SMR 12
78-89/01

REPORT ON GEOPHYSICAL SURVEY

Dan y Graig, Porthcawl

March 1989

CLIENT: G-GAT

REPORT ON GEOPHYSICAL SURVEY

Site: Dan-y-Graig, Porthcawl

Survey Number: 89/09

Date: March 1989

NGR: SS 843 782 (Approximate)

Location & Topography:
The area under investigation lies immediately south of the Roman civil settlement at Dan-y-Graig, some 2km north-east of Porthcawl. The field is under permanent pasture and there are several trees in the area. Low banks and mounds are also visible and these have been surveyed by G-GAT personnel.

Archaeology:
Recent excavations by G-GAT identified roman structures, including part of a corn drier, in the grounds of Dan-y-Graig House. The limited size of the excavation prevented any conclusions being drawn about the wider archaeological context of the remains.

Aim of Survey:
It was hoped that geophysical survey techniques would help established the extent and form of any archaeological remains surviving to the south of the excavated features.

Instrumentation:

Resistance Survey: Geoscan RM4 and DL10 data logger

Magnetometer Geoscan FM36 with ST1 automatic trigger

Survey Method:
Magnetic readings are logged at 0.5m intervals along the north-south axis (in 1.0m traverses, 800 readings per 20 x 20m grid) over the survey area and resistance readings are logged at 1.0m intervals. The data are then transferred to an Amstrad PPC640 field computer, and stored on 3.5" floppy discs. Field plots are produced on a portable HP Thinkjet. Further processing is carried out back at base on a Mission 386 linked to appropriate printers.

The location of the survey area is shown in Figure 1.

TECHNICAL AND DISPLAY INFORMATION

The following is a concise description of the equipment and display formats used by Geophysical Surveys in our 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 buried archaeological evidence at each site. The choice of diagrams are therefore based upon the experience and knowledge of Geophysical Surveys.

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(1) Instrumentation

(a) Fluxgate Gradiometer - This instrument comprises of two fluxgates mounted vertically apart, at a distance of 500mm. The gradiometer is carried by hand, with the bottom sensor some 100-300mm from the ground surface. At any survey point, the difference in magnetic field between the two fluxgates is conventionally measured in nanoTesla (nT) or gamma. The fluxgate gradiometer suppresses any diurnal or regional effects. If multiple readings are logged then, unless specified elsewhere in the report, it may be assumed that they are taken in the direction of grid north.

(b) Resistance meter - This measures the electrical resistance of the earth, using a system of four electrodes (two current, two potential). Depending on the arrangement of these electrodes, an exact measurement of a similar volume of earth may be acquired. In such a case the amount measured may be used to calculate the earth resistivity. Using a 'Twin-Probe' arrangement the terms 'resistance' and 'resistivity' may be interchanged. This arrangement involves the pairing of electrodes (one current and one potential), with one pair remaining in a fixed position whilst the other measures the resistivity variation across a fixed grid. Resistance is measured in ohms, whilst resistivity is measured in ohm-meter.

(c) Magnetic susceptibility - the instrument employed for measuring this culturally enhanced phenomenon is a laboratory based susceptibility bridge. Standard 50g soil samples are collected in the field.

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(2) 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 only one type of display mode may be used, although where necessary many, if not all, of the options may be presented.

(a) X-Y Plot - This involves a line representation of the data. Each succesive 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 - see 3-D mesh.

(b) Dot-Density - In this display, minimum and maximum cut-off levels are choosen. 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. Depending on the nature of the expected remains the focus of the display may be changed using different levels and a contrast factor (C.F.). When the contrast is equal to 1, then the scale between the two cut-off levels is linear. A C.F.>1 helps to enhance the higher readings. To assess lower than normal readings involves the use of an inverse plot. This plot simply reverses the minimum and maximum values, resulting in the lower values represented by more dots. In either representation, each reading is allocated a unique area dependant on its position on the survey grid, within which the numbers of the dots is randomly placed.

(c) Contour - This display form is either generated on the computer screen or plotted directly on a flat bed plotter. The former will generate either colour or black and white copies depending on the printer used.

(d) 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. Again, the output may be either colour or black and white. A hidden line option is occassionally used: this entails the blocking out of lines behind the major peaks and can aid interpretation.

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

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(3) Interpretation

This is the most important part of the report and is based on a consideration of not only the display plots , but also a study of the raw data. It is re-emphasised that the interpretation is not based only on the diagrams reproduced in this report.

In some instances geological and pedological anomalies may arise which are impossible to distinguish from those normally associated with archaeological features - in all cases of doubt trial excavation work is recommended to test the true nature of the observed anomalies.

Introduction

The geophysical survey at the site of Dan-y-Graig comprised a detailed survey of ten magnetic grids (A to J, Figure 1) and eighteen resistance grids (A to R, Figure 1). For ease of interpretation the survey results for the two techniques will be discussed separately.

