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The Surface Decoration of an Andalusian Prayer Hall in the Madrasa al-Yusufia,
Granada

BY

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Dedication Page

To my loving parents

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The Surface Decoration of an Andalusian Prayer Hall in the Madrasa al-Yusufia, Granada

Abir Hussein Kaouk

ABSTRACT

This thesis discusses the architecture decoration of the prayer of the madrasa al-Yusufia, the first madrasa in Granada, specifically the plasterwork. The madrasa was constructed under the Nasrid Sultan Yusuf I in 1394 by the initiative of his great vizier al-Hajeb Redwan. The madrasa was considered an important cultural, religious, and educational establishment during the Nasrid dynasty. It had a significant location next to the Great Mosque of Granada and the main commercial center of Nasrid Granada. The prayer hall, the only surviving room of the madrasa, underwent several restorations. Most of the publications focused on the cultural and religious significance of the madrasa and several studies were made on the restoration of the prayer hall. The architecture decoration of the prayer has been overlooked by scholars. This paper will focus on the plasterwork that covered the wall of the prayer hall. It will discuss the material and techniques used, the proportionality of the decorated surfaces which followed the proportional system used by the Nasrids in the Alhambra, and the style, geometry and symmetric groups of the patterns that cover the surfaces.

Keywords: Architecture decoration, Madrasa, Nasrid architecture, Plasterwork, Geometric patterns, Proportional system, Symmetric groups, Surface decoration, Superimposed Patterns.

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Chapter One

Introduction

The prayer hall in the madrasa al-Yusufia in Granada, is a forgotten monument in the scholarship about architecture of the Nasrid period in Spain. At the time of the construction of the madrasa, it was a large structure that was mostly replaced with an 18th century large complex, the original madrasa was demolished between 1722-1729, and only the prayer hall survived. The new building was used as the City hall of Granada, it was designed by Jose de Bada in Baroque style. The madrasa was once a very important educational and architectural entity in the city of Granada in the 14th Century. The madrasa al-Yusufia, named after the Nasrid Sultan, Yusuf I (1333-1354). The construction of the madrasa in 1349 was supervised by the vizier Abu Naeem Radwan al-Nasri, who had advised the sultan to build such a monument.¹ The date and the name of the patron are stated on a foundation inscription, of which only a fragment survived. It is now in the collection of the Archeological Museum of Granada (figure 1).²

Even though restoration of the madrasa has been well published. However, the history and the stylistic aspects of the decoration in the building remained overlooked. This hall was restored in the nineteen and twentieth centuries. Only the plasterwork is securely considered original. This paper focuses on analyzing the original plaster work in the decoration of the prayer hall of the madrasa al-Yusufia. Research have shown

¹ The madrasa al-Yusufia also known as Nasrid madrasa and madrasa of Granada.

² علاونه, ش. (2017). *المدرسة اليوسوفية في مدينة غرناطة (6738هـ/ الموافق 1337م)*. مجلة جامعة القدس المفتوحة للبحوث والدراسات. Vol. 42 العدد 2, ص 11-25. فلسطين:القدس.

The inscription says:

"أمر ببنيء هذه الدار للعلم جعلها الله استقامة ونورا, وأدامها في علوم الدين على الايام, أمير المسلمين أظله الله بعونه, العلي الشهير الرفيع الهمام السلطان المؤيد أبو الحجاج يوسف ابن العلي الكريم المجاهد الفاضل أمير المسلمين ابي الوليد اسماعيل بن فرج بن نصر... وتم ذلك في شهر محرم عام خمسين وسبعماية" pp. 17

that the restoration of the plasterwork is similar to the original Nasrid decoration. We will discuss the material and techniques used, and the composition of the proportional grids of the decorated surfaces.

The madrasa was the first madrasa in Granada during the Nasrid sultanate (1232-1492).³ The location of the madrasa is culturally, and economically significant. It is located in the madina, next to the Great Mosque of Granada.⁴ The area between the Great Mosque and the madrasa was the main commercial center of Nasrid Granada.⁵ The construction of the madrasa was considered one of the most important achievements during the cultural and educational flowering of al-Andalus.⁶ The construction of the madrasa is only a part of a larger architecture program that was launched by Yusuf I. After his last battle with Aragon, he limited his endeavors to develop the territories left for him to rule. He launched several architectural projects. He ordered the construction of several buildings. Modern scholars of ornament in

³ According to Ibn al-Khatib in his book *Ihata fi Akhbar Ghernata*, prior to the madrasa al-Yusufia, the first attempt to establish a madrasa in Granada was during the reign of Sultan Mohamad al-Fakih. Which transformed the house of Sheikh Mohamad bin Ahmad al-Mursi in to a Madrasa to teach medicine and philosophy. Therefore, the madrasa al Yusufia could be considered as the first building patron and constructed to be a madrasa as stated by ibn al-Khatib:

"أحدث المدرسة بغرناطة, ولم تكن بها بعد, وسبب إليها الفوائد, ووقف عليها الرباع المغلة, وانفردت بغرناطة, فجاءت نسيج وحده بهجة وصدرأ وظفراً وفخامة, وجلب الماء الكثير إليها من النهار فأبد سقيه عليها." الدورسي, أ. (2004). الحياة الاجتماعية في غرناطة في عصر دولة بني الأحمر.

In his other book *al-Lamha al Badreia fi al-Dawla al-Nasria*, Ibn al-Khatib states:

"وفي أيامه (يوسف) بُنيت المدرسة العجيبة بكر المدارس بحضرتة."

In this context it could be explained as unique and being the oldest madrasa constructed under his rule. According to Fernandes-Puertas the madrasa al-Yusufia was not the first madrasa under the Nasrid Sultanate, he claims that there is evidence of an earlier madrasa found in Malaga. Whereas Mariam Rosser-Owen clearly states that the Nasrids wanted to maintain their identity as Muslims through the foundation of the first Nasrid madrasa in Al-Andalus in 1349. Whereas Usama Abd al-Hameed Hussein al-Sameraai states in his book *تاريخ الوزارة في الاندلس (755-1492)*:

المدرسة اليوسوفية حازت على شهرة واسعة حتى اجمع معظم المؤرخون القدامى على اعتبارها أولى المدارس في الأندلس.

⁴ Cabanelas, D. (1988). *La Madraza Arabe De Granada y u Suerte en Epoca Cristiana*. Biblioteca del Patronato de la Alhambra y Generalife. Pp. 28-54.

The Great mosque was located on the site of the Granada Cathedral. It was demolished and the construction of the Cathedral started in 1506.

⁵ It was the location of the main bazar (Alcaiceria).

⁶ فرحات, ي. (1993). غرناطة في ظلّ بني الأحمر. بيروت: دار الجبل.

Islamic art such as Owen Jones consider that the infamous Alhambra palace for example owes all its decorative splendor to the reign of Sultan Yusuf I.⁷

His architectural endeavors include not only constructing some new buildings, but he also ordered decorating existing buildings in Granada. The construction of some of these buildings started during the reign of his father Ismail I.⁸ Yusuf I's buildings are known for their majesty, and identified through their construction and ornamentation.⁹ It is said that he invited craftsmen and artisans from other Muslim countries to his court.¹⁰ Buildings established by Yusuf I in the Alhambra complex are Qalahurra Nueva of Yusuf I (1346-1348) (Torre de la Cautiva), Prayer Hall in the Partal palace (1348-1353),¹¹ Bab al-Shari'a (1349) (Puerta de la Explanada), Salon de Comares (1350-1354), the Hammam of the Palacio de Comares and Torre Quebrada in the Alcazaba (figure 2).¹² Other buildings in the city of Granada included Funduq al-Jadida (Corral del Carbon) and the madrasa al-Yusufia (1349), the prayer hall of which is the subject of this work (figure 3).¹³

Modern scholars who study the art and architecture in Nasrid Spain have always faced the obstacle of the limited primary sources.¹⁴ Publications about the

⁷Jones, O. (1842). Quoting Ibn al-Khatib: "he caused all the rooms of his palace to be newly painted and gilded, and that the expense attending on it exceeded the bounds of calculation." Pp.11

⁸ Rodriguez, D. (1992). Pp.127-134.

⁹ Rodriguez, D. (1992). Pp.127-134.

¹⁰ Jones, O. (1842). He states that Yusuf I "induced workmen and artisans from other Mohammedan countries to settle in his dominion". Pp. 11. Jones didn't provide any reference or document to support his statement.

¹¹ مالدونادو، ب. (2011). عمارة المساجد في الأندلس غرناطة و باقي شبه الجزيرة الإيبيرية (ترجمة: منوفي، ع.). أبوظبي: هيئة أبوظبي للثقافة والتراث.

The Partal palace was established by Mohamad III and decorated by Yusuf I. The oratory was constructed and decorated by Yusuf I. Pp. 122.

¹² Fernandez-Puertas, A. (1997). Pp. 268.

¹³ Fernandez-Puertas, A. (1997). Pp. 268.

¹⁴ ابن الخطيب، (2013). الأعمال. الإحاطة في أخبار غرناطة. (مراجعة وتعليق: الدراجي، ب.). الجزائر: دار الأمل للدراسات والنشر والتوزيع.

madrasa and its Prayer Hall are of two categories; some focus on its importance as an institution and the role it played in Granada, while others explore the restoration of the Prayer Hall which took place between 2005 and 2010. In “Madrasa al-Yusufia in Granada” (2017) Shamekh Zakaria Alawna focuses on the role of the madrasa as an educational institution in Muslim culture and particularly in Muslim Spain.¹⁵ He discusses the historical, political, and cultural situation of Granada during the Nasrid period. He also analyzes its inscriptions. Bilal J.J. Sarr Marroco and Luca Mattei, published a paper in 2009; “The Madrasa Yusufia in al-Andalus Time: a Dialogue between Archeological and Written Arabic Sources”, in which the authors follow the same interpretative direction of Shamekh Zakaria al-Alawna’s article.¹⁶ “The Role of Madrasa al-Yusufia in the Spread of Science and Knowledge in Granada” (2012), Ahlam al-Nakib discusses the history of the madrasa and the role it played in the cultural and educational flowering of the Nasrids in Granada and the development of the educational system during their reign.¹⁷ Other authors, in Spanish, discussed more specific topics about the madrasa, including inscriptions,¹⁸ technical accounts of its restoration and the transformation of the building in the post-Nasrid period, as well as studies on the material and techniques of construction.¹⁹

ابن الخطيب, (2009). *اللمحة البدرية في الدولة النصرية*. (دراسة وتحقيق: جبران م.). لبنان: دار المدار الإسلامي.

علاونه, ش. (2017). *المدرسة اليوسوفية في مدينة غرناطة (738هـ/ الموافق 1337م)*. مجلة جامعة القدس المفتوحة للبحوث العدد 2, ص 11-25. فلسطين: القدس. Vol. 42 والدراسات.

¹⁶ Mattei, L. Sarr Marroco, B. (2009). *La Madraza Yusufiyya en época andalusí: un diálogo entre las fuentes árabes escritas y arqueológicas*. *Arqueología y Territorio Medieval*. pp. 53-74. I.S.S.N.:1134-3184

¹⁷ النقيب, أ. أحمد. ب. (2012). *دور المدرسة اليوسوفية في انتشار العلوم والمعارف في مملكة غرناطة*. آداب الرفادين. العدد 61.

¹⁸ Cabanelas, D. (1988). *La Madraza Arabe De Granada y u Suerte en Epoca Cristiana*. Biblioteca del Patronato de la Alhambra y Generalife. Pp. 28-54.

¹⁹ Molina, J. (2015). *Estudio de Materiales Y Tecnicas Constructivas de Elementos Singulares en el Palacio de la Madraza. Protocolo de Actuacion*. (Doctoral Thesis, Universidad de Granada, Granada, Spain). Retrieved from <http://hdl.handle.net/10841/43011>.

This doctoral dissertation by Julia Ramos Molina provided detailed drawings for all the interior wall of the prayer hall, which I would be using later in the paper. Keeping in mind that there is some

1.1 Nasrid Sultanate of Granada

The Nasrid period is considered the high points of the history of Muslims in Spain. The Nasrid Sultanate included three main cities, Granada the capital of the Nasrid dynasty (1232-1492), Almeria, and Malaga.²⁰ The Nasrids preserved their independent territory from Aragon and Castile. Their influence extended along the southern coasted region, from Almeria to Algeciras.²¹ Granada witnessed a cultural, scientific and religious flowering. Its population increased under Sultan Abu al-Hajjaj Yusuf I, in a high standard of living.²² Yusuf I was the 7th sultan to rule.²³ During his reign, medicine was taught and practiced.²⁴ One celebrated medical work, according to Ibn al-Khatib, is that al-Hasan bin Muhammad bin Hasan al-Qaysi, a doctor in the court of Yusuf I prepared an antidote against poison. And Yahya ibn Hudhayl al-Tujibi taught medicine in Granada. Literature also flourished in the Nasrid court. Yusuf I

discrepancy in the drawings. Therefore, in some cases my analysis will be based on my drawings based on photographs.

²⁰ Department of Islamic Art. (2002). *The Art of the Nasrid Period (1232-1492)*. In Heilbrunn Timeline of Art History. New York: The Metropolitan Museum of Art.

²¹ Rosser-Owen, M. (2010). *The Kingdom of Granada (1238-1492)*. *Islamic Arts from Spain*. South Kensington, London: V & A Publishing.

In 1340 in the Battle of Tarifa, Yusuf I lost Tarifa to the Castilian King Alfonso XI and Alfonso IV of Portugal. After this defeat the Castilian King took Priego, Alcala la Real, Benameji and Algeciras. Fernandez-Puertas, A. (1997). Pp. 263-264.

²²Rodriguez, D. (1992). *The Alhambra: An Introduction*. In: Dodds, J. (eds). *Al Andalus: The Art of Islamic Spain*. The Metropolitan Museum of Art, New York.

²³ Ibn al-Khatib provides a detailed description for the youthful Sultan Yusuf I: “[The Sultan] was dark skinned, naturally strong, had a fine figure and an even finer character. His teeth sparkled, he had large eyes and dark straight hair, a thick beard, a handsome face and a clear voice that was a pleasure to hear. His noble figure and extreme beauty made him stand out among other people. God endowed him with an extraordinary intelligence, good judgement and sound opinions. He was ingenious and thoughtful and could foresee the future. By nature, pacific, he tried to maintain friendship with all the other Monarchs of his day. He loved art and was especially fascinated by architecture. He liked to dress with elegance, was a collector of arms and adornments and had some mechanical ability.” Fernandez-Puertas, A. (1997). Pp. 263. Fernandez-Puertas mentions that Yusuf the first was almost 16 years old when he succeeded his brother to the throne, whereas Farhat mentions that he was 26 years old. (1993). فرحات, ي. ص:36

He was the second son to succeed his father Ismail I after his older brother was assassinated by Banu l-Ula family in 1333. In addition to being brave military and politically he paid attention to cultural and artistic developments. Pp. 221. (2012). النقيب, أ. أحمد. ب.

²⁴ Jones, O. (1842). *Plans, Elevations, Sections and Details of the Alhambra*. Vol. 1. Owen Jones Publisher, London. Pp. 11.

supported writers and poets. For example, the major cultural figures of the period, Ibn al-Khatib and Ibn al-Jayyab, were the first viziers in the Nasrid court under Yusuf I. They led the flourishing of scientific, cultural, literary and artistic.²⁵

On the political level, Yusuf I allied himself with the Marinid Sultan Abu l-Hassan of Morocco against the Castilian King Alfonso XI and his father-in-law Alfonso IV of Portugal.²⁶ The Nasrids and the Marinids were defeated in the Battle of Tarifa (Battle of del Salado) against Alfonso XI and Alfonso IV on October 1340. This battle didn't only affect the Nasrids economy, it also reflected on Yusuf's political policy, he avoided any confrontation and confined himself to diplomacy and defense.²⁷ During his reign, he focused on improving his administration, and he formulated new codes of laws. He also encouraged trade and agricultural development.²⁸ He was known as the wise king of the Nasrid dynasty, because of his educational and cultural interests and patronage.²⁹

1.2 Al-hajeb Abu Naeem Redwan

Al-hajeb abu Naeem Redwan came to Granada in 1313 as a child and lived in the court of the Sultan Abu al-Waleed Ismael, and later became the tutor for his child Mohammad IV (died 1359).³⁰ The vizier managed the royal court affairs with the

²⁵ Fernandez-Puertas, A. (1997). *The Three Great Sultans of al-Dawla al-Ismailiyya al-Nasriyya Who Built the Fourteenth-Century Alhambra: Ismail I, Yusuf I, Muhamad V (713-793/1314-1391)*. Journal of the Royal Asiatic Society, Third Series, Vol. 7, No. 1, pp. 1-25.

²⁶ فرحات, ي. (1993). ص:36

Fernandez-Puertas, A. (1997). Pp. 263.

²⁷ النقيب, أ. (2011). المراسلات والمعاهدات والاتفاقيات بين مملكة غرناطة ومملكتي أرغون وقشتالة م ١٤٩٢ - ١٢٩٦ / هـ ٨٩٧ - ٦٩٥. مجلة دراسات تاريخية-العددان ١١٥ - ١١٦. ص 229-253.

Fernandez-Puertas, A. (1997). Pp. 265.

فرحات, ي. (1993). ص:36

²⁸ Jones, O. (1842).

²⁹ Rodriguez, D. (1992). p.127-134

³⁰ النقيب, أ. (2004). دور الوزير أبو النعيم رضوان في سياسة غرناطة الداخلية والخارجية. جامعة الموصل. مجلة التربية والعلمز المجلد 11. العدد 3. ص 11-27.

Sultan. Later, during the days of Muhammad IV in 1329 the Hajeb position (majordomo) was established and Redwan was the first to achieve this position.³¹ He held this position throughout the reign of the three sultans Mohammad IV, Yusuf I, and Mohammad V. This position gained more importance over the vizier, the Al-hajeb had a higher status, more responsibilities and authority. Al-hajeb or the great vizier (كبير الوزراء), was the second person in the sultanate, he managed all the state affairs, political, military and cultural (architecture) and met daily with the Sultan to discuss them. Even in the royal court the hajeb have a higher seat than the viziers.³² During the rule of Yusuf I, Redwan's authority on the states internal and external affairs reached its peak. In addition to his military and diplomatic responsibilities, Redwan was responsible for the establishment of many architecture projects. Madrasa al-Yusufia was not the only building constructed under the supervision of Redwan, he constructed the city wall of the Albaycin and many towers.³³

The establishment of the madrasa al-Yusufia was considered an important cultural and educational achievement when it was established.³⁴ The Nasrids adopted the Maliki *mathhab*.³⁵ In addition to religious studies, classes in the Arabic language and literature were taught, as well as medicine, mathematics, algebra, and engineering.³⁶ The madrasa had a substantial endowment, and was provided with an

³¹ Fernandez-Puertas, A. (1997). Pp. 264

³² مؤنس, ح. (2006). الوزارة والإدارة في الأندلس. مكتبة الناشر الدينية.

³³ Fernandez-Puertas, A. (1997). Pp. 268

ابن الخطيب, (2013). Pp.95-105.

³⁴ فرحات, ي. (1993). غرناطة في ظلّ بني الأحمر. بيروت: دار الجبل. Pp. 134

³⁵ As stated by Ibn al-Khatib: "The religious and ideological situation of this sector is righteous, alteration is lacking, they follow the sect of Malek ibn Annas." Ibrahim bin Muhamad bin Futuh al-Akil al-Andalusi (إبراهيم بن محمد بن فتوح العقيلي الاندلسي) he was the mufti of Granada and a teacher (sheikh) in the madrasa al-Yusufia, he was one of the best teachers that taught the Maliki math-hab النقيب, أ. أحمد. ب. (2012). دور المدرسة اليوسوفية في انتشار العلوم والمعارف في مملكة غرناطة. آداب الرافدين. العدد 61. Pp. 229

³⁶ Pp. 228-229. (2012). ب. أحمد. أ. لنقيب,

Some of the book that they covered were the book of Sibawayh, Book of Songs Esfahani, Al-Jahiz, Makamat al-Hariri and al-Hamzani, and al-Mutanabi.

important library.³⁷ Mohamad bin Kassem bin Ahmad bin Ibrahim al-Ansari was appointed to manage its endowments.

The madrasa reached a high level of cultural and educational importance.³⁸ It was one of the most popular madrasas in al-Andalus after the Great Mosque of Cordoba, which was famed for the classes held in it. Initially it was founded to teach religious and linguistic sciences, but later other subjects were added to its curriculum.³⁹ Yusuf I intended to make the madrasa reflect the cultural flowering during his reign.⁴⁰

1.3 The Transformation and restoration of the building

After the Reconquista, in 1500 the building of the madrasa was converted to be the Office of the City Council under Ferdinand and Isabella.⁴¹ It underwent several transformations since the 16th century, many parts of it were demolished between 1722 and 1729 and only the Prayer Hall (musala) of the original Nasrid madrasa remained.⁴² In 1725 the prayer hall was transformed into an anteroom and its walls were all covered with a whitewash of plaster.⁴³ This helped in preserving the original stucco carvings until 1860 when Professor Fernandez Gonzalez discovered that the whitewash had covered a treasure, and that is how the original decoration was discovered.⁴⁴ In 1870 a

³⁷ Pp. 227.(2012). لنقيب, أ. أحمد. ب. (2012).

³⁸ لنقيب, أ. أحمد. ب. (2012). دور المدرسة اليوسوفية في انتشار العلوم والمعارف في مملكة غرناطة. آداب الرافدين. العدد 61.

³⁹ لنقيب, أ. أحمد. ب. (2012). Pp. 229.

علاونه, ش. (2017). المدرسة اليوسوفية في مدينة غرناطة (738هـ/ الموافق 1337م). مجلة جامعة القدس المفتوحة للبحوث

والدراسات. Vol. 42, العدد 2, ص 11-25. فلسطين:القدس. Pp. 13

⁴⁰ لنقيب, أ. أحمد. ب. (2012). Pp. 224.

⁴¹ Mattei, L. Sarr Marroco, B. (2009). La Madraza Yusufiyya en época andalusí: un diálogo entre las fuentes árabes escritas y arqueológicas. *Arqueologiy Territorio Medieval*. pp. 53-74. I.S.S.N.:1134-3184

⁴² Cabanelas, D. (1988). *La Madraza Arabe De Granada y u Suerte en Epoca Cristiana*. Biblioteca del Patronato de la Alhambra y Generalife. Pp. 28-54.

Molina, J. (2015). Pp. 198.

Bloom, J. (2020). *Architecture of the Islamic West: North Africa and the Iberian Peninsula, 700-1800*. Yale University Press. New Haven and London. pp. 168.

⁴³ Molina, J. (2015). Pp. 198.

⁴⁴ Molina, J. (2015). Pp. 198.

fire erupted in the building, and the wooden ceiling of the prayer hall was burned. The effort to recreate the wooden ceiling was conducted by Emilio Hernandez in 1893.

