Ancient Monuments Laboratory
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CLEEVE ABBEY, WASHFORD, SOMERSET, REPORT ON GEOPHYSICAL SURVEY, 1995

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Summary

A geophysical survey was carried out at Cleeve Abbey near Washford in Somerset to locate any possible buried archaeological remains, in advance of the excavation of a new field drain through the land surrounding the monument. Results were somewhat disappointing owing to the alluvial drift geology of the area; nevertheless, a number of potential features were identified.

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Report on geophysical survey, 1995

Introduction

The remains of Cleeve Abbey near the village of Washford in Somerset are in the custody of English Heritage and, amongst other features of note, are the important medieval wall paintings preserved in the Sacristy (Norton & Parks, 1986). In recent years the grounds of the Abbey have experience severe flooding during the winter months, owing to rainwater draining from the field to the east (field number 812), down slope to the Washford River that lies to the west of the Abbey site. The flooding is of particular concern as the Sacristy is one of the worst affected areas, threatening the continued survival of the wall paintings (Babbington & Rickerby 1989, McDonnell 1990).

A recent inspection of drainage facilities (Acer Consultants Ltd. 1994) indicated that the likely cause of the flooding was blockage of the field drains in field 812; it was proposed that a new drain be dug, running more directly towards the river, through the field to the north of the Abbey (field number 811). Earthworks, likely to be remains related to the Abbey, are visible in this field, hence the Historic Buildings inspector, Francis Kelly, requested that the Archaeometry Branch undertake a geophysical survey to help assess the archaeological impact of the proposal. This report describes the results of this survey and incorporates the results of a previous trial survey, carried out by the Branch in November 1993, to locate any medieval culverts in the vicinity of the Sacristy that might be used to assist drainage.

The Abbey is located at National Grid reference ST 047 407, on alluvium collected by the nearby Washford River. This overlies Upper Marl which becomes the primary substrate towards the eastern end of field 812; however the area surveyed in this field lies entirely over the alluvium.

Method

The proposed drain will run through field 811 for most of its length, hence a 60 by 120 metre area of this field, encompassing all possible routes that the drain might take, was targeted for initial survey. This area was divided up into a grid of 30 metre squares, located by triangulation to the field boundaries. A magnetometer survey was conducted over the entire area using the standard method outlined in Annex 1, note 2. This area was then resurveyed using the resistivity technique outlined in Annex 1, note 1, although, owing to time constraints, the 40 by 60 metre strip at the eastern end was omitted as it did not cover any part of the new drainage route.

Two smaller areas, covering the remaining sections of the drain, in fields 812 and 723 were also investigated. It was decided to concentrate on the resistivity technique for these surveys, as it had yielded the most informative results in field 811. These surveys were all conducted in the same manner as the resistivity survey of that field, as described above.

Additionally, the results of work carried out during a previous visit in 1993 are described. This work consisted of a resistivity survey, within the Abbey grounds, in the vicinity of the Sacristy, backed up by several resistivity depth profiles over targeted anomalies. The resistivity survey was conducted in the same manner as those described above. The resistivity profiles were measured according to the method described in Annex 1, note 3 and used a linear array of 25 electrodes, separated by 0.5 metre intervals, along a 12 metre baseline. The expanding Wenner measurement scheme was employed and results were collected using the Campus Geopulse system.

The location of all the surveyed areas, showing both resistivity and magnetometer coverage is depicted in the location plan (figure 1).

Results

The numerals within the following text refer to the identification of geophysical anomalies in the graphical summary guide, figure 4.

The Magnetometer Survey of field 811

The results of the magnetometer survey are depicted in figure 2. The data has been corrected for 'striping' between adjacent traverses and is plotted using equal area greyscale assignment. Measurements made along the southern edge of the plot exhibit disturbance caused by the proximity of a wire fence separating field 811 from the Abbey grounds. Also evident at the north-eastern end of this plot is a circular, negative magnetic gradient (black) anomaly, due to one of the steel manhole covers of the present field drain, marked as MH5 on the drainage inspection map.

Despite visible earthworks suggesting buried archaeological features, few concomitant anomalies are apparent in figure 2. This is not atypical on sites over alluvium because the magnetic minerals present in some alluvial deposits do not record past anthropogenic activity particularly well (Linford 1994).

Nevertheless, a small number of anomalies of possible interest may be discerned. The largest are two faint linear features about 20 metres long, one on an east-west alignment **(1)**, the other at an oblique angle to it **(2)**, in squares 4 and 5. Whilst these might be responses to man-made features such as ditches, their shape makes it difficult to ascribe any function to them.

