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Guess and Identify the Graves Site Located Under the Floor of the Golden Iwan of Emam Ali Holy Shrine Using Ground Penetrating Radar

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Abstract: ***In this study 7 profiles was carried out using GPR to determine the subsurface cavities under the Golden Iewan of the Emam Ali holy Shrine, we get promising results after removing undesired signal from the profiles.***

Keyword: Guess and identify the graves site located

1. Introduction

Ground Penetrating Radar (is also known as earth sounding radar, ground probing radar, subsurface radar, or georadar) (GPR) is a high-resolution electromagnetic technique used to evaluate the location and depth of buried objects and to investigate the presence and continuity of natural subsurface conditions and features, without drilling, probing, or digging, see [1] Thus GPR is used to locate the buried objects such as landmines [2], pipes, cables and reinforcement [3], the location of subsur face cavities and fractures in bedrock [4], as well as ground water and moisture [5], etc. Ground penetrating radar operates by transmitting electromagnetic wave that is radiated from a transmitting antenna down into the ground. The electromagnetic wave is reflected from various buried objects or distinct contacts between different earth materials that have contrasting dielectric properties, such as at the bound ary between soil and a landmine or between soil and a large rock. The reflections are created by an abrupt change with the dielectric properties in the ground. These electrical properties are namely, relative permittivity, relative permeability and conductivity. However, not all three parameters provide useful information to the GPR.

Conductivity generally affects the penetration depth of the GPR due to absorption of the radar signals in the medium. Soil with high moisture content increases the electrical conductivity, thus decreasing penetration. On the other hand, due to the lack of magnetic content in earths soil, relative permeability is hardly provides any useful information because it offers little contrast in the radiated EM pulses. Contrastingly, relative permittivity, which corresponds to the dielectric constant of the medium, provides the highest degree of contrast in the reflected wave, thus resulting in good characterization of the ground. Therefore, the contrast in permittivity usually leads to the reflection in the EM pulse. In addition to having a sufficient electromagnetic property contrast, the boundary between the two materials needs to be sharp.

2. Theory of the GPR

The ground penetrating radar method is based upon the transmission of pulsed electromagnetic waves. In this method, the travel times of the waves reflected from subsurface interfaces are recorded as they arrive at the surface, and the depth, D, to an interface is given by, [9, 10];

$$D = TV/2 \quad (1)$$

Where:

D is the depth to the reflector.
V is the velocity of the radar wave pulse through the subsurface material.
T is the two-way travel time to the reflector (taken from the GPR trace).

The conductivity of the ground imposes the greatest limitation on the use of radar probing, that is, the depth to which radar energy can penetrate depends upon the effective conductivity of the strata being probed. This, in turn, is governed mainly by the water content and its salinity. Furthermore, the value of effective conductivity is also a function of temperature and density, as well as the frequency of the electromagnetic waves being propagated. The least penetration occurs in saturated clayey materials or where the moisture content is saline. For example, attenuation of electromagnetic energy in wet clay and silt means that depth of penetration frequently is less than 1 m. The technique appears to be reasonably successful in sandy soils and rocks in which the moisture content is non-saline. Rocks such as limestone and granite can be penetrated for distances of tens of meters and in dry conditions the penetration may reach 100 m. Ground probing radars have been used for a variety of purposes in geotechnical engineering, for example, the detection of fractures and faults in rock masses, the location of subsurface voids and the delineation of contaminated plumes [7, 8]. GPR uses transmitting and receiving antennas or only one containing both functions. The transmitting antenna radiates short pulses of the high-frequency (usually polarized) radio waves into the ground. When the wave hits a buried object or a boundary with different dielectric constants, the receiving antenna records variations in the reflected return signal. The principles involved are similar to reflection seismology, except that electromagnetic energy is used instead of acoustic energy, and reflections appear at boundaries with different dielectric constants instead of acoustic impedances [11]. It is known that most of soils and rocks have very low conductivity (about < 10-2 S/m) thus the electromagnetic waves propagation is mainly affected by electrical dielectric constants of soils and rocks. The applied frequencies used are considered low compared with that of Radar frequencies to ascertain their penetration inside earth layers.

The propagation of the radar signals into earth layers depends upon the electromagnetic properties of soils and rocks which are dielectric Permittivity and electrical conductivity (σ).

