

ART. IV – *A geophysical survey of Milecastle 73 and Hadrian's Wall at Burgh-by-Sands, Cumbria*

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**T**IMESCAPE Research Surveys undertook a geophysical survey to confirm the line of Hadrian's Wall to the east of the point where it crossed Burgh Marsh, together with the location of Milecastle 73 and Turret 72b. Although excavations have been carried out on the Wall to the east and west of the marsh, this work has not detected its exact line from the eastern edge of the marsh to Turret 72b. No evidence of the Wall has been found where it passes over Burgh Marsh.

The present survey extended from the field boundary to the east of Turret 72b, and included the sites of the turret and Milecastle 73, terminating at the edge of the marsh to the west of the milecastle and was centred upon NY 312 592. The land is presently used for grazing, with the exception of the field to the west of the lane (lonning; Fig. 1). Evidence of ridge and furrow is present, some of which probably dates from medieval times. A magnetometry geophysical survey was conducted upon targeted areas to establish the route of the wall, and other associated features, before it entered Burgh Marsh. In addition a small area of resistivity survey was undertaken to provide complementary data.

Hadrian's Wall was originally constructed in turf between Bowness-on-Solway and the river Irthing, however, the turrets were built in stone and the wall butted up to them. The milecastles were built with turf ramparts and timber buildings, and were later reconstructed in stone.

### **Location of the survey and geology**

The survey area was located north of the Burgh-Dykesfield road on a locally prominent knoll, referred to as Watch Hill (Fig. 1). The currently plotted location of the Wall would appear to present a reverse-slope position towards the north, thereby not appearing to take advantage of the higher ground. The expected location of Milecastle 73 was some distance down the western slope of Watch Hill with limited vision to the north-east. The milecastle may, assuming a height of *c.* 5 m, have had direct line of sight to the Hadrianic forts 1 and 3 outside Burgh-by-Sands together with the fort 2 on the Wall.

The field boundaries have remained essentially unchanged since the 1850s although some intermediate boundaries have been removed and new fencing has been erected in places. The revised 1924 O.S. map indicates further removal of boundaries, and modern maps show a continuation of this process. The previous form of the boundaries indicated narrow fields with a distinctive reversed-S shape, generally indicative of medieval origins. Within some of the fields the remains of these intermediate boundaries are still extant as earthworks, together with some elements of later ridge and furrow. All of these features confuse the picture on the ground and may perhaps explain the disparity in agreeing on a uniform interpretation of the route of both the Wall and the Vallum.

