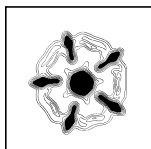


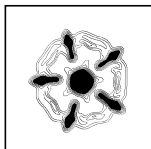
**Geophysical Survey Report
John O'Groats Mill, Caithness
RGC1377/JGM**



Project Number AOC_22376



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Executive Summary

Geophysical survey was requested as part of a wider archaeological evaluation of John O'Groat's Mill, Caithness and the surrounding area. Following the walkover and DBA two areas were selected for survey. Available areas surrounding the Mill were investigated using resistance survey. Gradiometer survey was not carried out over these areas due to the large amount of ferrous material within and adjacent to the survey area. Although the walkover survey did not identify any potential sites in the three pasture fields to the east of the Mill, geophysical survey was undertaken in the area adjacent to the Mill to assist with possible future developments at the site.

Interpretation of the results of the resistance survey in the areas within the Mill complex (Areas A & B) are complicated by the limited areas available for survey, making it difficult to place anomalies within a wider context. However, survey has identified some responses of potential interest including possible structures and mill races. Survey within the pasture field to the east has not detected any archaeologically significant anomalies, with the data being dominated by responses from drainage features and agricultural activity.

Survey:	John O'Groats Mill, Caithness
Client:	AOC Archaeology Group
Date of Survey:	14th March 2013
Survey Personnel:	Dr S M Ovenden and A S Wilson
Report Author:	Dr S M Ovenden
Date of Draft Report:	18th March 2013

1. Introduction

- 1.1 Geophysical survey was requested as part of a wider archaeological evaluation of John O'Groat's Mill, Caithness and the surrounding area. The general area is rich in archaeological sites including burial cairns, chambered cairns, souterrains, brochs and standing stones.
- 1.2 The original proposal requested six 20m by 20m (0.24ha) grids of gradiometer and resistance survey. The location of the survey areas was to be based on a Desk Based Assessment (DBA) and a walkover survey carried out as part of a wider evaluation.
- 1.3 Following the walkover and DBA two areas were selected for survey. Available areas surrounding the Mill were investigated using resistance survey with the equivalent of approximately four 20m by 20m grids being surveyed, together with a partial grid immediately adjacent to the mill, as indicated on Figure 1. Unfortunately steep slopes and vegetation limited the areas suitable for survey. Gradiometer survey was not carried out over these areas due to the large amount of ferrous material within and adjacent to the survey area.
- 1.4 Although the walkover survey did not identify any potential sites in the three pasture fields to the east of the Mill, geophysical survey was undertaken in the area adjacent to the Mill to assist with possible future developments at the site. As indicated on Figure 1 a further eight grids (0.32ha) of resistance survey and twelve grids (0.48ha) of gradiometry were undertaken.

2. Methodology

- 2.1 Prior to data collection a series of 20m grids were established across the site. The survey grid was tied-in to hard features depicted on plans provided using a Trimble Total Station.

Resistance Survey

- 2.2 Structural remains and graves can respond well to geophysical survey techniques. The most commonly used technique on such sites is area resistance survey. Resistance survey is ideally suited to locating walls, foundations, paths, and occasionally burials.
- 2.3 Earth resistance surveys measure variations in the moisture content of the earth's subsurface by passing a small electrical current through the subsurface. Features such as foundations/walls and paths will show as high resistance anomalies, while features such as

ditches, pits and robber trenches with their humic fill will usually result in a low resistance response.

- 2.4 Resistance survey was carried out using a Geoscan RM85 resistance meter. For this survey a standard twin probe configuration was used with a mobile probe separation of 0.5m providing a depth resolution of approximately 0.75m. Data was collected at 1m by 1m intervals.
- 2.5 The data was processed with Geoscan Research Geoplot 3.00 software, using a standard range of corrections and processing algorithms. Raw, interpolated and high pass filtered data have been included in the report. Interpolating data has the effect of smoothing the data image by interpolating the data in the X and Y direction resulting in the appearance of a 0.5m by 0.5m sample interval. Running a high pass filter on the data effectively removes background trends within the data thereby enhancing more discrete anomalies. The data have been displayed at a variety of levels, in an attempt to pull out more subtle anomalies. In area resistance survey the data values themselves are not significant but rather the changes relative to the background level of response are. In some of the figures the data are plotted at absolute values in ohms (Ω) to try to pull out different anomalies. In other plots the statistics of the full data range are used and the data are plotted at plus/minus one or two standard deviations (SD).

Gradiometer Survey

- 2.6 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.
- 2.7 The data were processed with Geoscan Research Geoplot 3.00 software, using a standard range of corrections and processing algorithms. These include setting the data mean to zero and destagger of the data. The edited data are displayed as XY traces and grey-scale images. Interpolated data are displayed as grey-scale images. 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. Results of Survey: Areas A & B

Anomaly letters referred to below are shown on the accompanying interpretation diagrams

Area A (Figures 2, 3, 6 - 9)

