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 1994
Contractor ~~National Roadstone~~ GSB Partners.	
County N. Yorks.	
OS Reference SE37	
Single sided ✓ Double sided A3 32 Colour 0	

REPORT ON GEOPHYSICAL SURVEY

A1 DISHFORTH TO NORTH OF LEEMING IMPROVEMENTS

Report number 94/103

Work commissioned by :

ANTHONY
WALKER
AND PARTNERS

The Old Sunday School,
Kipping Lane,
Thornton,
Bradford,
BD13 3EL
Tel: (0274) 835016
Fax: (0274) 830212

SITE SUMMARY SHEET

94 / 103 A1 Dishforth to North of Leeming Improvements

Location and geology

Five survey areas were surveyed alongside the present A1, in the stretch between Dishforth and the north of Leeming. Details of the location of each survey area is given in the results section. The underlying geology at the sites is thought to be Permian and Triassic sandstones, while the drift is largely glacially sand and gravels. The soils are argillic brown earths.

Archaeology

Four of the five surveys areas (6, 11/12, 13 and 15) have been undertaken in response to the findings of earlier geophysical investigations (see Geophysical Surveys of Bradford Reports 94 / 10, 39 and 51). The fifth area (39) was included after detailed fieldwalking commissioned by Anthony Walker and Partners (AWP) suggested that the field may contain buried archaeology.

Aims of Survey

The objectives of the survey are defined in the specification produced by AWP. It was hoped that the gradiometer survey would identify buried archaeological features within the areas surveyed.

Summary of Results *

The nature and form of the anomalies noted within the data sets collected at the five sites are similar to those found in earlier surveys along the proposed route of the A1(M). In the majority of cases the results suggest small individual features, although some of them may be non-archaeological in origin. Area 11/ 12 contains a discrete zone of archaeological type anomalies at the northern end of the survey.

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

SURVEY RESULTS

94 / 103 A1 Dishforth to North of Leeming Improvements

1. Survey Areas

1. Five areas were surveyed over five sites along the proposed route of the A1(M). The approximate position of the areas can be seen in Figure 1.

1.2 The 20m grid points were positioned by **AWP** using an EDM system.

2. Display

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

2.2. The graphical representation of the data and/or the interpreted plans are reproduced at varying scales. Both data and interpretations are reproduced at 1:500. The 1:500 diagrams give detailed information on the survey data and, for ease of display, an area may be divided into two or more parts. Overall summaries of the interpretation of each site is reproduced at varying scales.

3. General Considerations - Complicating Factors

3.1 Field conditions proved generally to be suitable for gradiometer survey, with the ground being level and under low vegetation. The areas were free of physical obstructions.

3.2 Within all the survey areas there are isolated ferrous responses. These are most likely to be due to modern debris in the topsoil and are therefore not discussed in the results section unless deemed significant. The most prominent of these are highlighted on the interpretation diagram.

4. Results of the Gradiometer Surveys

4.1 **Area 6** (NGR - SE 364737). Survey area approximately 1.04ha. Figures 6- 6D.

4.1.1 These three rectangular blocks append to data collected in Area A6 during previous geophysical work (GSB 94 / 39 and 51). The previous survey had indicated that there may be areas of discrete archaeological anomalies within this field. The data has been collected in three blocks (A-C).

4.1.2 Area 6A. The responses in this area are generally low although a suggestion of a curvilinear response has been recorded in the south of the survey. Two very weak linear trends have been detected and, while these may be archaeological, an agricultural origin cannot be ruled out.

4.1.3 Area 6B. A concentration of possible pit type responses is apparent in the north of the survey and appear to be a continuation of anomalies detected in the previous survey. While these anomalies appear archaeological, they could originate from localised pedological/geological variations.

4.1.4 Area 6C. Three possible ditch type anomalies have been recorded in this area. There is no clear correlation with previously detected responses.

4.2 Area 11/12 (NGR - SE 357763). Survey area approximately 0.79ha. Figures 11 - 12C.

4.2.1 This survey comprises four irregularly shaped blocks totalling 0.76 ha, conforming to the previous survey grid for Areas A11/A12. A concentration of ditch and pit type responses was recorded in Area A12.

4.2.2 Area 11A. Two ditch type responses and a possibe pit type anomaly have been detected. These anomalies suggest a continuation of the ditch and pit type responses seen in the previous survey to the south.

4.2.3 Area 11B. A curvilinear anomaly representing a continuation of a previously located ditch is visible in the data, although the response is weak. Just to the west of this is a further very weak linear response. It seems likely that this is agricultural in origin.

4.2.4 Area 12A. Two weak linear responses have been noted. Given that these are parallel to the existing field boundary an agricultural origin seems likely. Two possible pit type responses have been noted, although an archaeological interpretation is tentative.

4.2.5 Area 12B. The data indicates two linear anomalies of an archaeological nature. These are clearly a continuation of anomalies located by the previous survey.

4.3 Area 13 (NGR - SE 355769). Survey area approximately 0.76ha. Figures 13 - 13C.

4.3.1 A total of 0.76 ha in two areas was investigated using gradiometry adjacent to the previous survey, Area A10, which located a few possible pit type responses.

4.3.2 Area 13A. The level of response in this area is extremely low. No anomalies of archaeological interest have been detected.

4.3.3 Area 13B. The data from this survey are dominated by a relatively broad sinuous anomaly. Although an archaeological origin cannot be ruled out, a natural origin such as an increase in the depth of topsoil or stream deposits seems likely. Several pit type responses have also been noted and are similar to those detected in the previous survey. These may be archaeological but again localised pedological/geological variations may be the cause.

4.4 **Area 15** (NGR - SE 342796). Survey area approximately 0.96ha. Figures 15 - 15C

4.4.1 Two blocks expanding, and joining, the previous survey of Area B1 were investigated. This previous survey located clear linear anomalies and a concentration of ditch and pit type responses.

4.4.2 Area 15A. Three ditch type anomalies, two of which are curvilinear, have been located in this survey. These do not correspond with any of the anomalies located in the previous survey.

4.4.3 Area 15B. A complex of ditch type anomalies aligned north-south and east-west have been located in the east of the survey. Although these take on an archaeological form, a modern origin such as land drains or ploughing cannot be ruled out. Additional weak linear anomalies aligned north-south have also been noted and appear to be agricultural trends.

4.5 **Area 39** (NGR - SE 275913). Survey area approximately 1.05ha.Figures 39 -39C.

4.5.1 This survey area was based on the results of fieldwalking of Area E.

4.5.2 Area 39A. The data are dominated by a broad diffuse response running the length of this area. While an archaeological origin cannot be ruled out, the diffuse nature of the anomaly perhaps suggests a modern or natural origin. Several pit type anomalies have also been noted.

4.5.3 Area 39B. The level of response at this site is low although there is a clear band of magnetic disturbance along the northern limit of the survey, which is caused by a fence. Two pit type anomalies and a suggestion of a curvilinear anomaly have been located in this area.

5. Conclusions

5.1 Area 6. A number of anomalies of possible archaeological origin have been noted.

5.2 Area 11/12. A clear area of archaeological type anomalies has been identified in the northern half of this survey area.

5.3 Area 13. While anomalies of some potential have been found, there is some suggestion that pedological / geological factors may have produced some of them.

5.4 Area 15. The additional data collected at this site has produced some evidence short lengths of ditch type anomalies. It is possible that they are the result of ploughing.

5.5 Area 39. A few low level anomalies have been found during the survey of this area.

Project Co-ordinator: Dr C F Gaffney
Project Assistants: Dr C R Adam, M Copley, N Nemcek, D Shiels, A Shields and D Weston.

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

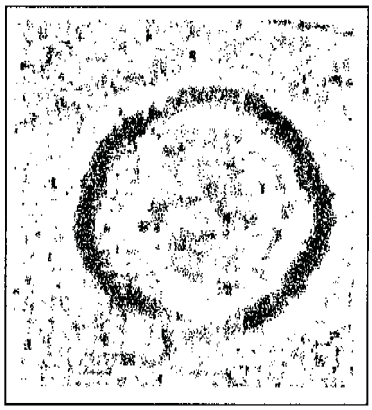
This measures the electrical resistance of the earth, using a system of four electrodes (two current and two potential.) Depending on the arrangement of these electrodes an exact measurement of a specific volume of earth may be acquired. This resistance value may then be used to calculate the earth resistivity.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

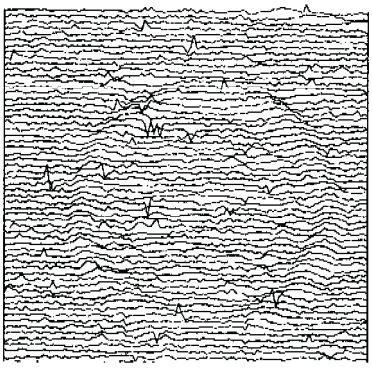
Display Options

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

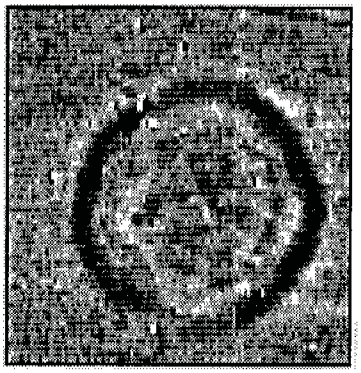
In this display, minimum and maximum cut-off levels are chosen. Any value that is below the minimum cut-off value will appear white, whilst any value above the maximum cut-off value will appear black. Any value that lies between these two cut-off levels will have a specified number of dots depending 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 indiviual anomalies. Results are produced on a flatbed plotter.

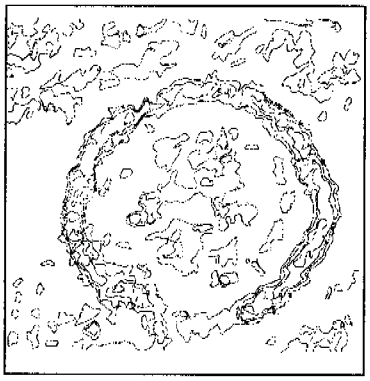
Display Options cont'd



(c) Grey-Scale

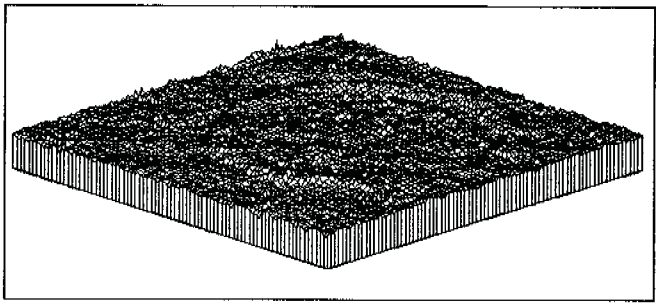
This format divides a given range of readings into a set number of classes. These classes have a predefined arrangement of dots or shade of grey, the intensity increasing with value. This gives an appearance of a toned or grey scale.

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.



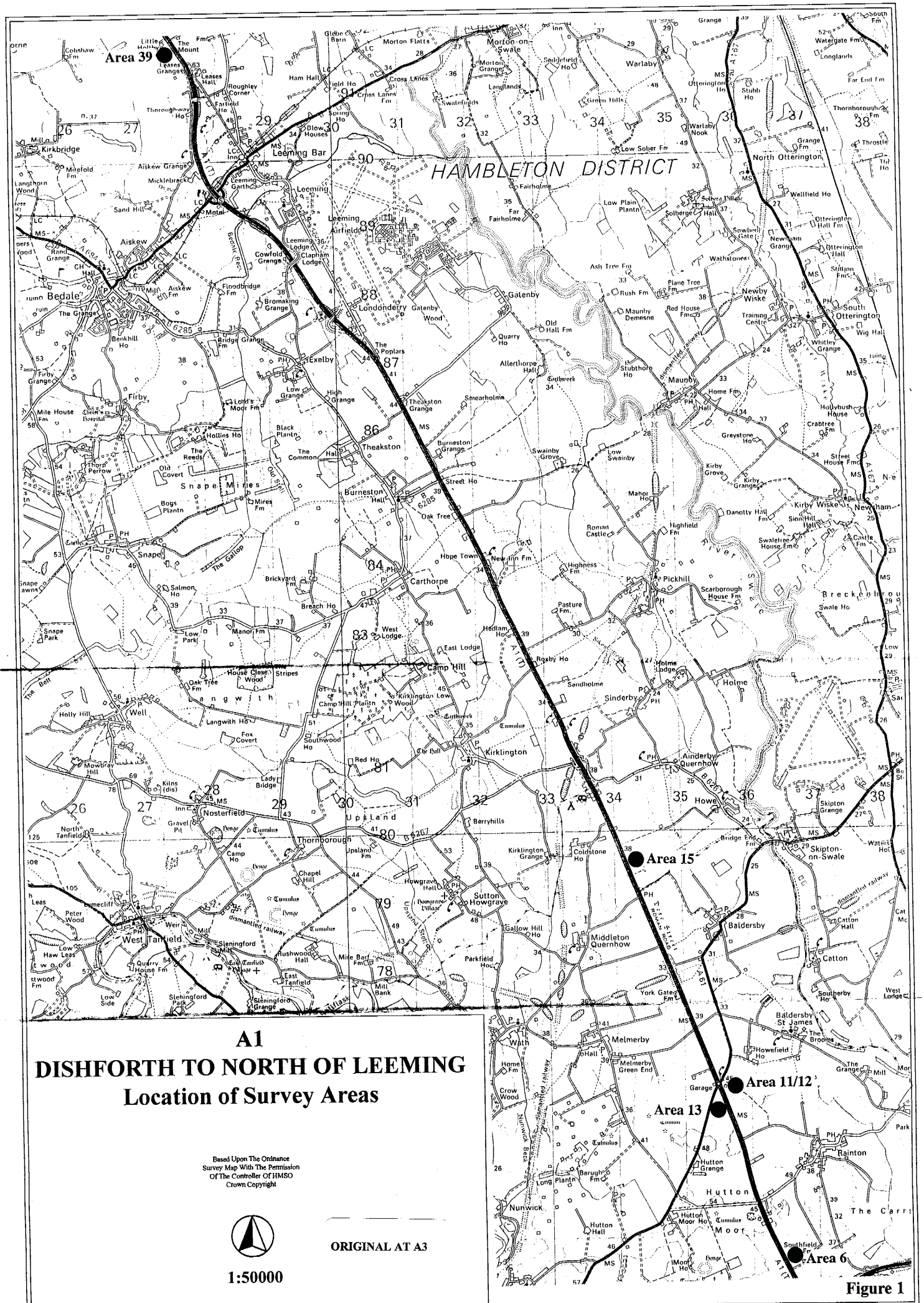
(d) Contour

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.

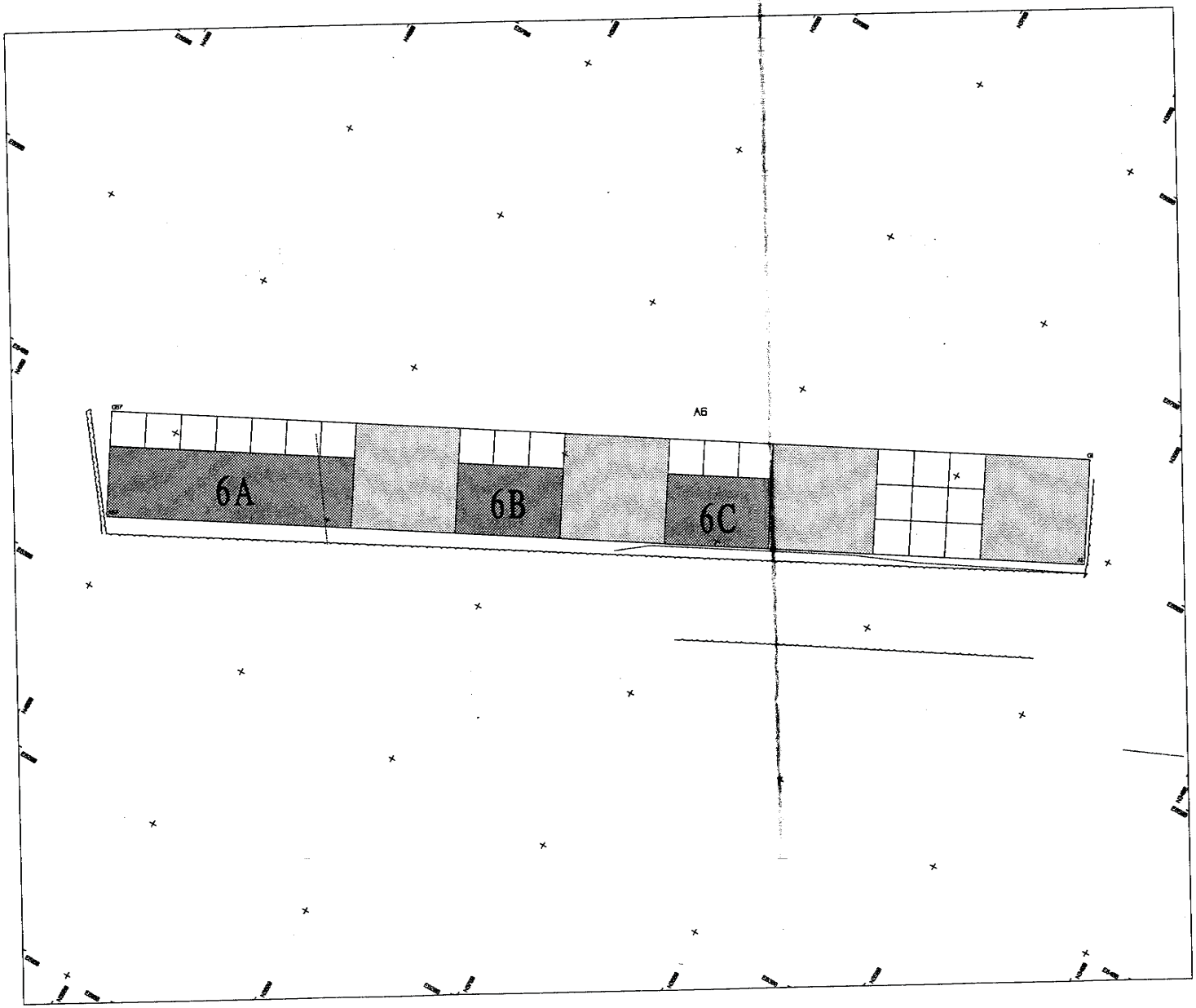


(e) 3-D Mesh

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).