The most striking feature in the figure lies in square 7 and consists of two strong parallel linear anomalies about 10-15 metres in length, running east-west, with the suggestion of several perpendicular linearities connecting them **(3)**. The magnetic field gradient over these anomalies reaches a magnitude of up to 30nT, consistent with fired archaeological features possessing remanent magnetism, such as hearths or kilns. Hence, they could represent ditches filled with burnt material. However, whilst almost certainly the result of human activity, the age of the feature cannot be determined from the geophysical evidence. Speculation about its nature is deferred until the conclusion but explanation in terms of recent agricultural practice cannot entirely be dismissed.

Approximately 30 metres to the east of the above feature, in square 8, is a group of three short linear anomalies exhibiting equally high magnetic field gradients **(4)**. These form two right angles, turning in opposite directions, suggesting perhaps a corner of some buried structure. Given their similarity to the anomalies described in the preceding paragraph it is likely that they represent a buried feature of similar type.

The Resistivity Surveys

The results of the all the resistivity surveys are depicted in figure 3. To enhance the contrast of the plot and accentuate anomalies less than 7 metres across, the data has been processed using the Wallis statistical differencing algorithm (Scollar 1990, p175).

Field 811 (squares 3-5 and 7-9)

Dominating the plot of the resistivity survey of field 811 are six parallel low resistance anomalies running east-west across the entire width of the surveyed area **(5)**. They are each 2-3 metres wide, are separated from each other by about 10 metres, and appear to terminate near the eastern edge of the survey. They can be discerned in the field as shallow linear depressions. The sharply defined contrast that they exhibit with their surroundings suggests that they might be recent ditches but, given that the field appears to have been used as pasture in recent times, it is not implausible that these features represent the remains of medieval ridge and furrow agriculture.

Further analysis of the plot is hampered by the background response which consists of a fluctuating pattern of high and low resistivity regions. This response appears to be common over alluvial deposits, reflecting variations in the average grain size of poorly sorted gravels and other sediments distributed across the area. Nevertheless, in square 7, a connected group of rectilinear, high resistance anomalies about one metre in thickness can be discerned **(3)**. This feature appears to correspond in position to the magnetic anomaly identified in this square and discussed above. Finally, some of the regions of high resistance visible in the plot, particularly those immediately to the north of the feature in square 7, could represent spreads of rubble from buried buildings but, given the potential alluvial variation, a firm interpretation is not possible.

Field 723 (squares 1-2)

A high resistivity linear anomaly running approximately north-south is apparent in the plot of this area, running along the eastern edge of the survey area **(6)**. It corresponds to a linear rise visible in the field and is likely to be an earthwork associated with the moat that runs around the north and west edges of field 811. A second, parallel, high resistivity linear anomaly may be perceived about 20 metres to the west **(7)** and, about 10 metres further west, an oval area **(8)** of similar width and resistivity. These anomalies may be caused by the rubble from buried walls but could also be artifacts of the alluvial drift geology.

At the western end of this area a narrow, 1 metre wide, linear, high resistivity anomaly **(9)** is evident, also running north-south. Manhole covers could be seen in the field in the vicinity of this feature and it is likely to be a recent drainage channel, although a medieval origin cannot be ruled out.

Field 812 (square 11)

Two linear, high resistivity anomalies with an approximate north-south alignment and just over one metre in width protrude into the southern end of this square **(10 & 11)**. Given the earthworks readily apparent in this field, it is possible that these are caused by buried medieval wall footings; however, the drainage report shows a system of french drains connecting to the existing main field drain in this area. Certainly the very faint linear, high resistivity anomaly **(12)** running out to the north-west corner coincides with the route of the main drain and is likely to be a response to it. The remaining high resistivity anomalies in this area are all consistent with response to the alluvial drift geology although, as above, the strongest might be caused by buried stone rubble.

The Abbey Grounds (squares 12-13)

This survey was carried out in 1993 in the hope of detecting medieval culverts that might be reactivated to assist in draining the Sacristy. Part of the existing Abbey drainage system has been detected as a circular, low resistivity anomaly **(13)**, with three linear anomalies **(14, 15 & 16)** radiating out from it, in the centre of square 13. Aside from this, buried wall footings are evident as high resistivity anomalies in square 12, adjacent to the standing ruins **(17)**. However, no narrow linear anomalies suggestive of culverts are readily apparent and, given that buried walls have been detected, it is not likely that any are present.

One other feature of note is the area of extremely low resistivity at the south-west corner of square 12 near to the Sacristy entrance **(18)**. This area was investigated further using the resistivity profiles described below.

<u>The Resistivity Profiles</u>

Four profiles were taken parallel to the Sacristy wall and offset increasing distances from it. The furthest from the Sacristy, profile 4, shows a buried wall at its western end that must have connected the Garth to the church. This is also visible in the resistivity plot for this area, discussed above. Immediately to the east of this is a dark, low resistivity anomaly; also apparent in the other three profiles, demonstrating that it extends towards the Sacristy wall. Anecdotal evidence indicates that a soakaway was dug here to try and drain winter floodwater from the Sacristy thus it is likely that this is what is being detected.

