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GEOPHYSICAL SURVEY REPORT 2002/01

WYGATE PARK
Spalding

Client:

APS
ARCHAEOLOGICAL
PROJECT
SERVICES

SITE SUMMARY SHEET

2002 / 01 Wygate Park, Spalding

NGR: TF 237 236 (approximate centre)

Location, topography and geology

The area of interest occupies a field on the north-western outskirts of Spalding, Lincolnshire. The triangular field is bounded to the south and east by recent housing development and to the north-west by Vernatt's Drain. At the time of survey, part of the field was under emergent cereal crop with other portions having been ploughed. The topography is flat with a slightly elevated area in the south-western corner. The soils are alluvial gleys comprising deep silty loams formed from a parent of marine and river alluvium (SSEW, 1983).

Archaeology

A topographical eminence in the south-west of the survey area is noted as a previously unidentified earthwork in a desk-based assessment by APS (APS, 2001). No other archaeological information for the site has been supplied.

Aims of Survey

Magnetic susceptibility mapping was undertaken over the entire area. Gradiometer survey sampled 20% of the area and was positioned on the basis of the susceptibility data and to encompass the possible earthwork feature. The aim was to locate any detectable anomalies of archaeological potential. This work forms part of a wider investigation by **Archaeological Project Services (APS)**.

Summary of Results *

The magnetic susceptibility data show the most elevated values to be along the southern and eastern edges of the field. Those close to the eastern margin of the field lack form and probably reflect modern contamination, however, the possibility that they represent plough-damaged archaeological deposits cannot be wholly dismissed. Along the southern margin of the field, the high susceptibility values form a band and are thought to represent a former field. Other trends may be due to agricultural practice.

The gradiometer data are dominated by magnetically strong natural responses, which are attributed to pedological and palaeo-environmental features. Given their strong magnetic signal, an archaeological origin cannot be wholly excluded. Also, these dominant responses may obscure any lesser archaeological anomalies. A single response of archaeological potential has been recorded but its interpretation is cautious. Several linear ferrous anomalies have been detected and these are thought to reflect plough damaged drains or pipes. There is also the possibility that some or all of them represent magnetic debris within backfilled drainage ditches.

*** It is essential that this summary is read in conjunction with the detailed results of the survey.**

SURVEY RESULTS

2002 / 01 Wygate Park, Spalding

1. Survey Areas

1.1 The entire field, covering over 10ha, was subject to volume-specific magnetic susceptibility survey using a Bartington field coil. Subsequently, 2ha of gradiometer survey in two areas (Areas A and B) were undertaken. Area A was positioned to encompass a topographic feature / earthwork. Area B was positioned to investigate the more credible anomalies in the susceptibility data. The location of survey is shown in Figure 1 at a scale of 1:2500.

1.2 The survey grids were set out and tied in by **GSB Prospection** using an EDM system. Stakes have been left *in situ* to facilitate the re-establishment of the grid.

2. Display

2.1 Figure 2 presents the susceptibility data as two greyscales, of the raw and interpolated data, at the scale of 1:4000. This is accompanied by an interpretation at the same scale (Figure 3).

2.2 Figure 4 is a summary greyscale of the gradiometer data for Areas A and B at the scale of 1:1000, with an interpretation (Figure 5) at the same scale.

2.3 Figures 6 to 9 present the gradiometer data as XY traces and dot density plots with interpretations at the scale of 1:625.

2.4 Numbers in parentheses in the text refer to specific anomalies noted on the interpretation diagrams.

2.5 These display formats and the interpretation categories employed are discussed in the *Technical Information* section at the end of the report.

3. General Considerations - Complicating Factors

3.1 Parts of the field had been recently ploughed which, along with extensive waterlogging, made it very difficult to walk at an even pace with the gradiometer. This has introduced a degree of noise to the data.

3.2 Several isolated ferrous type responses are apparent in the gradiometer datasets. These are presumed to reflect modern debris in the topsoil, although, given their context, they may reflect objects of greater antiquity. Only the most prominent of these are highlighted on the interpretation diagram and are not referred to in the text unless considered relevant.

4. Results of Magnetic Susceptibility Survey

4.1 The susceptibility survey noted a few zones of elevated readings which may be of possible interest. The mean value is 15SI and the standard deviation is 8SI. The values range from 6SI to 169SI, although once this outlying value is excluded the range is 6SI to 55SI and the standard deviation narrows to 6SI. The single reading of 169SI was not a spurious reading but coincides with a patch of charcoal and metal debris.

4.2 A band of elevated susceptibilities (1) along part of the southern margin of the study area may be of interest. It has a fairly distinct northern edge, which reflects a marked change in the levels of susceptibility. It is possible that this zone of enhanced susceptibilities respects a former field boundary. Old OS maps provided by the client show the study area, now a single large field, to have been previously subdivided by boundary ditches. The gradiometry data may also provide corroboration for this interpretation (see paragraph 5.5).

4.3 A more amorphous zone of increased topsoil susceptibility (2) has been recorded at the north-eastern edge of the study area. This coincides with a gateway and the susceptibilities are probably due to modern topsoil contamination, although an archaeological cause cannot be wholly dismissed.

4.4 Two narrow lines, running north-south, of high susceptibility readings (3) and (4) have been recorded. These may be archaeological, however, gradiometry survey, which investigated (3), provides no support for this. Faint edges or trends (5) and (6) can also be discerned within the data. Given that they are parallel with (1), they may reflect former field boundaries or past agricultural practice. There is no corresponding trend within the gradiometer data.

5. Results of Gradiometer Survey

Area A

This area was positioned to cover a topographical feature and not on the basis of the susceptibility data.

5.1 No anomalies of obvious archaeological potential coincident with the topographical feature, have been recorded. The data are dominated by a plethora of amorphous anomalies which, though their form is characteristic of natural features, the strength of the responses is less so. For this latter reason, an archaeological origin cannot be excluded for all these putative natural anomalies. Three negative responses, (7), (8) and (9) have also been noted on the basis of their form. These are believed to be natural, (7) and (9) may be palaeochannels, although the sub-circular form of (8) may indicate an archaeological cause but this is highly tentative.

5.2 Several linear ferrous anomalies and areas of magnetic disturbance have been recorded. These are thought to reflect pipe/services or tile drains and appear to have suffered a degree of plough damage. A more speculative suggestion is that they represent magnetic debris within the backfill of former drainage ditches.

