

THE PICTORIAL TECHNOLOGY OF THE VAULTS OF THE HALL OF KINGS: STUDY METHOD, MATERIALITY AND EXECUTIVE PRACTICE

TECNOLOGÍA PICTÓRICA DE LAS BÓVEDAS DE LA SALA
DE LOS REYES: MÉTODO DE ESTUDIO, MATERIALIDAD Y
PRAXIS EJECUTIVA

MARÍA-JOSÉ GONZÁLEZ-LÓPEZ

LECTURER AT THE UNIVERSITY OF SEVILLE

baglioni@us.es

ABSTRACT In this article, the technique of execution of the paintings that decorate the three vaults of the "Sala de los Reyes" of the Alhambra in Granada is analyzed in view of the main results obtained in the different projects in which it has been developed its research and intervention, as a result of the close collaboration between the Instituto Andaluz del patrimonio Histórico (IAPH) and the Patronato de la Alhambra y Generalife (PAG).

The investigations carried out have made it possible to determine the sequence of layers and the components present, their implementation and functionality; as well as, its operational praxis has been identified both in the paintings, as in its metallics decorations, delving into the different resources and effects used to achieve the plastic and technical qualities, so particular and characteristic, that these pieces have.

The results obtained allow us to affirm that we are faced with innovative paintings in which a host of circumstances converge that make them unique and benchmarks in the world, not only are the motifs and scenes represented, the location on the ceilings of the different environments for which they were conceived or the historical context in which they are immersed; the constructive and pictorial technology used in its execution, also has a lot to do with this appreciation.

KEYWORDS Pictorial technique, egg tempera, wood and leather support, relief gilding, burnish gilding, matte gilding, matte silver, mecca.

RESUMEN En este artículo, se analiza la técnica de ejecución de las pinturas que decoran las tres bóvedas de La Sala de los Reyes de la Alhambra de Granada a la vista de los principales resultados obtenidos en los diferentes proyectos en los que se ha desarrollado su investigación e intervención, fruto de la estrecha colaboración establecida entre el Instituto Andaluz del Patrimonio Histórico (IAPH) y el Patronato de la Alhambra y Generalife (PAG).

Las investigaciones efectuadas han permitido determinar la secuencia de estratos y los componentes presentes, su puesta en obra y funcionalidad; así como, se ha identificado su praxis operativa tanto en las pinturas, como en sus decoraciones metálicas, profundizándose en los distintos recursos y efectos empleados para conseguir las cualidades plásticas y técnicas, tan particulares y características, que tienen estas piezas.

Los resultados obtenidos nos permiten afirmar que nos encontramos frente a unas pinturas innovadoras en las que convergen un cúmulo de circunstancias que las hacen únicas y referentes en el mundo, no solo son los motivos y las escenas representadas, la ubicación en los techos de los distintos ambientes para los que fueron concebidas o el contexto histórico en el que se encuentran inmersas; la tecnología constructiva y pictórica empleada en su ejecución, también tiene mucho que ver en esta apreciación.

PALABRA CLAVE Técnica pictórica, temple de huevo, soporte de madera y cuero, dorado en relieve, dorado bruñido, dorado mate, plateado mate, corladura.

COMO CITAR/HOW TO CITE GÓNZÁLEZ LÓPEZ, M.J., Tecnología pictórica de la Sala de los Reyes: método de estudio, materialidad y praxis ejecutiva, *Cuadernos de la Alhambra*, 2021, 50, pp. ISSN 0590-1987

BACKGROUND

The paintings that decorate the vaults of the three bedchambers in the Hall of Kings, located in spaces connected to the Courtyard of the Lions, at the Alhambra in Granada, have been studied and intervened upon systematically throughout their history¹. However, it was not until July 1999, following the participation of the Andalusian Institute of Historical Heritage (IAPH), that these works began to be systematically studied in accordance with a scientific methodology, the first results being obtained in 2001². These results laid the foundations for defining the intervention required for these complex paintings, the various phases of which they consist, and the different projects into which the work is subdivided: facing, reverse and obverse sides. Within the framework of these projects, a number of conservation, technical, and intervention research projects have been carried out and which have allowed us to undertake, among others, the technological study we present here.

The background to the technical study of these works can be traced to the 19th and 20th centuries. The search for documentation from this time period generates many references to their material nature and execution. We have summarised them in Table 1. (Table 1). However, it was not until the final third of the 20th century, in the work of Bermúdez and Maldonado and the subsequent paper by Bermúdez Pareja³, that we find a description based on empirical knowledge of their characteristics.

Genuine technological study began during the development of the various projects demanded by the state of conservation of

these paintings, the result of collaboration between the IAPH and Alhambra and the Generalife Board of Trustees (PAG) (1999-2014). On the basis of the data obtained in the various investigations and the in situ studies carried out of their formal and visual characteristics, we have obtained scientific and technical results that have been confirmed and are contrastable and which have given us an insight into the construction technology of the ensemble and the nature of the different materials used in the complex stratigraphic sequence that forms part of it: from the creation of the mixed support, to the determination of the executive praxis of the painting and metallic decorations.

In this article, we will focus solely on describing operative praxis as it relates to the paintings, addressing the various layers that make them up – ground layers, pictorial matter and metallic decorations– without overlooking the hide covering, which, as we shall see, plays an important role in their installation. Similarly, we will provide relevant information on the wood support to gain an understanding of its construction technology, as this subject will be dealt with in depth in this same issue.

METHODOLOGY

The methodology used to carry out the technological study of these paintings is based on the analysis of existing sources and on the results of the research carried out⁴, all with a

4 For your information, the investigations that have been conducted are set out below:

A. Characterisation of materials present:

- Paint and gilding samples: reflected light microscopy, scanning electron microscopy (SEM) with elemental microanalysis by energy dispersive X-ray (EDX)
- Leather hide: Scanning electron microscopy and energy dispersive X-ray microanalysis (SEM /EDX); determination of aluminium by inductively coupled plasma mass spectroscopy (ICP), and proton-induced X-ray emission (PIXE). EAGLE III X-fluorescence equipment at the same time as stereo microscopic view of the sample.
- Hide identification: Study by optical and electron microscopy.
- Binding thread in the seams of the hide: Study under a binocular stereoscopic microscope and optical microscope with reflected light, polarised transmitted light, and transverse study of the fibres with the aid of the optical microscope, with transmitted light, polarised or otherwise.
- Dendrochronology

B. Studies that have allowed us to ascertain execution, sequence and state of conservation:

- Study of sources: treatises, archive documents (texts and photographs), and specialist documentation.
- Visual inspection with normal, raking, infrared, and ultraviolet light.
- Complete radiographic study of the works.
- Photogrammetry and orthophotogrammetry of paintings
- 3D scanning of the obverse and reverse side
- Documentation and graphic and photographic records.
- Production of infographs and thematic mapping

1 The documents consulted confirm that actions have been undertaken in the building since 1618-24, although the intervention that perhaps affected its state of conservation the most was that conducted by Contreras in 1855, which changed the layout of the roofs, accelerating their deterioration, and leading to systematic copies being made: Diego Sánchez Sarabia in the 18th century; Murphy's drawings in the 19th century; and 20th century tracings, which proved so helpful in revealing its state. Similarly, interventions conducted on the paintings to address their poor condition have been documented since Contreras' intervention. There is little doubt, however, that Gudiol's 1960 intervention caused the most interference due to the wax-based materials used in the various treatments applied. For further information, please consult: GONZÁLEZ- LÓPEZ, María-José (Coord.). Diagnóstico previo y propuesta de estudios e intervención de las pinturas sobre cuero de Las Salas de los Reyes, Alhambra, Granada, 24 de mayo 2001, pp 15-21 (inéed.).

2 Ibid. 15-21.

3 BERMÚDEZ PAREJA, Jesús and MALDONADO RODRÍGUEZ. Informe sobre técnicas, restauraciones y daños sufridos por los techos pintados de la Sala de los Reyes en el Palacio de los Leones de la Alhambra. In: Cuadernos de la Alhambra, no. 6, 1970, pp: 5-20; and BERMÚDEZ PAREJA, J. Pinturas sobre piel en la Alhambra de Granada. Patronato de la Alhambra y Generalife, 1987.

