

# 21 Geophysical prospection 2007 on the Brough of Birsay

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## 21.1 Background

by Christopher D Morris

Although the geophysical work was carried out in 1975, 1979 and 1982 by Drs Roger Walker and John Gater in association with the excavations carried out by the University of Bradford (see Hunter with contributions by Dockrill *et al.* 1986: Appendix 5), from the standpoint of the early twenty-first century, this work now seems very limited in technical scope and ambition, and in the intervening period, techniques have advanced very significantly, both on the ground and in terms of processing and display. One particularly notable change of focus in the modern-day is from a single-site approach to that of landscape analysis.

As briefly noted in 2.2 above, modern landscape analysis in Birsay has been a focus of attention as part of the Birsay-Skaill Landscape Archaeology Project, directed by Prof David Griffiths, University of Oxford, himself formerly a student at Durham University and a member of the VESARP team working at Earl's Bu, Orphir in the 1980s and 1990s. The Birsay-Skaill Landscape Project was set up in 2003 to explore the potential for geophysical and topographic survey aiding in characterising wider archaeological landscapes in Atlantic Scotland (Griffiths 2006; Birsay-Skaill LAP; and below, Chapter 23). As part of its initial campaign in 2003 and 2004, the team undertook surveying, including geophysical survey, on the mainland side of Birsay Bay – essentially following up the wider aspects of sites reported upon in Volume 1 of the Birsay Bay Project (Morris 1989). This project encompassed a collaborative research partnership with Orkney College Geophysics Unit (OCGU) from its inception in 2004 (now renamed ORCA Geophysics as part of the UHI Archaeological Institute).

As a natural extension to Prof Griffiths's work in Birsay Bay, and as a logical coda to the earlier work of the Birsay Bay Project on the Brough of Birsay, it was proposed to Historic Scotland that a larger-scale geophysical survey be undertaken on the Brough of Birsay, encompassing the whole area from the 'Peerie Brough' (see Chapter 17, above) across to and including the Guardianship area. Historic Scotland agreed to fund Oxford University to undertake this project; the fieldwork was led by Dr Susan Ovenden of OCGU.

## 21.2 Introduction to survey (Illus 21.1)

The Brough of Birsay is approximately 21 hectares in extent. A geophysical survey covering an area of approximately 4.3 hectares using both gradiometry and resistance survey was undertaken on behalf of the Birsay-Skaill Bay Landscape Project (Griffiths *et al.* 2019, 45–7) funded by Historic Scotland, in August 2007. This covered both outwith and within the surveyed and excavated areas of the Guardianship area (covering ground to the west and north of the church, but excluding the church itself, and the very dense area of exposed building remains on its eastern side): and the south-western area culminating in the small peninsula known as the Peerie or Little Brough, as well as the ground between them. These investigations were undertaken to help place the known archaeological features within the wider archaeological landscape. A primary aim of the geophysical survey was to determine the extent of the archaeological deposits on the south side of the island. It was hoped to reveal the extent to which the areas previously excavated covered the full archaeological potential in the Brough landscape, whether archaeological



remains are continuous between the Guardianship area and the Peerie Brough, and how far non-upstanding remains might extend beyond the Guardianship area.

A report by Dr Ovenden on the work undertaken between the 6 and 19 August 2007 was lodged with Oxford University as the Client by Orkney College Geophysics Unit (OCGU 2007b) with a copy to Historic Scotland. This report forms the basis of this chapter, as initially edited by Prof Griffiths, and its appendix on methodology, together with the archive plots of raw data have been included within the online material accompanying this volume (see online 21.2.2; Illus M21.1–M21.25).

### 21.3 Results of gradiometer survey (Illus 21.2 and 21.3)

The data from the gradiometer survey indicates a generally high level of magnetic response across the survey area with isolated pit type responses being evident throughout. Although an explanation in terms of an archaeological origin for these isolated responses is extremely cautious, with a natural origin being more likely, several clusters of well-defined anomalies suggesting an archaeological origin have been detected, with the strongest response being recorded within the Guardianship area.

