RPS Planning, Transport and Environment

INDEX DATA	RPS INFORMATION
Scheme Title A1 Dishforth to North of Leeming Improvements	Details Rep:- Geophysical survey
Road Number A1	Date
Contractor Pathway Keller & Partners	
County N. Yorks	
OS Reference	
Single sided ✓ Double sided A3 14 Colour C	

3.4

Geophysical Surveys of Bradford
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REPORT ON GEOPHYSICAL SURVEY

A1
DISFORTH TO NORTH OF LEEMING IMPROVEMENTS

Report number 94/39 & 94/51

Work commissioned by :

ANTHONY
WALKER
AND PARTNERS

SITE SUMMARY SHEET

94/39 and 94/51 A1 Dishforth to North of Leeming Improvements

NGR: Various, see text

Location, topography and geology

Both areas reported here lie adjacent to the present A1 trunk road, in a section between Dishforth and North of Leeming. The survey areas are underlain by Triassic and Permian sandstones. The drift geology is mostly glacial sand and gravels. The soils at all of the survey areas are Argillic brown earths.

Archaeology

A desktop study undertaken by **Anthony Walker and Partners (AWP)** has detailed the archaeological potential for this section of the proposed road upgrading. The geophysical survey work which is reported here focuses on two archaeologically sensitive areas identified by AWP. Information specific to the two areas will be detailed in the text

Aims of Survey

The general aims of the geophysical work, as defined in the specification set out by AWP include -

1. to provide a detailed area survey of any buried archaeological features and deposits, subject to the limitations of available techniques, within the survey areas;
2. to provide information about the nature and possible interpretation of anomalies revealed by the survey;
3. to identify, as far as possible, any areas which are not responsive to geophysical survey techniques and which therefore require the application of other methods to determine the nature and extent of sub-surface archaeological features and deposits.

Aims specific to each survey area will be described in the results section of the report.

Summary of Results *

It was decided that fluxgate gradiometry would be used to achieve the aims stated above. Few anomalies of high archaeological potential have been found at Areas A6 and C22.

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

SURVEY RESULTS
94/39 and 94/51 A1 Dishforth to North of Leeming Improvements

1. Survey Areas (Figure 1)

1.1 Two gradiometer surveys were undertaken at specific points along the A1 Dishforth to North of Leeming section. These locations were chosen by AWP on the basis of previous desktop studies and fieldwork.

1.2 In all cases the 20m grid at the survey locations was accurately positioned using an EDM by staff of AWP.

1.3 The general position of the surveys can be seen in Figures 1a and 2a.

2. Display

2.1 The results are displayed as dot-density plots, X-Y traces and grey scale images at a scale of 1:500. These display formats are discussed in the *Technical Information Section*, at the end of the text.

2.2 Summary interpretations based on AWP maps are reproduced at 1:1000, Figures 1b and 2b.

3. General Considerations - Complicating factors

3.1 Ground conditions were generally good at the sites, with the ground largely being level, covered by low vegetation and free of obstacles.

4. Results

4.A6 Area A6 (Figures A6.A.a to A6.D.2))

4.A.6.1 Aerial photographic evidence has indicated the presence of archaeological features in the area to the west of this sample. The brief was to establish whether the known archaeology extended into the survey area.

4.A.6.2 Four samples, each covering an area of 60 x 60m, were surveyed at A6. Each sample will be described separately.

4.A.6.3 **Area A6(A)**. The anomalies detected within this area are generally very weak and form few patterns that appear archaeologically meaningful. A sinuous line of anomalies can be seen that runs approximately north-south. It is believed that this anomaly is non-archaeological and possibly relates to a change in topography evident in the field.

4.A.6.4 **Area A6(B).** Small scale ferrous anomalies are scattered throughout the area. Only four anomalies with any archaeological potential have been found. Three of these are believed to represent pit-type features, while the other may indicate the corner of an enclosure. However, it must be stressed that the interpretation of all of the archaeological anomalies is tentative.

4.A.6.5 **Area A6(C).** The data set collected in this area contains greater noise levels than the previous two. As in the previous areas the majority of the anomalies can be discounted as being ferrous in origin. The two broken linear anomalies that have been indicated on the interpretation are likely to be former hedgelines or similar boundaries.

4.A.6.6 **Area A6(D).** A concentration of pit-type anomalies have been identified in the southern corner of the survey.

4.A.6.7 **Summary Area A6.** The majority of the anomalies in this area are likely to be ferrous in nature. Although there are a number of anomalies that have some archaeological potential their interpretation remains tentative. The anomalies are relatively weak and may be the product of soil noise and/or deeply buried ferrous material.

4.C22 Area C22 (Figures C22.1 to C22.2)

4.C.22.1 Geophysical work undertaken to the south of this area indicated that Area C22 was of high archaeological potential. The survey covered the whole of the area designated as C22.

4.C.22.2 The anomalies found in this area are dominated by the zone of disturbed readings next to the farm buildings to the west of C22. Throughout the remaining area can be found traces of ridge and furrow. Despite the confused response it is likely that few archaeological anomalies are present within C22.

5. Conclusions

5.1 Few anomalies of high archaeological potential have been found during the gradiometer survey at Areas A6 and C22.

Project Co-ordinator: Dr C F Gaffney
Project Assistants: Dr C Adam, S Gaffney, J Gater, Dr S Ovenden, N Nemcek, D Shiel, A Shields, C Stephens and A Wilson

TECHNICAL INFORMATION

The following is a description of the equipment and display formats used in **GEOPHYSICAL SURVEYS OF BRADFORD** 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 **GEOPHYSICAL SURVEYS OF BRADFORD**.

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.

Magnetic readings are logged at 0.5m intervals along one axis in 1m traverses giving 800 readings per 20m x 20m grid, unless otherwise stated. Resistance readings are logged at 1m intervals giving 400 readings per 20m x 20m grid. The data are then transferred to portable computers and stored on 3.5" floppy discs. Field plots are produced on a portable Hewlett Packard Thinkjet. Further processing is carried out back at base on computers linked to appropriate printers and plotters.

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.

(b) Resistance Meter - Geoscan RM4 or RM15

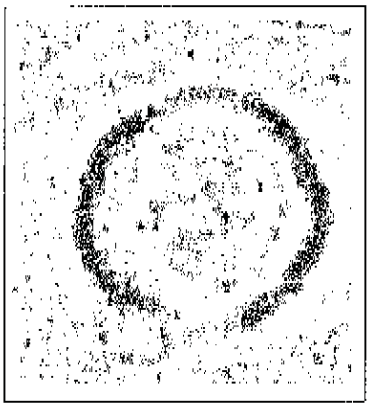
This measures the electrical resistance of the earth, using a system of four electrodes (two current and two potential.) Depending on the arrangement of these electrodes an exact measurement of a specific volume of earth may be acquired. This resistance value may then be used to calculate the earth resistivity. 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".

(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. The instrument employed for measuring this phenomenon is either a field coil or a laboratory based susceptibility bridge. For the latter 50g soil samples are collected in the field.

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 cut-off value will appear white, whilst any value above the maximum cut-off value will appear black. Any value that lies between these two cut-off levels will have a specified number of dots depending on the relative position between the two levels. The focus of the display may be changed using different levels and a contrast factor (C.F.). Usually the C.F. = 1, producing a linear scale between the cut-off levels. Assessing a lower than normal reading involves the use of an inverse plot, This plot simply 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. This display is much favoured for producing plans of sites, where positioning of the anomalies and features is important.

