Cem. Comm.

Identification of Unmarked Burials using Ground Penetrating Radar in the Madison City Cemetery, Morgan County, Georgia

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ABSTRACT

On February 21, 2006, staff archaeologists from the Georgia Department of Transportation (GDOT) conducted a ground penetrating radar (GPR) assessment of a small portion of the Madison City Cemetery, in Morgan County, Georgia (Figure 1). GDOT personnel included Shawn Patch and Teresa Lotti, with assistance from Patsy Harris and Woody Williams, Morgan County Archivist.

This investigation focused on an area of the cemetery that contains 24 grave markers for Confederate soldiers that were placed long after the war. Archival research indicated the possibility that the markers may have been misplaced and that additional unmarked graves might be present in close proximity. Because of Georgia state laws restricting cemetery investigations to non-invasive techniques, this case proved an excellent application of GPR technology.

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INTRODUCTION

On February 21, 2006, staff archaeologists from the Georgia Department of Transportation (GDOT) conducted a ground penetrating radar (GPR) assessment of a small portion of the Madison City Cemetery, in Morgan County, Georgia (Figure 1). GDOT personnel included Shawn Patch and Teresa Lotti, with assistance from Patsy Harris and Woody Williams, Morgan County Archivist.

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METHODS

GPR data collection works best using a grid format. To that end we used chaining pins to temporarily mark grid corners, then drove metal rebar in the ground to serve as permanent data points. This will allow for each grid to be reestablished in the future should the need arise. Each point was geo-referenced with a Leica GS50 global positioning system (GPS) with sub-meter accuracy for use in a geographic information system (GIS) program. While mapping with the total station we also collected points on objects that were assumed to be permanent (*e.g.* building corner, marker, signs).

GPR data were collected with a GSSI model SIR-3000 unit with an attached 400mhz antenna. Transects were spaced at 50 cm intervals, which is approximately the width of the antenna. Radan, the post-processing software, by default assigns the southwest corner of each grid coordinate values of 0,0. For this project we successfully surveyed two individual grids.

Surface conditions were ideal for GPR; a large grassed area relatively free of obstructions (Figure 2). Prior to our survey there had been a prolonged period of rather heavy rains. Although conditions were beautiful for our work, the ground was soft and wet. Water has a direct relationship on the quality of GPR data, but not always in an adverse way (Conyers 2004). In some cases the presence of water can highlight and enhance features or targets that might otherwise be poorly visible. However, that trend does not appear to be true for this case. Soil conditions in the cemetery are not the most favorable for GPR, and are essentially compacted red clay. Even under optimal conditions red clay is not the best matrix for identifying sub-surface targets. It is even worse when saturated, and the excessive precipitation may have affected the quality of the GPR results. However, even with the presence of water, large targets should still be identifiable. A relatively easy test of this problem would involve a resurvey of the same grids after a period of dry weather, using the same settings, and then comparing the results to see if there is any appreciable difference or if new targets are identified.

