UNDERSTANDING ARCHITECTURAL CHANGE AT THE ALHAMBRA: STRATIGRAPHIC ANALYSIS OF THE WESTERN GALLERY, COURT OF THE MYRTLES

Camilla Mileto and Fernando Vegas

The Alhambra, fortress and residence of the Nasrid rulers of Granada, comprises three main areas: the citadel (Alcazaba), the palaces, and the gardens. Although the origins of the fortress date from the ninth century, most of the buildings and palaces which stand today can be dated between the thirteenth and fourteenth centuries. This group of buildings was constructed by the Nasrids, the last dynasty to rule al-Andalus before the conquest of the Catholic Monarchs in 1492. The Alhambra not only includes buildings conceived or modified during the Islamic period, but also later additions and interventions, which responded to forces of fashion, functional adaptation, stylistic restoration, or simple mending. These interventions began with the conquest of Granada and have continued to the present day.

The present study, commissioned by the Patronato de la Alhambra, is part of a broader research project, begun in 2000, in which historians, geologists and architects are collaborating in applying the methodology of stratigraphic analysis of architecture to this monument for the first time, in order to elucidate the transformation of the Alhambra palaces during their long history. The present study focuses on the upper gallery of the western nave of the Court of the Myrtles, part of the Comares Palace, that was cut off at its southern end when the Renaissance palace was built. The area under discussion is delimited by the Mexuar and the Comares Palace at one end, and the Palace of Charles V at the other. This area of the Alhambra complex is of particular interest to researchers seeking to better understand the physical connection between the Nasrid palaces and the magnificent Renaissance palace constructed on the order of Charles V, King of Spain and Holy Roman

* The research team for this project is formed by Camilla Mileto (architect), Fernando Vegas López-Manzanares (architect), José Manuel López Osorio (architectural technician), Miguel Angel Sorroche Cueva (historian), and Francisco Martín Peinado (geologist). This article was translated from the Spanish by Elizabeth Power.
Emperor (1516–1556). He inherited from his grandparents, Ferdinand and Isabella, a vast kingdom encompassing Spain, the new territories in America, Austria, the Low Countries, and Southern Italy. He planned that Granada would be the capital of his empire, and the Alhambra his main headquarters, and ordered the new palace to be built as an extension of the Nasrid palaces.

The Comares Palace was built by the Nasrid Sultan Muhammad V (1354–1359 and 1362–1391), although the first constructions in this part of the palace complex were ordered by his grandfather Ismá'il I (1314–1325) and his father Yusuf I (1333–1354). An interesting description of the palace, written in 1362 by Ibn al-Khaṭṭāb (1313–1374), the Nasrid prime minister and court chronicler, describes the building process of this palace, and its first configuration. At that time, it seems, the rooms in the upper gallery of the western nave were probably used as residential quarters by the women of the court. The residence underwent later extensions and alterations, especially after the arrival of the Catholic Monarchs, who freely adapted the buildings to new functions and requirements. For example, among the minor changes made soon after the conquest, new rooms for the king and governors were built in a new storey over the existing Mexican, which was itself transformed from its Islamic function of court of justice into royal chapel. In 1526, Charles V decided to build a large palace alongside the Nasrid palaces, which was internally connected to them (Fig. 1). It is not known how many and what kind of buildings were destroyed in order to make room for his palace, but the most recent studies show that the major spaces of the Comares Palace were respected, and that an attempt was made to integrate the two palaces, despite the aesthetic clash between this massive new architectural volume, and the rather delicate appearance of the Nasrid palaces.


2 This point was suggested by Leopoldo Torres Balbás, and can be found in Carlos Vilchez Vilchez, La Alhambra de Leopoldo Torres Balbás, Obras de Restauración y Conservación 1923–1936 (Granada: Comares, 1988), p. 159. The original text is in Proyecto de Reparación de la Nave de Ponerla del Patio de los Arrayanes, 23–03–1923, Archivo Central de Administración del Estado (Alcalá de Henares, L-13.179–4).

3 Antonio Malpica Cuéllar, Eva Moreno León, Eva María López, and Jesús Bermúdez López, “El subsuelo. Acera de la implantación del Palacio de Carlos V. Informe...
Stratigraphic analysis of architecture is a powerful methodological tool that makes it possible to identify and document the material data of the fabric, in both an archaeological site and a building. This type of analysis allows scholars to make an objective observation of the different construction techniques and materials that comprise the fabric, and the physical interrelationships between original remains, superimposition, bowls, insertion, etc. An accurate study of the order in which the parts constituting the fabric were constructed allows one to formulate a hypothesis of the various construction phases at the building.