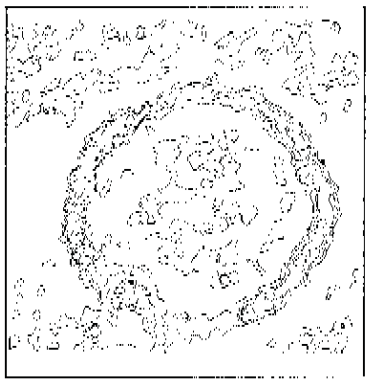
(b) X-Y Plot

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. 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 indivíual anomalies. Results are produced on a flatbed plotter.

(c) Grey-Scale

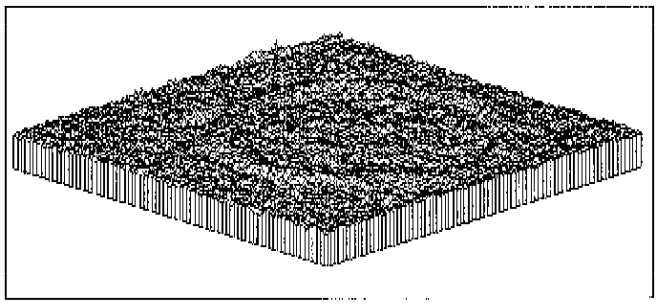
This format divides a given range of readings into a set number of classes. These classes have a predefined arrangement of dots or shade of grey, the intensity increasing with value. This gives an appearance of a toned or grey scale.

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, grey-scales tend to be more informative.



(d) Contour

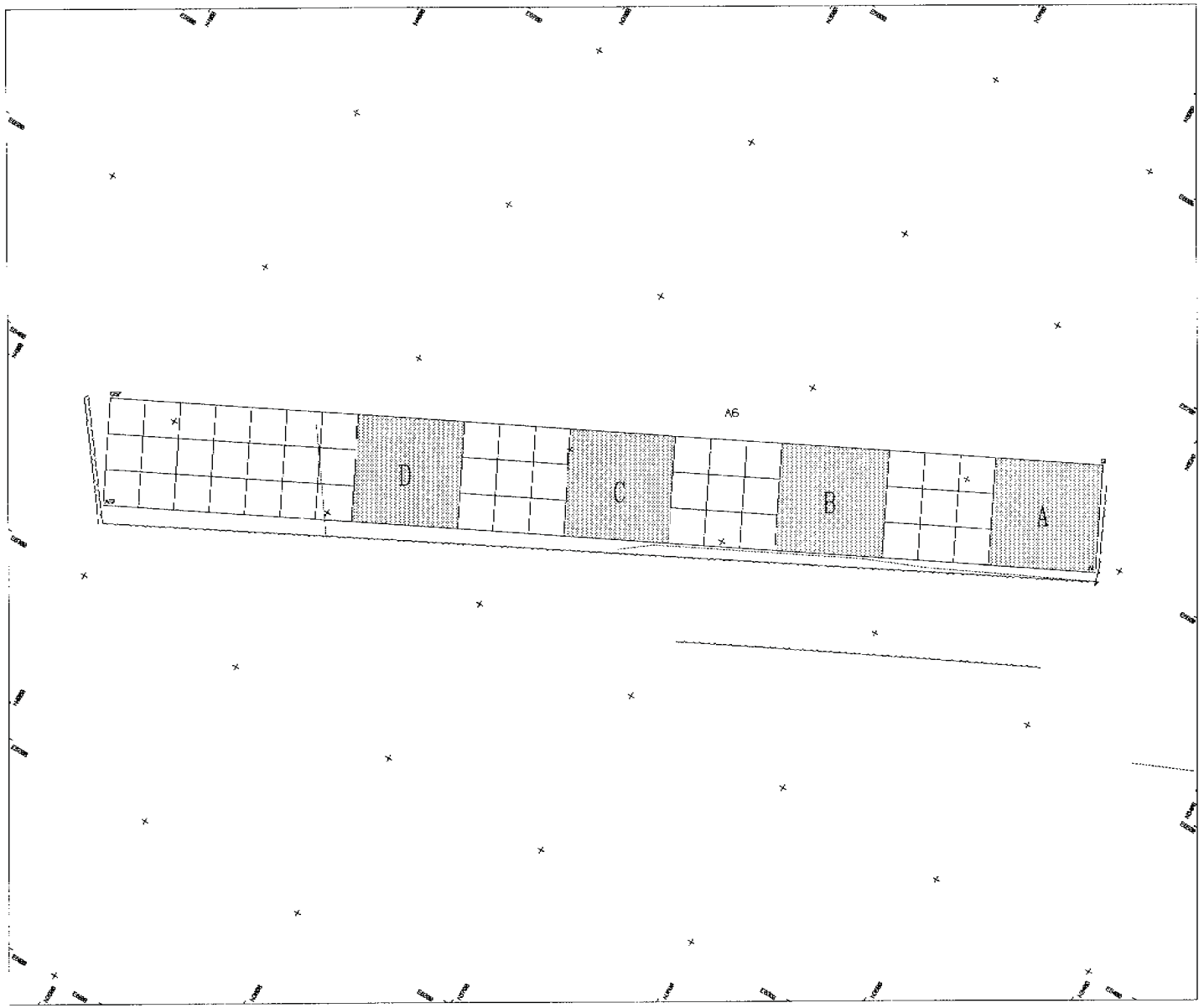
This display format is commonly used in cartographic displays. Data points of equal value are joined by a contour line. Closely packed contours indicate a sharp gradient. The contours therefore highlight an anomalous region. The range of contours and contour interval are selected manually and the display is then generated on the computer screen or plotted directly on a flat bed plotter / inkjet printer.



(e) 3-D Mesh

This display joins the data values in both the X and Y axis. The display may be changed by altering the horizontal viewing angle and the angle above the plane. The output may be either colour or black and white. A hidden line option is occasionally used (see (b) above).

GEOPHYSICAL SURVEYS OF BRADFORD	PROJECT: A1 DISHFORTH TO NORTH OF LEEMING	TITLE: Location Diagram	Based on a plan supplied by Anthony Walker & Partners