Area B

This area was positioned to investigate anomalies (1) and (3) and the two trends (5) and (6) noted in the susceptibility survey.

5.3 Again, the data are dominated by numerous amorphous responses attributed to natural causes. However, as in Area A, these are magnetically strong and may obscure any lesser archaeological anomalies. A single short ditch-type anomaly (10) has been recorded which may be of archaeological interest. Its lack of context, however, weighs against such an interpretation.

5.4 A number of trends can be discerned within the data. These are at the limits of detection and any interpretation would be speculative.

5.5 Several linear ferrous anomalies have been detected. These are thought to represent pipe/services or tile drains damaged by ploughing; again, they may reflect backfilled drainage ditches. The most prominent of these (11) broadly coincides with the northern edge of anomaly (1) noted in the magnetic susceptibility survey. Viewing the two data sources together, anomaly (11) may represent the boundary ditch to the field suggested by anomaly (1). On a more pessimistic note, as anomaly (10) shares a similar orientation to these ferrous responses, it may share a similar cause.

6. Conclusions

6.1 The mapping of topsoil susceptibility over the whole study area recorded two zones of enhanced susceptibility. One is thought to reflect a former field division, whereas the second is more probably due to modern contamination. Neither corresponded to a topographic feature / possible earthwork noted in the desktop survey (APS, 2001). Other anomalies and trends have been noted for which any explanation would be tentative, although the most credible cause is recent agricultural practice.

6.2 Gradiometer survey, which sampled 20% of the total study area, was conducted in two areas: one over the possible earthwork feature, and another investigated several of the anomalies noted in the susceptibility survey. The data are dominated by a plethora of amorphous responses which are thought to be natural in origin, although an archaeological explanation might apply to some. These pronounced anomalies may also obscure any lesser archaeological responses.

6.3 A single short ditch-type anomaly of archaeological potential has been detected but its lack of context militates against such an interpretation. Numerous trends can also be discerned in the data and whilst they may be archaeological, any interpretation would be conjecture.

6.4 Several linear ferrous anomalies and areas of magnetic disturbance have been recorded. These are thought to represent damaged pipe/services or field drains. Some or all of them may also reflect magnetic debris used to backfill former drainage ditches.

Project Co-ordinator: Dr D Weston
Project Assistants: J Leigh & F Robertson

Date of Survey: 7th to 9th January, 2002
Date of Report: 15th January, 2002

References:

APS, 2001 Archaeological Assessment of Wygate Park, Spalding, Lincolnshire (APS 112/01)

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

TECHNICAL INFORMATION

The following is a description of the equipment and display formats used in **GSB Prospection (GSB)** reports. It should be emphasised that whilst all of the display options are regularly used, the diagrams produced in the final reports are the most suitable to illustrate the data from each site. The choice of diagrams results from the experience and knowledge of the staff of **GSB.**

All survey reports are prepared and submitted on the basis that whilst they are based on a thorough survey of the site, no responsibility is accepted for any errors or omissions.

Instrumentation

(a) Fluxgate Gradiometer - Geoscan FM36

This instrument comprises of two fluxgates mounted vertically apart, at a distance of 500mm. The gradiometer is carried by hand, with the bottom sensor approximately 100-300mm from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is conventionally measured in nanoTesla (nT), or gamma. The fluxgate gradiometer suppresses any diurnal or regional effects. Generally features up to one metre deep may be detected by this method. Readings are normally logged at 0.5m intervals along traverses 1.0m apart.

(b) Resistance Meter - Geoscan RM15

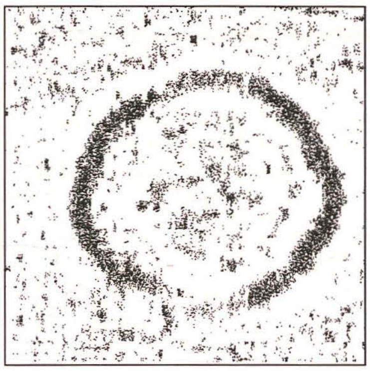
This measures the electrical resistance of the earth, using a system of four electrodes (two current and two potential.) Depending on the arrangement of these electrodes an exact measurement of a specific volume of earth may be acquired. This resistance value may then be used to calculate the earth resistivity. The "Twin Probe" arrangement involves the paring of electrodes (one current and one potential) with one pair remaining in a fixed position, whilst the other measures the resistance variations across a fixed grid. The resistance is measured in Ohms and the calculated resistivity is in Ohm-metres. The resistance method as used for area survey has a depth resolution of approximately 0.75m, although the nature of the overburden and underlying geology will cause variations in this generality. The technique can be adapted to sample greater depths of earth and can therefore be used to produce vertical "pseudo sections". In area survey readings are typically logged at 1.0m x 1.0m intervals.

(c) Magnetic Susceptibility

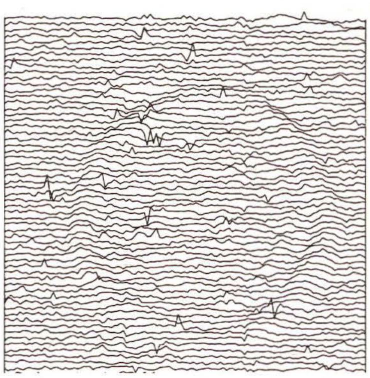
Variations in the magnetic susceptibility of subsoils and topsoils occur naturally, but greater enhanced susceptibility can also be a product of increased human/anthropogenic activity. This phenomenon of susceptibility enhancement can therefore be used to provide information about the "level of archaeological activity" associated with a site. It can also be used in a predictive manner to ascertain the suitability of a site for a magnetic survey. Sampling intervals vary widely but are often at the 10m or 20m level. The instrument employed for measuring this phenomenon is either a field coil or a laboratory based susceptibility bridge. The field coil measures the susceptibility of a volume of soil. The laboratory procedure determines the susceptibility of a specific mass of soil. For the latter 50g soil samples are collected in the field. These are then air-dried, ground down and sieved to exclude the coarse earth (>2mm) fraction. Readings are made using an AC-coil and susceptibility bridge, with results being expressed either as SI/kg x 10^{-8} or m^3/kg.

