GSB
PROSPECTION

Specialising in Shallow and Archaeological Prospection

• *Consultancy* •

• *Project Design* •

• *Rapid Assessment* •

• *Detailed Survey* •

• *Integrated Research* •

Cowburn Farm
Market Street, Thornton
Bradford, BD13 3HW
Tel: (01274) 835016
Fax: (01274) 830212
E-mail: gsbprospection@cs.com
Web: www.gsbprospection.com

GEOPHYSICAL SURVEY REPORT 2001/115

WHISBY QUARRY
Lincolnshire

Client:

JSAC JOHN SAMUELS ARCHAEOLOGICAL CONSULTANTS

EVENTS LI4355 - Magnetometry Scanning survey
LI4356 - Magnetometry systematic survey
Source : LI 8930
PRN 63576.

SITE SUMMARY SHEET

2001 / 115 Whisby Quarry, Lincolnshire

NGR: SK 887 662 (Approximate centre)

Location, topography and geology

The area under investigation lies 2km to the south-west of Whisby and to the south east of the village of Eagle. The topography is flat with a ground cover of oilseed, young cereal, pasture, set-aside and plough. The soils are stagnogleyic typical sandy gleys formed from a parent of fluvioglacial sands and gravels (SSEW 1983).

Archaeology

There is little evidence for archaeological remains within the application area. However, Eagle appears to have been a focus of some activity of interest as Eagle Hall was a former Templars' Preceptory; also fragments of Roman pottery have been found at Eagle.

Aims of Survey

The aim of the geophysical investigation was to locate any detectable anomalies of archaeological interest within the evaluation area. This survey forms part of a wider archaeological investigation being undertaken by **John Samuels Archaeological Consultants (JSAC).**

Summary of Results *

Scanning found the background magnetic response to be very quiet and a small number of anomalies were noted and marked for further investigation. Areas of detailed survey were deployed to investigate these scanned anomalies, to sample fields close to Eagle and to provide a wider spatial coverage of the application area. A small number of responses have been recorded which may be of archaeological potential but this is tentative. The majority of the anomalies detected are attributed to recent agriculture and pedological variation.

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

SURVEY RESULTS

2001 / 115 Whisby Quarry, Lincolnshire

1 Survey Area

1.1 The evaluation area, covering approximately 66ha, was subject to gradiometer survey in 'scanning' mode. Subsequently, *c.*5ha of detailed gradiometer survey was undertaken in 12 areas (labelled Areas 1 to 12). The extent of scanning and the location of the areas of detailed survey is shown in Figure 1 at a scale of 1:10 000.

1.2 The survey grids was set out by **GSB Prospection** and tied to existing boundary features using an EDM system and tapes. Detailed tie-in information has been lodged with the client. Canes and pegs marking the grid corners have been left *in situ* to allow the reconstruction of the survey grid.

2 Display

2.1 Figures 2 to 7 present the data as summary greyscale images with accompanying interpretation diagrams produced at a scale of 1:2500.

2.2 Within the archive section (Figures A1 to A20) the data for Areas 1 to 12 are displayed as XY traces, dot density plots and interpretation diagrams at a scale of 1:500.

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

2.4 Letters in parentheses in the text refer to specific anomalies highlighted on the relevant interpretation diagrams.

3 General Considerations - Complicating factors

3.1 Generally, conditions for survey were good with the site being relatively free from obstructions. Two fields at the north-west and south-west extremities of the application area had been ploughed prior to survey. Scanning was attempted in the former field but abandoned in the south-western one, no detailed survey was possible in either field.

3.2 The soils encountered within the survey area consist of deep homogeneous coarse loams and sands over gravels which are subject to a high water table. Such soils are not ideal for magnetic gradiometry and many features, such as isolated ditches and pits, will be at or beyond the limits of detection. Remains associated with intense industrial or domestic activity are more likely to be detected.

3.3 Numerous small isolated ferrous responses have been recorded throughout the survey area and these are considered to be the result of modern ferrous debris in the topsoil. The most prominent of these are noted on the interpretation diagrams, but are not referred to in the text unless considered particularly relevant.

4 Results of Scanning

4.1 With gradiometers in scanning mode, the evaluation area was examined along traverses spaced at intervals of approximately 10m. During this operation, fluctuations in magnetic signal were observed on the instruments' display panel. Any significant variations were investigated more closely to determine their likely origin and those anomalies considered to have archaeological potential were marked with canes for detailed recorded survey.

4.2 Scanning revealed the background variation to be very quiet (±0.5nT). However, a small number of anomalies and zones of fluctuating response were noted and marked for detailed survey to further clarify their nature.

5 Results of Detailed Survey

Area 1

5.1 Detailed survey was undertaken here because it was the closest surveyable field to Eagle. No anomalies if interest have been recorded.

Area 2

5.2 This area investigated a scanned anomaly and a slight topographical rise. The data contains a number of amorphous anomalies which are interpreted as being pedological although the possibility that they are archaeological cannot be excluded. Several trends have also been noted but it is impossible to be precise about their nature. They could easily be the result of recent ploughing.

Area 3

5.3 This block of detailed survey was positioned to investigate a scanned anomaly at its southern end and to give a wider spatial sample. No responses of unambiguous archaeological note were recorded. Two ill-defined anomalies have been detected and are presumed to be modern, although an archaeological explanation cannot be wholly rejected. A number of trends can be discerned but they are faint and possibly ephemeral and any interpretation would be conjecture.

Area 4

5.4 Detailed survey was undertaken to investigate two scanned anomalies. No responses of archaeological merit have been recorded. An alignment of ferrous anomalies towards the west of the area may relate to a former drain / field boundary noted on some of the maps provided by **JSAC**. However, they may reflect a damaged pipe/service or field drain.

Area 5

5.5 This area of detailed survey was positioned to investigate a zone of fluctuating response. The data contain broad, amorphous anomalies which are thought to be natural in origin.

5.6 Numerous trends have been noted and whilst an archaeological explanation cannot be excluded, it remains unlikely.

Area 6

5.7 Scanning noted an area of fluctuating response which was targeted by detailed survey. The data contain an amorphous response presumed to be natural and several trends of indeterminate nature.

Area 7

5.8 Scanning had noted an area of fluctuating response. Detailed survey, however, detected nothing of interest.

Area 8

5.9 Survey sought to examine the area around two scanned anomalies in greater detail. These transpired to be part of a number of broad and amorphous responses. They are most probably natural rather than archaeological, though the latter cause remains possible but only if the remains were heavily ploughed. An additional consideration is the proximity of a railway and these responses may reflect disturbance relating to the construction of the line.

Area 9

5.10 Broad amorphous anomalies, similar to those detected in Area 8 have been located. These are also thought be natural and may reflect lenses of magnetic gravels. Two linear anomalies (A) may be archaeological. However, this is a tentative interpretation and they may equally be due to modern agricultural practice. A number of trends parallel with (A) are characteristic of past ploughing.

Area 10

5.11 A single scanned anomaly was targeted by detailed survey. Whilst the data contain several trends, no anomalies of archaeological interest have been noted.

Area 11

5.12 This field was the 'noisiest' scanned, much of which was due to isolated ferrous debris within the topsoil. Detailed survey sampled this field but found nothing of archaeological merit. The data contain a number of trends but their nature is unclear and any interpretation would be speculation.

Area 12

5.13 Detailed survey was situated to encompass a broad spread of anomalies noted during scanning. The survey data showed these to relate to a number of broad amorphous responses. The most plausible explanation is that they are natural and/or spoil dredged form an adjacent ditch, although an archaeological cause for some can not be wholly rejected.

5.14 An ill-defined band of ferrous-type responses along the southern edge of the area is attributed to debris within spoil dredged from the adjacent ditch.

6 Conclusions

6.1 Scanning found the general background level of magnetic response to be uniformly very quiet A number of anomalies were marked as targets for subsequent detailed survey.

6.2 No anomalies of clear archaeological interest have been noted, although several responses are tentatively interpreted as possible archaeology. The data also contain anomalies attributed to natural or modern agricultural causes. Numerous trends have been discerned within the data and whilst an archaeological origin cannot be dismissed, their nature remains highly debatable and it is more plausible that they are due to ploughing.

6.3 The nature of the coarse mineral soils subject to a high water table is a cause for concern as gradiometry results over such pedologies tends to be very limited. However, the fact that subtle and ephemeral features such as ploughing trends have been detected suggests that archaeology would be recorded. Indeed, the lack of anomalies is probably due to the nature of the landscape: such low-lying, waterlogged soils do not tend to attract intensive human activity.

Project Co-ordinators: Dr D Weston
Project Assistants: I Dewar, R Friel, J Leigh, F Robertson and C Stephens

Date of Survey: 26th - 30th November and 3rd - 4th December 2001
Date of Report: 14th December 2001

References:

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

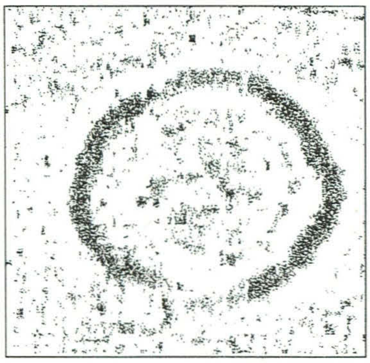
This measures the electrical resistance of the earth, using a system of four electrodes (two current and two potential.) Depending on the arrangement of these electrodes an exact measurement of a specific volume of earth may be acquired. This resistance value may then be used to calculate the earth resistivity.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

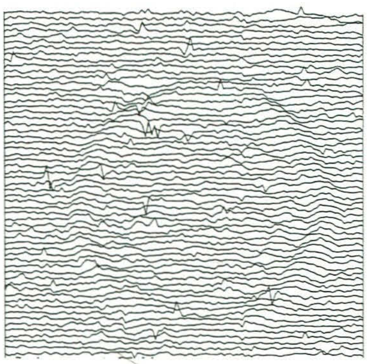
Variations in the magnetic susceptibility of subsoils and topsoils occur naturally, but greater enhanced susceptibility can also be a product of increased human/anthropogenic activity. This phenomenon of susceptibility enhancement can therefore be used to provide information about the "level of archaeological 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

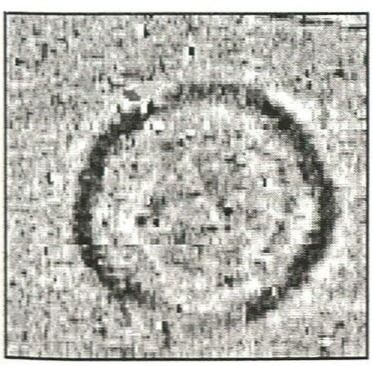
The following is a description of the display options used. Unless specifically mentioned in the text, it may be assumed that no filtering or smoothing has been used to enhance the data. For any particular report a limited number of display modes may be used.



(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

Locational Information

Summary Information

Archive Section

GSB PROSPECTION	PROJECT: 2001/115 WHISBY QUARRY	TITLE: Location Diagram	Based on a plan provided by the client

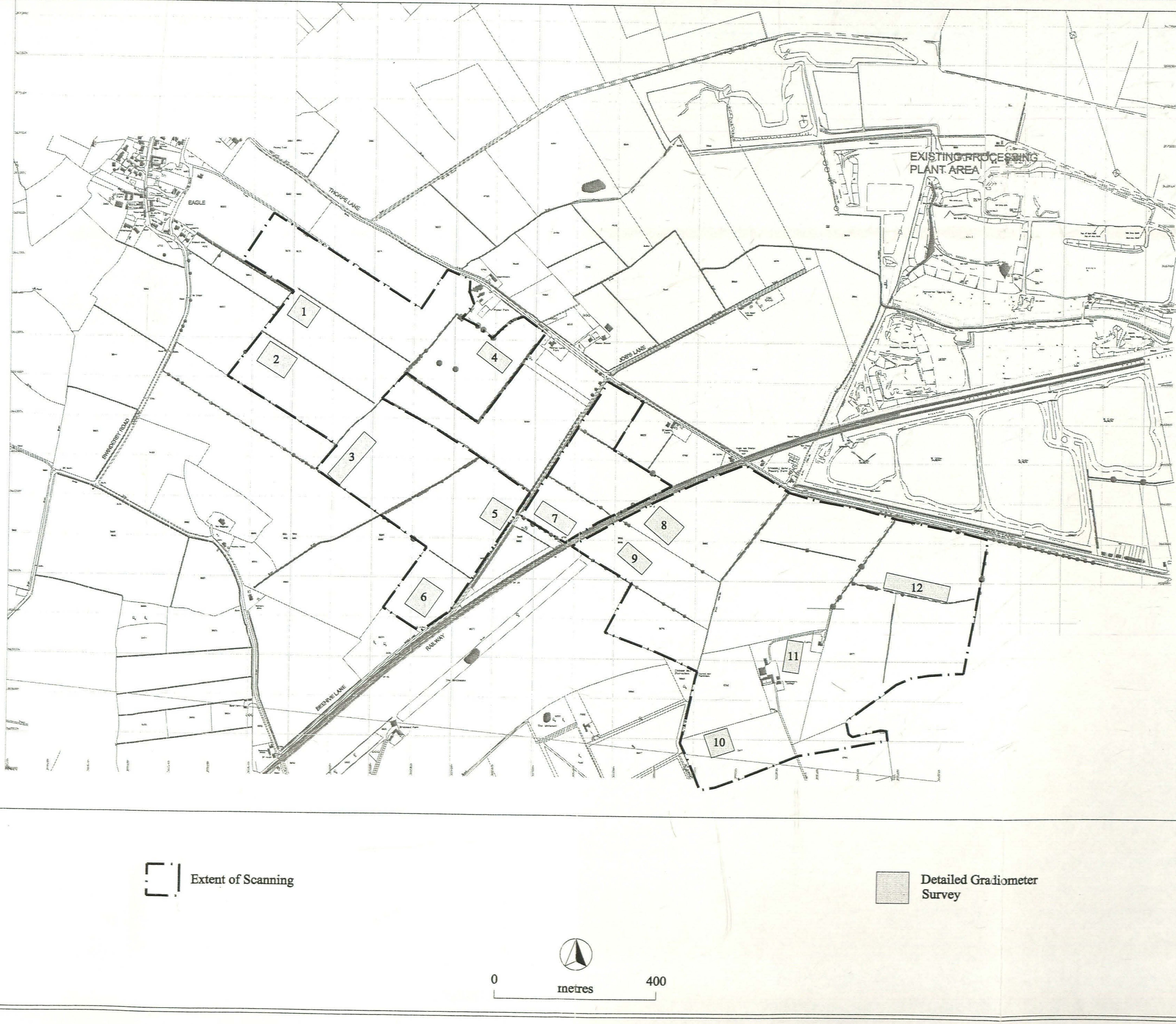


Figure 1

GSB PROSPECTION	PROJECT: 2001/115 WHISBY QUARRY	TITLE: Summary Greyscales - Areas 1 to 4	Based on a plan provided by the client

