

# **Ground Penetrating Radar Survey Report:**

## **Khirbet Summeily, Israel**



**View of Khirbet Summeily, Israel.**

**Data Acquired 14 and 15, June 2011**

**Report compiled 18 October, 2011**

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**Ground Penetrating Radar (GPR) Study:  
Khirbet Summeily Archaeological Project  
*18 October 2011 Report of 15-16, June 2011 Study***

## **Background**

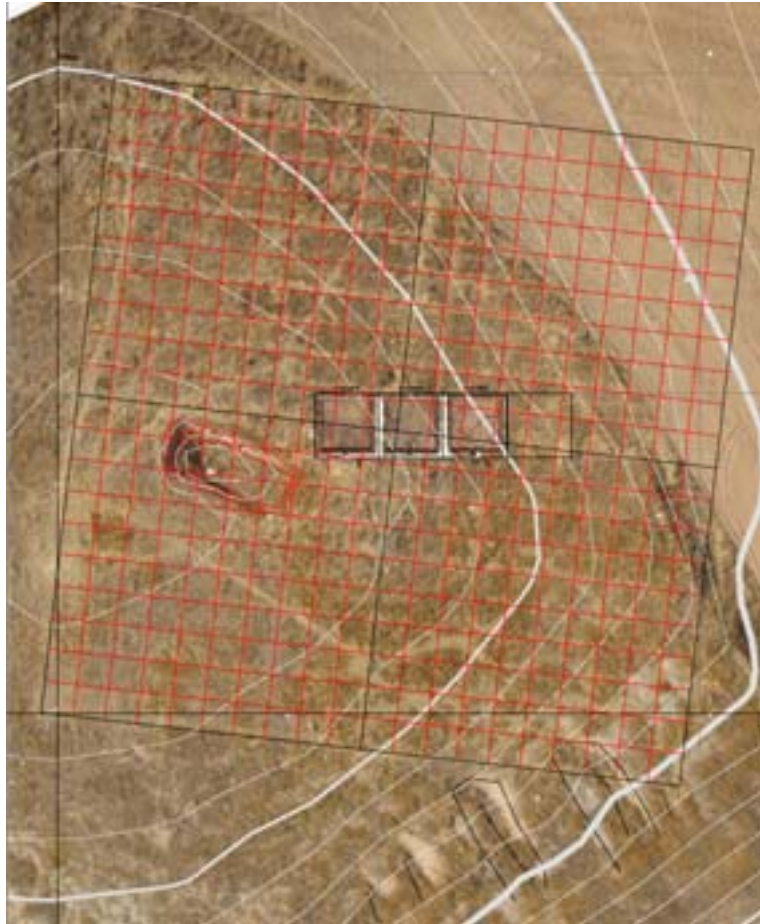
The site of Khirbet Summeily dates to the 10<sup>th</sup> to 8<sup>th</sup> c. BCE, located on the border between the ancient Land of the Philistines and Judah in the Northern Negev desert, Israel. The main objective of the archaeogeophysical survey was to locate potential walls of the supposed village, while also identifying potential graves to be avoided during archaeological excavation. Architecture of the time consisted of mudbrick houses in 2-3 or at most 4-5 meter wide circles. These houses would be linked like chains throughout a settlement. According to Jeffrey Blakely, a Director of the excavation project, based on the surface pottery he found, the site is Judahite, although many scholars believe the assemblage is Philistine.

## **Description of GPR Survey Area**

The survey area is a plateau with a steeper ridge on the southwest quarter. At the time of acquisition the area was fully covered with dry brush as during the year it is typically an agricultural area with crops. A 50x50 sq. meter area was marked accurately by the Field Surveyor, Bill Isenberg. The main soil matrix is Loess. The soil on the plateau where archaeological remains were expected is grey colored. The lower elevation is characterized by brown soil.