3. Location of the Study Area

The study area is the Emam Ali holy shrine, the province of Najaf, which lies in central Iraq in the south-western part of the capital Baghdad, one hundred and sixty kilometers, including distance, the coordinates of this region are
(31º54'25¨-32º02'45¨) and north (44 º15'23¨-44º25'25¨) to the east.

4. Work Field

Processing and interpretation of data Golden Iwan

The processing profile (344) of the antenna (250 MHz)

4.1 Profile (344)

The penetration depth in this profile was around (12.5m), has been observed sites numerous anomalies in the form of cavities and at different depths, where one of these cavities at a depth located (4.8m) and the distance (19m), and the second cavity is located at a depth of (5m), while the third cavity is located down the first cavity, at a depth (6.8m) almost, as shown in Figure (1-1), that these cavities are likely to be buried graves where many scientists within the Golden Iwan.

By applying (Dc-Removal) filter, which is the first step in the series processing usually, and choose (Start time = 208) and (End time = 259), note that paving including Granite or marble, cement and iron up layer (1m), as shown in The figure below.

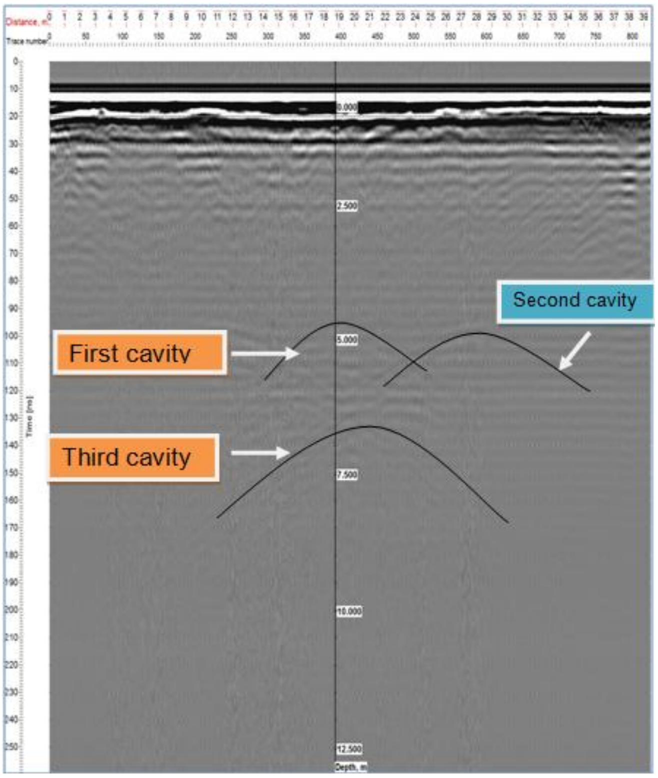

Figure 1: Profile (344) before treatment

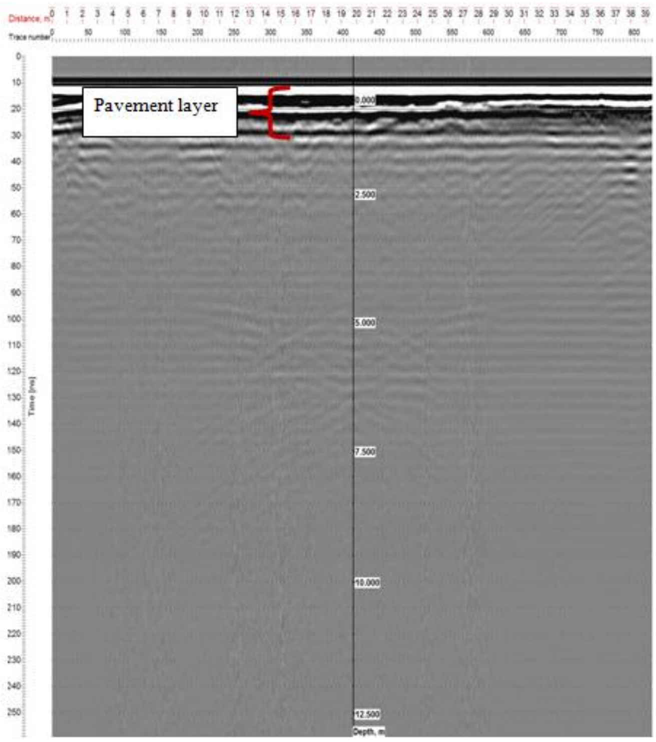

Figure 2: Profile (344) after the use (DC- Removal) filter

Apply filter (Time- Zero) and choose (first Break = 4.4), will observe the emergence of a dotted line to red color indicates zero emission wave as shown in Figure (3).