The fieldwork was carried out by two operators during the course of two days on site. This included the time taken to set out the survey grid. The latter was tied in to reference points established by Richard Newman of G-GAT (see Figure 1).

The resistance results are reproduced in Figure 2 as a dot-density plot, in Figure 3 and 4 as contour plots, and in Figures 5, 6 and 7 as 3-D wire frames. The magnetic data are displayed in Figure 8 as a stacked profile / X-Y plot. A simplified interpretation plot is shown in Figure 9.

Unless specified otherwise in the text, all numbers in brackets refer to Figure 9.

Results

Resistance Survey (Figures 2-7)

The site responded extremely well to the resistance technique and a complex of apparent archaeological features was identified. There are a number of clear, high and low anomalies which may be associated with buried walls, yards and paths. The approximate NW-SE trend of the anomalies appears to match the alignment of the structure found during the excavation at the site. In the light of the evidence, it would seem that the identified remains are also of Roman date.

There are several areas of modern disturbance within the survey: The trench associated with a water pipe running through grids A, B and G, appears as a linear low resistance response (1). A concrete platform in Grid F has resulted in some anomalous readings (2). A later bank, possibly of medieval date (?), which is on the line of an old field boundary (3), produces anomalies that tend to mask the underlying features. Apart from these factors the picture of the remains is remarkably clear.

The results in the southern part of the survey are most promising. The high resistance feature in grids E, K and L (4) is very strong and its shape could indicate a stone building. To the west of (4) lies a series of parallel, high resistance anomalies (5). Collectively, the anomalies at (5) could form a complex of buildings. Both (4) and (5) suggest that similar anomalies may lie to the south of the survey area.

The only interpretative difficulty in the resistance data is anomaly (6), which may indicate another building. The survey area has limited our ability to define the latter anomaly, and to assess its relationship with the other anomalies present.

In the northern part of the survey area, the high resistance data appear to follow the same general alignment as anomalies at (5). However, the trends at (7) are more ephemeral than those in the southern part of the survey area.

Magnetic Survey (Figure 8)

Ten grids were surveyed using the gradiometer and the results are shown as X-Y traces in Figure 8. Because of the limited time available, the eastern half of the survey grid was only scanned with the magnetometer. Although the scanning suggested the presence of anomalies of interest, it was felt that the resistance survey of this area could reveal information of greater archaeological interest. A follow-up magnetic survey of the remaining areas may well prove beneficial, and should help clarify some of the more confusing areas.

The majority of the magnetic anomalies would appear to correspond to modern disturbances. The water pipeline is clearly visible (1), as is the concrete platform (2) and the old field boundary (3). The magnetic anomaly associated with the latter appears to suggest the presence of a silted ditch along this line. In addition to these disturbances, which appeared on the resistance plots, there are other anomalous responses.

Young trees, surrounded by wire fences, are present in grid H (8), and the effects of the standing buildings are visible in grids A and D (9 and 10 respectively). A third, rather broken linear anomaly is visible (11) and this is thought to correspond to modern ferrous debris. Isolated peaks (both negative and positive) correspond to stray ferrous objects on the surface or in the topsoil.

A result of the modern noise is that it is difficult to identify any anomalies of archaeological interest. However, given the nature of the buried remains, it is possible that some of the anomalies (12-14) represent fired features - hearths, ovens or small kilns, for example.

