Methodology for the cataloguing and recovery of archaeological remains of architectural heritage

M. Galiana[1], A. Mas[2], C. Lerma[2] & J. Roldán[1]
[1]*Grado en Arquitectura, UCAM Universidad Católica de Murcia, Spain*
[2]*Escuela Técnica Superior de Arquitectura,*
Universitat Politècnica de València, Spain

Abstract

The destruction and plundering of cultural heritage which characterized the 19th century and the first half of the 20th led to the disappearance of true cultural treasures of different styles. Over the last six decades, people have once more become aware of the fact that we inherited from the past, and the past is everywhere, even in that which no longer exists. This has been the motivation behind the establishment of schemes for the conservation and reconstruction of architectural heritage, leading to archaeological work which has uncovered a wide range of fragments of these lost buildings.

This study aims to lay the methodological basis for the evaluation and reconstruction of archaeological remains of architectural heritage. This method combines fieldwork, instrumental laboratory techniques and deductive reasoning, based on a historical and documentary analysis of the building and its extant remains. It enables the architectural remains to be appropriately catalogued, by classifying them and determining their original position within the building they formed part of. The data collected, together with in-depth knowledge of the internal morphology of the material, the deterioration present and its possible causes, enable an appropriate intervention plan to be drawn up with the aim of proceeding to the reconstruction of the building in question.

The good results achieved during the study of the architectural remains of the recently reconstructed courtyard of the Ambassador Vich's Palace in Valencia suggests that the methodology used can be extended to other cases of similar characteristics, making a contribution to the complete reconstruction of lost architectural heritage.

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1 Introduction

The Ambassador Vich's Palace in Valencia was one of the first examples of renaissance architecture in Spain. The remodelling of the previously Gothic building in accordance with the new style [1] took place around 1526 [2], arousing great interest and having great influence on architecture in Valencia and indeed more widely within Spain. Unfortunately, a torrent of social changes, which gathered place in the 18th and 19th centuries, and the absence of an appreciation of heritage which was characteristic of those centuries, led to a series of irrevocable decisions, culminating in the demolition of this magnificent palace in April 1858 [3]. Only the marble elements of the patio were preserved, but they were scattered for a century and a half at various museum exposures across the city, being finally reunited in 2006 at the city's fine art museum, the Museum of Fine Arts San Pío V [4]. Thanks to this intervention, unprecedented in Spain and similar to the reconstruction of the courtyard from the Castle of Vélez Blanco at The Metropolitan Museum of Art in New York [5], some of the spatial, compositional and material essence of the building was recovered.

In the mid-19th century, it was common practice to sell the material remaining after demolition, with it being reused in the new constructions which replaced these emblematic buildings. Very often, high-quality ornamental architectural structures made of marble or limestone were discarded or used as a fill for the new foundations. Many of these pieces are being recovered at numerous archaeological excavations, undertaken at the places where these buildings formerly stood. In the case of the Vich palace, the excavations undertaken in 1999 uncovered numerous pieces belonging to various parts of the palace, which are currently stored in Bétera, in warehouses owned by Valencia's Museum of Prehistory and Archeology. These include pieces made of grey Italian limestone, *Pietra Serena*, which formed part of the reconstructed renaissance courtyard.

The full material recovery of the monument would allow, in cases as the courtyard of the Ambassador Vich's Palace, to perform a complete and accurate interpretation of its rich renaissance composition, where the grey limestone contrasted with the purest white statuary marble, creating a bichrome pattern which was characteristic of the compositional and aesthetic interplay of these "Brunelleschian" spaces [6].

The evaluation and reconstruction of lost archaeological heritage must be based on a historical and documentary analysis of the building, along with painstaking fieldwork, involving the study of both the pieces newly found and those previously conserved. Thus, similar and distinct morphological compositional patterns can be identified, enabling the original geometry to be determined and the pieces to be correctly catalogued, with a deductive method being employed to establish the possible position of the piece within the architectural whole. This information is combined with an analytical study of the stone materials using instrumental techniques in the laboratory, which determine

the most important characteristics of the internal morphology of the material, and an examination of the damage suffered by the different pieces and the causes of this damage. Together, such work enables the current state of the architectural remains to be determined and an appropriate intervention plan to be established [7].