- 3.1 The data from this area is general quiet. Relatively well-defined areas of high resistance readings (A) have been recorded along the eastern edge of the survey area. Given the narrow survey width interpretation of these variations is cautious. In addition, the majority of the eastern limit of the survey is delineated by a sharp change in slope. In some areas walling can be seen within this slope thought to be associated with another mill building known to have existed immediately to the east of this survey area. It is possible that the areas of high resistance (A) are simply due to this material or perhaps features associated with the mill i.e. the mill race.
- 3.2 Suggestions of linear anomalies (B) are apparent within the data. These may indicate stone drains, or potential remnants of structures associated with the walling visible adjacent to the eastern limit of the survey area.
- 3.3 Within the north of the survey area a broad zone (C) of high resistance readings has been recorded. This area is undulating and again close to a sharp change in slope leading down to the burn. It is not clear if these high readings are due to natural variations in the subsoil or are indicative of potential structural remains associated with the 1818 mill. When viewing the high pass filtered data (Figure 8) well defined low resistance linear responses are visible which may be significant.
- 3.4 In the west of the survey area well-defined low resistance trends are apparent in the data. It seems likely that (D) is due to a service trench/track-way associated with the now abandoned cottages to the north. However, it could be associated with an in-filled mill race or similar feature. The other trend (E) appears to be an extension of a field boundary to the west suggesting it may indicate a former field division. However, it may possibly be some feature associated with the 1818 mill i.e. a mill race running down slope to the mill.

Area B (Figures 2, 3, 10)

- 3.5 Survey of this area was requested with the hope of identifying wall foundations. However, the data from this very small survey area is difficult to interpret.

- 3.6 Although high resistance readings are apparent around the edge of the survey area it is not possible to determine if these are due to potential wall footings or simply due to adjacent slopes and extant walls.

4. Results of Survey: Area C

Anomaly numbers and letters referred to below are shown on the accompanying interpretation diagrams

4.1 Gradiometer Survey (Figures 4, 5, 11 - 13)

- 4.1.1 Gradiometer survey of this field indicates a very low level of magnetic response, although zones of increased response (1) are evident along the western edge of the survey area adjacent to the wire fence and in particular the Mill itself.
- 4.1.2 Isolated ferrous anomalies have been noted throughout the survey area and are most likely due to modern debris in the topsoil
- 4.1.3 Two sets of parallel linear trends (2) are visible within the data. The arrangement and nature of these anomalies suggest field drains.
- 4.1.4 Very weak parallel trends (3) aligned north-south are likely to be due to agricultural activity.

4.2 Resistance Survey (Figures 2, 3, 14 - 17)

- 4.2.1 Although the data appears to show a great deal of variation, statistically there is little range in the data.
- 4.2.2 Broad areas of high resistance (F) are visible in the north of the survey area. While this may be significant, it seems likely to reflect natural variations in the topsoil and subsoil. However, modern building rubble was noted immediately to the west of the survey area suggesting some of this response may be due to modern material, although if that was the case one would expect an associated higher magnetic response within the gradiometer data.
- 4.2.3 Parallel trends (G) are visible in the data which correspond with those seen in the gradiometer data (3) and are indicative of past agricultural processes.

- 4.2.4 Faint suggestions of linear trends (H) in the north of the area appear to correspond with the trends (2) detected in the gradiometer survey and support an interpretation of possible field drains.

5. Conclusions

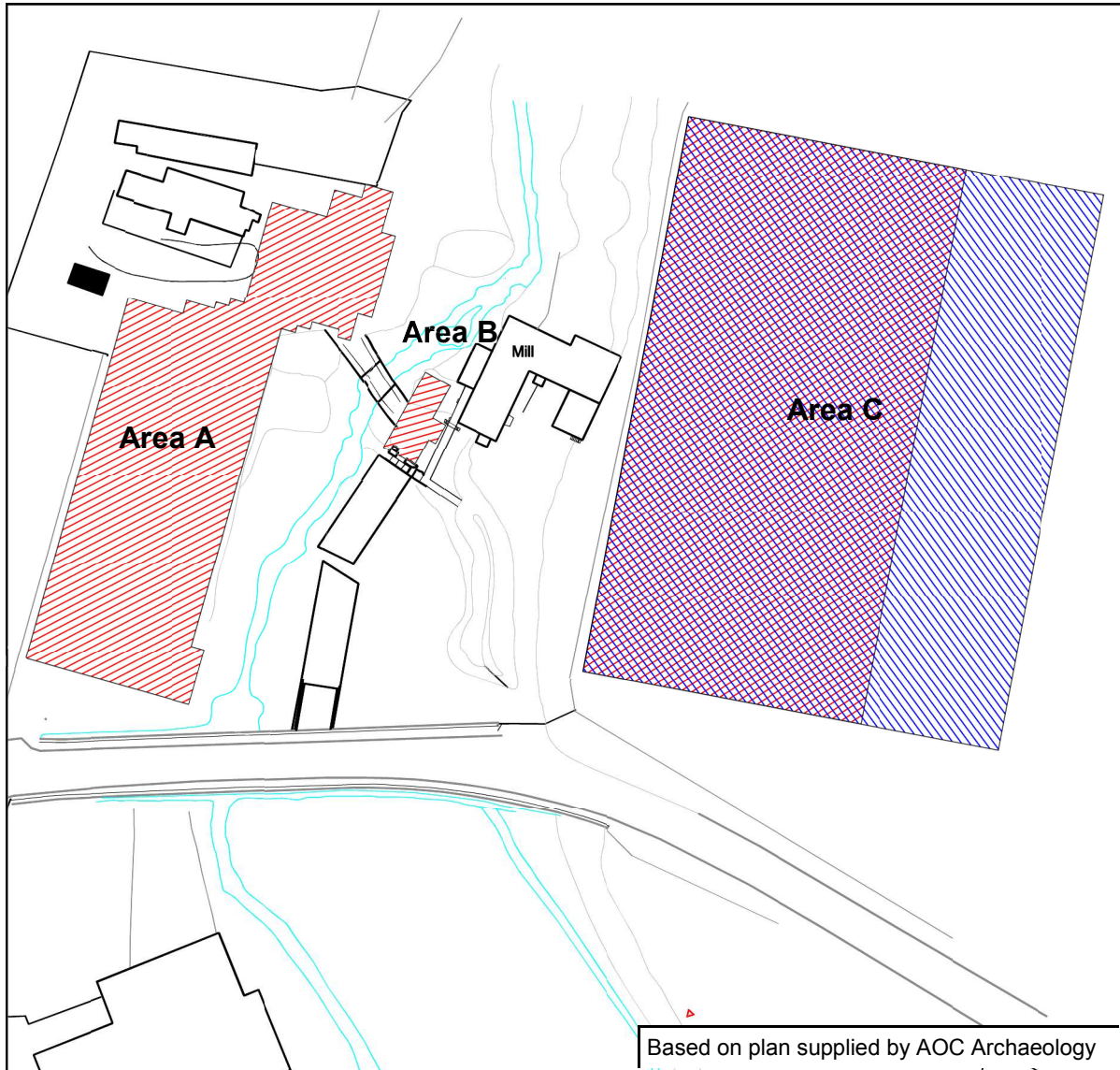
- 5.1 Interpretation of the results of the resistance survey in the areas within the Mill complex (Areas A & B) are complicated by the limited survey size, making it difficult to place anomalies within a wider context. However, survey has identified some responses of potential interest including possible structures and mill races.
- 5.2 Survey within the pasture field to the east has not detected any archaeologically significant anomalies, with the data being dominated by responses from drainage features and agricultural activity.