Display Options

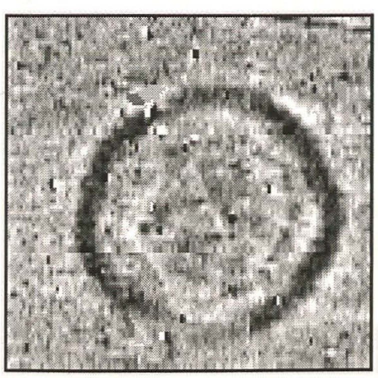
The following is a description of the display options used. Unless specifically mentioned in the text, it may be assumed that no filtering or smoothing has been used to enhance the data. For any particular report a limited number of display modes may be used.



(a) Dot Density
In this display minimum and maximum cut-off levels are chosen. Any value that is below the minimum will appear white, whilst any value above the maximum will be black. Values that lie between these two cut-off levels are depicted with a specified number of dots depending on their relative position between the two levels. Assessing a lower than normal reading involves the use of an inverse plot that reverses the minimum and maximum values, resulting in the lower values being presented by more dots. In either representation, each reading is allocated a unique area dependent on its position on the survey grid, within which numbers of dots are randomly placed. The main limitation of this display method is that multiple plots have to be produced in order to view the whole range of the data. It is also difficult to gauge the true strength of any anomaly without looking at the raw data values. However, this display is favoured for producing plans of sites, where positioning of the anomalies and features is important.



(b) XY Plot
This involves a line representation of the data. Each successive row of data is equally incremented in the Y axis, to produce a stacked profile effect. This display may incorporate a hidden-line removal algorithm, which blocks out lines behind the major peaks and can aid interpretation. The advantages of this type of display are that it allows the full range of the data to be viewed and shows the shape of the individual anomalies. The display may also be changed by altering the horizontal viewing angle and the angle above the plane. The output may be either colour or black and white.



(c) Greyscale
This format divides a given range of readings into a set number of classes. These classes have a predefined arrangement of dots or shade of grey, the intensity increasing with value. This gives an appearance of a toned or grey-scale. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. While colour plots can look impressive and can be used to highlight certain anomalies, greyscales tend to be more informative.

Terms commonly used in the graphical interpretation of gradiometer data

Ditch / Pit
This category is used only when other evidence is available that supports a clear archaeological interpretation e.g. cropmarks or excavation.

Archaeology
This term is used when the form, nature and pattern of the response is clearly or very probably archaeological but where no supporting evidence exists. These anomalies, whilst considered anthropogenic, could be of any age. If a more precise archaeological interpretation is possible then it will be indicated in the accompanying text.

? Archaeology
The interpretation of such anomalies is often tentative, with the anomalies exhibiting either weak signal strength or forming incomplete archaeological patterns. They may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.

Areas of Increased Magnetic Response
These responses show no visual indications on the ground surface and are considered to have some archaeological potential.

Industrial
Strong magnetic anomalies, that due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.

Natural
These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions e.g. palaeochannels or magnetic gravels.

? Natural
These are anomalies that are likely to be natural in origin i.e geological or pedological.

Ridge and Furrow
These are regular and broad linear anomalies that are presumed to be the result of ancient cultivation. In some cases the response may be the result of modern activity.

Ploughing Trend
These are isolated or grouped linear responses. They are normally narrow and are presumed modern when aligned to current field boundaries or following present ploughing.

Trend
This is usually an ill-defined, weak or isolated linear anomaly of unknown cause or date.

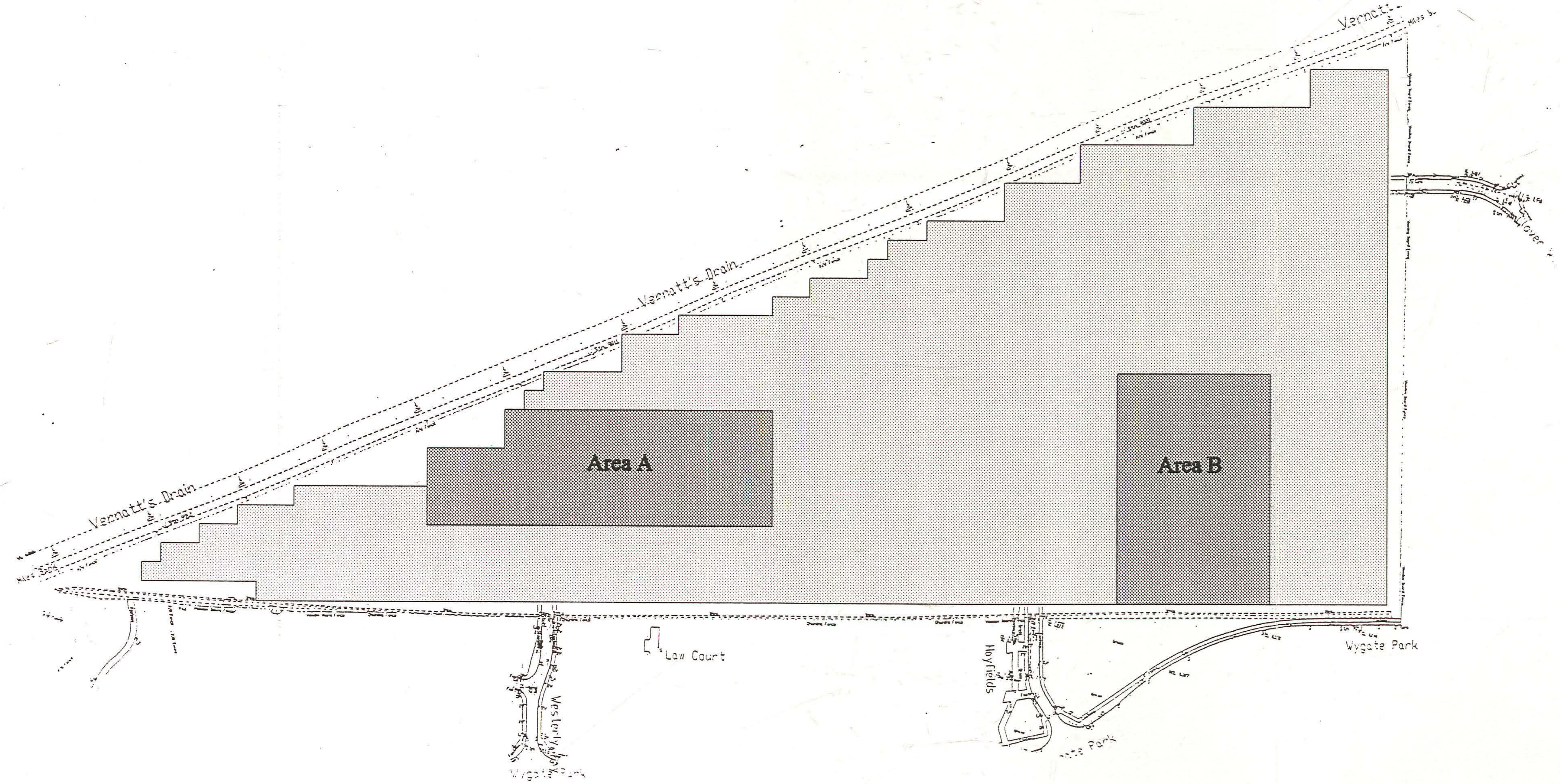
Areas of Magnetic Disturbance
These responses are commonly found in places where modern ferrous or fired materials are present e.g. brick rubble. They are presumed to be modern.