## **GPR Survey Actions Taken**

As mentioned, a 50x50 square meter area was first marked out in the field. The intent was that data would be acquired in transects first from the SW to the SE moving North. After that a second grid would be acquired with transects oriented SE to E moving west. By acquiring the data in two perpendicular oriented grids that were interlocked during post-processing, a 3D view of the sub-surface became possible. Figure 1 shows the GPR data survey on top of the regular survey map of the site.



**Figure 1: Plan view of Khirbet Summeily gridded area with dimensions. A trench is visible in the SW quadrant and excavation squares were completed along the central axis of the site.**

A 400 MHz antenna was used for all data acquired. The equipment used was the SIR System 2000, made by Geophysical Survey Systems, Inc. A shallow viewing window of 60 nanoseconds was used with an estimated depth scale of 2-5 meters. This was based on the soil type and geological situation at the site. Data transects, each creating a vertical profile, were collected every 2.5 meters throughout the entire survey. During post-processing the numerous vertical profiles were appended together to create a 3D-cube used to view the data from the surface down and from side to side.

## **Post-Processing and Analysis**

Standard post-processing methods were used including correcting the zero-position on each individual file to ensure we are studying only the data below the surface (i.e. ground coupling was edited out of the files); horizontal background removal was used to remove the presence of constant radar frequencies being employed for security in the area; high pass and low pass FIR Filters were used to put the final processing edge onto the data for ease of viewing and analysis. Once files were individually filtered they were appended into 3D files. These files were then appended into a Super 3D file of the whole area, which is what the following GPR figures show.

When viewing the GPR figures, different color tables were used to highlight different aspects of the data. GPR works in such a way as to highlight significantly

different anomaly areas. Thus as the GPR signal travels through the sub-surface, the more significantly different the new material is from the previous material the signal was just traveling through, the higher the amplitude reflection. For every positive reflection there is a reciprocal negative amplitude reflection. Anomalies are mapped and the colors are according to the strength of difference. An interpretation of the data is included on the figures when relevant. An animation was created for ease of understanding through the depth changes ([File name: Sanim1.gif](#)). Figures taken from this animation with explanations are included below (Figures 4-8).

The electromagnetic signal had good penetration into the sub-surface. Useful archaeological data seems to extend until about 2.0 meter depth.

As is discussed by the Site Directors in their excavation reports for this 2011 season, a series of floors and a significant destruction layer were discovered. Figure 2 below shows a view of the three excavation squares looking from east to west up the slope of the tel. These squares were chosen based on the initial interpretation of the results in June 2011 and are outlined in Figure 3.



**Figure 2: East to west view of the 2011 Khirbet Summeily excavation squares at the end of the season.**

Figure 3 shows in red an outline of the major areas of potential archaeologically related features. These features have similar signatures to that of the mud-brick walls and floors that were excavated during the 2011 season. It is possible that these are rings/groupings of structurally related features but this cannot be fully determined until excavation. The purpose of this survey was to locate areas of archaeological interest to aid in decision support and to see if it was possible to demarcate mud brick walls in this environment using GPR. The following figures show the change in the major anomalies taken directly from the uninterpreted data in the created animation.