HAMBLETON DISTRICT
Area 39
Area 15
Area 11/12
Area 13
Area 6
Leeming Bar
Bedale
Snape Mires
Burneston
Theakston
Carthorpe
Camp Hill
Kirklington
Sutton Howgrave
Nosterfield
Thorpe Perrow
Langwith
Upsland
Middleton Quernhow
Baldersby
Melmerby
Nunwick
Hutton Moor
Skipton-on-Swale
Ripon
Thirsk
A1
DISHFORTH TO NORTH OF LEEMING
Location of Survey Areas
Based Upon The Ordnance Survey Map With The Permission Of The Controller Of HMSO Crown Copyright
ORIGINAL AT A3
1:50000
Figure 1

GEOPHYSICAL SURVEYS OF BRADFORD	PROJECT: A1 DISHFORTH TO NORTH OF LEEMING	TITLE: Location of Areas 6 & A6	Based on a plan supplied by Anthony Walker & Partners



Gradiometer Survey

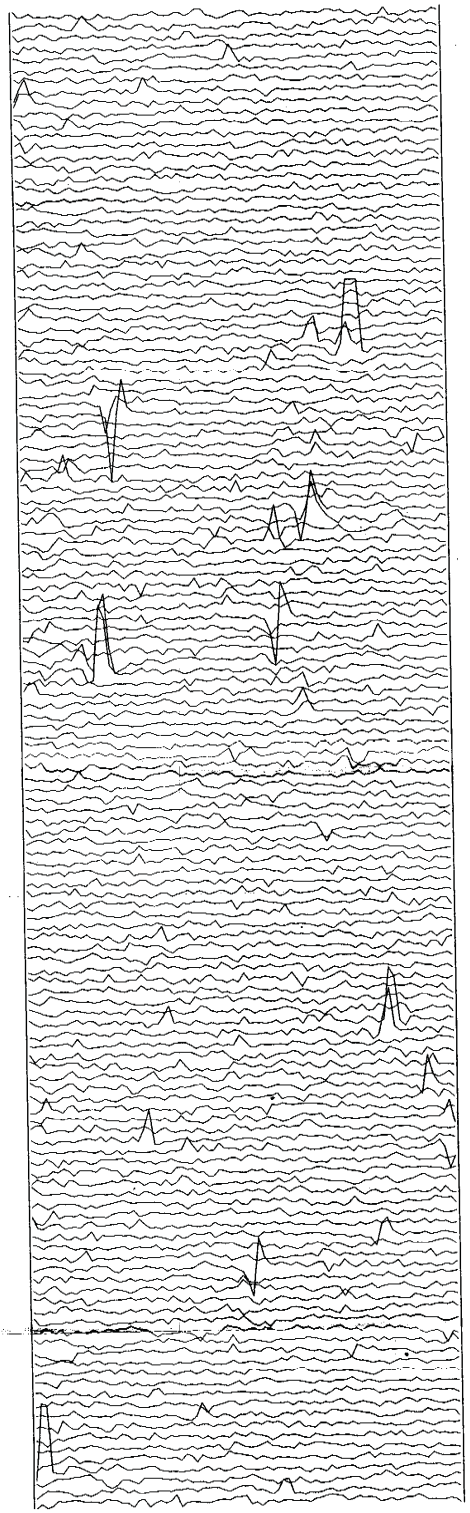
Previous Gradiometer Survey

0 100m

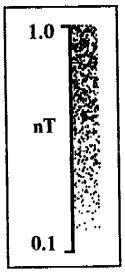
ORIGINAL AT A3

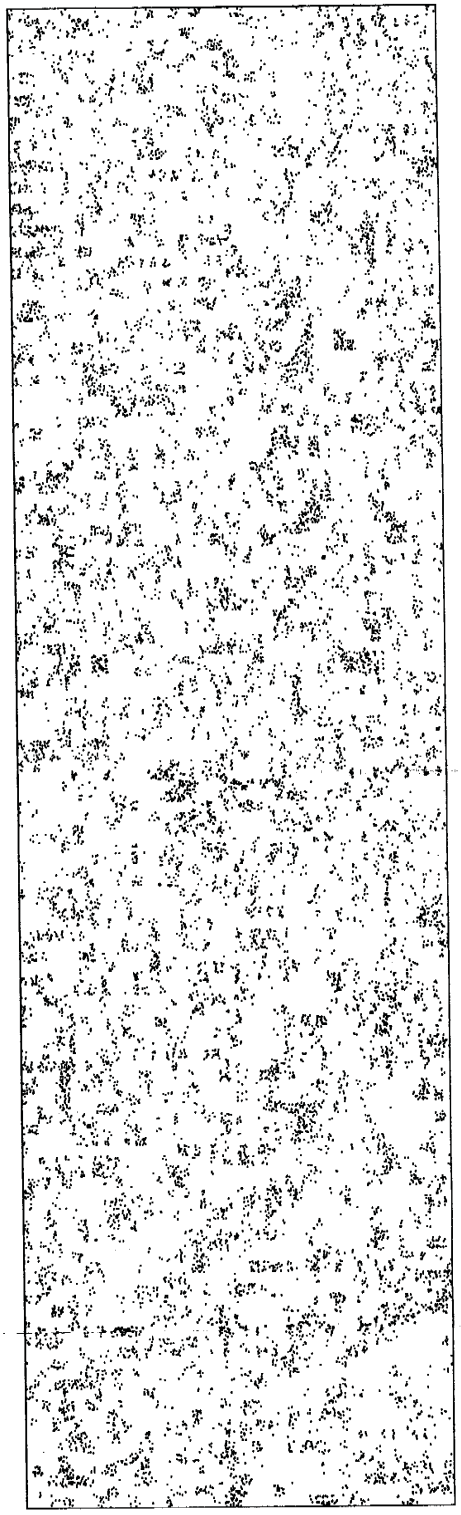
Figure 6

A1
DISHFORTH TO NORTH OF LEEMING
Area 6A



12 nT

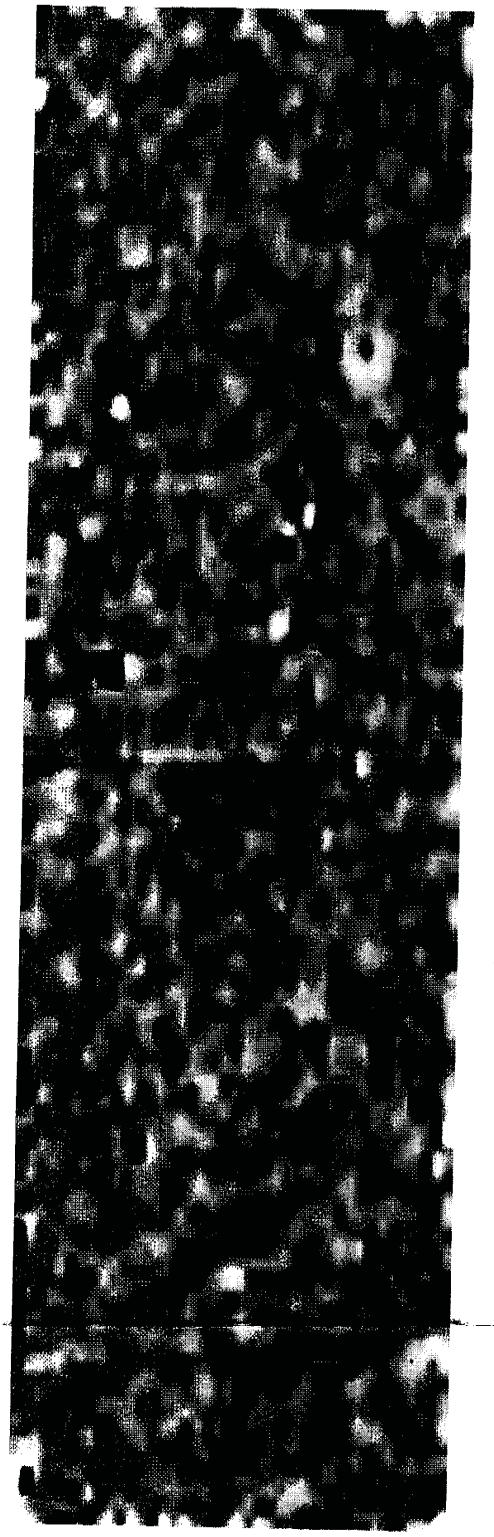


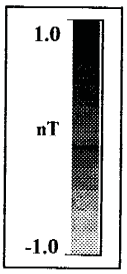


ORIGINAL AT A3

Figure 6A.1

A1
DISHFORTH TO NORTH OF LEEMING
Area 6A

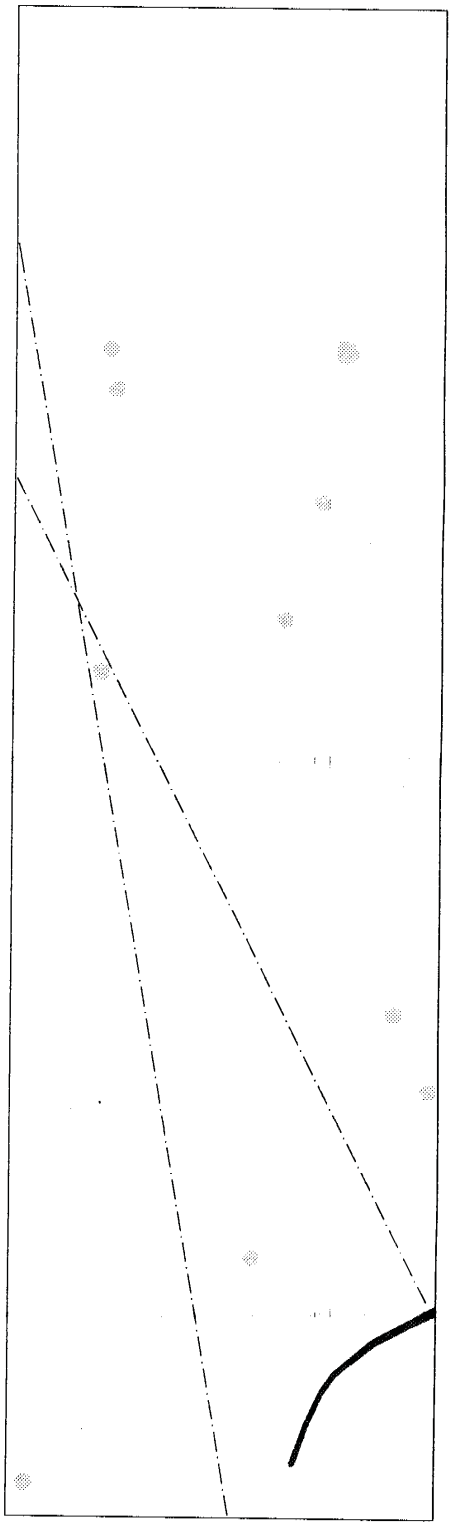




?Archaeology

Linear Trends

Ferrous

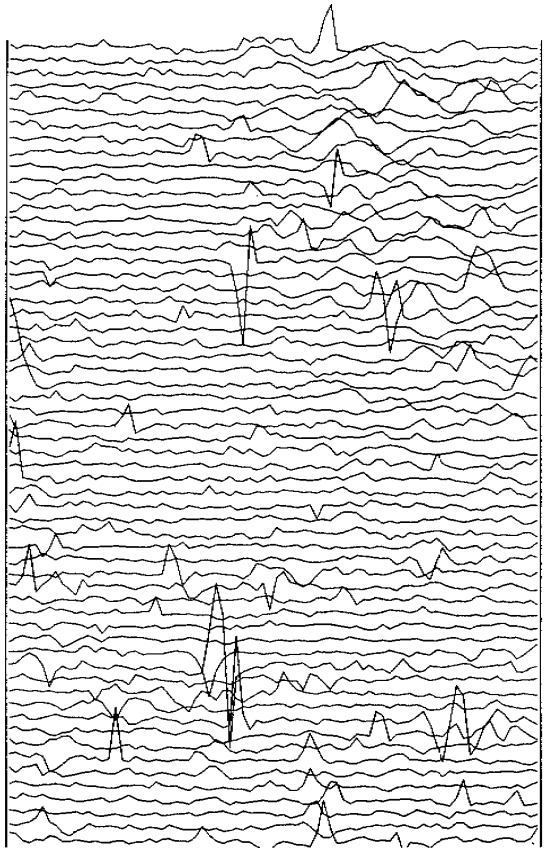


ORIGINAL AT A3

0 m 20

Figure 6A.2

A1
DISHFORTH TO NORTH OF LEEMING
Area 6B



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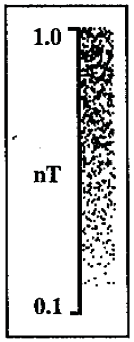
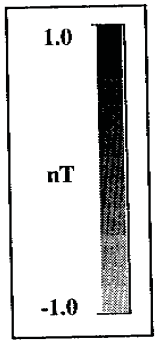


0 m 20

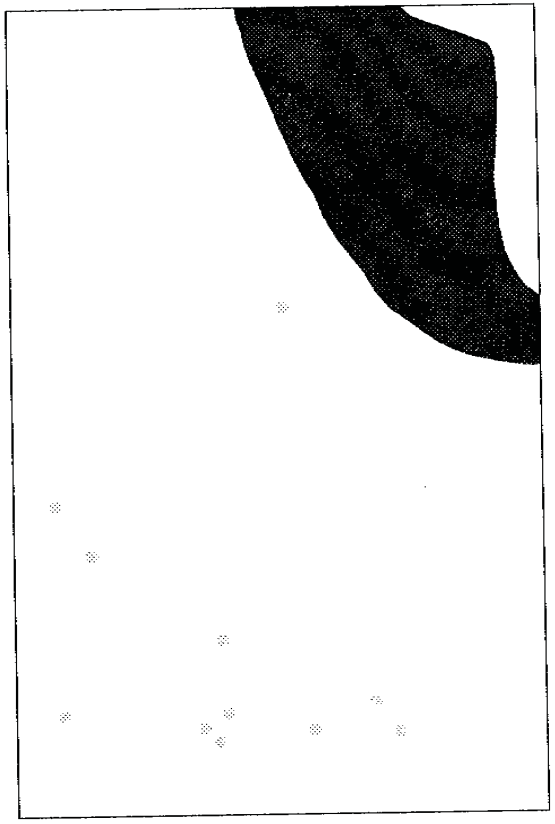
Figure 6B.1

A1
DISHFORTH TO NORTH OF LEEMING
Area 6B



?Archaeology

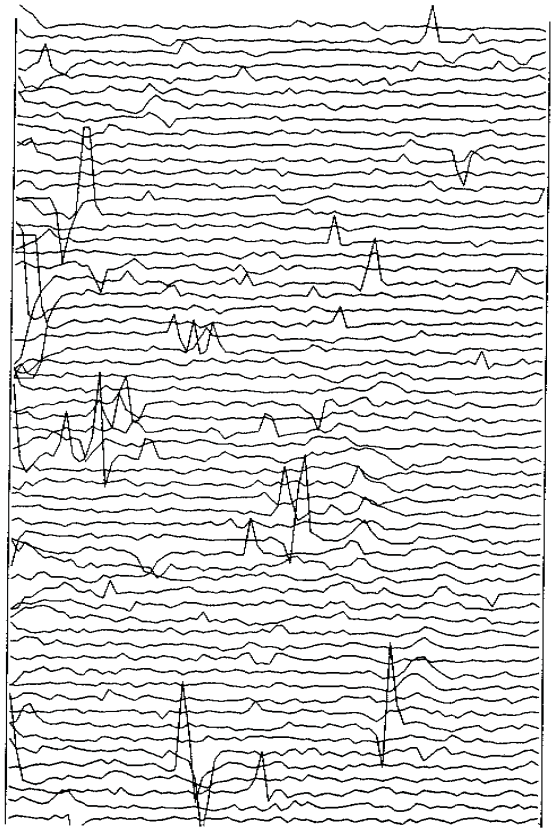
Ferrous



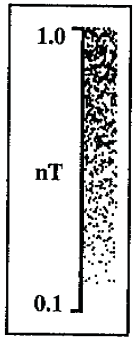
0 m 20

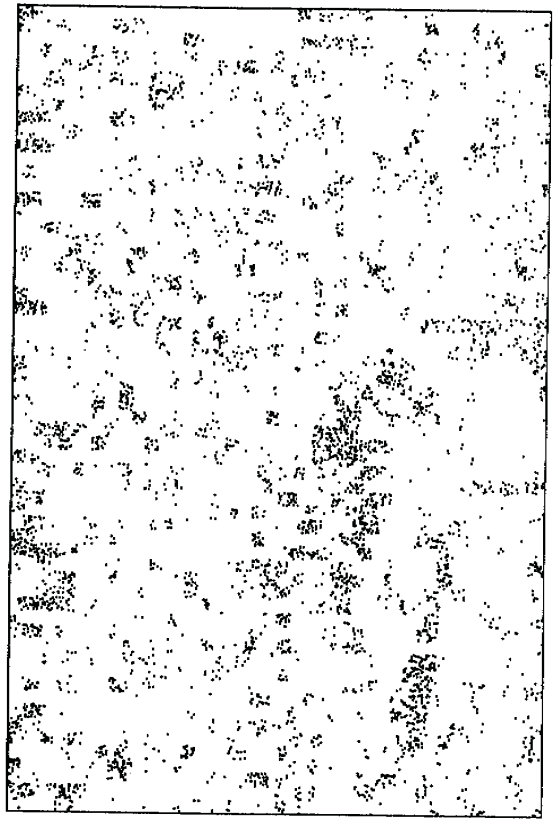
Figure 6B.2

A1
DISHFORTH TO NORTH OF LEEMING
Area 6C



12 nT





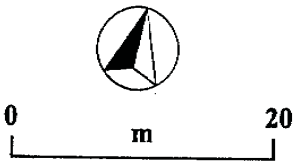
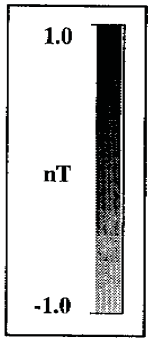


