

Ground Penetrating Radar Survey Report:

The Dig Mount Zion Archaeological Project Mount Zion, Jerusalem, Israel



Data Acquired 19 June, 2008

Report compiled 13 November, 2008

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Chief GPR Surveyor, Jessie Pincus Ben-Avraham

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**Ground Penetrating Radar (GPR) Study:
The Dig Mount Zion Archaeological Project
13 November 2008 Report of 19 June 2008 Study**

Background

The Dig Mount Zion archaeological project is located in Jerusalem, Israel close to many important historical locations of the city, specifically the Praetorium and the House of Caiaphas and other priestly families in the Upper City of Jerusalem during the first century CE. Many years later during the Byzantine period, the southern end of the Cardo Maximus was located exactly in this location. A columned street and a very large church found their homes here. Remains of columns indeed have been found in the excavations along with knowledge of the presence of as-yet unexcavated vaulted ceilings. Many other significant finds have been unearthed here reaching to the 13th century destruction of a gate-tower.

Because of the incredible preservation at the site, the chief investigators, Dr. Shimon Gibson, Dr. James Tabor, and Rafi Lewiss, wished to enlist the help of GPR at the site to gain a better understanding of what lay beneath already excavated areas. Mnemotrix, Israel, Ltd. was asked to perform an archaeogeophysical survey in the hopes of imaging the extent of a vaulted ceiling known to exist in the sub-surface of a section not-presently being excavated. A second survey area was located in the excavation area of the 2008 season. This was completed in order to give the excavators a better understanding of what was "to come" as the seasons will progress in this location. A rather interesting view of the sub-surface is included in this report.

Description of Survey Area

As mentioned above, there were two main survey areas. The first gridded area (including Grids 1 and 2) can be seen in the drawn-in map in Figure 1. It is located to the south of the ancient city wall, west and up-slope from the present excavations. This survey was completed inside of a previously excavated trench about 3-4 meters below the walking surface (See Figures 2 and 3). The location was chosen because of its relative ease of access and close location to a known and visible vaulted ceiling. The investigators wished to see if the ceiling extends beneath this surveyed area, and if so, what information is available.



Figure 1: Overview of the excavated area with 1st GPR area labeled ("GPR").



Figure 2: Location of Area 1 south of the wall of Jerusalem.



Figure 3: Dig Mount Zion GPR Survey Area 1 looking north (6.4 x 1.2 meters).

The second GPR area is located to the east in the present excavations (see Figure 4). It was within a small area surrounded by rock walls. The reason to complete this survey was so that we could have direct ground-truthing results of the survey as excavation was completed, a rare occurrence in archaeogeophysical surveying. Several significant observations of the sub-surface were seen here in the GPR data and will be discussed.



Figure 4: Dig Mount Zion GPR Survey Area 2 looking west (2.0 x 1.2 m).

GPR Survey Actions Taken

In this survey, the key goal was to see what kinds of sub-surface features were possible to be seen at the site, and to then identify them to the best of our ability to give a pre-excavation view and understanding of the site.

A 400 Mhz GSSI GPR antenna was used for both gridded areas. A 100 nanosecond window was chosen, which would give us a viewing window of about 2-5 meters. We chose a dielectric constant of 5 as we would be sending the GPR signal through soil and limestone for much of the area.

Grids 1 and 2

Grid 1 is a rectangle oriented north-south on the northern half of Area 1. The dimensions are 6.4x1.6 meters. The area was surveyed in two grids, the first in the northern section (1.6x2.6 m) followed by the second grid in the southern section (1.6x3.8 m). Data acquisition was smooth although at a sharp slope towards the edges.

Grid 3

Grid 3 is a rectangle 1.2x2 meters oriented east-west. Because of the close area within the excavation the survey wheel was managed by hand to mark correct distance within the grid.

Post-Processing and Analysis

For both grids, standard post-processing was completed including correction of the zero-position as the radar energy first enters the sub-surface and horizontal background removal. Horizontal background removal was used in order to filter out any area security radar and cell phone signals.