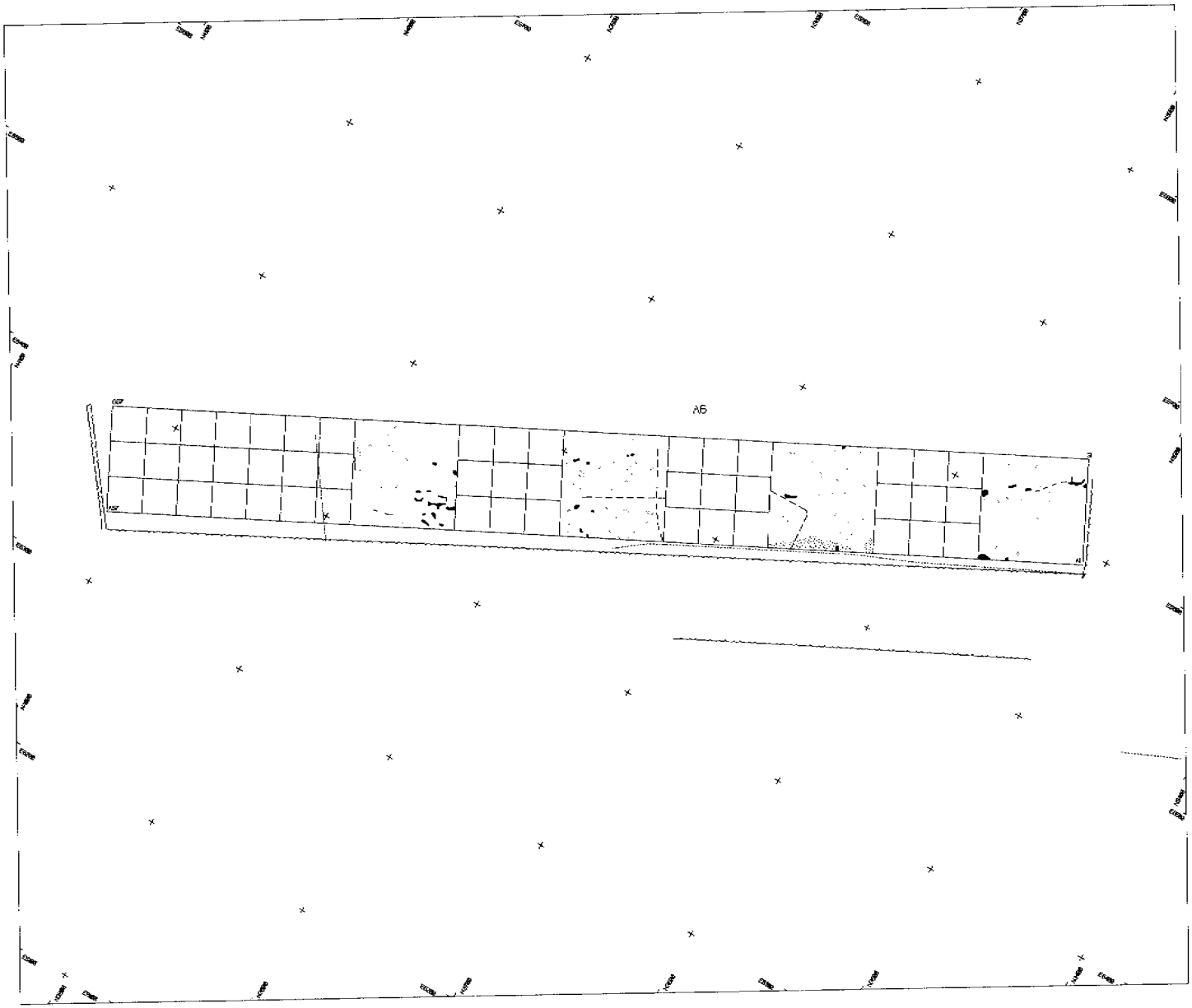
Graciometer Survey

1:2500

ORIGINAL AT A3

Figure 1a

GEOPHYSICAL SURVEYS OF BRADFORD	PROJECT: A1 DISHFORTH TO NORTH OF LEEMING	TITLE: Summary Interpretation	Based on a plan supplied by Anthony Walker & Partners



?Archaeology

Disturbed

?Field Boundary

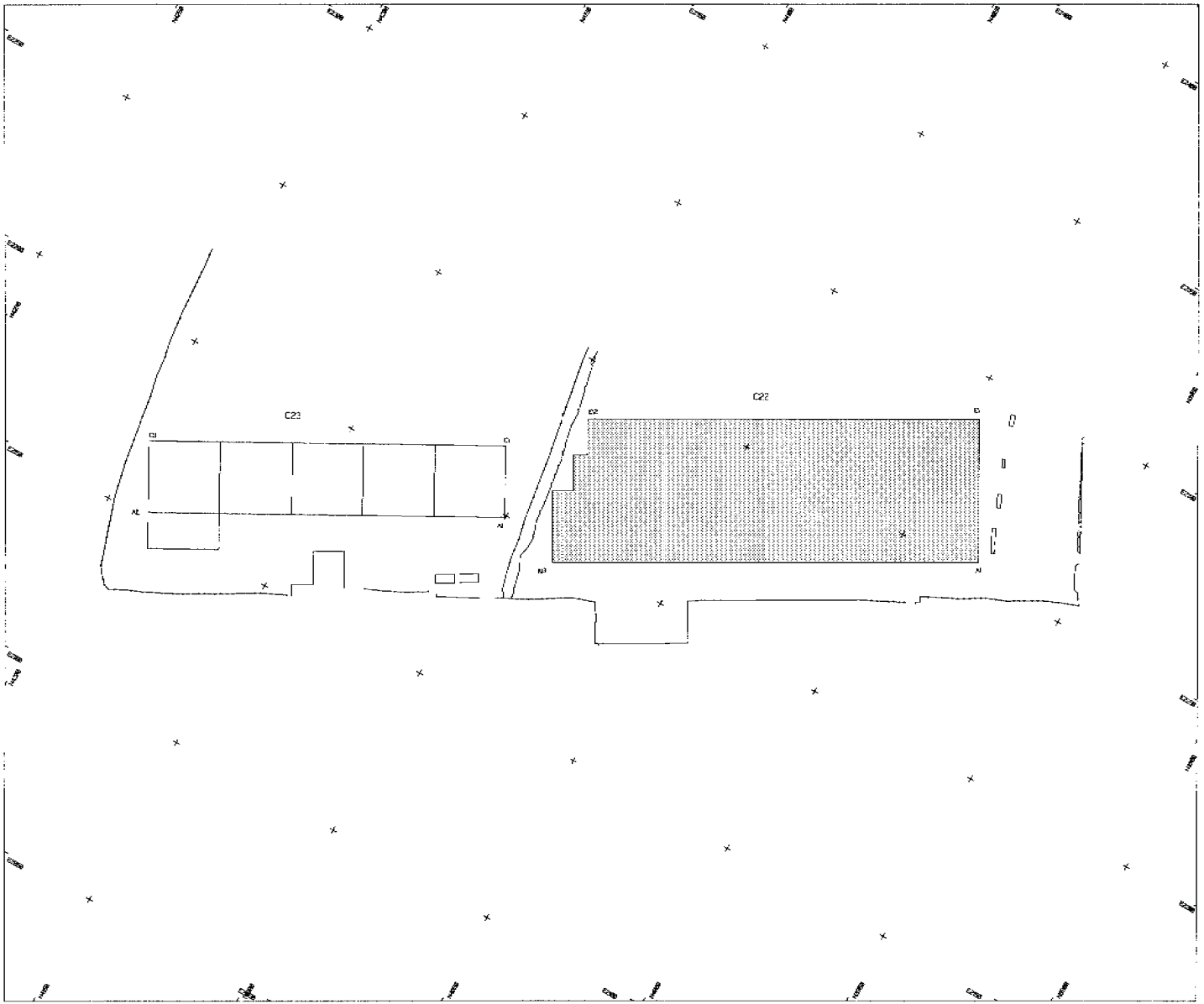
Ferrous

1:2500

ORIGINAL AT A3

Figure 1b

GEOPHYSICAL SURVEYS OF BRADFORD	PROJECT: A1 DISHFORTH TO NORTH OF LEEMING	TITLE: Location Diagram	Based on a plan supplied by Anthony Walker & Partners



