H2 Monitoring the Applicability of Ground- Penetrating Radar on Detecting Shallow Graves Using Proxy Cadavers

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After attending this presentation, attendees will have a better understanding of the benefits and limitations associated with the use of ground penetrating radar (GPR) in the search for clandestine graves, specifically in cases involving small bodies and shallow graves.

This presentation will impact the forensic science community by illustrating the ability of GPR, using a 250-MHz and 500-MHz antenna, to locate bodies in shallow graves in various burial scenarios.

The goal of this presentation is to demonstrate the ability of GPR to detect small cadavers buried in shallow graves over a period of six months. By using GPR to monitor controlled graves with multiple burial scenarios, questions can be answered concerning its applicability in the search for small cadavers in shallow graves. Burial scenarios also help distinguish which component or components of the grave, the disturbed soil, the body, or the additional material added to the grave, is producing the geophysical response once the GPR detects the grave.

The use of remote sensing geophysical techniques in the search and detection of clandestine graves in a forensic context has many advantages, particularly as it is non-invasive and can highlight smaller areas for more detailed searching. Controlled research has demonstrated that GPR is the most accurate geophysical tool in forensic investigations. Ground-penetrating radar is time efficient, results are displayed in real- time in the field, it provides the best subsurface-imaging resolution, and can be used in different scenarios, such as over the concrete of a house foundation or on a forested landscape. This presentation will focus on the first six months of data collection for a project evaluating the ability of GPR, using a 250-MHz and 500-MHz antenna, to locate shallow graves containing small pig cadavers in various burial scenarios.

The ground-penetrating radar unit used for this research was a MALA RAMAC X3 M with a 250-MHz and 500-MHz antenna. The

GPR data was processed using the REFLEXW computer program to display the data in a reflection profile, showing one transect at a time. These grid data were collected from a permanent grid, measuring 9 m by 15 m, containing six graves total, five with a single pig (*Sus scrofa*) carcass, and one control grave. Multiple-burial scenarios were incorporated into the project: a pig carcass buried under a layer of lime; a pig carcass buried under a layer of rocks; a pig carcass wrapped in a fleece blanket, a pig carcass wrapped in a tarpaulin; and a pig carcass without additional material. The final grave was an empty control grave to measure the response of soil disturbance only versus graves containing bodies. Each grave was 0.5 m deep, and the pig cadavers weighed an average of 25.8 kg. The soil at the research site is classified as Spodosol. However, due to the shallow depths of the graves, they were only buried in sandy horizons. The six graves were arranged in two rows with three graves in each row. Data was collected following both a north-to-south transect direction and an east-to-west transect direction with a transect spacing of 0.25 m.

Over the first six months of monitoring, all graves were detected in reflection profiles, although some had better resolution than others. While all of the graves containing a pig carcass produced prominent reflections for this monitoring period, the graves containing items (rocks and lime) placed over the pig carcass resulted in slightly better resolution. Conversely, the grave containing only the pig carcass produced the lowest resolution, but was easily detected. Throughout the first few months of data collection, a minimal response was exhibited by the empty control grave; however, after several months of soil compaction within the grave shaft, there was no longer a response from this grave. These results for the control hole were important in demonstrating that the reflections produced within the graves containing the pig carcasses were the result of the bodies and items added to the graves and not the disturbed soil. In terms of antenna performance, the 250-MHz data initially provided a better resolution within the first few months. However, over time the higher detail provided by the 500-MHz data consistently resulted in easily discernable reflections. While either antenna would be a good option when searching for shallow clandestine graves, the 500-MHz may be a better option depending on soil conditions.

Ground-Penetrating Radar, Controlled Graves, Geophysical Shallow Burial Searches

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