

Ground Penetrating Radar Survey Report:

German Hospice in Jerusalem, Israel

Data Acquired June 19, 2003

Report compiled August 26, 2003



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Introduction

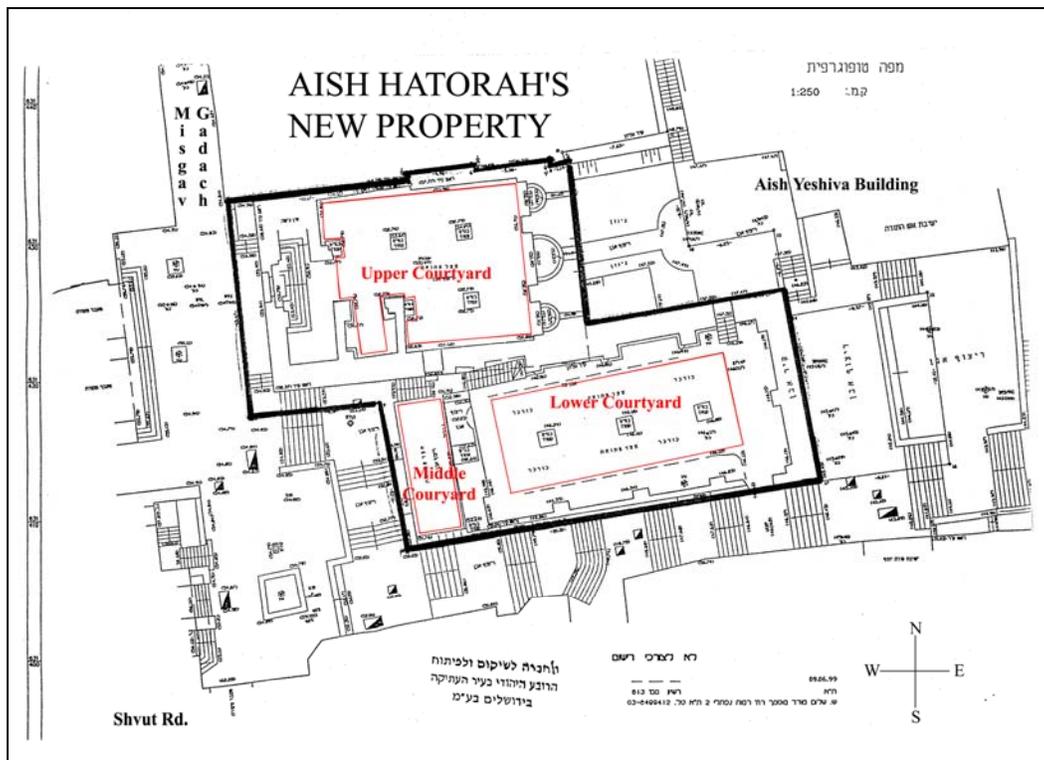
On June 19, 2003, a Ground Penetrating Radar (GPR) survey was completed on the three existing levels of the old German Hospice located in the Jewish quarter of the Old City of Jerusalem, facing the Temple Mount. This hospice was run by the Teutonic Church and the Order of the Teutonic Knights, known in 1190 A.D. as St. Mary's of the German Knights. The property is now owned by Aish HaTorah and is due west of the Western Wall, more commonly known as the Kotel. A view of the upper level of the Hospice complex looking east towards the Kotel is seen below. This section was thought to be the Church, and contains the famous 3 "apses" or windows, facing east.



