Geophysical Report No. 9

Blackabbey

Co. Down

Dr Steven Trick

Blackabbey, Co. Down

A geophysical survey carried out on behalf of

The Environment and Heritage Service
Department of the Environment, Northern Ireland

by

The Centre for Archaeological Fieldwork
School of Geography, Archaeology and Palaeoecology,
Queen's University,
Belfast
BT7 1NN

Dr Steven Trick
June 2006

1 Introduction

1.1 This document details the results of an evaluative geophysical survey carried out in the townland of Blackabbey, Co. Down, in response to a planning application issued by the landowner. The application site lies adjacent to a scheduled area containing the site of the 12th Benedictine Abbey of Blackabbey (DOW 012:010). In May 2006, EHS: Built Heritage requested the evaluation of this field since it may contain subsurface archaeology related to the monastery complex, and other previously unrecorded archaeological deposits. Figure 1 shows the location of the evaluation area within the Ards peninsular, Northern Ireland.

2 Historical background

2.1 According to the SMR entry (DOW 012:010), Blackabbey monastery was founded in the late 12th century by John de Courcy. The standing remnants of the abbey buildings were cleared away shortly before 1847, an event which may be related to the simultaneous building of a house half a mile to the south. Sections of medieval walling have been found in the field, and medieval tiles and pottery have been found after ploughing. A 13th century coffin lid found at the site is now at Greyabbey.

2.2 First and second edition OS maps depict the location of the 12th century monastery at Blackabbey, although the locations differ slightly on successive editions. Locally the field containing the abbey site is known as ‘Kirks’ (Noel 2002, 2). An aerial photograph of this field from 1962 shows dark staining of the soil at this site, possibly related to medieval activity (see Figure 2).

2.3 In 2002, the EHS commissioned a geophysical survey of Kirks, and half the field immediately to the northwest adjacent to Blackabbey Road, known as ‘Seven Acre’. The survey was carried out by GeoQuest Associates, of Co. Durham, England (Noel 2002). These areas were surveyed with a fluxgate gradiometer, and in addition a small area of Seven Acre was surveyed with earth resistance equipment. To summarise the results, a series of linear anomalies in Kirks were interpreted by the surveyors as representing ditches relating to the abbey precinct. Discrete areas of increased magnetic response in the same field were interpreted as scatters of brick, tile or burnt material related to demolition of the church and associated buildings. A sinuous band of increased magnetic response encountered in Seven Acre with geometric internal detail suggestive of a human derivation, were concluded as being of geological origin.

3 Geology

3.1 The whole region is covered by drumlins underlain by bedrock and stretches right across Co. Down and Armagh as part of the Southern Uplands-Down-Longford Terrane, which assembled by orogeny in the Ordivician, Silurian, and Devonian periods and forms the Irish and British Caledonides.

3.2 The bedrock consists of marine sedimentary rocks of the Lower Palaeozoic and forms a back-arc basin thrust stack which can be split up into a number of tracts younging to the south and separated by faults north and south. Each tract is comprised of thick, well-bedded turbidite sequences comprising greywacke sandstone, siltstone and mudstone. The rock on this site sits on one of these tracts, which is known as the Gala Group. This particular turbidite sequence is rich in quartz and contains layers of shale and occasional layers of bentonite (McAllister pers. comm.).

3.3 The drift geology of the site consists of shale till, above which has developed a brown ranker soil. East of the site are marly soils which can often be gleyed (Cruickshank 1997).

4 Site Description

4.1 The southern end of the evaluation area lies on a prominent drumlin ridge, which dips northeast-wards to lower ground of the northern end of the evaluation area (see Plate 1). This latter area is prone to waterlogging, explaining the presence of a number of *sheughs* which follow the field boundaries. In the adjacent Kirks field drains have been installed in the low-lying areas in order to combat surface water (Woods pers. comm.).

4.2 In the low-lying northern end of the evaluation area there is a distinctive landscape feature in the form of a low mound, measuring c. 40m across (indicated on Plate 1). It is uncertain whether this is a natural mound or an archaeological deposit. It continues into the next field to the north, where its form is more irregular and it merges gently with the surrounding terrain, suggesting it is a natural feature. However, the sheugh that mirrors the field boundary which bisects the mound, stops at the edge of the raised area. The profile of the sheugh at this point is comprised of rough stone blocks, suggesting the mound is a cairn of piled stone, which may add weight to the suggestion that it is anthropogenically formed. Despite its location at the edge of a field, it is perhaps too large to be a clearance cairn.

4.3 At the time of survey the field was under grass to be cut for silage. Patterns in the grass crop suggested that the seeding tractor traversed the field in a zig-zag pattern NE-SW. There were no particular complicating factors for the survey. Barbed-wire fencing bounded the evaluation area on the eastern and northern sides and this had some effect on the subsequent magnetic survey (see Section 7, Results, below).

5 Survey strategy

5.1 Taking into consideration the size of survey area, the solid geology and expected archaeology, it was decided that both resistance and magnetic methods should be applied to the site in order to maximise the chances of detecting anomalies of archaeological potential.

5.2 Due to the proximity of the evaluation area to former monastic complex, the site may be expected to contain subsurface remains of buildings or other activity related to the abbey. Magnetometry, specifically the use of fluxgate gradiometers, has been shown to be the fastest and best general method for detecting a broad range of archaeological anomalies. Resistance methods are proven to be particularly suited to detecting buried walls or the ditches of robbed-out foundations (Gaffney and Gater 2003). Both methods, particularly the former, have successfully been employed in archaeological evaluations in this part of the Ards peninsular (see Noel 2002).

