EGE - Revista de Expresión Gráfica en la Edificación, Nº 17, 2022. ISSN: 2605-082X
https://doi.org/10.4995/ege.2022.18902
APEGA, UPV

FROM DIRECT TO DIGITAL SURVEY. THE ABBEY OF SAN GIOVANNI BATTISTA IN LUCOLI (L'AQUILA)

Stefano Brusaporci[a], Andrea Ruggieri[b]

[a] Department of Civil, Construction-Architectural and Environmental Engineering, University of L'Aquila, Italia. Stefano.brusaporci@univaq.it
[b] Department of Biosciences and Territory, University of Molise, Italia. andrea.ruggieri@unimol.it

Abstract

Lucoli is a scattered municipality in the area of L'Aquila, in the Italian region of Abruzzo. In this place between the mountains of the *conca Aquilana* stands the Abbey of San Giovanni Battista, an important historic and religious site. Despite the damage suffered caused during the 2009 earthquake, the local people still use it and look at it as a symbol of community. With the aim of analyse and so mitigate the seismic vulnerability, the abbey has been the subject of an architectural survey with direct method in a first step, and then of digital laser scanning survey at a later stage, to integrate and verify the first.

Keywords: Local heritage; Laser scanner; Heritage conservation; Architectural survey.

*Correspondence author: Andrea Ruggieri, andrea.ruggieri@unimol.it
Received: 02 December 2022, Accepted: 26 December 2022, Published: 31 December 2022

1. INTRODUCTION

The Lucoli territory has an interconnected history with L'Aquila, because of the special connection between the city and its countryside, a peculiar characteristic of the foundation city. The first documental evidence of the abbey dates back to 1077 (Muratori, 1741), and its importance is highlighted by the role played in the new foundation of the city of L'Aquila: the Abruzzo's capital was built by the population of the castles around the territory - popular tradition speaks about 99 castles (Clementi, 1998), meaning the villages of the countryside, each one with his castle, therefore the legend of the number 99 recurring in the city – to which was provided a space – called locale – where to settle and built a church. The *intra moenia* church built by the lucolan population was entitled to San Giovanni just like the *extra civitatem* abbey, so becoming the *capoquarto* (head-of-quarter) church. The abbey mantains importance during the medieval times, being affected by expansion intervention between the XII and the XIV century (Marcotulli, 2009) and then enriched with decorative apparatus in modern era (Mancini, 2001). Nowadays, the architectural complex is composed by overlapping and flanked buildings, after a series of constructive modifications, expansions end restorations, due to historical and recent earthquakes.

Within the framework of a research study, the abbey was subject of integrated (direct and laser scanning) survey - throughout various campaigns during the spring of 2019 – with the aim of obtain a complete study and documentation of the case of study after the 2009 and 2016 earthquakes, and so a solid base on which develop an analysis for the mitigation of the seismic vulnerability of the complex.

2. THE INTEGRATED SURVEY

2.1 DIRECT SURVEY

The first phase of the direct survey was to build an external polygonal with 18 points. From these, the principal footprint points were taken, and so has been realized an interior polygonal, to survey the inner spaces through trilateration. The heights were taken using measuring rods, laser distance meter, plumb bobs and triplometers. For arches and vaults survey, the axis lines were marked on the ground and so were taken fixed pitch heights.

2.2 LASER SCANNING SURVEY

The digital survey was performed with a phase difference laser scanner FARO Focus S70, equipped with an integrated HDR camera to capture also chromatic information.

Given the extension of the complex, the survey was planned to be realized in three campaigns, one for the exterior and two for the interiors, to reach a total of 77 scans, to obtain a point cloud with minimized shadow areas and and uniform point density (Bianchini et al., 2015). The scanning parameters (point density, metric quality, RGB features) were ranged depending on the dimensions of the spaces, their complexity and the lighting conditions.

