



**magnitude
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Geophysical Survey of Formby Lifeboat House

Geophysical Survey Report

For

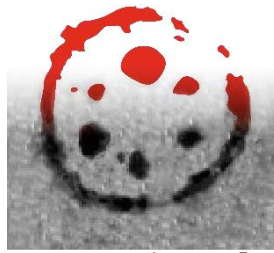
Big Heritage C.I.C

On Behalf Of

Sefton Coastal Landscape Partnership

Magnitude Surveys Ref: MSSD06

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Abstract

Magnitude Surveys was commissioned to carry out a geophysical survey on Formby beach, Merseyside to detect any remains associated with Formby Life Boat House. The survey detected a strong magnetic and conductive response from remains at and above ground level. A number of discrete and trending anomalies were located on the same alignment as the standing remains.

Contents

Abstract.....	1
1. Introduction:	2
2. Quality Assurance:	1
3. Objectives:	1
4. Geographic Background:.....	1
5. Archaeological Background:	2
6. Methodology:.....	2
6.1. Data Collection:.....	2
6.2. Data Processing:.....	3
6. Results:.....	4
6.1. Qualification:.....	4
6.2. Discussion:	4
6.3. Magnetometer Interpretation:	4
6.4. Electromagnetic Interpretation:	5
7. Conclusions:	5
8. Archiving:	6
9. Copyright:.....	6
10. References:	6

List of Figures:

Figure 1 Site Location

Figure 2 Location of Survey Area

Figure 3 Data Plots

Figure 4 Interpretation

1. Introduction:

- 1.1. Magnitude Surveys Ltd (MS) was commissioned by Big Heritage C.I.C on behalf of Sefton Coastal Landscape Partnership to conduct an archaeological geophysical survey on Formby Beach, Merseyside (SD270062).
- 1.2. The archaeological geophysical survey comprised:
 - 1.2.1. Hand pulled, cart mounted, magnetic gradiometer survey
 - 1.2.2. Hand pulled, cart mounted, electromagnetic survey
 - 1.2.3. Hand held magnetic gradiometer survey
- 1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England and the Chartered Institute of Field Archaeologists (CifA 2014, David et al. 2008).
- 1.4. This survey was undertaken on the 26 August 2015.

2. Quality Assurance:

- 2.1. Project management, survey, data processing and report production has been carried out by qualified and professional geophysicists to standards exceeding the current best practice (CifA 2014, David et al. 2008).
- 2.2. Magnitude Surveys is a corporate member of ISAP (International Society of Archaeological Prospection).
- 2.3. Finnegan Pope-Carter is a Fellow of the London Geological Society, the Chartered UK body for geophysicists and geologists.

3. Objectives:

- 3.1. The geophysical survey aimed to locate the remains of Formby Lifeboat House and any associated structures.

4. Geographic Background:

- 4.1. The investigation site comprises approximately 0.3Ha of beach at the end of Lifeboat Rd, Formby, Merseyside.
- 4.2. The site was located on a tidal sandy beach adjacent to sand dunes. This location experiences continual changes in ground conductivity and land surface conditions due to shifting sands and tidal variation.
- 4.3. The underlying Geology comprises Sidmouth Mudstone Formation with superficial deposits consisting of blown sands (BGS 2015)
- 4.4. The soils are classified as Sand Dune Soils (Soilscape 2015).

5. Archaeological Background:

- 5.1. The site is known to be the location of the Formby Lifeboat House from historic mapping and other documentary sources. The survey area was planned around the present standing remains of the building.

6. Methodology:

6.1. Data Collection:

- 6.1.1. Geophysical prospection comprised magnetic and electromagnetic methods as described in the following table.

- 6.1.2. Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Magnetic (Cart)	Bartington 1000L	1m	0.125m (10Hz)
Magnetic (Handheld)	Geoscan Research FM256	0.5m	0.125m
Electromagnetic	GF Instruments CMD Mini Explorer	2m	0.25m (5Hz)

- 6.1.3. Magnetometer data were collected using a bespoke hand-pulled cart system and a hand held system.

- 6.1.3.1. The cart is comprised of Bartington Instruments 1000L gradiometers operating in NMEA mode and a RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The data were logged on a USB flash drive housed in a custom data-logger and transferred to a laptop computer for processing. Data were collected at a sampling frequency of 10Hz along lines spaced 1.0m apart.