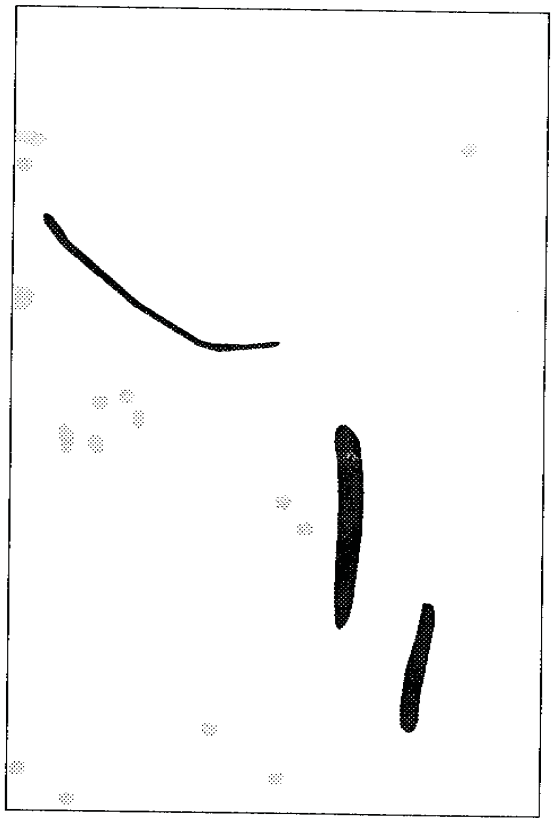
Figure 6C.1

A1
DISHFORTH TO NORTH OF LEEMING
Area 6C



?Archaeology

Ferrous

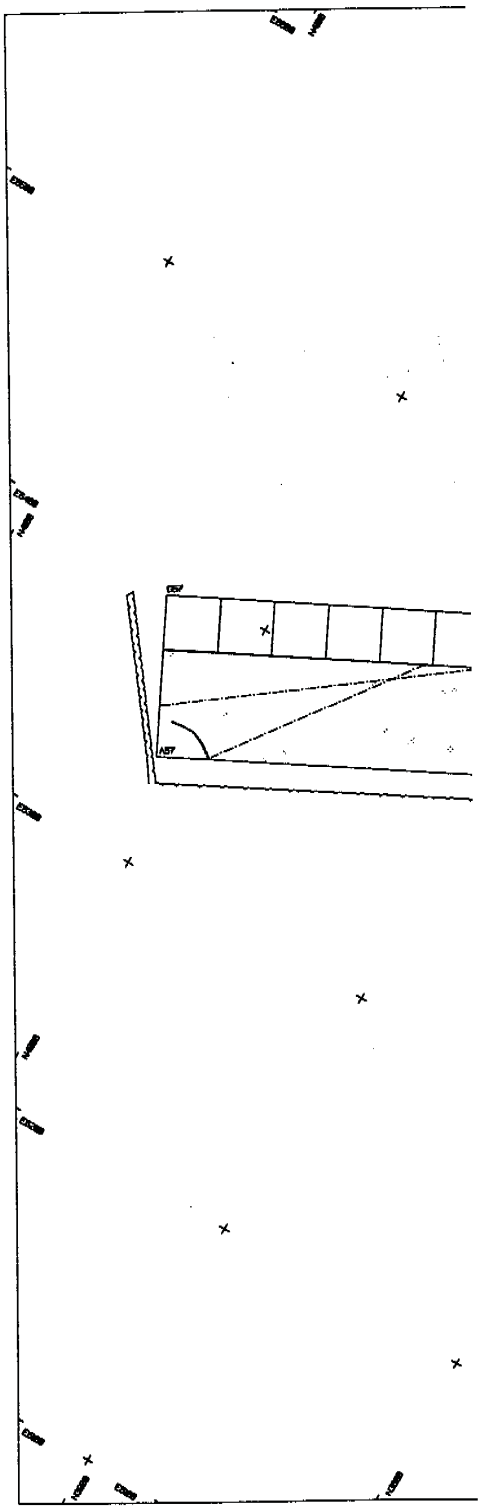


0 m 20

Figure 6C.2

GEOPHYSICAL SURVEYS OF BR.

Based on a plan supplied by
Anthony Walker & Partners



?Archaeology

Disturbed

Ploughing

?Field Boundary

Ferrous

0 100m

ORIGINAL AT A3

Figure 6D

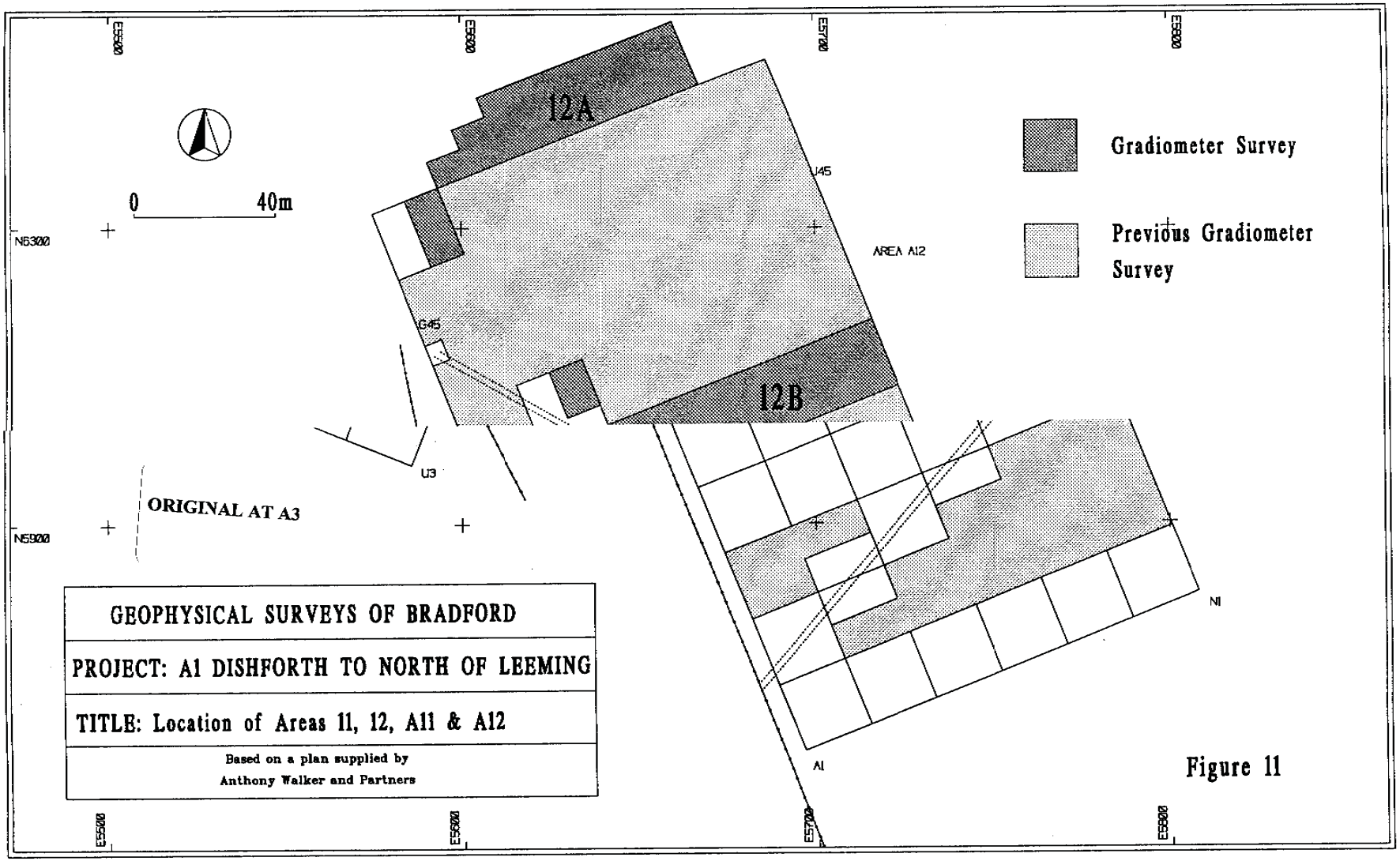
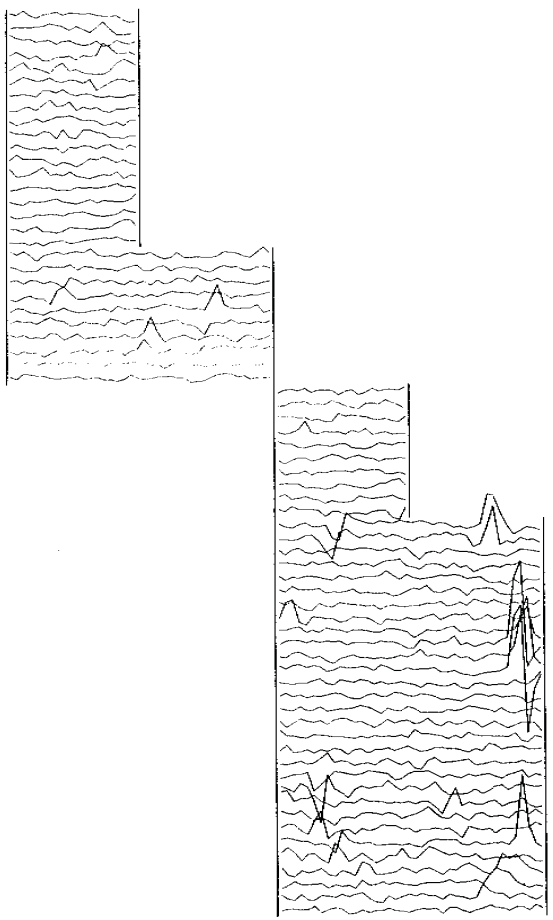
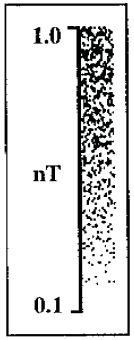

E5500
E5600
E5700
E5800
N6300
N5900
0
40m
12A
12B
U45
G45
U3
AREA A12
A1
N1
Gradiometer Survey
Previous Gradiometer Survey
ORIGINAL AT A3
GEOPHYSICAL SURVEYS OF BRADFORD
PROJECT: A1 DISHFORTH TO NORTH OF LEEMING
TITLE: Location of Areas 11, 12, A11 & A12
Based on a plan supplied by
Anthony Walker and Partners

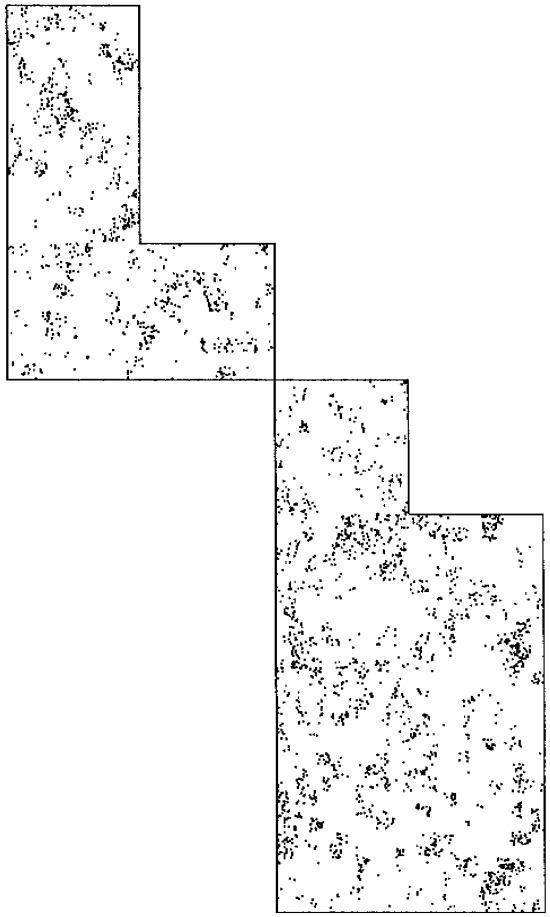
Figure 11

A1
DISHFORTH TO NORTH OF LEEMING
Area 11A



12 nT

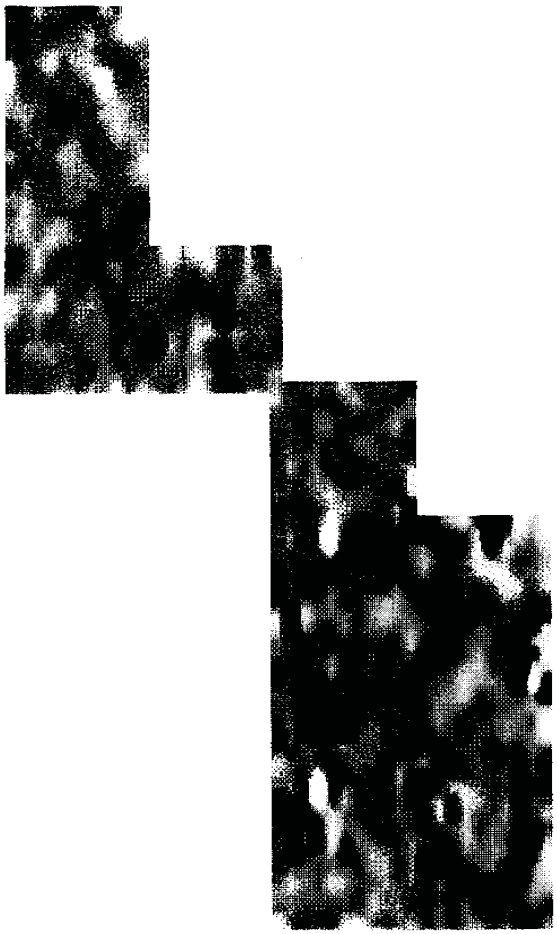


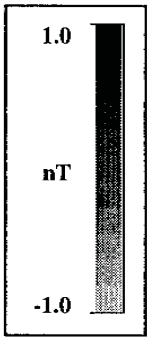


0 m 20

Figure 11A.1

A1
DISHFORTH TO NORTH OF LEEMING
Area 11A

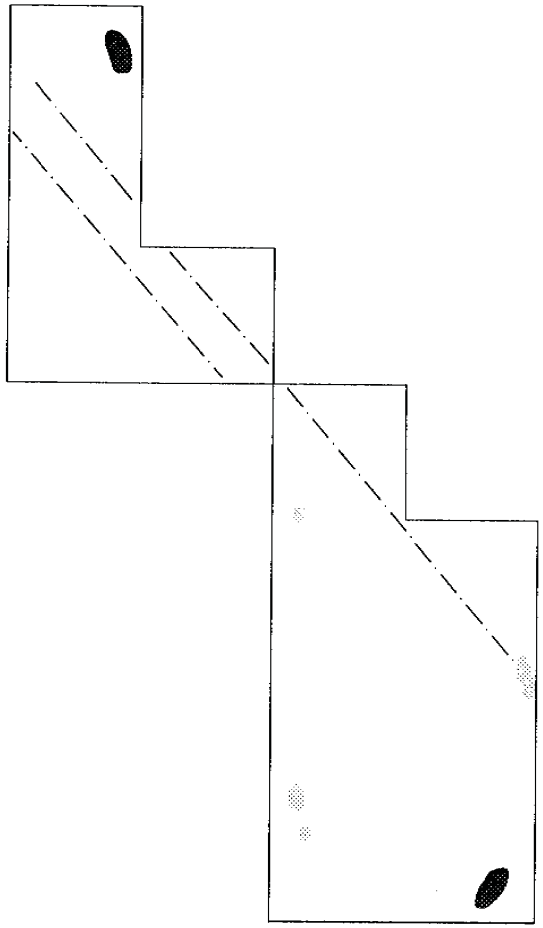




?Archaeology

Linear Trends

Ferrous

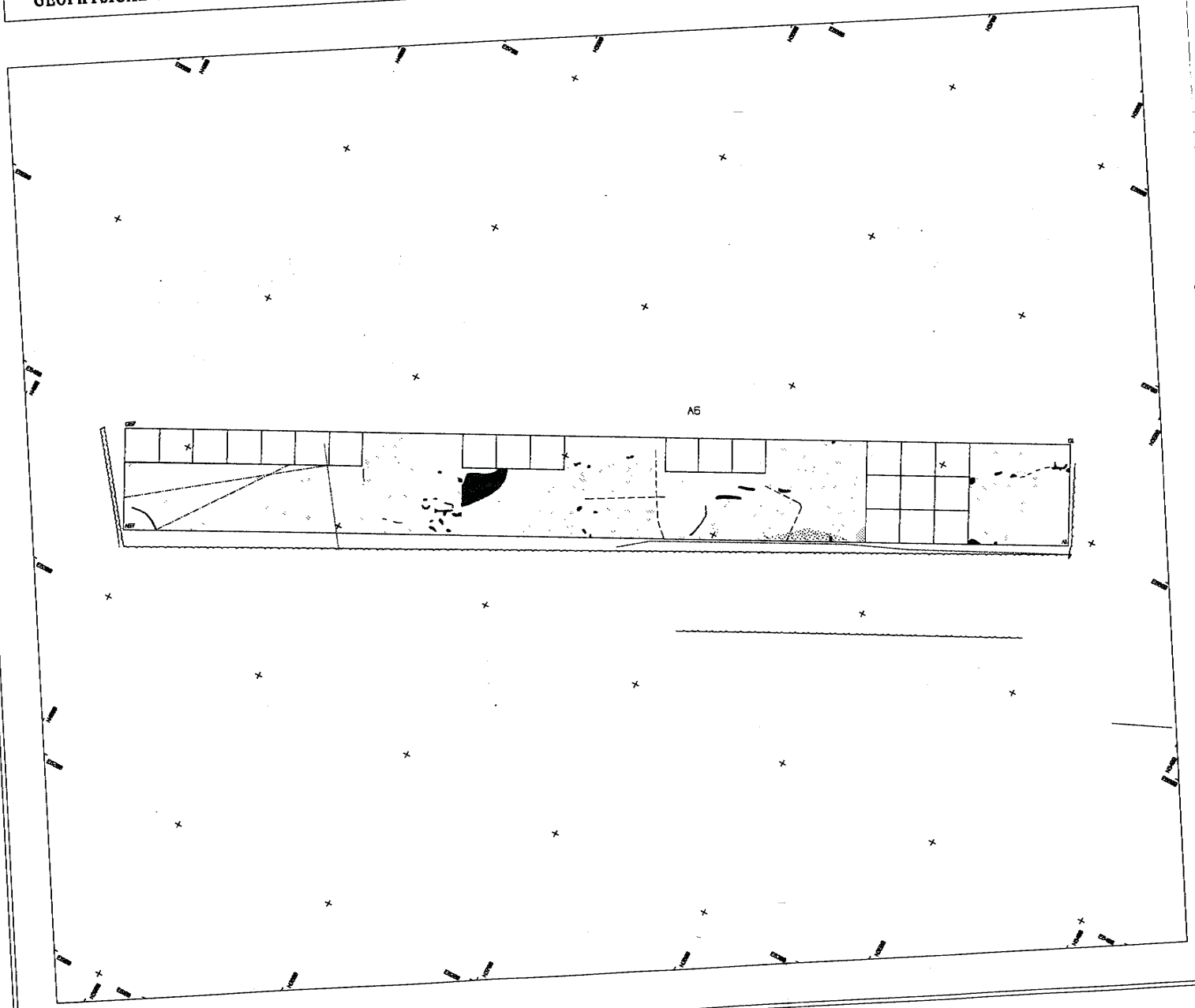


0 m 20

Figure 11A.2

GEOPHYSICAL SURVEYS OF BRADFORD | PROJECT: A1 DISHFORTH TO NORTH OF LEEMING | TITLE: Interpretation of Areas 6 & A6