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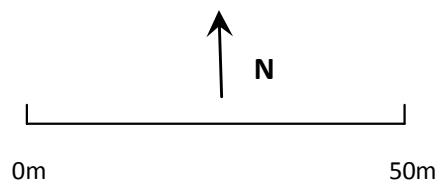
Location of Survey Areas



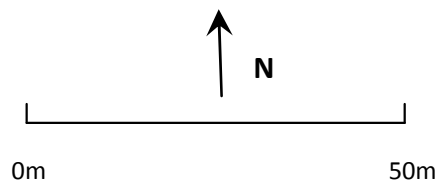
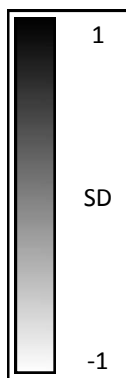
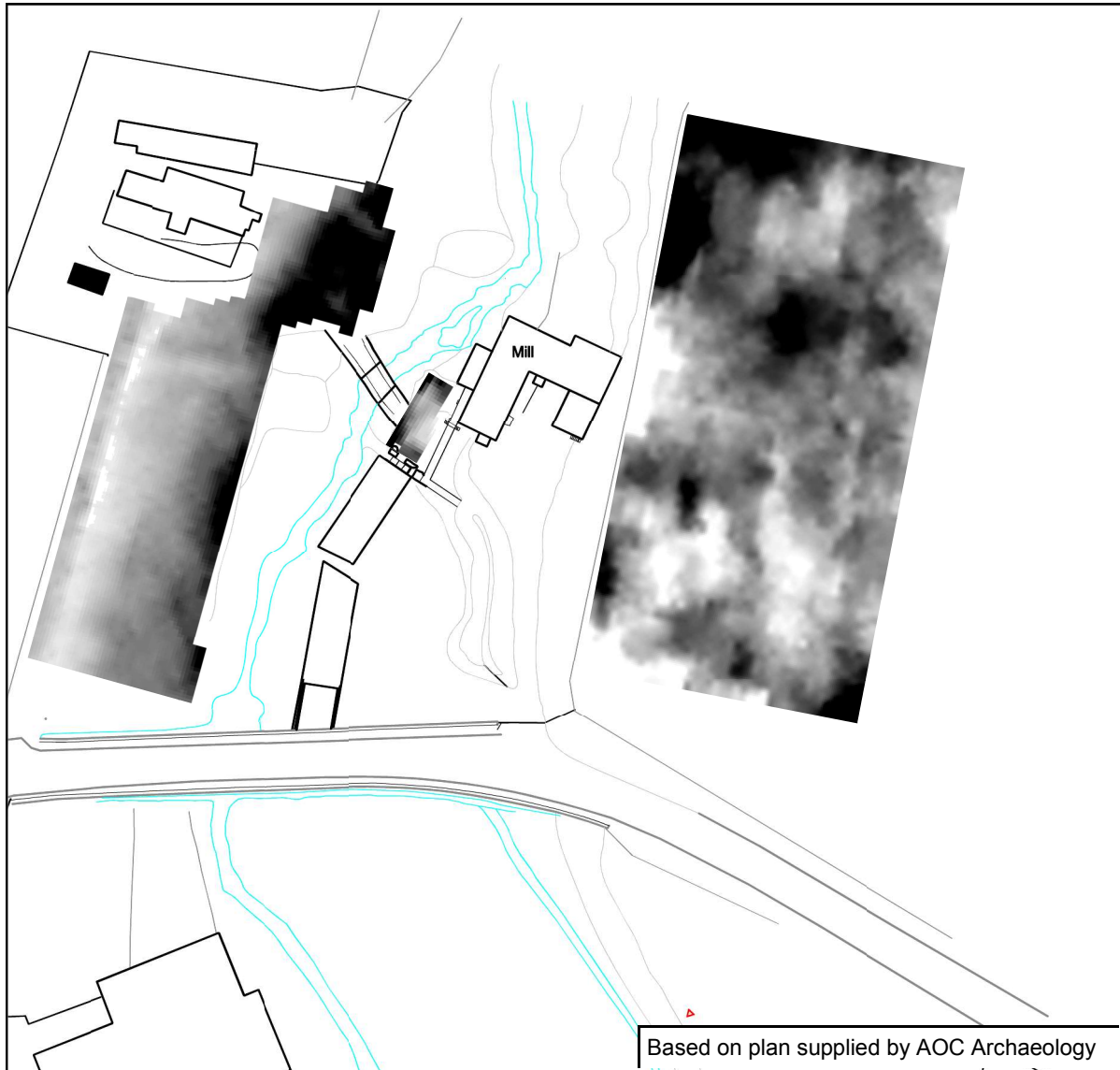
Resistance Survey