2 Methodology

2.1 Historical and documentary analysis and fieldwork

The first step towards the evaluation of archaeological remains is to establish the principal parameters of their geometry and morphology by means of painstaking fieldwork, enabling the possible relationship between the different pieces to be established and for those pieces which display the same parameters to be placed into well-differentiated groups. To achieve this, we examined the dimensions, the relief of the sections, the shape of the mouldings and ornaments, nature of the material, colour, etc. All of this information enabled us to make a scale drawing of each of the pieces using 2D computer graphics.

All of the information collated was synthesised and a set of technical records created, enabling quick and easy access to the key data required for the cataloguing of the pieces and the comparative study of the different groups found (fig. 1).

After this meticulous study of the remains, a deductive reasoning (based on comparing the different patterns found and the original marble pieces which had been conserved) enabled the determination of their structural nature to be determined: whether the piece was a cornice, a jamb, a lintel, etc. Thus, after examining the extant drawings of the original building, we were able to reliably identify the original location of the remains. These new data also placed on the previously created technical records.

2.2 Analytical study of the stone materials: petrographic characterization

Materials provide architectural structures with colours and textures that become an intrinsic part of the building. The relationship between form and material cannot be adulterated without some of the original essence being lost, which is even more true in the case of renaissance architecture, where the aesthetics of the shapes and the compositional interplay was based on the contrast achieved through the combination of the different textures and colours of natural stone, the basic material of most historic buildings.

For this reason, we studied the material of which these architectural remains were composed of, performing a petrographic characterization of *Pietra Serena*, a grey limestone of Italian origin, of which all of the pieces examined were made.

Thanks to advances in methods of analysis of stone materials, with instruments such as optical and electron microscopes and techniques including

