Classification and Technical Evaluation of Stucco in Iranian Architecture

Case study: The High and Low-relief Stucco Decorations in the Islamic Period

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Abstract

Stucco decoration is a prominent art form extensively used in Iranian architecture. Its history spans ancient times, reaching its zenith during the Ilkhanid period. Stucco's ease of use and abundance in Iran made it a preferred medium for embellishing walls, ceilings, columns, and windows, often in polychrome or monochrome, embossed, and decorated forms. The diversity of stucco art in Iran is remarkable, with various techniques and styles found even within a single structure or historical period. This diversity complicates the categorization and identification of numerous examples of this art. Although efforts have been made to classify stucco based on shaping techniques or relief contrasts, a clear framework encompassing the vast variety across periods—from the Elamite to the Pahlavi era—remains elusive.

This study categorizes stucco decorations based on shaping techniques and relief levels, analyzing the diversity of methods, materials, and techniques used. It incorporates desk-based research, field investigations, and interviews with two traditional Iranian craftsmen. The research identifies nine distinct categories of historical stucco art in Iran.

In its technical evaluation, two prominent stucco techniques were analyzed, examining shaping methods. A total of 33 high-relief and 23 low-relief stucco examples were studied. These investigations revealed construction methods, materials, and diverse samples. Additionally, field studies and interviews with craftsmen uncovered hidden aspects of these techniques, further clarifying shaping methods and materials.

By categorizing stucco art and analyzing its methods, this research contributes to understanding the evolution and diversity of stucco decoration in Iranian architecture.

Key Words

High-relief, Low-relief, Stucco, Historic architecture, Classification, Iran.

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Declaration

I, Sahar Basiri, declare that this thesis, titled ‘Classification and Technical Evaluation of Stucco in Iranian Architecture; Case Study: The High and Low-relief Decorations in Islamic Period ‘ is my work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from published or unpublished work of others has been acknowledged in the text and a list of references is given.

I confirm that the intellectual content of this thesis is the product of my work and all the assistance received in preparing this thesis and sources have been acknowledged. This thesis has been supplied on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgment.

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Sahar Basiri

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Glossary

1. Ahak (آهک) - /ˈɑːhæk/- Lime: A white, chalky mineral used in traditional Iranian stucco work, especially in the historical baths.

2. Ajdehkari (آژدکاری) - /ˈɑːdʒdɛˌkɑːri/- Ajdehkari: A decorative technique involving scratching, engraving, or stitching patterns onto a relief surface or on the background of the stucco decorations.

3. Ajornama (آجرنما) - /ˈeɪdʒɔːrˌnɑːmə/- Brickwork: Similar to Ajorkari, referring to the construction or arrangement of stucco which is exactly looks like bricks.

4. Astar (لایه آستر)- /ˈæstɑr/- Plaster coat: The layer which is done on the background or the base-coat of the stucco decorations to make the next layer to enable the creation of subsequent layers.

5. Band-Keshi (بندکشی)- /bænd ˈkeɪʃiː/- Bonding: Decorative plaster used as a bonding to create strength between bricks, stones, or tiles in masonry.

6. Barjasteh (برجسته)- /bɑːrdʒæsˈteɪ/- Elevated, raised: It denotes the raised or elevated decorative elements that protrude from a flat surface, adding texture and visual interest to the design.

7. Bastar (لایه بستر)- /ˈbæs.tɑr/- Base coat: It is the initial layer applied to a surface before adding additional layers or decorative elements.

8. Borheshteh (برجسته)- /bɔːrˈhɛs.teɪ/- Elevated, Raised. It denotes the raised or elevated decorative elements that protrude from a flat surface, adding texture and visual interest to the design.

9. Boom-Saab (بوم‌ساب) - /buːm sɑːb/- Relief: The projection of figures or designs from a background surface, creating a three-dimensional effect in a low-relief stucco decoration.

10. Boomnama (بوم نما) - /buːmˈnɑːmə/- Embossed: Refers to a decorative technique where noticeable space exists between the patterns, and so the background clearly displays its own field and among the patterns, it is well seen and distinguishable.

11. Copbory (کپ بری) - /ˈkɒp.bɔːriː/. - Cupboard: The stucco decorations which is the combination of plaster and the convex and curved mirror.

12. Do-Gacheh (دو گچه) - /dʌgtʃeɪ/ - Double Layer: Two layers of material applied to a surface.

13. Farangi-Saazi (فرنگی سازی)- /ˈfærɑːŋɪ ˈsɑːziː/- Western artistic styles: Western artistic styles refers to the various artistic movements, trends, techniques, and aesthetics that have originated

or developed primarily in Western cultures, particularly those of Europe and North America. These styles encompass a broad range of periods, genres, and influences, including but not limited to Renaissance, Baroque, Neoclassicism, Romanticism, Realism, Impressionism, Cubism, Surrealism, Abstract Expressionism, and Contemporary Art.

14. Ferdangi or Fandangi (فردنگی/فندنگی): /ˌfɜrdæŋˈgi/ or /ˌfændæŋˈgi/: Scratchwork: The act of creating shallow scratches on the surface of a base layer using a sharp metal tool.

15. Fetilei (فتیله) - /ˈfɛtɪˌleɪ/- Fillet: A narrow strip of material used for decorative molding or joining different architectural elements.

16. Gach (گچ) - /gætʃ/- Gypsum: A soft sulfate mineral composed of calcium sulfate dihydrate, commonly used in traditional plasterwork and decorative arts.

17. Gach-e-Koshteh: (گچ کشته)- /gætʃ-eɪ-ˈkɒs.tə/- Slaked plaster: The killed-gypsum, Wet plaster that is freshly prepared and applied for stucco work which is combined and kneaded with a large amount of water This is a proper plaster for carving and shaping and has a smooth layer but not strong enough as ‘fast-setting-gypsum’.

18. Gach-e-Zendeh (گچ زنده) - /gætʃ-eɪ-zen-deɪ/- Live Plaster: The ‘fast-setting-gypsum’. that is freshly prepared and combined with a small amount of water This is not a proper plaster for carving, painting or shaping as it hasn’t a smooth layer, but this is a strong plaster.

19. Garteh Kardan (گرته کردن) - /gɑrt/ /kɑrdɑn/- Griding: The act of Transferring a pattern on the stucco or tiles art, using charcoal powder consists of bags filled with black charcoal powder. By tapping them on the plaster surface, charcoal powder is released. In this method, a piece of paper with the desired design drawn on it is placed on the plaster surface. Previously, the surrounding lines of the design were fully perforated, and the bag containing charcoal powder was applied in a tapping motion along the perforated lines surrounding the design. This process continues until all the peripheral lines of the design are covered with charcoal powder. Then, after removing the paper from the design, the entire design is transferred onto the plaster surface.

20. Gerehchini (گره چینی) - /gəˈreɪˌtʃiːniː/- Knotting: A coherent arrangement of geometric shapes, intricately intertwined with orderly and harmonious patterns, formed by juxtaposing them together. This expression conveys a harmonious combination of intricately interwoven, symmetrical, and appealing geometric shapes formed through straight lines.

21. Hendesi (هندسی)- /hɛnˈdɛsi/Geometric: It refers to concepts and principles related to shapes, sizes, proportions, and properties of geometric spaces. In English, ‘geometric’ means relating to geometry or derived from geometry.

22. Ghaalebi (قالبی) - /ghɑːleɪbi/– Mold, Template: It refers to an object or shape used for casting a liquid material or for decorating and shaping surfaces, such as molds used in casting metals, plastics, or making building components.

23. Gach-e Mosalah (گچ مسلح)- / gætʃ-ɛ moʊˈsælə/-Reinforced aster :The additives such as fibers or straw were used to enhance the mechanical strength of gypsum, a traditional practice known as 'temper g' gypsum which is known among the tradition stucco's craftsmen as Gach-e Mosalah. These additives were added to prevent thick layers of plaster from cracking.

24. Ghors- Kardan (قرص کردن)- /gɔːrs kɑrdɑn/-Grattage or scraping off: Grattage or scraping off a design on the stucco layer, is typically done after transferring the scheme on the stucco surface (Garteh-Kardan).

25. Ivan (ایوان) - /ˈaɪvən/- Ivan: A vaulted hall or porch, often with one or more open sides, commonly found in Persian architecture.

26. Jameh (جامع) – /dʒæmeɪ/- Great, comprehensive, or inclusive: A historic mosque in the center of Islamic cities that has been a center of activities and important gatherings.

27. Kam-Barjasteh (کم‌برجسته) - /kæm bɑrˈdʒæsti/ - Subtle: Something that is not immediately obvious or noticeable; low-relief, Less Elevated.

28. Kam-Omgh (کم عمق)- /kæm ˈɒmg/- Shallow: It refers to something that has little depth, either physically or metaphorically. In a physical sense, it describes a small distance from the surface to the bottom. Metaphorically, it can describe something that lacks complexity, profundity, or seriousness.

29. Katira (کتیرا) - /kəˈtɪrə/-Gum tragacanth: It is a solid gum, white and curved like a ram's horn, which is the size of a pea or smaller.

30. Koshtebori (کشته‌بری) - /kɒʃteˈbɔːriː/- Relief Stucco: A decorative stucco technique where raised motifs are created by layering plaster and often created colorfully.

31. Koshteh Keshi (کشته کشی)- / kɒʃteˈkeʃiː/ - Plaster skim coating, known as Gache Koshteh in Persian, is a crucial step in the finishing process of construction work. After completing the base coat of plaster and smoothing out any imperfections on the walls, a layer of white finishing plaster is applied. Before this layer of plaster fully dries, a very thin layer of Gache Koshteh is spread over it, adding an extra level of smoothness and refinement to the surface.

32. Madrassa (مدرسه) - /məˈdrɑːsə/ - Madrassa: An Islamic educational institution or school, typically associated with the teaching of Islamic law and theology.

33. Mazar (مزار)-/mazār/ Also transliterated as mazaar, also known as marqad or in the Maghreb as ḍarīḥ, is a mausoleum or shrine in some places of the world, typically that of a saint or

notable religious leader. Medieval Arabic texts may also use the words mašhad or maqām to denote the same concept.

34. Monabbat (منبت)- /məˈnæbæt/- Carving and Sculpting or shaping a material such as wood or stone to create decorative designs or figures.

35. Motabbagh (مطبق)- /moʊˈtæbɑːg/ -Layered, stratified: Arranged or constructed in multiple layers.

36. Member (منبر)- /ˈmɛmbər/ - pulpit: It is a platform or staircase used in mosques or churches for delivering sermons and religious speeches.

37. Mihrab (محراب) -/miːhræb/: It refers to a niche, mark, or apex located in the front corner of a mosque that indicates the direction of the Qibla for prayer.

38. Mohri (مهری) - /ˈmoʊriː/. – Stamped: When the stucco decorations are Stenciled. ‘Stamped ornaments’ typically refer to decorative patterns or designs created by pressing or stamping a tool onto a surface, leaving an impression. The stamping process can create repetitive motifs, geometric patterns, or other intricate designs depending on the shape and texture of the stamp.

39. Mojavaf (مجوف) - /moʊˈdʒɑːvɑːf/- Hollow: An arched structure, typically forming a ceiling or roof. ‘Hollow’ or ‘void’ refers to having a space within itself. In architecture, this term typically refers to structures or surfaces that have internal voids, cavities, or hollow spaces, such as sections of walls or ceilings that have empty interiors. These empty spaces may be used as part of the design or may exist for structural or architectural reasons, such as reducing the structure’s weight, creating aesthetic appeal, or providing larger and wider interior spaces.

40. Moaragh (معرق) - /moʊˈɑːrɑːg/ - Marquetry: Carving: The cutting or shaping of a material such as wood stucco or tiles to create a design or pattern. It refers to the artistic technique of carving or engraving intricate designs or patterns onto a surface. This technique involves skillfully cutting into the material to create decorative motifs or reliefs. The carved patterns can range from geometric shapes to intricate floral motifs, and they are often used to enhance the aesthetic appeal of stucco, architectural elements, or decorative items.

41. Moshabak (مشبک) - /moʊˈʃɑːbæk/- lattice, gridwork: It is a decorative technique characterized by the creation of specific lattice-like patterns. This technique involves arranging small pieces of materials such as wood, metal, or ceramics in a grid or lattice pattern to create intricate designs and complex patterns. Moshabak designs can vary widely in complexity and style, ranging from simple geometric patterns to intricate floral designs. It is a decorative technique executed in a lattice or grid pattern, allowing light to pass through. For this reason, this technique is used as a light-filtering or beautifying element in windows and light spaces in traditional Iranian architecture. This technique can be implemented using various materials, including plaster, brick, tile, wood, stone, and metal.

42. Mosaic (موزاییک)- /moʊˈzeɪɪk/: A decorative art form where small pieces of material, such as glass, stone, or tile, are arranged to create patterns or images.

43. Muqarnas (مقرنس) - /muːˈkɑːrnəs/- Muqarnas: An ornamental architectural element typical in Islamic architecture, composed of niche-like components arranged in tiers. Muqarnas, also known as a decorative architectural element, used in Islamic architecture. It combines multiple geometric components arranged in a complex three-dimensional form under ceilings or domes. Muqarnas is used as a decorative element and is renowned for its intricate and visually appealing appearance. It is considered one of the prominent features of Islamic architecture.

44. Peivasteh (پیوسته) - /peɪˈvæstə/- Continuous: Something that is uninterrupted or unbroken. where patterns are densely arranged together.

45. Se-Gacheh (سه گچه) - /seɪ ˈgætʃeɪ/- Triple Layer: Three layers of stucco are applied to a surface to create a high-relief decoration.

46. Shaghool (شاقول)- /ˈʃɑːguːl/-A screed tool: It is a screed tool used in construction and masonry work. It is typically a straight-edge tool, often made of wood, metal, or plastic, used to level and smooth freshly poured concrete or other materials such as mortar or plaster. The screed tool helps ensure an even and uniform surface by removing excess material and filling in low spots, resulting in a flat and level finish.

47. Shemsheh (شمشه چوبی)- /ˈʃɛm.ʃeɪ/- lath: It can be wooden or plaster. It is a thin, narrow strip of material that is used in construction and building projects. Wooden laths are commonly used to provide a base for plaster walls or ceilings, helping to support and secure the plaster while it sets. Plaster laths, on the other hand, are typically made of gypsum or similar materials and serve a similar purpose in providing a base for plasterwork. Laths are installed horizontally or vertically, depending on the specific application, and they help create a smooth and even surface for finishing materials like plaster or stucco.

48. Shir-o-Shekar (شیر و شکر)- /ʃɪr oʊ ˈʃɛkɑr/- It refers to the technique where white plaster sections are painted with cream color, resembling the combination of milk and sugar.

49. Talfigh-ba-Aineh (تلفیق با آینه) - /ˈtɑːlfɪg bɑː ˈaɪnəh/- Mirror Inlay: A decorative technique of stucco that involves embedding pieces of mirror within a surface to create reflective patterns.

50. Talfigh-ba-Masaleh (تلفیق با مصالح) - /ˈtɑːlfɪg bɑː mæˈsɑːlɛh/- Inlay with construction materials: A decorative technique of stucco where different materials as tiles, bricks, woods,… are embedded within a surface to create patterns or designs.

51. Takht (تخت)- /tɑːxt/- Flat, Platform. It is a kind of stucco decoration that is created flatly without any level of projection among the ornaments.

52. Tongbori (تنگبری) - /tɒŋˈbɔːri/- Tongbori: A decorative technique in traditional Iranian stucco work involving fine incisions or carving to create intricate patterns. Also, it is a type of hollow ornamentation used in Iranian architecture. These decorations typically consist of geometric patterns and curved lines, often overflowing or cascading from a surface or architectural edge. Tangbiris are commonly found on the edges of gates, windows, cornices, and even on ceilings and interior and exterior walls of buildings. These decorations also serve as ornamental elements in traditional bricks, tiles, and even feltwork.

53. Yek-Gacheh (یک گچه) - /jɛk gæʃ/- Single Layer: A single coating or layer of material applied to a surface of stucco decoration.

Chapter One: Introduction

1.1 Research Statement

The comprehensive exploration and classification of the genesis of stucco decoration in Islamic-period Iranian architecture reveals a myriad of techniques, shaping methods, and decorative variations. In this research, the term ‘stucco’ is used to define the art of gypsum decoration, which is an artistic practice employed in the embellishment of interior sections of buildings in Iranian art and architecture. Although in Western art, stucco refers to techniques and decorations where lime mortar is used, this concept is related to the climatic conditions of moist Europe when compared to Iran. In Iran, the use of lime mortar is limited to the ornamentation of historical bathhouses (considering the presence of humidity in those spaces), while in other parts of buildings, gypsum mortar is utilised (Hosseini 2020, 15). Based on the discussed points, this research employs the term ‘stucco’ to define the art and decorations in Iranian art that have been created using gypsum mortar, in contrast to Western examples based on lime mortar.

Iranian artists during the Islamic period achieved a high level of sophistication and diversity in the ornamentation of architectural elements with stucco, drawing on the technology and artistry of their predecessors as well as the cognitive foundation provided by the properties of stucco. The stucco art played a significant role in the architectural composition of Iran. Unfortunately, despite the abundance and diversity of remaining stucco decorations in Iranian architecture, very few reliable written sources categorise the various types of stucco ornament, accompanied by precise technical and specialized knowledge based on laboratory studies. Some general texts, though, briefly mention the execution methods, indicating the valuable and high technical worth of these forgotten treasures (Hosseini 2020, 18; Jalili and Diba 2016, 129; Ahmadi and Bahadori 2014,18;).

Field studies and direct observations, within the scope of the remaining stucco artifacts, can lead to a scientific evaluation based on key technical and visual characteristics (Tanha 2018, 25). Studying historical decorations and identifying their creation techniques not only showcases rich culture but also helps conservators preserve them better. In addition, research into the technical characteristics of diverse stucco decorations supports the development of a common language among researchers in various fields such as conservation and preservation, archaeology, and art history.

Furthermore, one of the issues in studying the stucco in Iranian architecture is their classification, which this research tries to answer. The existing classification methods are based on the level of stucco projection and the method of shaping. Although they are acceptable in some cases (Mehrnia and Rajabi 2020, 40), they are not suitable in all (Hashemi et al. 2017, 163). This results in excessive generality and the inability to provide a logical classification from a technical perspective (Jalili and Diba 2016, 128). Therefore, one of the challenges in this study is categorizing existing stucco decorations. This categorization serves as a basis to continue to evaluate and identify decorations in terms of execution methods and techniques. In other words, the value of stucco decoration lies in what it represents historically, rather than its outward appearance, hile the cultural aspect of historical stucco and the conservation of its architectural significance become essential. The value of stucco decorations goes beyond their artistic and aesthetic qualities, as they hold a protective and cultural importance that should be recognised and safeguarded.

1.2 Research Questions

The main research question is:

- What are the characteristic features of Iranian stucco decoration in Iran?

In addition to identifying a suitable method for classifying stucco patterns in historical Iranian architecture, the inquiry delves into the diverse techniques utilised in architectural ornamentation and associated technical considerations. This encompasses examining constituent materials involved in each technique, the methodologies applied during stucco preparation, the procedures for shaping the prepared plaster, and the optimal timing for executing these steps. Special attention is given to the unique properties of the stucco at each stage, spanning from the initial preparation to the subsequent phases of drying and hardening. So, to address this question effectively, the main research inquiry is further subdivided as follows:

- What are the important technical characteristics that exist in identifying and distinguishing different types of stucco in Iran during the Islamic period (From 661 CE to the 20th century)

- How can historical Iranian stucco be categorised, and what classification can be used to separate the existing techniques?

- What are the characteristic features of Iran's high and low-relief stucco decorations, in the Islamic period?

1.3 Research Objective

Comprehensive historical studies as well as technical evaluation play a major role in conservation studies and the maintenance of cultural heritage. The categorisation and technical study of historical and cultural artifacts can lead to increased public attention and the gradual development of specialized restoration processes (Alonso 2008, 87; Feiden 2003,235). Also, when managing cultural heritage, it is essential to follow principles that focus on conserving and developing it sustainably (Hashemi and Jafari 2021, 340). These principles are based on specific decisions and orders about safeguarding historical and cultural items. The emphasis is on recognising and evaluating artifacts technically, categorising them, and understanding the methods used to create them (Lee 2008, 253). Considering the importance and necessity of the subject, the lack of specialised resources, as well as the terminological and common language among researchers in related fields, the main objective of this research is:

- Review of the technical studies of the stucco decorations, in the Islamic period.
- Understanding the methods used for shaping the prepared stucco decorations, in the Islamic period.
- The classification of historical stucco based on the technical differences.
- Evaluation of the different stucco decorations in Iranian architecture, in the Islamic period.

These aspects can be systematically categorised from a technical standpoint, showcasing the evolving methods and technical processes employed throughout different historical periods.

This research aims to conduct a technical evaluation of the existing studies and sources on historical stucco decorations in Iran, followed by field studies of existing works (high and low-relief plaster decorations) to be examined and analysed technically. Furthermore, to uncover all hidden aspects of the construction methods of this type of decoration and to address the questions in this research, interviews with two traditional master craftsmen in this field have been conducted, ultimately aiming to obtain comprehensive information in this area.

The dissertation is structured into eight chapters. Following the introduction in the First chapter, the Second chapter presents the research literature presenting the available information on the art of historical Persian plasterwork and its background. The Third chapter of this research presents the methodology including the ethical approach adopted. The Fourth chapter considers the different criteria and their integration, discusses the classification of plasterwork ornaments in Iranian historical architecture, and introduces various types of Iranian plasterwork styles. Given the technical importance and various methods in executing prominent and bas-relief plasterwork, the Fifth chapter evaluates the technical and executive procedures of the high-relief stucco artwork, and the Sixth chapter related to the consideration of the low-relief stucco in the art of historical Persian plasterwork. The Seventh chapter provides a discussion drawing together the evidence from the previous chapters initially, and the final chapter provides a conclusion for this research, noting challenges, and areas for future research.

Ultimately, the distinctive approach taken in this research is to move beyond the traditional classifications of stucco decorations. Until now, the criteria for categorising Iranian stucco decorations have been primarily based on their level of relief or the method of shaping, whether molded or in situ. To ensure a comprehensive and accurate classification that prevents important examples from being overlooked or miscategorised, this study considers not only the level of relief and shaping methods but also the technical and practical details of the decorations. This approach introduces a novel categorisation system for stucco decorations in Iranian architecture.
Furthermore, this research focuses on two major categories of stucco decorations for in-depth analysis. By examining these categories, the study not only reveals the hidden aspects of these remarkable stucco examples in Iranian architecture but also evaluates and investigates the various subcategories and techniques within each group.

Chapter Two: Literature Review

2.1 Introduction

Stucco, a traditional architectural craft, holds significant artistic and cultural value, representing an integral part of the heritage in various countries. Research on stucco not only supports its conservation but also plays a role in preserving craftsmanship for future generations (Crattan 2004, 30). Analysis of the Venice Charter of 1964 emphasises the importance of studying various scientific branches and advocating for traditional techniques (The Charter Venice 1964, 3). Technical studies are fundamental in conservation efforts, as highlighted in the ICOMOS General Assembly of 1993 (The Colombo Guidelines ICOMOS 1993, 12). Recognising the methods used in constructing historical artifacts has become crucial for conservation studies and safeguarding intangible heritage (Lee 2007, 139). Technical knowledge is indispensable for informed decision-making in conservation projects, preventing discrepancies in restoration and preservation approaches (UK ICOMOS Draft Charter 1998, 10).

2.2 The History of Stucco in Iran

Stucco has been a fundamental material in Persian architecture for millennia. Early evidence of stucco employed for decorative purposes dates to 5000 BCE in structures from the Neolithic and Chalcolithic eras such as *Tepe Sialk* where lime stucco was applied to walls and used for figural and geometric mural art (Fazeli 2006, 279). During the *Achaemenid* Empire (550 BCE to 330 BCE), palaces were decorated with ornate stucco relief carvings. The main audience hall of *Darius*' palace at *Persepolis* features carved rosettes, lotuses, and winged figures on cornices and doorways fashioned out of stucco (Curtis and Razmjou 2005, 286).

Stucco art advanced in the *Parthian* period (247 BCE to 224 CE) which can be seen in *Kuh-e Khwaja* in *Sistan*. These paintings include depictions of hunting grounds, battles, ceremonies, and scenes from daily life in ancient times, mostly belonging to the *Parthian* period (Fig 1). They have been drawn on the walls and rocky cliffs surrounding mountain *Khwaja*, situated in the middle of the *Lut* desert. These decorations were used by these early craftsmen to develop vaulting techniques to construct the famed domed ceilings of the first century BCE at Assyrian royal cities like *Nisa*, which were embellished with grapevines, beasts, and dancers (Reiche et al. 2015, 155).

Figure 1: The Stucco art decorations in the Parthian period (247 BCE – 224 CE) can be seen in Kuh-e Khwaja in Sistan. These paintings include depictions of hunting grounds, battles, ceremonies, and scenes from daily life in ancient times (Ghiyumi-Bidhendi 2016, 145).

During the *Sasanid* period (224-651 CE), stucco artistry was at its height with spectacular palaces exhibiting monumental stucco sculptures and richly painted interiors, surpassing the art of previous dynasties (Bier 1976, 68). Ornately carved stucco panels depicting scenes of royal festivities and hunts were discovered at *Ctesiphon*'s arch, in *Ivan-e-Madayen* and *Ardeshir-e-Babakan* palace in *Firoozabad.*

Figure 2: The stucco decoration, Ctesiphon, Iran, Sasanid period (Parham 2019, 110).

Figure 3: The stucco work from Ctesiphon, 6 CE, Pahlavi calligraphy, Sasanid period ((Parham 2019, 112).

Under Persian Islamic rule (652 CE–1220 CE) elaborate stucco Mihrab decorations with muqarnas (stalactite-shaped cornices), Islamic geometric patterns, and blue faience tilework in 9th–11th-century mosques appeared (Burckhardt 2009, 78).

The craft reached its peak between the 15th and 17th centuries during the *Safavid* Empire (1501 CE to 1796 CE) in *Jameh* mosques and palaces at the former capital *Isfahan*, alongside polychrome tile mosaics, seven-color painted stucco is seen at *Ali-Qapu* palace, *Sheikh Lotfollah* mosque, *Allāhverdi Khan* bridge and *Chehel Sotoun* (Blair & Bloom 1994, 17). Historical records indicate crafts experts were brought in from *Tabriz*, the *Caucasus*, *India,* and the *Ottoman* Empire, demonstrating Persian expertise in stuccowork over a wide area (Aslani 2011,34). Stucco remains a prevalent and versatile architectural medium in contemporary Iran, primarily owing to the abundance of local available gypsum. It is extensively employed in traditional construction practices throughout the country, serving purposes such as wall surfaces, room partitions, as well as thermal and acoustic insulation (Rajabi et al. 2015, 55).

2.3 The history of studying and evaluation of Iranian stucco

The International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM), recognises the role of technical experts in guiding future conservation practices (Price 1996, 60). A review of relevant sources on architectural decorations and historical ornaments by scholars such as Jana (2005) and Ratcliffe (2005) emphasises the importance and priority of technical expertise in conserving historical decorations. They have highlighted the necessity of using technical knowledge and experimental approaches to advance artwork studies, analysis, and damage assessment. Additionally, technical expertise proves valuable in determining the authenticity of architectural materials (Goffer 2007, 15).

Numerous studies conducted on historical and cultural artifacts have shown that neglecting to examine serious and irreversible damage has led to their deterioration (Ahmadi et al. 2019, 42; Agnew and Bridgland 2006, 68). This damage can be attributed to conservation interventions without proper technical knowledge. The absence of technical knowledge may cause mishandling and further damage to artworks (Stanley Price, Tally, & Vaccaro 1996, 360). Those overseeing conservation, restoration, and decision-making for historic buildings should thoroughly understand regional construction methods and relevant resources, incorporating technical theories from detailed studies (Feilden 2003, 32).

Conservation and sustainable development emphasise two fundamental aspects:

evaluation and technical analysis of the construction methods employed in creating historical and cultural artworks (Lee and Cross 2008, 249). However, regarding stucco decorations in Iran, this categorisation and identification of execution methods has yet to be undertaken. Examining past studies conducted both in Iran and globally, especially in the segment focusing on the background of gypsum-related research (Ahmadi et al. 2019; Rajabi et al. 2015; Aslani 2011; Agnew and Bridgland 2006), can underscore the importance of stucco decoration techniques in enhancing the architecture of Islamic-period Iran. This emphasises the essential need for a technical classification system for these artistic works.

The use of stucco decorations in Iranian architecture has been extensively explored by scholars, either through single or multiple periods (Rajabi et al. 2015; Aslani 2011; Burckhardt 2009; Tadini Chaharsooqi 2008; Mishmast 2006; Alvandian 2005; Kiani 1997). Comparative studies have been conducted on form and style, along with descriptive representations and categorizations. Notable researchers have contributed articles on topics such as the artistic influences of prehistoric art on subsequent stucco works (Bloor and Bloom 2006, 345), comparative formal studies with contemporaneous works, decorations, and motifs (Ansari 1987, 316) deciphering inscriptions, historical dating and the formation of motifs (Salehi Kakhki 2008, 11).

Most articles focus on the cultural and artistic aspects of Iranian stucco decorations, with articles covering motifs from different historical periods, particularly during the *Sasanid* period (224 CE to 651 CE) (Parham 2019, 75; Tajvidi 2005, 127; Golombek 1988, 57; Ansari 1987, 323). However, the absence of studies on the technical evaluation of architectural decorations is apparent. For example, Kiani (1997) discusses the historical background of stucco art in ancient Iran, the origin and creation of motifs, the classification of patterns and motifs, the continuity and influence of ancient Iranian stucco art in Islamic works as well as presenting examples of works from inside and outside Iran (Kiani 1997, 61).

3.3 A Review of Technical Studies and Classification of Iranian Stucco

In general, the relevant sources on the technology of Iranian stucco decoration can be divided into two main categories. The first category, which comprises a minimal number of studies, includes specialised case studies such as scientific research, and a few technical reports in the field of archaeology and conservation (Esfehanipour 2008, 28; Tadini

Chaharsooqi 2008, 55; Karimi 2008, 42; Hamzavi 2007, 61; Mishmast 2006, 39; Alvandian 2005,19; Schmidt, Matson 1997, 503; Wilkinson 1987, 275). For example, Alvandian conducted research at the *Isfahan* University of Art and the Research Institute of Historical and Cultural Heritage Preservation on a specific style of stucco decoration found in the *Seyyed Rokn-al-Din* building dating back to the *Ilkanid* period in *Yazd*. Through identification experiments using Scanning Electron Microscopy (SEM), Fourier-Transform Infrared Spectroscopy (FTIR), X-Ray Diffraction (XRD), and qualitative analysis of the decorative elements, the research successfully simulated a method of gypsum molding (Alvandian 2005, 18).
In addition, Mishmast and Abbassian have analysed the stucco decorations of *Kooh--e-Khajeh* in *Sistan*, attributed to the *Ashkanid* period (240-220 BCE), based on XRD and electron microscopy. They also researched and modeled the effect of various additives on the setting process and strength of stucco working after hardening (Mishmast 2006, 31). Esfehanipour also conducted comprehensive studies on the technical analysis of stucco art in (1256-1356 CE) sites in *Yazd* (Esfehanipour 2008, 31).

Some researchers have also presented classifications of stucco working decorations based on the abstract or realistic nature of the depicted patterns in the artworks (Azarnoush, 2007, 96; Hill, Grabar 1996, 132). Although valuable information exists about the history of art and the evolution of patterns used in stucco decorations, detailed technical information that can be beneficial in the technical presentation of these works, including materials, techniques, and execution methods, is not readily available. It should be noted that, in his book *Taziehnat-e-Memari* (Architectural Decorations), Makinejad (2008) provides a descriptive technical classification based on information gathered mainly from the collection of articles in the first conference on forgotten treasures of Iran. However, the majority of the content related to stucco decorations is based on historical and artistic descriptions, and regarding the stucco decorations of Mihrabs, there is some discussion of the use of inscriptions accompanied by floral motifs (Mekinejad 2008,65).

As such the current state of research focuses on details of structures and historical periods, providing technical evaluations of materials, shaping techniques, or historical classification. These examples illustrate that while there is some information available about studying stucco working in Iranian art and architecture, there is a lack of comprehensive study about the methods of fabricating stucco decorations in Iran and it emphasizes the necessity of the technical exploration as well as a more comprehensive classification of the stucco decorations in Iranian architecture.

Currently, research is predominantly focused on the details of structures and historical periods, providing technical evaluations of materials, shaping techniques, and historical classifications (Anisi 2023; Jalili and Diba 2016; Ahmadi 2014; Daneshdoust 2011; Esfahanipoor 2008; Mishmast 2006). These examples illustrate that although some information exists regarding the study of stucco work in Iranian art and architecture, there is a notable deficiency in comprehensive research on the techniques employed in stucco decorations in Iran. This underscores the need for technical exploration and classification of stucco decorations in Iranian architecture. On the other hand, McClary and Danesh in their studies had analysed three *Īlkhānī* period carved stucco Miḥrabs in *Urmia, Marand*, and *Tabrīz*, emphasizing *Tabrīz's* regional Madrassa of stucco carving. The study explores decoration, inscriptions, and connections between Iranian and *Mamlūk Cairo* stucco, presenting newly translated inscriptions using archival material, photographs, and drawings (McClary and Danesh 2023, 114). Grbanovic's article in Muqarnas (2017) investigates the *Ilkanid* architectural decoration of the *Pir-Bakran* mausoleum in *Linjan, Isfahan*. Proposing the intentional application of decorative elements based on specific principles, Grbanovic provides a hypothetical timeline, contributing to a nuanced understanding of the *Ilkanid* (1256 CE to 1353 CE), architectural legacy (Grbanovic 2017, 239).

There are two articles that explore the architecture of *Jameh* mosque in *Marand* Iran, aiming to find evidence of its origins in *Seljuk* architecture (Anisi 2023, 7; Blair and Bloom 1994, 22). Despite previous scholarly examinations (Tabbaa 1997, 37), definitive proof confirming the *Seljuk* origin of this construction is still lacking. The research emphasizes the chamber's unique features, such as the square dome and carved stucco band, which distinguish it from other Northwest Iranian mosques with domes (Golombek and Wilber, 1988, 63). Unpublished drawings and an examination of the Mihrab inscription and conservation efforts provide valuable new insights. Wider literature on the building traditions in the region is limited, for example the *Jameh* mosque in *Urmiya* in *Azerbaijan*, considered the earliest surviving mosque in the region (Anisi 2023, 15; Hillenbrand 1994, 413). Constructed in the mid-sixth-twelfth century, this mosque signifies the expansion of *Seljuk*-style domed mosques. Featuring an impressive *Ilkanid* Mihrāb from the seventh-thirteenth century (Pope 1965, 32), the study mainly focuses on the structure, rather than the stucco decorations. It introduces new inscriptions and drawings for a deeper understanding of *Seljuk*'s architectural style. Based on the information available there is a noticeable lack of data evaluating the technical aspects of various methods and the classification of Iranian stucco decorations. Therefore, this research strives to address some of these information gaps and delve into

the study and evaluation of unexplored sections in Iranian stucco art. Among the most crucial aspects is the classification and introduction of techniques used for stucco decorations in the interior and exterior spaces of historic buildings in Iran. After reviewing various types of stucco decorations, particularly the intricate and diverse art of stucco, the study focuses on assessing the various methods of shaping and the types of techniques prevalent in this significant Iranian art during the Islamic period.

Ultimately, this research examines the extensive artistic and historical significance of stucco decorations in Iranian architecture, from the Neolithic and Chalcolithic periods to their refinement during the Safavid period. While numerous studies have analysed the cultural and artistic aspects of stucco, a clear gap exists in the technical evaluations and comprehensive classification of the methods and techniques used in stucco decorations. This study emphasizes the need for a more detailed analysis of execution methods, materials, and shaping techniques to address these deficiencies.
A review of previous studies, such as the technical research conducted by Alvandian highlights the absence of an integrated approach to fully understanding stucco art. Moreover, this research underscores the importance of exploring overlooked aspects of Iranian stucco art, particularly through the classification and evaluation of techniques used in the interior and exterior spaces of historic buildings.
Overall, this research aims to fill the existing gaps in the technical understanding and classification of stucco decorations, while building on prior findings. This approach not only contributes to the preservation of Iran’s architectural heritage but also lays the foundation for more informed conservation and restoration practices.

Chapter Three: Methodology

In outlining the methodology employed in this research, it is important to note that it is characterised as a desk-based and field study. Regarding data collection and results, it adopts a semi-experimental approach, specifically field study. Furthermore, given the nature of the field studies, data interpretation, and the interview with the senior craftsmen of the traditional stucco art in Iran, it can also be classified as a qualitative study.

The research was conducted whilst registered at the University of York and based in the UK throughout. As such the work draws on the researchers' prior experience in the area as the head of the conservation team in *Bekhradi* historic house project on the polychrome stucco artworks in *Isfahan* (Basiri 2019); project manager in the conservation of decorations in *Zinatolmolk Imarat*, *Zand* period, *Shiraz* (Basiri 2017); a researcher of the polychrome stone decorations in *Shiraz* from *Safavid, zand* and *Qajar* periods (Basiri 2014); the researcher of the gilded stucco decorations in *Qajar* and *Safavid* Project (Basiri 2012); a restorer of the *Chehel-Setoun's* mural painting on the stucco base (Basiri 2007); a researcher on the stucco decorations in *akhavan-Haghighi* historic house, *Isfahan* (Basiri 2009); a restorer of *Hasht- Behesht* palace in the *Copbori* decorations from *Safavid* period in *Isfahan* (Basiri 2005), and also from the researchers' network of craftspeople, etc in *Isfahan*, Iran.

A structured research methodology has been designed to address the questions introduced in the research's introductory phase. Following a review of research methodologies related to architectural decoration technologies based on stucco work, the research implementation stages were formulated.

