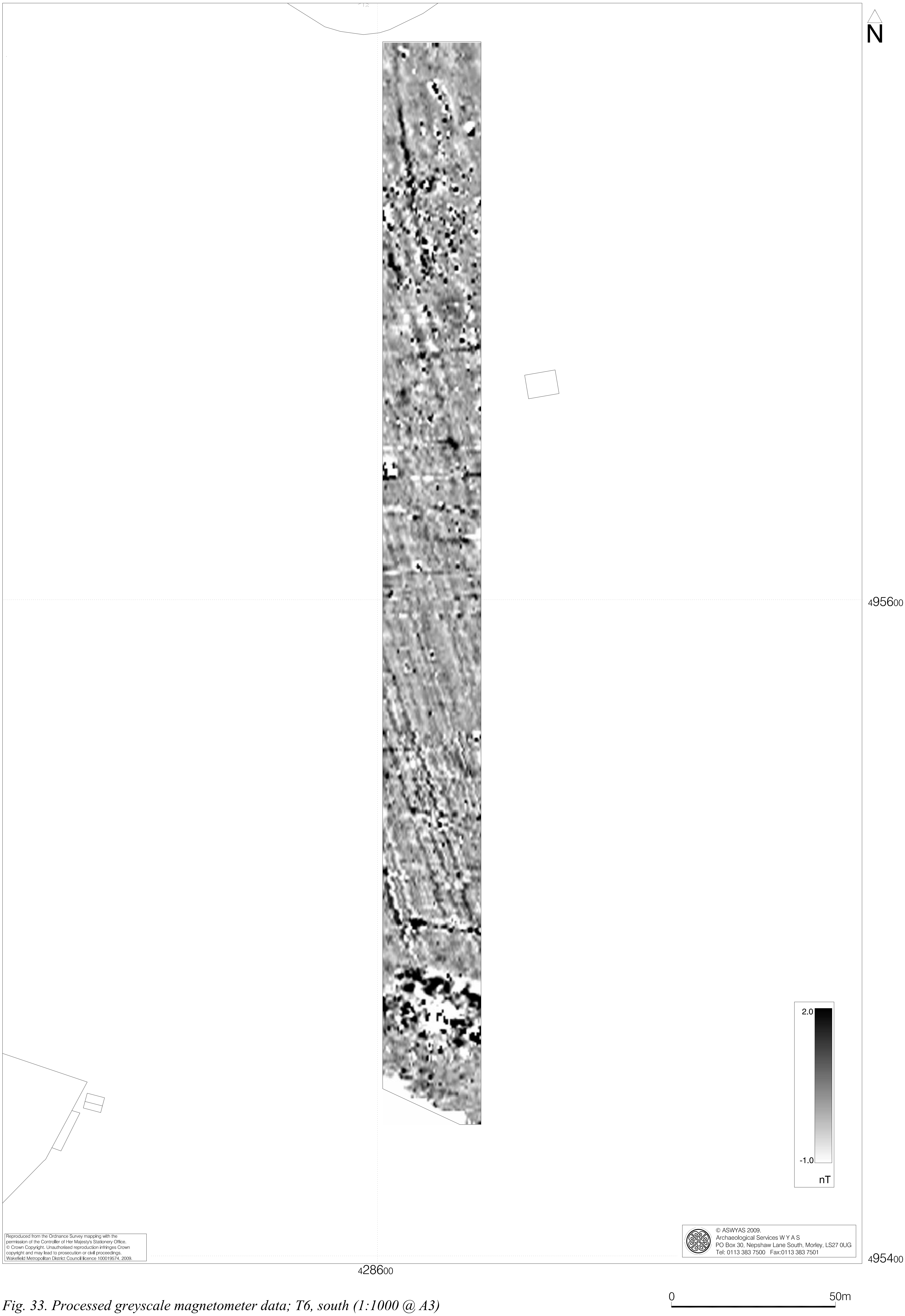

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Fig. 33. Processed greyscale magnetometer data; T6, south (1:1000 @ A3)

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Fig. 34. XY trace plot of magnetometer data; T6, south (1:1000 @ A3)