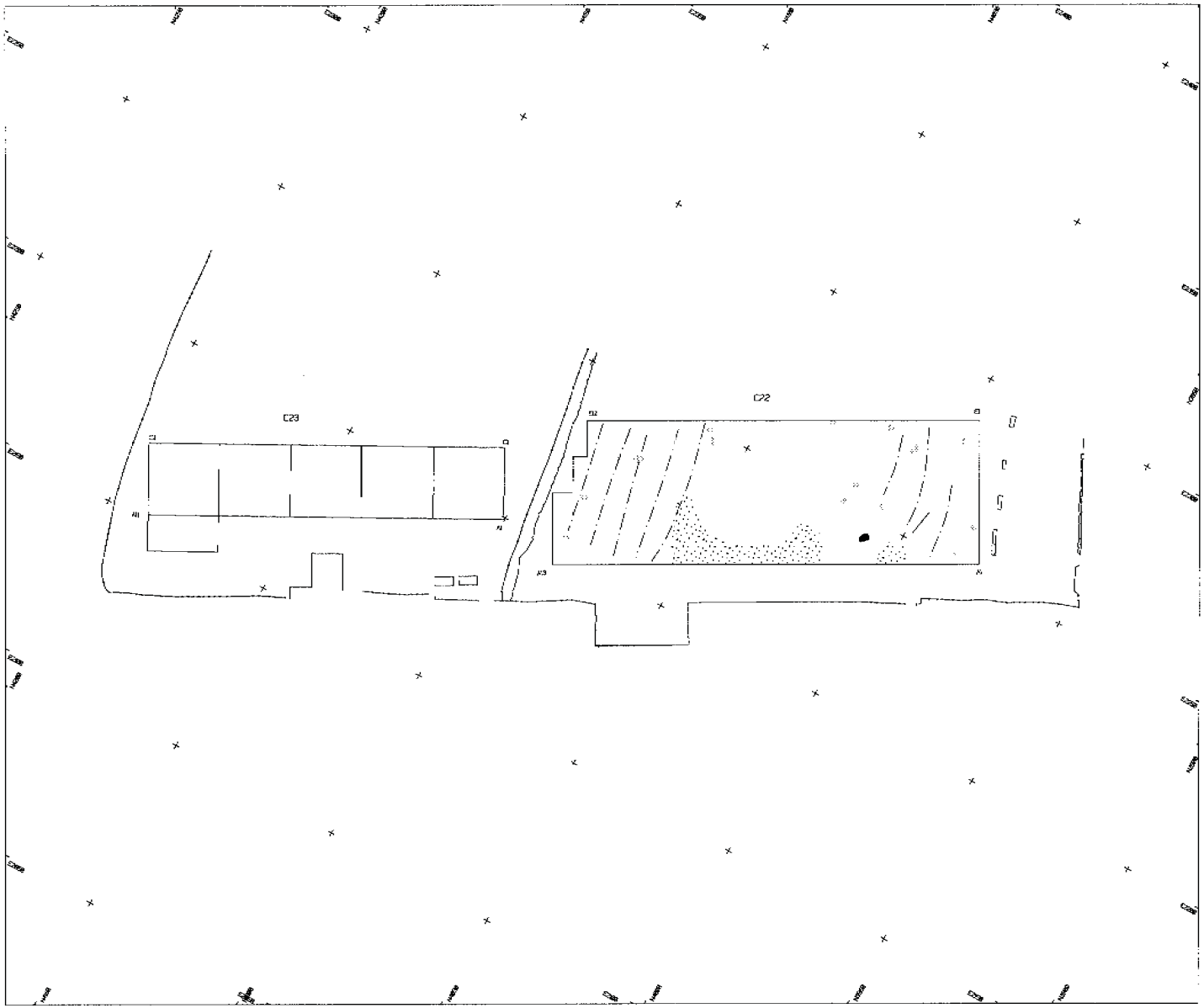
Gradiometer Survey

1:1250

ORIGINAL AT A3

Figure 2a

GEOPHYSICAL SURVEYS OF BRADFORD	PROJECT: A1 DISHFORTH TO NORTH OF LEEMING	TITLE: Summary Interpretation	Based on a plan supplied by Anthony Walker & Partners



?Archaeology

Disturbed

Ridge & Furrow

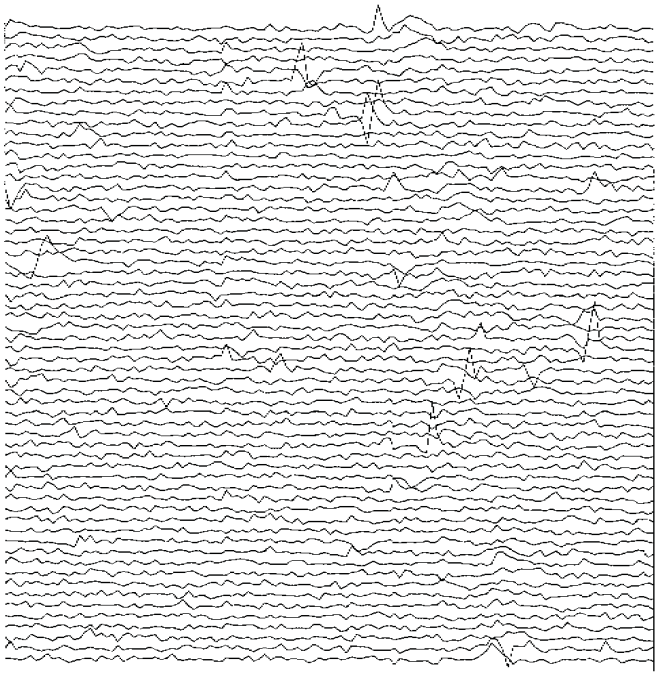
Ferrous

1:1250

ORIGINAL AT A3

Figure 2b

A1
DISHFORTH TO NORTH OF LEEMING
Area A6(A)



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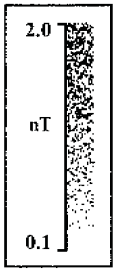
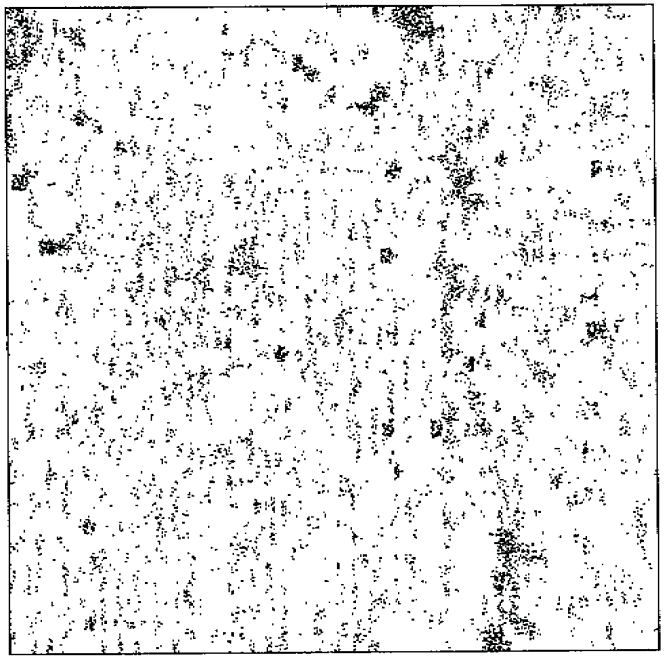
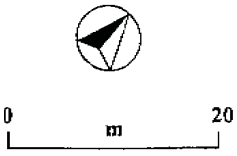