The initial research involves field studies and observations based on the existing literature. The primary objective of this is to complete an initial classification of stucco working applications in Islamic architecture in Iran. The proposed categorisation comprises the method of shaping, the level of projection as well as the execution of the stucco techniques for the classification of the numerous techniques in Iranian architecture.

After achieving the classification of existing techniques and methods, two significant yet extensive categories of stucco decorations in Islamic Iran were chosen as exemplary cases. The reason for selecting these categories lies in the diversity of execution,

different classifications, the complexity of implementation, and the existing differences. These techniques were abundantly utilised in the central regions of Iran during the *Seljuk, Ilkanid, Safavid, Zand*, and *Qajar* periods (spanning 700 years) and continue to embody unique stucco techniques in Iranian art and architecture. These methods include high-relief and low-relief stucco, the characteristics, and methods that will be examined in the subsequent sections of this research.

Regarding the study of the high-relief stucco decorations in Iranian architecture, field studies have been done on the 33 different decorations in historic architecture in Iran. For studying the low-relief stucco field studies have been done on 23 different decorations. In both cases these were chosen as they represent the current known stucco decorations utilising the technique present in Iran (Figure 27).

Historic Architecture	**Location**	**Historic period**	**Historic Architecture**	**Location**	**Historic period**
Jameh mosque	Ardebil	Ilkanid	Ali-Qapu palace	Isfahan	Safavid
Jameh mosque	Gonabad	Qajar/Ilkanid	Pirnya Historical House	Naein	Safavid
Pamenar mosque	Zavareh	Seljuk/Ilkanid	Gorgi Historical House	Yazd	Qajar
Jameh mosque	Isfahan	Ilkanid/ Seljuk	Akhavan-Haghani Historical House	Isfahan	Qajar
Jameh mosque	Gaz-Borkhar	Ilkanid	Chehel-Setoun Palace	Isfahan	Safavid
Jameh mosque	Saveh	Saljuk/ Ilkanid/ Safavid	Sharbet-Khanah entrance of Qeisariyeh Bazar	Isfahan	Safavid
Jameh mosque	Urmia	Ilkanid	Mozaffari Madrassa	Isfahan	Seljuk
Jameh mosque	Oshtorjan	Ilkanid	Sabz dome	Qom	Ilkanid
Jameh mosque	Maragheh	Ilkanid	Jameh mosque	Barsian	Seljuk
Jameh mosque	Marand	Ilkanid	Jameh mosque	Yazd	Ilkanid
Jameh mosque	Bastaam	Seljuk/Ilkanid	Jameh mosque	Ardestan	Safavid

Neishaboor Madrassa	Neishaboor	Timurid	Jameh mosque	Farfan	Ilkanid
Jameh mosque	Ardestan	Ilkanid/Safavid	Jameh mosque	Haftshooyeh	Ilkanid
Jameh mosque	Zavareh	Seljuk	Jameh mosque	Farumad	Ilkanid
Jameh mosque	Abarkooh	Ilkanid	Alavian dome	Hamedan	Ilkanid
Mosque of Faruamad	Sabzevar	Ilkanid	Gaar mosque	Gaar	Seljuk
Farafan mosque	Varzaneh	Seljuk	Kolahdooz House	Yazd	Qajar
Bayazid, Bastam's complex	Bastam	Ilkanid	Sine mosque	Gaz-Borkhar	Ilkanid
Rascat Tower	Mazandaran	Ilkanid	Sheikh Jam shrine	Torbat e Jaam	Ilkanid
Pir-Bakran Shrine	Falavarjan	Ilkanid	Emamzadeh Ismaeil	Isfahan	Ilkanid
Emamzadeh Ahmad	Isfahan	Qajar	Colonel Vasigh-Ansari's house	Isfahan	Qajar
House of Calligraphy	Isfahan	Qajar	Seyed Shafti Shrine	Isfahan	Qajar
Sultanieh dome	Zanjan	Ilkanid	Shah-Karam Mosque	East of Isfahan	Ilkanid
Seyed-Gholhovala mosque	Yazd	Seljuk			

Table 4: Exploring high-relief stucco decorations across 33 historic architectures in Iran, spanning from the Seljuk to Qajar periods (Author).

The different samples in the field studies of the high-relief and the low-relief techniques in stucco decorations in Iranian architecture are related to the existence of relevant literature relating to the stucco which allows evaluation and study.

After the initial classification, stucco decorations representing each category were selected based on preliminary field studies and visual observations. At this stage, some information remained unclear. Therefore, two proficient master craftsmen, well-versed in traditional stucco works, were interviewed for this research. By their preferences, their names are not disclosed in this study, and their details are kept confidential and not recorded. They are simply referred to as Artist A and Artist B, respectively, to maintain their confidentiality. In this study, interviews were conducted by formulating open-ended questions regarding prominent and subtle stucco techniques with traditional craftsmen. This knowledge, which has not been documented but resides within the experienced craftsmen who have practiced these techniques for years, is at risk of being lost. Therefore, this research serves as a means to preserve a significant part of the endangered intangible heritage of the world by conducting interviews with craftsmen. The research follows the University of York Research Ethics framework, a research consent form has been developed, covering research objectives, data usage, and the protection of personal information confidentiality.

The following information is included in the accompanying appendices: Appendix 1 contains the ethics application and consent forms, while Appendix 2 comprises the interview questions, answers, and transcripts. The content is translated, with the original provided in Farsi.
The consent form explicitly conveys the voluntary and informed nature of participants' involvement in the research, with the provision for them to withdraw at any stage. Before commencing interviews, the contents of the Consent Form are thoroughly explained to the participants, and their signatures are collected if they agree. Each participant is provided with a signed copy of the Consent Form. The formulation of the interviews was in Farsi, conducted by reaching out to traditional craftsmen, and ultimately translated into English. The information obtained from the interviews is utilised in various sections of different parts of this research to complement and fill gaps in existing knowledge. Having set out the methodology, the next chapter presents the initial classification of the Stucco.

Finally, this chapter has outlined the methodological framework employed in this research, addressing the need for a clear and structured approach to the study of Iranian stucco decorations. Key terms such as "low-relief," "high-relief," have been defined to

establish a consistent terminology throughout the thesis. The selection of case study sites was guided by their historical significance, diversity of techniques, and representation of various stylistic periods, ensuring a comprehensive analysis. The categorisation process, based on the dual criteria of relief levels and shaping methods, was systematically developed to include technical details and execution techniques, which are further analysed in subsequent chapters. The methodologies outlined here ensure that the complexities of stucco art are effectively contextualised, analysed, and presented, reinforcing the critical arguments of this thesis.

Chapter Four: Classification of Stucco Decorations in Iranian Architecture

4.1 Introduction

In the technical assessment of stucco from the Islamic period, it is essential to consider the technical recognition of construction methods for each category of stucco works present in Islamic architecture. Ultimately, after thoroughly understanding the methods, it's important to have an explicit discussion about the techniques involved. By reviewing the methods, the techniques are considered for various and diverse stucco examples. This comprehensive approach aims to achieve an understanding of the techniques present in historical Iranian stucco work, especially during the Islamic period.

This chapter explores the historical classification of stucco decorations in Iranian architecture and introduces a novel typology to address the limitations of previous systems. By focusing on technical and stylistic features, this study proposes a binary classification system based on relief levels (low-relief < 0.5 cm and high-relief > 0.5 cm) and connects these categories to nine distinct stucco types. The chapter aims to provide a clear framework for understanding the diversity and complexity of stucco art while addressing ambiguities in earlier classifications.

The classification of historic stucco is needed to achieve a better and more comprehensive understanding of these historic architectural decorations. In the first step, the level of projection has been evaluated as this is a helpful way to recognise and characterize the stucco. An initial classification was obtained through observations, field studies, and discussions with active traditional stucco craftsmen. Based on this information, criteria for categorizing stucco decorations can be identified:

- The prominence of decorations: This criterion evaluates the level of prominence and visibility of the stucco decorations.
- The method of shaping the stucco: This criterion focuses on the techniques used to shape and mold the stucco.

These two criteria have been utilised in this research based on the evaluation of previous studies, as efforts have always been made to assess and introduce works based on these two main criteria (Ahmadi et al. 2019; Parham 2019; Aslani 2011; Salehi Kakhki 2008; Agnew and Bridgland 2006; Tajvidi 2005; Blair & Bloom 1994; Golombek 1988; Ansari 1987).

4.2 The Level of Projection of the stucco's Decorations

The criterion for categorizing stucco decoration in Islamic architecture is the level of projection or protrusion (Aazami 2011, 210; Motififarad 2010, 189). The term 'level of projection' refers to the difference in elevation between the decorative patterns and the background. It is noted that in a single historical building and during a specific historical period, multiple decoration styles are seen alongside each other.

In general, the stucco decoration techniques of the Islamic period, mostly follow this method where the patterns are more prominently raised than the background, but there are exceptional cases such as certain sections of the stucco decorations in the main hall of *Ali-Qapu* palace in *Isfahan*, belonging to the *Safavid* period (1501 CE to 1796 CE), or the stucco decorations of the *Sharbatkhaneh* mansion in *Sardar-e-Qeisarieh*, historic *Bazaar*, *Isfahan*, where the patterns are placed at a lower elevation compared to the background.

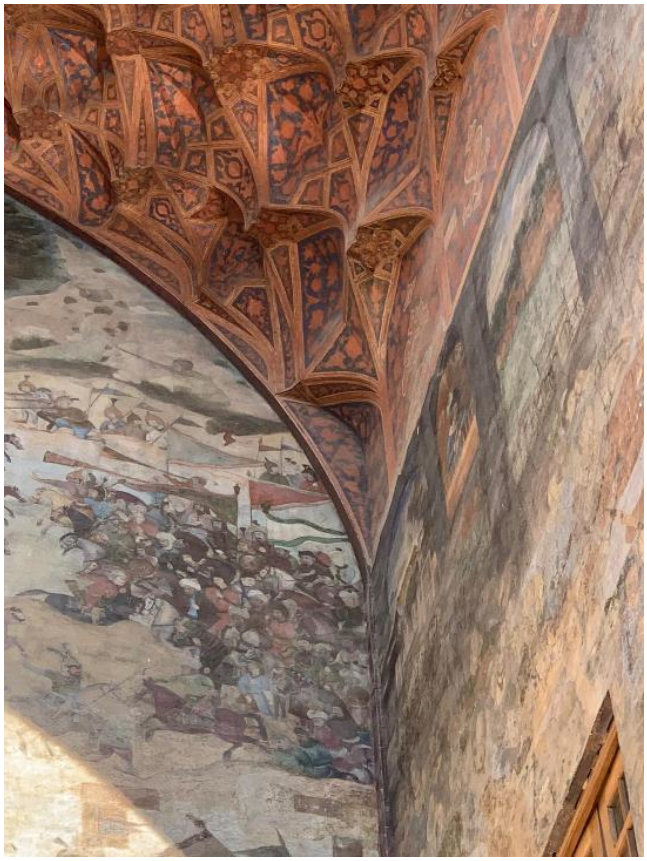


Figure 5: Plasterwork decorations used in the Qeysariyeh Bazaar in Isfahan from the Safavid period, where bas-relief plasterwork is seen alongside muqarnas and gilt decorations, and Solomonic and Khattai motifs have come together with battle scenes and human and animal figures (Author).

Figure 6: The coexistence of prominent stucco decorations in Ali-Qapu palace in Isfahan, from the Safavid period. These ornaments are known as 'Koshtabri' and 'Tangabri' decorations in traditional Iranian architecture, which are executed in two very different techniques and at completely different levels of projection (Author).

According to the pre-existing terminology in Iranian stucco, in the level of projection difference between the pattern and the background of stucco decorations, can be initially classified into five groups:

1. Highly Relief Stucco Decorations:
   These decorations have a relative elevation difference between the pattern and the background (More than 3 cm difference).

2. Relief Stucco Decorations:
   These decorations have noticeable projections or relief, but not as much relief as the highly raised ones (1.5 to 3 cm difference).

3. Semi- Relief Stucco Decorations:
   These decorations have a moderate level of projection or relief, creating a

partial elevation difference between the pattern and the background (0.5 to 3 cm difference).

4. Low-relief Stucco Decorations:
   These decorations have a minimal level of projection or relief, with a subtle elevation difference between the pattern and the background (0.5 to 0.9 cm difference).

5. Flat or Non-Relief Stucco Decorations:
   These decorations are characterized by a flat surface with no elevation difference between the pattern and the background.

This classification is based on the level of surface variation and projection in stucco decorations, providing insights into the different degrees of prominence and depth in their designs.

4.2.1 Highly Relief Stucco Decorations

The 'highly relief stucco decorations' or *Borheshte*, is a technique in the historic stucco decorations which its distinguished feature is the difference in the elevation between decorative patterns and the background of the ornamentation (Pirnia 1990, 486). The name itself implies this characteristic. Based on field and historical evidence, decorations with a difference of more than 3 cm in elevation from the background, can be classified within this group. In this type of decoration, achieving such a level of protrusion in stucco requires the utilization of either layered embedding or pre-made stucco molding techniques. This necessity arises due to limitations in executing thick stucco mortar layers. Therefore, to prevent a decline in quality and the occurrence of cracking in the embedding, the mentioned precautions are taken before execution (Figure 7).

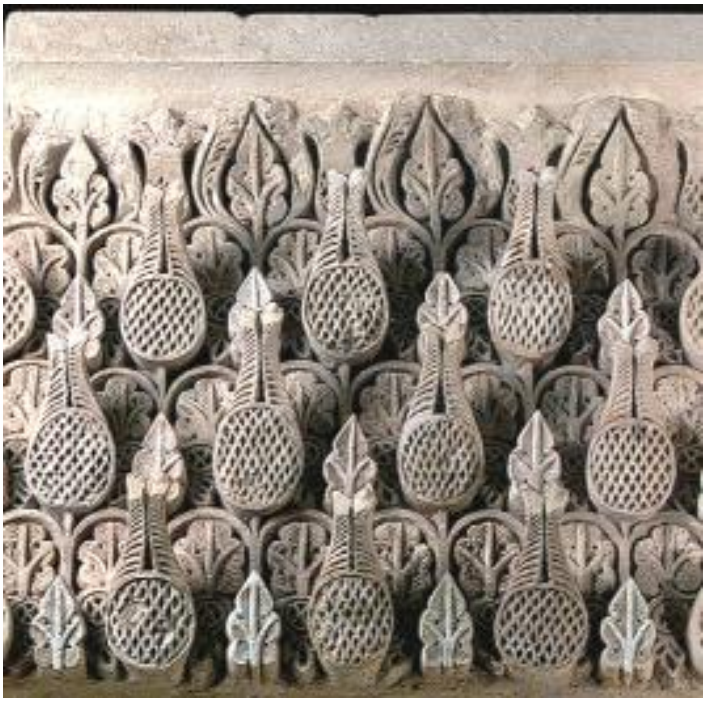


Figure 7: High-relief stucco decorations with high prominence, Nishabur. The high-relief decorations with a difference in prominence between the stucco's background and the depicted figures are more than 3 cm can be classified within this group (Metropolitan Museum of Art 2023).

4.2.2 Relief Stucco Decorations

Based on the field studies and categorizations of stucco decorations in Iran, there is a type of decoration that can be classified as relief stucco. These decorations have less difference in elevation between the motifs and the background. Their intricate patterns and exquisite artistry in this decoration, with a variance in prominence between the stucco's background and the depicted figures ranging from 1.5 cm to 3 cm contribute to their classification as relief stucco. These decorations, with their unique beauty and artistic value, reflect the skills and techniques of stucco during the Islamic period.

Figure 8: Relief stucco decorations at Farumad Great Mosque, Ilkanid period, Iran. These decorations have less difference in elevation between the motifs and the background. Their intricate patterns and exquisite artistry in this decoration, with a variance in prominence between the stucco's background and the depicted figures ranging from 1.5 cm to 3 cm, justify their categorization as relief stucco (Aslani 2023).

Figure 9: The High-relief stucco decorations with the difference in prominence between the stucco's background and the depicted figures range from 1.5 cm to 3 cm mosque of Ardestan, attributed to the Seljuk period, Isfahan, Iran (Aslani 2023).

4.2.3 Semi-Relief Stucco Decorations

These decorations have a moderate level of projection, creating a partial elevation difference between the pattern and the background (Aazami 2011, 116; Motififard 2010, 35). This technique, known as 'semi-relief', is used in the stucco decorations of the Islamic period. In this technique, there is an approximate 0.5 cm to 2 cm difference in elevation between the stucco's design and its background. Some elements of the stucco decorations are executed in a raised and three-dimensional form, while other parts may remain flat. This technique is recognised as one of the characteristics of Islamic architectural decorations and can be observed in many Islamic architectural works. Some notable applications of this technique include the decoration of walls, bricks, Mihrabs, minarets, and domes of temples and mosques.

Figure 10. A

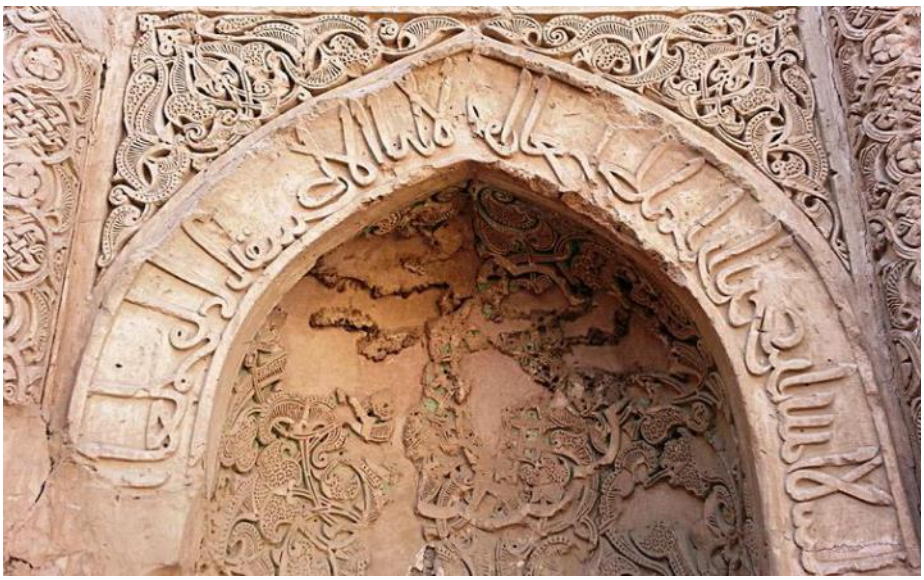


Figure 10. B

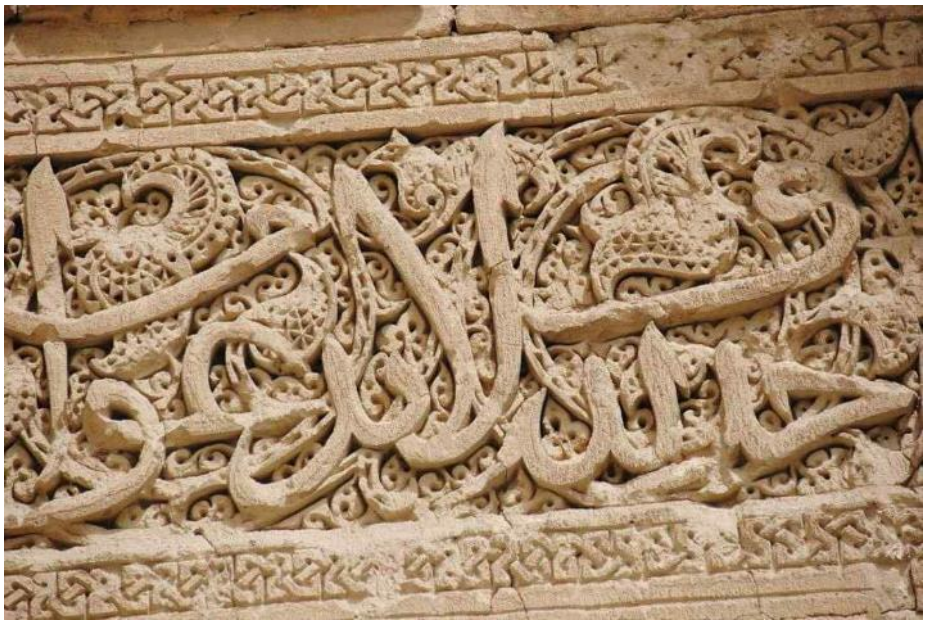


Figure 10: Two different photos of the semi-relief plaster decorations in Haftshooyeh Great Mosque, (Figure A: Central Mihrab. Figure B: The northern part of Mihrab) Isfahan, Ilkanid period, (Boroumand 2023).
As like the contemporaneous Mihrabs, it features decorative semi-arches and side columns, employing coloring to accentuate sanctity, visible in red and green segments. The thuluth script inscription includes the Ayat al-Kursi verse, with small leaves reminiscent of the Jameh mosque in Isfahan (Grube 1995,65).

4.2.4 Low-relief Plaster Decorations

These decorations have a minimal level of projection, with a subtle elevation difference between the pattern and the background. As previously mentioned, according to the classification of stucco decorations, the low-relief technique is a type of architectural ornamentation in plasterwork where the difference in prominence between the stucco's background and the depicted figures ranges from 0.5 cm to 0.9 cm. This style is different from other classifications and is characterized by its distinctive design (Aghajani 1980, 76). The widespread use of this particular plaster decoration style can be traced back to the popularization of traditional Iranian architecture in recent decades (Shahvandi 2008, 25).

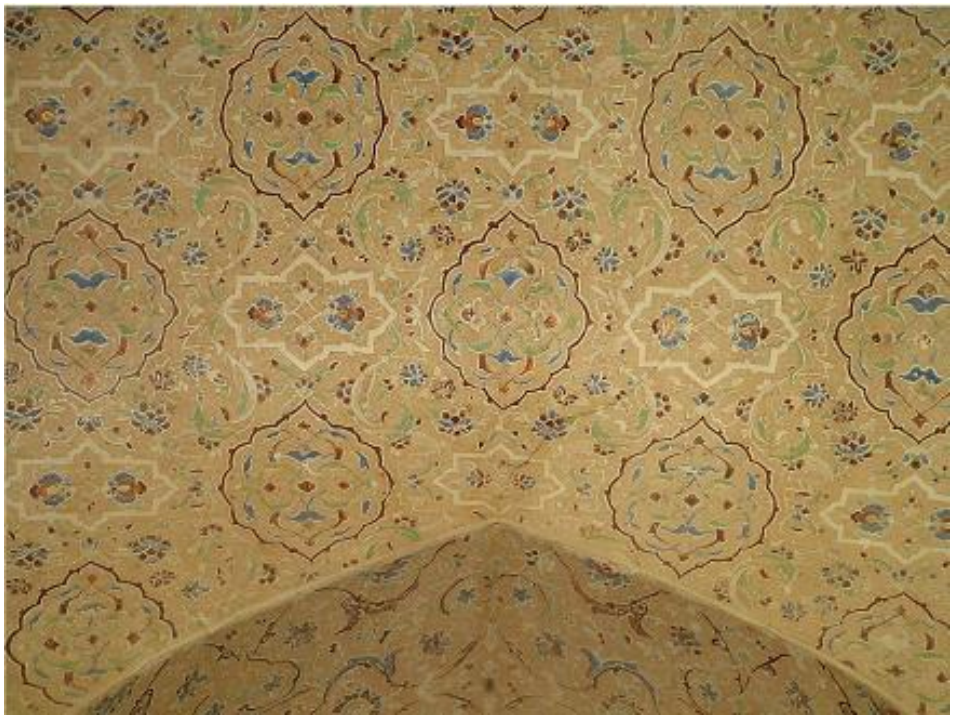


Figure 11: These decorations have a minimal level of projection, with a subtle elevation difference between the pattern and the background. the low-relief method is a kind of architectural decoration method in stucco-working where the difference in prominence between the stucco's background and the depicted figures ranges from 0.5 cm to 0.9 cm. The low-relief decorations known as 'Koshtebori', are located on the western veranda on the fifth floor of the Ali-Qapu palace in Isfahan, belonging to the Safavid period (Author).

Based on the various field studies that have been done on stucco art in Iranian architecture, especially in the Islamic period, there has been a wide range of stucco works that have been made in a ‘Semi-relief’ or Low-relief method.

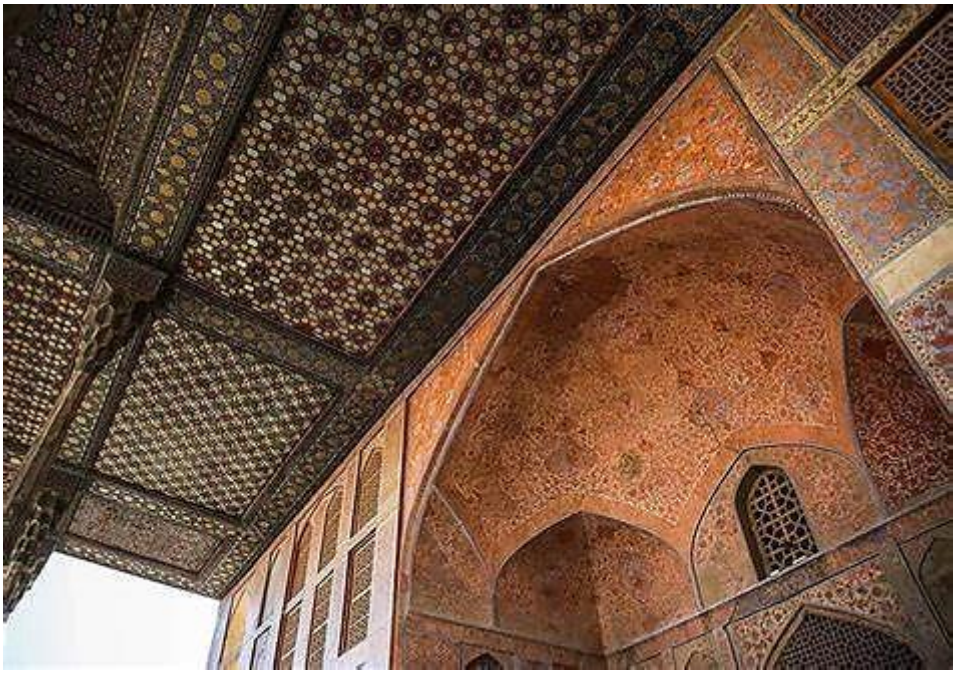


Figure 12: There has been a wide range of stucco works that have been made in a low-relief method. One of the distinctive features of low-relief stucco decorations in the architectural style of the Ivan of Ali-Qapu, Isfahan,
during the Safavid period (Boroumand 2023).

Based on the remaining works in Iranian architecture, the most relief application of polychrome stucco decorations is associated with the *Safavid* period (1501 CE to 1796 CE) These decorations that are known as ‘*Koshtebori*‘, can be seen in structures such as the *Ali-Qapu* palace, *Chehel-Sutun*, *Hasht-Behesht*, *Beit-al-Ham* church, and the *Pirnia* house in *Naein*. Notable examples of the use of these stucco arrays can be found in the important architectural works of the *Safavid* period in *Isfahan*. It is worth noting that in some examples of such decorations, such as in the *Ali-Qapu* palace, there is very little difference in the surface level between the design and the background, making it difficult to distinguish them from various smooth surfaces.

4.2.5 Flat or Non-Relief Stucco Decorations:

The other part of the stucco work is made as ‘flat stucco’ without any surface depth variation in terms of its visual appearance, the colorful types of this technique appear to resemble a painting. This technique is essential for achieving high-quality finishes during the manufacturing process. In particular, when it comes to stucco-based decorations, maintaining consistent and uniform stucco on the surface is crucial. The ‘flat relief’ stucco decorations are closer to painting rather than other types of stucco in Iranian architecture. In these decorations, they create shallow grooves on the stucco surface of the wall. These grooves form the outlines of patterns and some details, and then the decorations are completed by coloring them.

An example of this approach is the stucco decoration referred to as *Shir-o-Shekar*, which is the combination of two light colors ‘milk’ which is in Farsi ‘Shir’ and ‘sugar’ which is in Farsi named ‘*Shekar*’. Therefore, based on the bright color employed in this technique, this method is known by this name, and in this approach, certain sections of white plaster are painted with the ‘cream’ color.

Figure 13: The Shir-o-Shekar stucco technique, which is the flat method of plaster working and is the combination of two light colors. Javaheri House, Qajar period, Isfahan (Author).

In terms of stucco decorations, a variety of stucco techniques and designs are used. In traditional stucco, which is known as '*Tokhme Gozari*', various decorative motifs, geometric patterns, and floral designs are applied. These decorative elements are created using techniques such as engraving, carving, and stucco. The
stucco is mixed with natural pigments to achieve different colors and is applied on surfaces such as walls, ceilings, and architectural features. The combination of stucco techniques and decorative motifs in traditional stucco creates a unique and artistic effect.

The Classification of The Level of Projection in Different Stucco's Decorations				
	Level of Projection	**Definition**	**The difference in prominence between the background and the depicted figures**	**Existing historical examples**
1	Highly Relief Stucco Decorations	These decorations have a significant elevation difference between the pattern and the background.	Decorations with a difference of more than 3 cm in elevation from its background	
2	Relief Stucco Decorations	These decorations have noticeable projections or relief, but not as prominent as the highly raised ones.	Decorations with a depth range of 1.5 cm to 3 cm	
3	Semi relief Stucco Decorations	These decorations have a moderate level of projection or relief, creating a partial elevation difference between the pattern and the background.	There is an approximate 0.5 cm to 2 centimeter difference in elevation between the design and the background.	
4	Low-relief Stucco Decorations	These decorations have a minimal level of projection or relief, with a subtle elevation difference between the pattern and the background.	Decorations with a range of 0.5 to 0.9 cm difference in elevation between the design and the background	
5	Non-Relief Stucco Decorations	These decorations are characterized by a flat surface with no elevation difference between the pattern and the background.	Decorations with flat ornaments which grooves the outlines of patterns and then completed by coloring them	

Table 14: The classification of the stucco decorations and their characteristic features based on the level of their projection (Author).

Some historical examples of stucco decorations can be found in ancient buildings such as *Haroonie* tomb, particularly in the architecture of the *Safavid* period (1501 CE to 1796 CE) and *Qajar* period (1794 CE to 1925 CE) (Makinejad, 2008, 65; Aghajani 1980, 71). There have been numerous examples of *Tokhme Gozari*'s stucco work have been seen in historic buildings such as *Saveh Great Mosque*, The Great Mosque in *Yazd,* and *Mashhad-e-Ardehal* in *Kashan* (Tayari 2006, 59; Farahani 2001, 251).

Figure 15: 'Tokhme Gozari' is one of the traditional stucco techniques characterized by various decorative motifs, geometric patterns, and floral designs. These decorative elements are created through engraving and filling with colorful mortar. Stucco is mixed with natural pigments to achieve different colors and applied to surfaces such as walls, ceilings, and architectural features. The Tokhme Gozari stucco work is showcased in the Saveh Great Mosque, dating back to the Safavid period (Author).

4.3 The Shaping of Stucco

Based on a review of written sources and interviews with different master craftsmen, a classification of decorative stucco can be made according to the method of shaping the stucco mortar. In addition to the stucco carving technique, other methods such as molding (Wolff 1993, 90) prefabricated (Ansari 1987, 319), or semi-prefabricated (Rab Makinejad 2008, 65) are mentioned. The main criterion in this type of classification is the method of shaping the stucco mortar.

Two main methods can be identified (1) the in-situ shaping method and (2) the mold-made method.

In-situ shaping means that after the plaster mortar is applied on the desired architectural surface such as a wall, ceiling, column, etc., and after the required time has passed for the stucco to properly set, the artist starts to shape the stucco. This shaping is often done by cutting, carving, and scratching parts of the stucco layer applied on the work surface. This method is the in-situ stucco carving technique and most of the stucco decorations that adorn Islamic architecture in Iran have been shaped this way.
In the classification based on the method of shaping the mortar, the other method is mold-making. This method had a long history in *Mesopotamia* and was a common technique during the *Parthian* period (247 BCE to 224 CE) (Schmidt 1997, 510). Many of the *Sasanid* stucco decorations found in the palaces of *Kish, Tsifoon,* and *Taq-e Bostan* (Ansari 1964, 321) were also made using molds. Sources that refer to technical details of mold-made stucco decorations generally state that in this method the plaster mortar is poured in a liquid form into molds with the negative shape of the desired design, and after the mortar has set, the plaster pieces are removed from the mold and glued to the desired location using more plaster (Makinejad 2008, 66; Sajjadi 1997, 18; Wolff 1993, 96; Ansari 1987, 319).

Based on my field studies generally, mold-made stucco decorations themselves were executed in two ways (1) the in-situ method and (2) the prefabricated method. The common feature in all these types is the use of molds. These molds could be made in different shapes and from various materials.
The field studies show that the "in-situ mold" method itself has two different techniques (1) the *Mohri* method (such as some of the *Ilkanid* stucco carving), and (2) the appliqué method (such as the stucco decorations of *Ilkanid Shamsieh Madrassa* in Yazd). Therefore, the *Mohri* technique is a method of executing decorative "in situ mold" stucco, wherein a stamp is applied onto layers of plaster that have not yet dried, allowing repetitive patterns to be imprinted onto the plaster surface (Figure 17).

The 'appliqué' method is a method of stucco decorations which is done by adhering or attaching pieces or decorations onto another surface. In architecture and handicrafts, the appliqué technique is used to affix elements of an ornamentation or structure onto other surfaces, typically using gypsum, ceramics, or other materials (Figure 16). However, there are also examples of decorative stucco where the technique is a combination of numerous methods of shaping. For example, in some stucco decorations known as *Mohri* stucco carving from the *Ilkanid* and *Qajar* periods, although the shaping was done in situ on the wall, evidence suggests that a type of mold was used as a tool for shaping as well as, some stucco decoration was moulded in situ before it set). As a result,

the differentiation of these techniques is sometimes not straightforward, and these shaping methods have been integrated into certain decorations.

Figure 16: The 'appliqué' method is a method of stucco decorations which is done by adhering or attaching pieces or decorations onto another surface. The appliqué technique is used to affix elements of an ornamentation or structure onto other surfaces, typically using gypsum, ceramics, or other materials. Floral stucco studs executed in an applique method, Shamsiyeh Madrassa, Ilkanid period, Yazd (Author).

Figure 17: One of the in-situ mold methods in stucco art is the Mohri method which can be seen in Ilkanid stucco carving, in this method the repeating patterns are executed on the plaster layer using a single template. The Mohri patterns were executed in situ using a molding technique, Jameh mosque of Isfahan, attributed to the Seljuk period (Author).

Achieving a precise classification in Iranian stucco works cannot solely rely on the level of the pattern's projection or the shaping techniques. Using these two criteria is inadequate and may result in underrepresenting the diversity of execution methods under a single category and confusion in classifying and introducing Iranian stucco artworks. In these methods, since many of the key technical features of the decorations are ignored, proper differentiation among the various branches of stucco decorations is impossible. For example, in the classification based on relief height, several completely different execution techniques are placed in one sub-category of semi-relieved stucco decorations, which are only similar in terms of the surface difference between motif and background. This is while many key technical features have not been considered. For instance, the marquetry technique, the low-relief stucco work, the molded method, and the rolling stucco method decorations (see glossary of this research for more details) , are all placed in the semi-relieved stucco decorations group. Still, the techniques, methods, and steps of each are different from the others. Table 18 shows the extent of overlap created in the different decorative types classified based on the relief or mortar

shaping method. For example, for a molded stucco decoration, which itself may have been executed ‘in-situ’, there is the possibility that it could also be one of the projecting, high-relief, semi-relieved, or low-relief types.

Stucco Decorations	**The method of Shaping**			**The Level of Projection**				
	stucco molding by hand	Molding Method		Flat or Non-Relief stucco	Low Prominent stucco	Semi Prominant stucco	Prominent stucco	Highly Prominent stucco
		Pre Formed	In Situ					
Koshtebori	×				×	×		
Marquetry	×			×	×	×		
Hollow or cavity	×	×	×			×	×	×
Cop-Bori	×					×		
Tong-Bori	×	×				×	×	×
Succo on Thatch	×				×	×		
Glass embedded stucco	×	×				×	×	
Molded stucco work		×	×		×	×	×	×
Relief stucco	×	×				×	×	×
Semi-relief or subtle stucco	×	×	×		×	×	×	
Wicking method	×	×			×	×	×	×
Mirror inlaid or mirror embedded stucco	×		×		×	×	×	

Table 18: The comparison table of the sharing points of decorative species in the classification based on the degree of prominence and the method of shaping in Iranian stucco working (Author).