The other high resistance feature running through the eastern end of profiles 1-3 appears to relate to a buried wall footing extending from the Sacristy towards the church.

Conclusion

The alluvial drift geology has made reliable interpretation of the geophysical response difficult over much of the site. Nevertheless, a number of potentially archaeological features have been identified in field 811. The most striking are the strong east-west ditches, possibly indicating ridge and furrow agriculture, or drainage, in this area.

Furthermore, the group of features detected by both magnetometry and resistivity surveying in square 7 may also represent the remains of ruined structure associated with the Abbey. The very faint resistivity anomalies may represent the walls of the structure whilst the magnetometry could be responding to magnetically enhanced soil embanked against them. This magnetic enhancement would have been caused by burning suggesting an industrial function was being carried out in the vicinity; possibly the structure is the remains of a corn drier. This interpretation is, however, tentative and should be treated with caution, as recent features also tend to exhibit enhanced magnetic susceptibility in many cases.

The survey in field 812 has not detected any anomalies that could not be accounted for by the drainage plan of that area. However, in field 723, near the Washford River, three, possibly archaeological, linear anomalies have been noted. These might be of particular interest as they extend across the entire width of the survey and the new drainage ditch will have to cut through them. Finally, the survey work in the Abbey grounds, in the vicinity of the Sacristy was unsuccessful in locating any disused medieval culverts but did detect a number of wall footings not showing on the ground surface.

Surveyed by: P Linford
N Linford

Date of survey: 10-12/1/95

Reported by: P Linford
N Linford

Date of report: 19/1/95

Archaeometry Branch,
Ancient Monuments Laboratory,
English Heritage.

References

Acer Consultants Ltd. (1994). Cleeve Abbey, Washford, Somerset inspection of drainage facilities. *Unpublished report*.

Babbington, C. & Rickerby, S. (1989). CLEEVE ABBEY: Report on the Conservation Treatment of the Wall Paintings and Recommendations for Future Work. *Unpublished English Heritage report*.

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McDonnell, J. G. (1990). Analysis of plaster samples from Cleeve Abbey, Somerset. *Ancient Monuments Laboratory Report 1/90*.

Norton, C. & Parks D., eds. (1986). Cistercian Art and Architecture in the British Isles. p206-8.

Scollar, I, *et al* (1990). Archaeological Prospecting and Remote Sensing, p175, p349-350, Cambridge.

List of enclosed figures:

Annex 1: Notes on standard procedures

1)**Resistivity Survey:** Each 30 metre square is surveyed by making repeated parallel traverses across it, all aligned parallel to one pair of the square's edges, and each separated by a distance of 1 metre from the last; the first and last traverses being 0.5 metres from the nearest parallel square edge. Readings are taken along each traverse at 1 metre intervals, the first and last readings being 0.5 metres from the nearest square edge.