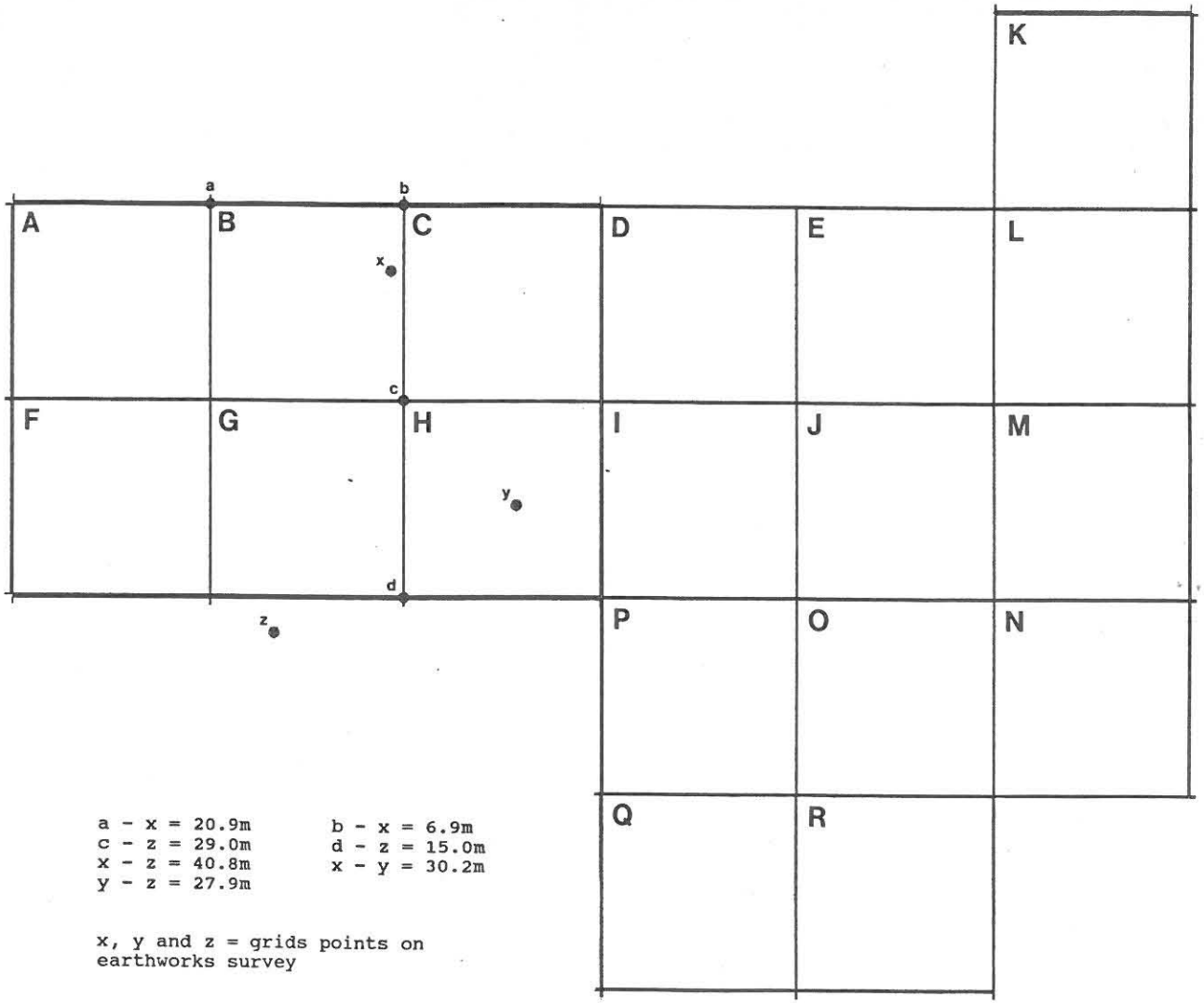
Conclusions

Both of the techniques responded to buried remains of potential archaeological interest, but the resistance technique was far less affected by modern disturbances. In the southern half of the survey area the resistance anomalies are remarkably clear, perhaps suggesting that the walls are surviving above foundation level and that there is little collapsed rubble. Whilst elsewhere, the picture is not quite well defined, it is still possible to see the same general building alignments.

Unfortunately, it was not possible to find the limits of the building remains in the time available. To date, however, the evidence points towards substantial structures at a scale which might easily be interpreted as part of a villa complex.

John A Gater & Chris Gaffney
May 1989

List of Figures.