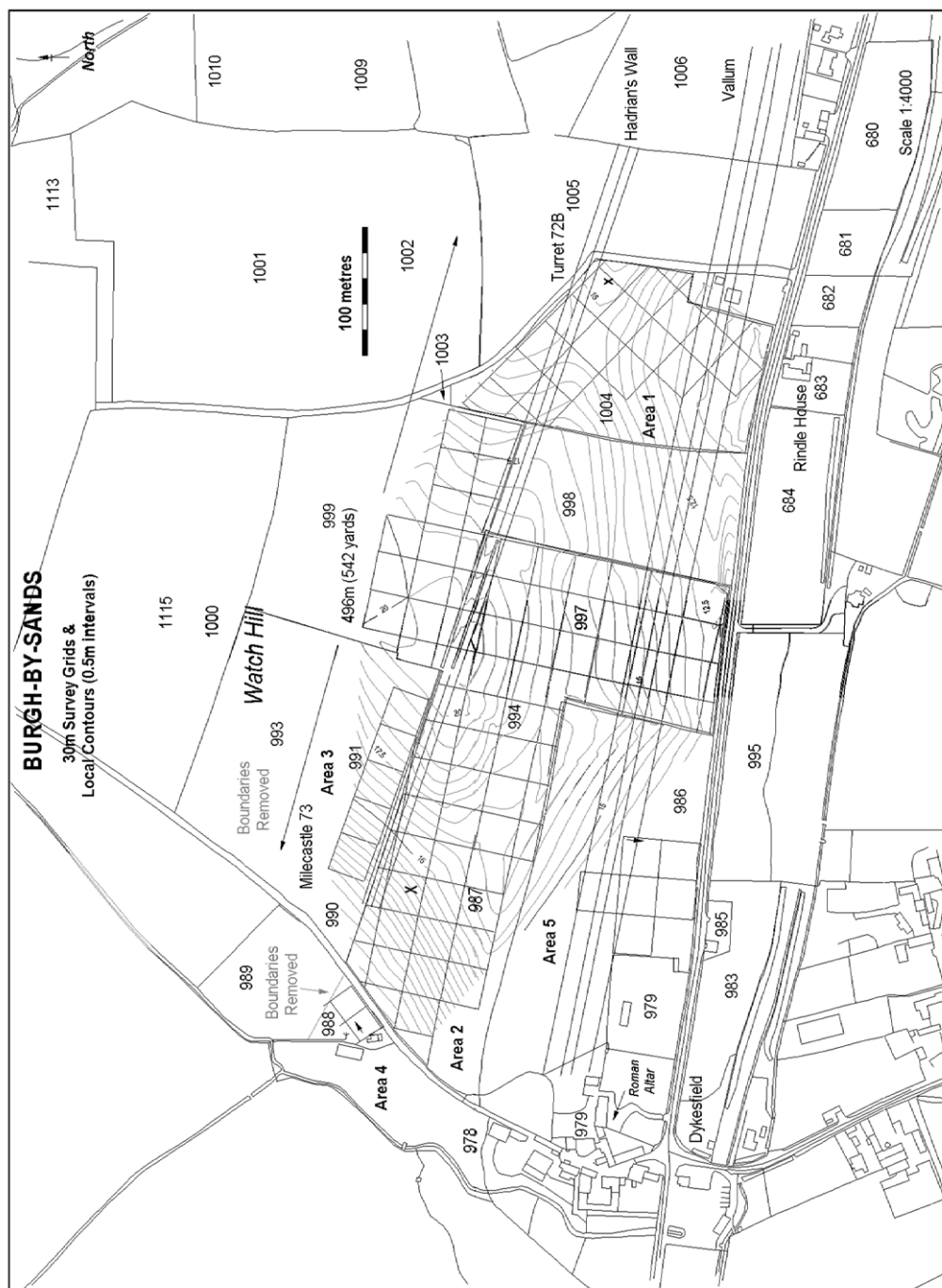


FIG. 1. Location, Survey Grids Layout and Contour Map.

The underlying solid geology for this section of the coastline comprises Triassic mudstones, although a short distance towards the west, separated by a dyke, Triassic sandstones are located. The drift geology comprises glacial clay till to some depth, with marine deposits towards the western lower ground. It follows that stone was not readily available locally for construction and must have been imported some distance to the site.

### **Archaeological and historical background**

The area around Burgh-by-Sands contains a number of Roman military installations, which were presumably placed strategically to guard the two highest major navigable Solway fords, the Sandwath and the Peat Wath. The former ran from Sandsfield to a point close to Dornock on the Scottish coast; the latter crossed the lower reaches of the river Eden. A further ford crossed from Bowness-on-Solway to Annan and was the shortest and lowest crossing of the Solway (McIntire, 1939). The fort at Burgh-by-Sands together with those at Drumburgh and Bowness-on-Solway can be seen to guard all the major crossings of the Solway. The perceived threat, according to Ptolemy (Breeze, 1982, 30, fig. 1), came from the northern tribes, especially the Brigantes to the north-east whose tribal lands had been split by the Hadrianic frontier. In addition to Hadrian's Wall there are two earlier auxiliary forts and a number of marching camps to the south.

Horsley (1733, 156-7) refers to evidence of Hadrian's Wall having been found at Watch Hill. He considered that there had been a "castellum" there as a larger quantity of stone had been dug up than was justified by the thickness of the Wall. He adds that there was a ditch visible to the south of the Wall from Burgh to Dykesfield at first five chains distant and by the village of Longburgh ten chains (*c.* 200 m). This he rightly assumed was the Vallum. The distance, derived from the survey, between the Wall and Vallum at Dykesfield is approximately 230 m. Horsley, together with Brand (Bruce, 1867, 301), could not find any evidence of the Wall passing over Burgh Marsh and assumed that it ran to the south by Boustead Hill and Easton, where local people told them it took that course as they frequently struck it whilst ploughing.

Simpson *et al.* (1935, 213-220) cut a section through the crest of Watch Hill in field 997 (Fig. 1) and revealed a footing course of flags of the Wall. The berm was seen to be abnormally wide with the lip of the ditch being 30 feet (9 m) from the north face of the Wall. The Turf Wall was found to be north of the Stone Wall within 8-9 feet (2.4-2.7 m) of the ditch. This evidence, he interpreted, as showing that the Stone Wall was built before the Turf Wall, was removed. No trace of the Milecastle 73 was found.

Simpson *et al.* (1952, 14-16) returned to Watch Hill again in 1948 and followed the Wall eastwards at five yard (4.6 m) intervals across fields 997, 998 and 1004 until turret 72b was located. This was found nineteen yards (17.4 m) from the east field boundary. From the report, the turret had been set on the foundation of the Turf Wall with its north and south elevations coinciding with the limits of the Wall. The Stone Wall abutted the side walls of the turret. The north wall of the turret and the north face of the Wall did not align as was usual practice. By measurement to the west, Milecastle 73 was located. The side walls and south walls were seen to be

6 ft 8 ins thick (2 m) and the internal dimensions were 62 ft 6 ins (19.1 m) north-south and 60 ft 8 ins (18.5 m) east-west. Simpson confirmed Haverfield's view that the Wall crossed the marsh. He proposed that Turret 73a would be positioned at the point where a salient angle projected from Milecastle 73 met the outward projected line from the Wall on the west of the marsh.

A geophysical survey was carried out by the English Heritage Ancient Monuments Laboratory in 1991 (English Heritage 1991, ref. 91/48). The survey was conducted some 75 m to the west of Turret 72b and found possible evidence of the Wall, but was inconclusive.

Paul Austen carried out an excavation on the line of the Wall at the west end of Burgh between 1978 and 1979. The excavation which took place some 45 m to the east of Turret 72b showed that the Stone Wall was built directly on the Turf Wall (Austen, 1994, 35-44), a feature also found at Turret 72b. Austen found that the Wall was set 11 m back from the lip of the ditch. Assuming that the Turf Wall ran in a straight line from this point to where Simpson cut his section on Watch Hill, the Turf Wall would appear not to be set parallel to the ditch, as it was set forward of the Stone Wall at that point.