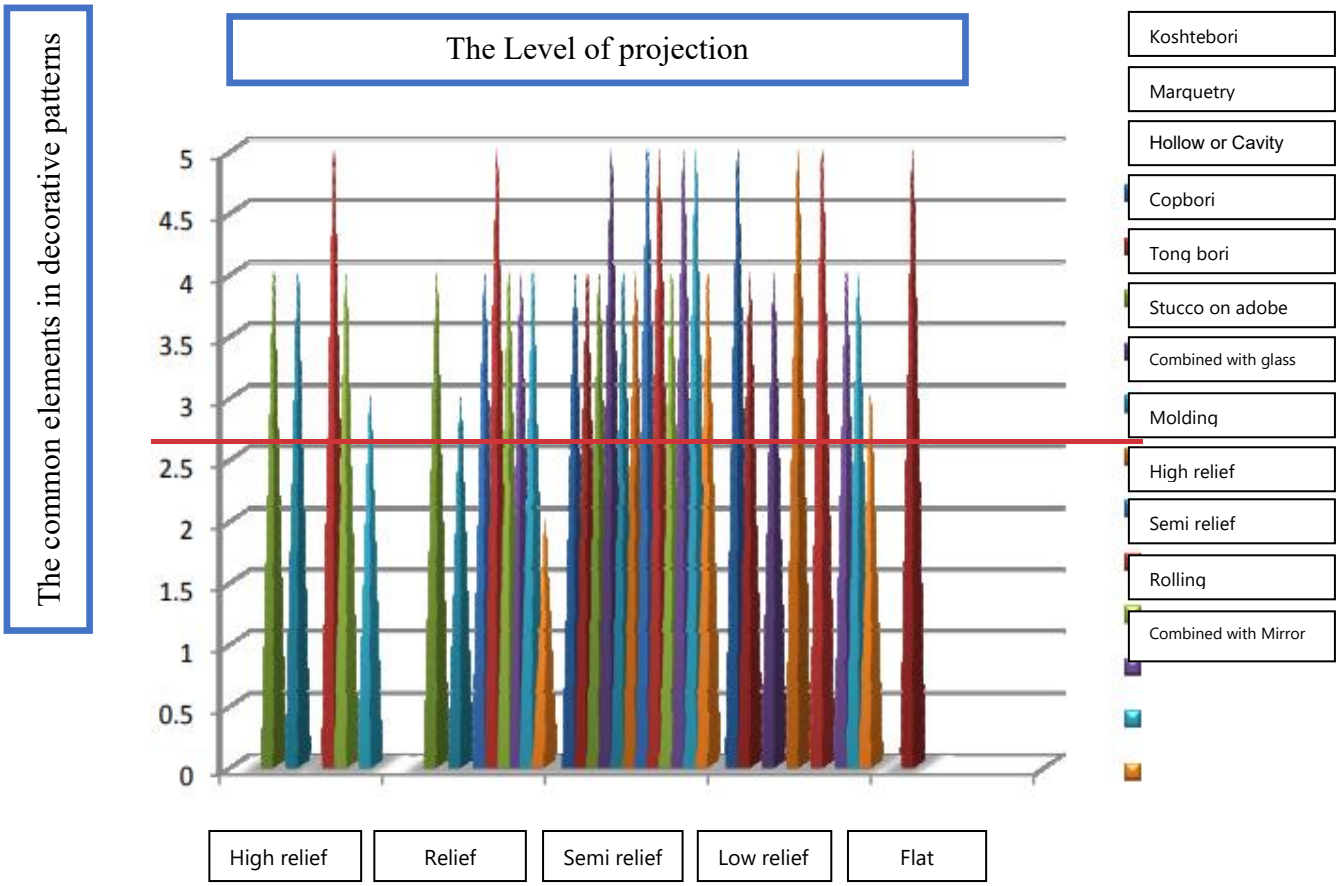


Chart 19: Comparison chart of shared aspects among decorative types in the classification based on prominence. In this chart, a different method of stucco is evaluated based on the level of projection (from flat to high relief) as well as the common elements in decorative patterns (Author).

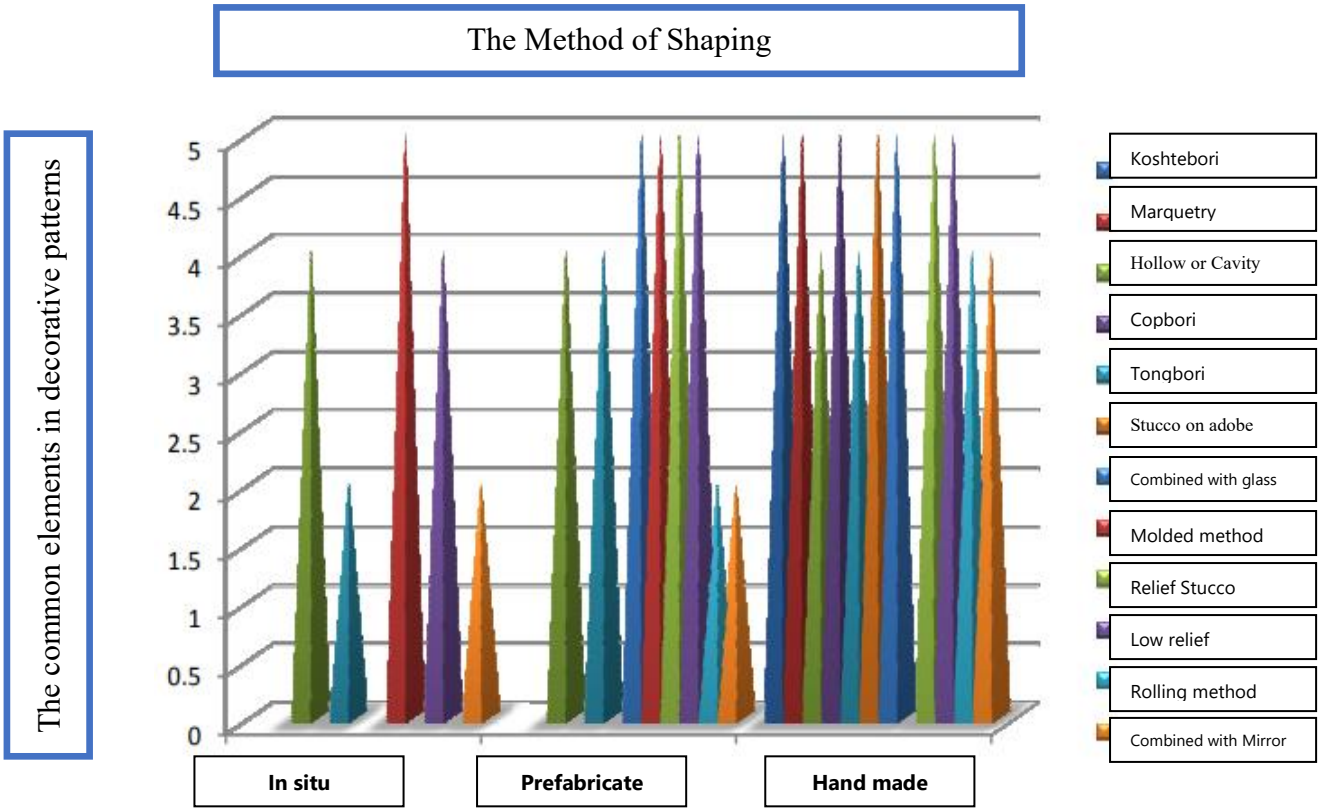


Chart 20: Comparison chart of shared aspects among decorative types in the classification based on shaping techniques. In this chart, the different characteristics of stucco are evaluated based on the method of shaping (in situ, prefabricate, handmade) as well as the common elements in decorative patterns (Author).

However, categorization based on execution details, given the need for technical studies is challenging. While detailed technical studies in conservation plans and field studies are integral parts of the necessary activities, they do not necessarily offer a suitable method for classification. This is because even within a specific technical approach, two samples can possess different execution details due to various reasons. Consequently, it seems that an appropriate classification should emerge from a blend of the two methods of shaping and level of projection as well as consideration of the execution techniques and distinctive technical tricks) which will be addressed later in the discussion) . The last criterion considers the execution techniques and unique technical method employed in creating the stucco decorations.

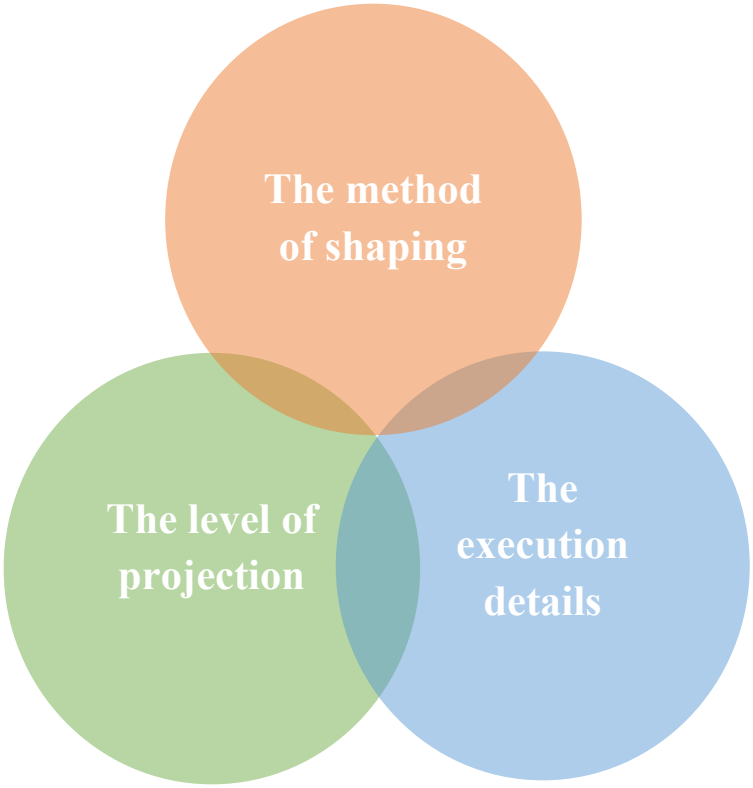


Figure 21: The integrated diagram of three different classification methods of the stucco decorations, comprising the method of shaping, the level of projection, and the execution techniques, for achieving the proper method of categorization (Author).

The binary classification system introduced in this study serves as a foundation for analysing stucco decorations. Relief height was chosen as a primary criterion (< 0.5 cm for low-relief and > 0.5 cm for high-relief) due to its clear distinction and relevance to historical execution techniques. This categorisation reflects the technical and artistic practices of different periods, offering a structured approach to organising complex data. For example, low-relief stucco is typically used for framing and paneling, with less pronounced patterns, while high-relief stucco is often associated with sculptural forms, including mihrabs and intricate façade decorations. This distinction ensures that each type is systematically placed within a broader framework for detailed analysis. Although the categorisation based on prominence levels is acceptable, due to the overlap between categories of decorations, especially in relief and semi-relief types, and because prominence is influenced by factors such as pattern density, coexistence with other decorations, modifications to the initial classification criteria, suggests two groups of stucco works relief and low-relief can be defined with the following technical feature as (1) The low-relief stucco where the difference between patterns and background is less than 0.5 centimeter. (2) The relief stucco where the difference between patterns and

background is more than 0.5 cm. This categorisation based on the level of ornamentation's prominence encompasses all techniques of stucco decoration in Iranian art, making it the most comprehensive method of classification.

Figure 22: The difference in relief stucco, between the patterns and background is more than 0.5 centimeter. Elaborate high-relief stucco decorations, Neishaboor Madrassa, attributed to the Ilkanid period, National Museum of Iran (Daneshdoust 2011, 63).

The integration of technical and stylistic features allows for a deeper understanding of stucco art. By combining relief levels and execution techniques, this classification offers a holistic perspective that aligns with both historical and technical contexts. The binary classification simplifies the analysis process while accommodating the complexity of the nine stucco types.

Finally, based on these evaluations as well as the desk-based studies, field-studies, and historical background, 9 different methods of stucco decoration have been identified in traditional Iranian architecture. In fact, all existing stucco decorations in Iranian architecture were selected for this categorisation. Subsequently, based on shaping techniques and the level of relief in the designs, overlaps, subsets, and merged elements were identified, and the redundant parts were eliminated. This process ultimately led to the identification of nine distinct and differentiated stucco techniques. Each method showcases a unique style and artistic expression, reflecting the rich cultural heritage and the mastery of stucco's craftsmanship. These diverse techniques demonstrate the versatility and innovation in decorations. Based on the classification of stucco, they can be categorised into different types depending on their origin as follows:

1. The relief stucco (*Barjasteh*)
2. The marquetry (*Moaragh*)
3. The hollow or cavity stucco (*Mojavaf*)
4. The lattice technique (Moshabak)
5. The low-relief stucco (*Kam-Barjasteh*)
6. The molded stucco (*Ghalebi*)
7. The mirror inlaid /mirror embedded stucco (*Talfigh-ba-Aineh*)
8. The stucco combined with architectural decorations (*Talfigh-ba-Masaleh*)
9. The rolling stucco technique (*Fetilei*).

This chapter presents a systematic framework for classifying Iranian stucco art, bridging gaps in previous studies and addressing ambiguities in earlier typologies. The binary classification, combined with the nine stucco types, provides a comprehensive understanding of the technical and artistic diversity of stucco decorations. This framework serves as a foundation for further exploration and analysis in subsequent chapters, contributing to the preservation and study of this significant cultural heritage. In conclusion, this chapter presents a novel classification framework for Iranian stucco art, bridging gaps in previous studies and offering a systematic approach to categorization. By combining binary classification with detailed analysis of execution techniques, this study provides a clearer understanding of the artistic and technical diversity in stucco decorations. These findings form the foundation for further exploration in the subsequent chapters.

Chapter Five: Technical Evaluation of High-Relief Stucco in Iranian Architecture

5.1 Introduction

The previous chapter categorised Iranian stucco into nine different and diverse groups based on execution methods, visual features, and specific technical characteristics (Figure 23). The following chapter provides a technical evaluation of each of these methods.

Figure 23: The integrated diagram of the final classification of the Iranian polychrome stucco decorations (Author).

This chapter presents the findings from the analysis of high-relief stucco decorations, focusing on their classification and typology. The aim is to establish a structured framework that captures the technical and artistic diversity of these decorations. By introducing a multi-layered classification system, this chapter seeks to address the challenges of organizing complex data and demonstrate the historical and cultural significance of high-relief stucco art.

The exploration of execution methods and techniques used in traditional stucco carving in Iran is ongoing and needs to be systematically evaluated and introduced. In each of these 9 main branches, some sub-branches and methods require extensive field studies and evaluations, consuming a considerable amount of time.

Considering the time constraints of the current study, the evaluation has focused on two of these 'high-relief' and 'low-relief' stucco techniques, these are also among the most extensive methods in Iranian stucco decorations. These techniques are abundantly observed throughout Iran, especially in the remaining architectures from various historical periods in the central regions of Iran. This section of the research therefore aims to identify the execution methods, various sub-branches, and techniques of both high and low-relief stucco to distinguish their shaping methods and variations and to introduce the remaining examples of these techniques. One of the main reasons for selecting these two techniques in this thesis was that these two categories of stucco work encompass numerous methods of stucco decoration in Iranian architecture and are executed in various forms and approaches. This diversity and variety can, for instance, be observed in the case of high relief stucco work, as illustrated in Figure 24.

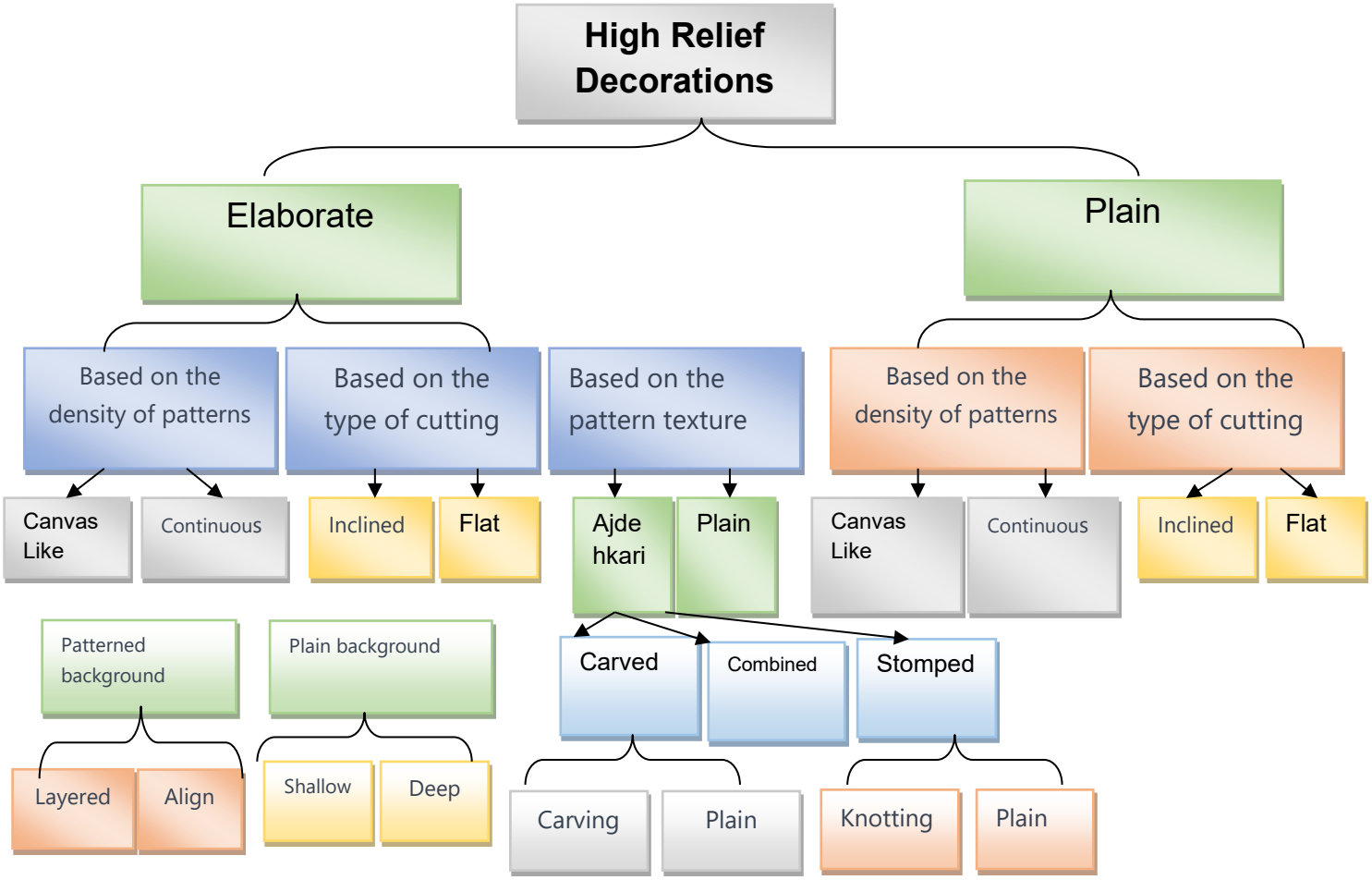


Figure 24: Classification and variation of the high-relief stucco decorations in Iranian architecture (Author).

The multi-layered classification system categorises high-relief stucco based on relief height, pattern complexity, and execution technique. This structure enables a comprehensive analysis of diverse artistic and technical approaches, providing a systematic framework for understanding these decorations.

5.2 Technical Evaluation of the High-relief Stucco

The findings from the field studies of the high-relief stucco decorations from various historical periods and regions in Islamic architecture in Iran indicate that the general method for executing relief stucco consists of six stages, namely:

- Surface preparation by applying a plaster coat.
- Execution of the initial base layer.
- Transferring the desired pattern onto the base surface.
- Application of the secondary layer selectively in required areas (only in some cases).
- Shaping the base layer through cutting, carving, and occasionally adding new pieces.
- Execution of supplementary operations (such as painting, polishing, stamping and carving).

5.2.1 Applying a Plaster Coat

Before elaborating on this part, it is necessary to first distinguish between the two distinct types of gypsum mortar:

- Killed gypsum (*Gach-e-Koshteh*)
- Lived gypsum or quick-setting gypsum (*Gach-e Zendeh*).

In general, gypsum plaster is quick-setting and dries rapidly. The quick-setting nature of gypsum means that the gypsum does not have sufficient working time to apply and smooth the gypsum over the surface. The gypsum quickly loses its plastic and malleable properties, making it difficult to work with. Slaked gypsum resolves all these issues.

Killed gypsum, or slow-setting gypsum, is made from the same gypsum plaster, but the method of preparing the killed-plaster mortar is different from regular gypsum mortar or quick-setting. This difference in mortar preparation causes the killed gypsum to have a slower setting time. As a result, *Gach-e-Koshteh* retains its plastic and malleable properties for a longer duration, giving the gypsum more time to work with and shape. It is worth noting that *Gach-e-Koshteh* has lower mechanical properties, and therefore the layer of *Gach-e-Koshteh* could be very thin. Consequently, the decorations should first be plastered with undercoat gypsum mortar to level the surface, and a thin layer of *Gach-e-Koshteh* should be applied only after the final whitewash coating.

As mentioned, the difference between *Gach-e-Koshteh* and live gypsum (or quick-setting) lies in the method of mortar preparation. In the preparation of live gypsum, after

adding the gypsum to water, a few minutes are allowed for the gypsum powder to soak in the water. However, for the preparation of *Gach-e-Koshteh*, the gypsum and water must be immediately mixed upon addition. According to interviews with traditional Iranian craftsmen regarding the process of preparing *Gach-e-Koshteh*, 'craftsman A' indicated that:

> "First, the necessary equipment for preparing the mortar is prepared. This includes a clean basin container, clean fresh water, regular gypsum powder, a trowel, a sieve, and a stick or other tool for stirring. To make *Gach-e-Koshteh*, fine-grained gypsum powder should be used to increase its flexibility and improve the quality of the work. Therefore, the plaster is first sieved. The basin container is filled halfway with water. For every 1 kilogram of gypsum, 0.7 to 0.8 liters of water is required; the amount of gypsum and water needed can be calculated based on the gypsum consumption in the architectural decorations before starting the work. Gradually add the sieved gypsum to the water while simultaneously stirring the gypsum and water. Once all the gypsum has been added, continue stirring the gypsum for an additional 10 minutes. This is the most crucial step in making *Gach-e-Koshteh*. After the gypsum has been thoroughly mixed and the mortar is smooth and homogeneous, the *Gach-e-Koshteh* plaster is ready." (Craftsman A)

As mentioned, the same gypsum used for making live-gypsum /quick-setting gypsum which is known among the traditional stucco craftsmen as *Gach-e-Zendeh* is used for making *Gach-e-Koshteh*, however, their properties are different. In the preparation of the *Gach-e-Zendeh* mortar, after adding the gypsum powder to the water, time is allowed for the gypsum to soak well in the water before mixing. This process leads to the formation of crystals in the gypsum mortar, which results in the hardening of it. But in the preparation of *Gach-e-Koshteh* mortar, since the mixing starts immediately, the formation of these crystals is prevented, and consequently, the gypsum takes longer to set.

According to the surface's roughness and non-uniformity in most base layers, it's necessary for almost every decorative method to prepare the base layer's surface for the execution of overlay and decorative layers. The first layer placed on the base's surface, tasked with leveling the unevenness of the base coat and providing a suitable background for other layers, is known as the basic coat or *āster* (Asalani 2006, 15). Common plaster coats (*āster)* in Iranian architecture are often made of mud or gypsum.

The thickness of the *āster* layer depends on the unevenness and the levelness of the base layer and can vary from 2 to approximately 20 cm. The texture of this mixture is usually coarse and rough due to impurities or coarse-grained elements within it. This

characteristic not only makes the application of the mixture more cost-effective, especially for thick applications on large surfaces but also enhances the adhesion and mechanical strength of the layers. Thus, in mud-based *āster*, besides clay, sand is normally added this includes relatively coarse silicate impurities, as well as long and tangled straw fibers.

It should be noted that additives such as fibers or straw were used to enhance the mechanical strength of gypsum, a traditional practice known as ‘tempering’ gypsum which is known among the tradition stucco craftsmen as *Gach-e Mosalah*. These additives were added to prevent thick layers of gypsum mortar from cracking. In the *āster* layer, less refined gypsum is commonly used, often containing varying amounts of ash or coal particles, burnt gypsum, and earth without sifting, sometimes accompanied by significant amounts of added earth. Additionally, the āster layer has another distinctive feature: it is applied using a technique called *Gach-e-Zendeh*, which translates to "fast-setting gypsum. Before applying the *āster* overlay in the high-relief stucco decorations, processes like scoring, scratching, and incising are typically carried out. The term ‘scoring’ refers to executing a 10x10 centimeter gypsum design on the āster’s surface (Motīfīfard 2010, 87). The work process starts by determining the stucco thickness using a scoring tool. Then, a scoring which is named *Gach-Keshi* in Iranian traditional stucco art is run on the upper area of the intended surface, followed by another scoring on the lower part, beneath the upper one. To level these two scorings, a wooden (or nowadays aluminum) lath tool is used for alignment to ensure they are entirely even. Long pieces of stucco lath are placed on the leveled surfaces of the scoring parts, filled underneath with mud mortar, forming rows of stucco screed. In the final step, the gaps between these stucco laths, are filled with the necessary plaster material (straw, clay, or gypsum). These stucco scorings act as precise control tools (screed tool) at each scored area, allowing for precise and uniform stucco application. The stucco surface of the plaster coat needs to be rough to establish proper adhesion with the base plaster layer applied in the subsequent phase (Motififard 2010, 91). This technique is mainly used for creation the of stucco on the wall and any vertical finishes.

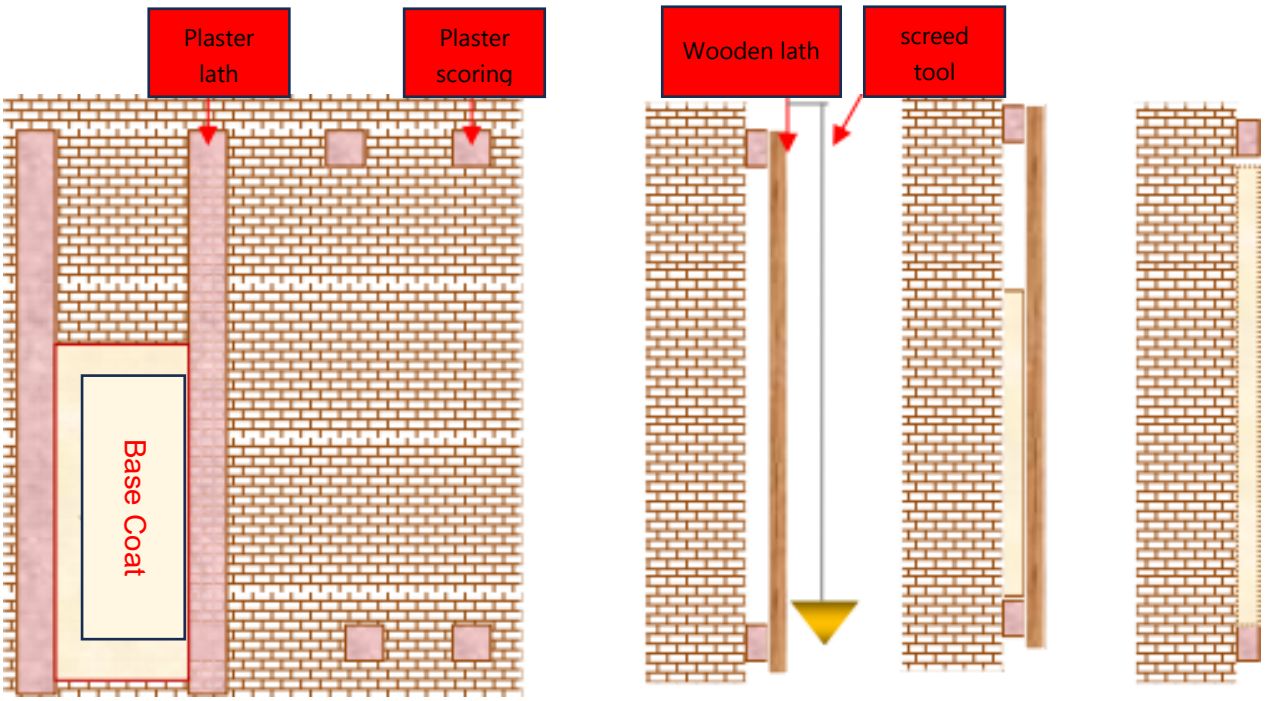


Figure 25: Design drawing of the method of applying plaster coat and sectional view of the four different Steps for plaster scoring and executing a plaster lath to application the 'Plaster-Coat' on the base:
A) Wall Elevation in Preparation for Plaster Application. Plaster Scoring, Lath Fixing, and Plaster Application.
B) 1 - Design Sketch of Wall Section, Plaster Scoring, and Screeding.
B) 2 - Design Sketch of Wall Section, Lath Fixing.
B) 3 - Design Sketch of Wall Section, Plaster Application in the Gaps Between Laths (Author).

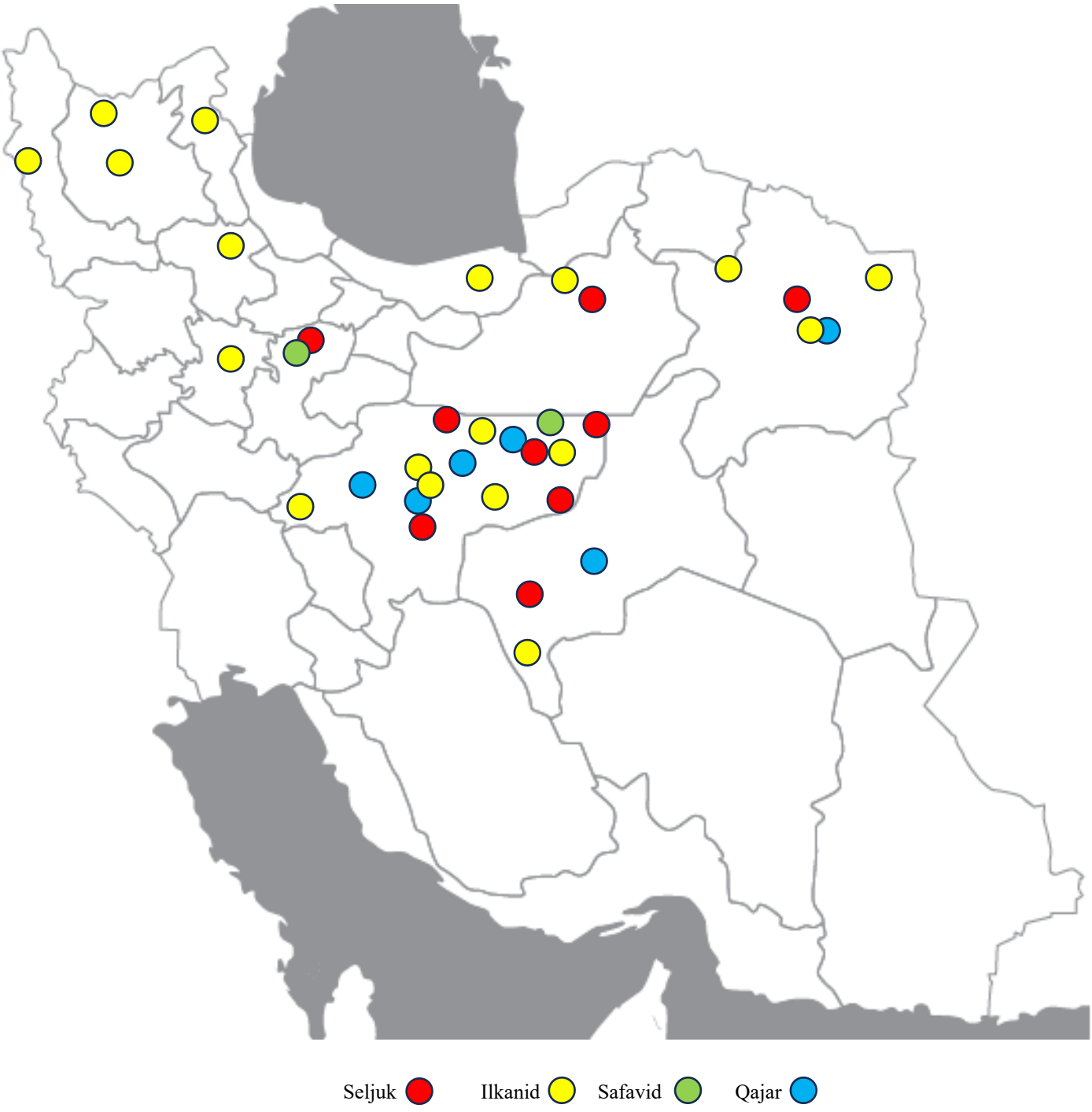
5.2.2 Studies on the High-relief Stucco

Concerning better information on the high-relief stucco in Iranian architecture, in this research field studies have been done on the 33 different decorations in historic architecture in Iran from the *Seljuk* (1040 to 1219 CE) to the *Qajar* period (1794 to 1925 CE).

Number	Historic Architecture	Location	Historic period	Decorations
1	Jameh mosque	Ardebil	Ilkanid	Simple relief stucco plaster coats with various impurities
2	Jameh mosque	Gonabad	Qajar/Ilkanid	Simple relief with flat cuts in incising lines
3	Pamenar mosque	Zavareh	Seljuk	Simple relief in Indigenous style, inclined cut method
4	Jameh mosque	Isfahan	Ilkanid/ Seljuk	Elaborately carved relief Boomnama stucco
5	Jameh mosque	Gaz-Borkhar	Ilkanid	An incised carving method stucco
6	Jameh mosque	Saveh	Seljuk/ Ilkanid/ Safavid	Simple relief decorations in flat incisions, incised lines around the patterns
7	Jameh mosque	Urmia	Ilkanid	Elaborately carved relief Boomnama with a hollowed background
8	Jameh mosque	Oshtorjan	Ilkanid	The Boomnama relief elaborated stucco ornaments
9	Jameh mosque	Maragheh	Ilkanid	The Boomnama relief elaborated flat ornaments
10	Jameh mosque	Marand	Ilkanid	Elaborate stucco decorations in Boomnama ornaments in a stratified double-coat- stucco
11	Jameh mosque	Bastaam	Seljuk/Ilkanid	The interlacing knot Ajdehkari decorations
12	Neishaboor Madrassa	Neishaboor	Ilkanid	Elaborate high-relief stucco decorations
13	Jameh mosque	Ardestan	Ilkanid/Safavid	Boomnama ornaments in a stratified ‘double coat’ method
14	Jameh mosque	Zavareh	Seljuk	Simple relief in inclined cut method
15	Jameh mosque	Abarkooh	Ilkanid	Boomnama ornaments in a stratified ‘double-coat- stucco’
16	Mosque of Faruamad	Sabzevar	Ilkanid	Relief Stucco with ash impurities
17	Farafan mosque	Varzaneh	Seljuk	Elaborately carved ‘Boomnama decorations with shallow ground
18	Bayazid, Bastam’s complex	Bastam	Ilkanid	High-relief Boomnama, with elaborated flat ornaments

19	Rascat Tower	Mazandaran	Ilkanid	Elaborate stucco decoration in the inclined method
20	Pir-Bakran Shrine	Falavarjan	Ilkanid	Kufic inscriptions in Peivasteh method
21	Emamzadeh Ahmad	Isfahan	Qajar	Polychrome ornaments in a Boomnama technique
22	House of Calligraphy	Isfahan	Qajar	Boomnama stucco working
23	Sultanieh dome	Zanjan	Ilkanid	Double coat ornaments in a stratified Boomnama method
24	Alavian dome	Hamedan	Ilkanid	Stratified double-coat stucco
25	Gaar mosque	Gaar	Seljuk	Boomnama ornaments in a stratified ‘double-coat’
26	Kolahdooz house	Yazd	Qajar	simple Ajdehkari technique
27	Sine mosque	Gaz-Borkhar	Ilkanid	Ajdehkari decorations with curvilinear motifs and colorful background
28	Sheikh Jam shrine	Torbat e Jaam	Ilkanid	Carved Ajdehkari succo
29	Emamzadeh Ismaeil	Isfahan	Ilkanid	Polychrome ‘wood carved-like’ technique in Ajdehkari technique
30	Colonel Vasigh-Ansari’s house	Isfahan	Qajar	The ‘wood carved-like’ stucco in the Ajdehkari technique
31	Seyed Shafti Shrine	Isfahan	Qajar	wood carved like stucco in the Ajdehkari technique
32	Shah-Karam mosque	East of Isfahan	Ilkanid	Carved Ajdehkari technique
33	Seyed-Gholhovala mosque	Yazd	Seljuk	Inclined incised Ajdehkari style

Table 26: Exploring high-relief stucco decorations across 33 historic architectures in Iran, spanning from the Seljuk to Qajar periods (Author).



Map 27: A scatter plot map of selected historical monuments in the geography of Iran is created to assess the high-relief stucco decorations in Iran and their historical periods using different color indicators (Author).

These field studies have indicated that in all high-relief stucco decorations, such as spirals, facade columns, vases, and similar arrays, whose protrusions sometimes reach more than 30 cm, initially, a plaster coat layer is applied to create the overall volume of the desired decoration. Then, with the application of one or several layers of the base coat plaster, the stucco operation is performed. The thickness of the base coat layer is significantly less than the plaster coat, and a major part of the carving and sculpting operations is conducted to embellish these decorations on this layer.

Figure 28: A close-up view of the plaster coat stucco with ash impurities and the base coat plaster on the part of the relief stucco decorations indicates that the plaster coat layer is applied to create the overall volume of the desired decoration. Then, with the application of one or several layers of the base coat plaster, the stucco operation is performed. mosque of Faruamad in Sabzevar, Ilkanid period (Author).

The results of field studies and experiments conducted on samples of gypsum coats used in the underlying of stucco decorations in the *Jameh* mosque of *Ardebil* and the *Ardestan* mosque confirm the presence of various impurities in the plaster coat mortar.

Figure 29: plaster coats used in the underlying layers of stucco decorations confirm the presence of various impurities in the plaster coat mortar. Plaster coat decoration in the vicinity of the Mihrab of the Jameh mosque of Ardebil (Author).

5.2.3 Base coat and plastering

The base layer can be carried out in one or multiple layers depending on the desired design and the level of prominence of different patterns present in the design. In preparing the plaster needed for smoothing the base, finely sieved gypsum without additives or impurities is utilised.

The preparation of the base plaster in ornamental gypsum highlights is commonly done using semi-hydrated gypsum. This plaster, in terms of water content and mechanical manipulation (molding), is prepared in a way that lies between the methods of preparing the 'quick-setting' gypsum *(Gach-e-Zendeh)* and the killed gypsum *(Gach-e-kosher)*. The 'quick setting' gypsum exhibits better mechanical strength compared to the 'killed' gypsum and thus is less susceptible to damage in thicker applications. Additionally, the 'killed' gypsum's hardness is lower than that of 'quick setting', allowing for easier cutting and carving for skilled stucco artists. After applying the gypsum undercoat, its thickness may vary between 0.5 to 5 cm, depending on the number of layers and stages of stucco creation.

