
Professor Richard Freund, Project Director, University of Hartford

Professor Harry Jol, Chief Geoscientist, University of Wisconsin, Eau Claire

Professor and Dean of the Sciences, Philip Reeder, Chief Cartographer, Duquesne University

Vanessa Workman, Assistant Director, Tel Aviv University

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HELENCIC REPUBLIC
MINISTRY OF CULTURE AND SPORTS
GENERAL DIRECTORATE OF ANTIQUITIES
AND CULTURAL HERITAGE
DIRECTORATE OF BYZANTINE AND POST-BYZANTINE ANTIQUITIES
DEPARTMENT OF GREEK AND FOREIGN EDUCATIONAL INSTITUTIONS, ORGANIZATIONS AND INTERNATIONAL AFFAIRS

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Athens, 27/10/2014

Ref. No.
ΥΠΠΟΑ/ΓΔΑΠΚ/ΔΒΜΑ/ΤΕΞΕΙ/278037/1
62382/9820/540

NOTIFICATION TO:

1) 4th Ephorate of Byzantine Antiquities,
85100 Rhodes

2) Israeli Community of Rhodes
Simiou & Dosiadou St., 851100 Rhodes

3) Professor Richard Freund,
Maurice Greenberg Center for Judaic Studies,
University of Hartford,
200 Bloomfield Avenue,
West Hartford CT 06117, USA
RE: Approval of pilot project concerning the study of four monuments in the Medieval Town of Rhodes in January 2015

DECISION

Taking into account the following

2. Presidential Decree 118/2013 (GGI 152/A/25-6-2013)
3. Presidential Decree 89/2014 (GGI 134/A/10-6-2014)
8. The inclusion of the Medieval Town of Rhodes in the World Heritage List of UNESCO
9. The unanimous opinion of the Central Archaeological Council, as expressed in its 31/16-9-2014 Meeting

WE DECIDE

We approve the realization of the pilot project concerning the study of the following four listed monuments of the Medieval Town of Rhodes in January 2015:

1. Jewish “Kahal Shalom” Synagogue, on Dossiadou St.
2. Site of the “Kahal Grande” Jewish Synagogue, on Kisthiniou St.
3. Church of “Our Lady of the Castle”, at the east end of the medieval town of Rhodes
4. The open courtyard round the “Neoclassical School”, opposite the Palace of the Grand Master.

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KONSTANTINOS TASSOULAS

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Figure 1-The research project investigated four selected research sites using GPR.

The GPR technique is based on the propagation and reflection of pulsed high frequency electromagnetic (EM) energy. This field technique can provide near surface,
high resolution, near continuous profiles of archaeological sites. GPR has become a popular method for investigation of the shallow subsurface because of the above properties, and the availability of portable robust and digital radar systems. Publications resulting from my past investigations, as well as others, have shown that GPR is a valuable, efficient and effective research methodology (Jol, 1995; Jol, 2009; Jol and Bristow, 2003; Jol and Smith, 1991).

Figure 2-The Kahal Shalom January, 2015 GPR study
The GPR acquisition system, Sensors and Software pulseEKKO™ 1000 was used for the research projects. The GPR profiles with 225, and 450 megahertz antennae and 200 volt transmitters provided images of the subsurface. Step sizes and antennae separation varied from 0.03 m to 0.5 m depending on the site conditions (Jol, 1995; Jol and Bristow, 2003). To reduce data collection time, a backpack transport system was employed. Each trace was vertically stacked with an appropriate sampling rate. The digital profiles were downloaded, saved to an external hard drive, processed and plotted. Basic processing will include automatic gain control (AGC), signal saturation correction, trace stacking (horizontal averaging) and point stacking (running average) as well as other routines when necessary. Near surface velocity measurements were calculated. The profiles, where necessary, will be corrected for topography. The application of radar stratigraphic analysis (distinct signature patterns) on the collected data provides the framework to investigate both lateral and vertical geometry and stratification of the archaeological features being assessed (Jol and Bristow, 2003; Jol and Smith, 1991).
Kahal Shalom Synagogue

Figure 3-The Kahal Shalom area of GPR study (only the main synagogue area was done)

A grid x m by x m was laid out in Kahal Shalom. Data was collected with 225 MHz (antennae separation: ; step size: ) and 450 MHz antennae.

1. Kahal Shalom Synagogue-Preliminary Results and Continuation—we successfully mapped 1/3 of the subsurface of the entire synagogue complex in three days in January 13, 14, 15 2014 to test the feasibility of
working in this environment and to provide information and a proposal for improvements to the site, providing historical data for the Ephorate and the Jewish community and provide Rhodes history of earthquake damage information.

The 2002 excavations revealed a distinct more ancient layer on the north wall.