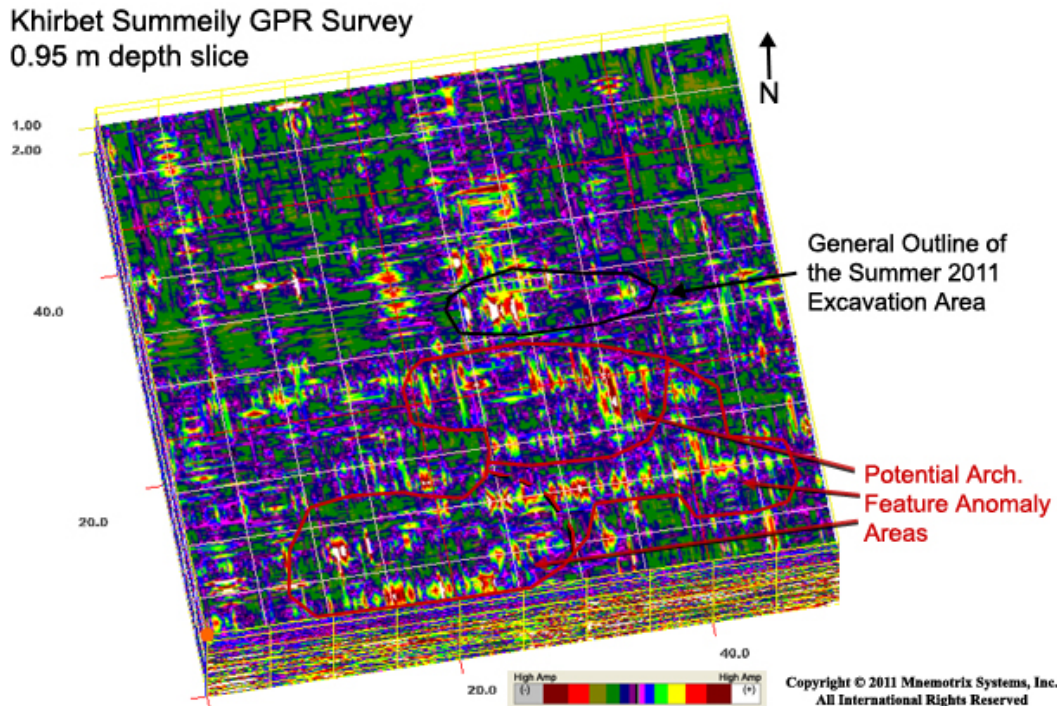


Figure 3: A depth slice of the GPR survey acquired in June 2011. The general outline of the excavation squares is seen in black. A larger area is outlined in red bringing attention to other potential archaeological remains in the whole of the survey. It is unknown exactly what these features are at this time, although their signature is similar to that of the floors and walls that were excavated (black outline). Thus a positive discovery is expected in upcoming excavation seasons.

