Short Paper

The Underground Church of Piedigrotta in Pizzo (VV)

A Digitalization Project Between Drawing and Matter

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Introduction

The subject of the analysis[1] is the underground church of Piedigrotta near Pizzo (VV), a city on the Tyrrhenian side of southern Calabria. It is a suggestive negative architecture, both enigmatic in its genesis, both interesting from a touristic and cultural standpoint[2]. Compared to the Calabrian underground cultural heritage, which is scattered from north to south with hypogeum of different nature, age and intended use, this underground church is unique for its location close to sea level, and for its construction history, which is not yet sufficiently documented. The church as museum is managed by a local cooperative, which checks the accesses and safeguards the integrity of the site. The site, reworked over the time, still represents an important resource for the city and for the community of believers, that goes there in devotion. The study involved the morphological analysis of the artefact through digital survey. Consequently, virtual products have been created that are useful for the fruition of the site and for its knowledge, both for scholars and a wide audience.

Fig. 1. Main elevation. Point cloud post-processing. (© L. Pizzonia).

[1] This work is a case study developed in occasion of a degree thesis, that was discussed at the "Mediterranean" University of Reggio Calabria, Department of Architecture and Territory. Thesis discussed on June 8, 2021. Supervisor: Prof. Arch. Gaetano Ginex; Co-supervisor: Arch. Francesco Stilo; Graduating: Lorella Pizzonia.

[2] The church is included in the list of architectural and/or monumental cultural heritage, protected by specific ministerial decrees pursuant to Law 1089/39 cultural heritage, whose protection is the exclusive responsibility of the state authority. QTRP tome 1 – cognitive framework. Regional Urban Planning Tool.

Description and historical information

Visited annually by thousands of tourists, the church is located in a high and rocky stretch of the coast. The access is via a staircase that leads from the street level (+31.00 m asl) to the actual entrance to the cavity (+3.50 m asl); it is a path that finally, after a few steps carved into the limestone, leads up to the beach and ultimately to the sea. The church has a single façade above ground, which was partly modelled in the rock and partly made of mixed masonry of rough stone and bricks; a wall facing about 80 cm thick (Figure 1). The interior is divided into different environments, even at different heights, and probably excavated in different periods. The main one has a length of about 17 meters, and houses on the bottom the altar with the painting of the Madonna.