Figure 2

GSB PROSPECTION	PROJECT: 2001/115 WHISBY QUARRY	TITLE: Summary Interpretation - Areas 1 to 4	Based on a plan provided by the client

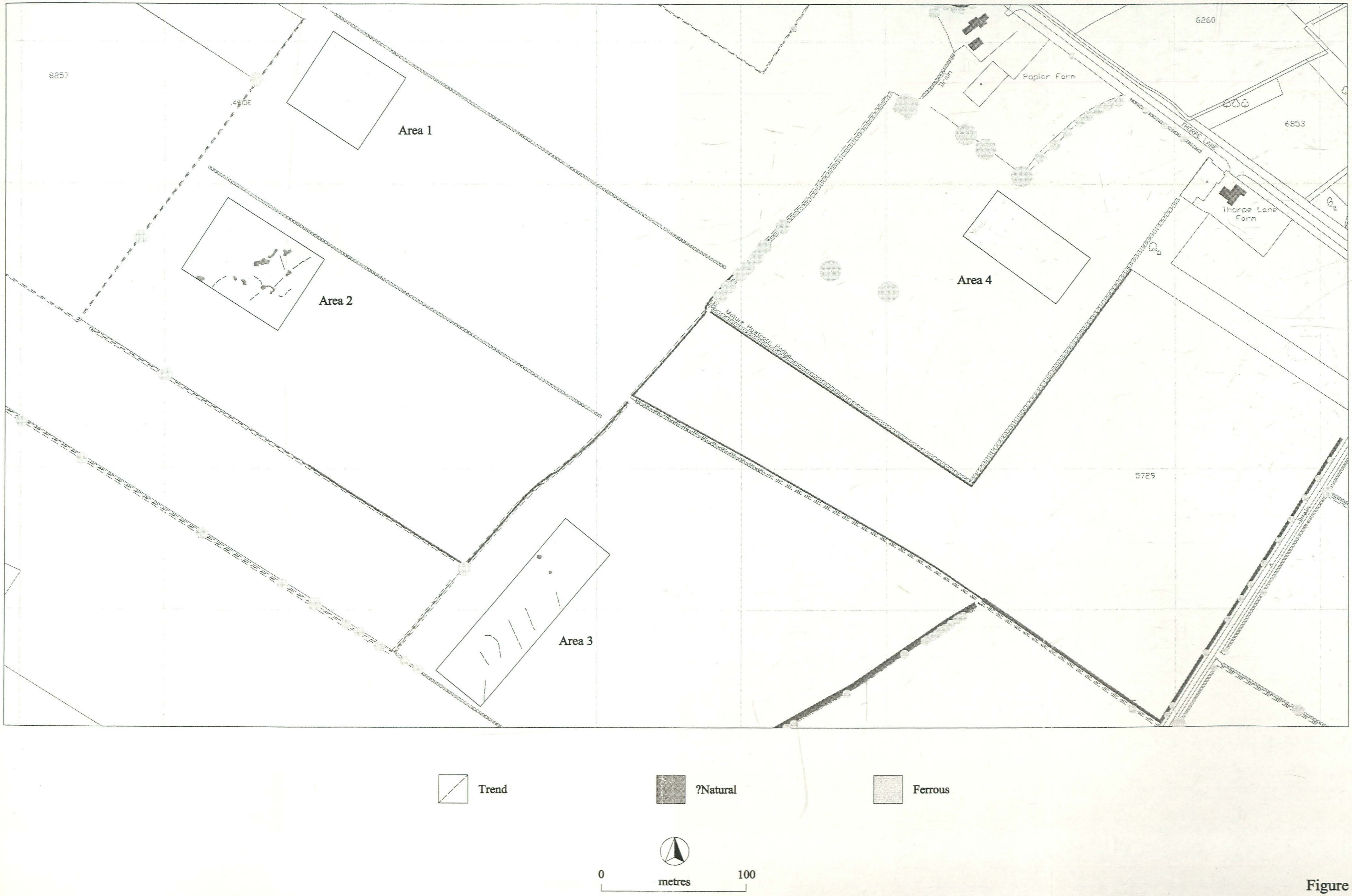


Figure 3

GSB PROSPECTION	PROJECT: 2001/115 WHISBY QUARRY	TITLE: Summary Greyscales - Areas 5 to 9	Based on a plan provided by the client

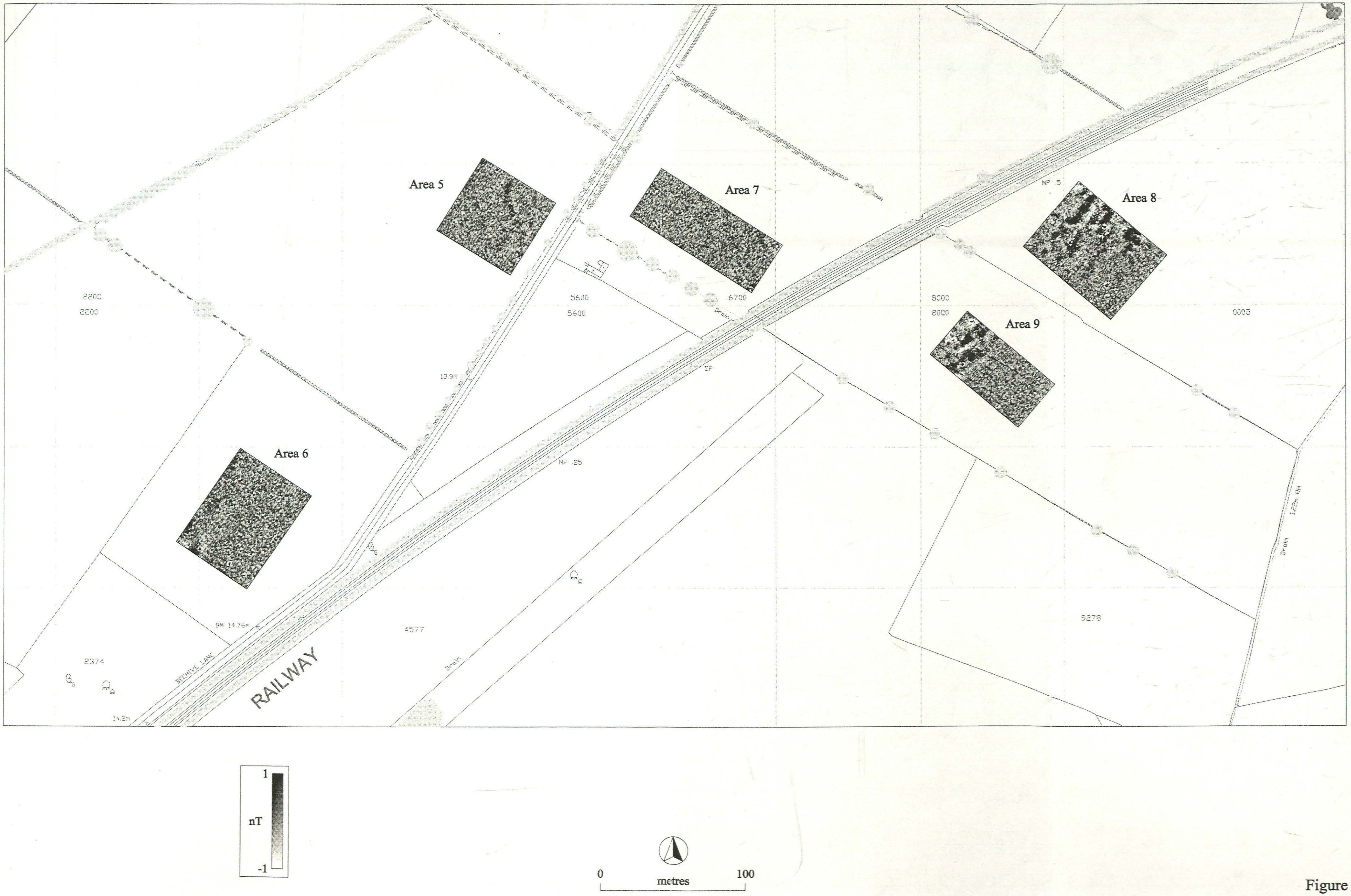
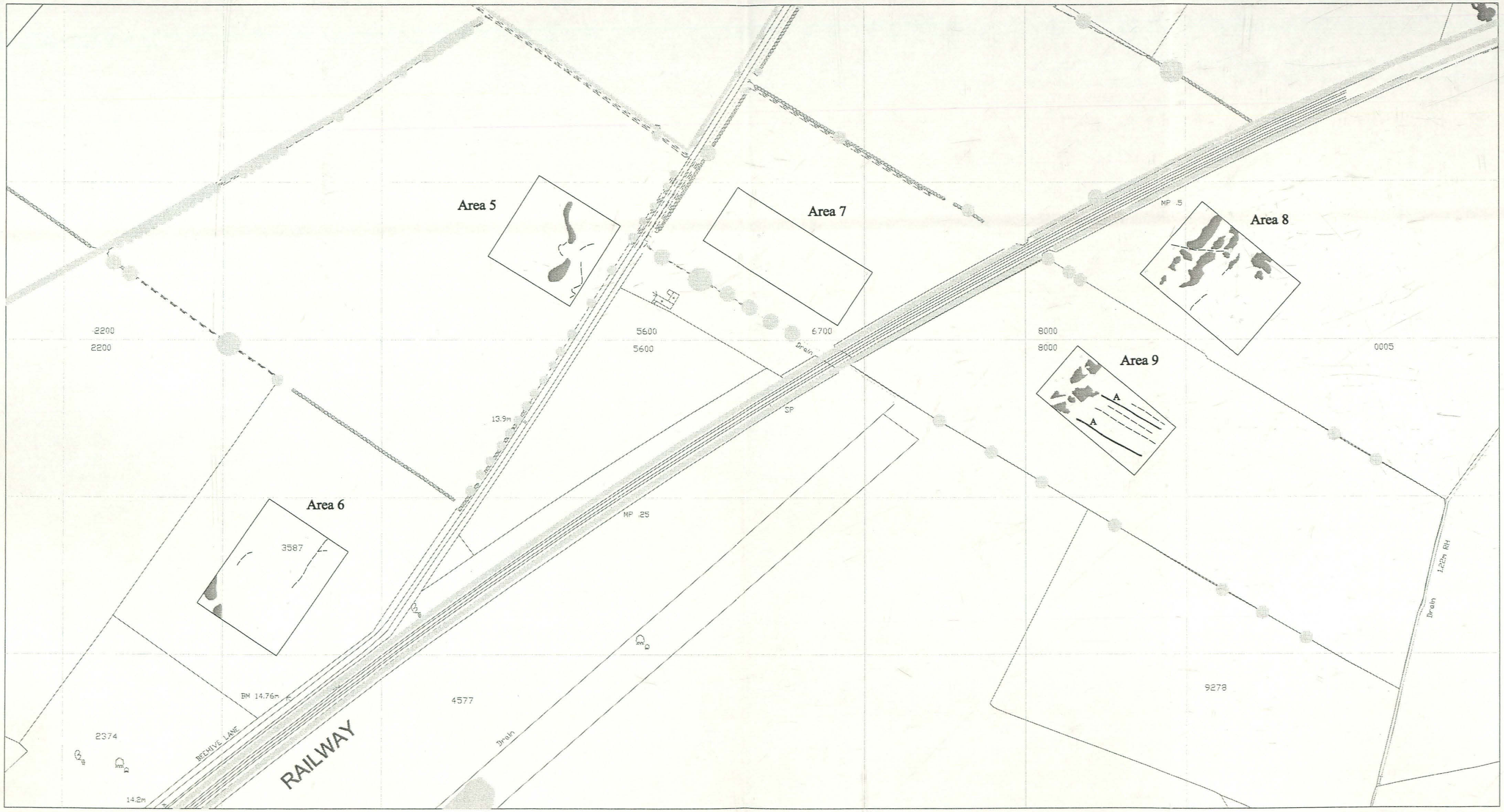


Figure 4

GSB PROSPECTION	PROJECT: 2001/115 WHISBY QUARRY	TITLE: Summary Interpretation - Areas 5 to 9	Based on a plan provided by the client



?Archaeology

Trend

?Natural

Ferrous

0 metres 100

Figure 5

GSB PROSPECTION	PROJECT: 2001/115 WHISBY QUARRY	TITLE: Summary Interpretation - Areas 10 to 12	Based on a plan provided by the client

