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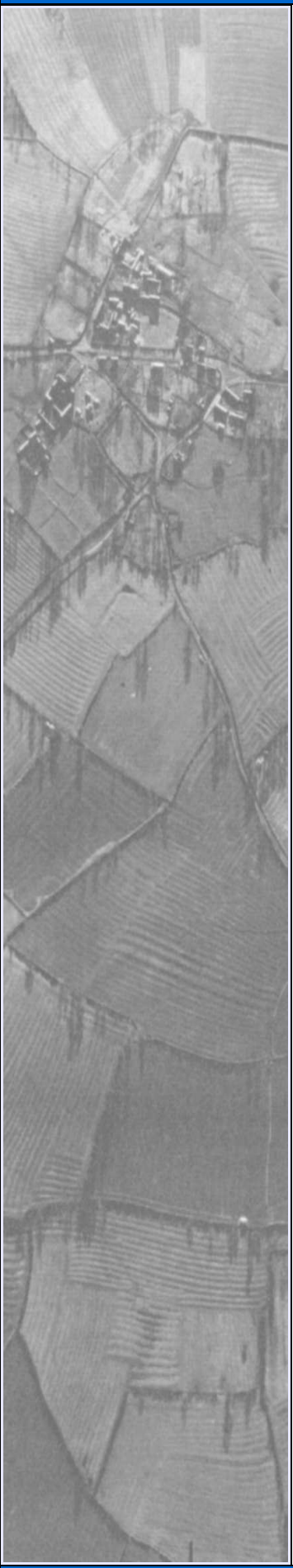

Land to the rear of Avon Mills Malmesbury, Wiltshire

MAGNETOMETER SURVEY REPORT

for

Prospect Archaeology

on behalf of

Simons Developments

David Sabin and Kerry Donaldson

October 2011

Ref. no. 378

ARCHAEOLOGICAL SURVEYS LTD

Land to the rear of Avon Mills
Malmesbury, Wiltshire

Magnetometer Survey

for

Prospect Archaeology

on behalf of

Simons Developments

Fieldwork by David Sabin
Report by David Sabin BSc (Hons) MIFA and Kerry Donaldson BSc (Hons)

Survey date - **5th October 2011**
Ordnance Survey Grid Reference – **ST 93643 86850**

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CONTENTS

SUMMARY....1

1 INTRODUCTION....1

1.1 Survey background....1

1.2 Survey objectives and techniques....1

1.3 Site location, description and survey conditions....2

1.4 Site history and archaeological potential....2

1.5 Geology and soils....2

2 METHODOLOGY....3

2.1 Technical synopsis....3

2.2 Equipment configuration, data collection and survey detail....3

2.3 Data processing and presentation....5

3 RESULTS....6

3.1 General overview....6

3.2 List of anomalies....7

4 DISCUSSION....9

5 CONCLUSION....9

6 REFERENCES....10

Appendix A – basic principles of magnetic survey....11

Appendix B – data processing notes....12

Appendix C – survey and data information....13

Appendix D – digital archive....14

LIST OF FIGURES

Figure 01 Map of survey area (1:25 000)

Figure 02 Referencing information (1:1000)

Figure 03 Greyscale plot of raw magnetometer data (1:1000)

Figure 04 Greyscale plot of processed magnetometer data (1:1000)

Figure 05 Abstraction and interpretation of magnetic anomalies (1:1000)

LIST OF TABLES

Table 1: Bartington fluxgate gradiometer sensor calibration results.....4

Table 2: List and description of interpretation categories.....7

SUMMARY

A magnetometer survey was commissioned by Prospect Archaeology Ltd, on behalf of Simons Developments, and carried out by Archaeological Surveys Ltd on land to the rear of Avon Mills, Malmesbury, Wiltshire. The magnetometer survey located numerous positive linear, curvilinear, rectilinear and discrete anomalies which relate to cut features with archaeological potential in the southern part of the survey area. These include enclosure ditches with internal features, pit-like features and a possible trackway that may relate to a Romano-British settlement. Roman pottery sherds were visible on the field surface in the vicinity of the anomalies and two Roman brooches are recorded from within the site. In the northern part of the survey area, a series of parallel linear anomalies indicate former ridge and furrow. An irregularly shaped positive linear anomaly may indicate a former quarry edge and this appears to be overlain by the ridge and furrow suggesting it is an early feature.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Prospect Archaeology Ltd, on behalf of Simons Developments, to carry out a magnetometer survey on land to the rear of Avon Mills in Malmesbury, Wiltshire. The site has been outlined for potential development and the survey forms part of an archaeological assessment of the site.

