

Ground-penetrating Radar surveys in the Lecce Cathedral

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Abstract – GPR surveys were carried out in the Baroque Cathedral of Lecce and in its crypt built in the 12th cent. and transformed in the 16th and 17th centuries. The investigations highlighted the presence of many unknown structures under the floor of the church. Some of them could belong to the previous building of the Romanesque period, while most of the anomalies are related to tombs and underground chambers (ossuaries) located under the floor of the Baroque church. Moreover, six tombs of the 19th and 20th centuries and other ancient structures were documented under the crypt floor.

I. INTRODUCTION

GPR surveys were performed in the Lecce Cathedral previously of restoration works that involved the crypt located under the transept. These investigations are part of a research project, started in 2013 by the Institute for the Archaeological and Monumental Heritage of the National Research Council of Italy in cooperation with the Department of Cultural Heritage of the Salento University, aimed at studying the transformations of Lecce from the Messapian era to the Medieval period and the creation of an archaeological map of the city. In particular, the GPR surveys inside the 17th cent. Cathedral were aimed to document the presence of unknown structures under the floors of the church and the crypt.

II. STUDY AREA

Lecce Cathedral is located in the centre of the city, on the south-eastern corner of a square where other edifices are built, including the bell tower, the bishop's residence, and the seminary [1,2,3]. The Cathedral, dedicated to the Assumption of the Virgin Mary, was first built in 1144 by bishop Formoso. In 1230 it was rebuilt in Romanesque style by bishop Voltorico. After the demolition of the previous building in 1658, it was rebuilt once again in Baroque style in 1659 by the architect Giuseppe Zimbalo and by order of bishop Luigi Pappacoda. It was completed

in 1670 and this is the building now preserved.

In the 13rd cent., the church had a Latin cross plan with three naves divided by columns (Fig. 1); three apses were at the end wall of the transept, while chapels were along the external naves. A bell tower was in the south-western corner of the building, close to the façade. A 12th cent. crypt was under the transept; transformed in the 16th cent., it has an elongated rectangular shape and it is divided in three naves characterized by 54 columns and 38 semicolumns.

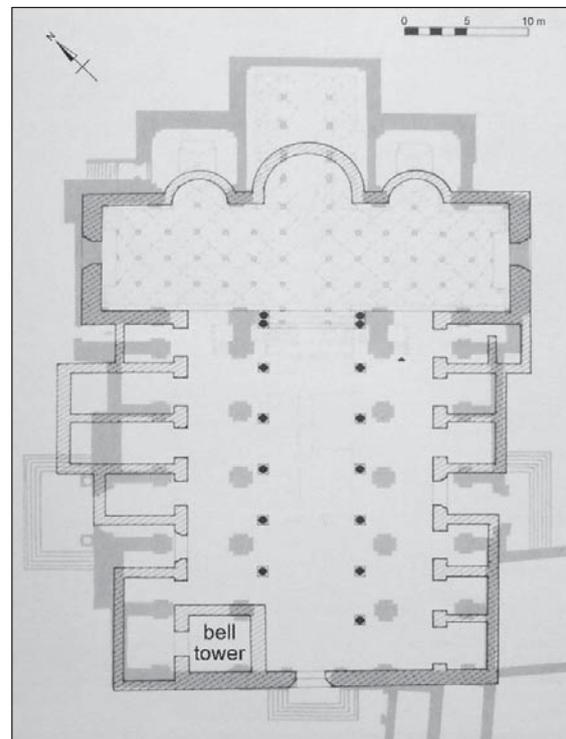


Fig. 1. Plan of the Lecce Cathedral. Hypothetical reconstruction of the church in the 13rd cent. (in black) overlapped on the plan of the church of the 17th cent. (in grey); also the crypt under the transept and the choir is documented (after Cazzato, Fagiolo 2013, fig. 12).

In the 17th cent., the church preserved the Latin cross plan with three naves, which were divided by pilasters and enlarged. The apses were extended and transformed into quadrangular shaped spaces: a choir was built in the central one, behind the altar, while two chapels dedicated to Saint Orontius and the Assumption of Mary were in the external ones. Other ten chapels are along the external naves and the shorter sides of the transept. Baroque modifications also involved the crypt, where some altars were built in this period. A new bell tower was built by Zimbalo in 1661-1682: it was separated from the church and located north-west of the transept.

III. GEOPHYSICAL INVESTIGATIONS

The georadar investigations were performed in 2008 in the crypt using the GSSI Sir 3000 with the 270MHz antenna and in 2017 in the church using the Ris Hi Mod (IDS) georadar equipped with the dual band antenna 200 and 600 MHz. In the both surveys the GPR data acquisition were performed along contiguous parallel profiles 50 cm wide, 512 samples per trace. The data were processed by background removal, bandpass filtering and migration [4,5].