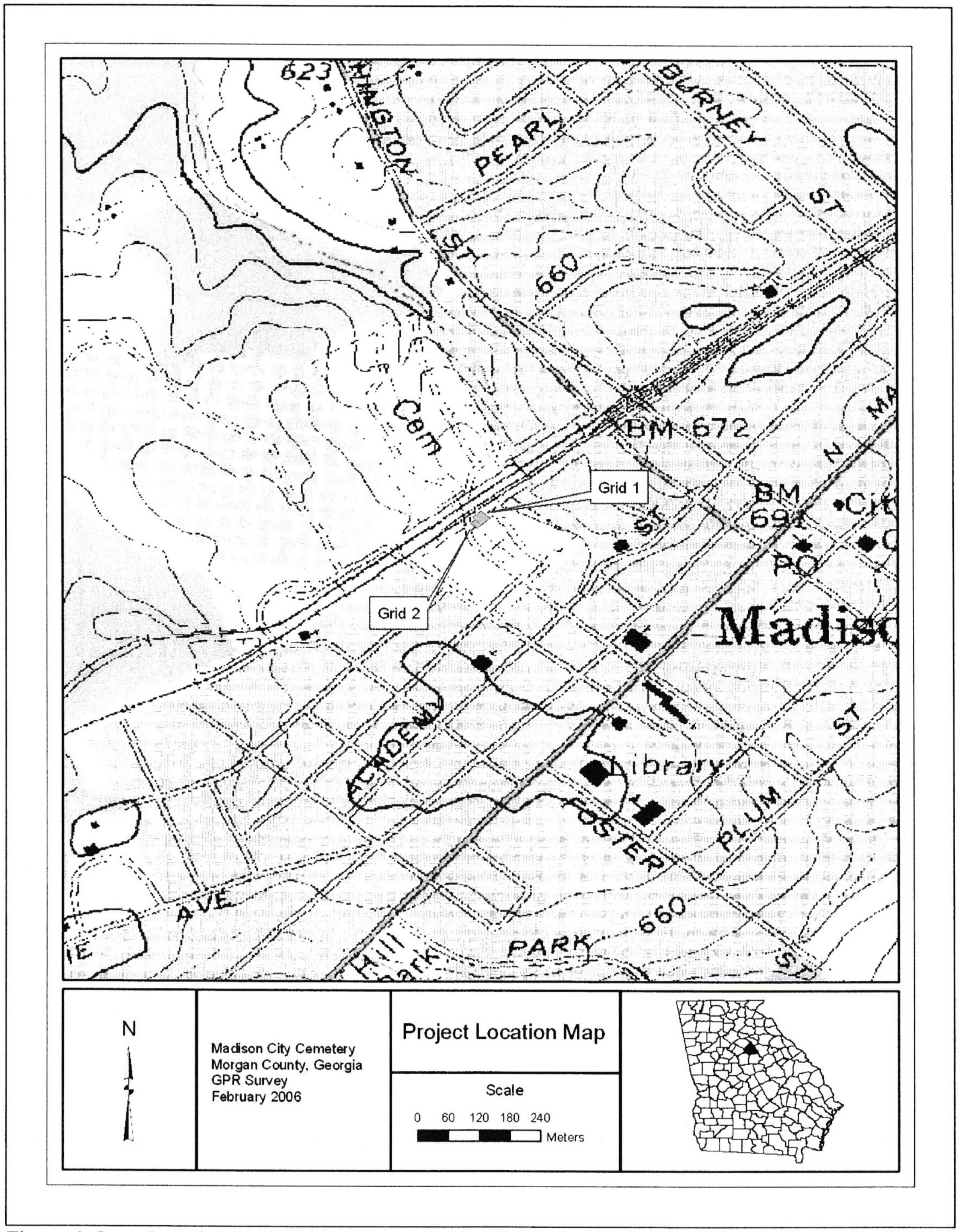

Figure 1. Location of project area within the City of Madison, Georgia.

Upon completion of each grid, GPR data were downloaded to a laptop computer for initial processing in the field. This step is designed to allow for an assessment of the overall quality of the data, look for possible errors, and get a general feel for sub-surface conditions and identify potential targets. Although initial processing in the field is invaluable, it also requires a substantial amount of time that might otherwise be spent collecting data.

Figure 2. View of survey area showing existing markers and overall conditions.

Additional post-processing was completed in much greater detail once we returned from the field. The primary advantage and use of Radan is its ability to process GPR data in 3D, although it also has other significant features such as removal of background noise, the application of different filters, and calculation of radar velocity through the ground. Each grid is recreated and can be displayed in plan view or rotated in almost any direction for custom viewing. A major component of the Radan work involved "time/depth" slicing. Radan has the ability to assign user-defined values to time slices (e.g. 10 cm, 20 cm), and these in turn can be exported as comma delimited files (CSV).

Once a 3D image was generated in Radan for each grid, we then created time slices at regular depths (20cm) and exported them to Surfer for additional processing. Surfer works very well at manipulating files containing X,Y, and Z coordinates; it can filter, refine and amplify targets, and display time slices side-by-side or stacked for better interpretive results.

RESULTS AND INTERPRETATIONS

Results of the survey are excellent; there are numerous areas of high reflectivity indicating substantial sub-surface targets, as well as overall sedimentary conditions. In the hopes of making this report easier to follow, composite images for each grid have been moved toward the back. Brief descriptions for each grid are provided below.

Grid 1 (20x20 meters) was placed in and around the existing grave markers to identify the number and extent of existing burials and use those results to identify unmarked ones. The results are a somewhat unexpected. There are very few strong anomalies, although two resemble graves (Figure 3).

