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REPORT ON GEOPHYSICAL SURVEY

MARFIELD QUARRY
Masham

Survey No: 96/112

Work Commissioned by:

MAP
Archaeological Consultancy Ltd

SITE SUMMARY SHEET

96 / 112 Marfield Quarry, Masham

NGR: SE 210 830 (approximate centre)

Location, topography and geology

The site lies approximately 2km to the north-west of Masham, North Yorkshire. The survey area comprises two fields situated between the A6106 and the River Ure. The topography is undulating with steep slopes in some places. The ground conditions for each area is described in the Results Section below. The site soils are typical brown earths formed over a parent of drift from Palaeozoic and Mesozoic sandstones and shales. Such soils usually comprise coarse and fine loams, often with slowly permeable subsoils, and are subject to slight seasonal waterlogging.

Archaeology

A desktop survey by **MAP** archaeological consultants of the area of the present Marfield Quarry, showed few areas of high archaeological potential. However, past geophysical survey (**GSB** 1995) detected several kiln like features.

Aims of Survey

The two fields were subjected to scanning with a fluxgate gradiometer followed by detailed survey of fifty percent of the area. This work forms part of a wider assessment by **MAP**.

Summary of Results *

Scanning located few anomalies of clear archaeological potential, however, it succeeded in locating broad areas of increased response. The detailed survey of Area 8 located several anomalies which are of archaeological interest and which may also be the product of fired remains. Several linear features which may be archaeologically significant were also detected. The dataset contains a broad area of increased noise: both archaeological and geological explanations are possible. The detailed survey of Area 13 detected several linear, sub-linear and pit-like anomalies: whilst these may be archaeological, a geological origin is equally likely. The dataset is dominated by north-south trends which are likely to have arisen from ploughing.

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

SURVEY RESULTS

96 / 112 Marfield Quarry, Masham

1. Survey Areas

1.1 Two areas, Area 8 (*c.* 5.4ha) and Area 13 (*c.* 4.7ha), were investigated using fluxgate gradiometer, both in scanning and detailed mode. The location of the areas is shown in Figure 1 (1:10000), and the positions of the detailed survey grids are given in Figure 2 (1:2500). Area 13 is divided into two parts 'Area 13 Arable' and 'Area 13 Pasture'.

1.2 The survey grid was established and tied-in by **Geophysical Surveys of Bradford** manually in Areas 13 and using an EDM system in Area 8. Detailed tie-in information has been lodged with the client and stakes were left *in situ* in each field in order to facilitate easier relocation of the survey grids.

2. Display

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

2.2 All figure numbers use the same protocol as the previous geophysical report (GSB, 1995). Hence, figures for Area 8 are numbered 8.1 etc; Area 13, 13.1 etc. A full list of figures is given before the diagram section.

2.3 The data plots and interpretation diagrams of the results are produced at 1:1000, with the exception of Area 13 Pasture which is at 1:500.

3. General Considerations - Complicating factors

3.1 Ground conditions were generally suitable for survey, although parts of the site were steeply sloping and this made it difficult to walk at a constant pace.

3.2 Limited parts of Area 8 were unsuitable for detailed survey because of the presence of large metal field mangers. Also, a steep break of slope with a fallen wall running along it was unsuitable for survey.

3.3 A past soil auger survey (GSB, 1995) found that the thickness of the topsoil varied across the site, with shallow ploughsoils on slopes and crests. This suggestion of ploughing enhanced erosion has implications for the integrity of any archaeological remains which may be present in the soil.

4. Methodology

4.1 The areas of interest were scanned at 10m intervals with the gradiometer in its 'free range' mode. During this scan the operator observes the instrument's LCD; areas of magnetic variation are noted and marked for subsequent detailed survey.

4.2 Recorded or detailed survey involves setting out 20m grids and logging readings at 0.5m intervals along traverses 1.0 m apart.