Ferrous Response
This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes or above ground features such as fencelines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.

NB This is by no means an exhaustive list and other categories may be used as necesssary.

List of Figures

WYGATE PARK, SPALDING
Location Diagram



Based on a plan supplied by the client

Gradiometer Survey

1:2500

Magnetic Susceptibility Survey

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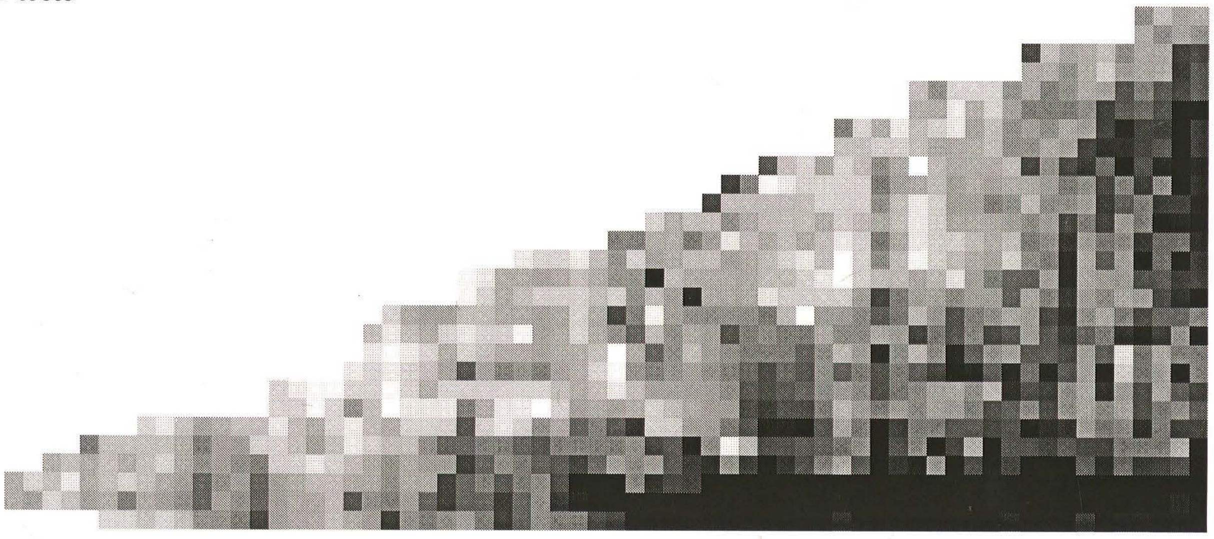
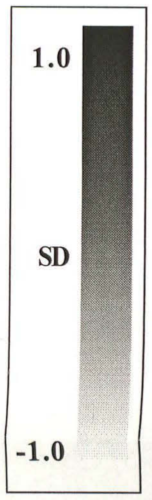
Figure 1

WYGATE PARK, SPALDING
Magnetic Susceptibility Data

Raw Data





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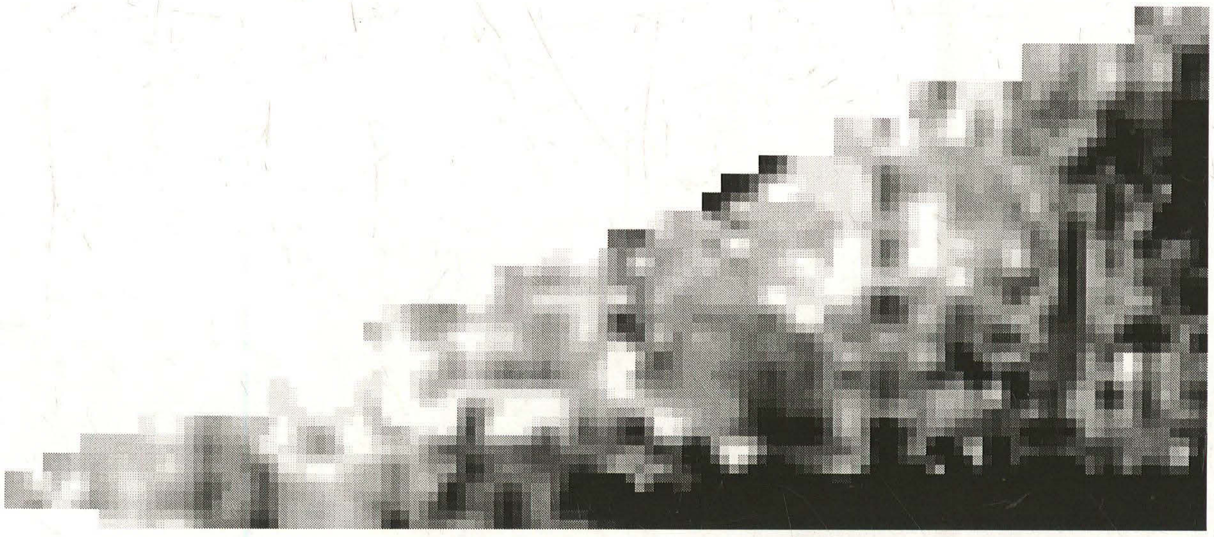
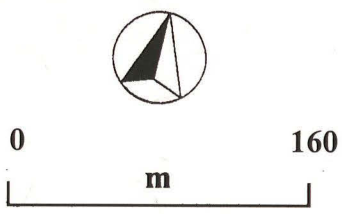
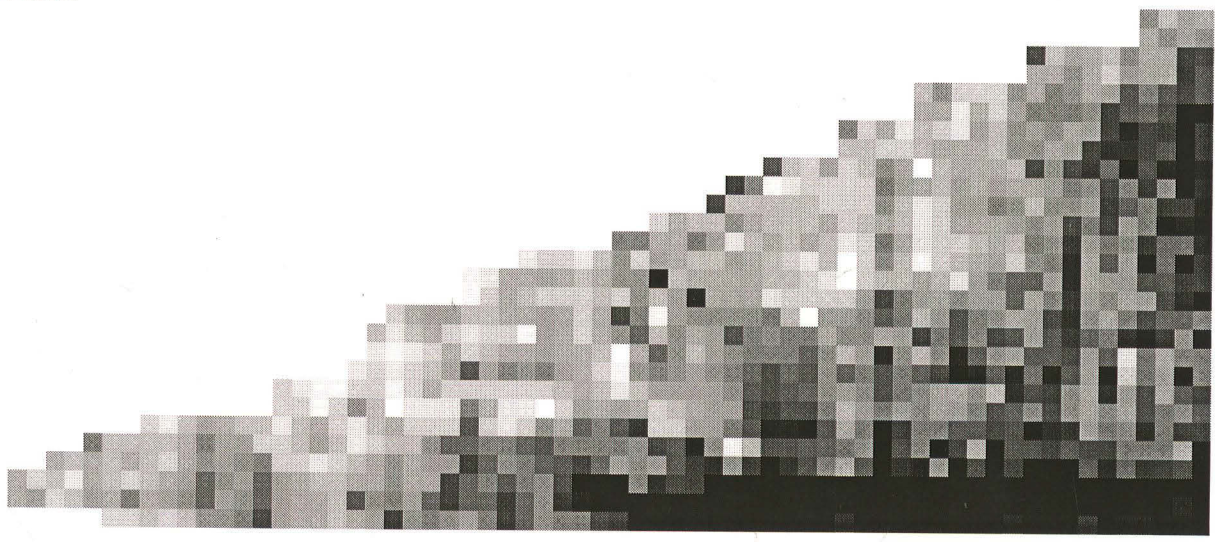
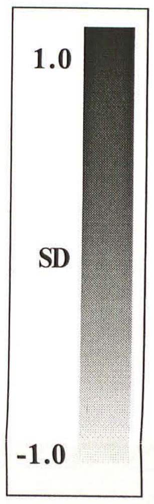