1.1.2 The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeological Surveys (2011) and issued to Melanie Pomeroy-Kellinger, County Archaeologist for Wiltshire Council, prior to commencing the fieldwork.

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use magnetometry to locate geophysical anomalies that may be archaeological in origin, so that they may be assessed prior to development of the site.

1.2.2 The methodology is considered an efficient and effective approach to archaeological prospection. The survey and report generally follow the recommendations set out by: English Heritage, 2008, *Geophysical survey in archaeological field evaluation*; and Institute for Archaeologists, 2002, *The use of Geophysical Techniques in Archaeological Evaluations*.

1.3 Site location, description and survey conditions

1.3.1 The site lies to the rear of Avon Mills in Malmesbury and is bounded to the east by the A429 and west by the B4042 and Avon Mills, see Fig01 below. The central OS Grid Reference is ST 93643 86850.

1.3.2 The survey covers approximately 2ha of land within a field that contained maize stubble at the time of survey. The land slopes gently down towards the north but is notably higher than buildings immediately beyond the western boundary. The south western part of the field contains a small area of trees and rough ground that mark the eastern side of a quarry depression that extends to the west, beyond the field boundary in the direction of Avon Mills.

1.3.3 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data. Weather conditions during the survey were variable with rain showers and high winds.

1.4 Site history and archaeological potential

1.4.1 The Wiltshire Sites and Monuments Record indicates that fragments of two Romano-British brooches have been found within the site. Roman pottery (mainly greyware with simple rims) was noted on the field surface during the survey and appeared to be concentrated within the south eastern quarter of the field. In addition, a widespread scatter of medieval pottery sherds was noted on the field surface (typically Minety wares) and these were often well abraded, suggesting dumping and manuring of agricultural land during the medieval period.

1.4.2 There is prehistoric settlement and activity within the town of Malmesbury, with evidence for the town walls being established on an Iron Age hillfort. Several isolated Romano-British finds have been recorded within the surrounding area and also an extensive settlement east of Marsh Farm, some 1.3km to the north east. During the early medieval period the nucleus for the first monastery was established by the Irish Monk Maildulph, in approximately 642AD, with the Abbey substantially completed by 1080. To the west, the River Avon has been utilised for milling since at least the 13th century, and to the south lies the site of the 13th century hospital of St Mary Magdalene. A medieval groat has also been found immediately to the east and a medieval buckle and buckle plate to the south.

1.4.3 Due to the presence of archaeological sites and findspots in the vicinity there is some potential to find geophysical anomalies that relate to archaeological features within the site.

1.5 Geology and soils

1.5.1 The underlying geology across the very southern and southeastern tip is mudstone from the Kellaways Clay Member, with the central south eastern part limestone from the Cornbrash Formation and the north western part

mudstone from the Forest Marble Formation (BGS, 2010).

1.5.2 The overlying soil across the survey area is likely to be from the Sherborne association, which is a brown rendzinas (Soil Survey of England and Wales, 1983).

1.5.3 Magnetometry survey carried out across similar soils has produced good results. The underlying geology and soils are therefore considered acceptable for magnetic survey.

2 METHODOLOGY

2.1 Technical synopsis

2.1.1 Magnetometry survey records localised magnetic fields that can be associated with features formed by human activity. Magnetic susceptibility and magnetic thermoremnance are factors associated with the formation of localised fields. Additional details are set out below and within Appendix A.

2.1.2 Iron minerals within the soil may become altered by burning and the break down of biological material; effectively the magnetic susceptibility of the soil is increased, and the iron minerals become magnetic in the presence of the Earth's magnetic field. Accumulations of magnetically enhanced soils within features, such as pits and ditches, may produce magnetic anomalies that can be mapped by magnetic prospection.

2.1.3 Magnetic thermoremnance can occur when ferrous minerals have been heated to high temperatures such as in a kiln, hearth, oven etc. On cooling, a permanent magnetisation may be acquired due to the presence of the Earth's magnetic field. Certain natural processes associated with the formation of some igneous and metamorphic rock may also result in magnetic thermoremnance.