5.3 The survey took place over four days between 2nd and 5th May 2006. The weather was wet and windy for the first two days, becoming drier and warmer for the final two days.

6 Method

6.1 A series of 20m x 20m grids were set out using a total station, from a baseline positioned alongside the eastern field boundary. The total station was also used to survey the position of the field corners so that the geophysical plot could be placed on the base mapping.

6.2 The earth resistivity equipment comprised a Geoscan RM15 earth resistance meter, used in the twin-probe configuration. The probe separation was 0.5m metres. Grids were surveyed in a zig-zag manner, with a traverse interval of 1m and a sample interval of 0.5m. The collected data were downloaded and processed using Geoplot 3.0s program by Geoscan Research (Geoscan 2005).

6.3 Figure 3 shows plots of the earth resistance survey at from Blackabbey. Figure 3a shows the raw data. Figure 3b shows the processed plot, where the data have been clipped to -1.5 to +1 standard deviations either side of the mean to provide better contrast, and the data have also been interpolated to provide a smoother plot. Since the background geological response is fairly strong in these data, a high-pass filter has been applied in order to combat the effect, the result is shown in figure 3c. In Figure 3d, the data have been clipped to bring better contrast to the high-resistance area around the mound at the bottom of the field. Some internal detail is now apparent. Figure 4 shows the standard processed data overlaid on the base map.

6.4 The magnetometry equipment consisted of a Bartington Grad601-2 dual sensor fluxgate gradiometer. The traverse interval was 1m and the sample interval was 0.25m. Grids were surveyed in a zig-zag pattern. The data were downloaded using the Bartington Grad601 application, and were then imported into Geoplot 3.0s for processing.

6.5 The magnetic data contained a number of 'spikes' caused by ferrous rubbish. To combat the effect of these spikes, the data were initially clipped to ± 75nT. Figure 5a shows a trace plot of the clipped data. The data were then passed through a despiking filter to further remove the effects of ferrous rubbish. Low-pass and interpolation filters were then applied to produce a smoother plot. The data were finally clipped to ±10 nT to provide more contrast. The processed data can be seen in figure 5b. Figure 6 shows this plot overlaid on the base mapping.

7 Results

7.1 Resistivity

7.1.1 It can be immediately seen in the resistivity plot in Figure 4 that the local geology has a marked effect on the response. This is seen in the plot as a gently undulating shift from darker to lighter shades across the evaluation area. Within these patterns are more localised changes in earth resistance that may represent archaeological features. Of note is the oval, high resistance feature at the north-eastern end of the study area, which corresponds with the topographic feature of a low mound, further discussed below.

7.1.2 Figure 7 shows a graphic summary of the anomalies identified which are further discussed below.

7.1.3 Visible in the western half of the evaluation area are a series of faint parallel lines (**r1**), spaced 5m apart, which share an alignment with the eastern field boundary. Similar patterns were noted by the 2002 resistance survey in Seven Acre field to the west (Noel 2002, figure 4). This earlier survey interpreted the anomalies as either the natural jointing of bedrock rising close to the surface, or a dense set of plastic drains oriented down-slope. The present author forwards two possible interpretations for these patterns. They may be geological in nature, as the earlier survey suggested, due to their geometric pattern suggestive of natural bedrock formation. Alternatively they may be the result of an episode of deep ploughing in the past. These anomalies are therefore considered to be of low archaeological significance.

7.1.4 Entering the southern corner of the study area and heading in a north-south direction is the low-resistance linear anomaly at **r2**. It is 1-2m wide and can be seen to continue through the plot for some 40m. It has no obvious interpretation although it may be a negative cut feature such as a ditch, which has filled up with fine water-holding soil. Since it traverses across the slope, it may alternatively represent a terraced trackway across the field, entered from a former gate in the corner.

7.1.5 Running perpendicular to Anomaly r1 are a number of sinuous, branching, high-resistance anomalies (**r3)**, measuring between 0.5m and 1m in diameter. Their organic morphology would suggest that they are natural in origin, perhaps the jointing of the bedrock beneath the surface. These anomalies share their alignment with the igneous dykes of the Ards peninsular i.e. NW-SE, formed in the Tertiary (Meaghan pers. comm.). Their high-resistance response suggests these fissures have filled with material such as boulders and stones. It is not inconceivable that they are the result of human action, perhaps in the form of field drains. The adjacent field, Kirks, is known to incorporate plastic-lined drains filled with gravel (Noel 2002). Contradictory to this latter interpretation is the fact that these anomalies continue someway up the slope of the drumlin ridge where theoretically any excess water would be carried away by natural run-off.

7.1.6 The pattern at **r4** is a zone of high-resistance readings recorded when traversing the low mound at the bottom of the field. Readings on the mound were between 100 - 204.7 ohms. As discussed above, it is uncertain whether this mound represents a natural, glacial feature, or is the result of human action. The profile of the sheugh which abuts the mound suggests that it is a cairn comprised of rough stone blocks, material which would indeed exhibit high resistance values. During the survey a number of large, flat stones were visible amongst the grass in the top of the mound. Figure 4d, provides some extra detail, showing discrete areas of very high resistance,

however these are incoherent in form, and perhaps simply indicate where the bedrock or cairn material is closest to the surface.