The desired design could then either be directly delineated onto the plaster surface, as seen in artifacts from the Ilkhanid period (1256 CE to 1353 CE). Alternatively, the design could be transferred onto the surface using the 'Charcoal Pouncing Tool,' a method known as *Garteh Kardan* in Iranian traditional art, which became a common technique during the Safavid period and thereafter.

cm. The Charcoal Pouncing Tool is a transfer tool using charcoal powder consisting of bags filled with black charcoal powder. By tapping them on the plaster surface, charcoal powder is released. In this method, a piece of paper with the desired design drawn on it is placed on the plaster surface. Previously, the surrounding lines of the design were fully perforated, and the bag containing charcoal powder was applied in a tapping

motion along the perforated lines surrounding the design. This process continues until all the peripheral lines of the design are covered with charcoal powder. Then, after removing the paper from the design, the entire design is transferred onto the plaster surface. Subsequently, the following stages of stucco working include at first, scraping off the designs, known as *Garteh Kardan*, followed by cutting the perimeter lines around the designs. Secondly, carving and hollowing out the surrounding background to highlight the designs which in some cases, even within a single layer of stucco, the designs had been done in two different depths, which is termed as 'undercutting' (Motefefifard 2010, 90). Finally, carving and adding volume to the raised surfaces of patterns, and in some cases, executing the stucco working and multiple carvings a few times.

Although the execution methods and their sequence can generally be considered overarching principles in most relief stucco decorations, field studies for identifying and categorizing existing artifacts reveal a remarkable diversity in the visual appearance of these decorations. This significant diversity might partly relate to technical considerations, yet what is predominantly observed largely correlates with tastes, artistic expertise, and the intentions of the creators of these works. Overall, relief stucco decorations can be broadly categorised into two groups: simple and elaborate. Each of these two groups can further be divided into smaller subgroups.

5.2.4 Simple relief stucco decorations

In the simple relief stucco decoration, creating the designs is achieved solely by making simple incisions using plaster carving tools. In this category, carving rarely occurs, with the major shaping of the stucco being executed through simple cutting. Examples of simple relief stucco decorations include remnants found in various locations such as the *Masjid-e-Jameh* in *Gonabad* (Figure 30), *Pamenaar* mosque in *Zavareh* (Figure 31) from the *Seljuk* period (1040 CE to 1219 CE), (Ghadar 2002, 180; Honarfar 197, 201), parts of the *Ilkanid* (1256 CE to 1353 CE), relief stucco in the *Masjid-e-Jameh* of *Gaz-e Borkhar* (Figure 32), remaining sections of the *Seljuk* inscriptions in the western Ivan of the *Masjid-e-Jameh* in *Saveh* (Figure 33), portions of decorations in the *Ardebil, Jameh* mosque, and numerous other specimens. These can be classified as instances of simple relief stucco decorations.

Figure 30: The remnants of simple relief stucco designs, flat cuts, executed by incising lines around the pattern, Jameh mosque of Gonabad (Author).

Figure 31: Simple relief stucco decorations in Indigenous style, inclined cut method, Pamenar mosque i Zavareh, Seljuk period (Author).

Figure 32: Simple relief stucco decorations executed using an incised carving method on the surface of patterns, Jameh mosque in Gaz-e-Borkhar, Isfahan, attributed to the Ilkanid period (Boroumand 2023).

Figure 33: Simple raised gypsum decorations, flat incisions, incised lines around the patterns, Jameh mosque of Saveh, Ilkanid period (Aslani 2023).

It is important to note that this simplicity is not tied to any specific historical period. As mentioned before, it is more related to aesthetic tastes, artistic skill, and the intentions of the creators of these works. Consequently, during a single period and within a single structure, alongside simpler decorations, highly elaborate relief stucco works were also executed.

Some of the simple relief stucco examples exhibit a degree of simplicity that might appear as unfinished work. For instance, in the initial relief stucco works in the *Jameh* mosque of *Gonabad* or the *Ilkanid* decorations in the *Jameh* mosque of *Gaz-e-Borkhar*, the method for highlighting patterns only involved relatively deep incisions into the gypsum base layer. In these simpler relief stucco works, as seen in the *Gonabad* example, incisions into the gypsum base were made around the design lines to accentuate the pattern. In some cases, such as parts of the *Jameh* mosque of *Gaz-e-Borkhar*, cutting and incising the plaster base have been applied directly onto the surface to create the design. Polychrome is achieved by adding a pigment powder to gypsum before the process of shaping to create a polychrome stucco decoration which is depicted in the simple relief stucco decorations in indigenous style, inclined cut method in *Pamenar* mosque in *Zavareh*, from *Seljuk* period (1040 CE to 1219 CE), (Figure 31) as well as *Jame* mosque in *Gaz-e-Borkhar,* attributed to the *Ilkanid* period (Figure 32).

5.2.5 Elaborate relief Stucco decorations

The elaborate relief stucco decorations refer to embellishments that, following the primary processes described for simple relief decorations, where initially only grooves are created on the gypsum layer to highlight patterns, involve additional steps by the artist. These steps might include additional actions like additional cuts, carving parts of the design or background, hollowing, or elevating certain segments of the pattern, creating supplementary decorations, and similar techniques to further embellish and enhance the created patterns or text. Some examples of this type of elaborate stucco work are the *Rascat* Tower stucco decorations (Figure 34). In these, after initially cutting and creating the overall relief pattern, some of the patterns had their edges, surfaces, and lines curved by executing inclined cuts and carvings on the sharp corners. Regarding the polychrome samples in this stucco working method, it should be added that the colorful ornaments were created with the mixture of pigments in the stage of stucco working, especially in the base-coat layer which the trace of this can be seen in the decorative border of the *Rascat* tower in *Mazandaran* mostly in the red and blue color, which is attributed to the *Ilkanid* period, 1256 CE to 1353 CE, (Figure 34).

Figure 34: The colorful ornaments were created with the mixture of pigments in the stage of stucco working, especially in the base-coat layer. A close-up view of the elaborate stucco decorations with additional cutting and carving along the edges of the patterns using an inclined method is evident in the decorative border of the Rascat tower in Mazandaran.
This is attributed to the Ilkanid period (Author).

5.2.5.1 Elaborate stucco decorations based on the density of ornaments

In evaluating the differences in the remaining samples of elaborate high-relief stucco decorations in Iranian architecture, two different types of stucco working can be seen which can be categorised based on the density of the patterns. The 'continuous' is named *Peivasteh* (Figure 35), where patterns are densely arranged together, and the 'canvas-like' which named *Boomnama* (Figure 36), which refers to a decorative technique where noticeable space exists between the patterns, and so the background (which is in traditional plasterwork art terminology, the background is named 'Canvas' or *Boom* in Farsi language) displays its field and among the patterns, it is well seen and distinguishable.

Figure 35: The continuous' which is named 'Peivasteh' stucco decoration, where patterns are densely arranged together. Elaborate and continuous relief stucco ornamentation, Kufic inscriptions on brick structure, Pir-Bakran Shrine, Ilkanid period (Author).

Based on the density of elaborated relief stucco decorations, there have been significant uncertainties regarding the execution technique and methodology of these sophisticated decorations. As a result, interviews conducted with two seasoned craftsmen gave insights into the execution process of the different layers. Considering the repairs he had done on the *Kufic* inscriptions of brickwork at the *Pir-Bakran* shrine (Figure 35) craftsman A commented:

> "The process is such that the entire thickness of the gypsum layer has been applied onto the surface of the wall. Following the transfer of the design onto this plaster layer, I proceeded by cutting and removing portions of the plaster layer's surface." (Craftsman A)

This approach extends to examples of *Boomnama* stucco working where there is a high density of stucco patterns, such as the low-relief high-density relief style at *Emamzadeh Ahmad* in *Isfahan* (Figure 36 and Figure 37) or the elaborate 'canvas-like' stucco belonging to the *Sultanieh* dome in *Zanjan* (Figure 38).

The sophisticated polychrome ornaments with the color in both the base coat and the plaster coat can be seen in elaborate *Boomnama* relief stucco ornamentation in *Emamzadeh Ahmad*, *Isfahan* from the *Qajar* period (1794 CE to 1925 CE), (Figure 36).

Figure 36: The wonderful sophisticated polychrome ornaments had been created in a Boomnama method, with the color in both the base coat and the plaster coat. Elaborate relief stucco ornamentation, Emamzadeh Ahmad, Isfahan, Qajar period (Author).

However, in some examples of the *Boomnama* stucco working, such as the highly decorated relief stucco decoration seen in the House of *Calligraphy* (Figure 37), it is observed that the background or base of the decorations has claimed a considerable surface. The stucco's patterns, sparsely distributed with minimal density, are notably distanced from each other.

In this case, the profuse pattern, decorations, and the difference in level between the motif and background could be very difficult and time-consuming. However, craftsman B, who has good expertise and skill specifically in elaborate *Qajar* period (1794 CE to 1925 CE) relief decorations indicated that:

> "In such adornments, for ease of execution and to save time and resources, we opt to apply the gypsum plaster only in necessary areas based on the relevant pattern and the arrangement of designs on the decorative surface, rather than covering the entire surface of the work." (Craftsman B)

Figure 37: In some examples of the Boomnama stucco working, it is observed that the background or base of the decorations has claimed a considerable surface. The plain and paint-style relief stucco ornamentation with a deep base coat, House of Calligraphy, Isfahan, Qajar period (Author).

It is important to note that recently for better adherence of the stucco's patterns to the wall, a localized background layer has been applied on the rough stucco surface. Following the completion of the stucco decorations and shaping the patterns, they proceeded to execute the underlay in the flat base around the relief *Boomnama* stucco work designs. Over time and due to environmental conditions or technical flaws, a separation between the edges of the *Boomnama* patterns and the background layer occurs, which serves as a characteristic feature of this method. For instance, the separation and lines of demarcation observed along the edges of the *Boomnama* stucco patterns in the decorative margin of the *Raskat* tower in *Mazandaran* (Figure 34) indicate that the gypsum background layer has been applied after the formation of the stucco decorative patterns, in the spaces between the executed patterns.

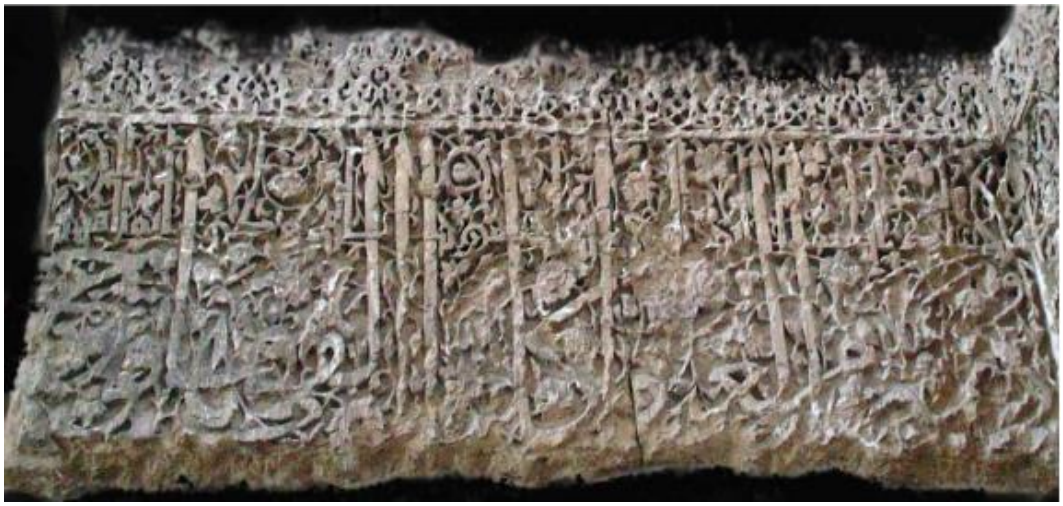


Figure 38: The elaborate Boomnama stucco belonging to the Sultanieh dome in Zanjan. The separation and lines of demarcation observed along the edges of the Boomnama stucco patterns in the decorative margin of this decoration indicate that the gypsum background layer has been applied after the formation of the stucco decorative patterns, in the spaces between the executed patterns (Aslani 2023).

Furthermore, there are other examples of relief-style decorations that, based on the method of carving and shaping the background, can be observed in two types: 'shallow' and 'deep background'. In the deep types of stucco backgrounds, the designs are relief and easily visible. For instance, the relief-style backgrounds of earthen decorations seen in *Rascat Tower* (Figure 34), as well as *Emamzadeh Ahamad* and the House of *Calligraphy*'s stucco decorations (Figure 36 and Figure 37), all belong to the category of elaborate relief-style earthen decorations with a deep background.

5.2.5.2 The relief *Boomnama* technique in shallow and deep background

Based on the field studies there are different modes in the simple *Boomnama* shallow technique applied to backgrounds where the cutting and carving of stucco are performed in a method that gives the appearance of decorative motifs resembling intertwined, hollow stucco patterns. While there is evidence suggesting the prevalence of this method in the *Seljuk* period (Figure 39) or even earlier periods, such as sections of stucco decorations unearthed in *Neishaboor* dating back to the *Ilkanid* period, or artifacts attributed to the 12th and 13th centuries BCE from *Rey* (Figure 39), the peak usage of

this method can be observed in exceptional examples from the *Ilkanid* period (1256 CE to 1353 CE). For instance, in unique sections of architectural elements like the *Mihrab* of the *Urmia Jameh* mosque (Figure 42), the northern *Ivan* of the *Isfahan Jameh* mosque (Figure 41), or the *Mihrab* of the *Farafan* mosque (Figure 43).

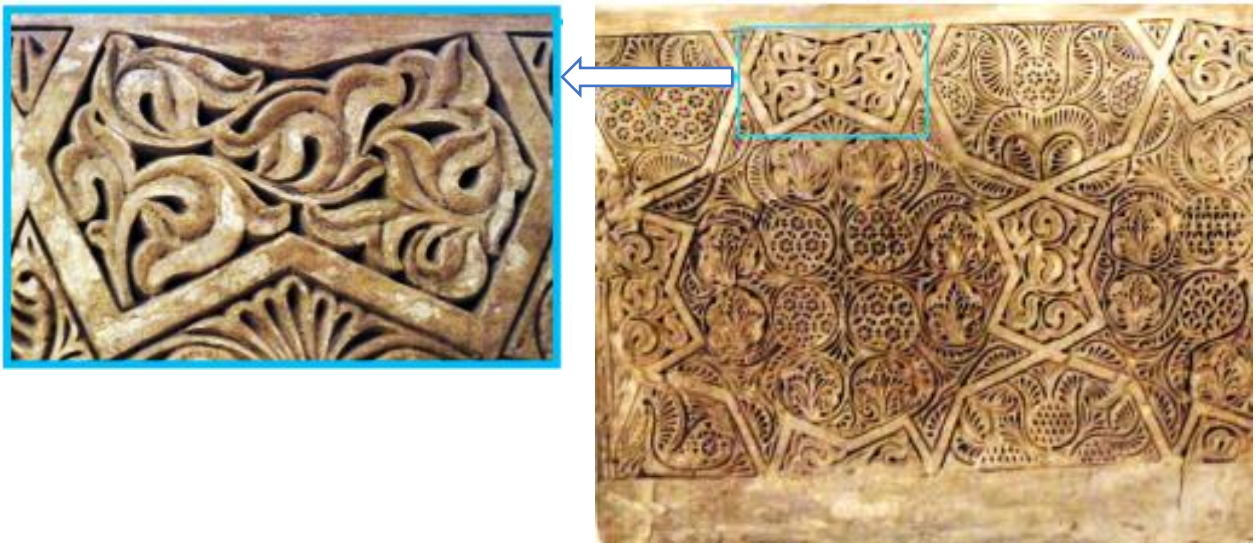


Figure 39: In the simple Boomnama, the shallow technique is applied to backgrounds where the cutting and carving of stucco are performed in a method that gives the appearance of decorative motifs resembling intertwined, hollow stucco patterns. The relief, elaborate stucco decorations executed in a Boomnama with a hollow effect, discovered in Rey, dating back to the 12th and 13th centuries (Daneshdoust 2011, 27).

Figure 40: The relief Boomnama stucco piece adorned with human motifs and ornate arabesques embellished with vegetal patterns, executed in the Boomnama technique and shallow, dating back to the Seljuk period. Currently housed in the Metropolitan Museum of Art, New York City (Metropolitan Museum of Art 2023).

Figure 41: The section of elaborately carved relief Boomnama stucco working with a hollowed background, from the northern Ivan of the Jameh mosque of Isfahan, dating back to the Ilkanid period (Boroumand 2023).

Figure 42: The part of elaborately carved relief Boomnama stucco working with a hollowed background, from the side margin of the Mihrab in the Jameh mosque of Urmia, dating back to the Ilkanid period (Author).

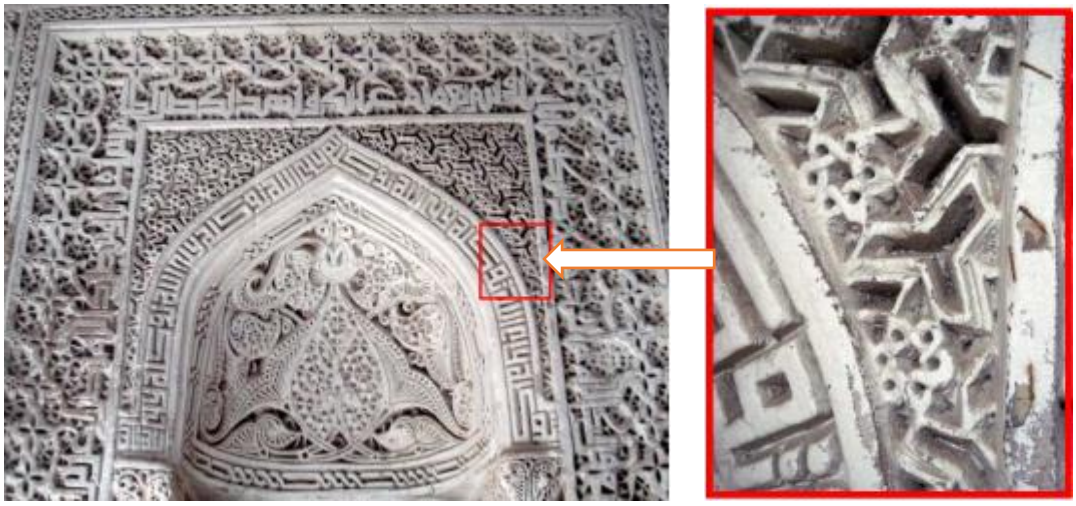


Figure 43: The left side: Part of elaborately carved relief Boomnama Stucco decorations with shallow ground base, Farafan mosque's Mihrab, in Varzaneh Seljuk period. The right side: The nearby view shows how the cuts were made for the shallow grounding and the patterns (Author).

As seen in the above images (Figure 43), this decorative technique results in a very delicate and elaborate appearance to the stucco surfaces and is achieved solely by skillfully and deeply cutting portions of the plaster layer. Employing a beveled technique during the cutting and carving process in the angle relative to the base surface. As illustrated above (Figure 44), this method of grounding results in the concealed thickness of the plastering areas on the facing surface. Consequently, not only do the edges appear much finer than their actual thickness, but the overall appearance resembles a woven texture or intertwined hollow patterns.

Given that in this stucco's technique, numerous and intricate patterns are executed in multiple layers, the endeavor of the stucco's artist has always been to showcase their artistry and skill in a method that creates a multidimensional space full of shadows and prominent and recessed motifs in a single color. They work with this material in a way that, despite the need to use paint in executing these arrays, they can even display the motifs to their audience from a distance and manifest their artistry.

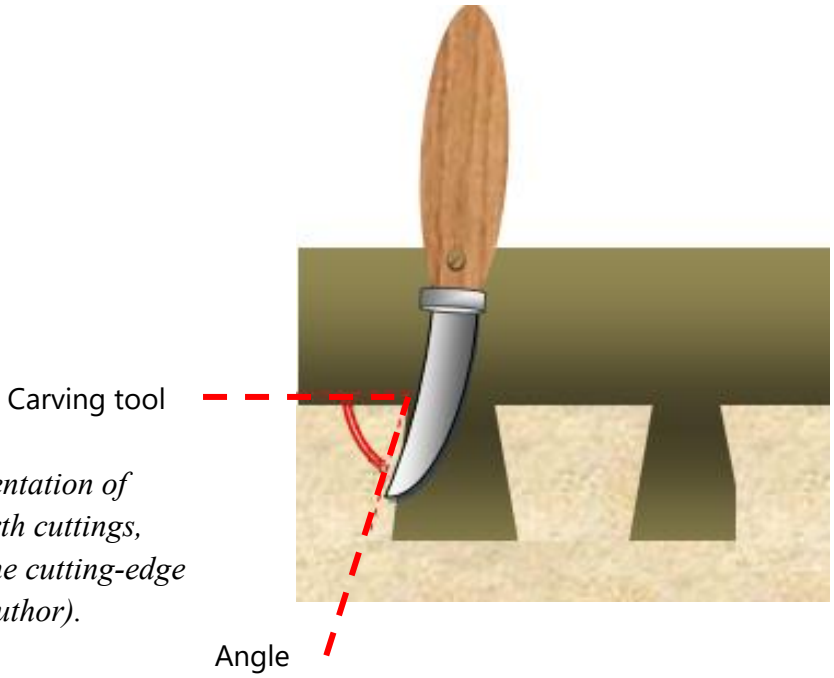


Figure 44: A schematic representation of the elevation and section of earth cuttings, displaying the angle between the cutting-edge and the background surface (Author).

It should be noted that the important part of relief and elaborate stucco working in Islamic Iran is where the base coat (background) is also decorated. We can categorise them as 'relief elaborate *Boomnama* decorations with patterned backgrounds. In these decorations there is a distinctive difference in the level of primary ornaments with their background as relief stucco in the inscription panel in *Bayazid* complex in *Bastam* (Figure 45), parts of stucco decorations in *Farumad* mosque in *Sabzevar* (Figure 46), the inscription beneath the arch of the northern porch of the *Jameh* mosque of *Oshtorjan* (Figure 47). Additionally, various relief stucco patterns have been executed in the *Boomnama* style, where, in contrast to previous techniques, there is no difference in the level of projection between the ornaments and their background, and they are almost flush with each other.

Samples of this kind of Islamic decorations can be seen in the parts of the decorations in *Uljaytu*'s *Mihrab* in *Jameh* mosque, *Isfahan*; *Jameh* mosque in *Maragheh* (Figure 48); The remaining part of *Mihrab* in *Jameh* mosque in *Golpaigan*; The *Seljuk Mihrab* of *Jameh* mosque in *Saveh; are* the samples of these 'flat' technique.

Figure 45: In some stucco decorations there is a distinctive difference in the level of primary ornaments with their background. The relief is Boomnama, elaborated flat ornaments in the stucco working of Bayazid, Bastam's Kufic script inscriptions (Aslani 2023).

Figure 46: The Boomnama relief elaborated flat ornaments in the stucco of Jameh mosque, Farumad in Sabzevar (Aslani 2023).

Figure 47: In these decorations, there is a distinctive difference in the level of primary ornaments with their background. The Boomnama relief elaborated stucco ornaments which are in binary (flat and shallow both) technique, the northern Ivan of Jameh mosque, Oshtorjan (Author).

Figure 48: In the Boomnama background, there is no difference in the level of primary layer with the ornaments and their background. The Boomnama relief elaborated flat ornaments in the stucco of the Mihrab of Jameh mosque in Maragheh (Boroumand 2023).

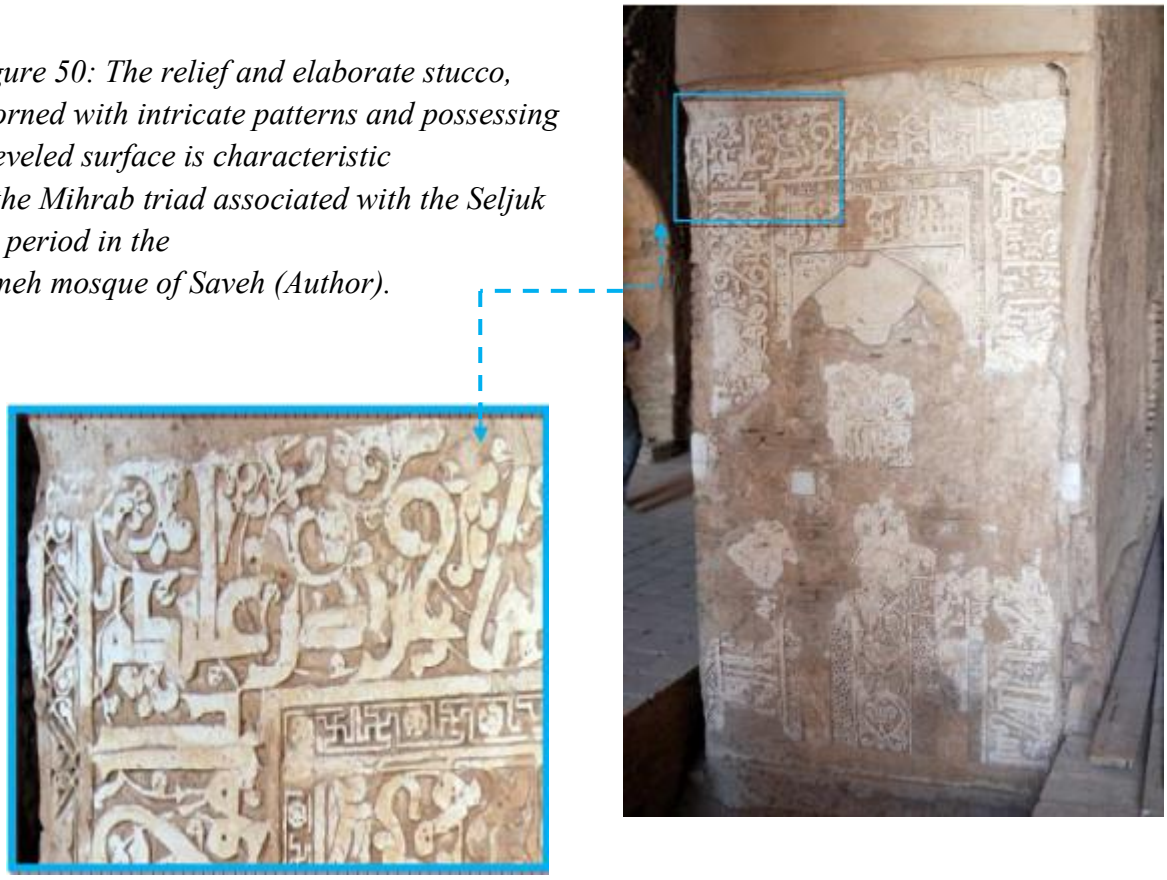
In this type of ornamentation, there is a very interesting and unique technique for executing relief designs. In the process of cutting and carving the stucco layer of the substrate to highlight the patterns, cutting can be done in a flat or inclined method (Fig 49). The difference between the two types of flat and inclined cutting can be discerned with a little precision in the edge of the cut areas. In the flat type, the angle formed between the surface and the wall of the substrate, which is the edge between the stucco's surface and the carved area, is almost perpendicular. However, in the inclined method, the perpendicular edge between the surface and the wall of the substrate is curved or beveled.
In the book *Architectural Decorations,* the term 'rough stucco' is used for the flat method and 'relief stucco' for the inclined method (Makinezhad 2008, 71).

The flat method *The inclined method*

Figure 49: Drawing of sections of two types of embossed stucco work in the relief Boomnama elaborated stucco ornaments in Iranian architectural decorations (Makinezhad 2008, 73).

As noticeable in the above figures, these decorations might have been executed in an inclined method similar to the examples in *Bayazid Bastam*, *Farumad*, *Oshtorjan*, *Maragheh*, and *Saveh* (Figure 50), with a flat-cutting technique. Alternatively, they could resemble the middle section of the *Mihrab* of *Uljaytu* in the *Jameh* mosque of *Isfahan* (Figure 51 and Figure 52), executed with additional cutting and carving on the edges of the patterns (in an inclined method), creating a rounded and curved state on the surface of the patterns. In some instances, like the *Mihrab* of *Kohpayeh* mosque, a combination of both methods mentioned might have been employed.
It is worth noting that in the remnants of the embossed stucco of *Golpayegan's Mihrab*, on the margin ornamented with *Quranic* verses, the cutting method has letters in a flat view, and the surface of the foliage arrays surrounding the inscribed letters has been inclined cut and carved. One common technical feature in all embossed stucco with a leveled surface is that in this type, the execution of all layers or the stucco panel is uniform and in one stage. In other words, this method does not require the implementation of successive layers of stucco locally for embossing specific areas of decoration.

Figure 50: The relief and elaborate stucco, adorned with intricate patterns and possessing a leveled surface is characteristic of the Mihrab triad associated with the Seljuk the period in the Jameh mosque of Saveh (Author).



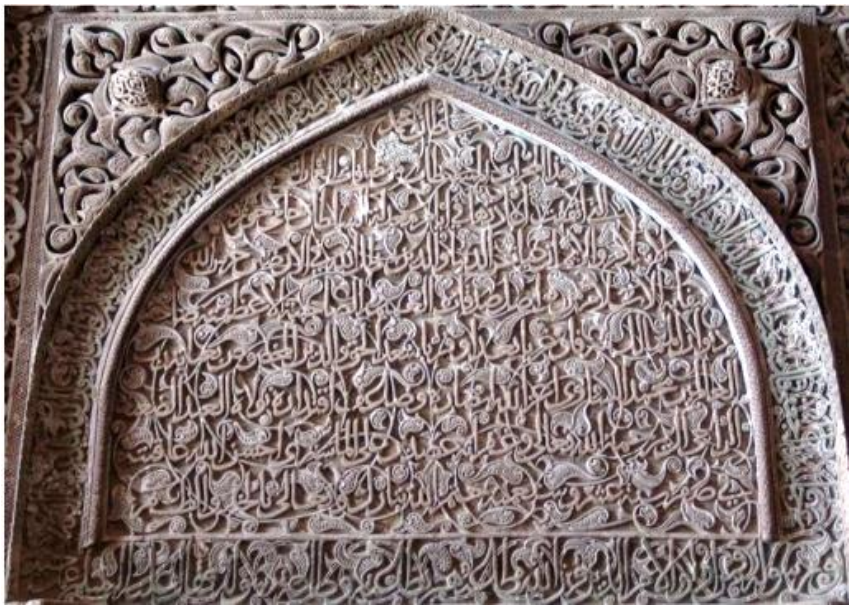


Figure 51: The relief elaborate Boomnama stucco in a dual (plain and patterned) flat style with small lace-like patterns, in the middle section of the Mihrab of Oljaytu's mosque in Isfahan, dating back to the Ilkanid period (Author).

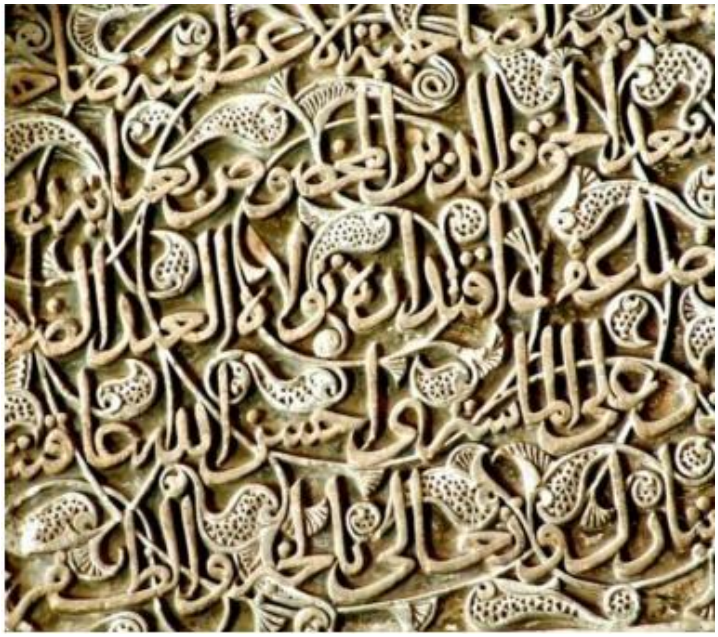


Figure 52: Close-up view of elaborated decorated Boomnama stucco work in a dual (plain and patterned) elevated style of the homogeneous type, located in the middle section of the Mihrab of Uljaytu's mosque in Isfahan, dating back to the Ilkanid period (Author).

5.2.5.3 The *Boomnama* relief stucco (stratified)

In the field studies and evaluation of the historic elaborated relief stucco works in a *Boomnama* method there is a technique that can be named stratified (*Motabagh*). Among the traditional craftsmen there is an idiom which is concave and convex; or depressed and elevated. While the terms concave and convex are somewhat vague and can be confused with other decorations, depressed and elevated a suitable term that can be synonymous with this type of ornamentation, this means creating a difference in level between the components of a decorative design by applying layers of stucco's decorations. However, depressed and elevated means that after cutting flowers and leaves using a chisel, hammer, and round bump, they cover the entire surface based on the existing pattern and relevant rotations. (Motififard 2010, 79).

The stucco-working artists creating these kinds of works must anticipate the final thickness, surface level, and form of each part of the stucco infill. As Pope says:

> "It requires a strong memory, visualization, and high precision to ensure that the result of the work is reasonable and free from confusion and ambiguity" (Pope 1965, 38).

Typically, in these decorations, the process has been such that the main patterns and background designs are carved at varying depths into a single surface. This method, in traditional terminology, is called *Yek-Gacheh* or 'Single-coat-stucco' (Aazami 2011, 109; Motififard 2010, 32). However, in some cases, to create more contrast between the main patterns and textural designs, additional plaster layering may be employed. Sections of relief and elaborated crafted plastering which is *Boomnama*, stratified ornamentations, of the embossed indigenous pattern type, are found in the *Jameh* mosque of *Oshtorjan* (Figure 55); parts of the *Ilkanid Mihrab* in the *Jameh* mosque of *Saveh* (Figure 53); the inscription of the *Mihrab* in the *Jameh* mosque of *Farumad* (Figure 54); significant portions of *Kermani Mihrab* arrays in the shrine of *Sheikh-e-Jaam*; and the lintel and portal spandrel of *Pir-Bakran* shrine's entrance (Figure 56). Examples of patterned relief stucco are considered the *Yek-Gacheh* technique.

Figure 53: In some stucco decorations, the main patterns and background designs are carved at varying depths into a single surface. This method, in traditional terminology, is called 'Yek-Gacheh' or 'Single-coat- stucco'. Part of the relief and elaborate stucco decorations in Boomnama ornaments have been executed in a stratified 'Single-coat- stucco' method, Mihrab Ilkanid of Jameh mosque in Saveh (Borumand 2023).

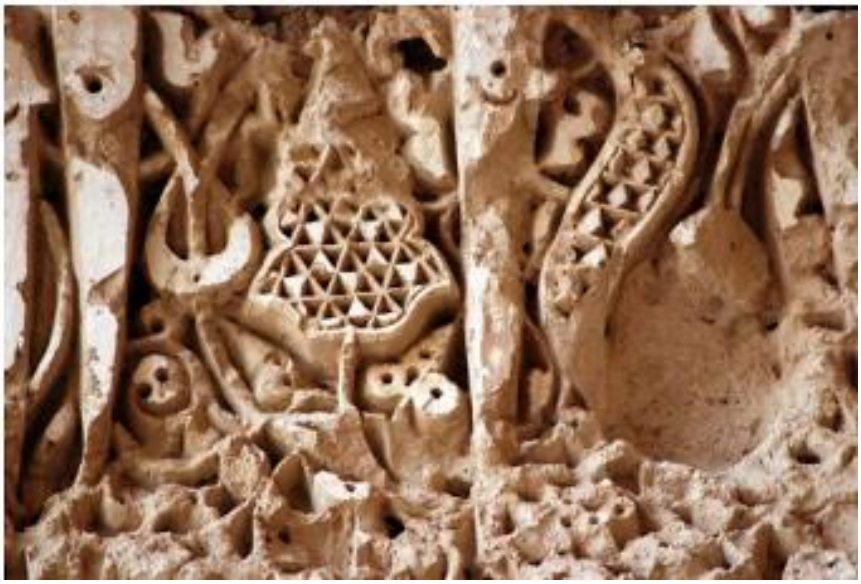


Figure 54: In the Single-coat- stucco decorations, the main patterns and background designs are carved at varying depths into a single surface. Part of the relief inscription in a stratified 'Single-coat- stucco or Yek-Gacheh method of the Mihrab in the Jameh mosque of Farumad, Sabzevar (Peimani 2023).

Figure 55: Part of the relief and elaborate stucco decorations in Boomnama ornaments which have been executed in a stratified 'Single-coat- stucco' method, Ilkanid decorations of Jameh mosque in Oshtorjan (Author).

Figure 56: Part of the relief and elaborate stucco decorations in Boomnama ornaments which have been executed in a stratified Single-piece- stucco method, Ilkanid decorations of the lintel and portal spandrel of Pir-Bakran shrine's entrance (Author).

In general, there were ambiguities and questions about how this technique was implemented. The interviews gave additional insight craftsman A noted two general methods have been used for executing the concave and convex forms of the plaster infill. In this regard, he said:

> "The first method, which is known as *'Yek-Gacheh'* is similar to the flat type and involves the uniform execution of all layers in one stage. The second method involves the execution of the base layer or layers of plaster infill in two or several separate stages." (Craftsman A)

This method is known as 'double-coat-stucco' or *Do-Gacheh,* or 'triple-coat-stucco' *Se-Gacheh* (Aazami 2011, 32; Javdani 2008, 114). In this approach, after executing one phase of plaster infill and determining the overall form of the decoration, localized areas requiring more prominent raised surfaces undergo re-plaster infilling, in a *Do-Gacheh* or *Se-Gacheh* method.