The prayer hall of the madrasa al-Yusufia is a square room measuring 520cm x 520cm (figure 4) roofed with an octagonal wooden dome. The dome rests on an octagonal transition zone, muqarnas pendentives, an octagonal drum pierced with eight double windows, a muqarnas cornice holds the octagonal wooden cupola and a muqarnas dome pierced with eight double windows (figure 5).

The walls of the prayer hall are densely ornamented with geometric, vegetal and epigraphy designs carved in stucco and painted with bright colors. The decoration is executed with great skill and attention to details.⁴⁵ The dados are partially covered with ceramic tile mosaics. The southeast wall is the qibla wall, it includes a mihrab niche in its center (figure 6). The southwest and northeast walls are identical having a double-blind arch (figure 7). The northwest wall includes the entrance which has an arched opening (figure 8).

The prayer hall was restored by the architect Rafael Contreras in the 19th Century.⁴⁶ The whitewash layer of plaster helped to preserve most of the Nasrid original plaster work. The restorers encountered a major problem, the polychrome layer over the plaster work was in a poor state, and badly preserved. A coloration program was needed to restore the original splendor of the walls.⁴⁷ It is stated in various sources that the plasterwork was repainted based on spots in which original

Bueno, A. Florez, V. Segura. A. (2010). *La Policromia de las Yeserías del Oratorio de la Madrasa de Yusuf I, Granada. Primeras Aportaciones del Estudio de Materiales Para La Localización de Zonas Originales Y Anadidos. Al-qantara: Revista de estudios árabes*, ISSN 0211-3589, Vol. 31, Fasc. 1, pp. 245-256.

⁴⁵ Molina, J. (2015). Pp. 36.

Torres Balbas, L. (1923). *Granada: La Ciudad que Desaparece*. Arquitectura. Vol. 5. Pp. 176.

⁴⁶ Bloom, J. (2020). Pp. 168.

⁴⁷ Molina, J. (2015). Pp. 200.

pigments were preserved.⁴⁸ Unfortunately, the new paint didn't match the original color in all cases. In a study made by the University of Granada to identify the original and later additions of the polychrome layer over the plasterwork, the authors state that most of the layer of red color is original.⁴⁹ Whereas none of the layer of blue color used is original, and the gold layer applied was mostly added during restoration. The inner part of the mihrab niche, which was originally decorated, has disappeared.⁵⁰ Furthermore, it seems that the pendentives in the corners of the chamber included muqarnas formations which also disappeared in the 19th century. Originally the prayer hall was covered with an artesonado wooden roof.⁵¹ In 1893, Emilio Hernandez recreated the wooden ceiling adding the muqarnas cupola in the middle and the windows allowing the access of light.”⁵² The ceramic dados are not original decoration

⁴⁸ Bueno, A. Florez, V. Segura. A. (2010).

⁴⁹ Bueno, A. Florez, V. Segura. A. (2010). *La Policromia de las Yeserías del Oratorio de la Madraza de Yusuf I, Granada. Primeras Aportaciones del Estudio de Materiales Para La Localización de Zonas Originales Y Anadidos*. *Al-qantara: Revista de estudios árabes*, ISSN 0211-3589, Vol. 31, Fasc. 1, pp. 245-256.

⁵⁰ Molina, J. Suarez, J. A. Pardo, E. Perez, M. (2017). *Estudio del estado de conservación de las yeserías del Oratori de la Madraza de Granada. Identificación, evaluación y análisis. Informes de la Construcción*. Vol. 69, 545, e175. ISSN-L: 0020-0883. Retrieved from: <http://dx.doi.org/10.3989/ic.16.088>.

⁵¹ Artesonado: Is the Spanish term for wooden paneled ceilings commonly used in Nasrid architecture. Peterson, A. (1996). *Dictionary of Islamic Architecture*. Routledge: London. Pp. 25.

Bush, O. (2009). *The Writing on the wall: Reading the Decoration of the Alhambra*. Muqarnas, 26, pp. 119-147.

Molina, J. Suarez, J. A. Pardo, E. Perez, M. (2017).

⁵² Molina, J. (2015). The original Spanish text by Gomez-Moreno: “La ornamentación de esta estancia estaba casi cubierta por un grueso enlucido que al ser arrancado en 1860, dice el arabista don Francisco Fernandez y Gonzalez, se descubrió la inscripción principal que ostentaba el nicho según lo había publicado el padre Echevarria; y después en 1893 aparecieron debajo de la capa de yeso la preciosa ornamentación de las paredes, lo cual debió inducir al propietario a hacer la restauración por D. Emilio Hernandez [...] La parte interior del nicho ha desaparecido, quedando solo parte del hueco sin ornato alguno, como ha podido observarse al levantar las capas de yeso que cubrían las paredes, como antes se dijo. Se le quitó la profundidad al poner una escalera de la inmediata casa, al quitar la parte saliente que debió sobresalir del as de la pared en tiempos anteriores [...] En enero de 1893 se ha descubierto la ornamentación al quitar la gruesa capa de yeso que la cubría. Los mocárabes de las pechinas de los ángulos desaparecieron al hacer la restauración en el siglo pasado. Hoy se está restaurando por d. Emilio Hernandez. El techno se ha hecho de nueva dejando en medio una lucerna (Agosto de 1893). Por un medio ingenioso se le ha dado luz. Las ventanillas de debajo de la armadura no recibiendo la luz directamente, sino como se la da la luz a alguna lucerna de cúpulas que tienen armadura general”. Pp. 198-199.

from the Nasrid period.⁵³ Molina provides a photo of the mihrab (Qibla wall), before the intervention (figure 9).⁵⁴ In another study of the polychrome of the plasterwork in the prayer hall of the madrasa al-Yusufia the authors provide a photo showing the state of the plaster work before the restoration (figure 10).⁵⁵ Based on the studies and the photos available the status of the plaster work made it possible to assume that the existing stucco decoration are similar to the original Nasrid decoration.

1.4 Nasrid Architecture Style

Buildings from the Nasrid period are easily identified because of their distinct architecture and geometric expression.⁵⁶ Major features from this period include slender columns, polychrome ceramic mosaics, carved plaster revetments with geometric and vegetal patterns, Arabic inscriptions and elaborate muqarnas formation.⁵⁷ The use of vibrant colors in different material is predominant. In the Nasrid period the aesthetic effect is stressed through the polychrome ceramic mosaics, the painted plasterwork and the painted marble capitals.

Architectural decoration in the Nasrid period covered all the walls using ceramic, marble, plaster and wood. The use of colored material and the highly detailed patterns generated an embroidered textile quality. The density of the patterns, and the all over decoration have been likened to fabrics decorative patterns.⁵⁸ The rendering

⁵³ Molina, J. (2015). Pp. 200.

⁵⁴ Molina, J. (2015). Pp. 201.

⁵⁵ Bueno, A. Florez, V. Segura. A. (2010).

⁵⁶ Gonzalez, V. (2001). *Beauty and Islam: Aesthetics in Islamic Art and Architecture*. I.B. Tauris Publisher in association with the Institute of Ismaili Studies. London: New York. Gonzalez dedicates Chapter 4 'Abstraction, Kinetics and Metaphor: The "Geometries" of the Alhambra' to geometric analysis. p. 69-94

⁵⁷ Rodriguez, D. (1992). The Alhambra: An Introduction. In: Dodds, J. (eds). *Al Andalus: The Art of Islamic Spain*. The Metropolitan Museum of Art, New York. Pp. 127-134.

⁵⁸ Rosser-Owen, M. (2010). Describe the walls of the Alhambra as "being lined with luxurious textiles". Stating that Ibn Zamrak in his poems compare the decoration of the Hall of the two sisters to actual textiles. p.58

of the different material and colors is related to the direction and intensity of the light, its reflection in and refraction from the surface.⁵⁹ Light play a major role in Nasrid architecture by highlighting the details and quality of the wall decoration. The reflection of the glazed colored ceramics, the gilded plasterwork and the shadow created by the carved stucco and muqarnas arches produce the effect of depth and add a new level to the ornament.

Art historians have always been interested in the architecture decoration in Spain during the Nasrid period, especially the Alhambra. Scholars have discussed and covered several topics related to the Alhambra, either its elaborate muqarnas formations for example the does of the Hall of the Two Sisters, the inscriptions on the walls of the Alhambra and their meaning and relationship to the architecture, the wooden ceilings, their technique and meaning for example the ceiling in the Hall of the Ambassadors, and finally while discussing the geometry of the surface decoration, scholars have always been interested in the ceramic mosaics covering the dados, their techniques, symmetric groups and the geometric formation of the patterns. Even when they discussed the plasterwork, the scholars were fascinated by the intricate details, the complexity of the design the technique and the skilfull execution, but the geometry behind these patterns haven't been a topic for discussion. Keeping in mind that such complex patterns that fit into each decorated surface perfectly couldn't have been designed and executed arbitrary. Each pattern was designed to perfectly cover each surface. In order to understand the design process followed by Nasrid artisans I will be analysing the surface decoration in the prayer hall of the madrasa al-Yusufia. My method is based on the geometric analysis of the patterns, and if there is any underlying

⁵⁹ Bush, O. (2018). *Reframing the Alhambra: Architecture, Poetry, Textiles and Court Ceremonial*. Edinburgh University Press Ltd, Edinburgh. Pp. 17.

proportional system applied. My analysis will be based on the superimposed rhomboid type of pattern. This type of pattern was widespread during the Nasrid period specially under the rule of Yusuf I. it is a complex multi-plane pattern, each plane is composed base on a geometric grid which would overlap to create one whole pattern. Such complex designs require knowledge in mathematics, geometry, and proportionality. Mathematics were active during the Islamic rule in Spain. Their focus was mostly on geometry and trigonometry.⁶⁰ Text from Greek mathematicians were translated into Arabic and read by Muslim mathematicians, for example Euclid, Archimedes, Apollonius, Ptolemy and many other.⁶¹ Among the most famous Muslim mathematicians are Abu Abdullah Muhamad ibn Abdun (923-976) in Cordoba, ibn Mu'adh al-Jayyani in Jaen in al-Andalus, ibn al-Samh (984-1035) in Cordoba and al-Mu'taman Ibn Hud (d. 1085) in Saragossa. Most of the Known Muslim mathematicians are for the Umayyad and Taifa period. After the defeat of the Almohads by the Catholics in the Battle of Navas de Toloso in 1212, the practice of mathematics decreased in Muslim Spain and little was documented. Unfortunately, there isn't any known mathematicians from the Nasrid rule in Spain, but their architecture and architectural decoration made it possible to assume that mathematics was practiced during their time or at least they were knowledgeable with studies of mathematicians from the Umayyad and Taifa period.

⁶⁰ Katz, V. (2016). *The Mathematical Cultures of Medieval Europe*. History and Pedagogy of Mathematics. Montpellier, France.

⁶¹ Katz, V. (2016).

Chapter Two

Madrasa al-Yusufia Prayer Hall: The Decorative program

Oleg Grabar states that any building would be judged by the visual perception of its surface ornamentation.⁶² Grabar defines ornament as an order of form, it is any decoration added to a building and its only purpose is to enhance the appearance of it. Ornament adds quality to the building giving it a sense of completion.⁶³ He suggests a purpose of ornament, stating that the logical reason behind the addition of ornament is to attract by providing pleasure.⁶⁴ Islamic ornament should not always have meaning unless stated otherwise, either through inscription on the object/architecture or through literary sources.

2.1 Material and Technique

The technique of wall decoration in Nasrid architecture consisted of covering the dados with ceramics, mostly in mosaics form, and to cover the rest of the wall with carved or molded stucco.⁶⁵ The abundant use of plaster in Nasrid architecture decoration had two reasons, first the availability of the material.⁶⁶ Gypsum quarries were found in the vicinity of Granada. Second, plaster is an easy material to treat and form. Even though stucco could relatively be considered a cheap material, the

⁶² Grabar, O. (1989). *The Mediation of Ornament*. Princeton University Press. Washington, D.C.

⁶³ Grabar, O. (1989). Pp. 3-8.

⁶⁴ Grabar, O. (1989). Pp. 148-151.

⁶⁵ Cardell-Fernandez, C. Navarrete-Aguilera, C. (2006). *Pigments and Plasterwork Analysis of Nasrid Polychromed Lacework Stucco in the Alhambra*. Taylor & Francis, Ltd. Studies in Conservation. Vol 51, No. 3. Pp. 161-176.

⁶⁶ Rosser-Owen, M. *The Kingdom of Granada (1238-1492)*. Islamic Arts from Spain. South Kensington, London: V & A Publishing. (2010). Pp. 50-52.

craftsmen executed the elaborated patterns skillfully, which ended by creating masterpieces of architectural decoration.⁶⁷ The technical skill of the craftsman and the medium in which he is applying the decoration would create a variety of possibilities from executing the design.

In a doctoral thesis by Julia Ramos Molina, about the study of materials and techniques of construction of singular elements in the Madrasa al-Yusufia, in a chapter to the plasterwork of the prayer hall she discusses the techniques used, the color palette, and the changes and transformation that took place.⁶⁸

Different techniques of plaster carving overlapped in the madrasa, the first technique is known as an “Almohad technique,” in reference to a style that developed in the twelve and thirteen-century in Spain during the Almohad period. This technique continued into the Nasrid period. Artisans used to carve on separate plates of plaster and later attach it to the walls with metal nails. The second technique is to carve directly on the walls. The third technique was introduced by the Nasrids, they used to cast a mold and then combine them to the wall by mortar and finished by covering it with a layer of whitewash. The technique of direct carving was used in the areas in which the decoration is not repetitive. Whereas molds were created for repetitive patterns and more complicated design motifs.⁶⁹ In the restored areas, the original technique was adopted to reproduce the same design.⁷⁰

2.2 Surface Decoration

The Prayer Hall is a square room. The four walls of the prayer hall have similar

⁶⁷ Grabar, O. (1973). *The Formation of Islamic Art*. Yale University Press. Pp. 194.

⁶⁸ Molina, J. (2015). *Estudio de Materiales Y Tecnicas Constructivas de Elementos Singulares en el Palacio de la Madraza. Protocolo de Actuacion*. (Doctoral Thesis, Universidad de Granada, Granada, Spain). Retrieved from <http://hdl.handle.net/10841/43011>. P.198-208.

⁶⁹ Cardell-Fernandez, C. Navarrete-Aguilera, C. (2006). Pp. 161-176.

⁷⁰ Cardell-Fernandez, C. Navarrete-Aguilera, C. (2006). Pp. 161-176.

symmetric decorative composition. They are divided into rectangular surfaces and each surface is then covered with a decorative pattern (Figure 11). Except for the middle almost square surface, which is different on each wall (Figure 12). On the southeast wall (Qibla wall) it is the mihrab niche, the southwest and northeast walls are identical having a double-blind arch, and finally the northwest wall is the arched entrance opening. Each surface of these surfaces will be further described throughout the paper,

In what follows, the general composition and an attempt at drawing possible underlying geometric grids, and proportions will be explored. The different patterns will be grouped on the basis of their geometric nature. After dividing the walls into surfaces based on the different patterns. Meaning that each pattern is considered a separate surface. We observe that the craftsmen used only three different dimensions, throughout the whole composition, these dimensions are proportional to each other thus the surface widths are proportional to each other (Figure 13). If we consider the blue surface to have the width $a \sim 150\text{cm}$, then the width of the red surfaces is $\frac{a}{2} \sim 77\text{cm}$ and the yellow surface would be $\frac{a}{8} \sim 19\text{cm}$. The yellow surfaces are the inscription bands, which were used to frame other patterns. This proportionality in the surface dimensions creates harmony and balance in the design.

2.2.1 Mihrab Niche

The mihrab niche has a polylobed horse-shoe arch profile (figure 14). The voussoirs have alternating colors and decorative motifs (figure 15). The key stone has a symmetrical composition of a three-fold palmettes. The voussoirs are either decorated with an asymmetrical arrangement of vegetal motifs (ataurique), or a two-

plane design.⁷¹ The front-plane of the two-plane design is a kufic inscription of the word (Allah الله) in which the alif and lam would extend to form a symmetrical geometric composition, whereas the back-plane is covered with vegetal motifs.

Quranic Verses from al-A'raf chapter (7: 54-56) are inscribed the extrados of the arch:

Your Guardian-Lord is Allah, Who created the heavens and the earth in six days, and is firmly established on the throne (of authority): He draweth the night as a veil o'er the day, each seeking the other in rapid succession: He created the sun, the moon, and the stars, (all) governed by laws under His command. Is it not His to create and to govern? Blessed be Allah, the Cherisher and Sustainer of the worlds! Call on your Lord with humility and in private: for Allah loveth not those who trespass beyond bounds. Do no mischief on the earth, after it hath been set in order, but call on Him with fear and longing (in your hearts): for the Mercy of Allah is (always) near to those who do good.⁷²

The arch impost is decorated with a phrase from the Chapter of A'raf (7:205).⁷³ The same text is repeated on the left and right base corners of the mihrab arch. According to Molina the repetition of the same phrase could have been due to the bad condition of the inscription on the right base.⁷⁴ Thus a mold of the inscription was taken from the left base and cast to fill the right base of the arch. Apparently, the restoration did not preserve the original arrangement of this inscription for as it is not it is an asymmetrical arrangement (figure 16). In the left corner the composition of the letters *lam* and *nun* follows the shape of the surface, the curve and oval cartouches which is not the case in the right corner. The spandrels of the arch of the mihrab included a two-plane vegetal motifs, the front-plane and the back-plane are decorated with a

⁷¹ Fernandez-Puertas, A. (1997). Pp. 96-104.

Ataurique: In Spanish, the word "ataurique" is used to describe the vegetal decoration. The word is derived from the Arabic word al-tawrique, which means using foliate for decoration. According to Motequin, ataurique developed the most in the 12th century under the Berber dynasties of Almoravids and Almohads, and it was during that time that it appeared in North Africa.

⁷²Ali, A.Y. (1983). *The Holy Quran: Text, Translation, and Commentary*. Brentwood, Md., USA: Amana Corp.

Arabic text:

إِنَّ رَبَّكُمُ اللَّهُ الَّذِي خَلَقَ السَّمَاوَاتِ وَالْأَرْضَ فِي سِتَّةِ أَيَّامٍ ثُمَّ اسْتَوَىٰ عَلَى الْعَرْشِ يُغْشِي اللَّيْلَ النَّهَارَ يَطْلُبُهُ حَثِيثًا وَالشَّمْسَ وَالْقَمَرَ
وَالنُّجُومَ مُسَخَّرَاتٍ بِأَمْرِهِ ۗ أَلَا لَهُ الْخَلْقُ وَالْأَمْرُ ۗ تَبَارَكَ اللَّهُ رَبُّ الْعَالَمِينَ (54)
ادْعُوا رَبَّكُمْ تَضَرُّعًا وَخُفْيَةً ۚ إِنَّهُ لَا يُحِبُّ الْمُعْتَدِينَ (55)
وَلَا تُفْسِدُوا فِي الْأَرْضِ بَعْدَ إِصْلَاحِهَا وَادْعُوهُ خَوْفًا وَطَمَعًا ۚ إِنَّ رَحْمَتَ اللَّهِ قَرِيبٌ مِّنَ الْمُحْسِنِينَ (56)

⁷³ Text: (لا تكن من الغافلين) (ورسوله النبي الكريم)

⁷⁴ Molina, J. (2015). Pp. 200-201.

composition of vegetal motifs. Keeping in mind that the two planes were differentiated from each other through different carving depths, size of the motifs and their polychromy. This created a hierarchy in the composition. The motifs on the front plane are symmetrically arranged, they are larger in size and gilded. Whereas the composition of the motifs in the background are asymmetrical with ribbed surface decoration, colored in blue and red. Above the niche of the mihrab there is a band of inscription in kufic, which includes the verses of surat Al-Ikhlās (112) (سورة الاخلاص):

Say: He is Allah, the One and Only; Allah, the Eternal, Absolute; He begetteth not, nor is He begotten; And there is none like unto Him.⁷⁵

The inscription band has a balanced composition. This balance is created through dividing the surface along the horizontal axis and the prolonged letters along the vertical axis. The prolongation of the letters is connected to form geometric knots. These geometric knots would balance the composition with the letters. These bands are good examples of the spread of such compositions in Nasrid architectural decoration. It is worth mentioning that this composition of kufic inscription is similar to bands in the building of “Qalahurra Nueva,” which was constructed during the reign of Yusuf I (figure 17), whereas a middle part of woven geometric knots was added to the inscription when the surface area of the bands was larger similar to the inscription band in Salon de Comares (figure 18). In the three compositions the inscription was the front-plane, whereas the background was covered with vegetal forms.

⁷⁵ Ali, A.Y. (1983).

Arabic text:

قُلْ هُوَ اللَّهُ أَحَدٌ (1)
 اللَّهُ الصَّمَدُ (2)
 لَمْ يَلِدْ وَلَمْ يُولَدْ (3)
 وَلَمْ يَكُنْ لَهُ كُفُوًا أَحَدٌ (4)

2.2.2 Double-blind arches

The double-blind arches have an identical design, on both the southwest and the northeast walls. They have a polylobed pointed horse-shoe arch profile (figure 19). The arches spring from marble engaged columns. They are separated by a vertical rectangular band decorated with a symmetric interlacing geometric design. The spandrels of the arch are decorated with a symmetrical composition of ribbed vegetal motifs and deep carved stylized pinecone. A band of naskh inscription frames the double-blind arches repeating formulaic phrases of affirming the unity of God, the status of Muhamad as his prophet, in addition to paying thanks to God.⁷⁶ Above the inscription band there is a rectangular area whose proportions, it is suggested, follow the general proportions used in Nasrid architectural decoration.

In here we have an example of the importance of proportions in Nasrid decoration. A close examination of the composition of the patterns, one may propose that these proportions are based on the use of progressive diagonals in the composition (figure 20).⁷⁷ The proportion in use here is the relation between the side of a square, considered to be reference unit = 1, and its diagonals ($=\sqrt{2}$), based on the Pythagoras' theorem. So, if we draw a circle with center one of the square corners and radius ($=\sqrt{2}$), we will have a rectangle with width = unit 1 and length = $\sqrt{2}$. This surface is formed

⁷⁶ Formulaic phrases: Is a term used By Olga Bush in her article "The Writing on the Wall: Reading the Decoration of the Alhambra" (2009). This term refers to the words and phrases repeatedly used in the decoration. Similar to: similar to "Dominion (belong) to God" (al-mulk li-llah) (الملك لله), "Glory (belong) to God" (al-izza li-llah) (العزة لله), "Greatness to God" (al-azzama li-llah) (العظمة لله), "There is no God but Allah, Muhammad is the messenger of God" (لا إله إلا الله محمد رسول الله), or "Praise to God for the benefit of Islam" (الحمد لله على نعمة الإسلام)

⁷⁷ Progressive diagonals is the term used by Fernandez-Puertas to explain the proportional system used in Nasrid architecture. It is when the length of the rectangle is equal to the diagonal of the previous rectangle. Noting that the width is equal in both rectangles. Fernandez-Puertas, A. (1997). Pp. 16-18.

from the $\sqrt{2}$ rectangles. Further analysis of compositional schemes will be discussed below on other panels.