Quoting the Ephorate report: page 16 “-Foundation

(3) On the base of the north front, along its total length, there is a more recent stone bench, approximately 65 to 90 cm high and approximately 40 cm wide. Its role was tracked with an exploratory section in depth (III. 7). It was found that there is no broadened bedrock on the north wall and that the base of the latter does not have much depth, in fact it is at a level higher than the street.
Figure 4 is the 2002 photo of the area by the pillar.

At a depth of approximately 50 cm a layer of white clay was found, and it is followed by soft rock (virgin ground). Another section was made in the interior accordingly, from the south side of the northern wall, in the area of the west semi-pillar (III. 8) revealing successive phases of the construction as well as traces of an older building, with a configuration unrelated to the present one. The foundation appears normal from the interior side. One wonders whether the road was at some point higher than its current level, perhaps formed with a few steps. Then, the bench must have been constructed in order to support the wall on its base, following a possible modification of the road or following
a discovery of instability problems or ascending humidity.” PG 16/85, 2002 report of excavations and restoration of the Kahal Shalom Synagogue by the Rhodes Ephorate (translated from Greek).
Ground Penetrating Radar Scanning WNW -> ESE along the northern wall of synagogue gradually moving south to the center of the building using a Pulse Echo 1000 (GPR sensor and software). Recording 225 (megahertz) mhz every 20 cm, recording trace every 5 cm. The 2 antennae separated by 50 cm. Prof Harry Jol and University of Hartford student Nicole Awad on device, Emily Galica and Vanessa Workman, Tel Aviv University measuring and documenting a limited space for testing.

Work done up to the 4 main pillars: two “semi-pillars” (to the central podium-bemah-section) built into northern wall 4.5 meters apart and two 4.45 meters apart 3.6 meters south from the wall. The southernmost pillars will interrupt the recording of GPR lines between the 3 and 4 meter markings. 30 lines were completed between northern wall and the bemah in the center of the synagogue at 225 mhz. Line 0 on the northern wall was not recorded, line 30 along the edge of the bemah was recorded. Lines 17-20 were affected slightly by the two pillars in the center of the surveyed space, as the GPR was not able to complete a direct path from wall to wall, but maneuvered around the two pillars in these lines.

GPR scanning the same area in the WNW -> ESE direction now using 450 mhz, recording lines every 10 cm, and
recording trace every 3cm. This records the subsurface area at a higher resolution within a shallower depth. 31 lines of potential 60 lines of assessment and all 60 lines finished in three days with 1/3 of entire space being processed by our geophysicist in Los Angeles, Dr. Dean Goodman of GPR-Slice Software, Geophysical Archaeometry Laboratory, Los Angeles, CA USA January 13, 14, 15, 2015 data slices with the two clear layers below surface consistent with early floors of a building in the same location. The following are the depths of anomalies that we would be tracking in the next work we are proposing for January, 2016: RAW DATA
Figure 6-The Raw Data from GPR-Slice with indicated anomalies

The synagogue’s present level is tied to the 1577 foundation stone date. Data was collected with 225 MHz and 450 MHz at Kahal Shalom. Thirty transects with a line spacing of 0.20 m were collected with the 225 MHz...
antennae at an antenae separation of 0.5 m and a step size of 0.05 m resulting in a grid of ~ 6 m x 12 m. Sixty transects with a line spacing of 0.10 m were collected with the 450 MHz antennae at an antenae separation of m and a step size of 0.03 m resulting in a grid of ~ 6 m x 12 m.

Preliminary data analysis indicated several subsurface anomalies (see figure for locations) at the following depths 1) 135-150 cm, 2) 143-150 cm, 3) 150-166 cm, 4) 278-293 cm

**Anomalies and Areas of Interest for Coring, Sampling and Excavation:**

![Figure 7-GPR Raw data zoom](image-url)
Anomalies and Analysis:

Anomaly 1 at a depth of 135-150 cm below the present floor could be cored and sampled BUT only after the entire field of the main floor is GPR surveyed. It would, we think be easier to core and sample in a more obscure area and repair. The odd configuration of the anomaly may indicate that the door was oriented much differently than the later version.

Anomaly 2 at a depth of 140-160 cm appears to be from the same historical period, perhaps from the time before the earlier 1481 earthquake.

