Monasteries in Iceland
Report on Geophysical Survey – Season 1

Interim Report
November 2014

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Index

Cover Photo: Geophysical survey at Thingeyrar. Mangnetometry (FM256) on left and Resistivity (RM 15) on right.

Summary

Between 24th April and 2nd May 2014 Grampus Heritage and Training Ltd undertook geophysical survey on three sites commissioned by the Monasteries in Iceland project. The survey was funded through the Rannis programme and this interim report summarises the results of the first of two planned seasons of survey fieldwork.

This report shows the results of the geophysical surveys at Thingeyrar, Reynistadir and Helgafell.

The survey results on each of these sites show the potential to apply both magnetometry and resistivity techniques in Iceland successfully and helps us to understand the appropriateness of each technique in different site conditions. The aim of the surveys was to search for archaeological evidence of the Monastic houses known to exist at these sites from documentary sources.

The survey results showed good evidence of archaeological activity at Thingeyrar and Reynistadir. The results at Helgafel are from resistance survey only and show several possible archaeological anomalies.

Acknowledgements

We would like to thank Professor Steinunn Kristjansdottir for commissioning this work within the Monasteries in Iceland Project, for leading the fieldwork team and for planning such an innovative and exciting survey programme. Thanks are also due to Margret Valmundsdottir (GPR operator & GIS specialist) and to the rest of the UK survey team Joanne Stamper, Ray Newton, Mick Fairfield, Ian Thomson and Frank Giecco.

1.0 Fieldwork Methodology

Magnetometry: The magnetometer surveys were conducted using a Geoscan FM256 dual fluxgate gradiometer system, with data processed using Geoscan's Geoplot 3 software. Data was downloaded daily and processed in the evenings to identify anomalies and inform the direction of survey work the following day. The survey was conducted at the following resolution: 0.1nT readings, traverse interval 0.5m, readings taken every 0.25m in the traverse direction. (0.5 X 0.25)

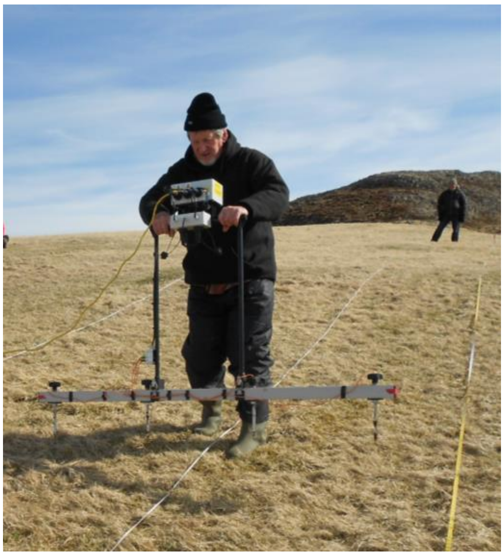
Resistivity: The resistivity surveys were conducted using a Geoscan RM15 resistivity meter with multiplexer and PA20 beam and four probe array. The overall resolution of the survey was 1 meter traverses with readings taken every 0.5 metres in the traverse direction. (1 X 0.5)

A physical grid of 20m cells was established on each site using hand tapes and grid pegs. Traverse lines were established on each grid to enable accurate coverage of the survey area. The same survey grid was used for both magnetometry and resistivity to allow for a direct comparison of results.

Following completion of the geophysical survey, a Leica TCR 307 Total Station was used to survey the grid in relation to other visible features and fixed points. This was to enable the location of anomalies in the field from known reference points and to facilitate the georeferencing of surey data within appropriate coordinate systems.

The collection of resistivity data in the field is a slower process than magnetometry. Therefore, where both techniques have been used, the area covered by the magnetometer survey is larger than the area covered through resistivity. This is because the magnetometers automatically log readings every 0.25m as they are being carried in the traverse direction, whereas resistivity survey requires the operator to stop and insert the probes in the ground at set increments (0.5m in this case).

Magnetometer Survey (FM256)



Resistivity Survey (RM15)

2.0 Results

The results of the magnetometer and resistivity surveys are shown in Figures 1 to 14 in appendix 1 of this report. Interpretation is limited and only offered for the clearest proposed archaeological anomalies. Understanding of the anomalies will only be achieved through excavation and the survey data should be viewed as a tool for the targetting of further fieldwork. The parameters of the displayed data are shown in the key on the right hand side of each plot. For each area, several plots have been produced and studied to assist in interpretation including raw data, positive, negative, bluescale, dot density and relief. To illustrate the results clearly in this report, only positive and negative greyscale plots of the data are included.