This methodology, as it is used today, was born directly from the studies that Edward C. Harris published in 1979 in his *Principles of Archaeological Stratigraphy*, a text that immediately became a primary point of reference for the discipline of archaeology. Archaeologists had for over a century been discussing how to perform excavations stratigraphically, that is, following the layers in a site, and Harris’s research provided a key contribution to the systemization of that methodology: he defined the principles of archaeological stratigraphy by means of the re-elaboration of the laws of geology, in particular the ‘Law of Superposition’ and the ‘Law of Original Continuity’.

The first law states that in every geological stratification, the upper layers are always younger than the lower ones. The second law affirms that every geological layer was in origin continuous, hence every observable discontinuity is the result of a later modification. Among other contributions, Harris adapted these principles to archaeological stratigraphy, reformulating the ‘Law of Superposition’, so that in a series of layers, the upper units of stratification are younger and the lower are older; and the ‘Law of Original Continuity’, so that if any edge of a deposit is exposed in a vertical view, a part of its original extent or continuity has been destroyed. This type of study addressed chronological aspects, the diachronic and anachronic relationships of stratification, and the objective analysis of the excavation, and was not simply an historical interpretation of the archaeological finds.

Harris himself was responsible for introducing the stratigraphic study of walls as elements present in archaeological sites. However, the first applications and the systematization and development of the

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*Fig. 2. The state of the gallery during the stratigraphical study.*

**Methodology**

The study commissioned by the Patronato de la Alhambra involved formulating an historical and constructional analysis of the evolution of this upper gallery in the western wave of the Court of the Myrtles (Fig. 2). At the time this work was undertaken, the fabric was free from the gypsum cladding that was applied in the 1950s, and therefore perfect for direct observation of the traces left by history on the walls. To this end, four parallel lines of research were developed: an historical and documentary study; a stratigraphic analysis of the walls; the classification of materials by means of chemical tests; and a study of the evolution of the layout and fenestration in the room. This article focuses on the investigation, results and conclusions obtained during the stratigraphic analysis of the gallery.

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6 Harris, *Principles of Archaeological Stratigraphy*, p. 32.
methodology of stratigraphic studies in architecture were undertaken in the early 1980s by a group of Italian architects. The procedure involves a detailed, methodical examination of the wall to be studied, identifying the different building works and the relationships between them, that is, a chronology of earliest to latest, how they are superimposed, their breakages, etc. Once these building phases have been identified and systematically arranged, a relative chronology can be established for these interventions. This relative chronology can be compared with studies of the construction materials, or can provide an absolute chronology, allowing one to put a name to each period, if the information is cross-referenced with historical and documentary study.

Despite the close relationship between architectural and archaeological stratigraphy, there are evident conceptual differences which must be taken into account when applying this method to the vertical walls of a building, as observed by the architect Francesco Doglioni. Above all, archaeological, or horizontal, stratification constitutes a deposit that responds to natural criteria (especially gravity), whereas architectural stratification responds to artificial criteria involving the construction of spaces, that is to say, internal rooms that will be readable as vacuums. This peculiarity involves the presence of many more surfaces, which are visible and legible at the same time; furthermore, the process of deposition of layers does not move in a single direction, as is the case in archaeological sites. Moreover, the surface of the layer, in the case of archaeology, represents the physical limit that separates two different adjacent layers, while in architecture the surface is not only a physical limit but also a finished surface, on which the characteristics proper to that surface can be read.

There are even fundamental operational differences: the stratigraphic reading of an archaeological site is always associated with an excavation, so that, once the characteristics of a layer have been recognised, they are removed and thereby eliminated. On the other hand, in the stratigraphic reading of architecture, there is no excavation, so that the layers can be read simultaneously but never completely. It is therefore necessary to bear in mind that the stratigraphic reading of a building can be more or less complete or exhaustive according to the degree of legibility of the stratification.

The collection of material data—such as the materials used, processing, building methods, etc.—plays a fundamental role when formulating a project of conscientious restoration that strives to respect and conserve these same data and to guarantee their survival for posterity. Equally important are the relationships established between these data, because of their capacity to register and show the significance and uniqueness of the marks left by individual interventions.