Gradiometer Survey



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Resistance Survey
Summary Greyscale



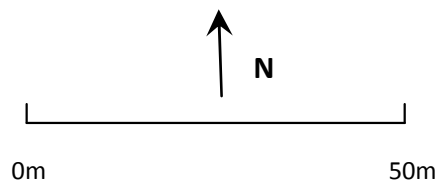
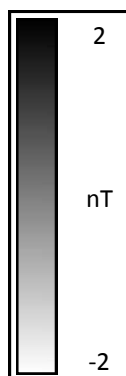
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Resistance Survey

Summary Interpretation



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Gradiometer Survey
Summary Greyscale



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Gradiometer Survey

Summary Interpretation



Magnetic Disturbance



?Drainage



Ferrous



Plough Trends



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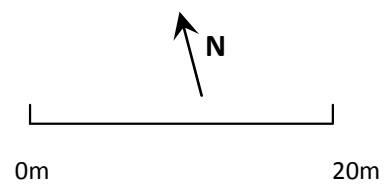
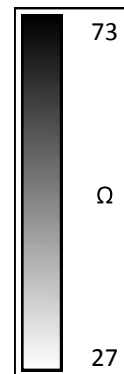
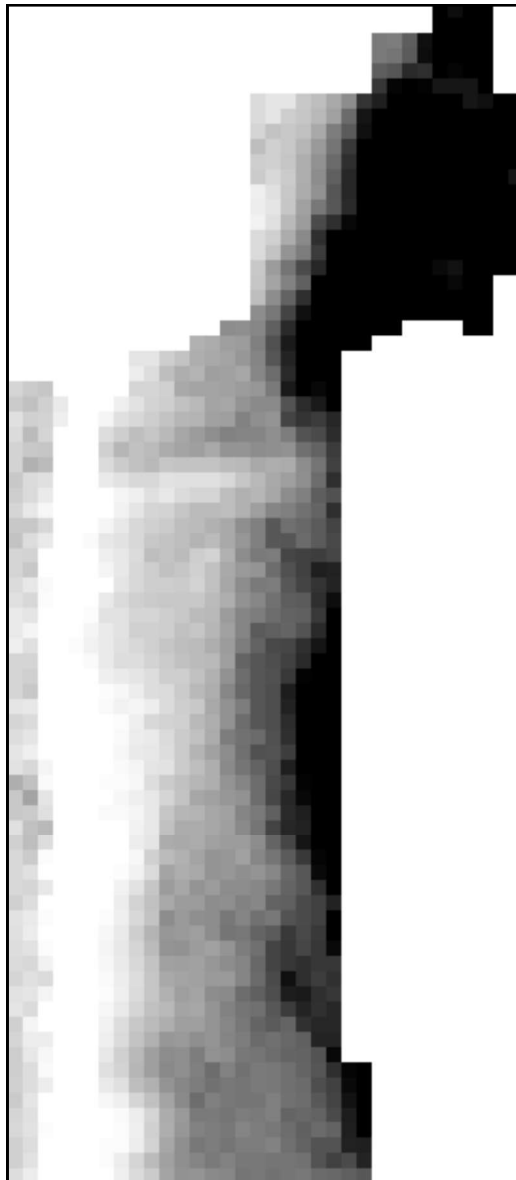
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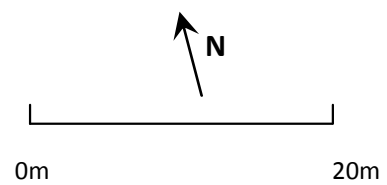
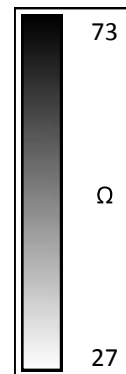
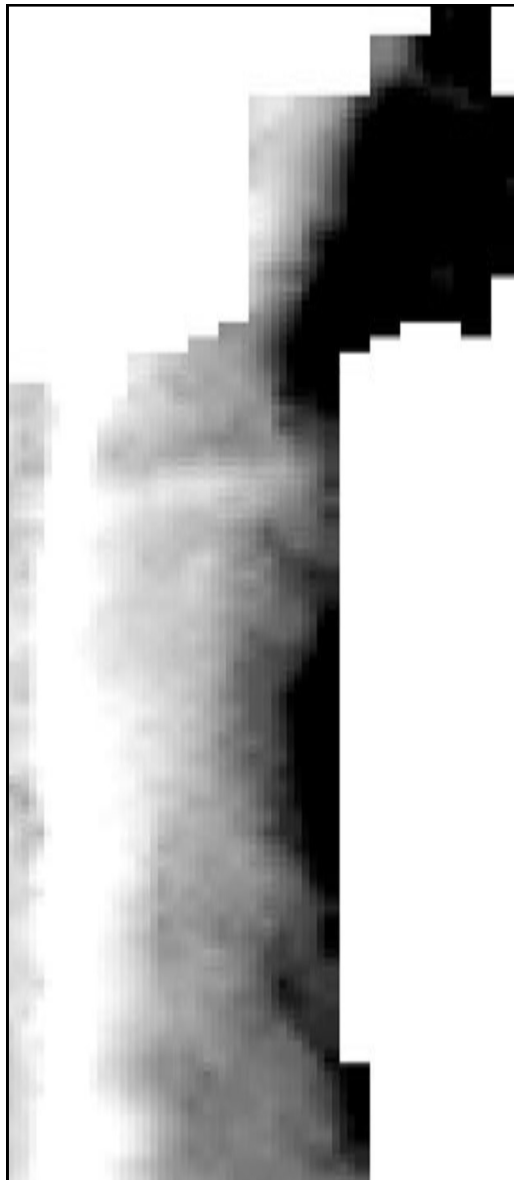
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Figure 5