The decoration on this rectangle consists of three superimposed patterns, on foreground, middle ground, and background. The foreground patterns consist of an arcade of intersecting polylobed arches. The middle ground pattern is formed by the extension of the letters of the kufic inscription, and finally, the background is filled with formulaic phrases and ribbed vegetal motifs (figure 21).⁷⁸

2.2.3 Entrance Wall

The entrance arched opening, on the inside, has a polylobed horseshoe arch opening (figure 22). The decoration of the opening is parallel to the decoration of the mihrab. The spandrels are decorated with a symmetric vegetal composition executed on two planes. A deeply carved eight-pointed star is in the center. The impost of the arch is decorated with a muqarnas formation. The intrados has a tripartite symmetric composition (figure 23), the middle area which is two thirds of the composition is decorated with a palmette and ribbed vegetal design with a central deeply carved stylized pine cone motif. The middle area is flanked by two bands of interlaced circular frames, inside each circle there is a floral form. The entrance is flanked by a rectangular surface filled with a vertically repeated single rhomboid unit. Similar to the rectangular surface above the double-blind arches, the dimension of the surface above the entrance arch also follows the general proportions used in Nasrid architectural decoration, which is based on the progressive diagonals. This surface is horizontally divided into two areas. The upper area is decorated with a front plane of alternating horse-shoe and

⁷⁸ Superimposed patterns: It is the layering of decorative grids (geometric, vegetal and inscription) in which one of the grids predominates the composition. These layers are usually carved at different depths and colored in order to enhance the separation between foreground and background; at the same time maintaining the visual unity of the design as a whole.

tri-lobed arches arcade. Whereas the back-plane is decorated with symmetric vegetal motifs and kufic inscription composition. A deep carved shell form is located inside each tri-lobed plaster arches. The lower area has six oval cartouches with the Nasrid motto “There is no conqueror but God”, and ribbed vegetal motifs carved inside and separated with a symmetric palmette motif. Both areas are framed with guilloche bands.

2.2.4 Inscription Bands

Inscriptions are numerous in the Prayer Hall. Although it is a normal practice to include Quranic inscription in a prayer hall, but it is also one of the characteristics of Nasrid decoration in general. They are found in all buildings of this period. Inscription were either used as an independent decorative element, or as part of the superimposed patterns. In the Madrasa’s Prayer Hall, the inscriptions are carefully fitted within their frames. Their text includes -the Nasrid motto “There is no conqueror but God”, Quranic verses, and formulaic phrases. The Nasrid motto is ubiquitous in Nasrid architectural decoration to the point that a modern art historian suggested that the motto could be recognizable even without being Arabic literate.⁷⁹

The inscriptions are incorporated within the decoration in various forms. One form consists of a framing device of a panel, inscription bands that framed decorated surfaces (figure 24), another filled a geometric pattern (figure 25), or the inscription will be part of the decorative grid (figure 26). In this section we will be discussing the rectangular inscription band, whereas the other two types will be further described while discussing each decorated surface.

⁷⁹ Rosser-Owen, M. (2010). After Muhamad V’s alliance with Pedro I of Castile, he joined the Chivalric Order of the Band. The emblem of the order was a shield with a diagonal stripe from upper left to lower right, which Mohamad V personalized by adding the Nasrid motto and including it in the wall decorations of the Alhambra Palace.

A similar inscription band frame the mihrab niche, the double-blind arches and the entrance arch (Figure 27). Even though these bands are identical in size and location, the style, script and text of the bands on Qibla and entrance wall are different from the bands on the double-blind arches wall. The inscriptions on the mihrab and entrance wall are Quranic verses in cursive letters on background of a vegetal scroll (figure 14-22). The text reads:

I seek refuge in Allah from the cursed Satan, In the name of Allah, Most Gracious, Most Merciful. God’s blessing and peace on our lord Muhammad and on his family”, followed by chapter An-Nur (24:36-38) (سورة النور) (Lit is such a Light) in houses, which Allah hath permitted to be raised to honour; for the celebration, in them, of His name: In them is He glorified in the mornings and in the evenings, (again and again),- By men whom neither traffic nor merchandise can divert from the Remembrance of Allah, nor from regular Prayer, nor from the practice of regular Charity: Their (only) fear is for the Day when hearts and eyes will be transformed (in a world wholly new),- That Allah may reward them according to the best of their deeds, and add even more for them out of His Grace:...⁸⁰ (verse 24:38 is not complete)

The Quranic verses are contained in an elongated oval cartouche and joined on the corners of the inscription band with polylobed circular medallions.

The inscription on the double-blind arch walls is in knotted kufic script with a background of vegetal motifs (figure 19). It reads:

“I seek refuge in Allah from the cursed Satan, In the name of Allah, Most Gracious, Most Merciful. God’s blessing and peace on our lord Muhammad and on his family”, followed by chapter Al Imran (3:190-191) (سورة آل عمران).

It is important to note that the two verses are not completely coherent. The text as inscribed starts with verse 190:

Behold! in the creation of the heavens and the earth, and the alternation of night and day, - there are indeed Signs for men of understanding, -

⁸⁰ Ali, A.Y. (1983).

Arabic text:

في بُيُوتِ أَذْنِ اللَّهِ أَنْ تُرْفَعَ وَيُذْكَرَ فِيهَا اسْمُهُ يُسَبِّحُ لَهُ فِيهَا بِالْغُدُوِّ وَالْآصَالِ (36)
 رَجَالٌ لَا تُلْهِيهِمْ تِجَارَةٌ وَلَا بَيْعٌ عَنْ ذِكْرِ اللَّهِ وَإِقَامِ الصَّلَاةِ وَإِيتَاءِ الزَّكَاةِ يَخَافُونَ يَوْمًا تَتَقَلَّبُ فِيهِ الْقُلُوبُ وَالْأَبْصَارُ (37)
 لِيَجْزِيََهُمُ اللَّهُ أَحْسَنَ مَا عَمِلُوا وَيَزِيدَهُم مِّن فَضْلِهِ... (38)

Continuing verse 191 on the same band:

“Men who celebrate the praises of Allah, standing, sitting, and lying down on their sides, and contemplate the (wonders of) creation in the heavens and the earth, (this verse is interrupted) and verse 190 is inscribed from its middle: “...and the alternation of night and day, - there are indeed Signs for men of understanding, -.”

Verse 191 continue with the first three words:

“Men who celebrate the praises of Allah....” (figure 28).⁸¹

Although this occurrence of changing the order of the verses may be a subject of interpretation, it is safe to suggest that it may have occurred during the restoration of the building when one panel may have been placed before the other, similarly to the case of the mihrab previously discussed (figure 16). A section of the inscription band could have been in a bad condition, so a copied mold was taken from the other band and cast replacing the missing inscription. Figure 10 shows the bad state of the plasterwork in the inscription band. Which may have been the reason that led to the mix up in the Quranic verses.

Two bands of inscription frame the geometric patterns in the four corners of the prayer hall, located under the muqarnas pendentives (figure 29). The inscription of the upper band is verse 153 from Surat Al Baqarah (سورة البقرة, 2:153): “O ye who believe! seek help with patient perseverance and prayer; for Allah is with those who patiently persevere.”⁸² Whereas the decoration of lower inscription band is filled with the Nasrid motto “There is no conqueror but God”, as a front-plane and vegetal motif as a back-plane. Similar to the other bands the inscriptions were in the

⁸¹ Ali, A.Y. (1983).

Arabic text:

إِنَّ فِي خَلْقِ السَّمَاوَاتِ وَالْأَرْضِ وَالاخْتِلافِ اللَّيْلِ وَالنَّهَارِ لآيَاتٍ لِّأُولِي الْأَلْبَابِ (190)
الَّذِينَ يَذْكُرُونَ اللَّهَ قِيَامًا وَقُعُودًا وَعَلَىٰ جُنُوبِهِمْ وَيَتَفَكَّرُونَ فِي خَلْقِ السَّمَاوَاتِ وَالْأَرْضِ... (191)
... وَالاخْتِلافِ اللَّيْلِ وَالنَّهَارِ لآيَاتٍ لِّأُولِي الْأَلْبَابِ (190)
الَّذِينَ يَذْكُرُونَ اللَّهَ... (191)

⁸² Ali, A.Y. (1983).

Arabic text: يَا أَيُّهَا الَّذِينَ آمَنُوا اسْتَعِينُوا بِالصَّبْرِ وَالصَّلَاةِ إِنَّ اللَّهَ مَعَ الصَّابِرِينَ

foreground of the composition, whereas the background is with foliate motifs. The meaning of the verse has a direct link with the function of the space which is a prayer hall. Either chapter An-Nur (24:36-38) (سورة النور) which is located on the mihrab and entrance wall and talk about remembering Allah and performing the prayers, or chapter Al Baqarah (2:153) which are located in the four corners of the prayer hall and address the believers that seek help through patience and prayer.

The muqarnas arches are framed by a similar inscription band (figure 30). They repeat the formulaic phrases, “Praises to God for the benefit of Islam” in naskh script. The phrase is repeated four times vertically and five times horizontally. A vegetal motif decorated the corners of the rectangular bands. This vegetal motif is extensively used in various decorative programs during the reign of Yusuf I.⁸³ It is found in several units in the Alhambra palace complex, including the Qallahura Nueva (figure 31), Salon de Comares (figure 32), and the prayer hall in the Partal palace (figure 33). It has symmetric composition of two palm leaves facing each other, creating a three-lobed design.

2.3 Superimposed Patterns

The ornaments in the Prayer Hall of the madrasa al-Yusufia gives the space its identity. Ornament is not simply a means to fill a void or an empty surface, according to Oleg Grabar, it rather can be “the subject” of the composition.⁸⁴ The hierarchal arrangement of motifs affects the whole ornamental program. Grabar argues that the difference between filling the space or covering it is that the process of covering a surface with ornament could change its purpose or function. The artists did not fill the empty space arbitrarily rather they created a complex overlapping/interlocking

⁸³ Fernandez-Puertas, A. (1997). Pp. 103.

⁸⁴ Grabar, O. (1989). Pp. 119-154.

composition of different patterns which make it become the subject for looking.⁸⁵ In the prayer hall they are the superimposed patterns. These patterns consist of layers of three of the elements of Islamic art; geometric forms, vegetal motifs, and inscription. Each plane is carved on a different depth and painted with a different color.

In this section the planes of the superimposed patterns are discussed in relation to each other, since in most cases the surface decoration is a combination of two types or in some cases the three types are layered together. It is not the individual motif that create the aesthetic attraction rather the perception of the composition as a whole.⁸⁶

Overlapping patterns create many possibilities of decoration. For example, calligraphy could have a great stylistic variation as inscription on building than in the art of the book.⁸⁷ Jay Bonner, in his study of Islamic geometric patterns, divides the overlapping patterns into two types: self-similar and not self-similar. A not self-similar pattern could be the combination of a floral motif with a calligraphic design. Similar to the inscription bands we have previously discussed, framing the muqarnas arches, mihrab, entrance and double-blind arches or the band above the mihrab (figure 24). Bonner defines the self-similar patterns as having similar primary and secondary patterns in which the secondary pattern is expressed on a smaller scale.⁸⁸ A self-similar pattern employs an additive process, in which a primary geometric pattern has a smaller scale geometric pattern added to it. A self-similar pattern may be detected if the decoration on the niche of the mihrab, or the spandrel of the arch of the entrance; in this case both the primary and the secondary patterns are a composition of vegetal

⁸⁵ Ettingshausen, R. (1979). *The Taming of the Horror Vaccui in Islamic Art*. Proceedings of the American Philosophical Society, Vol. 123, No. 1, p. 15-28.

⁸⁶ Ettingshausen, R. (1979).

⁸⁷ Bonner, J. (2003). *Three Traditions of Self-Similarity in Fourteenth Century and Fifteenth Century Islamic Geometric Ornament*. The International Society of the Arts, Mathematics, and Architecture. Pp. 1-12.

⁸⁸ Bonner, J. (2003).

motifs (figure 15). Color, the size of the motifs, the thickness of the lines, and the depth of carving are employed to differentiate between the primary and the secondary pattern.

The patterns in Figures (29) and (34) are not self-similar superimposed patterns, meaning they are composed of two planes a geometric front plane and vegetal motifs filling the back plane. They are decorated with a star and polygon pattern, where the star is eight-pointed. The eight-pointed stars seems to generate various polygonal shapes in between. The polygonal shapes are further ornamented with symmetric compositions of palmettes and vegetal motifs. The eight-pointed star in figure (29) is filled with the inscription of the Nasrid motto with a background of vegetal motifs whereas in the pattern in figure (34) the star is ornamented with a deep carved shell motif. In this pattern the primary front plane is the geometric composition, with a smaller scale secondary back plane filled with vegetal motifs creating a more complex composition. Ettingshausen refers to these patterns as “structural or skeletal scheme”, in which a front-plane will be the main pattern and on a smaller scale a secondary pattern will fill the empty spaces around the main pattern.⁸⁹ The separation between front and back planes is easily perceived in these compositions.

In figure (35) the spandrels of the muqarnas arches and figure (21) the rectangular surface above the double-blind arches, both surfaces are ornamented with a superimposed pattern composed of three planes geometric, vegetal and inscription. Later in this paper these patterns will be further discussed and due to the complexity of the pattern each plane will be discussed separately. In these patterns, inscription didn't only cover the back-plane; rather it generated the design. Because it is the

⁸⁹ Ettingshausen, R. (1979). Pp. 15-28.

extension of the kufic letters that would create the pattern. Similar to the patterns discussed previously the back-plane of these compositions are covered with ribbed vegetal motifs and formulaic phrases.

These superimposed patterns are carved at various depths, thus creating planes of fore-plane, middle-plane, and back-plane. The planes would overlap or interlock in the same way in which the superimposed patterns are based on the rhomboid grid. The geometric and epigraphic planes are interlaced patterns that both occupied the foreground. In which the back plane will be covered with ribbed or plane vegetal motifs, this would create an enriched surface ornamentation. As a result of the varying depths of the carving the plaster decoration creates a sculptural quality. The layered carving of the plaster on different depths would add hierarchy to the composition. In addition to the carving depth and width of the pattern, color added another quality to the design composition. Even though the pattern is composed of multiple planes, the final result is a unified textured surface.

In the following two section, I will present analyses of the geometric and vegetal patterns used on the walls of the Prayer Hall. My method consists of analyzing the geometric forms and the proportional system. I will be dividing each pattern into planes and tracing the main grid that the whole pattern is based on. Further I will apply the Nasrid proportional system on the main grid.

2.4 Geometry and Proportions

Since the 19th century, geometry in Islamic art received considerable attention, with various way of analyzing and interpreting the various patters. These studies intensified after the publication of Owen Jones' Grammar of Ornament which includes substantial plates of geometric patterns from Alhambra palace in Granada. Jones also

paid attention to the question of proportion in Islamic decorative patterns in Spain. In this regard, he states that:

As with proportion, we think that these proportions will be the most beautiful which it will be most difficult for the eye to detect.” Further explaining that: “All compositions of squares or of circles will be monotonous, and afford but little pleasure, because the means whereby they are produced are very apparent. So, we think that compositions distributed in equal lines or divisions will be less beautiful than those which require a higher mental effort to appreciate them.⁹⁰

The visual impact of the forms and proportions of ornament in the Nasrid period are the result of the general arrangement and growth of the lines out of each other.⁹¹ Meaning that the dimensions of the repeated unit in a pattern would be proportional to the decorated surface which would also be proportional to the dimensions of the wall and plan of the room. Harmony and balance could be observed throughout the whole design. Starting with the general lines and division of surfaces, then filling them with decorative patterns, which will be further subdivided and filled with intricate details.⁹² Therefore, depending on the distance of the beholder a different visual understanding would be created.⁹³ From a distance the detail does not interfere with the main lines of the composition. Such is the case of the patterns in the prayer hall of the madrasa al-Yusufia, in which the curves are arranged according to a grid that is not perceived to the beholder to understand. Yet the viewer will be aware that the curves are divided and composed proportionally

Oleg Grabar divides geometric forms into three different groups.⁹⁴ The first form is defined as regular geometric pattern created from a regular figure. Regardless of the complexity of this, it is the basic form belongs to one of the 17 planer symmetry

⁹⁰ Jones, O. (1997). Pp. 117-119

⁹¹ Jones, O. (1997). Pp. 116

⁹² Jones, O. (1997). Pp.117

⁹³ Jones, O. (1997). Pp.117

⁹⁴ Grabar, O. (1989). Pp. 119-154.

groups. In the second type, geometric forms support a writing, vegetation, floral or visual representation of human figures. The third kind which Grabar called, “loose geometry”, this form is created by calculated rhythmic repetition of a motif. In this type if geometric rendition the viewer perceives a repeated regular geometric form (square, circle, triangle), acting as a support for the composition.

Robert Hamilton, in his study of the decoration in the Umayyad site of Khirbat al-Mafjar near Jericho, defines some way of using geometry as “wallpaper method”.⁹⁵ The wallpaper method is recognized by the unlimited growth of the pattern, it is simply ended by a wall, end of the surface or a boarder. Most of these patterns are created through a vertical or horizontal growth. This may describe the decoration in the prayer hall of the madrasa al-Yusufia. In most of the decorative patterns, the growth of the pattern is stopped by the horizontal or vertical borders of the given surfaces. For example, the pattern in figure (21), the interlaced arches create a limitless pattern which expand horizontally, that is defined by the vertical boundaries of the surface. The interlace arches create the sense of movement and continuity.

The decorative program used in the prayer hall of the madrasa al-Yusufia relies on a proportional system that was detected on decorated surfaces in Nasrid architecture, this was mentioned earlier: the progressive diagonals. The patterns and motifs chosen to cover the walls are proportioned and calculated, thus creating a harmonious work and an obvious sense of continuity. The beauty of a pattern is the result of the rhythmic balance of its composition and the proportion relationship between its components. The pattern is a composition of a group of units. This unit is reflected and translated in orderly sequence. No matter how complex the design unit

⁹⁵ Grabar, O. (1989). Pp. 136-141. Robert Hamilton, discussed the unique bath floor mosaics in his book, Khirbat al-Mafjar (Oxford, 1959).

that is to be repeated, it is the process of repetition that carries the artisan from initial step to the completion of a pattern.⁹⁶ Either the decorative unit is applied to a frame or covering a surface, it is easy and rapid on the artisan to repeat it once the basic unit is created. The pattern would be generated by the horizontal and vertical expansion of the unit. A proportional system could be detected in the prayer hall surface decoration. The proportion of the repeated unit in a pattern is based on the dimensions of the surface which the pattern would decorate. Similar to figure (21) in which the unit of decoration have the same proportion as the surface it covers (figure 20). This unit would be repeated on the horizontal axis to cover the whole surface.

Jones described the Nasrid architecture decoration as superior to other styles based on the harmony and aesthetic quality of rhomboid type of ornament.⁹⁷ The design perceived by the beholder is only a segment from the complete design.⁹⁸ In the prayer hall the repeated unit is just a highlighted section from a larger much more complex pattern.

In order to understand the proportional system between the dimensions of the decorated surface, the rhomboid grid and the repeated unit, I will discuss the superimposed pattern on the spandrels of the muqarnas arches (figure 35). The multiple planes in the superimposed pattern makes it harder to the observer to comprehend it all at once. The three decorated planes are arranged according to the same main geometric grid. In order to understand the symmetry in the patterns used each plane will be discussed separately.

⁹⁶ Bier, C. (2008). *Art and Mithal: Reading Geometry as Visual Commentary*. Iranian Studies, Vol. 41, No. 4, Sciences, Crafts, and the Production of Knowledge: Iran and Eastern Islamic Lands. Pp. 491-509. Taylor & Francis.

⁹⁷ Jones, O. (1997). Jones named this type of ornament “Lozenge Diapers” and gave a variety of forms which belong to the same group.

⁹⁸ Grabar, O. (1989). Pp. 147.

I took the rectangular surface EFGH to be the decorated surface, the rectangle EFGH is a reconstruction of the pattern covering the spandrels of the muqarnas arches (figure 35-36). I divided the length HG into six equal lengths (figure 37), it could be divided into other equal lengths in which only the scale of the pattern would change but the proportions would stay the same. I divided it into 6 equal parts just to simplify the explanation. Each length is considered to be: side = 1 of the rectangles constructed based on the progressive diagonals proportional system. Thus, if one side of the rectangle is equal to 1 then the other side is $\sqrt{2}$. The $\sqrt{2}$ rectangle is repeated along the vertical and horizontal axis with an inscribed rhombus (figure 38). Based on this process of repetition the main structural rhomboid grid and the repeated unit are identified. Therefore, this pattern is considered to be based on the $\sqrt{2}$ proportional system (figure 39). In this case the process of repetition is stopped by the sides EH and FG. Similarly, the same process is applied to the entrance wall, the surface flanking the entrance arched opening (figure 40). In some cases, a slight variation could occur in applying the proportional systems, in which the lower corner of the rhombus is slightly moved downward to fill the whole composition (figure 41). Now that the repeated unit is identified, the decorated elements are arranged along the sides of the inscribed rhombus. Thus, creating a composition of tangential circles. The gradual transition of the curved lines is through the tangential smaller circle. The circles which the curved lines are based on are also tangential to each other (figure 42). The smooth transition would create a more pleasant and comfortable visual experience to the viewer.

The repeated unit is reflected and translated according to the symmetric group. A different type of symmetry group is applied on each plane of the superimposed pattern. Symmetry groups are divided into 17 types, known as the wallpaper symmetry

groups.⁹⁹ They are the linear transformation or isometry of a given regular polygon. The regular polygon is either rotated about a point or reflected along an axis. In my research I have found that 2 types of symmetry groups are represented in the prayer hall of the madrasa al-Yusufia, types P1 and Pm. In the front plane of this pattern a combination of two symmetric groups were applied (P1 and Pm) (figure 43). The type P1 symmetry is the simplest, in which the unit is translated in respect to one or more of the edges. In this case the rectangle ABCD is translated along the diagonal's AC and BD. Whereas type Pm symmetry is a combination of translation and reflection process. The translation that was applied is already mentioned (P1). The second process applied is reflected, in which the unit is reflected along AD or BC. The second level belongs to type P1 wallpaper symmetry group (figure 44). The main unit rhombus EFGH, is translated along its four edges. The main unit has a horizontal reflection, where the unit is symmetric along the vertical diagonal HF of the rhombus.

It has to be stressed in this context that this process of generating proportions was applied in other buildings constructed under Yusuf I. Artisans divided walls into surfaces which were further divided into a main structural grid. And the repeated unit was generated from the main structural grid. Even though the decorated surfaces may vary in scale. Regardless of the scale of the decorated surface the dimensions of the repeated unit would be based on it. One may hypnotize that this process was applied on the exterior and interior walls of the buildings.