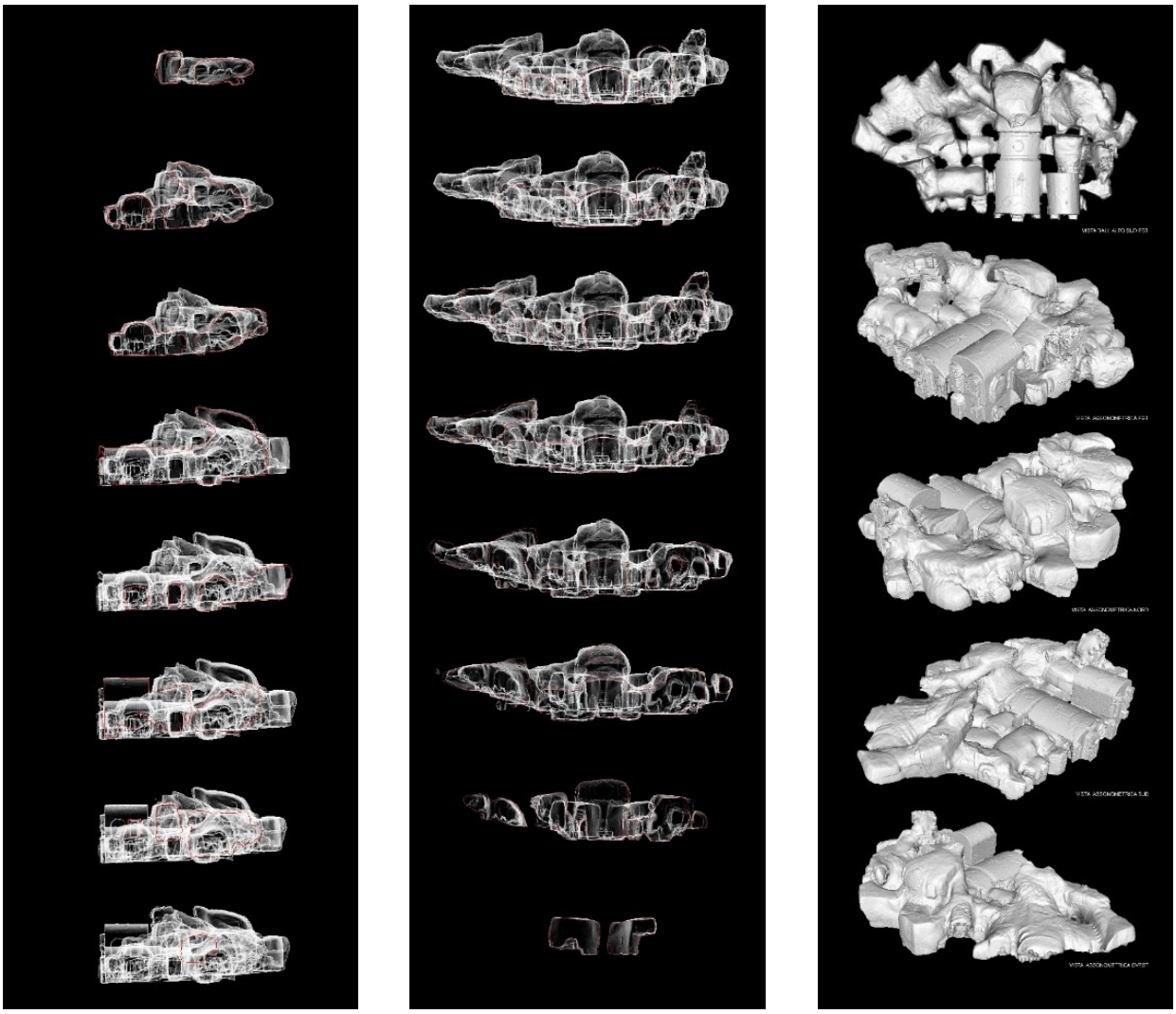
The first direct documentary source attests the presence of the church starting from 1725 (Tranquillo, 1725, p. 63), although numerous clues and indirect sources suggest a much older realization. Currently, what is certain, is that the cult of this sacred place, which was born in a small fishing village, is linked to the legend of a shipwreck and to the veneration of the painting of the Madonna di Piedigrotta. However, it was at the end of the 19th century that a local artist, Angelo Barone, decided to transform the cave, enlarging it and creating statues. After Angelo's death, it was his son Alfonso who continued the work, creating further statues. Other interventions are recorded in 1968 by a descendant of the Barons. These interventions, although they have upset the primitive aspect of the structure, thus hindering the analysis for its understanding, have made the environment a very characteristic site. The photographer Federico Patellani, in 1952, dedicated several shots to the church in his reportage "Southern Italy, magical Italy".

From matter to virtual

There are several aspects that led this study not to take into consideration only the tools offered by traditional surveying. Although the relationship with the place plays an important role for a visitor, virtualization allows an equal fruition of the church, as well as allowing the analysis not of individual parts, but of the totality of the existing volume as a result. It is necessary to build a digital archive for cultural dissemination and to preserve, fix at a given moment, an architecture in a parallel digital world, which can be considered its identity card, and which can be consulted in its parts and navigable in its wholeness.

Digitalization

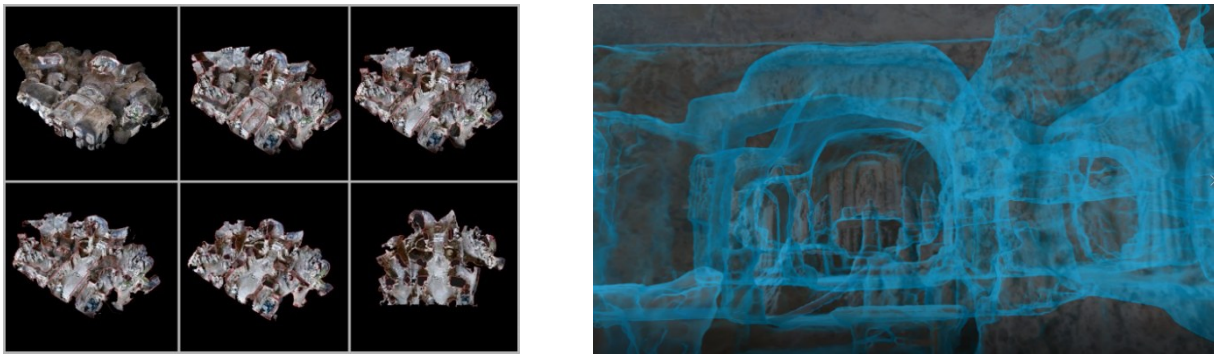
The digital architectural survey was designed and performed with Structure From Motion (SFM) Technology, a low-cost technique that combines the principles of classical photogrammetry with the most recent developments in computer vision (Stilo, 2020, p. 39). The technique is well suited to be used in environments characterized by rough surfaces and uneven floors. A photographic survey campaign was planned, in order to evaluate the most difficult points to reach and paying attention to sunlight. In succession this part of the work involved the calculation of the key points, the dense cloud, the 3D model and the textured model. At this point the camera goes from being a machine for capturing reality to becoming a machine for projecting reality (De Luca, 2011, p. 24).