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Area A
Resistance Survey: Raw Data



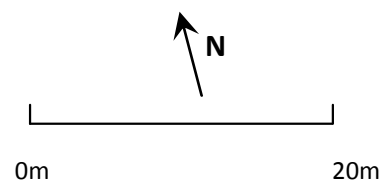
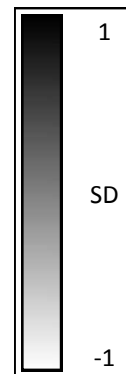
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Area A
Resistance Survey: Interpolated Data



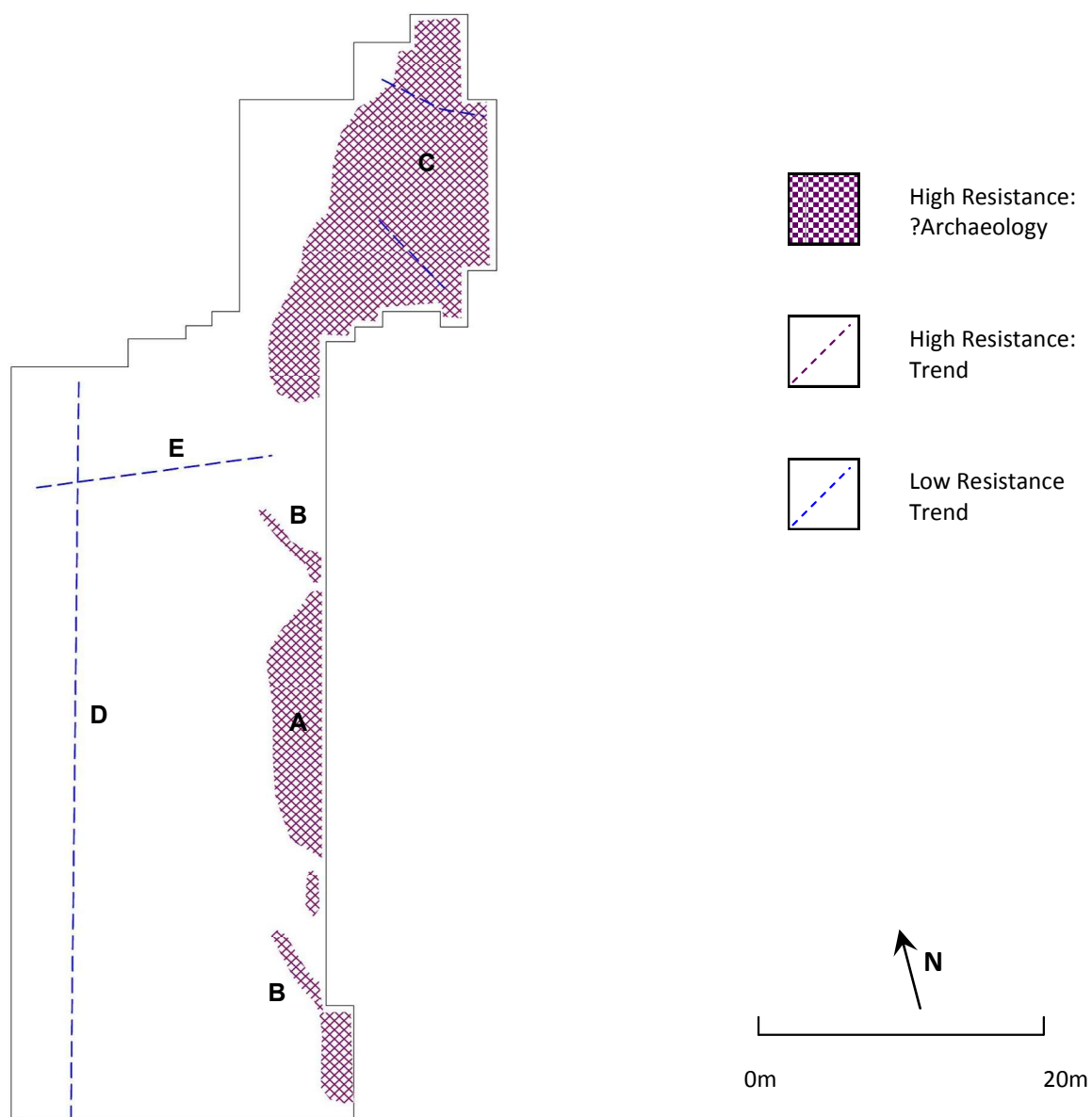
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Area A