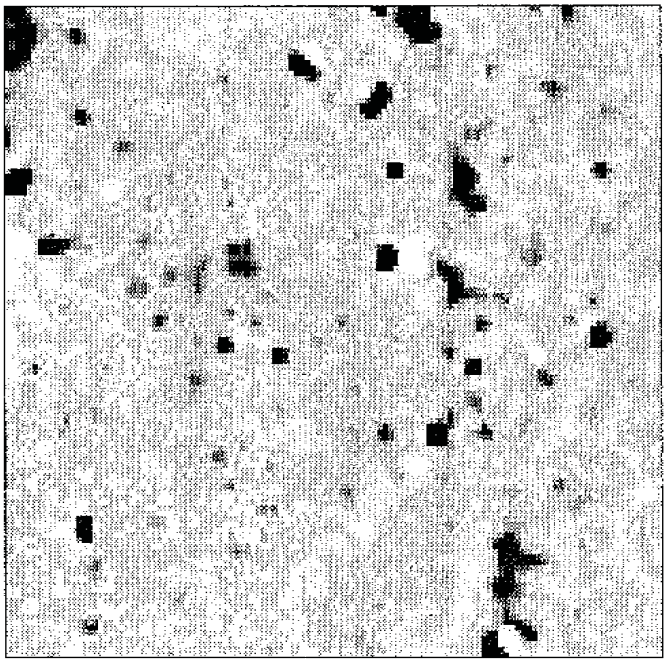


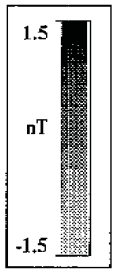


ORIGINAL AT A3

Figure A6A.1

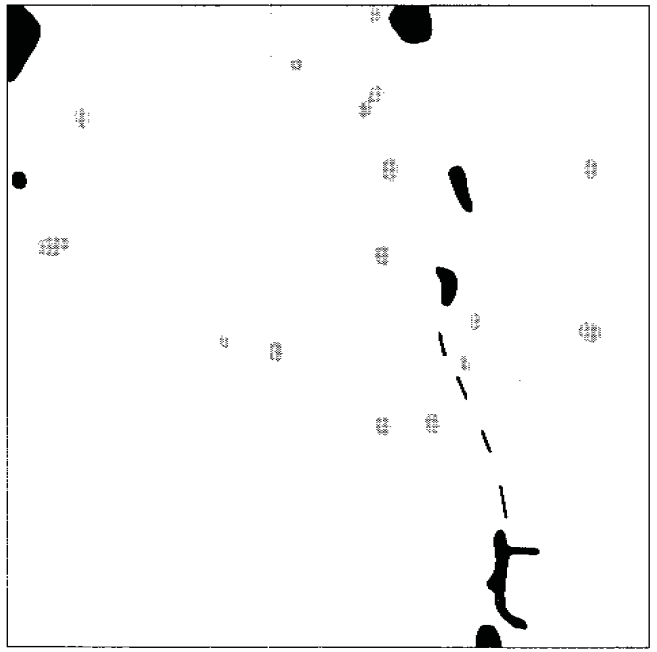
A1
DISHFORTH TO NORTH OF LEEMING
Area A6(A)





?Archaeology

Ferrous



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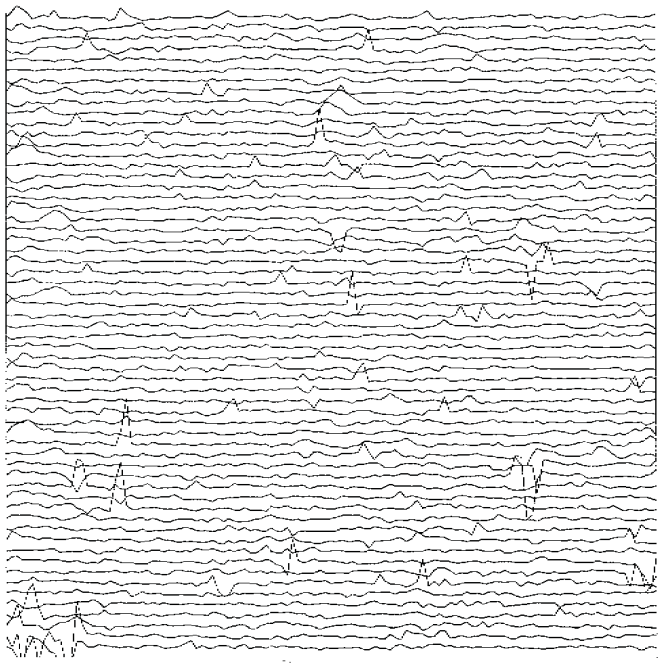
ORIGINAL AT A3

Figure A6A.2

A1
DISHFORTH TO NORTH OF LEEMING
Area A6(B)



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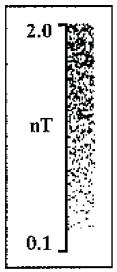

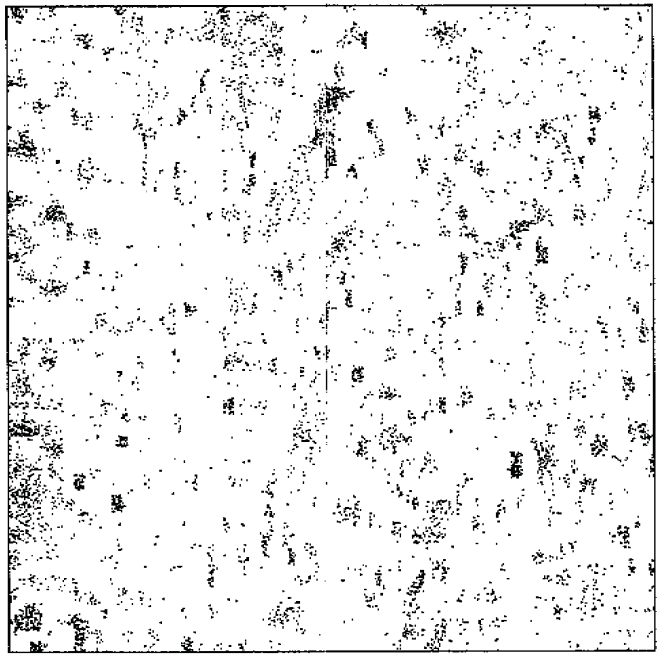

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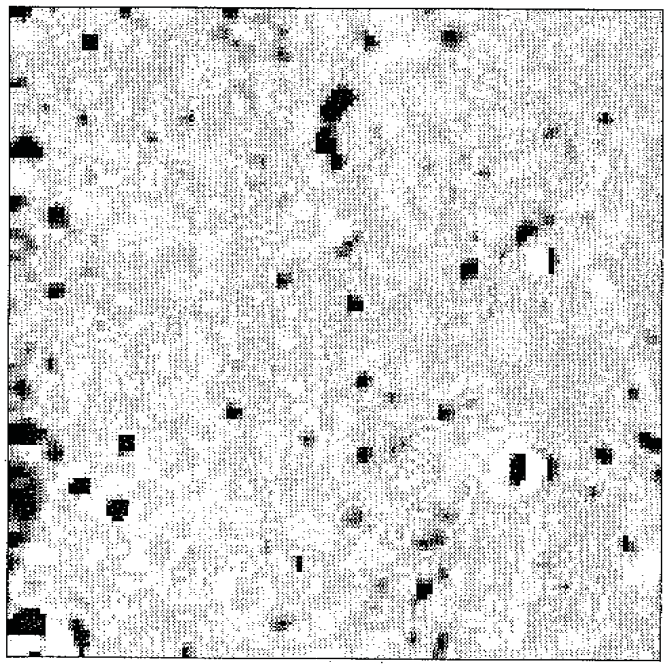
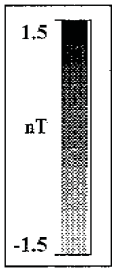
ORIGINAL AT A3

Figure A6B.1

A1
DISHFORTH TO NORTH OF LEEMING
Area A6(B)