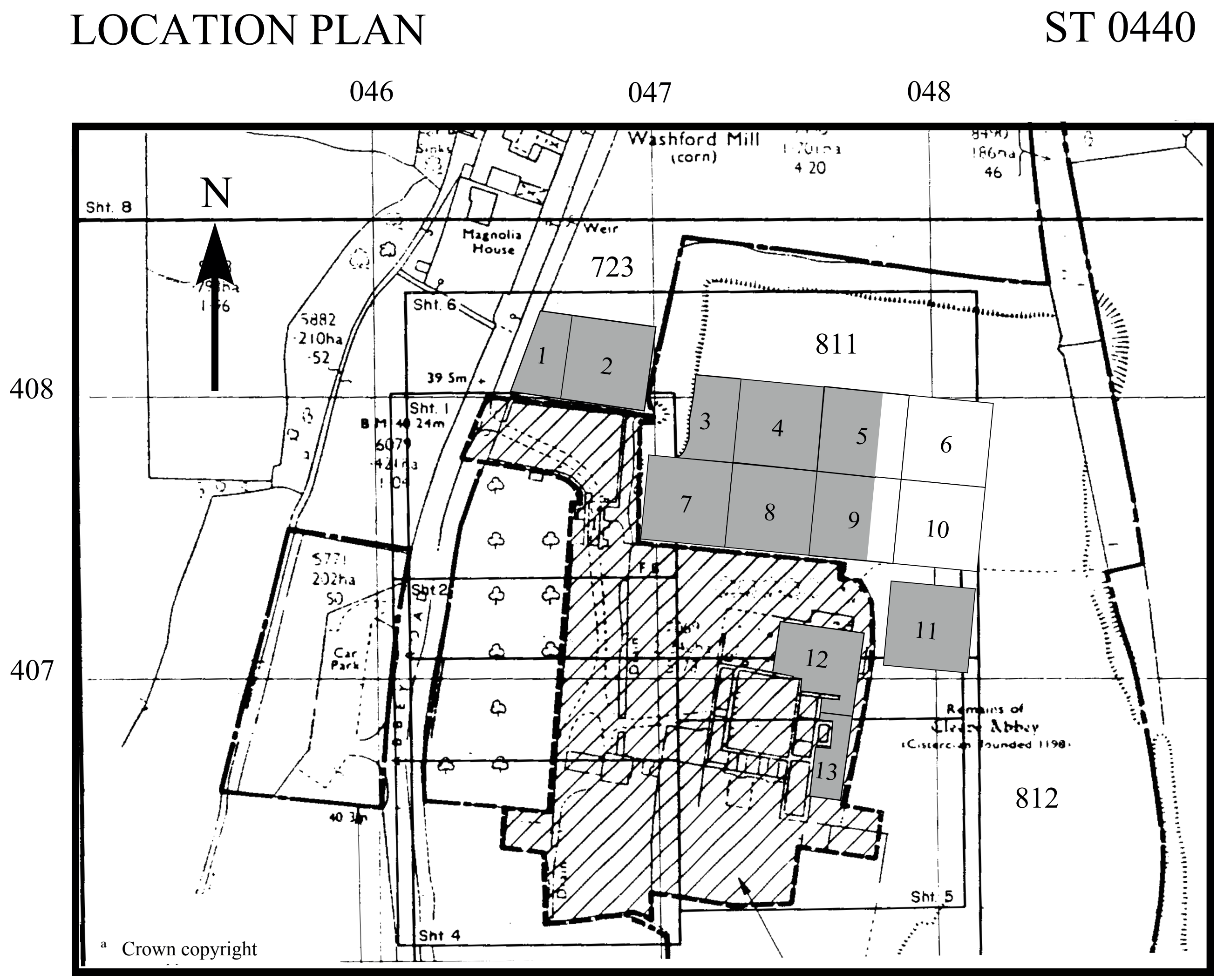
Unless otherwise stated the measurements are made with a Geoscan RM15 earth resistance meter incorporating a built-in data logger, using the twin electrode configuration with a 0.5 metre mobile electrode separation. The measurements are recorded digitally by the RM15 and subsequently transferred to a portable laptop computer for permanent storage and preliminary processing. Additional processing is performed on return to the Ancient Monuments Laboratory using desktop workstations.

2)**Magnetometer Survey:** Each 30 metre square is surveyed by making repeated parallel traverses across it, all parallel to that pair of square edges most closely aligned with the direction of magnetic North. Each traverse is separated by a distance of 1 metre from the last; the first and last traverses being 0.5 metre from the nearest parallel square edge. Readings are taken along each traverse at 0.25 metre intervals, the first and last readings being 0.125 metre from the nearest square edge.

Unless otherwise stated the measurements are made with a Geoscan FM36 fluxgate gradiometer which incorporates two vertically aligned fluxgates, one situated 0.5 metre above the other; the bottom fluxgate is carried at a height of approximately 0.2 metre above the ground surface. The FM36 incorporates a built-in data logger that records measurements digitally; these are subsequently transferred to a portable laptop computer for permanent storage and preliminary processing. Additional processing is performed on return to the Ancient Monuments Laboratory using desktop workstations.

3)**Resistivity Profiling:** This technique measures the electrical resistivity of the subsurface in a similar manner to the standard resistivity mapping method outlined in note 1. However, instead of mapping changes in the near surface resistivity over an area, it produces a vertical section, illustrating how resistivity varies with increasing depth. This is possible because the resistivity meter becomes sensitive to more deeply buried anomalies as the separation between the measurement electrodes is increased. Hence, instead of using a single, fixed electrode separation as in resistivity mapping, readings are repeated over the same point with increasing separations to investigate the resistivity at greater depths. It should be noted that the relationship between electrode separation and depth sensitivity is complex so the vertical scale quoted for the section is only approximate. Furthermore, as depth of investigation increases the size of the smallest anomaly that can be resolved also increases.

Typically a line of 25 electrodes is laid out separated by 1 or 0.5 metre intervals. The resistivity of a vertical section is measured by selecting successive four electrode subsets at increasing separations and making a resistivity measurement with each. Several different schemes may be employed to determine which electrode subsets to use, of which the Wenner and Dipole-Dipole are typical examples. A Campus Geopulse earth resistance meter, with built in multiplexer, is used to make the measurements and the Campus Imager software is used to automate reading collection and construct a resistivity section from the results.