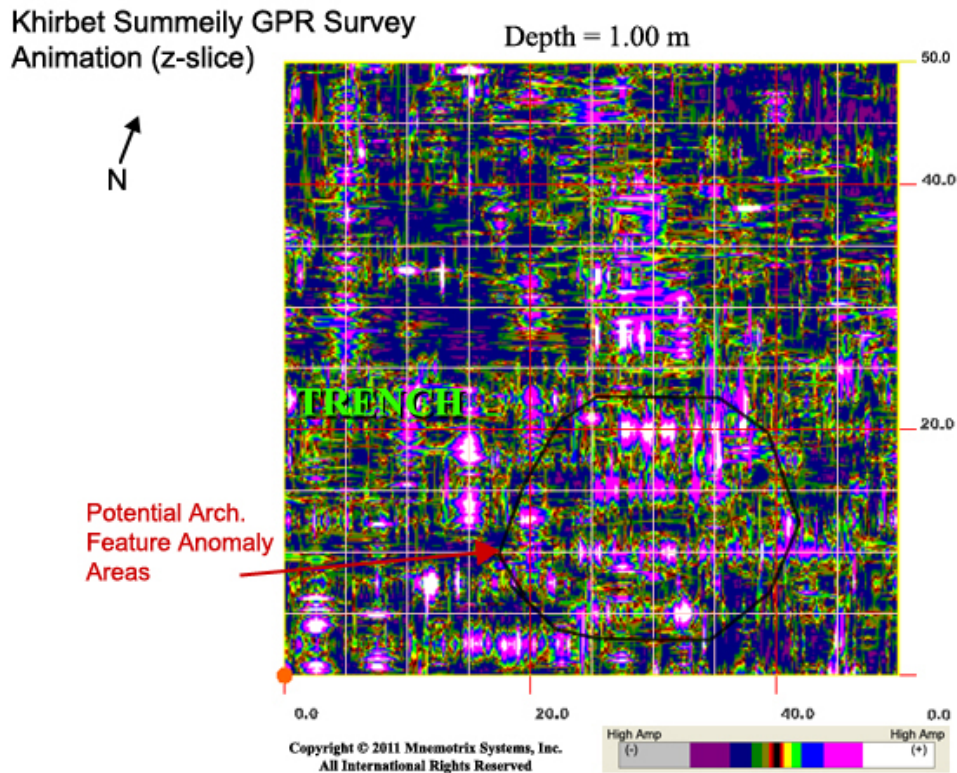


Figure 4: Depth slice (1.0 m) taken from the animation. The main area of potential archaeologically related features is circled in black.

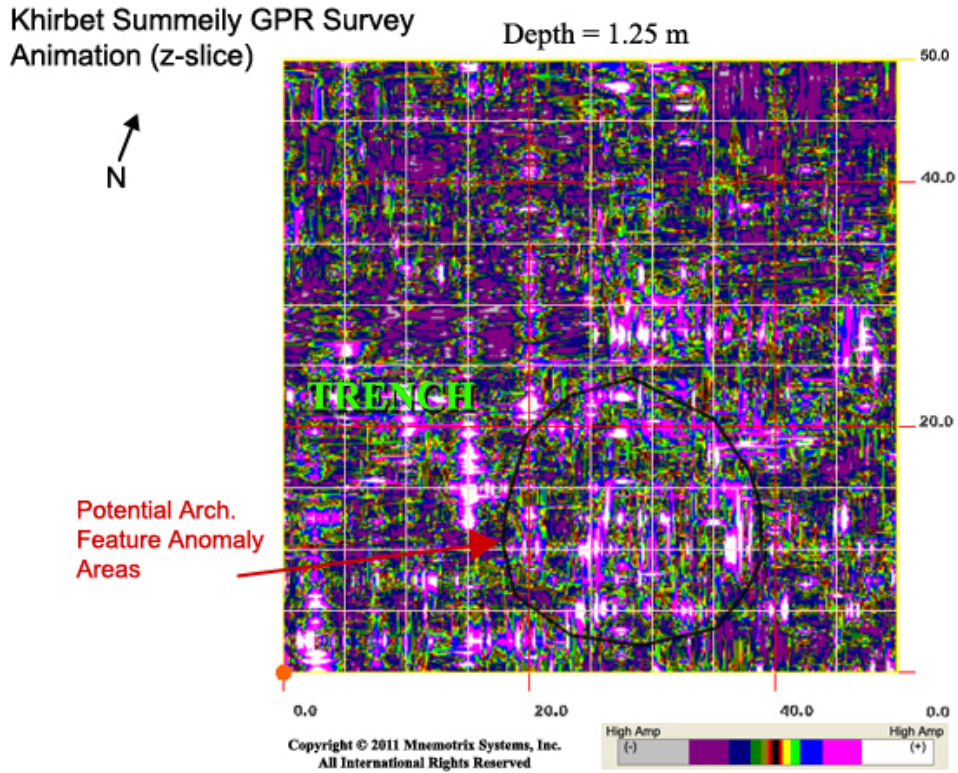


Figure 5: Depth slice (1.25 m) taken from the animation. The main area of potential archaeologically related features is circled in black.

