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Geophysical surveys in the external areas of the Basilica of St Nicholas (Bari, Italy)

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Abstract –
In this paper, we present the results of a non-destructive ground penetrating radar (GPR) survey performed in the external areas of the Basilica of St Nicholas in Bari, Italy. The aim was to investigate the presence of features of archaeological interest. The ground-penetrating radar analysis showed them to be anomalies likely associated with archaeological remains.

I. INTRODUCTION

The Basilica of St Nicholas is located in the Bari city, (Italy), on the Adriatic sea (see Fig. 1), and originally was not a church. In particular, around the year 1000, when a large part of southern Italy was enclosed in the Byzantine Empire, the Basilica was the residence of the Byzantine governor, which made Bari an important town from a political and economic point of view. However, in 1071 the Normans conquered this area, and a series of political events after this conquest (whose details, of course, are avoided) eventually made Bari quite marginal and peripheral concerning the role it used to have during the Byzantine period. The area adjacent to the Basilica could hide important structures related to the oldest settlements.
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].
The GPR surveys were undertaken in some areas outside the Basilica to ascertain the extent and location the oldest structures related to the oldest settlement.

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 Reflex 8.0 software. On each GPR processed profile (Fig. 2a) hyperbolic shaped reflection events labeled “W” are visible. They size is about 0.4m and depth between 0.8m and 1.4 m (with an average electromagnetic wave velocity of 0.06 m/ns). These reflection events were interpreted as probably due to buried walls. In Fig. 2b the data set is displayed with time slices. Relatively strong continuous reflections are visible on the slices. In this case, the shape and dimensions of the walls are clearly evidenced.

III. CONCLUSIONS

The GPR survey allowed the acquisition of new data about the archaeological buried structures. In this paper, we have shown the results of the prospecting outside the Basilica of St Nicholas in Bari. The GPR methodology

allows us to locate buried archaeological remains. The existence in the radar sections of many hyperbolic anomalies, due to small inhomogeneities, made it possible to perform an EM-wave velocity analysis. This, in turn, made it possible to estimate the depth of the buried structures.

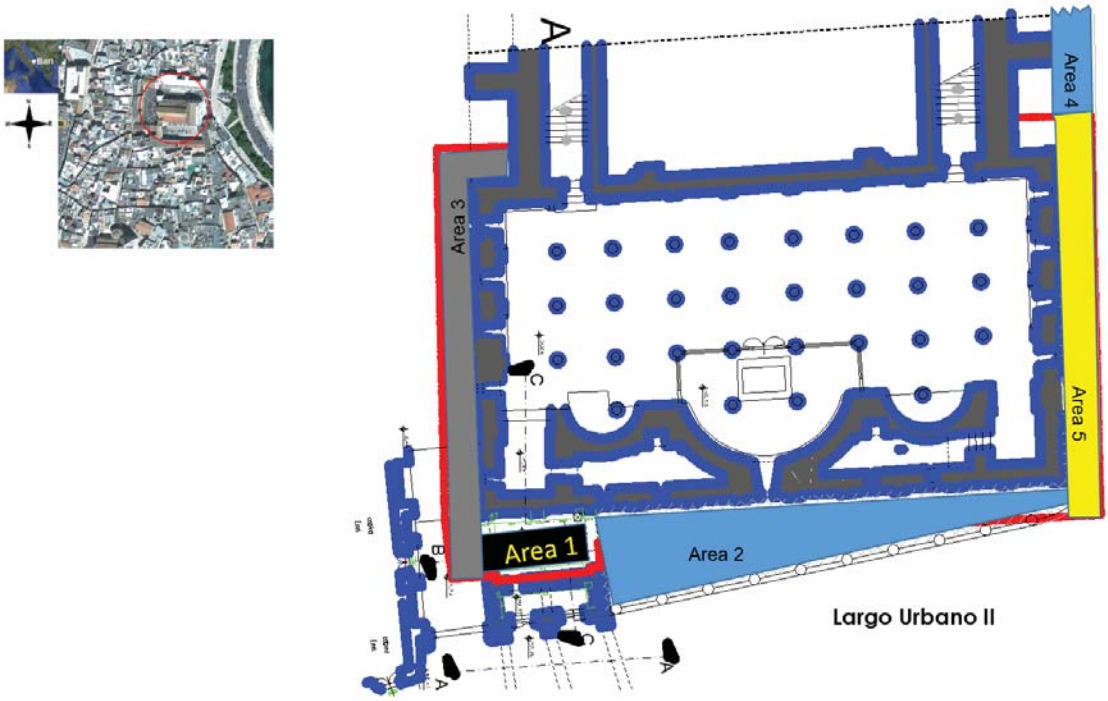

Fig. 1. The surveyed areas

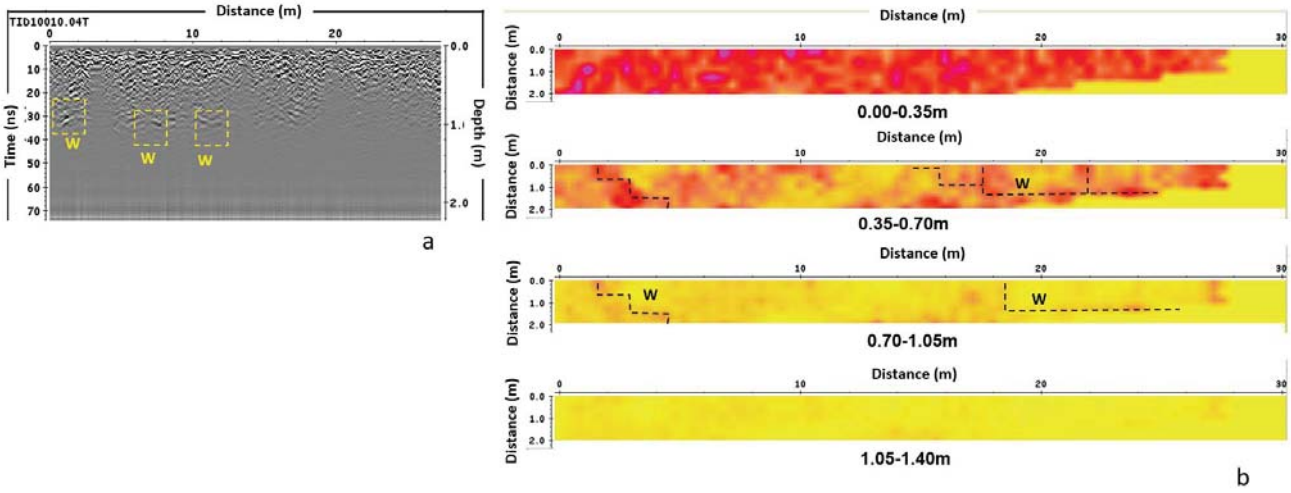

Fig. 2. a) GPR processed section; b) 3D visualization by using time slices

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