a - x = 20.9m
c - z = 29.0m
x - z = 40.8m
y - z = 27.9m

b - x = 6.9m
d - z = 15.0m
x - y = 30.2m

x, y and z = grids points on earthworks survey

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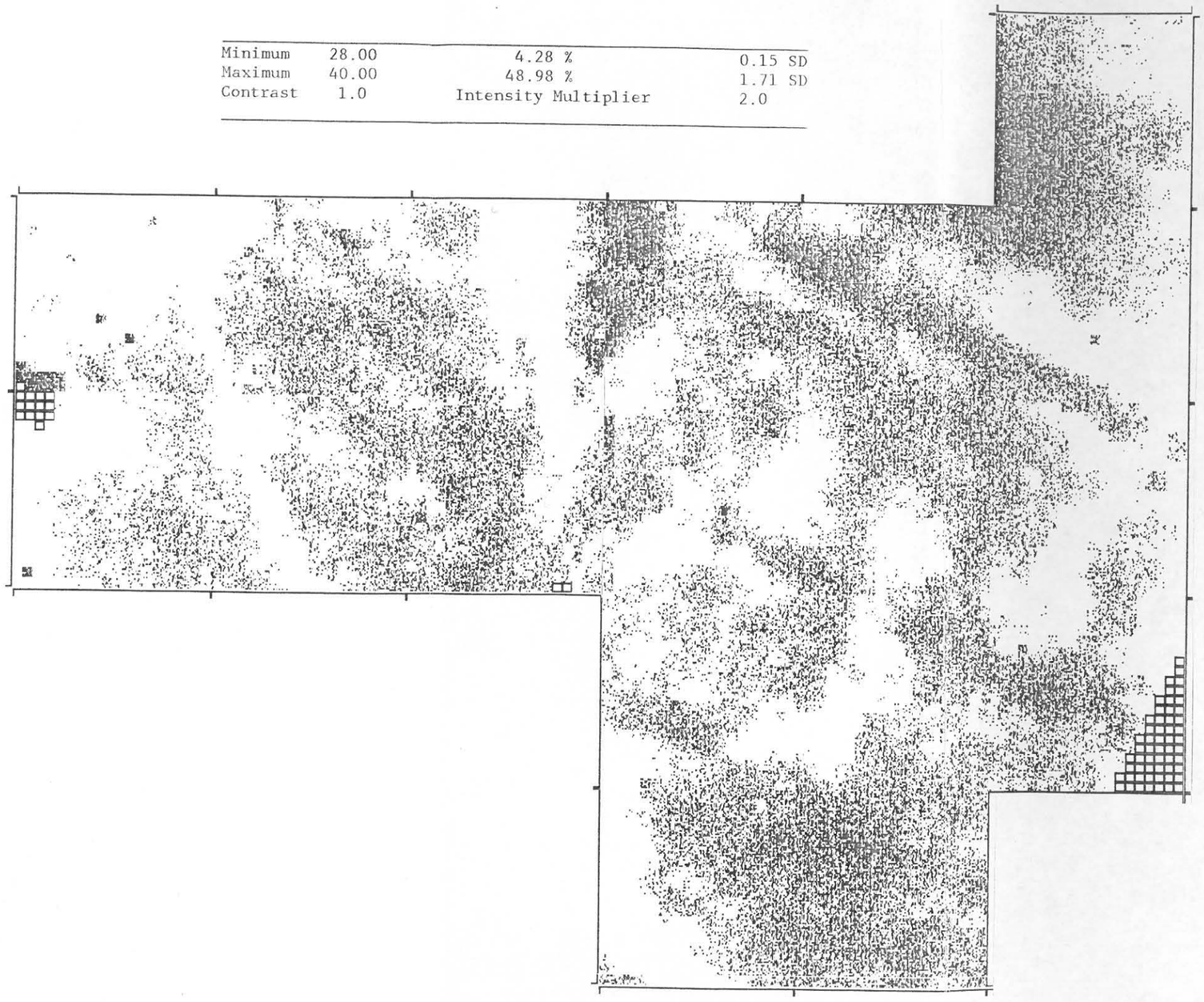
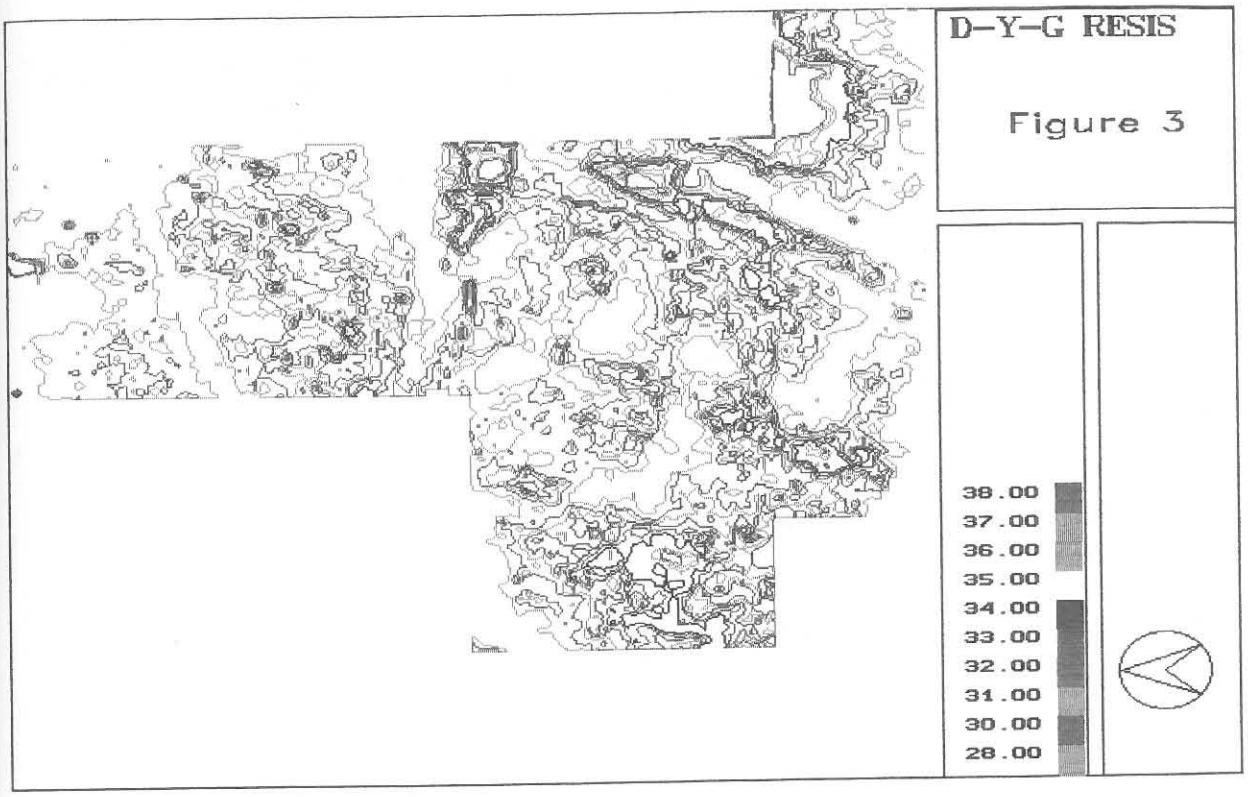
Maximum	40.00	48.98 %	1.71 SD
Contrast	1.0	Intensity Multiplier	2.0