Resistivity survey

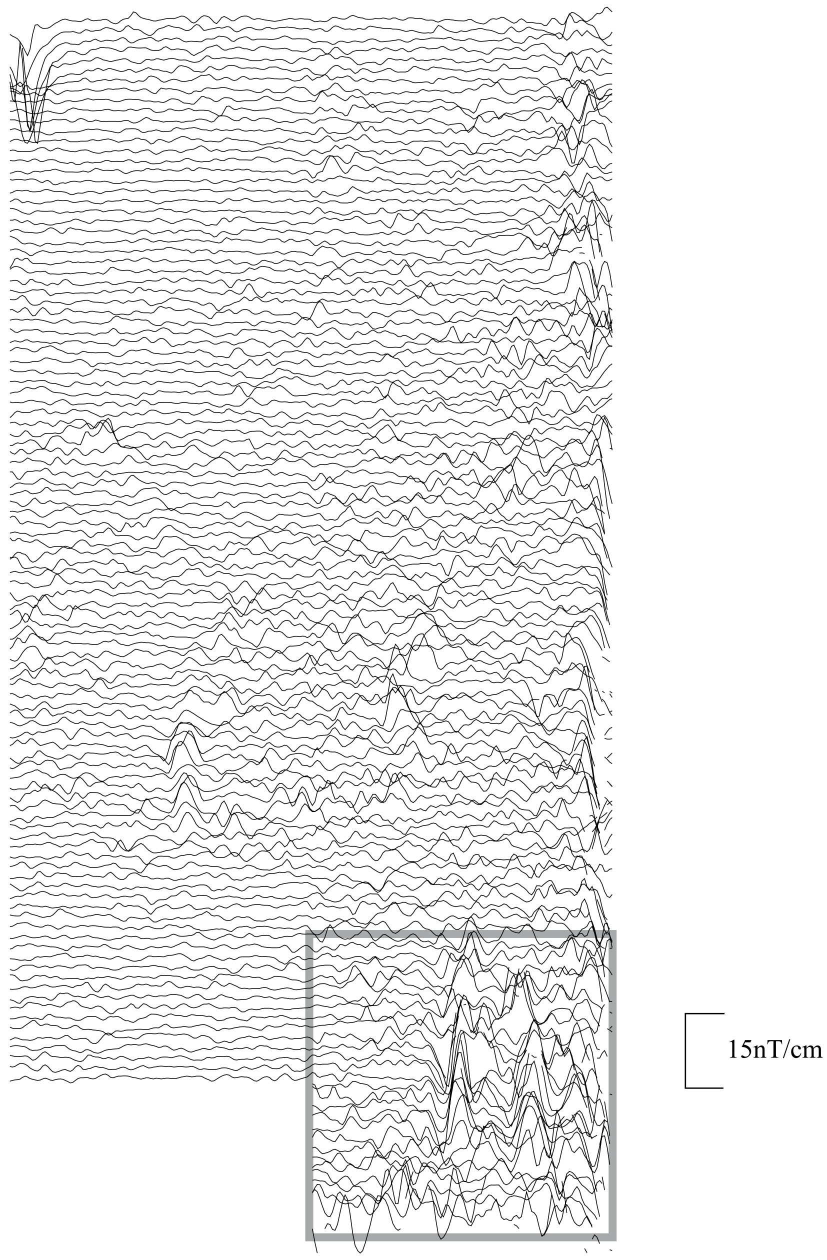
Magnetometer survey, squares 3-10

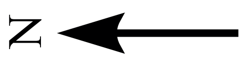
0 90m

Figure 1; CLEEVE ABBEY, location of geophysical survey.

1.

2.





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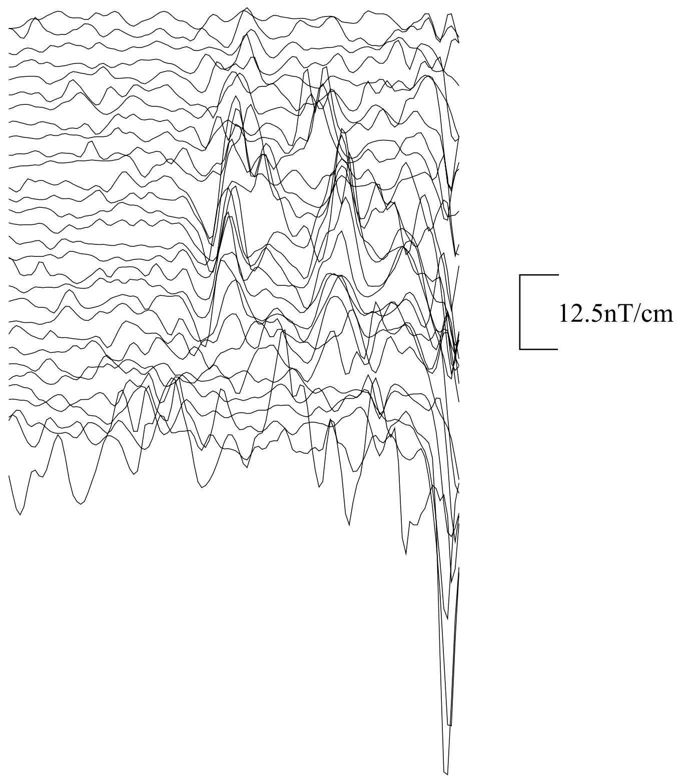
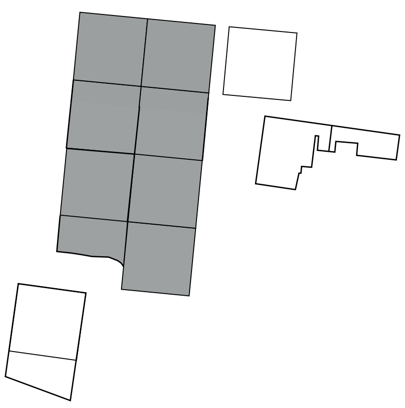


