

Conservation of Building and Decorative Elements of Ottoman Architecture in the Medieval City of Rhodes

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Abstract: The transformation of the medieval city of Rhodes and the modification of its buildings since the siege of 1522 by Suleiman the Magnificent up to the 20th century, were imposed by the social and religious needs of each of its conquerors. In particular, during the period of the Ottoman rule (1522-1912), most of the churches were converted into mosques while new buildings like public baths and mansions were constructed, resulting in alterations in the morphological characteristics of the city. Although the buildings of the Hospitalier's period (1307-1522) were preserved, the additions and adjustments resulted into a mixture of western and oriental architecture, which today determines the multicultural identity of the city. In 1988, UNESCO (United Nations Educational, Scientific, and Cultural Organization) designated the medieval city of Rhodes as a world heritage city for its exemplary architectural complexity and variability, which perfectly reflects the complex historical phenomena and the unique integration of various cultures for more than seven centuries. In this paper, the management of the modifications and the restoration approach of four representative mosques are presented.

Key words: Historic buildings, conservation, restoration, ottoman architecture.

1. Introduction

The second siege of the island of Rhodes by the Ottomans ended in December 1522 with the surrender of the city from the Order of Knights of the Hospital of Saint John of Jerusalem to the forces of Sultan Suleiman the Magnificent. The island of Rhodes, being a bridge between east and west and a distribution centre of ideas and goods, it was subsequently connected with the vital area of Asia Minor. This new reality imposed the adaptation of churches, of orthodox and catholic doctrine, to the needs of the new religion [1]. These modifications did not bring any radical changes to the original architectural fabric of the churches, but they merely added structural, morphological and decorative elements, such as porches, minarets and mihrabs.

Apart from the transformation of the existent structures into religious buildings, seven new mosques were constructed in the city: Ibrahim Pasha (1540),

Retzep Pasha (1588), Moustafa (1765), Suleiman (1808), Mehmed Aga (1820), Hamza Bey (early 19th century) and Sintrivan (1887) mosques. For the construction and decoration of these new buildings, architectural elements from the Byzantine and Hospitalier's constructions were widely used.

The island of Rhodes was, throughout its history, an important economic and cultural center in the region of Dodecanese. Nowadays, it is one of the most popular touristic destinations in the Mediterranean, attracting visitors for its natural and cultural heritage. However, the rapidly accelerated dynamic touristic development of the island and the demands for infrastructures affected negatively its heritage. The Ottoman monuments were converted into storage areas, residences, or were abandoned to deteriorate. The last decade, a great effort to protect and preserve the integrity and the authentic cultural content of the Ottoman architecture of the medieval city of Rhodes was completed with the restoration of the four representative mosques of the 19th century, Suleiman, Mehmed Aga, Hamza Bey and Sintrivan, which are

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the case studies of this work.

It is important to mention that the restoration of the specific buildings aimed at decay prevention and at the same time, at the preservation and promotion of their messages and values. Thus, the main parameter that had to be considered in their restoration was their “multi-interpretability” and how the “interrelated cultural content and values” are depicted to their tangible elements [2, 3].

2. Building Typology

The examination of the structure of the buildings and their categorization according to their typology brought to light their architectural, social usage and value and enabled, to a great extent, the identification of the changes they have sustained as well as the documentation of modern interventions.

The typological organization of the mosques was simple and essential in order to allow visitors to have a view of the imam from each side of the main hall. The simplification of the ground plan, with its rectangular arrangement and the symmetrical organization of the area, was the main architectural socio-spatial organization that served the religious needs and social principles (place of worship and community center). Based on their particular morphological characteristics, the four mosques were categorized into the following types: rectangular hall with tiled roofing (Mehmed Aga mosque) (Fig. 1), square hall with dome (Hamza Bey mosque) (Fig. 2), great rectangular hall with adherent smaller halls with domes (Suleiman mosque) (Fig. 3), and polygonal hall with dome (Sintrivan mosque) (Fig. 4).

3. Building and Decorative Elements

The dominant building material that was used in almost every building of the medieval city of Rhodes is the local bioclastic limestone [4, 5]. The preservation state of the building stones depends on their position in the structure and the prevailing climatic and microclimatic conditions. Pure limestone

has also been used to decorate their individual and exceptional elements such as fountains.

Plasters and mortars used in the buildings were lime-based with natural aggregates, mainly calcitic with a great percentage of quartz and crushed volcanic rocks. In almost every building, pozzolanic additives



Fig. 1 The restored Mehmed Aga mosque.



Fig. 2 The restored Hamza Bey mosque.