Numerous examples of stucco belonging to or associated with the *Ilkanid* period (1256 CE to 1353 CE), such as sections of intricately crafted and indigenous patterned relief stucco ornamentations in artifacts like the *Mihrab* of the *Jameh* mosque of *Marand* (Figure 57), *Alavian* dome in *Hamadan* (Figure 58), parts of the *Mihrab* of the *Jameh* mosque of *Ardestan* (Figure 59), remnants of stucco's decorations in the *Gaar* mosque

in the east of *Isfahan* (Figure 60), the crown and central part of the *Mihrab* of the *Jameh* mosque of *Oshtorjan* (Figure 61), the *Mihrab* of the western *Ivan* in the *Jameh* mosque of *Abarkooh* (Figure 62), the *Mihrab* of *Pir-Bakran* shrine (Figure 63), and parts of the precious *Mihrab* of *Oljaytu* in the *Jameh* mosque of *Isfahan* (Figure 64) have been executed using the method of '*Do-Gacheh'or 'Se-Gacheh'*.
Upon examining the damaged sections of some of these elements the uniform separation and shedding of stucco layers can be observed on the surface tracing back the number and various stages of execution of the base layers (Figure 64).

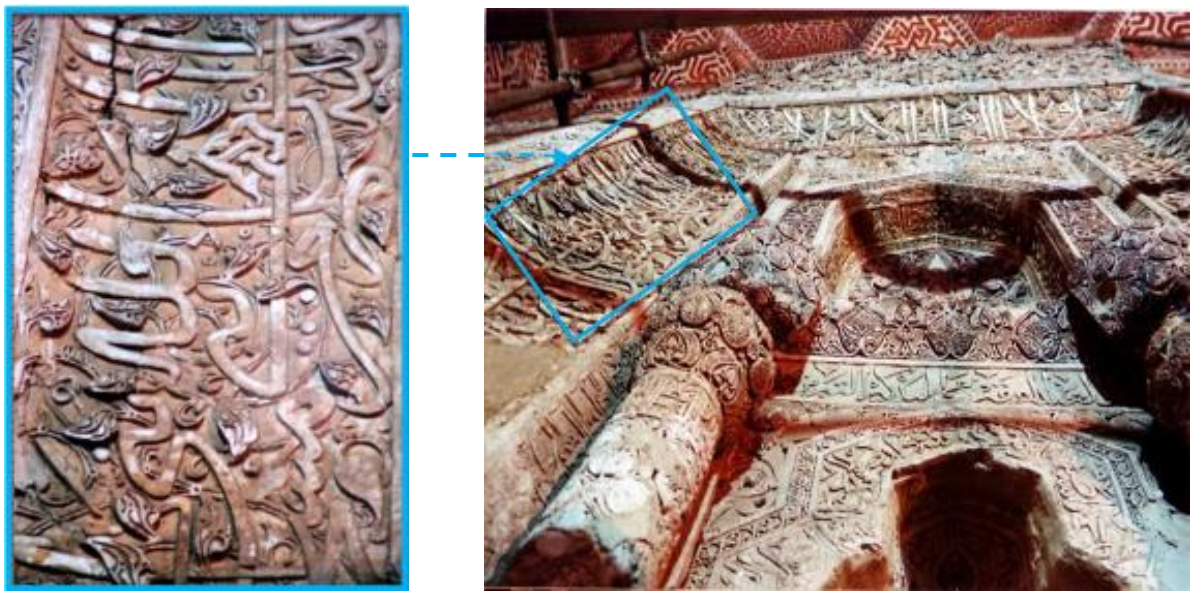


Figure 57: Part of the relief and elaborate stucco decorations in Boomnama ornaments which have been executed in a stratified double-coat- stucco method,
Ilkanid decorations Marand Jameh mosque (Author).

Figure 58: Part of the relief and elaborate stucco decorations in Boomnama ornaments which have been executed in a stratified double-coat-stucco method, Ilkanid decorations, Alavian dome in Hamadan (Author).

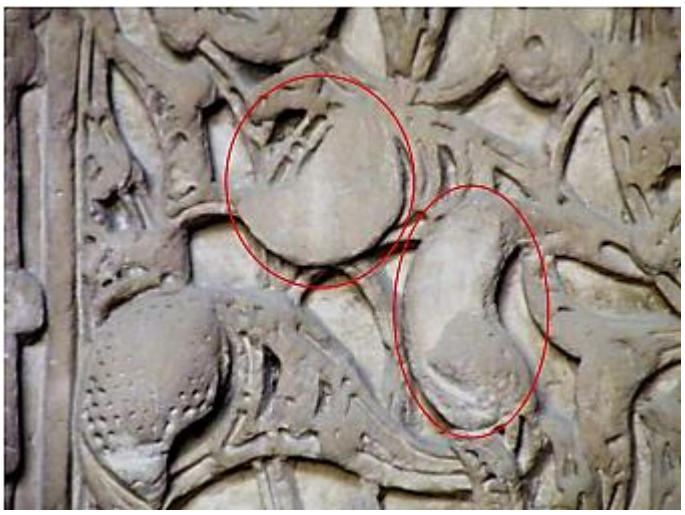


Figure 59:
Right picture: Part of the relief and elaborate stucco decorations in Boomnama ornaments which have been executed in a stratified 'double-coat- stucco' or Do-Gacheh method, Jameh mosque, Ardestan (Author).
Left picture: The close-up view of the raised stucco facade executed in the Do-Gacheh method, exhibits a uniform layer of surface stucco, and reveals the smooth base layer of stucco with underlying patterns which has been determined in a red circle. Part of Mihrab's ornaments in Jameh mosque, Ardestan (Author).

Figure 60: The relief and elaborate stucco decorations in Boomnama ornaments which have been executed in a stratified Do-Gacheh method, Gaar mosque, East of Isfahan, Seljuk period (Author).

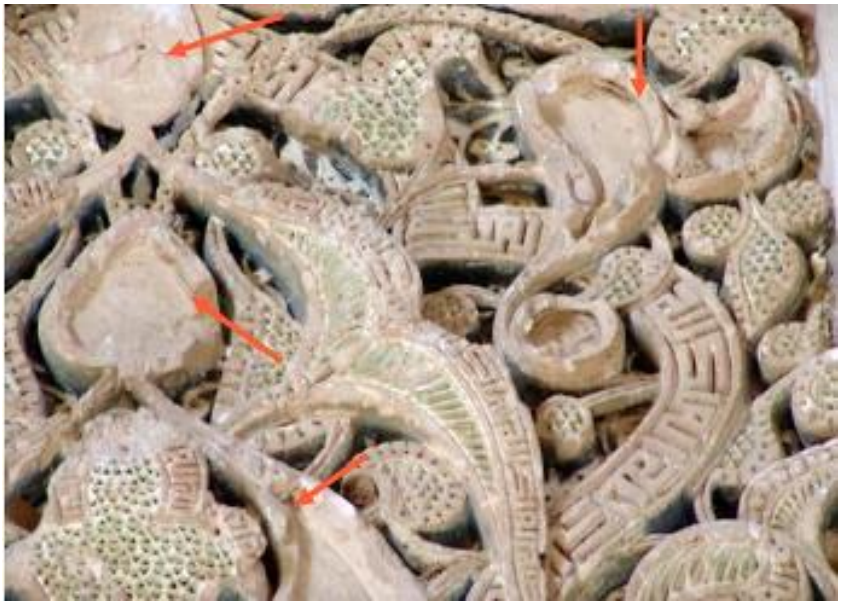


Figure 61: The number and different stages of executing the base layers can be traced by examining the separation and shedding of stucco layers on the surface, as observed in specific areas of the depicted. The relief and elaborate stucco decorations in Boomnama ornaments have been executed in a stratified 'triple-coat- stucco' or Se-Gacheh method, the middle part of Mihrab in Jameh mosque, Oshtorjan. Ilkanid period (Author).

Figure 62: The relief and elaborate stucco decorations in Boomnama ornaments which have been executed in a stratified Do-Gacheh method, the eastern Ivan's Mihrab in Jameh mosque, Abarkooh.in Yazd (Author).

Based on field studies and research conducted in this study, polychrome samples in the art of stucco within this technique are less commonly observed. Artists predominantly emphasize creating prominent, *Yek-Gacheh* arrays with intricate details, reaching their peak notably during the *Ilkanid* (1256 CE to 1353 CE) and *Seljuk* periods (1040 CE to 1219 CE) in Iran. Among the rare examples are the utilization of color and the creation of exquisite polychrome effects, highlighted prominently while combining pigments with stucco. Especially in the background of motifs, one can observe this fusion in the eastern *Ivan*'s *Mihrab* in *Jameh* mosque, *Abarkooh* in *Yazd*, in the relief and elaborate stucco decorations in *Boomnama* ornaments which have been executed in a stratified '*Do-Gacheh*' method, with the combination of blue and green and ochre pigments (Figure 62).

Figure 63: The relief and elaborate stucco decorations in Boomnama ornaments which have been executed in a stratified 'Do-Gacheh' method,
the top part of Mihrab's Pir-Bakran shrine (Author).

The number and different stages of executing the base layers can be traced by observing the separation and shedding of plaster layers on the surface, as can be seen in specific areas of the depicted images (Figures 59; 61; 64; 65). For instance, in the elaborately adorned dome of *Alavian* (Figure 64), the separation lines between the lower layers, which contain flat textural patterns, and the surface layer executed during the second phase of plaster infilling, creating the necessary pattern prominence and surface differentiation in the intended areas, are distinguishable. Similarly, in the close-up view of the *Mihrab* stucco decorations in the *Jameh* mosque of *Ardestan* (Figure 59), the consistent shedding of the surface layer of plaster in some parts confirms the implementation of the 'double coat stucco' method and indicates the technique of 'concave and convex'.

The evidence of the stucco adornments in the *Oljaytu Mihrab*, *Shah'Abdol-Azim* Shrine, suggests the presence of 'triple-coat' stucco or *Se-Gacheh* of plaster infilling methods. As marked areas in the image (Figure 65) and the schematic illustration, after the initial stucco decorations infill on the 'plaster coat', this layer, or rather the underlying base, is shaped according to the outlined pattern. This shaping can be executed through two methods: a simple and aligned (flat) method, or by creating surface differentiation, resembling the technique used in the stratified plaster infilling, applied in subsequent stages, the second, third, and even fourth layers in some parts.

Figure 64: The close-up view of the relief stucco facade executed in the 'Double coat' method, featuring the separation of the surface stucco layer and the appearance of the boundary between the surface stucco background and the smooth base layer with underlying patterns, is evident with the red marks, Alavian dome, Hamedan (Author).

*Figure 65: The two sections delineated by **red arrows** indicate the underlying base layer. One layer comprises the complete background pattern volume in the lowest tier of decorations, while the other underlying layer represents the more prominent raised patterns in the second tier of decorations which are indicated **by blue arrows**. The relief and elaborate stucco decorations in Boomnama ornaments have been executed in a stratified Se-Gacheh method, the Mihrab of Oljaytu in the Jameh mosque of Isfahan (Author).*

In samples like the central part of the *Mihrab* of the *Jameh mosque* of *Oshtorjan* (Figure 61), similar processes as mentioned above have been undertaken, with the difference being that remnants of the most prominent base and damaged sections suggest the presence of prefabricated stucco pieces in some areas.

5.2.5.4 Classification of the elaborate relief stucco based on the pattern's surface

In general, elaborate relief stucco decorations can be divided into two main categories based on the simplicity or complexity of their pattern surface: simple and intricate. The simple types lack any specific design or pattern on their surface or involve minimal stucco-creating processes. Nearly, all types of relief stucco decorations fall into the simple category, including some examples of intricate raised stucco decorations, as depicted in the figures 34, 35, and 36.

In the prominent gypsum decorations in Iranian architecture, the artist creates texture on patterns and sometimes even on the background of the patterns, presenting an eye-catching play of light and shadow on these otherwise plain stucco surfaces. Craftsman A indicated that:

> "This technique in the traditional Iranian stucco art is named *Ajdehkari*. The rationale for this approach is the plaster nodules present on extensive surfaces, acting as decorative motifs, especially in cases where multiple layers are used to enhance prominence, are not uniformly distributed and one of the prominent characteristics that often distinguishes this technique is the visible irregularities which observed due to the tool marks on the surface." (Craftsman A)

The extensive nature of the patterns and the uniform white of the stucco, if left in a simple state, would not create an aesthetically pleasing effect. This aspect can be well understood by examining incomplete or damaged samples, such as a piece of plaster retrieved from the ruins of a mosque in *Rey*, attributed to the 11th and 12th BCE AH. For this reason, traditional stucco craftsmen throughout the Islamic period have employed various techniques to address these shortcomings and enhance the beauty and allure of their decorations.

In general, three common methods have been used to create patterns known as *Ajdehkari* on prominent stucco surfaces: At first the cutting and carving method, secondly the use of molds or stamping techniques, and finally the combined method of cutting, carving, molds, and stamping. However, the stamped method of *Ajdehkari* includes both intricate and simple knot patterns, while the carved method comprises simple cuts and reliefs that can be divided.

The majority of the remaining examples of *Ajdehkari* on prominent stucco, or duplicative stucco, have been created using the cutting and carving method. In this technique, the desired pattern is incised onto the surface of the plaster to achieve the desired surface contrast between the pattern components and the background. Most executed *Ajdehkari* through the cutting and carving method, including perforated patterns, relief duplicative stucco, and even pieces created using intersecting grooves (crosshatching) resembling the technique of carving or marking on wood to create designs. Craftsman B indicated that:

> "In most cases, except for the perforation method where such a requirement doesn't apply, the plaster used for these purposes is manipulated through a semi-prepared stucco technique or a refined stucco application. The ideal time for working, considering the quality of the stucco's cutting and carving is after the initial setting of the gypsum and before its complete drying." (Craftsman B)

5.2.5.4.1 Elaborate relief stucco with simple carved patterns

The relief stucco decorations featuring simple scratching involve texturing the surface of the patterns or texts using straightforward operations like engraving or perforation. Examples of such works include scratched patterns on mirror surfaces in the *Jameh* mosque of *Isfahan* (Figure 66), decorative elements on the *Chehel-Stoon* palace from the *Safavid* period (1501 CE to 1796 CE) and the tomb of *Seyyed Shafie* from the *Qajar* period (1794 CE to 1925 CE), sections of gypsum ornamentation in the Colonel-*Vasigh*'s house from the *Qajar* period, all in *Isfahan*, examples of *Qajar* period stucco in *Nakhjir* castle in *Mobarakeh*, or some stucco decorations in the *Kollahdooz*'s house in *Yazd* from the *Qajar* period (Figure 67). These are instances illustrating the method of simple *Ajdehkari* through deep incisions on the surface of the patterns.

Figure 66: Ajdehkari, is the relief stucco decorations featuring simple scratching that involves texturing the surface of the patterns or texts using straightforward operations like engraving or perforation. The close-up view of the intricate stucco, Ajdehkari, in the scratch style, can be observed in the Jameh mosque of Isfahan, dating back to the Ilkanid period (Author).

Figure 67: The stucco decorations of the simple Ajdehkari technique through deep incisions on the surface of the patterns. The close-up view of the intricate stucco, Ajdehkari in the 'scratch-style, Kolahdooz house, Yazd, Qajar period (Author).

5.2.5.4.2 Elaborate relief stucco featuring intricate carved *Ajdehkari* stucco

Although the cutting and scratching methods of this type of *Ajdehkari are similar to* 'scratch relief' *Ajdehkari,* involves surface cutting and scratching operations, encompassing a wide spectrum of both simple and intricate stucco methods (Zanganeh 2008, 59; Sajjadi 1997, 41; Ansari 1987, 321). In this type of decoration, the *Ajdehkari* patterns consist of regularly geometric shapes, often created through a stamping method on the surface of relief stucco decorations. These patterns generate a delicate and systematic texture, creating an intricate and geometric knotwork on the surface of the decorations. Almost all adorned works on the relief stucco from the early Islamic periods onwards, wherever *Ajdehkari* has been used for supplementary ornamentation, a rich utilization of knot motifs can be observed.

The pieces of stucco decoration from *Sabz-Pooshan* hill, *Neishaboor,* attributed *from Timurid* period, The *Mihrab* of *Malek-Zuzan* mosque, *Seljuk* period (1040 CE to 1219 CE), with relatively less intricate *Ajdehkari* motifs, a portion of the executed *Ajdehkari* designs on the relief stucco surfaces of *Rasakht* tower in *Mazandaran* (Figure 68), attributed to the *Ilkanid* period (1256 CE to 1353 CE), constitute a significant portion of the motifs executed on the Mihrab of *Pamanar*, *Zavareh* from *Seljuk* period (Figure 69), *Ilkanid Mihrab* of *Jameh* mosque of *Oshtorjan*, *Ilkanid Mihrab* of *Pir-Bakran* shrine (Figure 70), or part of plastering's decoration, *Jameh* mosque of *Farumad* in *Sabzevar* (Figure 71), which encompass some of the most exquisite examples of Islamic-period *Ajdehkari* stucco's decoration within itself.

A point to note in the utilization of these decorations is the use of color, which has led to the creation of beautiful polychrome arrays during this historical period. The colorful sections of these decorations were primarily situated in the background, while the carved sections, due to the use of scratching and decoration on the surface of the stucco layer, remained raw and devoid of color. This execution aimed to create a striking contrast with the colorful background, resulting in an exceptionally captivating combination (Figures 68 and 71).

Figure 68: The colorful sections of these decorations were primarily situated in the background, while the carved sections, due to the use of scratching and decoration on the surface of the stucco layer, remained raw and devoid of color. Ajdehkari ornaments, beneath the dome of Rasakht Tower, Mazandaran, attributed to the Ilkanid period (Author).

Fig 69: Ajdehkari, duplicative stucco technique, in a hole and geometric method, part of Mihrab of Pamanar mosque, Zavareh, attributed to the Seljuk period (Author).

Figure 70: The prominent stucco according to the concave and convex, Ajdehkari motifs of the stomp type knot, Pir-Bakran Shrine, Ilkanid period (Author).

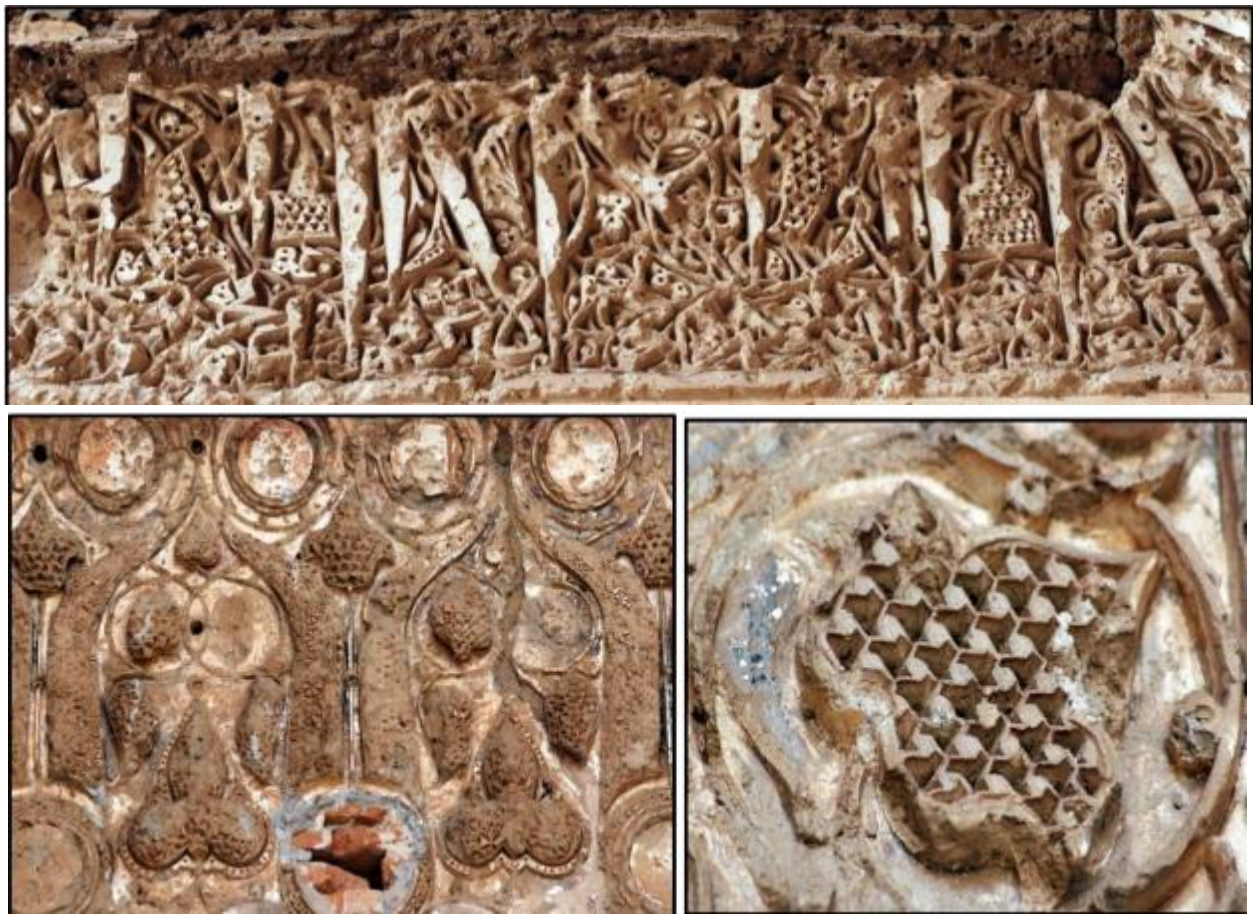


Figure. 71: Three different Ajdehkari motifs on the stucco surfaces with stomping technique, Frumad mosque, Sabzevar, Ilkanid period (Aslani 2023).

5.2.5.4.3 Elaborate relief *Ajdehkari* stucco with curving ornaments

As mentioned in previous sections, in some examples of incised decorations, the stucco artist has created simple circular openings in various shapes. In many cases, these shapes lack sharp corners and form the basis for the emergence of vegetal patterns in stucco decorations. The method of incising curved and twisting lines onto the surface of stucco arrays is, in fact, a form of incising and carving, which, across a wide spectrum, has given life to lifeless stucco surfaces within the diversity of stucco techniques.

The incising of curved lines onto the surfaces of decorations might only involve the passage of an extended or interrupted line amidst other patterns, such as the central area of the *Mihrab* of *Jameh* mosque in *Zavareh* (Figure 72) or the border patterns of the *Mihrab* of the *Sin* mosque in the *Borkhar* region of *Isfahan* (Figure 73). In some cases, this method encompasses a series of previously mentioned incisions and carvings in the discussions of elaborate stucco but is applied with more precision and delicacy on flat and simple surfaces of decorations on a smaller scale. This category of works displays a remarkable diversity in the appearance of the stucco arrays, resembling the carved wooden decorations, such as those seen in the incised stucco at *Sheikh Jam'*s tomb (Figure 74), the *Mihrab* of *Alavian* dome in *Hamadan* (Figure 75), *Safavid* decorations at the *Imamzadeh-Ismail* (Figure 76), the *Qajar* mosque of *Sayyed-Shafie* (Figure 78), and the *Vasegh-Ansari* house from the *Qajar* period (Figure 77) in *Isfahan*.

Figure 72: The incising of curved lines onto the surfaces of decorations might only involve the passage of an extended or interrupted line amidst other patterns. The Ajdehkari with curving ornaments, Central area of the Mihrab of Jameh mosque in Zavareh, Seljuk period (Author).

In this instance of *Ajdehkari* decorations with curvilinear motifs, polychrome stucco with colorful backgrounds and patterns is observed, resembling the beautiful effects seen in the other Iranian artifacts as a wood carving (Figure 74). These decorations involve the fusion of mineral pigments with gypsum paste, used for both the textured plaster in the substrate layer and the smooth plaster in the surface layer of the decorations. Examples of these exquisite stucco can be observed in the carved *Ajdehkari* in the *Sin* mosque, *Baroukhar* region, *Isfahan, Ilkanid* period (1256 CE to 1353 CE), (Figure 73). An interesting point in this exquisite stucco from the *Ilkanid* period is the attempt, in both groups of decorations, whether polychrome examples or those without color, to mimic the appearance of wooden carvings (Figures 73 and 74).

Figure 73: The Ajdehkari decorations with curvilinear motifs and colorful backgrounds and patterns involve the fusion of mineral pigments with gypsum paste, used for both the textured plaster in the substrate layer and the smooth plaster in the surface layer of the decorations. Carved Ajdehkari, Sin mosque, Gaz-Borkhar region, Isfahan, Ilkanid period (Author).

Figure 74: An interesting point in this exquisite stucco from the Ilkanid period is the attempt, in both groups of decorations, to mimic the appearance of wooden carvings.
A close-up view of the carved Ajdehkari motifs, the border of the Mihrab of Sheikh Jam's shrine, Ilkanid period (Author).

Figure 75: A close-up view of the 'wood carved-like' technique in Ajdehkari's method of shaping the ornaments, the Mihrab of Alavian mosque, Hamedan, Ilkanid period (Author).

Figure 76: A close-up view of the 'wood carved-like' technique in Ajdehkari's method of shaping the ornaments adorned with gold leaf in the Mihrab of Emamzadeh Ismaeil, Isfahan, Ilkanid period (Author).

One of the most fascinating and valuable aspects of Iranian stucco decorations is observing the examples of polychrome work within it. In these examples, as depicted in the previous images (Figures 76 and 73) the artist has not only employed the technique of relief to adorn the executed patterns but has also strived to enhance the allure and grandeur by adding various colors. While observing the polychrome decorations of the *Qajar* period (1794 CE to 1925 CE), one can witness the utilization of newer techniques in creating artworks, indicating the Western influence and the use of oil-based colors in this section of Iran's historical decorations.

However, efforts have consistently been made to either color only the background and leave the patterns or monochrome similar to wooden carvings or, adhere to the method of gilding using gold leaf (which, based on previous studies on the *Safavid* (1501 CE to 1796 CE) and *Qajar* (1794 CE to 1925 CE) gold decorations are adorned with combinations of brass and bronze (Basiri 2012, 59) so that the patterns and scratches resulting from relief work still shine through the golden color to the audiences.

Figure 77: The 'wood carved-like' stucco in the Ajdehkari technique, which had been executed in the Western artistic styles, Colonel Vasigh-Ansari's house, Isfahan, Qajar period (Author).

Furthermore, in other instances of this art, particularly in the artifacts and embellishments preserved from the *Qajar* period (1794 CE to 1925 CE), evident in the *Seyyed-Shahfti* stucco adornments at the *Seyyed* mosque in *Isfahan* (Figure 78), the artist's inclination towards raised relief work and gilding of patterns against a white backdrop is prominent. The artist abstains from employing additional colors in the decoration, placing primary emphasis on raised designs, and gilding on the white surface.

Figure 78: The artist abstains from employing additional colors in the decoration, placing primary emphasis on raised designs and gilding on the white surface. The 'wood carved-like' stucco in Ajdehkari technique, which adorned with gold leaf, Seyed-Shafti Shrine, Seyed, Isfahan, Qajar period (Author).

The knotwork incised decorations, which are named *Gerehchini* in Iranian traditional stucco art, whether geometric or relief, have been used as supplementary and complementary ornamentation in most cases. However, in some instances, they have played a primary role in embellishing architectural elements. Examples of the incised decorations with knot motifs in the remaining *Mihrab* of the *Shah-Karam* mosque in the eastern part of *Isfahan,* attributed to the *Ilkanid* period (Figure 79), and a combination of knot and curved motifs on the surfaces of the *Muqarnas* of the *Jameh* mosque in *Farumad* in *Sabzevar* (Figure 80), are two instances where this style of incised decorations has been applied.

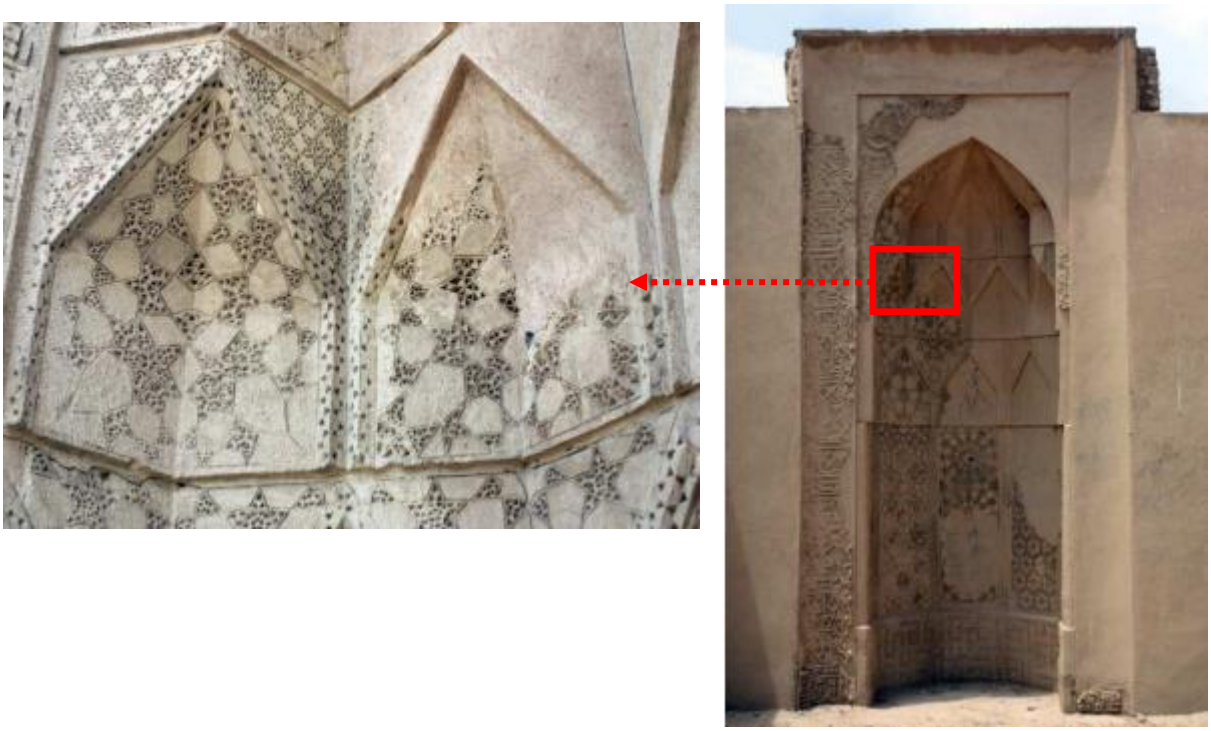


Figure 79: The knotwork incised decorations (Gerehchini), whether geometric or relief, have been used predominantly as supplementary and complementary ornamentation in most cases. The carved Ajdehkari technique in the stucco of the Muqarnas decoration of the Shah-Karam mosque in the eastern part of Isfahan is attributed to the Ilkanid period (Author).

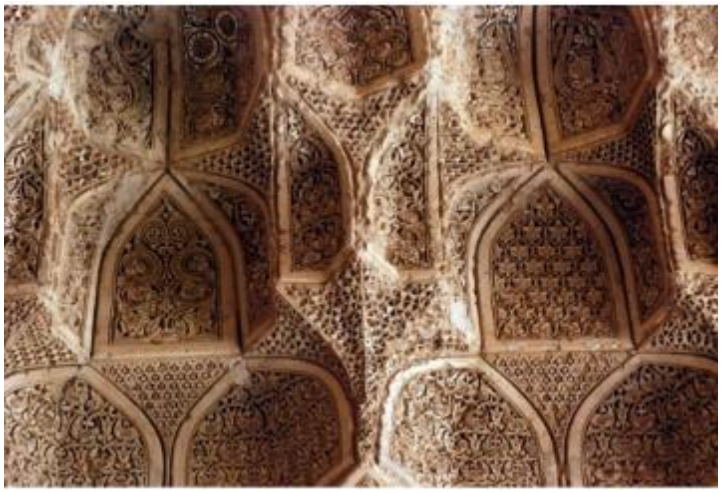


Figure 80: The curving Ajdehkari technique in stucco of the Muqarnas decoration of the Mihrab of Muqarnas, Jameh mosque in Farumad, Sabzevar (Author).

Carved incised decorations or *Gerehchini*, like stucco ornamentations themselves, can be classified based on their flat or inclined carving method. For instance, incising the

surface patterns with a slant-cutting method can also be considered a form of incised relief carving. Examples of this can be traced back to pre-Islamic times in the arrangement of stucco decorations. Notably, stucco attributed to the *Parthian* period (247 BCE to 224 CE) in *Koh-e-Khajeh* in *Sistan* (Mishmast 2006, 35), gypsum fragments from the 5th century discovered at *Tapeh-Hesar* in *Damghan* (Figure 81), or parts of *Sasanid* (224 CE to 651 CE), stucco decorations from *Bandiyan* excavations in *Gaz* (Figure 82) are examples of pre-Islamic works.

In the Islamic period, evidence exists for the use of both inclined incised decorations, such as in the *Mihrab* of the *Seyed-Gholhovala* mosque in *Yazd* from the *Seljuk* period (Figure 83), and flat incised carving, as seen in samples related to the *Jameh* mosque of *Farumad, Sabzevar* (Figure 80).

Figure 81: The carved incised decorations or Gerehchini, like stucco ornamentations themselves, can be classified based on their flat or inclined carving method. For instance, incising the surface patterns with a slant-cutting method can also be considered a form of incised relief carving. A relief stucco's ornaments with the inclined Ajdehkari style have been unearthed from the Tapeh Hesar in Damghan, dating back to the 5th century CE, and is currently housed in the Ancient Iran Museum (Pakzad 2007, 74).

Figure 82: A close-up view of the stucco artifacts with the incised Ajdehkari style, discovered in Bandian in Gaz, dating back to the Sasanid period. housed in the Ancient Iran Museum (Mousavi-Haji and Daryaei 2009, 32).

Figure 83: The relief stucco's ornaments with the inclined incised Ajdehkari style, Mihrab of the Seyed-Gholhovala mosque in Yazd from the Seljuk period (Author).

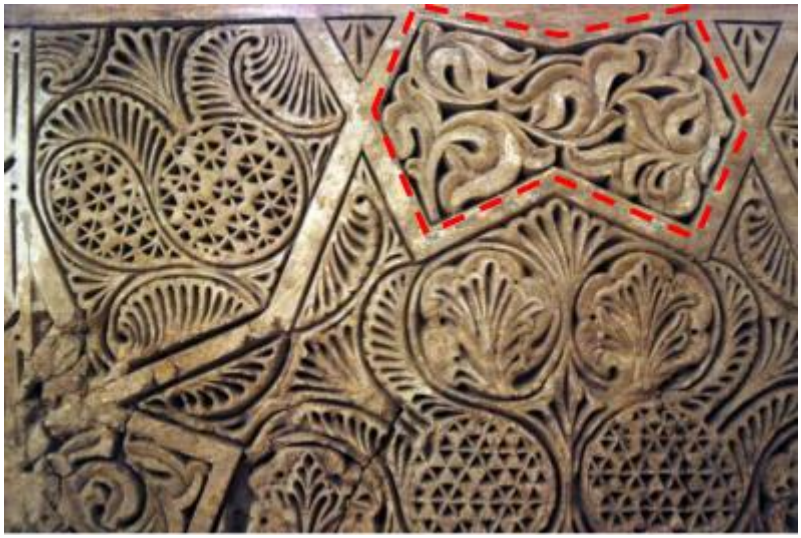


Figure 84: The reliefs stucco with the inclined incised Ajdehkari style and stamped decorations, part of the walls of Rey Madrassa, 11th century BCE, National Museum of Iran, inventory number 3267 (Mozaffari and Sauer 2014, 53).

Mostly, the *Ajdehkari* ornamentation serves as an embellishment for surface patterns. Occasionally, as seen in examples like those in the *Jameh* mosque of *Bastaam* (Figure 85), it also adorns the background layer of the decorations. Often, stucco works present an artistic amalgamation of various techniques, a fusion of executed *Ajdehkari* works using numerous methods such as perforation, carving, incised knotwork, or curved lines. These techniques are realized by employing diverse cutting and carving methods on stucco. Images on the following pages depict examples of these combined stucco techniques (Figures 84, 86, 87, 88, 89, and 90).

Figure 85: The interlacing knot Ajdehkari decorations in the background of the ornamentation, Jameh mosque of Bastaam, Seljuk period (Author).

Figure 86: Often, stucco works present an artistic amalgamation of various techniques, a fusion of executed Ajdehkari works using numerous methods such as perforation, carving, incised knotwork, or curved lines. These techniques are realized by employing diverse cutting and carving methods on stucco. The combined technique of the reliefs stucco *with the inclined incised Ajdehkari style and stamped decorations, Neishabor Madrassa, 12th century (Aslani 2011, 68).*

Figure 87: The combined technique of the reliefs stucco with the inclined incised Ajdehkari style and stamped decorations, Mihrab of Jameh mosque, Isfahan, Seljuk period (Author).

Figure 88: The combined technique of the reliefs stucco with the curved incised and stamped decorations in Ajdehkari style, Bayazid Complex, Bastaam, Ilkanid period (Author).

Figure 89: The combined technique of the reliefs stucco with the inclined incised Ajdehkari style and stamped decorations, Mihrab of Pri-Bakran Shrine, Lenjan, Isfahan, Ilkanid period (Author).

Figure 90: The combined technique of the reliefs stucco with the inclined incised and stamped in Ajdehkari decorations, Mihrab of Jameh mosque, Isfahan, Ilkanid period (Author).

The point of emphasis in executing *Ajdekari* decorations, especially concerning the implementation of their intricate patterns, is paying attention to the ideal timing of the gypsum setting and the execution of these complex designs. This is because the gypsum used must possess both good resistance and suitable formability. Regarding this, craftsman B clarified:

> "There is an important aspect to consider regarding certain intricate patterns used in relief decoration. *Ajdekari* decoration relies on the concept that there is an optimal window of time for executing specific patterns. This means that gypsum plaster, when applied under certain conditions, exhibits the most favorable malleability for carving and sculpting to achieve desired designs. Leveraging this property of stucco to enhance quality, ease, and speed of execution involves establishing these ideal conditions through one of two methods: either by preparing the plaster appropriately or by working during the opportune period between initial setting and complete drying of the gypsum plaster. Therefore, it appears that the most effective technique for manipulating stucco in creating these types of decorations is to use semi-set or slightly set gypsum plaster at the precise moment after initial setting and before it fully dries." (Craftsman B)

Furthermore, based on the field studies, observing elements such as parts of the decorations in the *Jameh* mosque of *Farumad* (Figure 91) reveals that the carving process occurred prematurely, at a time when the gypsum plaster was still unable to retain the edges' shape after being cut. As a result, there is a noticeable issue of edges losing their form. The distortion present on the uncut surfaces of this example is another indication of inappropriate handling of the plaster or failure to adhere to the suitable time for carving.