7.1.7 Anomaly **r5** is an intersection of high-resistance linear anomalies, only faintly visible in the plot. Their coincidence at right-angles may suggest that they are anthropogenic in origin, possibly buried walls forming the corner of a building. However this patterning could be the result of a coincidence of the two types of anomaly already identified and discussed, i.e. Anomalies **r1** and **r3**.

7.2 Magnetometry

7.2.1 Overall the survey area was magnetically quiet, with only a few areas of increased magnetic response that may be archaeological in nature. A scattering of spikes in the data, visible in the trace plot (Figure 5a) are likely to be modern ferrous rubbish such as strands of barbed-wire fencing or bits of agricultural machinery. Their effect on the final processed plot (Figure 5b) has been reduced through the application of a despiking filter. The high readings along the southeastern edge of the plot are caused by the barbed-wire fence adjacent to the survey baseline. Figure 8 shows a graphical summary of anomalies discussed below.

7.2.2 Anomaly **m1** is a circular anomaly c. 3m in diameter, which provided a moderately strong, positive magnetic response. This is interpreted as a pit which has filled with enhanced materials, or a hearth which has baked the ground surface.

7.2.3 Anomaly **m2** is a faint linear arrangement of positive magnetic response. This anomaly is not mirrored in the resistance plot, and its interpretation is uncertain. It may represent a former field division against which enhanced material has come to rest, or a trackway across the field.

7.2.4 The patterning at **m3** is an area of increased magnetic response which continues beyond the edge of the survey area. It is uncertain whether this represents an archaeological or geological deposit, due to its limited extend within the survey area. Further survey would be required to ascertain the nature of this anomalous area.

7.2.5 In the eastern corner of the survey area is a discrete area of increased magnetic response (Anomaly **m4**), roughly oval in shape, measuring 20m x 13m in diameter. This area exhibits a strong bipolar response, with a maximum positive reading of 75nT. The detail within this anomaly is best visualised in the trace plot in figure 5a. Interestingly this anomaly does not coincide spatially with the mound which provided the high-resistance values (**r4**), but instead lies some 5m to the south. It may

however be related to resistance anomaly **r5** with which it coincides. The strong magnetic response would suggest a thermo-remnant quality to the subsurface materials, suggesting perhaps a former area of industrial activity where furnaces or kilns were located. Alternatively there may be a geological explanation for this anomaly. It is possible that it represents an igneous lamprophyre, where volcanic lava has shot up vertically through faults in the rock, to present on the surface as an igneous 'boss' (Meaghan pers. comm.). This basalt deposit in the subsoil would provide a strong magnetic response, lacking in spatial structure such as this.

8 Conclusions and recommendations for future work

8.1 The survey at Blackabbey highlighted a number of geophysical anomalies, some of which may be archaeological in nature. The majority of the anomalies however are suggestive of recent agricultural practice, or the result of natural pedological process.

8.2 The paucity of rectilinear resistance anomalies provides negative evidence for a continuation of the Benedictine abbey precinct into this field. However, the strong magnetic response in the eastern corner of the survey area (m4) possibly represents an industrial area, perhaps linked with activities at the monastery.

8.3 The mound at the northeastern edge of the study area (r4) is enigmatic. The high-resistance nature of this landscape feature suggests it may be a cairn of some archaeological significance.

8.4 In light of the points above, it is recommended that Anomalies r4 and m4 be further investigated through an exploratory excavation, to ascertain their nature, and if applicable, their dating, and extent.

Acknowledgements

The following people are thanked for their assistance in the preparation and implementation of the fieldwork, and the writing of this report. Brian Sloan, Janet Bell, Lauren Mansell, Billy Orr (landowner), Barry Woods (landowner, Kirks and Seven Acre), Ian Meaghan, Naomi Carver, Rachel McAllister (Glover Site Investigations), Dr Phil Macdonald, Dr Colm Donnelly, Gina Baban (EHS), Declan Hurl (EHS).

Bibliography

Cruickshank, J.G. 1997. *Soil and environment: Northern Ireland*. Belfast: Agricultural and Environmental Science Division/DANI/Agricultural and Environmental Science Department, Queen's University Belfast.

Geological Survey of Northern Ireland. 1997. *Northern Ireland. Solid Geology* (Second Edition). 1:250 000. (Keyworth, Nottingham; British Geological Survey).

Gaffney, J. and Gater, C. 2003. *Revealing the buried past: geophysics for archaeologists*. London: Tempus.

Geoscan 2005. *Geoplot 3.00s for Windows instruction manual*. Bradford: Geoscan Research.

Mitchell, W. I. (ed.). 2004. *The Geology of Northern Ireland -Our Natural Foundation*. (Second Edition). Geological Survey of Northern Ireland, Belfast.

Noel, M.J. 2002. *Geophysical surveys on the site of Black Abbey, Ards, County Down*. Geoquest Associates, Co. Durham.

