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Resistivity survey at Arthur's Stone, Dorstone, Herefordshire

Dr Tim Young

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Dr T.P. Young

Abstract

Geophysical survey was undertaken at Arthur's Stone in May 2011. Testing showed that the magnetic field from remnants of earlier ferrous fencing masked much of the site, so gradiometry was not pursued. Ground resistivity survey of the site showed that this property was mainly controlled by the modern topography and by disturbance (probably including both holes and spoil mounds).

The survey provided little evidence for the original form of the mound. There is some slight suggestion that the SE end of the mound might be formed by a straight margin parallel to the side-passage, but it is not possible to discriminate whether this anomaly is truly due to buried features or to the modern topography in this area.

Contents

Methods

The survey was conducted on 23rd May 2011.

The site was laid out with partial 20m grids based on an axis designed to allow an unimpeded baseline running between the standing stones in the centre of the site.

The intention was to locate and survey the grid using a high resolution survey-grade Trimble RTK GPS system. Equipment failure meant this was not possible on the day of the survey. The grid points were tagged with plastic marker pegs to allow their survey on the earliest possible return visit. Unfortunately, in the short time before the return visit the pegs had been removed from the site (apparently by the EH maintenance staff). Despite this issue, the known constraints on the positioning of the base line mean that any potential error in the location of the survey remains very small. The location of the survey is shown in Figure 1

Trial magnetic gradiometer survey was conducted using a Geoscan FM36 gradiometer. Because of the multiple impediments on the site to walking traverses, it was intended to walk the grids recording data using the hand switch.

The ground resistivity survey was undertaken with a Geoscan RM15 resistivity meter, operating two pairs of mobile electrodes on a PA5 frame, via an MPX15 multiplexer. The mobile electrode pairs had a 0.5m spacing (giving the main component of the response from 0.5-0.7m depth), with 1m between centres, to give a 1m effective traverse interval. Data were collected on 20m grids, walked in a zig-zag pattern, with 0.5m sample interval (i.e. raw data grid has 1.0 x 0.5m node spacing). Data processing in *Geoplot* was limited to edge matching grids and removal of any minor data spikes (due to poor electrode contact). Data were exported from *Geoplot* and imported to Golden Software's *Surfer*. The data were gridded by kriging to a node spacing of 0.125m for production of the final images.

This survey was undertaken for Dr Keith Ray of Herefordshire Archaeology.

Results

The trial magnetic gradiometer work quickly established that the line of the present wooden fence surrounding the protected monument corresponded to the source of a major magnetic anomaly, with a field sufficient to mask any anomalies of potential archaeological significance for a distance at least 4m to north and south. Additional modern 'noise' was also provided by signage and the external fences to the southeast and west. Anecdotal evidence indicated that the scheduled monument had previously been protected by iron railings and it is assumed that the settings of the railings, and possibly corrosion from them, remain in-situ.

Since so little of the monument was free from the influence of these various modern sources of strong magnetic fields, it was decided that the magnetic survey of the site would not be productive and therefore should not be pursued.

The ground resistivity survey was conducted as planned. The raw results of the survey are shown on Figure 2. The hard dry ground, particularly over the elevated areas and breaks of slope, produced high contact resistance on frequent basis and this has affected data quality. Removal of the data spikes was undertaken using Geoscan's 'despike' command, applied twice.

The processed data were kriged to 0.125m node spacing and the results are displayed in Figure 3.

Interpretation

The trackway bounding the monument to the SE appears as a strong resistivity low from the present parking area to the farm gate to the south of the monument. This contrast with the remainder of the surveyed area probably indicates that the surficial wet deposits in the trackway extend to a considerable distance below surface. It is uncertain whether the margin of the track follows an original margin to the mound, or whether it cross-cuts it.

In contrast, the trackway to the west and southwest of the monument is much less strongly marked, although lower resistivity was recorded progressively towards the modern road. Within the area of the track there is a single slight axial curvilinear negative resistivity anomaly (blue line on Figure 4). This feature is likely to be associated with the modern footpath, rather than a peripheral ditch to the monument, since it appears to extend directly towards the modern farm gate in the south. There was little indication of any abrupt margin to the mound structure on this side of the monument, unless indicated by the narrow linear negative anomaly mentioned above.