Figure 6

TITLE: Summary Greyscales/Interpretation - Areas 10 to 12

Based on a plan provided by the client

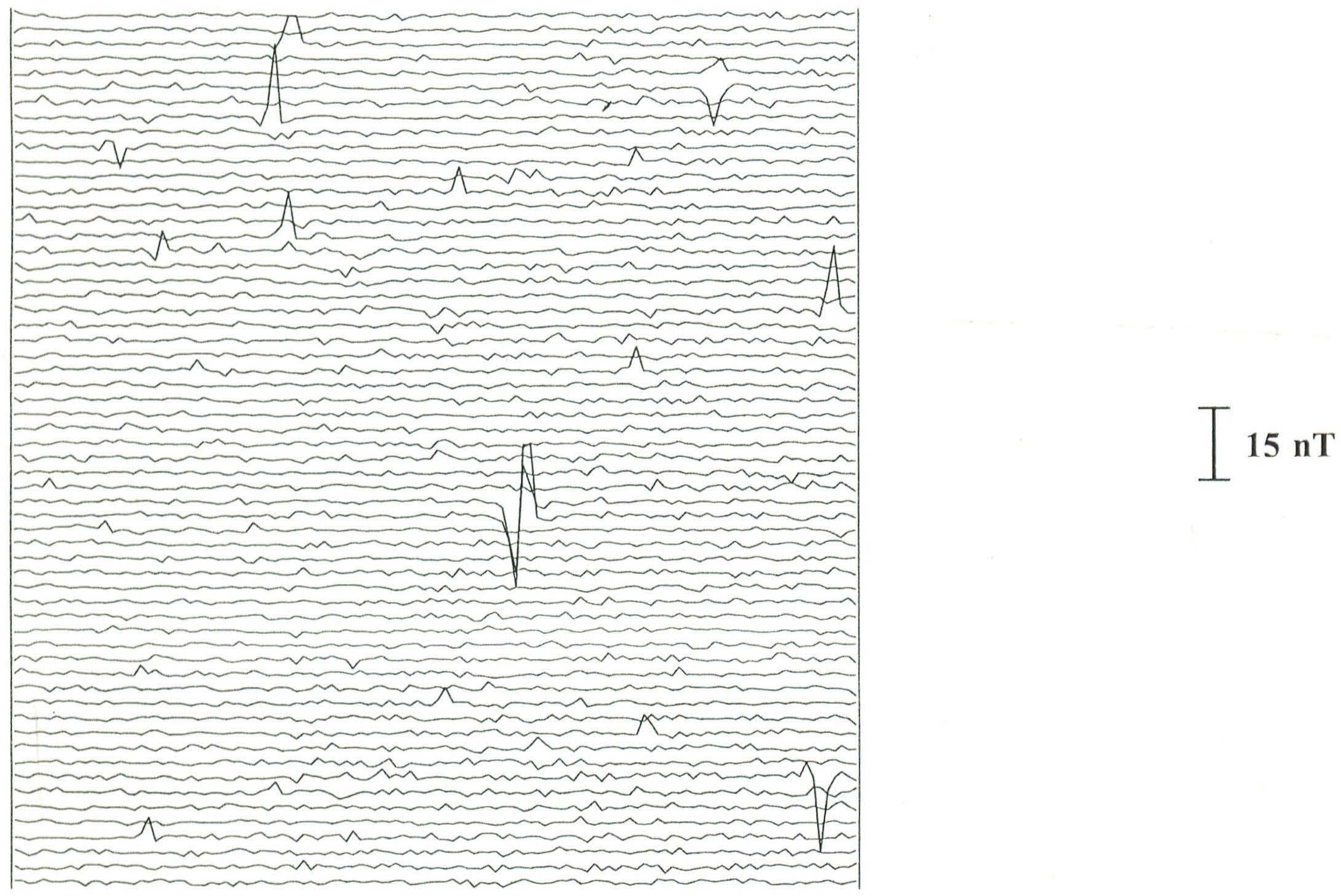
?Natural

Ferrous

tres 100

Figure 7

WHISBY QUARRY
Area 1



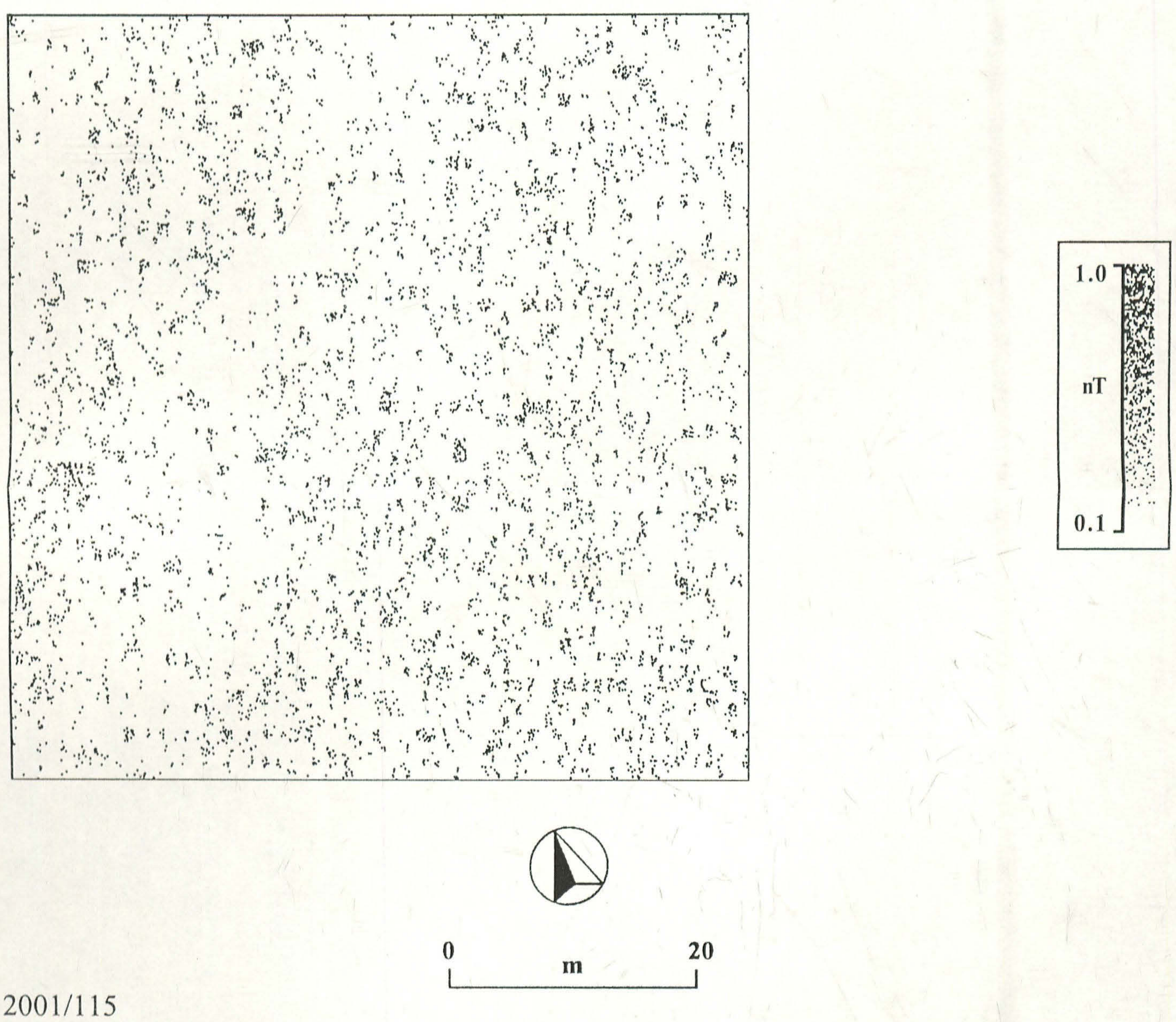
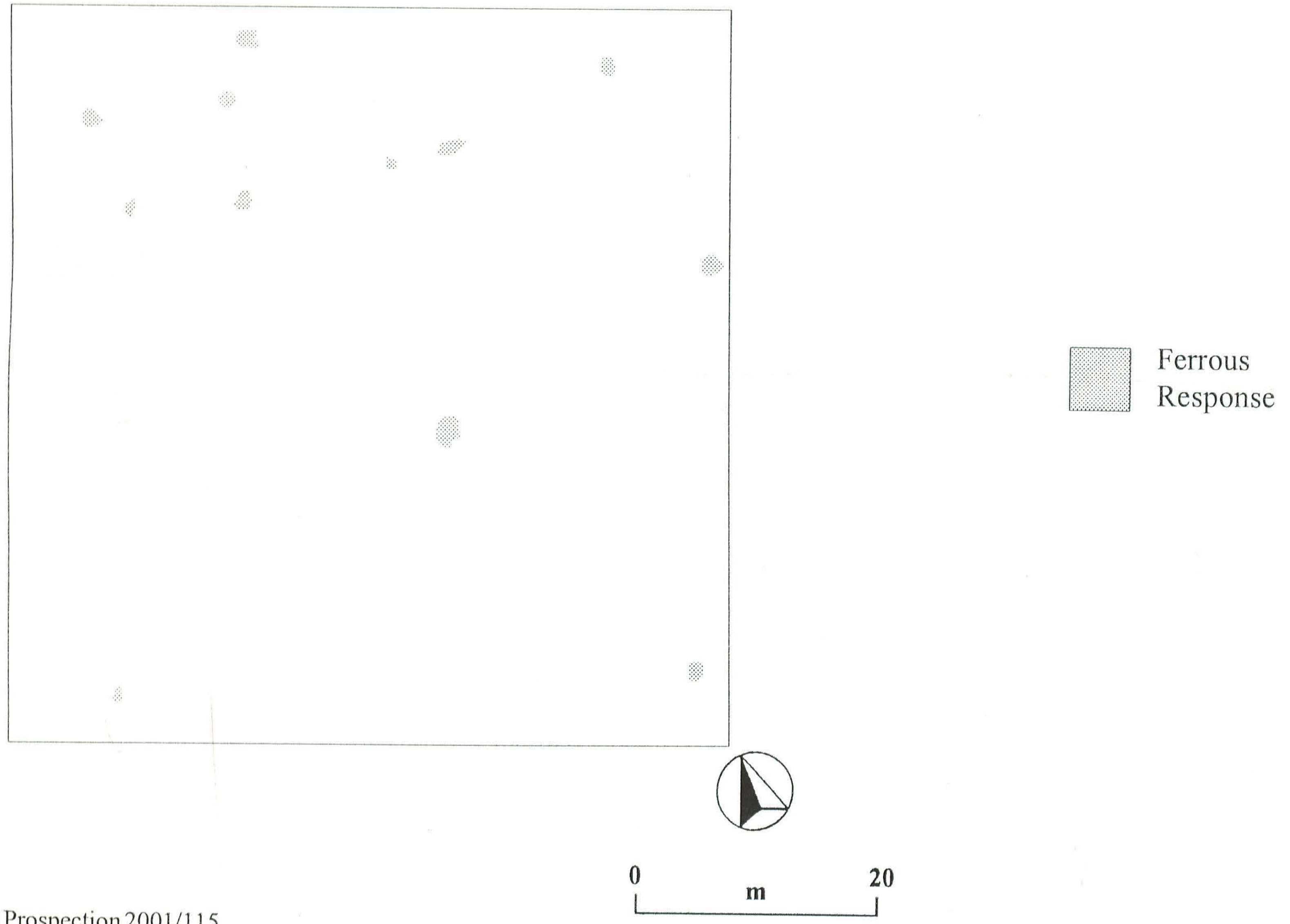