Based on a plan supplied by Anthony Walker & Partners



?Archaeology

Disturbed

Ploughing

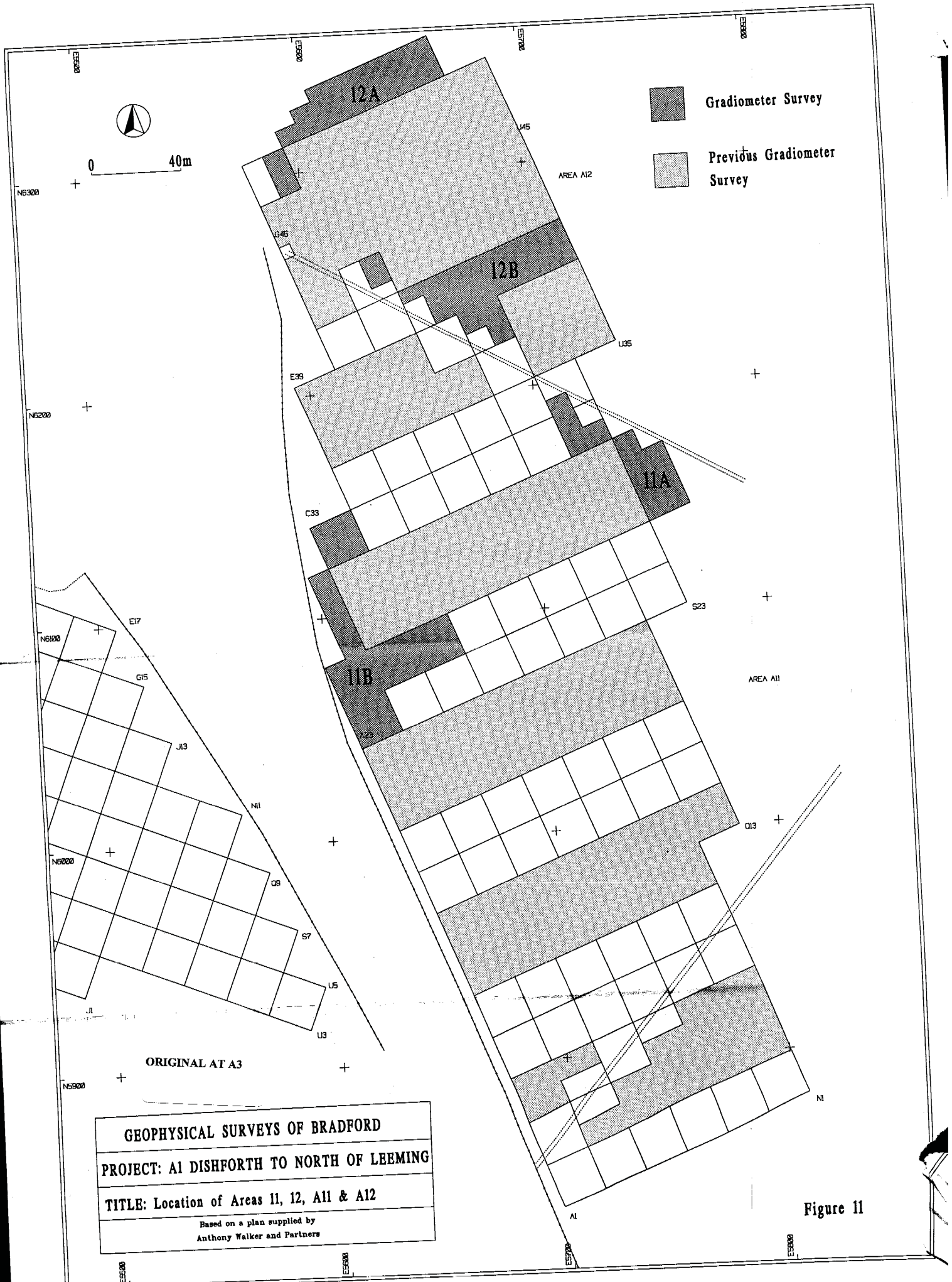
?Field Boundary

Ferrous

0 100m

ORIGINAL AT A3

Figure 6D



ORIGINAL AT A3

GEOPHYSICAL SURVEYS OF BRADFORD

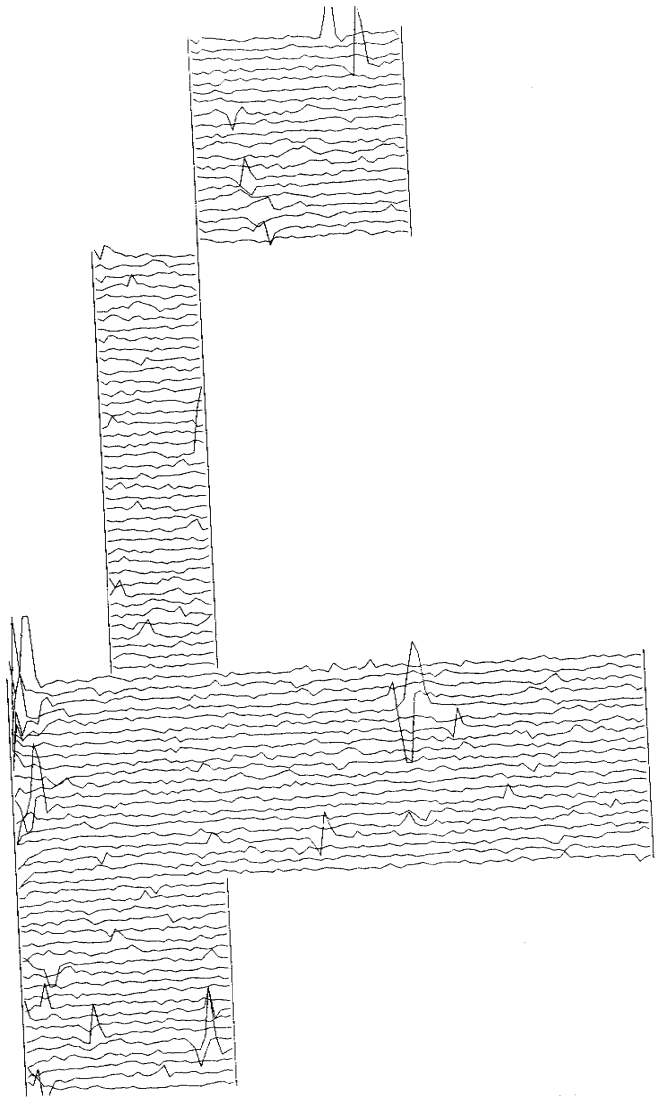
PROJECT: A1 DISHFORTH TO NORTH OF LEEMING

TITLE: Location of Areas 11, 12, A11 & A12

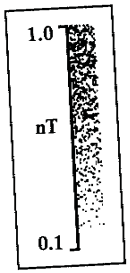
Based on a plan supplied by
Anthony Walker and Partners

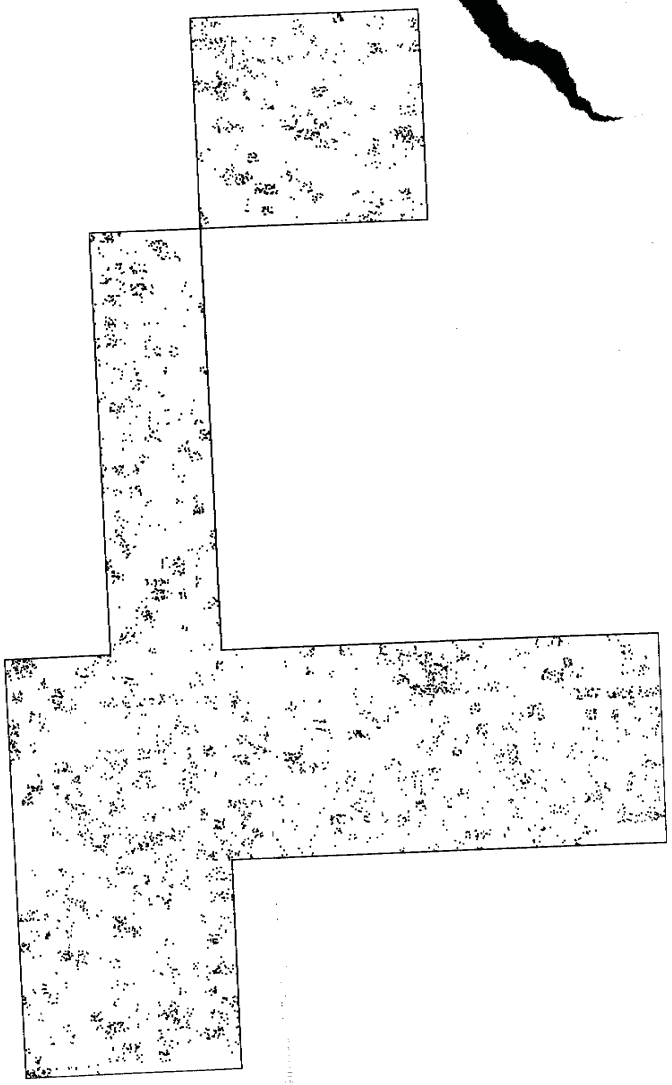
Figure 11

A1
DISHFORTH TO NORTH OF LEEMING
Area 11B



12 nT



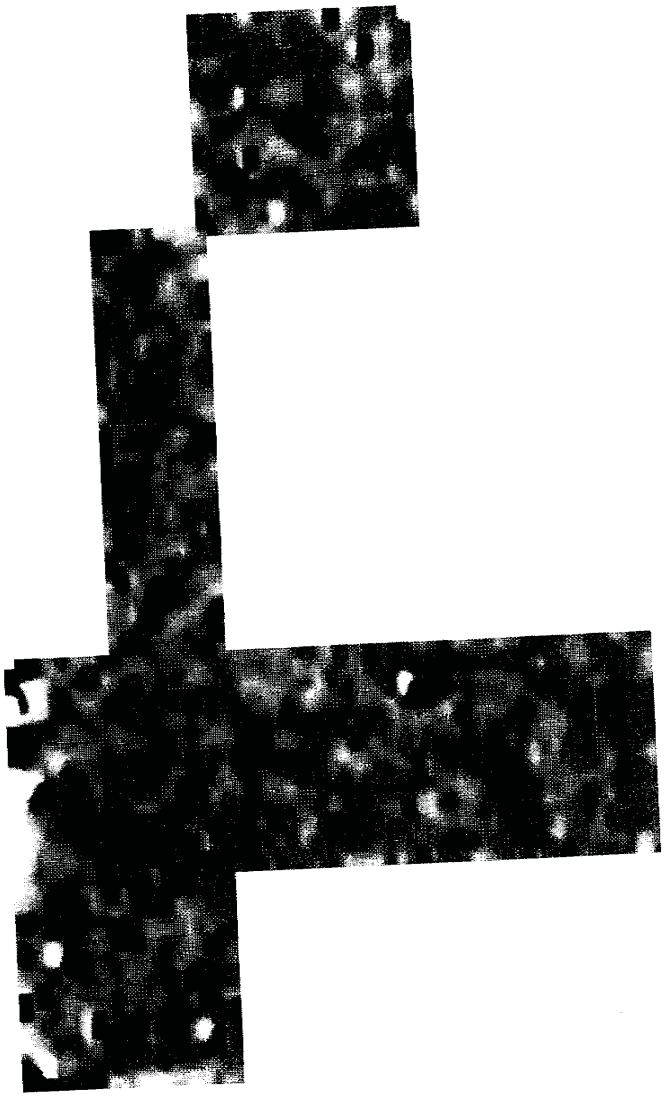


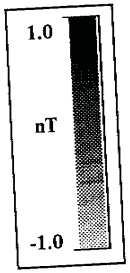
0 m 20

ORIGINAL AT A3

Figure 11B.1

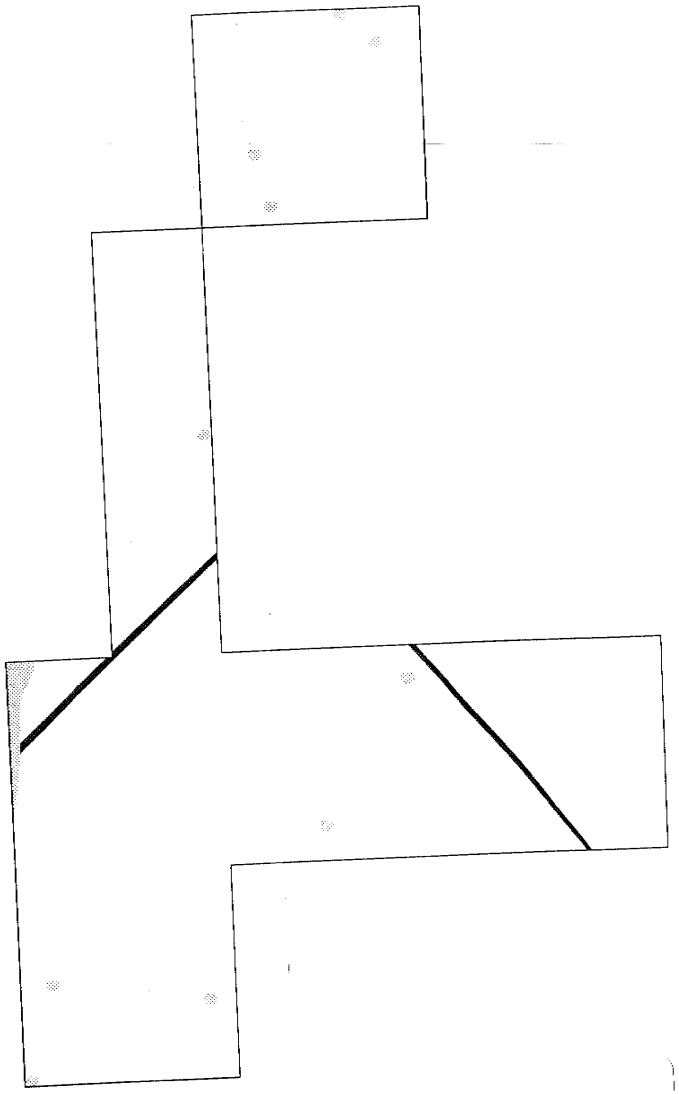
A1
DISHFORTH TO NORTH OF LEEMING
Area 11B