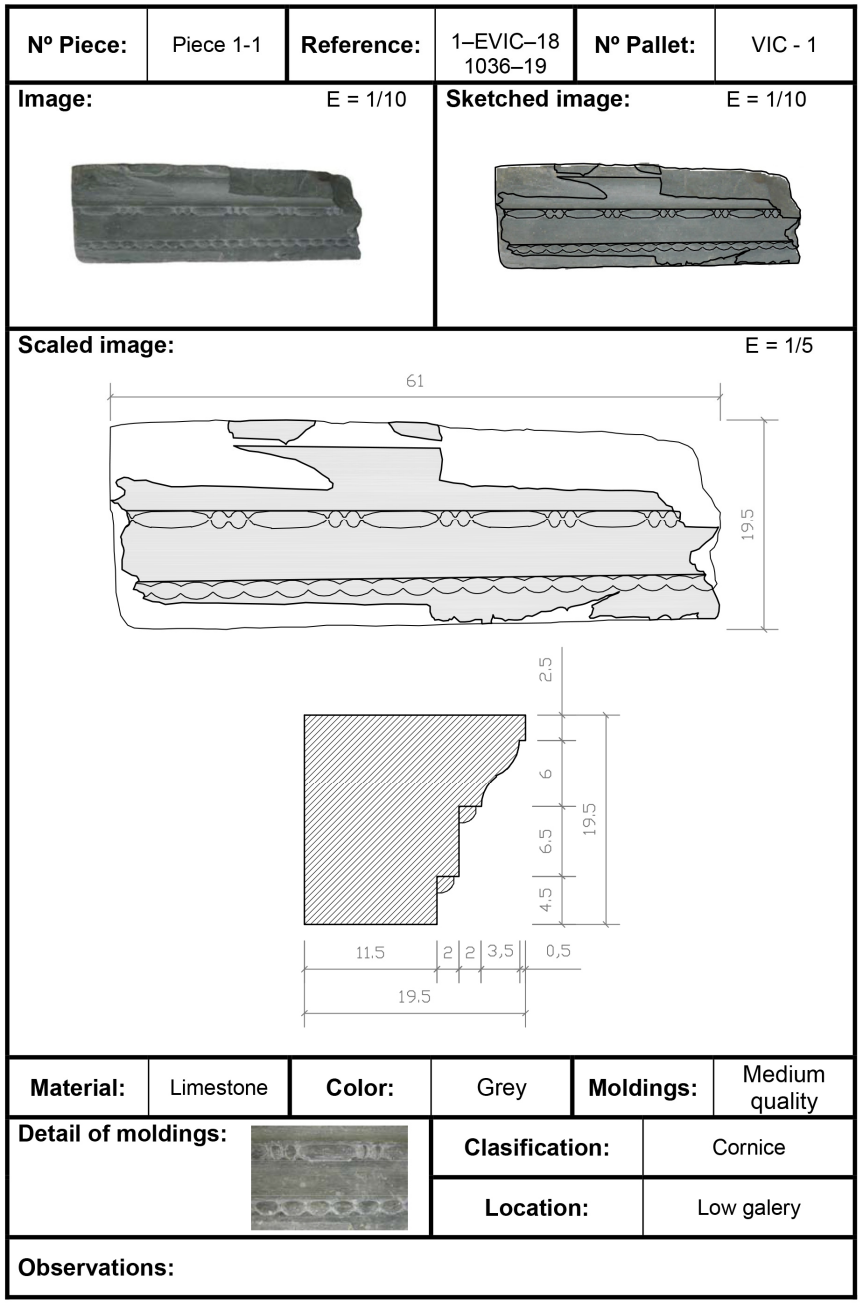

Figure 1: Example of a technical record, containing the data obtained from the fieldwork.

X-ray diffraction, mercury porosimetry and so forth, we were able to obtain valuable information regarding its internal morphology. This allowed the current state of the stone to be established, for predictions to be made concerning future pathologies or changes to the stone, and for the determination of appropriate methods of cleaning, consolidation and restitution, based on the results obtained during previous similar interventions.

The choice of the tests carried out was based on three issues:

- the objective of the study: to evaluate the archaeological remains and establish an appropriate action plan for their restoration;
- the function of the pieces: ornamental, structural, etc.;
- the possible new location of the pieces after the proposed intervention: the climatological and environmental conditions of the city, the level of exposure of the pieces to atmospheric agents, etc.

2.3 Damage diagnosis

In order to correctly establish the state of the architectural remains of a building, the damage suffered by its constituent parts must be diagnosed, so that this damage can be repaired. The possible causes of this damage and the factors which leave the material vulnerable to deterioration can be determined, enabling the future behaviour of the material to be predicted and further damage to be pre-empted. To this end, we took into account all of the issues which contributed to the deterioration of the pieces. The degradation processes of stone materials derive from different internal causes, such as their chemical composition, morphology or texture, and also external causes, such as their location within the architectural structure or interaction with the environment.

2.4 Intervention proposal

In the last thirty years of the twentieth century, international charters were drawn up concerning the conservation and restoration of "*...architectural monuments...*, *even if they are only fragments...*" (Article 1 of the *Carta del Restauro*, 1972), with restoration being understood to mean "*...any intervention aimed at facilitating the interpretation and at fully preserving works of art for the future...*" (Article 4 of the *Carta del Restauro*, 1972).

In these terms, the reconstruction of the remains of architectural heritage, in those cases where there is an opportunity to put them back into the architectural structure they once belonged to (whether this in their original location or, in our case, as part of a reconstruction in a museum), must ensure that the new fragments constitute the minimum number necessary to reconstruct the geometry of the original and provide continuity to its shapes. Thus, the partial losses deriving from damage due to exfoliation, corrosion, and so forth, will not be visible. The outer shape of the pieces must be modified into geometrical forms, preferably wedge-shaped, so that they fit perfectly with the prostheses and implants, while aiming for the least possible loss of material, especially with regard to the carved faces of the stone, which are of greater aesthetic value. The

new sections will be attached to the originals using small fibre glass filaments and epoxy resins, enabling a solid and coherent new whole to be created.

3 Results

3.1 Historical and documentary analysis and fieldwork

Our analysis led to the establishment of three well-differentiated groups:

First group: 11 items, pieces which in cross section fit into a square with sides measuring 19.5 cm, and which have a moulded outer face decorated with two lines of beads (fig. 2).The carving was similar to the marble pieces. However, the carving was of a manifestly inferior quality, as it did not achieve the characteristic three-dimensional nature of renaissance ornaments, seeming more similar to Gothic bas-reliefs (fig. 2).

Figure 2: Example of a typical piece and cross-section from the first group.

This set of items were originally made as separate modules, measuring around 60 cm in length and with the mouldings demonstrating continuity. A deductive method let us to conclude that these pieces may have formed a linear cornice [8] (fig. 2).

Second group: 9 items with similar characteristics to the first set (fig. 3). They differed, first of all, in cross-section, making a 26 cm-sided square, and the second difference was the quality of the carving, which was similar to the marble pieces of the courtyard. The beads were joined by a thin line of stone, providing an element of chiaroscuro which enhances the relief, making it more three-dimensional, a classic feature of renaissance carving (fig. 3).