As discussed above, extensive excavation and consolidation has taken place within the Guardianship area. This combined with the amount of extant archaeological remains has resulted in a confused, and in some places ambiguous, data-set. However, certain aspects of the site are readily apparent. Within the centre of the Guardianship area is a well-defined zone of increased magnetic enhancement (1) within which coherent anomalies on a north-west to south-east alignment can be identified. Many of these correspond to the known structures and are noted as archaeological on the interpretation diagram. In this area, some strongly positive and relatively discrete magnetic anomalies located in the central interior areas of buildings (at sites identified as K, L and M) imply the presence of hearth material. However, across the Guardianship area as a whole, the cumulative effects of extensive past excavation, earth-removal and reinstatement, and the partial rebuilding of the structures all serve to exaggerate, confuse and mask the chance of 'true' archaeological signals being evident in the data. Other responses suggestive of enhanced deposits are apparent in the data, but interpretation is tentative, and these have been noted as '?archaeology'. Some negative magnetic responses have been noted on the interpretation diagram and indicate possible structural elements. However, interpretation of negative magnetic anomalies has to be cautious, as a negative anomaly can simply be a 'mathematical' component of a positive response, part of a di-polar anomaly, or indeed due to structural remains consisting of non-magnetic material. Interpretation of such responses on this site is further complicated by the apparent levels of magnetic disturbance in the area. It is not clear if the zone of magnetic enhancement is archaeological in

origin, the product of previous archaeological intervention, or a combination of both. It is of interest that comparable levels of enhancement are not apparent around the extant structures to the south-west. However while this variation in response could indicate different phases of settlement or different activity across the site, it could simply be due to different modern activity and treatment of the site.