2.1 Thingeyrar

The first site visited by the survey team was at Thingeyrar. Here, a sub-circular earthwork is clearly visible above ground. This site provided a good opportunity to test both magnetometry and resistivity on a visible feature to compare how each technique recorded the feature and if any further anomalies could be identified in association with the known earthwork.

Resistivity Survey (Figures 1 to 4):
Figure 1 shows the results of the completed survey of the earthwork and immediate surroundings in association with the church fence to the north and water pump and grave plot to the south. Seven complete grid squares and three partial squares were surveyed. The grid squares are shown as red lines in figure 1.

The resistivity survey at Thingeyrar worked very well and the outline of the small enclosure can clearly be seen in the positive and negative greyscale plots (figures 2 and 3). The main enclosure shows as a black outline in the positive data (figure 2), showing that the enclosure bank has a lower resistance than the surrounding ground. The lower resistance shows a higher moisture content and is related to the presence of more soil or turf in the bank of the structure. The interior of the enclosure also shows a lower resistance than the surrounding land and is visibly darker in the positive data (figure 2). This may be a result of a greater depth of soil in the interior or may be a result of the earthwork itself retaining moisture within the enclosure. At least four dark sub circular anomalies can be seen within the enclosure which may be pits or postholes.

The shape of the enclosure in the survey data was surprising because, above ground, the shape of the earthwork appears to be broadly ‘sub-circular’. In the data however, we can clearly see that the shape is more carefully layed out, being broader in width with curving corners in the southern part and narrowing to the north with a very straight shorter northern boundary. This northern boundary appears to correspond to an area of high resistance outside of the enclosure to the north which is highlighted with a green outline in figure 4. This area of high resistance represents the presence of stone close to the surface and may be one large stone or outcrop of bedrock, or may be a concentration of smaller stones. The enclosure boundary appears to have an entrace approximately 3.5m wide in the north east corner shown as a break in the red line in figure 4. The darker termini of the enclosure boundaries on either side of this entrance may represent the postholes of a gate structure. A second possible entrance is visible as a double line in the enclosure boundary in the south west corner.

Two additional linear features can be seen inside of the enclosure, highlighted in yellow in figure 4. These can also be interpreted as the footings of earth banks though may represent a different phase of activity to the visible earthwork. A short boundary can also be seen running from the enclosure to the south east.

The arrangement of the enclosure is reminiscent of an auditorium layout, being broadest in the south to accommodate the audience and narrowing to the north with the area of high resistance (stone) outside of the enclosure perhaps functioning as a platform or stage. Access to ‘the stage’ could be provided by the break in the northern boundary, while access to the main enclosure could be through the double bank line in the south west.

A clearly defined area of low resistance is visible in the south east corner of the plot, outlined in blue in figure 4. This is interpreted as the old graveyard which is known to have existed at the site. A series of postholes can be seen marking the outer boundary of this feature.

Magnetometry Survey (Figures 5 to 7)

The first attempt at magnetometry on the site was unnsuccessful. This was due to the presence of a highly magnetic area in the west of the site and difficulty in locating a suitable zero point to represent the average background magnetism. With this experience however, the second attempt to set up the instruments was successful and allowed for one full day of surveying to be undertaken.

As with the resistivity survey, the magnetometry survey clearly shows the shape of the earthwork enclosure. In addition to the visible earthwork, the magnetometry data shows a more complex layout of associated banks and enclosure boundaries, some of which respect the visible earthwork and may therefore be considered contemporary with the use of the feature. An interpretation of these associated enclosures is highlighted in red in figure 7, with the outline of the visible earthwork shown in green.

The clarity of the associated boundaries and enclosures varies in the data and makes confident interpretation difficult. Without doubt some of these linear features respect the visible earthwork, however others appear to cut through the feature suggesting several phases of activity.

A subcircular positive magnetic anomaly is clearly visible in the data on the couth east boundary of the visible earthwork. This may be a large pit and is highlighted in yellow in figure 7.