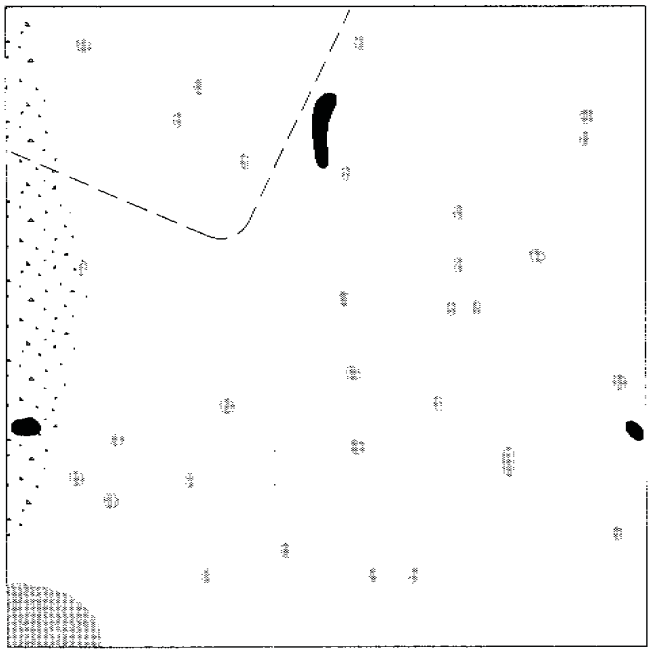


?Archaeology

??Ditch

Disturbed

Ferrous



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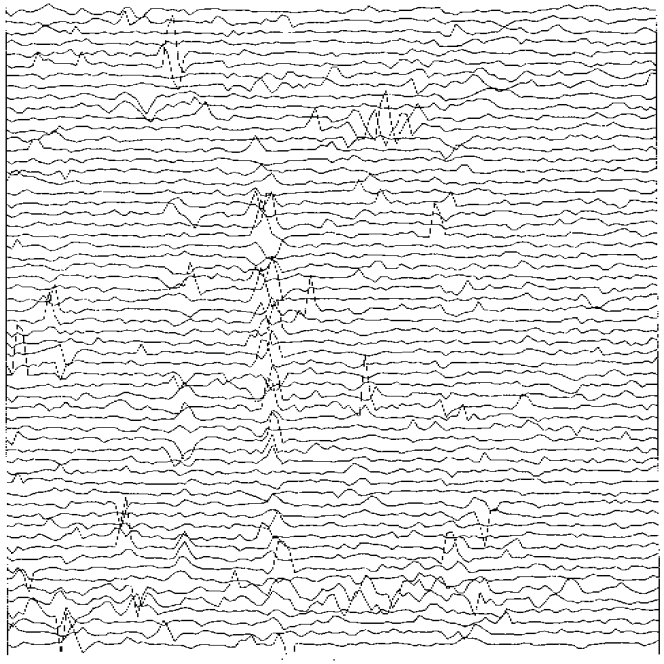
ORIGINAL AT A3

Figure A6B.2

A1
DISHFORTH TO NORTH OF LEEMING
Area A6(C)



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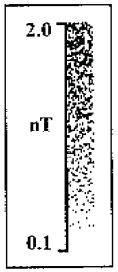

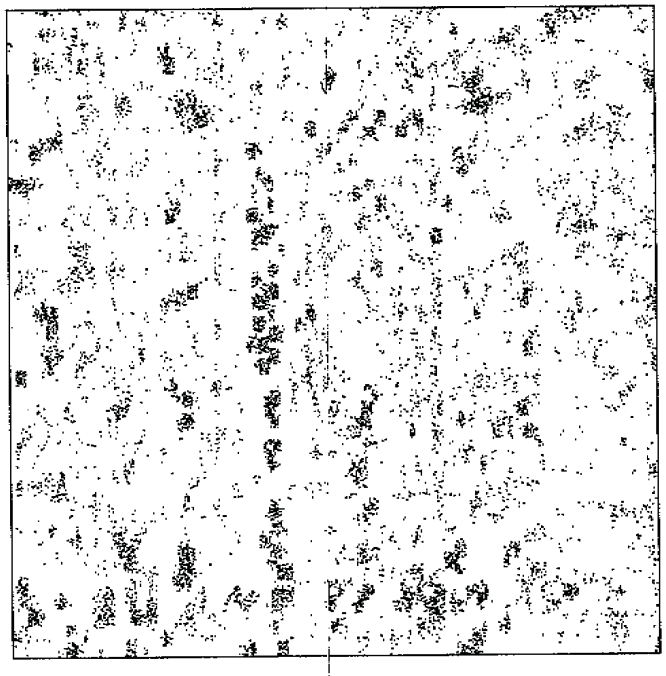

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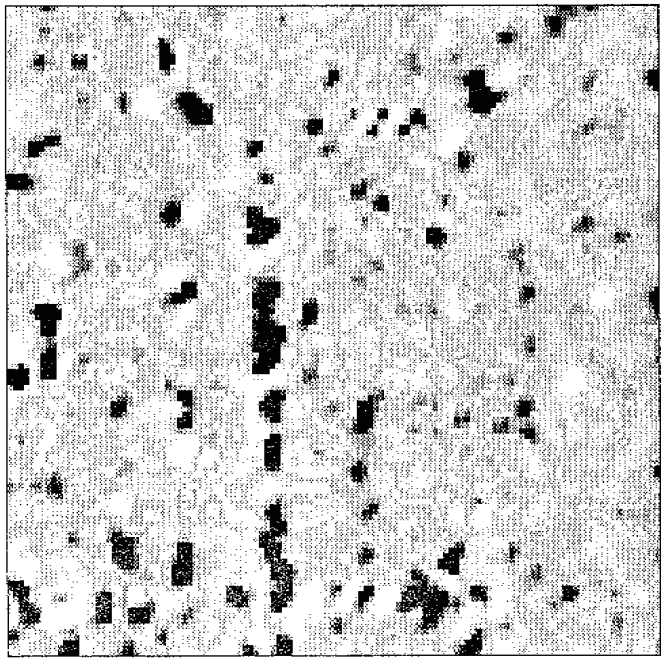
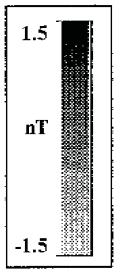
ORIGINAL AT A3

Figure A6C.1

A1
DISHFORTH TO NORTH OF LEEMING
Area A6(C)