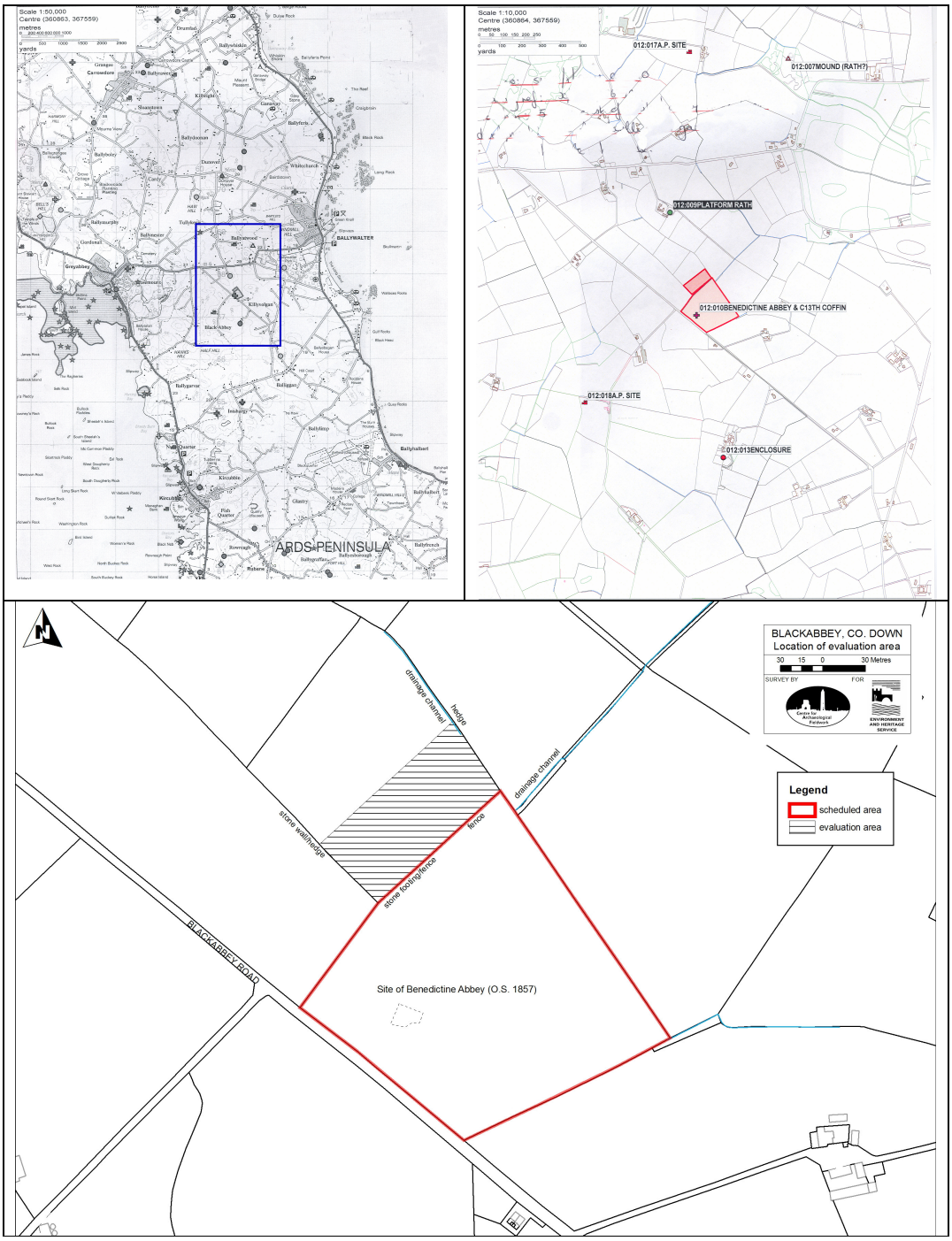
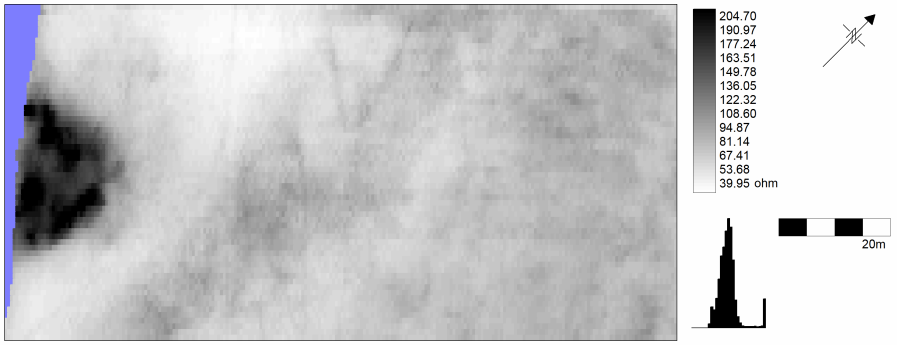


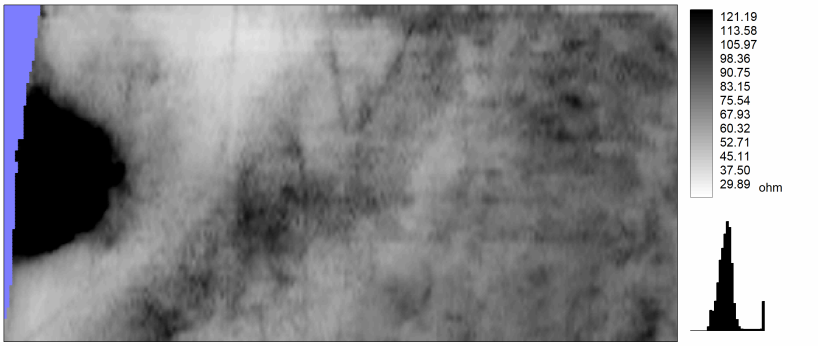
Figure 1. Location map of evaluation area.