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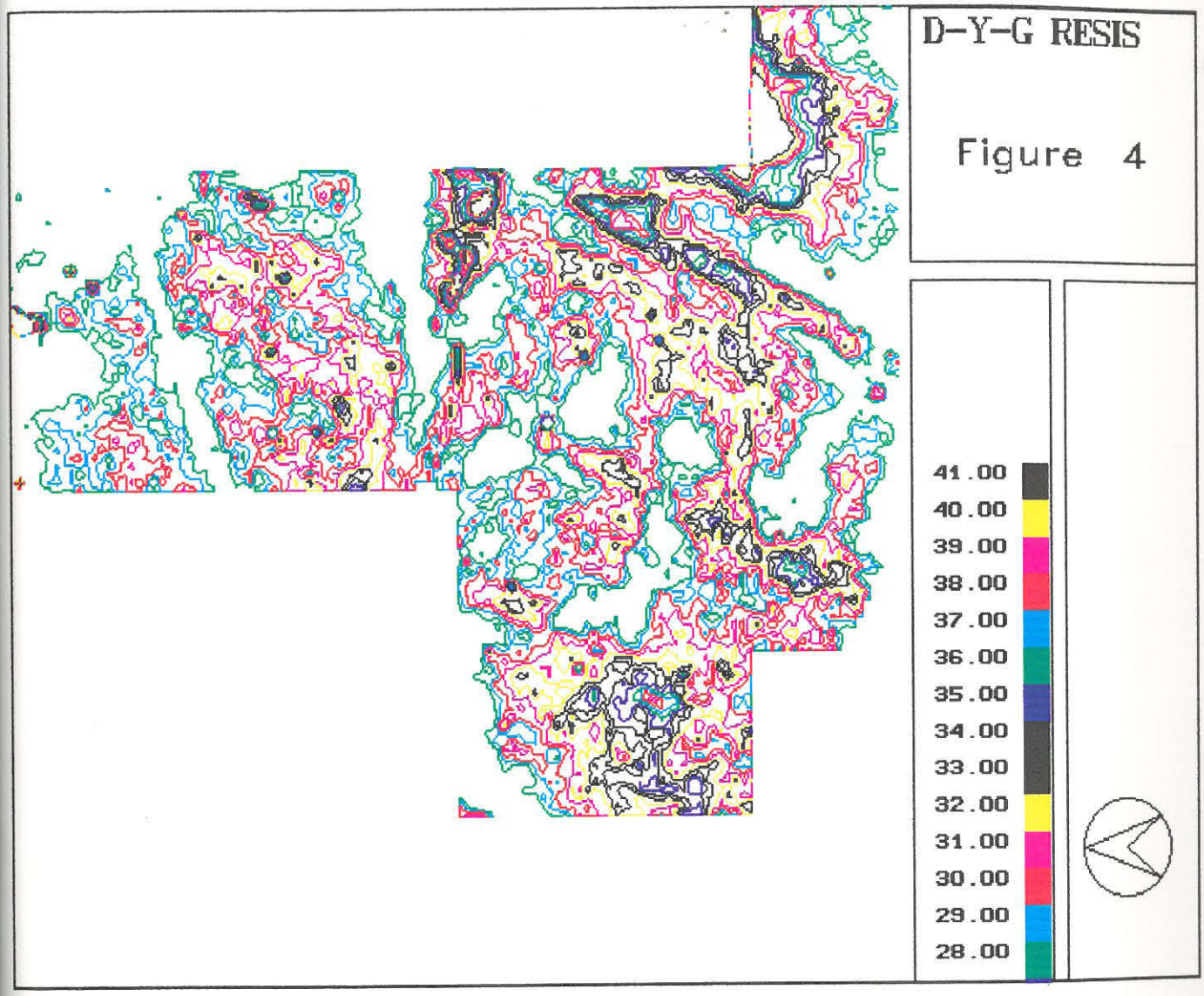