5. Results of Scan

5.1 Scanning detected few 'strong' anomalies although, in Area 8, it was apparent that areas of enhanced response / noise existed.

5.2 Detailed survey grids were set out so as to encompass the scanned anomalies and to take in an extensive sample. The grids were laid out in stages so that any anomalies positively identified in the detailed survey could then be investigated further.

6. Results of Detailed Survey

6.1 Area 8 (Figures 8.1 - 8.4)

At the time of survey the area was under pasture. The land undulates markedly, with the survey area lying either side of a ridge running approximately east-west.

6.1.1 The dataset is marked by frequent sharp peaks which are due to ferrous debris; these are noticeable on the X-Y trace (Figure 8.1); the main anomalies are marked on the interpretation diagram (Figure 8.4). The presence of these responses has obscured low level responses within the dataset, some of which may be archaeological in origin.

6.1.2 Within the data there are possibly five anomalies (A-E) which may be the product of fired remains, although deeply buried large ferrous objects / clasts may be equally responsible.

6.1.3 In the eastern most corner of the detailed survey grid, several indistinct ditch-type anomalies were detected. These may represent the remains of a former field boundary; they might relate, however, to an old trackway as they lie close to an extant but unused gateway.

6.1.4 There is a diffuse band of increased response which is concentrated around the centre of the area of detailed survey and the group of anomalies (F). A more discrete area of increased response (G) lies to the north of the diffuse linear anomalies. These anomalies may relate to ditch-type responses mentioned in Section 6.1.3. It is not possible to ascribe a cause to this area of noise with any degree of certainty, although a geological origin is more plausible than an archaeological one.

6.1.5 The separate southern block of detailed survey exhibits an increased level of response, and this is especially concentrated within a band marked 'area of increased noise' (Figure 8.4). This noise may be associated with a fallen wall. The general increase in the noisiness of response has obscured the interpretation of the dataset, however, two previously noted anomalies (D and E) are found within this area.

6.2 Area 13 Arable (Figures 13.1-13.4)

At the time of survey the area was under a very young crop of wheat and the terrain was undulating with steep slopes locally.

6.2.1 The dataset contains a general north-south trend which can be attributed to ploughing. A linear ferrous anomaly, characteristic of a pipeline, is clearly visible running across the middle of the survey area. The dataset is marked by frequent sharp peaks which are due to ferrous debris, the main ones are noted on the interpretation diagram (Figure 13.4).

6.2.2 A few ditch and pit anomalies were detected throughout the survey area. Whilst these may be archaeological, this interpretation remains tentative.

6.2.3 Throughout the dataset, but most clearly seen in the western margin of the survey area, diffuse and sinuous linear anomalies and trends were recorded. Whilst an archaeological cause cannot be wholly excluded, a geological / natural origin is more plausible.

6.3 Area 13 Pasture (Figures 13.5-13.8)

At the time of survey the area was under rough pasture; the terrain was steeply sloping.

6.3.1 The results are generally quieter than in the other areas. There are a few linear trends, running approximately north-south, which are likely to relate to past ploughing. The survey area is bisected by a pipeline which runs toward a metal field trough.

6.3.2 There are two linear trends (H and I) which may be of archaeological significance. However, anomaly (H) is on the same alignment as the ploughing trend and may relate more to recent agricultural practice. Several lesser anomalies, which appear to be geological / natural in origin, lie close to (I) and this spatial association may detract from an archaeological interpretation.

7. Conclusions

7.1 Scanning indicated broad changes in the level of magnetic response across the site and identified a few anomalies of potential interest.

7.2 Detailed survey in Areas 8 and 13 detected several weak linear features. In Area 8 strong anomalies, which may reflect fired remains, were detected. Also within Area 8, several discrete and diffuse areas of increased response were noted, although no certain cause can be attached to them. The prevalence of ferrous type anomalies and geological / natural anomalies throughout the datasets, and especially at Area 8, have obscured the interpretation of the data.