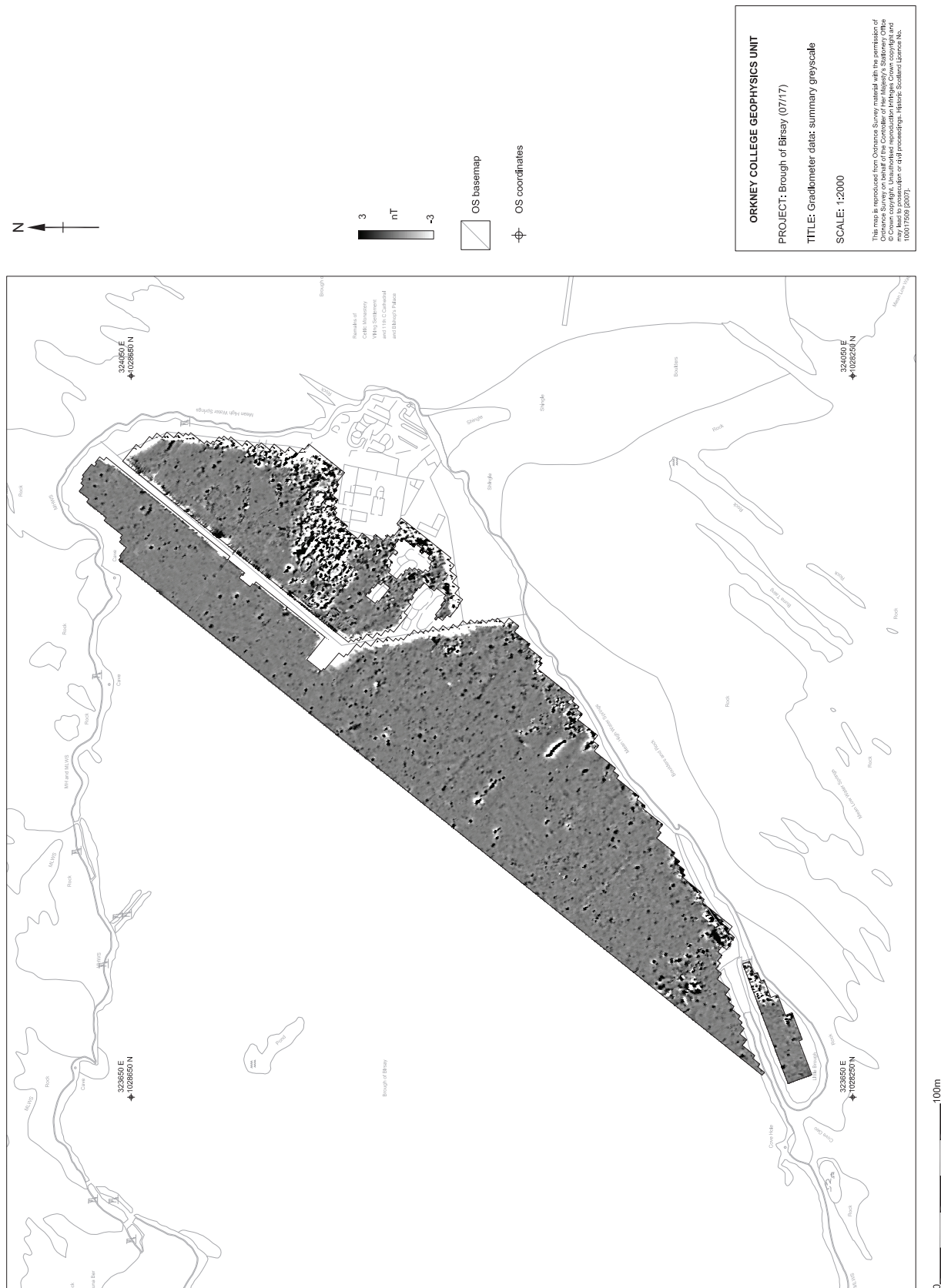
To the north-east of (1) and truncated by the small cliff are two further groups of responses (2) and (3), both of which are associated with known archaeological remains (Sites F, P and R: Emery and Morris 1996, 250; Hunter 1986, Site VII). A rectilinear anomaly (4) has been detected in the north of the Guardianship area, beyond the well-defined concentration of responses (1). This anomaly appears to be archaeological in origin and may indicate the presence of a hitherto-undetected structure. Although no structure has been recorded in this area, the size and form of the response is comparable with the extant structures in the south-west of the site. However the isolated and weak nature of the response and the lack of any corresponding anomaly in the resistance data, means that an archaeological interpretation has to be viewed with caution.

The data collected immediately to the north and west of the Guardianship area suggests that the built-up area of the settlement does not extend significantly beyond the current fenced boundary. A small area immediately to the west of the boundary could not be surveyed due to a spring and associated modern water-tank. A few trends are apparent (5) in the vicinity of the spring and are likely to be natural or agricultural in origin. As stated above, isolated pit-type responses are evident throughout the survey area, although the response (6) in the far north of the survey area has a slightly more coherent form and as a result may have an archaeological origin. Immediately to the south-west of the Guardianship boundary is a cluster of anomalies (7), which may indicate the end of another hitherto-undetected building extending just beyond Guardianship area. However, the adjacent wire-and-post fence confuses interpretation of the data.