Figure 2. Aerial photograph of evaluation area, taken on 23rd April 1962.(Courtesy of B.K.S. Air Survey Ltd, Surrey).

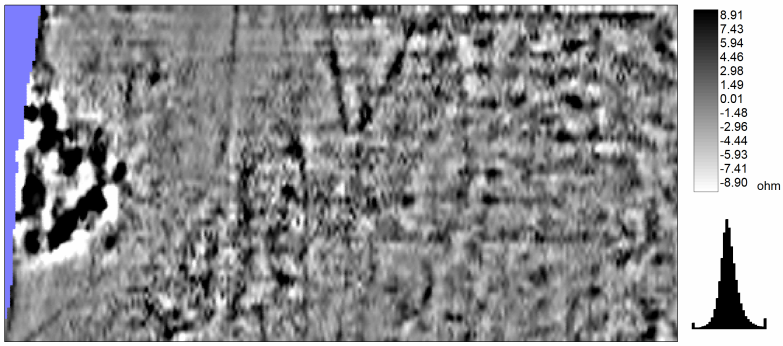
Plate 1. Evaluation area from the southern corner. Location of mound is marked.



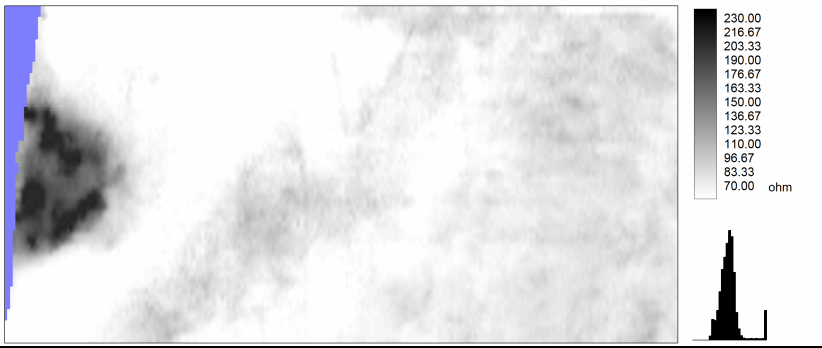
A) Raw Data



B) Processed Data



C) Geology removed



D) Higher resistance values

Figure 3. Earth resistance survey data.

