Locating a Historic Norman Gravesite with Geophysical Methods

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The worst fire in Norman history occurred on April 14, 1918. It is believed an electrical fault started a fire in the early morning hours at the Oklahoma State Hospital for mental patients. As patients were evacuated the firefighters rushed into the structure to attempt more rescues. Two buildings were destroyed and others damaged. The first floor ward, which contained 48 male residents 10-15 years old, reported 38 deaths. Some of the deaths were attendants, but all of the bodies were burned beyond recognition and placed in one grave in the IOOF (Independent Order of Odd Fellows) Cemetery near Rock Creek Road.

Over 90 years later, the University of Oklahoma's Principles of Geophysics class went to the IOOF cemetery to attempt to locate the gravesite in collaboration with the Oklahoma Archaeological Survey. The location was specified in historical documents as the northeastern portion of the cemetery, but the exact location had been lost. Armed with ground penetrating radar, seismic gear, magnetometers, and an electrical resistivity apparatus, the students, headed by Assistant Professor Dr. Katie Keranen, spent a Saturday in the field.

Title Photo: Students collect data at the IOOF cemetery located off Rock Creek Road in Norman (left to right) Ahmed Awami, Brittany Pritchett, John Leeman, and Brandon Guttery. (Photo: J. Chang)

While the GPR, seismic, and magnetic methods were carried out with commercial equipment, the electrical resistivity measurements were attempted with a new homemade demonstration device. The device, built by John Leeman and loosely based on a design by Herman (2001), consisted of a deep cycle battery, electrical inverter, two digital multi-meters (DMM), copper grounding rods, and a simple control box **(Figure 1)**.

The basic principle of operation is to place a current across two electrodes and measure the potential difference across the pair of electrodes. While the geometry of the electrode spacing can vary, the general idea is that increasing electrode spacing systematically obtains a vertical sounding of apparent earth resistivity. Commercial units use large arrays of electrodes and computerized switching to collect a greater number of data points with great speed, but this method was much more hands-on.

Students set up the electrodes and then took readings of current and voltage in various array configurations by manually plugging electrodes into different metering ports on the control box. Then the power was turned off, the electrodes were moved, and the process repeated. This was done in the two areas likely to contain the grave. In one of the areas, two differ

Figure 1: The simple equipment needed for a resistivity survey. Inverters (left), control box, meters, charger, and electrode solution (center), and copper rods/ battery (right). (Photo: J. Leeman)

different electrode configurations were tried, including a square, which allows the electrical anisotropy of the material below to be examined.

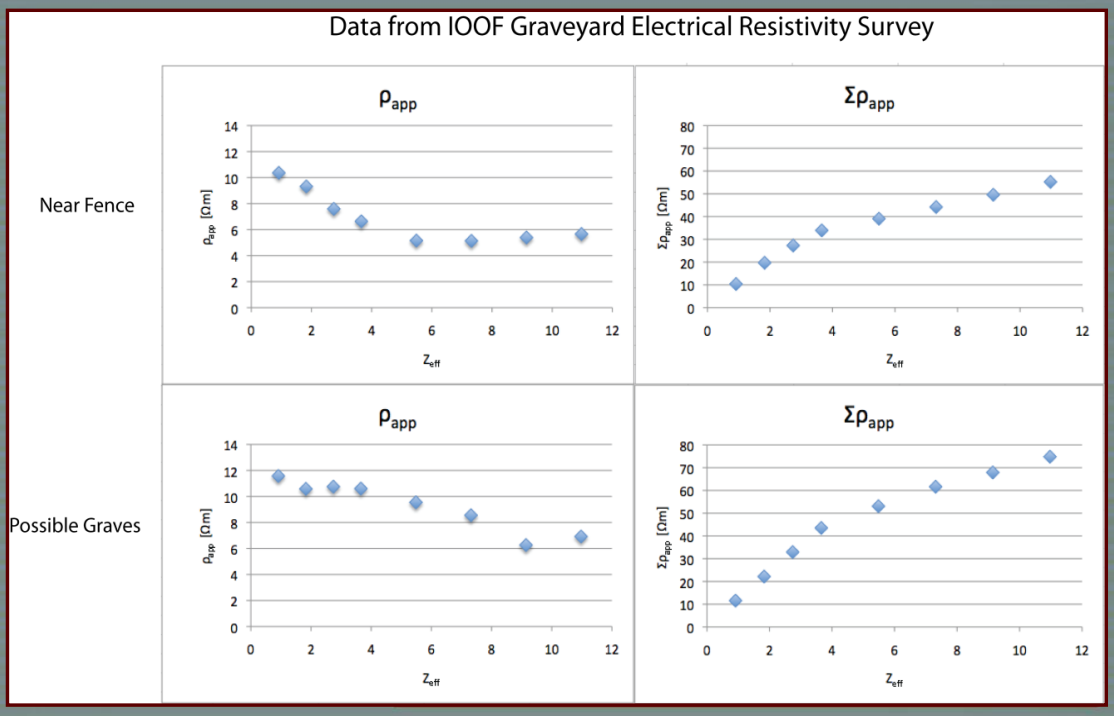

Figure 2: Data collected at the IOOF cemetery near the fence (top) shows a basic two layer structure, but the data collected over the believed gravesite (bottom) shows an anomaly 2-4 m deep which is the expected depth of the graves. This is most easily viewed on the graph of ρ_{app}.

A simple spreadsheet allowed the data to be plotted in real time so areas of interest could be determined and examined in more detail by using finer electrode spacing. **Figure 2** shows the results of the experiment. Data is plotted with effective depth on the x-axis (Z_{eff}) and either apparent resistivity (ρ_{app}) or the sum of apparent resistivity ($\Sigma\rho_{app}$) on the y-axis. The top row examines an area near the corner of the cemetery by the fence. The bottom row is what we believe to be the most likely location of the graves. Notice the anomaly 2-4m below the surface. This could be the graves as it is the correct depth and shows up on all array configurations. This particular data set was collected in the Wenner β configuration.

This experiment allowed students to have a more hands-on experience with the electrical resistivity method and resulted in a deeper understanding than would have been gained by using a commercial instrument that would automatically switch out all settings and easily plot the data. In addition, this setup can be easily used in a classroom environment as a tabletop demonstration of the method, as it can easily resolve the difference between soil, a plastic container, and the table.

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