Resistance Survey: High Pass Filtered Data



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Area A
Resistance Survey: Interpretation

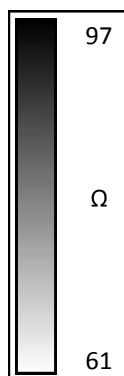


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Area B
Resistance Survey

Raw Data



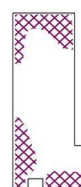
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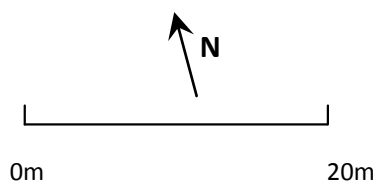
High Pass Filtered Data



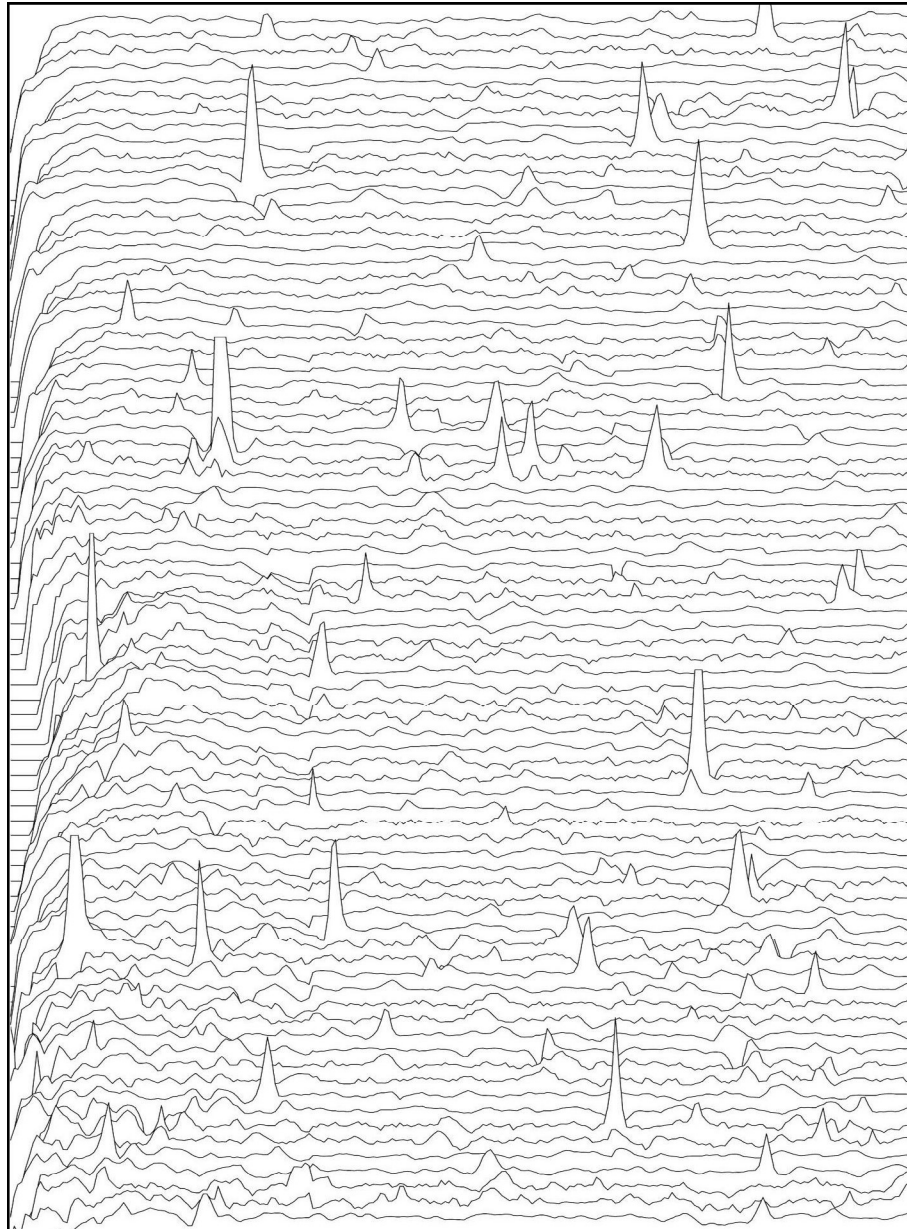
Interpretation



High Resistance:
?Archaeology



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Area C
Gradiometer Survey: Raw Data