The earliest available map of the area is an estate map of 1820, which indicates that some of the modern field boundaries date from at least that time, most notably the lane or lonning towards the east of the survey area. A windmill, not indicated on later maps was shown on this map. The 1856 Ordnance Survey map indicates that there has been some field boundary changes within the survey area. Received local wisdom suggests that the site of a former Customs Post may have been located in the vicinity of the milecastle, but its exact location has not been recorded. A similar structure was detected directly north of Milecastle 72 and was a square stone building. The survey has indicated that the route mapped by the Ordnance Survey and other authorities does not accurately represent the location of the Roman features.

## **Methodology**

The greater part of the survey was conducted during December 2002 during a period of dry but cold weather conditions. A small area to the east of Dykesfield and the field to the west of the lonning were covered in late June in fine weather. An RM15 resistivity meter was used to carry out the resistivity survey using 0.5 m sample intervals. A Geoscan FM36 fluxgate gradiometer was used to carry out a magnetometry survey employing 1 m parallel traverses with 0.25 m sample intervals. A Leica TC403L EDM was used to set out 30 m grids and the grids and other relevant mapping features were recorded.

It must be stressed at this stage that geophysical survey techniques cannot normally distinguish between the different phases of archaeological deposits, and can only provide a composite image of all the features within an instrument's operating depth.

## **Survey results and discussion**

Magnetometry results were plotted at a scale of 1:2500 (Fig. 2). Additional types of plots were used to determine magnetometry anomalies and produce an anomaly

plan of the area (Fig. 3). Because of the complexity of the data in the region of the milecastle a separate enlarged figure was used to illustrate them (Fig. 4). These anomalies have been enumerated and discussed within the text, whereas the milecastle anomalies were indicated alphanumerically. Any anomaly plan must be considered subjective and for this reason the plan is not an interpretative representation, although some features can be described with a degree of certainty. It is proposed to employ the same field enumeration as Simpson *et al.* (1935), using the 1924 edition O.S. map which was referred to in their monograph describing the investigations in 1933 at the western end of the Wall.

#### *Area 1 (Field 1004)*

The survey strategy within Area 1 was designed to detect any remains of Turret 72b which had previously been excavated, together with the route of the Wall, ditch and Vallum. As a general rule archaeological horizons which have previously been disturbed tend not to give such an intense response as their intact counterparts.

This field had been cultivated using ridge and furrow ploughing techniques, which are readily visible on the magnetometer survey, giving a distinctive corduroy effect. The periodicity of about 3.5 m generally indicates a later origin. Some previously marginal land was taken into arable culture during the Napoleonic wars and there is evidence of this regime being used into the first decade of the 19th century (Bailey, 1810). The practical effects of this agricultural practice are to create unwanted linear striations, which may obscure the detail of older features.

The location of the Wall ditch was not identified during the 1952 excavation, but was seen by Austen to be 11 m to the north, some 45 m to the east of the turret. The current survey has identified a linear positive anomaly (1), some 60 m in length, giving a response 3-4 m in width. This is almost 10 m north of the postulated line of the Wall (4) and is almost certainly the Wall ditch. There is some indication that this ditch may change direction towards the south-east in the region of the turret. Further west the ditch appears to bifurcate (1A and 1B). At the point of change a distinct platform was detected on the ground and the ditch which follows the northerly route (1A) appears to kink around the platform. The linear anomaly (1B) appears to continue as a direct extrapolation of the major ditch. This is readily visible on the ground as a wide water-logged depression, possibly with a reduced berm and counterscarp. The significance will be discussed later.

A distinctive magnetic signature was not found in this region for either the turret or the Wall. The most appropriate anomalies for the turret were either anomalies (2) or (3), both of which were located along the line of a very faint linear, intermittent, positive anomaly which was thought to represent the robbed-out path of the Stone Wall (4). This feature may not indicate the central route of the Wall, but one of the infilled robber trenches, either of the north or south faces. Anomaly (2) was a sub-rectangular positive anomaly, some 6 m along the east-west axis and 5 m north-south. The line of the Wall (4) would appear to be set back too far to confirm this as the turret. The anomaly (3) comprising a sub-rectangular negative anomaly, would appear to be a better candidate for the turret. It contains both negative (stonework) and a substantial bipolar anomaly (usually ferrous) set towards the north-east corner. Its location some 17-18 m from the eastern fenceline corresponds well with the previous estimate of the location (19 yards or 17.4 m: Simpson *et al.*, 1952, 15).



FIG. 2. Magnetometry and Resistivity Survey Overview, 1:2500.

Some 20 m towards the south of this group of features a broad diffuse positive anomaly (5) was detected running north-west to south-east. There is some slight evidence that this turns through an angle of approximately 90° at the western end towards the north-east, possibly joining the Wall ditch (1). Towards the south of Area 1, a linear positive anomaly (6) ran obliquely across the survey area. It is probable that this feature is a modern services trench or drain. The probable route of the Vallum showed as a linear positive anomaly (7). It is possible that a crossing point may be present towards the western sector. The Vallum is present as a distinct ditch at this point some 10 m in width and up to 1 m in depth, with vestigial elements of a scarp and counterscarp. What is less obvious is why such a prominent feature should exhibit such an undistinguished positive response. It may be that a ditch of no great depth was initially formed at this stretch of the Vallum, alternately, local saturated soil conditions may have ensured a rapid natural infilling. The magnetically disturbed area (8) is commonly found at field entrances where farmers have attempted to consolidate the entrance routes by dumping rubble and hardcore, which often contains ceramic material such as bricks, tiles, etc.