2.1.4 The localised variations in magnetism are measured as sub-units of the Tesla, which is a SI unit of magnetic flux density. These sub-units are nano Teslas (nT), which are equivalent to 10^{-9} Tesla (T).

2.2 Equipment configuration, data collection and survey detail

2.2.1 The detailed magnetic survey was carried out using Bartington Grad 601-2 gradiometers. The instruments effectively measure a magnetic gradient between two fluxgate sensors mounted vertically 1m apart. Two sets of sensors are mounted on a single frame 1m apart horizontally.

2.2.2 The instruments are extremely sensitive and are able to measure magnetic variation to 0.01nanoTesla (nT), with an effective resolution of 0.03nT. The data are limited to ±100nT when surveying with the highest sensitivity. All

readings are saved to an integral data logger for analysis and presentation.

2.2.3 The instruments are operated according to the manufacturer's instructions with consideration given to the local conditions. An adjustment procedure is required, prior to collection of data, in order to balance the sensors and remove the effects of the Earth's magnetic field; further adjustment is required during the survey due to instrument drift often associated with temperature change.

2.2.4 It can be very difficult to obtain optimum balance for the sensors due to localised magnetic vectors that may be associated with large ferrous objects, geological/pedological features, 'magnetic debris' within the topsoil and natural temperature fluctuations. Imperfect balance results in a heading error often visible as striping within the data; this can be effectively removed by software processing and generally has little effect on the data unless extreme.

2.2.5 The Bartington gradiometers undergo regular servicing and calibration by the manufacturer. A current assessment of the instruments is shown in Table 1 below.

Sensor type and serial numbers	Bartington Grad - 01 – 1000 Nos. 084 & 085
Date of certified calibration/service	Sensors 084 and 085 - 6th August 2010 (due Aug 2012)
Bandwidth	12Hz (100nT range) both sensors
Noise	<100pT peak to peak
Adjustable errors	<2nT

Table 1: Bartington fluxgate gradiometer sensor calibration results

The instruments were considered to be in good working order prior to the survey, with no known faults or defects.

2.2.6 Data were collected at 0.25m centres along traverses 1m apart. The survey area was separated into 30m by 30m grids (900m²) giving 3600 recorded measurements per grid. This sampling interval is very effective at locating archaeological features and is the recommended methodology for archaeological prospection (English Heritage, 2008).

2.2.7 The survey grids were set out to the Ordnance Survey OSGB36 datum using a Penmap RTK GPS and oriented parallel to the long axis of the site.. The GPS is used in conjunction with Leica's SmartNet service, where positional corrections are sent via a mobile telephone link. Positional accuracy of around 10 – 20mm is possible using the system. The instrument is regularly checked against the ETRS89 reference framework using Ordnance Survey ground marker C1ST7784 (Horton).

2.3 Data processing and presentation

2.3.1 Magnetometry data downloaded from the Grad 601-2 data logger are analysed and processed in specialist software known as ArcheoSurveyor. The software allows greyscale and trace plots to be produced for presentation and display. Survey grids are assembled to form an overall composite of data (composite file) creating a dataset of the complete survey area. Appendix C contains specific information concerning the survey and data attributes and is derived directly from ArcheoSurveyor; this should be used in conjunction with information provided by Figure 02.

2.3.2 Only minimal processing is carried out in order to enhance the results of the survey for display. Raw data are always analysed, as processing can modify anomalies. The following schedule sets out the data and image processing used in this survey:

- clipping of the raw data at ±30nT to improve greyscale resolution,
- clipping of processed data at ±5nT to enhance low magnitude anomalies,
- de-stagger is used to enhance linear anomalies,
- zero median/mean traverse is applied in order to balance readings along each traverse.

Reference should be made to Appendix B for further information on the specific processes carried out on the data. Appendix C metadata includes details on the processing sequence used.

2.3.3 An abstraction and interpretation is offered for all geophysical anomalies located by the survey. A brief summary of each anomaly, with an appropriate reference number, is set out in list form within the results (Section 3) to allow a rapid and objective assessment of features within the survey area. Where further interpretation is possible, or where a number of possible origins should be considered, more subjective discussion is set out in Section 4.

2.3.4 The main form of data display prepared for this report is the greyscale plot. Both 'raw' and 'processed' data have been shown followed by an abstraction and interpretation plot. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing.