?Archaeology

Ferrous

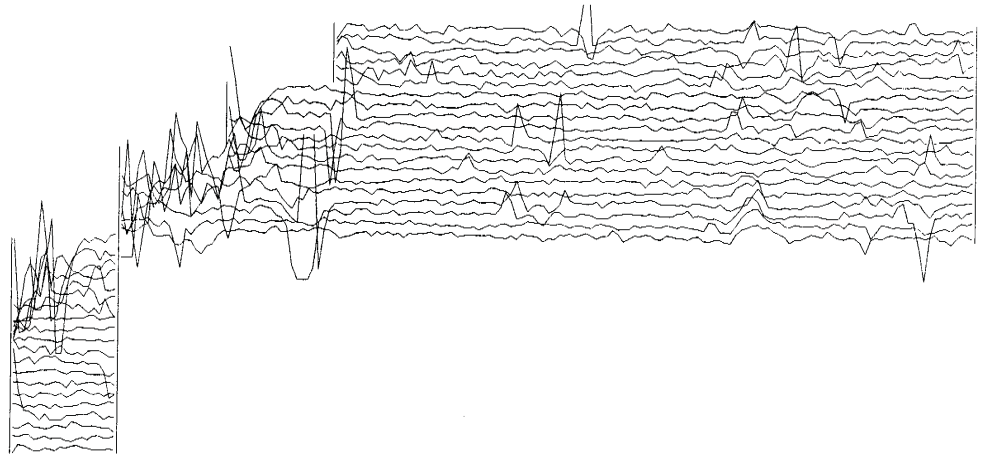


0 m 20

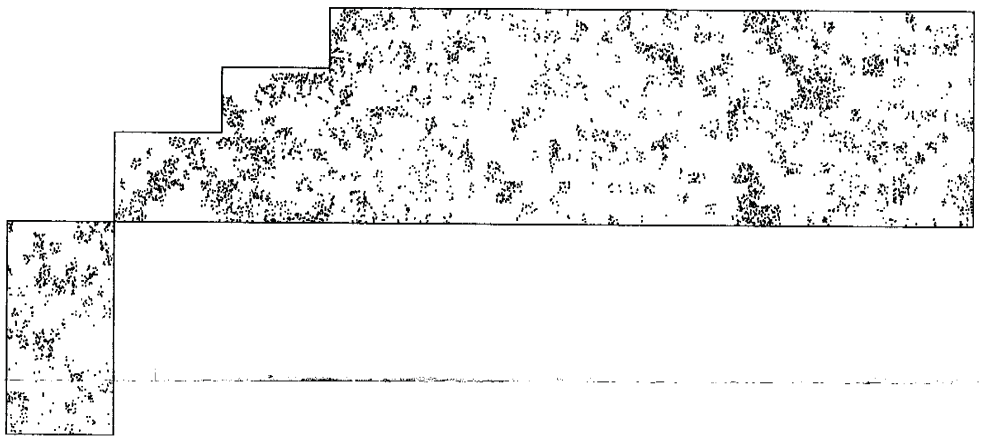
ORIGINAL AT A3

Figure 11B.2

A1
DISHFORTH TO NORTH OF LEEMING
Area 12A



12 nT



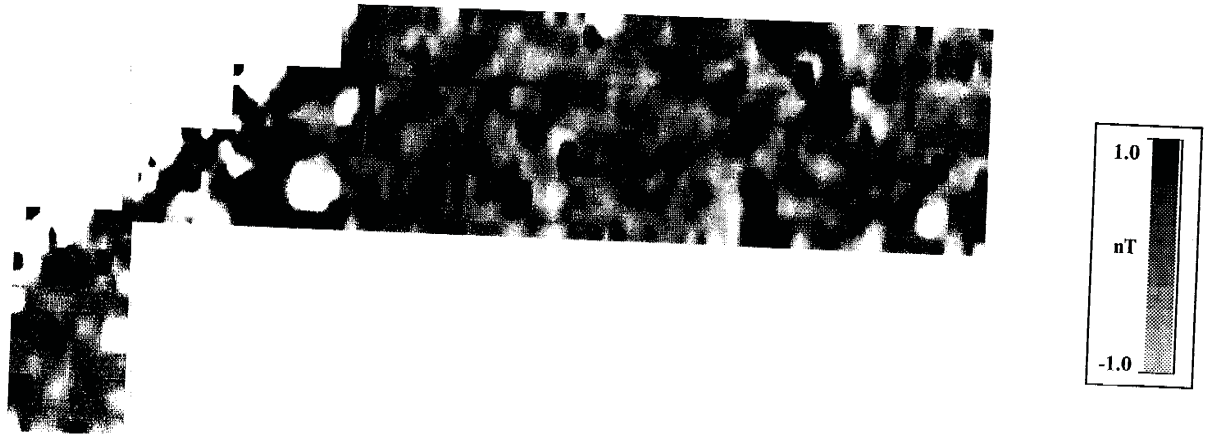
1.0
nT
0.1

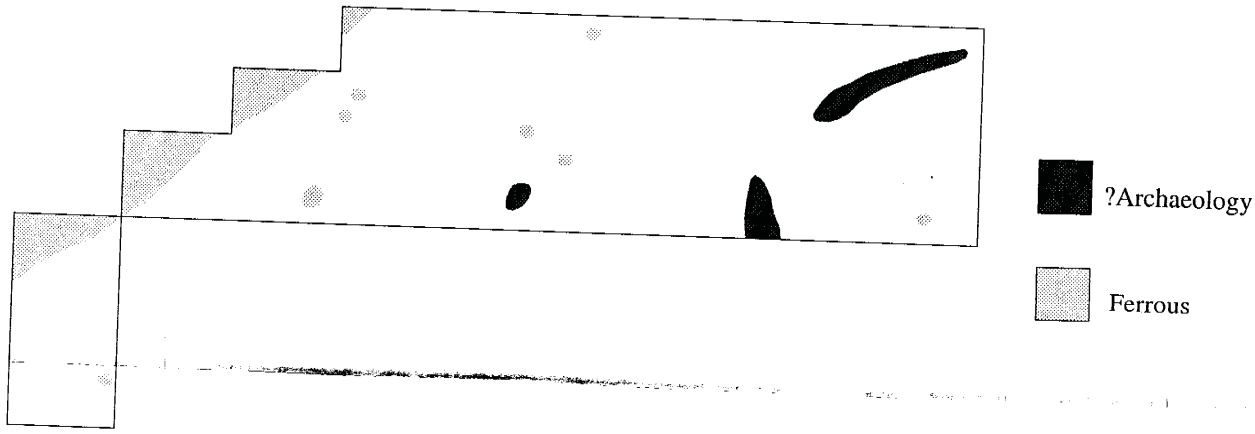
0 m 20

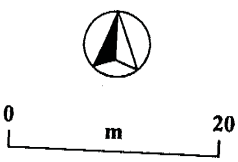
ORIGINAL AT A3

Figure 12A.1

A1
DISHFORTH TO NORTH OF LEEMING
Area 12A



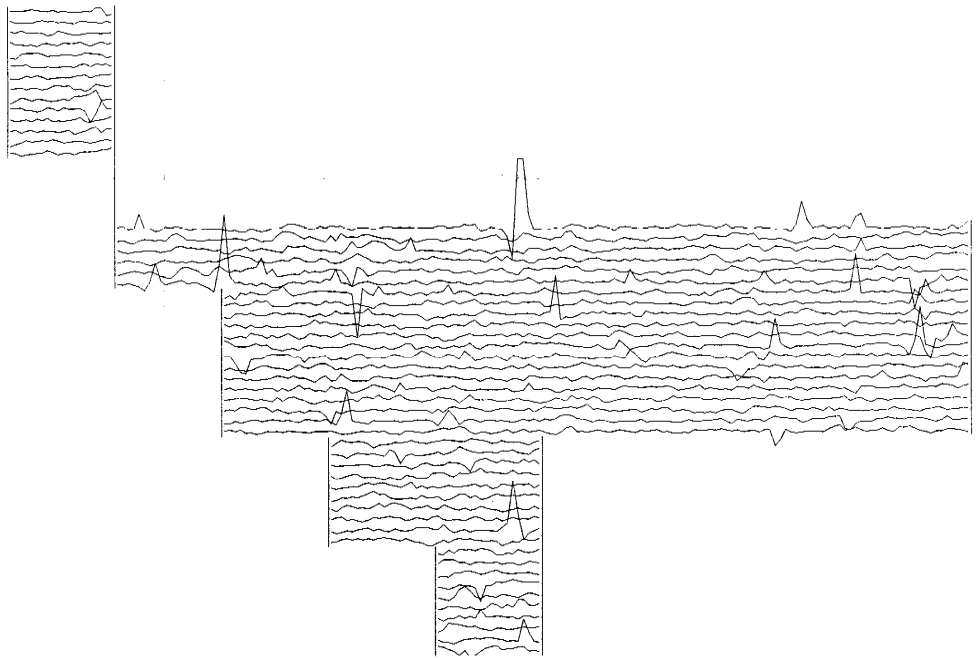




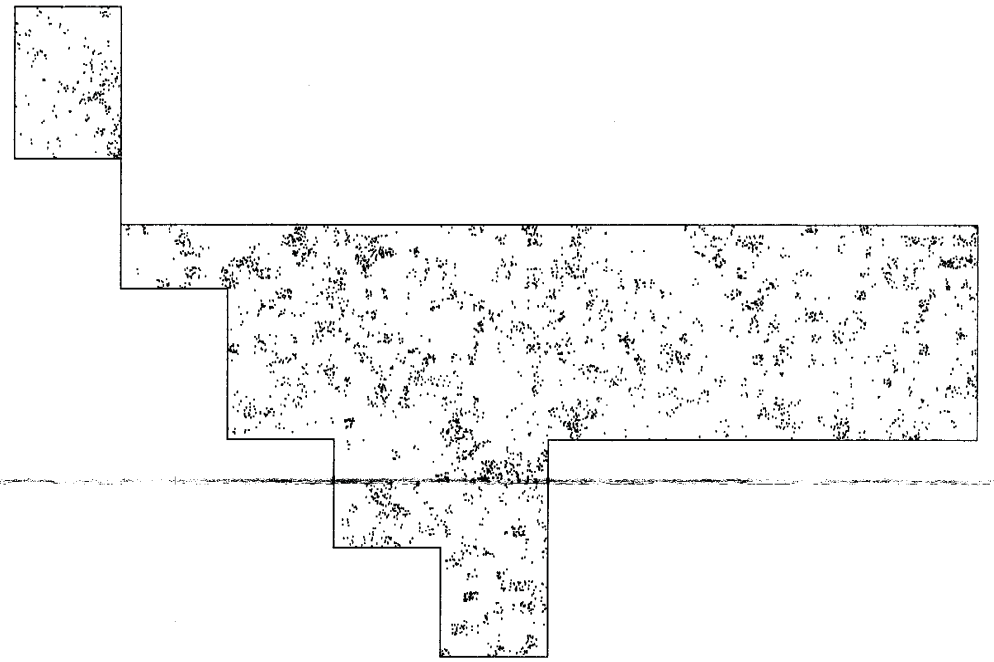
ORIGINAL AT A3

Figure 12A.2

A1
DISHFORTH TO NORTH OF LEEMING
Area 12B



12 nT



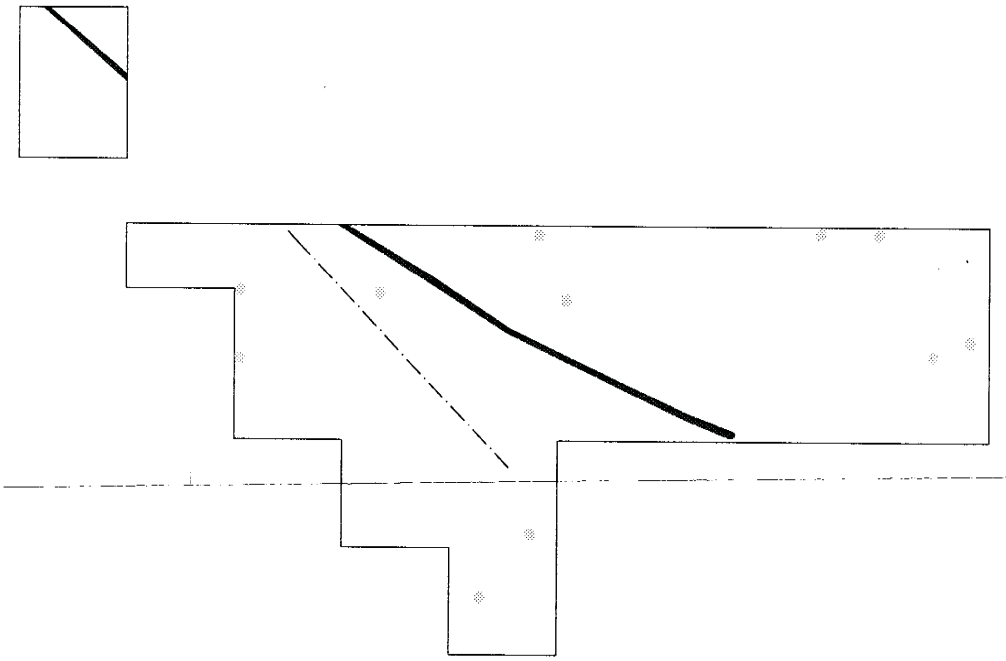
1.0
nT
0.1

0 m 20

ORIGINAL AT A3

Figure 12B.1

A1
DISHFORTH TO NORTH OF LEEMING
Area 12B



?Archaeology

Linear Trends

Ferrous

ORIGINAL AT A3

0 m 20

Figure 12B.2


0 40m
?Archaeology
Ploughing
Ferrous
AREA A11
ORIGINAL AT A3
GEOPHYSICAL SURVEYS OF BRADFORD
PROJECT: A1 DISHFORTH TO NORTH OF LEEMING
TITLE: Interpretation of Areas 11, 12, A11 & A12
Based on a plan supplied by
Anthony Walker and Partners

Figure 12C

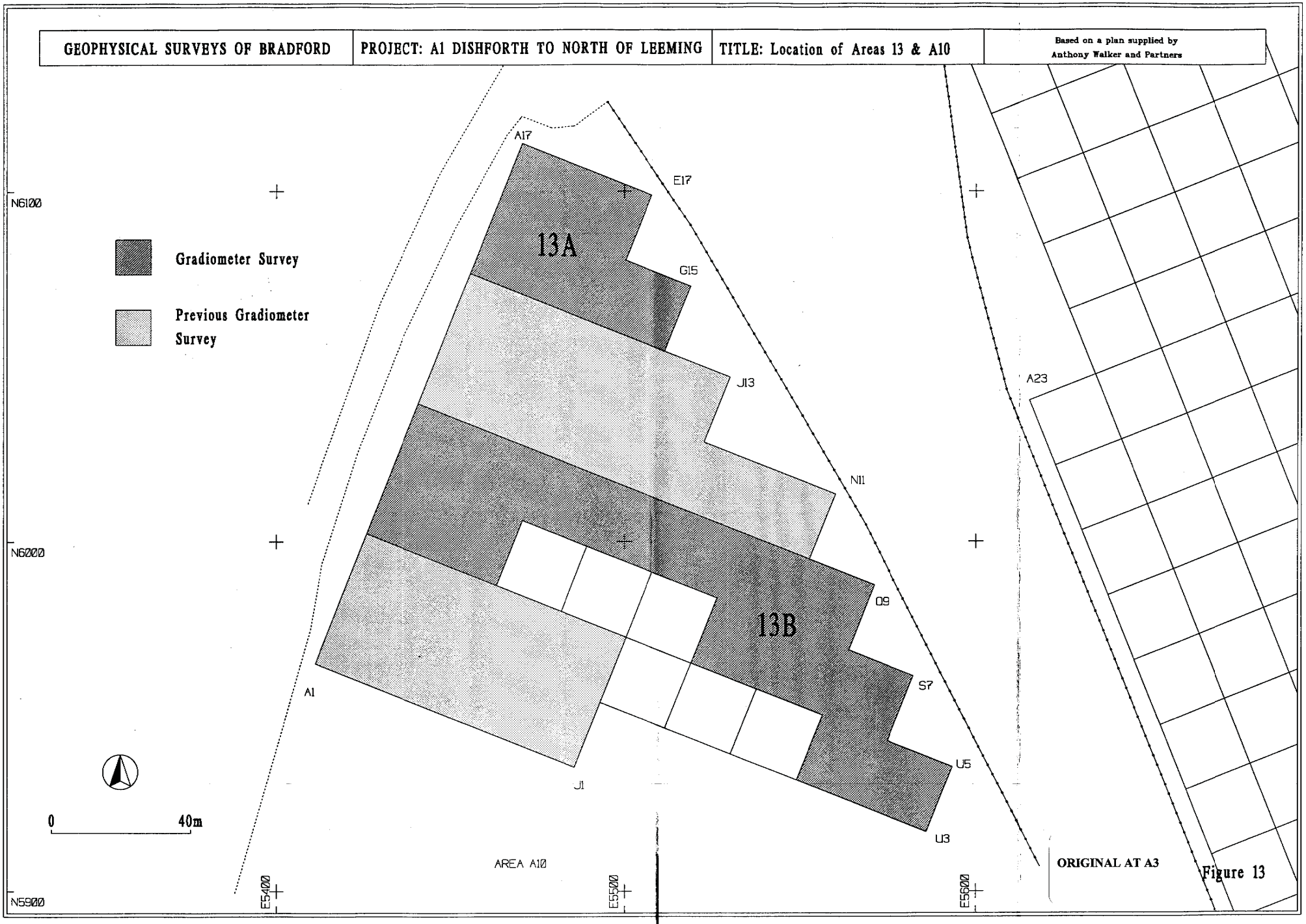

GEOPHYSICAL SURVEYS OF BRADFORD
PROJECT: A1 DISHFORTH TO NORTH OF LEEMING
TITLE: Location of Areas 13 & A10
Based on a plan supplied by
Anthony Walker and Partners
Gradiometer Survey
Previous Gradiometer Survey
13A
13B
A17
E17
G15
J13
N11
09
S7
U5
U3
J1
A1
A23
N6100
N6000
N5900
E5400
E5500
E5600
0
40m
AREA A10
ORIGINAL AT A3

