4.0 Phase II Geophysical Survey at Catholme

Phase II investigations provided the opportunity to continue the geophysical research in the 'Catholme Ceremonial Complex'. This work sought further to investigate areas of interest brought to light in Phase I, in order to better understand the relationship between the survey data, archaeology and soil properties, as a means to enhance the interpretation of survey results and as a guide to future best practice.

The bulk of survey work which was undertaken at Catholme produced varied results. Some clearly showed well-defined anomalies closely corresponding to the cropmarks. Other results, however, showed weak or indistinct anomalies corresponding in part to known features, although with some not represented at all.

4.1 Site Selection and Justification

Six areas were selected for ground truthing which focused on the three principal monuments of the 'Catholme Ceremonial Complex'. Three of these areas measured 20m x 10m and three measured 10m x 10m. In order to limit disturbance to the monuments these were the minimum believed necessary to achieve the project aims.

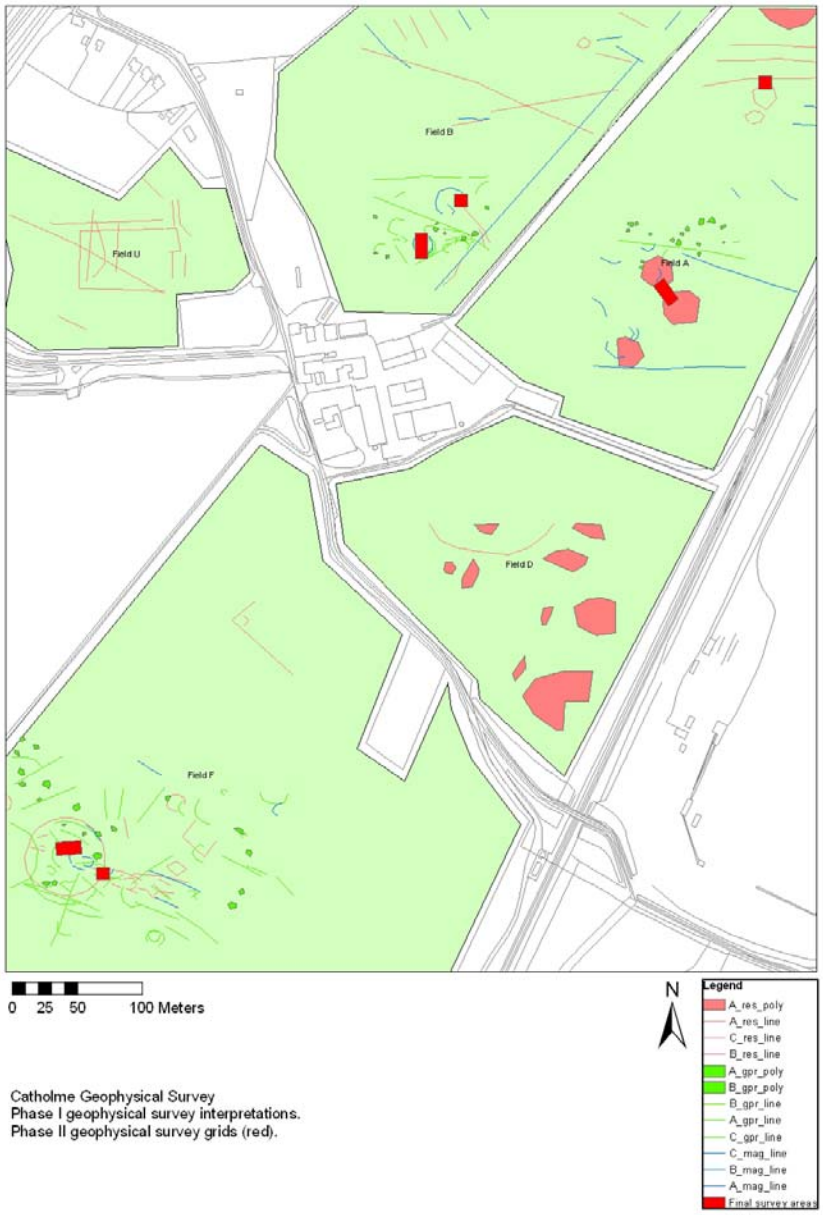

Figure 12. Phase II WRM geophysical survey areas as red blocks.