Within the area of the monument the observed resistivity appeared largely controlled by topography. The northern part of the site (broadly that part north of the site grid line at N=20) shows the exposed stones to be surrounded by an area of low resistivity (pale grey tone on Figure 4), with somewhat elevated resistivity to the west and with strongly and irregularly elevated resistivity to the east (dark grey tone on Figure 4), apparently corresponding to a mound of spoil. Some very slight NW-SE linear fluctuations within this eastern anomaly may reflect its internal structure, or may be associated with the use of equipment in landscaping.

To the south of the prominent spoil dump, a slight resistivity low marks the topographic low of the modern footpath from the eastern entrance into the monument, passing to the south of the capstone.

To the southeast of the southern stones an approximately east-west resistivity high (pink tone on Figure 4) broadly follows the line of the break of slope, but is rather more linear and there is suggestion of a prolongation of this anomaly to the west into the area of the trackway southwest of the enclosed monument. If this anomaly reflects a margin to the mound, then the margin is both unexpectedly straight and is truncated by the trackway to the east. It is worth commenting, however, that this direction is also parallel to that of the side-passage, so an abrupt and angular SE end to the mound might possibly be suggested.

To the west of the southern stones and bounded to the south by the positive resistivity anomaly just described, there is a small area of moderate to low resistivity, with a rather irregular appearance. This zone is bounded to the west by a small zone of elevated resistivity, which is slightly elevated ground and might correspond to another small spoil dump (dark tone on Figure 4). The irregularity of the resistivity in this area (compared, for instance with that just to northwest) may indicate that this area too has been disturbed. The positive anomaly associated with the possible small spoil dump shows a slight prolongation to the WSW, sub-parallel to the elongate anomaly to its south (pink tone on Figure 4). This slight suggestion of parallel lineation at an angle to any expected direction associated with the mound may indicate some small degree of bedrock influence on the resistivity in this area.

In summary, the resistivity data show no certain control by any ancient features. Rather, the data suggest control by topography and by more recent features, perhaps including both early excavation and more recent landscaping. Some degree of influence by the original structure of the mound might be indicated by the linear positive feature in the south, but this is far from certain. The margin of the mound to the west is not well imaged and the resistivity decreases progressively in this direction. Certain discrimination of ancient features from the more modern is unlikely to be practicable by geophysical means. It is possible however, that 'ground truthing', through excavation, of areas of the features identified here would improve their interpretation and might allow the use of the survey in extrapolating that interpretation.

The strong surface relief means that resurvey of the resistivity of the monument under different groundwater conditions would probably be unlikely to generate additional useful information. The testing of the gradiometer survey also indicates that useful information is unlikely to be obtained from the application of magnetic techniques to the site.

Figure Captions

Figure 1. Position of survey grids. Black linework indicates site grid, brown linework indicates National Grid, both with coordinates. Green lines indicate topographic base. Red lines give the approximate outline of the major stones.

Figure 2. Raw resistivity data. Site north to top; grid outlines as in Figure 1:

a) Grey scale 0Ω measured resistance (black) to 800Ω measured resistance (white).

b) Grey scale 50Ω measured resistance (black) to 500Ω measured resistance (white).

Figure 3. Processed resistivity data kriged to 0.125m node spacing displayed on site base.

Grey scale 50Ω measured resistance (black) to 450Ω measured resistance (white).

Figure 4. Summary interpretation of ground resistivity survey. For explanation of colours see text.