Reference: GSB 1995. Report on Geophysical Survey at *Marfield Quarry, Masham,* Report No. 95/95. Geophysical Surveys of Bradford. unpublished report.

Project Co-ordinators: D. Weston
Project Assistants: L. Harvey, K Holroyd, D. Shiel, A Shields & C Stephens

Start of Survey: 28th November 1996
Date of Report: 20th January 1997

TECHNICAL INFORMATION

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

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.

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

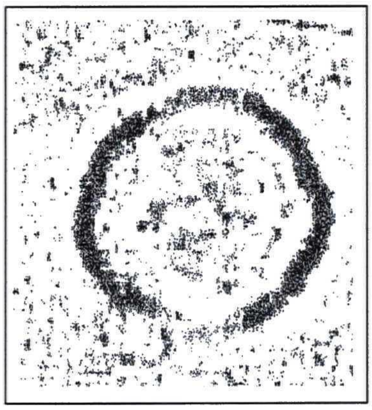
This measures the electrical resistance of the earth, using a system of four electrodes (two current and two potential.) Depending on the arrangement of these electrodes an exact measurement of a specific volume of earth may be acquired. This resistance value may then be used to calculate the earth resistivity.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

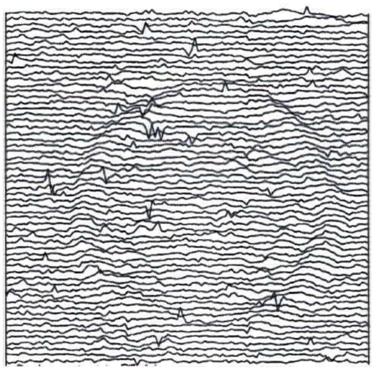
Display Options

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.



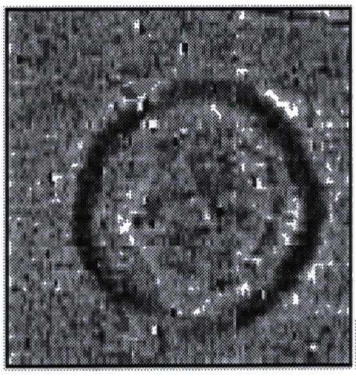
(a) Dot-Density

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

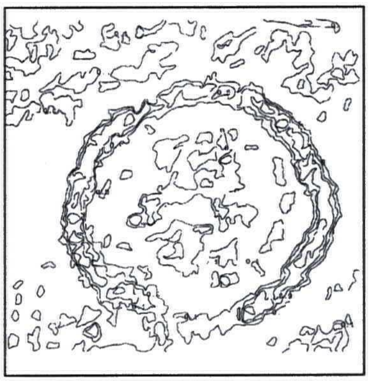
This involves a line representation of the data. Each successive row of data is equally incremented in the Y axis, to produce a stacked profile effect. This display may incorporate a hidden-line removal algorithm, which blocks out lines behind the major peaks and can aid interpretation. Advantages of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

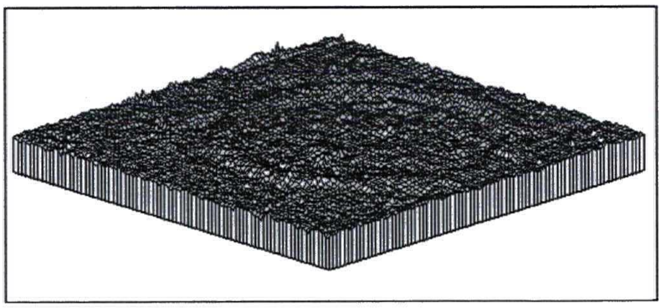
This format divides a given range of readings into a set number of classes. These classes have a predefined arrangement of dots or shade of grey, the intensity increasing with value. This gives an appearance of a toned or grey scale.

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).

LIST OF FIGURES