Figure A1

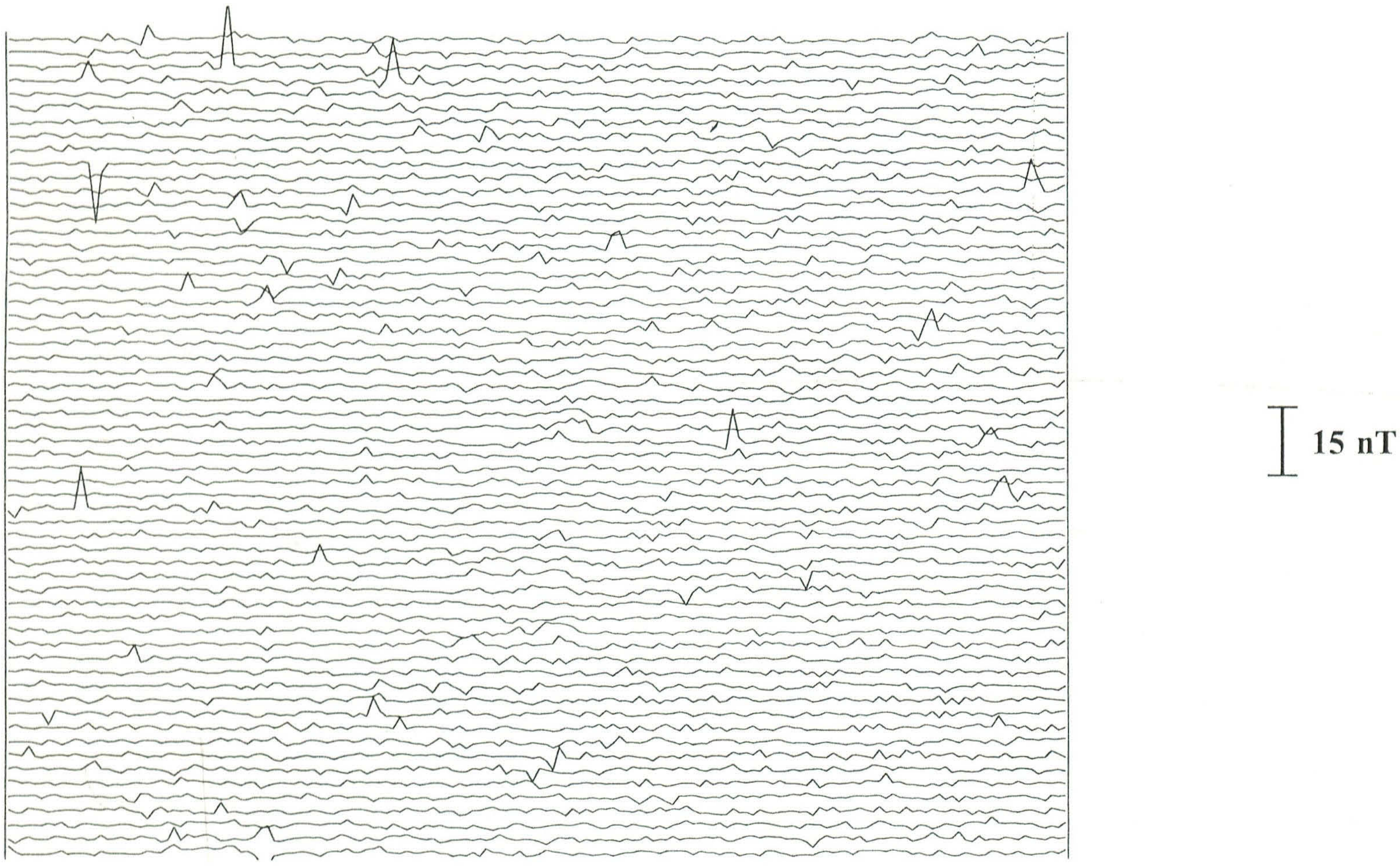
WHISBY QUARRY
Area 1

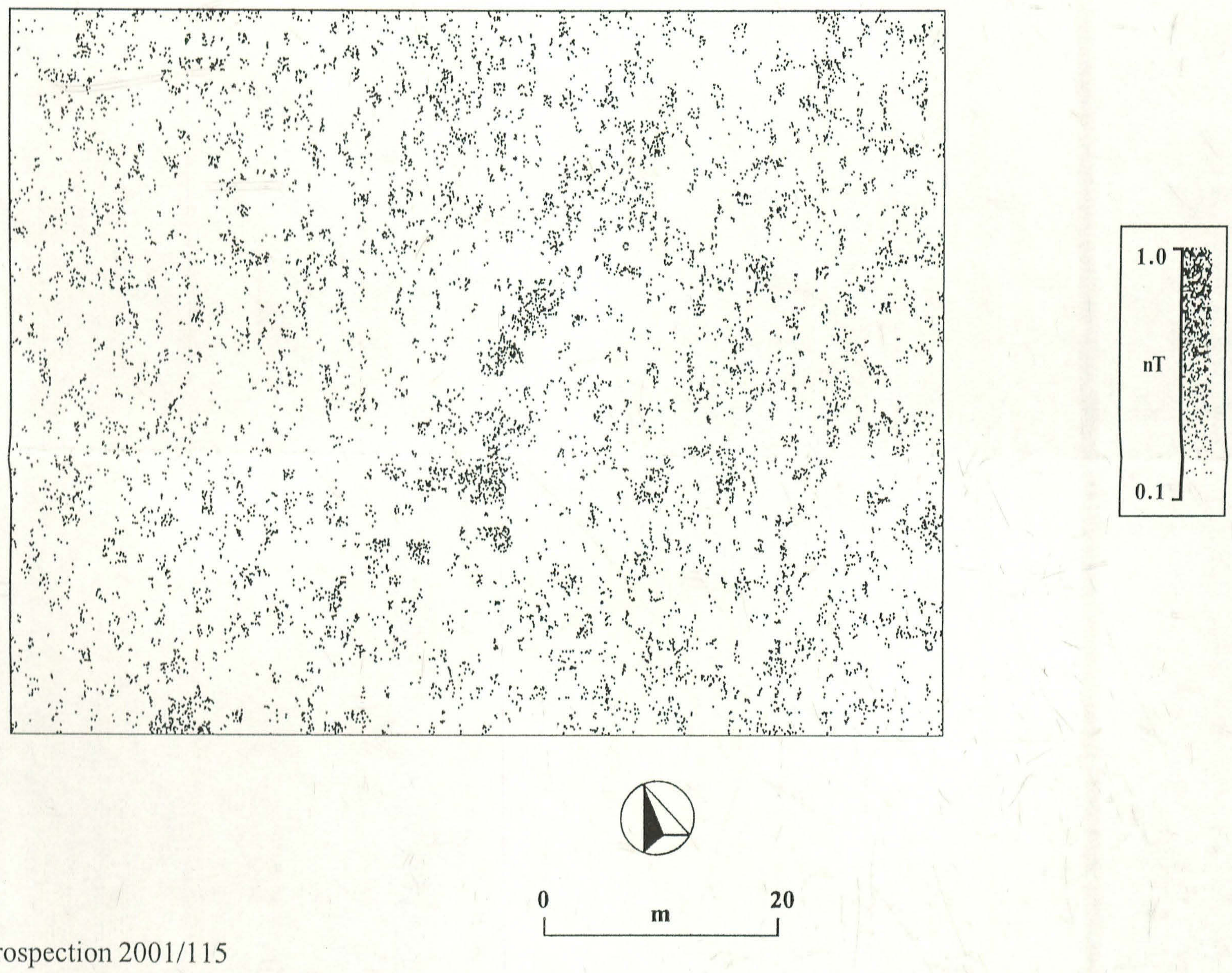


GSB Prospection 2001/115

Figure A2

WHISBY QUARRY
Area 2





GSB Prospection 2001/115

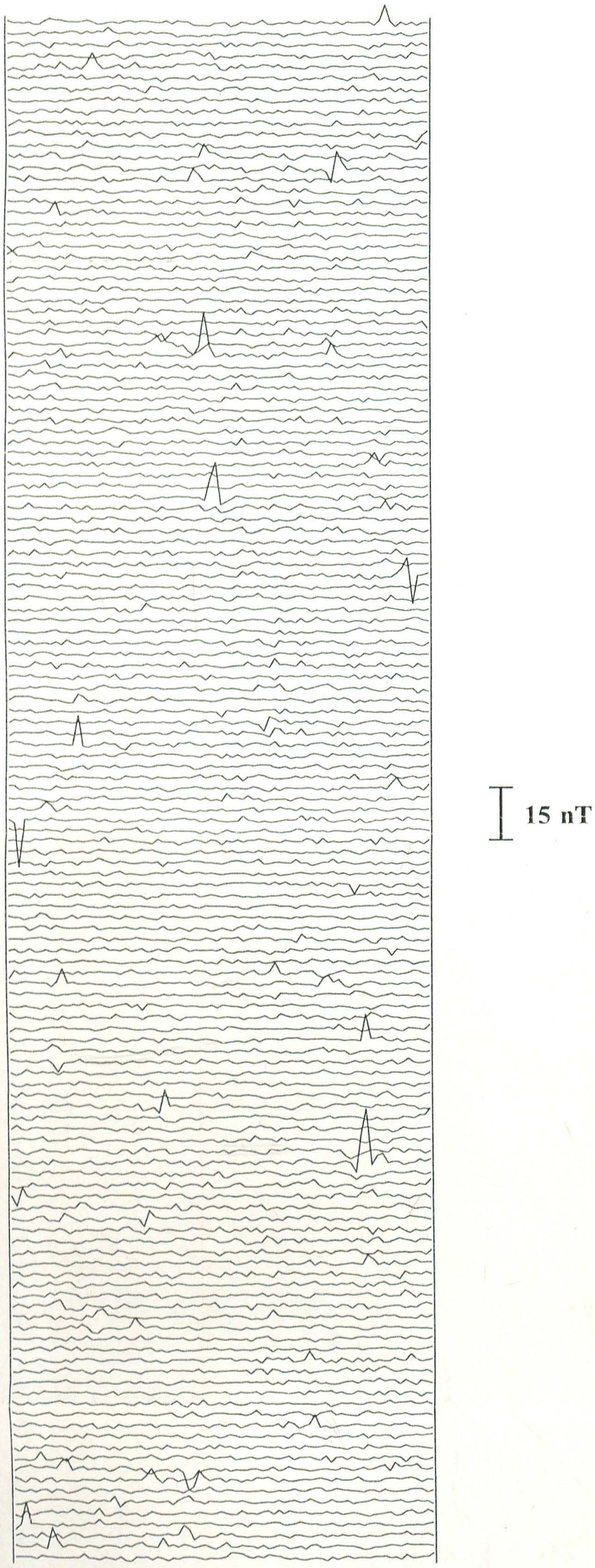
Figure A3

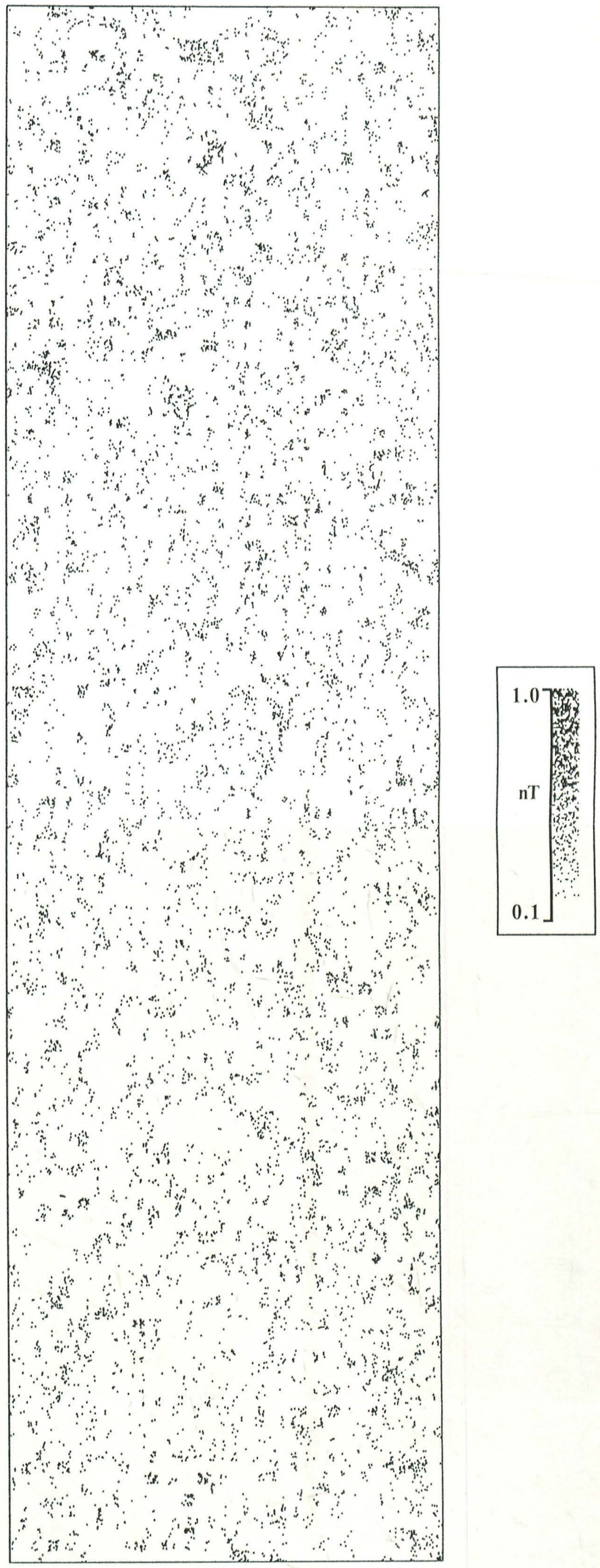
WHISBY QUARRY
Area 2

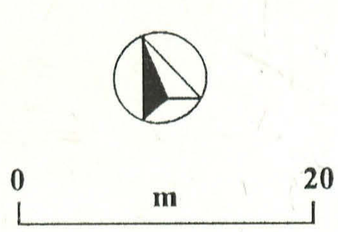
GSB Prospection 2001/115