Figure 91: The close-up views depict the surface distortions and the shape deformities of the carved edges, which are part of the prominent gypsum decorations of the Jameh mosque of Farumad in Sabzevar (Borumand 2023).

To sum up, the intricate art of *Ajdehkari* in Iranian stucco decoration demonstrates a profound mastery of craftsmanship and an exceptional understanding of material properties. Through various carving and incising methods, these decorations bring life and depth to architectural elements, reflecting cultural, historical, and artistic significance. The ability to achieve such precision relies heavily on the ideal timing of gypsum setting, as highlighted by the examples and craftsman testimony. The evolution of *Ajdehkari*, from its pre-Islamic origins to its Islamic refinement, showcases an enduring legacy of innovation and aesthetic sophistication in Iranian stucco art. This analysis not only sheds light on the technical and artistic intricacies of *Ajdehkari* but also emphasises its broader role as a cultural narrative that bridges different historical eras.

Ajdehkari ornamentation is a multifaceted category characterised by diverse techniques, including perforation, carving, incised knotwork, and curved line decorations. These techniques have been subdivided based on their methods of execution—such as flat or inclined carving—and their artistic purpose, whether as surface embellishments or background adornments. This subdivision clarifies the breadth of the *Ajdehkari* category, illustrating its versatility in integrating patterns and designs across different architectural and historical contexts. By examining these distinctions, the analysis reinforces the argument that *Ajdehkari* is not merely an aesthetic practice but also a testament to the adaptive and innovative spirit of Iranian stucco art.

Ultimately, this chapter has systematically analysed high-relief stucco decorations, presenting a structured framework for their classification and typology. By exploring their technical and artistic characteristics, it has highlighted the complexity and diversity of these works in Iranian architecture. The inclusion of visual aids and the application of a multi-layered classification approach have clarified the intricate relationships between different categories. These findings not only provide a deeper understanding of high-relief stucco but also lay the foundation for broader discussions in the following chapters, contributing to the overarching goals of this thesis.

In conclusion, the multi-layered classification of high-relief stucco decorations provides a systematic framework for understanding their technical and artistic diversity. By categorising stucco into distinct types and subtypes, this chapter bridges gaps in existing studies and lays the foundation for further exploration in subsequent chapters.

Chapter Six: Technical evaluation of Low-relief stucco in Iranian architecture

6.1 Introduction

In this chapter, the focus will be on the technique of low-relief stucco. Essentially, a significant characteristic of these forms of stucco involves the use of incised and carved stucco methods post-application onto architectural surfaces. Arrays of stucco, regardless of the level of projection or the shaping method, do not belong to this category. Another distinguishing feature of low-relief stucco is the minimal difference in elevation between the patterns and texts, which typically does not exceed half a centimeter.

Considering the decorations and techniques present in the lesser-known Iranian low-relief stucco art, one of the existing ambiguities was the integration of the engraving stucco technique (*Koshtebori*) and surface scraping techniques (*Boom-Saab*). In this regard, Craftsman B said:

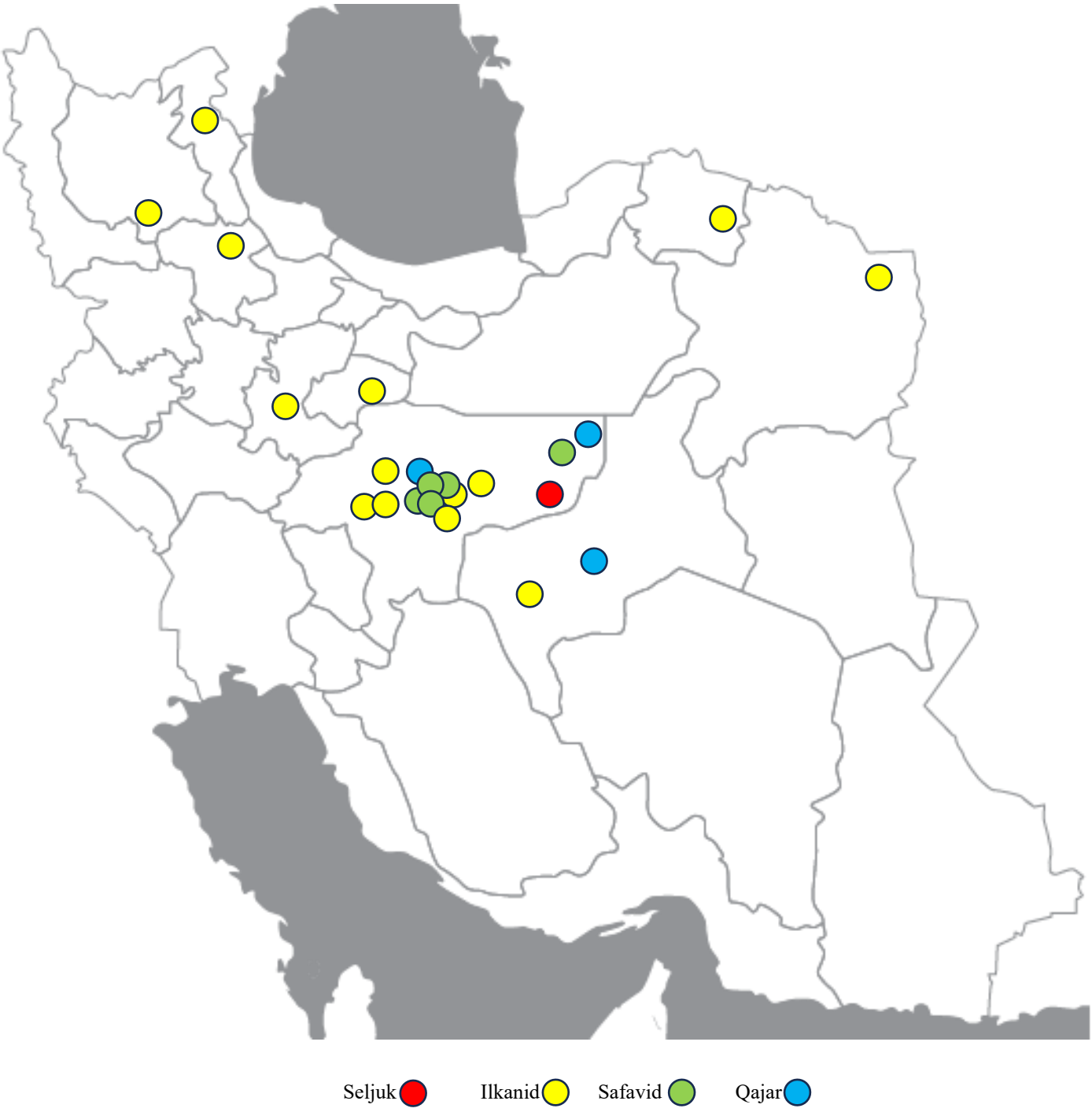
> "It is not possible to categories the techniques of *Koshtebori* and *Boom-Saab* stucco into a single group as despite their superficial similarities, they differ significantly in technical aspects. One involves carving patterns on a layer of *Gach-e-Zendeh*, while the other is executed on a *Gach-e-Koshteh* surface." (Craftsman B)

So, regardless of the typologies described before, explaining their technical aspects, three distinct types of low-relief stucco were identified. These types include the *Koshtebori* (Incised gypsum layer carving,) the *Boom-Saab* (Surface scraping), and the *Ajornama* (Brick-facade appearance).

In the evaluation of low-relief gypsum decorations in Iran, field studies were conducted on numerous artifacts, and based on this, existing artifacts with this technique in Iran were selected for further assessment and study. These artifacts are observed in 23 various historical sites in Iran, which are introduced and evaluated in this research (Table 92).

Number	Historic Architecture	Location	Historic period	Decorations
1	Ali-Qapu palace	Isfahan	Safavid	*The low-relief stucco decorations in Boom-Saab technique*
2	Pirnya Historical House	Naein	Safavid	*Scraping the design onto the white preparatory layer in the Koshtebori technique*
3	Gorgi Historical House	Yazd	Qajar	*Low-relief stucco decorations*
4	Akhavan-Haghani Historical House	Isfahan	Qajar	*low-relief Koshtebori stucco decorations*
5	Chehel-Setoun Palace	Isfahan	Safavid	*Low-relief stucco with gold leaf decorations*
6	Sharbet-Khanah entrance of Qeisariyeh Bazar	Isfahan	Safavid	*Boom-saab decoration*
7	Sultanieh dome	Zanjan	Ilkanid	*Stucco decorations in Ajornama technique*
8	Mozaffari Madrassa	Isfahan	Seljuk	*Painted Ajornama decorations*
9	Pir-Bakran Shrine	Falavarjan	Ilkanid	*Simulating patterned brick*
10	Sabz dome	Qom	Ilkanid	*Polychrome stucco decoration in the Ajornama decorations*
11	Jameh mosque	Barsian	Seljuk	*The combined brickwork and stucco decorations*
12	Jameh mosque	Isfahan	Ilkanid/ Safavid	*Boom-Saab stucco with deep groove carvings around the patterns*
13	Jameh mosque	Gonabad	Qajar	*Ajornama decorations in molding technique*
14	Jameh mosque	Saveh	Sajuk	*The low-relief stucco decorations*
15	Jameh mosque	Ardebil	Ilkanid	*The stamped Ajornama technique*
16	Jameh mosque	Yazd	Ilkanid	*The stamped Ajornama technique*
17	Jameh mosque	Ardestan	Safavid	*Boom-Saab stucco decorations*
18	Jameh mosque	Maragheh	Ilkanid	*The stamped Ajornama technique*
19	Jameh mosque	Farfan	Ilkanid	*Simulating patterned brick*
20	Jameh mosque	Haftshooyeh	Ilkanid	*Simulating patterned brick*
21	Jameh mosque	Oshtorjan	Ilkanid	*Simulating patterned brick*
22	Jameh mosque	Farumad	Ilkanid	*Simulating patterned brick*
23	Jameh mosque	Zavareh	Ilkanid	*Simulating patterned brick*

Table 92: Exploring low-relief stucco decorations across 23 historic architectures in Iran, spanning from the Seljuk to Qajar period (Author).



Map 93: A scatter plot map of selected historical monuments in the geography of Iran is created to assess the low-relief stucco decorations in Iran and their historical periods using different color indicators (Author).

6.2 Evaluation of the *Koshtebori* Technique in low-relief stucco

The *Koshtebori* technique is a method employed by skilled artisans in stucco artistry, characterized by the incision of gypsum mortar to create decorative layers. Unlike traditional methods, *Koshtebori* involves carving or cutting patterns into the *Gach-e-Koshteh* layer after its application, allowing for intricate designs and textures. To prepare the gypsum for *Koshtebori*, a significant amount of powdered gypsum is mixed with water and mechanically processed through extensive mixing and kneading. This process reduces the plaster's cohesive properties, which is crucial for achieving the desired carving depth and detail (Woolf 1992, 35). Despite claims made by some researchers, such as Makhinejad (2008) and Zomorshidi (1998), experimental findings have raised questions about the effectiveness of this preparation method for different types of stucco. These results suggest that the method may not perform as reliably or consistently as previously asserted

In *Koshtebori* decorations, intricate Islamic motifs such as floral and vegetal patterns (Arabesque ornaments) are painted on a smooth surface, while the background is carved to a depth of approximately one millimeter (Aghajani 1980, 116). Field studies confirm that *Koshtebori* is specifically suited for low-relief stucco applications, where the incised gypsum layer distinguishes itself from underlying layers through visible characteristics such as texture, color, and crystalline structure, observable even under electron microscopy. During the hardening phase, the gypsum mortar used in *Koshtebori* expands by about 1%, ensuring minimal volume change post-application and a smooth, low-porosity surface. This property makes *Koshtebori* ideal for covering large surfaces without the risk of cracking or fissures (Farutani 2005, 38).

Figure 94: To make pure gypsum plaster in this stucco technique,d 65% to 85% water by weight is added to the gypsum. The terms 'kneading' and 'beating' refer to the process of working the mixture of gypsum and water to prepare incised gypsum or Gach-e-Koshteh for the Koshtebori technique (Author).

If additional water is added to gypsum before its setting begins, or if specific organic materials such as plant stems or animal hair are introduced, the setting process of gypsum is delayed, and it remains in a paste-like state for a longer period. This delay occurs due to excessive beating and intense mixing, which disrupts the formation and growth of nascent crystals inside the gypsum paste (Abbassian 1991, 21). This paste-like gypsum is known as *Gach-e-Koshteh* in traditional terminology (Abbassian 1991, 22). Traditional additives used for this purpose include substances like gum tragacanth (*Katira*), Arabic gum, milk, hair, and silk (Aslani 2011, 59). Moreover, the setting time of gypsum also depends on factors such as water content, mixing duration, and the conditions during the gypsum rock calcination process. Lower calcination temperatures result in quick-setting gypsum (*Gach-e-Zendeh* in Iranian traditional crafts), which requires less water to convert back into gypsum (Hamidi 1992, 108).

However, quick-setting gypsum can be more fragile and less cohesive due to void spaces left by evaporated water, weakening its structural integrity compared to the *Gach-e-Koshteh* layer. Additives in gypsum may retain and gradually release water, keeping the gypsum moist and paste-like for extended periods, influencing its handling properties (Tadin 2008, 43).

Gypsum with a monoclinic crystal structure, when kneaded or exposed to excessive water, forms parallel, slide-able layers instead of collapsing into each other. This characteristic retains the gypsum's plasticity until free moisture evaporates, contributing to its susceptibility to fractures and separation (Basiri 2012, 67). Microscopic comparisons of experimental samples from the *Gach-e-Koshteh* layer confirm these behaviors (Figure 95).

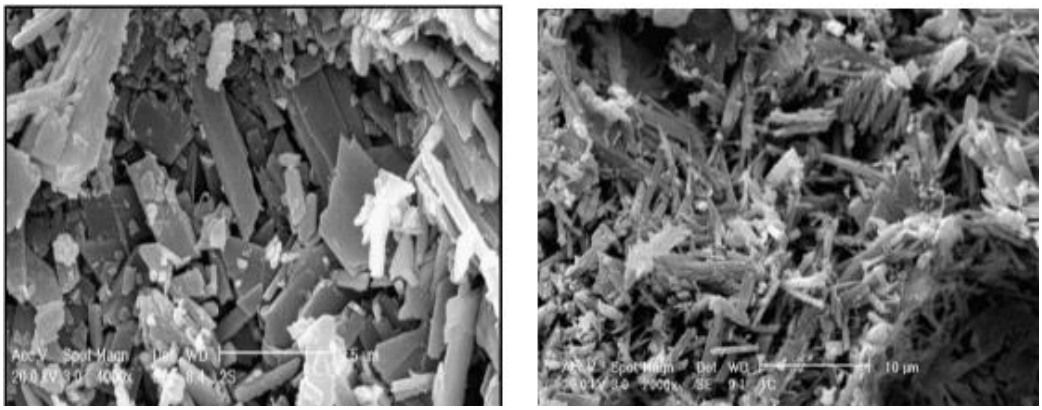


Figure 95: Electron microscopy of the crystal structure of traditional gypsum plaster in Isfahan in two different sample states.
Right Image: Experimental plaster sample processed using the 'Gach-e-Zendeh' method, magnification X2000. Left Image: Experimental plaster sample processed using the 'Gach-e-Koshteh' method, magnification X4000. Source: (Basiri 2012, 67).

Based on the field studies conducted in this research, the *Koshtebori* decoration technique and its constituent layers are identified as follows: The foundation includes the background, base coat, underlying substrates, primer layer, and color layer. When investigating the technological aspects of *Koshtebori* decorations, the layers consist of the foundation, background layer, sub-base layers, and surface base. The foundation of these decorations varies depending on the technical goals of the creators and the historical period of construction, often using bricks with gypsum or lime mortar. The plaster layer serves to cover and smooth irregularities in the foundation, creating a suitable surface for subsequent layers.

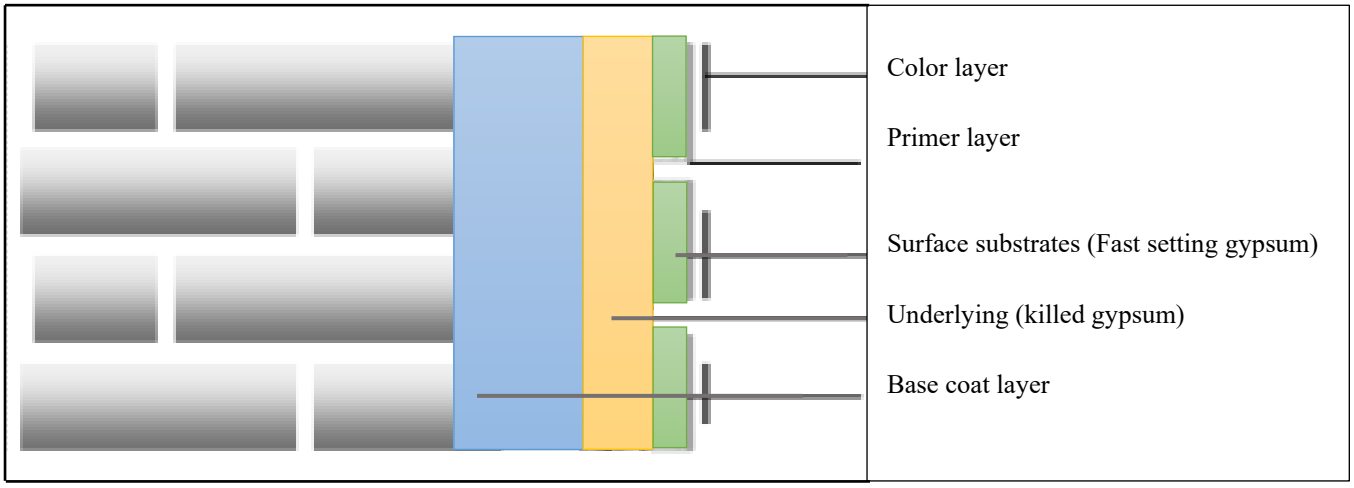


Figure 96: As can be seen in this diagram illustrates the incised layers composing a decorative incised pattern's stucco in the Koshtebori technique (Author).

In Iranian Islamic art, two types of plaster are commonly used: gypsum and clay. These plasters are reinforced with fibers, straw, and plant stems to enhance their quality and strength. Straw helps prevent cracking during the drying phase of clay and reduces its plasticity, ensuring a smooth and even surface.

The underlying is applied over the base coat layer to fill openings and cavities, providing a stable foundation for decorative work. In some cases, the underlying consists of two layers: a lower layer made of gypsum with medium grain size using the fast-setting method (*Gach-e-Zendeh*), which solidifies quickly and provides strength. This layer is approximately 2 to 3 cm thick. The second layer serves as a background for the preparation and color layers, made of finely grained gypsum mortar prepared with the slow-setting method (*Gach-e-Koshteh*), known for its delicate nature and typically 1 to 3 mm thick. Due to the rapid solidification and strength of *Gach-e-Zendeh* and the slower setting but finer texture of *Gach-e-Koshteh*, the sub-base is applied in two distinct layers: the sturdy *Gach-e-Zendeh* as the lower layer and the delicate *Gach-e-Koshteh* as the surface layer. This method ensures durable and uniform coverage while providing a smooth and consistent working surface (Figure 97).

Figure 97: A sample test demonstrating the execution of inlaying Gach-e-Koshteh (Killed gypsum) on the surface of Gach-e-zendeh (fast-setting gypsum) in a simulating sample of stucco in the Koshtebori technique (Author).

A preparatory or priming layer is an underlay applied before painting on the surface of a work to prepare a better surface. This process, known as priming or ground preparation, involves covering the surface with a very thin layer of a solution containing a natural resin, either plant-based or animal-based, creating a suitable surface for painting. In decorative finishes, the preparatory layers are typical of the white clay' which is the white-colored priming plaster. Regarding the details of the white clay layer and its constituent materials for forming stucco decorations. Craftsman A noted that:

> "The use of this layer diminishes the absorbency of the surface and facilitates working with a paintbrush on the wall, preserving more transparency and color brilliance due to the reduction of paint penetration into the gypsum layer. These are among the capabilities the surface gains after the priming process. In some cases, a coloring agent is added to the priming material, resulting in colored preparatory layers. This layer is a type of calcium carbonate known as 'white clay' or *Gel-Sefid*. It constitutes about 12% and, after mixing with a resin solution in water (likely Shellac or Gum), is applied on the prepared surface. The *Gel-Sefid* layer (white preparatory) is also used in its color composition within certain sections of the work." (Craftsman A)

Furthermore, the field studies of the existence of stucco decorations demonstrate that the applied paint layer on the white preparatory layer can be considered the final decorative layer in the *Koshtebori* technique. This layer consists of two main components: pigments and a binder. The pigments used mostly have mineral origins and are employed in various pigmentations within different paint formulations. The binder or pigment fixative is usually water-soluble, potentially Arabic-Gum or Shellac. However, tempera-style painting is also a possibility. In mural decorations, surface coloring is applied flatly and using a watercolor technique.

6.2.1 The stages of execution of inlay layers in *Koshtebori*

In evaluating the *Koshtebori* technique and the manner of its execution, Craftsman B noted that:

> "The *Koshtebori* decorations were made using a specific method. First, the base was covered with inlay plaster to create a smooth surface. Then, a layer of *Gach-e-Zendeh*, the base coat with medium-sized grains, was applied on top. After letting the background layer set, the inlay surface was smoothed using a serrated edge float. Finally, a very thin layer of *Gach-e-Koshteh* was applied to cover the surface coat. After the necessary time elapsed for the initial setting of the *Koshtebori* layers, the surface was worked on using a floating tool." (Craftsman B)

During this finishing process, the drawbacks such as ridges, minor surface protrusions, and traces of the plastering tool disappeared, resulting in a compact, smooth, and uniform surface. One of the criteria for technical excellence in *Koshtebori* decorations is the complete and seamless bonding between the layers of the base and the inlay. Factors contributing to achieving this outstanding feature include the roughness of the base surface, aiding mechanical engagement and better bonding between the two layers, the application of the inlay layer before the gypsum sets completely and dries, and ultimately, correct, and timely finishing of the inlay surface. Failure to adhere to these aspects could compromise the quality of the work, resulting in defects such as cracking and separation of the inlay layer from the base coat (Azimi 2011, 57; Moftifarad 2010, 48).

6.2.2 The preparatory layer and pattern transfer in *Koshtebori*

In studying the preparation method of multiple layers in the *Koshtebori* technique and the method of pattern transfer and ultimately its execution, there were ambiguities and questions that field evaluations of artworks and textual studies could not precisely answer. This was because there were two different hypotheses on this matter, and it was not clear which one could be precisely and definitively accepted and introduced. The first hypothesis suggests that the preparatory layer was applied before the pattern transfer and fixation onto the surface. The second hypothesis implies the execution of the preparatory layer after the pattern transfer and fixation.

To clarify this matter, Craftsman A admitted that:

> "In the *Koshtebori* technique, as can be seen in *Ali-Qapu* palace, the preparatory layer was applied before the pattern transfer and fixation onto the surface of this technique." (Craftsman A)

So, based on this fact, the validity of the first hypothesis was adopted in the *Koshtebori* technique (Figure 98). Also, the scratches and grooves resulting from the scraping of the design without any trace of a white paint layer left from the preparatory phase in the *Koshtebori* technique indicate that the application of the white preparatory layer occurred before the stage of transferring and scraping the design. Thus, it can be said that after the complete drying of the stucco's surface, the thin white preparatory layer was initially applied in one or more coats to entirely cover the base surface. Following that, the transfer of the desired design onto the working surface was carried out.

This process, following the necessary divisions, was performed in a method known as *Garteh.* Due to the instability of the transferred design in the *Garteh* method and the potential for charcoal dust removal or disruption of the design during work, the operation of fixing the pattern becomes necessary. This stabilization process, termed Scraping or Line drawing, is carried out using a sharp metal tool called a *Ferdangi* or *Fandango*, creating shallow scratches on the surface of the base layer. Scraping the design in this method not only delineates the design for the continuation of stucco but also serves as a guide for the painter in executing various stages of coloring and pattern writing.

Figure 98: The grooves from the stage of scraping the design onto the 'white clay' preparatory layer adorn the unfinished Koshtebori decorations on the third floor of the Ali-Qapu palace, Safavid period, Isfahan, Iran (Author).

Figure 99: The grooves from the stage of scraping the design onto the white preparatory layer adorn the Koshtebori decorations of the Pirnya historical house in Naein, dating back to the Safavid period (Author).

6.2.3 Plastering Stage in *Koshtbori*

After transferring the pattern using the *Garteh-kardan* method and scraping the design, any leftover powdered gypsum is cleared from the surface. The carving and cutting operations on the gypsum plaster begin in the *Koshtebori* technique. This process starts by incising contour lines on the plaster using a knife-like tool called a *Dambar* in Iranian traditional crafts (Motififar 2002,301). These incisions continue until the tip of the *Dambar* reaches the rough layer of gypsum beneath. The purpose of these incisions is to delineate the boundary between the patterns and the background, preventing mistakes during carving, and ensuring the edges of the design remain intact during subsequent processes. The carved gypsum in the background section is then shaved down to reach the rough surface of the underlying base using a tool known as a *Bomkhar,* which comes in various shapes and sizes (Graminejad 2007,152). Depending on the thickness and moisture content of the *Gach-e-Koshteh* layer, this shaving process may occur in one or two stages, involving lightening and cleaning operations (Azami 2011; Motififard 2010).

6.2.4 Coloring Stage in *Koshtebori*

After the completion of stucco carving, skilled painters undertake the decoration's final stages. Coloring in the *Koshtebori* technique is particularly significant due to the subtle surface differences between patterns and the background, as well as the generally flat nature of the patterns. The preparatory layer is painted in a watercolor style, typically in one to three stages. Pigments used include various iron oxide pigments, copper green, lapis lazuli blue, white lead, and vermilion. Despite their limited number, the diverse and aesthetically pleasing combinations of these pigments create visual diversity (Aslani 2011,42).

6.2.5 Technical evaluation of different samples in *Koshtebori*

The term *Koshtebori* requires a clear understanding of the stucco creation techniques involved. For instance, the technique has been observed in the decorations of the *Hasht-Behesht* Palace in *Isfahan* (Figure 101) and the *Pirnia* house in *Naein*. The execution method of *Koshtebori* in the *Ali-Qapu* Palace in *Isfahan* differs from other techniques.

Figure 100: The bounder and separation of two types of gypsum layers (Gach-e-Koshteh and Gach-e-Zendeh) in Ali-Qapu palace, Safavid period, Isfahan, Iran,
50 X Magnification (Author).

In some cases, the layers of coatings can separate without direct connection to the arrangement of the *Gach-e-Koshteh* layer over the *Gach-e-Zendeh* layer (Foroutani 2005, 68). Quality of execution and environmental conditions also play crucial roles; while separation and shedding of the surface layer are important indicators, they alone are insufficient. Cross-sectional layer examinations and crystallography studies using electron microscopy are necessary for accurate assessment, although these were not pursued in this research for future investigations.

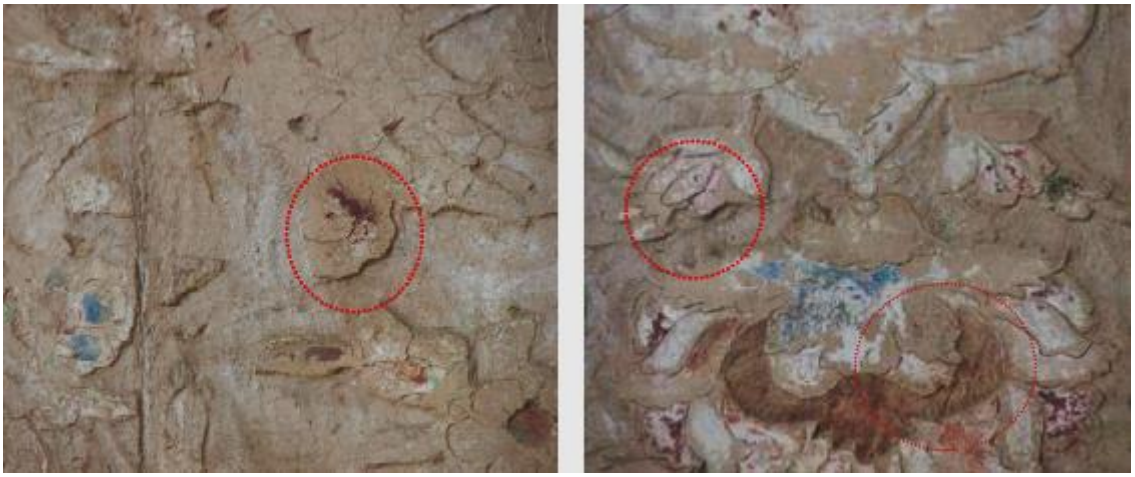


Figure 101: Two close-up views of decorations and the separation and shedding of the surface layer from the underlying gypsum layer, Koshtebori stucco decoration, Hasht-Behesht palace, Safavid period, Isfahan (Author).

In the *Hasht-Behesht* Palace, despite its height from the ground, separation between layers is visible in some sections, with noticeable differences between the roughened background surface and the polished patterns. The *Gach-e-Koshteh* layer has detached from the underlying layer and shows signs of shedding. Tool marks around patterns are also visible on the underlying base surface in certain areas (Figure 102).

By revising and structuring the information this way, the technical processes, and challenges in the *Koshtebori* technique are more clearly presented, enhancing understanding and readability.

Figure 102: The separation and detachment of decorative stucco layers from the underlying surface substrate occur due to the differential behaviour of these layers towards moisture. This phenomenon is observed in the low-relief stucco decorations of the courtyard walls of a Gorji historical house, Yazd, dating back to the Qajar period (Author).

The historic *Pirnia* house near the *Jameh* mosque in *Naein* showcases exceptional examples of low-relief stucco decorations dating back to the *Safavid* period (1501 CE to 1796 CE). These stucco decorations are renowned for their intricate craftsmanship and diverse motifs, including vegetal, human, animal figures, inscriptions, and calligraphy (Figures 103 and 104). Field studies on *Koshtebori* decorations have highlighted the meticulous craftsmanship evident in the stucco decorations of the *Pirnia* house. These decorations are divided into two sections: colorful and white stucco. The coloring observed is not simply paint applied to the gypsum surface but appears to be a substance mixed with gypsum itself. This mixture is applied in layers over the underlying gypsum, with parts of the design incised into the material (Tadayon 2008, 253).

Figure 103: The color variation between the surface layer and the underlying stratum is a part of the incised Koshtebori decoration found in Pirnia house, Naein, Safavid period (Author).

Figure 104: The stucco decorations of the Safavid period are considered a unique instance of low-relief gypsum ornamentation in Iran, both in terms of intricate craftsmanship and diverse motifs encompassing various designs such as vegetal, human, animal, inscriptions, and calligraphy. A depiction of the Koshtebori decorations on the wooden beams of Pirnia house, Naein, from the Safavid period (Author).

Among other embellished works adorned with low-relief stucco decorations, likely executed through the incising *Koshtebori* technique, one can mention certain sections. These include a tripartite *Mihrab* attributed to the *Seljuk* period (1040 CE to 1219 CE) at Jameh mosque of *Saveh* (Figure 105); the back recesses of *Safavid Mihrabs* at *Haruniyeh* shrine in *Isfahan* with intricate curved incisions; portions of decorations on the central arch of the bathhouse and caravanserai within the *Ganjali-Khan* complex in *Kerman*; sections of wall decorations in the courtyard of *Akhavan-Haghighi* house in *Isfahan*, displaying clear instances of dual-layer motifs, with the affected areas revealing the duality between the surface and underlying layers (Figure 106).

Figure 105: The low-relief stucco decorations, possibly achieved through Koshtebori, adorn one of the tripartite Mihrabs from the Seljuk period in the Saveh mosque (Author).

Figure 106: Two views showcasing the low-relief Koshtebori stucco decorations and areas affected by deterioration at the Akhavan-Haghani house in Isfahan, attributed to the Zand-Qajar period (Author).

This part of the research, focuses on the analysis of stucco decorations in *Ali-Qapu* Palace, particularly addressing the misclassification of certain decorations as *Koshtebori*, which, as argued here, are in fact *Boom-Saab*. By closely examining the technical and stylistic features of these decorations, this research aims to clarify this distinction and demonstrate the implications of such misclassifications for the broader study of Iranian stucco art.

The technique of *Boom-Saab* stucco decorations, classified in traditional Iranian crafts, emerged during the *Safavid* period (1501 CE to 1796 CE) and continued into later periods, starting from the reign of *Shah Abbas I*. This decorative style involves deliberately creating textured motifs that protrude from the surface substrate, effectively distinguishing motifs from backgrounds. Detailed examinations at the *Ali-Qapu* Palace in *Isfahan* prompted investigations into these *Boom-Saab* decorations. Previous scholars and traditional craftsmen had introduced incised decorations, but the concept of subsurface relief became distinct through meticulous observation (Mosavi 2001, 226; Nakouee 1999, 312; Aghajani 1980, 61), and traditional masters (Aslani 2011,101; Azimi 2011, 59; Motififard 2010, 49; Purshirvan 2008, 187; Javdani 2007, 119).

Figure 107: A portion of the subsurface relief stucco decorations of Boom-Saab can be found on the ceiling of the central hall on the third floor of the Ali-Qapu Palace in Isfahan (Author).

Historically, stucco decorations on the ceilings of *Ali-Qapu* Palace have been regarded as *Koshtebori* decorations, characterized by a two-layered method using *Gach-e-Zendeh* and *Gach-e-Koshteh*. However, comparisons with *Koshtebori* decorations in other historical sites reveal differences in appearance and damage patterns. Observable

separation and flaking of the incised layer were common in other buildings but less prominent in *Ali-Qapu*, despite its extensive decorations. Moreover, significant differences in color, texture, and surface between the base coat and surface layer are noticeable in other examples but not apparent in *Ali-Qapu* Palace. This suggests a hypothesis that the decorations at *Ali-Qapu* may not entirely adhere to the *Koshtebori* technique (Figure 108).

Figure 108: The notable differences in color, texture, and surface between the two layers (basecoat and surface layer) present a significant hypothesis suggesting that the decorations employed in Ali-Qapu might not be Koshtebori decorations.
A partially unfinished section of low-relief stucco decorations, third floor of the Ali-Qapu Palace, Safavid period (Author).

Figure 109: Unlike other buildings with similar-looking decorations, Ali-Qapu exhibits minimal surface disparities, sometimes limited to slight roughening of certain design areas. Moreover, the absence of surface layer separation from the underlying layer in comparison to similar decorations signifies differences in the material properties and execution method between this structure and other comparable samples. The part of the low-relief stucco decorations in Boom-Saab technique, Ali-Qapu Palace, Isfahan, Safavid period (Author).

In addition to coloring and pattern tracing, the subsurface relief *Boom-Saab* decorations at *Ali-Qapu* Palace exhibit supplementary ornamentation. For instance, in the central hall on the third floor, designs are intricately carved in stucco, followed by the application of a *Safavid* red primer layer (a mixture of Ochre and Isinglass) adorned with gold leaf (Figure 110). Evidence of gilding ornamentation alongside *Boom-Saab* relief stucco decorations can also be observed in other sections of the palace.

Figure 110: In the central hall on the third floor of Ali-Qapu palace, sections of the designs have been intricately carved in stucco, and following the execution, a preparatory layer of Safavid red primer layer (a mixture of Ochre and Isinglass) has been applied, accented with gold leaf. Boom-Saab technique of stucco with gilding and gold leaf decorations, the ceiling of the third-floor hall, of Ali-Qapu Palace (Author).

Field studies conducted as part of this research have identified various structures from the *Safavid* period, particularly during the reign of *Shah Abbas I* (1597 CE to 1629 CE), showcasing elements of *Boom-Saab* stucco decorations in specific historical sites across *Isfahan*. For instance, sections within the alcoves and niches of the side rooms at *Chehel-Setoon* Palace in *Isfahan* feature *Boom-Saab* decorations adorned with gold leaf, where stucco artists intricately carved deep grooves around motifs to accentuate their shapes (Figure 111). Similarly, in *Sharbat-Khanah* at *Qeisariyeh* Bazaar in *Isfahan*, western rooms exhibit *Safavid* period subsurface relief decorations where raised patterns replace carved backgrounds (Figure 112).

Detailed analysis of the stucco decorations in *Ali-Qapu* Palace reveals a critical misclassification of these works as *Koshtebori*. Upon closer inspection, the technical features, including the degree of relief, shaping methods, and stylistic details, align more closely with the *Boom-Saab* technique. For instance, the shallow relief patterns and intricate execution techniques observed in these decorations are hallmarks of *Boom-Saab,* distinguishing them from the deeper, more sculptural nature of *Koshtebori.*

Further examples were observed at *Jameh* mosque of *Ardestan* in *Isfahan*, where stucco artists enhanced motif visibility by creating deep grooves around them (Figure 114). These subsurface relief decorations were also noted in additional sections within *Jameh* mosque, highlighting instances of applying *Boom-Saab* stucco decorations in architectural settings during the *Safavid* era (Figure 113).

Figure 111: Sections of the Alcoves and Niches in the side rooms of the Chehel-Setoun Palace in Isfahan, adorned with gold leaf decorations, showcased features of Safavid-period subsurface relief decorations. In this technique, the stucco artist meticulously carved relatively deep grooves around the motifs, accentuating their shapes. Two views of indigenous dome-shaped vaults, accompanied by gold ornamentation, from the Safavid period,
can be seen in the Chehel-Setoun palace in Isfahan (Author).

Figure 112: The stucco decorations in the indigenous 'Boom-Saab' style refer to the carved patterns on plasterwork instead of a plain background, in Sharbat-Khanah of Qeisariyeh transom, Isfahan, Safavid period (Author).