2.3.5 Graphic raster images in bitmap format (.BMP) are initially prepared in ArcheoSurveyor. Regardless of survey orientation, data captured along each traverse are displayed and processed by ArcheoSurveyor from left to right. Prior to displaying against base mapping, raster graphics require a rotation of 56° anticlockwise to restore north to the top of th e image. Greyscale images are rotated by AutoCAD.

2.3.6 The raster images are combined with base mapping using ProgeCAD Professional 2009 and AutoCAD LT 2007, creating DWG file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. Quality can be compromised by rotation of graphics in

order to allow the data to be orientated with respect to grid north; this is considered acceptable as the survey results are effectively georeferenced allowing relocation of features using GPS, resection method etc.. A digital archive, including raster images, is produced with this report allowing separate analysis if necessary, see Appendix D below.

3 RESULTS

3.1 General overview

3.1.1 The detailed magnetic survey was carried out over approximately 2ha. Geophysical anomalies located can be generally classified as positive linear and discrete positive responses of archaeological potential, positive and negative linear anomalies of an uncertain origin, linear anomalies of an agricultural origin, areas of magnetic debris and disturbance and strong discrete dipolar anomalies relating to ferrous objects. Anomalies located within each survey area have been numbered and are described below with subsequent discussion in Section 4.

3.1.2 Data are considered representative of the magnetic conditions and magnetic anomalies within the site. Zones of magnetic disturbance have been caused by modern ferrous objects, including a steel gate and water trough, and by underground services. Although it is possible the disturbance had obscured minor anomalies of archaeological potential, the areas involved are only a small fraction of the site. Data was not captured from a small area of trees and rough ground marking the eastern extent of a former quarry.

3.1.3 The list of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the survey. A basic explanation of the characteristics of the magnetic anomalies is set out for each category in order to justify interpretation, a basic key is indicated to allow cross referencing to the abstraction and interpretation plot. CAD layer names are included to aid reference to associated digital files (.dwg/.dxf). Sub-headings are then used to group anomalies with similar characteristics for each survey area.

Report sub-heading **CAD layer names and plot colour**	**Description and origin of anomalies**
Anomalies with archaeological potential AS-ABST MAG POS LINEAR ARCHAEOLOGY AS-ABST MAG POS DISCRETE ARCHAEOLOGY	Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as pits, ring ditches, enclosures, etc..
Anomalies with an uncertain origin AS-ABST MAG POS LINEAR UNCERTAIN AS-ABST MAG NEG LINEAR UNCERTAIN AS-ABST MAG POS DISCRETE UNCERTAIN	The category applies to a range of anomalies where there is not enough evidence to confidently suggest an origin. Anomalies in this category may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered. Positive anomalies are indicative of magnetically enhanced soils that may form the fill of 'cut' features or may be

	produced by accumulation within layers or 'earthwork' features; soils subject to burning may also produce positive anomalies. Negative anomalies are produced by material of comparatively low magnetic susceptibility such as stone and subsoil.
Anomalies with an agricultural origin AS-ABST MAG AGRICULTURAL AS-ABST MAG RIDGE AND FURROW	The anomalies are often linear and form a series of parallel responses or are parallel to extant land boundaries. Where the response is broad, former ridge and furrow is likely; narrow response is often related to modern ploughing.
Anomalies associated with magnetic debris AS-ABST MAG DEBRIS AS-ABST MAG STRONG DIPOLAR	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. It often occurs where there has been dumping or ground make-up and is related to magnetically thermoremnant materials such as brick or tile or other small fragments of ferrous material. This type of response is occasionally associated with kilns, furnace structures, or hearths and may therefore be archaeologically significant. It is also possible that the response may be caused by natural material such as certain gravels and fragments of igneous or metamorphic rock. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.
Anomalies with a modern origin AS-ABST MAG DISTURBANCE	The magnetic response is often strong and dipolar indicative of ferrous material and may be associated with extant above surface features such as wire fencing, cables, pylons etc.. Often a significant area around such features has a strong magnetic flux which may create magnetic disturbance; such disturbance can effectively obscure low magnitude anomalies if they are present. Fluxgate sensors may respond erratically and with hysteresis adjacent to strong magnetic sources.

Table 2: List and description of interpretation categories

3.2 List of anomalies

Anomalies of archaeological potential

(1) – At least two interconnecting positive curvilinear anomalies appear to relate to sub-circular enclosure ditches with internal features and are associated with anomalies (2) to (5).