Figure 1

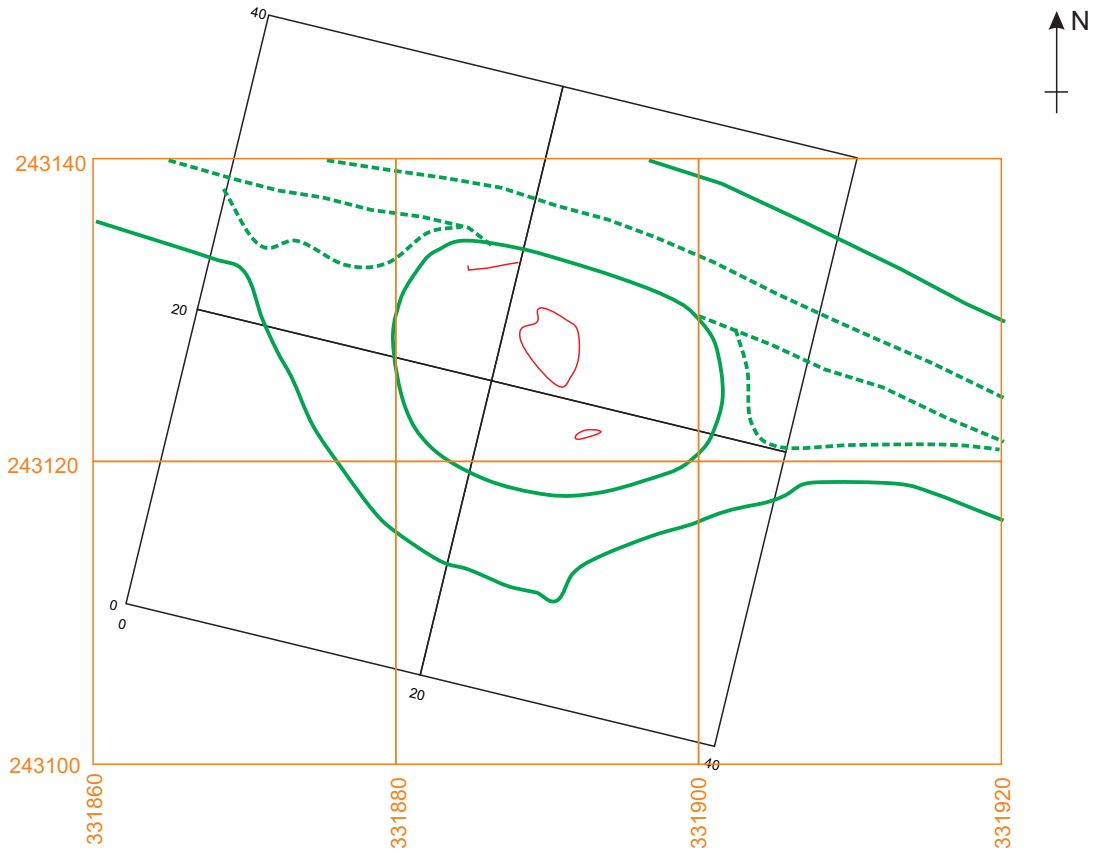
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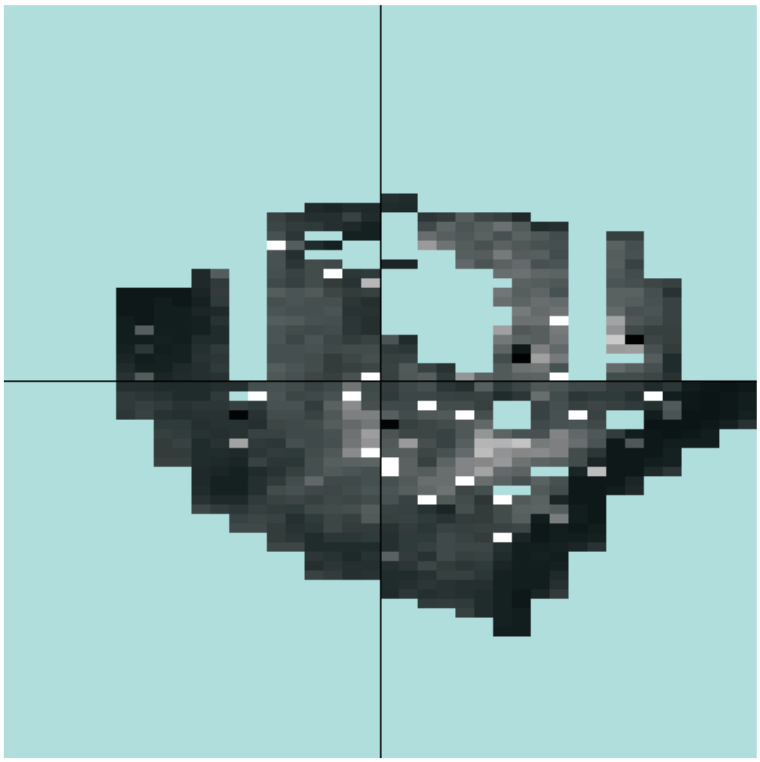
Figure 2

