Chapter 12

Stratigraphic Analyses, Historical Evidences, and 3D Documentation Tools: Deepening Built Heritage – New Researches for Historical Building Sites in Staffarda

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ABSTRACT

The stratigraphic analysis of the masonries has been variously used to interpret the construction phases of the historical buildings of different eras and has assumed the contours of a consolidated method. In this chapter the stratigraphic analysis of a portion of an important and exemplary architectural complex of southern Piedmont (the church of the medieval Staffarda Abbey) will be presented highlighting two relevant objectives. The first aim concerns the methods of investigation: the deep observation of the signs of alteration of the masonries has been flanked by 3D modeling methods generated by integrated photogrammetric and lidar techniques, and the representation of the stratigraphic units has been realized through the support of GIS technology. The connection between 3D surveys and historical documents and the direct reading on the constructive elements and its 3D models, allowed the rewriting and new interpretation of the construction phases of the Santa Maria Church, previously unknown.

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INTRODUCTION

Archaeological methods are used in the study of architecture to enrich the knowledge phase since buildings, as well as archaeological excavation, clearly manifest signs of the construction, transformation, restoration, demolition and reconstruction phases.

The results obtained through the analysis of buildings aim at the reconstruction of their different cycles, constructive technologies and building techniques in relation to the client and the workers. They are also purposed to clarify the economic values in quantitative and qualitative terms (in the analysis of a building, the quantity of re-used and new materials, stone or brick, etc.) and the social impact of these investments especially on the territorial or urban scale.

The premise of any in-depth historical study is the recognition of the different phases of construction and transformation of the architectural products, from the stratigraphic analyses of individual buildings to the identification of the sequences of the processes of degradation and instability (Parenti, 2000).

The results of these analyses may often be difficult to interpret due to the complexity of the study and the emergence of a significant quantity of data to be processed. Despite they are based on acquired definitions and principles (stratigraphic unity, stratigraphic relationships, phase, period) and on standard data processing procedures (stratigraphic diagram, relative and absolute sequence), which can be applied to any kind of manmade product, the accumulation of information often complicates their immediate comprehension. Above all, critical analyses are important and necessary in order to process and propose a reconstruction of the phases and a vast interpretation of the architectural heritage.

The study presented in this chapter tries to demonstrate how the great complexity of the analyses just mentioned can be effectively supported by a targeted integration of the most common 3D survey methods based on Geomatics technologies and by the GIS tools. The integrated photogrammetric and LiDAR techniques have been developed using multi-sensor strategy that allow to obtain dense and accurate 3D models, which are able to return the smallest characterization of shape or thematic data with a high degree of detail and accuracy, reachable also by high resolution imagery and textures. Further, the recognition and subsequent representation of the stratigraphic units have been managed with the support of GIS tools, able to store spatial and thematic data of a different nature in a unique coordinated database.

The experimentation is conducted through the presentation of a case study: the church of Santa Maria in the Staffarda Abbey, an interesting and rare case of Cistercian architecture in Piedmont, that presents open problems of periodization that were not solved yet. It is particularly significant that the collaborative use of survey tools such as dense 3D models based on reality-based methods and the collaboration of data management, through GIS, allowed the synergic comparison with archival documents and other historical knowledge already known. The possibility to find profitable comparisons between the material data and the historical sources, therefore, has allowed to rewrite a part of the history of the building.

BACKGROUND ON STRATIGRAPHIC ANALYSIS AND ON CULTURAL HERITAGE 3D DOCUMENTATION

Stratigraphic methods have been originally applied in archaeology, starting from Edward Harris’ experiences, which date back to the second half of the 19th century (Harris, 1979), with the aim to define the chronological sequences of excavations. Over the past twenty years, stratigraphic analysis has been