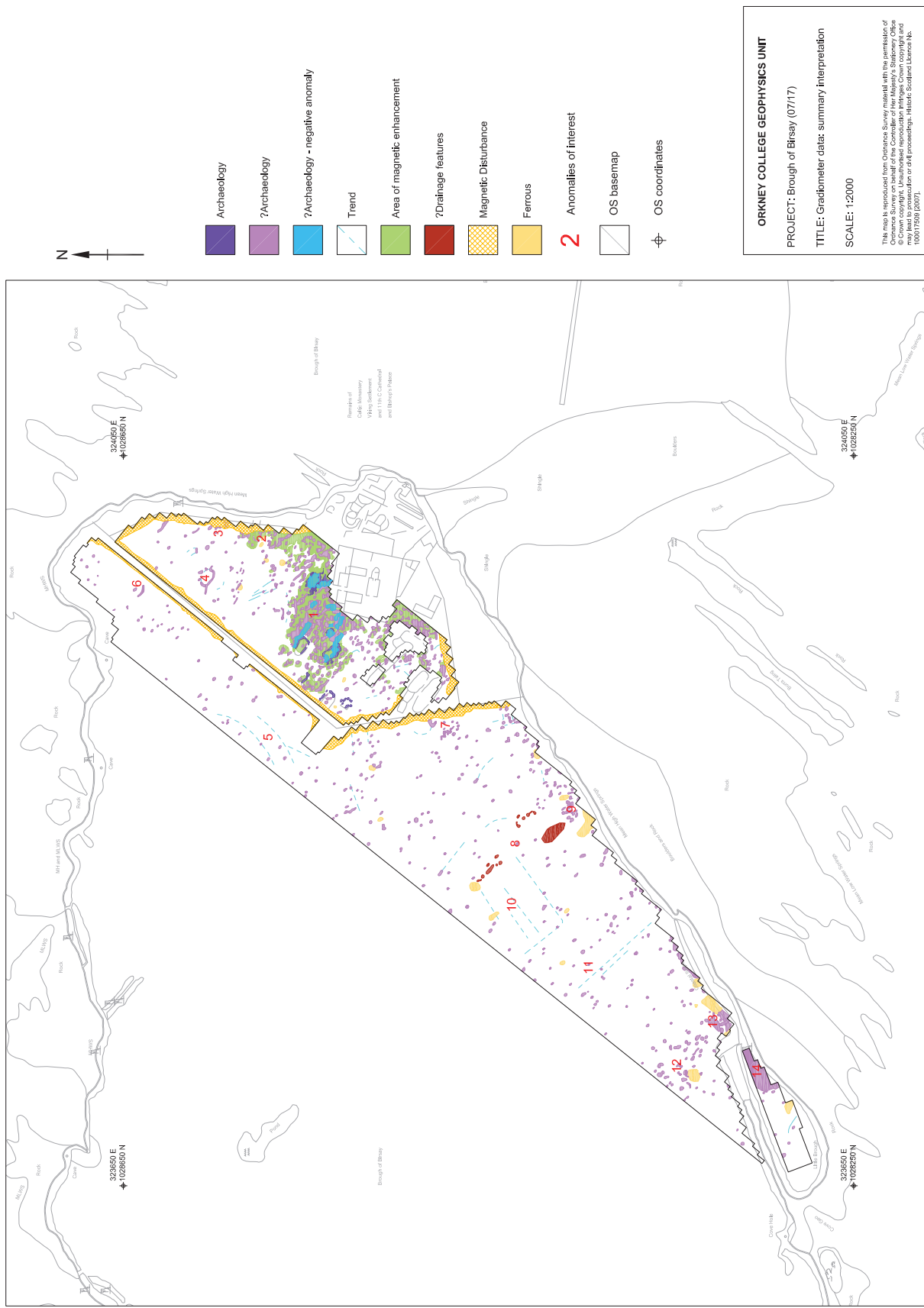
Towards the centre of the survey area several linear responses (8) on a north-west to south-east alignment have been noted. These vary in strength and although they may be relatively modern, possibly relating to drainage, an archaeological origin cannot be ruled out. Along the south-eastern coastal edge are archaeological-type anomalies (9) which, unfortunately, have been seriously truncated by coastal erosion (see below: 17.2 for overall survey and 17.5–17.7 for trial excavation of cliff-edge features in this area).

Several linear trends (10) running approximately east-north-east to west-south-west are apparent in the centre of the survey area and are possibly indicative of rig-and-furrow or runrig cultivation ridges.