KEY TO PLOTS

1. Greytone of raw magnetometer data.
2. Traceplot of raw magnetometer data.
3. Detail of magnetometer data from square 7 (1:500).

FIGURE 2



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0 — 90m

1:750

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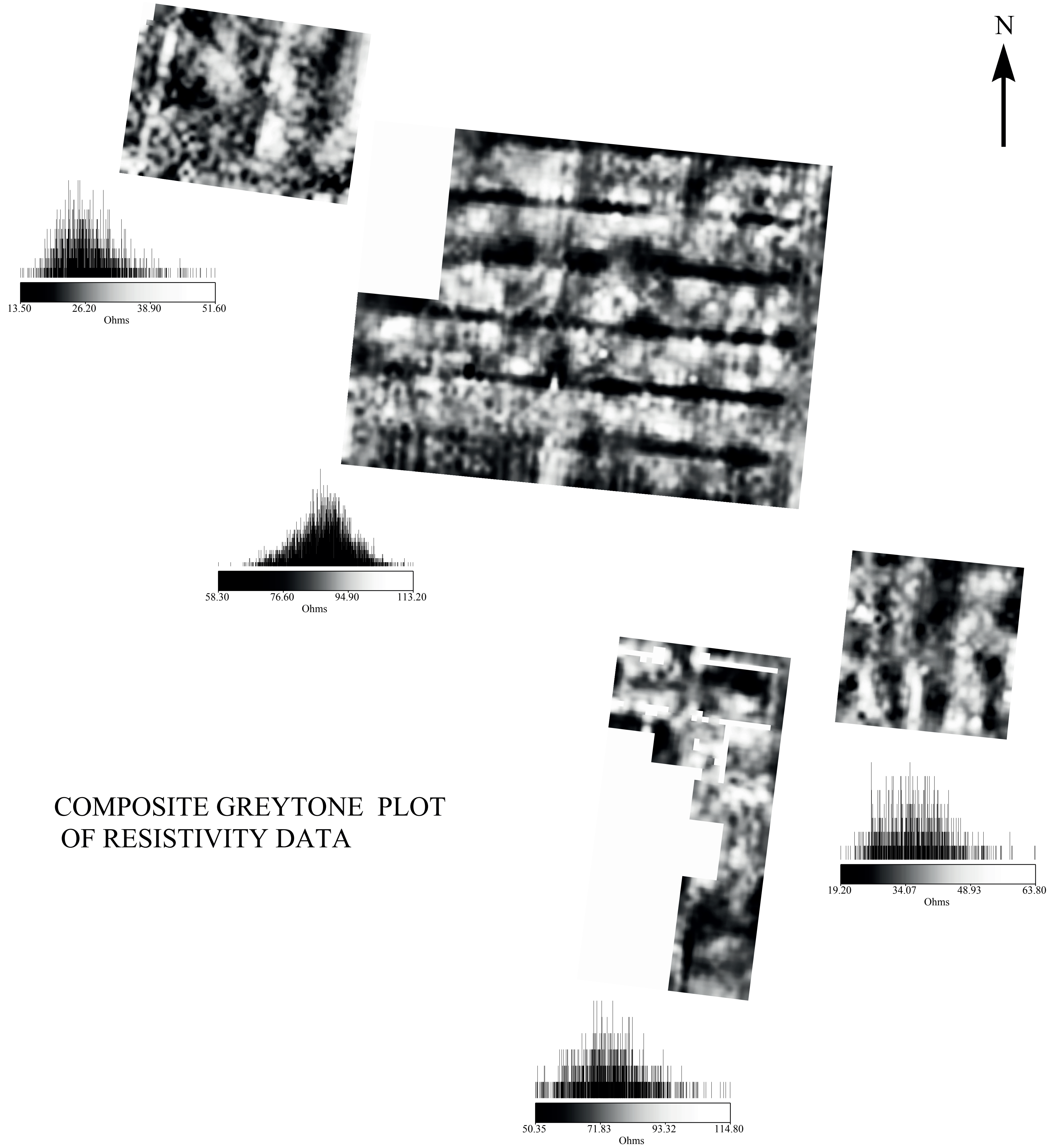
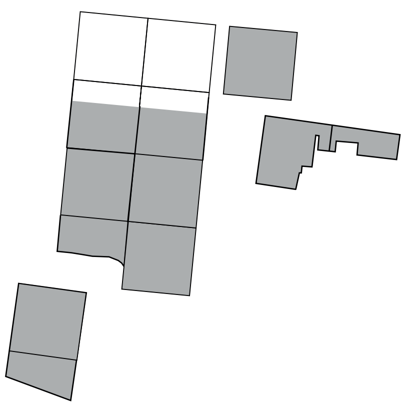