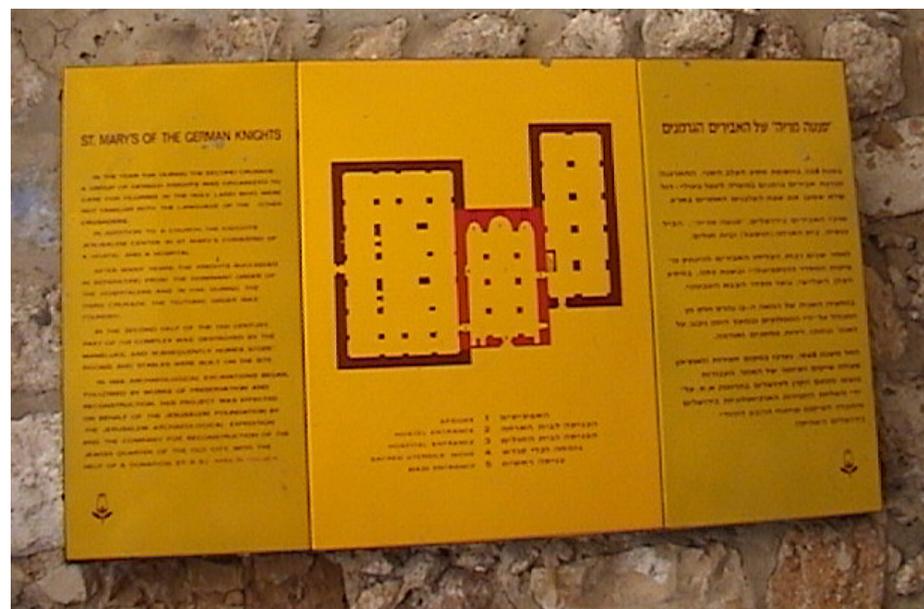
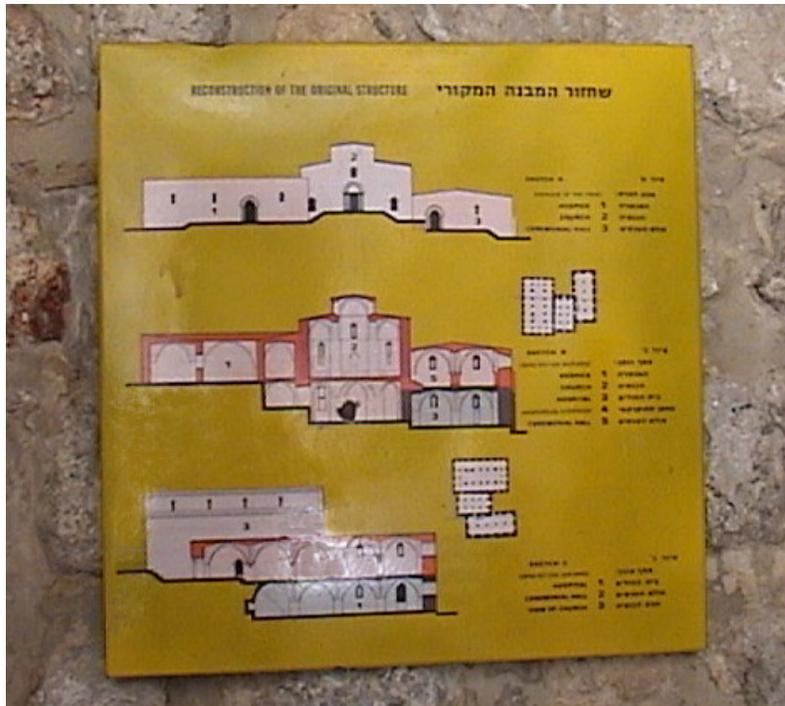
The German Hospice was first built during the 12th century AD when Jerusalem was under Crusader rule. It was subsequently destroyed, rebuilt, and destroyed again. It was only in the rebuilding of Jerusalem after the Six-Day War in 1967 that the German

hospice complex came to modern-day attention. Following excavations at that time, reconstruction and preservation of the buildings began, along with imaging of its original state and documentation placed on the walls of the structure for viewing.

When the property was acquired by Aish HaTorah in recent years, there was renewed interest in the archaeology of their acquisition. Mnemotrix Systems, Inc. was asked to complete an exploratory GPR survey in order to gain a better understanding of what exists in the sub-surface. Below is a map of the new property courtesy of Aish HaTorah. The upper, middle, and lower courtyard areas which are discussed in this report are indicated below in red. The Kotel is just to the East.



At the time of survey, reconstructed plans located on the walls of an alcove of the upper courtyard area of the Hospice were used to give us a background on which to plan the survey. These reconstructed plans can be seen below, having been placed there as a result of the excavation and reconstruction in the late 1960's.



At the time of our GPR Survey in June 2003, it was understood from the first of the above two figures that the complex originally had several levels. Remnants of these upper, middle, and lower sections make up the property owned and thus after studying these diagrams we decided to do GPR surveys of each. It was not until after our data acquisition that we gained a better historical background of the area.