(2) – Positive linear anomalies relating to linear, curvilinear and rectilinear ditch-like features likely to be of archaeological potential.

(3) – Positive sub-rectlinear anomalies located towards the southern edge of the survey area appear to relate to small enclosures.

(4) – Two parallel positive linear anomalies extend between anomalies (1) and (3) and may relate to a trackway. There is some evidence that they may extend northwards beyond anomalies (1).

(5) – Positive discrete, linear, curvilinear and rectilinear anomalies in the centre of the site relate to pits and ditches and are likely to be associated with anomalies (1) and (2).

(6) – A positive linear anomaly extends across the central part of the survey area. It is possible that it bounds the archaeological features (1) to (5) which appear to be located to the south west of it.

Anomalies with an uncertain origin

(7) – An irregularly shaped positive linear anomaly located in the northern part of the survey area. This type of response may indicate the edge of a former quarry, although there is no visible evidence within the field, and the land to the north is also overlain by former ridge and furrow.

(8) – Discrete positive anomalies in the northern part of the survey area appear to relate to “pit-like” features, and although they may be anthropogenic in origin, their archaeological potential cannot be determined.

(9) – Close to, and parallel with the northern field boundary, is a series of positive and negative linear anomalies. Although they may relate to agricultural activity, this is not certain.

(10) – Short positive linear and curvilinear anomalies located in the northern part of the survey area are of uncertain origin.

Anomalies with an agricultural origin

(11) – A series of parallel linear anomalies are located in the northern part of the survey area and oriented almost north to south. These are likely to relate to former ridge and furrow and there is some evidence to suggest that they extend further south within the survey area.

(12) – Linear anomalies, parallel with, and located close to the current field boundaries relates to modern agricultural activity. The plough trend is parallel with the eastern field boundary and has been effectively removed during data processing.

Anomalies associated with magnetic debris

(13) – A zone of strongly magnetic debris is located close to the western edge of the site. This magnetic debris is likely to relate to ferrous and other magnetically thermoremant material used within the backfill of a quarry hole which extends to the western field boundary.

(14) – Strong, discrete, dipolar anomalies are responses to ferrous objects within the topsoil.

Anomalies with a modern origin

(15) – Magnetic disturbance along the north western edge of the survey area, may be a response to a buried service located to the west of the survey area.

4 DISCUSSION

4.1.1 The southern part of the site contains numerous discrete, linear, rectilinear and curvilinear anomalies that relate to former pits and ditches with archaeological potential. Within this area a fragment of a decorated trumpet brooch and fragments of a Colchester type one-piece bow brooch, plus a fragment of possible Roman bronze wire, are recorded on the Wiltshire SMR. Roman pottery sherds were also evident on the surface at the time of survey strongly suggesting that the geophysical anomalies are associated with a Romano-British farmstead that has undergone numerous changes and adaptations through time.

4.1.2 Medieval pottery fragments were visible on the field surface over much of the survey area and these were mainly well abraded and showed no particular concentration. Fragments of Minety ware were very commonly represented within this material. Although it is possible that some of the anomalies interpreted as having archaeological potential are medieval in date, their morphology and association with Roman pottery and brooch finds tend to support a Romano-British interpretation.

4.1.3 In the northern part of the site an irregularly shaped linear anomaly (7) may indicate the edge of a former quarry, although this is not certain as there is little supporting topographic evidence in this part of the site. It appears to be partially overlain by former ridge and furrow, suggesting a very early date, and it may represent a quarry edge where shallow stone has been exploited for use within the locality, possibly within the early medieval town nearby.

5 CONCLUSION

5.1.1 Magnetometry has provided widespread evidence of former ditch-like and pit-like features within the survey area. Many anomalies within the southern half of the site appear to have archaeological potential. Their morphology and association with a scatter of Romano-British pottery sherds on the field surface, along with previous finds of Roman brooches, suggest that they are related to Roman activity, possibly a farmstead.

5.1.2 Anomalies within the northern part of the field include evidence of a possible former quarry face and ridge and furrow, the latter appear to overlie the possible quarry suggesting that it is an early feature. Other pit-like and linear anomalies could not be confidently interpreted.

6 REFERENCES

Archaeological Surveys, 2011. *Land to the rear of Avon Mills, Malmesbury, Wiltshire. Geophysical Survey Written Scheme of Investigation.*

British Geological Survey, 2010. *Geology of Britain viewer, 1:50 000 scale [online]* available from http://maps.bgs.ac.uk/geologyviewer/ [accessed 04/10/2011].