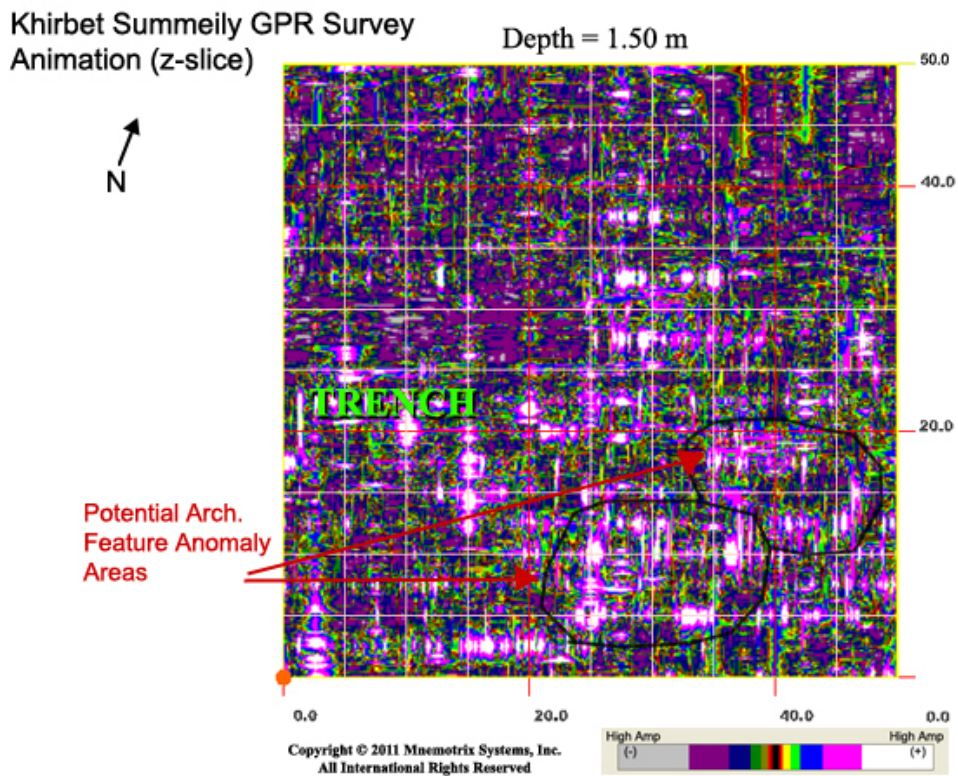


Figure 6: Depth slice (1.50 m) taken from the animation. The main area of potential archaeologically related features is circled in black.