Fig. 3 The restored Suleiman mosque.



Fig. 4 The restored Sintrivan mosque.

have been used to improve the quality and durability of the plaster. Crushed brick was extensively used to produce the characteristic, for the area and period, plaster identified as “horasan”, which is a mixture of lime and fine crushed brick, presenting waterproofing properties.

The pigments used to decorate walls and wooden structures were mineral oxides. The binding material in all cases is organic. Thorough investigations have revealed that all interior wall decorations were performed *a secco* (painting on dry plaster). The style of the decorations is mainly geometric with colored bands and surfaces using mainly red, green and blue colors. The most distinctive style is found in Sintrivan mosque, which is influenced by neoclassicism using floral decorations.

Two kinds of timber were used for the construction of the buildings. Cypress, which is found in abundance in the forests of the island and was mostly used during the Hospitalier’s period and cedar, which was imported from Asia Minor and was used during the Ottoman period. Wood from Asia Minor was mainly used for the load-bearing beams, floors and window frames.

4. Pathology

The preservation problems of the buildings are associated to their long abandonment, which affected, to a significant degree, their integrity. One of the main decay factors of the porous building materials was the presence of soluble salts. Salt weathering action caused loss of the mortar and disaggregation of the building stones leading to localized disorganization of the walls. External wall surfaces which were plastered with lime or hydraulic lime, presented losses and disintegration of the plaster. The sources of soluble salts were identified in ground waters, in sea-salt aerosol and anthropogenic airborne particles, as well as in conservation materials of past interventions. The commonest salt species were sulphates, nitrates, chlorides and carbonates. Soluble salt weathering mechanisms acted within the pores of the building materials causing the development of mechanical stresses that led to cracking, loss of cohesion, flaking and disintegration of the materials. Decay forms were found to be dependent upon salt species, the orientation of the buildings and the degree of exposure

of the external surfaces [6, 7]. All data collected on salt weathering were correlated to the environmental conditions as well to the rate and the range of temperature and relative humidity fluctuations [8].

Furthermore, stone surfaces presented several types of depositions. At Hamza Bey mosque, it was observed that thin crusts were formed on the exposed to the rain surfaces where usually carbonates, iron and silicon oxides are diluted and transferred. At Hamza Bey and Suleiman mosques, coherent crusts were formed on protected from rainwater surfaces where airborne particles, produced from anthropogenic activities, are deposited and become extremely drastic when they react with water vapors. Due to their small size and their large surface area, strong absorption forces are developed, binding together calcium, sulphur, and metallic oxides acting catalytically to the conversion of the calcitic material to gypsum. At Suleiman and Sintrivan mosques, loose depositions were found in protected positions, which presented irregular surfaces with coagulated crystals with high concentrations of sodium, chlorine and potassium ions. On all four buildings, dark crusts that are composed of dust and airborne particles were formed, as well as biological films on positions where the stones retained water due to their structure and surface weathering.

A significant decay factor of the decorative and building wooden elements of the buildings was biological growth. In some cases, such as Hamza Bey mosque, the extensive crack network of the walls permitted the penetration of water, which subsequently led to the decay of timber due to biological growth.

The roofing of the buildings varies in construction techniques, in the use of materials and in the weathering degree. The domes of Suleiman mosque were covered by lead sheets, which were severely damaged by corrosion and high-speed winds. The ceramic roof tiles of the dome of Hamza Bey and of the roof of Mehmed Aga were also heavily damaged. Only the plaster covering the dome of Hamza Bey

was in a better condition.

Inversely, the processes of abandonment and modern interventions did not always have a negative effect on the integrity of historic buildings. Original painted decorations of the wooden elements such as ceilings, lofts, mimbars, were covered by oil paints of grey and brown colors whereas wall paintings were covered by several layers of plasters. These paint and plaster layers proved to be a significant protective factor for the excellent preservation of the original color layers.

5. Methodological Approach

In order to design the restoration interventions, all the particular typological and morphological characteristics of the buildings as well as the technology of the building and decorative materials were considered with the ultimate aim to promote their aesthetic, historical, architectural, social, reuse and new use values.

The necessity of an interdisciplinary approach was established during the first stages of the restoration and conservation studies by analyzing the individual problems of the buildings. The solution of integrated studies was adopted by bringing together specialists from different fields. Special attention was drawn to the collaboration with civil engineers who studied the behavior of the buildings, especially in an area of high seismic activity such as Rhodes.