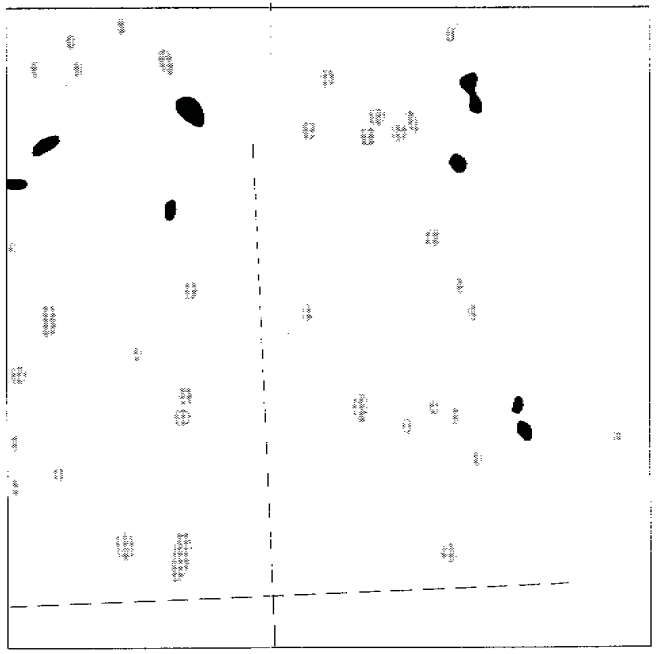




?Archaeology

?Former Hedgeline

Ferrous



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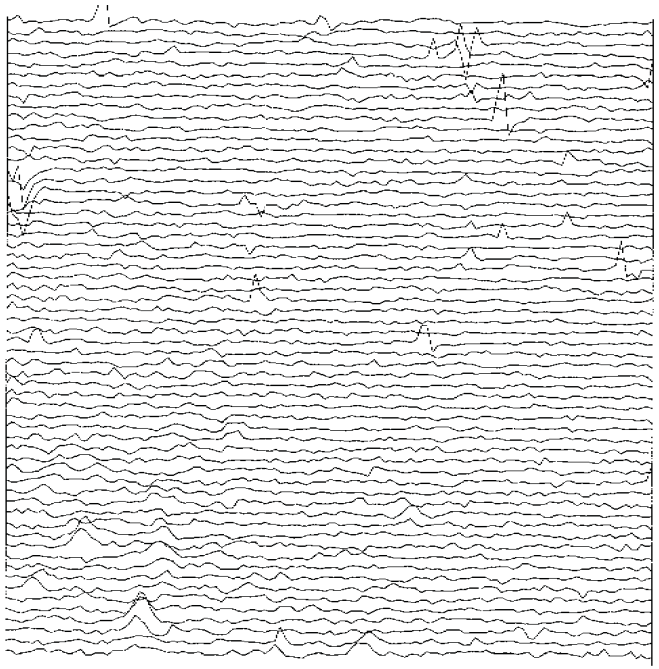
ORIGINAL AT A3

Figure A6C.2

A1
DISHFORTH TO NORTH OF LEEMING
Area A6(D)



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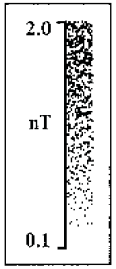
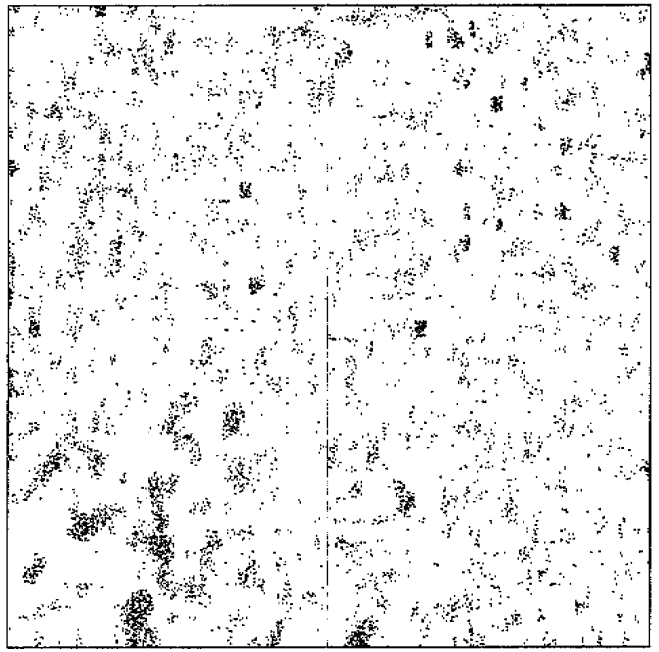
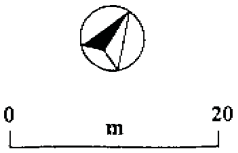


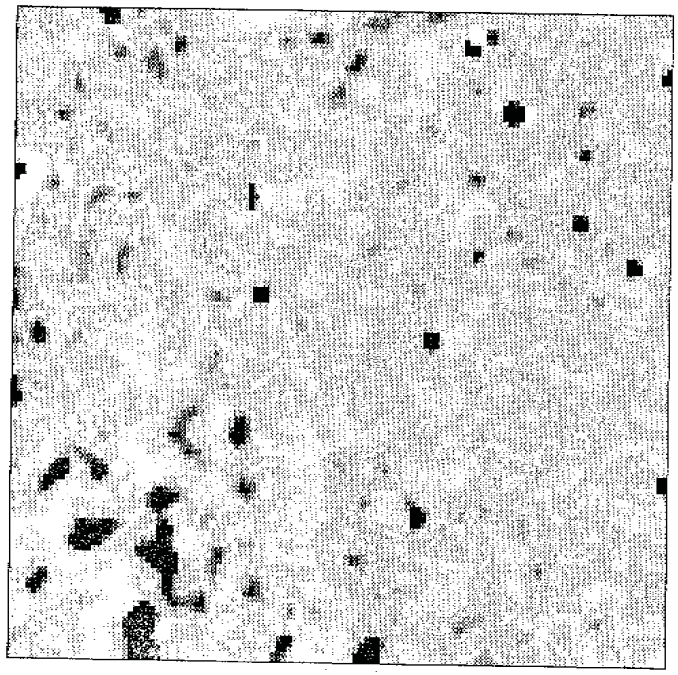


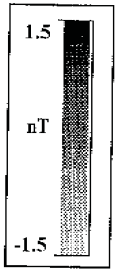


ORIGINAL AT A3

Figure A6D.1

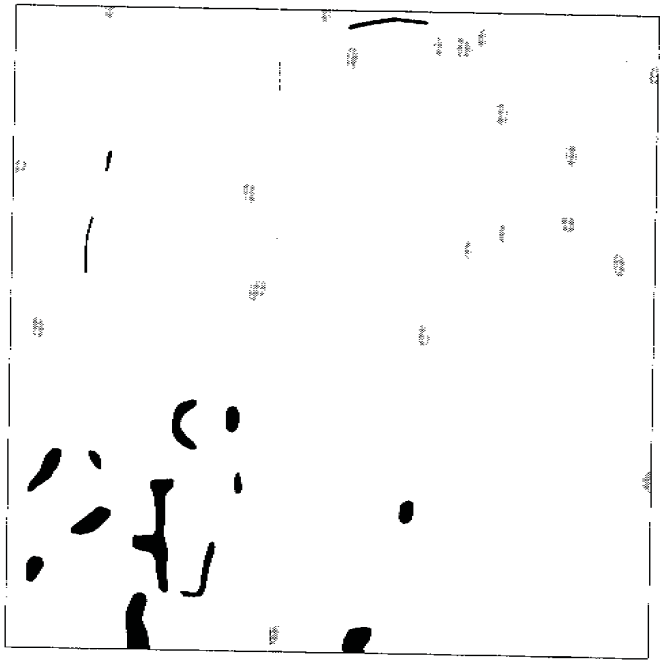
A1
DISHFORTH TO NORTH OF LEEMING
Area A6(D)