a



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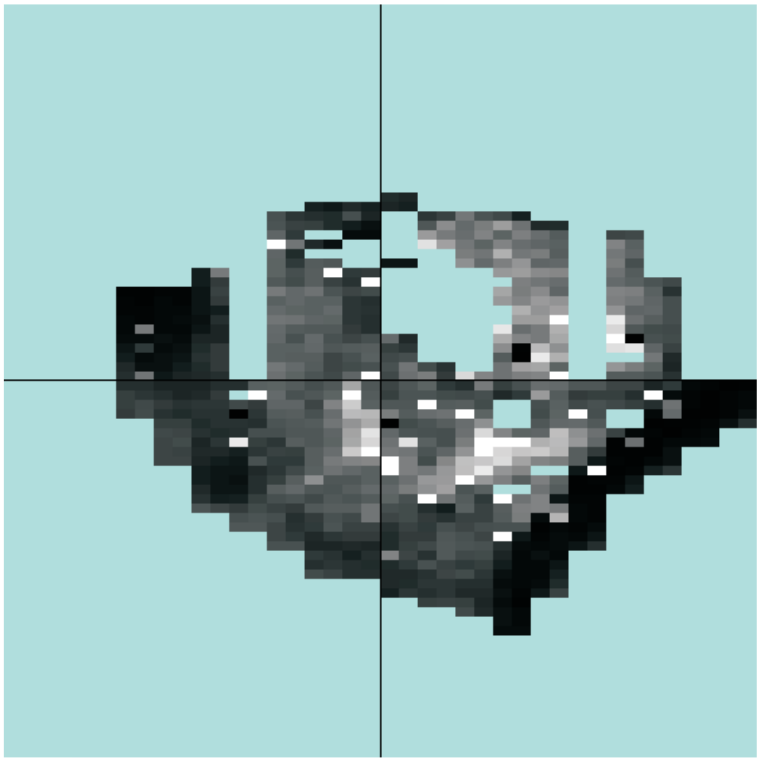