WYGATE PARK, SPALDING
Magnetic Susceptibility Data

Raw Data





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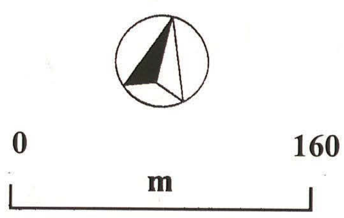

Figure 2

WYGATE PARK, SPALDING
Magnetic Susceptibility Data

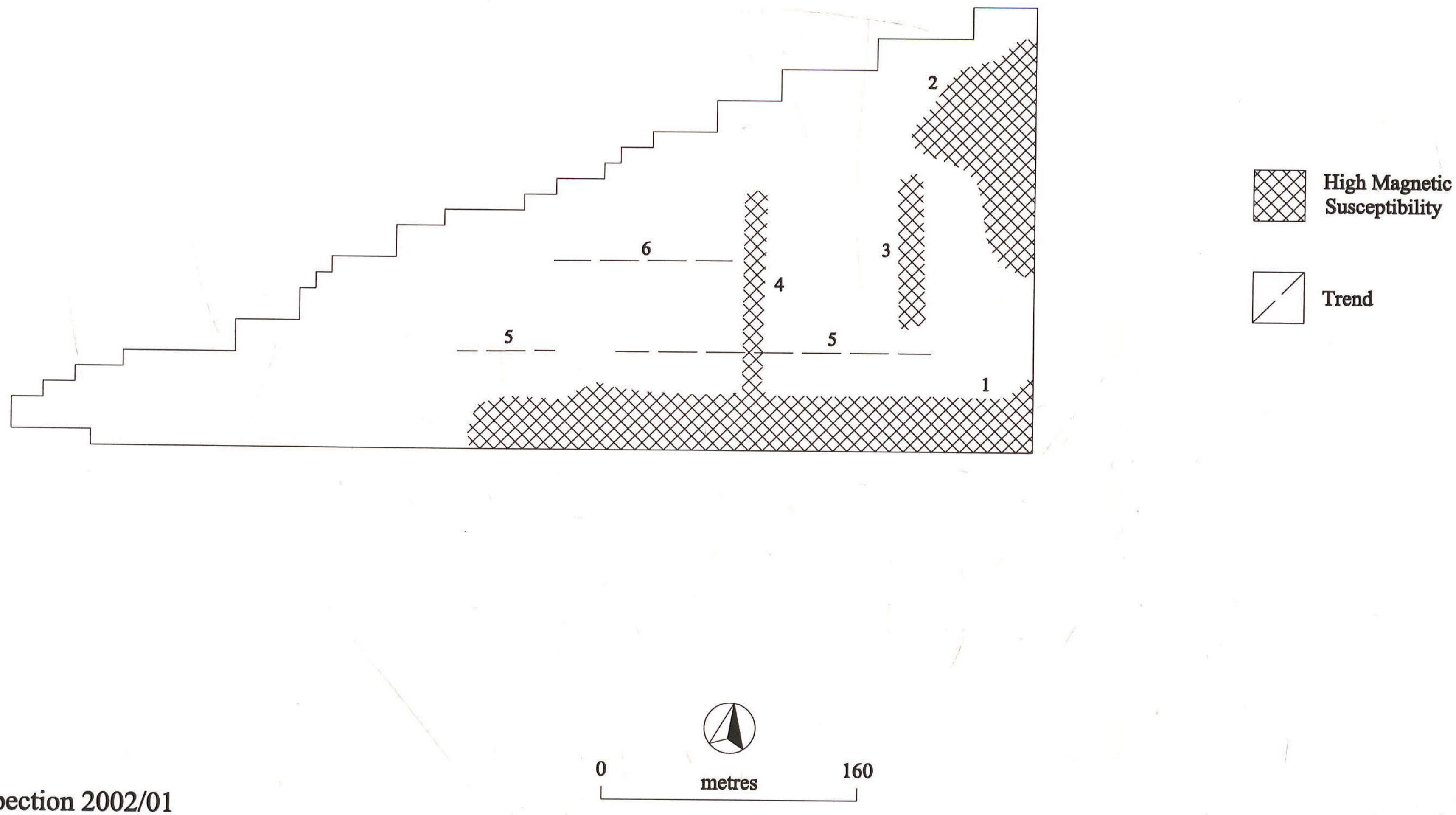

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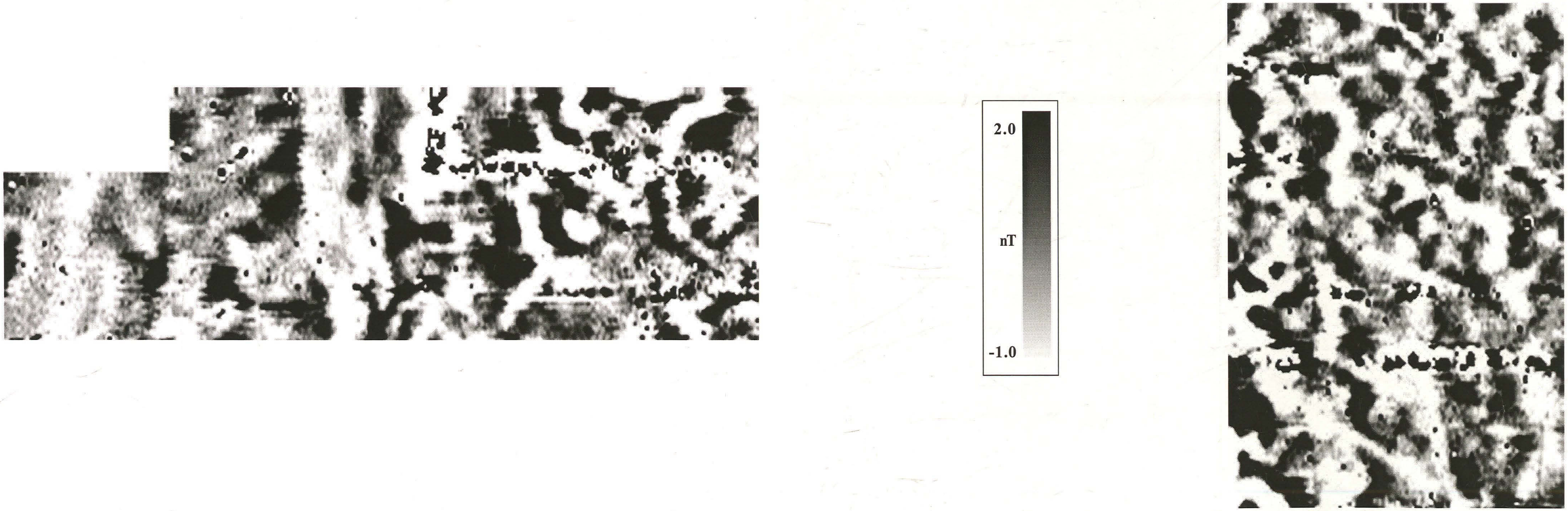
Figure 3