⁹⁹ Blanco, M. Harris, A. (2011). Symmetry Groups in the Alhambra. Mathematical Institute of the Serbian Academy of Sciences and Arts.

Grunbaum, B. (2006). What Symmetry Groups are Present in the Alhambra? American Mathematical Society. Vol. 53, No. 6, pp. 670-673.

Schattschneider, D. (1978). The Plane Symmetry Groups: Their Recognition and Notation. Taylor & Francis, Ltd. On behalf of the Mathematical Association of American. Vol. 85, No. 6, pp. 439-450.

Schwarzenberger, R.L.E. (1974). The 17 Plane Symmetry Groups. The Mathematical Association. Vol. 58, No. 404, pp. 123-131.

Wallpaper symmetry groups are: p1, p2, pm, pg, cm, pmm, pmg, pgg, cmm, p4, p4m, p4g, p3, p31m, p3m1, p6, p6m.

The palatial complex of Alhambra was the official residence of the Nasrid Sultans. Most constructions of the Alhambra were made during the rule of Muhamad III, Isma'1 I. Yusuf I, and Muhamad V. But most of the surviving building and architecture decoration existed today are the work of Yusuf I and his son Muhamad V. Yusuf I's architecture effort and program was significant, he built many buildings, the Alhambra was the most famous of them. He built a palace, prayer halls, a hammam, fortress, city gates and royal dwelling. Scholars focused the most on the Alhambra because it survived and was well preserved.

In this section of the paper, I will discuss other buildings decorated under Yusuf which similar to the madrasa prayer hall were richly decorated with skillful stucco carvings and complex geometric patterns. The building discussed are of various functions, the prayer hall in the Partal Palace (1348-1354) a private prayer hall, the Qalahurra Nueva (1346-1348) a military tower and a royal dwelling, the Salon de Comares (1350-1354) a throne room, and the Hammam of the Palacio de Comares a royal bath. The prayer hall in the Partal palace was constructed between 1348 and 1353 and its plan measuring 3x4.16m (figure 2-45).¹⁰⁰ It is the smallest prayer hall in Nasrid architecture. It has a rectangular plan divided into two spaces, a square space for prayer and a rectangular space acting as a transition space (figure 46). The two spaces are separated with horse-shoe arch resting on engaged columns (figure 47). The transition area is surmounted by wooden beams, whereas the prayer area with a square paneled wooden ceiling. The prayer hall is an independent construction with an elevated entrance and a horseshoe arched entrance on the North East wall. The South-East wall is the qibla wall, it includes a mihrab niche in its center (figure 48). The composition

¹⁰⁰ مالدونادو، ب. (2011). عمارة المساجد في الأندلس غرناطة و باقي شبه الجزيرة الإيبيرية (ترجمة: منوفي، ع.). أبوظبي: هيئة أبوظبي للثقافة والتراث.

and decoration of this mihrab is similar to the mihrab in the prayer hall of the madrasa. It has a polylobed horse-shoe arch profile. The plasterwork here is not colored. The voussoirs have alternating decorative motifs. The spandrels of the arch of the mihrab are decorated with a composition of a single plane vegetal motif. The inner part of the mihrab niche have survived, it has an octagonal composition with a half muqarnas dome (figure 49). The southwest and northwest walls are identical having a semi-circular arch in the center pierced with double-arched openings. Both the interior and exterior walls of the prayer hall are decorated with carved stucco (figure 50).

The Qalahurra Nueva or Qalahurra al-Jadida also known as the Tower of the Captive, constructed between 1346 and 1348 and its plan measuring 4.4x4.4m (figure 2-51).¹⁰¹ The Qalahurra Nueva is a military tower and a royal dwelling located northeast of the Alhambra palace. The tower was constructed by the initiative of the vizir Ibn al-Jayyab. During the rule of Yusuf, Ibn al-Jayyab was the head of Diwan al-Insha'. The dual function of the tower was specified through poems of Ibn al-Jayyab which were inscribed on the walls. Yusuf wanted the tower to be a space for pleasure and yet reflect their military strength.¹⁰² The Qalahurra Nueva hardly different externally from the rest of the military towers (figures 52). However, the architecture decoration of the interior is of the most outstanding in the Alhambra (figure 53). The main hall in the Qalahurra Nueva has a square plan, with 1.5m thick walls. Its entrance is on the southwest wall and the other three walls have a similar symmetric composition. The thick walls are pierced with double semi-circular arch window opening in the center of the wall. The tower underwent several restorations starting in 1814, the wooden ceiling was completely replaced. The ceramic dados are highly

¹⁰¹ Fernandez-Puertas, A. (1997). Pp. 265.

¹⁰² Bush, O. (2009).

renovated. However, the plasterwork decoration has been well preserved, maintaining the original Nasrid decorative composition.

The Comares Palace was the official residence of Yusuf I (figure 2). The palace included several constructions, the Salon de Comares, Comares Tower, Court of the Myrtles, Sala de la Barca, and the baths. We will further discuss the Salon de Comares and the baths in the Comares palace. The Salon de Comares also known as the Hall of the Ambassadors. It is the throne room in the Comares Palace (1350-1354). The Salon de Comares has a square plan measuring 11.5x11.5 and 18.20m height and 2.5m thick walls (figure 54). The entrance is on the south wall, and similar to the Qalahurra Nueva the other three walls have a similar composition. The thick walls are pierced each with three semi-circular arched opening creating galleries and framing the breathtaking views of Granada (figure 55). The walls of the Salon de Comares are richly ornamented, it is the most lavishly decorated building in the Alhambra. Even the bath in the Comares palace were decorated (figure 56). They were constructed by Ismail I, but they were decorated by Yusuf I.¹⁰³

All of the building by Yusuf shared similar decorative programs, their walls were lavishly ornamented and completely covered with decorative patterns. The artisans used different materials in the decoration, ceramic, stucco and wood. Ceramic tiles covered the dadoes of the room, over them the walls were divided into surfaces and decorated with skillfully executed plasterwork, the transition between the plasterwork and the wooden ceiling was through a muqarnas cornice. The ceramic tiles are composed of complex geometric mosaics. The plasterwork was either multiple plane designs, superimposed patterns, or inscription. The text of the inscription

¹⁰³ Rodriguez, D. (1992). Pp. 127-134

differed from one building to the other based on the function of each building. Similar to the plans and sections of these constructions, the decorative program was simple and harmonious, nevertheless an understanding of geometry underlies the various compositions. The proportions used to compose the decoration in here were discussed by Fernandez Puertas. In his publication about Alhambra palace, he indicates that the proportion of the $\sqrt{2}$ proved in his book *The Alhambra* that the plans and sections of the builds discussed previously were based on the $\sqrt{2}$ proportion system. The side dimensions and height of the buildings were related to each other creating a proportionally harmonious atmosphere. The Nasrid artisans did not only apply proportionality on architecture plans and sections rather they divided the decorated surfaces and the details of the architecture decoration based on the $\sqrt{2}$ proportional system. The Nasrid artisans under Yusuf I used the same structural grid that generated the rhomboid superimposed pattern. Similar to the process followed in the prayer hall in the Madrasa al-Yusufia, a given surface will be divided into equal widths and this width will be considered unit 1 and the length is $\sqrt{2}$ thus generating the $\sqrt{2}$ rhomboid which would be the repeated unit that would cover the decorated surface. As we have previously mentioned each building have a different function and scale yet similar patterns were applied to the decorated surface, Partal Palace prayer hall (figure 57), the Qalahurra Nueva (figure 58), the Salon de Comares (figure 59), and the bathe of the Comares palace (figure 60), which prove that this grid could be applied to any surface with scalability.

The rhomboid pattern is based on the rhomboid main structural grid, and the repeated unit is applied to the grid. variations could exist between the grid structure and the generated pattern. While analyzing pattern construction minor elements are not identified as part of the structural grid. In some cases, these elements may ad

uniqueness and an identity to the pattern. Similar to the patterns discussed in the prayer hall of the madrasa al-Yusufia and in the other buildings constructed under Yusuf, in which similar grid structures generated different patterns. The intricate details added to the repeated unit will result in a different pattern.

2.5 Vegetal Forms

The vegetal motifs are often used in the decorative program in Islamic art in Spain. It is suggested that they were first used on the arches of the Aljaferia palace during the Taifa period (11th Century) in Zaragoza, Spain.¹⁰⁴ Later this was developed in the Almoravid (1062-1150) and Almohad (1150-1269) periods, and naturally the Nasrids benefited from earlier development. One way of employing vegetal forms in decorative schemes is to form a background for another pattern, sometimes geometric, and at others inscription or both. A good example is what we see on the spandrels of the mihrab arch, background of the inscription band and the surface area flanking the engaged columns (figure 61). The background surface is covered with vegetal motifs. During its early period under Muhammad I (1232-1273) and Muhammad II (1273-1302) the Nasrid artisans carved vegetal motifs directly on wet plaster, leading to imperfections in the finish.¹⁰⁵ Later under Ismail I (1314-1325) and Yusuf I (1333-1354) molds were introduced that created a higher quality in execution. During this period vegetal motifs covered larger surface areas, leading to the use of larger forms. The vegetal forms used in the prayer hall are a result of the composition of tangential circles. These circles are arranged to create variety of forms which are further decorated (Figure 62). As identified by Fernandez-Puertas, the Nasrid stylized palm leaf may have been decorated in different form, either kept plain, ribbed or ornamented

¹⁰⁴ Fernandez-Puertas, A. (1997). Pp. 96-104.

¹⁰⁵ Fernandez-Puertas, A. (1997). Pp. 96-104.

with beads, chains or other forms. In the madrasa they used the ribbed and plain vegetal motifs; carved and painted (Figure 63). The vegetal ornament is either used to fill the background of a pattern, or inscription or decorate a whole surface. The vegetal motifs may have been added arbitrary to fill the gaps, or rather the surfaces are equally divided and the details are added around these dividing lines creating a symmetric and balanced arrangement.¹⁰⁶

Vegetal motifs were also used by Nasrid artists to ornament column capitals. Two types of engaged columns were used in the madrasa prayer hall. Similar capital compositions were used in the buildings constructed under Yusuf I (Figure 64). Nasrid capitals are colored with bright colors similar to other decorations and material used in the building. The capital is divided into two parts, the lower part has a cylindrical form decorated with a highly stylized acanthus leaves which would extend over the transition to the second part.¹⁰⁷ The second part has a polygonal form usually cubic in plan. This part is decorated with geometric, floral, and inscriptions. The level of details added to the motifs used depended on the scale of the capital. In the madrasa prayer hall two types of marble engaged columns were used. The first column capital has a cylindrical base and a cubic upper part with a symmetric decorative composition of geometric and floral motifs. Whereas the second type located on the corners of the octagonal transition zone, thus having a cylindrical lower part but the upper part of the capital has a polygonal plan. This capital is decorated with complex vegetal motifs and inscriptions. Color pigments could still be traced on this capital. It has a symmetric composition with a deeply carved pine cone motif in the middle and a combination of differently decorated vegetal motifs, plain, ribbed and dented. The inscriptions in

¹⁰⁶ Jones, O. (1997). 65-74

¹⁰⁷ Fernandez-Puertas, A. (1997). Pp. 79-87.

Naskhi script stated the Nasrid motto in the middle flanked by formulaic inscriptions (العزة لله, بركة). Similar capital decoration could be found in buildings patron by Yusuf I, Salon de Comares (1350-54), Puerta de la Justicia (1349) (Bab al-Sharia) and the Partial prayer hall.¹⁰⁸ The decorative program of these capitals shares a similar composition of inscription, vegetal motifs and a central pine cone form. Keeping in mind that the combination of the three types of vegetal forms only existed in the madrasa prayer hall and the Salon de Comares.

2.6 Muqarnas

Muqarnas is an important part of the prayer hall of the madrasa al-Yusufia. It is included in the decoration of the pendentives, arches, cornice and in the domed roof (figure 65-66). The muqarnas is a three-dimensional ornamental form which added volume to the decorated walls of the prayer hall. It has a sophisticated and complex geometric composition which make it dazzling to the eye of the onlooker. As mentioned earlier, the present muqarnas groups in the prayer hall were reconstructed when the decoration of the room was restored in the 19th C. This is also the case of the muqarnas dome, originally the prayer hall was covered with a wooden roof and in 1983, Emilio Hernandez recreated the wooden ceiling adding the muqarnas cupola in the middle and the windows allowing the access of light. Unfortunately, we don't know if the restored pendentives are similar to the original design. However, the design seems to fit with the general decorative program. Therefore, in this part of the paper I will be discussing the composition of the muqarnas pendentives (figure 66).

Muqarnas usually have a structural role in forming a transitional zone between two structures whose plans are different such as a square chamber surmounted by a

¹⁰⁸ Bab al-Sharia was constructed in 1348 by Yusuf I while ibn al-Jayyab was the head of Diwan al-Insha.

semi spherical dome, or a transition between two planes. Muqarnas has no architectural limitation, neither scale nor architectural situation, they could adapt to any surface or transition zone.¹⁰⁹ Muqarnas at times is used only for decorative purpose. The Muqarnas formations in the Yusufia prayer hall are simply decorative since the roof of the hall is not topped with a dome. All muqarnas groups are executed with molded plaster and painted. Their execution requires skillful artisans that master plasterwork and are knowledgeable in mathematics and geometry.

Plaster muqarnas are composed of cluster of overlapping suspended three-dimensional forms.¹¹⁰ Similar to other architecture elements in the madrasa, muqarnas was also colored. Pigments of color could still be seen.¹¹¹ In order to understand the geometric composition of muqarnas, it should be simplified to its main units.¹¹² In some cases due to its three-dimensional characteristics, a plan and a section would not communicate its volumetric shape. Nasrid muqarnas are constructed from seven different prisms, that originate from three primary geometric forms.¹¹³ These three forms are a right-angled triangle, a rectangle, and an isosceles triangle, in which they all share an equal side (Figure 67). The right angles triangle and the isosceles triangle has three variations in section whereas the rectangle only has one form in section. The curves formed by the projection of the prisms are similar in the three primary forms. The seven different prisms are repeated and located on top of each other in a stair like arrangement.

¹⁰⁹ Ferrer, I. Gordon, A. (2019). *A Grammar of Muqarnas: Drawing of the Alhambra by Jones and Gourey (1834-1845)*. VLC arquitectura. Vol. 6. Pp. 57-87.

¹¹⁰ Gonzalez, V. (2001). Pp. 79

¹¹¹ Rosser-Owen, M. (2010).

¹¹² Necipoglu, G. Al-Asud, M. (1995): *The Topkapi Scroll: Geometry and Ornament in Islamic Architecture*. Santa Monica, CA: Getty Center for the History of Art and the Humanities.

¹¹³ Jones, O. (1842). *Plans, Elevations, Sections and Details of the Alhambra*. Vol. 1. Owen Jones Publisher, London.

The muqarnas pendentives in the prayer hall of the madrasa al-Yusufia have a decorative role, they create a visual transition between the square plan and the octagonal transition zone. They have a triangular symmetric composition with a muqarnas arch (figure 68). The center of the bisector of the right-angled triangle is decorated with a 16-pointed star with a rosette detail. The 16-pointed star is flanked by an octagonal form projecting and decorated with vegetal motifs. Due to its complex composition, it is harder to identify which of the 7 prisms were used. Technically all the muqarnas pieces should belong to one of the prisms and they should all have the same proportions. But in execution some varieties maybe observed, in the size of the prisms or a difference in the angles of the isosceles triangle. Along the circumference the prisms are proportional and to scale, while the prisms connection the octagon and the 16-pointed star are deformed and stretched triangles.

There are doubts about the present muqarnas whether they are similar to the original design or they could be a replacement.¹¹⁴ Or they may have been added to the prayer hall. They perfectly belong in the design composition. These muqarnas formations on the pendentives and arches are similar to those in the Hall of the Two Sisters in the Alhambra., they may have been modelled accordingly, or if they are based on fragments from the earlier building then this adds to the notion of that patterns in the Nasrid period were based on a grid or structural formulas that were scalable. The Hall of the Two Sisters is part of the Palace of the Lions, built by Yusuf's son Mohamad V (1354-1359 and 1362-1391). Muqarnas reached its high peak during the rule of Muhamad V.¹¹⁵ The hall has a square plan and an octagonal transition zone.

¹¹⁴ Molina, J. (2015). Pp. 200.

¹¹⁵ Ferrer, I. Gordon, A. (2019).

Similar to the madrasa prayer hall the transition is through muqarnas pendentives and muqarnas arches that run along the sides of the octagonal zone (figure 69).

Chapter Three

Conclusion

Granada witnessed a cultural, educational, artistic, scientific and religious flowering during the rule of Yusuf I. The madrasa al-Yusufia played an important role during the time of Yusuf. It reflected the education and artistic situation that existed in Granada during that time. In light of the many architectural work constructed and decorated during the reign Yusuf I, the palatial complex at Alhambra stands in the midst of remarkable artistic setting in the city. The architecture decoration of the prayer hall of the madrasa al-Yusufia is a majestic achievement during the rule of Yusuf I. The artisans created a masterpiece of complex and detailed decorative program, which covered the walls of the prayer hall with decorative patterns, without losing the harmony and balance in the design. Yusuf's effort produced an array of decorated surfaces that reflected not only the ability of the artists of the period to show a sophisticated taste, but also to demonstrate acute knowledge in geometry. According to Grabar the use of geometry in Islamic art added a form of prestige and importance to the art or architecture, either geometry was recessive or a dominant part of the composition.¹¹⁶ The laws of nature which are the mathematical principles underlie and structure the pattern in two dimensions, a limitation understood by Islamic artisans.¹¹⁷ Owen Jones mused about the Nasrid in saying "we can find no work so fitted to illustrate a Grammar of Ornament as that in which every ornament contains a grammar

¹¹⁶ Grabar, O. (1989). Pp. 119-154.

¹¹⁷ Bier. (2008). Cites Peter S. Stevens, *Handbook of Regular Patterns: An Introduction to Symmetry in Two Dimensions*.

in itself.”¹¹⁸ In addition to expertise of artists in this period, they drew on the artistic development in the preceding periods.¹¹⁹

The Nasrid artists and patrons were aware of the power of geometric patterns. They used geometry and proportions as a tool to create a design process which they followed in their decorative compositions. This design process helped them to establish an infinite variety in the decorative patterns, from one simple geometric grid. A simple rhomboid grid based on the $\sqrt{2}$ proportional system generated a complex pattern composed of multiple planes. These planes overlap to create one single repeated unit that is proportioned to the surface it is decorating. The repeated unit is then reflected and translated along an axis or a point of symmetry in order to fill the whole surface resulting with a unified pattern. This pattern is observed by the viewer one whole design that could be perceived on different levels depending on the distance in which it is perceived from. This simple process led this pattern to spread in the architecture on Nasrid Granada, specially in the building constructed by Yusuf I.

Based on my analysis it is clear that the reason behind this harmony and balance is that the whole composition was based on a proportional system and each decorative pattern belonged to a simple geometric framework. The patterns don't just look similar in the buildings discussed previously, rather they were arranged based on the same grid and proportional system, which made it easier on the artisan to apply the pattern on any surface. The importance of this grid system is that it could be scaled to fit any surface. This helped in the spread of this pattern. Based on the available studies

¹¹⁸ Jones, O. (1997). p.115

¹¹⁹ Rosser-Owen, M. (2010). Pp. 40-45.

and the primary sources this is what we could conclude. Further studies may prove the exact methods of construction and the mathematical knowledge of the Nasrid artisans.

Figures



Figure 1 Inscription panels from outside the prayer hall, now located in the Archeological Museum of Granada, Molina, J. (2015). Pp. 52.