Detailed geophysical surface surveys were undertaken in each target area using multiple techniques, as described below. Following the surface survey the topsoil was removed, and detailed geophysical survey repeated. Four 2m x 5m sub-areas were then selected over archaeological and geophysical features of interest. Further geophysical measurements, along with measurement of soil properties and sampling for laboratory analysis was conducted in these smaller sub-areas.

4.1.1 Area A1

The survey area in A1 was positioned over one of the pit-alignments that cross the WRM landscape. The pit-alignment was mapped in Phase I of survey at Catholme along with two other linear features to the north of the pit alignment. With consideration of the inaccuracy of the cropmark map, Area A1 was positioned over the linear feature that continues into Field B to the west.

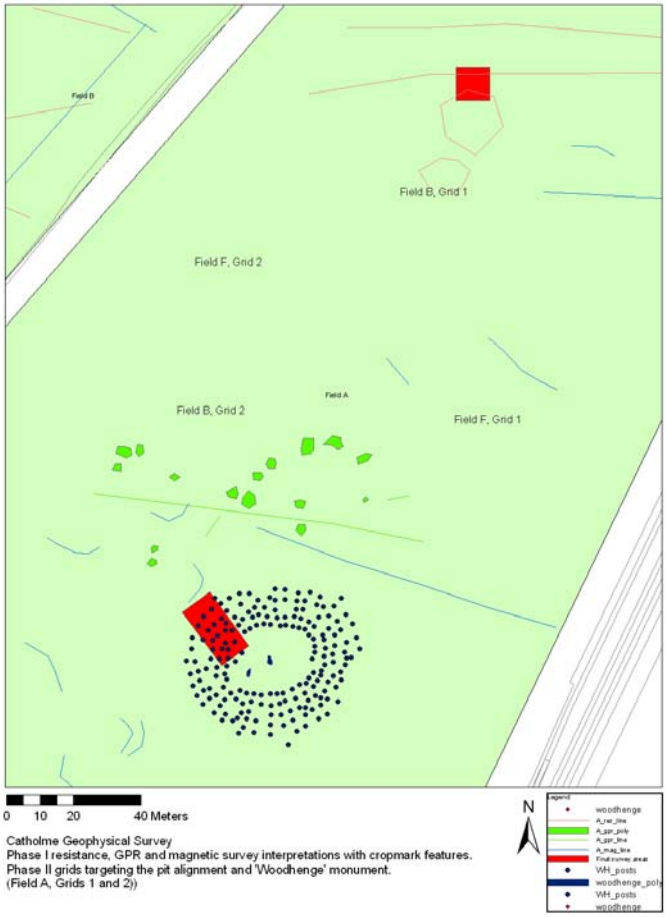

Figure 13. Phase II Field A area locations. A1 is in the north and A2 in the south.

The objective of this investigation was to establish the location of the pit-alignment and to investigate the properties of the pit fills, along with other potential archaeological features and the surrounding gravels.

4.1.2 Area A2

The area of the 'Woodhenge' had a number of GPR and resistance anomalies which were thought to correspond with the cropmark.

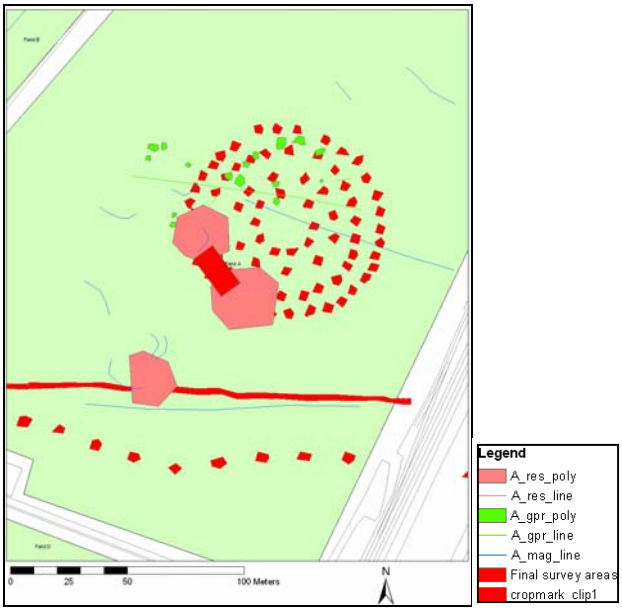

Figure 14. Phase II survey area selected to investigate the 'Woodhenge' feature in Field A.