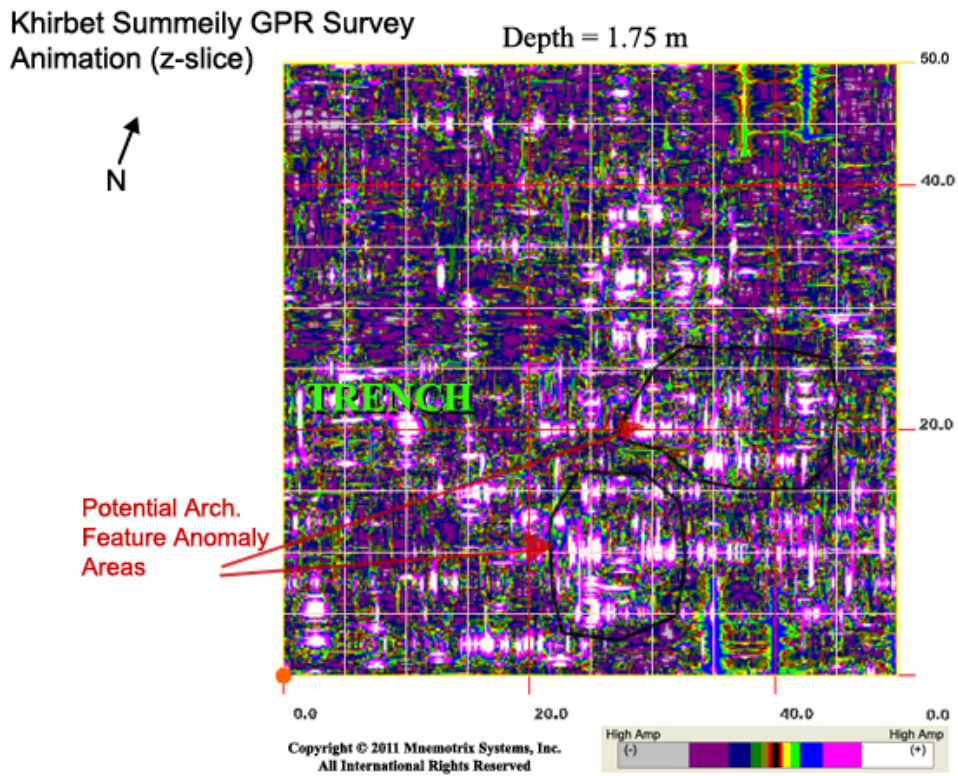


Figure 7: Depth slice (1.75 m) taken from the animation. The main area of potential archaeologically related features is circled in black.

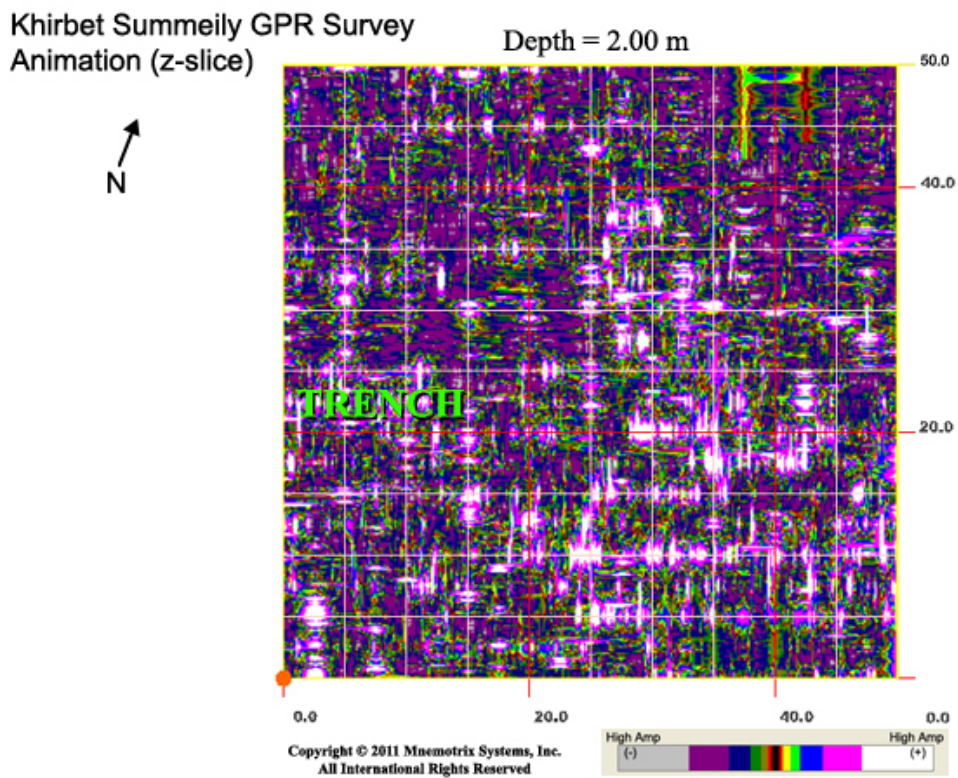


Figure 8: Depth slice (2.00 m) taken from the animation.

## **Recommendations**

Based on the results of this archaeogeophysical survey there are some recommendations for next steps. Of course, full excavation of the entire area would enable us to see the extent of the occupation at the site. If this would actually occur it would take many seasons and indeed the directors are planning a long-term study at the site. It is recommended that a higher resolution GPR survey (data profile lines acquired every half-meter) of specific sub-areas marked in these figures would allow for significantly better understanding if excavation is not possible in future seasons.

Mnemotrix Systems, Inc. looks forward to following up with Jeffrey Blakley and Jimmy Hardin in order to decide upon which areas may benefit the most from a geophysical view if excavation is not possible or planned for in these areas. In all cases a formal discussion, explanation, and answering of questions is expected by the Mnemotrix team in coordination with the archaeological team.