Grid 1

The first grid showed a horizontal layer at about 0.6 m depth with an angled layer above and below it. A second lower horizontal layer is seen at about 1.5 meter depth. These features are present in the NW corner of the square and correspond to an early

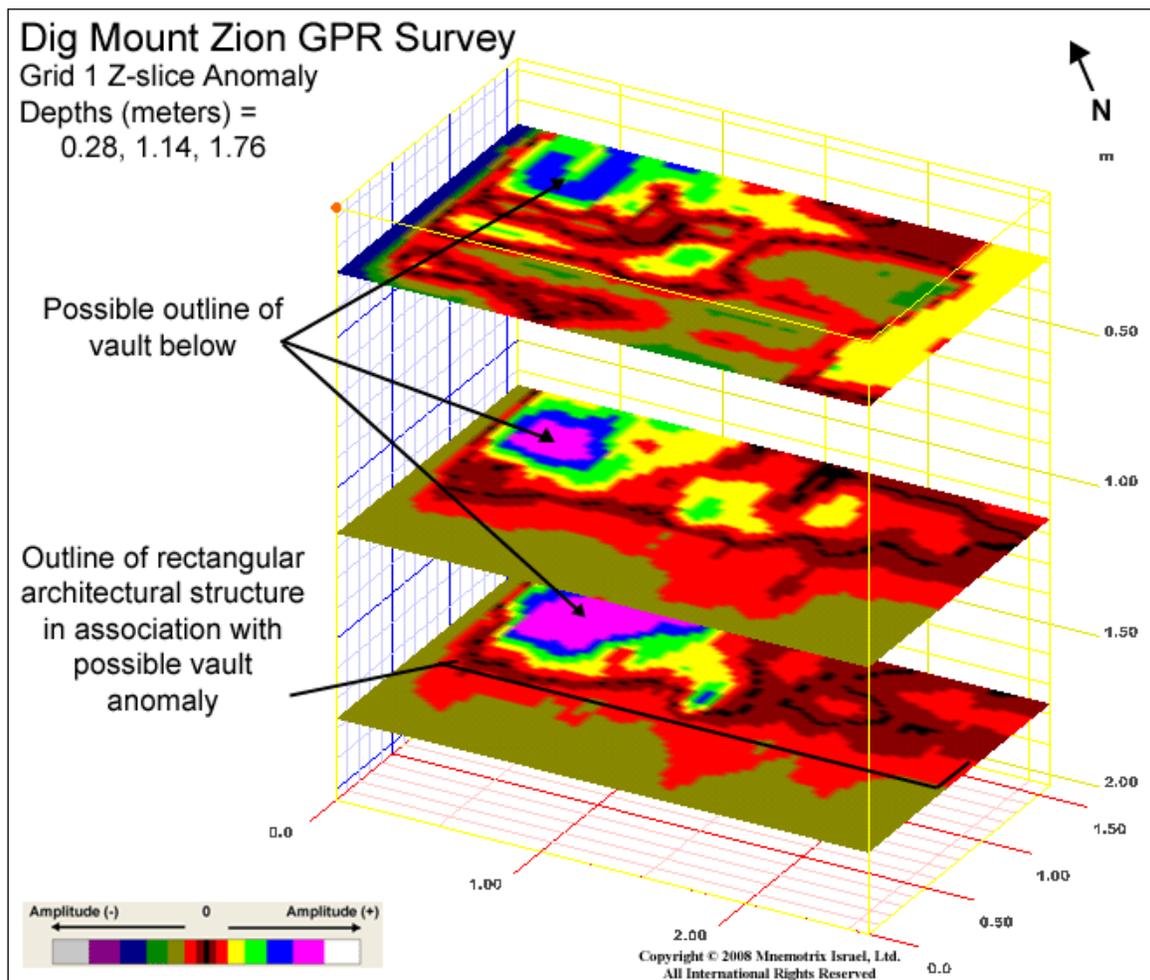


Figure 5: Early interpretation of the GPR survey in Grid 1. The architectural structure seems to possibly be related to a vault, or otherwise horizontal layer.

interpretation of the data seen in Figure 5. Perhaps this is a continuation of the vault seen to the east of the gridded area, or is another vault from a separate room. The strongest horizontal feature is seen from 1 -1.4 m ("possible outline of vault below" in Figure 5).

