GEOPHYSICAL SURVEY REPORT

Dumbarnie

RGC17259DMB

Commissioned by:

CFA ARCHAEOLOGY LTD

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Executive Summary

Gradiometer survey was undertaken to the south of Dumbarnie Farm, Fife, over an area where aerial photography shows cropmarks indicative of possible prehistoric settlement. The survey was undertaken to provide more detail on the nature of the archaeology indicated by the cropmarks. The whole area earmarked for survey covers an area of approximately 20ha. However, due to livestock, only two of the fields, covering 13.3ha, were available for survey.

The site responded well to gradiometer survey with a wide variety of anomalies being detected across the survey area and shows excellent correlation with the aerial photographs, while providing greater detail.

The strongest responses are due to a gas pipe and ridge and furrow cultivation. Several linear anomalies suggesting past field divisions have been detected.

A cluster of anomalies indicative of possible settlement features has been detected together with weaker, more ephemeral, responses of likely archaeology significance. Additional anomalies suggestive of larger enclosures have also been detected. The variation in the nature and form of responses suggests the potential for different phases of activity across the site.

Survey:	Geophysical Survey at Dumbarnie (RGC17259/DMB)
Client:	CFA Archaeology Ltd
Date of Survey:	24th – 28th October 2017
Survey Personnel:	Dr S M Ovenden and A S Wilson
Date of Report:	13th November 2017
Report Author:	Dr S M Ovenden

1. Introduction

1.1 Gradiometer survey was undertaken to the south of Dumbarnie Farm, Fife, over an area where aerial photography shows cropmarks indicative of possible prehistoric settlement. The survey was undertaken to provide more detail on the nature of the archaeology indicated by the cropmarks.

1.2 The whole area earmarked for survey covers an area of approximately 20ha. However, due to livestock, only two of the fields, covering 13.3ha, were available for survey. The location of the survey areas are indicated on Figure 1 at a scale of at a scale of 1:2500.

1.3 Overview images of the data are provided in Figures 2 – 4 at 1:2500, with the data displayed in a variety of formats. An accompanying interpretation diagram is provided in Figure 5. Further summary grayscales and interpretations are provided in Figures 6 – 11 at a scale of 1:1250.

1.4 Archive data plots and interpretations are displayed in Figures A1 – I3 at a scale of 1:625. The relative location of the archive areas is indicated on Figure 11 at 1:2500.

2. Methodology

2.1 Prior to data collection a series of 20m grids were established across the site and georeferenced using a Trimble R8 GPS system. CAD files containing data images, interpretations and geo-referencing information has been passed to the client.

2.2 Gradiometer survey was undertaken using a Bartington Grad601-2 gradiometer. The gradiometer comprises two fluxgate sensors mounted 1m apart on a vertical axis. Each sensor measures the earth's magnetic field, in nanoTesla (nT), and the instrument records the difference between the observed readings for each sensor. As a result the instrument is able to record subtle changes or anomalies in the earth's magnetic field caused by material in the top metre or so of the earth's surface. Data was collected at 0.25m intervals along traverses 1m apart within the series of 20m grids, which were later merged together.

2.3 The data were processed with Geoscan Research Geoplot 4.00 software, using a standard range of corrections and processing algorithms. These include setting the data mean to zero and a destagger of the data, if required. The edited data are displayed as XY traces and grey-scale images in the archive section. Interpolated data are displayed as grey-scale images in the summary plots. In these images the data have been interpolated in the Y direction to create a 'square dataset' which has the overall effect of smoothing the data.

3. General Considerations / Complicating Factors

3.1 Geophysical data can be ambiguous and while every effort has been made to ensure that the interpretations contained within this report represent an accurate record of potential surviving archaeological deposits, it is a subjective analysis of the data.

3.2 The geology of the general area comprises sedimentary bedrock overlain by sand which responds well to gradiometer survey.

3.3 Gradiometers are extremely sensitive to ferrous material and areas of magnetic disturbance and instrument noise are to be expected close to fences and in areas of buried services.

3.4 The differentiation between 'Presumed Archaeology', 'Possible Archaeology' and 'Positive Response' is based on the form of the response and the wider context. Anomalies noted as 'Presumed Archaeology' coincide with features visible on the aerial photographs. 'Possible Archaeology' responses have a form and context which suggest a likely archaeological origin.

3.5 Anomalies noted as 'Positive Response' may have an archaeological origin but it is less certain; they could be due to natural variations.

3.6 Throughout the survey areas numerous isolated 'iron spikes' have been noted. These indicate isolated ferrous or fired material within the topsoil/subsoil. Only the most prominent of these are noted on the interpretations and are only discussed when relevant. The differentiation between a 'ferrous / fired' and a Positive Response is based on the strength and form of the anomaly, and the wider context. However, more deeply buried fired/ferrous material can give an anomaly comparable to that produced by ferrous material and vice versa.

4. Results of Gradiometer Survey

Anomaly numbers are shown on the summary interpretation diagrams (Figures 5, 7, 9,11) and the archive interpretation diagrams.