English Heritage, 2008. *Geophysical survey in archaeological field evaluation. Research and Professional Service Guideline No.1.* 2nd ed. Swindon: English Heritage.

Institute for Archaeologists, 2002. *The use of Geophysical Techniques in Archaeological Evaluations*. IFA Paper No. 6. IFA, University of Reading.

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 5 South West England.*

Wiltshire and Swindon Sites and Monument Record Information, 2008. *Field between Silk Mills & roundabout by Police Sn [online] available from http://history.wiltshire.gov.uk/smr/getsmr.php?id=5294 [accessed 4/10/2011].*

Appendix A – basic principles of magnetic survey

Iron minerals are always present to some degree within the topsoil and enhancement associated with human activity is related to increases in the level of magnetic susceptibility and thermoremnant material.

Magnetic susceptibility is an induced magnetism within a material when it is in the presence of a magnetic field. This can be thought of as effectively permanent due to the presence of the Earth's magnetic field.

Thermoremnant magnetism occurs when ferrous material is heated beyond a specific temperature known as the Curie Point. Demagnetisation occurs at this temperature with re-magnetisation by the Earth's magnetic field upon cooling.

Enhancement of magnetic susceptibility can occur in areas subject to burning and complex fermentation processes on biological material; these are frequently associated with human settlement. Thermoremnant features include ovens, hearths, and kilns. In addition thermoremnant material such as tile and brick may also be associated with human activity and settlement.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil can create an area of enhancement compared with surrounding soils and subsoils into which the feature is cut. Mapping enhanced areas will produce linear and discrete anomalies allowing an assessment and characterisation of hidden subsurface features.

It should be noted that areas of negative enhancement can be produced from material having lower magnetic properties compared to the topsoil. This is common for many sedimentary bedrocks and subsoils which were often used in the construction of banks and walls etc. Mapping these 'negative' anomalies may also reveal archaeological features.

Magnetic survey or magnetometry can be carried out using a fluxgate gradiometer and may be referred to as gradiometry. The gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the upper sensor measures the Earth's magnetic field as does the lower sensor but this is influenced to a greater degree by any localised buried field. The difference between the two sensors will relate to the strength the magnetic field created by the buried feature. If no enhanced feature is present the field measured by both sensors will be similar and the difference close to zero.

There are a number of factors that may affect the magnetic survey and these include soil type, local geology and previous human activity. Situations arise where magnetic disturbance associated with modern services, metal fencing, dumped waste material etc., obscures low magnitude fields associated with archaeological features.

Appendix B – data processing notes

Clipping

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. It has been found that clipping data to ranges between ±5nT and ±1nT often improves the appearance of features associated with archaeology. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

Zero Median/Mean Traverse

The median (or mean) of each traverse is calculated ignoring data outside a threshold value, the median (or mean) is then subtracted from the traverse. The process is used to equalise slight differences between the set-up and stability of gradiometer sensors and can remove striping. The process can remove archaeological features that run along a traverse so data analysis is also carried out prior its application.

De-stagger

Compensates for small positional errors within data collection by shifting the position of the readings along each traverse by a specified amount. Data lost at the end of each traverse are extrapolated from adjacent value in the same row.

Deslope

Corrects for striping and distortion caused by metal objects/services etc.. The process calculates a curve based on a polynomial best fit mathematical function for each traverse. This curve is then subtracted from the actual data.

Edge Match

Calculates the mean of the 2 lines (rows or columns) of data either side of the edge to match. It then subtracts the difference between the means from all datapoints in the selected area.

FFT (Fast Fourier Transform) spectral filtering

A mathematical process used to determine the frequency components of a traverse. Repetitive features, such as plough marks, produce characteristic spectral zones that can be suppressed allowing greyscale images to appear clearer.