Anomaly 3 at 270-290 cm appears to represent an even earlier stratum of the synagogue perhaps dating to a 15th century as in the case of Anomaly #4 and #4 or even earlier.
Figure 8-Map of all of the places of Interest

Recommendation is to continue to finish the GPR survey of the rest of the Kahal Shalom building area in January, 2016 to determine the extent of the size of the anomalies and to find an appropriate place for coring and sampling.
Ground Penetrating Radar Rhodes, Greece Church of “Our Lady of the Castle” Pilot Project January, 2015 Report and Recommendations

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**Church of the Victory/ Church of “Our Lady of the Castle,” at the east end of the medieval town of Rhodes**

The archaeologists’ original theory in this area indicated that the Church of the Victory was located by Agia Eikaterini’s Gate. The result of an excavation at a nearby unidentified “anonymous” church, however, on Kisthiniou street, created doubts as to which of the two churches is the Catholic church of *Panagia tis Nikis*. It was built by the Grand Master Pierre d’ Aubusson in the 15th century and was destroyed by the second Ottoman siege in 1522. This church originally accommodated the Franciscan order. Along with the Augustinian order, they were the most important Catholic monasteries on the
island of Rhodes. This church is located on the northeast end of the Medieval Town, near Agia Ekaterini’s Gate. It was built after the first siege from the Ottomans on July 27th (day of the church’s celebration) 1480. The present architect of the city, Dr. George Ntellas, in discussion with our team proposed that the orientation of some of the present structure might indicate that it was built over an earlier building or perhaps even a synagogue. Our project was intended to take a part of the possible earlier building and survey the sub-surface for any indication of footings or architectural features that would indicate that a differently oriented building was located in the Church. The results indicate that we need to do another section to complete our work here in 2016.
Figure 2-Photo of the area with the side wall features present

A grid 10.6 m (E-W) by 4.3 m (N-S) was laid out along the east-west running Templar fortification/outer city wall in the area of the Church of the Victory. The northeast boundary of the GPR area is defined by the outer wall, which follows the coastline in Rhodes’ Commercial Harbor. Data was collected first with a 225 MHz antennae with trace recorded every 5 cm and secondly with a 450 MHZ antennae with trace recorded every 3 cm. This was done to achieve maximum resolution despite
minimizing the depth of recording. 17 lines of data were recorded every 25 cm using the 225 MHz antennae and every 10 cm using the 450 MHz antennae.

A blocked window sits X meters above the current floor level suggesting that the space was used for another purpose previous to the establishment of the medieval church.

Figure 3-Assigned area from Ephorate
Figure 4-Final map of the GPR Surveyed area
Recommendation for the site is to continue beyond the present GPR section to the west. George Ntellas recommendation was to continue and we would do a further section.

Figure 5-Raw Data from the GPR survey

There is an indication that there is just below the surface there is a different orientation of the architecture. We would like to continue one more section to the west.
Ground Penetrating Radar Rhodes, Greece at the Kahal Gadol Synagogue Pilot Project Report, January, 2015

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The Kahal Gadol Synagogue is thought to be the older synagogue of the two synagogues Kahal Shalom and Kahal Gadol under investigation. The first iteration of the Kahal Gadol synagogue is thought to have been constructed in late 1480s following the first siege of Rhodes by the Ottomans but after the 1481 earthquake. The present structure has been significantly updated in the past 100 years and was destroyed after bombing in 1944. The area was covered with debris up until 2004 when the area was cleaned down to the exposed floor. The GPR survey was intended to see if there were earlier iterations of the synagogue below the present floor and to see where areas could be cored, sampled and potentially excavated to recover materials from the earlier synagogue structures or alternatively suggest a
preservation and reconstruction plan based upon the state of the materials below the present floor.

Figure 2-edge of the Kahal Gadol/Grande Synagogue and the Anonymous Church to the North

The so-called “Anonymous Church” is located directly adjacent to the Kahal Gadol Synagogue and has been dated to the Byzantine period. Based upon the GPR’s initial study of the synagogue there would seem to be a similar elevation of the earlier floor of the Synagogue and the Church. One recommendation is to
do a fuller GPR survey of the area in between the two locations to determine if the street level was indeed lower.

Figure 3-The interior of the “anonymous” Church looking south.

The present Church excavations suggest that the floor of the “anonymous” Church was some two meters below the present level of the Kahal Gadol synagogue but may have been situated at a similar level in the earlier iteration of the KG synagogue.
Figure 4-The “Anonymous” Church and the Synagogue
Figure 5-The stratum below the surface of the present Kahal Gadol Synagogue floor is some 4 meters down
Figure 6-GPR Anomaly at the KG
Figure 7-Final GPR Survey map

Recommendations:

The most impressive part of the Kahal Gadol synagogue work involves the clear stratum of another floor at 4 meters below the surface. This area is in many parts intact and available for serious research. The finishing of the synagogue, up to and including the Bet Midrash area is the central recommendation. The second recommendation is to do a survey of the plaza in between the Church and the Synagogue to see if a street was located at the 4 meter level as well. Coring and
Sampling at an appropriate area of the Synagogue at the anomaly identified. It would be suggested in the January, 2016 work that the GPR survey continue and sampling and coring be done at that time in an appropriate area. Sampling for C-14 testing.
Ground Penetrating Radar Rhodes, Greece-The Ottoman School and Grandmaster Palace GPR results of the Byzantine Wall Survey