?Archaeology

Ferrous

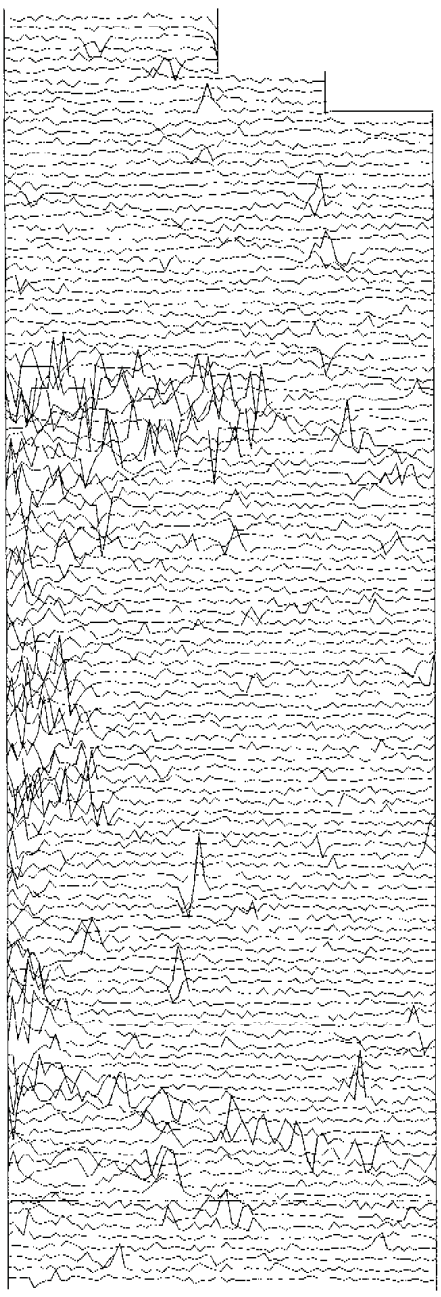


0 m 20

ORIGINAL AT A3

Figure A6D.2

A1
DISFORTH TO NORTH OF LEEMING
Area C22



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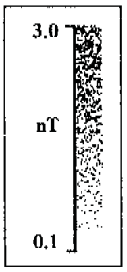
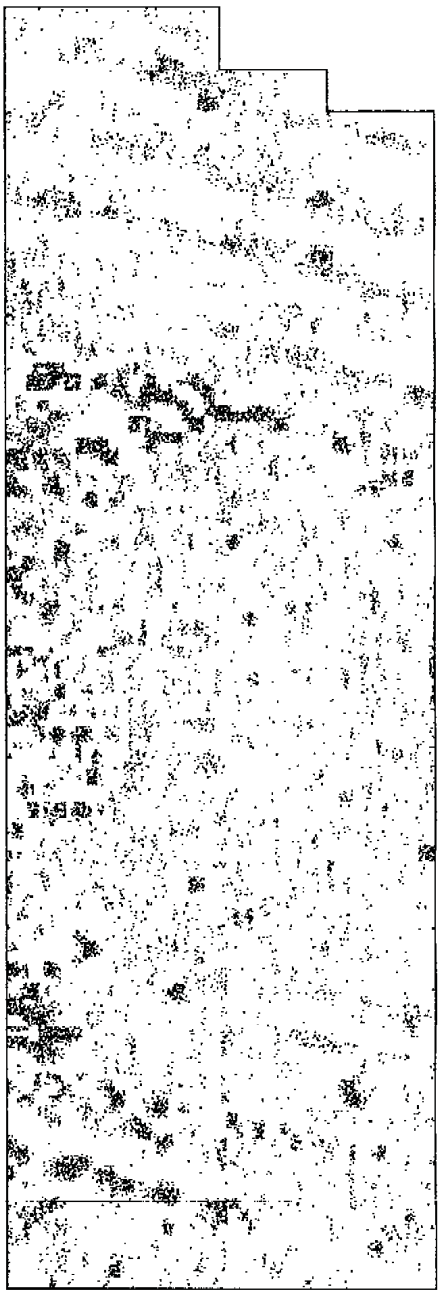


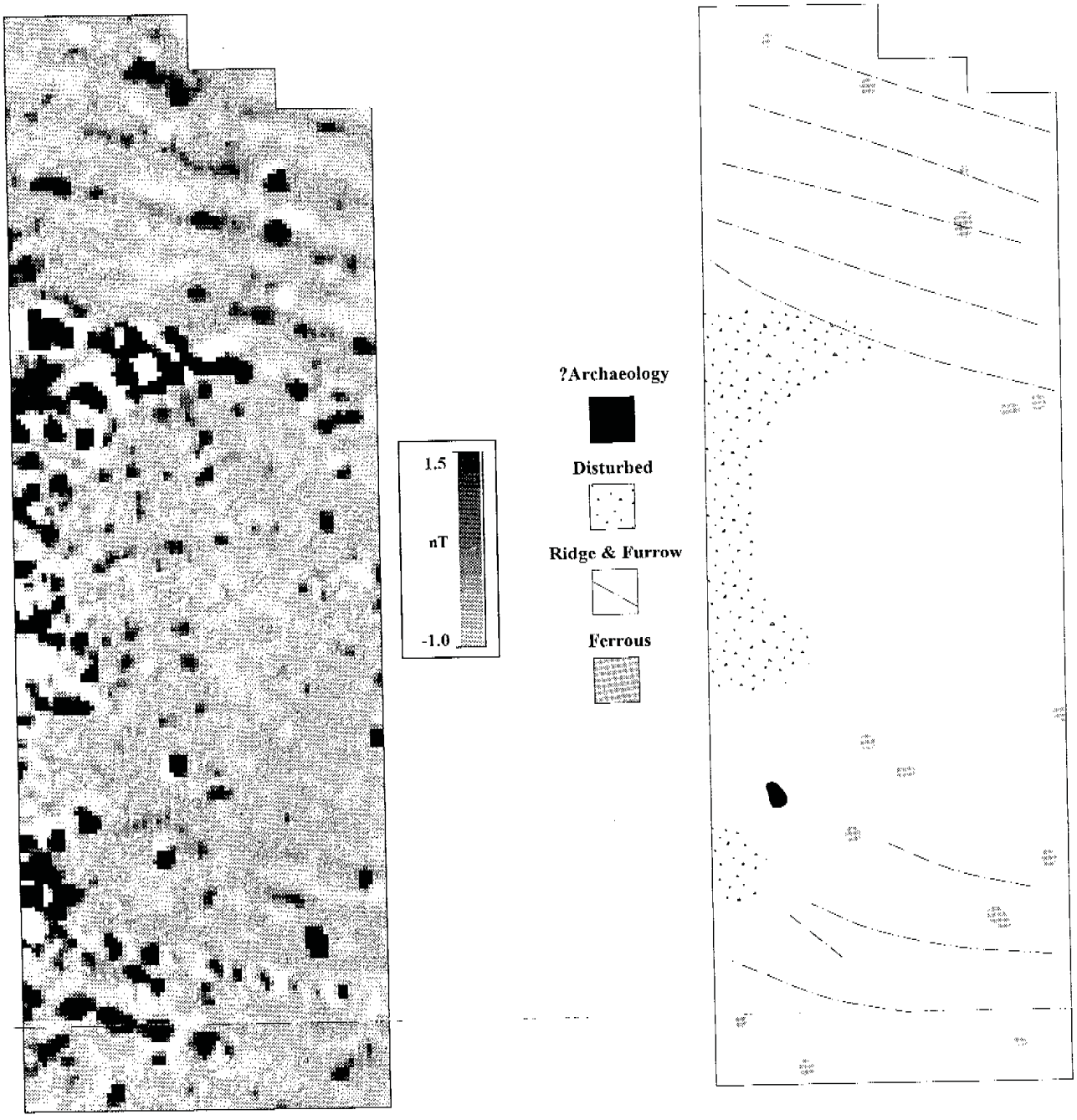


0 m 20

ORIGINAL AT A3

Figure C22.1

A1
DISFORTH TO NORTH OF LEEMING
Area C22



ORIGINAL AT A3

Figure C22.2