About 1 meter from the eastern edge is a vertically ringing anomaly that begins around 0.20 meters below the surface. The bottom of the significant features is at 1.85 meter depth. By 2.0 meters there seems to be a lack of archaeologically related material as anomaly strengths are rather low and homogenous. In the eastern portion of the grid towards the middle of the combined area is a feature that may be a pile of something of a homogenous nature; however this is significantly different than the surrounding matrix. This leads us to believe that potentially this is a wall of dried clay brick, or of boulders. Perhaps this is an extension from an adjoining wall or other feature to the east.

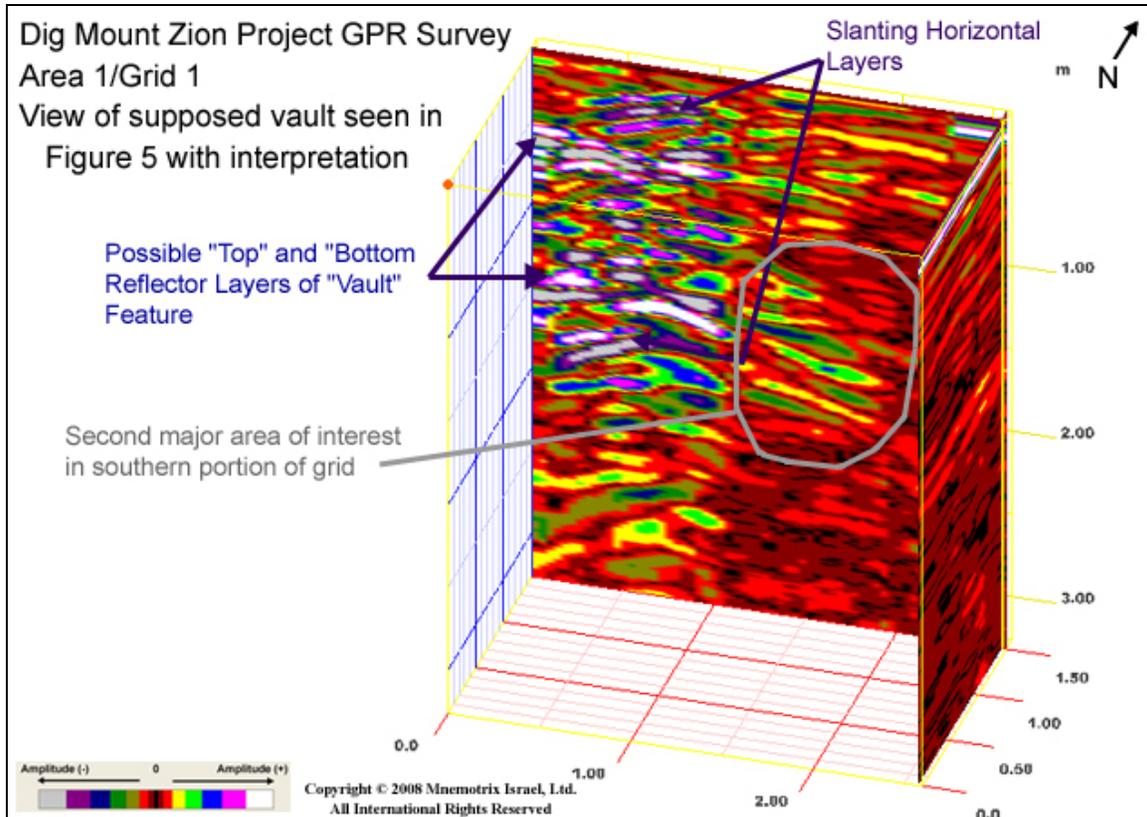


Figure 6: Area 1/Grid 1. Possible "vault" or other related large feature existing from 0.5 m to 2 meter depth. Slanting Horizontal layers surround the flat-lying horizontal reflector layers marked in blue.

