Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford
Geophysical Surveys of Bradford

The Old Sunday School,
Kipping Lane,
Thornton,
Bradford,
BD13 3EL.
Tel: (01274) 835016
Fax: (01274) 830212

REPORT ON GEOPHYSICAL SURVEY

MARFIELD QUARRY
Masham

Report number 95/95

Work commissioned by :

MAP
Archaeological Consultancy Ltd

received 19.6.96 from MAP. recorded 20.6.96. ack 25.6.96.

SITE SUMMARY SHEET

95 / 95 Marfield Quarry, Masham

NGR: SE 210 830 (approximate centre)

Location, topography and geology

The site lies approximately 2km to the north-west of the village of Masham, North Yorkshire. The survey area comprises four fields situated between the A6106 road and the River Ure. The topography and ground cover are variable. The Soil Survey of England and Wales sheet for the area shows the soils as typical brown earths of the East Keswick 1 association (541x) formed over a parent of drift from Palaeozoic and Mesozoic sandstones and shales. Such soils usually comprise deep well drained fine or coarse loamy soils, sometimes with slowly permeable subsoils and subject to slight seasonal waterlogging.

Archaeology

A desktop study by **MAP** archaeological consultants, of the area around the present Marfield Quarry, revealed that there are few areas of high archaeological potential in the proposed quarry extension. However, some fields were identified for further archaeological investigation.

Aims of Survey

A methodology was devised using a fluxgate gradiometer in both scanning and detailed mode. The work was undertaken on four fields (Areas 6, 9, 12 and 14), that had been identified as being of some archaeological interest. It was hoped that the scanning would locate possible anthropogenic anomalies and the detailed survey would establish their likely nature. This work forms part of a wider assessment of the area by **MAP**. The interpretation of the detailed survey work has benefited from some initial trial excavation within Area 12.

Summary of Results *

The surveys within the four fields have revealed a number of anomalies that are of possible archaeological interest. The interpretation of the results from Area 12 in particular indicated a concentration of anomalies that may originate from kiln-type features. Four of these have been confirmed on excavation by **MAP**. Within two of the other areas there are further anomalies that may indicate fired remains, as well as possible former field boundaries. Although there are a great number of these anomalies, their interpretation is cautious. This caution is due to the general background of ferrous anomalies and the lack of associated waste material. It is possible that the latter may be due to the nature of the remains i.e. they may relate to 'corn driers' rather than kilns.

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

SURVEY RESULTS

95 / 95 Marfield Quarry, Masham

1. Survey Area

1.1 Four areas of interest were investigated using a fluxgate gradiometer. In three of the areas (6, 9 and 14), both scanning and detailed survey was undertaken, while in one area (12) only a detailed survey was conducted. The location of the four areas is shown in Figure 1, which is produced at a scale of 1:10000.

1.2 The survey grid was set out by **Geophysical Surveys of Bradford** using an EDM. Tie-in information has been lodged with the client.

2. Display

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

2.2 The data plots and interpretation diagrams of the results are produced at a scale of 1:1000, except for the summaries of Area 9 (Figures 9.10 and 9.11), which are at 1:2000.

3. General Considerations - Complicating factors

3.1 In the majority of the fields the ground was undulating and free of obstacles. Low ground cover also contributed to the generally good survey conditions. Information relating to individual fields will be reported in the results section of the report.

3.2 Augering in Area 12 found that the soils were coarse loamy typical brown earths. The profile comprised a surface scatter of angular and subangular mainly sandstone clasts, this overlay an Ap (0-25cm) horizon of dark reddy brown coarse loams. Augering beyond 30cm was prevented by the stoniness of the B/C horizon. The shallowness of the soils may be a local variation peculiar to the field and / or it may be due to topsoil erosion and ploughing. The mass magnetic susceptibility (χ) of a sample from the Ap was 51 SI/kg x 10-8, while that of a sample from the upper Bh/C was 46 SI/kg x 10-8. If the shallowness of the soil is due to erosion and ploughing, then it is possible that any features may have been ploughed out. The coarseness, and especially the stoniness, of the soil could give rise to a 'speckled' pattern of magnetic noise which may obscure weaker anomalies.

3.3 Characteristic ferrous anomalies are prevalent throughout the datasets. These anomalies are likely to be due to modern material in the topsoil. However, when they are present in any quantity they inhibit the interpretation of the data.