The mutual objective of the stratigraphic analysis and the restoration project must therefore be a study of the materials from which the building is constructed, in order to conserve it. Conservation of its materials, the possibility of maintaining and transmitting the stratigraphic relationships, and the legibility of the intervention must be guaranteed by a suitable methodology for the project. It is not a question of freezing the building in time, but of conceiving of the intervention as another phase in its stratification. It is a question of defining the forms of contact between what already exists and what is newly added, in such a way that respects the materials, building techniques, significance and character of the existing structure.

**Analysis**

The gallery in question is one of the cornerstones of the Alhambra, as it was the point of entry to the Nasrid palaces from the palace built by Charles V (Fig. 3). This majestic Renaissance palace was designed in 1530 by Pedro Machuca (1490–1550), a Spanish architect who was trained in Italy under both Raffaelle Sanzio and Michelangelo Buonarroti. Machuca built a linear staircase which linked the ground floor of the Renaissance building to the upper gallery of the western nave of the Court of the Myrtles. This staircase was later demolished and replaced by a similar one, which stands today, on the occasion of a visit by King Philip V in 1729. Both staircases led to the northern

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1. Such as Roberto Parenti, Riccardo Francovich, Tiziano Mannoni, Francesco Bonora and Gian Pietro Brogliato, who initiated the debate about the subject by publishing their research in the periodical *Archaeologia Medicea*. At the same time, important contributions were made by architects such as Romeo Palladini and Francesco Doglioni from the Department of Architectural Restoration, at the Institute of Architecture of Venice University, and Carla Tomasini Petramellara and Luigi Martisi from the Department of the History of Architecture and Monument Restoration, at the Architecture Faculty of Florence University.


end of the gallery under discussion, under an arch whose voussoirs still interrupt the rammed earth fabric today, in one of the most interesting interventions in the history of architecture (Fig. 4).

The gallery long ago lost its decoration, if it was ever in fact decorated. Between 1924 and 1925, Leopoldo Torres Balbás carried out restoration works on this space, leaving it more or less in the state it is today. In the mid-twentieth century, the gallery and other adjacent spaces were converted into exhibition galleries for the Museo Nacional de Arte Hispánomusulmán. In the works undertaken to adapt it to this use, the stairs leading into the Palace of Charles V were closed and covered, and the stairs reconstructed by Torres Balbás were closed off and have remained so until the present time.

The process of stratigraphic analysis on the gallery wall construction commenced with the removal of the various recent surface finishes, in order to replace them with a porous lime cladding that would not affect the conservation of the monument. In addition, important works were side, reconstructing the old Islamic stairs which connected the ground and first floors; plastering all the interior walls with gypsum; and chipping and cladding the façade of the Court of the Myrtles, whose surface had been re-clad on earlier occasions.
carried out on the roof, where the boards, rafters and beams in poor condition were replaced with new timber. The following section describes the hypothesis developed regarding the sequence which evolved during the construction of the gallery. The study of the fabrics identified three major building periods, each of which comprises a series of different phases (illustrated in Colour Plates 15, 16 and 17).

**Period I: 14th–early 15th century (Nasrid period)**

The first building period encompasses the construction phase of most of the fabrics in the room, and can be placed between the fourteenth and early fifteenth century. They are walls mostly made of tapial (the typical Nasrid construction technique), a small proportion of lime granules, and some courses of reddish brick (measuring 29.5 × 3.5 × 14 cm), bonded with mortar made of red soil and lime granules. In some places, there are remains of the original finished tapial surface, identifiable as a smooth surface. The strongly tamped soil adheres to the plank moulding, and when the moulding is removed, the tapial mass shows the support surface of the timber moulding on its exterior. Most of this finish of the wall in the room under study was missing for reasons of erosion, the passage of time, the removal of plaster cladding, etc., but where it is preserved, it bears witness to the building method used.

This type of fabric is often plastered and rendered with gypsum mortar, which at the present time is rather eroded and slightly chipped. This layer of cladding is thought to belong to the first period because it always seems to adhere to the tapial surface, though there are no other elements to date it. The thin layer of lime on top of this cladding, seen especially in the eastern wall, may be the finished surface from the same period, while the superficial layer belongs to later periods.