19TH CENTURY			
YEAR	AUTHOR	DOCUMENT	TECHNIQUE
1841-1844	Girault de Prangey	<i>"Granada y la Alhambra. Monumentos árabes y moriscos de Córdoba, Sevilla y Granada" pp.72</i>	"painted on animal skins, sewn together, and then glued to the wood that forms the vault"
1842	Jules Goury and Owen Jones	<i>Plans, Elevations, Sections and Details of the Alhambra. Vol. I. pp. 180</i>	Very brightly coloured, but made with flat inks, with no shadowing, and with the outlines drawn with a brownish line. They are painted on animal skins that were stitched together, nailed between the wooden vaults, and covered with a thin layer of gypsum plaster to receive the paint. The ornamentation in the background is embossed.
1846	José Giménez Serrano	<i>Manual del artista y del viajero en Granada. pp. 96-99.</i>	Completed on leather prepared with a ground layer and then finished with finely blended colours, with Prussian blue and vermillion to the fore, along with glittering silver and gold fillets.
1853	Isidoro Severín Justín Baron de Taylor	<i>La Alhambra pp. 3.</i>	The Hall of Justice has depictions of figures painted on pieces of stitched leather that are glued onto the wooden structures.
1854		<i>Informe de las obras necesarias a realizar en los edificios del Real Patrimonio de la Alhambra en el año próximo de 1855</i>	The ceilings of the alcoves in the Hall of Justice are painted in oil on leather hides, these being "all that remains of this type from the days of the Arabs"
1866	Owen Jones	<i>The Alhambra Court in the Crystal Palace. pp. 201</i>	Paintings on animal skins, sewn together and nailed to each of the wooden vaults. A thin layer of plaster was applied to the skins, with bright colours, in flat inks and with no shadowing.
1872	Eugène Poitou	<i>Viaje por Andalucía. pp. 214-215 and 217.</i>	The most notable is the central room, where a court is depicted <i>"The colours are bright with no shades or shadowing. The outlines are drawn with soot, while the background is gold with relief decoration."</i>
1872	Adolf Friedrich Von Schack	<i>Poetry and Art of the Arabs of Spain and Sicily, pp. 421.</i>	Paintings on leather and placed in the vaults. Ten male figures on a gold background...
	Remigio Salomon	<i>Guía del viajero de Granada. pp. 136-138.</i>	Completed on leather prepared with a ground layer and then finished with finely blended colours, with Prussian blue and vermillion to the fore, along with glittering silver and gold fillets.
1878	Rafael Contreras		Wood support: -poplar (white poplar), an abundant species in Granada. -Boards measuring 7cm thick and carved into pieces of different sizes. -Fitted together using tin-plated iron nails. Leather covering: covers the support and adhered to it with thick glue paste and nailed in all directions with square-headed crutch-shaped nails.
1889	Charles Davillier	<i>Travels in Spain pp. 226-227.</i>	"They are painted on hides stitched together and affixed to resinous wooden boards. The leather is covered with a layer of plaster which seemed to us to be similar to that used in the paintings of the Italian Primitive School. Another very noteworthy parallel is that the colours, which appear to have been prepared with glue or tempera, are also placed on a gold background dotted with small embossed adornments."

20TH CENTURY			
YEAR	AUTHOR	DOCUMENT	TECHNIQUE
1919	Luis Seco de Lucena	La Alhambra. Novísimo estudio de historia y arte. pp. 123-124.	Ellipsoidal wooden dome lined with leather with paintings.
1929	Macario Golferichs	"I. Informe emitido por el arquitecto inspector de la Alhambra don Ricardo Velázquez Bosco en 1903", in <i>Informes acerca del estado de la Alhambra</i> . pp. 9.	<p>The drawing of the paintings: Previously drawn on a template, which, crushed, would then be sprinkled onto the plaster of the ceiling, where it would be corrected and reworked and scratched with an iron tool. Then, on the parts that were to be gilded, beaten gold leaf was applied, which was then burnished. On the remaining parts, the other colours, prepared beforehand with egg yolk, were applied.</p> <p>Technique used to build the vault, indicating that the domes on which the paintings on leather rest consist of a ribbed frame with a distinctive Fatimid-type structure, i.e. a semicircular vault with two quarter-sphere caps at the ends. The frame is covered with hides fastened to the wood by tin-coated nails.</p> <p>Preparation of the leather: Thin layers of plaster were applied to the leather with hide glue to form a homogeneous surface, which was then smoothed with an iron. A layer of glue was applied to this preparation to enable painting.</p>
1970	Bermúdez Pareja, Jesús and Maldonado Rodríguez	Bermúdez Pareja, Jesús and Maldonado Rodríguez. Informe sobre técnicas, restauraciones y daños sufridos por los techos pintados de la Sala de los Reyes en el Palacio de los Leones de la Alhambra. In: Cuadernos de la Alhambra, no. 6, 1970, pp: 5-20.	<p>Wood support: Mixed poplar wood composite (white poplar). Vaulted ceilings with "white poplar" boards that are between 12cm and 28cm wide and 7cm thick. The boards are bound together at the edges using spindle-shaped, tin-plated iron pegs, which are pressed together (without the need for glue).</p> <p>Sheepskin lining: The various skins that form the covering are arranged lengthwise (from head to tail) to match the direction of the grain of the wood support. The edges of the skins are pared to conceal the joints.</p> <p>The skins were glued with wheat flour paste and glue or casein and fixed with blunt bamboo cane pegs, staked to the support (without piercing the skin), starting at the corners of the skin in a diagonal direction and then continuing along the edges.</p>
1987	Bermúdez Pareja, Jesús	<p>Pinturas sobre piel en la Alhambra de Granada. Jesús Bermúdez Pareja</p> <p>Granada: Board of Trustees of the Alhambra and the Generalife, 1987.</p> <p>ISBN 84-86827-00-0</p>	Same information
1987	Marino Antequera García	La Alhambra y el Generalife, P. 50	Elliptical wooden vaults bound with leather bearing egg tempera paintings, with gilding and embossed decoration. The technique is executed with virtually no modelling. Outlines highlighted in black.
1991	José María Velasco Gómez	Memoria de las intervenciones y documentación referente a las bóvedas y pinturas de la sala de los reyes. APAG. Conservación/restauración/informes 2/1.	They are boards covered with hides, fixed with bamboo nails and glue. Stucco and paint.

The execution technique through documentary sources. M^a José González López.

threefold objective: firstly, to understand the terrible state they are currently in with a view to proposing the most appropriate actions for addressing the damage done to them (preventive and remedial); secondly, to describe the various materials used in their execution and in the previous treatments; and, finally, to gauge the importance and extent of the repairs and “restorations” suffered over time, which have not only undermined the original paintings, but have also had a very negative influence on their state of conservation (Il. nº 1), in order to propose the restoration treatments best suited to their correct aesthetic presentation. Based on these considerations, and in our awareness of the extent of the repainting and the existing retouchings (see Il. 1), it has been deemed essential to determine, *a priori*, original areas from ones that have been intervened on, so that once they have been identified a study of the techniques used and their materiality – without the interference deriving from new treatments – can be conducted. For this reason, we have focused on the documentation, results and observations acquired prior to intervention on the obverse side.

Based on these premises, the material characterisation of the main components used in each of the constituent strata was determined, identifying the materials present – original and otherwise – in order to discard those originating from previous interventions throughout the paintings’ material history, the purpose being that they do not interfere in the assessment of the original technique, as well as identifying the operative praxis both in the paintings and in their metallic decorations, investigating the various resources used to achieve the unique and characteristic visual effects and pictorial qualities of these pieces.

The results obtained confirm some existing hypotheses about their composition, while providing new data confirming their specific characteristics. Their execution involves aspects that make them unique, exemplary and special, from their inverted-boat structure on an unusual support – prepared differently on their reverse and obverse sides – and the transfer of the composition by means of a drawing technique, more akin to parietal art, to the use of a pictorial technique characteristic of lean tempera on wood – so prevalent at that time in the rest of Europe. This was evidenced by the colour range and the technical resources used.