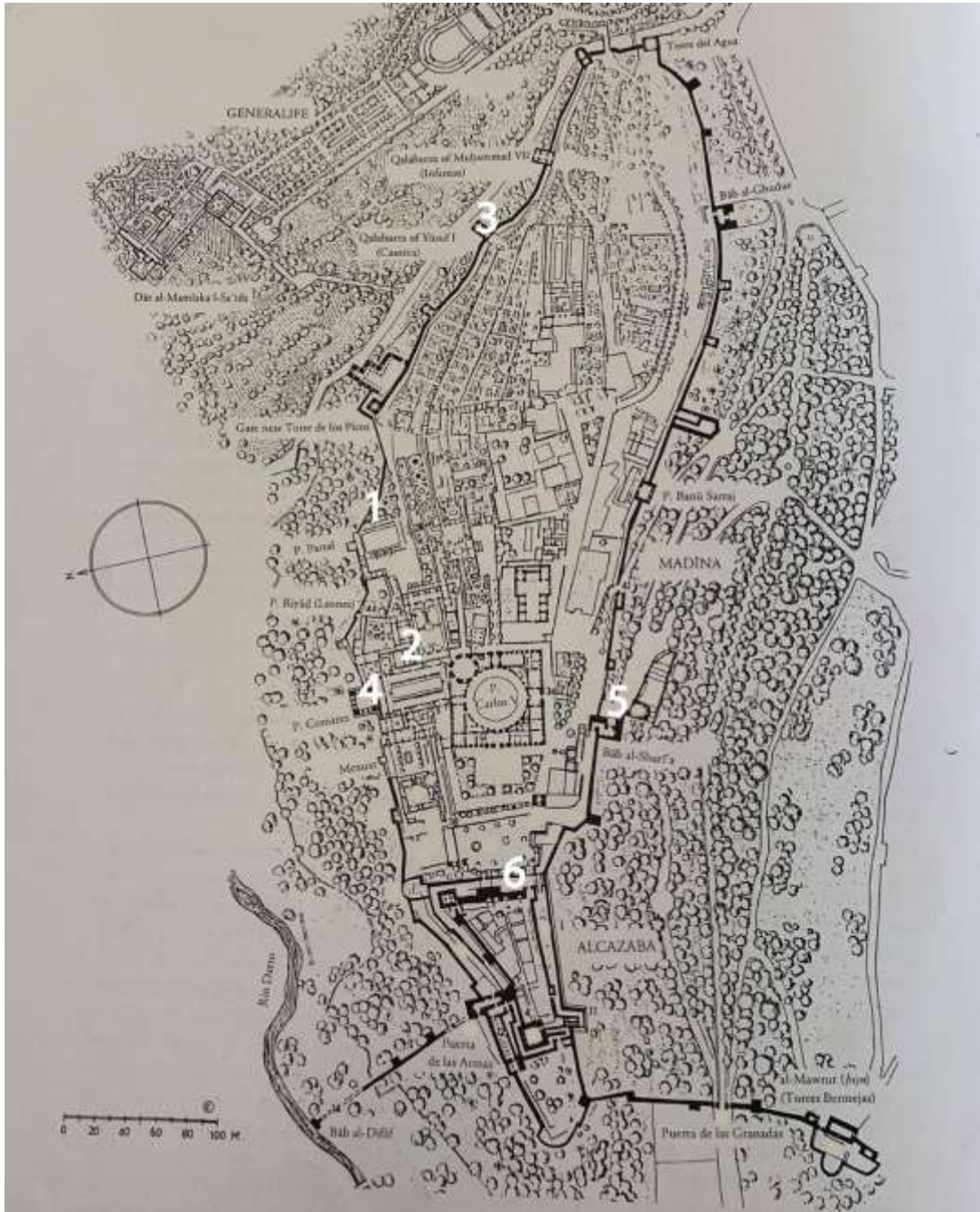


Figure 2 Alhambra Map

1 Prayer Hall in the Partal palace (1348-1353), 2 Hammam of the Palacio de Comares, 3 Qal'ahorra Nueva of Yusuf I (1346-1348) (Torre de la Cautiva), 4 Salon de Comares (1350-1354), 5 Bab al-Shari'a (1349) (Puerta de la Explanada), 6 Torre Quebrada in the Alcazaba



Figure 3 Granada Map

1 Madrasa al-Yusufia, 2 Funduq al-Jadida, 3 Cathedral of Granada (Corral del Carbon), 4 Alhambra Palace

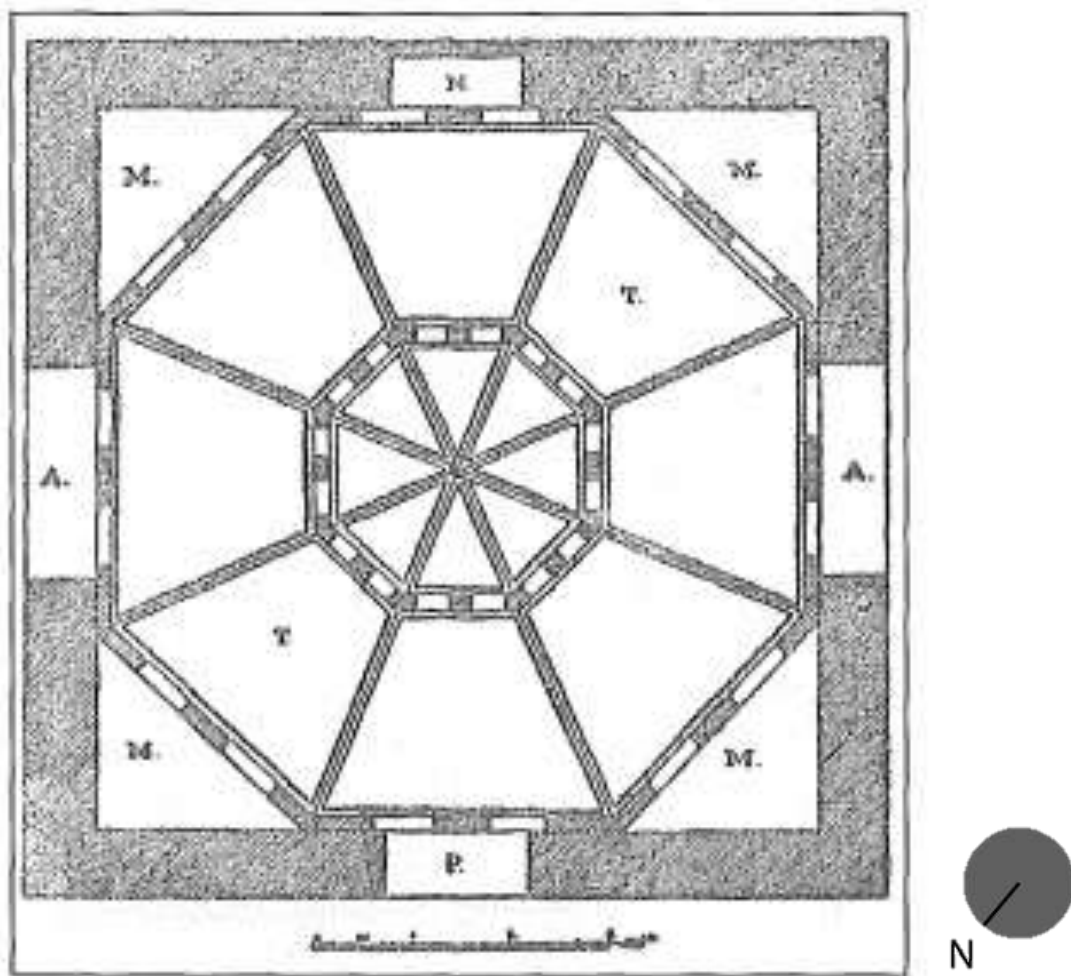


Figure 4 Prayer hall – Madrasa al-Yusufia Plan



Figure 5 Prayer hall – Madrasa al-Yusufia

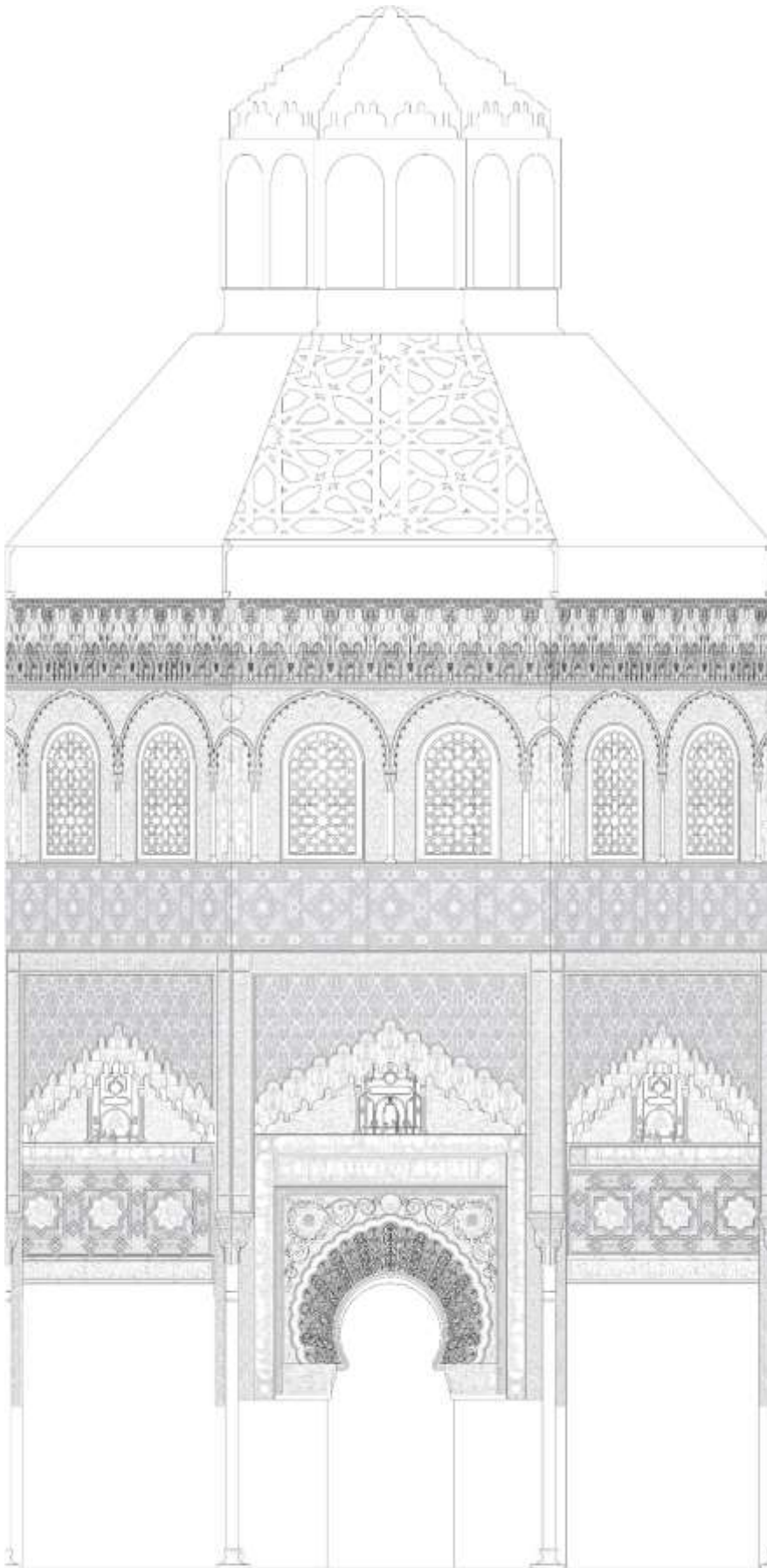


Figure 6 Qibla wall-Mihrab niche (southeast wall)

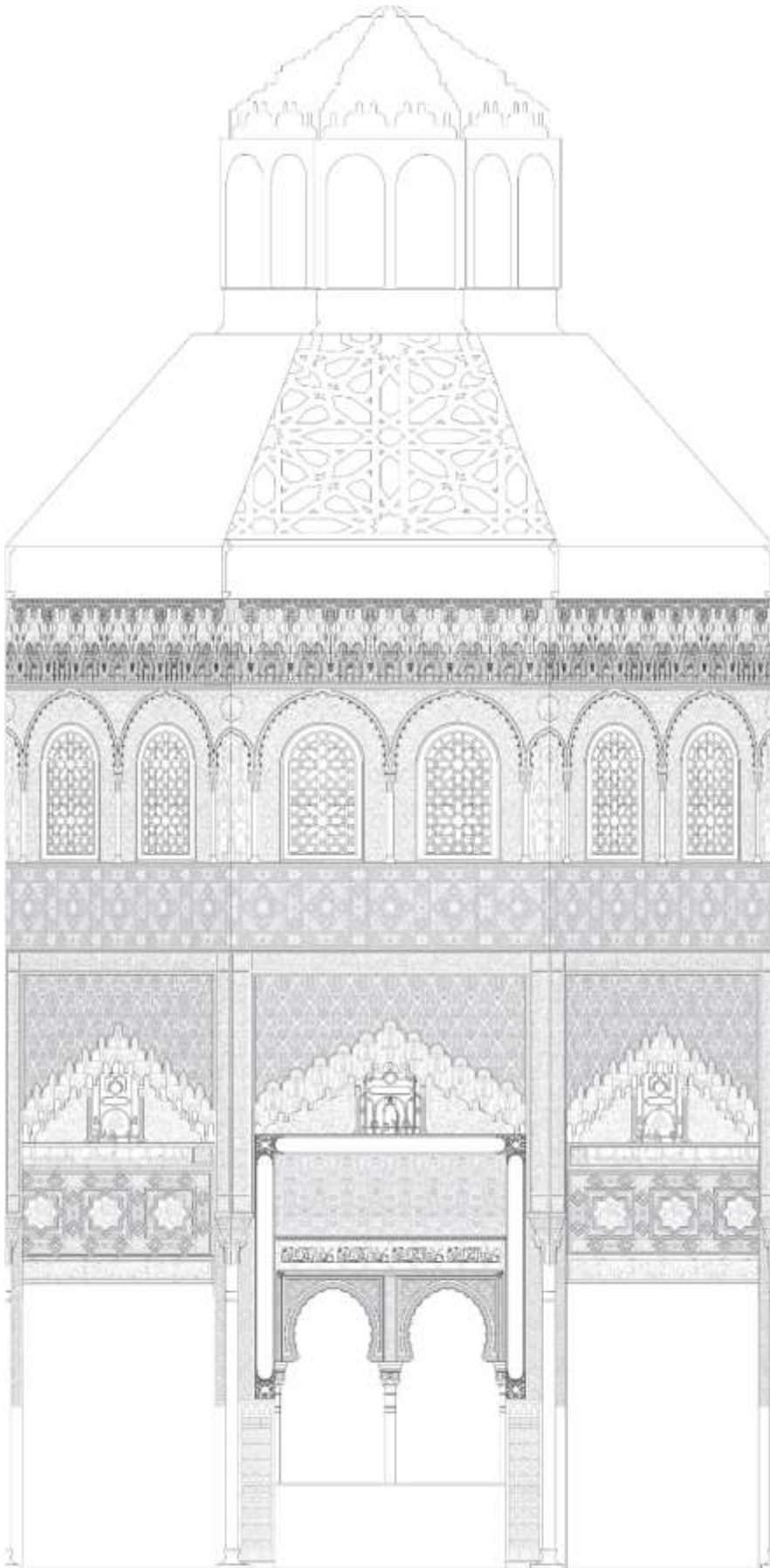


Figure 7 Identical double-blind arches (southwest and northeast walls)

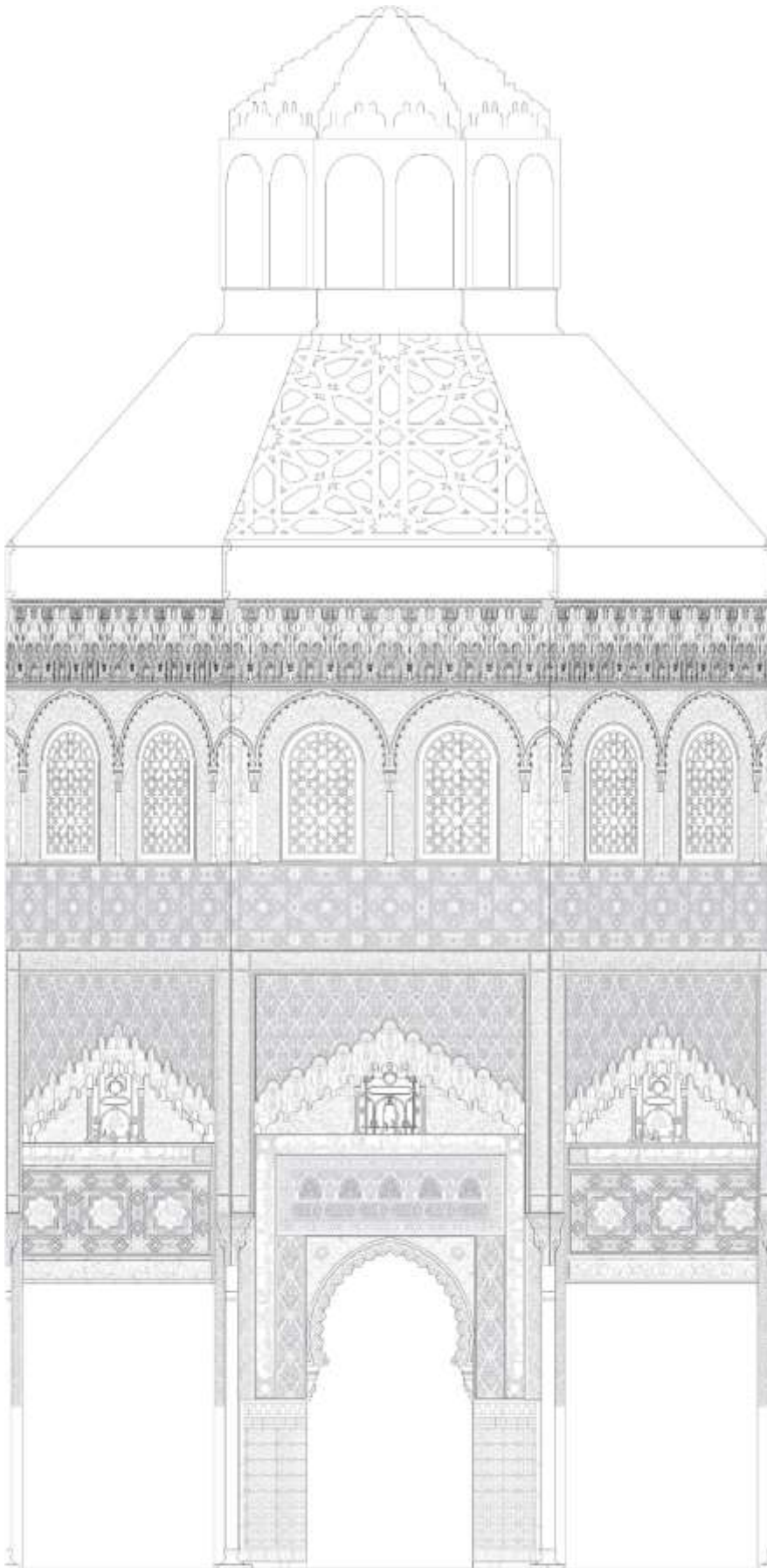


Figure 8 Entrance wall (northwest wall)



Figure 9 Mihrab niche before the intervention



Figure 10 Prayer hall – State of the plasterwork before the restoration

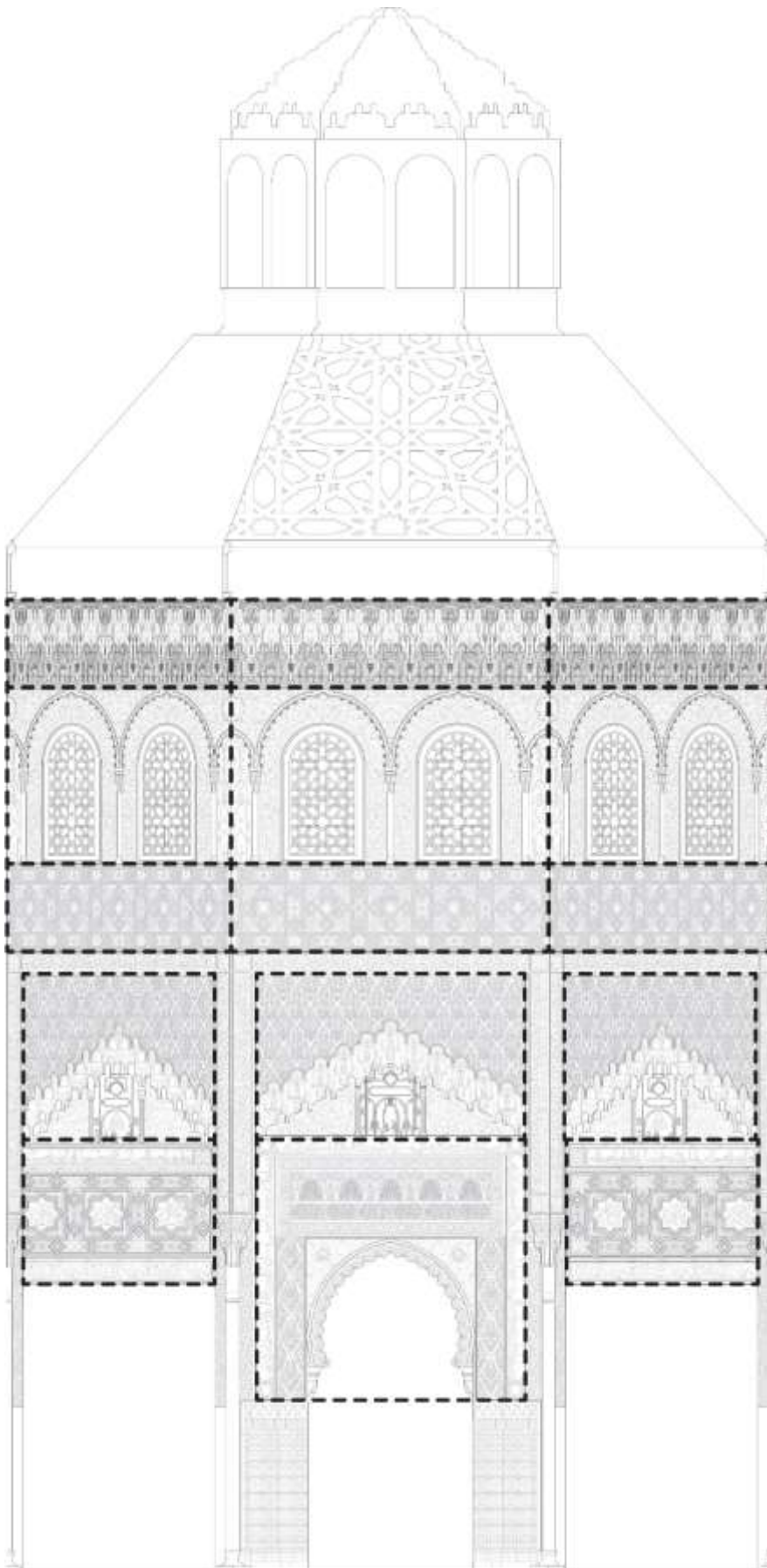


Figure 11 Rectangular decorated surfaces

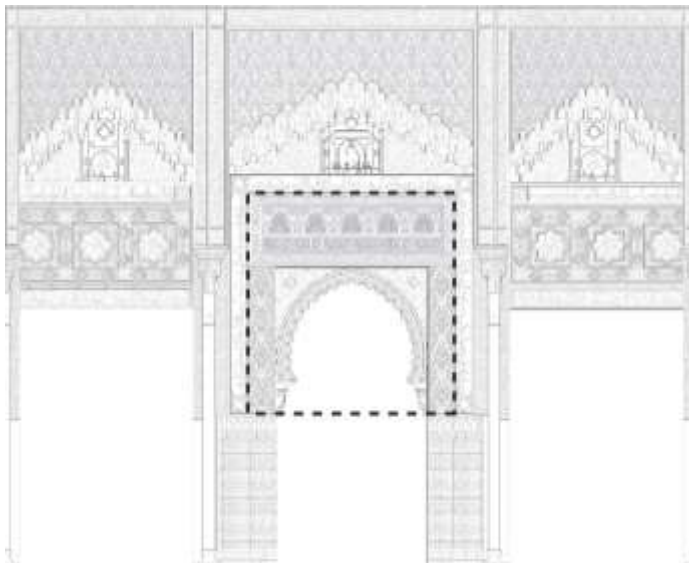
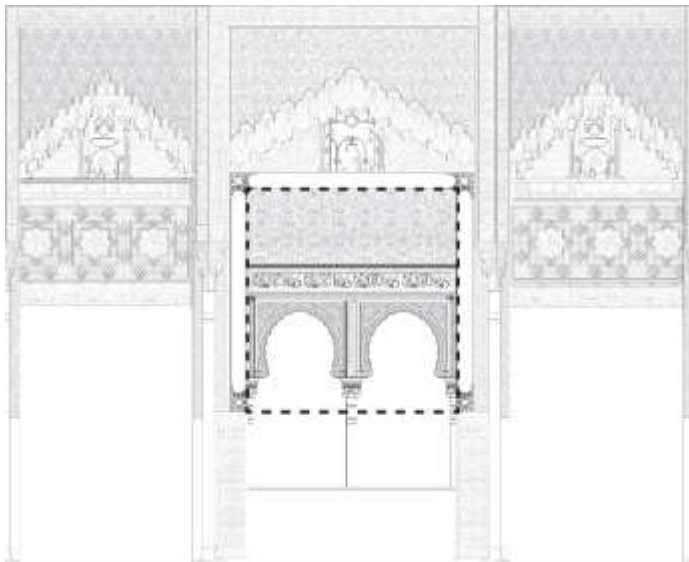
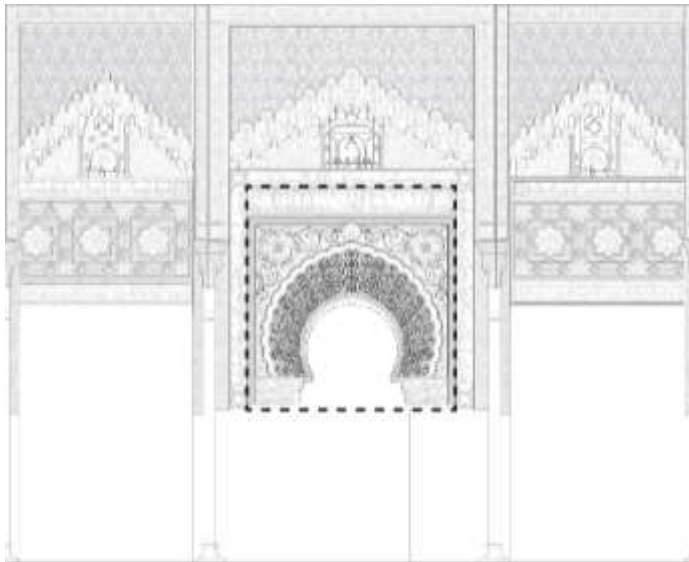