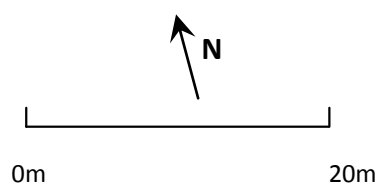
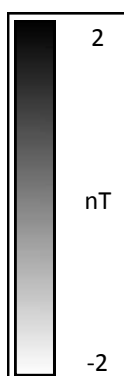
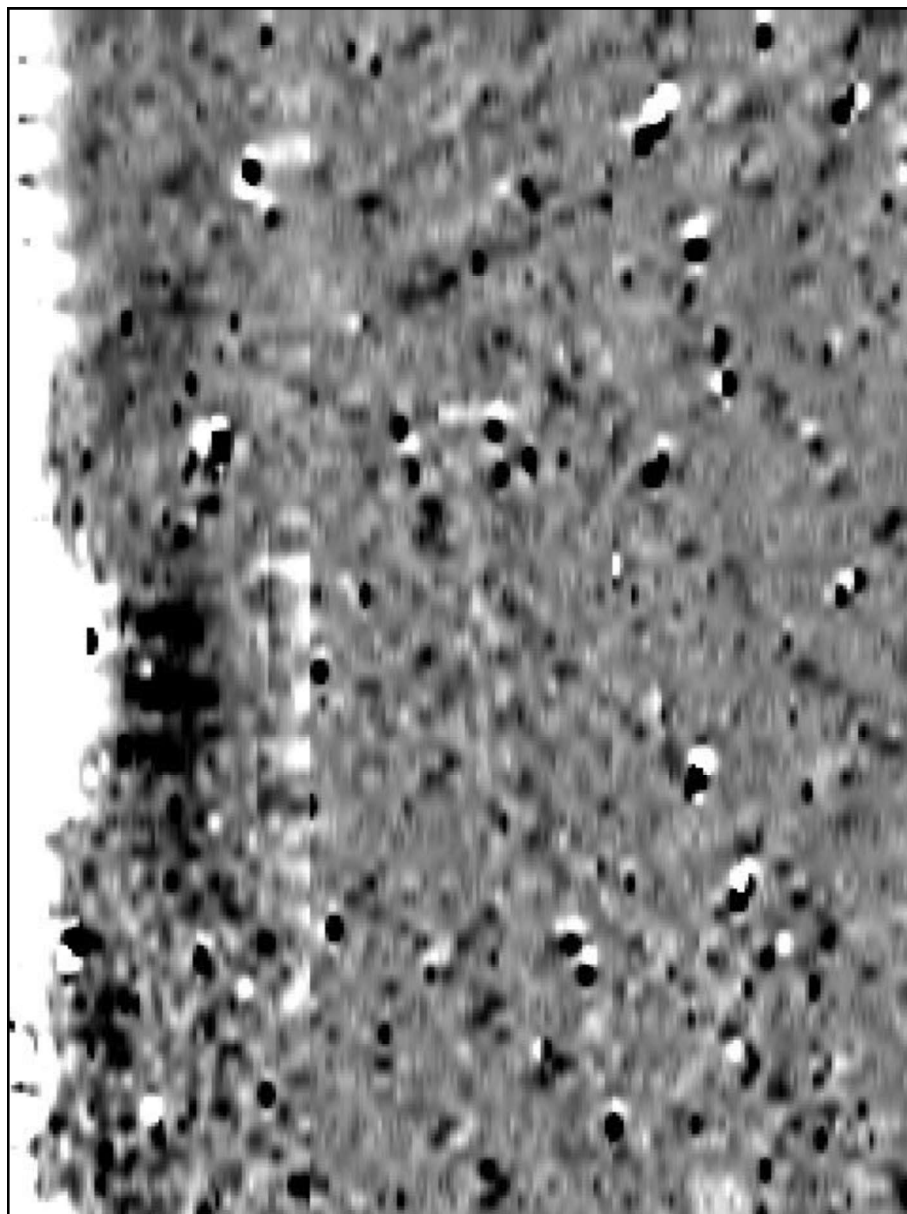
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JOHN O'GROATS MILL
Area C
Gradiometer Survey: Interpolated Data



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Area C
Gradiometer Survey: Interpretation