The apparent change in the path of the Wall defensive ditch coincides with the presence of a distinctive platform located immediately to its north. This platform is raised some 20-30 cm above the level of the ditch at that point. In the face of this evidence there must be some reason for a significant change in direction. A curvilinear positive anomaly (9) is contiguous with the wall ditch (1). Two co-located strong positive anomalies (10; *c.* 20  $\eta$ Teslas) are located north-west of this small enclosure, with evidence of a small sub-rectilinear ditch to its north. Whether this represents some form of building or other feature is difficult to determine, but its maximal dimensions of 5-6 m might suggest the former supposition. It is possible that the ditch was diverted around this feature.

Another possible reason for the divergence of the Wall ditch was the anomalies located some 12 m south-west of these features (9 and 10). Two parallel rows of positive anomalies (11) may indicate the presence of pits, which gave variations in response of between 3 to 12  $\eta$ Teslas. A moderate response of this magnitude may be interpreted as pits, possibly post-pits for some form of building. If this is so the dimensions would be 4 m east-west and 12 m in length, with an exact north-south alignment.

Towards the west and situated between the two putative candidates for the Wall ditch (1A and 1B) a number of slight positive sub-rectangular anomalies (*c.* 0.5  $\eta$ Teslas) were located (12). Categorical classification of these anomalies as significant archaeological features was problematic because of the co-alignment of the ridge and furrow. They were however contained in what could be described as an enclosure created by the Wall (4) and the most northerly of the two ditches (1A), which could be a later diversion of (1B). An additional ditch (13), or positive anomaly, although indistinct, was located some 10 m north of the northern wall ditch (1A), delineated by feature (9) to the east. This particular ditch should be noted because it appears to run parallel with the route of the Wall across several field boundaries and continues some distance to the west.

Other features detected within Area 1 were a number of circular positive anomalies of unknown aetiology and a number of small bipolar anomalies, usually the result of ferrous farming debris. None of the linear features described in this

section appear to coincide with previous field boundaries as indicated on earlier maps.

*Area 2 (Fields 987, 994, 997 and 999)*

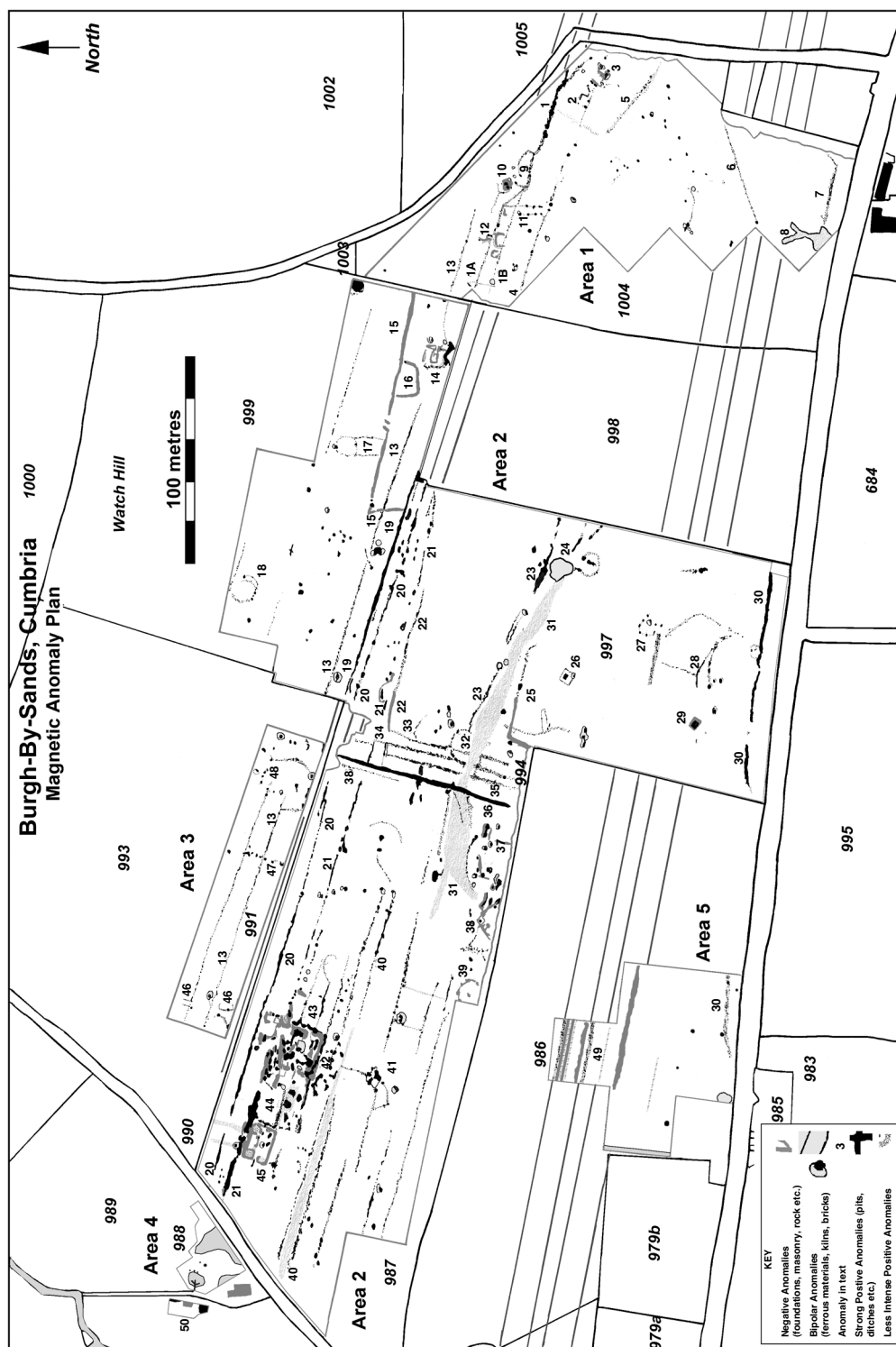
This was the largest contiguous area surveyed and had the advantage of crossing previously removed field boundaries. If the route of ditch (1A) were extrapolated towards the west, within field 999, it would continue to a large positive anomaly (14), which was detected close to the fenceline. This anomaly is probably a bipolar response, which may extend to the southern fenceline, although an associated linear positive anomaly continues northwards. However, a small rectilinear negative anomaly appears to be co-located with major dimensions east-west of 5-6 m. The significance of this anomaly is uncertain as it has maximal negative values of only 2  $\eta$ Teslas, which does not signify substantial foundations. Two small bipolar anomalies were detected on the eastern side. Some 15 m north of this feature a linear negative anomaly (15) measures east-west 110 m and may extend to the south at its western limit. A small D-shaped enclosure appears to be attached towards the south (16). The relatively narrow, straight and regular morphology may indicate the foundations of a now removed field boundary. The earlier maps do not indicate the presence of a field sub-division in this location. Two other anomalies detected within the north-east sector of Area 2 were sub-circular positive anomalies (17 and 18). Although these features have the right dimensions to indicate prehistoric hut circles their cause may be as prosaic as the turning circle of agricultural vehicles on wet ground.