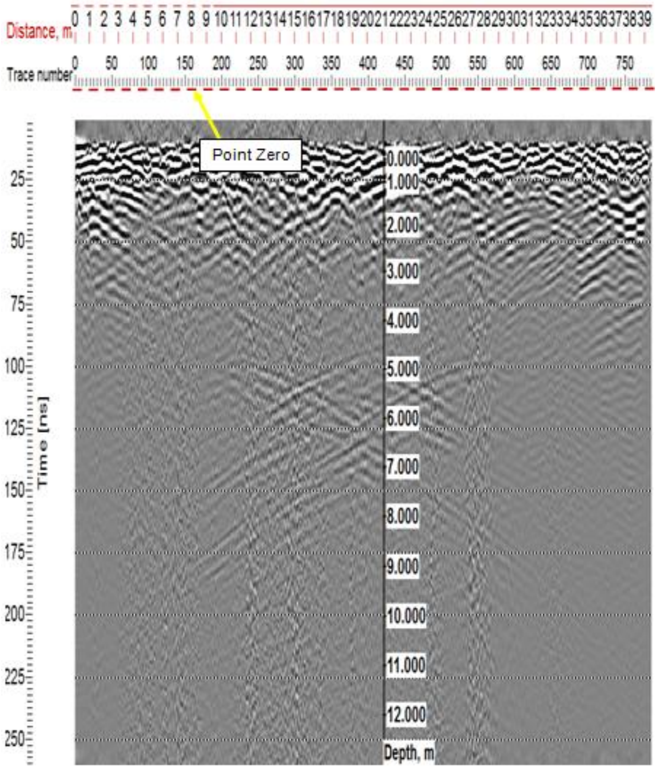

Figure 3: Profile (344) after application (Time- Zero) filter

Then we apply (Background Removal) filter, where the use of this filter is a necessary measure to get rid of noise clips and access to the wanted signal, when you apply this filter with degree (strong), anomaly appears in this profile as shown in Figure (1-6), which can be interpreted due to the presence of metal awnings that we experienced in the course of the survey, as shown in Figure (4).

Figure 4: Shows umbrellas that cause the emergence anomalies in the profile (344)

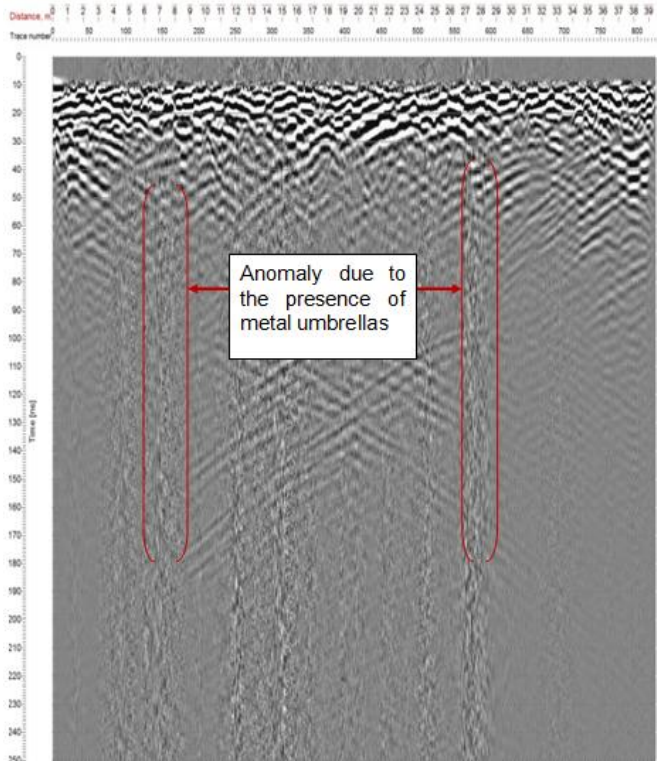

Figure 5: Shows the anomaly in profile (344) after the application (Background Removal) filter by applying (Band -pass) filter, low cut =50 MHz, low pass=100 MHz, high cut =296 MHz, high pass =588MHz the profile will be more clear for illustrations, the curve (hyperbola) data will appear in this curved (speed = 30.6 cm / ns) and dielectric constant (1), this information is especially dry sand, the Figure (6).