We can attribute to the same period a series of bays, in both the interior eastern and western walls, because their position vis-à-vis the line of the mud walls, in most cases, suggests that they are contemporary with the fabric. This is the case in bays 2, 3, 5, 8, 7, 15, 16, 17 and 18 (see Colour Plates 15 and 16). A series of vertical marks in the walls, which correspond to the position of partitions dividing the spaces, probably also dates from this period. From the traces that can be identified as belonging to the first period, we can hypothesize that this was an architectural space similar to the present one in terms of its dimensions, with a series of windows on both sides, as though it were a long gallery open to the exterior by windows (1.70 m wide and 1.90 m high), along the two long sides. The roof of the space probably consisted of a single hip inclined towards the eastern side of the gallery, towards the Court of the Myrtles.

**Period II: 16th–18th century (Hapsburg reign)**

The second period comprised three phases, which could either have been different, successive building stages, or different stages within the same programme of works. There are no specific, reliable data for this period, so any hypothesis remains to be confirmed or refuted. This entire period can be placed between the sixteenth and eighteenth centuries. The first significant intervention that can be identified is an attempt to join the Palace of Charles V to the western gallery of the Comares Palace, to be used as part of the imperial palace; the interior rooms in this zone were also refurbished at this time. A series of works on some bays in the western wall of the upper gallery belong to this period. Above all, there were two major interventions: the insertion into the gallery fabric of the arch and window of the Palace of Charles V, which connected the Nasrid and Hapsburg palaces; and the inclusion of a door, possibly attached to the staircase, connecting the gallery to the Comares Palace.

Judging by what can be deduced from direct observation of the walls, we may be able to attribute to this same phase the insertion of the large girders that cross the south end of the nave, later shortened to insert the door of the museum. The girder seems to have been inserted at the same time as alterations were made to the little room at the southern end of the nave, as the same girder is inserted in a brick fabric apparently different from the brick fabric which characterizes the walls of this little room. Also related with this same period, although at another building stage, is a series of works on the central bays of the western wall, whose dimensions are altered or their positions shifted. The portal in the western façade may have been opened in 1634, on the occasion of the visit of King Philip IV.13

Period III: 19th-century to present day

The third period covers a long stretch of time, from the interventions of the nineteenth century until the present day. This period in turn comprises five building sub-phases. The first sub-phase corresponds to the works carried out between 1826 and 1923, from the first neo-Nasrid restorations carried out by José Contreras, to the arrival at the Alhambra of the architect Leopoldo Torres Balbás. Above all, an important intervention was detected in the eastern wall, which consisted of thickening it by the addition of masonry fabric. According to the findings of our historical investigation, this operation took place in this period, when the single-hipped roof giving on to the Court of the Myrtles was changed into a double-pitched one.

The second sub-phase corresponds to the works performed between 1923 and 1936, when Torres Balbás was the architect in charge of restoration at the Alhambra—the available documentation shows more precisely that Torres Balbás worked on this zone between 1923 and 1929. Many works were carried out on the western bays, including the closure of some of the windows which opened on to the exterior, and in the exterior western façade, as well as several other repairs. These works are well documented in Torres Balbás’ Work Diary, so they were easy to locate in the building. The work carried out on the lower part of the walls of the little room at the south end of the nave, where some doors were opened to connect it with the main hall, is believed to belong to this period. The jambbs of these doors show in the bonding of their fabric some bricks with a groove at the centre of their upper surface, of a type which used to be employed to channel the water in Islamic baths, and which Torres Balbás himself had specially made in order to leave a recognisable mark of his intervention. In addition, the fabric around the bays is finished with the toothing that Torres Balbás left when he wanted to suggest that the wall originally continued beyond the bay opened up within it. The fabric of the zone in question seems to be a continuation of the fabric around the doors on the ground floor which communicate between the Palace of Charles V and the Court of the Myrtles, and which was made by Torres Balbás.

The third building sub-phase corresponds to the earliest construction of the Alhambra Museum. This project was developed in 1948, and is represented in the plan of 1956 mentioned in Miguel Sorroche Cueva’s historical research, conducted as part of this project. The works performed during this phase are reflected above all in the closure of nearly all the bays in the western wall, although some of them had been closed during previous phases. The creation of the entrance into the gallery from the south of the nave, opened to give access to the museum, deserves special mention (bay number 4, in Colour Plate 16).