Figure 12 Middle almost square surface

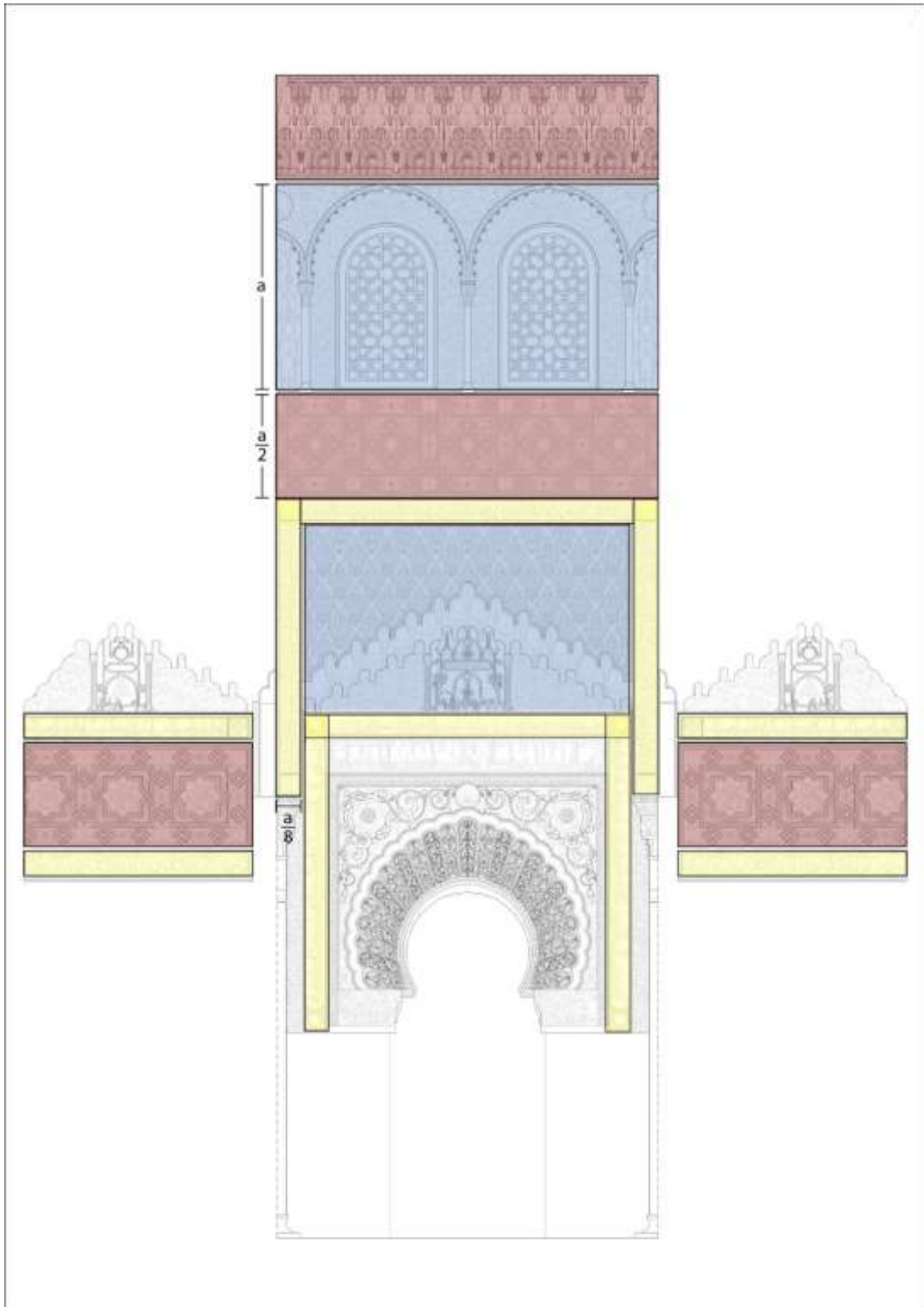


Figure 13 Proportional decorated surfaces widths



Figure 14 Mihrab niche



Figure 15 Mihrab detail – voussoirs and spandrels



Figure 16 Restored mihrab inscription



Figure 17 Qalahurra Nueva of Yusuf I



Figure 18 Salon de Comares



Figure 19 Double-blind arche

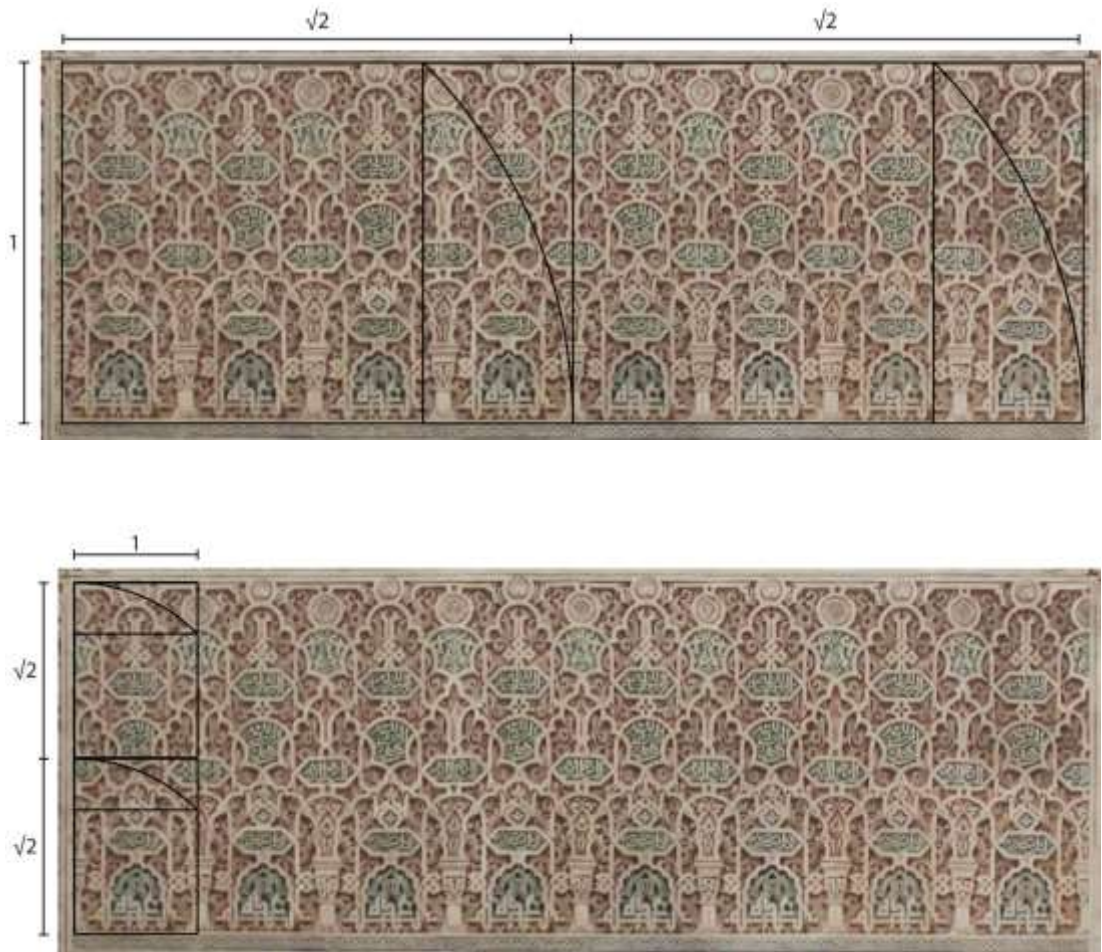


Figure 20 Proportional system based on the progressive diagonals

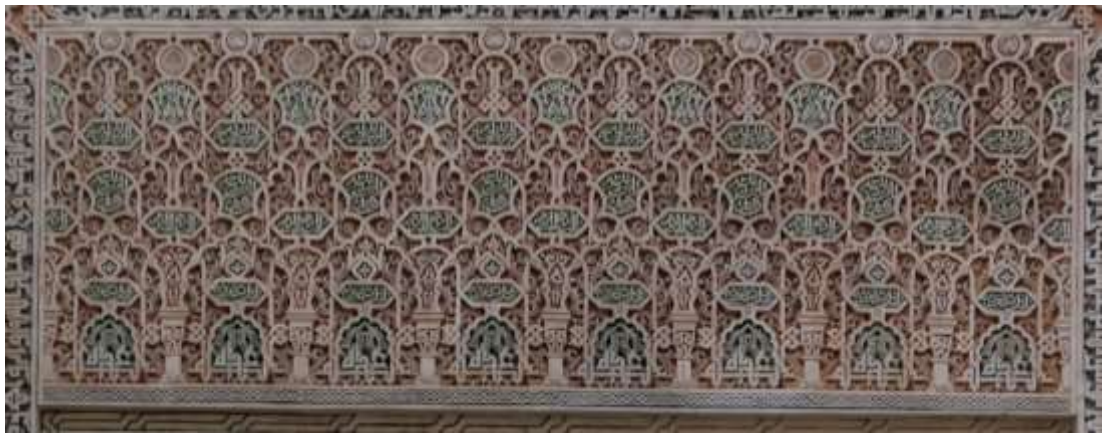
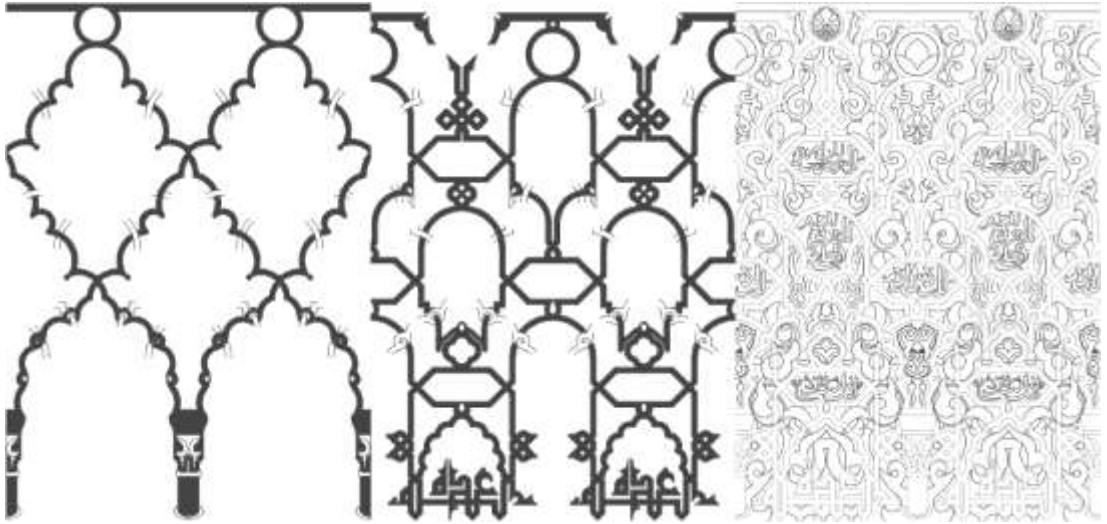


Figure 21 Superimposed Patterns



Figure 22 Entrance Arch



Figure 23 Intrados of Entrance arch



Figure 24 Inscription Bands



Figure 25 Inscription filled a geometric grid

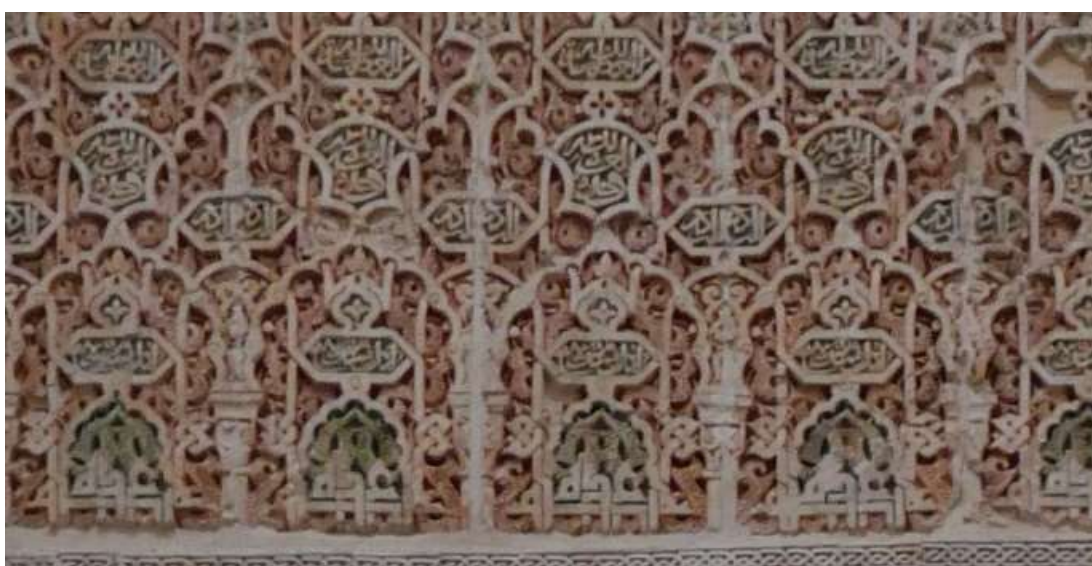
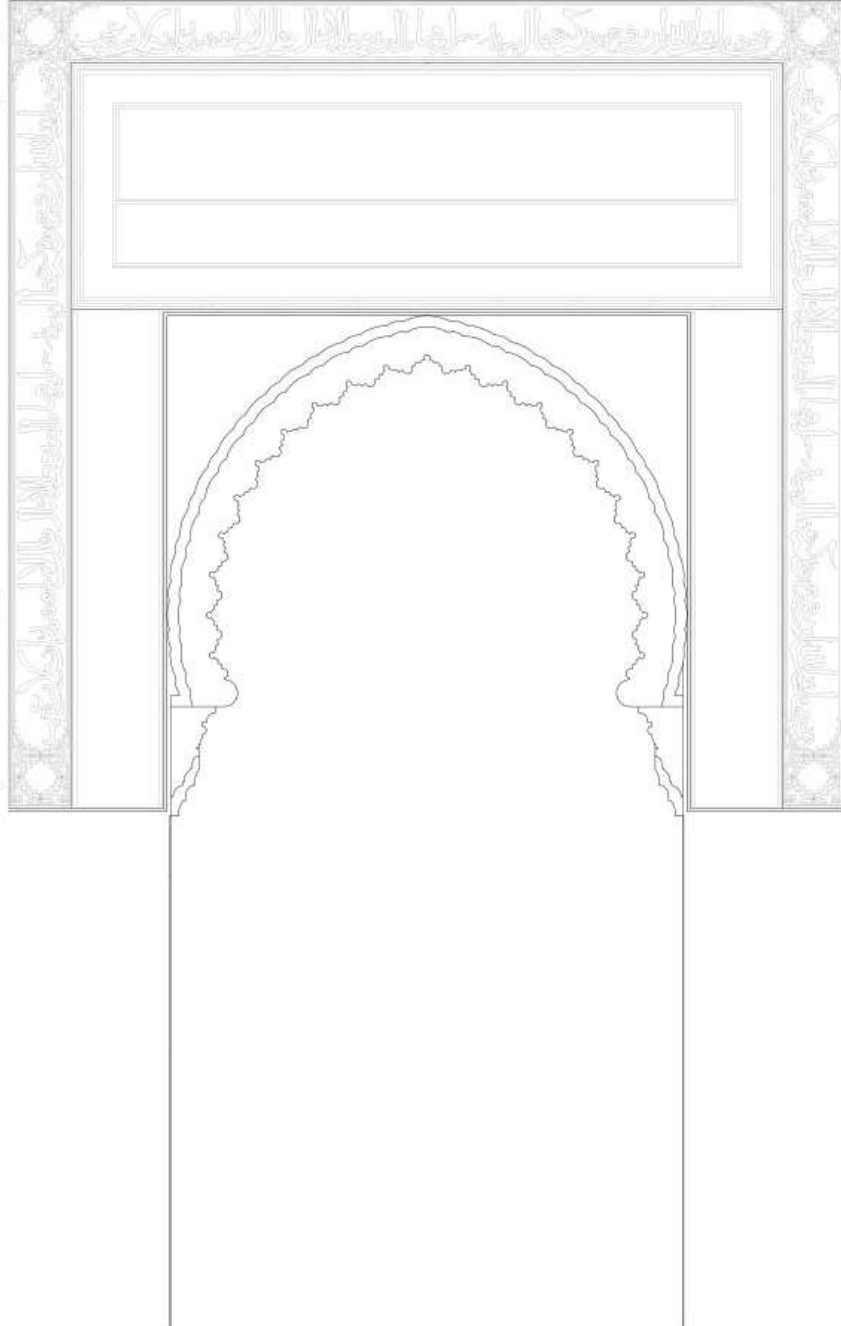


Figure 26 Inscription as a decorative grid

فِي بُيُوتِ الَّذِينَ اللَّهُ أَنْ تُزْفَعَ وَيُذْكَرَ فِيهَا اسْمُهُ يُسَبِّحُ لَهُ فِيهَا بِالْغُدُوِّ وَالْآصَالِ (36) رِجَالٌ لَا تُلْهِيهِمْ تِجَارَةٌ وَلَا بَيْعٌ عَن

دِكْرِ اللَّهِ وَاقَامَ الصَّلَاةَ وَآتَاةَ الزَّكَاةَ يَخَافُونَ يَوْمًا تَتَقَلَّبُ فِيهِ الْقُلُوبُ وَالْأَبْصَارُ (37) لِيَجْزِيَئَهُمُ اللَّهُ أَحْسَنَ مَا عَمِلُوا وَيَزِيدَهُم مِّن فَضْلِهِ... (38)



أَعُوذُ بِاللَّهِ مِنَ الشَّيْطَانِ الرَّجِيمِ بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ صَلِّ اللَّهُ عَلٰى سَيِّدِنَا مُحَمَّدٍ وَجَلِّ لَهُ وَسَلِّمْ تَسْلِيمًا

Figure 27 Mihrab and Entrance inscription band

إِنَّ فِي خَلْقِ السَّمَاوَاتِ وَالْأَرْضِ وَاخْتِلَافِ اللَّيْلِ وَالنَّهَارِ لآيَاتٍ لِّأُولِي الْأَلْبَابِ (190) الَّذِينَ يَذْكُرُونَ اللَّهَ هَيَامًا وَفُجُودًا وَعَلَىٰ

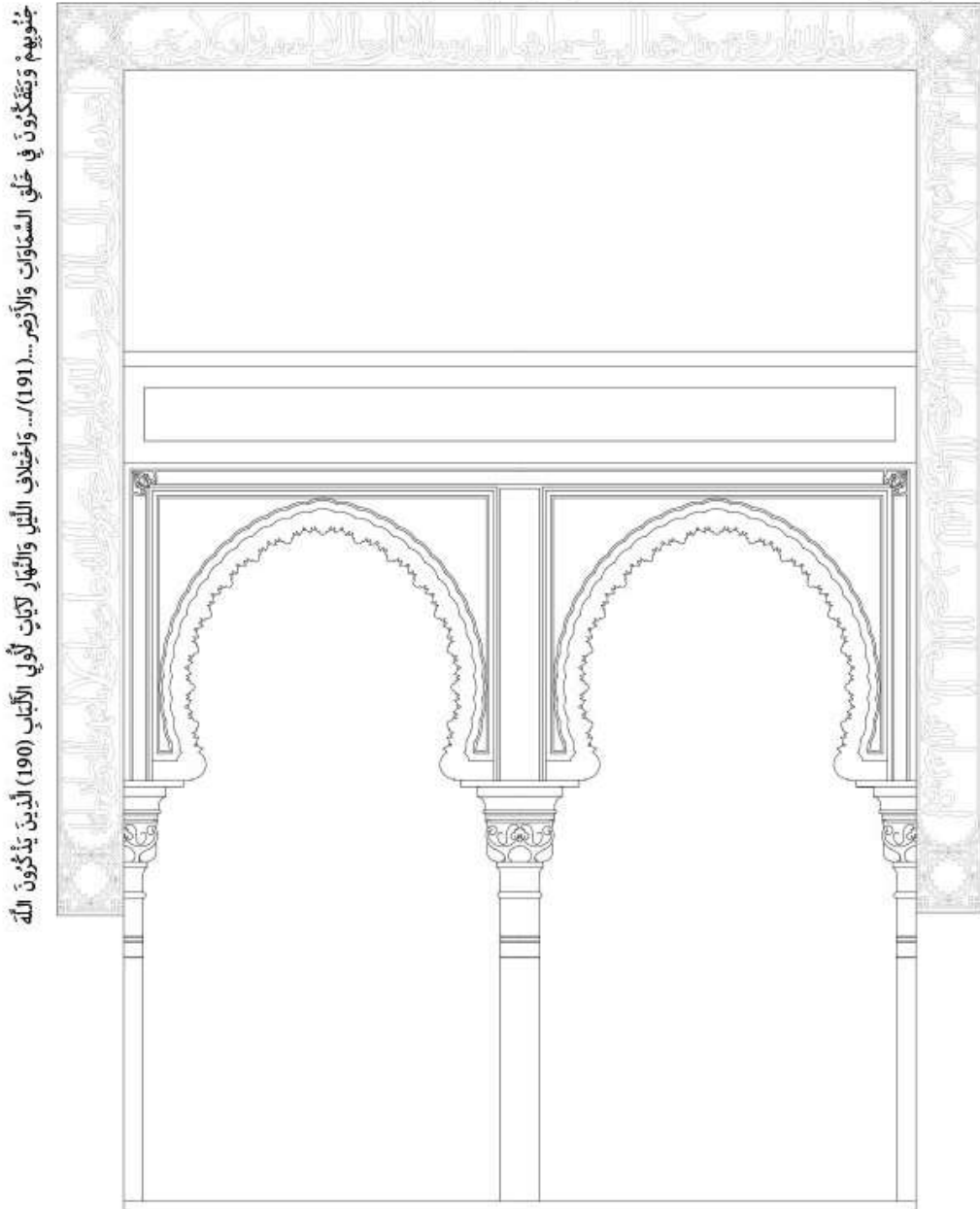


Figure 28 Double-blind niche inscription band



Figure 29 Inscription band framing not self-similar superimposed geometric pattern