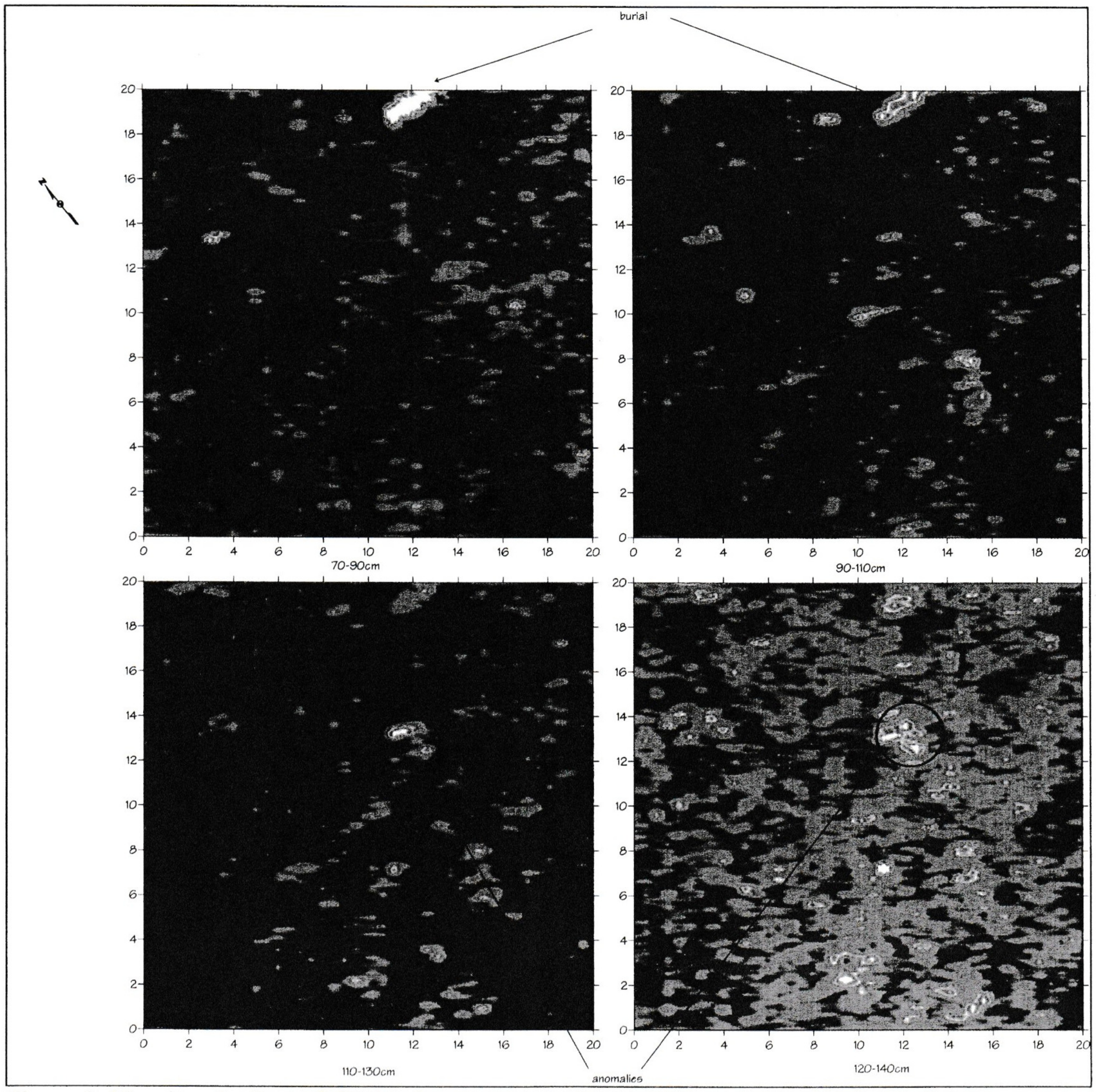

Figure 3. Time/depth slices of Grid 1 showing anomalies.

One of these is marked on the surface by a small outline of bricks so its identification is not surprising. Its depth, orientation, and strength of reflection are all characteristic of burials (Figure 4). The linescan for this feature shows the burial shaft, with two vertical lines, and the burial itself, likely a casket or coffin that has not degraded. The other noteworthy anomaly is similar in orientation, but more diffuse and at a depth of approximately 100-130cm. There are a few other anomalies that, while strong, are relatively small and do not appear to be burials.