After the data acquisition, the post-processing of the point cloud has been carried out in the software SCENE 2018 (version 2018.0.0.648). The first step is to process the raw data taken by the scanner, obtaining the individual clouds, applying them the RGB information by overlapping the cloud with the spherical HDR panorama composed by a stitching process, and also automatically detecting the spherical targets used during the acquisition. Right after, the registration phase was realized with an automatic target-based method, including the scans for each campaign, obtaining three registered clouds. Subsequently, a cloud-to-cloud visual registration was performed within the three clouds of the three campaigns, obtaining a total registration. The last step is to create the final point cloud, by merging all the registered clouds leading them to a single coordinate reference system, applying filters to enhance the uniformity of the point density and also of the RGB values. This final cloud consists of 1.833.460.115 points.

3. RESULTS AND CONCLUSIONS

The integration between the methods was realized using the point cloud to refine and confirm the results of the direct survey, and also to complete it regarding parts hardly reachable due to its conformation or the risk level, therefore resulting in complete architectural plans being a strong knowledge base (Docci & Maestri, 1994) of the case of study, as far as a base for the analysis of the seismic vulnerability, in order to encourage a tangible conservation of this important piece of local heritage.

REFERENCES

Clementi, Alessandro. 1998. *Storia dell'Aquila. Dalle origini alla prima guerra mondiale*. Bari: Laterza.

Bianchini, Carlo, Ippolito, Alfonso, Bartolomei, Cristiana. 2015. "The Surveying and Representation Process Applied to Architecture: Non-Contact Methods for the Documentation of Cultural Heritage". In Brusaporci, Stefano, ed. *Handbook of Research on Emerging Digital Tools for Architectural Surveying, Modeling, and Representation*., Hershey (PA): IGI Global, pp.44-93. https://doi.org/10.4018/978-1-4666-8379-2.ch002

Docci, Mario, Maestri, Diego. 1994. *Manuale di rilevamento architettonico e urbano*. Bari: Laterza.

Mancini, Renzo. 2001. *San Giovanni Battista di Lucoli. Storia, cronologia, restauro*. L'Aquila: Japadre.

Marcotulli, Chiara. 2009. "Lo viscovo e lo abbate, ambo con le mitre, stavano cantulato. San Giovanni Battista di Collimento di Lucoli dentro e fuori le mura dell'Aquila: luoghi del potere e maestranze". In Volpe Giuliano, Favia Pasquale, eds. *V Congresso Nazionale di Archeologia Medievale*. Firenze: Insegna del Giglio, pp. 767-772.

Muratori, Anton Ludovico. 1741. *Antiquitates Italicae Medii Aevii*, V, Mediolani, col. 817, 1741.

How to cite this article: Brusaporci, S., Ruggieri, A. 2022. "From direct to digital survey. The abbey of San Giovanni Battista in Lucoli (L'Aquila)", *EGE Revista de Expresión Gráfica en la Edificación*, No. 17, Valencia: Universitat Politècnica de València. pp. 56-71. https://doi.org/10.4995/ege.2022.18902