Figure A4

WHISBY QUARRY
Area 3



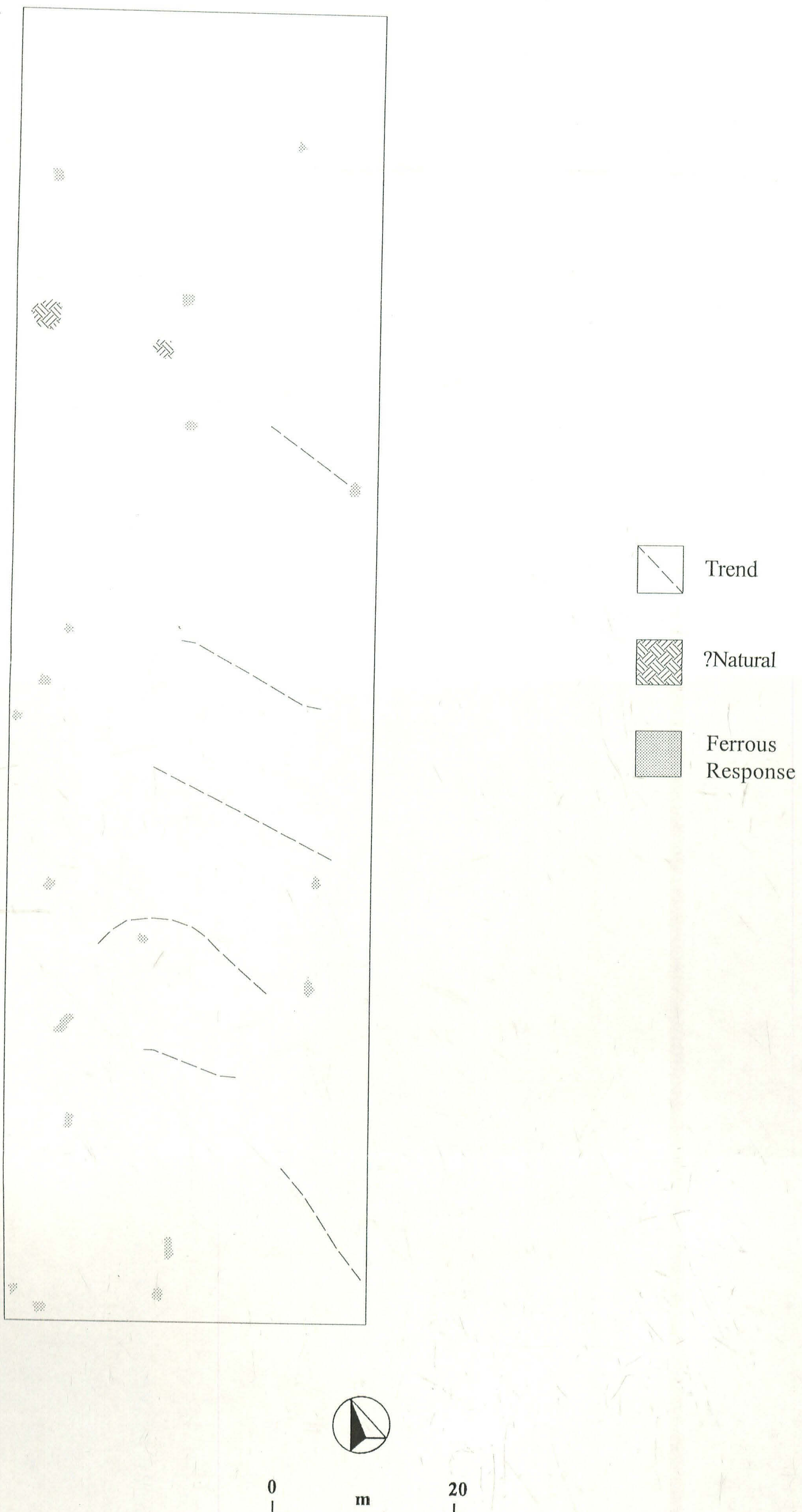




GSB Prospection 2001/115

Figure A5

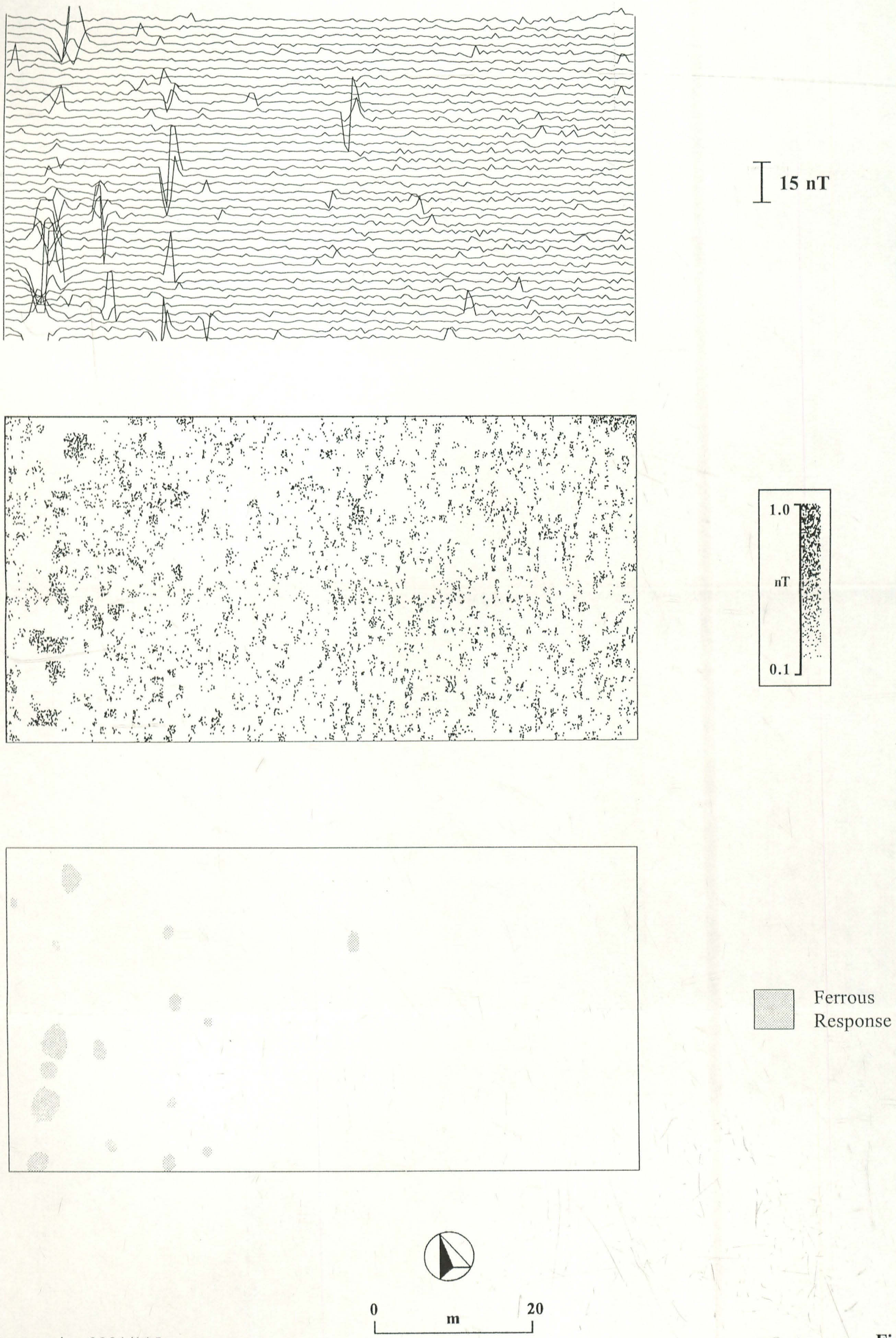
WHISBY QUARRY
Area 3



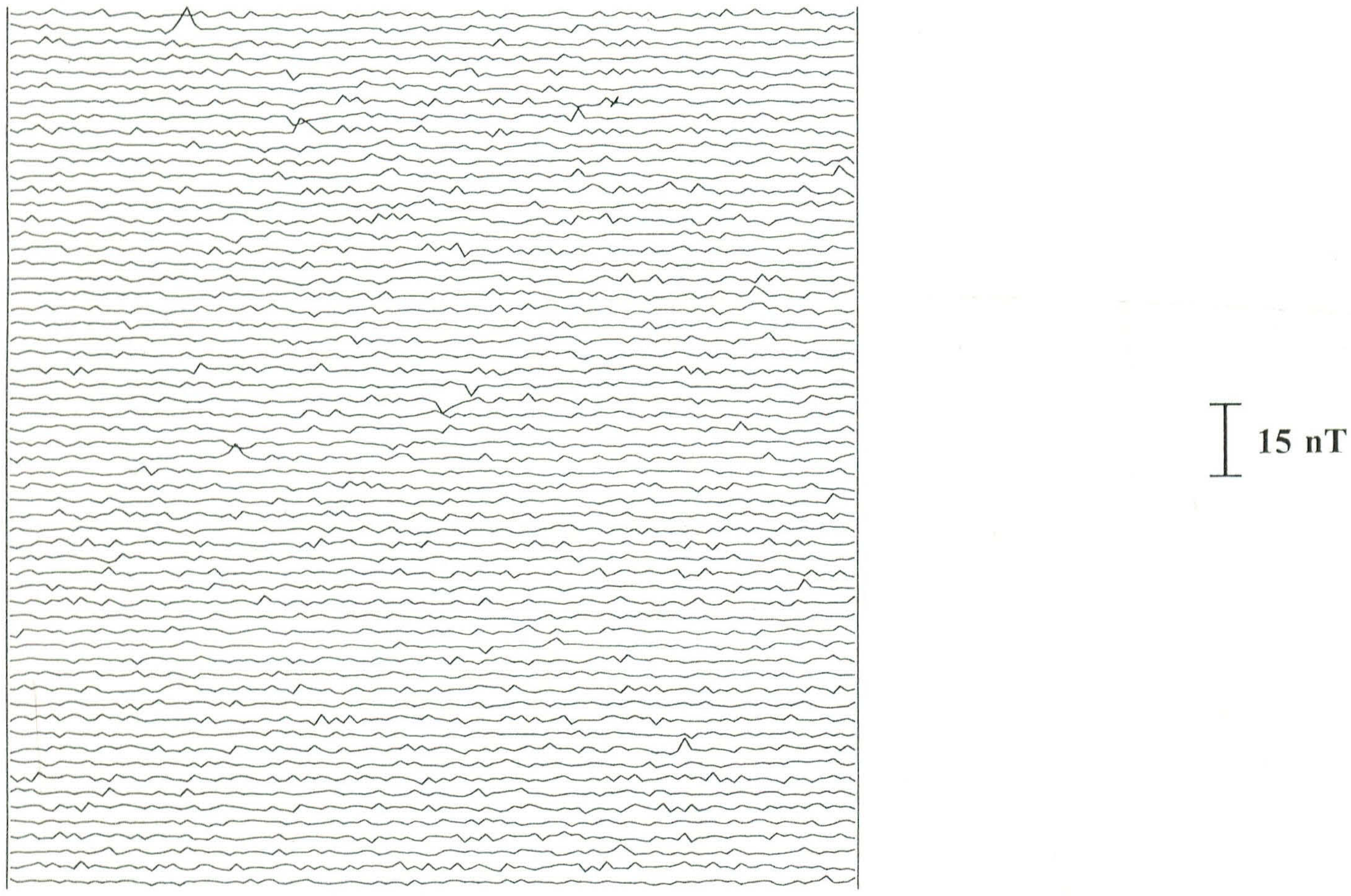
GSB Prospection 2001/115

Figure A6

WHISBY QUARRY
Area 4



WHISBY QUARRY
Area 5



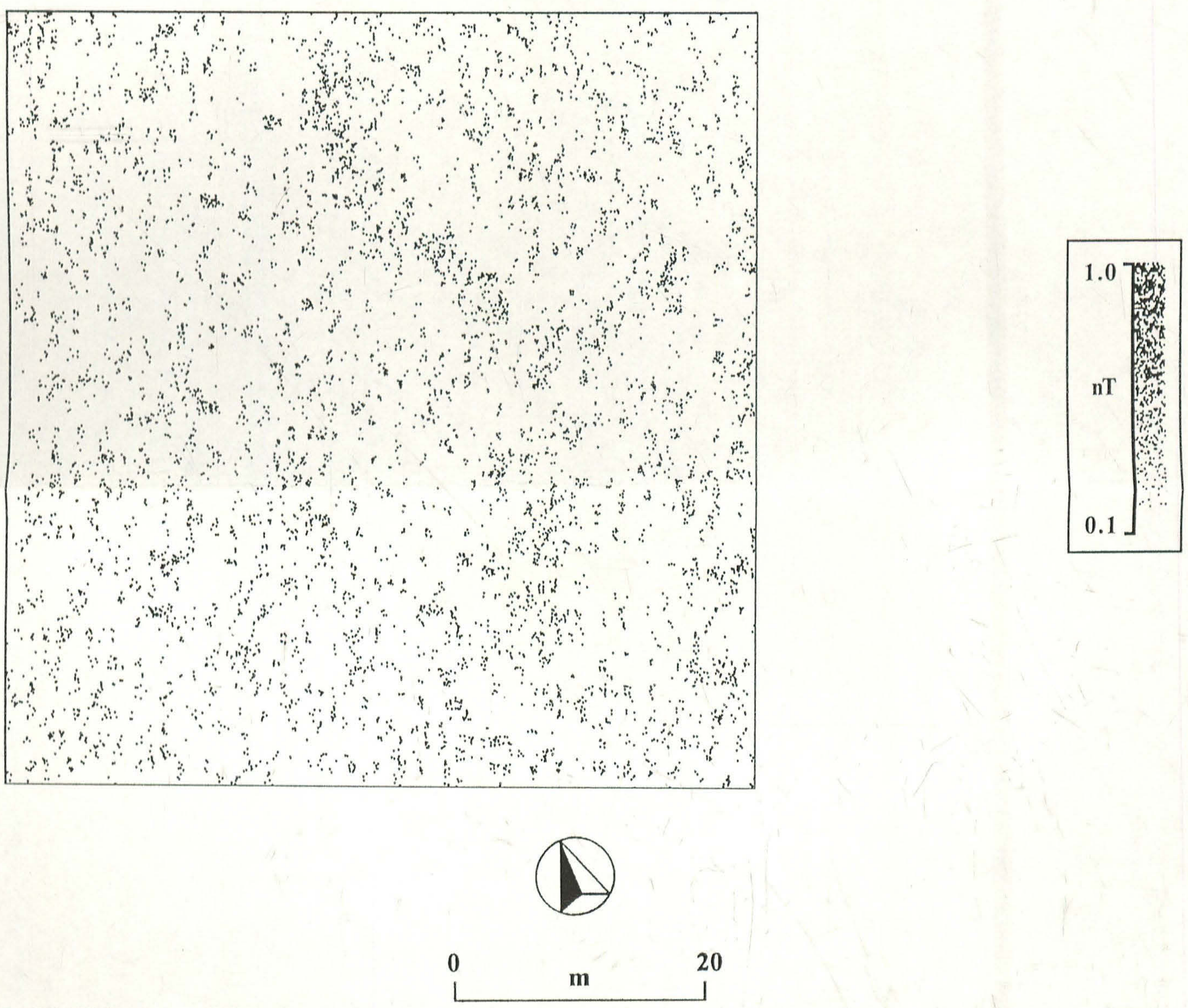
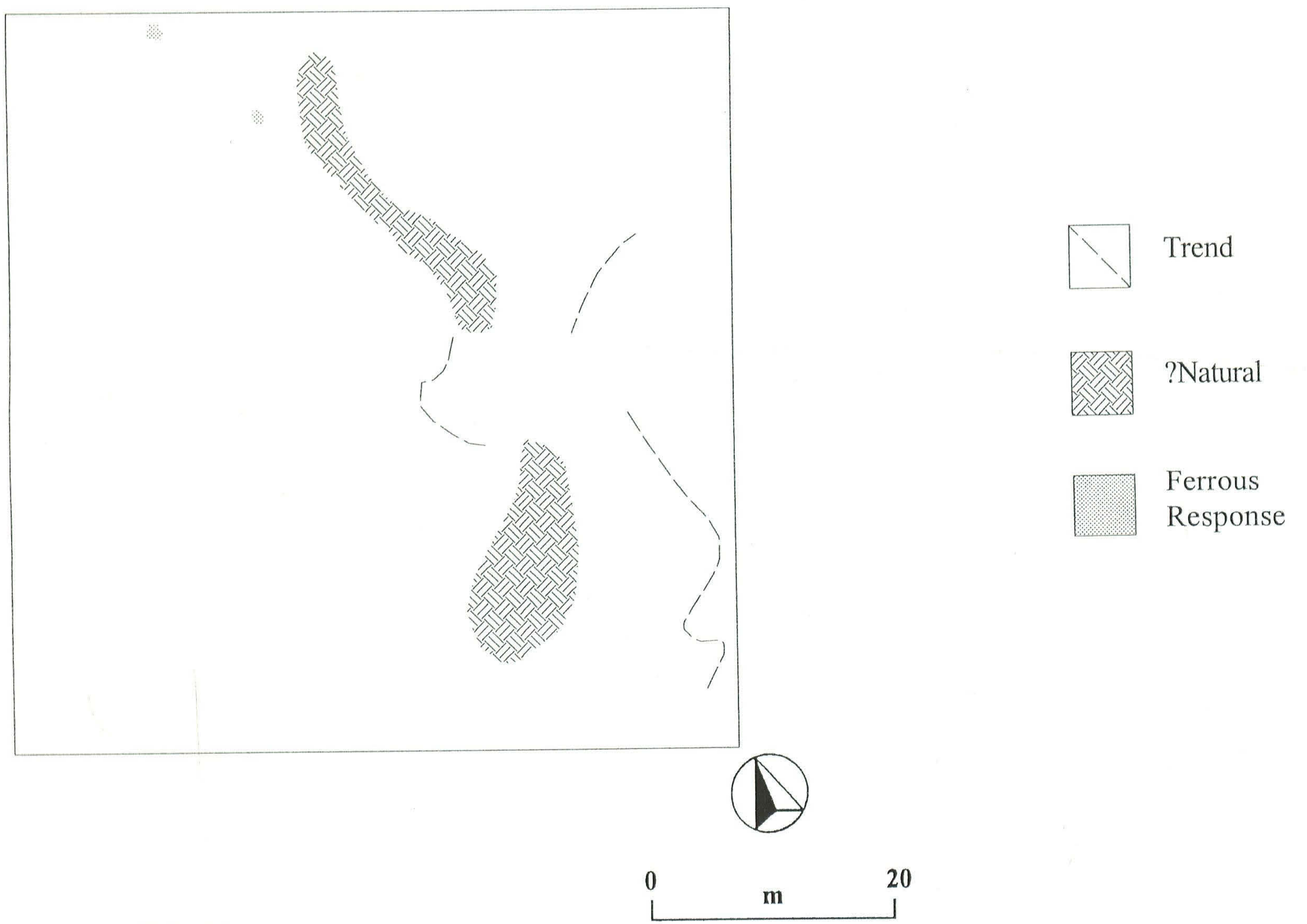