For the best placement over this feature, the oblique aerial photograph was rectified to the project GIS. The results of this rectification altered the supposition that hitherto mapped geophysical anomalies may have corresponded to the 'Woodhenge' monument. The correct location of the cropmark meant a shift of between 17m - 53m, with the 'Woodhenge' altered in size to 47m in diameter.

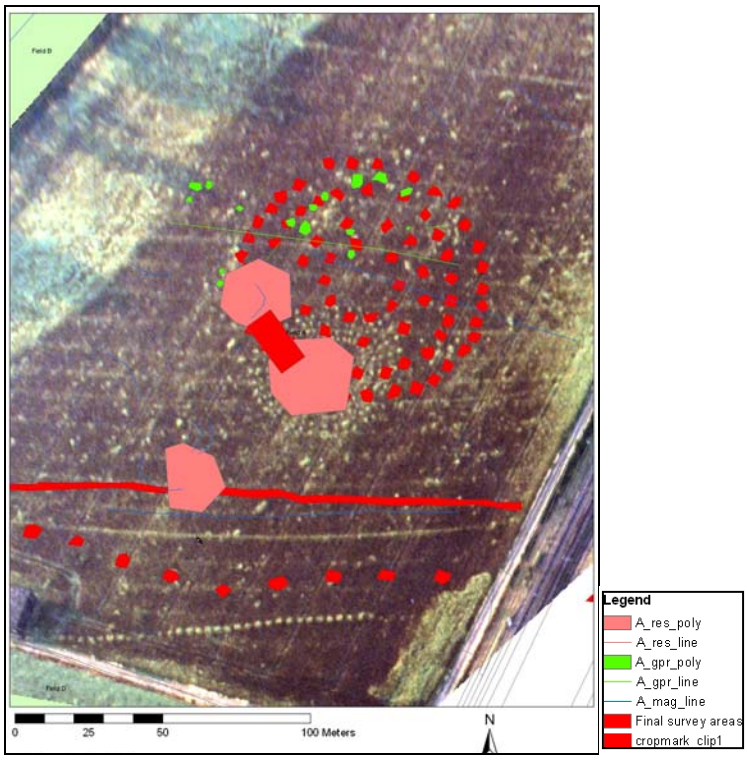

Figure 15. Rectified oblique aerial photo with 'Woodhenge' cropmark, Phase I geophysical interpretations and overlain operating cropmark GIS layer.

The location of the 10m x 20m area was established over the northwestern edge of the 'Woodhenge' monument. The aim was to attempt an assessment of the monument, in

terms of its archaeological structure, and to gather information about its geophysical and geological properties.

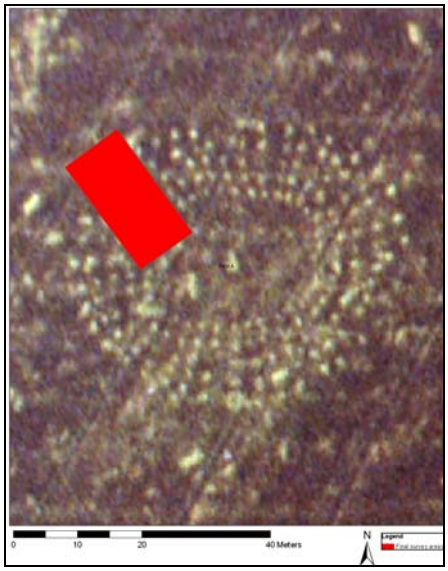

Figure 16. A2 positioned over the north-west section of the 'Woodhenge' cropmark.

4.1.3 Area B1

The 10m x10m area in Field B was selected in order to investigate the potential location of a possible outer ring of a double ring ditch which was identified as a cropmark across the northern section of the 'Sunburst' monument. B1 was established over an area which corresponded to known cropmarks and an area of low resistivity. A semi-circular magnetic anomaly occurred at the same location. The area was established in order to sample anomalies from the resistivity and magnetic surveys to attempt to understand the causes of anomalies and the archaeological potential of the cropmark at this location.