Within the central northern sector of Area 2, at the interface of fields 997 and 999 (now removed), a very prominent ditch is visible, which spans some 10 m in width and has a prominent counterscarp to the north. Along the line of the ditch run two intense linear positive anomalies (19 and 20) which follow the route of a previous field boundary seen on the 1856 O.S. map. The northern, more intense anomaly (19) is probably the ditch as seen today; the location of which was confirmed by topographical survey across the ditch. The second parallel ditch (20), some 5-6 m to the south may indicate the route of the former field boundary, and the Wall ditch. This response is less intense and appears to have a contiguous linear negative anomaly directly to its north, possibly suggesting a scarp before the main ditch. Some large, intense bipolar anomalies were detected between the ditches, which appeared to be more numerous towards the eastern side.

Some 15 m north of these linear anomalies a third parallel positive anomaly (13) was seen to cross the entire northern survey area. This is possibly an extension of the linear ditch seen in Area 1 and appears to maintain the same distance north of the Wall's defensive ditch. Interestingly this ditch appears to head towards the north-western boundary of the group of positive rectilinear anomalies (14). This feature may be linked to both that anomaly and the Hadrianic Wall.

South of the two distinctive positive anomalies (19 and 20), effectively within field 997, a number of other linear anomalies were detected. The faint linear feature (21) almost certainly indicates the route of the Stone Wall, although the response is largely absent in places. An additional linear positive anomaly (22), which has some positive elements at its western terminus, may relate to a former field boundary. Towards the centre of the field a linear positive anomaly (23), which although





intermittent in places, extends across the entire field. At the eastern edge it produces a broad relatively intense response (2 $\eta$ Teslas), where the ground is particularly waterlogged and is visible as a linear depression. Almost contiguous with this feature is a large (8 m) highly disturbed bipolar area (24). Upon investigation this area was found to contain rubble including modern bricks. A slight curvilinear positive anomaly is situated directly south with two central pits, with an overall diameter of 5m, but its origin is ambiguous.

A sub-rectangular linear anomaly (25) with elements of positive and negative responses may be the vestigial remains of an old field boundary. A small rectangular pit was detected (26), which appeared to have a rectangular surrounding ditch. The size of the inner anomaly was 1.5-2.0 m with a maximal dimension of 4.5 m for the surrounding ditch. The origin and significance of this feature are uncertain. A ring of circular positive anomalies (27) contains a small central bipolar anomaly. The diameter of 8 m may indicate a small prehistoric round-house (e.g. Biggins *et al.*, 1997), although the evidence is not compelling. It is however, associated with a number of linear and curvilinear positive anomalies (28) which have some resemblance to small "Celtic" fields (e.g. Biggins and Heslop, 2002) known to be associated with unenclosed settlements of Iron Age chronology. Towards the west of these features is a distinct square strong (12  $\eta$ Teslas) positive anomaly (29), with dimensions of 3.0 m. The "halo" effect (apparent negative surround) is common on strongly positive features. The regularity of this feature may indicate the location of a well and has been observed on other Roman sites such as the Wall fort at Castlesteads (Biggins and Taylor, 2001).

At the southern edge of field 997 a prominent ditch was detected some 6 m from the fenceline bordering the Dykesfield to Burgh-by-Sands road. In places this was c.0.8 m in depth and had a distinct counterscarp. The scarp was less easy to detect, probably having been subsumed by the modern road. This ditch was waterlogged in places at the time of survey and was in the region of 10 m crest to crest. The magnetometry response (30) was relatively modest for such a large feature (averaging +2-3  $\eta$ Teslas), with a larger response being expected. Towards the western sector a gap in the ditch appeared to be present, some 6 m in width. Unlike the suspected Vallum in Area 1, which had substantial amounts of modern material dumped to create a crossing point, this sector of the Vallum did not. It would seem that the break had been created in antiquity and may not have been deliberately left as a crossing point. The reason for the lower than expected response may be due to the nature of the local soil conditions, a result not expected when the visual prominence of the feature is taken into account. After construction the elastic instability of the soil may have caused rapid solifluction effectively infilling the ditch very quickly.

