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Ground-penetrating Radar survey at the Basilica of Santa Caterina D'Alessandria (Galatina-Italy)

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Abstract **–The basilica of Santa Caterina D'Alessandria was built between 1369 and 1391, by order of Raimondello Orsini del Balzo. These, on one of his many journeys, returning from the Crusades, went as far as the summit of Mount Sinai to pay homage to the body of Saint Catherine. The building, on Raimondello's death in 1405, will be completed by his wife, Princess Maria d'Enghien, and then by his son, Giovanni Antonio Orsini Del Balzo. A study, using ground penetrating radar tecnique (GPR) was undertaken inside the Basilica in order to investigate the oldest structure of the church. The GPR analysis showed a series of anomalies that could be related to the old plant of the basilica.**

I. INTRODUCTION

The basilica of Santa Caterina d'Alessandria, one of the most famous monuments of Apulian Romanesque and Gothic art in Apulia region, is a building in the historic center of Galatina (Figure 1). The basilica was built between 1369 and 1391, by the will of Raimondello Orsini del Balzo.

The hypothesis is that the basilica was built on a pre-existing Byzantine church of Greek rite dating back to the IX-X century whose traces could be on the right side of the external wall in which a nave is visible which is assumed to have been incorporated into the current basilica, probably to save building material (Figure 2).

Ground-penetrating radar (GPR) measurements were undertaken in order to have information about the oldest structures related to the Basilica. GPR is well known that is a near-surface geophysical technique that allows to investigate and map buried archaeological features and the conservation state of some building structures [1]. The method consists of measuring the travel time of the radar energy pulses 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 structures, or other associated cultural features, high definition three-dimensional maps and images of buried archaeological remains can be produced.

A growing community of archaeologists, architect and restores has been incorporating GPR as a routine preventive procedure for landscape and structural analysis [1, 2, 3]. The efficacy and applicability of GPR in the detection of invisible structures have demonstrate by several authors [2].