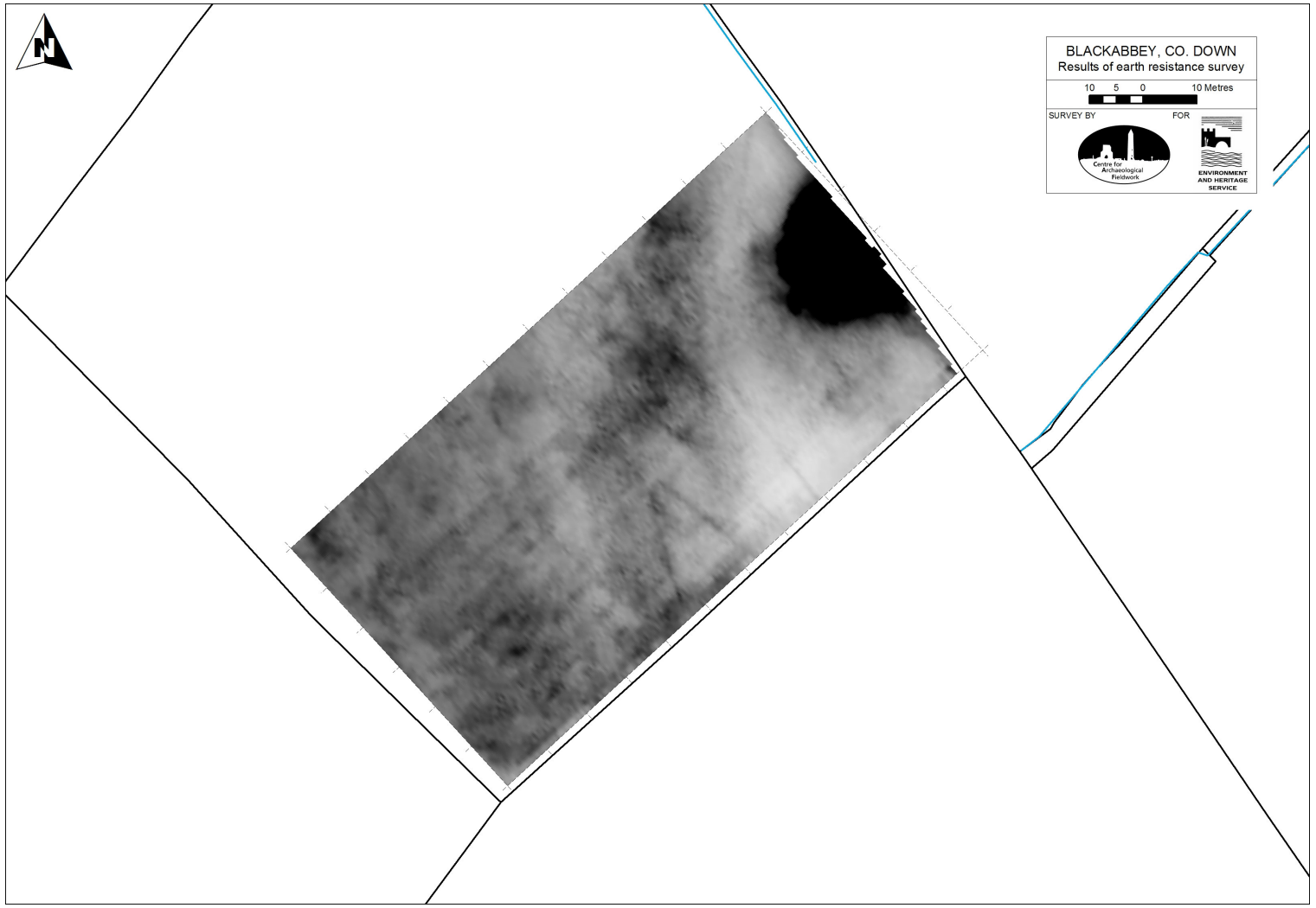
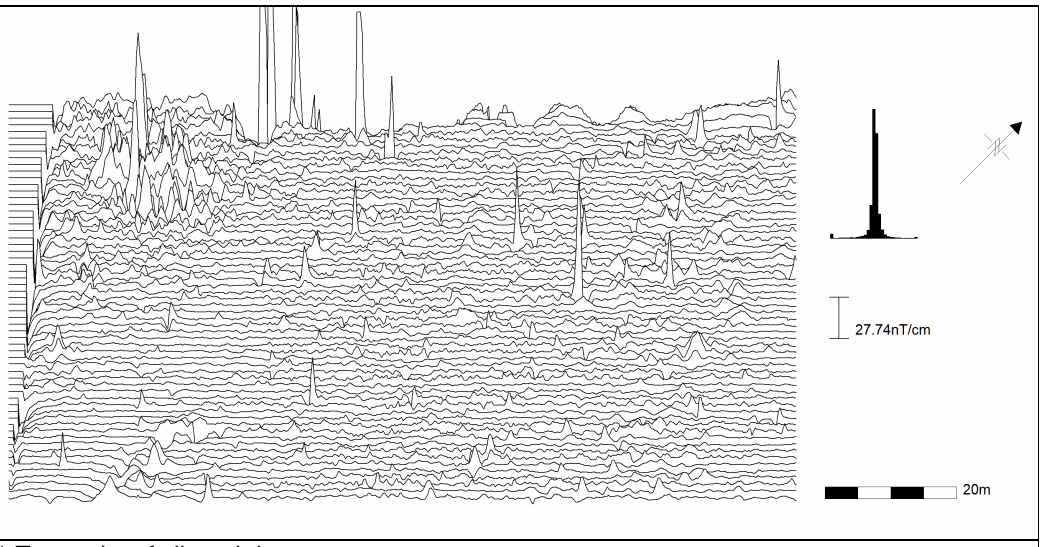
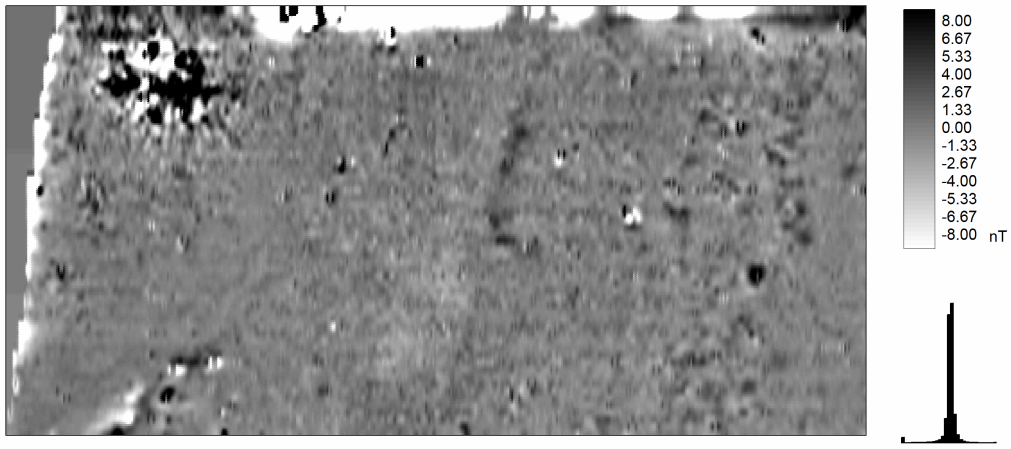


Figure 4. Earth resistance plot overlaid on the base map. Map lines based on Ordnance Survey 1971 1:2500 mapping.



A) Trace plot of clipped data



B) Processed data

Figure 5. Trace plot and shade plot of the processed magnetometry data from Blackabbey.

