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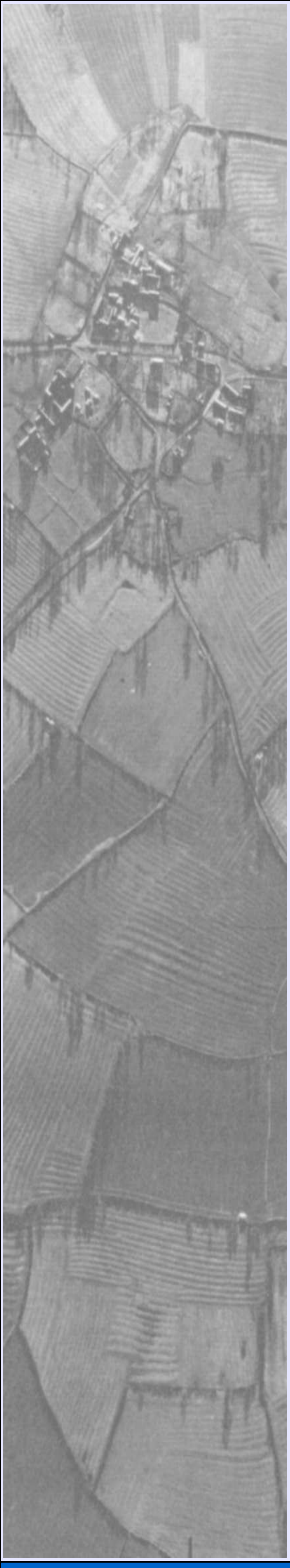

# Hole Ground
# Wookey Hole
# Somerset

## MAGNETOMETER SURVEY REPORT

for

# AC Archaeology

David Sabin and Kerry Donaldson

December 2013

Ref. no. 518

ARCHAEOLOGICAL SURVEYS LTD

# Hole Ground
# Wookey Hole
# Somerset

Magnetometer Survey Report

for

**AC Archaeology**

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

Survey dates – 6th & 13th December 2013
Ordnance Survey Grid Reference – **ST 53380 47920**

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## SUMMARY

A detailed magnetometer survey was carried out by Archaeological Surveys Ltd at the request of AC Archaeology. The survey was conducted within a field known as Hole Ground at Wookey Hole, Somerset, which lies to the east of the Wookey Hole ravine. Archaeological excavations in the north western part of the site during the 1950s uncovered a series of Iron Age and Roman structures just below the ground surface. The site also contains a series of earthworks relating to lynchets. The survey responded to the lynchets as a series of positive and negative anomalies relating to increased depth of topsoil and rock cut terraces. A number of similar responses were evident towards the north eastern corner of the site, but it is possible that these relate to holloways. A number of linear and discrete anomalies were located within the north western corner of the survey area, but none could be easily identified as archaeological features. While it is possible that they are associated with the Iron Age or Roman structures it is also possible that the relate to the disturbed and backfilled remains of the excavations. Evidence for infilled quarrying and ground make up were also located within the eastern part of the site.

## 1 INTRODUCTION

### *1.1 Survey background*

1.1.1 Archaeological Surveys Ltd was commissioned by AC Archaeology to undertake a magnetometer survey of an area of land at Wookey Hole in Somerset. The survey forms part of an archaeological assessment of the site. The survey area is located on agricultural land above and to the east of Wookey Hole ravine and its associated caves.

### *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. The methodology is considered an efficient and effective approach to archaeological prospection.

1.2.2 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*. The work has been carried out to the Institute for Archaeologists (2011) *Standard and Guidance for Archaeological Geophysical Survey.*

### *1.3 Site location, description and survey conditions*

1.3.1 The site is located at at Hole Ground, Wookey Hole in Somerset. It is centred on Ordnance Survey National Grid Reference (OS NGR) ST 53380 47920, see Figures 01 and 02.

1.3.2 The geophysical survey covers approximately 3.2ha within a pasture field used for grazing horses. It contains several large lynchets, oriented almost north to south, and there are other earthwork features that may relate to possible holloways in the north eastern part of the site. The land slopes down steeply from approximately 125m ODN in the northern part of the site to approximately 70m ODN at the south western corner. The land also slopes down steeply from east to west.