CONSTRUCTION TECHNOLOGY

The technology of the paintings will be described according to the construction sequence: mixed support, starting with the wood base and then the leather covering, followed by a

description of the preparatory layers and the ground layers, and concluding with the execution of the painting and the gilding.

Supports

We must start by saying that the support used for these paintings comprises two types of materials, each of which fulfils a different function. The wood provides the base on which to support the work, while its complete leather covering provides a level and sufficiently rough surface on which to apply the paint. It is for this reason that we believe that its denomination as a “painting on leather” – on the basis of one of its two constituent supports – is incorrect.

Wood support: The lower support is made up of a primary structure that is very simple in its design and in which three fundamental parts can be distinguished: a base ring that forms its perimeter; a shell made up of a series of ribs equidistant from each other; and, lastly, a frame made of boards, joined together with a protruding joint, which covers it and which is nailed to it with forged nails.

In the three halls, the frame is arranged in such a way as to form the morphology of the vault. It revolves around a central axis, from which the various pieces are arranged. They are more or less symmetrical, longitudinal and regular, with the largest pieces being found in the straightest section, and the most numerous, smallest and most irregular pieces being found in both hemispherical cupolas. As for their size, we have to say that they do not follow any precise criteria, with the boards ranging from 20x15cm to 200x40cm. The number of boards also varies. There are 43 in “Lady Playing Chess”, 37 in “The Hall of Dignitaries” and 45 in “The Fountain of Youth” (Il. 2).

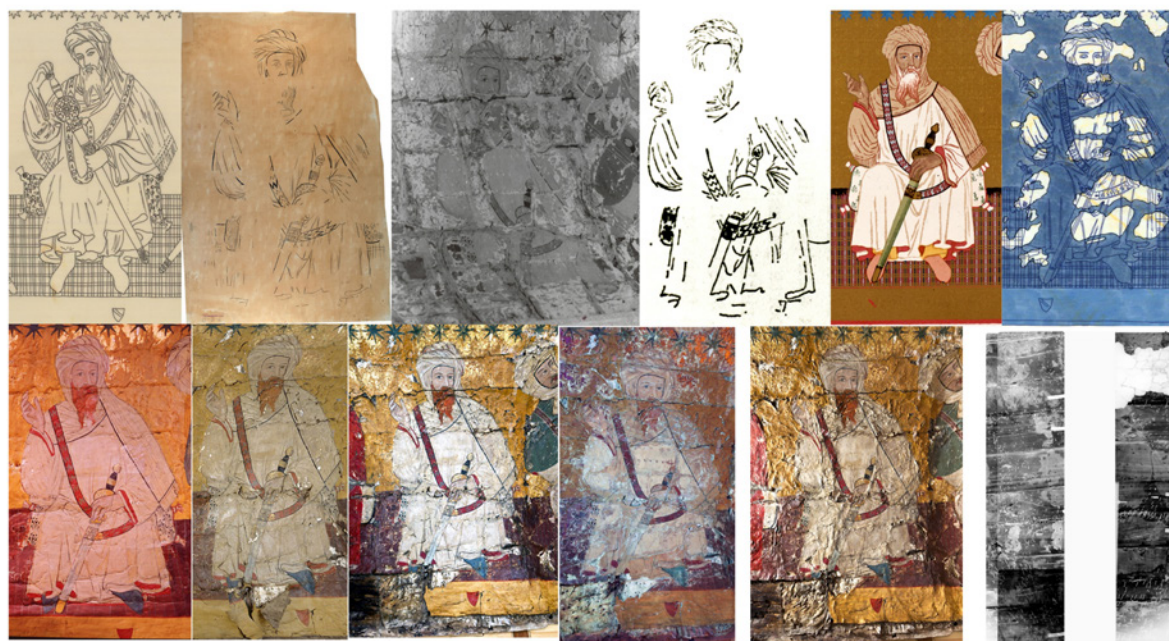
The board joints are caulked for improved insulation and stability, and are filled with wood chips (poplar) and pieces of cotton fabric and burlap⁵. The surfaces of the reverse sides of the three supports are in turn coated with two layers. The lower layer is pine pitch, applied generally for protection, insulation and as an insecticide,⁶ while the upper layer – applied on the board only – consists of a light “layer of plaster” providing protection against fire⁷ (Il. 3).

In vaults 1 (Lady Playing Chess) and 2 (The Hall of Dignitaries) the boards that make up the partition and the ribs are

5 GONZÁLEZ-LÓPEZ, María-José (coord.). *Pinturas de La Sala de los Reyes. Alhambra, Granada. Proyecto de intervención en los reversos de las pinturas*. Seville, 2008, pp. 49 and 172-175 (unpublished).

6 *Ibid.* pp. 206-209.

7 *Ibid.* 182-205.



KING 1

1. Owen Jones (1842)
2. Tracings, Manuel Gómez Moreno (1875)
3. Photos, MAS archives (Amatler d'Art Hispanic 1962)
4. Basilio Pavón Maldonado (1950-1960?)
5. Colour drawing, Owen Jones (1842)
6. Drawing in Blue J. Santos (1978)
7. Oronoz Archive (1970), Gudiol intervention
8. Vicente del Amo (2007)
9. Unwrapped. Alhambra (2021)
10. Photo with ultraviolet light, IAPH (2012)
11. Photo with raking light. Alhambra (2012)
12. X-rays. Aplus (2010)

II. 1. Study of the conservation of King 1 based on the analysis of graphic and photographic documentation (Infographic: María José González López).

made of poplar (*Populus alba* L.), while Vault 3 (The Fountain of Youth) is made of three different species: *Populus alba* L. in the ribs and quadral; wild cherry (*Prunus avium* L.) in a specific area of rib 8; and stone pine (*Pinus pinea* L.) in the boards forming the boarding⁸.

The dendrochronological study revealed that the wood used in the three roofs came from the same stand and was cut at the same time or over a very small number of years. The time period was identified as the mid-14th century, with the study indicating that the wood was cut in 1366 *post quem* and that, on average, around 50 years elapsed between the wood being felled and it being used, between 1390-1400⁹. Recently, new data have been published on the dating of these pieces based on the analysis of two samples by C-14, which date them to the following periods: Sample no. 1: 1279 CE; 1331 CE; 1338

CE; 1397 CE; and sample no. 2: 1208 CE; 1300 CE, respectively, without specifying whether the estimated date corresponds to the felling of the tree or the use of the wood¹⁰.