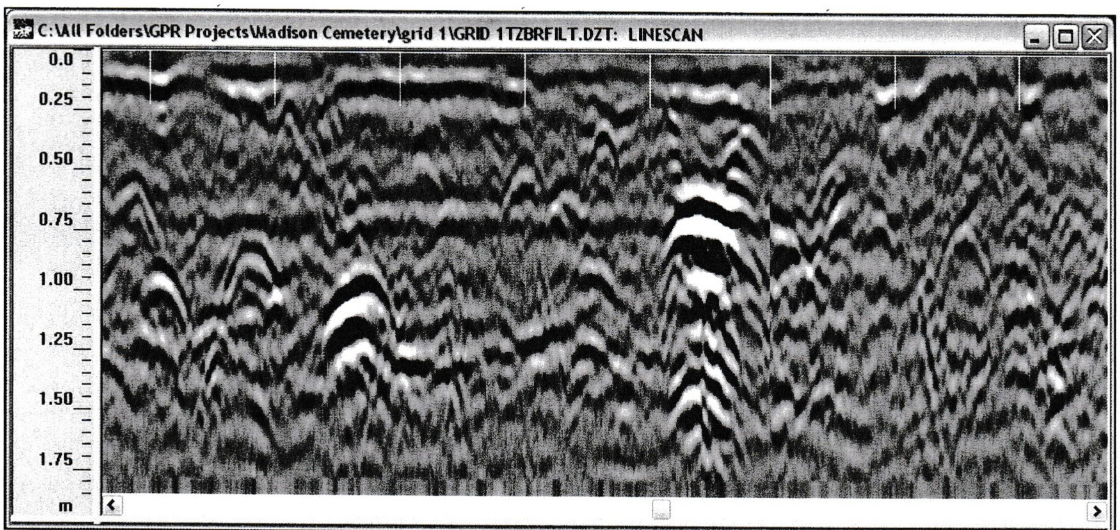

Figure 4. Linescan showing known burial in Grid 1 (right side) and possible second burial (left side).

Grid 2 (10x15 meters) was placed along the baseline of Grid 1. Placement of this grid was guided by the existing paved road that runs through the cemetery. There are no obvious graves and only a few anomalies (Figures 5-6).

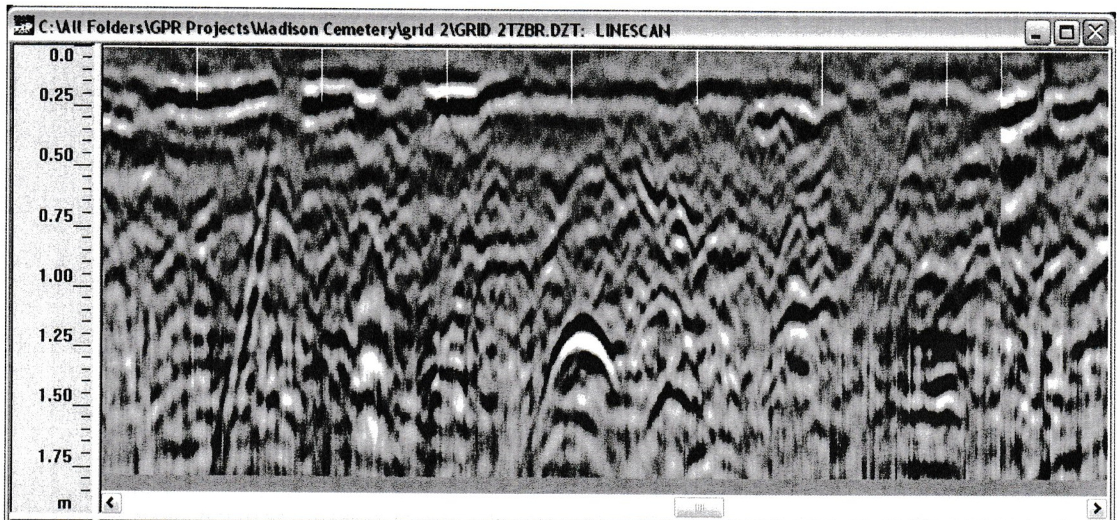

Figure 5. Linescan of Grid 2 showing single anomaly at approximately 100cm.