Historical Background

In order to understand the anomalies found in the GPR Study, one must understand the function of this complex over its time of existence, which can only be done in light of the context of its history, since it was built and destroyed twice in older times. As is well-documented elsewhere in sources focused on the history of ancient Jerusalem, the city has been ruled by different forces. We are grateful to the studies of Meir Ben-Dov as written down in his book, *In the Shadow of the Temple: The Discovery of Ancient Jerusalem*, which gives historical background to his archaeological work during the late 1960's reconstruction of the city. Here we will give a brief discussion taken from his chapter, "A Cross on the Temple Mount," to put this location into a working context. A timeline relevant to this site is covered in the table below.

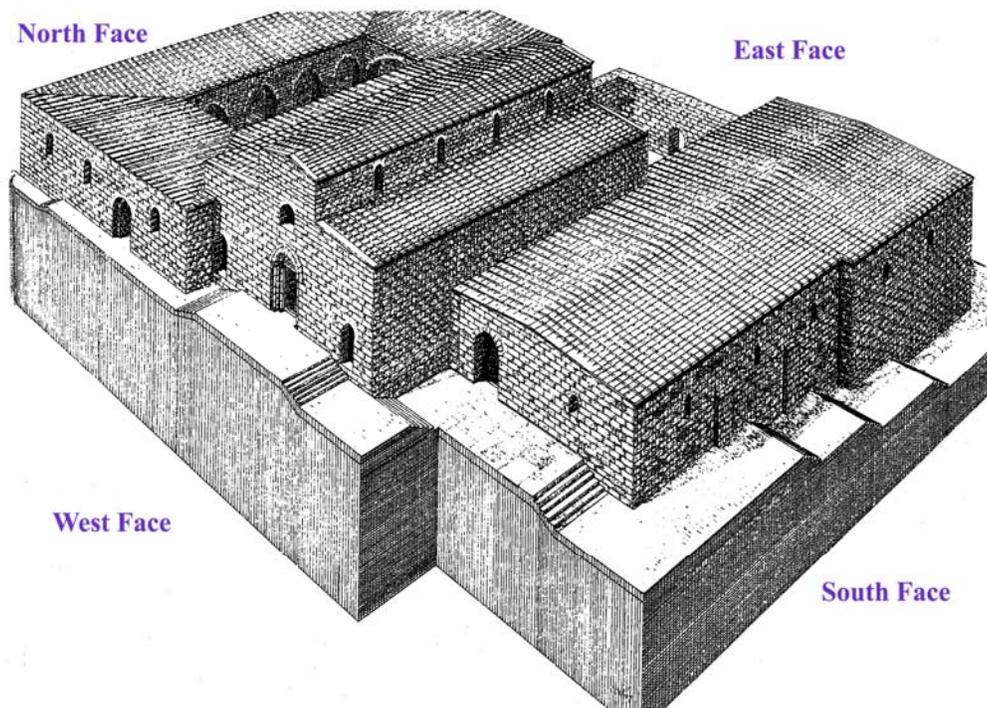
Timeline (A.D.)	Major Event	Additional Notes
1099-1187	Crusader Rule – Church built during this time	
1187-1229	Muslim Rule – Church destroyed ~1219	Jerusalem's foundations and much of the rest of the city destroyed in 1219
1229-1244	Crusaders allowed to rebuild – Church rebuilt	
1244-modern times	Tartars/Mamelukes Rule – many former Christian buildings become Muslim and many buildings are destroyed. It is assumed somewhere after the 1260's this complex was destroyed the second time.	Clear mention of the hospice and church complex still standing by a German pilgrim during the 1260's
1967 (after Six-Day War)	Foundations of the church complex are rediscovered in the rubble during reconstruction of the city – subsequently church and hospice complex was reconstructed for archaeological preservation.	Research done concerning the site including imaging of the original structure and reference material posted at the archaeological site

Little was known of the German Hospice until after the Six-Day War when it was first found and excavated while the city was once again being re-built. What is known is that at the beginning of the 1100's when the Crusader Order of St. John of the Hospitallers took over, a German subgroup started to organize independently. However, it was not until 1190 that St. Mary of the Teutons (the German military order) was independently founded. It was this group that began a hospice in the city to take care of pilgrims from Germany who did not understand French, but required care and hospitalization.

