

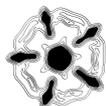
**Geophysical Survey Report**  
**Reed's Field, Cromarty**  
RGC1375/RFC



On behalf of:



***Ross and Cromarty Archaeological Services***  
***West Coast Archaeological Services***



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### **Executive Summary**

Recent storms have exposed midden deposits close to what would have been the core area of the medieval burgh of Cromarty. In addition to small finds, both post holes and walling are apparent in the exposed section. In addition excavation carried out during emplacement of a water pipe revealed further midden deposits, post holes and gullies. Geophysical survey was carried out over Reed's Field in Cromarty with the aim of determining the nature and extent of any anomalies extending inland from the exposed coastal section.

While the result of the surveys are not as exciting as one might have hoped the gradiometry has identified a zone of potentially archeologically significant anomalies in the north-west of the survey area suggesting that the site exposed on the coast may extend some 30m inland. The resistance data is dominated by responses from ridge and furrow cultivation and more amorphous anomalies which are thought to be due to natural pedological/geological variations. Both resistance and gradiometry have indicated the line of Thief's Lane and the yards to the rear of previous cottages on the Causeway.

<b>Survey:</b>	Reed's Field, Cromarty
<b>Client:</b>	RoCAS and WCAS
<b>Date of Survey:</b>	11th - 12th April 2013
<b>Survey Personnel:</b>	Dr S M Ovenden and A S Wilson
<b>Report Author:</b>	Dr S M Ovenden
<b>Date of Final Report:</b>	26th April 2013

## **1. Introduction**

- 1.1 Recent storms have exposed midden deposits close to what would have been the core area of the medieval burgh of Cromarty. In addition to small finds, post holes and walling are apparent in the exposed section. In addition excavation carried out during emplacement of a water pipe revealed further midden deposits, post holes and gullies.
- 1.2 Geophysical survey was carried out over Reed's Field in Cromarty with the aim of determining the nature and extent of any anomalies extending inland from the exposed coastal section. Gradiometer and resistance survey were carried out over the area indicated on Figure 1.

## **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 Ordnance Survey maps and has been lodged with the client.

### **Gradiometer Survey**

- 2.2 Gradiometer survey was undertaken using a Bartington Grad601-2 gradiometer. The gradiometer comprises two fluxgate sensors mounted 1m apart on a vertical axis. Each sensor measures the earth's magnetic field, in nanoTesla (nT), and the instrument records the difference between the observed readings for each sensor. As a result the instrument is able to record subtle changes or anomalies in the earth's magnetic field caused by material in the top metre or so of the earth's surface. Data was collected at 0.25m intervals along traverses 1m apart within the series of 20m grids, which were later merged together.
- 2.3 The data were processed with Geoscan Research Geoplot 3.00 software, using a standard range of corrections and processing algorithms. These include setting the data mean to zero and applying a destagger to 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.

## Resistance Survey

- 2.4 Structural remains and garden features 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 flowerbeds.
- 2.5 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 walls and paths will show as high resistance anomalies, while features such as ditches, robber trenches and planting beds with their humic fill will usually result in a low resistance response.
- 2.6 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.
- 2.7 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 0.25m by 0.25m 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 ( $\Omega$ ) 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).

## 3. Results of Gradiometer Survey (Figures 2 - 3, 6 - 11)

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

- 3.1 The level of magnetic response across this site is varied but on the whole relatively high. The strongest response within the data is due to a buried service (A) in the south of the survey area which corresponds with a low resistance anomaly (4).