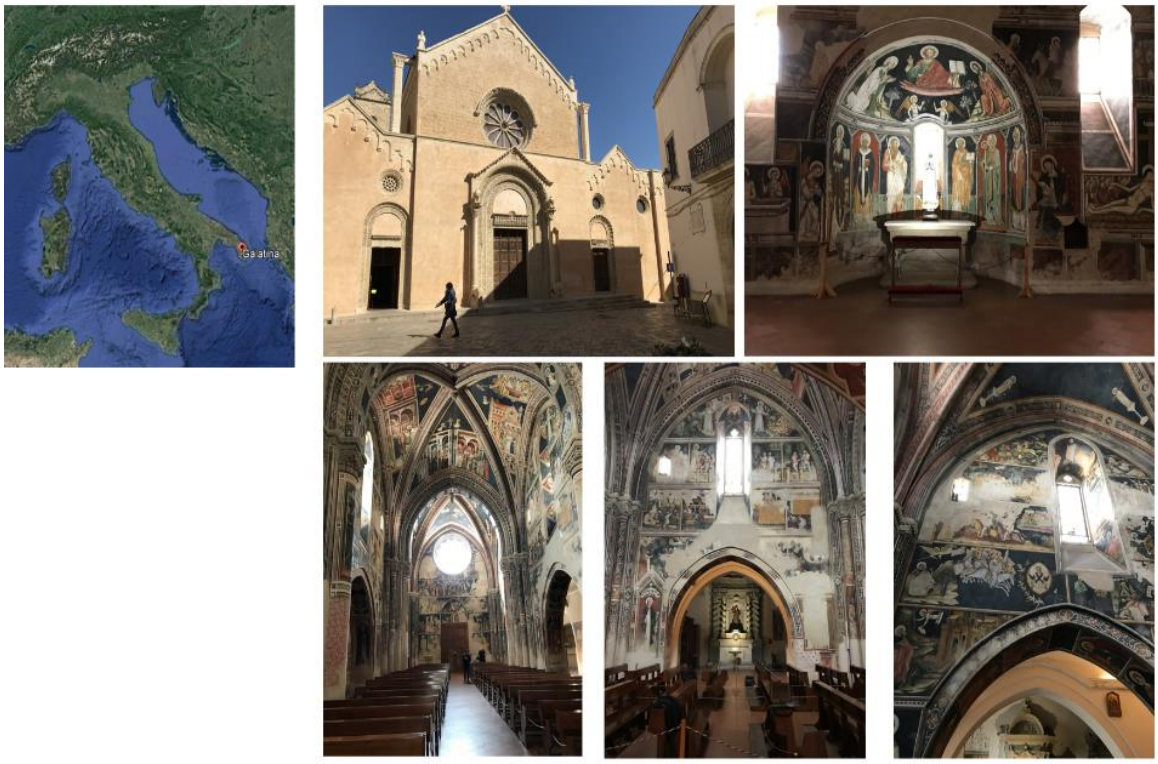

Fig. 1. Basilica of Santa Caterina (Lecce, Italy) with the inside beautiful frescoes.

Fig. 1. The Cathedral of Nardò

a b

Fig. 2. The right side a) external, b) internal where the nave is visible

II. GEOPHYSICAL DATA PROCESSING AND INTERPRETATION

GPR data were acquired with a georadar Ris Hi Mod equipped with the 200-600 MHz dual band antenna. Data were acquired in a grid with parallel profiles spaced 0.25 m.

The quality of the raw data was moderate thanks to a series of expedients adopted in the acquisition phase. However, in order to try to eliminate a noise component, present in the data, and to allow simple interpretation of the data themselves, a processing was carried out [1].

The planimetry of the profiles, acquired in a grid with a step of 0.25m, made it possible to spatially correlate, in a 3D way, the anomalies present on each section using the analysis of the amplitude of the events reflected within assigned time intervals (time slices) [2, 3].

The type of analysis applied to the study area gave satisfactory results. Amplitude slices were constructed at about 0.17m intervals. The blue color indicates a weak amplitude of the reflected signal (substantially homogeneous material); the colors from light blue to more intense red indicate variations in the amplitude of the reflected signal and therefore the presence of significant electromagnetic discontinuities. The variations in amplitude (therefore in colour) in the same slice indicate horizontal variations in the electromagnetic characteristics of the medium being investigated. Figure 3 shows the amplitude slices relating to the 600MHz antenna. In them, it is possible to identify, at depth between 1.87 m and 2.06 m, an area indicated with A relating to probable old structure of the church.

this hypothesis is supported by the fact that in correspondence with the lateral apse the GPR investigations on the wall have highlighted the presence of a vertical masonry (Figure 4).