1.3.3 The field contains a small barn or stable near the entrance at the south western corner. In addition, there are building groundworks close to the south eastern corner of the field. An area of approximately 0.5ha in the south eastern part of the field had clearly been recently made up. With the exception of the eastern field boundary, the field edges were poorly defined due to the presence of brambles. Some clumps of brambles and thorn were also located in the vicinity of the lynchets.

1.3.4 The sloping ground across the site provided difficult conditions for the collection of magnetometry data. Very steep land in the vicinity of the lynchets was also very difficult to traverse. Clumps of thorn and briar within the field also impeded survey. Weather conditions during the survey were variable with fine conditions on the 6th December and very heavy rain on the 13th December.

### *1.4 Site history and archaeological potential*

1.4.1 An appraisal of the heritage assets associated with the site has been carried out by AC Archaeology (2013). During the 1950s, excavations in the north western corner of the site uncovered building remains associated with an Iron Age round house and a sequence of structures and occupational debris from throughout the Roman period. The site lies above several caves on the eastern side of the Wookey Hole ravine, including the Scheduled Monument of Badger Hole Cave, situated immediately below the site. The majority of these caves contain evidence for Palaeolithic and Mesolithic activity and also for Roman deposits and burials. The site also contains a series of strip lynchets oriented north north east to south south west. These well preserved earthworks are over 2m in height in places. The central eastern part of site is also mapped from at least 1886 as containing the remains of a former quarry.

1.4.2 The presence of Iron Age and Romano-British occupation within the site indicates a potential for the survey to locate anomalies associated with possible structural remains and occupational debris. The presence of large lynchets are also likely to result in associated anomalies.

### *1.5 Geology and soils*

1.5.1 The underlying geology is Triassic Mercia Mudstone (Dolomitic Conglomerate) (BGS, 2013).

1.5.2 The overlying soils across the site are from the Crwbin association which are brown rankers. These consist of very shallow and shallow, well drained loamy soils often on steep slopes (Soil Survey of England and Wales, 1983).

1.5.3 Detailed magnetometry carried out over similar soils and geology have provided useful results. However, given the often shallow geology, many anomalies can be associated with natural features and difficult to differentiate from those with an anthropogenic origin.

# 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 a Bartington Grad 601-2 gradiometer. The instrument effectively measures 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 instrument is extremely sensitive and is 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 instrument is 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 gradiometer undergoes regular servicing and calibration by the manufacturer. A current assessment of the instrument is shown in Table 1 below.

| | |
|---|---|
| **Sensor type and serial numbers** | Bartington Grad - 01 – 1000<br>Nos. 085 and 396 |
| **Date of certified calibration/service** | Sensors 085 & 396 – October 2013 (due Oct 2016) |
| **Bandwidth** | 12Hz (100nT range) both sensors |
| **Noise** | <100pT peak to peak |
| **Adjustable errors** | <2nT |

Table 1: Bartington fluxgate gradiometer sensor calibration results

The instrument was 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 Leica GS10 RTK GPS. 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).

2.2.8 The fixed orientation of survey grids based on the OSGB36 datum was considered appropriate given that the orientation of land boundaries was variable and consequently partial survey grids were unavoidable. Traverses were walked from west to east due to the majority of the site sloping down from north to south.

### 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 TerraSurveyor (formerly 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 TerraSurveyor; 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.

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 TerraSurveyor. Regardless of survey orientation, data captured along each traverse are displayed and processed by TerraSurveyor from left to right; this corresponds to a direction of west to east in the field and no rotation of the image is required.

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.

2.3.7 A digital archive is produced with this report, see Appendix D below. The main archive is held at the offices of Archaeological Surveys Ltd.

# 3 RESULTS

## *3.1 General assessment of survey results*

3.1.1 The detailed magnetic survey was carried out over 3.2ha within one field.

3.1.2 Magnetic anomalies located can be generally classified as positive and negative anomalies of an uncertain origin, linear anomalies of an agricultural origin, areas of magnetic debris and disturbance, strong discrete dipolar anomalies relating to ferrous objects and strong multiple dipolar linear anomalies relating to buried services or pipelines.

## *3.2 Statement of data quality*

3.2.1 Data are considered representative of the magnetic anomalies present within the site. Positional errors are present within the dataset due to steeply sloping land. Magnetic disturbance has been caused by modern ferrous material infilling a former quarry. Survey was not possible along steep terraces associated with lynchets. Areas of thorn and briar also prevented survey along the lynchets and around the periphery of the site.