- 3.2 Broad weak linear anomalies (B) are due to past ridge and furrow cultivation which has also been detected in the resistance survey.
- 3.3 Although some pit-type anomalies are apparent within the southern half of the survey area they are not particularly coherent. However, the magnetic response (C) visible in the southeast of the survey area is consistent with a ditch type anomaly. However, this could have a fairly recent origin. The negative anomaly (D) just a little further to the south is due to a telegraph pole.
- 3.4 A weak negative linear anomaly (E) has been detected in the west of the survey area. This appears to terminate at (A) suggesting a possible buried service, although it may simply indicate a former field boundary. The 'rippled' appearance of the data in this area is due to very weak responses from more recent agricultural activity which is visible on the survey as very slight earthworks on a comparable alignment to (E).
- 3.5 There is a well-defined zone of increased magnetic response in the north of the survey area in the vicinity of the known archaeology. Linear anomalies (F) may correspond with tracks/boundaries associated with the former cottages in the area and show some correlation with the resistance data. However, it is of interest that the data is relatively quiet given the previous dwellings on the site suggesting they were very efficiently removed. Although the name of 'Thief's Lane' may suggest dwellings that were perhaps not particularly well built or permanent.
- 3.6 Within the northern half of the survey area there is a noticeable increase in the level of magnetic response with numerous coherent anomalies having been detected. Interpretation of the individual anomalies is cautious as more deeply buried ferrous material can produce an anomaly similar to that from a pit. Interpretation of the anomalies is based on the nature, form and strength of the response. Numerous large pit type anomalies have been detected in this area (G) with a clear concentration and some coherence in the north-west of the survey area. The known archaeology of the medieval/postmed middens are immediately to the north and the pits are at the same location as the cottages shown on Aitken's survey of 1764. However if the 'pits' are associated with the known cottages little other magnetic signature survives of these dwellings which is surprising. Although numerous ferrous type responses are noted this is normal on any site, particularly within a pasture field near houses and a foot path. The lack of more significant ferrous disturbance which one would expect with more recent structures suggests the anomalies may be archaeologically significant rather than simply due to modern debris. Pit type anomalies (H) have also been detected to the west of the site of Grove Cottage.

- 3.7 Ephemeral linear trends (l) are apparent in the west of the survey area indicating the possible line of the yards of cottages associated with the causeway.

#### **4. Results of Resistance Survey (Figures 4 - 5, 12 - 19)**

*Anomaly numbers referred to below are shown on the accompanying interpretation diagrams.*

- 4.1 The resistance data are dominated by a zone of high resistance towards the centre of the survey area. This comprises linear responses (1) indicative of ridge and furrow cultivation and more amorphous areas of high resistance (2). While it is not unusual for ridge and furrow to produce clear anomalies within resistance data, the variation in the strength of the responses may be significant. However, this may simply be due to natural subsoil variations.
- 4.2 The low resistance response (3) may indicate a ditch type feature and corresponds with gradiometer anomaly (C), although this could be modern and associated with relatively recent activity within the field.
- 4.3 The well-defined low resistance anomaly (4) in the south of the area is due to a service trench associated with the service (A) identified in the gradiometer survey.
- 4.4 In the north of the survey area, in the vicinity of the known archaeology revealed in the eroding section, no well-defined resistance anomalies are apparent. However, an area of low resistance (5) is apparent which would be consistent with midden deposits. A similar response has been detected further to the south (6). When viewing the data, in particular the relief plot in Figure 5, these lie within a relatively well-defined broader area of low resistance defined by trend (7). While this may simply be due to natural variations in the subsoil, its apparent correlation with the exposed archaeology immediately to the north suggest it may be significant indicating the limit of anthropogenic soils.
- 4.5 A broad, ill-defined area of high resistance (8) and suggestions of east-west trends (9) have also been detected in the north of the survey area, one running to northwest corner of the field. It is likely that they are associated with the former cottages that used to be on the site or the track way (Thief's Lane) leading to Grove Cottage, as shown on the Ordnance Survey map of 1871.

4.6 Weak linear responses (10) apparent in the southwest of the survey area are thought to indicate the line of yards at the rear of cottages on the Causeway, as shown on the Aitken's survey of 1764.

## **5. Conclusions**

5.1 While the result of the surveys are not as exciting as one might have hoped the gradiometry has identified a zone of potentially archeologically significant anomalies in the north-west of the survey area suggesting that the site exposed on the coast may extend some 30m inland.

5.2 The resistance data is dominated by responses from ridge and furrow cultivation and more amorphous anomalies which are thought to be due to natural pedological/geological variations.

5.3 Both resistance and gradiometry have indicated the line of Thief's Lane and the yards to the rear of previous cottages on the Causeway.

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