Figure 3

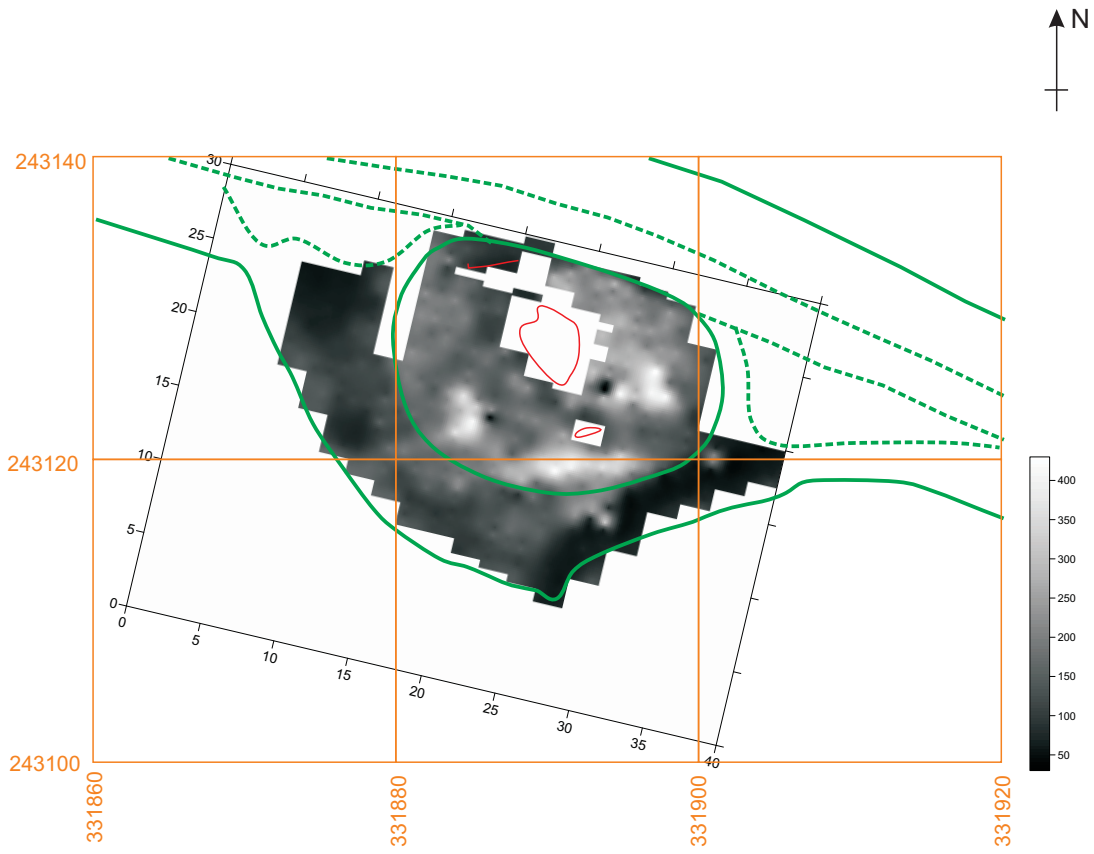
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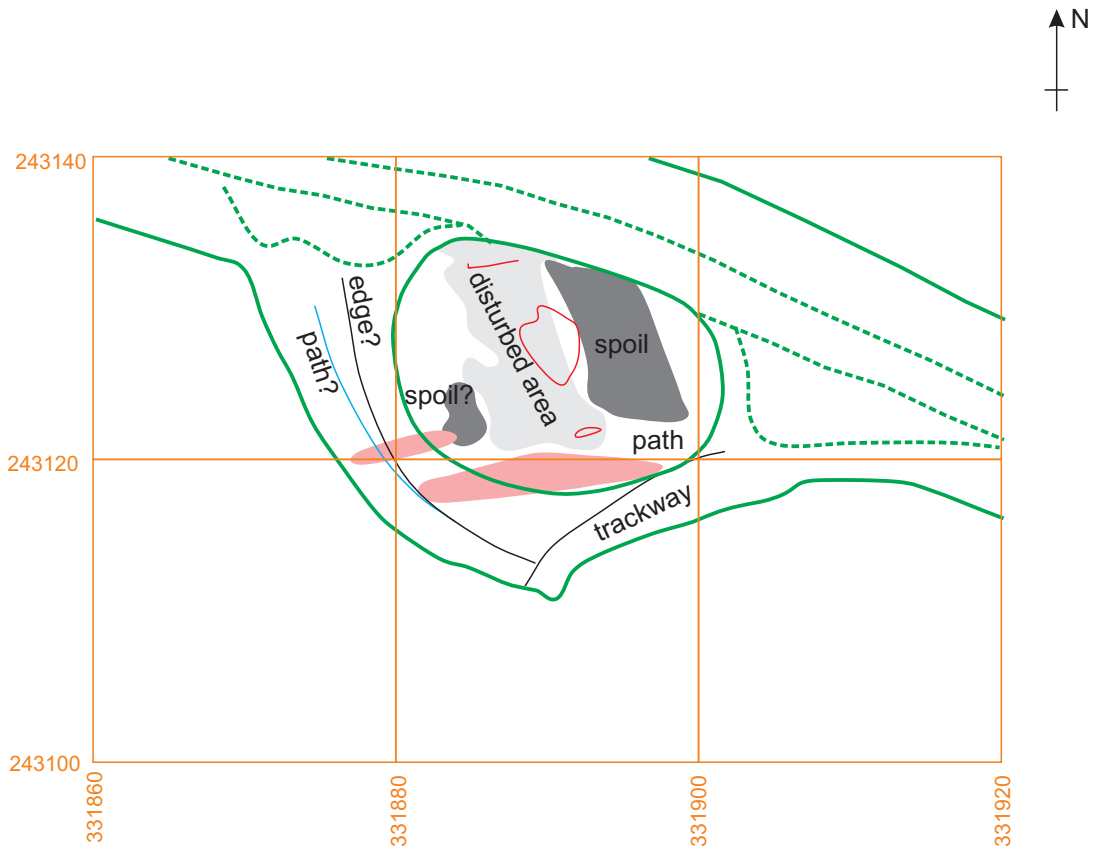
Figure 4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