## *3.3 Data interpretation*

3.3.1 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.

| **Report sub-heading**<br>**CAD layer names and plot colour** | **Description and origin of anomalies** |
|---|---|
| ***Anomalies with an uncertain origin***<br><br>AS-ABST MAG POS LINEAR UNCERTAIN<br>AS-ABST MAG NEG LINEAR UNCERTAIN<br>AS-ABST MAG POS DISCRETE UNCERTAIN<br>AS-ABST MAG POS UNCERTAIN<br>AS-ABST MAG NEG 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 relating to land management***<br><br>AS-ABST MAG TRACK | Single or multiple linear anomalies associated with present or mapped trackway. May be associated with magnetic debris. |
| ***Anomalies with an agricultural origin***<br><br>AS-ABST MAG LYNCHET | 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***<br><br>AS-ABST MAG DEBRIS<br>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***<br><br>AS-ABST MAG DISTURBANCE<br>AS-ABST MAG SERVICE | Fluxgate sensors may respond erratically and with hysteresis adjacent to strong magnetic sources. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction. |

Table 2: List and description of interpretation categories

## *3.4 List of anomalies*

Area centred on OS NGR 353380 147920, see Figures 04 & 05.

*Anomalies with an uncertain origin*

(1) – A number of positive discrete and linear anomalies are located in the north western corner of the survey area. There are also several short negative linear anomalies. This part of the site contains the remains of several buildings dating to the Iron Age and Roman periods, and it is possible that these anomalies are associated. However, it is not possible to determine if they relate to further features, or to the backfilled remains of those previously excavated. Several lynchets (10) appear to extend towards them or even over them.

(2) – A positive linear anomaly is located in the northern part of the survey area. It extends from the northern field boundary and appears to cross several lynchets. It is not possible to determine if this anomaly is an anthropogenic feature, such as a holloway, or if it is a naturally formed feature.

(3) – A positive linear anomaly extends towards anomaly (2) from the north east. Several other linear anomalies are located parallel to it and a number of discrete anomalies are located close to it. It is not possible to determine if these relate to cut

features or other forms of magnetic enhancement.

(4) – A short section of what appears to be a positive linear anomaly. It is not possible to determine the origin of the anomaly.

(5) – A positive linear anomaly may indicate a cut, ditch-like feature; however, it is parallel with the general trend of the lynchets (10) within the field.

(6 & 7) – In the north eastern part of the site are broad positive anomalies with associated negative responses. Although anomaly (6) is generally parallel with the lynchets within the field the response is different. Anomaly (7) is not parallel with the lynchets and it is possible that these anomalies are associated with a series of holloways.

(8) – A large number of weakly positive linear anomalies are located in the north eastern part of the site. The majority of them are oriented parallel with anomalies (5), (6) and (10) and although this type of response may indicate cut features, it is possible that they are naturally formed.

(9) – A number of positive linear and discrete anomalies are located in the southern part of the survey area. Although it is possible that they relate to cut features, there is no coherent pattern or morphology and their origin is uncertain.

*Anomalies with an agricultural origin*

(10) – A series of parallel broad positive and negative linear anomalies extend across the western half of the survey area. They are oriented north north east to south south west and are a response to a series of banks and terraces relating to strip lynchets. The positive response is likely to relate to an increased depth of topsoil within the embankments.

*Anomalies associated with land management*

(11) – A double negative linear anomaly and associated positive linear anomaly extends across the southern part of the survey area. This relates to a trackway that used to access a former quarry situated in the centre of the site (12) and is now used as a footpath.

*Anomalies associated with magnetic debris*

(12) – A large zone of very strongly magnetic debris is located in the central eastern part of the site. This relates to magnetic material that has been used to backfill a former quarry that was recorded on mapping from at least 1886 until 1970.

(13) – Several small patches of magnetic debris are evident to the west of anomaly (12). It is likely that they relate to dumped magnetically thermoremnant material.

(14) – A zone of magnetic debris is evident in the south eastern part of the survey area. This is associated with modern material used in ground make-up within this

part of the site.

*Anomalies with a modern origin*

(15) – A strong, multiple dipolar linear anomaly extends across the western part of the survey area and is a response to a buried water pipe that extends to a water trough at the southern edge of the site.