4. Method

4.1 Two methods of magnetic prospection ('scanning' and 'detailed' gradiometry) were undertaken using a fluxgate gradiometer. In the method of scanning adopted for this project, Areas 6, 9 and 14 were initially traversed in parallel lines which were 10-20m apart. The LCD of the instrument was monitored along the traverses and any anomalous readings were marked with a cane in the field. Detailed surveying was then undertaken in the area surrounding the anomalies. In Area 12 no scanning was attempted, rather a detailed sample was established that covered the western part of the field.

5. Results of the Gradiometer Survey

5.1 Area 6 (Figures 6.1 - 6.5)

At the time of survey the area was under stubble. The land undulates quite dramatically, with a general drop in elevation towards the north-west of the area.

5.1.1 In general, the scan suggested that the majority of the area was relatively magnetically quiet. However, a number of strong anomalies were noted, and these, and some possible weaker linear anomalies, formed the basis for the detailed work.

5.1.2 The detailed gradiometer survey indicated that there were 18 anomalies that may be the product of fired remains. The majority of these anomalies are relatively small in extent and they may be due to relatively large ferrous material. In fact there are a number of ferrous peaks that can be seen in the X-Y plot (Figure 6.3), and this has confused the interpretation. Throughout the western part of the survey area a number of linear anomalies have been detected that may indicate the presence of ditches or even ploughing remnants. Some broad, weak anomalies have been interpreted as the product of geological variation.

5.2 Area 9 (Figures 9.1 - 9.11)

At the time of the survey the area was under stubble. As with Area 6, the land undulates quite dramatically, with a general drop in elevation towards the north. For ease of presentation the data are divided into two blocks.

5.2.1 The whole of this large, undulating field was scanned and a number of low level anomalies were noted.

5.2.2 **Area 9A**. This is the data collected in the northern part of the field. Again, the scanning suggested that the data set was relatively quiet, although some discrete anomalies were noted. The detailed survey identified a series of broad, but weak anomalies that are believed to be natural in origin. However, there are a few linear and pit type anomalies that may be of archaeological interest. There is a general spread of ferrous type anomalies and an occasional strong anomaly that may indicate fired remains. However, there appears to be little focus to the possible archaeological features.

5.2.3 **Area 9B**. This area, situated in the southern part of the field, provided evidence for strong anomalies throughout the scanning. While some were thought to be associated with a pipe, a number of non-linear anomalies were noted, some close to the pipe. The detailed survey revealed the position of the pipe and also noted a number of strong anomalies that may relate to fired material. The majority of the linear anomalies are aligned north-south and may be the result of ploughing and/or former field divisions. Of some interest are the two areas of increased noise. While the interpretation of such areas is very cautious, it is possible that the noise may be due to general soil disturbance. It is unclear if this disturbance is natural or anthropogenic.

5.3 Area 12 (Figures 12.1 - 12.5)

Area 12 is relatively flat and had recently had a crop of potatoes harvested. The agricultural furrows had weathered to some degree by the time of the survey. In order to reduce the potential interference due to the furrows the detailed grid was aligned along them.

5.3.1 The magnetic results from this area, and the subsequent excavation of some of the anomalies are important to the interpretation of the datasets collected in the other areas. No scanning was undertaken in this field, and the sample was directed by **MAP** to the western part of the area.

5.3.2 The general east-west trend that can be seen in the data is due to the existing furrows. These have been largely suppressed, although other weak anomalies may be difficult to identify due to this factor. Initial assessment of the results indicated a number of strong anomalies that were considered to be the product of fired remains such as kilns. Four of these were subsequently excavated and found to be kilns. As a result of this confirmation all of the datasets have been reanalysed and the interpretations altered accordingly. The magnetic responses are unusual in that there appears to be very little magnetic debris surrounding the kilns. However, areas of increased noise have been noted in the eastern and western parts of the survey and this may relate to human activity. A number of linear and curvilinear anomalies were noted although there is some caution in their interpretation. It is believed that many of them are likely to be geological.

5.4 Area 14 (Figures 14.1 - 14.3)

This area is a flat pasture field, with no obstructions to hinder survey.

5.4.1 The area was scanned and a 50% sample was then surveyed in detail. The scanning was dominated by a presumed pipe crossing the site approximately east-west. However, a few weaker anomalies were also noted in the environs of the pipe.