Grid 2

In this gridded area we have a rounded feature seen in the middle of the grid, depth of 1 meter, corresponding to the same depth as the horizontal feature mentioned above (see Figure 7). Towards the southern portion of the grid we have the continuation of the rounded feature that becomes a horizontal layer from 2-1.22 meters range. By 2.43 meters (X) this anomaly has disappeared. As we move further south, there are several horizontal features all focused around 0.7 meter depth. Again, the bottom of the potentially archaeologically related features is about 2 meters depth.

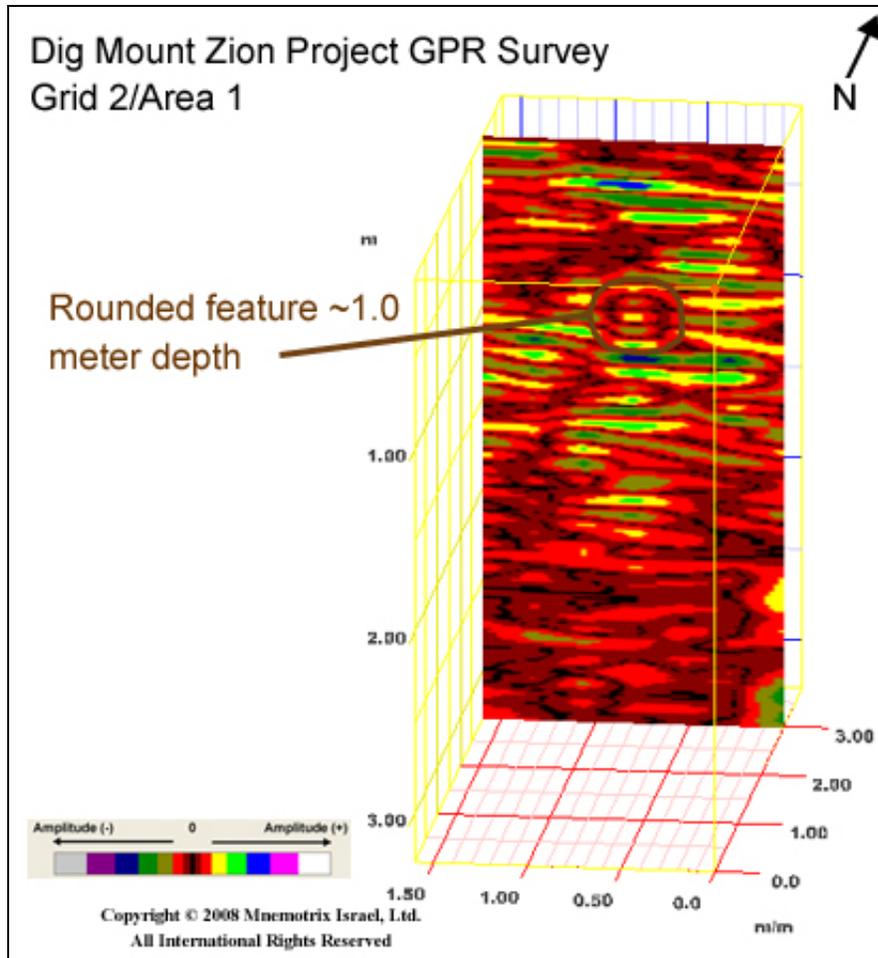


Figure 7: View of rounded feature that seems to become a horizontal layer as we move south in Grid 2. This is located at the same depth as other layers seen in Grids 1 and 3.

Grid 3

This gridded area was located within the present excavations of the site. In general, what is present is a mildly sloping horizontal layer that extends from east to west. The top of this layer is ~1.2 meters while the base is ~1.75 to ~1.85 meter depth. In the western portion of the grid (~0.2 meter depth) we see a constant horizontal layer that is believed to be the remains of the mosaic floor that we were told was unearthed in this location. At some points within the grid this layer curves/slopes upward but then returns to straight. A view of both layers can be seen in Figure 8.