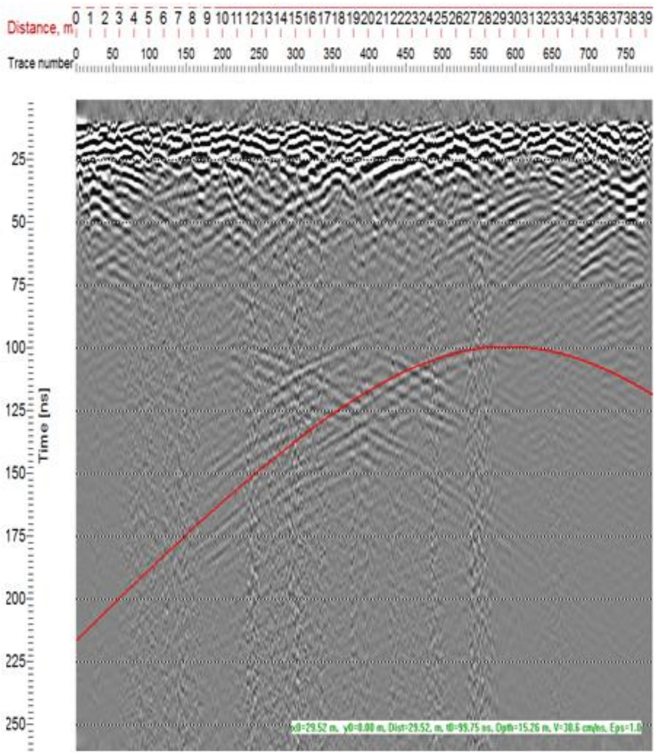

Figure 6: Profile (344) after applying Band -pass filter

References

[1] Daniels. J. J. Surface Penetrating Radar. Radar sonar navigation and avionics series, The Institution of Electrical Engineers, London, UK, 1996.
[2] Buan S. T. TEM horn antennas for landmine detection applications. Thesis report, Queensland University, May 2002
[3] Benson R. C., Glaccum, R. A., and Noel M. R. Geophysical techniques for sensing buried wastes and waste migration. National water Well Association., 1983.http://www.hanford.gov/dqo/project/level5/burwm/burwm.pdf.
[4] Imse, J.P. and. Levine, E.N. Conventional and state-of-the-art geophysical techniques for fracture detection. Proceedings Second Annual Eastern Groundwater Conference, pages 261–278, 1985..
[5] Wright D.L., Olhoeft G.R., and Watts R.D. Ground-penetrating radar studies on Cape Cod, in conference on surface and borehole geophysical methods in ground water investigations. Proceedings: U.S. Environmental Protection Agency and National Water Well Association, San Antonio, TX, , pages 666–680, 1984.
[6] Pradip, K. M., Three-dimensional Borehole Radar Imaging.
PhD thesis, University of Cape Town, Department of Electrical Engineering, 2005.
[7] Annan A. P., and Cosway S. W, 1992, "Simplified GPR beam model for survey design", Society of Exploration Geophysicists, New Orleans, USA..
[8] Chen, J., 2001, "Bayesian Approaches for subsurface characterization using Hydro geological and Geophysical Data". Ph.D. Thesis Engineering. Civil and Environmental Engineering. University of California, Berkeley.
[9] Daniels, J.J., 2000, "Ground Penetrating Radar Fundamentals", published report, Department of Geological sciences, Ohio State University, Region V, pp:1-21.
[10] Environmental Protection Agency. Ground Penetrating Radar.(http://www.epa.gov/region5superfound/sfd_fss/htm/gpr.htm0)
[11] Davis, J.L, Annan, A.P., 1989, "Ground penetrating radar for high- resolution mapping of soil and rock stratigraphy". Geophysical prospecting. Vol. 37, pp. 531-551