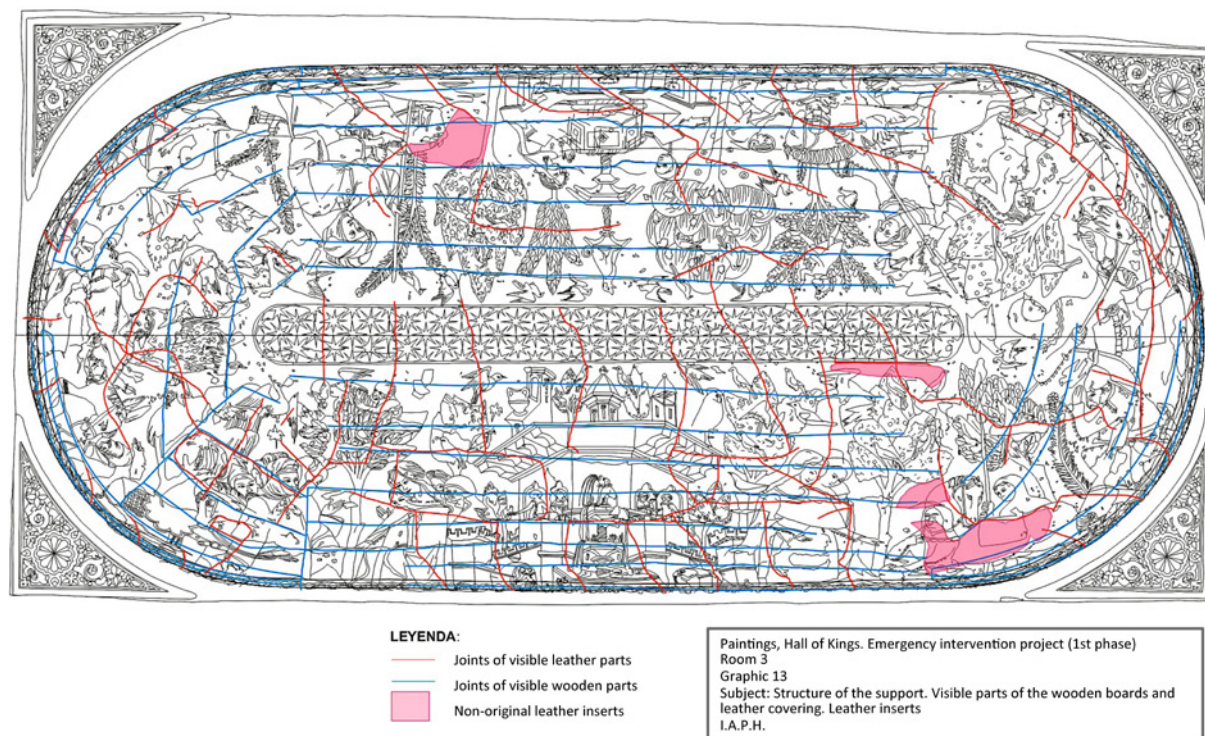
At this point, it should be noted that the spindle-shaped tin-plated iron pegs, fastened together by pressure (without adhesive) mentioned by Bermúdez Pareja and Maldonado Rodríguez¹¹ and used in the construction of the wooden support were not observed, either during the conservation-restoration intervention carried out on the reverse side or with the naked eye in the gap in the joints of the boarding. Most significantly of all, they are not visible in the X-rays, where, in contrast, all the existing metallic elements (forged nails, tacks and screws) are very clearly visible. It is for this reason that we cannot confirm their existence.

⁸ Ibid. 92-165.

⁹ RODRÍGUEZ TROBAJO, Eduardo. Estudio de dendrodatación de La Sala de los Reyes de la Alhambra, julio de 2008, pp. 13 and 14 (unpublished).

¹⁰ FRANQUELOA, M.L.; DURAN, A. and PEREZ-RODRIGUEZ, J.L. "Laboratory multi-technique study of Spanish decorated leather from the 12th to 14th centuries" In: *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* no. 218, 2019, pp. 333.

¹¹ Ibid. note 3. pp. 12.



II. 2. Constituent parts present in the mixed support. The number and arrangement of the wood and leather pieces can be seen (Infographic: M^a José González López).

Leather lining: Although not very common, the type of mixed support (wood and leather) found in these paintings¹² was not completely unknown to the treatise writers of the day. It is, in fact, mentioned by both Theophilus (12th century) and Heraclius (10th-13th century) in their respective treatises. Both refer to the wooden base being covered entirely with untanned donkey or horse hide that was applied to the wood when damp.

Theophilus writes of wooden supports being covered with horse, donkey and cow hides, which were shaven and affixed to the support with casein glue¹³.

"Then the panels should be covered with the raw hide of horse or an ass or a cow which should have soaked in water. As soon as the hairs have been scraped off, a little of the water should be wrung out and the hide, while still damp, laid on top of the panels with cheese glue" Book 1, chap. 17, p. 26 *Theophilus on Divers Arts. The Foremost Medieval Treatise on Painting, Glassmaking and Metalwork*.¹⁴

In contrast, Heraclius only mentions the type of leather

to be used in covering the wood support to be painted; in this case, horsehide or parchment¹⁵:

*"If the Wood, which you wish to paint upon is [not] smooth, cover it with leather made of horse-skin or with parchment."*¹⁶

In the three vaults as a whole, the obverse side of the wooden boards is completely covered by a support made up of pieces of horse hide (*Equus caballus*) that have been stitched together, as shown by the mitochondrial DNA analysis conducted on several samples belonging to scattered fragments of original hides¹⁷. The skins were alum tanned. Also known as white tanning, this method was used when the intention was not to remove the hair, as is the case here. The hides were mounted, without being shaven, on the grain side and facing

15 MERRIFIELD, M.P. *Medieval and Renaissance Treatises on the Arts of Painting: Original Texts with English Translations*. Ed. Dover Fine Art, History of Art. 1999, pp. 230.

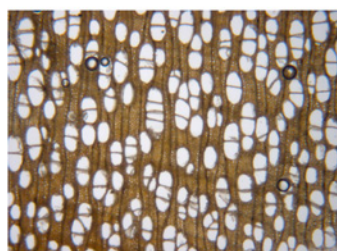
16 Proofreader's note: no need for author's translation here.

17 Although the presence of sheep hide (*Ovis aries*) and cow hide (*Bos Taurus*) was detected in two of the samples, possibly coinciding with hides used in previous interventions, the genetic study conducted on the leather detected the presence of horse hide (*Equus caballus*) in most of the original samples analysed. See report: GENOCLINICS. Investigación genética de muestras biológicas procedentes de tejidos animales obtenidos en los trabajos de recuperación de los restos históricos de la Alhambra de Granada. 2009, pp. 9 (unpublished).

12 We have found no references of other works built in such a way, nor of these dimensions, in Europe, either at this time period or later.

13 HAWTHORNE, J.G. and STANLEY SMITH, C. *Theophilus on Divers Arts. The Foremost Medieval Treatise on Painting, Glassmaking and Metalwork*. Dover. 1963, Book 1, chap. 17, p. 26.

14 Proofreader's note: no need for author's translation here. Proofreader's note: no need for author's translation here.



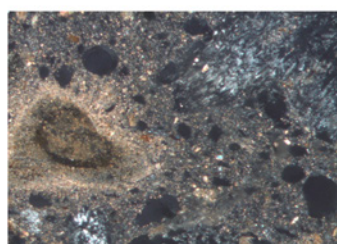
Populus alba L. Muestra: P1k11802. Cross section, 25x. Vault 1 (Photo: Víctor Menguiano).



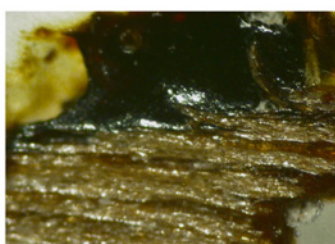
Coniferous wood fibres: fenestriform cross-field pitting, 100X (Photo: Lourdes Martín).



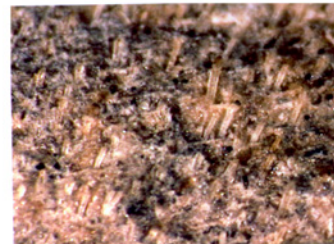
Cotton fibres viewed under optical microscope, 200x (Photo: Lourdes Martín).



Mortar. Sample: P2C04P09 Partially calcined lime nodule. On the right, aggregates of fibrous gypsum. 5x (Photo: Jesús Espinosa Gaitán).



Resin coating: Photomicrograph corresponding to sample P2E03Q19 (25x) (Photo: Lourdes Martín).



Unshaven leather viewed under optical microscope (Photo: Cristina Berardi)

Il. 3. Characterisation of materials present on the reverse sides of the paintings: wood support, fibres and filling materials in the board joints, and mortar and resin coatings (Infographic): María José González López).

outwards, with the hair facing outwards to enable the subsequent layers of paint to adhere and grip¹⁸ (see Il. 3).

As a whole, the hide covering is made up of pieces that are very irregular in size and shape, ranging from 12.5x6cm in size for the smallest ones to approximately 75x98cm for the largest. Given that they are covered in paint, it is very difficult to detect them in areas where the seam marks are not visible, which is why it has not been possible to provide an exact count. The number of pieces that can be seen with the naked eye are as follows: a total of 47 were counted in Lady Playing Chess; 58 fragments were identified in the The Hall of Dignitaries; and in The Fountain of Youth 53 can be seen (see Il. 2).