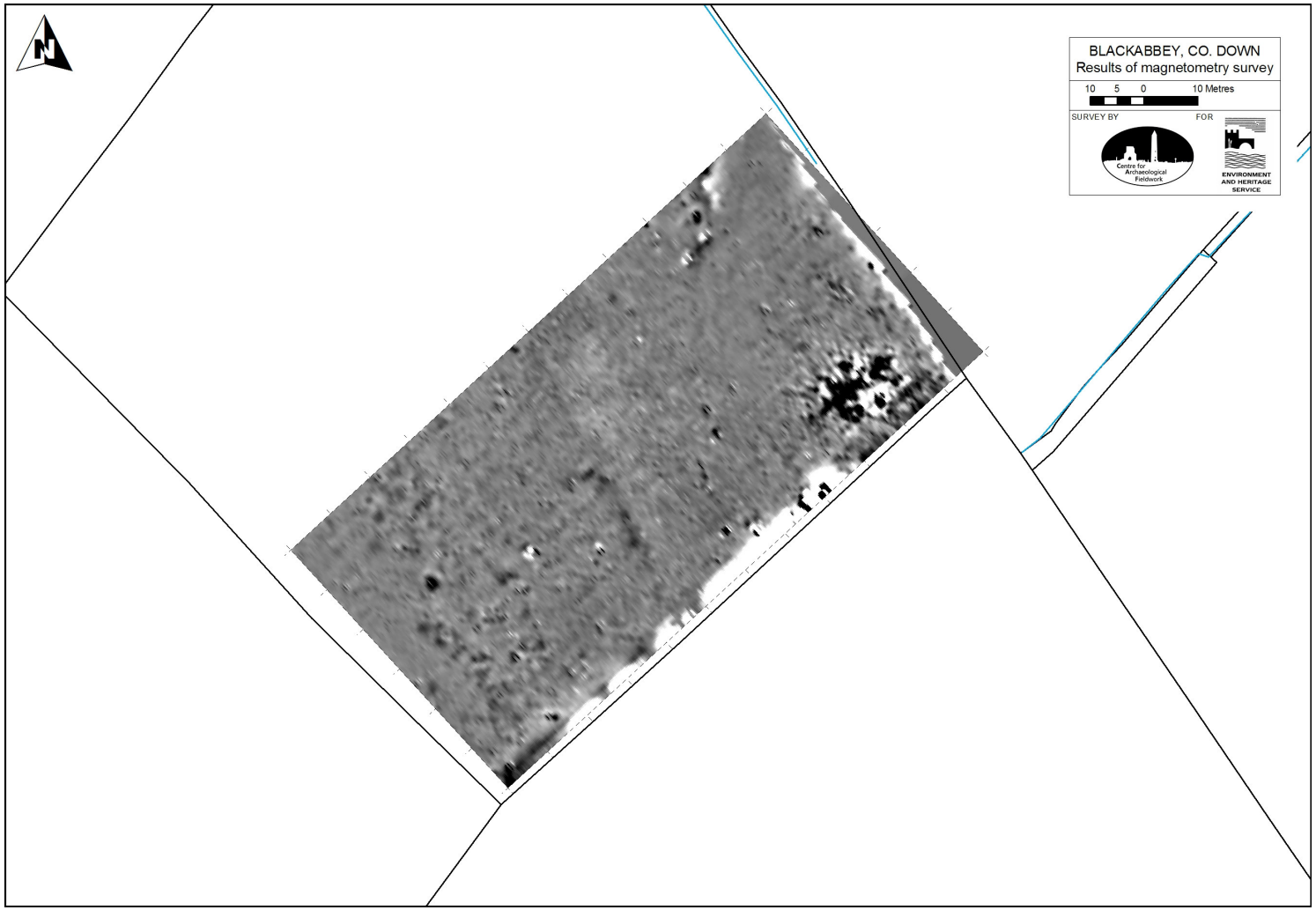


Figure 6. Plot of the magnetometry data overlaid on the base map.