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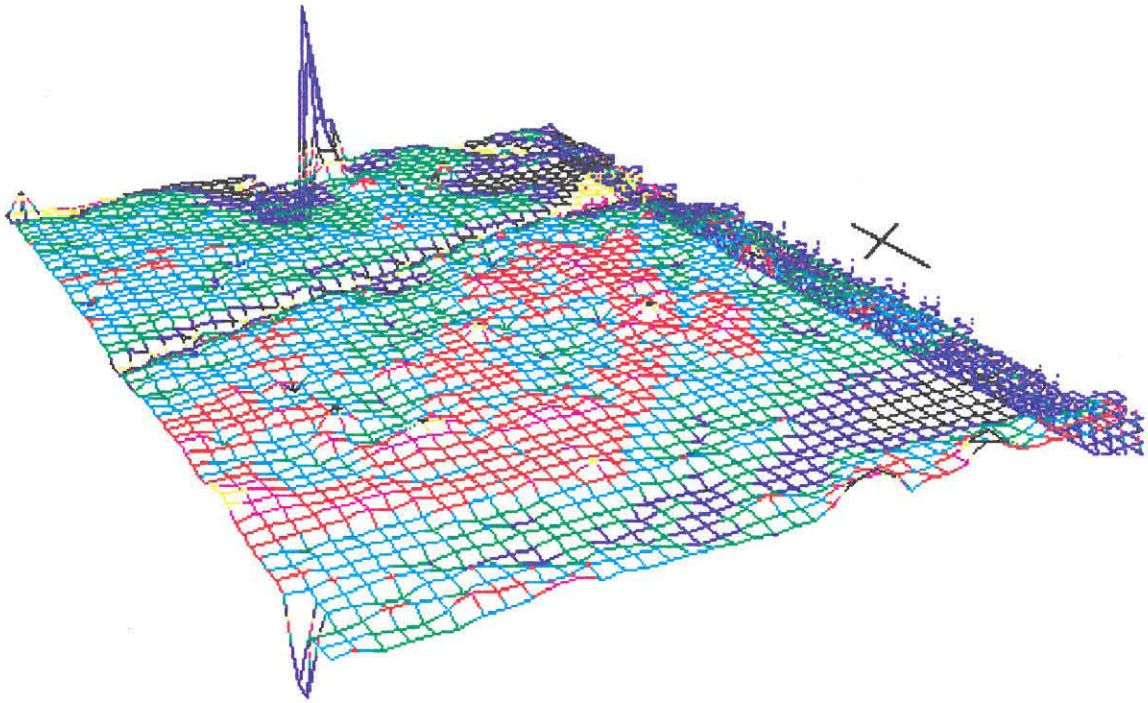
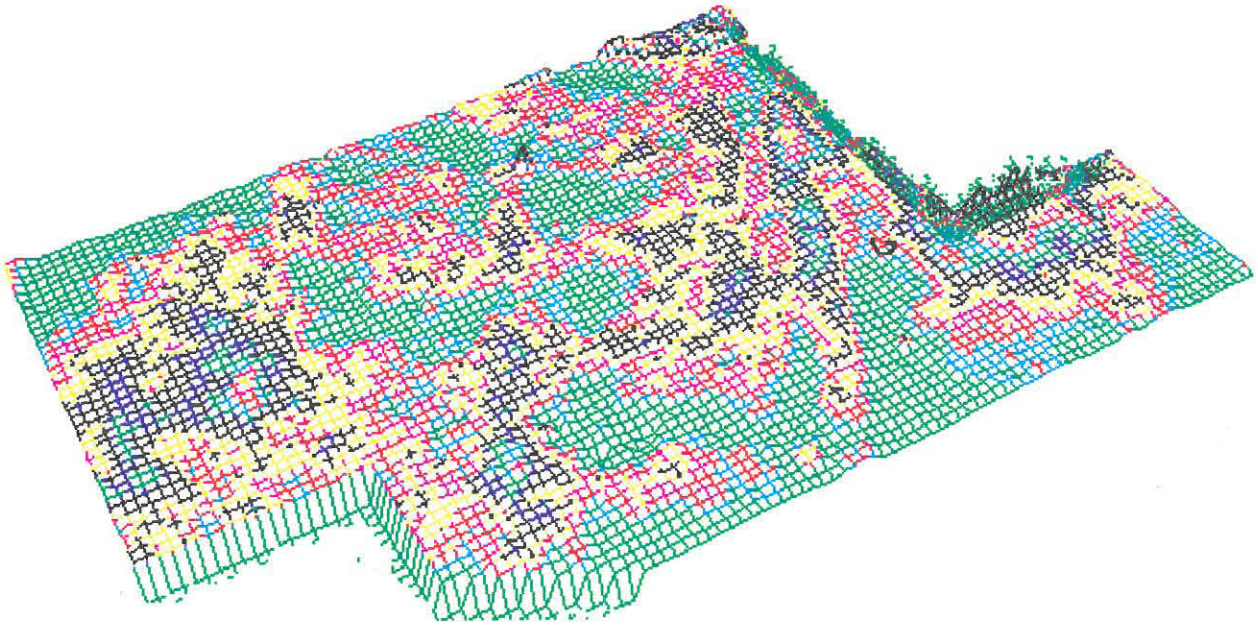