They were assembled by means of a construction system that was unprecedented in large-format paintings such as the ones in question. The pieces of leather are joined together "by thread" with a type of stitch called "en repulgo", which allows the pieces to be joined edge to edge, without any overlapping

or excess thickness being created when the thread is pulled, leaving a characteristic undulation on the edges of the hides (Il. 4). This allows them to fit perfectly together, keeping the pieces level and tightly bound to each other. Linen yarn was used for this task¹⁹.

The coating is placed on the wooden support in such a way that the pieces run transversally to the grain of the boards. This results in a level surface that adapts to the curvature of the obverse sides and without marks being transferred from the underlying support (see Il. 2). The manner of its installation remains a mystery. Two theories have been put forward in this respect: firstly, the covering was put together separately and, like a sheath, affixed to the wood *in situ*; secondly, the pieces were glued and/or nailed (bamboo pegs), individually or in groups, with the edges being left unfixed and then stitched and glued to the support²⁰.

18 GONZÁLEZ-LÓPEZ, María-José (coord.). "Pinturas de la Sala de los Reyes. Alhambra, Granada. Proyecto de intervención de urgencia. Primera fase: fijación preliminar y facing de protección", diciembre de 2002, pp. 84 (unpublished).

19 Ibid. pp.82

20 PARIS, M. B. and VALERIA JERVIS, A.M. Granada, Alhambra, Patio de los Leones. Bóvedas pintadas de la Sala de los Reyes: proyecto de intervención. 17-19 December 2012, p. 21 (unpublished).

After the leather support had been formed, in one of the two aforementioned ways, it was affixed to the inside of the wooden boards with the aid of an adhesive. Although the treatises referred to make mention of cheese glue (casein glue) for this purpose and for joining the various pieces – owing to its great adhesive strength and because it is not affected by humidity or heat – we cannot scientifically confirm this fact. Thanks to the results of the mitochondrial DNA analysis of hide samples, however, we can confirm the presence of red drum (*Sciaenops ocellatus*), a saltwater fish belonging to the *Sciaenidae* family. It was not possible to determine whether it corresponds to the adhesive used to affix the hide to the wood, to the gluing of the surface, or to the creation of the ground layer²¹. Animal-based adhesives are ideal for creating rigid and flexible supports, as they are tensioning agents. When moist, they enable the fitting and shaping of the hide on the support on which it is spread, allowing it to be smoothed and aligned. Once dry, the hides become taut, which makes it easier to interlink them and remove any wrinkles and unwanted deformations in the hide coating, resulting in a flat and taut surface that is firmly affixed to the base wood.

The skin was kept in position while drying took place, thanks to being fastened in place by small nails or “bamboo pegs”, distributed in parallel rows and positioned at regular intervals of about 3,5cm²², as indicated by Bermúdez and Maldonado²³. These pegs are visible to the naked eye beneath the equidistant discoloured patches that can be seen in some areas of the artworks. Signs of their presence can also be seen in the X-rays taken (Il.5). They are not easy to identify. This is because only the colour has faded in these areas and only the ground layer is left visible, and because the numerous repainting and intervention materials that are present prevent the original material beneath them from being seen, leaving them hidden from view.

As for their chronology, the C-14 dating of the two hide samples analysed places them in the following time period: 1280 CE:1333 CE and 1336 CE:1398 CE²⁴.

As can be deduced from its construction, we are faced with a highly unusual composite support, similar to an inverted boat, the outer surface of which is caulked and waterproofed with a material more commonly used on boats than on painting panels. This structure reflects a desire on the part



Il. 4: Detail of the head of King 9 in the Hall of Dignitaries. In the king's beard can be seen the join between two pieces of hide bound together by “en repulgo” stitching, as well as possible traces of “pegs” (equidistant faded circles) in his turban and, finally, micropores originating in the ground layer and visible on the right cheek (Photo: Eugenio Fernández Ruíz).

of the architects who built it to create a stable base that would minimise the movements of the various constituent parts as much as possible so as to prevent interference or unwanted marks from appearing on the painting, this through the application of the coatings on the extrados (resin and mortar) and the hide covering on the obverse side.

Painting technique:

The painting technique used was common for the period, if we take into account the results of the dating studies (dendrochronology – date of felling and use – and carbon-14). The estimated date of execution would be the mid-to-late 14th or early 15th century²⁵. Although C-14 dating has provided an

21 Ibid note 17. pp 8.

22 Ibid note 20, pp 21 (unpublished).

23 Ibid. Note 3. pp. 15 by Bermúdez Pareja and Maldonado Rodríguez.

24 Ibid. Note 10. pp. 333.

25 This timeframe coincides with that proposed by Albarracín Navarro (pp. 111) and Bernis, C. (pp. 33-45).



II. 5. Comparative study of King 5, normal light and X-ray. The gaps in colour, the joints between the boards, and the loss of the pictorial ensemble can be seen in both images. Some technical details are also visible, such as the presence of micropores on the face, the assured lines of colour that provide touches of light in the modelling of the flesh, and the loss of colour brought about by the presence of "pegs" (small equidistant holes), which are visible to the naked eye and in X-rays (Infographic: María José González López).

earlier date for some of the leather samples, it is possible that they were manufactured prior to the date of use.

The estimated dates are supported by the nature of the painting technique, which broadly corresponds to descriptions found in earlier and contemporary treatises²⁶ for panel supports. Despite their location, context and construction, the operative praxis involved in these paintings is very strongly linked to the free-standing polyptych and altarpiece panel painting of the European schools of the 13th, 14th and later centuries. They are executed on a mixed support (wood and leather) using tempera (egg yolk) and gilding or silvering (with water and size), both flat and in relief.

²⁶ See the description of the technique used on rigid supports in the preparatory layers, gilding and painting in the treatises by Theophilus, Eraclius, Cennini and Jean le Bègue in: GONZÁLEZ-LÓPEZ, María-José. *Estudio de las Preparaciones de Pintura sobre Soportes de Tela y Tabla. Caracterización de sus principales componentes, comportamiento y factores de deterioro*. 1992. pp. 36-79.

Although leather has been used as a painting support in *cordobanes* (iron-worked, relief-embossed leather) and *guadamecies* (leather coated with a thin film of silver to imitate gilding and then painted) and in paintings, furniture and furnishings, and also in painted and gilded decorations in tapestries for covering walls (gilded and painted leather), the paintings of the Alhambra bear no comparison with them.

Although all the evidence suggests that they were executed by Christian hands, we see in them a mixture of technical, visual and stylistic resources from European tempera painting on mural and wood and Arabic ornamentation on leather. In fact, the lower frieze around the central painting in the Hall of the Dignitaries contains a reproduction of a *guadamecí* with floral motifs in relief on a background bearing decorative punchmarks. As in the central room, the decoration with palmettes in relief in the background is copied in the painted and gilded leather tapestries that covered the walls of some stately and palatial buildings. In both cases, they are executed with

the same materiality and technology used in the rest of the work: a lean ground layer, motif in relief, water gilding and, in the frieze, a grainy background. It is precisely here, in another of the specific features that makes them unique, that they reproduce, in specific areas of the central painting, the *guadamecí* (or gilded and painted leather) technique, albeit using the technology of tempera painting on a rigid support. It is in this central painting that we find, more than ever, a fusion of Arabic and Christian traditions.

The stratigraphic sequence of these paintings is characteristic of lean tempera painting: preparatory layers, drawing, metallic decorations, underpainting, and finishing effects. No traces of any original varnish were detected, which is logical, in view of the lean technique used and also the fact that the paintings were treated in the 20th century with waxy substances such as fixatives, and stucco, retouching and protective binding media²⁷. This not only spoiled the original semi-matte appearance of the surface, but also contaminated the structure and most of the samples taken.

The results obtained in the studies conducted in each of the stratum are shown below (Il. 6):

Ground layer: The preparatory layers are applied on the leather and consist of a double white preparation of variable thickness, depending on whether the areas are painted or feature flat or embossed metallic decorations.

The composition is very common: calcium sulphate as a filler and animal glue as a binding agent. Both materials are regularly cited by earlier and contemporary treatise writers for the manufacture of ground layers for lean tempera on panel and for gilded areas: Theophilus, Cennino Cennini, Jean le Begue, and later: Armenini, Pacheco and Palomino²⁸.