Figure 113: Boom-Saab' stucco with deep groove carvings around the patterns, adorn the Safavid-period Jameh mosque in Isfahan (Author).

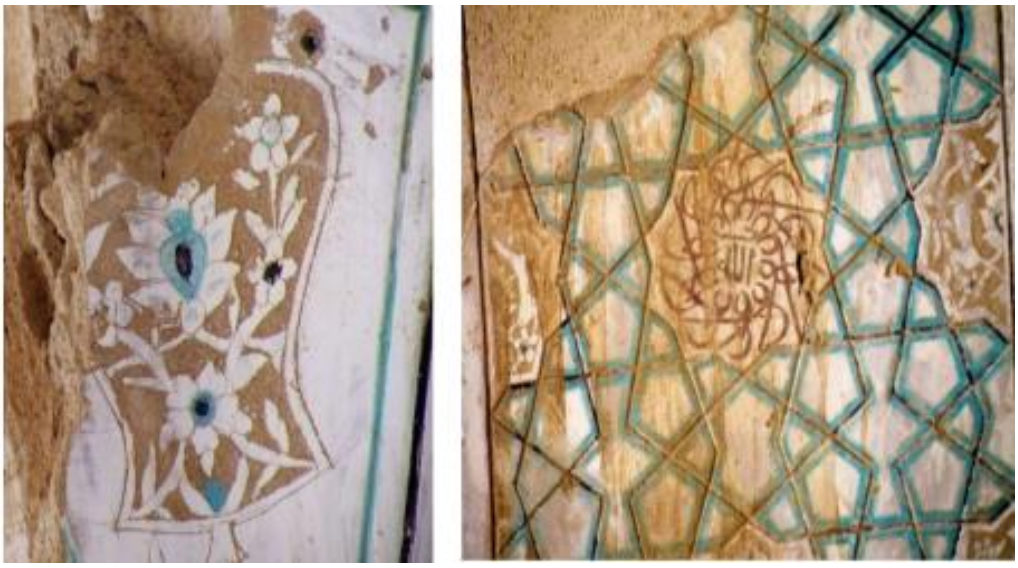


Figure 114: Two perspectives of Boom-Saab stucco decorations in the Jāmeh mosque of Ardestan. As visible in the close-up view, the gypsum coating is a single layer, and the patterns are achieved through partial carving. The surrounding background is adorned with a layer of intricate white floral motifs, Safavid period, Isfahan (Author).

Regarding presenting a schematic scheme (Figure 115) of the layers constituting the raised relief *Boom-Saab* stucco's technique, one can discern the differences between these decorations and various forms of *Koshtebori* ornamentation. By comparing the given figure with the schematic diagram related to the layers forming the *Koshtebori* decorations, one can observe the fundamental distinction in layering. In the *Koshtebori* ornamentation, the underlying layer serves a decorative function and contributes to the visible composition of the ornamentation. However, in *Boom-Saab* stuccoes, even if for technical reasons such as unevenness in the base, an intricate base execution may require multiple layers, all carving and incising operations are exclusively performed on the final applied layer of the base.

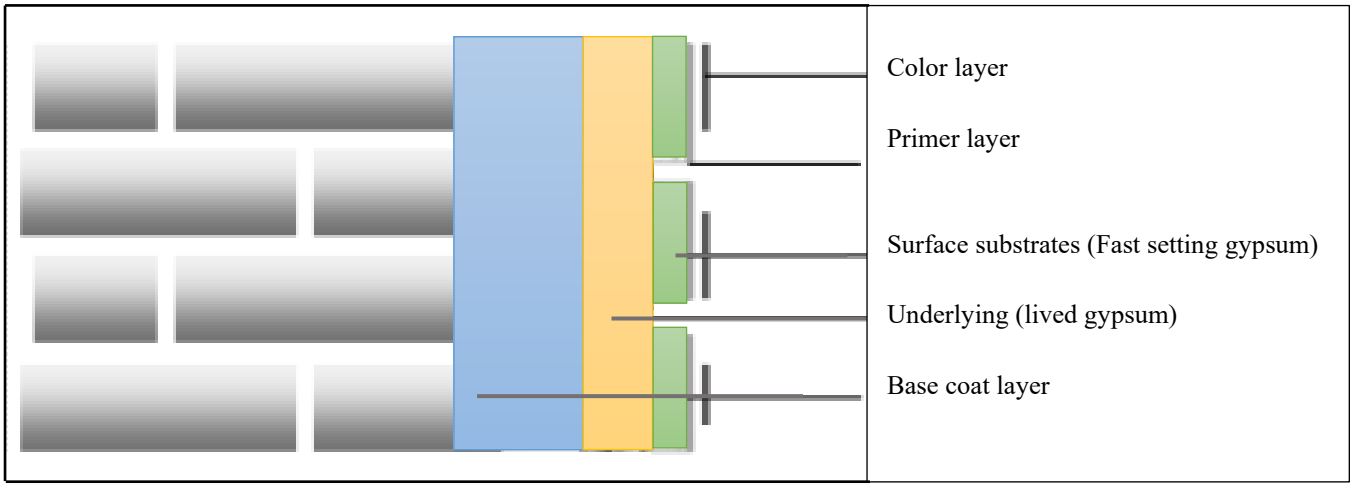


Figure 115: Diagram illustrating the incised layers composing a decorative incised pattern in the Boom-Saab technique. In Koshtebori ornamentation, the underlying layer serves a decorative function and contributes to the visible composition of the ornamentation. However, in Boom-Saab stuccoes, even if for technical reasons such as unevenness in the base, an intricate base execution may require multiple layers, all carving and incising operations are exclusively performed on the final applied layer of the base (Author).

6.3 Stucco Decorations on *Ajornama* Technique

Before the *Ilkanid* period (1256 CE to 1353 CE), particularly during the *Seljuk* period (1040 CE to 1219 CE), gypsum ornamentation on *Ajornama* was preferred, and stucco art, like in the *Ilkanid* period, was not a prominent architectural decoration (Makinijad 2008, 61). A distinctive feature of gypsum art during the *Ilkanid* period was the use of gypsum to simulate the luxurious brick decorations from the previous period which was named *Ajornama* in Iranian stucco art. During this period, many gypsum works were

executed in low-relief and essentially served as substitutes for the brick decorations of the previous period, especially the *Seljuk* period (Figure 116).

Figure 116: An illustration of the plaster decorations of the Ajornama (simulating low-relief plasterwork with spherical elements and brickwork knots), Sultanieh dome, Zanjan, Ilkanid period (Author).

In addition to the low-relief stucco decorations, which were more or less utilised in all *Ilkanid* structures, *Ajornama* paintings were also used in the *Al-Muzaffar* period, such as the decorations of the *Muzaffari-Madrassa* in *Isfahan*, aiming to imitate architectural surfaces with brick ornamentation. The technique for executing these paintings typically involved applying a layer of yellow brick-colored paint on the gypsum wall surface as a background, followed by drawing brick decorations with white paint on this background. It is worth noting that this white paint represents the mortar between the brick decorations.

During the *Seljuk* period (1040 CE to 1219 CE), the so-called 'Buttoned-bricks' decorations, which are *Toopi-Tah-Ajori* in Iranian traditional architecture, were one of the distinctive features of architectural ornamentation. As we have described in the relevant discussions, these types of decorations were a combination of brickwork and stucco art, where most of the surfaces were covered with brick materials. In these works, gypsum decorations, executed in two methods of carving and molding (using pressure

molds on the gypsum paste surface), were only applied in limited sections of the brickwork and the intervals left between the brick bands.

Figure 117: Two views of the painted Ajornama decorations (simulated with painted designs on plaster), Mozaffari Madrassa, Jameh mosque of Isfahan (Author).

Figure 118: An example of combined Ajornma and stucco decorations, Barsian Jameh mosque, Seljuk period (Author).

Although the zenith of gypsum decoration art with *Ajornama* can be attributed to the *Ilkanid* period (1256 CE to 1353 CE), it is worth noting that this technique was not limited to that period alone. Examples of this method can be found in artworks predating this period, such as the decorations on the *Jorjeer* sarcophagi from the *Al-Booieh* dynasty, as well as in structures from later periods, including those from the *Seljuk* period (1040 CE to 1219 CE) and those remaining from the *Safavid*, *Qajar*, and *Pahlavi* periods (1925 CE to 1979 CE). It is important to note that referring to this group of decorations as stamped technique, which is called *Mohri* in Iranian traditional crafts, is a common misconception, as in most of these examples, the gypsum carving method (cutting and engraving on gypsum) has been used.

The only case that may be classified as the *Mohri* technique is the *Ajdekari* decorations created through molding techniques with relatively high relief. For example, such examples of decorations can be seen in the additional decorations of the *Gonabad Jameh* mosque from the *Qajar* period (1794 CE to 1925 CE).

Figure 119: The stucco classified as the Mohri technique is the Ajdekari decorations created through molding techniques with relatively high-relief ornaments. Ajornama decorations (executed using molding technique), Jameh mosque of Gonabad, adornments dating back to the Qajar period (Author).

For low-relief stucco *Ajornama* decorations, after applying the plaster base according to the desired pattern, the carving process involves cutting and engraving areas corresponding to the empty spaces between bricks. In the subsequent stages, surface coloring enhances the resemblance of stucco decorations to brickwork even further. In many architectural decorations from the *Ilkhanid* period (1256 CE to 1353 CE), stucco decorations simulate brick decorations using the stamped *Ajornama* technique from the *Seljuk* period (1040 CE to 1219 CE).

In damaged sections, one can discern the execution method. For example, the stucco *Ajornama* decorations in certain sections of the *Jameh* mosque of *Zavareh* from the *Ilkhanid* period show how these arrays were constructed. As seen in the images, these decorations are visible beneath a layer of additional gypsum from the *Qajar* period (1794 CE to 1925 CE). A delicate layer of gypsum plaster has been directly applied to the brick support (which is not of particularly high quality) without the need for an additional layer of plaster. The carving and engraving operations are then performed on this plaster base. Finally, the stucco surfaces are painted with colors that combine mineral pigments and natural resin. These coloring materials not only transform the appearance of stucco *Ajornama* decorations to resemble real brickwork but also strengthen and reinforce the gypsum plaster surfaces. The stucco *Ajornama* decorations in the *Jameh* mosque of *Ardebil* (Figure 121), *Yazd* (Figure 122), *Saveh* (Figure 123), *Ardestan* (Figure 124), *Maragheh* (Figure 125), are some instances of this type of ornamentation.

As evident in the remains of some of these arrays, in certain cases, the applied gypsum plaster has uniformly covered all surfaces of the bricks. The reasons for this condition can be explained as follows:

- The shedding of the gypsum layer from the surface of the brick support.
- Selective application of gypsum in the gaps between brickwork and on the edges of brick pieces to repair chipped edges and unevenness.
- The excavation of the surface of the brick veneer and the failure to conceal the middle sections of the bricks due to excessive convexity and thinness of the gypsum plaster base.
- Repairs and interventions performed after the creation of the artifact on the *Ajornama* decorations. In such cases, the decorations will not be classified as stucco *Ajornama* decorations.

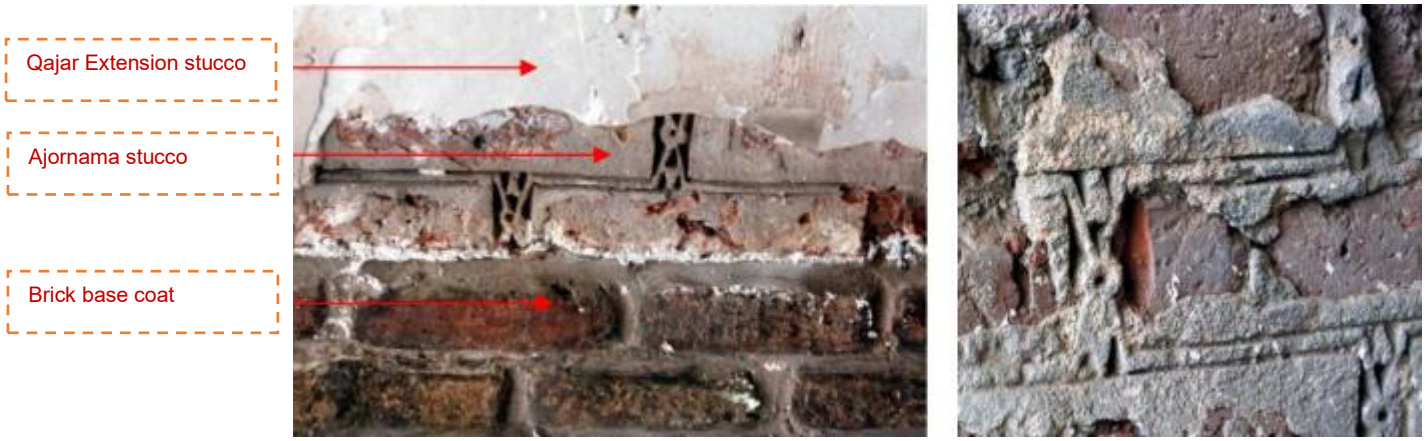


Figure 120: The Simulating patterned brick stucco, Zavareh Jameh mosque, decorations belonging to the Ilkanid period (Author).

Figure 121: The stucco brickwork 'stamped Ajornama' technique, Ardebil Jameh mosque, decorations dating back to the Ilkanid period (Author).

Figure 122: The stucco brickwork 'stamped Ajornama' technique, Jameh mosque of Yazd, Ilkanid period (Author).

Figure 123: The stucco brickwork 'stamped Ajornama' technique, Jameh mosque of Saveh, Ilkanid period (Author).

Figure 124: The stucco brickwork 'stamped Ajornama' technique, Jameh mosque of Ardestan, Ilkanid period (Author).

Figure 125: Plaster brickwork 'stamped Ajornama' technique, Jameh mosque of Maragheh lkhanid period (Author).

As seen in the images, these decorations are shaped using carving or stucco work. The presence of characteristic effects such as tool marks from carving and sculpting tools (Figure 126), scratch lines from the drawing and transfer stage of the pattern, and intricate gridlines applied for pattern drawing and execution in *Ajornama* stucco decorations, especially in the congregational mosques of *Isfahan*, *Oshtorjan*, and *Yazd*, provide compelling evidence against labeling these decorations as *Mohri* designs (Figure 127).

For example, in a sample from the Grand *Jameh* mosque of *Yazd*, attributed to the *Ilkhanid* period (1256 CE to 1353 CE), the pattern transfer method involves drawing and marking on the work surface. Initially, a delicate grid pattern in the form of small squares, approximately 5 by 5 cm, is executed on the plaster bed. Then, based on this grid, the desired knot pattern is drawn and marked, and finally, it is carved and sculpted.

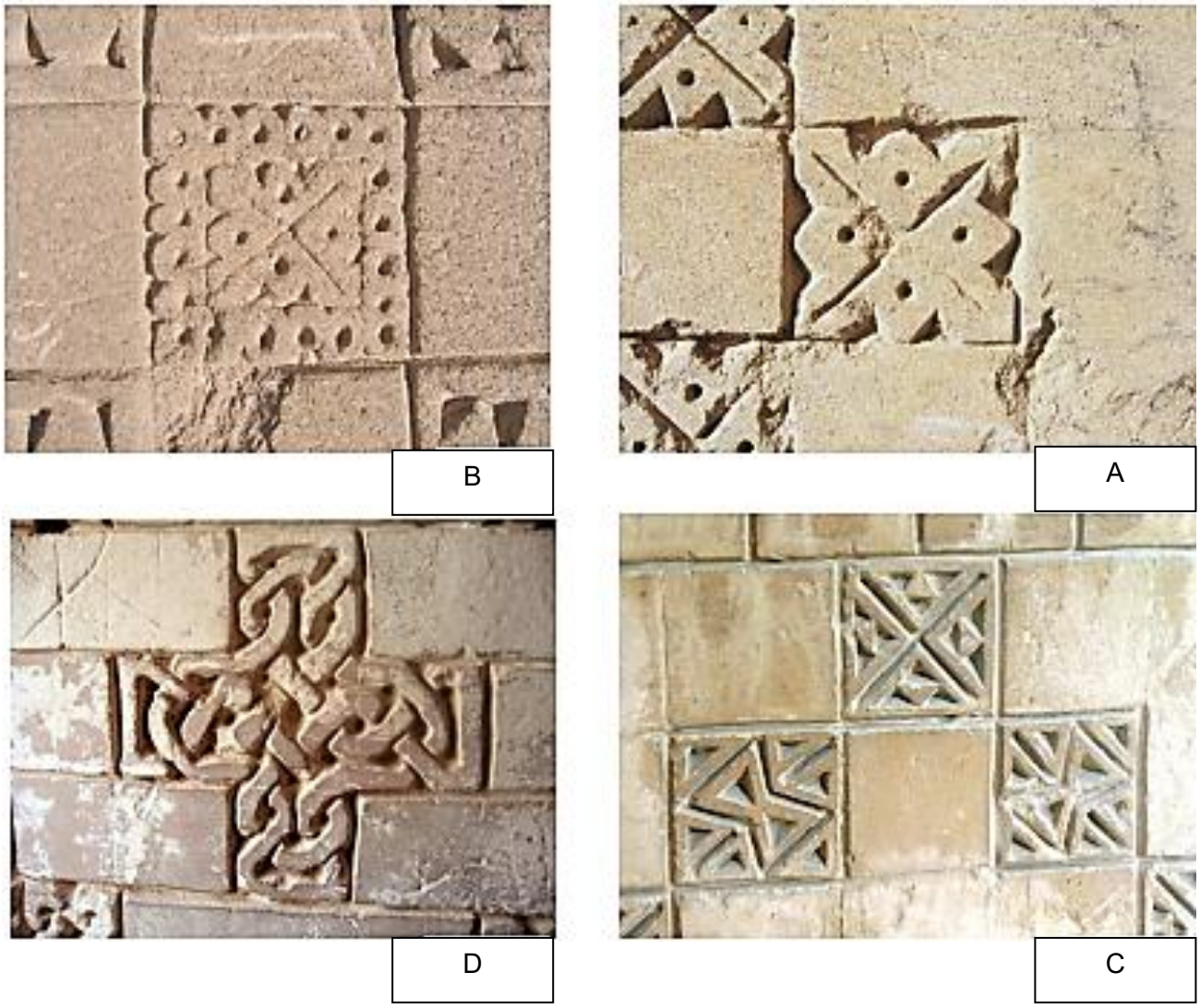


Figure 126: Simulating patterned brick, Ilkanid period.
A: Jameh mosque of Oshtorjan. B: Jameh mosque of Haftshooyeh. C: Pir-Bakran Shrine
D: Farfan mosque (Author).

Figure 127: A close-up view of the tool marks of cutting and carving, the grooves related to the grid pattern of low-relief plasterwork mimicking rounded brick bottoms, Grand Jameh mosque of Yazd, attributed to the Ilkanid period (Author).

Field studies were conducted on various samples of low-relief stucco decorations related to the *Pir-Bakran* shrine, *Jameh* mosque of *Oshtorjan*, *Sultanieh* dome of *Zanjan*, Grand *Jameh* mosque of *Yazd*, and *Jameh* mosque of *Ardestan* to further investigate this brick-facade technique (*Ajornama*). It was entirely evident that these gypsum decorations possess good mechanical resistance. Therefore, as there was a need to elucidate further details of the *Ajornama* technique, Craftsman A was asked in the interview about the traditional method of executing this technique in Iranian architectural stucco decorations. In this regard, Craftsman A stated that:

> "In the *Ajornama* stucco decorations, assessing the quality of the gypsum, the method of plaster preparation, and the types of primary colors used on the surface of the stucco arrays are so important. In this technique, the gypsum used in all samples should be free from significant impurities and have a fine-grain texture. Also, the prepared gypsum plaster for such decorations, to facilitate carving and shaping, is usually *Gach-e-Koshteh*, as in the cases of the decorations in the *Jameh* mosque of *Ardestan* and *Pir-Bakran* shrine. Consequently, the mechanical resistance of the plaster after drying is not particularly suitable. The application of a paint layer and the penetration of a binding resin in the paint coat contribute to enhancing the mechanical strength of certain surface areas. ultimately, this issue was able to effectively fill the existing knowledge gaps in the field of executing the technical and methodological aspects of *Ajornama* gypsum decorations." (Craftsman A)

After the stucco carving stage in this method, further embellishment of the decorations was achieved through painting the surface layer of the stucco. In most cases, the colors used include two dominant hues: Mustard yellow to simulate bricks and white for areas intended to represent gypsum facades. However, other colors such as red, green, blue, and black can also be employed, as seen in examples like the *Sultanieh* dome of *Zanjan* (Figure 128) or the *Sabz* dome of *Qom*.

Figure 128: After the stucco carving stage in this method, further embellishment of the decorations was achieved through painting the surface layer of the stucco. In most cases, the colors used include two dominant hues: Mustard yellow to simulate bricks and white for areas intended to represent gypsum facades. Traces of remaining paint on two samples of Ajornama decorations, Sultanieh dome, Zanjan, Ilkanid period (Author).

Figure 129: In most Ajornama stucco arrays, the colors used include two dominant hues: Mustard yellow to simulate bricks and white for areas intended to represent gypsum facades. However, other colors such as red, green, blue, and black can also be employed. Two views of the plaster brickwork decorations, remnants of white and mustard yellow paint on the adornments, Jameh mosque of Oshtorjan, Ilkanid period (Author).

Figure 130: The remnants of mustard yellow paint on the plaster brickwork decorations, Pir-Bakran Shrine, Ilkanid period (Author).

Figure 131: The variety of coloration in the stucco, Ajornama decorations, Sabz dome, Qom, Ilkanid period (Rahimi 2023).

Figure 132: Remnants of white paint on the decorations of Farumad Jameh mosque, Sabzevar, Ilkanid period (Author).

In this study, following field investigations on *Ajornama* decorations regarding the quality of gypsum grain distribution, the method of gypsum preparation, and the types of primary colors used on the surfaces of decorations, interviews were conducted with traditional Craftsmen A and Craftsman B. In this regard, the Craftsman A mentioned that:

> "Pre-prepared gypsum for executing *Ajornama* decorations, to facilitate cutting and executing intricate and delicate patterns, is applied in some cases using the 'half-coated' or *Gach-e-Koshteh* method."(Craftsman A)

Furthermore, in the expression of this issue, Craftsman B stated:

> "The gypsum mortar for the *Ajornama* decorations is prepared in a *Gach-e-Koshteh* form. Also, applying a layer of paint on *Ajornama* decorations is not only for embellishment but also for the penetration of coloring materials into gypsum grains and enhancing the mechanical resistance of these decorations." (Craftsman B)

Finally, the noteworthy point regarding the low-relief stucco decorations of the brick facades or *Ajornama* in Iran is that in this type of ornamentation, a colorful layer resembling liquid adhesive is spread over the surfaces of gypsum crystals, enhancing the cohesion and connection between the crystals. This colorful layer enhances the aesthetic properties and compensates for the weakness and low resistance of the gypsum layer against pressure and abrasion in the stucco decorations of *Ajornama* in historical buildings. In areas where this colorful layer was absent or had disappeared, more damage was observable in the brickwork decorations.

In summary, this chapter examines the techniques of low-relief stucco work in Iranian architecture, focusing on three main methods: *Koshtebori, Boom-Saab,* and *Ajornama*. Each of these techniques showcases the complex and unique characteristics of Iranian low relief stucco artistry.

Firstly, the *Koshtebori* technique (incised gypsum layer carving) was discussed. This involves carving patterns on a layer of quick-setting gypsum (*Gach-e-Zendeh*). The execution stages include applying a base layer, sub-base, transferring the design using the *Garteh* method, and final carving. Typically, the coloring is done in a watercolor style. Examples of this art can be found in the *Hasht Behesht* Palace in *Isfahan* and the *Pirnia* house in *Naein.* A key feature of *Koshtebori* decorations is the potential separation of the surface layer from the underlying layer, creating detailed low-relief decorations and leveraging the unique properties of gypsum for aesthetic and structural integrity.

Another technique explored is the *Boom-Saab* (surface scraping) decoration, which developed extensively during the Safavid period. This method involves creating raised motifs from the surface background and differs from *Koshtebori* in its layering and execution. Prominent examples can be found in the *Ali-Qapu* Palace in *Isfahan*. *Boom-Saab* decorations are often accompanied by gilding. Artists used deep carving techniques to create distinctive visual effects and intricate designs, illustrating the widespread application of *Boom-Saab* stucco decorations during the *Safavid* period in *Isfahan.*

Finally, the *Ajornama* (brick-facade appearance) technique aims to simulate brick decorations using stucco, mainly popular during the *Ilkhanid* period. This method involves carving and painting to resemble brickwork and uses slow-setting gypsum (*Gach-e-Koshteh*) for easier carving. Examples can be seen in the *Jameh* mosques of *Ardestan*, *Yazd*, and *Zavareh*. The execution method includes a delicate gypsum grid

pattern for transferring designs, followed by carving and painting, which enhances the resemblance of stucco decorations to real brickwork. This technique combines mineral pigments and natural resin for increased durability and aesthetic appeal.

Key points and unique features of *Ajornama* decorations highlight that each technique has its materials, execution methods, and historical contexts, crucial for the proper identification, conservation, and restoration of these decorative elements. The skills and knowledge of traditional craftsmen are vital for preserving these historical techniques, as Iranian stucco work is complex and delicate, requiring careful analysis and documentation.

Ultimately, in response to one of the research questions, the low-relief stucco decorations represent an important aspect of Iran's architectural heritage. Understanding the differences between *Koshtebori, Boom-Saab*, and *Ajornama* techniques is essential for the proper identification, conservation, and restoration of these decorative elements.

Chapter Seven: Discussion

This research delves into the intricate world of stucco decorations in Iranian architecture, exploring a comprehensive classification system that sheds light on the nuances and complexities of this rich artistic tradition. At the heart of the study are two primary criteria that form the foundation of the classification: the level of projection of the stucco decorations and the method of shaping the stucco. Furthermore, this chapter provides a comprehensive synthesis of the analyses presented in the preceding chapters, highlighting how they collectively address the research questions and contribute to the broader understanding of Iranian stucco decorations. By linking the findings to the themes discussed in the literature review, this chapter aims to demonstrate the academic and practical implications of the research in areas such as historical understanding, dating, conservation, and management of stucco art.

The level of projection, a crucial factor, allows the researchers to categorise the stucco decorations into five distinct groups, ranging from the highly prominent and relief-laden to the subtly flat and non-relief. This detailed taxonomy provides a deeper understanding of the visual interplay between the decorative patterns and their backgrounds, revealing the sheer artistry and technical mastery of the stucco craftsmen. Alongside the prominence-based classification, the study also examines the methods employed in shaping the stucco, identifying two primary approaches: in-situ shaping and mold-making. These techniques, rooted in ancient traditions and refined over centuries, have imbued the stucco decorations with a rich diversity of styles and expressions.

However, a classification based solely on these two criteria is insufficient to capture the full breadth and complexity of the stucco art. Delving deeper, the research presents a more comprehensive taxonomy that incorporates the distinctive execution techniques and unique technical nuances employed by the craftsmen. In this research, the framework unveils a tapestry of nine different stucco decoration methods, each with its captivating characteristics and historical significance. Acknowledging the potential for overlap and the need for a more streamlined approach, ultimately it has been proposed the refined classification system that distills the stucco decorations into two primary groups: relief stucco and low-relief stucco. This delineation, based on the difference in elevation between the patterns and the background, provides a more concise and informative framework for understanding the intricacies of this architectural art form.

The findings of this research directly address the gaps identified in the literature review, particularly the lack of comprehensive technical evaluations and systematic classifications of Iranian stucco art. By integrating advanced analytical methods with historical and stylistic analysis, this thesis provides a new framework for understanding the diversity and complexity of stucco decorations across different historical periods. So, the significance of this research lies not only in its meticulous cataloging of stucco techniques but also in its introduction of specialized vocabulary and terminology. By establishing a common lexicon, the study lays the groundwork for more precise documentation and a deeper appreciation of the rich heritage of stucco art in Iranian architecture. This holistic approach promises to enhance our understanding and preservation of this captivating artistic legacy, ensuring that the stories etched in stucco continue to inspire and captivate future generations.

The evaluation and field studies of different stucco art in historical architectures in Iran reveal that the general method and technical points shared in creating high-relief stucco works involve six stages including, at first surface preparation by applying a plaster layer, secondly executing the primary base-coat layer, transferring the desired pattern onto the base-coat layer, then implementing the secondary layer selectively in necessary areas, shaping the base layer through cutting, carving, and adding new pieces, and carrying out supplementary operations.

In order to assess prominent gypsum decorations, field studies were conducted on 33 distinct works in historical Iranian architecture spanning from the *Seljuk* period to the *Qajar* era. These gypsum decorations, predominantly found in the northern half of Iran, were executed in various cities including *Ardabil*, *Gonabad*, *Zavareh*, *Isfahan*, *Gonabad*, *Saveh*, *Urmia, Oshtorjan*, *Maragheh, Marand, Bastam, Neishabour*, *Ardestan, Abarkuh, Sabzevar,* zavareh, *Mazandaran, Falavarjan, Zanjan, Hamadan, Gar, Yazd, and Torbat-e-Jam.* They were observed in both the interior and exterior sections of buildings, employing diverse techniques and methods, ranging from simple to elaborte, indigenous to foreign-influenced, single-colored to polychrome, engraved to relief, and more. These variations are detailed throughout this research. Despite the diversity of these high-relief stucco works, a significant feature is the use of *Gach-e-Koshteh* techniques after execution on the architectural surfaces. Consequently, stucco formed by various methods such as prefabrication or in situ, do not belong to this group. The difference in elevation between the patterns and the text in high-relief stucco works is typically more than half a centimeter. Furthermore, the artistry of the high-relief

stucco works indicates that the execution of the base-coat layer, depending on the desired pattern and the level of projection of various patterns within the design, can be done as a single layer or in multiple layers (*Yek-Gacheh* or *Do-Gacheh*). Also, the preparation of the required plaster for embedding the base involves using fine-grained pure gypsum without additives or impurities.

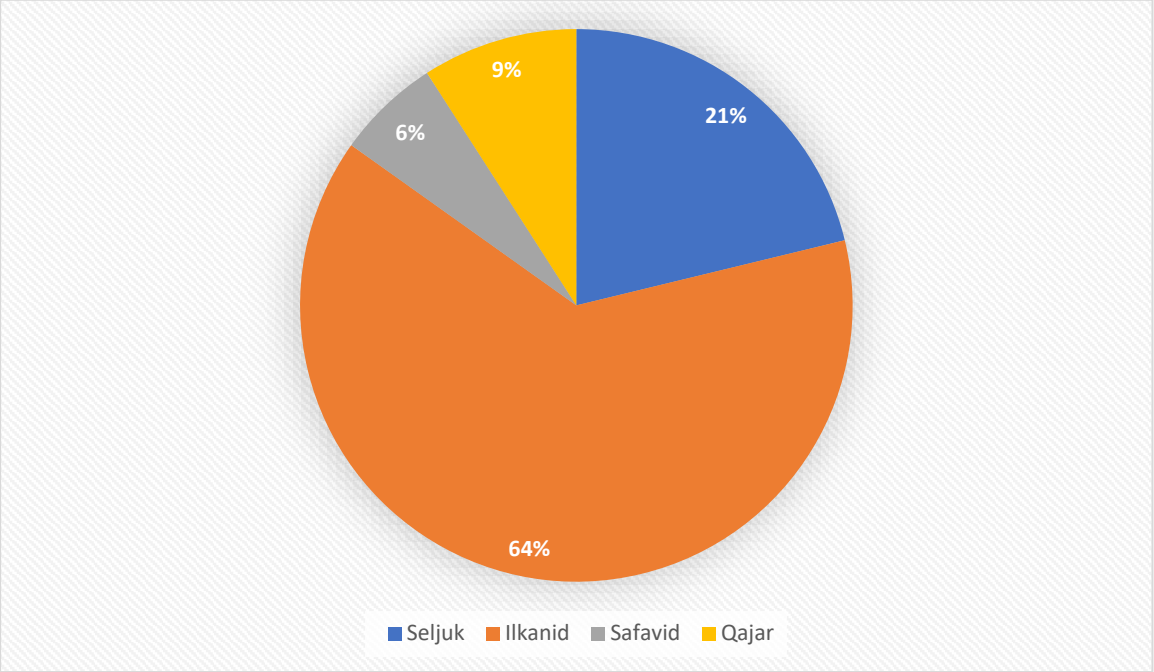


Chart 133: Numerous high-relief stucco artworks across different historical periods in the different 33 field-studies samples in this research (Author).

Based on the evaluations conducted, most of the remaining high-relief stucco artworks in historical Iranian architecture, which were also studied in the field studies of this research, belong to the *Ilkanid* period. Accordingly, the peak of the creation of high-relief stucco decorations in Iran dates back to the *Ilkanid* period (Chart 133). It is worth mentioning that the majority of these decorations executed in this era are seen in monochrome or with limited (non-vibrant) color schemes. Following the *Ilkanid* period, the subsequent periods include the *Seljuk, Qajar*, and *Safavid* eras. According to this research, it is apparent that there is a lesser inclination towards creating high-relief stucco decorations in the *Safavid* period, with more attention given to the techniques of low-relief stucco.

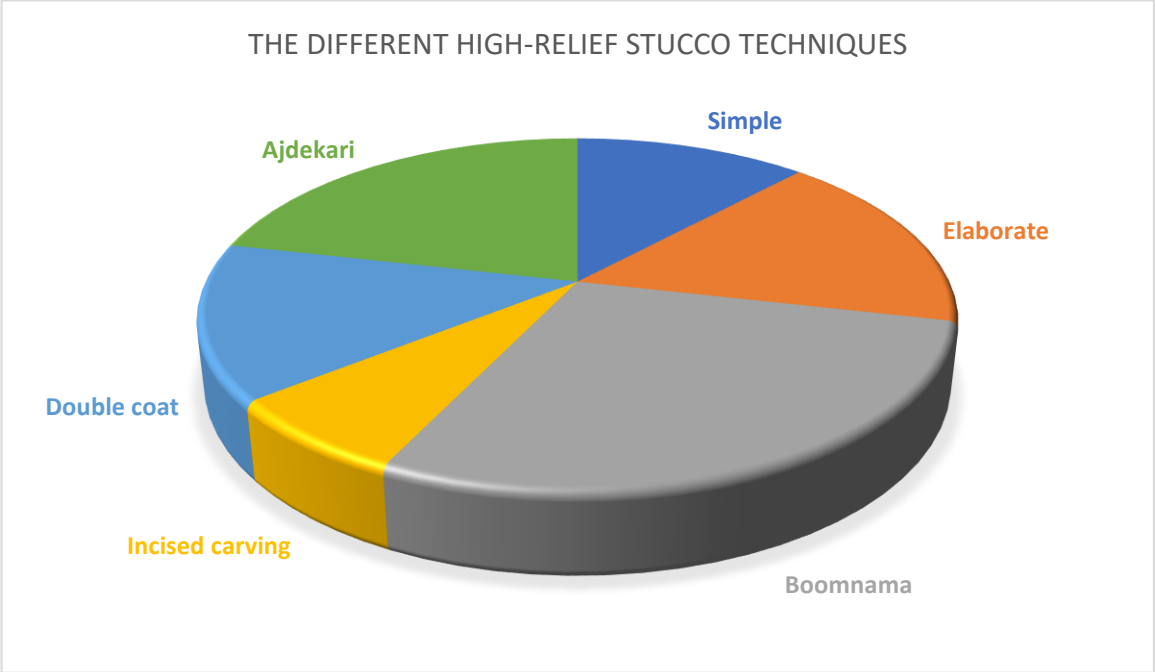


Chart 134: The different high-relief stucco techniques in the 33 numerous field-studies' samples in this research (Author).

Based on the conducted studies, it can be stated that among the techniques employed in the high-relief decorations in 33 sampled cases in this research, the majority were executed using the *Ajdekari* relief technique, followed by the *Boomnama* relief stucco which garnered significant attention, with numerous examples of this technique remaining from the *Seljuk, Ilkanid*, and *Qajar* periods. In the execution of high-relief stucco decorations, simple and elaborate techniques, as well as the *Do-Gacheh* (double-coat) method, have been applied to a similar extent. Ultimately, the incised carving technique was the least prevalent among these decorations, accounting for the smallest proportion.

Also, the fields studies aimed at identifying and categorizing existing works of high-relief stucco, display a wide variety in their visual appearance. While this diversity is related to technical aspects, what is mostly observed seems to be more associated with artistic tastes, craftsmanship, and the intentions of the creators. On this basis, two general subgroups defining the high-relief stucco works can be delineated, which include simple and elaborate relief decorations. Each of these can further be divided into smaller subgroups. They are classified based on the type of incised base layer, whether flat or inclined, and the density of patterns, classified as continuous or resembling

earthwork. Furthermore, in intricate high-relief stucco works, in addition to classification based on the type of incisions and pattern density, there are various additional operations carried out on the surface of the patterns. These operations include different types of simple and elaborate patterns, which can be executed in relief or carving methods, featuring various designs such as simple, knot-like, and carved patterns.

The examination of 23 case studies in this research indicates that the historical scope of low-relief stucco artworks primarily belongs to the *Ilkanid* period. It was during this era that stucco decoration emerged as one of the most prominent embellishments of historical buildings, surpassing other materials such as tilework, wall paintings, mirror work, woodworking, or brickwork. Therefore, it is not surprising that the majority of stucco works in Iran originated during this historical period. Following the *Ilkanid* period, the highest number of low-relief stucco artworks among the selected case studies in this research is attributed to the *Safavid* era. This is while the technique of low-relief stucco was comparatively less utilised during the *Qajar* and *Seljuk* periods.