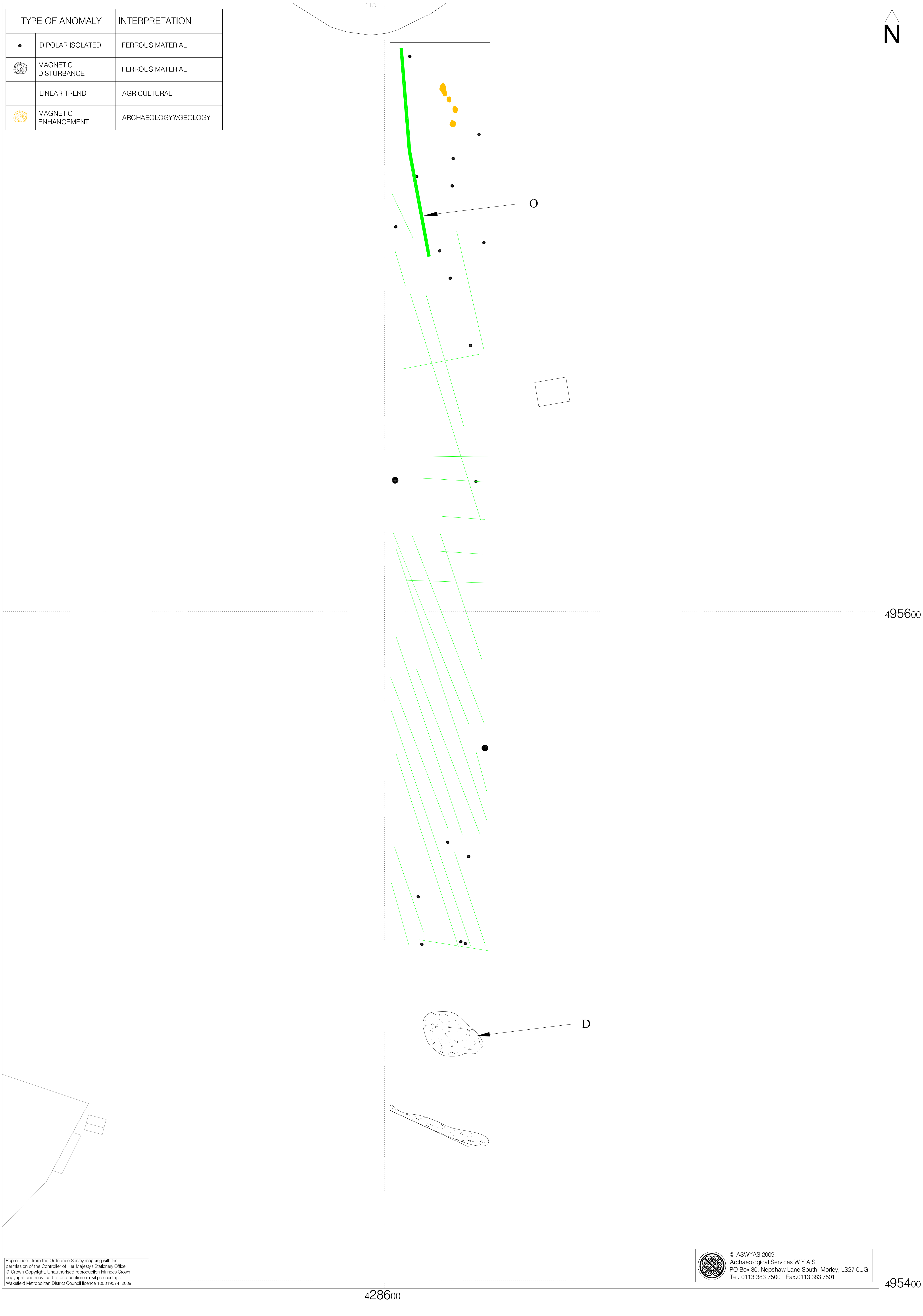

Fig. 35. Interpretation of magnetometer data; T6, south (1:1000 @ A3)

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Fig. 36. Processed greyscale magnetometer data; T7 (1:1000 @ A3)

Fig. 37. XY trace plot of magnetometer data; T7 (1:1000 @ A3)