Another notable different is the considerable length of some of these pieces, over 90 cm, with the mouldings also displaying 90° turns, plainly representing the corner of a particular structure. These pieces belonged to a window or door frame, part of the jamb or the lintel, given that both such structures have identical forms at the corners (fig. 3).

The four items in the third group had the same dimensions as those of the second, with the difference being the absence of decorative carving in this group (fig. 4). These pieces also belonging to jambs or lintels of windows or doorways into the palace. The ornamental quality of the pieces marked a hierarchy between the doorways.

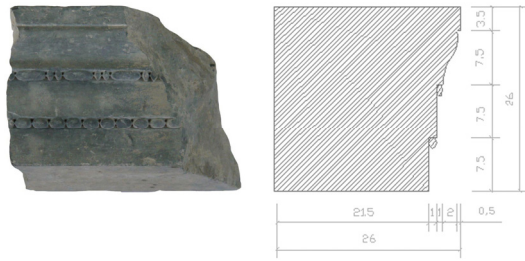

Figure 3: Example of a typical piece and cross-section from the second group.

Figure 4: Example of a piece from the third group.

The next task was to determine their possible location within it, by examining the extant pictures of the original courtyard. The sketch made by José Fornés (1801) for a competition organized by Valencia's fine art school, the Fine Arts Academy of San Carlos [1], reveals the existence of a continuous cornice along the interior wall of the lower gallery, supporting the groin vault above it, and also a series of doorways into the building, including a large central doorway and another smaller one along one of the longer galleries.

Given that none of these elements were preserved, that the material of the exterior façade of the courtyard is known (white Carrara marble), and the widespread use of *Pietra Serena* in renaissance architecture – with its intense dark grey contrasting with the pure statuary white marble – we concluded that the pieces analysed must have been part of the cornices and door and window frames in the gallery around the courtyard.

3.2 Analytical study of the stone materials: petrographic characterization

These pieces are made of a grey limestone from Italy, called *Pietra Serena.* It was characterized and its most important properties were determined by means of laboratory tests [9]. The tests were carried out on small flakes that had fallen from the pieces, so that their physical integrity was not diminished in any way.

Examination of the samples with a petrographic microscope (Zeiss Axioskop) enabled the stone to be indentified as a metamorphosed argillaceous limestone. It was banded and had a microcrystalline texture (fig. 5A).

By means of X-ray diffraction (PHILIPS PW-1710 diffractometer), the mineralogical composition of the sample was determined and found to be mainly composed of calcite, making up 65% of the total weight, with quartz and mica

each making up around 10% of the weight. Other minerals present in smaller quantities were dolomite, kaolinite and chlorite.

A scanning electron microscope (HITACHI S-3000N) enabled the identification of the opaque minerals: some well-preserved pyrites and iron oxyhydroxides, deriving from the reaction of the former with atmospheric agents (fig. 5B and 5C).

The colour was determined by making 15 measurements using a spectrophotometer (CM-700d de Konica Minolta) on the surface of the sample, calibrating the grey colour of the *Pietra Serena* in an L*a*b* graph and an XY graph, based on the CIE system.

Finally, by means of mercury porosimetry (Micromeritics Autopore IV 9510 porosimeter), we obtained a distribution graph of the pore size of the stone, demonstrating that *Pietra Serena* is a characteristically compact rock, with very low connected porosity of around 2.65% (fig. 5D).