Figure 5. Grids A—C, F—H

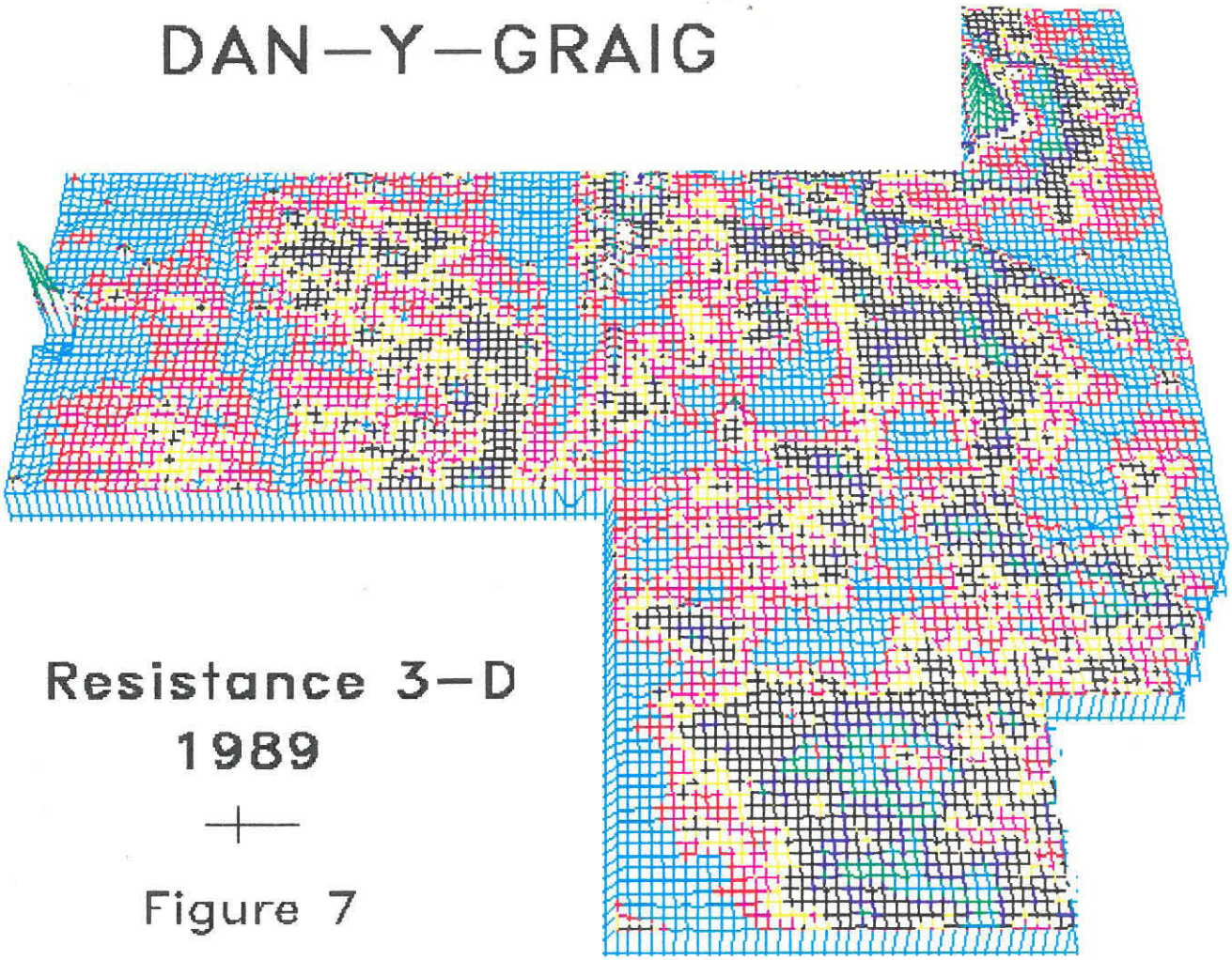
DAN—Y—GRAIG



Grids D,E,I—R

Figure 6.