An extant ditch and bank is just discernible as a weak linear trend (11) running north-west to south-east through the survey area. The response is most likely a topographic effect rather than a reflection of the composition of the bank



Illus 21.2 Gradiometer data: Summary greyscale 1:2000



Illus 21.3 Gradiometer data: Summary interpretation 1:2000

and ditch, given its strength. In the south-western corner of the survey area is a group of pit-type responses (12), which may be archaeologically significant.

On the south-eastern limit of the area, responses (13) associated with extant remains at the approach to the Peerie Brough have been detected. However, ferrous responses are also evident in the data, and it is likely that many of these responses relate to the earlier excavations on Area VI (see below: 17.8–17.10). Survey over the Peerie Brough has identified a cluster of responses noted as probable archaeology (14) at its eastern end. It is not yet clear whether any of these responses indicate intact archaeological remains, or whether they are solely the result of the previous excavations on Area V (see below, 18.1–18.4).

#### 21.4 Results of resistance survey (Illus 21.4 and 21.5)

The resistance data show marked variations in background resistance across the site, with the north-eastern portion of the site recording a noticeably lower background resistance. The change appears to be generally associated with a spring-line running north-west to south-east through the centre of the survey area. The even lower resistance levels within the Guardianship site could be due to the effects of conservation of the site, and potentially less erosion resulting in thicker soil.

Most of the Historic Scotland Guardianship area to the north and north-west of the Custodian's office and the churchyard was surveyed. Wherever possible, the extant archaeology was surveyed. However, in some parts this was impossible due to topographic constraints or hard surfaces, with some structures having to be omitted in their entirety. Numerous somewhat ephemeral responses (A) have been detected – which coincide with extant archaeology and are indicated as such on site interpretations. Unfortunately some of these responses are likely to be simply the product of preferential drainage of the extant earthworks, rather than indicative of the composition of the remains.

Of interest are several anomalies which lie within the area of extant archaeology but that do not correspond with features on the ground. A series of rectilinear and sub-circular anomalies (B) suggestive of buildings and/or walled areas are discernable in the data. These responses are on different alignments suggesting they may be associated with the different phases of the site.

Corresponding with extant archaeology to the north of the churchyard and associated buildings are well-defined relatively high resistance responses (C). Although these anomalies show some correlation with a known site, the results indicate a possible rectangular building *c.* 20m in length somewhat different to that suggested by existing records of the site (see Chapter 15).

On the ground to the west of the churchyard and underlying its construction, can be seen a roughly rectangular wall line showing as two sections. This is visible

in the data as high resistance responses (D), although the survey appears to have provided more detail regarding the structure, showing three sides of a rectangular anomaly with a further adjoining rectilinear anomaly subdividing it and running approximately east–west. The outer limits of (D) align with the supposed pre-Norse remains, previously interpreted as a 'Pictish cashel' (see 7.3, 7.4.5 and 7.9; also see Hunter 1986, 19). However, more recent work suggests a different context (see Chapter 8, especially 8.3 and 8.5).

A further high resistance response (E) can also be some distance to north of the Guardianship area. This appears to coincide with a known site (Sites P and R: Emery and Morris 1996, 250; Hunter 1986, Site VII) that has been further truncated by coastal erosion. In the northern quadrant of the survey area are two linear changes in the resistance readings that run for some distance and have been noted as potentially natural in origin. One edge of these anomalies coincides with an old fence-line that can be seen on aerial photographs running north–south. The other coincides with a curvilinear ditch-like feature that can be seen on the ground running approximately north-east to south-west.