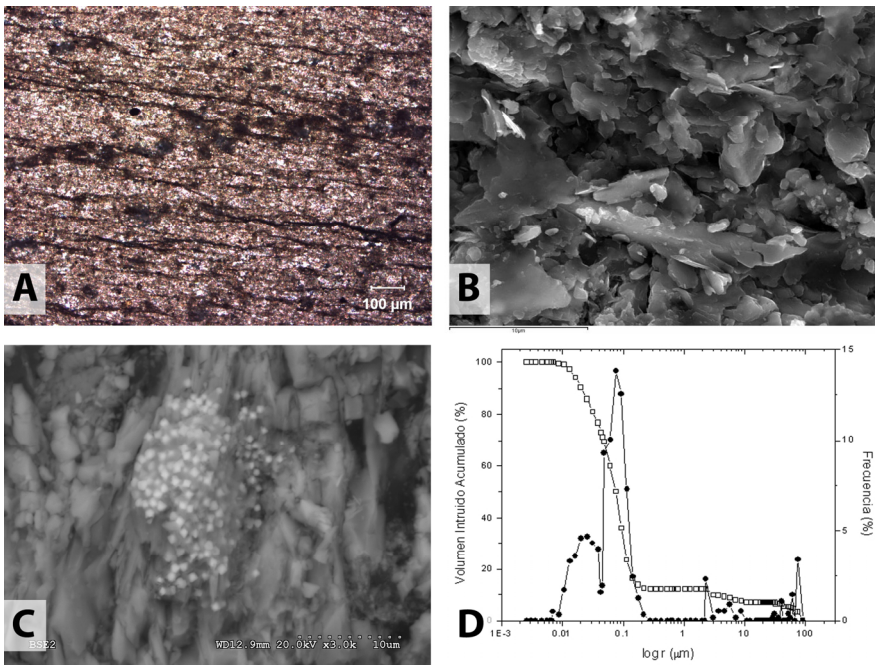

Figure 5: Images of the sample taken with the petrographic microscope, the scanning electron microscope and pore size distribution graph.

No mechanical resistance tests were carried out for this study due to the basically ornamental character of the pieces in question, which were subjected to unimportant static loads. Nor were frost resistance tests performed, given that Valencia has a Mediterranean climate, which is mild and humid, without extreme temperatures over the course of the year, with average values ranging from 11.5°C in January and 25.5°C in August [10].

3.3 Damage diagnosis

We distinguished between:

- Superficial damage:
  - chromate, variation in the colour of the stone due to contact with other material such as earth, aggregate, etc.;
  - natural patinas, due to aging over time;
  - coatings and artificial patinas of different shades applied to the surface;
  - loose superficial deposits such as dust, earth, mud, etc.;
  - and incrustations, mainly material from the aggregate from which the pieces were extracted and more compact than the previous deposits.
- Damage relating to the loss of material:
  - fragmentation, often with the loss of most of the original volume;
  - fracturing due to the formation of exfoliation joints;
  - and corrosion, wearing the sharp corners away.

As can be seen, the main causes of the damage and pathologies present in the original pieces were external factors, of largely human origin, due to the poor level of care shown to them during the last years of existence of the palace and the deterioration suffered as a result of its demolition. With regard to the internal factors, the most important of these concerned the banding of the stone, facilitating fracturing through the formation of exfoliation joints. In general terms, we concluded that the stone was in a relatively well-preserved state and that it did not suffer from internal degradation nor loss of cohesion.

3.4 Intervention proposal

The results of this study enable us to propose the possibility of the restoration of the original pieces, which together with the reproduction via anastylosis of those that are missing, making possible the reconstruction of at least one of the lower sides of the courtyard [11].

To this end, the pieces of the cornice would be established as being modular and 60 cm in length, so that with the 11 original pieces and 13 reproductions, it would be possible to reconstruct the cornice of one of the lateral elevations at the Museum, measuring 14.4 m in length.

The 9 pieces of the frame were brought together around the central doorway to the rooms on the lower floor, given that this was present in present in Fornés's elevation and it coincided with the actual doorway to the courtyard from the inside of the Museum.

The result of this intervention would be the complete reconstruction of at least one side of the patio, enabling the complete and correct interpretation of its rich renaissance composition (fig. 6) [12].

Figure 6: Proposed reconstruction of one side of the renaissance courtyard.

4 Conclusions

The methodology employed in this study of the archaeological remains of the courtyard of the Ambassador Vich's Palace in Valencia, which combined fieldwork, laboratory techniques and deductive reasoning, was highly effective for the reconstruction of part of this vanished architectural heritage using the original fragments.

The fieldwork carried out enabled the remains to be catalogued into a series of groups sharing well-established common characteristics, which were used to create a set of technical records. These were then used for a comparison with the preserved items from the building.

The deductive method enabled the original location of these pieces to be reliably identified, making the intervention proposal possible.

For their part, the laboratory techniques made it possible to determine the internal characteristics of the stone material, laying the basis for a concrete proposal for the reconstruction of the building to be made.

The good results obtained through the use of this methodology, with the architectural fragments from the patio of the Ambassador Vich's Palace in Valencia, mean its use could be extended to the study of the archaeological remains of other lost buildings of similar characteristics and make the reconstruction of such architectural heritage possible.

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