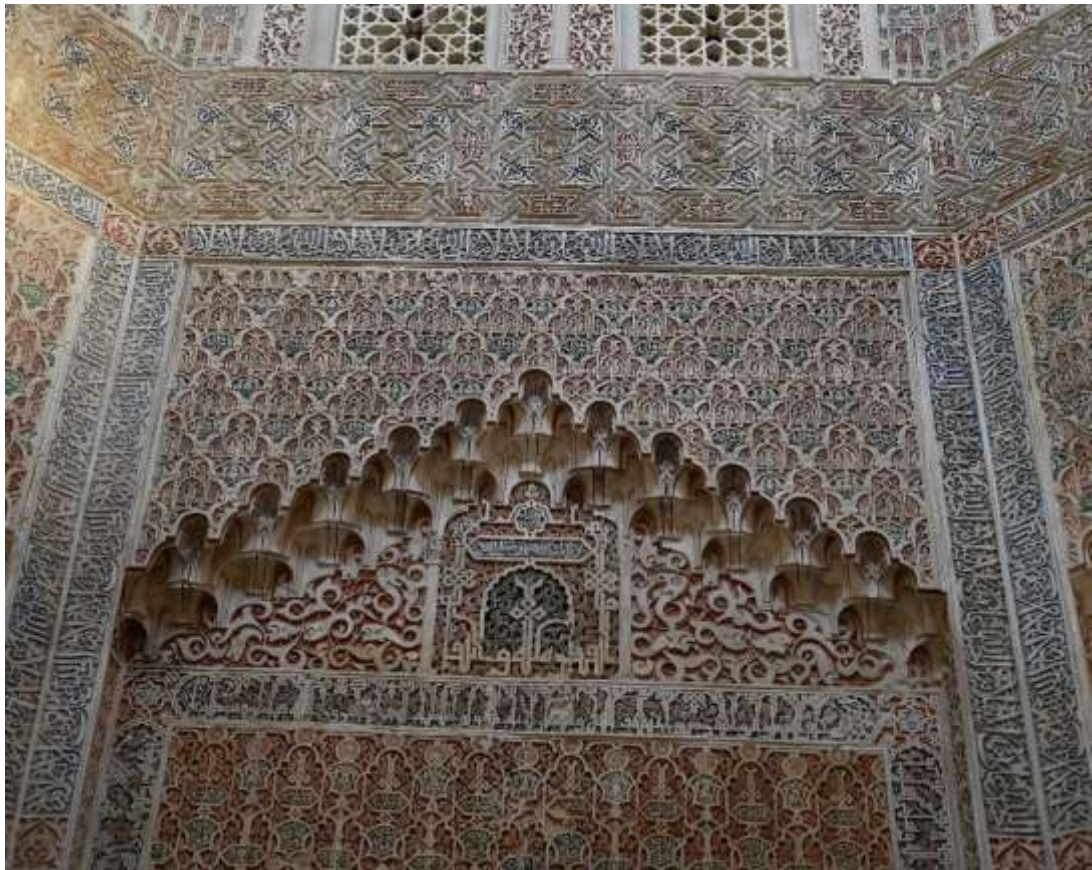


Figure 30 Inscription Band framing muqarnas arches



Figure 31 Qalahurra Nueva of Yusuf I



Figure 32 Salon de Comares



Figure 33 Partal prayer hall



Figure 34 Not self-similar superimposed geometric band

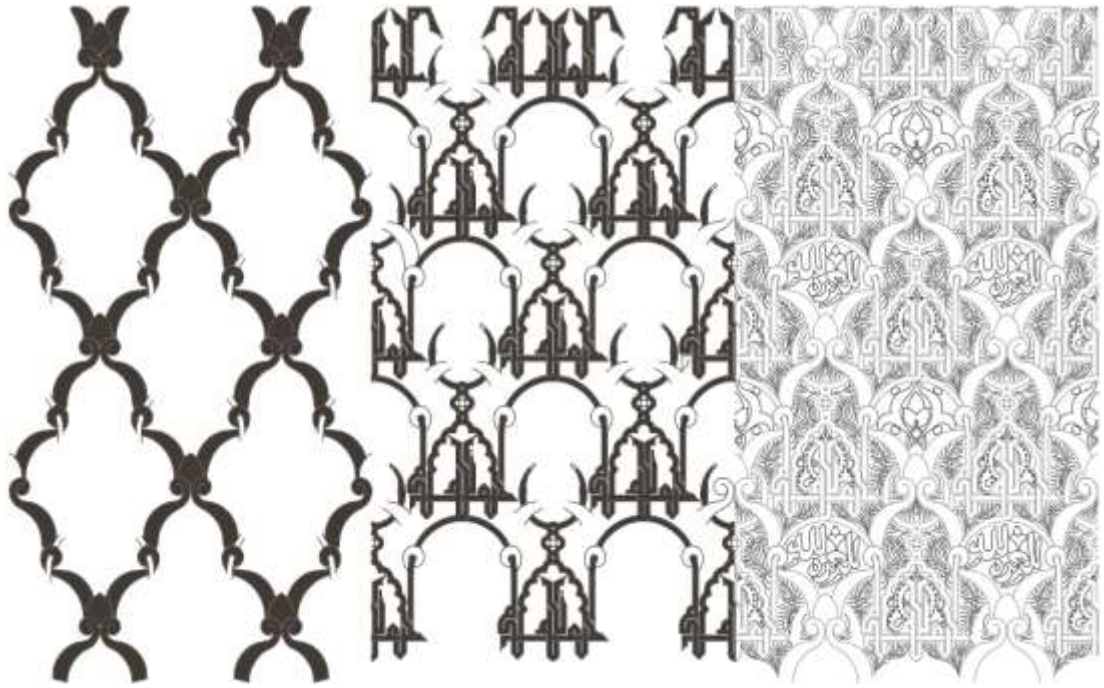


Figure 35 Superimposed Pattern

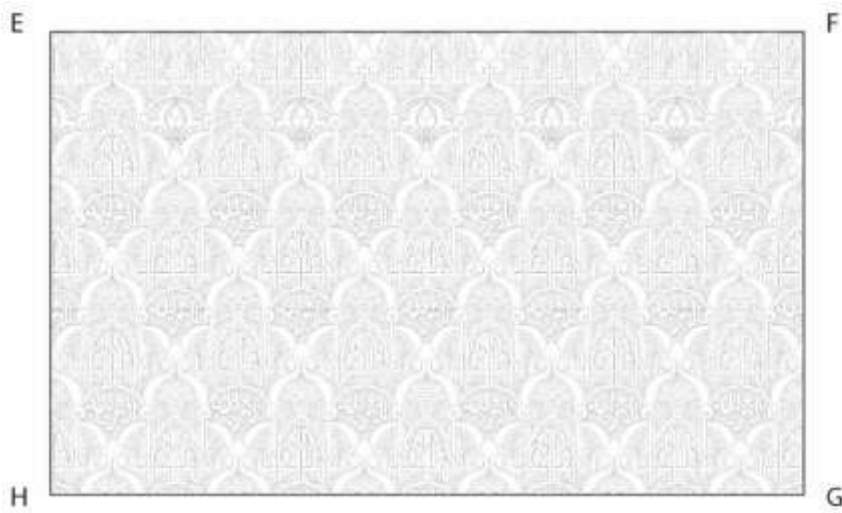


Figure 36 Superimposed Pattern, reconstruction of the pattern covering the spandrel of the muqarnas arches