FIGURE 3



CLEEVE ABBEY
Geophysical survey January 1995

0 90m
1:750

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Summary guide of significant anomalies

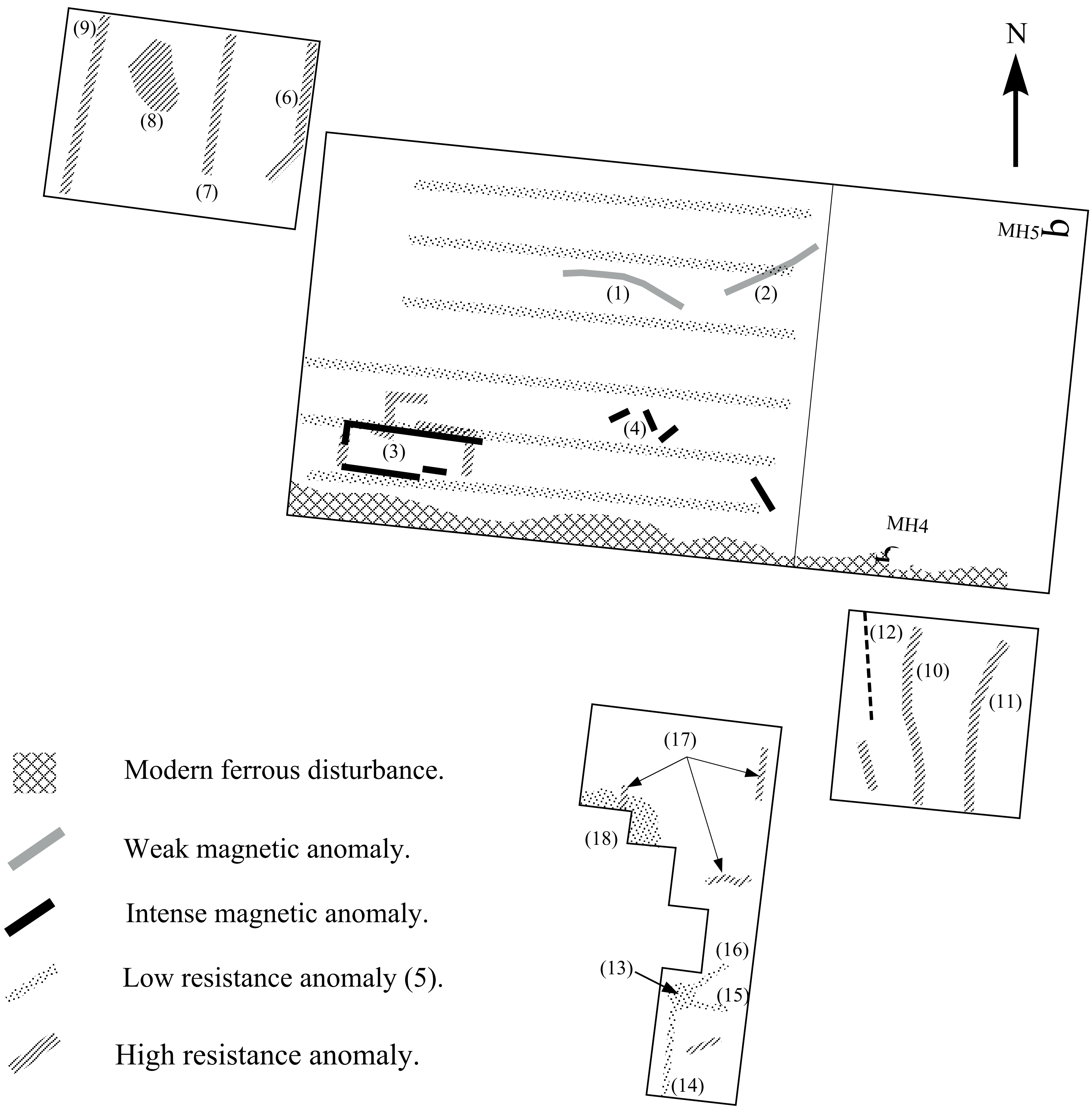
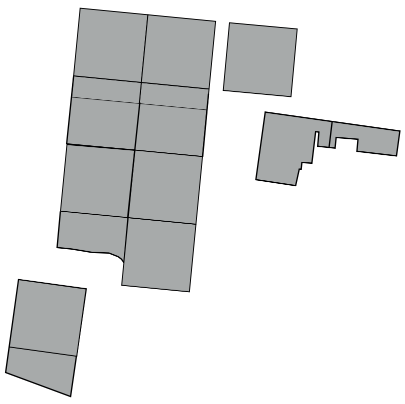