Figure A8

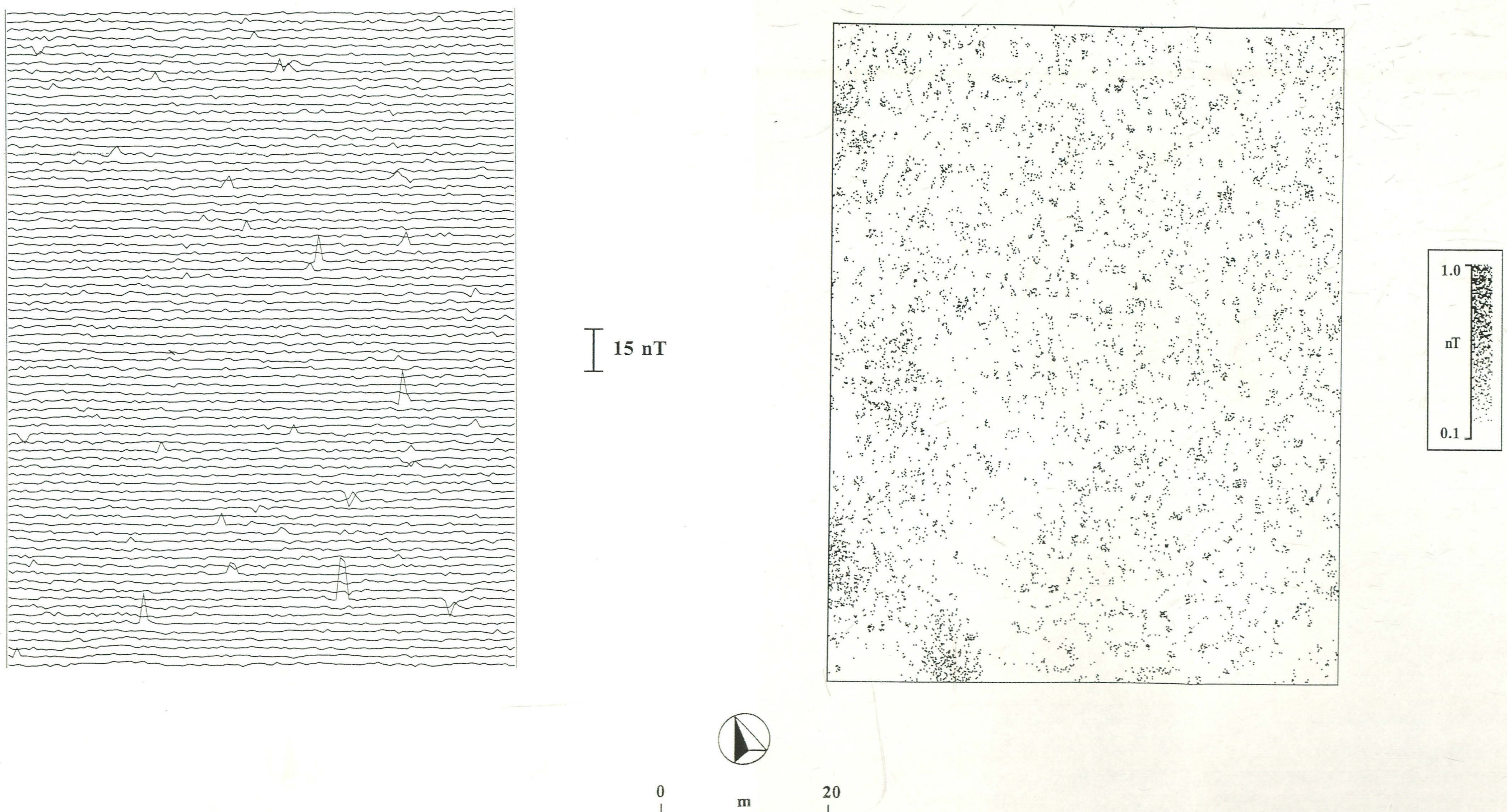
WHISBY QUARRY
Area 5



GSB Prospection 2001/115

Figure A9

WHISBY QUARRY
Area 6



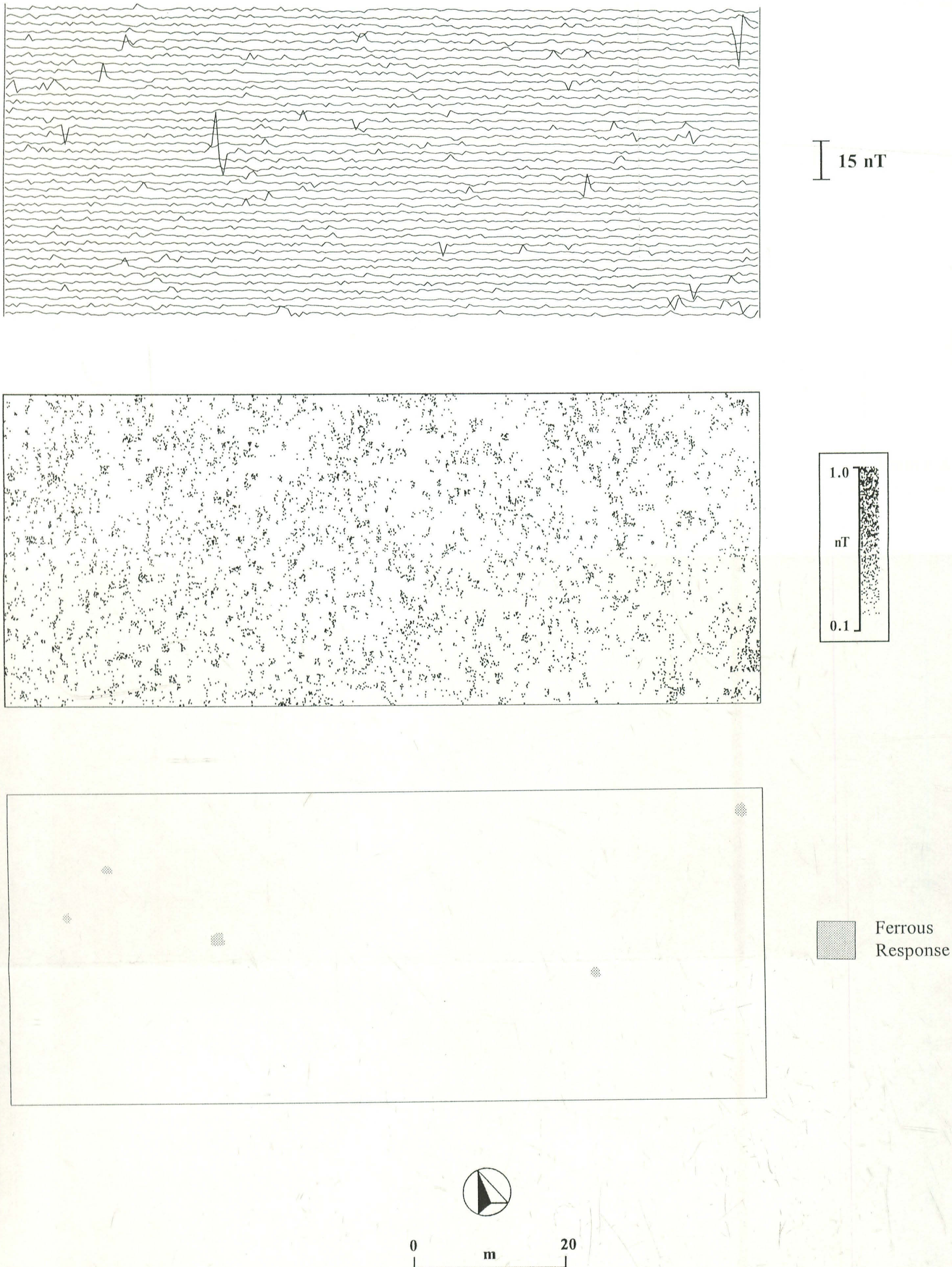
GSB Prospection 2001/115

Figure A10

WHISBY QUARRY
Area 6

Figure A11

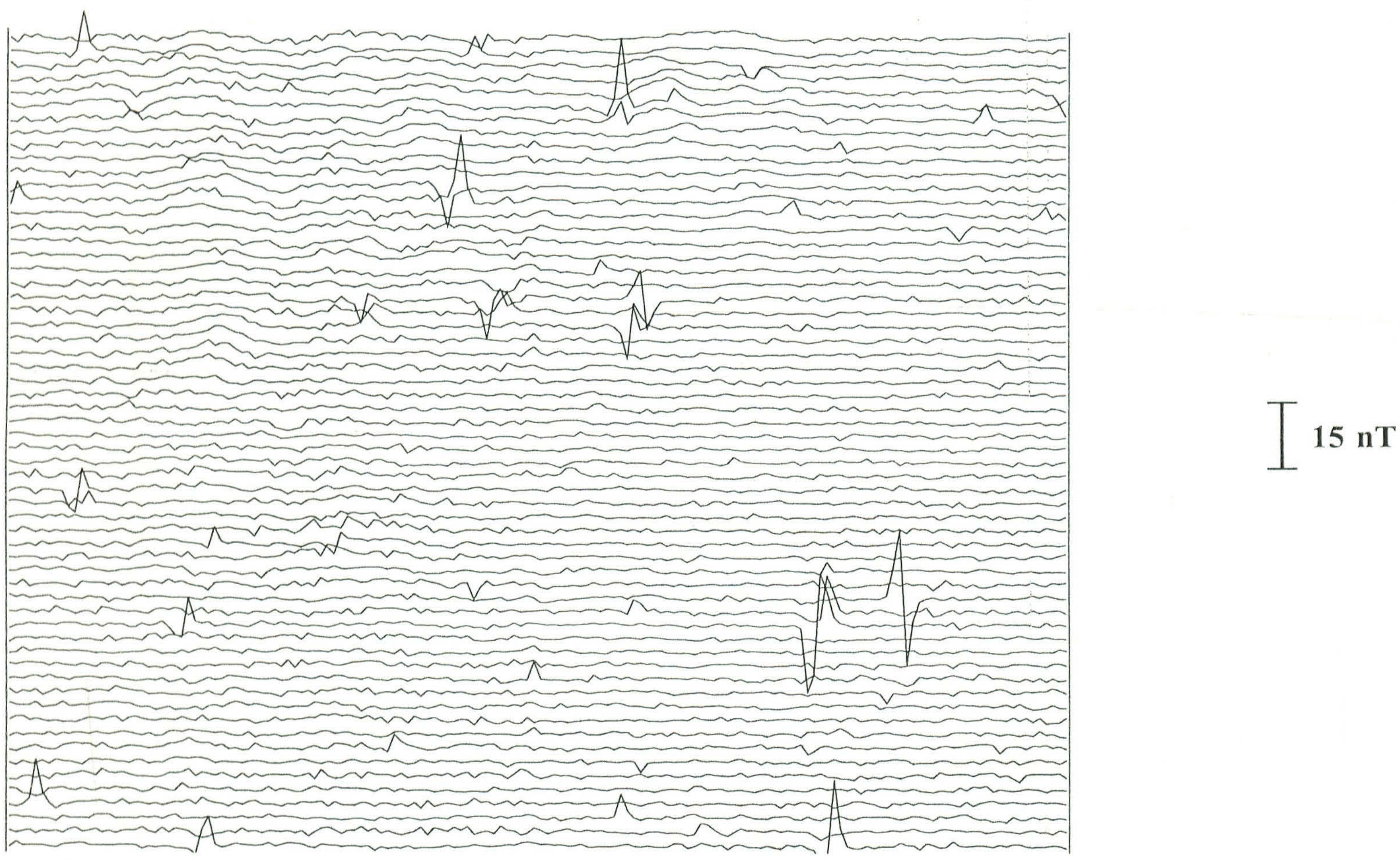
WHISBY QUARRY
Area 7

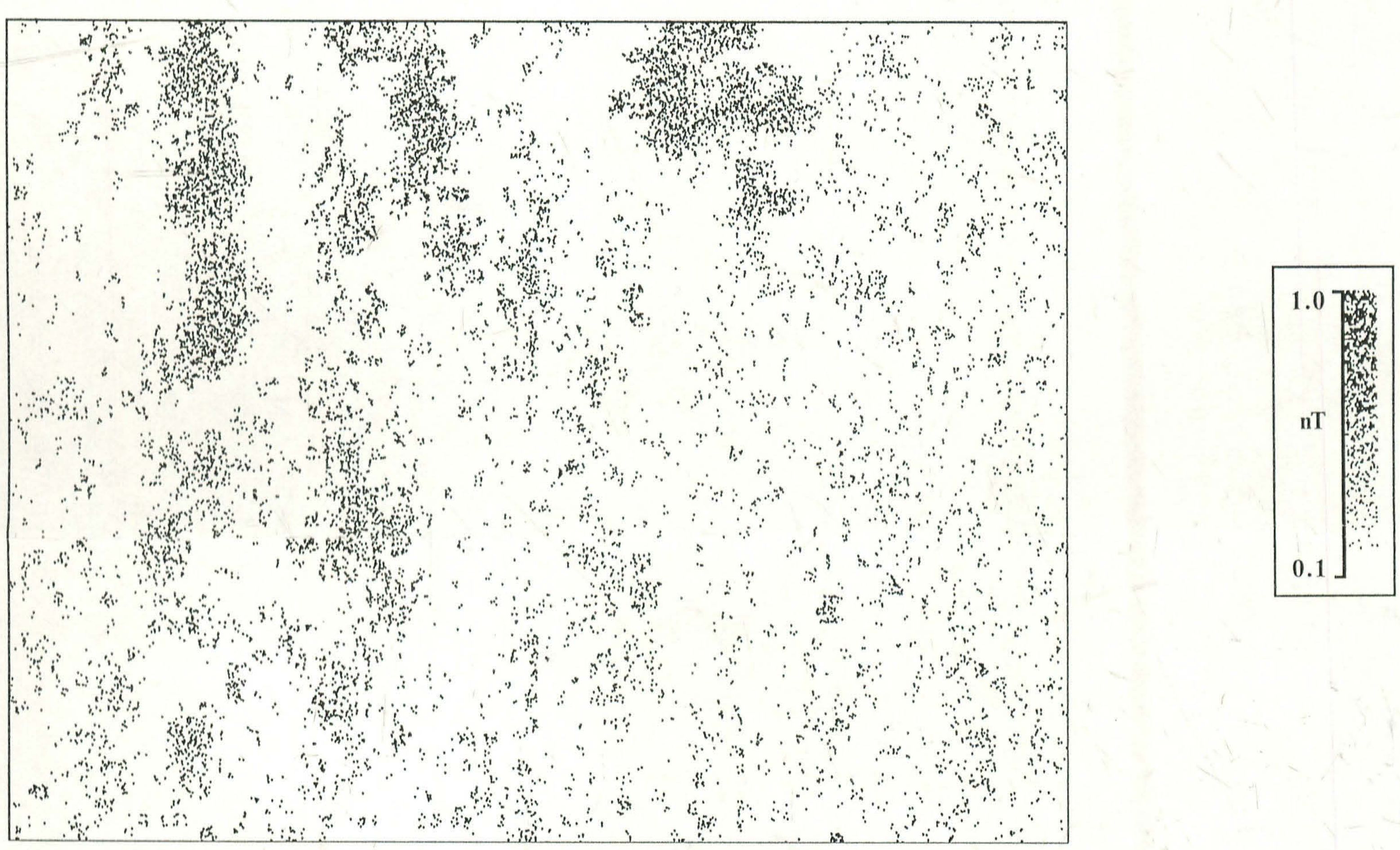