- 6.1.3.2. The hand carried system comprised a Geoscan Research FM256 gradiometer operating in time mode. Measurements are logged at regular time intervals, which have been calibrated to match the walking pace of the operator. The data were logged internally and transferred to a laptop computer for processing. Data were collected at a sampling frequency of 0.125m along lines spaced 0.5m apart.

- 6.1.4. Electromagnetic data were collected using a bespoke hand-pulled cart system.

- 6.1.4.1. The cart is comprised of a GF instruments CMD Mini Explorer operating in real-time output mode and a RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The data were logged on a USB flash drive housed in a custom data-logger and transferred to a laptop computer for processing. Data were collected at a sampling frequency of 5Hz along lines spaced 2.0m apart.

- 6.1.5. A series of temporary sight markers were established in each survey area to guide the surveyor and ensure full coverage with the cart. Data were collected by traversing the survey area along the longest possible lines, to ensure that the data were efficiently collected and processed.

6.2. Data Processing:

6.2.1. Data were processed in bespoke in-house software produced by MS and Geoscan Research Geoplot 4.0.

6.2.2. Magnetometer processing steps were limited to:

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping affects caused by small variations in sensor electronics. Care is taken to ensure this filter does not remove linear trends running parallel to the survey direction.

Projection to a Regular Grid – Data collected using an RTK GPS for positioning requires a uniform grid projection to allow visualisation. Data are rotated to best fit an orthogonal grid projection and resampled onto the grid using an inverse distance weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

6.2.3. Electromagnetic processing steps were limited to:

Rolling Zero Median – The median of a rolling window is calculated within a specified range and subtracted from the collected data. This removes striping affects caused by drift in sensor electronics. Care is taken to ensure this filter does not remove linear trends running parallel to the survey direction.

Projection to a Regular Grid – Data collected using an RTK GPS for positioning requires a uniform grid projection to allow visualisation. Data are rotated to best fit an orthogonal grid projection and resampled onto the grid using an inverse distance weighting algorithm.

High Pass Filter – A High Pass filter is used to remove large scale background trends related to changes in geology or soil moisture content. These trends can mask small scale features which may be of archaeological significance. The resultant data is compared to pre-filtered data to ensure no features have been lost.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

6.3. Data Visualisation:

6.3.1. Unprocessed and processed data are presented as greyscales within a layered environment. Multiple greyscales with different plotting ranges may be suitable to highlight features spanning different response strengths.

6.3.2. Greyscales should be viewed alongside the accompanying XY trace plots; these plots visualise the magnitude and form of the geophysical response, aiding in anomaly interpretation.

7. Results:

7.1. Qualification:

7.1.1. *Geophysical techniques are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is always subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency it is often not possible to classify all anomaly sources; while there will be degrees of certainty for others. Where possible an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports, MS actively seek feedback on their reports as well as reports of further work in order to constantly improve our knowledge and service.*

7.2. Discussion:

7.2.1. Both magnetic and electromagnetic datasets have located the standing remains of the former Formby Lifeboat House and similar responses, which do not correspond with standing remains. A number of discrete ferrous-like anomalies have been detected which follow the alignment of the life boat house. It is conceivable that these features are also associated with remains of the Lifeboat House.

7.3. Magnetometer Interpretation:

7.3.1. The plots produced from the cart based magnetometer and hand carried magnetometer have been used in combination to produce a single interpretation diagram.

7.3.2. The feature characterised as Archaeology (Standing Remains) are highly magnetic and correspond to remains of walls and surfaces evident when the survey was being conducted. These remains comprised a hand fired brick surface, presumed slipway or similar and row of red sandstone blocks, connected by iron staples forming a low wall with a 90 degree turn at the North Western End. The response is considerably broader than the standing remains however this is likely a result of the magnetic strength of the feature as compared to broader buried remains. The nature, orientation and position of the response suggests that the source is associated with the remains of Formby Lifeboat House.

7.3.3. The feature characterised as Archaeology (Probable) exhibits similar characteristics to that of Archaeology (Standing Remains) however the signal strength is weaker. The responses do not correspond with any feature evident above ground at the time of survey however aerial photography (Google Earth 2015) shows that more remains were visible until at least June 2012. The nature, orientation and position of the response suggests that the source is likely to be associated with the remains of Formby Lifeboat House.