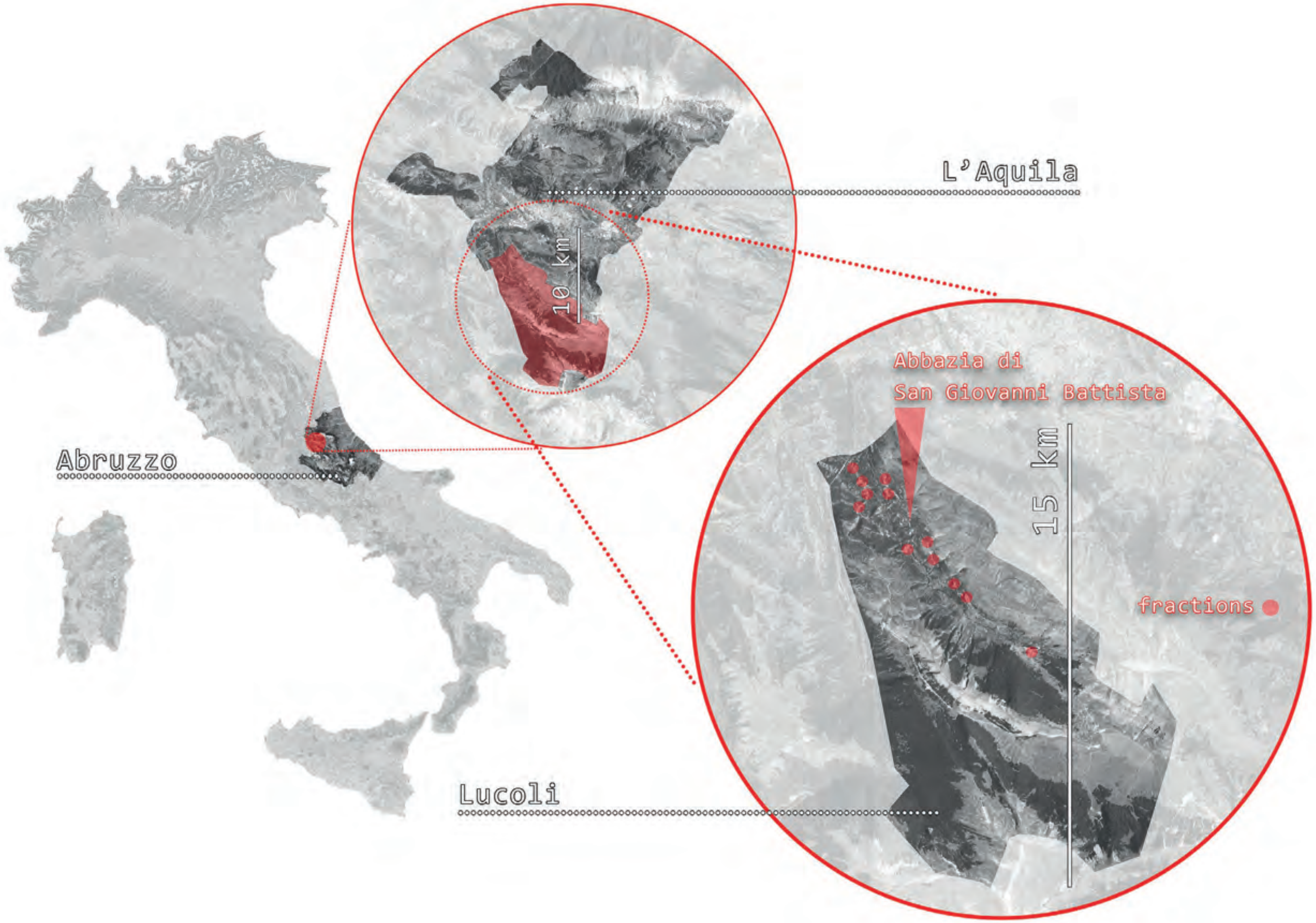

Fig. 1. Territorial context (Source: the authors).

Fig. 2. Photographic documentation (Source: the authors).

Fig. 3. Support Polygonal (Source: the authors).

Fig. 4. Digital survey campaigns (Source: the authors).

Fig. 5. Point cloud (Source: the authors).

Fig. 6. Point cloud (Source: the authors).

Fig. 7. Ground floor of the church with first floor of the cloister and ground floor of the cloister (Source: the authors).

Fig. 8. Ground floor of the church with first floor of the cloister and ground floor of the cloister, with projection of the roofing system (Source: the authors).