The final anomaly of consequence in this field was a broad, slightly negative band (31) extending from anomaly (24), through the removed boundaries field 994 and into field 987. At its northern boundary it is flanked by a linear positive anomaly (23) with rather less evidence of a ditch to the south. Towards the western extremity this feature dilates to create a broad funnel some 20 m in width. A number of very intense linear positive anomalies within field 994 appear to be cut by this feature. A slight earthwork is visible in part of field 997, but based on the present evidence it is difficult to ascribe an archaeological, as opposed to geological origin. Given the local

topographical prominence of Watch Hill, prehistoric origins cannot be discounted.

Within the area, which used to constitute field 994, a number of prominent linear negative anomalies were detected, together with a curvilinear anomaly (32). The curvilinear anomaly (32) described a semi-circle some 15 m in diameter and appears to be cut by the broad positive anomaly (31). A number of small bipolar anomalies are in proximity, but they may be associated with the now removed boundary dividing fields 994 and 997. Four broad bands of linear positive anomalies (33, 34, 35 and 36) were also detected of which (36) was associated with a prominent linear earthwork, undoubtedly the field boundary seen on earlier maps. This anomaly and the other three anomalies were all contained in a small field (No. 994). This field, before the boundaries were removed, was 100 m in length and only 18 m broad. It is difficult to determine what use it could have been as it was too small to be efficiently worked by oxen or horses. The "ditches" may have predated the field boundary and may indicate medieval ridge and furrow or possibly lazy beds. If this latter interpretation is correct the use of strip-cultivation indicates origins in medieval times (Rackham, 1994, 74).

A complex series of anomalies were detected in the south-east corner of field 987. It was at this point that the broad positive anomaly appeared to terminate. A curvilinear positive anomaly was seen to bound the southern edge of feature (31), which was associated with a high number of bipolar, positive and negative anomalies (37) towards its south. These anomalies did not exhibit any morphological characteristics and must be classified in the "unknown significance" assemblage. Some 10 m west of this group of anomalies a sub-rectilinear anomaly was detected (38). The strength of the response was not very intense, suggesting an insubstantial source. It was in propinquity to some linear positive anomalies directly to its west. A small, negative sub-circular anomaly (39), of approximately 8-9 m in diameter, was detected to the west of features 37 and 38. It contained a small central bipolar anomaly, and the outer ring appeared to have buttresses at intervals.

A pronounced linear earthwork was seen to extend much of the length of field 987. This centrally located earthwork was much more prominent towards the west, with a drop to the north of up to 1.5 m, which in all probability presents as a field lynchet created by the boundary observed on the 1856 O.S. map. The land slopes from the higher ground in the south towards the north with a gradual declination towards the west. What was not so obvious, were the very prominent parallel, linear positive anomalies with a central negative course (40) (Fig. 4). As a candidate for the military road this feature may be an aspirant, but similar effects were seen at Halton Chesters (Taylor *et al.*, 2000), where the extant ridge and furrow gave an identical effect. The proximity to the milecastle should however be noted. A large bipolar anomaly (41), with dimensions of 8 m was detected. Nothing was visible on the ground (*c.f.* anomaly 24), but a narrow linear positive anomaly descended the hill in the direction of the lower ground and incidentally the location of the milecastle.

Milecastle 73 was detected (42), together with two possible attached annexes (43 and 44), built onto both the east and west walls. Another stone enclosure (45) was built up against the west wall of the western enclosure and the south face of the Wall. Due to the complexity of the milecastle and its associated features this issue will be discussed in a later section.

*Area 3 (Field 991)*

A small exploratory survey (0.5 ha) was conducted north of the boundary fence dividing fields 987 and 991. The survey was carried out entirely in what used to be field 991, but is now combined with field 993 and 990. Its purpose was to detect any elements of the Wall ditch north of the fenceline. The faint indication of a pair of curvilinear positive anomalies (46) was detected, which appeared to extend to the north as a pair of parallel anomalies. Whether this is an axial road from the milecastle is undetermined at this time. Further to the east a series of large circular positive anomalies (47) was seen to have a north-south alignment. Their origin and function are unknown. Towards the extreme east of field 991 large positive anomalies or pits (48) were detected which with the eye of faith, could be designated a sub-circular arrangement. The series of bipolar anomalies, close to the eastern fenceline, follows the route of a former field boundary. This can be seen as late as the 1924 O.S. map and probably indicates the location of ferrous debris often dumped in a hedgeline. The continued presence of a linear positive anomaly (13) still poses the question as to its function. The barren area at the junction of fields 991, 994, 997 and 999 was caused by extremely waterlogged ground in the presence of a cattle trough. Even in dry weather this cannot be surveyed due to the presence of modern rubble containing bricks and other ceramic material

*Milecastle 73 (Field 987)*

A larger scale plan of the area around the milecastle is used to describe the complexities of this sector (Fig. 4), and the salient features are indicated alphanumerically. The location of Milecastle 73 was definitively identified during this survey. It proved to be 496 m (542 yards) from Turret 72b, which compares well with previous estimates of 540 yards or  $\frac{1}{3}$  of a Roman mile (e.g. Bartle, 1961, 34). This measurement was based upon taking the centre point for each structure and assuming a planar distance. The site of the milecastle is visible as a low platform, although the defensive ditch is not readily visible to the naked eye.