In these paints, the calcium sulphate (dihydrate) is bound with animal glue and applied in two layers that are separated from each other by a layer of this same glue. The lower layer is coarser (above 220µ), more granular in texture, and has a greater amount of impurities (silicates and calcite) and/or the odd nodule of celestine (strontium sulphate)²⁹. The upper, thinner layer (between 75 and 95µ) is formed by a very fine and pure plaster³⁰. This

type of plaster had already been used at the Alhambra. In fact, *espejuelo* (crystalline gypsum) plaster is mentioned in documents from the 16th century, according to Basilio Pavón Maldonado³¹.

The surface of the final preparation layer is treated to provide a flat, uniform surface upon which to apply the paint. Stratigraphic studies show that it is isolated. The purpose of this isolating layer was to limit the excess absorption of the paint by the lean preparation, which by its nature is very absorbent. In this case, animal glue³² was used as an insulating layer.

This last layer, depending on the area of the artwork, was painted, embossed decorations applied to it (stars, the cord bordering them, and the palmettes in the background of the central hall), and red-clay bole (the base of the gilding) spread on it³³. It was also water-gilded and burnished to create a polished, shiny appearance. If the gilding or silvering was carried out on specific decorations on flat areas with no embossing, size was applied, followed by the metal leaf, which in the case of gilding, could be colour-glazed³⁴ or not. In these areas, the metal was not burnished and was left with a characteristic matte finish.

Only in the central hall was the presence of micropores visible to the naked eye detected. These are distributed irregularly across the painted surface. They are possibly the result of poor workmanship in the preparation and application of the layers, a consequence of the presence of air bubbles in their composition, which burst after drying to leave these characteristic micropores (see Il. 4 and 5).

Drawing: Various drawing techniques used to outline the composition were observed with the naked eye, under raking light, and also by studying the X-rays. The first is underdrawing, and the second corresponds to the transfer of the present composition.

Underdrawing: In the central painting a composition preceding the existing one was detected. It was executed by means of transferring the indirect-incision drawing directly onto the dry preparation. It is visible to the naked eye, in raking light, and in X-rays. The background is made up of 17 stars, each with seven points and inscribed in circles with a diameter of

27 Ibid. Note 2. pp. 18-19

28 Ibid. Note 26, pp. 245 ff.

29 GONZÁLEZ-LÓPEZ, María-José (coord.). "Pinturas de La Sala de los Reyes. Alhambra, Granada. proyecto de intervención en el anverso de las bóvedas 1, 2 y 3". See results of the stratigraphic and analytical studies conducted by Lourdes Martín and Abel Bocalandro Rodríguez, pp. 350-490 (unpublished).

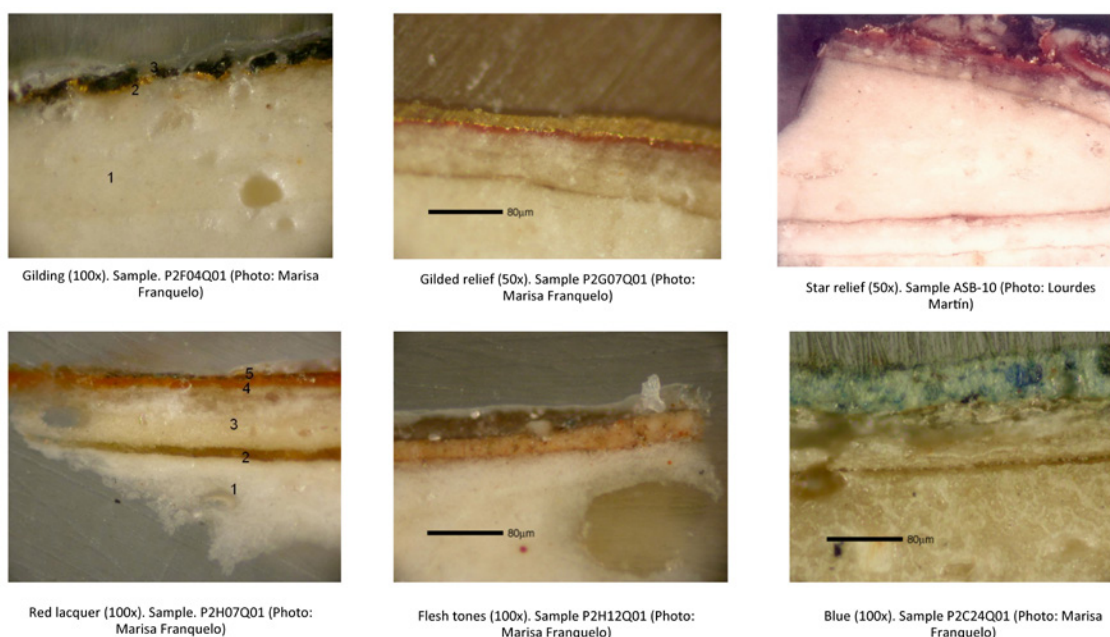
30 Ibid. Note 29. pp. 340.

31 PAVÓN MALDONADO, Basilio. *Tratado de Arquitectura Hispano-Musulmán*: Palacios. III. CSIC, 2004, pp. 720.

32 Ibid. Note 29, pp. 333.

33 Ibid. Note 29, pp. 334.

34 In Spanish this glaze is known as *corla* or *corladura*: a translucent coloured glaze applied to the metal leaf (gold, silver, tin or alloy) to lend a different shade to it. When the intention was to replicate shades of bronze, the process was known as "bronzing".



II.6. Stratigraphic studies of paint and gilding samples: the stratigraphic sequence present in each sample can be seen, as well as their thickness (Infographic: María José González López).

approximately 23cm. Based on measurements taken from their centres, they are approximately 35cm apart. They appear in very specific areas of the vaults and have a very peculiar arrangement, as they do not correspond with the paintings of the kings represented and hidden by them. All this information leads us to assume that the original intention in the central vault was to depict a starry sky, possibly with constellations, which was later modified with the current scene during the course of its execution, as it was not even drawn in its entirety. These stars have only been found in this vault. No incised drawings were found in the other two vaults (II. 7).

If to the existence of this underlying drawing, we add the presence of micropores in the ground layer – also visible in this vault only – we could make the following two hypotheses, once it has been scientifically confirmed that the materiality of the preparatory layers is the same in the three halls: first, that the manufacture and application of the preparatory layers in the central room could have been carried out by different craftsmen to those who worked on the side room; and second, that they were applied prior to these, a hypothesis that remains open to future lines of investigation.

Existing drawing: Executed on the final preparatory ground layer, using a technique that is rare in painting on wood panels or altarpieces but highly characteristic of mural painting. In the artworks in question, the silhouettes of the animals and characters

and the outlines of the various floral and vegetal motifs, etc are created with a brush in a reddish pigment – red ochre – known as sinopia, visible to the naked eye where there are gaps in colour and in the outlines of certain elements of the composition. The visible lines of the drawing show great assurance. Unbroken and showing no hesitation, they denote the outlines of the characters only. There are no visible internal lines that would suggest areas of modelling – simple or criss-crossing marks (II. 8).

The use of sinopia was also detected on the reverse sides of the supports in certain areas of the Fountain of Youth, specifically inside of some of the joints between the boards. Small traces of this material can be seen on them with the naked eye and seem to coincide with cutting and adjustment marks³⁵.

No indications or indicative elements could be detected either with the naked eye or through infra-red reflectography that would allow us to state that what we have here is a transfer of the base drawing using an indirect method (stencil, grid, incision, etc). It seems evident from the size and the inverted arrangement of the paintings, however, that any of these methods could well have been used to outline the general composition. Notwithstanding this, we have to say that study of the X-ray

35 GESTIONARTE. Memoria de la intervención en los reversos de las pinturas. Gestionarte Servicios integrales aplicados a los Bienes Culturales. Seville, May 2010. pp. 41 (unpublished).

of King 6 (the last one on the left on the side of the Partial) revealed the use of an incised drawing directly on the preparation. This can be seen very clearly in the turban, the hood, and in some of the lines of the folds of his clothing, which were subsequently brushed with sinopia, as was the case with the rest of the kings. On the basis of the information available to date, we can assume that the direct method – application of sinopia with a brush – was the method used in the execution of the preparatory drawing prior to the execution of the painting. As for modifications, such as revisions or transformations, we can affirm that in the areas where the drawing has been observed, there is evidence of insignificant changes that simply adjust or reposition parts of the composition. In general, they respect the limits and margins of the underlying drawing (see Il. 8).