7.3.4. A number of discrete features have been categorised as undetermined. These features exhibit characteristics akin to isolated ferrous-like anomalies, however the orientation and increasing density towards the standing remains suggest that they may be associated with the archaeological features.

7.3.5. The feature characterised as Ferrous is associated with a modern safety sign positioned a short distance to the east of the survey area.

7.4. Electromagnetic Interpretation:

- 7.4.1. The features identified within the electromagnetic data are broadly similar to the features identified within the magnetic data. The coarser data collection used for the electromagnetic data means some features that can be isolated in the magnetic data are unable to be resolved.
- 7.4.2. The features identified as Archaeology (Standing Remains) and Archaeology (Probable) exhibit similar characteristics. They are more easily resolved in the shallower datasets (C2 & I2) than the deeper datasets (C3 & I3) suggesting that less contrast exists between any remains and the background at increased depth.
- 7.4.3. The electromagnetic data also identifies banding running SSE-NNW through the survey area. This corresponds to an increase in conductivity as the survey area moves towards the tidal zone.

8. Conclusions:

- 8.1. There is excellent correlation between the two techniques used at Formby Beach. Each survey has successfully mapped some further extent to the above ground remains; although it was not possible to map a complete plan of the Lifeboat Station. This was partly due to the depth of sand overlying the presumed eastern end of the building.
- 8.2. Anomalies beyond the extent of the building as shown on historic mapping have been more tentatively categorised as of an Undetermined Origin. While these do appear to form lines that correlate well to the size and orientation of the main structure it is not possible to say if they are previously unmapped features associated with the complex or more parts of the ruined structure that have been dragged away by the tide.

9. Archiving:

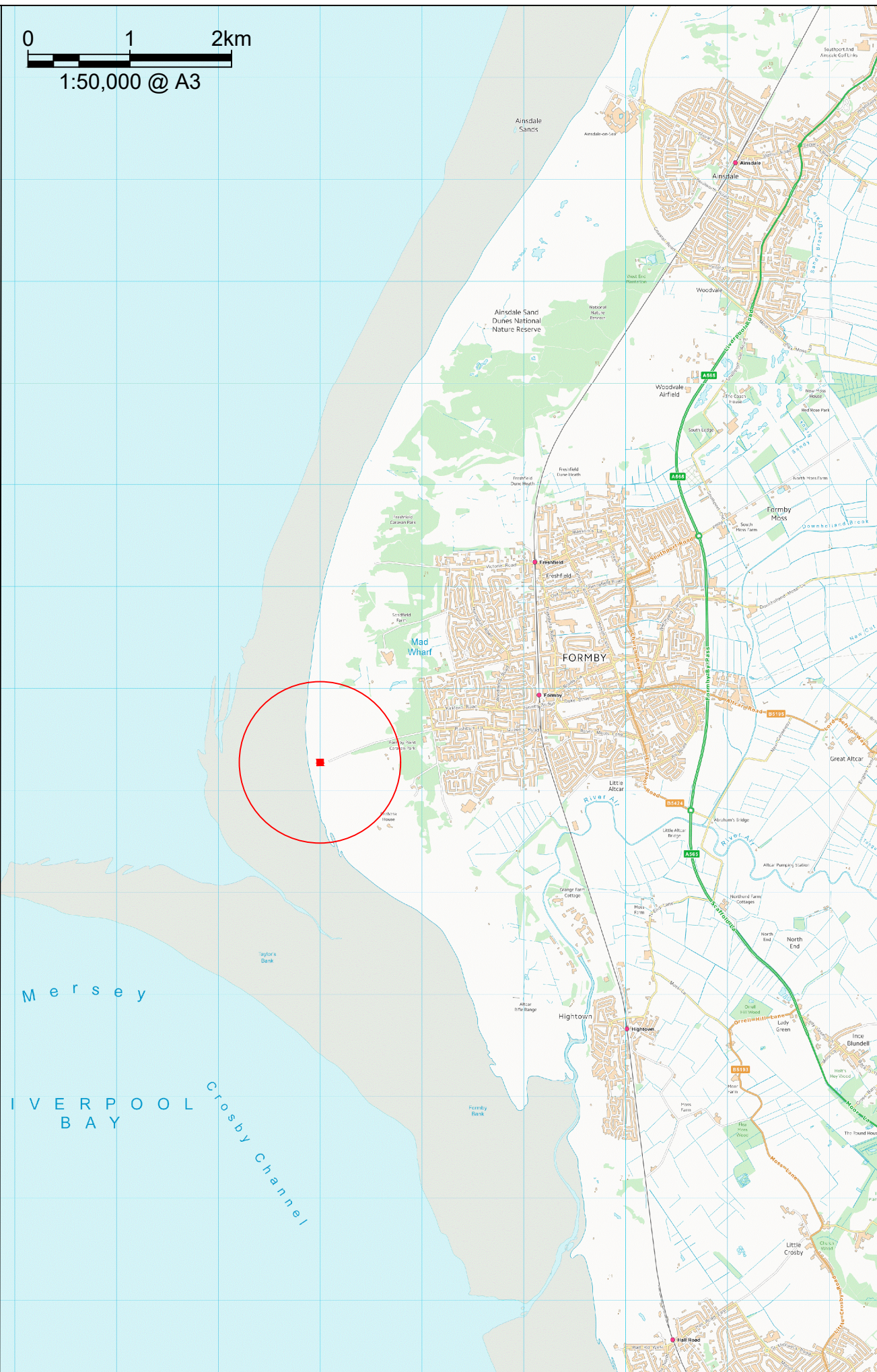
- 9.1. Magnitude Surveys Ltd maintains an in-house digital archive which aims to conform to (Schmidt, A. 2013).
- 9.2. Magnitude Surveys Ltd contributes all reports to the ADS Grey Literature Library subject to any timed embargoes dictated by the client.
- 9.3. Whenever possible Magnitude Surveys has a policy of making data available to view in easy to use forms on its website. This can benefit the client by making all of their reports available in a single repository, while also being a useful resource for research. Should a client wish to impose a time embargo on the availability of data this can be achieved in discussion with MS.