The dimensions externally and internally respectively of the milecastle (A) east-west were 26.0 m, 18.0 m (85.3 and 59.1 feet) and north-south (B) of 24.75 m, 19.25 m (81.2 and 63 feet). For comparison the internal dimensions of the stone replacements of two known Turf Wall milecastles are, Milecastle 49 19.81 by 22.86 m (65 by 75 feet) and Milecastle 79 17.5 by 17.5 m (57.5 by 57.5 feet). The difficulties of accurate measurement using magnetic anomalies are manifest, however, Milecastle 73 can be seen to be dimensionally close to 79 (Daniels, 1978, 197, 253).

A large bipolar anomaly appears to be centrally placed within the milecastle (C). The magnitude of the response (+25 to -13  $\eta$ Teslas) suggests that the source is brick or tile rather than ferrous in origin. Within the south-east corner of the milecastle a pair of parallel linear positive anomalies were detected (D) which might indicate the location of a wooden building with dimensions east-west of 8 m and north-south of 3.5 m. The north-east corner appears to contain a building constructed of stone (E), with similar dimensions, although its long axis is aligned north-south.

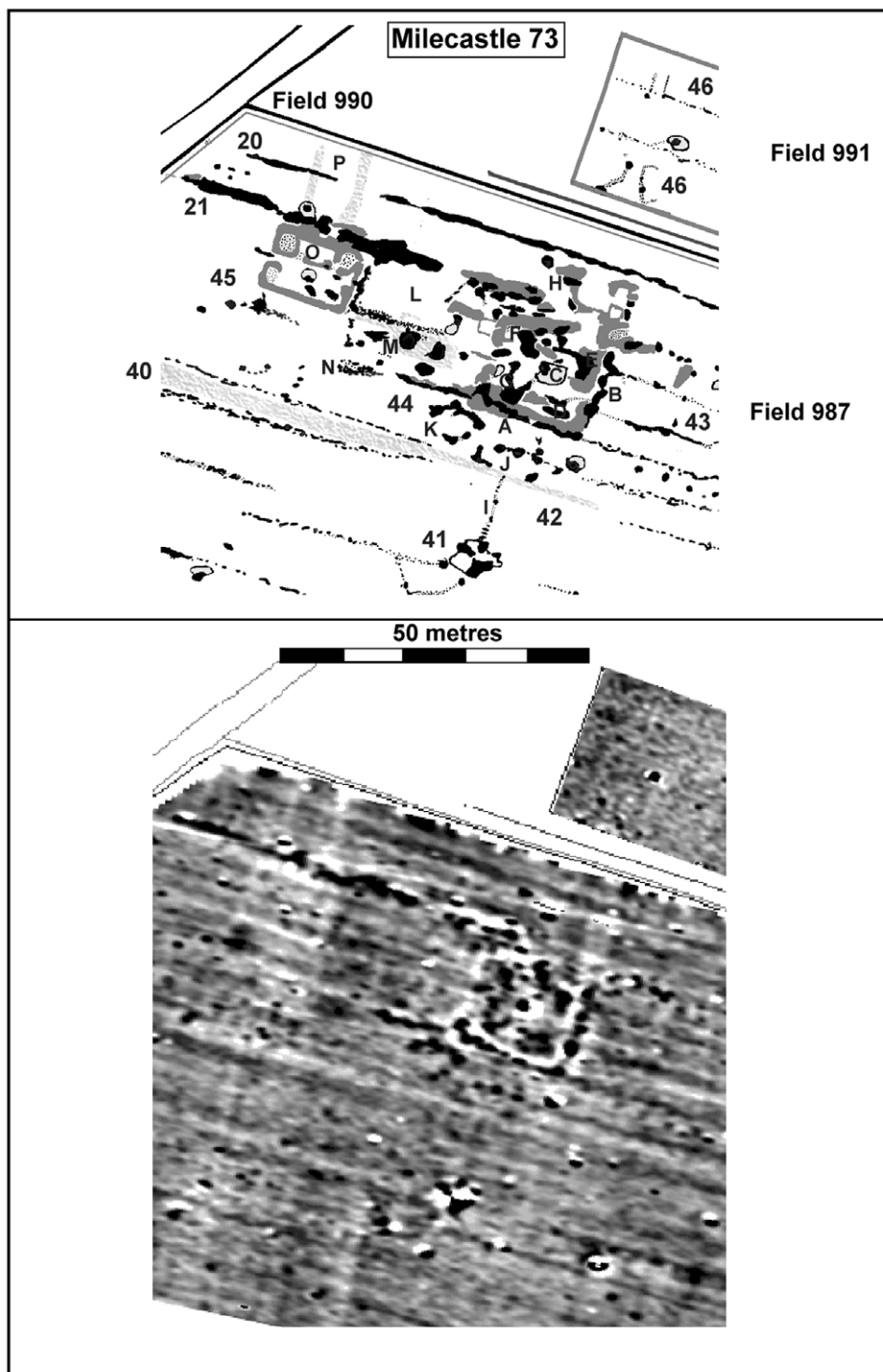


FIG. 4. Milecastle 73 Magnetometry and Anomaly Plan.