Painting: The operative practice employed in the execution of the paintings is relatively simple. Painting involved superimposing prepared layers on a base tone, normally applied in a single ink, onto which the finish was applied by overlaying flat brushstrokes, in a lighter tone. Finally, details were applied, with accurate touches of colour and precise outlining. Lastly, the perimeter of the area of colour of the various compositional planes of the figures and the elements represented was marked out with a linear line in black, dark red or brown, drawn with a single ink, without any modulations in colour and in the manner of a silhouette. This technical resource, which is very characteristic of lean tempera, can be found in the facial features (face, eyes, eyebrows, etc), in the outlines of the figures (dress, turbans, etc), animals, ornamental elements, and the compositional planes of the scenes (Il. 9 and 10).

The density of the paint varies from one area to another. There are areas in which it is applied very fluidly, as can be seen with the naked eye in some of the kings' robes and turbans, in which the inner lines of the folds of the underlying drawing can be seen, due to transparency. In contrast, denser paint, which is used to execute details applied with precise strokes on lips, the ridges of the philtrum, wrinkles on the forehead, the bridge of the nose and light areas of flesh tones, for example, is more opaque in these areas (see Il. 9).

A feature of the preparation of the paint is the use of pure colours without degradation. At most, tones are achieved by simple mixing with one or two colours, to lighten or darken the tone, without striving for tonal degradation or nuances. Nor does the operative practice involve the use of complex technical resources. There is no evidence of merging or degradation – merely the uniform application of colour. The overlaying or juxtaposing of flat inks made with pure, undegraded

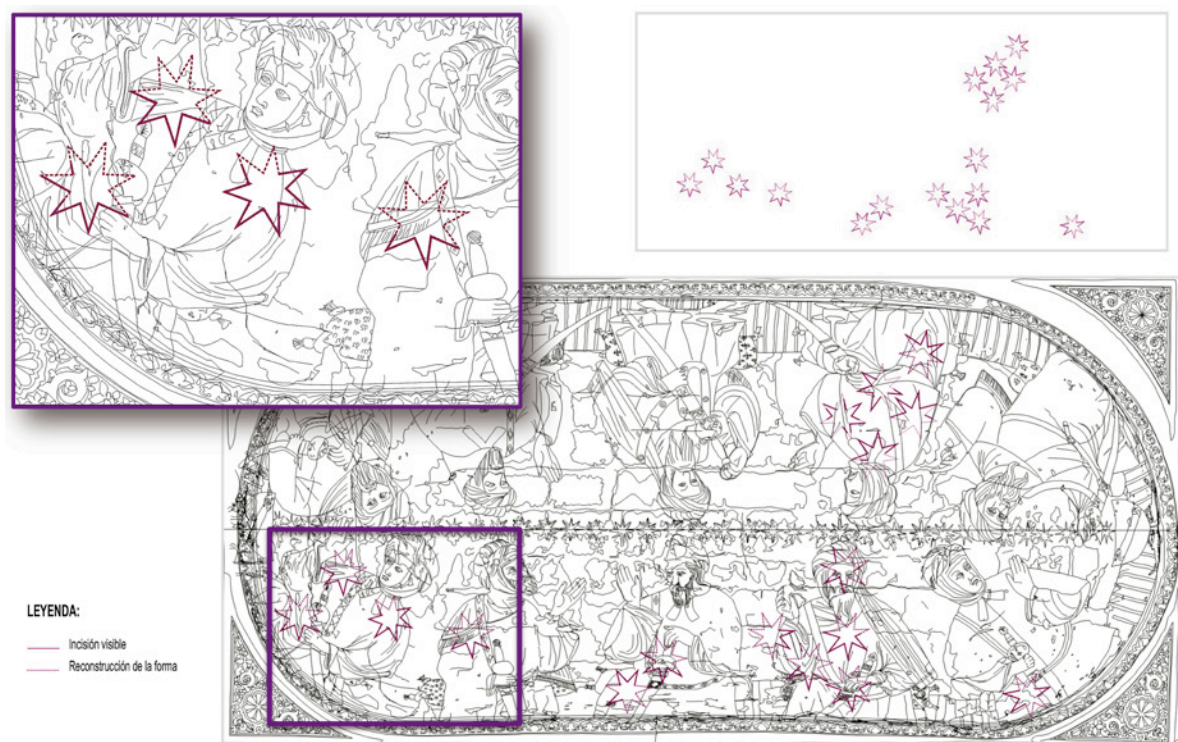
colours allows for modulations in colour and the volume of the composition, reinforced by the use of silhouetting to define limits. As we can see, the technical resources used are very characteristic of mural painting or panel painting in tempera, which, due to the fact it dries quickly, does not allow for other visual effects (See Il. 9 and 10).

The manner in which the facial features of the figures and any ornamentation has been depicted in the three vaults is highly unusual, not to say unique. Eyes: highly delineated and defined from the silhouette of their outline. The rendering of the iris is noteworthy, it being filled, wholly or otherwise, with the assigned colour. Lips: depicted in a pure red tone, without modulating, degrading or outlining, and resolved with an assured brushstroke, effected with a very sinuous and precise heart shape in the case of the upper lip and with straighter stroke in the lower lip. Lips are separated by a firm, dark line, both in the female and male figures (Il. 11, 12 and 13). Elongated hands with long, sharp nails (see Il. 8). The earrings on the female figures are fashioned with flat colours and precise touches of pure colour (see Il. 12). Also highly unusual is the level of detail that has gone into depicting the hilts of the swords, the bridles on the horses, the knots in their tails, the anatomical features of the various animals, and the detail in the plants, which are outlined with a very assured black brushstroke that both delimits the figures and outlines them and shapes their details, either on a base tone or a tone provided by the background itself, all rounded off with assured touches of colour (see Il. 10).

If we compare the execution of the facial features of the figures depicted in the three vaults, we note the presence of different artists. Although the technique and the effects used in their rendering are the same, at first sight there are differences in the rendering of certain features (lips, eyes, earrings, silhouetting, etc), which leads us to believe that we are dealing with different authors, a theory that will require future research to prove or disprove (See Il. 11, 12 and 13).

On the whole, we can say that this is painting executed *alla prima*, in which hardly any visual resources are used in its rendering, undertaken as it is with great assuredness and speed of brushstroke and line, while also being extremely vivid, realistic and beautiful. Its direct, assured and accurate execution is highlighted by the visual quality of this pictorial ensemble, in which cultures and technical traditions are fused as never before in a single work.

In terms of material, we have been able to confirm that it was painted with egg tempera. Egg – egg yolk, to be specific



II. 7. Distribution of the incised stars beneath the existing pictorial composition of the Hall of the Kings (Infographic: M^a José González López).



II. 8. Details of the underlying drawing and compositional modifications made with sinopia and visible to the naked eye (Infographic: María José González López).

– was found in the samples of paint analysed³⁶. Drying oil was also detected in certain pigments and corresponded to later interventions. The use of egg yolk as a binding agent points to a knowledge of the prevailing techniques in contemporary European schools and of the singular intrinsic characteristics of the material, as egg yolk contains fatty substances (lecithin and fats)³⁷, which allow for more fluid execution and increase the working time, enabling, in a certain way, the overlaying and fusing of tones and layers, as it behaves more like a fat tempera than a lean glue or casein tempera.