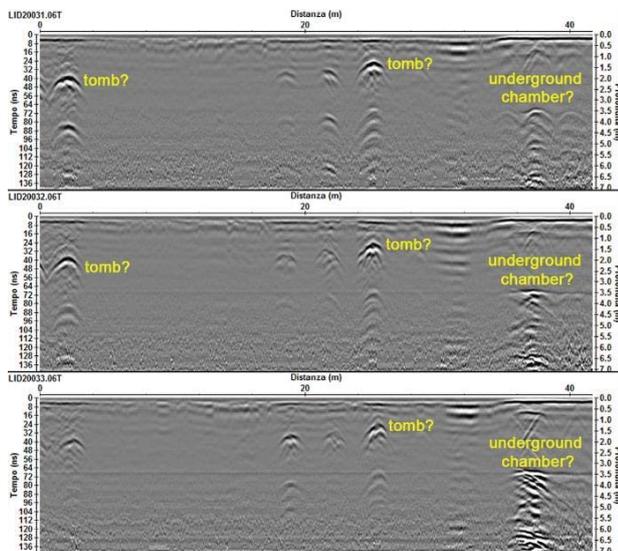


Fig. 2. Lecce Cathedral: GPR profiles along the southern nave (200 MHz antenna).

IV. RESULTS AND DISCUSSION

The GPR results highlighted a series of anomalies regarding various structures under the church floor (Figs. 2, 3, 4), which correspond to the already known crypt under the transept and to other unknown ancient structures under the three naves: tombs, masonries and especially underground chambers. Some of the last ones, located under the central nave (Fig. 3, A) and accessible from the crypt, were investigated by archaeologists after the

geophysical surveys: inside them, numerous human bones have been found, suggesting also the presence of a putridarium. This is a temporary burial place, in which bodies, commonly of monks or nuns, can be stored in wall niches, often seated on masonry chairs with a central hole and vessel to collect the liquids of decomposition; once the bodies have reached a proper stage of decomposition, the bones are collected, cleaned, and stored in an ossuary. Other possible underground chambers, which could also reuse the masonries of the previous Romanesque church that survived demolitions, are also at the westernmost sector of the southern nave and in the central sector of the northern nave (Fig. 4). Moreover, other anomalies probably concerning an underground chamber are in the westernmost sector of the same northern nave, where the bell tower of the previous church was constructed.

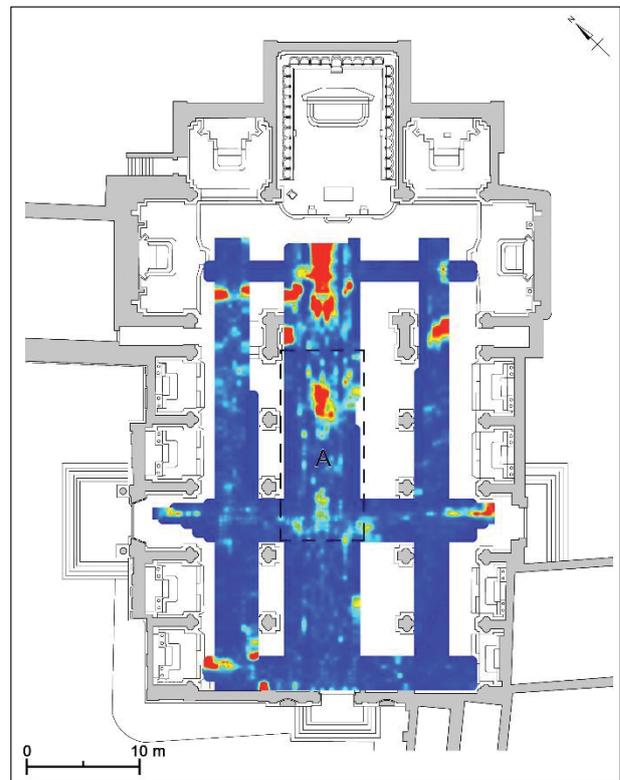


Fig. 3. Lecce Cathedral: GPR time slice (200 MHz antenna; depth corresponding to 1.42-1.92 m).

The GPR investigations inside the crypt highlighted other anomalies regarding underground tombs and structures (Figs. 5, 6), integrating the results of a previous research [6]. In particular, at a little depth, immediately under the floor, are visible the anomalies regarding the tombs of Bernardini Family (undated), Michael Mincuzzi (1988), and Martirano (1858), in the southern nave (Figs. 5, nos. 2-3), and of an unknown person or family in the northern nave (Fig. 5, no. 6); their presence is suggested by the tombstones that are in the floor of the crypt, above or near the tombs. Only at greater depths, over two meters,

anomalies probably linked to the tombs of Marasco-Specchia (1838) and Raffaele Perulli (1858) are visible in the southern apse (Fig. 6, nos. 4-5). Moreover, other anomalies probably linked to buried ancient structures are visible at a depth of about 2.5 m (Fig. 6, A).