WYGATE PARK, SPALDING
Gradiometer Data



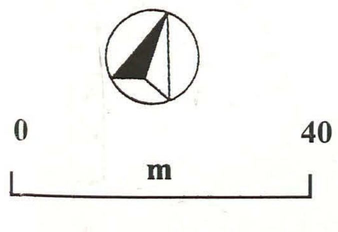


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Figure 4

WYGATE PARK, SPALDING
Gradiometer Data

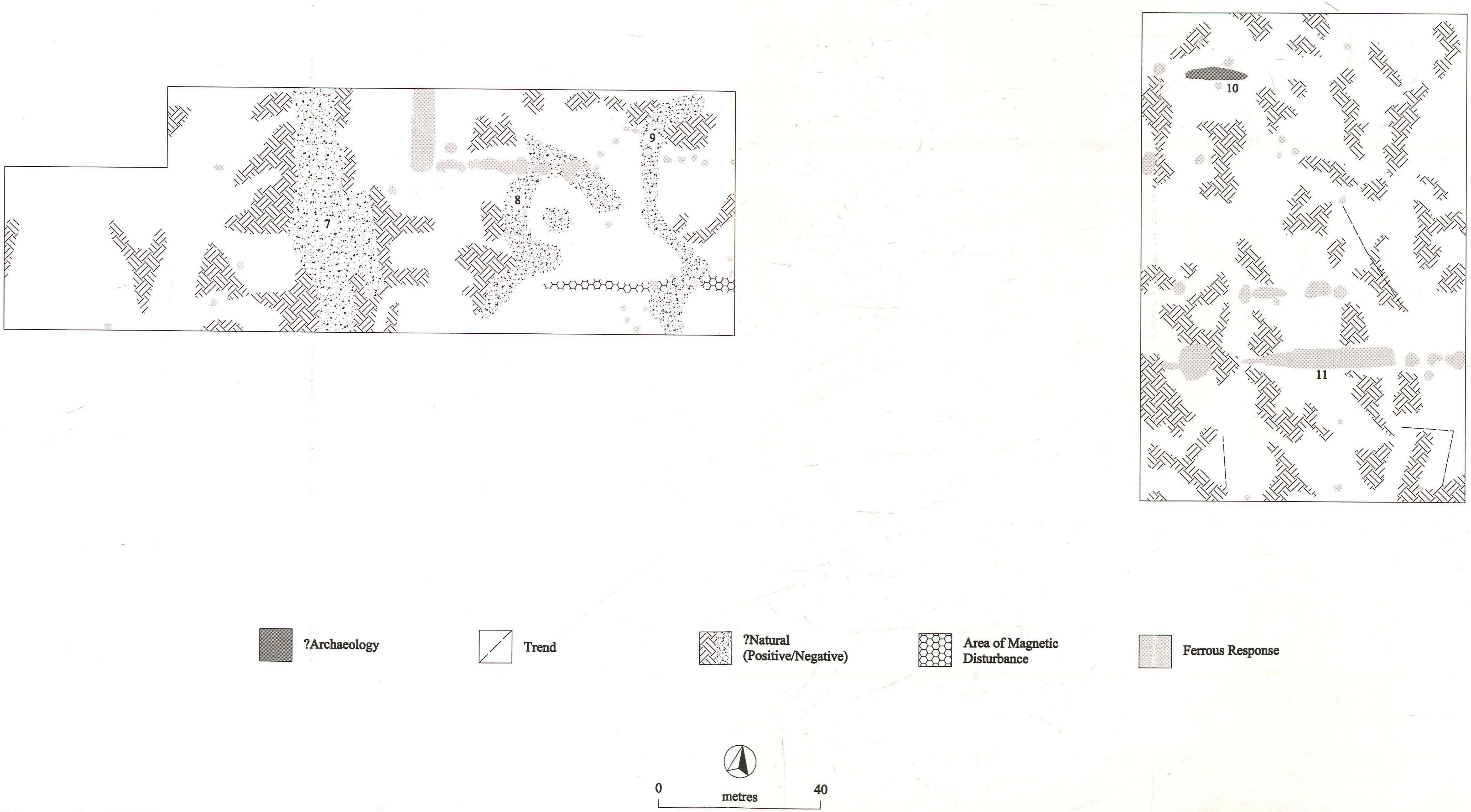