GSB Prospection 2001/115

Figure A12

WHISBY QUARRY
Area 8





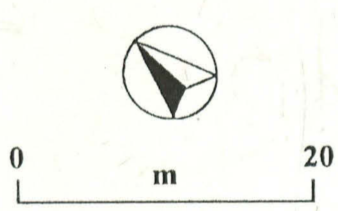


Figure A13

WHISBY QUARRY
Area 8

GSB Prospection 2001/115

Figure A14

WHISBY QUARRY
Area 9

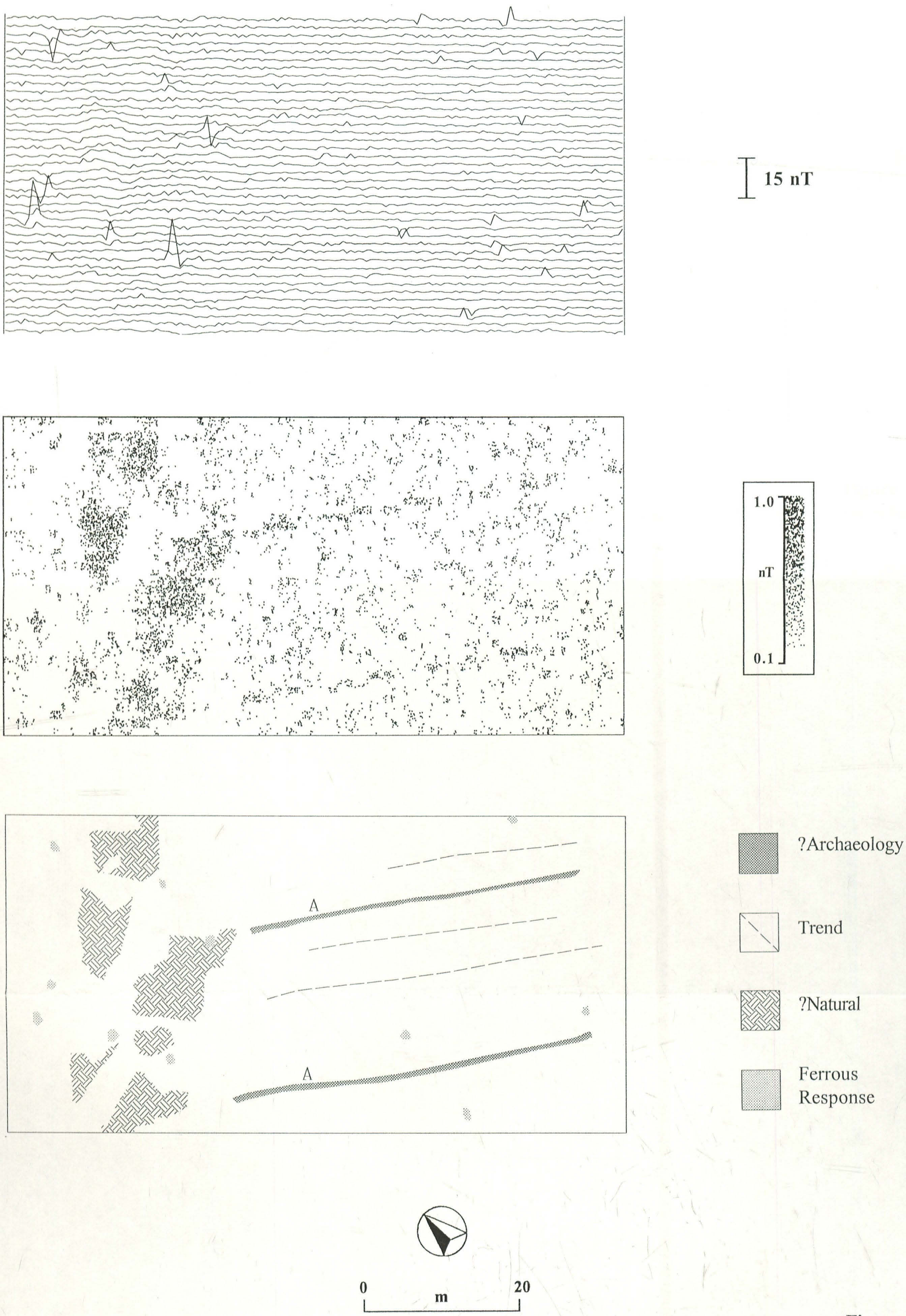
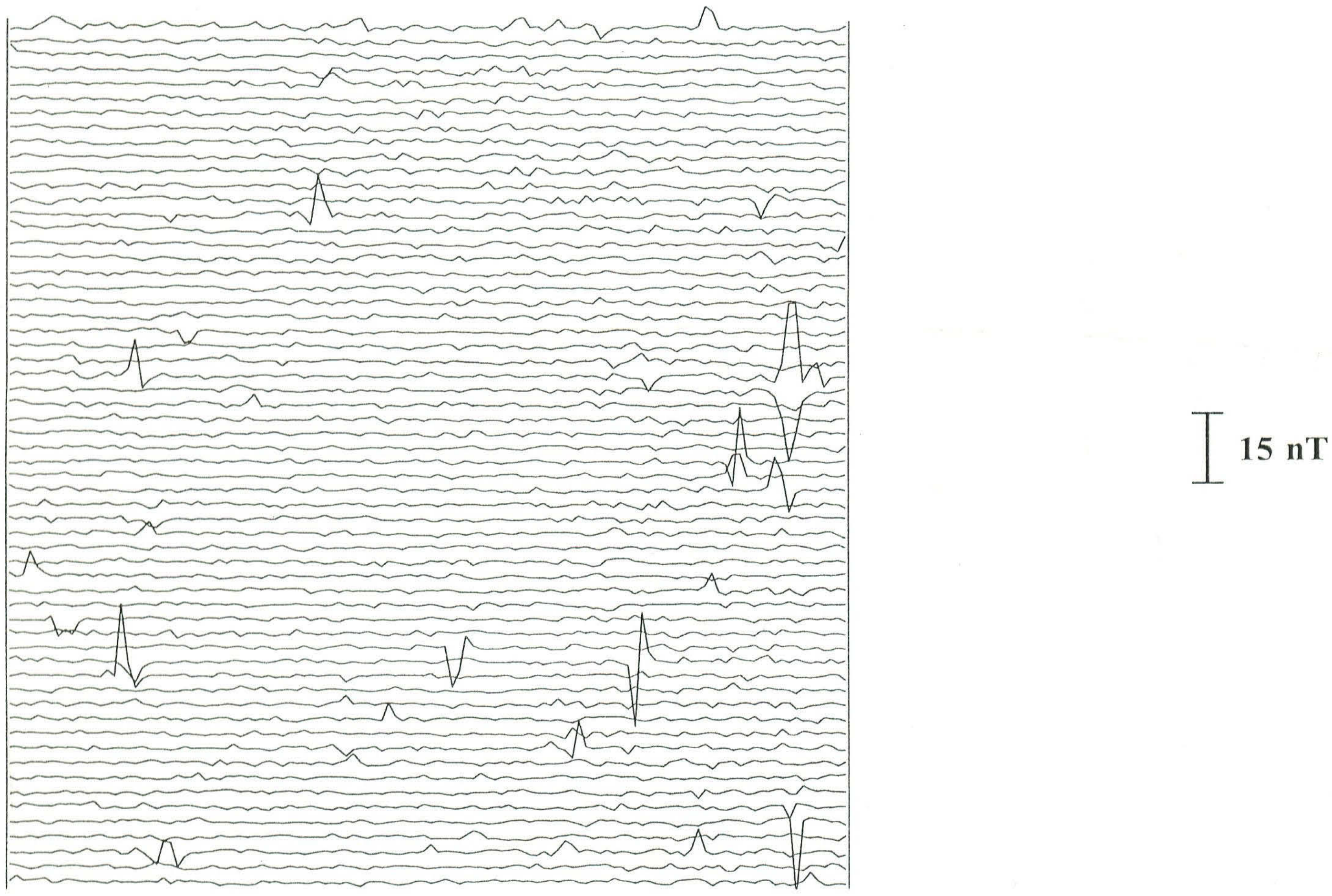
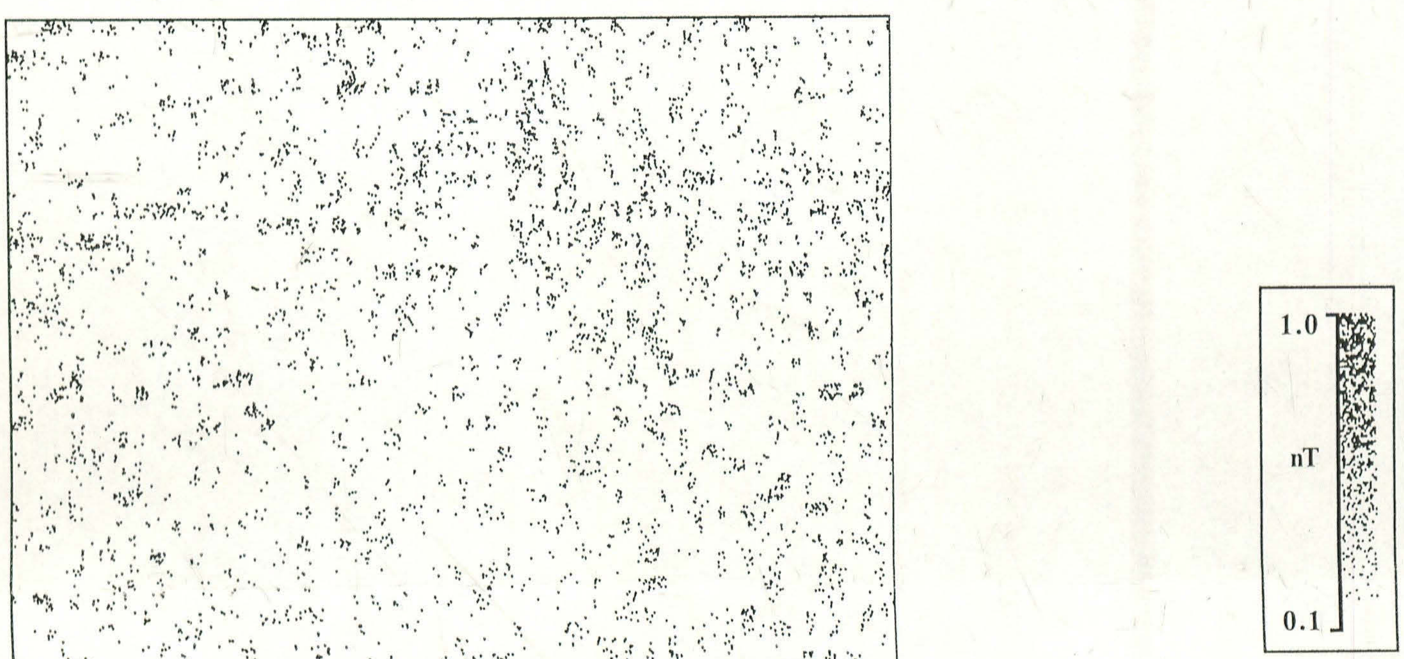
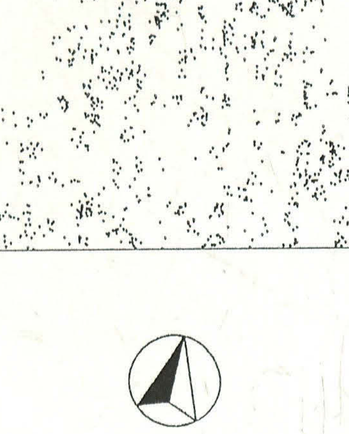