5.4.2 The detailed survey confirmed the presence of the pipe. A number of isolated ferrous anomalies were also found. It is believed that the weak linear anomalies crossing the pipe are likely to be geological or the remains of ploughing. There are no clear archaeological anomalies, although some have been labelled as being of potential interest. The evidence from the initial excavation in Area 12 would indicate that such weak anomalies may be geological.

6. Conclusions

6.1 In general the gradiometer datasets collected in this evaluation are relatively quiet, with the majority of the anomalies being very weak. However, there are numerous ferrous type anomalies that have confused the interpretation of these weak anomalies, as well as the interpretation of stronger anomalies. The latter are uncommonly prevalent in Areas 6, 9 and 12. Four of the strong anomalies in Area 12 have already been excavated and proved to be in situ or plough damaged fired remains. There is a very good chance that similar remains exist in Areas 6 and 9. Few other anomalies of archaeological interest have been found and no foci of activity have been clearly identified.

Project Co-ordinator: Dr C F Gaffney
Project Assistants: Dr C R Adam, J A Gater, K Hamilton, A Shields and D Weston

Start Date of Survey: 23rd August 1995
Date of Final Report: 5th January 1996

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".

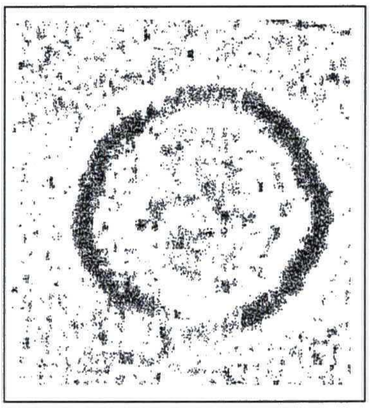
(c) Magnetic Susceptibility

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.

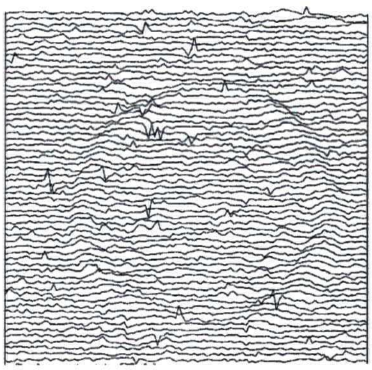
Display Options

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

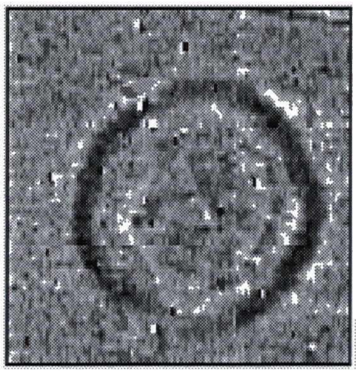


In this display, minimum and maximum cut-off levels are chosen. Any value that is below the minimum cut-off value will appear white, whilst any value above the maximum cut-off value will appear black. Any value that lies between these two cut-off levels will have a specified number of dots depending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

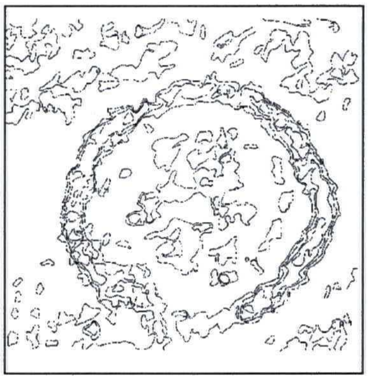
This involves a line representation of the data. Each successive row of data is equally incremented in the Y axis, to produce a stacked profile effect. This display may incorporate a hidden-line removal algorithm, which blocks out lines behind the major peaks and can aid interpretation. Advantages of 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.



(c) Grey-Scale

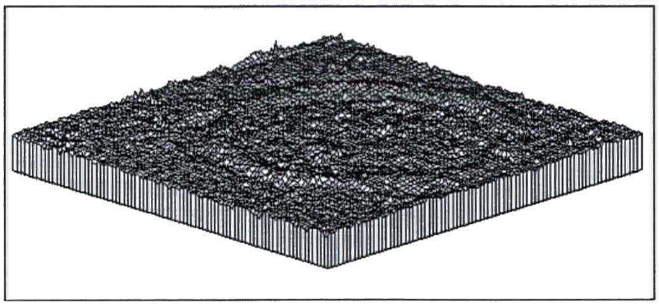
This format divides a given range of readings into a set number of classes. These classes have a predefined arrangement of dots or shade of grey, the intensity increasing with value. This gives an appearance of a toned or grey scale.

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).