Figure 13

A1
DISHFORTH TO NORTH OF LEEMING
Area 13A

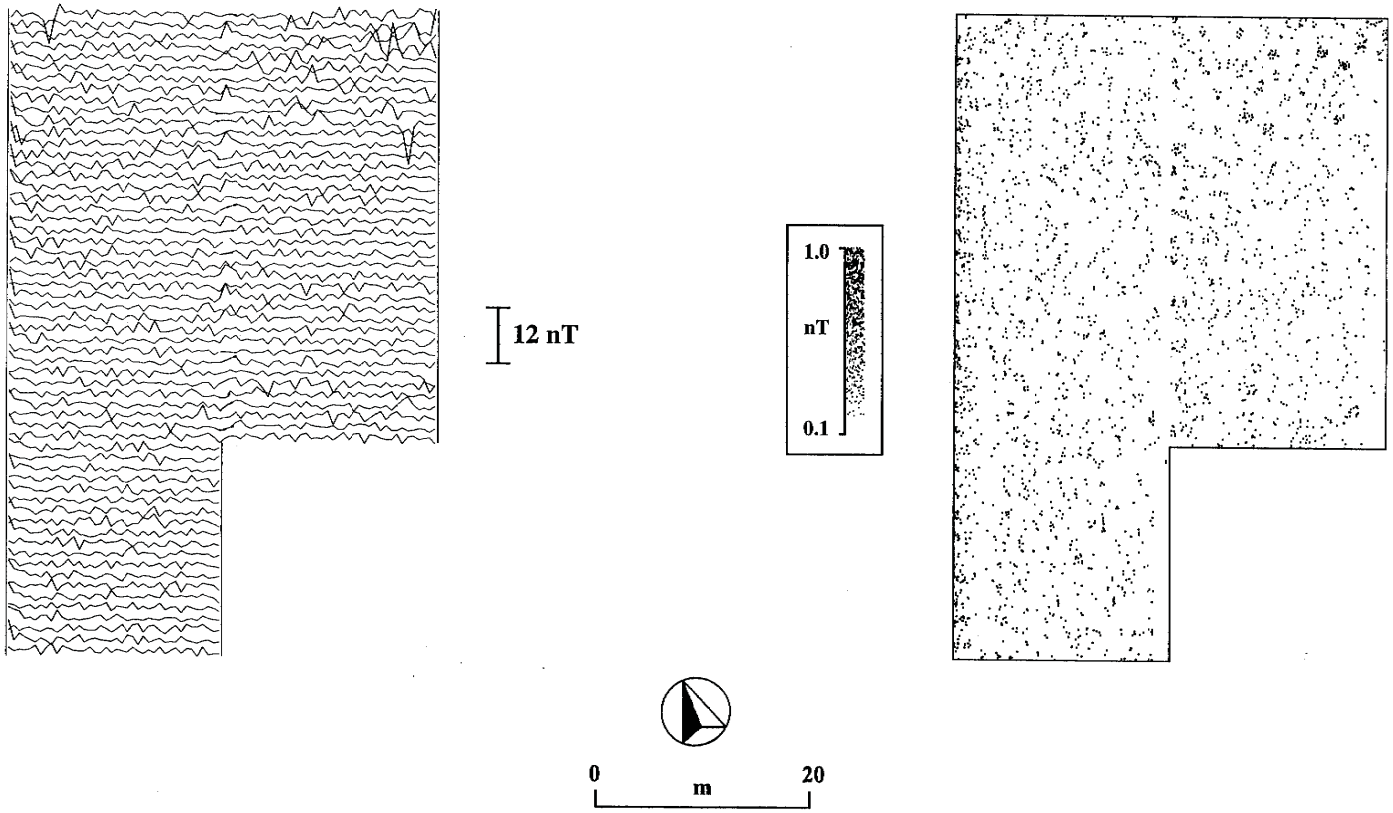


Figure 13A.2

A1
DISHFORTH TO NORTH OF LEEMING
Area 13A

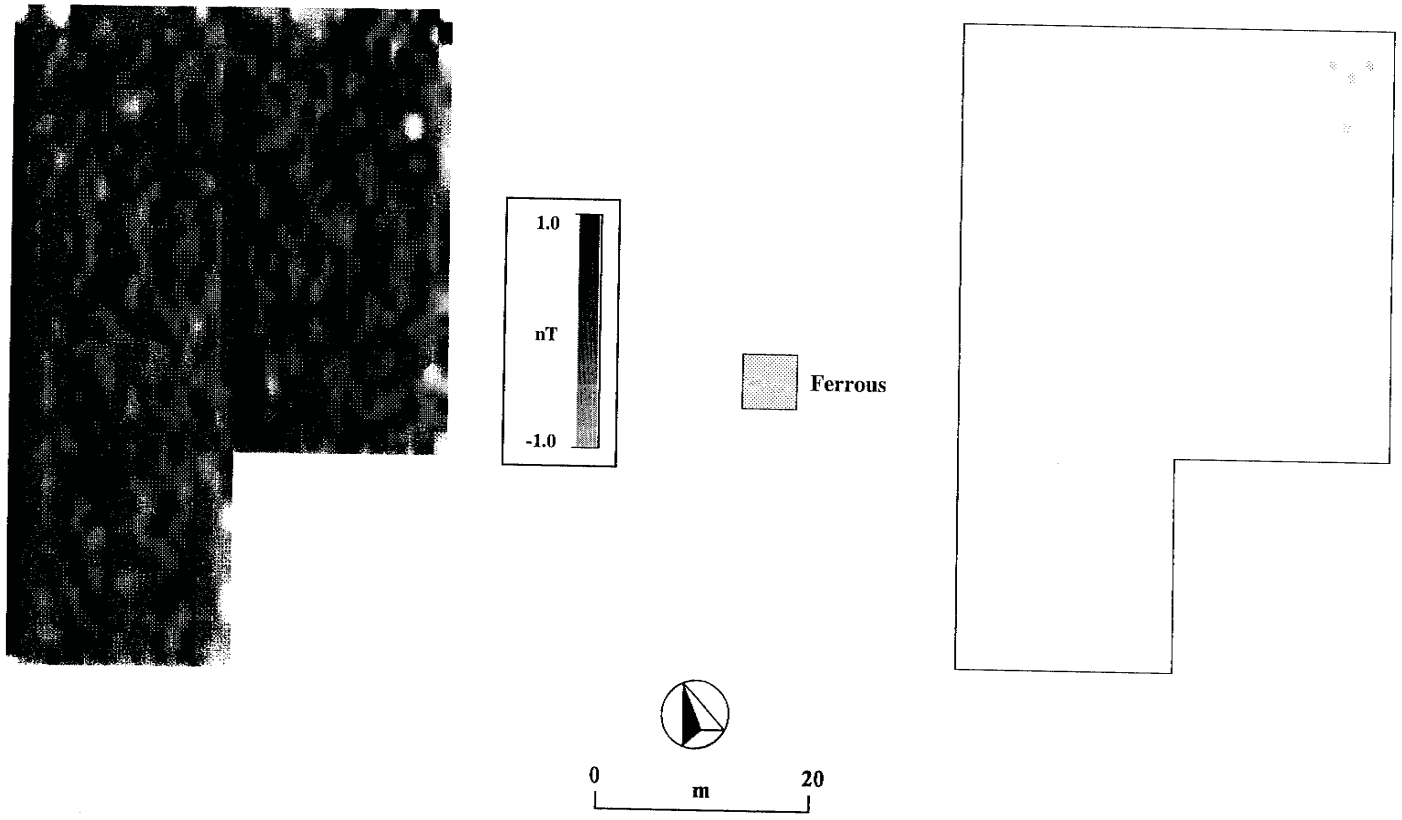
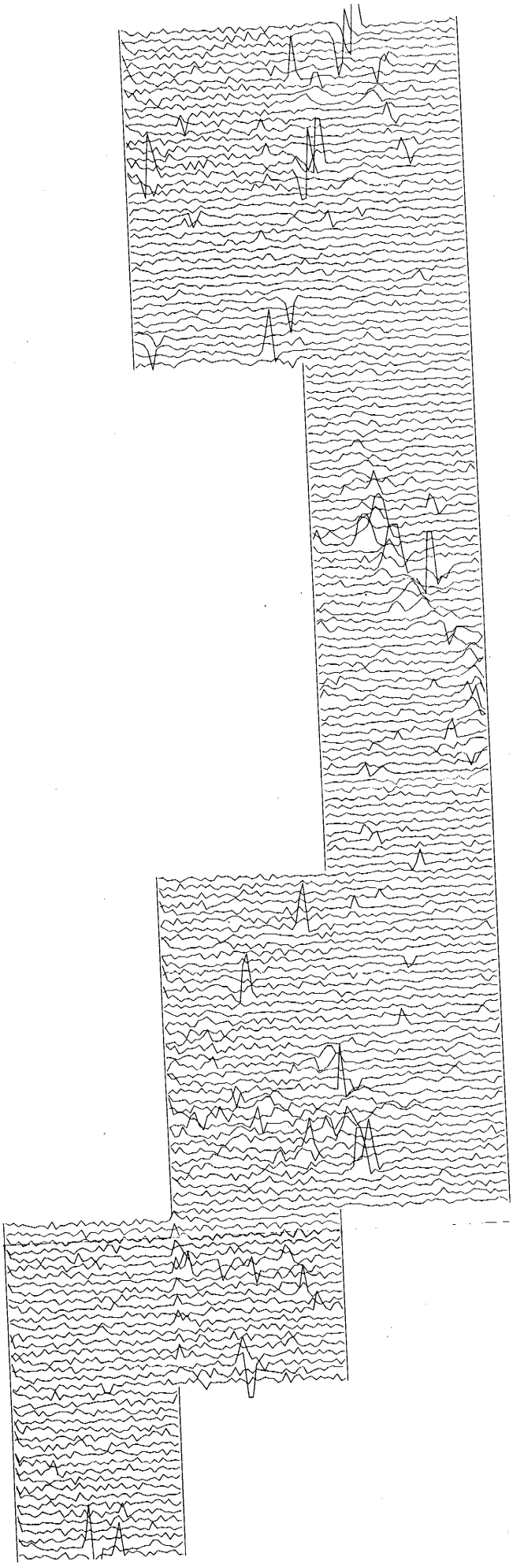


Figure 13A.2

A1
DISHFORTH TO NORTH OF LEEMING
Area 13B



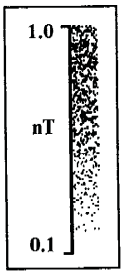
12 nT

0 m 20

ORIGINAL AT A3

Figure

A1
DISHFORTH TO NORTH OF LEEMING
Area 13B

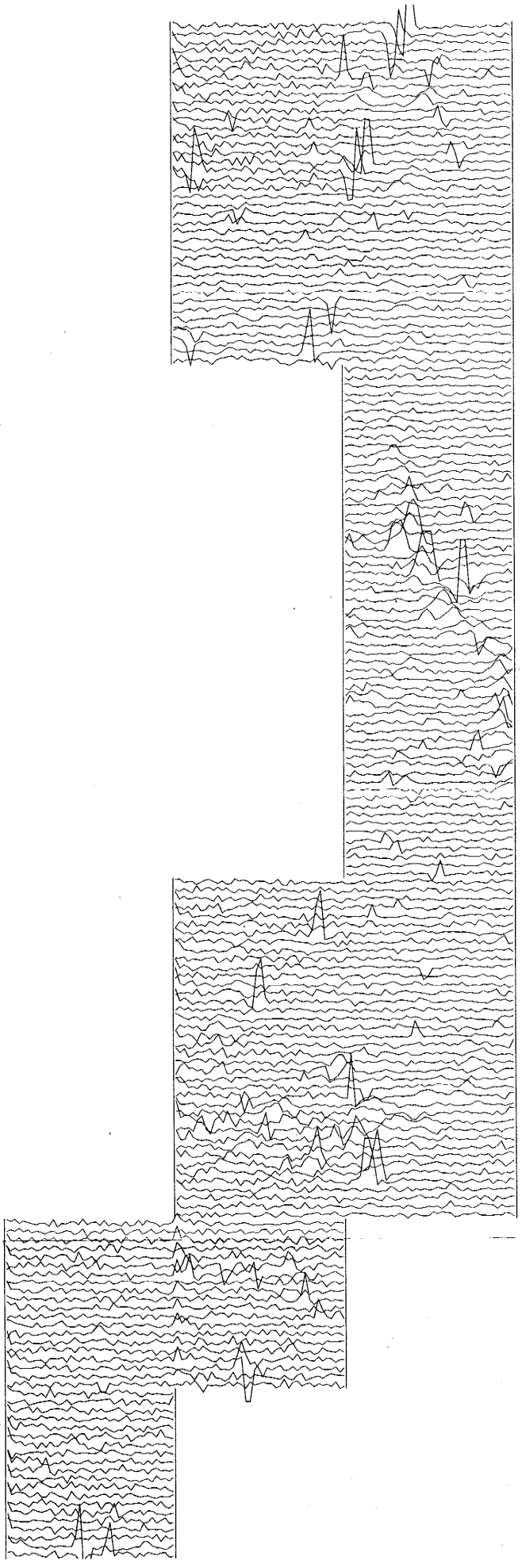


0 m 20

ORIGINAL AT A3

Figure 13B.2

A1
DISHFORTH TO NORTH OF LEEMING
Area 13B

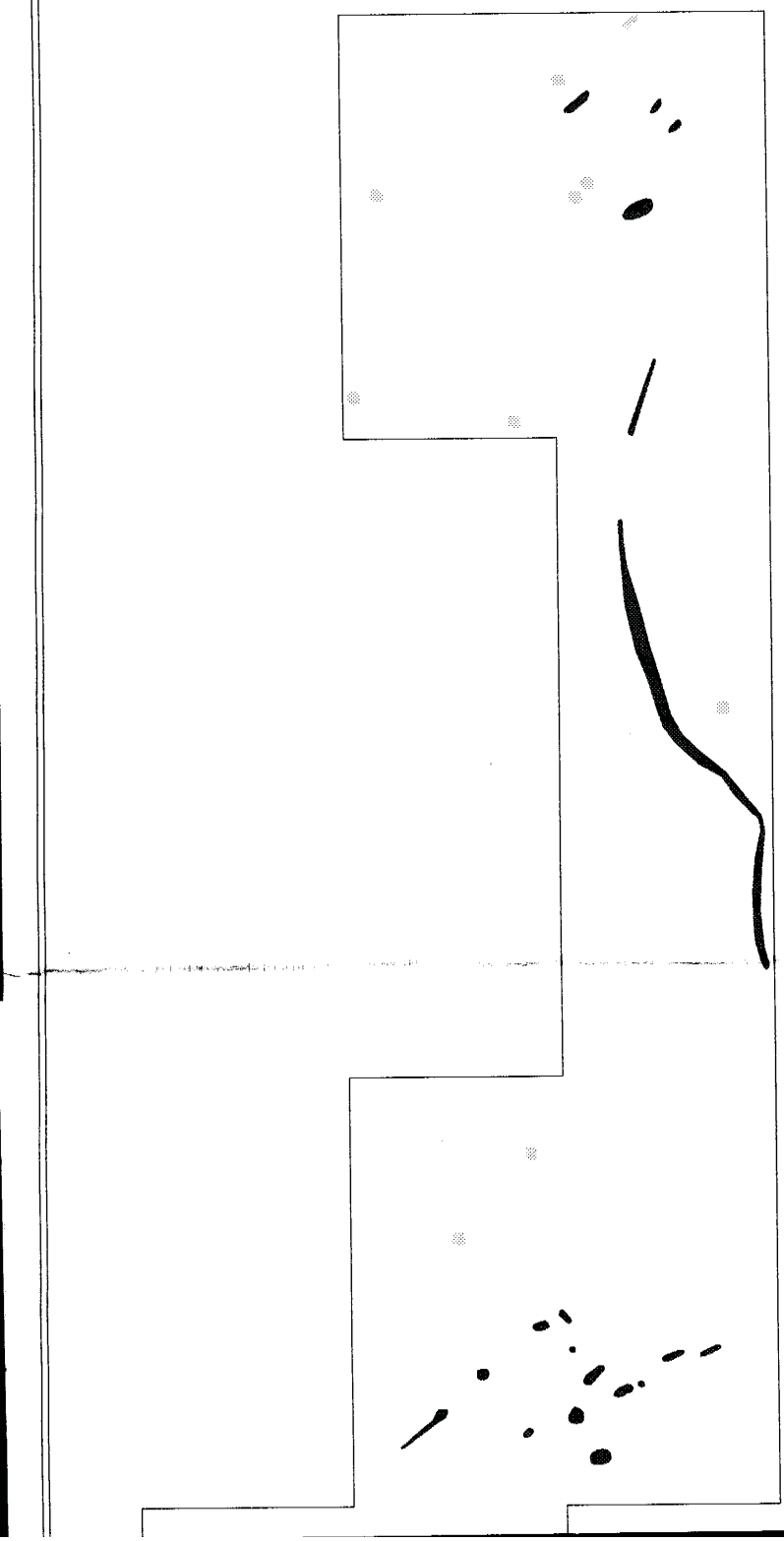


12 nT

0 m 20

ORIGINAL AT A3

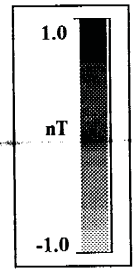
A1
DISHFORTH TO NORTH OF LEEMING
Area 13B



?Archaeology

Ferrous

A1
DISHFORTH TO NORTH OF LEEMING
Area 13B



0 m 20

ORIGINAL AT A3

Figure 13B.3

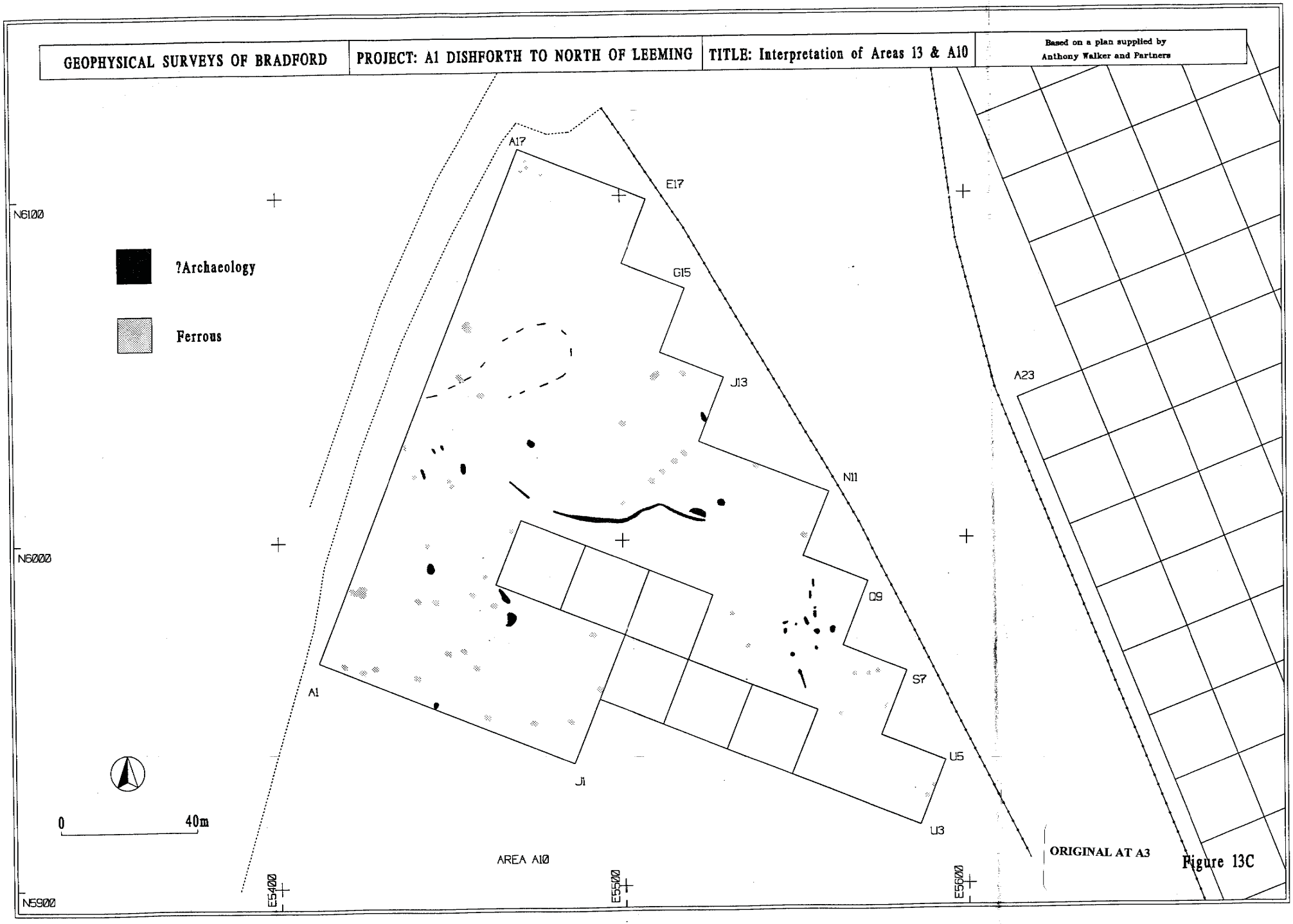

GEOPHYSICAL SURVEYS OF BRADFORD
PROJECT: A1 DISHFORTH TO NORTH OF LEEMING
TITLE: Interpretation of Areas 13 & A10
Based on a plan supplied by Anthony Walker and Partners
?Archaeology
Ferrous
A17
E17
G15
J13
N11
Q9
S7
U5
U3
J1
A1
A23
N6100
N6000
N5900
E5400
E5500
E5600
0
40m
AREA A10
ORIGINAL AT A3