This hospice complex included a church in the middle with a service wing, dormitory, and hospital with a small ceremonial hall above. The church was 21x12 meters with three halls (a nave and two side aisles) with three semicircular windowed apses in the upper section on the eastern wall. This can be seen on the map as the GPR Survey area marked "Upper Courtyard". According to Ben-Dov's text, to the east of the church was another court with a room below for storage.

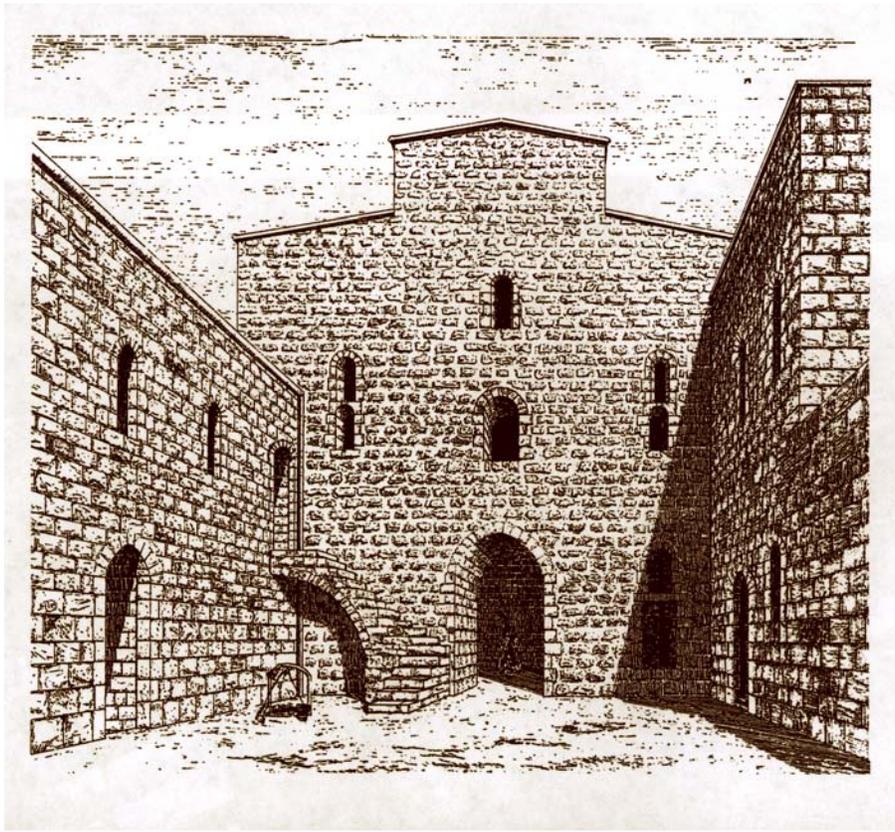
The hospice had five or more cisterns, one of which was cleaned out by Meir Ben-Dov proving it to be used at least during the Mameluke period after 1244. In addition, under the floor of the hospital hall archaeologists found "remains of a Byzantine mosaic floor typical of the sixth century" in addition to "ruins of a cistern that had been coated in a black plaster" (remnants of the residential quarter during the Second Temple period)¹. As far as we can tell, this would have been underneath the GPR Survey area marked "Middle Courtyard", and possibly extending to the area marked "Lower Courtyard".

As mentioned previously, at the time of reconstruction for preservation, Meir Ben-Dov made a view of what the complex would have looked like during its initial existence. These figures, as supplied in his book, are shown below. We have added the directional notations for clarification. It was also noted that it appeared to have been surrounded at the time by other buildings on all sides, some of these for residential purposes.



In this figure, the central building represents the Church, including the ceremonial second floor. This is what can be seen today as the Upper Courtyard with its eastern wall containing the three apses. The building to the right, on the southern side of the church, was thought to be the hospital area, and covers what can be seen today as the Middle Courtyard, and the larger Lower Courtyard below. The steps down to the Kotel can be seen at the far right. The building to the left, west of the church, was thought to be the dormitory area. This was not part of the June 2003 GPR Survey.