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Figure 5

WYGATE PARK, SPALDING
Gradiometry Survey: Area A

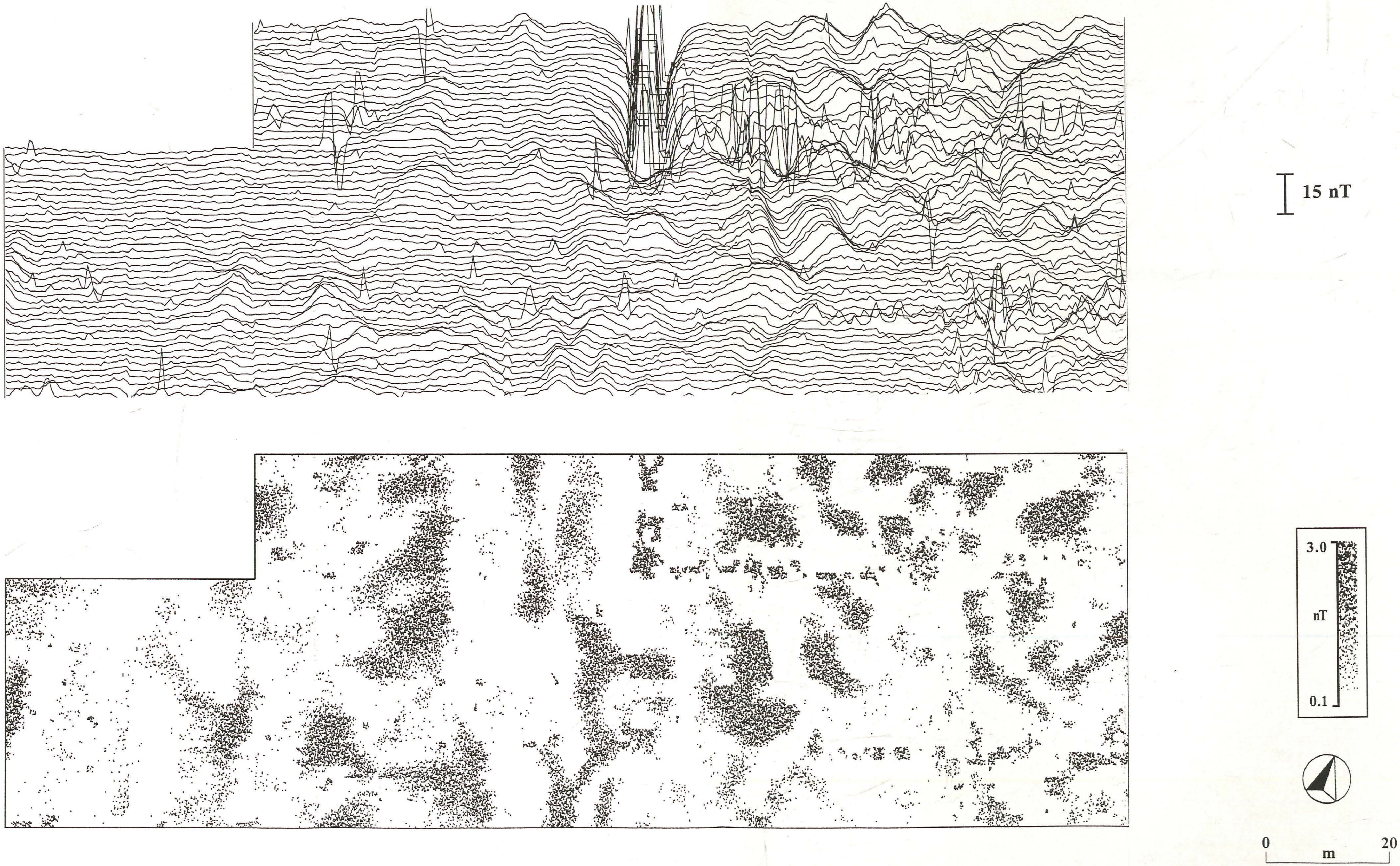

Figure 6

WYGATE PARK, SPALDING
Gradiometry Survey: Area A

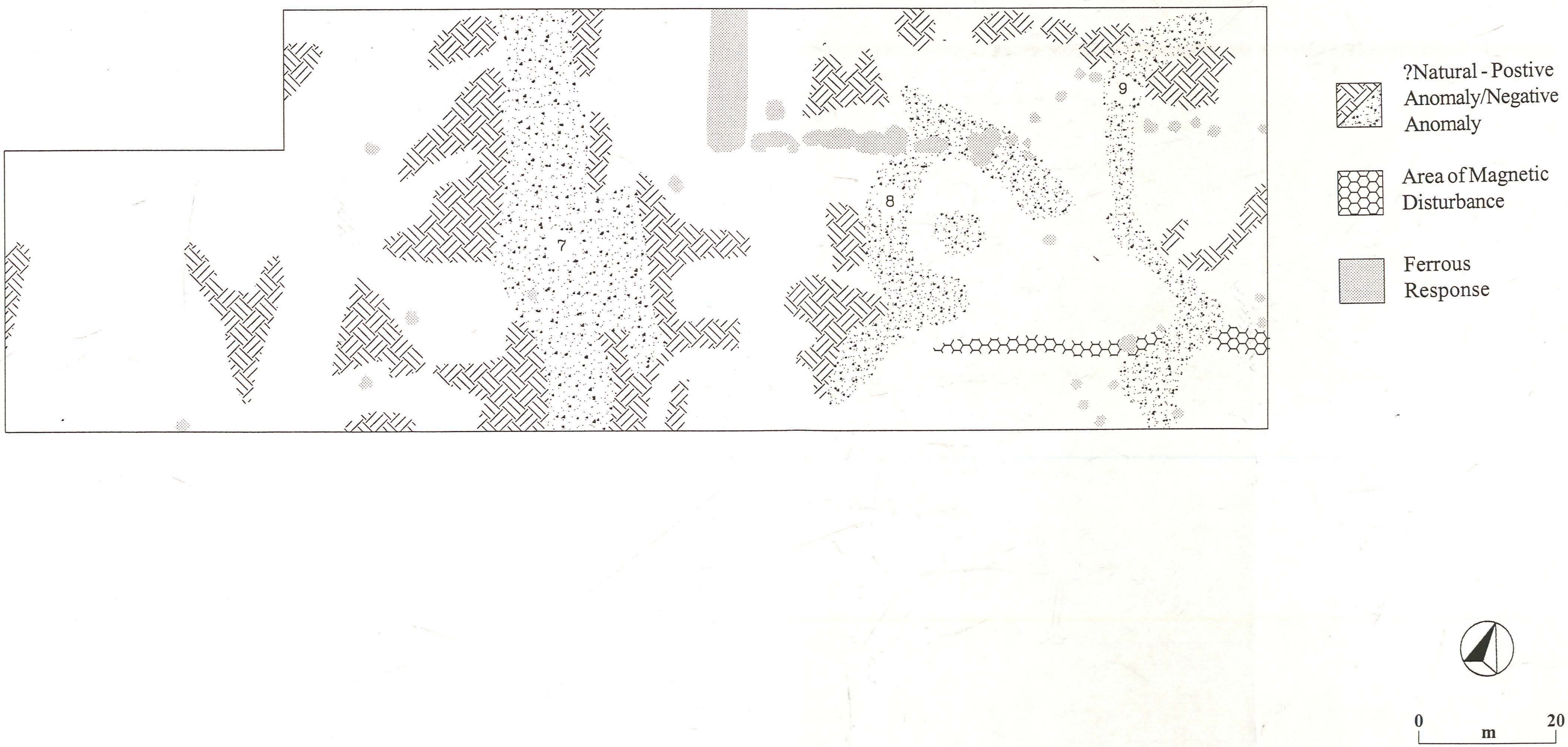