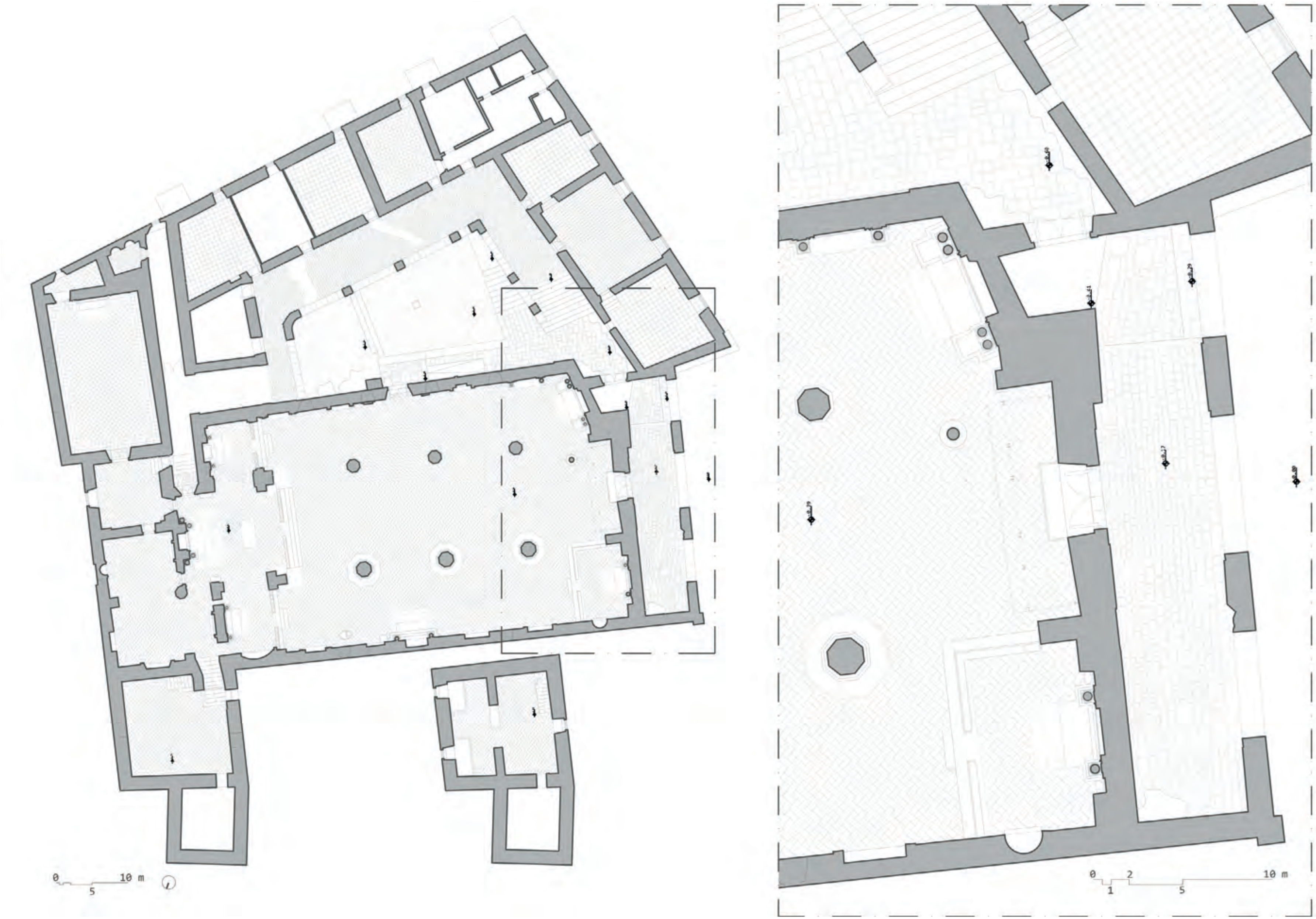

Fig. 9. Ground floor of the church with detail (Source: the authors).

Fig. 10. Sections (Source: the authors).