Figure 13C

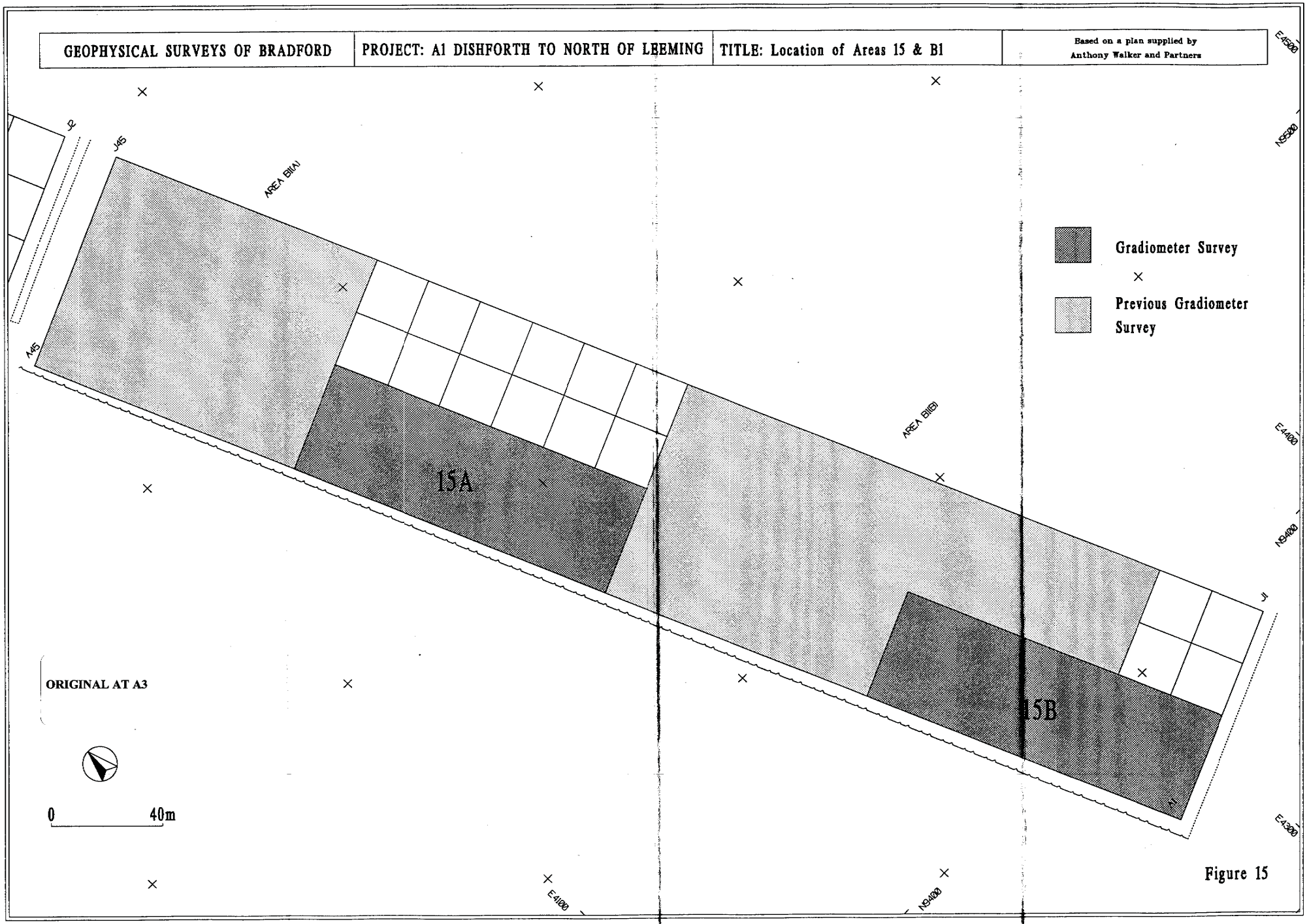
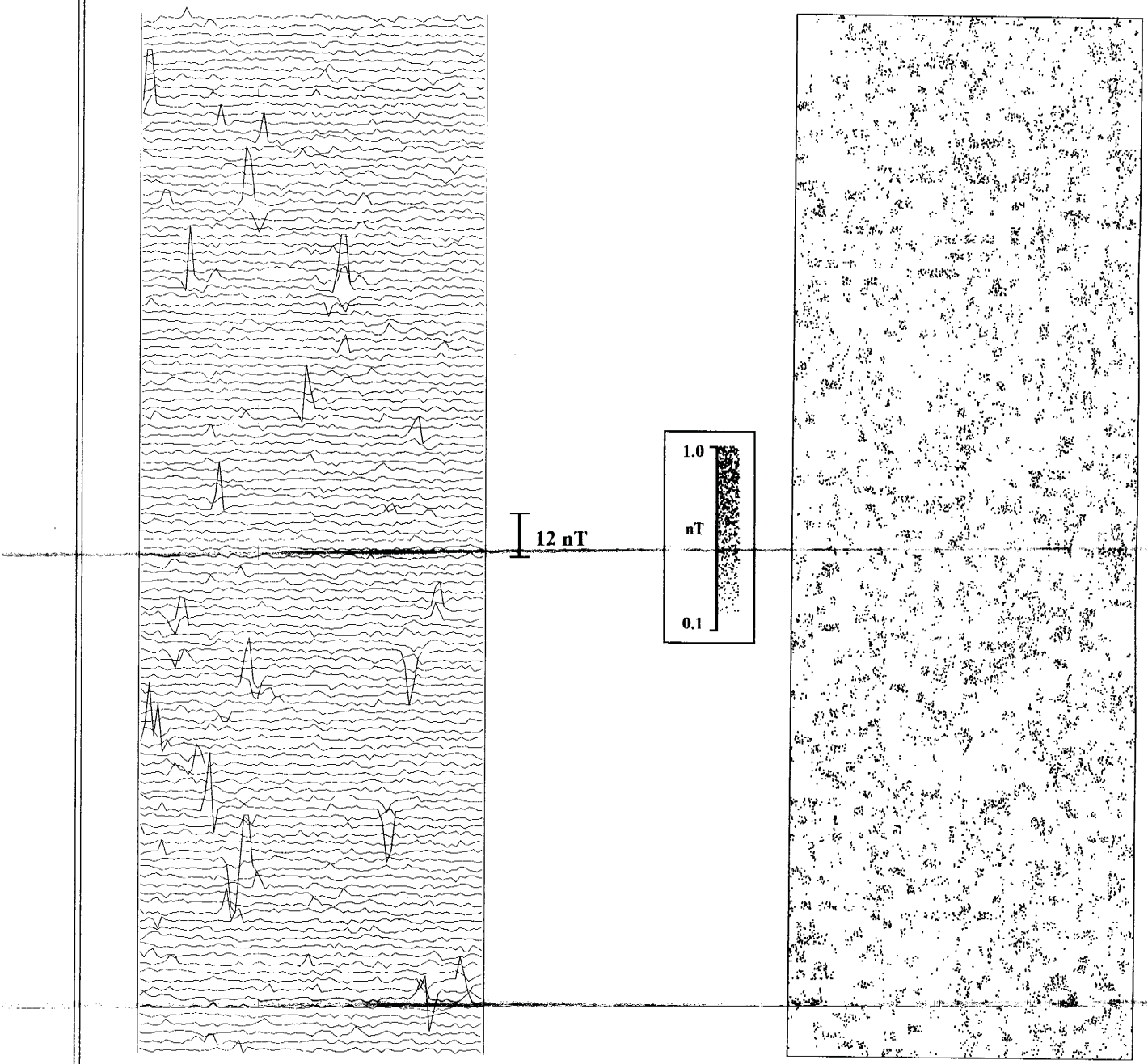

GEOPHYSICAL SURVEYS OF BRADFORD
PROJECT: A1 DISHFORTH TO NORTH OF LEEMING
TITLE: Location of Areas 15 & B1
Based on a plan supplied by Anthony Walker and Partners
AREA B1(A)
AREA B1(B)
15A
15B
Gradiometer Survey
Previous Gradiometer Survey
ORIGINAL AT A3
0
40m
E4500
N5300
E4400
N5400
E4300
E4100
N5400

Figure 15

A1
DISHFORTH TO NORTH OF LEEMING
Area 15A

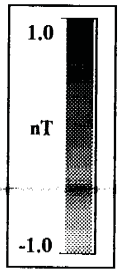


ORIGINAL AT A3

0 m 20

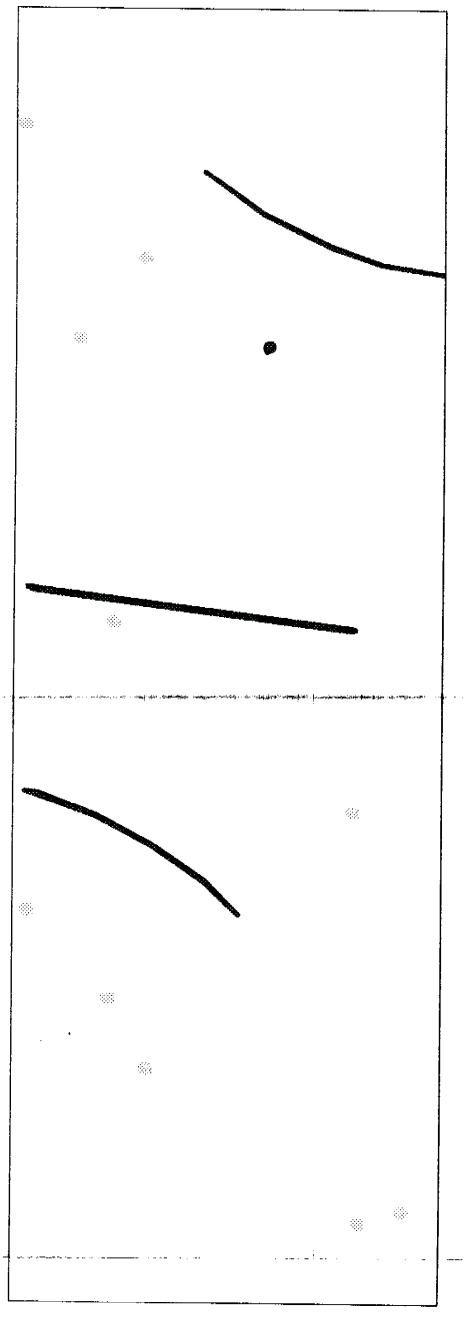
Figure 15A.1

A1
DISHFORTH TO NORTH OF LEEMING
Area 15A



?Archaeology

Ferrous

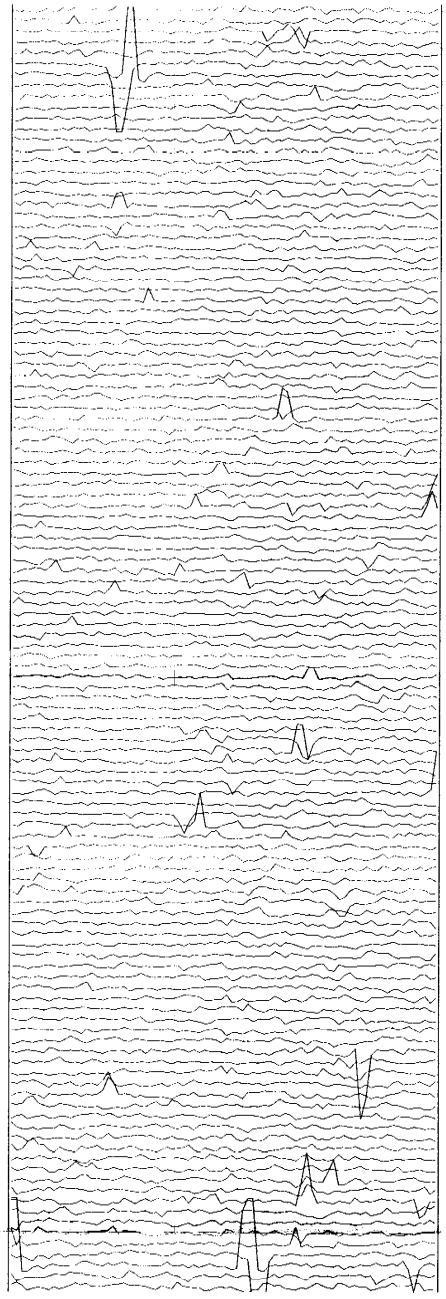


ORIGINAL AT A3

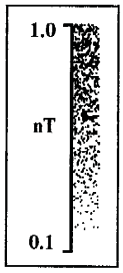
0 m 20

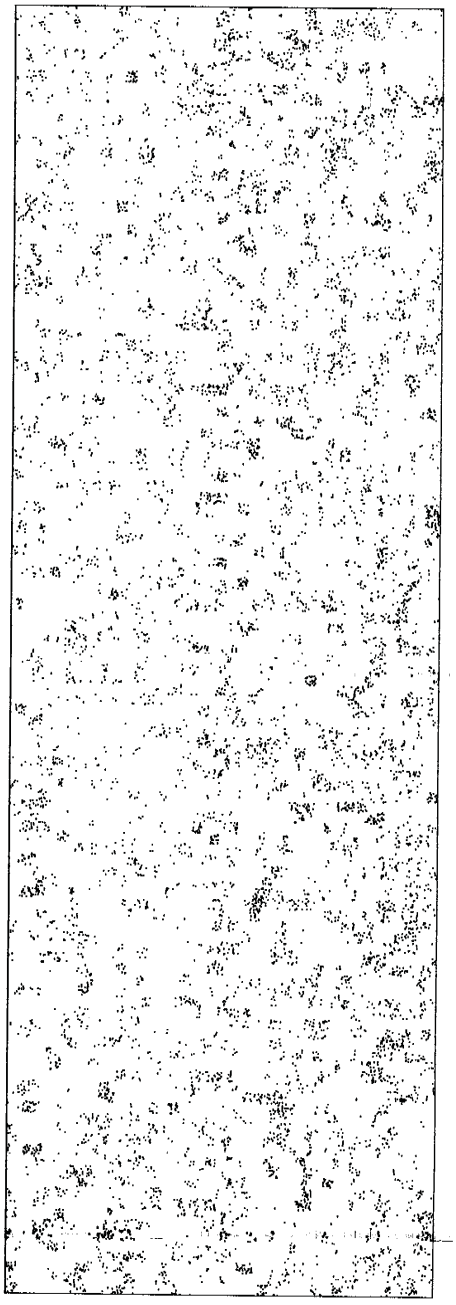
Figure 15A.2

A1
DISHFORTH TO NORTH OF LEEMING
Area 15B



12 nT



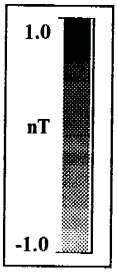


ORIGINAL AT A3

0 m 20

Figure 15B.1

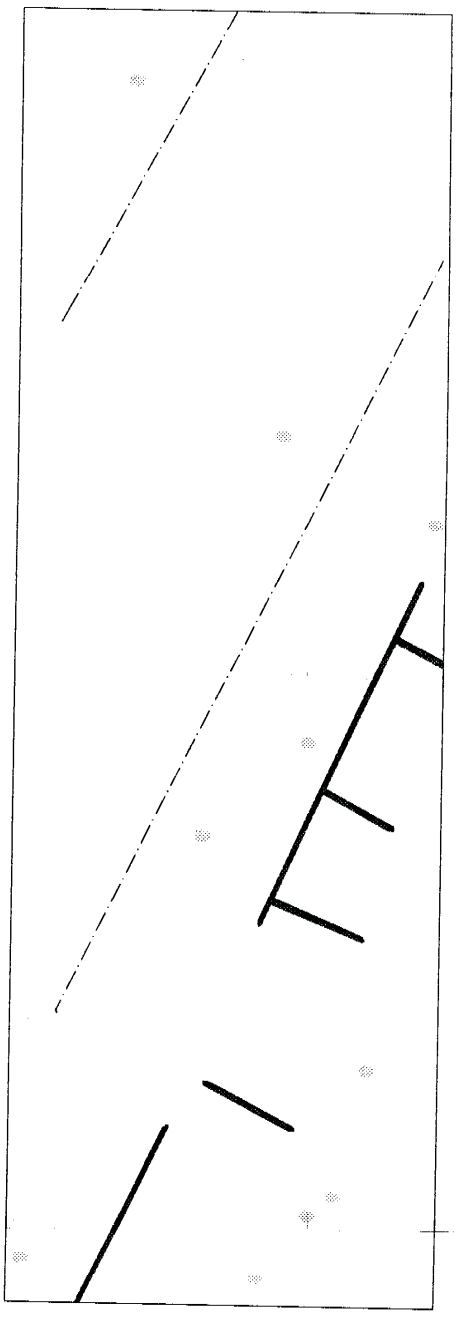
A1
DISHFORTH TO NORTH OF LEEMING
Area 15B



?Archaeology

Linear Trends

Ferrous



0 m 20

ORIGINAL AT A3

Figure 15B.2

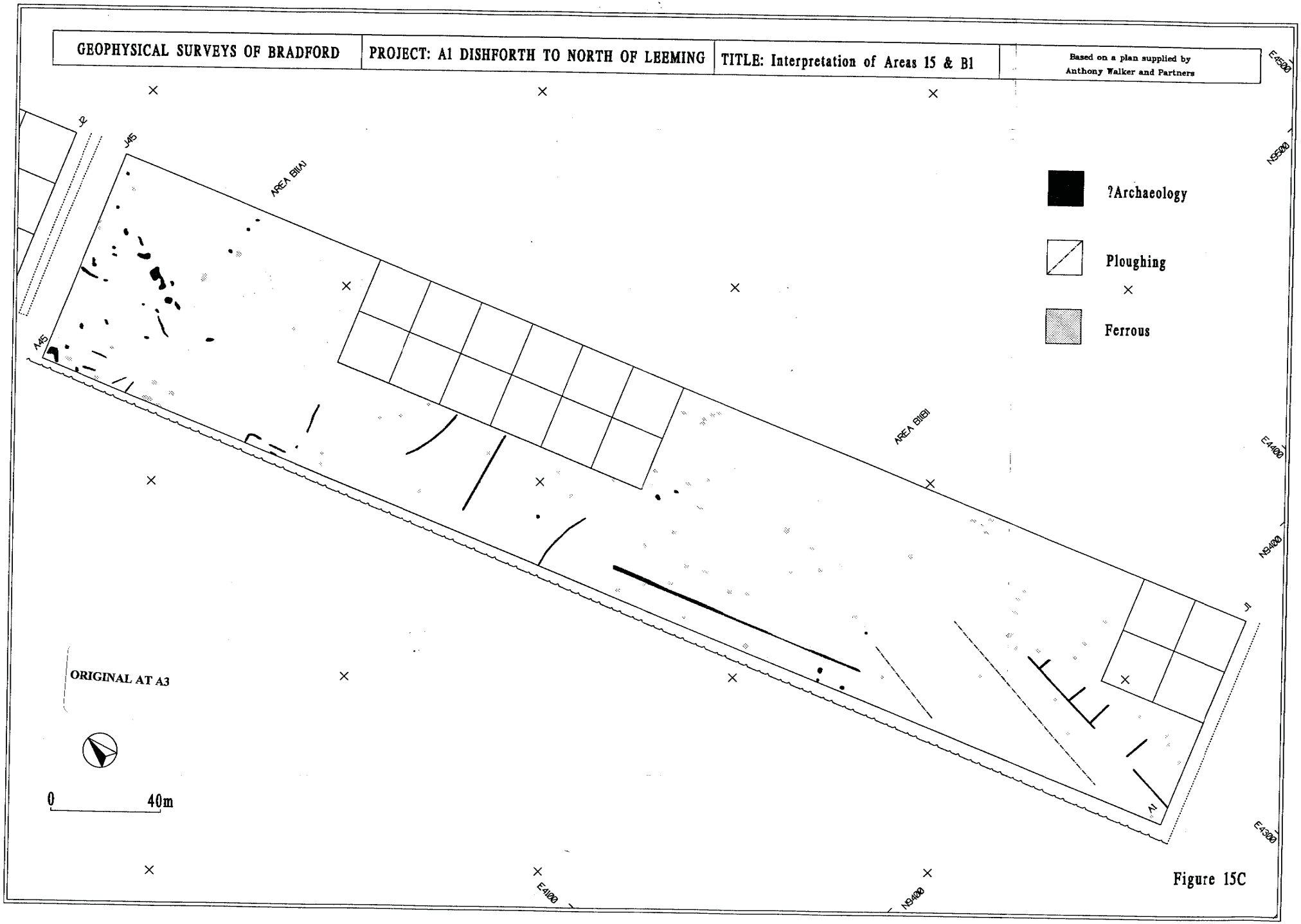
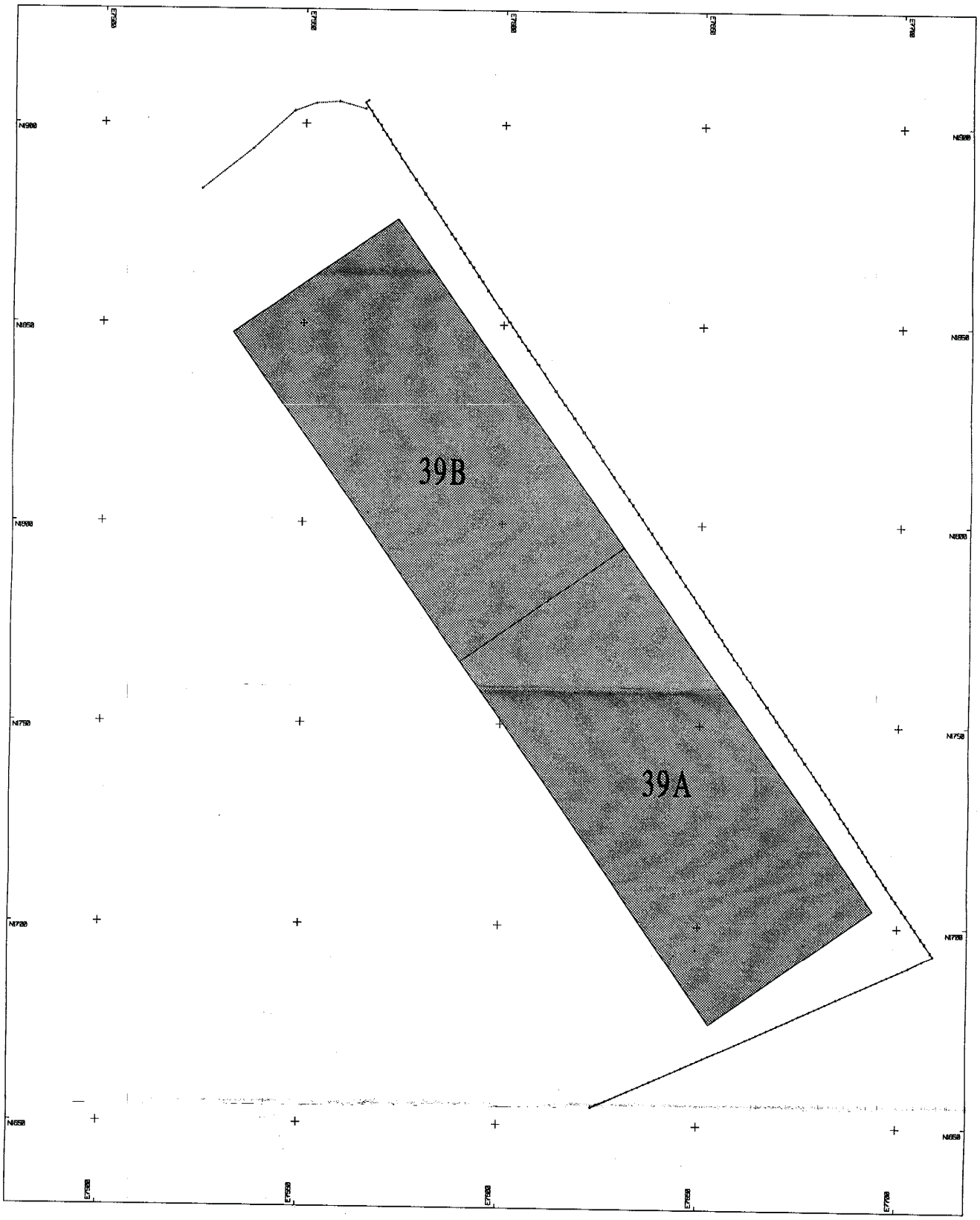