## 4 CONCLUSION

4.1.1 The detailed magnetometer survey located a number of anomalies within the site, although none could be confidently interpreted as archaeological in origin. A number of linear and discrete anomalies are clustered around the site of a series of structures dating to the Iron Age and Roman periods and excavated during the 1950s. However, it is not possible to determine if these anomalies are associated with archaeological features, such as ditches, pits and structures, or if they relate to backfilled material from the excavations. A number of positive linear anomalies have been located in the northern part of the survey area and while some may appear to relate to cut, ditch-like features, it is not possible to determine their origin.

4.1.2 The survey area contains a series of broad positive and negative anomalies which are responses to a number of linear earthwork banks associated with strip lynchets. It appears in the north western part of the survey area that these lynchets extend towards and possibly over the area containing the excavated Iron Age and Roman structures. Towards the north eastern corner of the site are a number of broad positive anomalies with associated negative responses and these may relate to holloways.

4.1.3 Zones of magnetic debris and disturbance indicate the location of a former quarry in the central eastern part of the site and recent ground make up towards the south eastern corner.

# 5 REFERENCES

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## 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 magnetometer data**

COMPOSITE
Filename: J518-mag-raw.xcp
Instrument Type: Bartington (Gradiometer)
Units: nT
Direction of 1st Traverse: 90 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32000

Dimensions
Composite Size (readings): 1200 x 270
Survey Size (meters): 300 m x 270 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: 11.65
Mean: -0.80
Median: 0.44
Composite Area: 8.1 ha
Surveyed Area: 2.97 ha

PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0

Processes: 3
1 Base Layer
2 Search & Replace 32702 With: Dummy
3 Clip from -30.00 to 30.00 nT

Source Grids: 55
1 Col:0 Row:2 grids\01.xgd
2 Col:0 Row:3 grids\02.xgd
3 Col:0 Row:5 grids\08.xgd
4 Col:0 Row:6 grids\09.xgd
5 Col:1 Row:2 grids\03.xgd
6 Col:1 Row:3 grids\04.xgd
7 Col:1 Row:4 grids\05.xgd
8 Col:1 Row:5 grids\06.xgd
9 Col:1 Row:6 grids\07.xgd
10 Col:2 Row:2 grids\10.xgd
11 Col:2 Row:3 grids\11.xgd
12 Col:2 Row:4 grids\12.xgd
13 Col:2 Row:5 grids\13.xgd
14 Col:2 Row:6 grids\14+15.xgd
15 Col:2 Row:7 grids\23.xgd
16 Col:2 Row:8 grids\24.xgd
17 Col:3 Row:2 grids\16.xgd
18 Col:3 Row:3 grids\17+19.xgd
19 Col:3 Row:4 grids\18+20.xgd
20 Col:3 Row:5 grids\21.xgd
21 Col:3 Row:6 grids\22.xgd
22 Col:3 Row:7 grids\25.xgd
23 Col:3 Row:8 grids\26.xgd
24 Col:4 Row:3 grids\27.xgd
25 Col:4 Row:4 grids\28.xgd
26 Col:4 Row:5 grids\29.xgd
27 Col:4 Row:6 grids\30.xgd
28 Col:4 Row:7 grids\31.xgd
29 Col:5 Row:1 grids\32.xgd
30 Col:5 Row:2 grids\33.xgd
31 Col:5 Row:3 grids\34.xgd
32 Col:5 Row:4 grids\35.xgd
33 Col:5 Row:5 grids\36.xgd
34 Col:5 Row:6 grids\38.xgd
35 Col:5 Row:7 grids\39.xgd
36 Col:6 Row:1 grids\40.xgd
37 Col:6 Row:2 grids\41.xgd
38 Col:6 Row:3 grids\42.xgd
39 Col:6 Row:4 grids\43.xgd
40 Col:6 Row:5 grids\44.xgd
41 Col:6 Row:6 grids\45.xgd
42 Col:7 Row:1 grids\46.xgd
43 Col:7 Row:2 grids\47.xgd
44 Col:7 Row:3 grids\48.xgd
45 Col:7 Row:4 grids\49.xgd
46 Col:7 Row:5 grids\50.xgd
47 Col:7 Row:6 grids\51.xgd
48 Col:8 Row:0 grids\52.xgd
49 Col:8 Row:1 grids\53.xgd
50 Col:8 Row:2 grids\54.xgd
51 Col:8 Row:3 grids\55.xgd
52 Col:8 Row:4 grids\56.xgd
53 Col:9 Row:0 grids\57.xgd
54 Col:9 Row:1 grids\58.xgd
55 Col:9 Row:2 grids\59.xgd