10. Copyright:

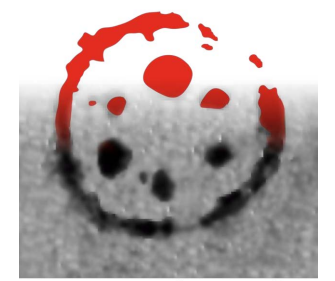
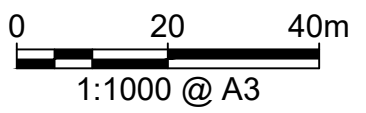
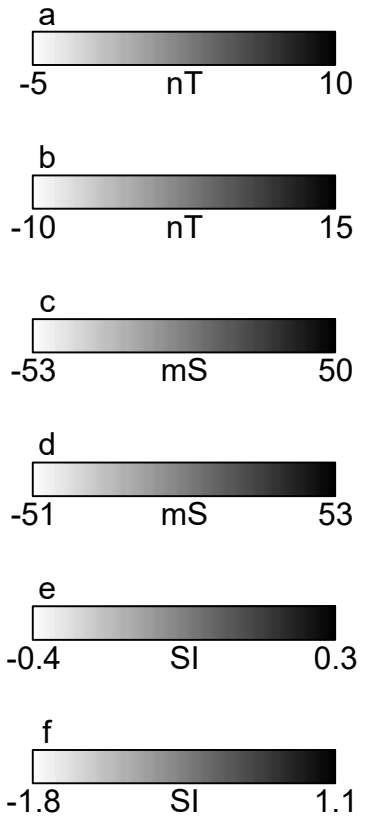
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11. References:

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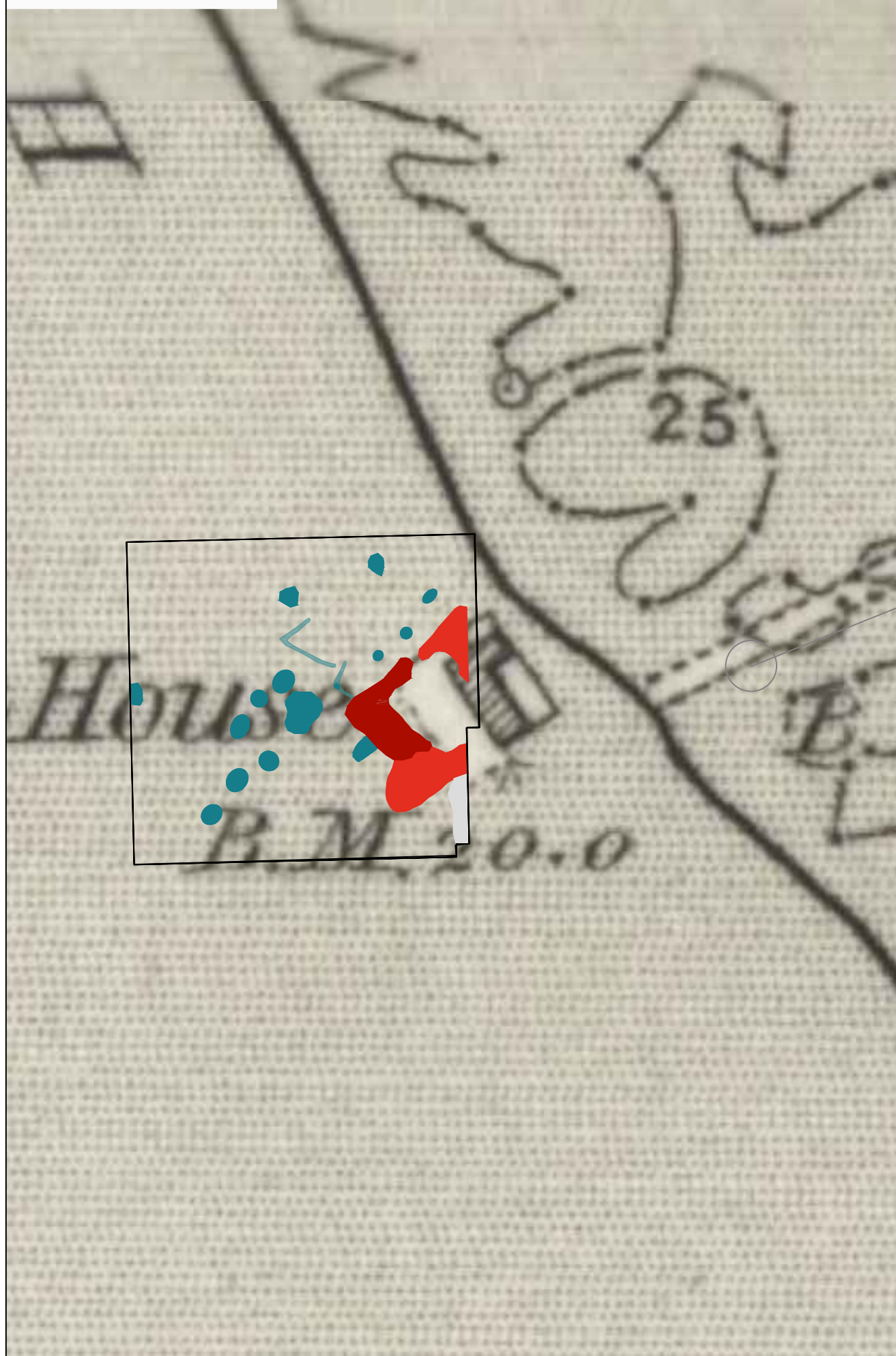


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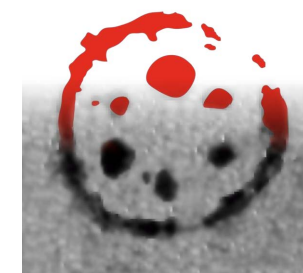
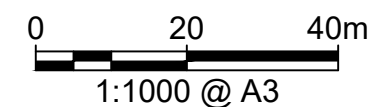
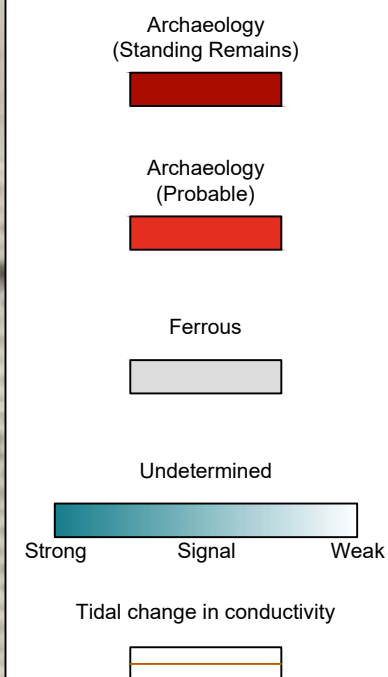
on behalf of:



a: Fluxgate Interpretation



b: Electro-magnetic Interpretation



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