The next figure shows what would have been the central Church, from the inside looking West (away from the Kotel). Part of these walls and alcoves stand today. This was the Upper Courtyard area which was given the most thorough attention in our GPR study.



The Storage Area

As can be seen in the Aish HaTorah map on page 3, the Aish HaTorah building lies behind and to the east of the old church site. When our GPR study began, the location of a storage shed area in current use which is juxtaposed to one of Aish HaTorah's buildings and the hospice, was brought to our attention. We also know as mentioned above, that during Crusader times there was a room for storage located below another court to the east of the church². This gives us reason to believe that this storage area is the same one originally constructed during the 12th – 13th centuries.

This storage area can be seen in the figure below. The grated storage area lies directly under the southern apse, or window, of the reconstructed wall of the church in the Upper Courtyard area of the German hospice. As will be discussed, this seems to be one of the major sub-surface features revealed in our GPR survey.



Upper Courtyard GPR Survey

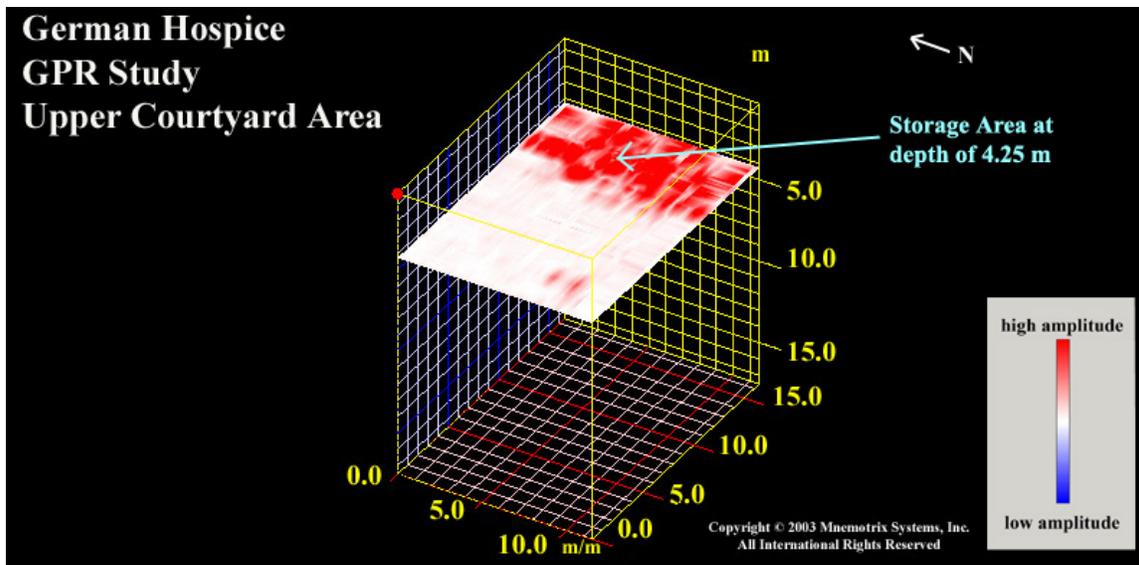
Although the old church floor, or Upper Courtyard area, contained obstructions, it was possible using a survey wheel to do a rather intensive grid of perpendicular survey lines in both North-South and East-West directions, of the full breadth of the accessible area of the flagstone courtyard. Putting these lines together in post-processing, we were able to create a rather complete picture of what the sub-surface area beneath this courtyard “looks” like in a 3D view.

A 200 MHz antenna was chosen for the task allowing for the deepest view possible to us. Due to the elevation of this area, we were able to see rather deeply free of interference, and as our figure will show, a useful depth of 17.5 meters was obtained.

What was of most interest was that on the western side of the floor the surface seemed relatively free of anomalies and somewhat homogenous, while the eastern side showed what appeared to be a large area of cavern or storage space, empty to differing degrees. We were able to correlate an area at a depth of about 3 to 5 meters from the surface of the Upper Courtyard, with the area known to be the Aish HaTorah storage shed. A closeup view of the top of the storage area is shown below, where what appears to be rolled carpets are stored.



What is most interesting is the degree to which this cavern-like feature appears in the GPR study. As we follow the study down from top to bottom, one can see that this feature continues below the modern storage area, and would seem to indicate similar cavities below, extending to the bottom of our useful signal range, which we estimate to be a depth of 17 to 18 meters. This can be seen in the GPR imaging shown below, where the surveyed area was a grid of 11.5 meters (N/S) by 16.5 meters (E/W).