A similar stone building may be located within the north-west corner of the milecastle (F). Although interpretation is difficult, the south-west corner may contain a building, possibly originally of wood, but aligned north-south (G). The strength of the responses indicates that the eastern side of the milecastle is more strongly responsive, perhaps suggesting hearths of braziers within the buildings. The slight negative anomaly (H) leading from the north gate may suggest a causeway over what must be assumed to be the Wall ditch (20). There is some indication of the road proceeding north (46) with a funnel formed near the crossing. If that is the case it is probable that the crossing was later abandoned, as the ditch appears to be continuous. The berm would seem to be unusually wide at this point, in the region of 9 metres, suggesting that the Stone Wall was built behind the Turf Wall at this point, so confirming Simpson's archaeological record.

Some 30 m south of the milecastle a large bipolar anomaly was detected (41) which was some 8 m wide. The response elicited by this feature, although bipolar in nature, was not of the magnitude expected of ferrous material. There is some evidence that a linear positive anomaly (I), possibly a path, extends from the feature northwards towards a rectilinear anomaly (J), which appears to be comprised of post-pipes. This configuration suggests a wooden building. A sub-rectangular positive anomaly (K), some 7-8 m in length was detected towards the west of feature (I).

Although the striations created by the ridge and furrow make interpretation difficult, an enclosure may be attached to the east of the milecastle (43). Within it are a number of positive anomalies (possible pits), but no morphologically distinguishing characteristics were noted. A second contiguous enclosure was detected outside the western wall of the milecastle (45). The dimensions of the enclosure (L) appear to be 20 m by 14 m, although it is possible that a secondary enclosure (M) could extend some 9 m further to the south. Within this enclosure (M) a number of faint negative anomalies suggest the foundations of buildings. This conclusion is by no means certain because of the interfering effects of co-aligned ridge and furrow.

Some 25 m west of the milecastle a distinctive rectilinear negative anomaly was detected (45). This had dimensions of 13 m east-west and 10 m north-south, with its northern face abutting the Wall. There is some evidence that stone buildings, with internal sub-divisions may have been located adjacent to the path of the Hadrianic Wall. A pivotal small bipolar anomaly was detected in the central part of the enclosure. North of the Wall, two parallel negative anomalies were detected (P), with a north-south alignment. Their function is uncertain, but as they appear to pass through the Wall they undoubtedly post-date it.

#### *Area 4 (Field 988 and portion of unnumbered field to west)*

This small area to the west of the lonning fronted a small disused stone building sited to the south. Close to the western boundary of this field was a dry dyke with trees and other vegetation on either side; beyond this the western boundary was fenced. To the east of the boundary was a small headland some 1.00-1.5 m above the surrounding land which formed the edge of the marsh. Some evidence of stonework was seen in the sides of the dyke, on the projected line of the Wall, which could be interpreted as relating to it. Two isolated large blocks of stone were also

seen close to the dyke. Magnetometry was employed over all of the available area, with one grid adjoining the lonning being conducted using resistivity to provide complementary data.

The survey results of the field adjacent to the lonning are generally inconclusive. There are many small areas of high negative anomalies. These could be seen as brick hardcore laid in front of the stone building to provide a hard standing. The larger sub-rectangular area adjacent to the field boundary could be the site of an earlier building.

The strong negative reading on the headland to the extreme west of the survey (49) is very high (*c.* -180 nT). This is a far greater value than is expected for a stone wall. Two strong positive anomalies are positioned to either side. In view of the high negative value, interpretation of the physical nature of this feature can only be speculative. It is possible that both this feature and the headland represent the end of the Wall and show that it was not built across the Marsh.

#### *Area 5 (Field 986)*

This small area to the west of field 986 was surveyed in the hope that it might indicate the position of the Vallum crossing. A slight positive linear anomaly can be seen close to the southern field boundary: this could be a continuation of the Vallum (30) seen in area 2. Further linear positive anomalies in the northernmost grid almost certainly reflect an earlier field boundary. It is likely that the topographical features of this boundary were interpreted as being the line of the Vallum by earlier archaeologists, as they coincide with the line of the Vallum shown on present-day OS maps.

### **Conclusions**

The location of Hadrian's Wall was plotted and was found to follow a line some 7 m south of the route marked on present-day O.S. maps. The insubstantial magnetometry response would suggest that for much of its route it had been robbed to foundation level. The Vallum was identified as both an earthwork and a ditch opposite Rindle House (Field 1004) and further west in field 997, and possibly field 986, and confirms visual evidence. In both instances the route was close to the Dykesfield to Burgh-by-Sands road. The modern road probably follows the route of the scarp, but the magnetometer response was much less substantial than expected. This may be due to a combination of causes including the nature of the soil and/or rapid infilling after construction. The route of the Vallum is 45 m south of its plotted course on the current O.S. maps.

The location of Milecastle 73 was established and found to be 496 planar metres west of Turret 72b. From the magnetometry response, it would appear that the state of sub-surface preservation of the milecastle is much better than many this far west (e.g. Milecastles 69 and 70). Two probable enclosures flank the milecastle and abut the south face of the Wall. A number of anomalies outside the milecastle suggest that buildings, possibly of timber, had been constructed, with one being linked by a footpath. The line of the Wall was confirmed, for the first time, where it crossed the lonning in a direct line to the west of Milecastle 73 (21). The site of Turret 72b was

also established and the survey confirmed that it had been extensively robbed of stone.

A strong negative feature on the headland to the west of field 988 could represent the terminus of the Wall at the edge of the Marsh. This supposition is one, which can only be proved by excavation in the future.

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