Figure A15

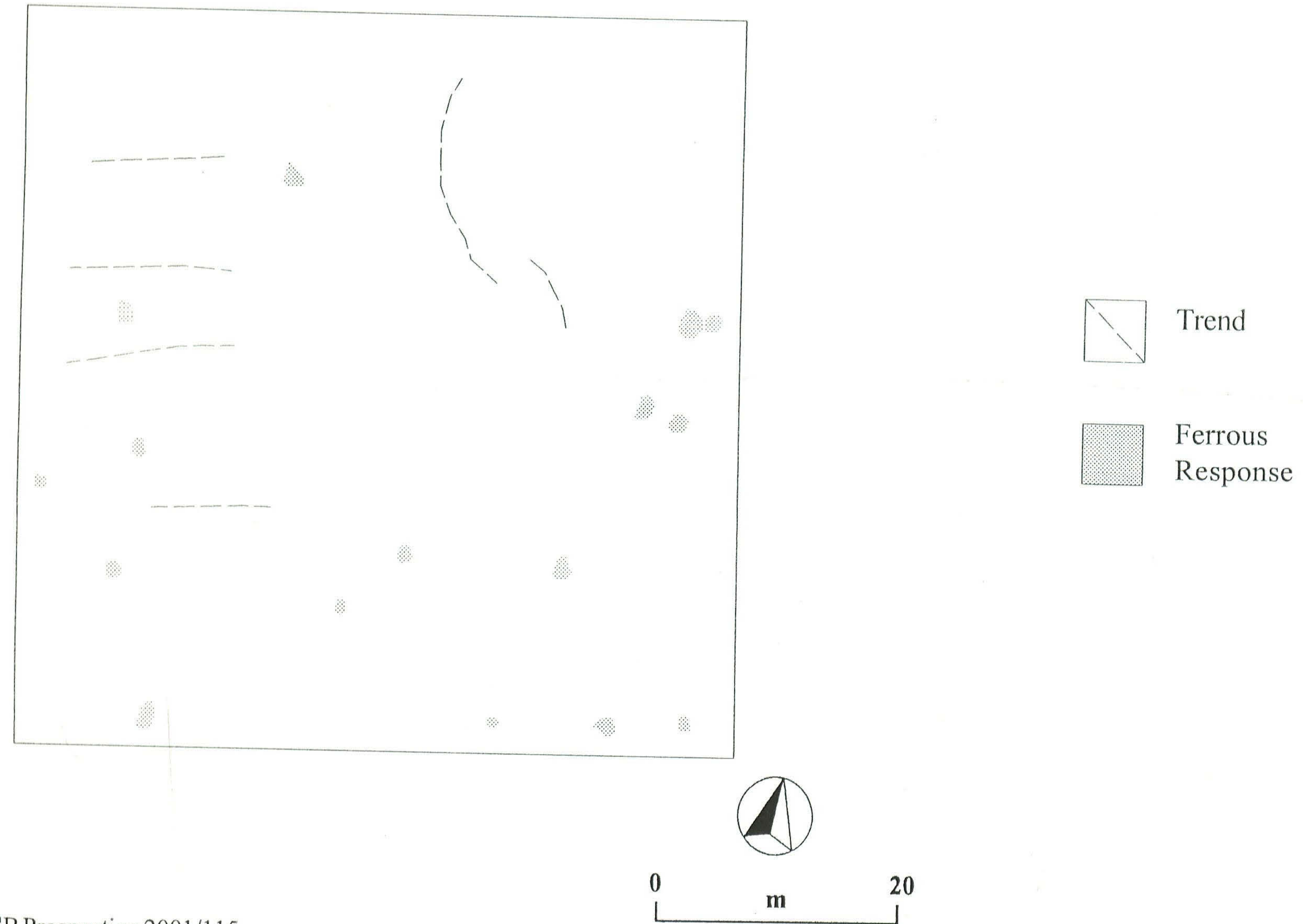
WHISBY QUARRY
Area 10







WHISBY QUARRY
Area 10



GSB Prospection 2001/115

Figure A17

WHISBY QUARRY
Area 11

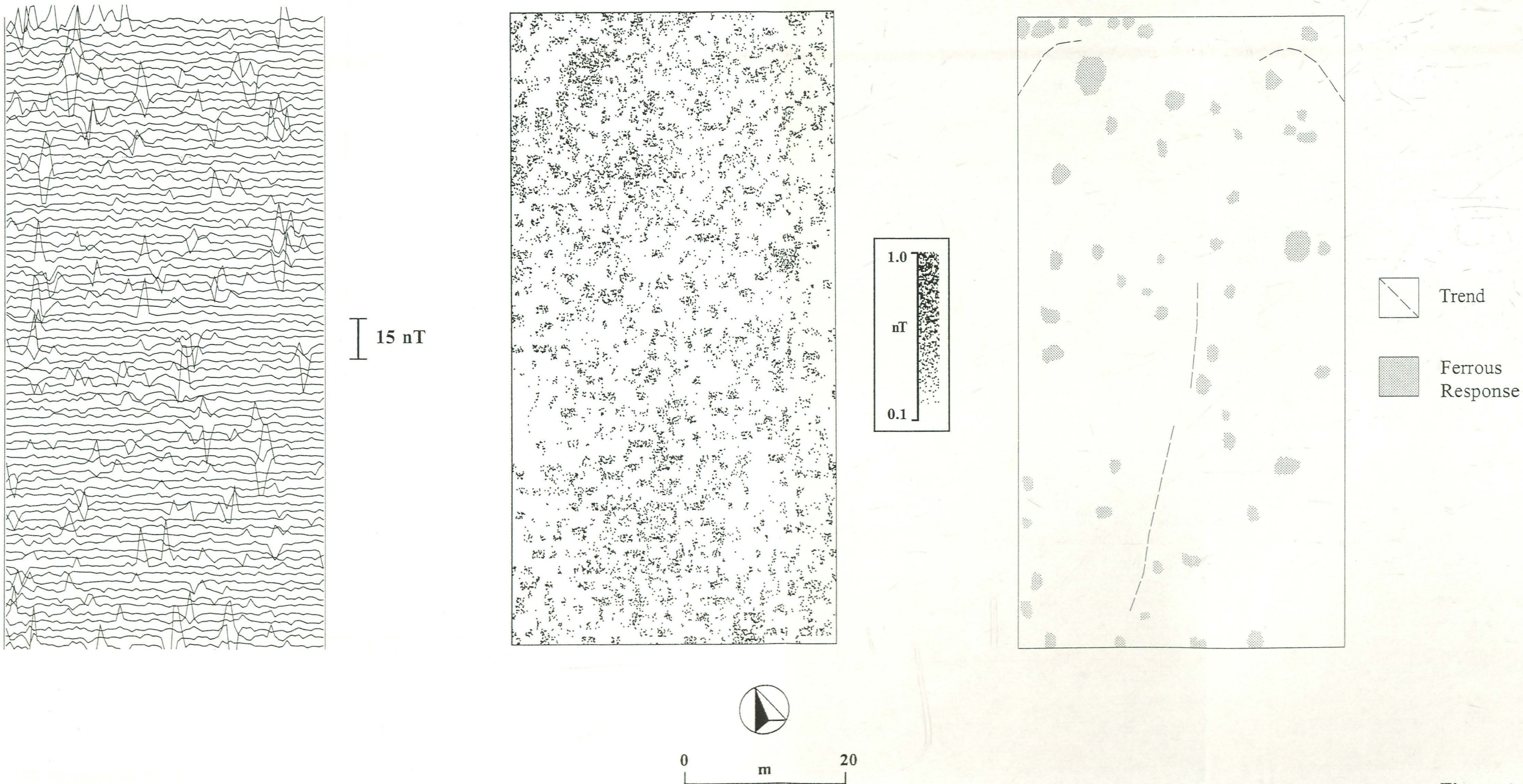


Figure A18

WHISBY QUARRY
Area 12

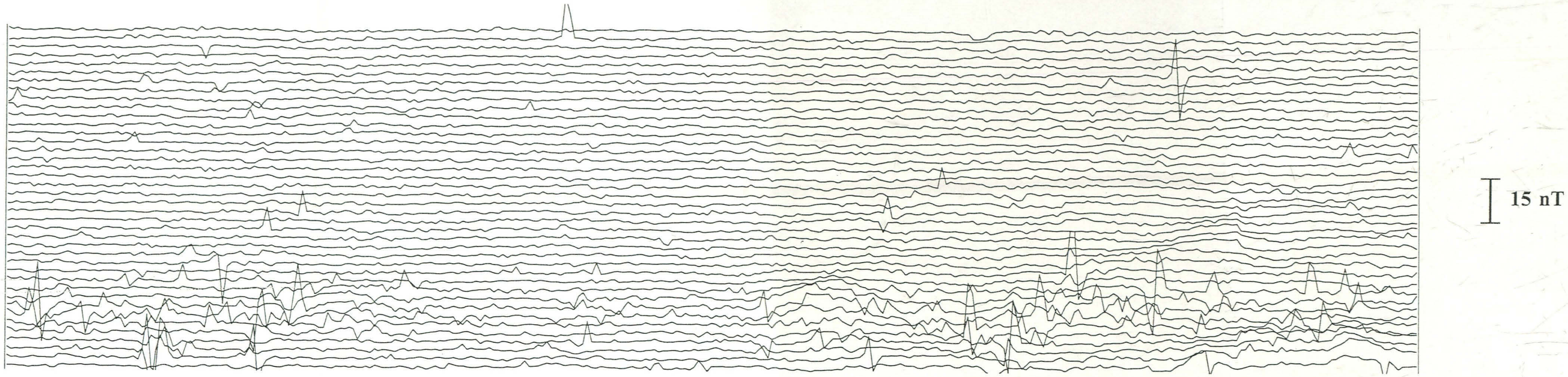


Figure A19

WHISBY QUARRY
Area 12

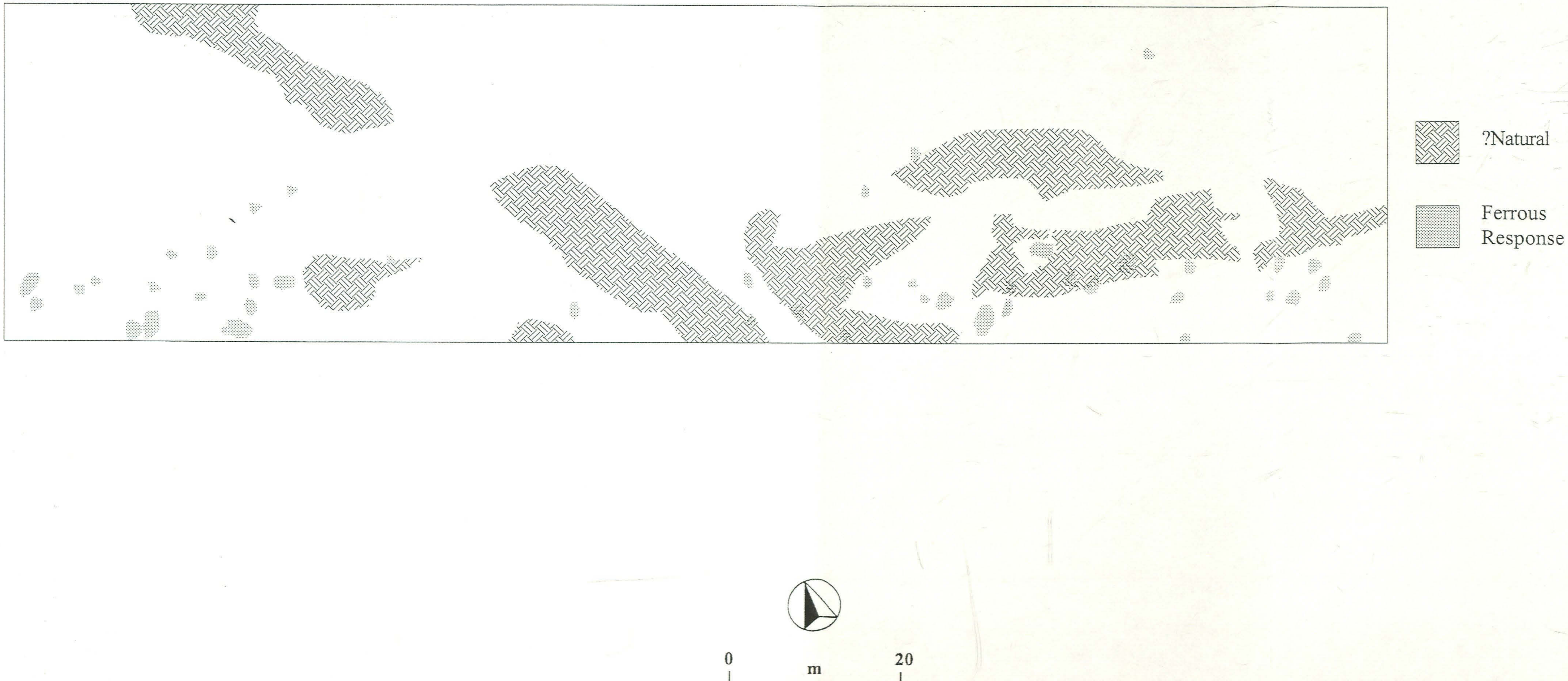


Figure A20