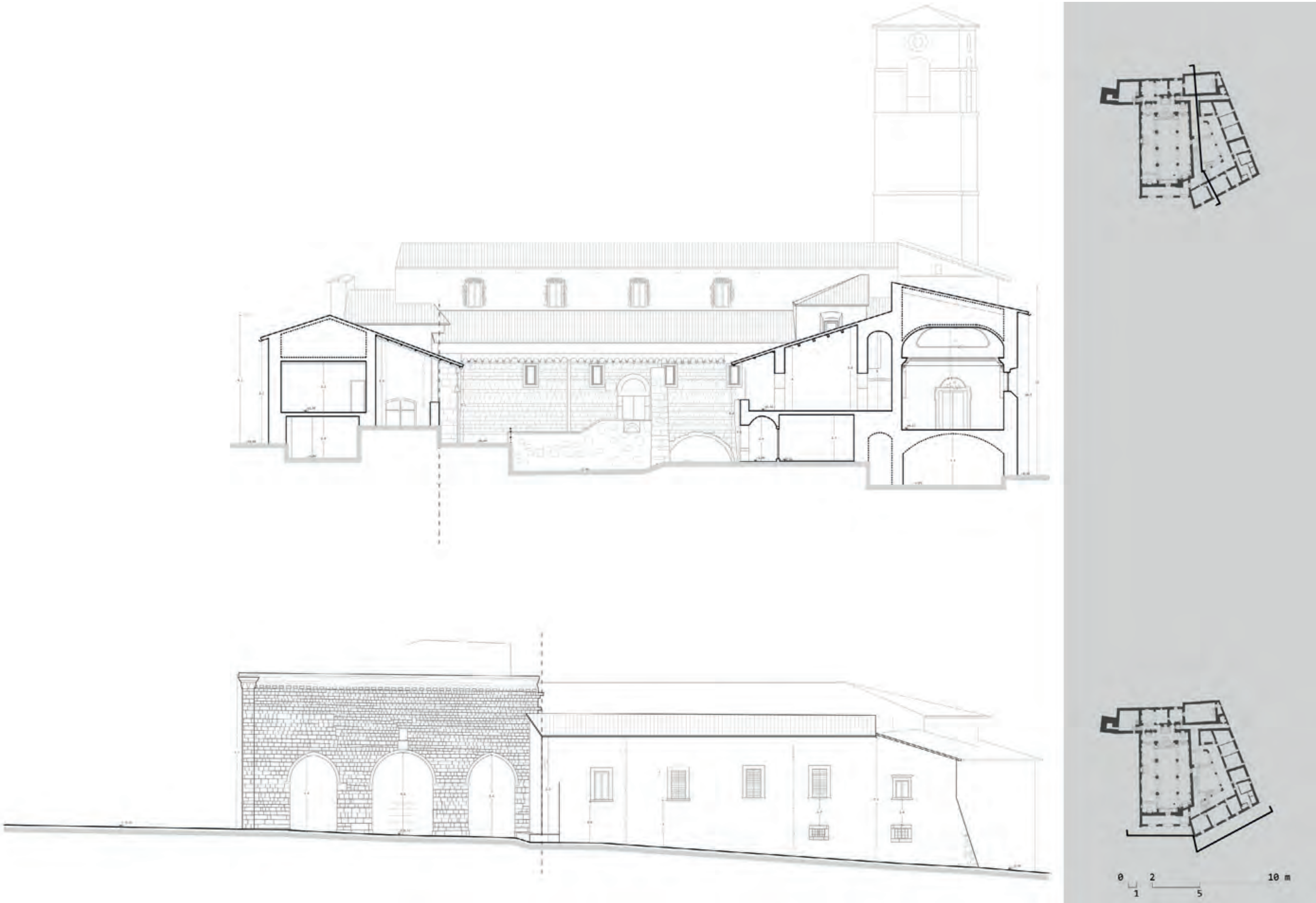

Fig. 11. Section and elevation (Source: the authors).

Fig. 12. Section and elevations (Source: the authors).