**Processed magnetometer data**

COMPOSITE
Filename: J518-mag-proc.xcp

Stats
Max: 5.00
Min: -5.00
Std Dev: 3.10
Mean: -0.18
Median: -0.12
Composite Area: 8.1 ha
Surveyed Area: 2.9679 ha

Processes: 14
1 Base Layer
2 Search & Replace 32702 With: Dummy
3 DeStripe Mean Traverse: Grids: All Threshold: 0.5 SDs
4 De Stagger: Grids: 07.xgd Mode: Both By: 1 intervals
5 De Stagger: Grids: 21.xgd Mode: Both By: 1 intervals
6 De Stagger: Grids: 48.xgd Mode: Both By: 1 intervals
7 De Stagger: Grids: 03.xgd Mode: Both By: 2 intervals
8 De Stagger: Grids: 04.xgd Mode: Both By: 1 intervals
9 De Stagger: Grids: 10.xgd 11.xgd 12.xgd 13.xgd Mode: Both By: 1 intervals
10 De Stagger: Grids: 05.xgd Mode: Both By: 1 intervals
11 De Stagger: Grids: 06.xgd Mode: Outbound By: 1 intervals
12 De Stagger: Grids: 29.xgd Mode: Both By: 1 intervals
13 De Stagger: Grids: 28.xgd Mode: Both By: 1 intervals
14 Clip from -5.00 to 5.00 nT

## Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at their offices in 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.

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:

- TerraSurveyor version 3.0.23.0 (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 produced by the survey and report include the following files:

- TerraSurveyor 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.

N


Survey location

## Archaeological Surveys Ltd

## Geophysical Survey
## Hole Ground
## Wookey Hole
## Somerset

### Map of survey area

Reproduced from OS Explorer map no. 141 1:25 000 by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office.