Appendix C – survey and data information

Raw magnetometry data

COMPOSITE
Filename: J378-mag-raw.xcp
Description:
Instrument Type: Bartington (Gradiometer)
Units: nT
Surveyed by: on 05/10/2011
Assembled by: on 05/10/2011
Direction of 1st Traverse: 45 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702

Dimensions
Composite Size (readings): 960 x 150
Survey Size (meters): 240 m x 150 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 30.00
Min: -30.00
Std Dev: 4.91
Mean: -0.62
Median: -0.22
Composite Area: 3.6 ha
Surveyed Area: 1.7409 ha

Processes: 2
1 Base Layer
2 Clip from -30.00 to 30.00 nT

Source Grids: 31
1 Col:0 Row:1 grids\29.xgd
2 Col:0 Row:2 grids\30.xgd
3 Col:0 Row:3 grids\31.xgd
4 Col:1 Row:1 grids\26.xgd
5 Col:1 Row:2 grids\27.xgd
6 Col:1 Row:3 grids\28.xgd
7 Col:2 Row:0 grids\22.xgd
8 Col:2 Row:1 grids\23.xgd
9 Col:2 Row:2 grids\24.xgd
10 Col:2 Row:3 grids\25.xgd
11 Col:3 Row:0 grids\17.xgd
12 Col:3 Row:1 grids\18.xgd
13 Col:3 Row:2 grids\19.xgd
14 Col:3 Row:3 grids\20.xgd
15 Col:3 Row:4 grids\21.xgd
16 Col:4 Row:0 grids\12.xgd
17 Col:4 Row:1 grids\13.xgd
18 Col:4 Row:2 grids\14.xgd
19 Col:4 Row:3 grids\15.xgd
20 Col:4 Row:4 grids\16.xgd
21 Col:5 Row:0 grids\07.xgd
22 Col:5 Row:1 grids\08.xgd
23 Col:5 Row:2 grids\09.xgd
24 Col:5 Row:3 grids\10.xgd
25 Col:5 Row:4 grids\11.xgd
26 Col:6 Row:0 grids\03.xgd
27 Col:6 Row:1 grids\04.xgd
28 Col:6 Row:2 grids\05.xgd
29 Col:6 Row:3 grids\06.xgd
30 Col:7 Row:2 grids\01.xgd
31 Col:7 Row:3 grids\02.xgd

Processed magnetometry data

Filename: J378-mag-proc.xcp

Stats
Max: 5.00
Min: -5.00
Std Dev: 2.23
Mean: -0.14
Median: -0.15
Composite Area: 3.6 ha
Surveyed Area: 1.7406 ha

Processes: 6
1 Base Layer
2 De Stagger: Grids: 25.xgd Mode: Both By: 1 intervals
3 De Stagger: Grids: 20.xgd Mode: Both By: -1 intervals
4 De Stagger: Grids: 26.xgd Mode: Both By: 1 intervals
5 DeStripe Mean Traverse: Grids: All Threshold: 1 SDs
6 Clip from -5.00 to 5.00 nT

Source Grids: 31 as above

Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at Castle Combe, Wiltshire (see inside cover for address). Data are backed-up onto an on-site data storage drive and at the earliest opportunity data are copied to CD ROM for storage on-site and off-site. Digital data may be supplied to the client on CD ROM, see below.

Surveys are reported on in hardcopy (recycled paper) using A4 for text and A3 for plots (all plots are scaled for A3). The distribution of both hardcopy report and digital data is considered the responsibility of the Client unless explicitly stated in the survey Brief, Written Scheme of Investigation or other contractual agreement.

This report has been prepared using the following software on a Windows XP platform:

- ArcheoSurveyor version 2.5.9.4 (geophysical data analysis),
- ProgeCAD Professional 2009 (report graphics),
- AutoCAD LT 2007 (report figures),
- OpenOffice.org 3.0.1 Writer (document text),
- PDF Creator version 0.9 (PDF archive).

Digital data include the following files:

- ArcheoSurveyor grid and composite files for all geophysical data,
- CSV files for raw and processed composites,
- geophysical composite file graphics as Bitmap images,
- AutoCAD DWG files in 2000 and 2007 versions,
- report text as OpenOffice.org ODT file,
- report text as Word 2000 doc file,
- report text as rich text format (RTF),
- report text as PDF,
- PDFs of all figures.

The CD ROM structure is formed from a tree of directories under the title J378 Malmesbury – CD. Directory titles include Data, Documentation, CAD and PDFs. Multiple directories exist under Data and hold Grid, Composite and Graphic files with CSV composite data held in Export.

The CAD file contains externally referenced graphics that are rotated with separate A3 size layouts for each figure. Layouts are fixed using frozen layers and named views allowing straightforward plotting or analysis on screen. (Note – CAD files are prepared using AutoCAD's e Transmit function to produce a directory containing the digital drawing along with any externally referenced graphics which may need reloading).