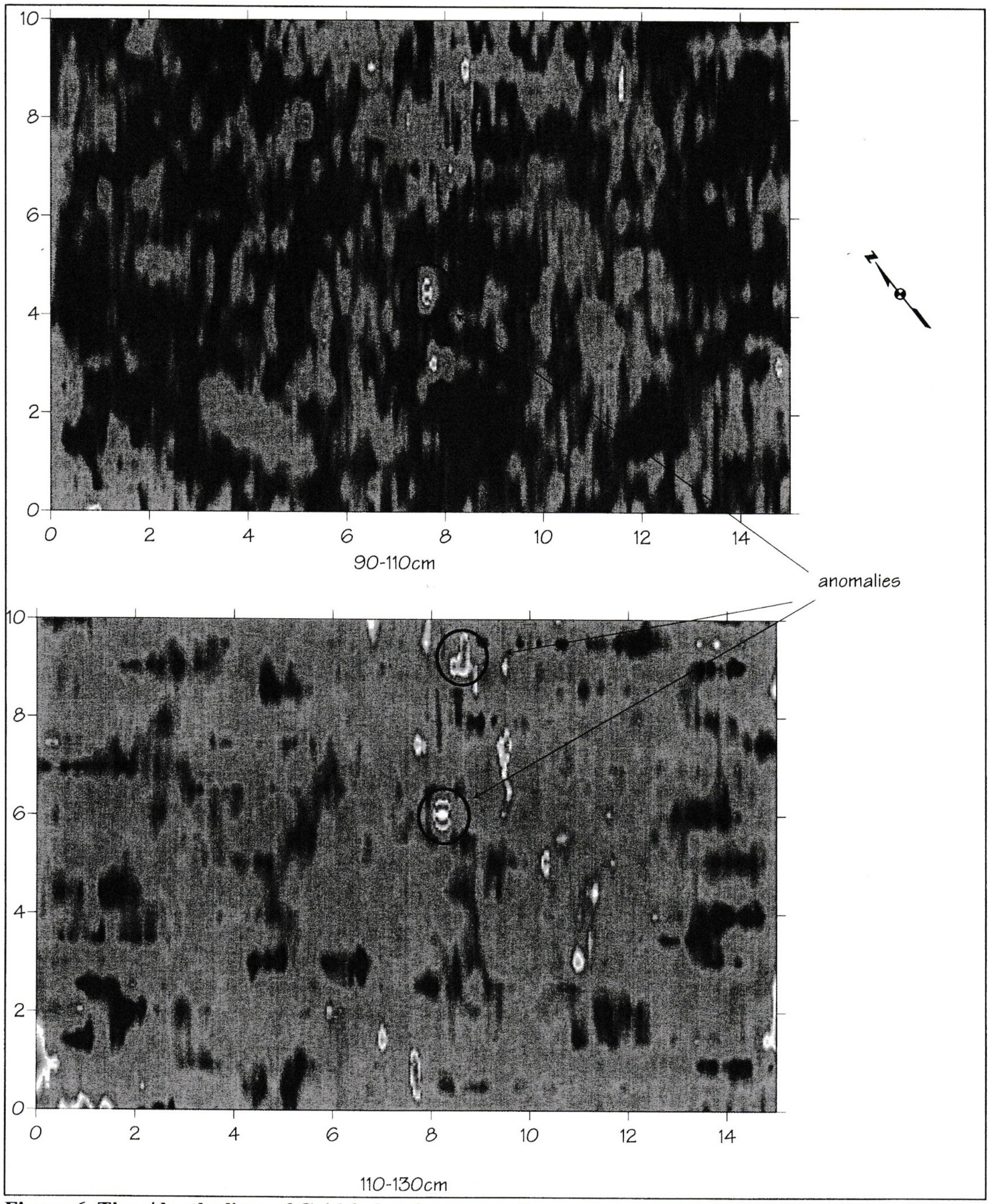

Figure 6. Time/depth slices of Grid 2 showing anomalies.

CONCLUSIONS AND RECOMMENDATIONS

The primary goal of this project was to identify additional unmarked graves to help cemetery trustees replace the existing markers in more accurate locations. The results of the GPR survey indicate only one additional burial (Grid 1); although there is no marker it is identified by a small brick wall. There is a second anomaly in Grid 1 that may be a grave, but its appearance is not as well defined. This feature actually has good potential and may represent an older burial that has undergone more transformations since its interment. The remaining anomalies, some of which are strong and well defined, may be natural, geological, or cultural. Based on the current GPR survey, there does not appear to be a large number of additional unmarked graves. There could be several reasons for this, the most likely of which is that this portion of the cemetery was never used to bury bodies.

REFERENCE CITED

Conyers, Lawrence B.
2004 Ground Penetrating Radar for Archaeologists. Altamira Press, Walnut Creek, CA.