In a GPR study, high amplitude colors signify a strong reflection of the material, while low amplitude colors signify a weak reflection in the surrounding material or matrix. Therefore when using this color table, where the reddest hue is present, there exists a strong difference between layers of sub-surface materials, which can be viewed as an anomaly. The red area on the eastern side of the Upper Courtyard therefore can only be assured to be an anomaly, but given the nature of the distinct difference, when correlated to the known data regarding the storage shed, it would appear that this indicates the presence of a storage area. And if this is true, then it may also be true that more similarly empty cavities may also lie beneath that area, as can be studied in the 3D visualization shown below.

This report, at this address, <http://www.mnemotrix.com/geo/hospice.doc> can be seen posted on our website. If you are connected to the Internet while reading this report, you can view this animation by clicking below:

[Click here to view the Vertical Depth Profile Animation](#)

Note: What appears as small white rectangles throughout this animation are simply areas where data was not acquired, due to stone blocks and other obstructions in the courtyard.

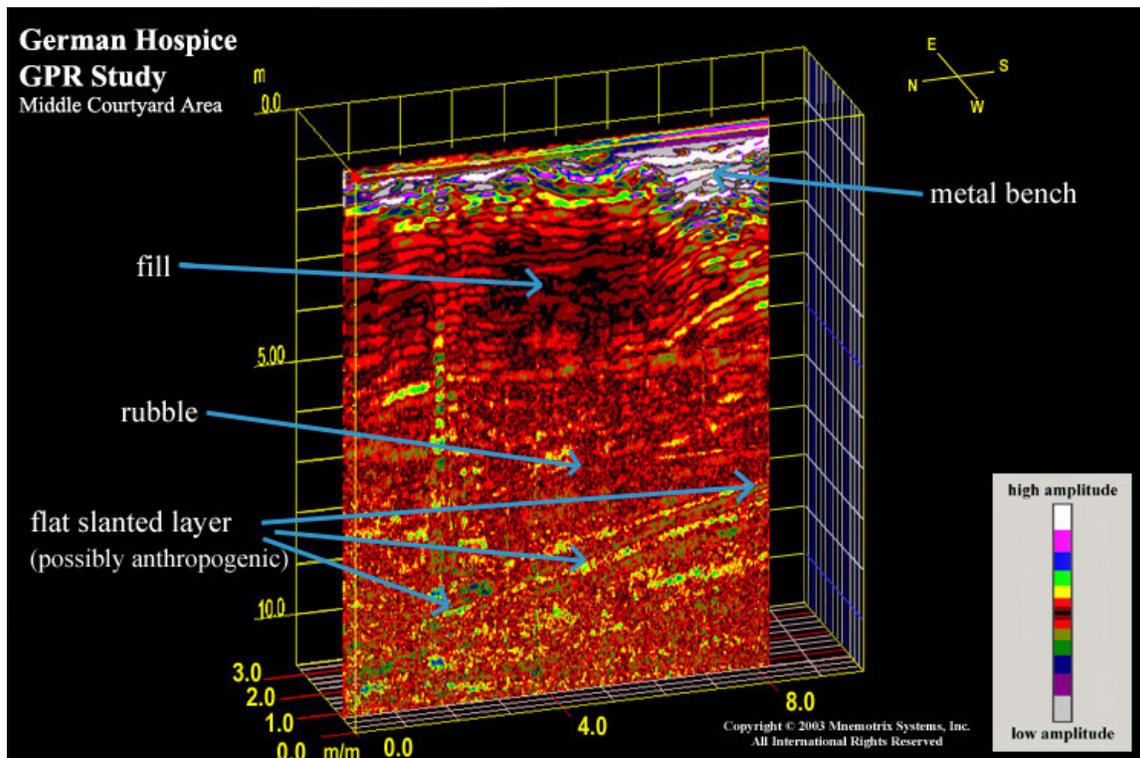
Middle Courtyard GPR Survey

To review, the Middle Courtyard area was thought to be underneath what had been the hospital portion of the German Hospice. Unlike the Upper Courtyard which had been restored to allow tourists to see a good portion of the church as it may have been, only a small portion of what had been the hospital still remains as the Middle Courtyard; the rest of that area has been built over, leaving only a small area available and accessible for a ground sub-surface study. Nevertheless, in the smaller area which was surveyed, some quite interesting features were drawn to our attention, as different from the Upper Courtyard area.