The fourth sub-phase corresponds to the second phase of building the Museum, which is only documented after 1956. This can be seen particularly in the grooves made in the walls to house electrical wiring and other systems, and the renovation of the interior space with cement rendering, completely covering the walls. The fifth building sub-phase comprised the works performed between 1999 and 2000, involving above all the replacement of the timber roof.

In parallel to the stratigraphic study, the materials in the gallery were classified and, in some cases, their state of conservation was assessed. Previously, other researchers have performed general chemical and petrographic identification of the Alhambra’s Nasrid common building materials mainly in the citadel and the palaces, and their findings have been recently published. In this case, new and specific samples were taken in the gallery from the mass of taqiel, the finished surface, the rests of various former cladding layers, not only of the supposedly Nasrid building materials, but of all the constructive history of this space, in order to begin to understand the changes of the way of building through the history of the Alhambra. X-ray diffractograms (electro-magnetic identification of chemical elements) were performed, polarised light optical microscopy was used on thin sections, and carbonates were determined by Bernard’s calcimeter method. All tests were verified in the laboratory of the Departamento de Mineralogía y Petrología at Granada University. The reasons for conducting chemical

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and petrographic analyses of the samples obtained in the gallery were twofold: the first was to compare the chemical composition of two samples taken from separate locations, in order to assess their possible contemporaneity, and thus complete the data obtained at first sight by the stratigraphic study; the second aim was to classify the building materials of the gallery and, by extension, of the Alhambra.

In the first place, a stratigraphic building analysis permits one to draw up a relative chronology for the architectural example under investigation. Secondly, by comparing this relative sequence with the available historical data, specific periods can be identified and an absolute chronology can be obtained. Thirdly, it is possible to distinguish the building methods of each period, with its concrete solutions, assembly methods, the dimensions of its bricks, type of mortar and aggregate, etc. Finally, the chemical analysis completes this range of possibilities, and allows scholars to characterize the fabrics used at each period by means of the chemical classification of the materials. This methodology has since been followed by the same research team in similar, subsequent projects in other parts of the Alhambra complex.17

During this study, a database was designed to record the building methods used in the upper gallery of the western nave of the Court of the Myrtles; information was later added to it from similar databases developed during later studies on, for example, the so-called Small Kitchen (Sala de la Cocinilla) in the Court of the Lions, or the so-called Barber's Room (Sala de la Barbería) annexed to the Mexuar,18 all rooms within the architectural complex of the Alhambra. The systematic recording of these facts regarding building methods and materials will soon provide an enormously valuable database for investigating the history of the Alhambra, making it possible to discover transformations in situ rather than relying on the available written documents (kept mainly in the Patronato de la Alhambra archives), which do not often detail the entire history of both the major and minor alterations to the monument. Furthermore, registering and classifying the materials, building techniques and solutions of each stage of the monument's history can facilitate the dating and identification of other fragments of the same monument, or even other buildings in the vicinity. Such databases are therefore starting to supersede the limited number of extant documents as the grounds on which to establish future research in this field.

**Conclusion**

The archaeology of architecture helps scholars to comprehend the history of a building by a direct examination of the walls, supported by a study of the building methods, and by chemical and petrographic analyses that permit the identification, characterization and comparison of samples, in order to discover the temporal relationship between them. The stratigraphic analysis performed on the upper gallery of the western nave of the Court of the Myrtles revealed the constructional evolution of an interesting part of the Alhambra. This methodology allowed us to establish a hypothetical chronology of the different building stages for this site, from the Nasrid use of tapial fabrics, through the refurbishment works carried out during the Renaissance, the romantic neo-Nasrid restorations of the nineteenth century, and the conversion of the space into the Museo Nacional de Arte Hispanomusulmán in the twentieth century (Colour Plate 18). We were able to identify the building methods used at each period, and to use this information to create a database, located in the Alhambra, which will form an important resource for future investigations of this monument.

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17 Camilla Miletto and Fernando Vegas, “Estudio estratigráfico constructivo de la Sala de la Cocinilla en el Puño de los Leones de la Alhambra”, unpublished research report, Granada 2002; Miletto and Vegas, “Estudio estratigráfico constructivo de la Sala anexa al Mexuar de la Alhambra”, unpublished research report, Granada 2003. The reports referred to are all deposited in the Archivo de la Alhambra and can be consulted by researchers. We hope to publish more of this research in future issues of *Cuadernos de la Alhambra*.

18 The Spanish names by which these rooms are now known derive from the functions of these rooms during the seventeenth and eighteenth centuries.