From the specialized perspective of conservation science, climatic and microclimatic conditions were thoroughly studied and correlated to the occurrence of damage, the weathering rate and the weathering mechanisms. Measurements of the climatic parameters that influence the weathering factors were obtained. A monitoring network was set up in order to perform measurements of temperature, relative humidity, wind speed and wind direction. Data loggers were placed in and around the monuments before, during and after restoration interventions.

In addition, information on the origin of the

materials and technological characteristics was derived by the study of the building and decorative materials samples with analytical techniques such as optical microscopy, XRD (X-ray diffraction), SEM/EDX (electron scanning microscopy coupled with X-ray analyzer) and MIP (mercury intrusion porosimetry).

The monuments presented challenging and complex problems regarding the conservation of the interior decorations of the walls, ceilings, sculptures and other architectural elements of different historical phases. New information came to light regarding the modifications of the buildings in style and morphology that had to be preserved and presented with innovative methods. All interventions on the building and decorative materials aimed at the restoration of the original morphology of the mosques, preserving at the same time all their values and significance.

The selected methodological approach, enabled to design the appropriate treatments and inventions by selecting the most suitable conservation materials [9]. The variety of the materials used for the construction and decoration of the mosques, characterize the diversity of the methods applied for the conservation treatments. The aim was to use conservation materials physically and chemically stable as well as compatible to the original building and decorative materials. All interventions were the product of a systematic study of the construction technology and of research of the weathering phenomena.

6. Conservation Interventions

The complexities of conservation of the building and decorative elements of the mosques due to their high significance and severe deterioration and alteration problems, dictated a focused practice. During the application of the treatments, emphasis was given to the weathering action of each decay factor as well as on the properties of the selected conservation materials in order to secure the integrity of the

buildings and safeguard their authenticity [10].

Soluble salts in historic buildings and especially in marine environments, is a complicated issue. Any desalination treatment has to be targeted to friable and decayed material. It was decided to apply poultices with deionized water to remove soluble salts only in positions where either the weathering was severe, or the architectural feature was significant. Decayed stone was consolidated by the use of silanes.

Depositions and crusts from the wall surfaces were removed either by chemical or mechanical methods. Black crusts and loose depositions were removed by the use of chemical poultices, whereas encrustations and coherent depositions were removed by the use of sandblast.

During the phase of the restoration of the stonewalls, it was very important to consider the embedded timber beams used either to reinforce the building or as bearing parts of the roofing. The approach was to remove all decayed timber and replace it by new. Cedar was selected due to its exceptional durability in mechanical stresses and environmental factors. The replacement was joined to the original sound part with titanium blades, whereas all other parts were cleaned, disinfected and consolidated with acrylic resins. Conservation treatments that were applied in all other wooden elements, such as frames, windows and decorative elements followed the same approach.

Roofing was replaced in three buildings, except Sintrivan mosque, ensuring suitable microclimatic conditions within the buildings. Accurate reconstruction of the roofing following traditional techniques was applied in each building in accordance to the documentation of morphological characteristics and the principle of reuse.

Cleaning of the architectural surfaces is a complex and important phase of conservation. The aim of the treatments was to reveal the original surface, on the best possible state by reducing, at the same time, all relevant hazards. Cleaning treatments did not cause direct or indirect damage on the surface, preserved the

patina and the authentic polychromy, did not produce any hazardous by-products that could affect the original material in the future and they were controllable at all stages of the procedure. The methods that were used were either water based (water vapor, water abrasion), mechanical (hand tools, sand blasting), or chemical with the use of poultices.

Decorated wall surfaces were cleaned and superficial layers and overpaintings were removed in order to uncover the original decoration, which was of an exceptional and characteristic style. After restoration, it was confirmed that all original decorations were not damaged in the past, so the most probable reason that could justify these past interventions is a change in the socio-economic status of the late Ottoman occupation of the island.

According to the results of the analyses of the original building materials as well as of the study of their pathology, special attention was drawn to the issue of compatibility. The characterization of the original mortars and plasters led to the restoration of the wall structures with improved compositions of traditional mortars. Decayed building mortars were replaced with new ones of compatible composition and physical properties. Extremely weathered plaster was removed and replaced, whereas sound decorated parts were preserved in situ.

7. Conclusions

Conservation interventions on the four mosques of the medieval city of Rhodes were designed with the contribution of specialists from different fields. All interventions were guided by the architectural complexity and historical particularity of each building. The specific requirements set by the special architectural features and their unique aesthetic, historical, social and reuse values as well as the critical role of physical degradation in safeguarding

the authenticity and integrity of the buildings were considered. The evaluation of the interventions and treatments, demonstrated the successful application of resourceful techniques and compatible materials.

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