Magnetic Disturbance



?Drainage



Ferrous



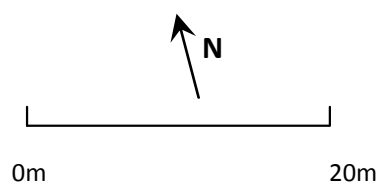
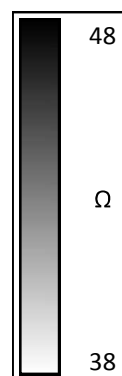
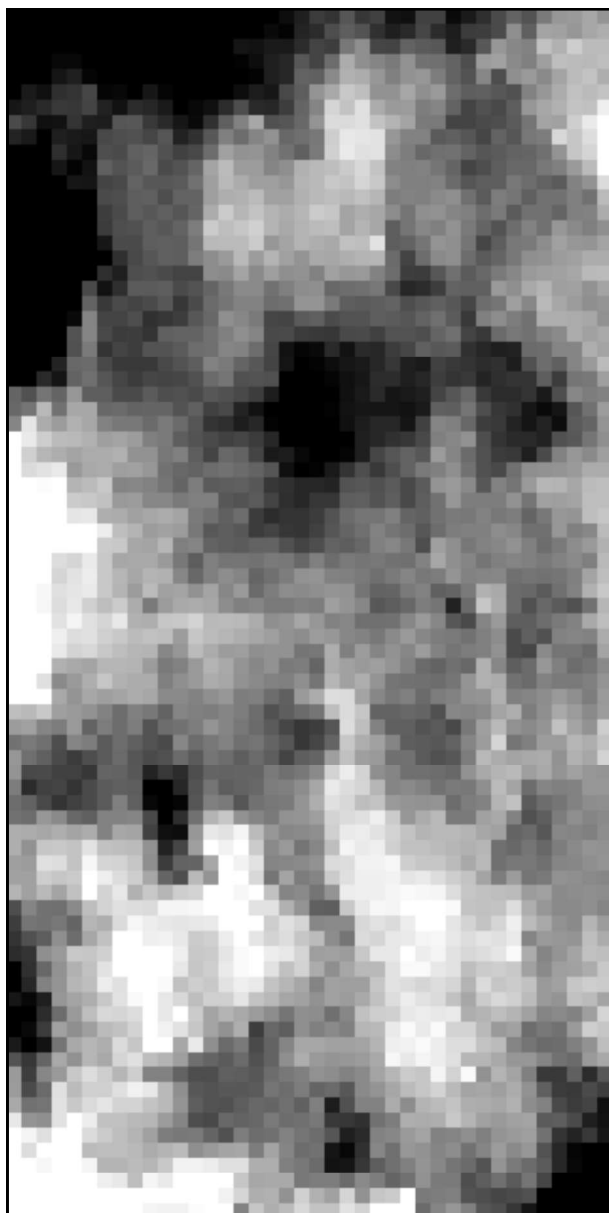
Plough Trends



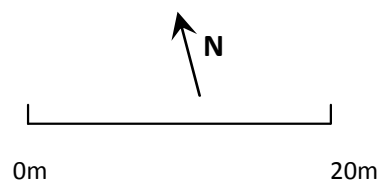
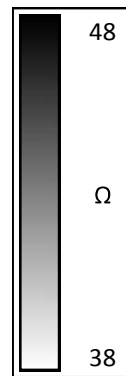
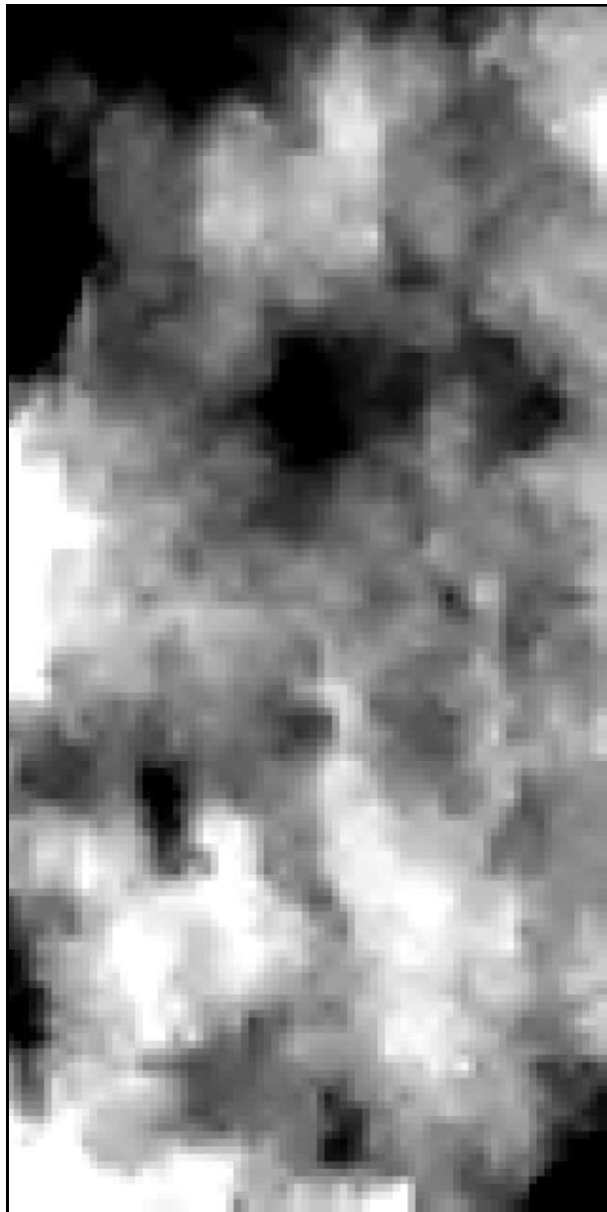
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Area C
Resistance Survey: Raw Data



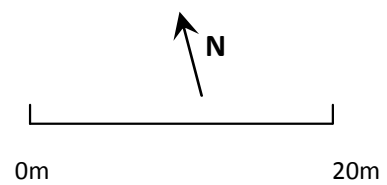
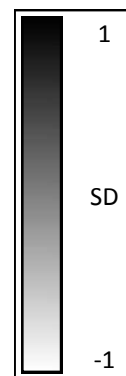
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Area C
Resistance Survey: Interpolated Data



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Area C

Resistance Survey: High Pass Filtered Data



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Area C
Resistance Survey: Interpretation