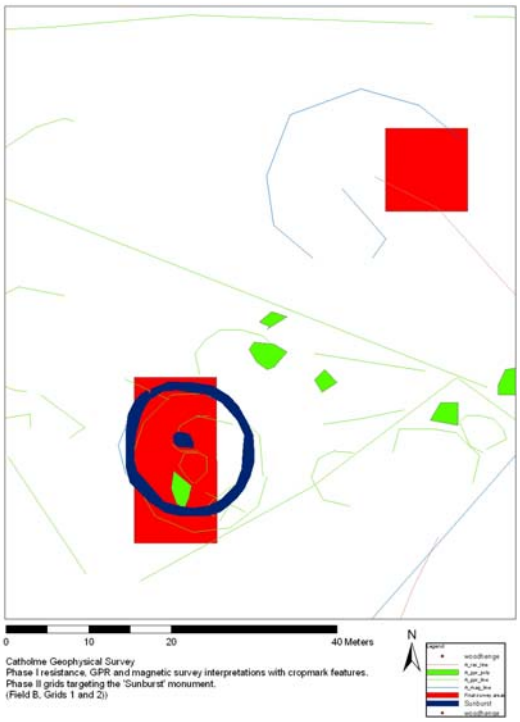

Figure 17. Phase II survey areas in field B.

4.1.4 Area B2

The second area measured 20m x 10m and was established at a location where magnetic and GPR anomalies corresponded with the 'Sunburst' monument (Fig. 17). Both magnetic and GPR data revealed a ring ditch and various anomalies within and surrounding the ditch. The area was positioned with the intention of mapping the ring ditch from both the interior and the exterior. The strong magnetic and GPR anomalies at the centre of the ring ditch and immediately east of the centre were also important targets for assessment.

The aim was to understand the nature of the magnetic and GPR anomalies. Equally important was the intention to assess known cropmark features which were not identified in the geophysical results, such as the radiating pit-alignments of the 'Sunburst' monument, and to determine why the resistivity survey failed to locate the ring ditch here in Field B when it clearly did so in Field F.

4.1.5 Area F1

The cropmark in Field F was mapped successfully with GPR and resistivity techniques. The magnetic survey revealed only the vague outlines of the ring ditch and radiating linear features. Due to the size of this monument, measured at approximately 60m in diameter, with associated linear features extending a further 80m to the southeast, the placement of both ground truthing areas was very important.

Area F1 measured 10m x 10m and was located directly over the ring ditch at a point where the two extending linear features appeared to cross the ring ditch. The previous survey results produced extensive anomalies within and surrounding the ring ditch and the linear features. The area was located with the intention of investigating the

ring ditch and its properties, as well as those of the linear features. In addition, an assessment of additional archaeological and geological features was undertaken.

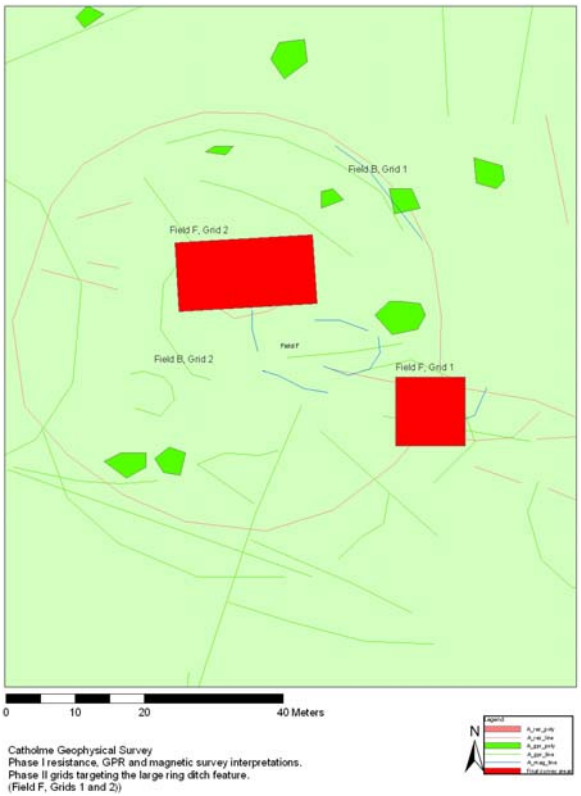

Figure 18. Field F area positions focused on anomalies defined through Phase I geophysical investigations.