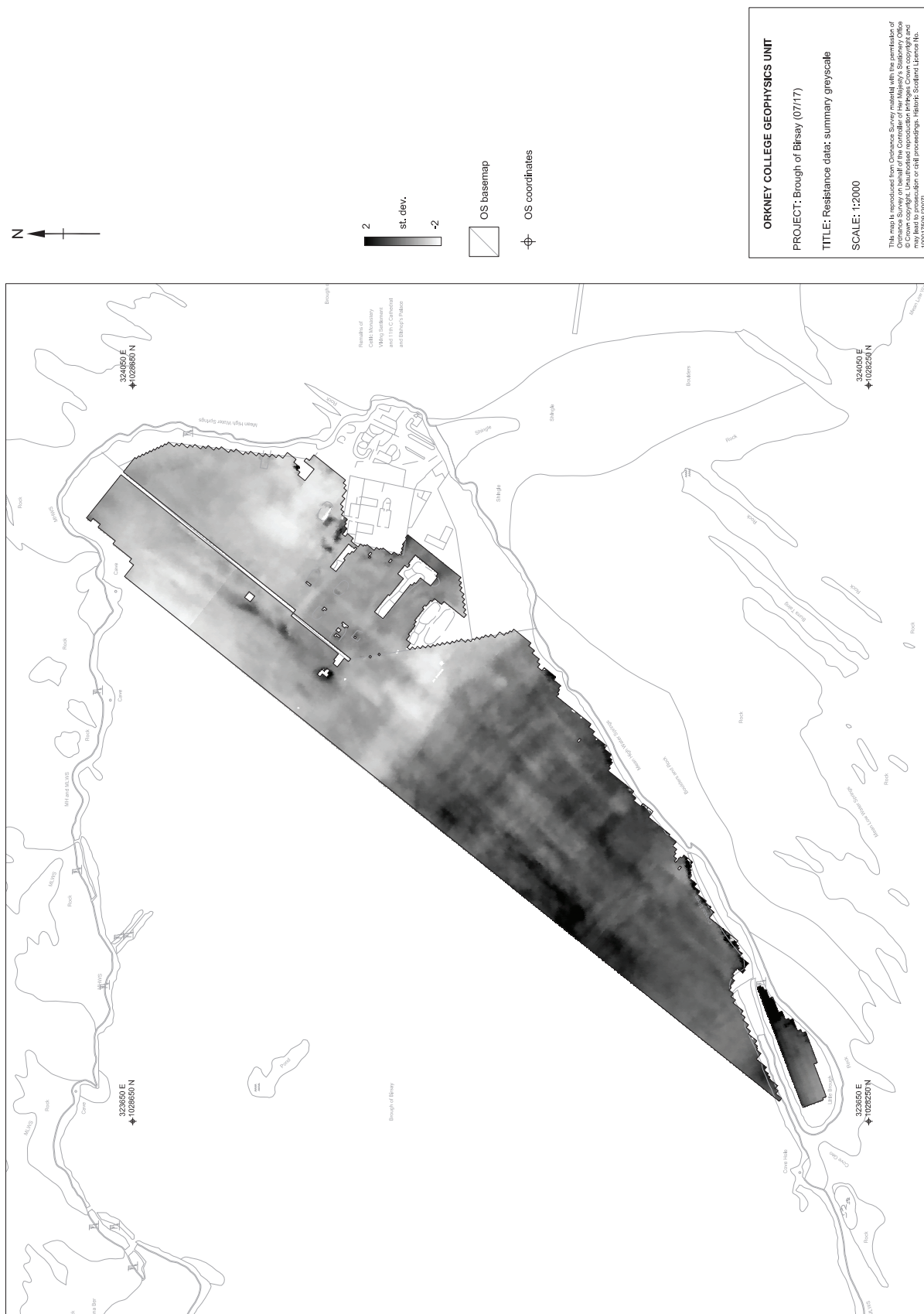
To the north-west of the Guardianship area, an area of high resistance (F) is clearly apparent in the data. This probable geological response coincides with an observed spring-line on the ground. Areas of high resistance along the northern limit of the survey area are also noted as likely to be of natural origin and are probably due to the erosion of the cliff-top soils associated with extensive burrowing by rabbits.