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Figure 7

WYGATE PARK, SPALDING
Gradiometry Survey: Area B

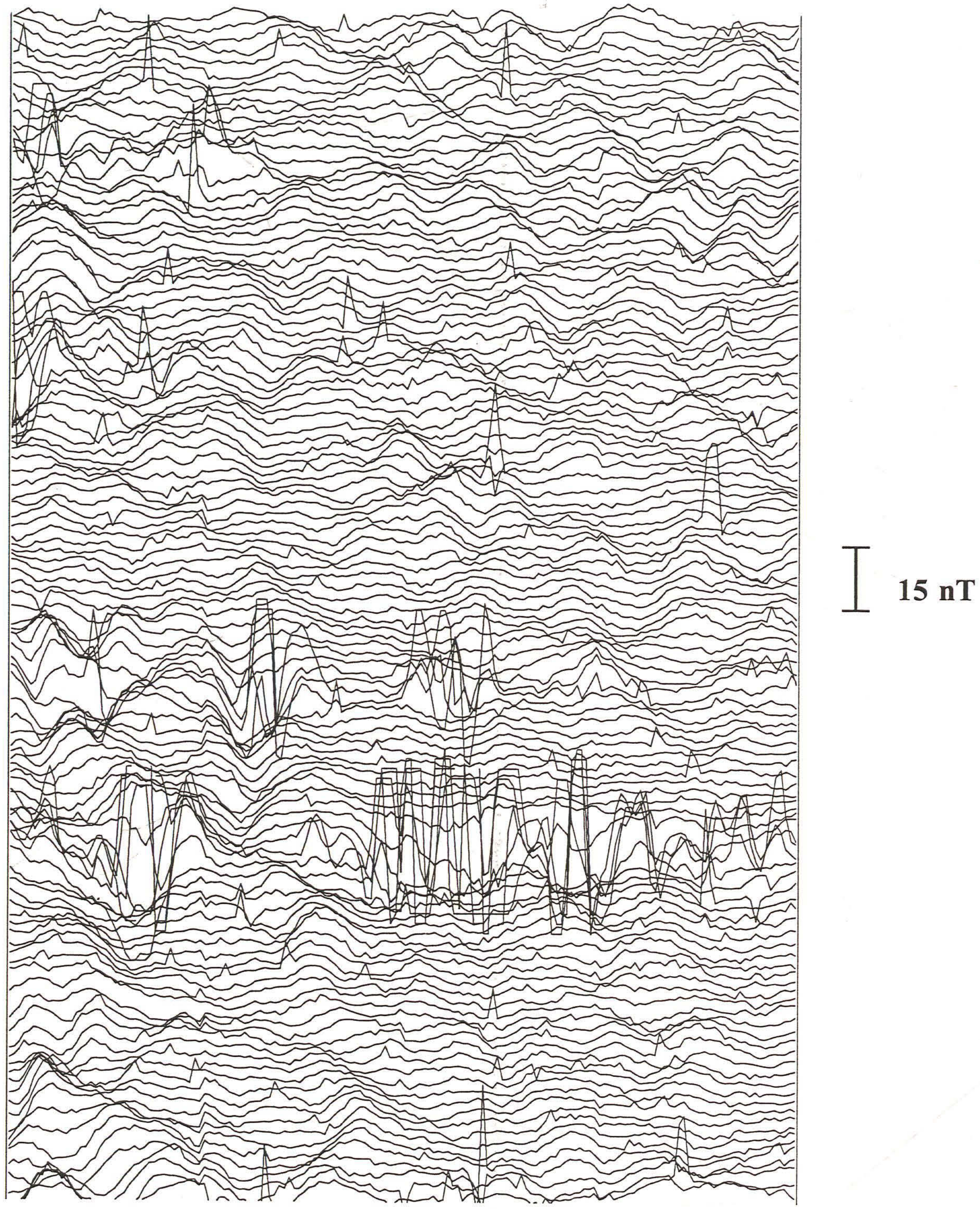

Figure 8

WYGATE PARK, SPALDING
Gradiometer Survey: Area B