4.1.6 Area F2

Area F2 measured 20m x 10m and was located in the interior of the ring ditch at a point of distinct overlapping resistivity and GPR anomalies. The cause of these anomalies was unknown, but was suspected to represent some form of activity, structure, or other anthropogenic feature located within the confines of the large ring ditch. The investigation sought to assess the possible significance of the archaeological and geophysical anomalies within this area.

4.2 Geophysical Survey Area Mapping and Data Collection

All the survey areas were selected after careful consideration of Phase I geophysical survey results, past geophysical and archaeological investigations in the Full Area, aerial photography and cropmark information. Once the Phase II survey areas were established and justified, they were plotted in the project GIS. Files were generated in order for accurate (+/- 2 cm) GPS location in the field. A Leica 500 series differential GPS unit was used to establish the areas. Geophysical survey grids were set directly on the established corners of each area.

All geophysical data were collected on the basis of guidelines set out in the project design. Data collection was conducted in three main stages: at the modern surface, at the surface of the natural subsoil and in each of the 0.2m spits of the four 2m x 5m sub-areas.

4.2.1 Magnetometry Data Collection

The vertical gradient of the vertical magnetic field was collected with the G858 cesium vapor magnetometer with a sensor spacing of 1m, positioned at 0.3m from the ground surface. Samples were collected every 0.2m across the survey area. Data were collected through manually triggered readings following a uni-directional survey grid. This enabled accurate sensor position and orientation (vertical) for the best quality data.

Figure 19. G858 Cesium Vapor magnetometer (right) in vertical gradient mode and the FM256 Fluxgate Gradiometer (left).

A remote magnetometer station collected a single total field of magnetic field strength at regular intervals of 1 per second at a fixed position significantly distant from the area and all project activities. Areas A2, B2, F1 and F2 were also surveyed with the FM256 fluxgate gradiometer on the surface of the natural subsoil (and in F1 and F2,

also on the modern surface). Data were collected with a sampling interval of 0.125 m along transects spaced at 0.25m apart.

4.2.2 Magnetic Susceptibility

Magnetic susceptibility data were collected with the Bartington MS2 susceptibility meter. Data were collected manually, values recorded by hand and later entered into digital spreadsheets. Magnetic susceptibility data were collected at 0.5m sample intervals across the survey area.

Figure 20. Magnetic Susceptibility data were collected with the Bartington MS2 susceptibility meter.

4.2.3 2m x 5m Sub-area Magnetic Susceptibility

Magnetic susceptibility data were collected with the Bartington MS2 susceptibility meter. Data were collected manually, values recorded by hand and later entered into digital spreadsheets. Magnetic susceptibility data were collected at 0.2m sample intervals across the 2m x 5m sub-area along strips at 0.2m depth from the ground surface to the terminus of archaeological features.

4.2.4 Resistivity Data Collection

Resistance data were collected with the RM15 resistivity meter and converted to resistivity data for analysis. Data collection employed the RM15 multi-plexer which enabled multiple depths to be recorded at each position. The resistivity array comprised 6 probes at a spacing of 0.25m. Six readings were collected at each array position at 0.25m, 0.5m, 0.75m, 1m, 1.25m and 1.5m. Data were collected along a uni-directional survey grid with a 0.25m sample spacing.