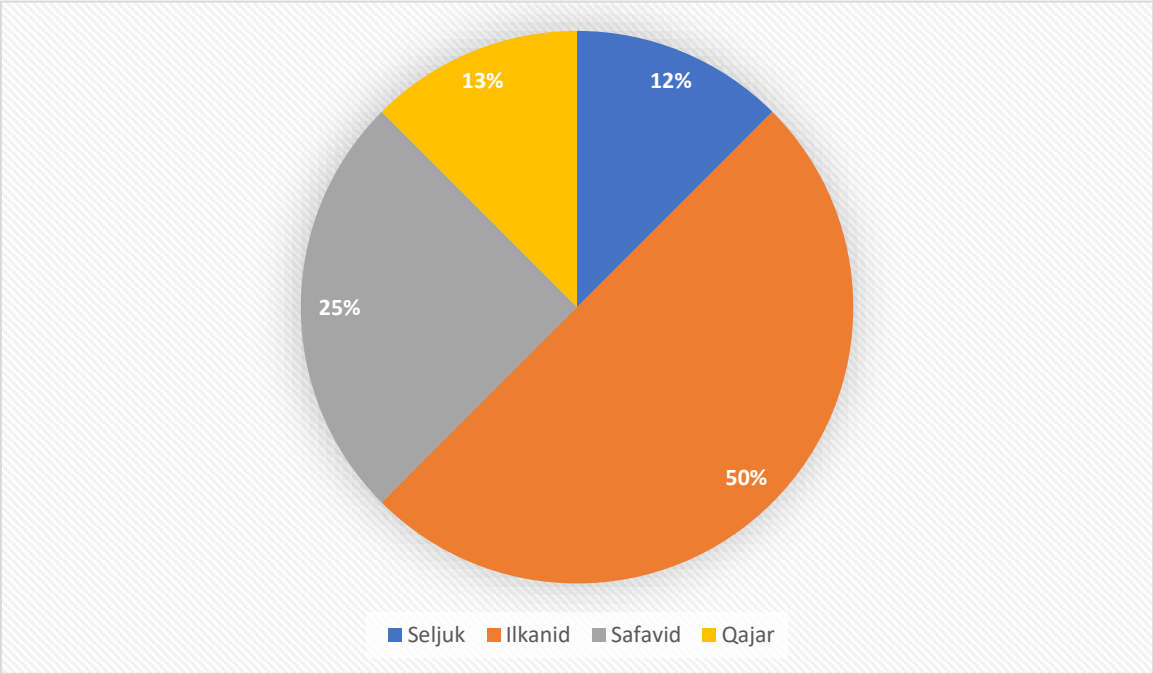


Chart 135: Numerous low-relief stucco artworks across different historical periods in the different 23 field studies's samples in this research (Author).

What stands out in the examination of twenty-three selected case studies of low-relief stucco in this research is that among the studied stucco decorations, the most commonly employed technique in low-relief stucco was *Ajonama* stucco decoration, followed by *Koshtebori* techniques resembling simulating patterned brick, methods prevalent in the architectural ornamentation of Iranian structures. Finally, the low-relief stucco techniques in this research included the indigenous *Boom-Saab* method and the stamped stucco method (Chart 136).

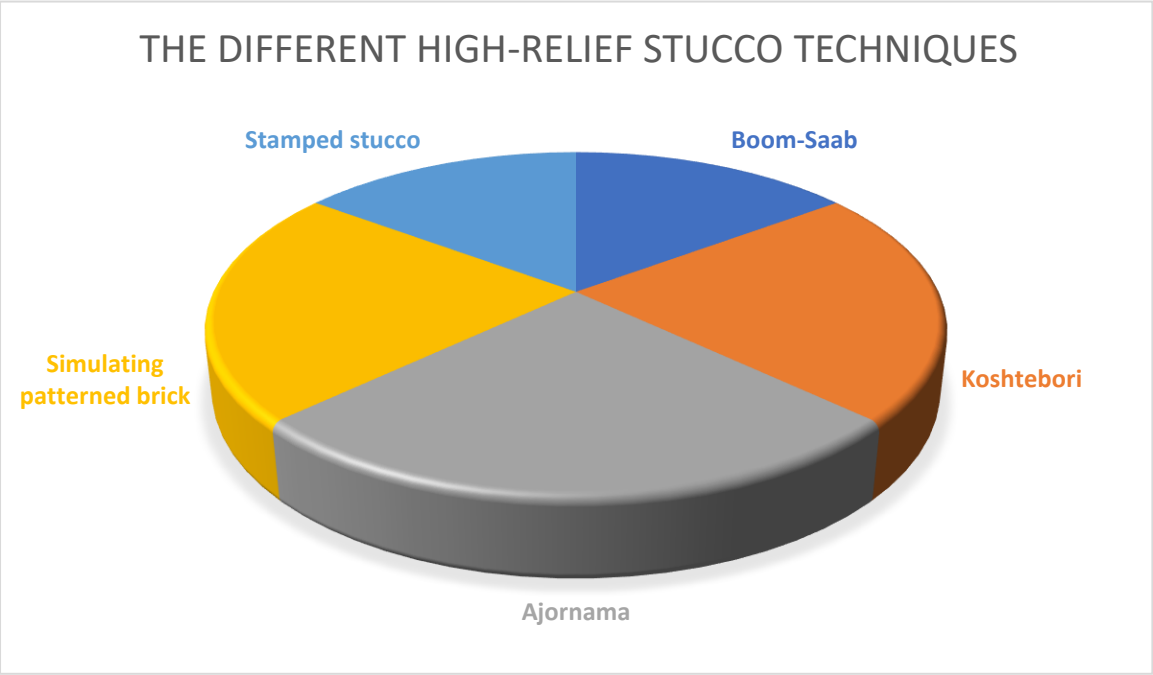


Chart 136: The different low-relief stucco techniques in the 23 numerous field-studies' samples in this research (Author).

On the other hand, field studies and evaluation of the different historical architecture in Iran reveal that in the group of low-relief stucco art, based on their visual appearance, specific technical features, and the method of execution identified during precise observations and stratigraphic studies, three types of stucco decorations exist as *Koshrebori* decorations, Boom-Saab decorations, and the brick façade or *Ajornama* decorations.

In the *Koshrebori* stucco, the gypsum required for the surface layer is applied through a *Gach-e-Koshteh* technique. In these decorations, the differentiation between the surface layer and underlying layers can be discerned based on visual indicators such as

texture, grain, color, the demarcation line between layers, or the crystalline structure's stratigraphy. In most *Koshrebori* stucco arrays, a significant and notable issue is the separation of the surface layer from the background layer. Even in intact examples, evidence of the separation between the surface layer of the stucco and underlying layers can be observed.

However, the field studies in this research show that in the low-raised *Boom-Saab* stucco technique, a distinctive technical feature involves the partial carving of the base thickness to create a different texture between patterns and the background. In these decorations, both the pattern and background are executed on a single base layer, hence multiple layers of decorative plaster are not visible. In *Boom-Saab* stucco, after applying a prepared layer of gypsum mortar in a wet method, for finishing and polishing the surface of decorations, significant pressure is exerted using a float, which, while the grip has not fully set, induces fracturing and displacement of crystals in the surface layer of the stucco as identification of impurities extending from the depth to the surface, further exemplify the characteristics of *Boom-Saab.*
Numerous field studies on various samples taken from low-relief stucco arrays, including an examination of the quality of the gypsum granulation used, the method of mortar application, and the types of primary colors employed on the surface decorations, demonstrate that the gypsum used in all samples is free from significant impurities and possesses fine granulation. The prepared gypsum mortar for such decorations in the *Boom-Saab* technique, for ease in cutting and shaping, is mostly *Gach-e-Koshteh*, leading to the insufficient mechanical resistance of the reliefs after drying. The application of a paint layer and the penetration of a binding resin-based paint seem to enhance areas of the surface with better strength properties.

In the case of low-relief stucco *Ajornama* decorations, all the implementation stages and technical methods used in this type of decoration are similar to those of the *Ajdekari* decorations, however, the visual differences between these arrays and the *Ajdekari* stucco decorations lie in the patterns and designs executed on the plaster surface. While high-relief *Ajdekari* decorations exhibit a wide variety of patterns and designs, low-relief stucco *Ajornama* decorations are limited to patterns commonly seen in brickwork. Another difference is that *Ajdekari* decorations are typically applied to a portion of the pre-gypsum plastered surface, serving as supplementary decorations, while low-relief *Ajornama* stucco decorations are applied directly onto plain gypsum plaster surfaces.

The findings from field studies and interviews with traditional craftsmen A and B shed light on the techniques employed in the execution of *Ajornama* decorations, particularly focusing on the preparation of gypsum and the application of colors. Craftsmen A and B provided insights into the intricate methods involved in preparing the gypsum mortar, emphasizing the use of techniques such as the "half-coated" or *Gach-e-Koshteh* approach to facilitate the execution of complex patterns. Moreover, the discussions highlighted the significance of paint application beyond mere aesthetic enhancement. Craftsman B emphasized that the layering of paint serves a dual purpose: embellishment and enhancing the mechanical strength of the decorations. This is achieved through the penetration of coloring materials into the gypsum grains, reinforcing the structural integrity of the decorations. These insights underscore the nuanced craftsmanship and meticulous attention to detail involved in *Ajornama* decorations. By understanding the traditional methods and materials used, contemporary artisans and researchers can further explore and innovate within this rich cultural heritage of decorative arts. Additionally, these findings contribute to the preservation and appreciation of traditional crafts and techniques in the context of cultural heritage conservation.

Finally, studies have shown that despite the use of stucco decorations in outdoor environments, their durability and longevity are remarkable due to their fine-grained and uniform texture, adequate compactness, and appropriate mortar bond strength. However, because of the vulnerability of gypsum to factors such as moisture and freeze-thaw cycles, damage such as layer separation, spalling, or cracking has been observed. Despite the diversity of stucco decorations, many common patterns and attributes existed among them, indicating the continuity of plastering traditions and techniques throughout the history of Iranian architectural art. These patterns included combinations of lines, geometric shapes, plants, animals, and human motifs that were formed through the creativity and artistry of artists in each period.

Finally, this research makes significant contributions to the study of Iranian stucco art by introducing a novel classification system that incorporates both technical and stylistic criteria. It demonstrates the importance of combining relief levels, shaping methods, and execution details to achieve a more accurate understanding of stucco decorations. Furthermore, the research advances the field by refining historical dating techniques and proposing new strategies for conservation and management, ensuring the preservation of this intangible cultural heritage for future generations.
In conclusion, this chapter has synthesised the research findings, demonstrating their relevance to the broader academic and practical contexts of Iranian stucco art. By

addressing the gaps identified in previous studies and proposing a comprehensive classification system, this research not only enhances our understanding of stucco decorations but also establishes a foundation for future studies in the conservation and management of Iranian architectural heritage.

Research Question/Gap	**Findings/Contributions**	**Implications**
Lack of comprehensive classification of stucco decorations	Proposed a novel classification system incorporating relief levels, shaping methods, and execution details	Provides a systematic framework for categorising stucco art
Insufficient technical evaluation methods	Integrated the review of advanced analytical tools for technical evaluation	Enhances precision in technical studies of stucco decorations
Limited understanding of historical dating of stucco art	Refined historical dating techniques for stucco decorations	Improves accuracy in historical and stylistic analyses
Need for improved conservation strategies	Suggested strategies for conservation and management of stucco art	Supports preservation of stucco as cultural heritage

Table 137: Summary of research questions, key findings, and their implications, highlighting how this study addresses existing gaps in the classification, technical evaluation, historical understanding, and conservation of Iranian stucco decorations (Author).

Chapter Eight: Conclusion

The results obtained from this research showed that stucco decorations in historical buildings of Iran have great diversity and variety, and in a single building from different historical periods, one can observe very different techniques of stucco art. The classification of stucco decorations in this research facilitates their study and recognition for future research.

Iranian stucco decoration is renowned for its intricate and precise designs, encompassing geometric patterns, arabesques, floral motifs, and calligraphy. This decorative art has a rich historical legacy in Iran, dating back to ancient times and influenced by civilizations such as the *Achaemenids, Parthians, Sasanids*, and Islamic periods. Traditionally, stucco in Iran is made from gypsum, allowing for precise carving and modeling. These stucco embellishments adorn various architectural components like walls, ceilings, and exteriors of buildings, enhancing their beauty and architectural significance.

Iranian stucco decoration has employed diverse techniques throughout history, each with unique characteristics and reaching its peak during specific historical periods. For example, the zenith of high-relief stucco decoration can be observed during the *Ilkanid* period (1256 CE to 1353 CE), while low-relief decorations like the fresco technique flourished during the *Safavid* period. Despite the variety of stucco techniques, it is important to note that stucco decorations have been used both internally and externally in famous historical buildings. This includes significant historical structures where stucco decorations continue to adorn interiors and exteriors, serving as enduring artistic representations of Iran's architectural wealth and the diverse artistic and cultural influences across different historical periods.

Historical techniques of stucco decoration in Iran can be categorised based on historical periods, the prominence of patterns and embellishments, and methods of shaping. This thesis combines all of these approaches to ultimately introduce nine distinct techniques in stucco art, which include: Relief stucco (Barjasteh), Marquetry (*Moaragh*), Hollow or cavity stucco (*Mojavaf*), Lattice technique (*Moshabak)*, Low-relief stucco (*Kam-Barjasteh*), Molded stucco (*Ghalebi*), Mirror inlaid /mirror embedded stucco (*Talfigh-ba-Aineh*), Stucco combined with architectural decorations (*Talfigh-ba-Masaleh*), and Rolling stucco technique (*Fetilei*).

One of the most important and prominent differences between high-relief and low-relief decorations is the degree of projection between the decorative motifs and the background, each creating a different texture in the ornamentation. The relief stucco

decorations comprise simple relief decorations, elaborate decorations, and the *Boomnama* technique in the shallow, deep, and stratified background. Also, there is the *Ajdekari* technique which is kind of a relief stucco decoration and has been executed in three different types of decorations simple carved patterns, duplicative *Ajdekari*, and curving ornaments. In this while, the low-relief stucco decorations consist of *Koshrebori* decorations, *Boom-Saab*, and brick-façade or *Ajornama* decorations. Based on the research findings, the high-relief stucco decorations aim to create intricate ornaments by utilizing variations in depth and embellishments.

One of the limitations of this research was the evaluation of existing works, some of which had been destroyed or were not in good physical condition. This issue made the study and classification challenging. Furthermore, some of the historical stucco decorations, such as *Seljuk* and *Ilkanid* decorations, which had a longer period since their creation, had undergone deterioration due to numerous damages. However, another challenge that existed in this field and was more noticeable was the execution of restoration interventions observed specifically on certain historical stucco works in Iran, making it difficult to discern the authenticity and technique of each decoration. In this regard, one can refer to the stucco decorations of *Safavid* palaces, such as the *Ali-Qapu* Mansion in *Isfahan*, where three distinct layers of stucco decoration are present. Recognizing their layering or classifying these decorations into prominent or low-relief categories was challenging and limited due to the deterioration. Sometimes, it was necessary to rely on historical studies, old photographs, and interviews with craftsmen to understand the remaining stucco works. Additionally, most of the historical stucco decorations were applied on the upper surfaces of walls, ceilings, or under domes, which made accessing and studying them challenging.

Another limitation we faced in conducting this research was the ambiguity of available information and the lack of knowledge about the construction methods and details of some historical Iranian stucco techniques, which have not been practiced for a long time and were being forgotten. This information was neither available in published articles and books nor in the documents and reports of the Iranian Cultural Heritage Organization. Therefore, traditional craftsmen are critical for understanding but unfortunately, many of them had either passed away or the few remaining ones were reluctant to cooperate for various reasons. Among them, individuals with the necessary knowledge and information were very limited, and ultimately, only two people showed willingness to be interviewed and answer questions.

Finally, with the completion of this research, the way for studying each stucco decoration has been paved because the classification of each stucco decoration, the category it belongs to, and the differences or similarities it has with other methods can make the study of each technique easier and avoid potential ambiguities or mistakes. Moreover, the accurate technical evaluation of each prominent and low-relief stucco method can henceforth be considered a clear and reliable reference for all similar works. For instance, since prominent stucco works have a very complex and diverse classification, with the research and field studies conducted in this project and the introduced classification for them, the shaping methods of decorations can be fully specified, indicating how they were shaped or executed and with what techniques. This issue will undoubtedly have favorable impacts on future studies.

Among the aspects that can pave the way for future research is the evaluation of plaster decorations. Additionally, numerous alterations and renovations during the *Safavid, Qajar, Pahlavi*, and contemporary periods have impacted the palace's decorations. Considering this text, future research should include a more detailed examination of the coating layers and the crystallography of the low-relief plaster decorations of the historic stucco using electron microscopy to gain a better understanding of the construction and historical decoration methods. The complexities involved in the maintenance and preservation of plaster artifacts should also be considered, as the multiple changes and renovations over various historical periods present significant challenges in preserving the authenticity and maintenance of these decorations, influencing the methods of protective interventions.

Moreover, with the completion of this research, the path for future studies remains open. Studying each stucco technique and examining the materials used, as well as the grading method or impurities employed, requires precise instrumental tests. Methods such as XRD, SEM, FTIR, and various chemical tests can contribute to a more accurate evaluation and characterization of each technique and the materials used in each historical stucco technique in Iranian architecture. Due to time constraints and existing writing limitations, this research only technically evaluated two general categories of prominent and low-relief stucco among the nine introduced categories of stucco art. This leaves the way open for future research to accurately assess the remaining seven methods and to study and investigate the materials and shaping techniques used in them.

Suggestions for future research include:

- Comparative study of the historic stucco decorations in other countries neighboring Iran.
- Application of advanced laboratory techniques such as high-resolution electron microscopes.
- Developing executive and technical guidelines for the restoration and rehabilitation of the historic stucco decorations.
- Identifying and documenting other stucco techniques such as *Moqarnas*, *Monabat*, and combined decorations.

In summary, this research attempted to utilise an interdisciplinary approach to re-explore and technically evaluate different types of historic stucco decorations and provide a comprehensive and profound understanding of the various dimensions of this valuable artistic industry (summarised in Table 137). It is hoped that the obtained results pave the way for continuing and expanding studies in this area.Considering the importance and status of stucco decorations in Iranian historical architecture, a precise understanding of the materials, structures, and techniques used for their preservation and restoration seems essential. Therefore, it is expected that the findings of this research can serve as a reference for further study and recognition of stucco decorations and assist in their proper conservation and restoration.

This chapter provides a comprehensive summary of the research findings, demonstrating how this thesis has addressed the research questions, objectives, and aims. By introducing a novel methodological framework, the study fills existing gaps in the classification, technical evaluation, historical understanding, and conservation of Iranian stucco decorations.

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Appendix 1

Consent Form for Interview with Traditional Craftsmen in the Field of Stucco Art in Historical Architectural Decorations in Iran

I, _____ [Participant's Name], hereby give my voluntary and informed consent to participate in an interview for the research project titled 'Methods of Executing Polychrome Gypsum Art in Historical Architectural Decorations in Iran,' which is being conducted as part of a master's thesis.

I understand that the purpose of this interview is to gather information about the methods, techniques, and experiences related to polychrome gypsum art in historical architectural decorations in Iran. I am aware that the information provided during the interview will be used solely for research purposes.

I acknowledge that this interview will be conducted with respect for my privacy, and the information shared will be kept confidential. I consent to the recording of this interview in audio or video format, with access limited to the researchers involved in this study.

I agree that the data and insights shared during the interview may be used as a source of information for the master's thesis titled 'Methods of Executing Polychrome Gypsum Art in Historical Architectural Decorations in Iran' without disclosing my identity.

I confirm that I have been fully informed about the purpose and significance of this interview and any questions I had have been addressed satisfactorily.

I understand that my participation in this interview is entirely voluntary, and I have the right to withdraw my consent at any time without any negative consequences.

I grant permission for the research team to use the information I provide during the interview for academic and research purposes related to the master's thesis project.

I acknowledge that I will not receive any financial compensation or incentives for participating in this interview.

By signing this consent form, I affirm that I am at least 18 years old and fully understand the contents and implications of this consent.

Participant's Signature: _____ Date: _____

Researcher's Signature: _____ Date: _____

Appendix 2

Interview in the English Language

The interview conducted in this research invited two master craftsmen of traditional Persian pottery in Iran to answer these questions. These individuals preferred not to have their names mentioned in this research; therefore, only the questions posed are referenced in this section. The responses they provided to the questions and the information gathered from these interviews, which were used in various sections of this study, are presented. It is worth mentioning that efforts have been made to eliminate redundancies and present the information obtained clearly to be more understandable and avoid ambiguity.

Craftsman A

- What preparations are required for preparing gypsum mortar to achieve the desired consistency and quality of the *Gach-e-Koshteh* plaster?

> "First, the necessary equipment for preparing the mortar is prepared. This includes a clean basin container, clean fresh water, regular gypsum powder, a trowel, a sieve, and a stick or other tool for stirring. To make *Gach-e-Koshteh*, fine-grained gypsum powder should be used to increase its flexibility and improve the quality of the work. Therefore, the plaster is first sieved. The basin container is filled halfway with water. For every 1 kilogram of gypsum, 0.7 to 0.8 liters of water is required; the amount of gypsum and water needed can be calculated based on the gypsum consumption in the architectural decorations before starting the work. Gradually add the sieved gypsum to the water while simultaneously stirring the gypsum and water. Once all the gypsum has been added, continue stirring the gypsum for an additional 10 minutes. This is the most crucial step in making *Gach-e-Koshteh.* After the gypsum has been thoroughly mixed and the mortar is smooth and homogeneous, the *Gach-e-Koshteh* plaster is ready."

- When is the preparatory layer applied in the *Koshtebori* technique?

> "In the *Koshtebori* technique, as can be seen in *Ali-Qapu* palace, the preparatory layer was applied before the pattern transfer and fixation onto the surface of this technique."

- What were the traditional methods in the execution of the *Ajornama* technique, in Iranian architectural stucco decorations?

  “In the *Ajornama* stucco decorations, assessing the quality of the gypsum, the method of plaster preparation, and the types of primary colors used on the surface of the stucco arrays are so important. In this technique, the gypsum used in all samples should be free from significant impurities and have a fine-grain texture. Also, the prepared gypsum plaster for such decorations, to facilitate carving and shaping, is usually *Gach-e-Koshteh*, as in the cases of the decorations in the *Jameh* mosque of *Ardestan* and *Pir-Bakran* shrine. Consequently, the mechanical resistance of the plaster after drying is not particularly suitable. The application of a paint layer and the penetration of a binding resin in the paint coat contribute to enhancing the mechanical strength of certain surface areas. ultimately, this issue was able to effectively fill the existing knowledge gaps in the field of executing the technical and methodological aspects of *Ajornama* gypsum decorations.”

- What type of gypsum mortar is used for executing intricate patterns in *Ajornama* decorations?

  "Pre-prepared gypsum for executing *Ajornama* decorations, to facilitate cutting and executing intricate and delicate patterns, is applied in some cases using the 'half-coated' or *Gach-e-Koshteh* method."

- How was the design implemented in the plaster layer in *Ajorkari* decorations?

  “The process is such that the entire thickness of the gypsum layer has been applied onto the surface of the wall. Following the transfer of the design onto this plaster layer, It proceeded by cutting and removing portions of the plaster layer’s surface.”

- What are the general methods for executing the concave and convex forms of plaster infill?

  “The first method, which is known as ‘*Yek-Gacheh’* is similar to the flat type and involves the uniform execution of all layers in one stage. The

second method involves the execution of the base layer or layers of plaster infill in two or several separate stages."

- What is the *Ajdehkari* technique, and what are the characteristics that distinguish this technique?

  "This technique in the traditional Iranian stucco art is named *Ajdehkari*. The rationale for this approach is the plaster nodules present on extensive surfaces, acting as decorative motifs, especially in cases where multiple layers are used to enhance prominence, are not uniformly distributed and one of the prominent characteristics that often distinguishes this technique is the visible irregularities which observed due to the tool marks on the surface."

- What is the composition of the *Gel-Sefid* layer and how is it prepared?

  "The use of this layer diminishes the absorbency of the surface and facilitates working with a paintbrush on the wall, preserving more transparency and color brilliance due to the reduction of paint penetration into the gypsum layer. These are among the capabilities the surface gains after the priming process. In some cases, a coloring agent is added to the priming material, resulting in colored preparatory layers. This layer is a type of calcium carbonate known as 'white clay' or *Gel-Sefid*. It constitutes about 12% and, after mixing with a resin solution in water (likely Shellac or Gum), is applied on the prepared surface. The *Gel-Sefid* layer (white preparatory) is also used in its color composition within certain sections of the work."

Craftsman B

- How is the execution technique of intricate patterns in *Ajdekari* decorations?

  "There is an important aspect to consider regarding certain intricate patterns used in relief decoration. *Ajdekari* decoration relies on the concept that there is an optimal window of time for executing specific patterns. This means that gypsum plaster, when applied under certain conditions, exhibits the most favorable malleability for carving and sculpting to achieve desired designs. Leveraging this property of stucco to enhance quality, ease, and

speed of execution involves establishing these ideal conditions through one of two methods: either by preparing the stucco appropriately or by working during the opportune period between initial setting and complete drying of the gypsum stucco. Therefore, it appears that the most effective technique for manipulating stucco in creating these types of decorations is to use semi-set or slightly set gypsum at the precise moment after initial setting and before it fully dries."

- Considering the execution methods and shaping techniques, can the two techniques of *Koshtebori* and *Boom-Saab* be considered the same?

  "It is not possible to categorise the techniques of *Koshtebori* and *Boom-Saab* stucco into a single group as despite their superficial similarities, they differ significantly in technical aspects. One involves carving patterns on a layer of *Gach-e-Zendeh*, while the other is executed on a *Gach-e-Koshteh* surface."

- What specific steps were involved in the execution of the *Koshtebori* technique?

  "The *Koshtebori* decorations were made using a specific method. First, the base was covered with inlay plaster to create a smooth surface. Then, a layer of Gach-e-Zendeh, the base coat with medium-sized grains, was applied on top. After letting the background layer set, the inlay surface was smoothed using a serrated edge float. Finally, a fragile layer of *Gach-e-Koshteh* was applied to cover the surface coat. After the necessary time elapsed for the initial setting of the *Koshtebori* layers, the surface was worked on using a floating tool."

- How is gypsum plaster applied to execute elaborate relief decorations?

  "In such adornments, for ease of execution and to save time and resources, we opt to apply the gypsum plaster only in necessary areas based on the relevant pattern and the arrangement of designs on the decorative surface, rather than covering the entire surface of the work."

- What type of plaster is used for the *Ajdekari* technique and when can these decorations be cut and carved?

  "In most cases, except for the perforation method where such a requirement doesn't apply, the plaster used for these purposes is manipulated through a semi-prepared stucco technique or a refined stucco application. The ideal time for working, considering the quality of the stucco's cutting and carving is after the initial setting of the gypsum and before its complete drying."

- How is the plaster used in *Ajornama* decorations prepared and what is the purpose of applying a layer of paint on these decorations?

  "The gypsum mortar for the *Ajornama* decorations is prepared in a *Gach-e-Koshteh* form. Also, applying a layer of paint on *Ajornama* decorations is not only for embellishment but also for the penetration of coloring materials into gypsum grains and enhancing the mechanical resistance of these decorations."

Interview in the Farsi Language

در این تحقیق، از دو استادکار ماهر سفالگری سنتی ایرانی دعوت شد تا به سوالات مطرح شده پاسخ دهند. این افراد ترجیح دادند که نامشان در این تحقیق ذکر نشود؛ بنابراین، تنها سوالات مطرح شده در این بخش آورده شده است. پاسخ‌های ارائه شده توسط آن‌ها و اطلاعات جمع‌آوری شده از این مصاحبه‌ها که در بخش‌های مختلف این مطالعه استفاده شده، ارائه می‌شود. شایان ذکر است که تلاش شده تا از تکرارها اجتناب شود و اطلاعات به‌دست‌آمده به صورت واضح و بدون ابهام ارائه شود.

استادکار الف

- چه آماده‌سازی‌هایی برای تهیه ملات گچ به منظور دستیابی به قوام و کیفیت مطلوب گچ کشته لازم است؟

  "ابتدا تجهیزات لازم برای تهیه ملات آماده می‌شود. این شامل یک تشت تمیز، آب تازه و تمیز، پودر گچ معمولی، ماله، الک و چوب یا ابزار دیگری برای هم‌زدن است. برای تهیه گچ کشته باید از پودر گچ دانه‌ریز استفاده شود تا انعطاف‌پذیری آن افزایش یابد و کیفیت کار بهتر شود. بنابراین، ابتدا گچ الک می‌شود. تشت تا نیمه با آب پر می‌شود. برای هر ۱ کیلوگرم گچ، ۰.۷ تا ۰.۸ لیتر آب لازم است؛ مقدار گچ و آب مورد نیاز می‌تواند بر اساس مصرف گچ در تزئینات معماری قبل از شروع کار محاسبه شود. پودر گچ الک‌شده به تدریج به آب اضافه می‌شود و همزمان با آن، گچ و آب هم زده می‌شوند. پس از اضافه شدن تمام گچ، هم‌زدن گچ برای ۱۰ دقیقه دیگر ادامه می‌یابد. این مرحله مهم‌ترین مرحله در تهیه گچ کشته است. پس از آن که گچ به خوبی مخلوط شد و ملات صاف و همگن شد، گچ کشته آماده است".

- در تکنیک کشته‌بری، لایه آماده‌سازی چه زمانی اعمال می‌شود؟

  "در تکنیک کشته‌بری، همان‌طور که در کاخ عالی‌قاپو مشاهده می‌شود، لایه آماده‌سازی قبل از انتقال و تثبیت الگو بر روی سطح این تکنیک اعمال شده است".

- روش‌های سنتی در اجرای تکنیک آجرنما در تزئینات گچی معماری ایرانی چه بوده است؟

  "در تزئینات گچی آجرنما، ارزیابی کیفیت گچ، روش تهیه ملات و انواع رنگ‌های اولیه استفاده شده بر روی سطح آرایه‌های گچی بسیار مهم است. در این تکنیک، گچ استفاده شده در همه نمونه‌ها باید خالص و بدون ناخالصی‌های عمده و دارای بافت دانه‌ریز باشد. همچنین، گچ تهیه شده برای چنین تزئیناتی، به منظور تسهیل در حکاکی و شکل‌دهی، معمولاً گچ کشته است، همان‌طور که در موارد تزئینات مسجد جامع اردستان و مقبره پیر بکران دیده می‌شود. بنابراین، مقاومت مکانیکی گچ پس از خشک شدن به‌ویژه مناسب نیست. استفاده از لایه رنگ و نفوذ رزین در لایه رنگ به تقویت مکانیکی بخش‌های خاصی از سطح کمک می‌کند. در نهایت، این موضوع توانست به طور موثری خلأهای دانش موجود در زمینه اجرای جنبه‌های فنی و روشی تزئینات گچی آجرنما را پر کند".

- چه نوع ملاتی برای اجرای طرح‌های پیچیده در تزئینات آجرنما استفاده می‌شود؟

  "گچ از پیش‌تهیه شده برای اجرای تزئینات آجرنما، به منظور تسهیل در برش و اجرای طرح‌های پیچیده و ظریف، در برخی موارد با روش 'نیم کشته' یا کشته استفاده می‌شود".

- طرح چگونه در لایه گچی در تزئینات آجرکاری اجرا شده است؟

  "فرآیند به این صورت است که تمام ضخامت لایه گچ بر روی سطح دیوار اعمال شده است. پس از انتقال طرح به این لایه گچی، با برش و حذف قسمت‌هایی از سطح لایه گچ ادامه می‌یابد".

- روش‌های کلی برای اجرای فرم‌های مقعر و محدب گچ چیست؟

"روش اول که به 'یک‌گچه' معروف است، مشابه نوع مسطح بوده و شامل اجرای یکنواخت همه لایه‌ها در یک مرحله است. روش دوم شامل اجرای لایه بستر یا لایه‌های گچ در دو یا چند مرحله جداگانه است".

- تکنیک اجده‌کاری چیست و چه ویژگی‌هایی این تکنیک را متمایز می‌کند؟

"این تکنیک در هنر گچ‌بری سنتی ایرانی به نام اجده‌کاری معروف است. دلیل این رویکرد، گره‌های گچی موجود بر روی سطوح وسیع است که به عنوان نقوش تزئینی عمل می‌کنند، به ویژه در مواردی که برای برجسته‌سازی از چندین لایه استفاده می‌شود، به‌طور یکنواخت توزیع نشده‌اند و یکی از ویژگی‌های برجسته که اغلب این تکنیک را متمایز می‌کند، ناهماهنگی‌های قابل مشاهده به دلیل آثار ابزار بر روی سطح است".

- ترکیب این لایه "گل سفید" چیست و چگونه تهیه می‌شود؟

"استفاده از این لایه جذب سطحی را کاهش می‌دهد و کار با قلم‌مو بر روی دیوار را تسهیل می‌کند، شفافیت و درخشندگی رنگ را به دلیل کاهش نفوذ رنگ به لایه گچی بیشتر حفظ می‌کند. این‌ها از قابلیت‌هایی است که سطح پس از فرآیند آماده‌سازی کسب می‌کند. در برخی موارد، یک عامل رنگی به ماده آماده‌سازی اضافه می‌شود و در نتیجه لایه‌های آماده‌سازی رنگی به‌دست می‌آید. این لایه نوعی کربنات کلسیم معروف به 'گل سفید' یا گِل سفید است. این ماده حدود ۱۲ درصد از ترکیب را تشکیل می‌دهد و پس از مخلوط شدن با محلول رزین در آب (احتمالاً شلاک یا صمغ)، بر روی سطح آماده‌شده اعمال می‌شود. نکته جالب این است که در برخی موارد، لایه گل سفید (آماده‌سازی سفید) علاوه بر داشتن ویژگی‌های مذکور، در ترکیب رنگی خود نیز در بخش‌های خاصی از کار استفاده می‌شود".

استادکار ب

- تکنیک اجرای الگوهای پیچیده در تزئینات اجده‌کاری چگونه است؟

"یک جنبه مهم در نظر گرفتن برخی از الگوهای پیچیده استفاده شده در تزئینات برجسته است. تزئینات اجده‌کاری بر این مفهوم استوار است که یک بازه زمانی بهینه برای اجرای الگوهای خاص وجود دارد. این به این معناست که گچ، هنگامی که تحت شرایط خاصی اعمال می‌شود، بهترین حالت انعطاف‌پذیری برای حکاکی و شکل‌دهی به طرح‌های دلخواه را نشان می‌دهد. استفاده از این ویژگی گچ برای بهبود کیفیت، سهولت و سرعت اجرای کار مستلزم ایجاد این شرایط ایده‌آل از طریق یکی از دو روش است: یا با آماده‌سازی مناسب گچ یا با کار کردن در دوره زمانی مناسب بین سفت شدن اولیه و خشک شدن کامل گچ. بنابراین، به نظر می‌رسد که موثرترین تکنیک برای شکل‌دهی گچ در ایجاد این نوع تزئینات، استفاده از گچ نیم‌سفت یا کمی سفت‌شده در لحظه دقیق پس از سفت شدن اولیه و قبل از خشک شدن کامل آن است".

- با توجه به روش‌های اجرا و تکنیک‌های شکل‌دهی، آیا می‌توان دو تکنیک کشته‌بری و بوم‌ساب را یکسان در نظر گرفت؟

"نمی‌توان تکنیک‌های کشته‌بری و بوم‌ساب را به عنوان یک گروه واحد دسته‌بندی کرد زیرا با وجود شباهت‌های ظاهری، این دو تکنیک از لحاظ فنی تفاوت‌های قابل توجهی دارند. یکی شامل حکاکی الگوها بر روی لایه‌ای از گچ زنده است، در حالی که دیگری بر روی سطحی از گچ کشته اجرا می‌شود".

- چه مراحل خاصی در اجرای تکنیک کشته‌بری دخیل است؟
  "تزئینات کشته‌بری با استفاده از یک روش خاص انجام می‌شد. ابتدا، پایه با گچ تزیینی پوشانده می‌شد تا سطحی صاف ایجاد شود. سپس، یک لایه گچ زنده با دانه‌های متوسط بر روی آن اعمال می‌شد. بعد از سفت شدن لایه زمینه، سطح تزئینی با استفاده از یک تخته لبه‌دندانه‌دار صاف می‌شد. در نهایت، یک لایه نازک از گچ کشته برای پوشاندن لایه سطحی اعمال می‌شد. پس از گذشت زمان لازم برای سفت شدن اولیه لایه‌های کشته‌بری، سطح با استفاده از یک ابزار شناور کار می‌شد".

- چگونه گچ برای اجرای تزئینات برجسته پیچیده اعمال می‌شود؟
  "در چنین تزئیناتی، برای سهولت در اجرا و صرفه‌جویی در زمان و منابع، ما ترجیح می‌دهیم گچ را تنها در نواحی لازم بر اساس الگو و ترتیب طرح‌ها بر روی سطح تزئینی اعمال کنیم، به جای پوشاندن تمام سطح کار".

- چه نوع گچی برای تکنیک اجده‌کاری استفاده می‌شود و چه زمانی می‌توان این تزئینات را برش و حکاکی کرد؟
  "در بیشتر موارد، به جز روش سوراخ‌کاری که چنین نیازی ندارد، گچی که برای این اهداف استفاده می‌شود از طریق تکنیک گچ نیمه‌تهیه‌شده یا کاربرد گچ تصفیه‌شده به کار گرفته می‌شود. زمان ایده‌آل برای کار کردن، با در نظر گرفتن کیفیت برش و حکاکی گچ، بعد از سفت شدن اولیه گچ و قبل از خشک شدن کامل آن است".

- گچ مورد استفاده در تزئینات آجرنما چگونه تهیه می‌شود و هدف از اعمال یک لایه رنگ بر روی این تزئینات چیست؟
  "ملات گچ برای تزئینات آجرنما به صورت گچ کشته تهیه می‌شود. همچنین، اعمال یک لایه رنگ بر روی تزئینات آجرنما نه تنها برای تزئین بلکه برای نفوذ مواد رنگی به دانه‌های گچ و تقویت مقاومت مکانیکی این تزئینات است."