FIGURE 4



CLEEVE ABBEY
Geophysical survey January 1995

0 — 90m
1:750

AML '95

Figure 5; CLEEVE ABBEY, resistivity data and location of resistivity sections.

CLEEVE ABBEY

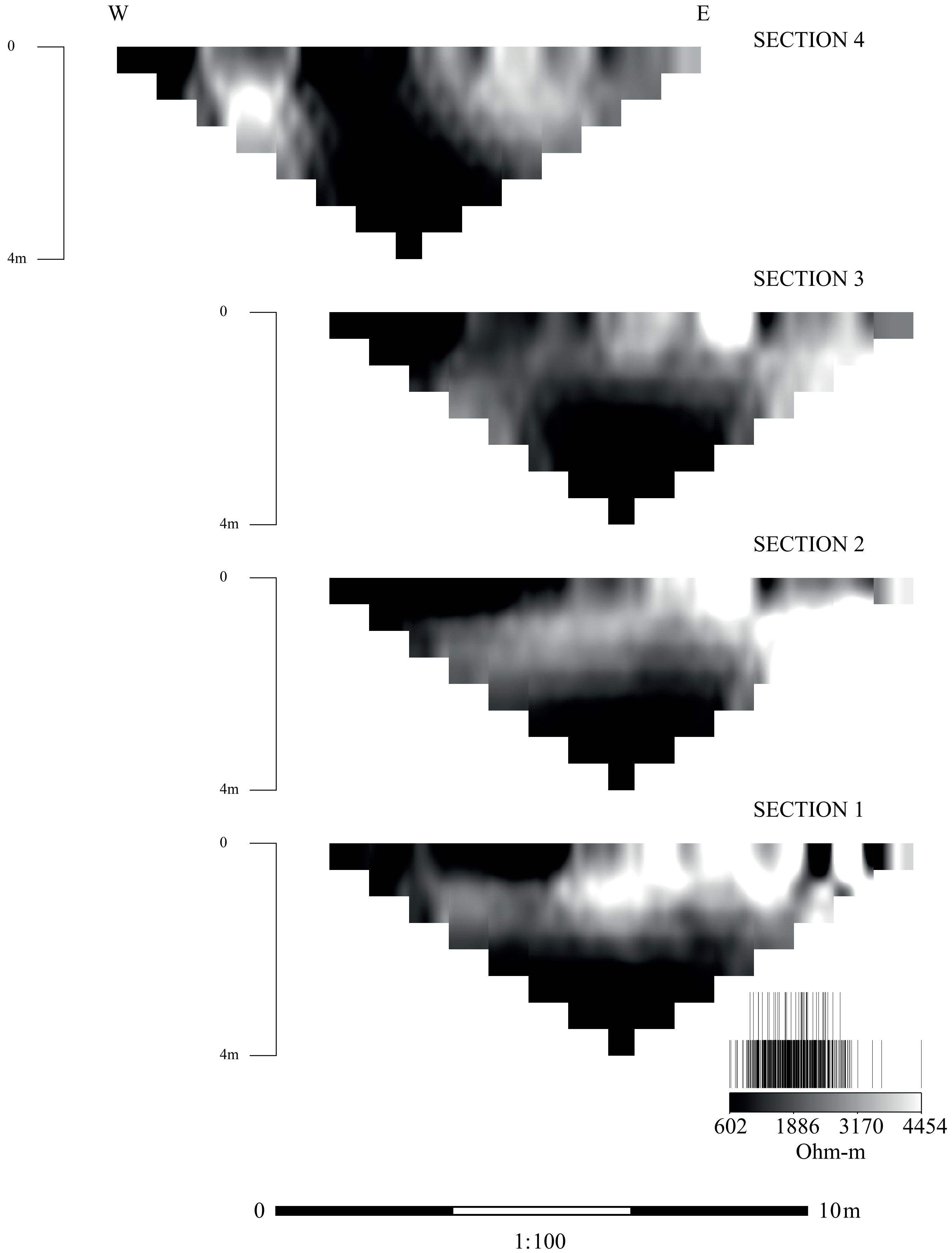


Figure 6; CLEEVE ABBEY, wenner array inverted resistivity sections.