The colour range is very basic and corresponds broadly to the pigments used with tempera at the time. The colours are bright and vivid, with reds, blues, greens and browns standing out in contrast to the pale flesh of the figures and the brightness of the metallic decorations. The following pigments were used³⁸:

- Blue: azurite, lapis lazuli, and natural ultramarine blue.
- Whites: white lead, and calcite.
- Reds: Red ochre, red lead, cinnabar, vermilion, and red lacquer.
- Yellows: ochre, orpiment, and lead-tin yellow.
- Green: earth green
- Black: charcoal black
- Ground: calcium sulphate dihydrate
- Brown: natural sienna
- Metal leaf: gold and silver

Metallic decorations: There are two types of metal-leaf decorations on the paintings: water-based, burnished and matte, unburnished (also known as size, mordant, and, more recently, mixtion).

Embossed gilding: Located in the stars in the centre of the domes of the side rooms and in the lower band and background of the central room. It seems that we are dealing with decoration in which the relief motif is created using the stamping technique, widely used in the decoration of furniture, boxes, chests, panel painting and polychrome sculpture, and which is known as *pastiglia* or *pastillatge* ("pastework").

It is very simple to make, using the same materials as those used in the ground layer. First of all, a mould in the shape of the motif is filled. When the mixture sets, it is removed from the mould and the resulting mass is affixed with animal glue to

the dry preparation in the areas provided for this purpose. The bole is then applied before it is water-gilded, and burnished, resulting in a bas-relief. A stratigraphic study carried out on a sample taken from one of the stars reveals this sequence. On the ground layer in the painting can be seen the filling of the star, with a thickness of between 700 and 800µ³⁹.

The gold used contains a small amount of silver (under 2%) and it has a thickness of less than 5µ⁴⁰. This composition was checked against all the samples taken from the gilding.

The use of this relief technique is evident from the gaps in the stars' rays, in the cord that flanks them, and in the swirls of the palmettes, which reveal the smooth stratum of the underlying ground layer, this being the level where the paintings are executed.

The relief motifs are described below:

-Stars: Longitudinal band composed of eight-pointed stars inscribed in a circle of approximately 10cm in diameter, in varying numbers: 101 in the Lady Playing Chess and 98 in the Fountain of Youth.

-Half spheres: Arranged between the tips of the rays of the blue stars in the central room (eight in each star).

-Twisted cord: Bordering the perimeter of the star areas in the side vaults.

-Palmettes: Located in the central vault, replicating a weave in the background of the composition, made from a module that is repeated vertically and horizontally to obtain the motifs.

-Bands: A broad frieze around the perimeter of the lower edge in the Hall of Kings, comprising vegetable motifs inscribed in circles that make up the foliage. The background of the frieze is decorated with punchmarks created by tapping on a blunt-tipped punch.

Flat gilding and silvering: The latter, flat, can be found in very specific areas in the decoration of the clothing and figures: buttons, friezes and specific elements, such as the hilts of swords, and shields. It is made with size (oils and drying pigments with or without resins), a technique that involves applying the size, which acts as an adhesive for the metal leaf, on the areas to be gilded or silvered. When it is tacky, the gold or silver is applied and the excess is removed when it is dry, leaving the metal affixed only where the size has been applied, with its characteristic matte finish. In the artwork in question, analysis revealed the composition of the pigments in the gilded areas (white lead

36 Ibid. Note 29. pp. 4, 89, 109, 130, 135 and 197.

37 GETTENS, R and STOUT, R. *Painting Materials: A Short Encyclopaedia*. Dover. 1966. pp. 20.

38 See analytical results in the documents. Ibid, notes: 2, 5, 18 and 29.

39 Ibid. Note 29. pp. 478 and 479

40 Ibid. Note 29. pp. 374, 450, 454, 478, 479, 486, and 488.



Il. 9. Details of the painting technique. Silhouettes, flat inks and touches of light can be seen in the execution of the figure's face and in the details of their clothing (Photo: José Manuel Santos Madrid).

and earth)⁴¹ but not that of the binding agent. These areas have matte, unburnished gilding and silvering, where the metal leaf (gold and silver) is no thicker than 5µ.

The presence of silver leaf has only been scientifically identified in a sample taken from the leg armour of the Christian knight in the duel scene depicted in the *Lady Playing Chess*⁴². In this case, it was applied directly to the size on the last layer of lean preparation (see Il. 14). Although there are other areas where there would appear to be silvering, such as the lady's girdle, these are in such a state of conservation – oxidised and painted over – that it is not possible to determine their exact distribution in the artwork.

The presence of traces of colour glazing on the gilding – using organic yellow lacquer⁴³ to replicate different metallic

tones – was detected with the naked eye and scientifically verified. Very little of it is left and what does remain has suffered extensive wear due to the various interventions that have taken place over the years (Il. 14).

The combination of techniques used in the rendering of the areas with metallic decorations make these paintings extremely beautiful and richly decorative, especially in the central room, in which relief and flat decorations happily coexist and are in perfect harmony with the different effects achieved by fusing matte, gilded and colour-glazed areas. Using these resources, the artists managed to replicate not only the gleam of the gilding (polished) or its tones (without burnishing), but also the interplay between the various metallic tones achieved with colour glazing in very small areas, thus increasing the sense of volume and depth (light/shading in the reliefs) and material richness (brilliant, matte or bronzed gilding). Il. 14 shows the different types of gilt decorations used (see Il. 14).

41 Ibid. Note 2. Sample 6 of the analytical report.

42 Ibid. Note 29. pp. 428 and 470.

43 Ibid. Note 10. pp. 338.



Il. 10. Details of the technical rendering of some of the animals in the side rooms, in which – in addition to the visual effects – the speed of execution and the assuredness of the lines can be seen (Infographic: María José González López).



The Fountain of Youth



Lady Playing Chess

Il. 11. Details of some of the heads of male figures in the side rooms show common and divergent aspects in the technical rendering of the facial features: eyes, lips, nose, teeth, hair, etc. (Infographic: María José González López).



Lady Playing Chess

The Fountain of Youth

II. 12. Details of the heads of female figures in the side rooms. There are differences in the rendering of eyes, lips, noses, hair, flowers and earrings (Infographic: María José González López).



II. 13. Details of the faces of some of the kings in the central room. The technical resources used in the execution of facial features can be seen: eyes, nose, lips, hair, and beards, and in the folds of the turbans (Infographic: María José González López).



II. 14. Details of the different types of metal-leaf decorations in the three rooms. From left to right and from top to bottom: polished gilding in relief: star in the central frieze; background with palmettes, and lower frieze with plant motifs. Silvering with size (Christian knight's breastplate) and colour glazing on gilding to replicate bronzing (spur and stirrup). Gilding with size: hilt of the sword, mouldings on the castle roof, the dog's bell collar, the horse's harness, and the trim and buttons of the figures leaning out of the window (Infographic: María José González López).

CONCLUSIONS

From a technological point of view, the execution of these paintings points to the use of a series of different techniques used in different trades and crafts (tanners, ship carpenters, painters, etc) and cultures (Christian and Muslim), as evidenced by the wealth of data provided and checked during the research project in order to identify their intervention in the time period under analysis.

Meaningful facts such as the construction of the wood support (an inverted, caulked and waterproofed boat); the covering of the entire surface with horse hide (tanned and unsalvaged); the scenes and figures depicted (side rooms with chivalric scenes and a central room with Nasrid dignitaries); the reproduction of ornamental elements of the time and place (*guadamecí* and gilded leather made following the same operative practice as panel painting); their location; the vault-style decoration of three spaces of the Nasrid palace (bedchambers in the Hall of Kings); the practical execution using techniques borrowed from mural, panel and altarpiece painting (egg tempera with gilt decorations); and the visual resources used in the gilding (matte, brilliant, and colour-glazed and combining relief and flat areas) and silvering (with size) all lead us to conclude, without any fear of equivocation, that what have before us here are innovative paintings in which a whole host

of circumstances have converged to make them unique and admired throughout the world.

As we have identified, the construction technology and operative practice used in their execution have much to do with this assessment, even if we now only have a mere glimpse of what they once were, owing to the defective state of conservation in which they have been handed down to us and the unfortunate interventions they have undergone during their history. Technological study has given us an overall idea of its original splendour, which we can imagine if we consider the many techniques used and the visual resources employed in its rendering.