A second site of archaeological earthworks was identified by Professor Kristjansdottir from aerial photographs and was visited as part of the survey. Resistivity survey was attempted at this site but the terrain and vegetation were so uneven, and walking steadily and evenly so difficult, that neither resistivity nor magnetometry could be used successfully.

2.2 Reynistadir – Klausterhol

Magnetometry: (Figures 8 and 9)

The magnetometry survey at Reynistadir worked well. A suitable zero point was established on the site and the instruments re-zeroed after completion of each grid. The survey focused on a visible earthwork close to a house, though a larger area was covered to investigate possible associated features. Figure 8 shows the whole survey result and surveyed fixed points. These include four electricity poles, the church fence and nearby house.

The underlying geology creates a rather confusing background to the whole survey, however figure 9 focuses on the area of the visible earthwork and highlights the area of archaeological activity identified in the results. The red lines indicate likely wall and boundary lines. The archaeological activity appears to be cut by the sewage outflow pipe from the nearby house, shown in blue in figure 9.

Resistivity: (Figure 10)

The resistivity survey worked reasonably well on the site, though it proved difficult to find a suitable matching reference point on the second day. This led to a mismatched appearance when processing the two grids together and is the reason that the north and east survey results in figure 10 appear darker than the rest of the survey. Nevertheless, the results clearly show wall lines which are highlighted in red in figure 10. These are high resistance linear anomalies and suggest the presence of stone in these foundations.

As with the results at Thingeyrar, there is a good correlation between the archaeological anomalies identified in both the resistivity and magnetometry surveys at Reynistadir. Using both datasets we can confidently interpret a spread of archaeological activity and buildings aligned roughly NE / SW which seems to focus on the visible mound but also extends to a possible square building in the south west and to the north east where it has been truncated by the sewage pipe. Targeting of the clearest wall lines could quickly establish the nature of the identified structures.

2.3 Helgafell (Figures 11 – 14)

The main survey area at Helgafell focused on an area to the west of the fell close to the visitor car park and lake. This site was considered to be of high potential due to the terrain and identification of possible ruins. It was immediately apparent that magnetometry was not suitable for this site due to the highly magnetic geology. The gradiometers could not be set up or zeroed and were registering readings over 1000nT.

The resistivity meter worked reasonably well, though the thin soil and stone in many areas made the survey difficult. Figures 11 and 12 show the whole result of the survey in association with the surveyed points of the road edge, WC and nearby shed.

Figure 13 offers a simple interpretation of the anomalies and highlights the most likely archaeological anomaly in red. This apparent rectilinear structure may be a building, however the general east / west alignment of the anomalies and linear features certainly include a great deal of geology and it is possible that the survey is only showing resistance variation as a result of varying depth of the underlying geology. The bedrock is visible in parts of the site.

The rectilinear area of low resistance in the data, highlighted in blue in figure 13, stands out in the data and is worthy of investigation. A key area to target through excavation to establish if all of the anomalies are geological would be the western extent of the possible building.

A small grid was established and surveyed to the north of the present church at the foot of Helgafell. The aim was to survey a visible curving boundary and search for evidence of other features. Figure 14 shows the results of this survey, with the old churchyard boundary highlighted in green. A high resistance anomaly, apparently rectilinear in form, was identified to the west of the old boundary (north west from the present church) and is highlighted in red in figure 14. This anomaly is located on the track leading to the present farm and may simply be a result of stone in the trackway. However, the apparent rectilinear form of the anomaly, with a lower resistance reading in the middle, may be a building foundation and warrants further investigation.

3.0 Conclusion

The first phase of geophysical survey within the Monasteries in Iceland Project has established that both magnetometry and resistivity techniques can be used successfully in Iceland, depending on site conditions. Furthermore, a number of interesting anomalies have been recorded at each of the three survey sites which suggest archaeological activity and which provide well justified excavation targets for future fieldwork.

As with all geophysical survey, the results can only be fully understood following excavation, though with the benefit of the survey data we can understand a great deal about the layout and nature of the anomalies from a few small evaluation trenches. The results of future evaluation through excavation will be invaluable in helping is to understand the cause of the identified anomalies (geological or archaeological) and will help in providing more accurate interpretation of future survey results.

A full report of the whole survey will be produced following the completion of a second planned season of fieldwork in 2015.

APPENDIX 1

SURVEY PLOTS

FIGURES 1 to 14