GEOPHYSICAL SURVEYS OF BRADFORD
PROJECT: A1 DISHFORTH TO NORTH OF LEEMING
TITLE: Interpretation of Areas 15 & B1
Based on a plan supplied by Anthony Walker and Partners
?Archaeology
Ploughing
Ferrous
AREA B1A1
AREA B1B1
J2
J45
A45
J1
J4
E4500
N5300
E4400
N5400
E4300
E4100
N5400
ORIGINAL AT A3
0
40m

Figure 15C



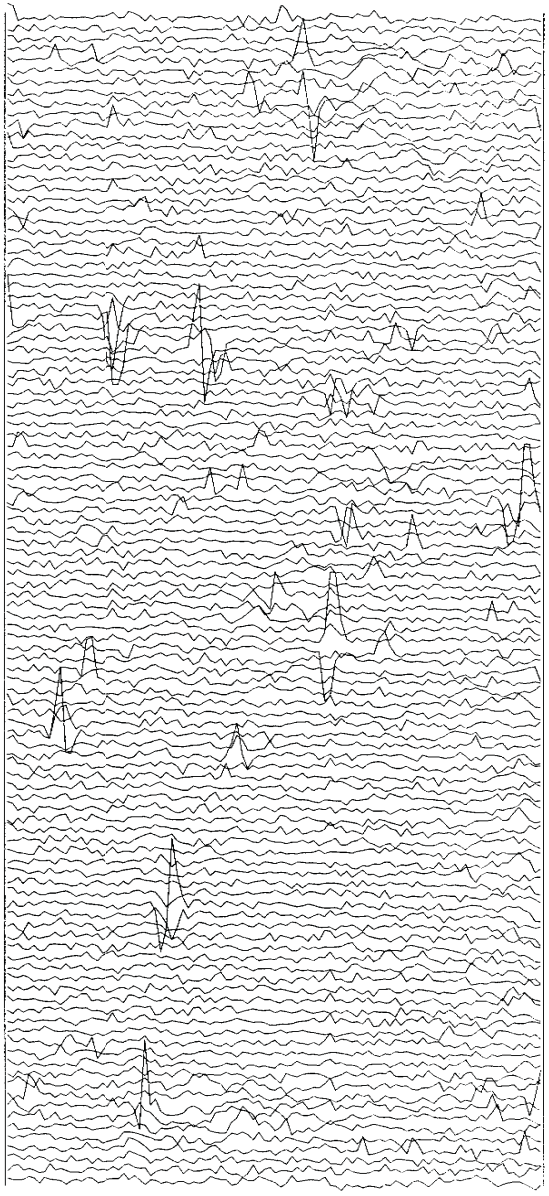
Gradiometer Survey

ORIGINAL AT A3

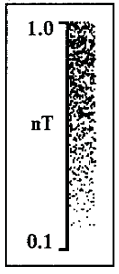
0 40m

GEOPHYSICAL SURVEYS OF BRADFORD	
PROJECT: A1 DISHFORTH TO NORTH OF LEEMING	
TITLE: Location of Area 39	
Based on a plan supplied by Anthony Walker & Partners	Figure 39

A1
DISHFORTH TO NORTH OF LEEMING
Area 39A



12 nT



ORIGINAL AT A3

0 m 20

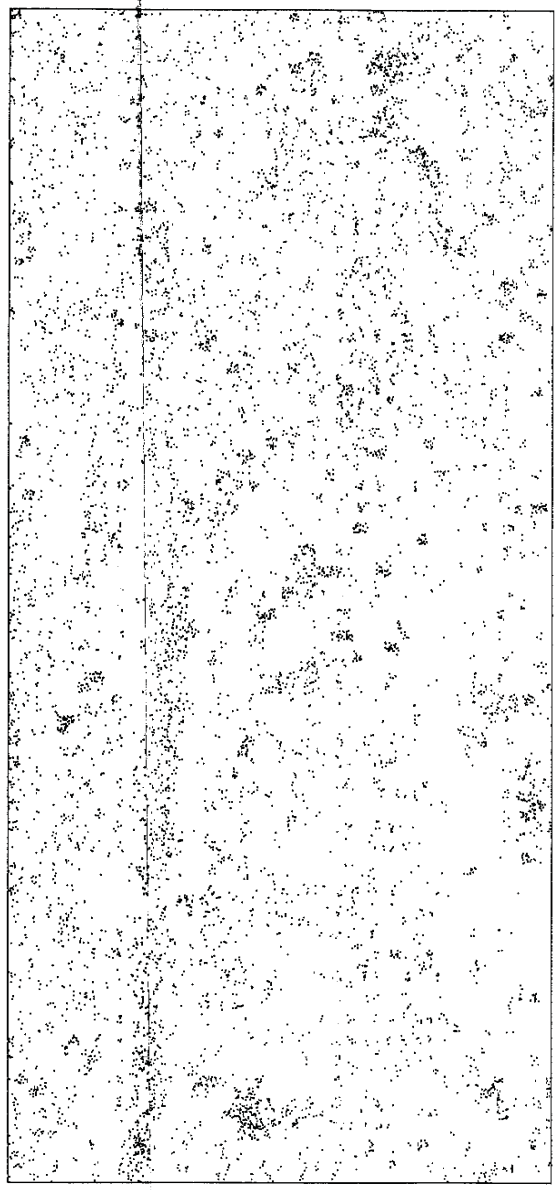
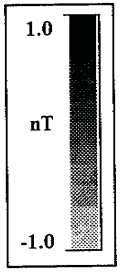


Figure 39A.1

A1
DISHFORTH TO NORTH OF LEEMING
Area 39A



?Archaeology

Ferrous

ORIGINAL AT A3

0 m 20

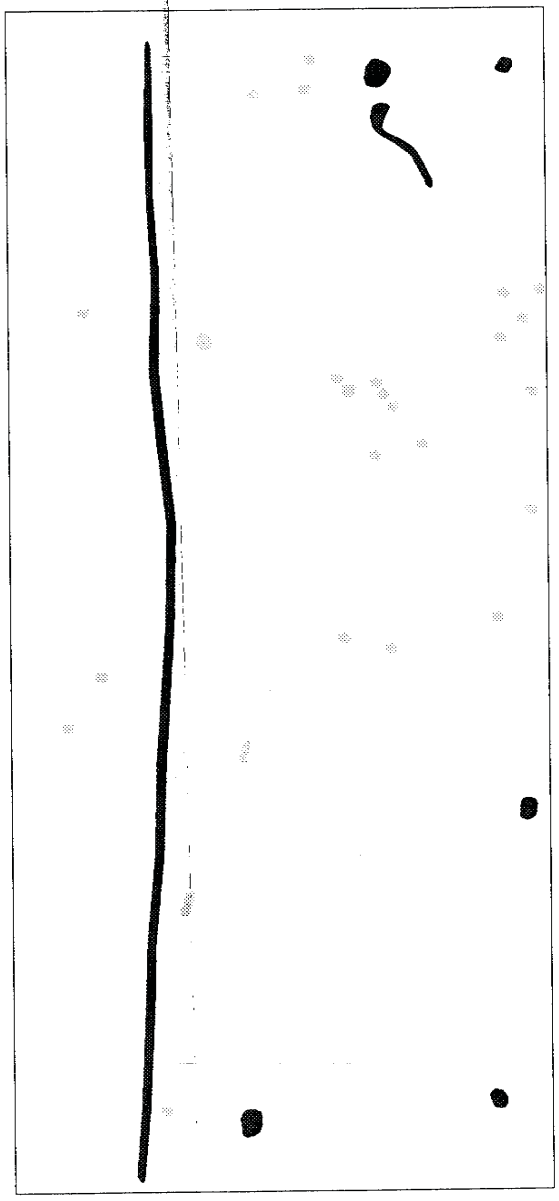
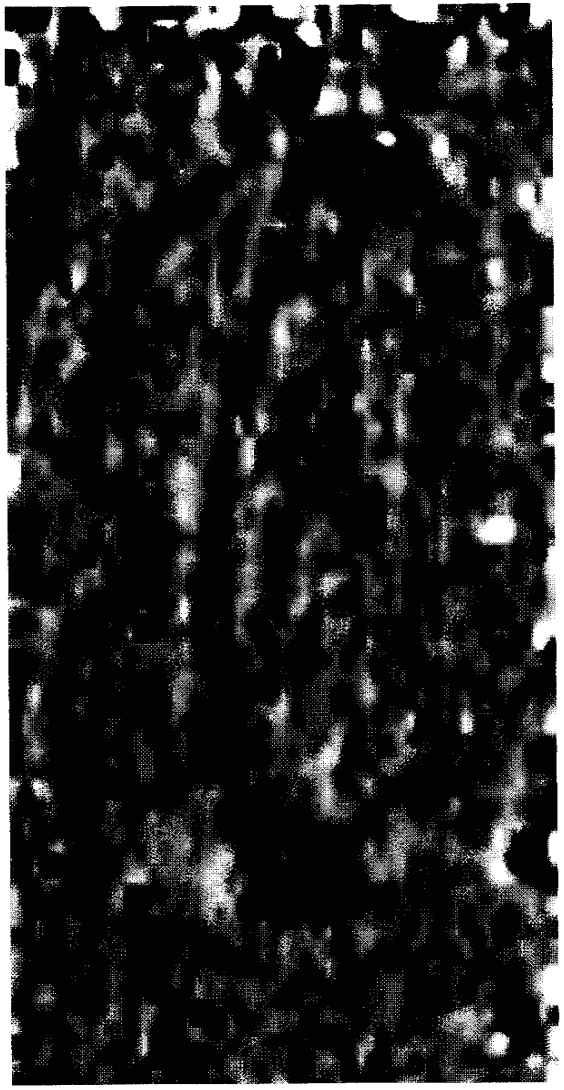


Figure 39A.2

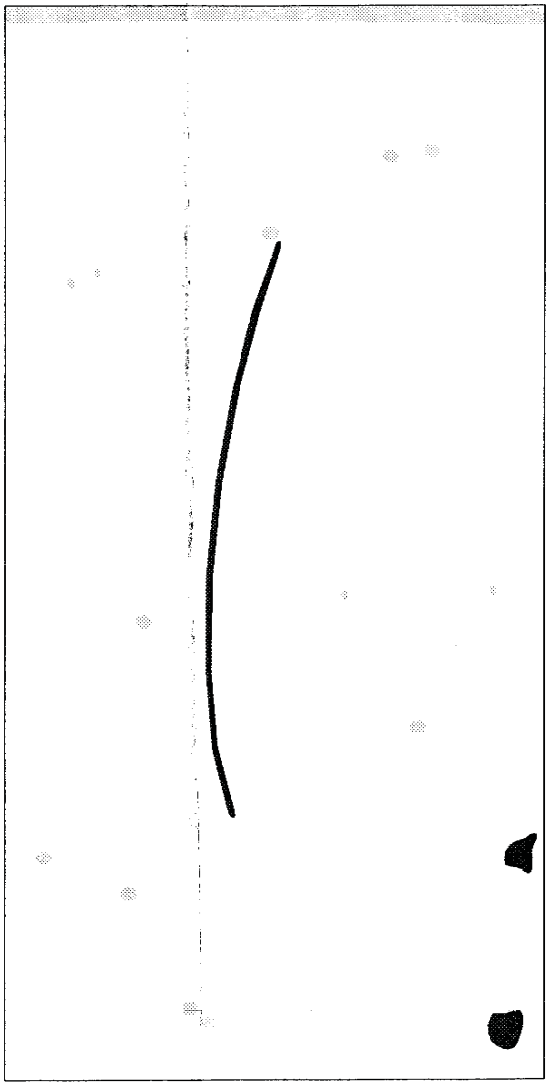
A1
DISHFORTH TO NORTH OF LEEMING
Area 39B



1.0
nT
-1.0

?Archaeology

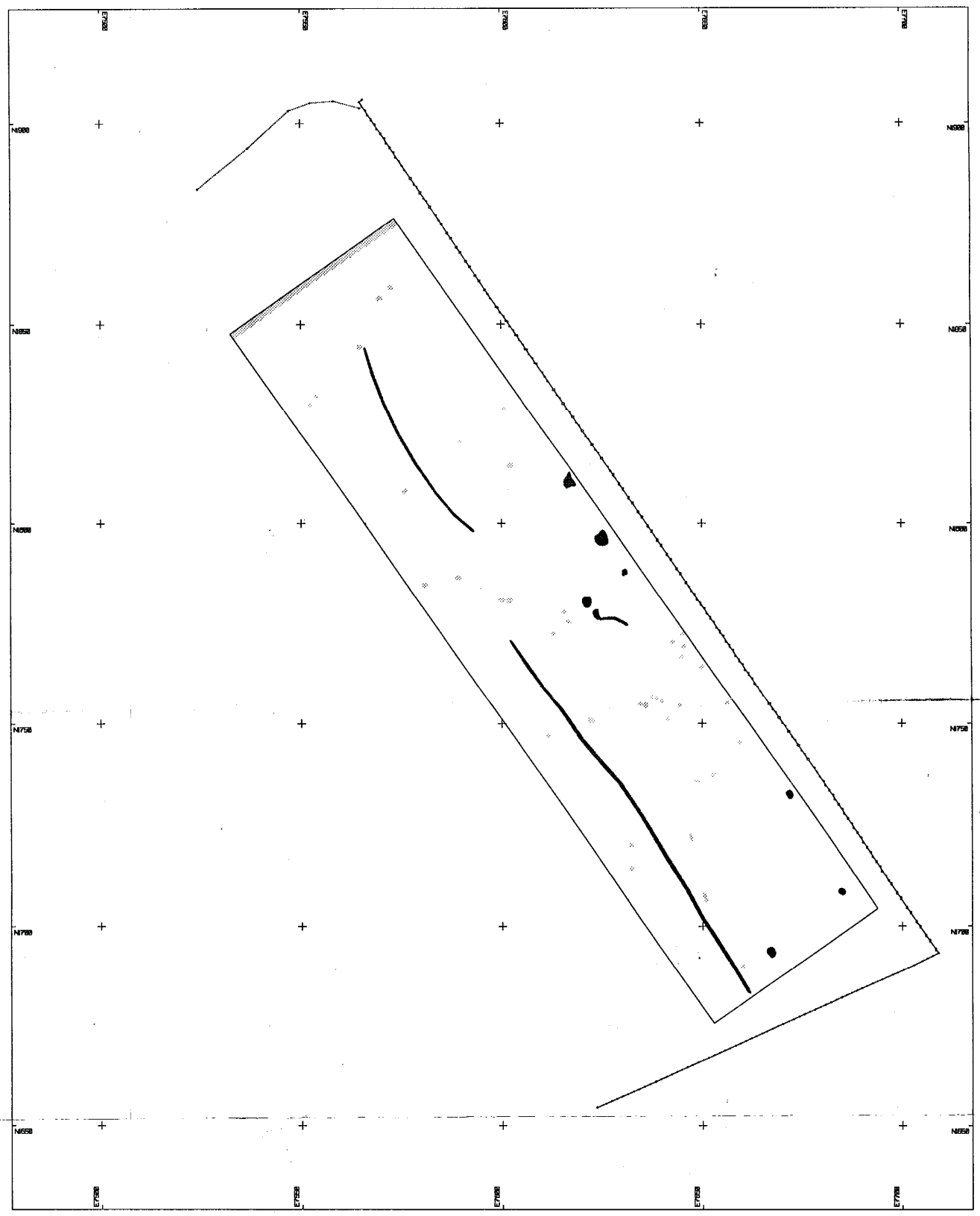
Ferrous



ORIGINAL AT A3

0 m 20

Figure 39B.2



?Archaeology

Ferrous

0 40m

ORIGINAL AT A3

GEOPHYSICAL SURVEYS OF BRADFORD	
PROJECT: A1 DISHFORTH TO NORTH OF LEEMING	
TITLE: Interpretation of Area 39	
Based on a plan supplied by Anthony Walker & Partners	Figure 39C