

The Monastery of Santa Chiara in Nardó (Lecce, Italy): GPR preliminary results

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Abstract –

The Monastery of S. Chiara of Nardò, the oldest in southern Italy, was erected in 1256, only three years after the birth of St. Chiara in heaven. It was Tommaso Gentile, Count of Nardò, who opened the doors of the medieval city walls to receive the first Clarisse nuns. Following the example of Mother St. Chiara, many young women over the centuries have consecrated their lives at the service of the Lord and of the brothers in the cloister, generous and holy souls among whom Sister Chiara Isabella D'Amato of Secli, who died in the concept of holiness. A study was undertaken in some areas inside of the Monastery to investigate the buried archaeological structures. The ground-penetrating radar analysis showed them to be anomalies likely associated with archaeological remains.

I. INTRODUCTION

Ground-penetrating radar (GPR) is a near-surface geophysical technique that allows archaeologists to discover and map buried archaeological features for landscape analysis in ways not possible using traditional field methods. The method consists of measuring the elapsed time between when pulses of radar energy are transmitted from a surface antenna, reflected from buried discontinuities, and then received back at the surface. When the distribution and orientation of those subsurface reflections can be related to certain aspects of archaeological sites such as the presence of architecture, use areas or other associated cultural features, high definition three-dimensional maps and images of buried archaeological remains can be produced. Ground-penetrating radar is a geophysical technique that is most effective with buried sites where artifacts and features of interest are located within 2–6 meters of the surface but has occasionally been used for more deeply buried deposits.

A growing community of archaeologists has been incorporating ground-penetrating radar (GPR) as a routine field procedure for landscape analysis [1, 2, 3, 4,

5]. The efficacy and applicability of GPR in the detection of buried structures have demonstrated by several authors [2]. Ground-penetrating radar surveys were undertaken in some areas inside the Monastery in order to ascertain the extent and location of oldest structures related to the Monastery and to the Church adjacent to the Monastery. Conclusions from these studies indicate that GPR was the most important tool used to delineate structures and hypogean and to maps and images act as primary data that can be used to guide the placement of excavations.

II. RESULTS AND DISCUSSION

The GPR surveys were carried out with the IDS Hi-Mod system with 600 MHz and 200 MHz antennae. Data were acquired in continuous mode along 0.5m spaced survey lines, using 512 samples per trace, 80 ns time range for 600MHz antenna and 160 ns for 200MHz antenna, manual time-varying gain function. In this paper, the results of area A were shown (Fig. 1).

The data were subsequently processed using standard two-dimensional processing techniques by means of the GPR-Slice Version 7.0 software [6]. On each GPR processed profile (Fig. 2a) hyperbolic shaped reflection events labeled “crypt” are visible. The size is about 6m and the depth of the top is between 0.5m and 0.6 m (with an average electromagnetic wave velocity of 0.1 m/ns). This reflection event was interpreted as probably due to a buried crypt. In Fig. 2b the data set is displayed with iso-amplitude surfaces using four threshold values 60% of the maximum complex trace amplitude. Lowering the threshold value increases the visibility of the main anomaly and smaller objects, but also heterogeneity noise.

Relatively strong continuous reflections are visible on the threshold volumes. In this case, the shape and dimensions of the crypt are clearly evidenced. The analysis of the GPR data acquired with the 200MHz antenna does not do information about the deeper buried structures.

III. CONCLUSIONS

The GPR survey allowed the acquisition of new data about the archaeological buried structures. In the area A several reflection events were underlined. The reflection event labeled crypt in Fig. 2a shows a changing in the polarity of em wave. This important event could be related to a strong changing in the em properties of the

subsoil. For example the presence of voids [4, 5]. The 3D iso-surface representation highlights the presence of empty space.

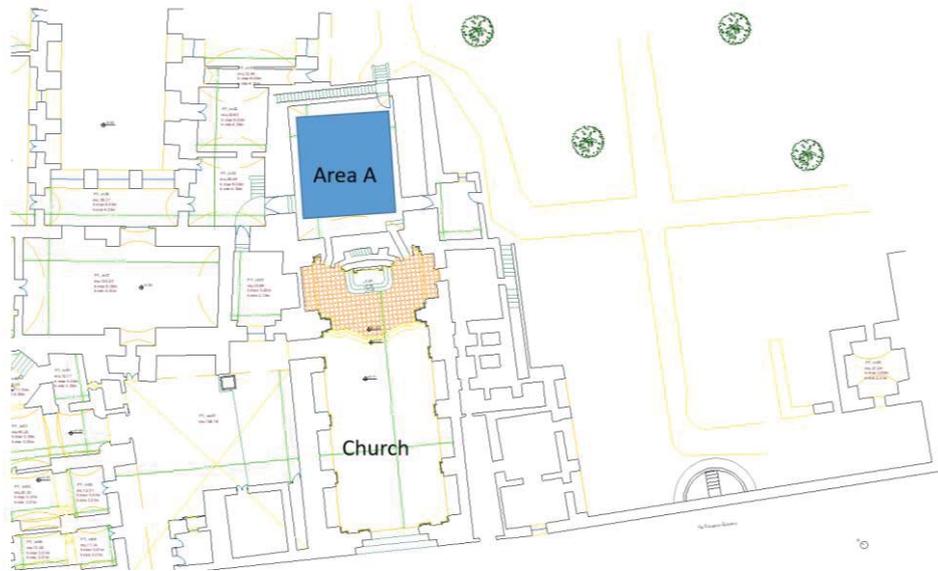


Fig. 1. The surveyed areas

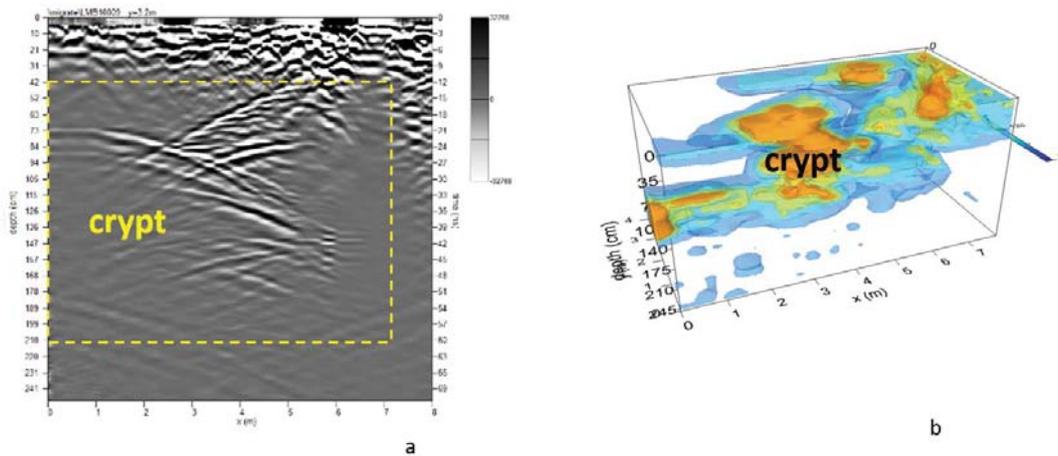


Fig. 2. a) GPR processed section; b) 3D iso-amplitude volume

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