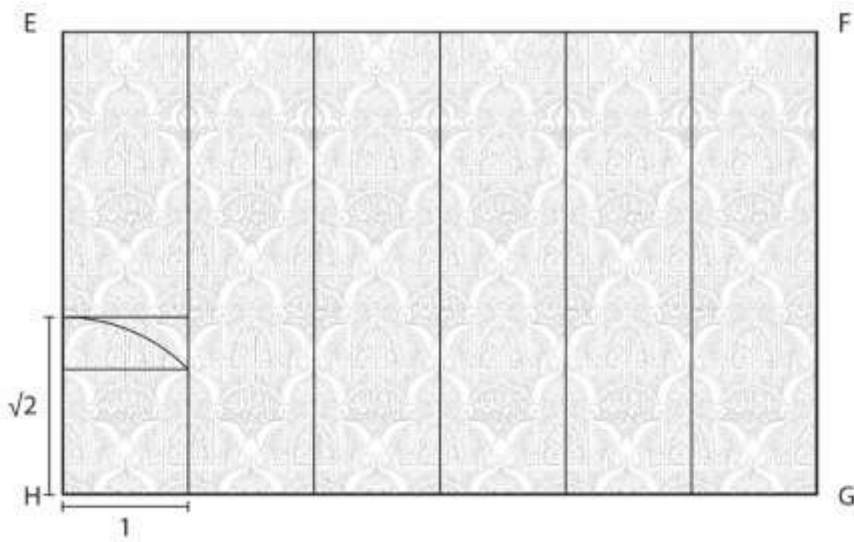


Figure 37 Rectangle based on progressive diagonals

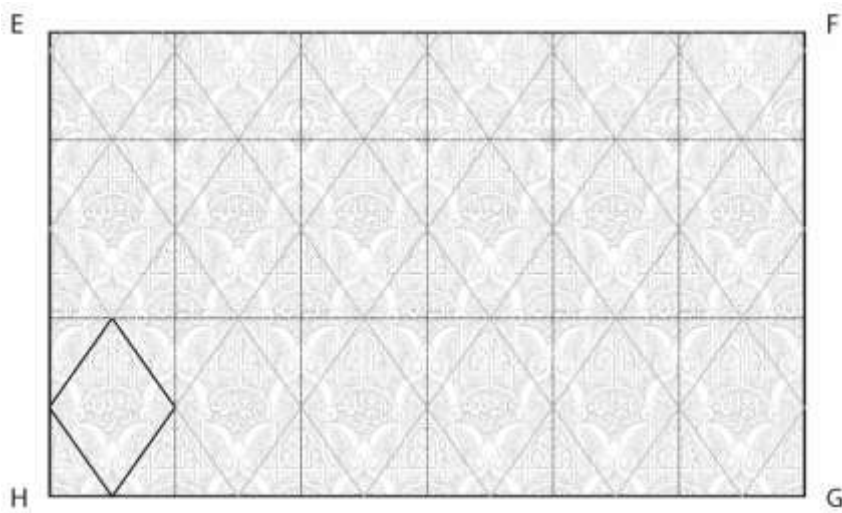


Figure 38 Rhomboid geometric grid

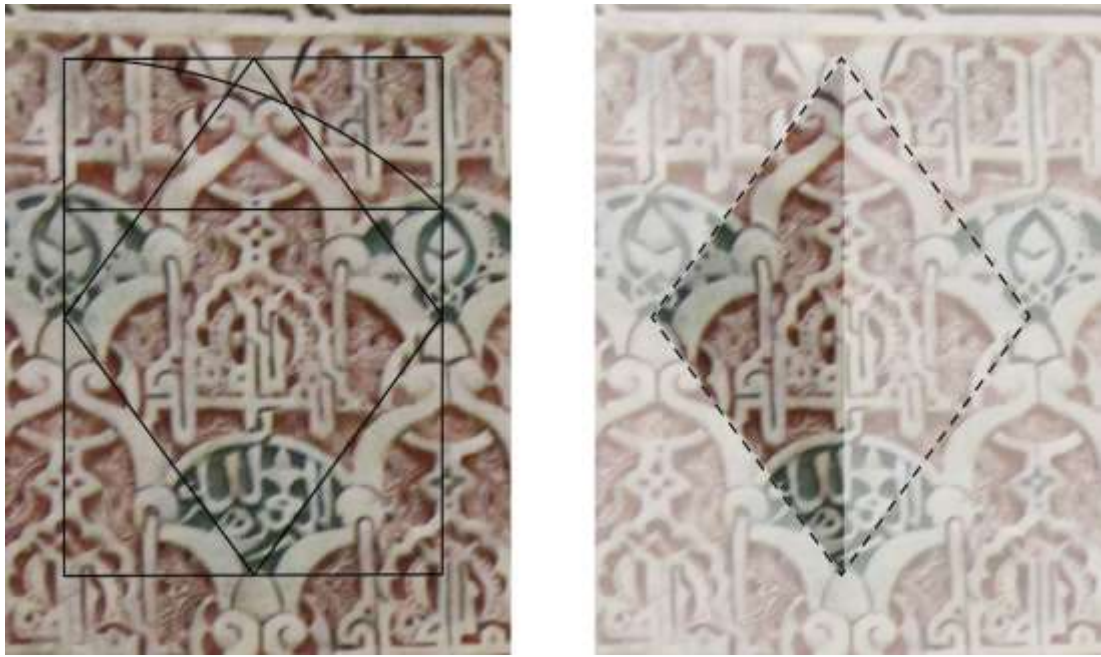


Figure 39 Proportional system

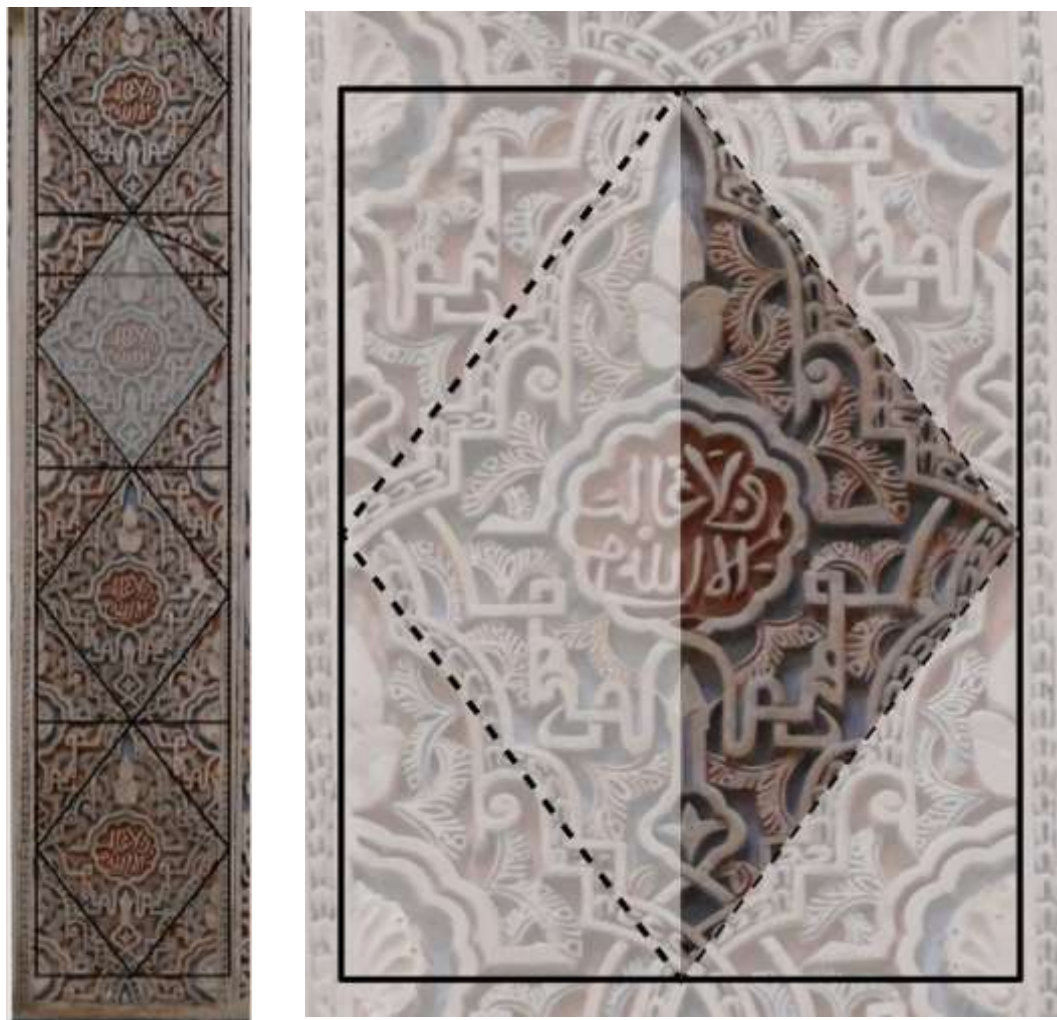


Figure 40 Proportional system

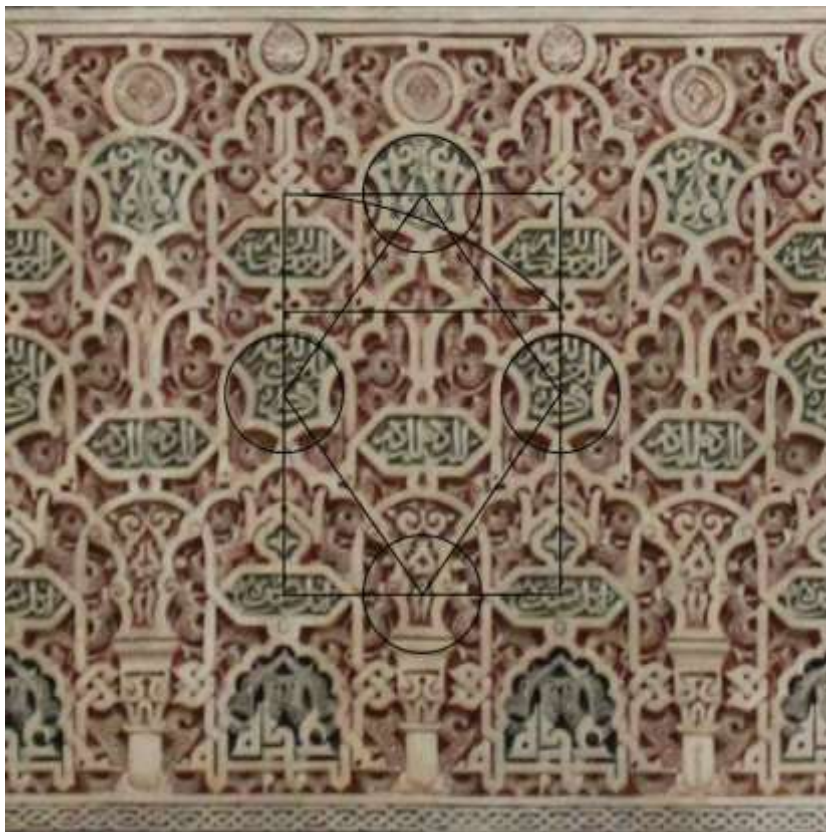


Figure 41 Proportional system



Figure 42 Tangential circles transition

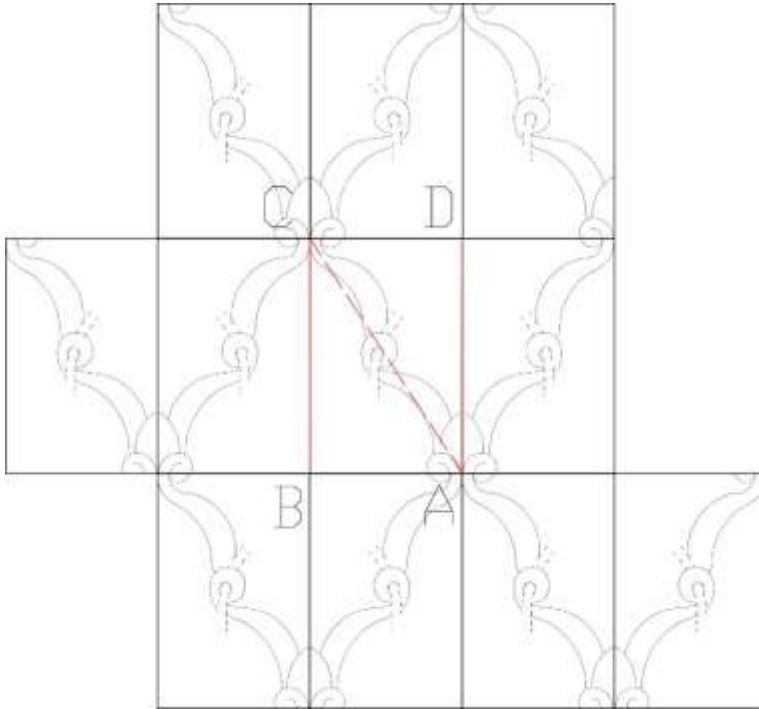


Figure 43 Symmetric group (P1 AND Pm) – Front plane

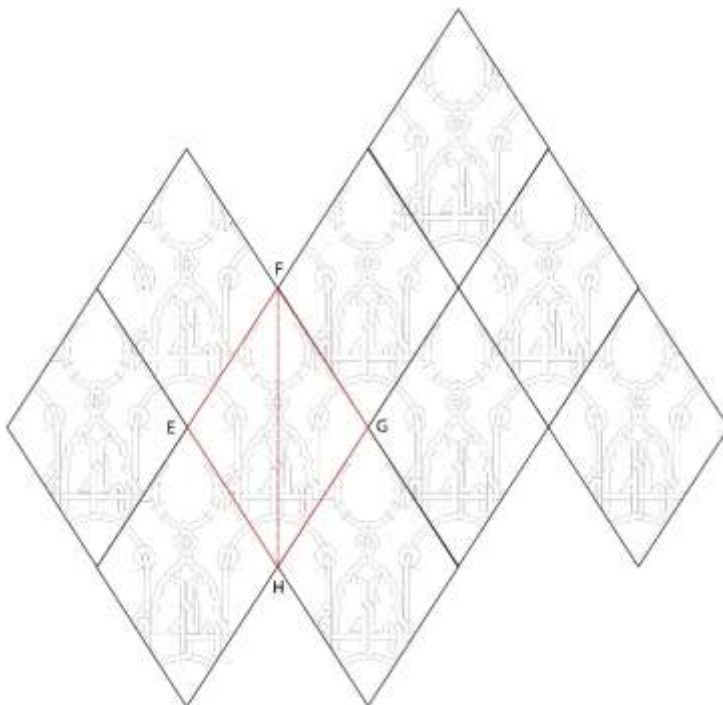


Figure 44 Symmetric group (P1) – Middle plane



Figure 45 Partal Palace prayer hall

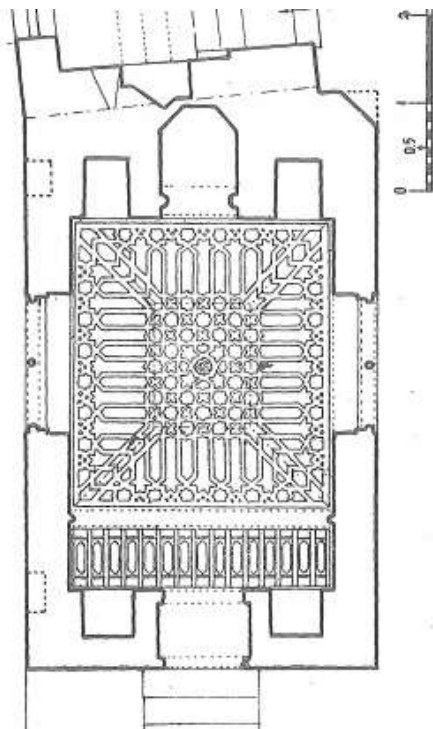


Figure 46 Partal Palace prayer hall plan



Figure 47 Horseshoe arch separating two area



Figure 48 Partal Palace prayer hall – Qibla Wall



Figure 49 Partal Palace prayer hall – Mihrab muqarnas dome/ wooden ceiling



Figure 50 Partal Palace prayer hall – Exterior wall

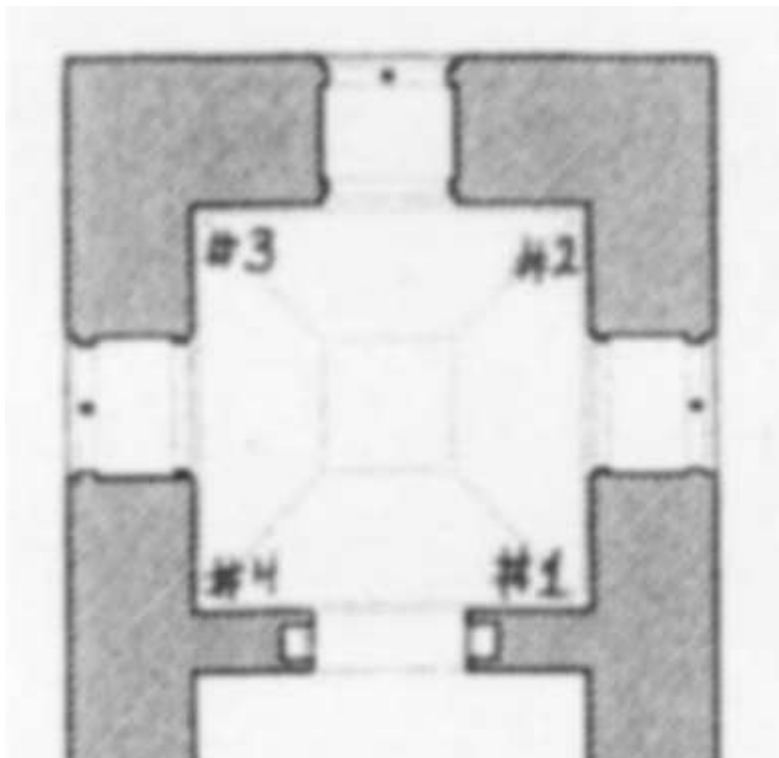


Figure 51 Qalaturra Nueva – plan



Figure 52 Qalahurra Nueva



Figure 53 Qalahurra Nueva – Plasterwork wall decoration

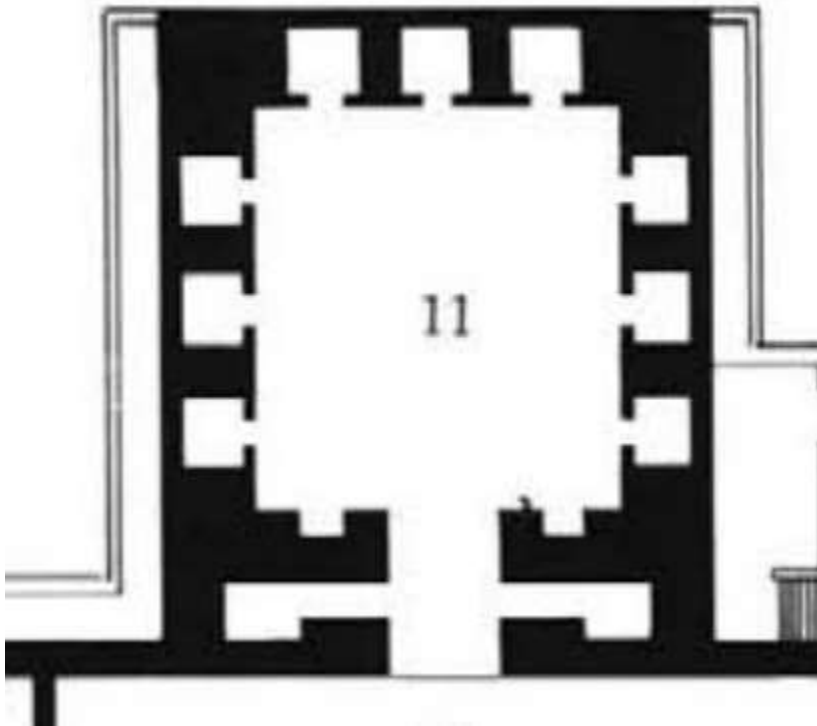


Figure 54 Salon de Comares – plan



Figure 55 Salon de Comares



Figure 56 Baths of the Comares Palace

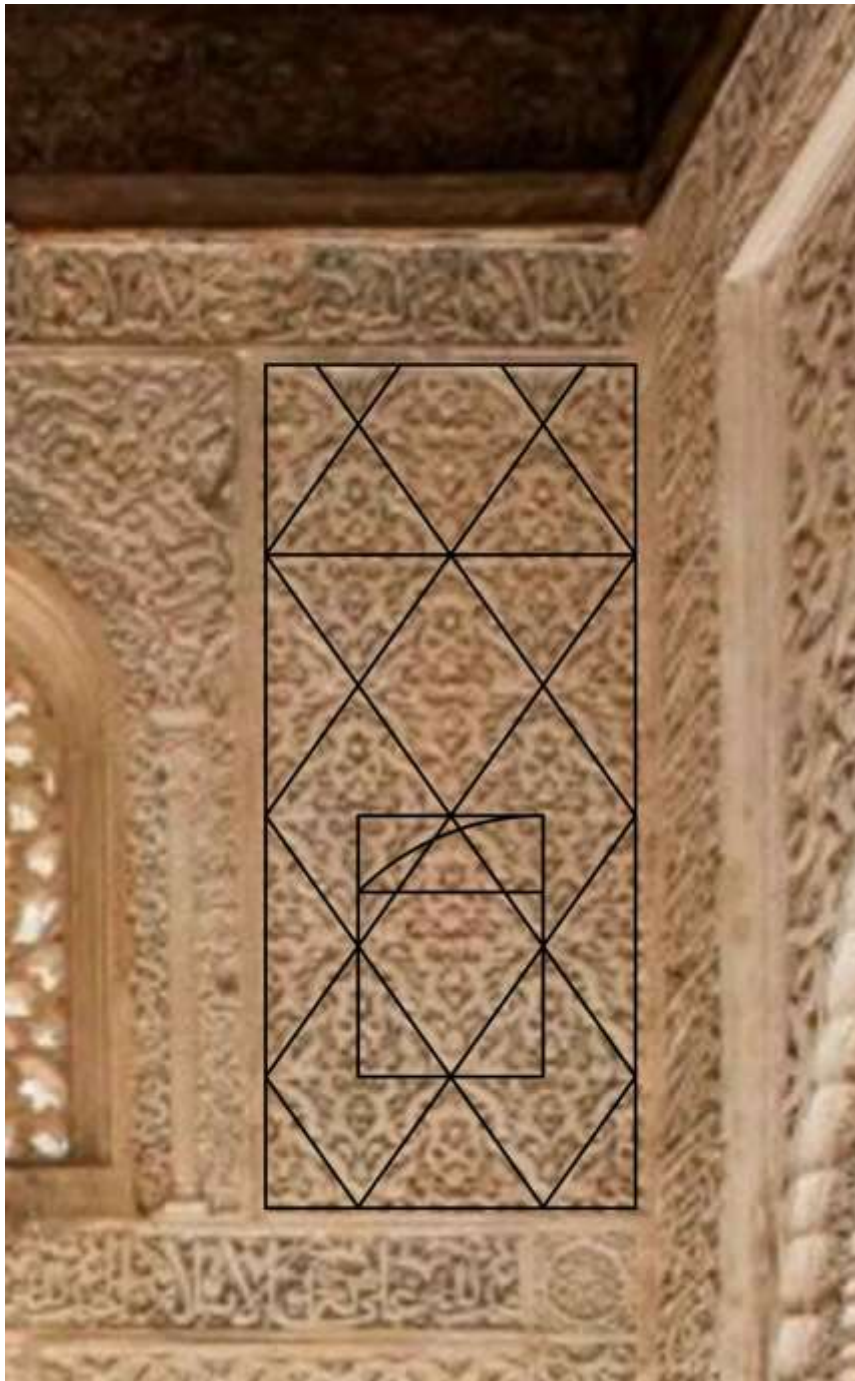


Figure 57 Partal Palace Prayer hall

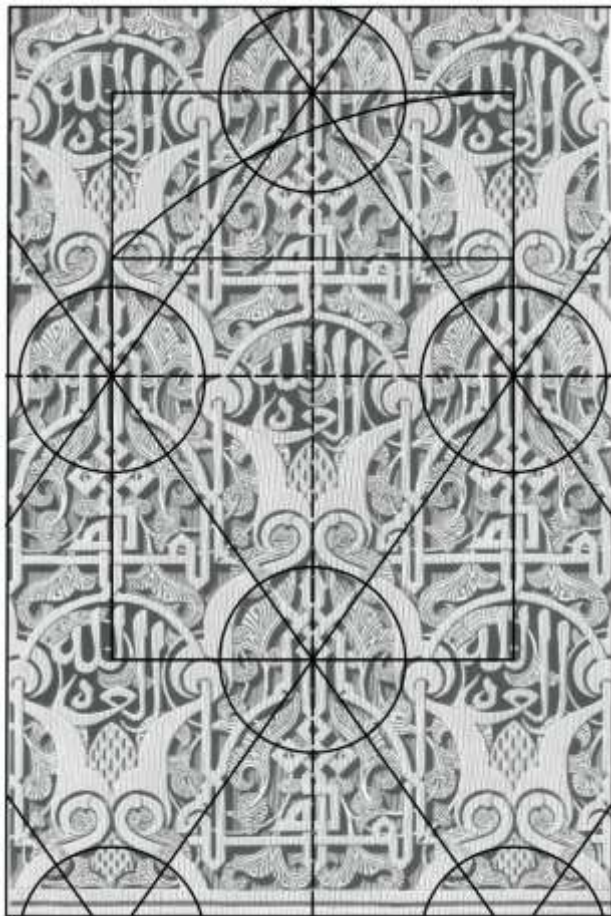
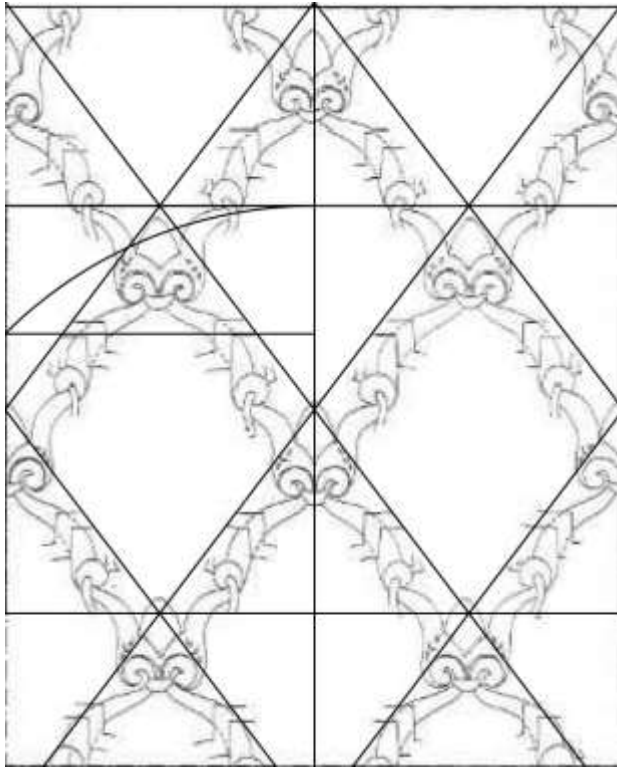


Figure 58 Qalahurra Nueva

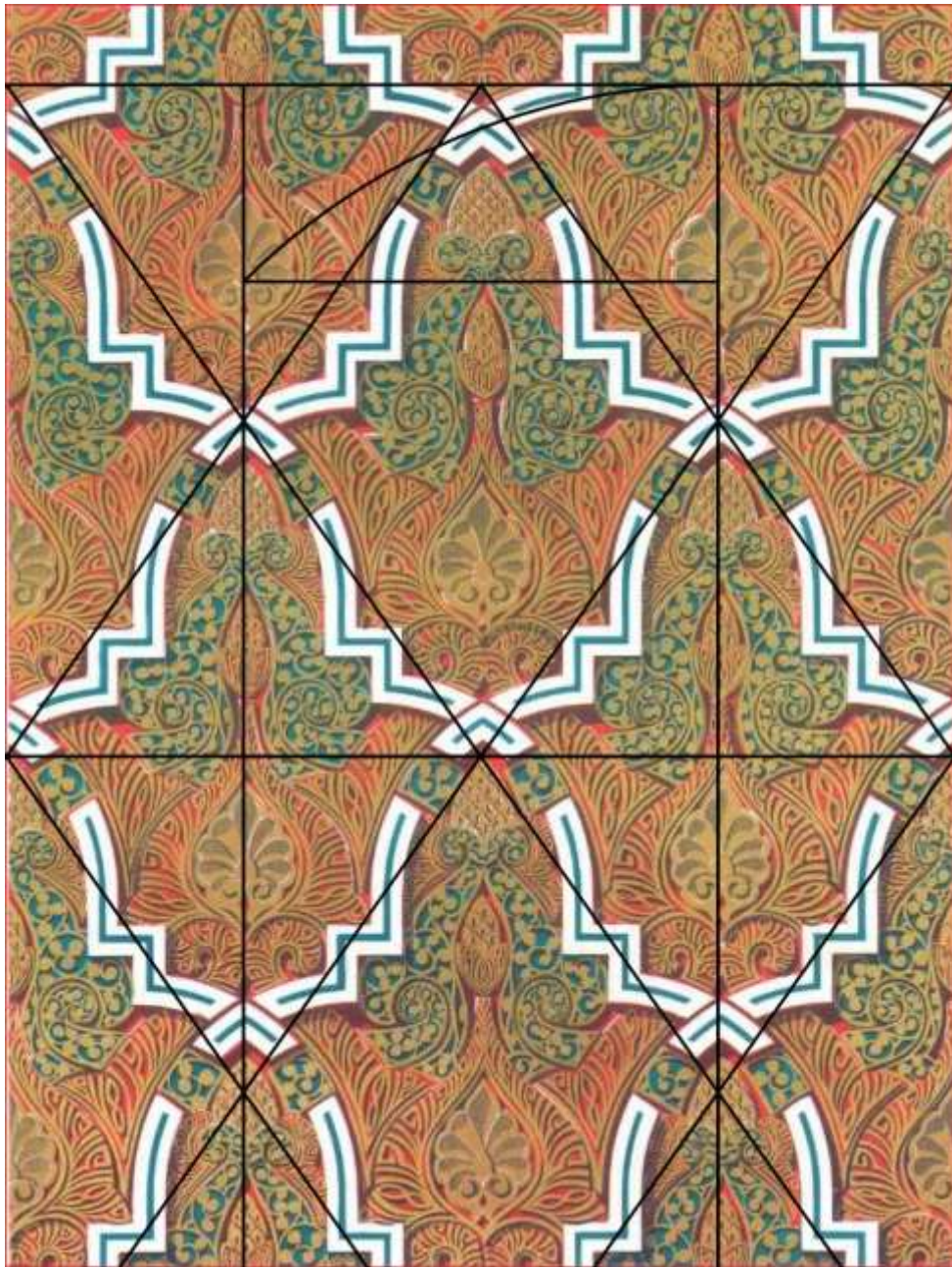


Figure 59 Salon de Comares



Figure 60 Baths of the Comares Palace



Figure 61 Vegetal Motifs

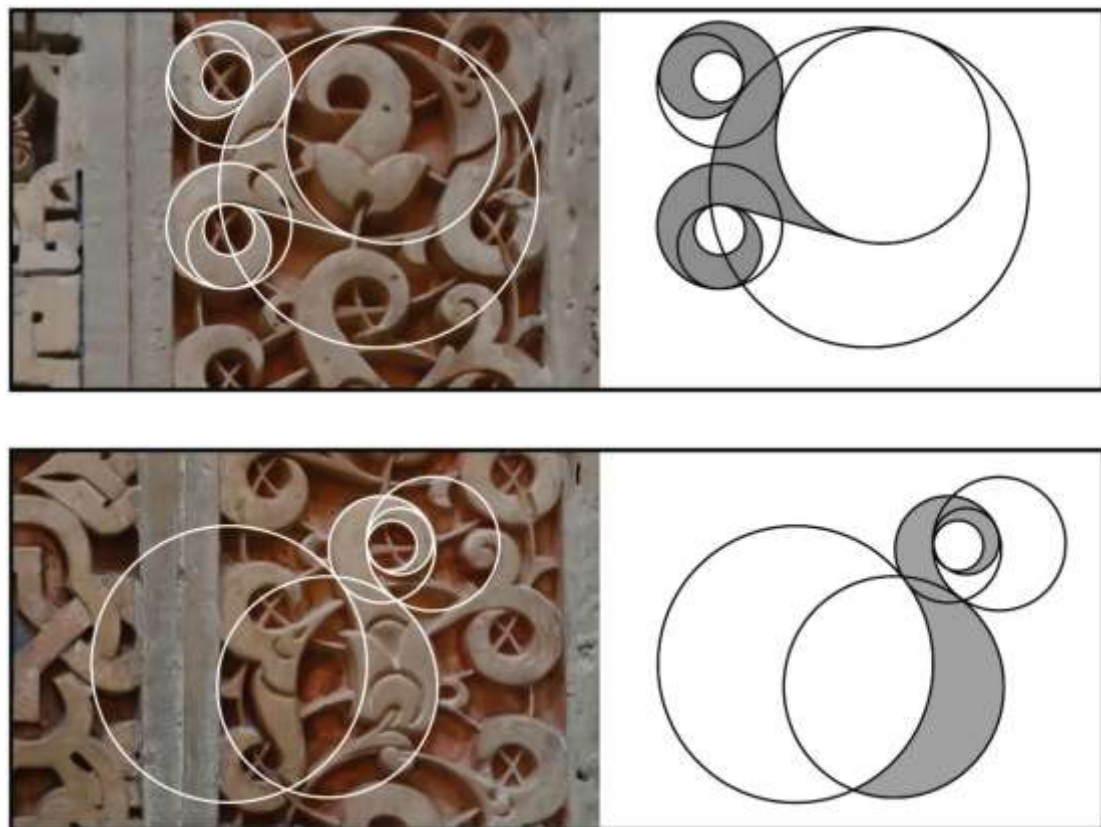


Figure 62 Tangential Circles forming Vegetal motifs



Beaded vegetal motifs – Plain vegetal motifs



Ribbed vegetal motifs



Lenticular vegetal motifs

Figure 63 Vegetal motifs



Madrasa Yusufia prayer hall



Qalaturra Nueva



Madrasa Yusufia prayer hall



Partal prayer hall



Comares Hall



Comares Hall



Puerta de la Justicia



Comares Hall

Figure 64 Vegetal decorative Capitals



Muqarnas arches



Muqarnas Dome

Figure 65 Muqarnas – Madrasa al-Yusufia Prayer hall



Figure 66 Muqarnas Pendentives

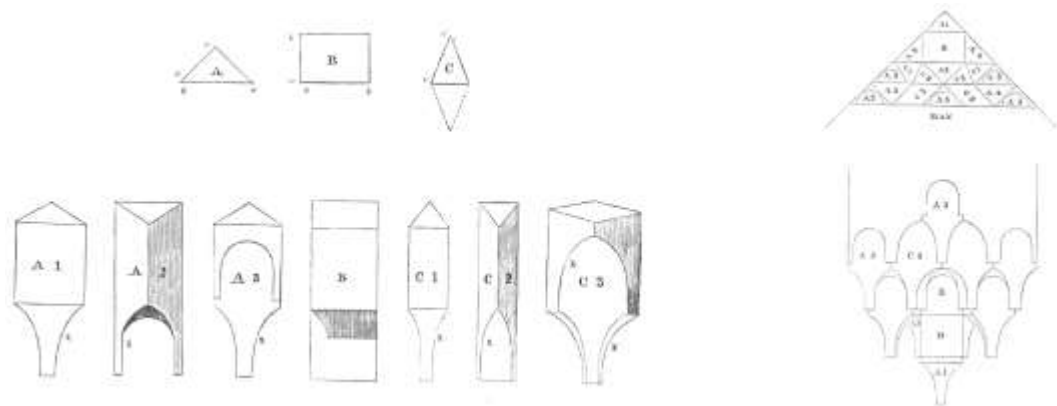


Figure 67 Muqarnas prisms

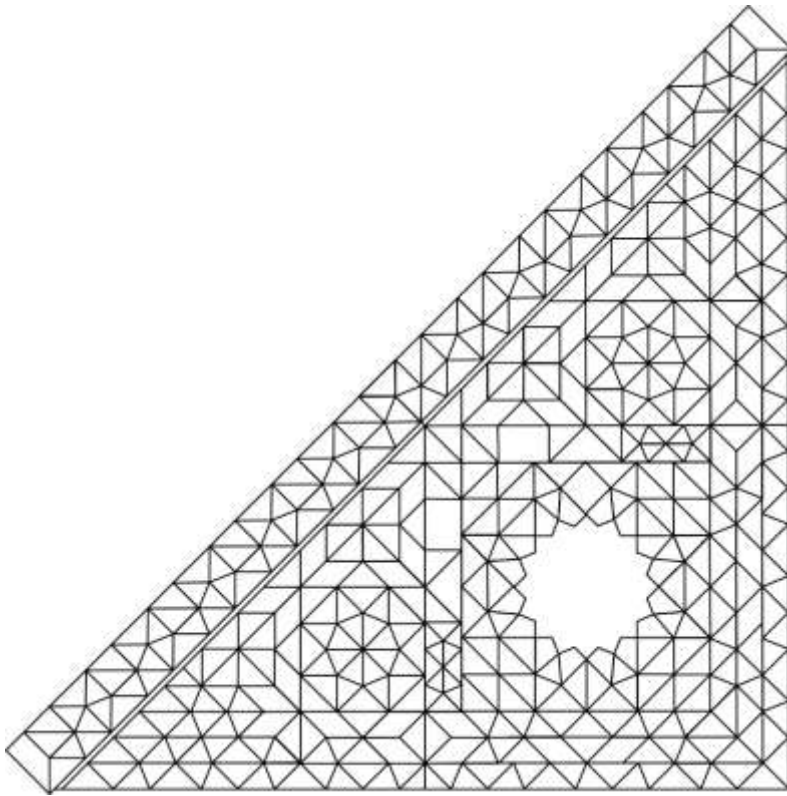


Figure 68 Muqarnas pendentives – arch plan



Figure 69 Hall of the Two Sisters

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