

Identifying the Great Synagogue of Vilnius, Lithuania WITH GROUND PENETRATING RADAR

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ABSTRACT

The Great Synagogue of Vilnius, Lithuania was heavily damaged by the Nazi's during World War II. Following the war, the Soviets destroyed the Synagogue between 1955 and 1957. In 2015, a team of scientists from the United States, Israel and Lithuania attempted to locate the synagogue's foundation by using ground penetrating radar (GPR). GPR is a non-invasive survey technology which can be used to explore the subsurface which will result in further investigation on survey sites. GPR sends electromagnetic waves into the subsurface through antennae, where the waves are reflected back from reflectors under the surface. A pulseEKKO 1000 GPR unit with 225 MHz antennae was used to map six GPR grids. The focus of the analysis of the paper are the results from Grid #2 which has the length of 44 meters long by 10 meters wide, with a transect collected every 0.25 m and a step size of 0.05 m. From preliminary analysis, remains of the synagogue's walls have been located in Grid #2 and further analysis with EKKO_Project software will be able to determine the feasibility to of future archeological excavations. All analysis made will be available on the official project website for the use and reference of the historical scientific community.

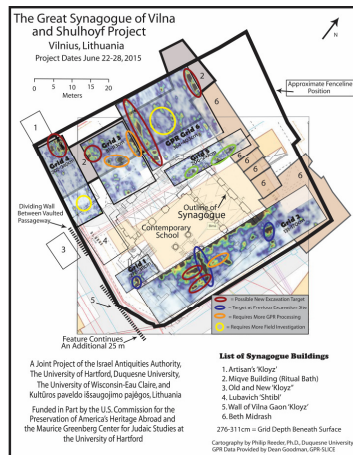


Figure 1: Map depicting the Vilna Synagogue project

INTRODUCTION

A team of scientists in the summer of 2015 started preliminary research to locate the exact position of the Great Synagogue of Vilna in Vilnius, Lithuania. To accomplish this, it was decided to use ground penetrating radar (GPR) as the easiest and most cost efficient method to assist then in the project. GPR uses electromagnetic waves, also known as radio waves, to reflect off objects in the subsurface which is captured by the antenna on the surface. The GPR user then can get a virtual picture of what lies under the earth's surface below them.

METHODS

Programs used:
Ekko_Project LineView
Ekko_Project SliceView
GPF Edit

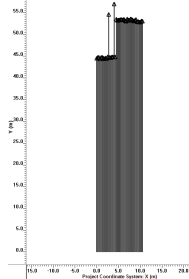


Figure 2: The 43 lines in Ekko_Project

Once the data is collected in the field, all 43 lines of data needed to be analyzed for creating a visualization with Ekko_Project SliceView. The PlanView and LineView features in Ekko_Project were used first to gain an understanding of the data. One can see where the electromagnetic waves reflect off of features and parabola's show areas that have a greater chance of human created disturbances. This kind of feature was what was identified because the synagogue structure is human made.

A GPF file, which creates a GPR file grid, was then created and the lines of data then imported into GPF Edit, which was the first step for viewing in SliceView. It was important to offset the data by -0.25 meters so the lines matched to their location on the grid in which they were collected. Once the orientation was completed the data was opened in Ekko_Project and processed so the visualization in SliceView would work correctly. In SliceView it is possible to move through different layers of the surface to better understand what the two dimensional data in LineView is showing.

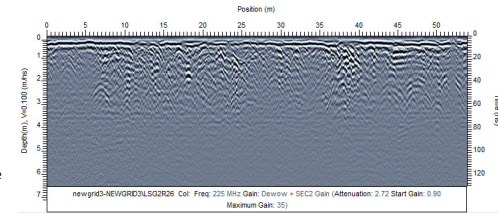


Figure 3: Ekko_Project LineView

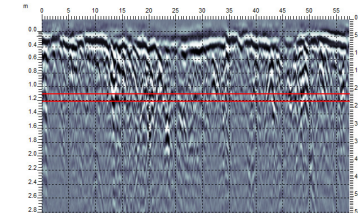


Figure 4: Viewing 2 meters below the surface in Ekko_Project SliceView

RESULTS

After all 43 lines of data of Grid #2 was analyzed in Ekko_Project LineView and SliceView, a few key features were identified. The first was a large rectangle which the center is about 10 meters left (x-axis) and 38 meters up (y-axis) from the 0 point of the grid (Figure 5). It is difficult to understand the exact structure but it is also known that it is about 2 meters below the surface of the earth. This will help the archeologists locate the structure if it decided that this area is of importance.

The other feature of note is a large section of wall which is about 1.2 meters below the earth's surface. This structure runs about 8 meters across (x-axis) and 6 meters down (y-axis) (Figure 5). Other grids also need to be analyzed to see how far this wall section could continue however the school building on the site at present could hamper this.

There is also an object located about 2.4 meters under the surface which is located at about 8 meters right (x-axis) and 16 meters up (y-axis) from the zero point which is located about 0.5 meters under the wall (Figure 7). It is unclear what this object is.

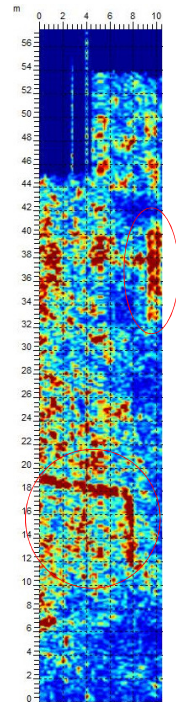


Figure 5: Both sections of the walls are visible in dark red

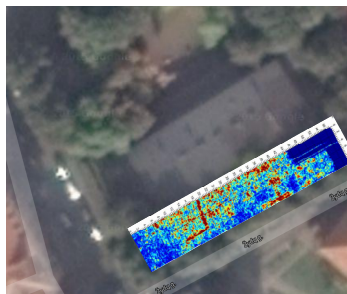


Figure 6: Grid #2 placed on the surface of the earth

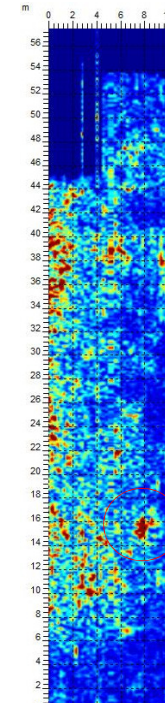


Figure 7: 2.4 meters below the Earth's surface

DISCUSSION

The current work is focusing on the Great Synagogue of Vilna but it is only the centerpiece of the Shulhof of Vilna, a complex of twelve synagogues and other religious oriented structures that surrounded the Synagogue. Since the Great Synagogue is the easiest area to access with GPR technology with the current development patterns of Vilnius, the research has been limited to this site. However, access has been granted to research Grids #1, 3, 4, 5 and 6.

CONCLUSION

Several subsurface structures were able to be identified with using GPR. With these results, an archeological dig will occur starting in the summer of 2016. This project will use the work that has been done and future GPR survey data taken in 2016 with processing to follow. It is hoped that the outcome of this project will reestablish some of the Jewish heritage in Vilnius, Lithuania with the ultimate goal of creating a Jewish Memorial Center at the location of the destroyed Synagogue.

ACKNOWLEDGEMENTS

I would like to thank Alexis Pingel, University of Minnesota- Twin Cities, and Nicole Ward, University of Hartford, for their work in collecting the data in the summer of 2015 and also Harry Jol for making this possible. Finally I want to thank ORSP for providing financial support for this project.

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