The 200 MHz antenna was again used in the Middle Courtyard area so as to see down as deeply as possible. In this area, the differences in signal velocity to adjacent material areas were much more subtle than in the Upper Courtyard study. Thus a different color table was used to highlight these subtle differences. This does not mean there is nothing significant lying underneath; it does indicate that the materials lying beneath the surface seem to be more homogenous relative to each other.

The Middle Courtyard area is a lower elevation, and as would be expected, the depth of the useful signal is less than at the higher elevation. We were able to capture a clean signal here down to a depth of about 11 meters, as shown in the next GPR visualization. Data was acquired in North-South survey lines in a marked out grid of the dimensions of 10 meters (N/S) by 3.35 meters (E/W).

A metal bench was located on the southeast side of the area. This can be seen in the GPR view shown below, and appears underneath it as metal ringing as we come closer to it. This type of ringing also appeared when we approached the metal in the steps which lead down to the Kotel. (See animated version referenced later on.)



Perhaps the most important feature is what appears quite deeply as a flat slanted layer. This can be seen in the above figure as a yellow line showing left to right (north to south) rising at about a 30° angle. Of note is the consistency of this characteristic throughout both the Upper Courtyard and the Lower Courtyard area. The line is subtle and somewhat difficult to ascertain, which would indicate that it is of materials not vastly different than the surrounding rubble and fill in which it is located. But its appearance in each survey line at what seems to be a rather man-made “straight” line made us think this could be a possibly anthropogenic layer within a larger area of destroyed material; perhaps a fallen in roof, or a foundation made of indigenous materials, or even something

related to the mosaic floor which was said to be seen by Ben-Dov's excavators. This layer appears at a depth of our estimated 9 to 10 meters.

If you are reading this report while connected to the Internet, you can see the animated view of this Middle Courtyard study by clicking here:

[Click here to view the Horizontal Slice Profile Animation](#)

The slanted flat layer can be seen in each view.