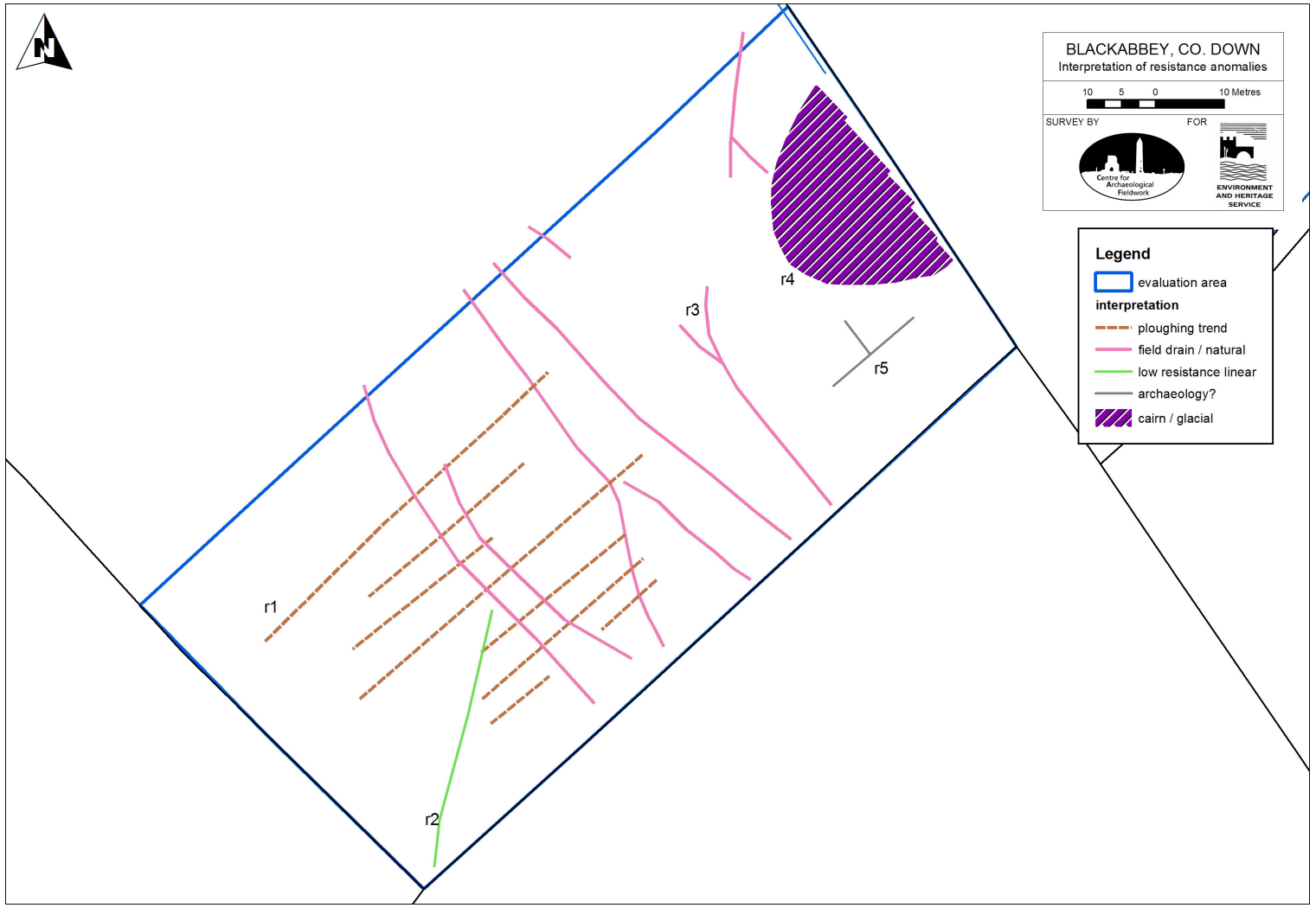


Figure 7. Graphic summary of resistance anomalies discussed in the text.

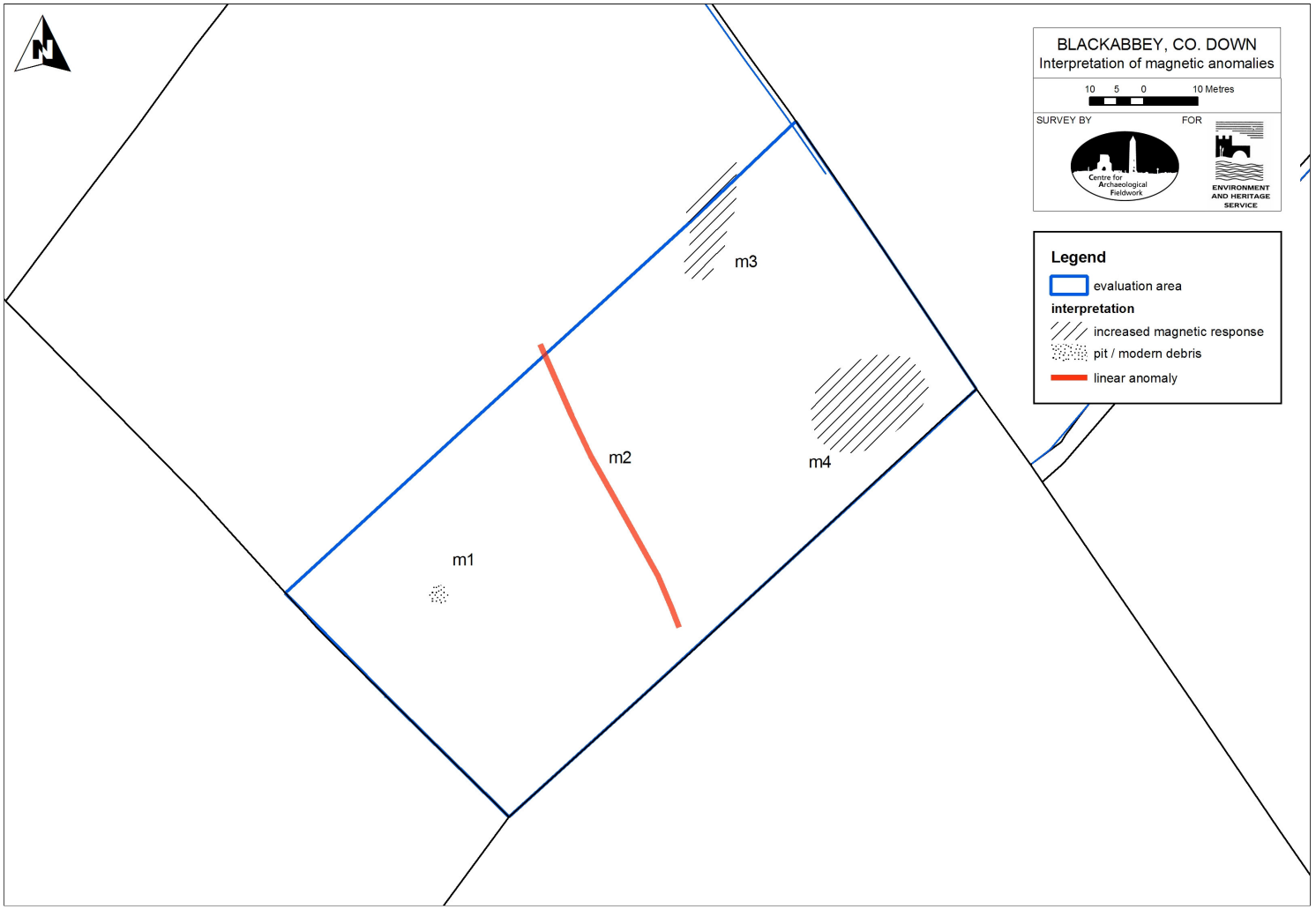


Figure 8. Graphical summary of the magnetic anomalies discussed in the text.