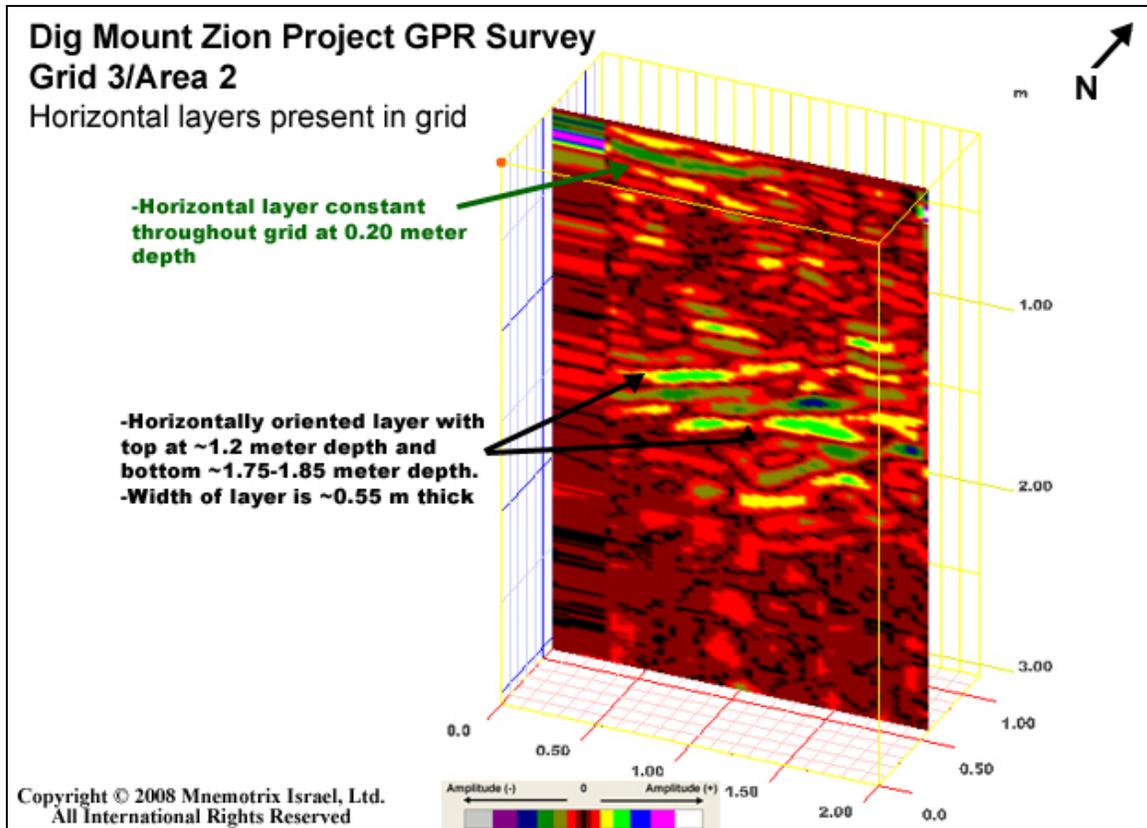


Figure 8: Grid 3 horizontal anomalies.

Summary and Recommendations

What has been clearly imaged is the existence of a slightly sloping layer that is present in Area 1 from north the south. In the northwestern corner is what appears to be a very large anomaly. Given the archaeological data and structural knowledge that we have, we would venture to say that is possibly remains of a vault structure in the sub-surface. In the eastern portion of the grid there are half-meter thick vertical standing anomalies. These potentially could be walls of some kind, perhaps made of clay brick or large boulders. Because the data is so close to the surface, within 1 meter, it is recommended to indeed excavate in this location as there for certain is a feature of archaeological origin of some great size.

Area 2 seems to show very nicely the remains of a mosaic floor, or otherwise easily recognized floor to the building. It is constant from north to south in this location at relatively the same depth. Additionally, the sloping horizontal layer is within 2 meter depth, perfectly able to be uncovered in a season.

Thus we would fully recommend excavating both of these sections as soon as possible. Although we are unable to fully identify the features here (GPR always requires ground-truth excavation to be sure the data is correct), it is clear that excavation will result in worthy finds as have been described here.