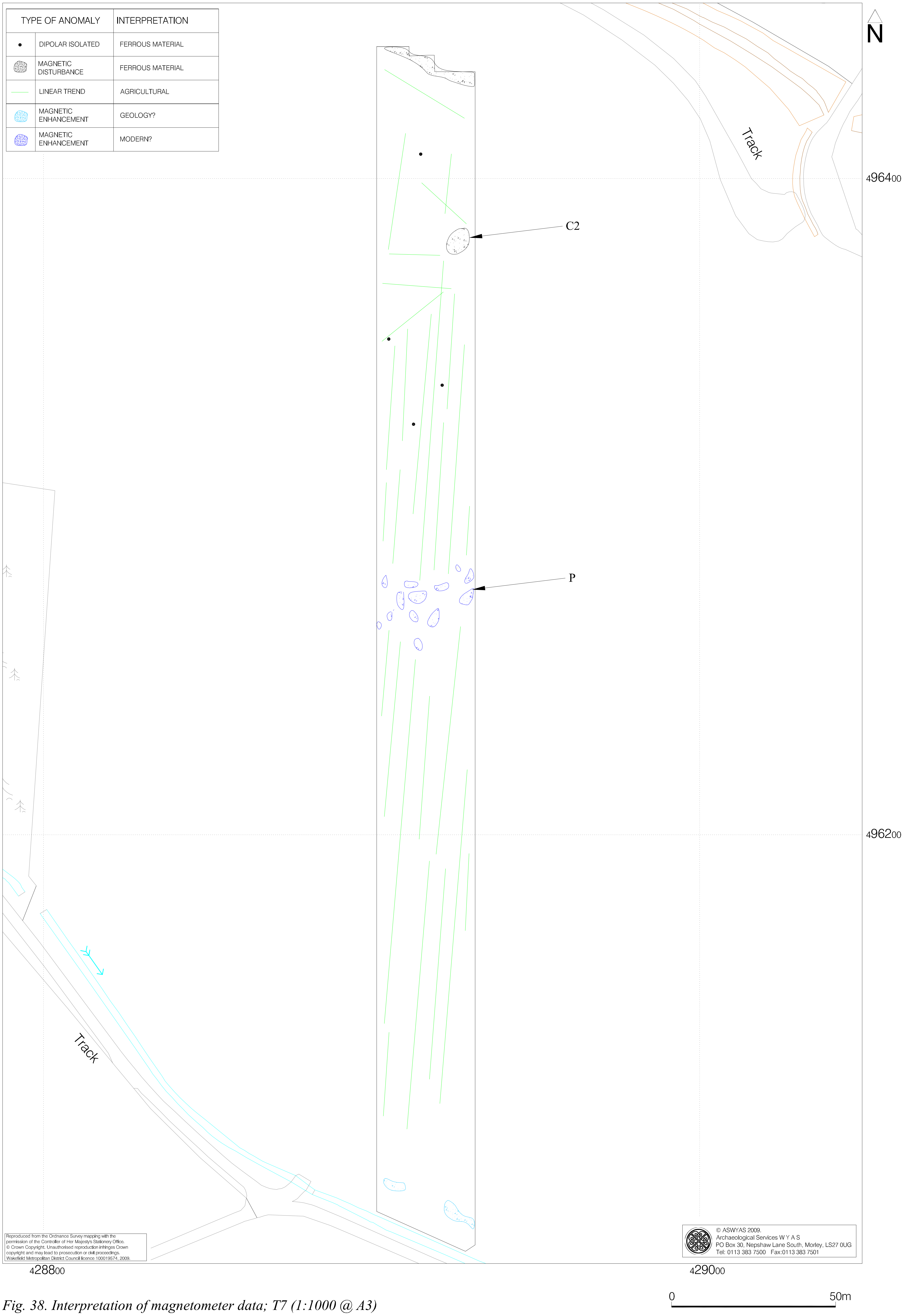

Fig. 38. Interpretation of magnetometer data; T7 (1:1000 @ A3)

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 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. 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 5500 total station theodolite and a Trimble 5600 RTK dGPS and tied in to the corners of permanent landscape features and to temporary reference points (survey marker stakes) that were established and left in place following completion of the fieldwork for accurate geo-referencing. The locations of the temporary reference points are shown on Figure 2 and the Ordnance Survey grid co-ordinates tabulated below. The internal accuracy of the survey grid relative to these markers is better than 0.05m. The survey grids were then superimposed onto a map base provided by the client as a 'best fit' to produce the displayed block locations. Overall there was a good correlation between the local survey and the digital map base and it is estimated that the average 'best fit' error is better than ±1.5m. However, it should be noted that Ordnance Survey co-ordinates for 1:2500 map data have an error of ±1.9m at 95% confidence. This potential error must be considered if co-ordinates are measured off for relocation purposes.

Temporary reference objects were left on site (see Fig. 2). The Ordnance Survey reference points are listed below.

Station	**Easting**	**Northing**
A	427915.6930	495947.6860
B	428089.9270	496021.3620
C	428134.7150	496327.0670
D	427905.0810	496353.4890
E	427396.5630	496341.7900
F	427346.3643	496011.7330
G	427603.1634	495942.5106
H	428141.4470	496323.6190
J	428343.9790	496610.4950
K	428628.0660	496521.8420
L	428942.4020	496423.5300
M	428656.1120	496328.1790
N	428573.5420	495985.1620
O	428409.4850	496005.9250
P	428644.0670	495660.6840

Q	428820.4980	495545.6630
R	428279.7850	495790.8690
S	428037.6570	496500.9840
T	427427.4600	496414.5800
U	427551.3050	496381.5390
V	427697.9050	496494.3930

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.
- 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 relevant Sites and Monument Record Office).

Bibliography

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