To the north-west of (F) is a low resistance anomaly (G) roughly rectangular in plan with a high resistance linear along its south-eastern side. Whilst the low resistance portion of the anomaly is ephemeral, and the high resistance could be associated with the shallow geology, an archaeological origin cannot be dismissed due to the presence of two long, low linear sandstone orthostats associated with the latter response.

Along the north-western limit of the survey is an area of high resistance (H), probably geological in origin, and possibly comparable to (F). This presumed geological response is bisected by an anomaly (I) running through the survey area north-west to south-east that coincides with a ditch and bank, which can still be seen on the ground.

To the south of (H) and to the east of, and adjoining, the ditch and bank is an area of high resistance (J). The responses could indicate a range of buildings that appear to partially enclose a rectangular area of increased resistance. This has been noted as possibly natural in origin and leads down to the coast where a truncated circular anomaly can be seen. However although these anomalies are noted as potentially archaeological in origin, there is no corresponding magnetic enhancement (see 17.2 for account of survey of archaeological sites exposed in 1979–80).

In the centre of the survey area there is a pattern of crossing linear trends (K). It is unclear whether these are archaeological, agricultural or geological in origin,



Illus 21.4 Resistance data: Summary greyscale 1:2000



or possibly a combination of all three, although they are comparable to the magnetic trends (10).

Along the southern edge of the survey area are a series of sub-circular high resistance responses (L), most of which coincide with structures/earthworks visible on the ground. All appear to have been severely truncated by coastal erosion (see 17.2).

At the eastern limit of the Peerie Brough is a high resistance anomaly that has been interpreted as possible archaeology and coincides with Area V (see Chapter 18). However, it is not clear if these anomalies reflect intact archaeological features or are all due to past excavation. The high resistance response around the edges of the Peerie Brough are probably due to the effect of erosion at the cliff-edge.

## 21.5 Conclusions

Geophysical investigations on the Brough of Birsay have identified a variety of anomalies of archaeological interest, although the survey results indicate that buried archaeological remains are largely concentrated within and around the excavated sites. Both the Guardianship area and the area extending north-west from the Peerie Brough show evidence of archaeological potential beyond those areas which have been excavated, but there does not seem to be evidence of contiguous settlement remains in the area between the Guardianship site to the Peerie Brough on the same scale as within these two focal areas. The current southern cliff edge between Guardianship site and Peerie Brough is characterised by the greatest remaining number and most concentrated clusters of anomalies and structures. It is however unknown how

much archaeology has been lost to coastal erosion over the centuries and indeed since the archaeological work undertaken on the Brough in the 1970s–80s (although recent examination of the cliff-edge has indicated that several of the sites recorded in Chapter 17.2 are still extant and visible).

The gradiometer survey has located numerous anomalies of possible archaeological interest, although many of the pit-type responses detected across the site may be natural in origin. Clusters of anomalies such as 9, 12, 13 and 14 strongly suggest as-yet unexplored archaeological potential. Gradiometry data collected within the Guardianship area is complicated by disturbance caused by previous excavations, metallic contamination and modern reconstructions within the site.

Resistance data collected within the Guardianship area has identified numerous anomalies of possible interest, including anomalies suggestive of previously unknown structures. In particular B, C and D contribute significantly to the plan and possibly the phasing of the complex of structures within the built-up area. Outwith the Guardianship area discrete anomalies such as J and L confirm that further archaeological potential exists (confirmed by surface traces in the case of L).

The geophysical surveys undertaken in 2007 confirm that not only are the chosen techniques viable on the Brough of Birsay (and may be extended in future to other areas of the Brough – the vast majority of which has not yet been explored archaeologically) but also that surface-based prospection is an essential counterpart to understanding the extent and range of excavated remains, even when (as in this case), it is undertaken some time after the excavations themselves.