● Survey location

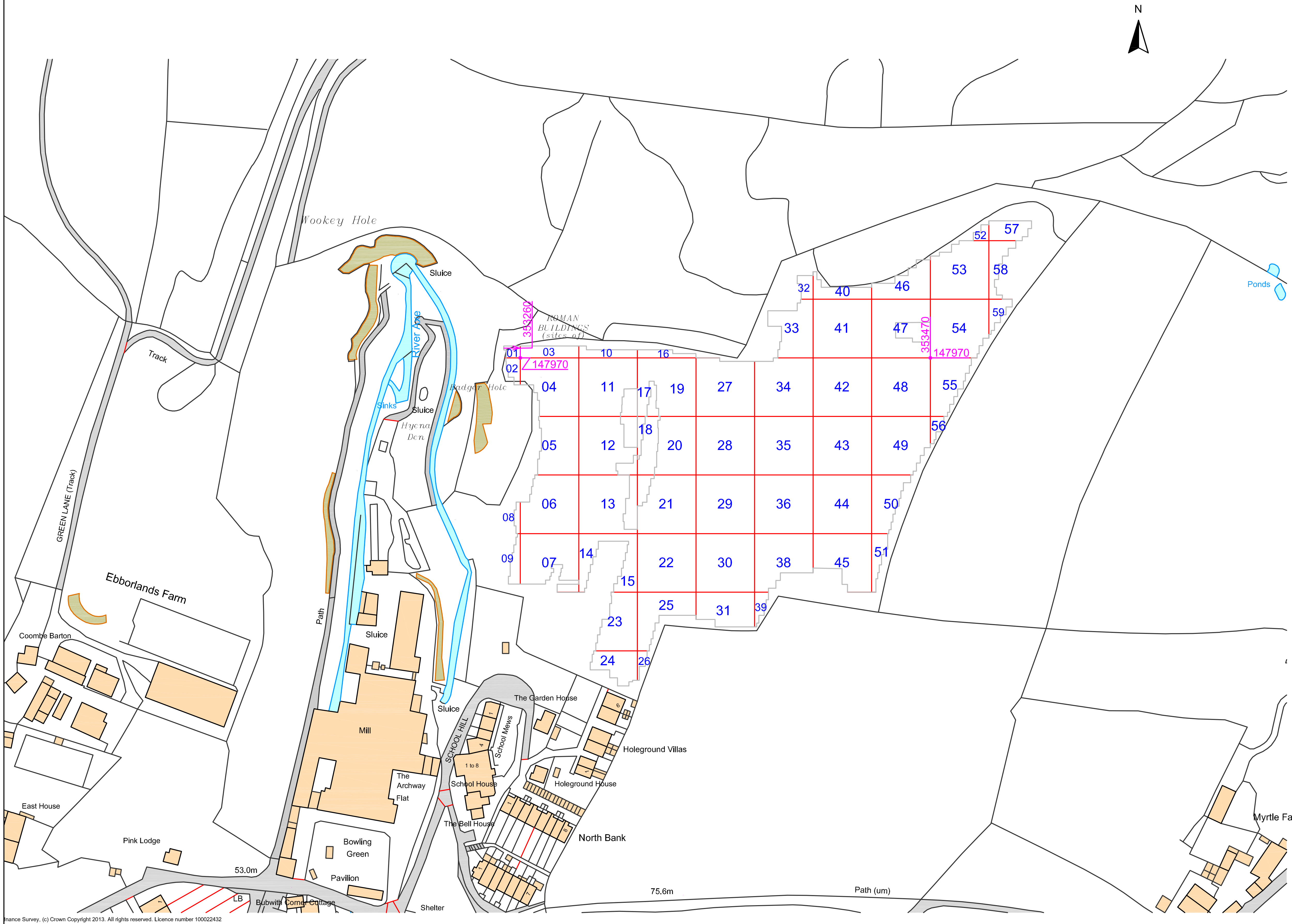
Site centred on OS NGR
ST 53380 47920

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

FIG 01






## Archaeological Surveys Ltd

# Geophysical Survey
# Hole Ground
# Wookey Hole
# Somerset

### Referencing information

Grid coordinates based on Ordnance Survey OSGB36 datum

Grids set out using RTK GPS with Leica SmartNet correction data RTCMv2 format OSTN02 transformation

Survey grid size = 30m

Survey start and traverse direction

01 Grid reference number and filename

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

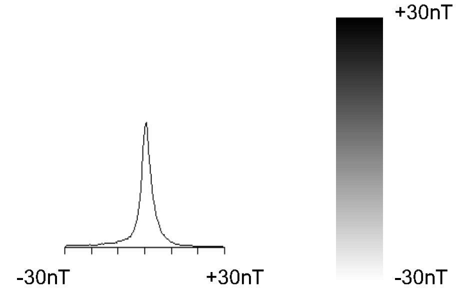


FIG 02

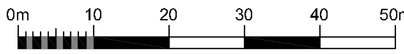

Archaeological Surveys Ltd

**Geophysical Survey**
**Hole Ground**
**Wookey Hole**
**Somerset**

**Greyscale plot of raw magnetometer data**




SCALE 1:1000




SCALE TRUE AT A3

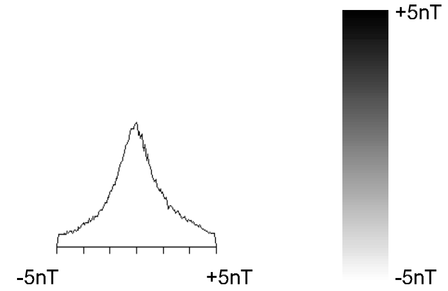


FIG 03

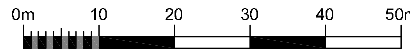
Archaeological Surveys Ltd

**Geophysical Survey**
**Hole Ground**
**Wookey Hole**
**Somerset**

**Greyscale plot of processed magnetometer data**


SCALE 1:1000




SCALE TRUE AT A3



FIG 04

Archaeological Surveys Ltd

# Geophysical Survey
# Hole Ground
# Wookey Hole
# Somerset

## Abstraction and interpretation of magnetometer anomalies


- Positive linear anomaly - magnetically enhanced material
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - possible pit-like feature
- Positive and negative anomaly - lynchet
- Positive anomaly - magnetically enhanced material
- Negative anomaly - material with low magnetic susceptibility
- Variable magnetic response - associated with track
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3



FIG 05