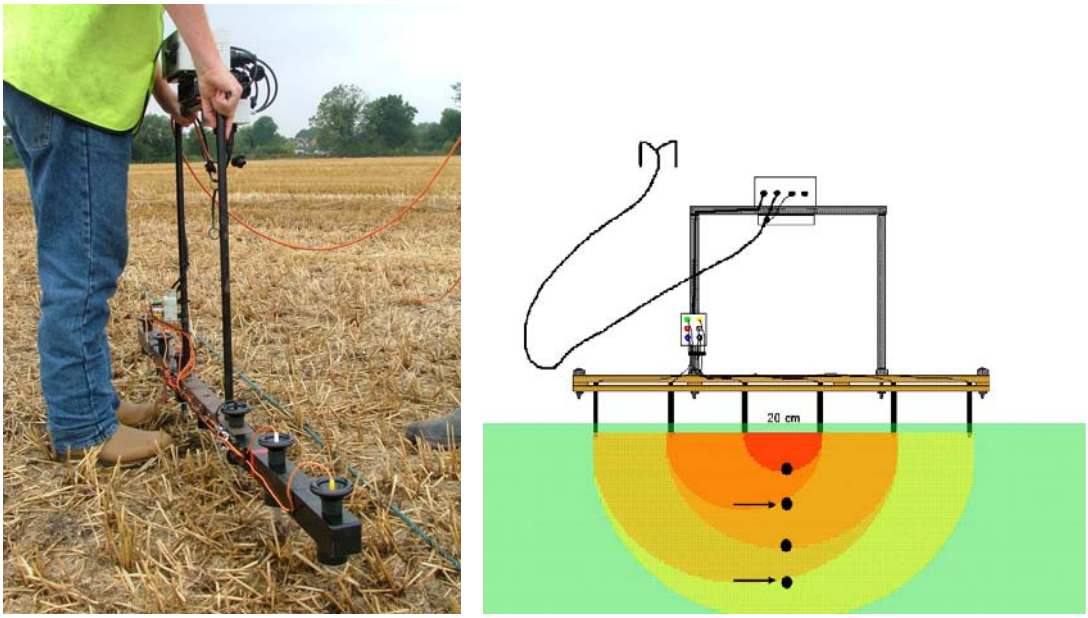

Figure 21. RM15 resistivity meter configured to collect readings at multiple depths across the site. The second image illustrates the basic premise behind this multi-plexing technique.

4.2.5 2m x 5m Sub-area Resistivity Data Collection

A specially built square array was used to collect resistivity data in the 2m x 5m sub-areas. The square array had 6 probes at 0.25m spacing that enabled the collection of 2 positions of data per array position. Data were recorded with the RM15 multi-plexer unit collecting the α, β and γ readings at each position. The α value is used in this report. Data were collected at 0.25m spacing across the grid.

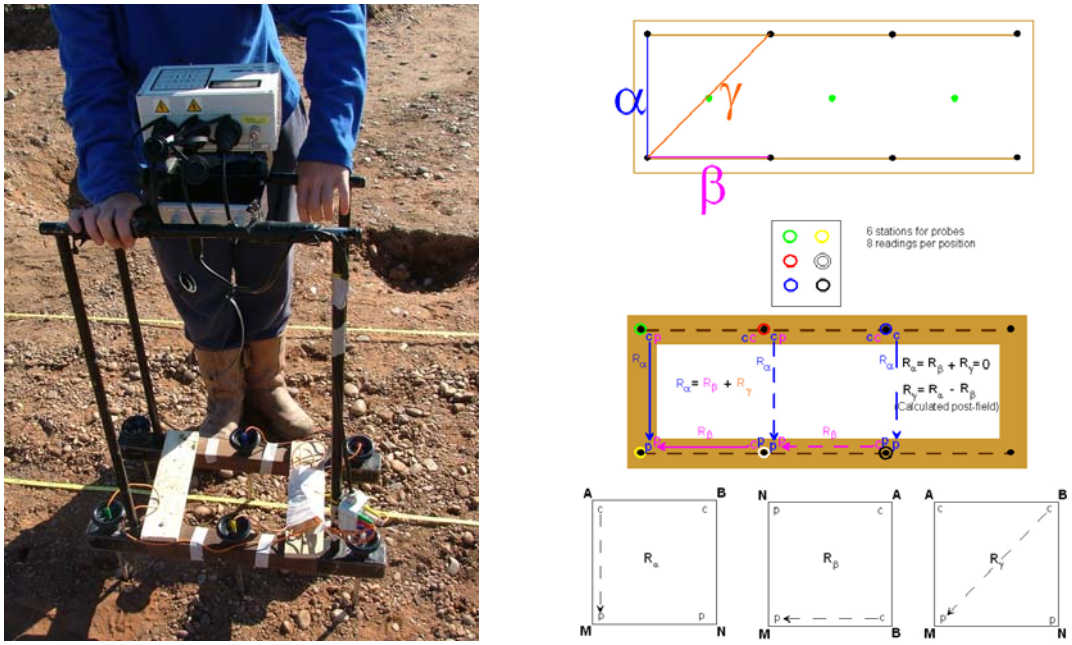

Figure 22. Data were collected using the RM15 resistivity meter on a custom-designed square array. Three data samples were collected at each station: α, β and γ.