DAN-Y-GRAIG



Resistance 3-D
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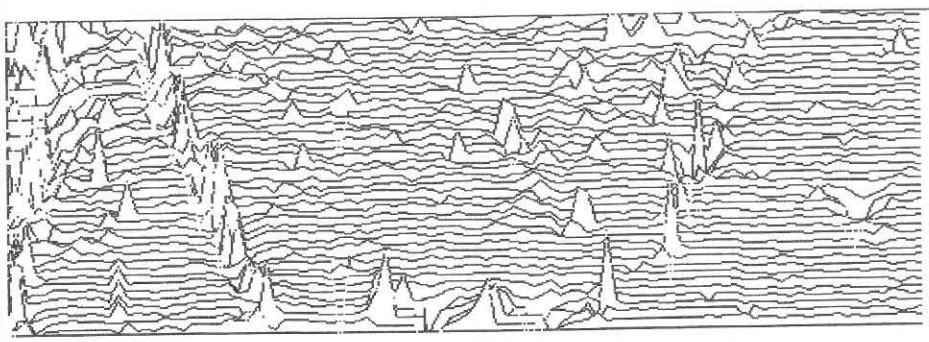
Figure 7



DAN–Y–GRAIG
MAGNETIC DATA

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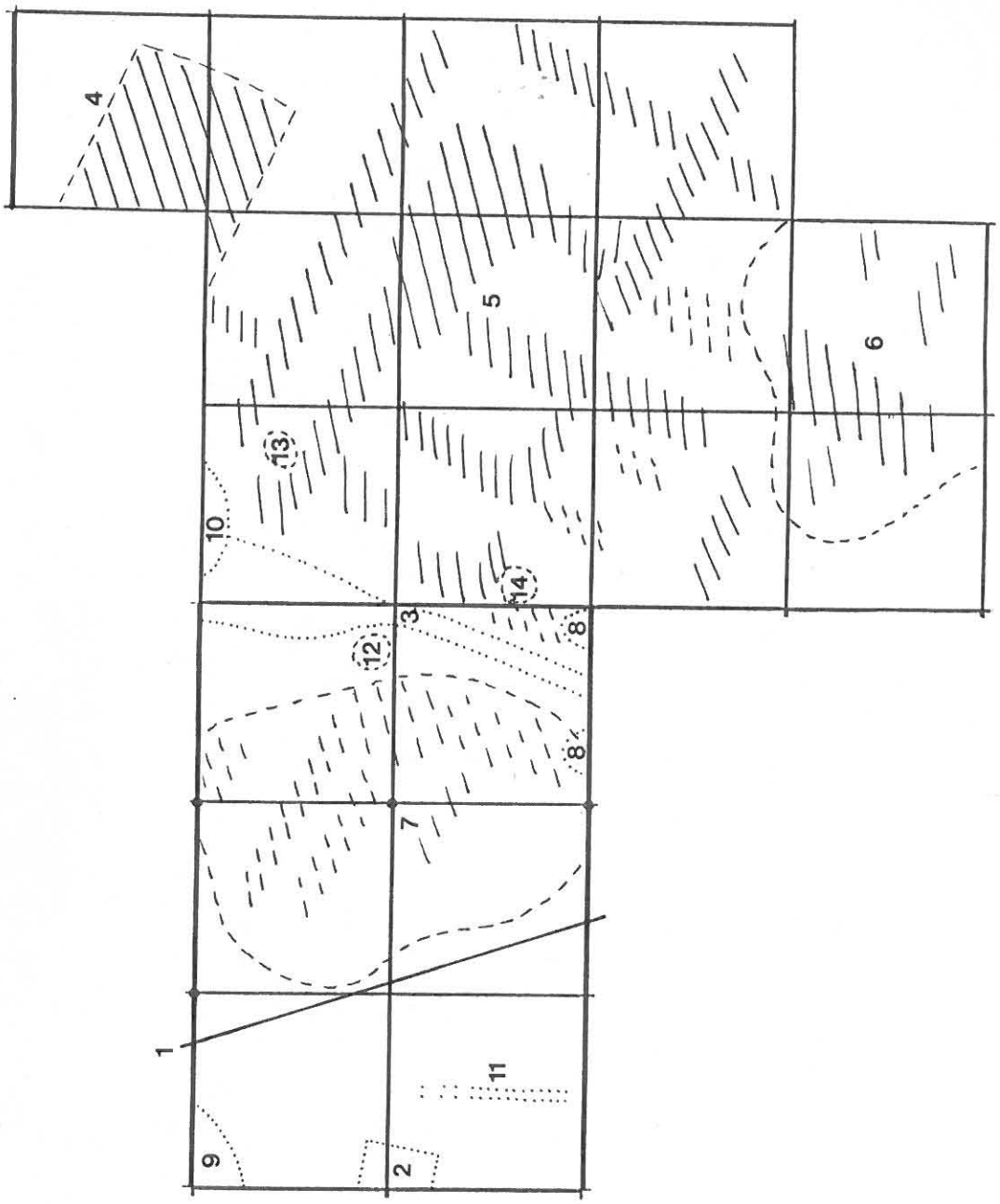
Figure 8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