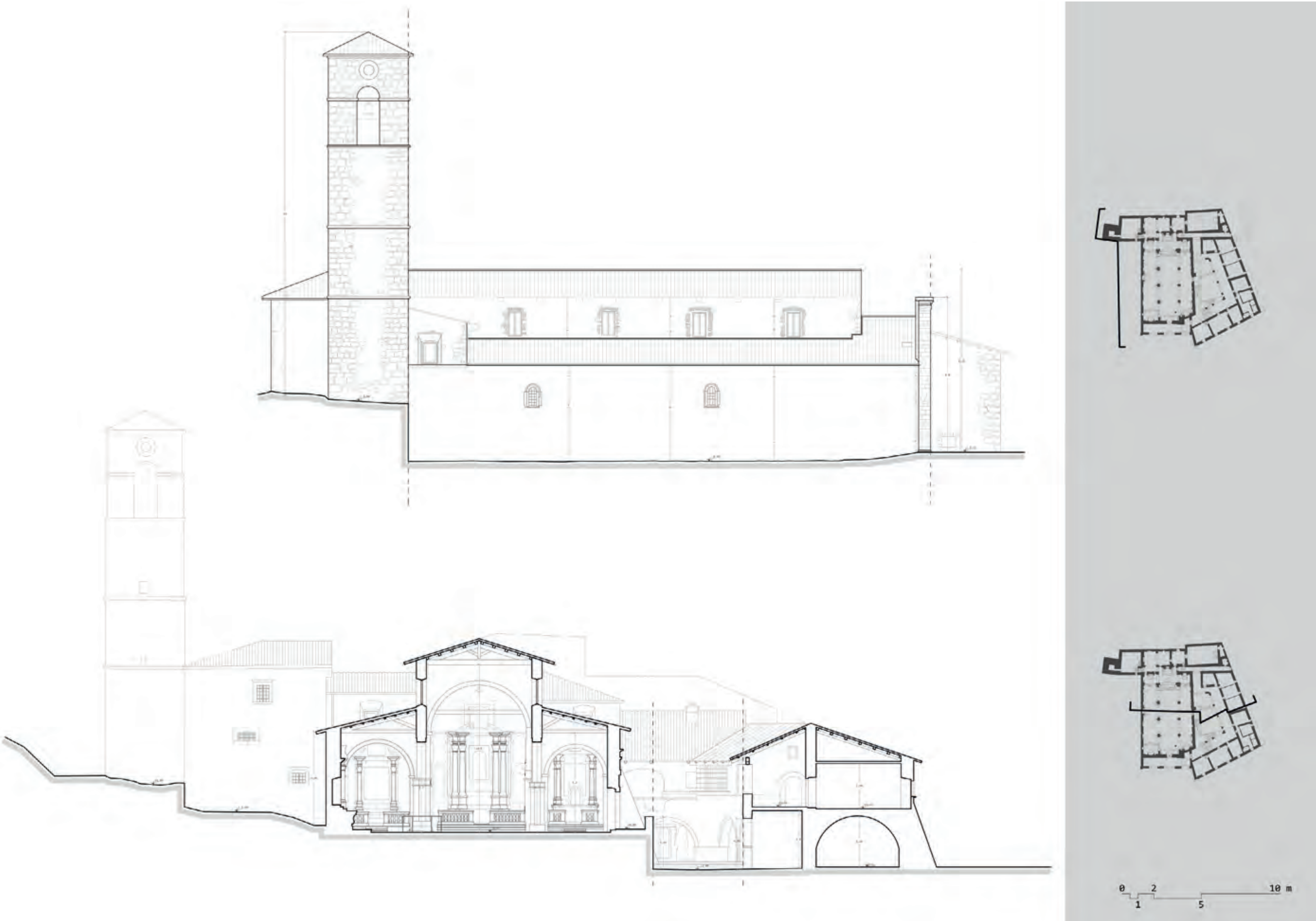

Fig. 13. Elevation and section (Source: the authors)..