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Figure 2-The Ottoman School before Intervention

GPR Survey

A GPR project was undertaken outside of the Palace of the Grand Master and the Neo-Classical Ottoman School during the 2015 season. The project aimed to connect a “supposed” portion of the Byzantine
wall and identify and map an unexposed portion of the double parallel Byzantine fortification wall from the north of the Ottoman School as a possible continuation of the exposed portion of the wall in the plaza of the Palace of the Grand Master. This goal was thought to be achievable using Ground Penetrating Radar since the Byzantine wall was so close to the surface. We began by establishing a grid on the southwestern grounds of the Palace’s plaza next to the location of the exposed Byzantine wall. This was intended to provide a control area as the wall and its depth are visible and can be accurately measured. A 22 m (E-W) by 10 m (N-S) grid was chosen just north and adjacent to the excavated wall. A modern stone pavement covers the wall there. The data collected from this area, depth and width of the wall(s), was assumed to have close connections to that collected from the smaller grid established to the north of the Ottoman School. A 14 m (E-W) x 3 m (N-S) grid was laid on the northern grounds of the Ottoman School. The modern road cut a 2m deep E-W transect through the wall, which exposed a parallel double wall below ground level in this area of the Ottoman School (seen below in Figure 8). For this reason, we chose to lay an E-W grid over that area and attempt to understand the depth, width, and trajectory of the unexposed wall.

Data was collected with the 225 MHz antennae at the Palace and with the 250 MHz antennae at the Ottoman School; in both places trace was recorded every 5 cm. In the plaza, lines were established every 25cm and 40 lines of GPR data were recorded. At the Ottoman School, 13 lines were recorded spaced every 25cm.

Our Project was designed to see if the missing pieces of the Byzantine wall that could be found from earlier surveys and to trace the Byzantine wall to see if sub-surface imaging could find the missing parts and see down to where they meet the earlier Hellenistic walls. In the final piece of the project we theorized that the Hellenistic wall could indeed be mapped as well using the Electrical Resistivity Tomography equipment which we are proposing for January, 2016.
Figure 3-the missing sections of the Byzantine wall

Figure 4-The Ottoman School area presented extreme challenges to the GPR survey of the sections of the Byzantine Wall Survey because of the debris piles that sit on the area which would need to be surveyed.
One of the main issues of the Ottoman school Byzantine Wall survey was to find an area that was clean from debris that would attenuate the signal and to test that the equipment would indeed locate the exposed part of the wall for work. One of our main suggestions for the continuation of this project is to use Electrical Resistivity Tomography equipment on the areas because the ERT would be able to distinguish the debris and the sub-surface parts of the wall. Plus the Byzantine wall would/should be located near or upon the Hellenistic Wall section that we think may be a part of structure.
Figure 6—one clear section for GPR work on the side of the School. The grounds of the Neo-Classical Ottoman school, where the wall continues, has only one area where the GPR work was feasible. The GPR signal was at risk near all of the debris piles and equipment being used for the reconstruction project at the Ottoman school. But the signal of the area was clear and is consistent with the signal across the parking lot at the plaza of the Grandmaster Palace.
The **Ottoman School and the** Grand Master Palace continuation of the Byzantine Wall section

In tracing the GPR survey of the Byzantine Wall we extended (with Ephorate approval) our work along the side of the Grandmaster palace starting from the plaza and the exposed area in front of the Palace.
Figure 8—shows the entire Ottoman School and Grandmaster Palace Byzantine Wall section

A grid x m by x m was laid out at two locations at the Grand Master. Data was collected with 225 MHz antennae.
By far we documented the exposed walls of the Grandmaster Palace and the Ottoman school with the greatest detail. The Byzantine Wall sits only a 110-150 cm below the surface but extends down beyond the scope of the GPR. The depth of the wall was measured in varying parts of the wall to insure that we could carefully evaluate the wall’s depth and width.
The Ottoman school where the wall continues had only one area where the GPR could work. The signal was at risk near all of the debris piles of equipment being used for the reconstruction project by the Ottoman school. But the signal of the area was clear and is consistent with the signal across the parking lot at the plaza of the Grandmaster Palace.

The debris piles would not be a problem for the proposed Electrical Resistivity Tomography equipment which can distinguish the modern metal from buried wall fragments.
SECTION OF BYZANTINE WALL AT NEO-CLASSICAL SCHOOL ALONG GPR LINE, NORTHERN-MOST SECTION ALONG THE MODERN ROAD

Legend:
- Fill/Collapse
- Templar Wall/Construction
- Possible Byzantine Wall