a *b* *c*

Fig. 2. Digitalization a) cross X-Ray sections; b) longitudinal X-Ray sections; c) Plaster Digital Model. (© L. Pizzonia).

From an initial data processing, with photogrammetry software and CAD it was possible to obtain some preliminary information on the internal scanning of the spaces, highlighted by the processing of the point cloud. It is quite easy to produce, in a relatively short time, a complete documentation of the artifact, through a constant comparison between 2D and 3D representations, as well as between reality and model. A three-dimensional documentation was produced, able to tell the negative architectural form of this church-cave. The concepts of Plaster Digital Model (PDM), a visualization that recalls the idea of the plaster cast, and of X-Ray sections, a graphic solution that recalls the X-ray plates or the results of a CT scan, were devised (Figure 2). The PDM and X-Ray sections are contrasting concepts, used to symbolically represent the body and soul of the church: a solid body to recall the idea of the plaster cast and its roughness, and a liquid soul to take a look through the hollow body. Images have been prepared, to photograph the interior of the cavity that can be explored in point cloud mode, a solution that enhances the almost magmatic features of the surfaces and the irregularity of the environments.



a *b*

Fig. 3. Virtualization. a) frames taken from the multimedia section; b) frames taken from the video in transition. (© L. Pizzonia).

Virtualization

The data collected during the digitization phase was further processed with modelling and video programs. The digitization process has made it possible to create a multimedia section, materialized in a film that allows a complete view at different altimetric levels. The virtual movie, which can be explored in different ways, shows the interior spaces, even those closed to the public, and was created by navigating the model in its various consistencies (Figure 3). The realization of a virtual tour opens to a more accessible use of the church, inaccessible to the public in certain environments, due to their intrinsic fragility[3]. Beyond the contingent data, the pandemic one, the creation of a virtual tour aims to guarantee accessibility to the hypogeum even in the periods of scheduled and extraordinary maintenance, and to make the church open also to those users who due to disabilities cannot access it. In any case, the choice of making a virtual tour using specific software is matched by the possibility of study and use by groups of users with different interests.

Conclusions

Creating the virtual movie has proved of great help, especially during the unprecedented times of the pandemic, improving the capability of the site to accommodate new ways of fruition and discovery. The target of the operation is vast, in fact, if on the one hand it was decided to advance the state of the art on the knowledge of the church, providing the scientific community with graphic drawings with a high degree of detail and precision, on the other, through the realization of the virtual movie, the church has come closer to the general public[4]. More generally, faced with a monument so little investigated and with such an unclear history, digital survey, representation, virtualization, are the tools that have made it possible to understand and tell something more about a site that is still so enigmatic.

[3] The sedimentary rock, so easy to excavate, is at the same time subject to erosion phenomena; furthermore, being formed by large and medium-sized granules interspaced by air pores, it allows water infiltration, with the need for periodic maintenance to ensure its conservation.

[4] The architectural survey took place when the church was closed to the public, courtesy of the Kairos cooperative. The alarming levels of pandemic spread have led the church to increasingly restrictive levels of use, in line with state directives. Lastly, it should be noted that the transmission of the covid-19 virus is dangerously accentuated in underground environments, due to the lower air exchange of these environments, and in this case also due to spaces which, without the aid of contingent entrances, do not allow for adequate social distancing.

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Conflict of Interests Disclosure

No conflicts of interest are reported.

Author Contributions

Conceptualization, Formal Analysis, Funding acquisition, Project Administration, Resources, Writing – original draft, Writing – review & editing: Pizzonia L., Stilo F.
Data curation, Investigation, Software, Visualization: Pizzonia L.
Supervision, Methodology, Validation: Stilo F.

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