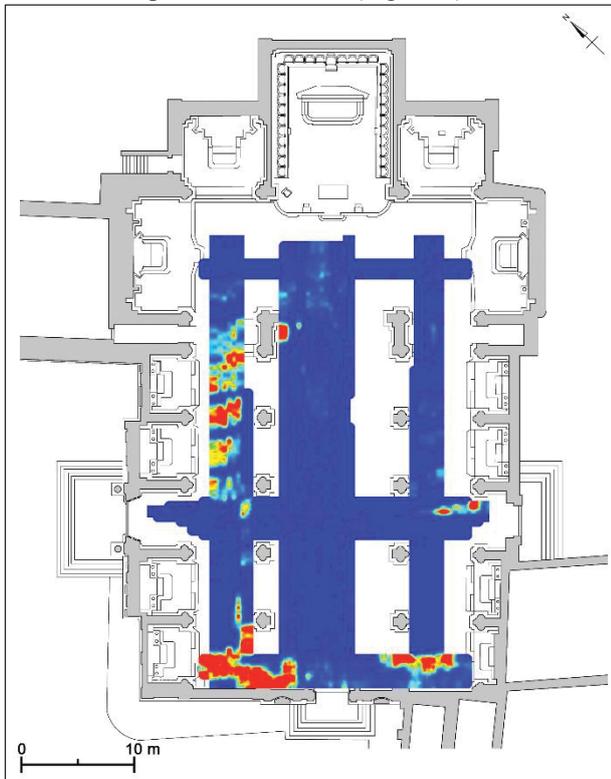


Fig. 4. Lecce Cathedral: GPR time slice (200 MHz antenna; depth corresponding to 5.29-5.79 m).

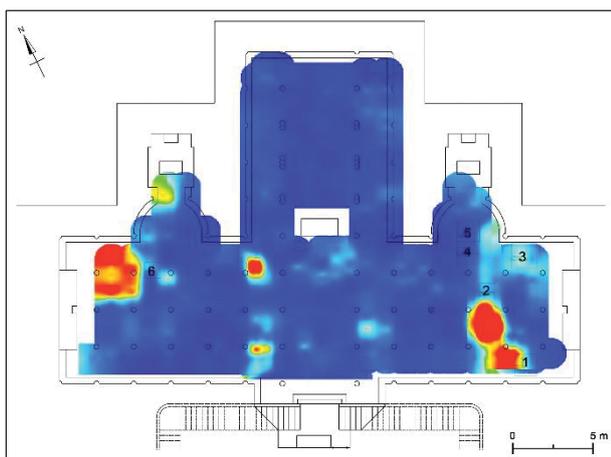


Fig. 5. Lecce Cathedral, crypt under the transept: GPR time slice (200 MHz antenna; depth corresponding to 0.34-0.81 m). The numbers indicate the tombstones in the floor.

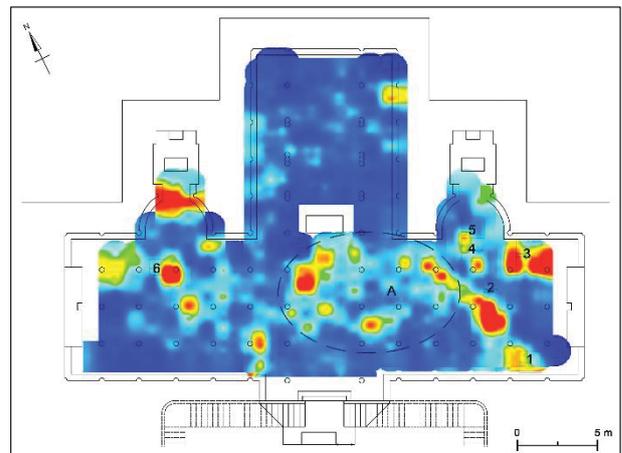


Fig. 6. Lecce Cathedral, crypt under the transept: GPR time slice (200 MHz antenna; depth corresponding to 2.39-2.86 m). The numbers indicate the tombstones in the floor.

V. CONCLUSIONS

GPR surveys in the Baroque Cathedral of Lecce highlighted the presence of many unknown structures under the floor of the church. Some of them could be belong to the previous building of the Romanesque period. Most of the anomalies are related to tombs and underground chambers located under the floor of the church, which in the central nave are also investigated by archeologists who highlighted their ossuaries function and suggested also the presence of a putridarium. Moreover, the presence of other tombs of the 19th and 20th centuries under the crypt floor was documented by GPR investigations, which also highlighted some anomalies probably linked to ancient buried structures.

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