

Measurements for the reconstruction of ancient walls in opus reticulatum in the basement of the castle of Santo Stefano in Puglia (Italy)

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Abstract - One of the results of the study of the Castle of Santo Stefano in Monopoli, in Puglia (Italy) - aimed at its restoration - is the discovery of the different construction phases of the building. The investigation made use of different types of measurements which, intertwined with each other, determined a clear picture of the construction phases. This work presents the investigations carried out in the basement of the castle, which returned the morphotopological relief of the walls in opus reticulatum built between the second century BC. and the second century AD. It can be seen that the walls were reused in the late ancient and medieval ages. The data obtained from the experimental investigation were compared with other data such as the definition of the historical-topographical framework, the archaeological investigation, the prospecting.

In this study, direct and indirect measures proved crucial to highlight the construction phases of the building.

The comparison between the basements and the upper church led to the determination of the causes of degradation.

Keywords: different types of measurement, relief, castle

I. INTRODUCTION

The castle of Santo Stefano is located along the route of the Via Traiana, 3 km south-east from the coastal city of Monopoli and about 5 km from the archaeological site of Egnazia. The abbey-castle stands on a peninsula between two ancient natural harbors. The castle has a closed courtyard. The oldest arm is that of the Benedictine church. Two arms with bastions from the 16th century are added. First in defense and then in buildings for living or high gardens. The outermost north wall probably dates back to a pre-Roman era.

The castle is the result of a complex stratification: the first dates back to Roman times. F.M. In 1745 Pratilli observed the masonry in situ in the opus reticulatum. In the Middle Ages an important Benedictine abbey developed in Santo Stefano. In the XIV century with the arrival of the Gerosolimiti Knights the castle became a fortress and, after 1813, with the suppression of the feud it was transformed into a private residence.

For the first time in its history, the different construction phases of the building were studied. One of the main results

deriving from the survey subject of this work concerns the acquisition of data in the basement, which was the subject of a direct survey project. A measurement study was conducted of all the underground environments which highlighted the walls of the corridors in opus reticulatum and the different construction phases. The data obtained, compared with those deriving from other investigations, such as the historical-topographical framework and archaeological inspections, have allowed us to reconstruct some completely unknown historical and construction phases.

The operational methodologies for measuring the castle aimed to report the artifact or details of the castle on different scales. The instruments used: laser distance meter, total station. For the metric-dimensional restitution of the facades, the measurements were carried out using digital photogrammetry and archaeological survey, both at different scales of representation, allowing accurate and close-up analysis of historical-archaeological evidence, decorative elements, construction techniques and transformations carried out over the centuries, aspects of material degradation affecting the internal and external fronts of the building. The drawings have returned the entire complex to the basement, the ground floor and the first floor, dividing the various buildings not only on one level, but considering the cutting plane at + 1 m, from the level of the internal floor: this representative choice lies in the desire not to intersect the vaulted systems that, very often, cover the rooms, favoring the overall reading of the thickness of the walls. The relationships between the areas, in which it is possible to divide the complex, and the plan-elevation trend, strongly modified by the anthropization of the place, are instead evident in the sections traced. In particular, the privileged point of view is the volume in which the medieval church stood (sectioned longitudinally in AA', crosswise in BB'), in relation to the underlying environments, the moats, the courtyard, the remaining buildings that surround it.



Fig. 1. The Santo Stefano Castle, aerial view from East: the two natural ports, the peninsula, and the Castle.

II. THE TOPOGRAPHY OF THE REMAINS OF THE ROMAN VILLA IN THE BASEMENT OF THE CASTLE

The walls in opus reticulatum and opus incertum rediscovered in the castle are: in the lower level of the marine garden (a, b); under the courtyard (c) and in the basement of the former Benedictine church (d). The structures (a) and (b) located during the inspections come from the western garden.

The first artifact **(a)** is a corridor with branches pointing towards the sea. The ground level cannot be detected and could coincide with the underlying rock. The construction typology is the opus incertum. It is possible to highlight similarities between this masonry and that of the cryptoporticus of Egnazia ¹. The **(b)** structure consists of two short parallel sections of walls in opus reticulatum, which have been later incorporated in a cistern. The masonry (c) represents a different situation. On the ground floor of the eastern arm, a staircase leads to a small space with a buttress vault. The southern wall is in opus reticulatum placed on the rock and has large traces of the ancient cocchiopesto plaster. The architectural relief showed cubilia of 10 x 10 cm equal to those under the church. The other walls that delimit this space date back to a modern era. In light of the planimetric layout of the building, there is no relationship between the underground space and the upper one. The masonry in opus reticulatum is parallel to that of the basements (d).

¹ Important center of the Adriatic coast of Puglia, inhabited since the 16th century BC. C. until the 13th d. C.

The architectural complex in opus reticulatum (d) contains structures that are located in the basement of the church block; in this case, there are characteristics different from those analyzed so far. First of all, different construction phases can be traced back to both the techniques and the criteria of the masonry building. The Roman walls (d) have been reused for the construction of a crypt and adjacent rooms which over time has undergone different changes.



Fig. 2 Survey and reconstruction hypothesis of the masonry in opus reticulatum



Fig.3. Thermography from above in which are highlighted anomalies that can be referred to a masonry in opus in the basement.

4. **The D wall** is characterized by a masonry composed of an infill wall made of irregular shreds with a perimeter of bricks' flakes and splinters with a small apse on the top, with an arc and piers made of regular shreds. The masonry is plastered, which indicates that the wall could be coeval with the construction of the central naves. The stairs, which were built in the 1950s, lay on a wall whose original form is difficult to hypothesize.