4.1 The data are dominated by a strong response (1) from a gas pipe running through the east of the area. This is a large cast iron pipe and has resulted in a broad band of magnetic disturbance. Responses from archaeological features within this band, if present, will have been masked by the magnetic disturbance. Smaller areas of magnetic disturbance are present on the edges of the surveys areas, adjacent to wire fences, etc.

4.2 Strong responses (2) from the rig and furrow cultivation have been recorded in the north of the survey area. Normally one would associate the positive (black) response with a furrow which has infilled with more magnetic topsoil and the negative (white response) with the rig. However, on this site that may be reversed with the furrow showing as a relative negative anomaly due to it being infilled with 'clean' sand. In either case the responses from the rig and furrow cultivation are extremely strong. This could suggest that the cultivation is disturbing earlier enhanced deposits within the area. This could explain why the responses weaken to the south and west, if the strong rig and furrow is overlying significant settlement deposits. However, whether that enhancement is due to natural variations or archaeological deposits is uncertain. There is some suggestion of different phases of rig and furrow cultivation. This is most noticeable in the Filtered Data plot, Figure 3, which has had a filter applied to remove the responses from rig and furrow cultivation. Although it has introduced artefacts into the data it is useful to visualise anomalies potentially not associated with the past cultivation. Most of the responses from the rig and furrow have been filtered out with the remnants of the responses suggesting a slightly different alignment and spacing.

4.3 Throughout the survey area numerous anomalies of potential archaeological significance have been detected. For ease of discussion the anomalies are grouped and discussed by their form and strength.

4.4 Two well-defined linear anomalies (3), on an approximate east-west alignment, cross the centre of the area and are visible on the AP's. It is likely that these indicate former field divisions. Anomalies suggestive of larger enclosures have been detected in apparent association with the southern of these presumed field boundaries. The response (4), in the west, suggest a possible sub-circular enclosure some 20m by 26m. To the east the data suggests a possible rectangular enclosure (5) approximately 20m by 8m.

4.5 Weaker trends (6) on comparable alignments to (3) are apparent throughout the survey area. These (6) may be due to natural variations given they follow the natural line of the raised beach.

4.6 An interrupted linear response (7), on an approximately NNE-SSW alignment, is also evident in the centre of the survey area and may also indicate a former field division or trackway. Although this is not as well-defined as (3), it is discernible on the AP's.

4.7 In the southwest of the area a cluster of distinct sub-circular responses (8) have been recorded which correspond with features visible on the AP's. The responses are approximately 8m in diameter and relatively strong with a consistent negative component (i.e. the response is suggestive of anthropogenic enhancement rather than modern ferrous material). The nature, form and strength of these responses suggest possible settlement

features with their strength potentially being due to burning and / or midden deposits. A comparable response (9) may have been recorded along the southern limits of the survey area.

4.8 Throughout the area several large (5m – 8m) pit type anomalies (10) have been detected. These are not as strong as those (6 & 7) recorded in the south and have a slightly different form. However, this could be due to variations in the preservation of the buried deposits

4.9 A concentration of linear and curvilinear anomalies has been detected in the centre of the survey area. While some (11) are relatively well-defined and show good correlation with the AP's, others (12) are more ephemeral. The weaker strength of these anomalies may be due to their nature, for example ritual rather than settlement. However, it is possible that the weaker responses are due to truncation of the features which has resulted in less magnetically enhanced material surviving *in situ.*

4.10 Several additional linear and pit type anomalies have been noted throughout the southern field, which may be of archaeological interest in particular (13).

4.11 The origin of the linear responses (14) in the south of the survey area is unclear. There is some suggestion they might extend to the northeast (15). While the responses may indicate a large enclosure, they could have a natural or agricultural origin. The negative responses (16) along the north-eastern limits of the survey area are thought to have a modern origin.

4.12 The data within the northern field is dominated by strong responses from the rig and furrow cultivation. Although anomalies (17) have been noted in the northwest of the field, which are comparable to anomalies (10) seen in the southern field, their origin is less clear. Their nature and form suggest a possible natural origin, although an archaeological one cannot be dismissed.

4.13 The data in Figure 3 suggests that there is a general area of increased response (18) in the east of the northern field which may indicate the presence of earlier archaeological deposits. The results are not particularly coherent suggesting that subsequent cultivation may have significantly disturbed the underlying deposits.

4.14 The linear anomalies (19) in the northern field are thought to be due to former field boundaries and / or possibly buried pipe / drains.

4.15 The broad anomaly (20) in the south of the survey area is visible on AP's and is thought to have a natural origin.

5. Conclusions

5.1 The site responded well to gradiometer survey with a wide variety of anomalies being detected across the survey area and shows excellent correlation with the aerial photographs of the area while providing greater detail.

5.2 The strongest responses are due to a gas pipe and rig and furrow cultivation. Several linear anomalies suggesting past field divisions have been detected.

5.3 A cluster of anomalies indicative of possible settlement features has been detected together with weaker, more ephemeral, responses of likely archaeology significance. Additional anomalies suggestive of larger enclosures have also been detected. The variation in the nature and form of responses suggests the potential for different phases of activity across the site.

List of Figures