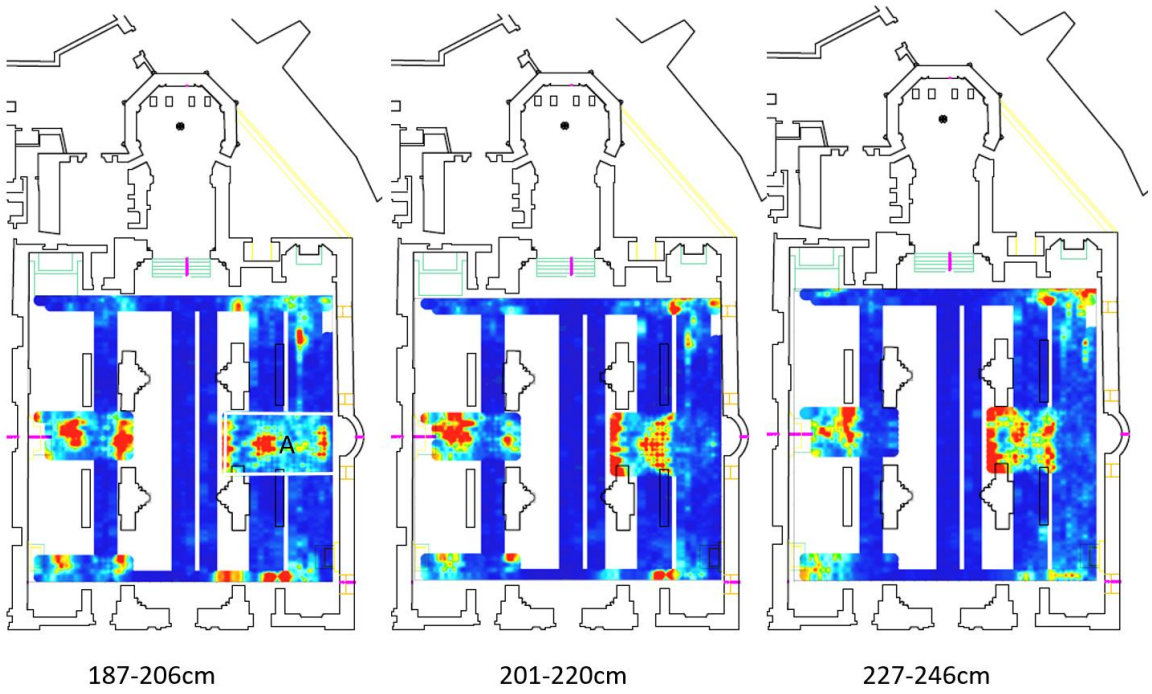

Fig. 3. depth slices superimposed on the planimetry (600MHz antenna), A indicate structures of probable archaeological interest

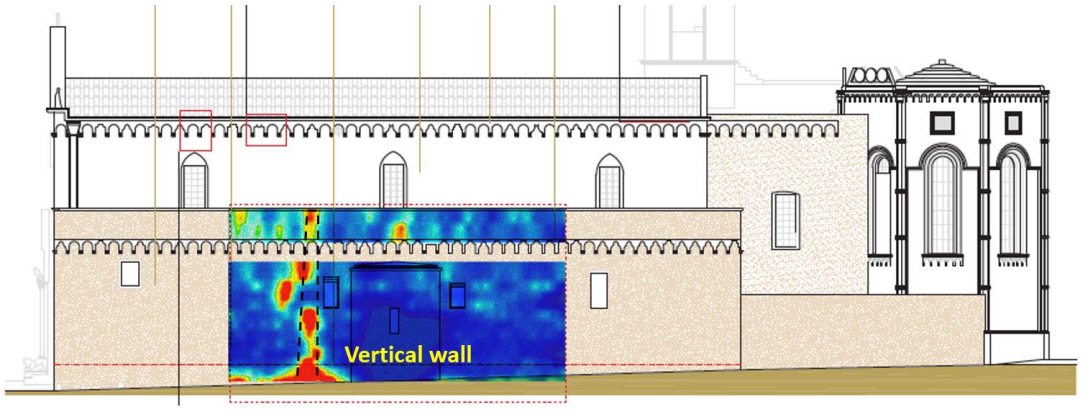

Fig. 4. depth slices superimposed on the external walls

The visualizzation as iso surfaces amplitudes [1] allow to well evidenced in a 3D way the buried structure A (Figure 5).

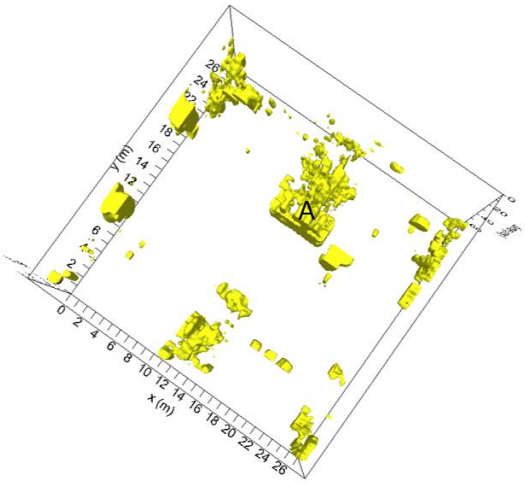

Fig. 5. 3D visualization as iso surfaces

III. CONCLUSIONS

The geophysical investigations have provided good results regarding the identification of structures present in the subsoil of the Basilica. The GPR method made it possible to extend the investigation to a depth of approximately 2.5 m, highlighting anomalies probably attributable to structures related to the oldest church.

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