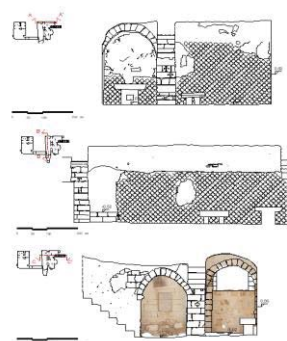
5. Wall E is characterized by a first wall on which the stairs rest; it is in opus reticulatum covered with plaster; then there is an arc welded to the east in the wall previously analyzed and to the west in the central column. The arch turns out to be built after the column.

6. **Wall F** is characterized by a pillar from N to S; two arches that unload on a central pillar (60 x 70 cm), and on a wall which in the lower part is in opus reticulatum and in the upper part in irregular ashlar with a scale and fragments of bricks, according to a technique similar to that used on the wall apse. A filling of gravel and bricks, laid between the extrados of the arches and the vault, affirm the subsequent construction of the naves.

The corridor (400 x 90 cm), has two different walls, the first, external, coincides with the wall of the upper church. The second is tamponade. A first section in opus reticulatum 60 cm thick is observed. Its core is composed of gravel, sea pebbles, sand and cocciopesto.

The corridor ends in a rectangular space (b) whose dimensions are similar to those of the crypt. Originally, this space was probably composed of two small rooms with a barrel vault and divided by a central wall 20 cm thick in opus reticulatum. Wall E, in opus reticulatum, has 10 x 10 cm tiles with 0.5 cm mortar fillings. On the first wall, a fragment of the base of the vault indicates the continuity

between the perimeter wall and the vault. There are no traces of plaster on the walls. On the south-western wall, there are portions that still present, in the lower part, fragments of opus reticulatum. On the western wall, a walled opening - resulting from the restoration of the last century - allows us to hypothesize that the space branched in the same way as the upper church. The floor is made up of 30 cm stone slabs in opus incertum placed on a layer of soil, stone chips, wood and rock. In the second vaulted space, on the side wall, there is a space in which a rectangular slab has been set. For this work, we developed a preliminary stratigraphic map ordered in situ to represent the chronological sequence of the construction and deconstruction phases that can be identified in the building. On the Harris diagram (see below) the walls in opus reticulatum are green; the small naves of the crypt and the infill walls in space b are beige; the internal wall of the corridor and the one on which the apse lies are blue; the walls built in the modern period are blue. At first glance, the crypt differs from the adjacent spaces because it is a palimpsest deriving from different construction phases².



² A. Diceglie 2018

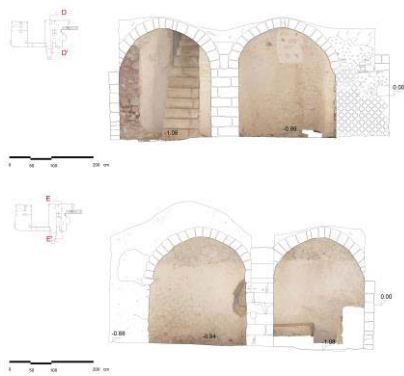


Fig. 6/7. morphotypological and construction characteristics of the walls

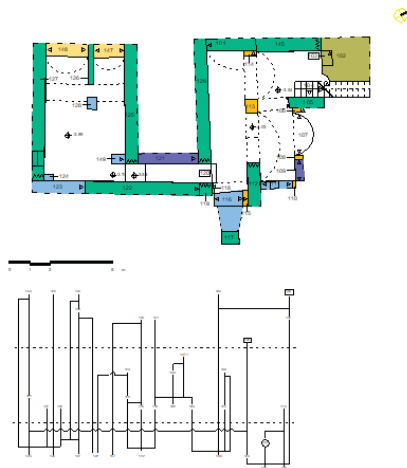


Fig. 7 – The Harris diagram

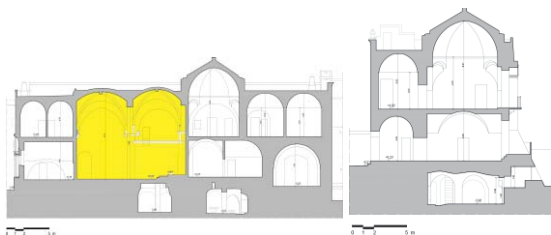


Fig.8/9 OE section of the church block - in yellow the current church NS section of the church bloc

4. Conclusion

Comparing the basement with the upper church it is possible to highlight that the church rose, on one side, on the southern wall of the basement; on the other, on the northern infill walls of the basement, as can be seen in the section. the infill walls of the basement were built at the same time as construction work on the upper church began (13th century). Probably in the same period, spaces

b became functional to the needs of the Benedictine abbey. The first phase of construction corresponds to the corridors in opus reticulatum built in a period that extends from the second century BC. to the 2nd century AD. During late antiquity and the Middle Ages - the second phase, parts of these walls, morphologically similar to the corridors, were exploited by inserting new filling walls on the shorter sides and reusing the longer sides by cutting them and inserting pillars and arches to build an ancient place of worship, a crypt under the church similar to others in the area. The third phase concerned the Benedictine presence and the last that crossed the modern age. The results of the survey made it possible to establish a relationship between the upper and lower masonry structure. Furthermore, the morpho-typological analysis and the plan of the lower masonry suggest that the wall of the eastern end of the crypt could have had two or three apses. This work made it possible to map the construction system in opus reticulatum referable to the foundations of a Roman villa and to identify a place of worship from the late ancient period. in addition, it provided useful data for the study of the Benedictine church³.

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