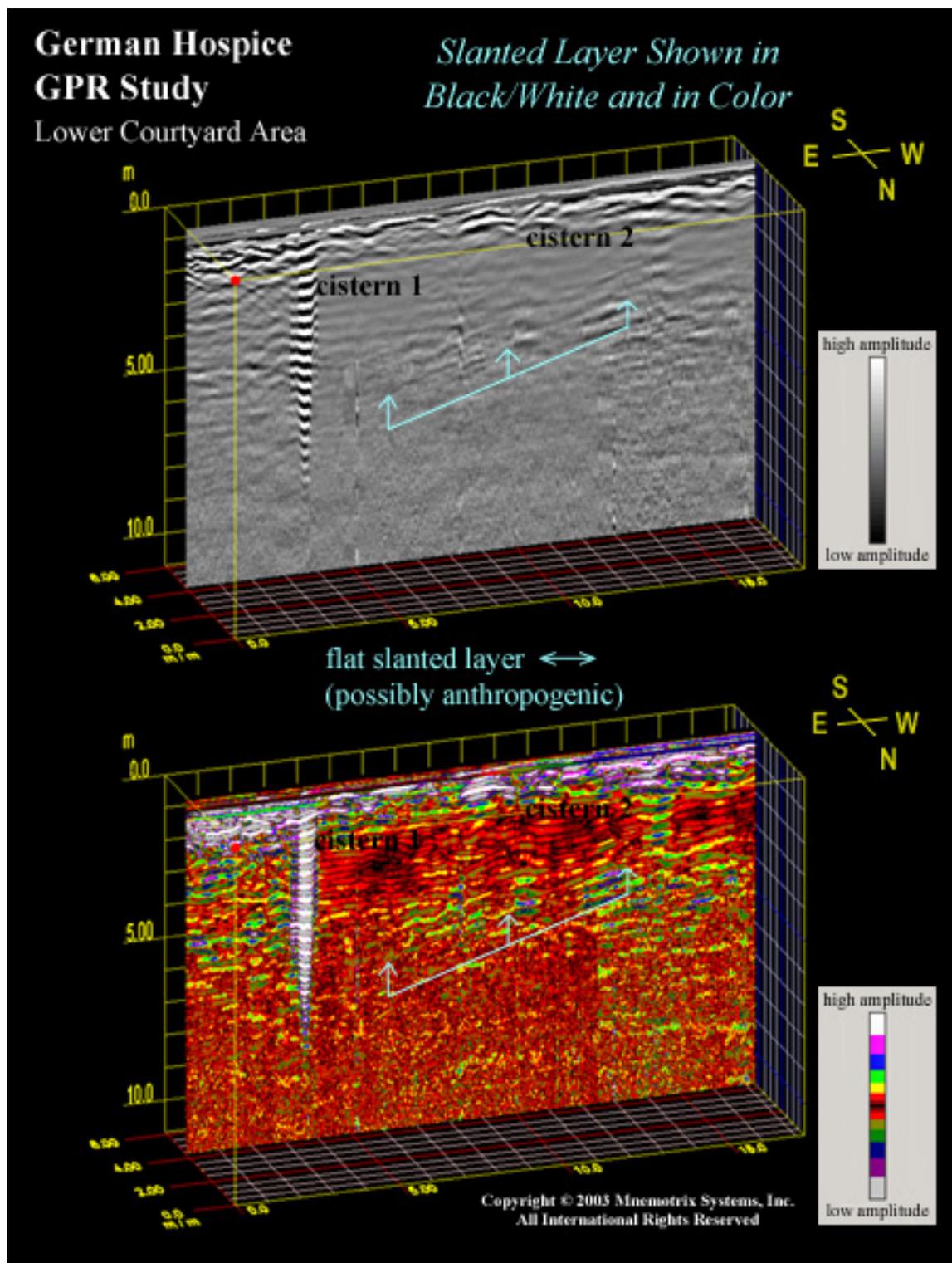
Lower Courtyard GPR Survey

The Lower Courtyard is at a lower elevation than either of the previous studies, but allowed for a useful depth of about 10 to 11 meters, again using the 200 MHz antenna. This would have been an extended courtyard behind the church, and is where cisterns have been found and though closed off now are marked within the area.

We acquired useful data in an East-West direction in a grid of about 17 meters (E/W) by 6 meters (N/S). Though there was more interference in the signal data, we were still able to see some interesting features, and made a rather surprising discovery. The same flat, slanted, possibly anthropogenic layer, could be seen in a plane comparable to that of the Middle Courtyard study, in this GPR study as well.

While the depth of the slanted layer in the Middle Courtyard is at about 9 to 10 meters, the depth of the layer in the Lower Courtyard is at about 5 to 6 meters. We have not done accurate relative depth calculations as to the difference in elevation of the Middle and Lower Courtyards, but it would seem that this depth is comparable from surface level down to where the feature appears. It also compares in angle and direction.

The layer is discerned most clearly in a grayscale color table, but can be seen as well in the same color table used for the previous study. Both are shown in comparison:



The clearest survey line, in this case going East-West, is shown in this figure. The flat slanted layer can be seen in both black and white, and also in color.

The location of the cisterns can also be seen in this survey, Cistern 1 on the eastern side more clearly than the other. As has been documented earlier, artifacts were found in some cisterns on this site, and this is another clear indication of this earlier habitation.

Summary and Recommendations:

This is obviously an intriguing site, and we would welcome the opportunity for further exploration and study. Contact with the previous excavators of this site from the late 60's would be most helpful in sharing information and insight, to make a better guess as to what these features might indicate. Of most opportunity towards shedding new light on known discoveries would be a better understanding of any underground cavities, and an understanding of what this flat slanted layer might be.

Clearly this site adds to the romance and adventure of Jerusalem and all that has transpired in this historically rich city.

Footnotes:

1. Meir Ben-Dov, *In the Shadow of the Temple: The Discovery of Ancient Jerusalem*, trans. Ina Friedman. (New York: Harper & Row, 1985), 353.
2. Meir Ben-Dov, *In the Shadow of the Temple: The Discovery of Ancient Jerusalem*, trans. Ina Friedman. (New York: Harper & Row, 1985), 351.