ICONARP
International Journal of Architecture and Planning
Received: 09.12.2023 Accepted: 25.01.2024
Volume 12, Issue 1/ Published: 30.06.2024
DOI: 10.15320/ICONARP.2024.292 E- ISSN:2147-9380

Research Article

ICONARP

Transformation of Transitional Elements with Muqarnas from Early Ottoman Period to Classical Ottoman Period

Hüdai Sırrı Şenalp*
Can Şakir Binan**

Abstract

Since the beginning of the Ottoman era, muqarnas have been incorporated into building designs. Along with advances in construction techniques, muqarnas were used structurally in the construction of mosques, baths, madrasahs and palaces as a means of transition to the dome. From the 14th century during the early Ottoman period, the Timurtaş Pasha Mosque in Bursa (1379-92) and the Iznik Green Mosque (1378-91) were built with a focus on maintaining visual structural integrity within interior spaces. This was a common practice that persisted until the mid 18th century. While muqarnas can reinforce the visual integrity of a building as a transitional element, in some cases it can also transfer the weight of the dome to the walls and strengthen the building's structure when designed in the form of pendentives and squinches. It is important to note this duality in the use of muqarnas in the construction of buildings. The muqarnas utilised in the interiors during this period had a brick base, hidden by plaster on the outside. Many monumental buildings display this aspect of muqarnas, which requires expertise, particularly during restoration. Very little research has been conducted in this field. In the study, the transitional elements to the muqarnas dome, starting from the early Ottoman Period, will be examined until the Classical Ottoman Period, and the formal analysis between the 14th and 16th centuries will be made to understand the nature of the change it showed. After the literature review It is aimed to reach a synthesis with the inferences made through field research based on outputs.

Keywords:
Early Ottoman period, Classical Ottoman period, Muqarnas, restoration, Transitional zone

*Faculty of Architecture, Yildiz Technical University, Istanbul, Turkey. (*Corresponding author*)
Email: hssenalp@gmail.com

**Faculty of Architecture, Yildiz Technical University, Istanbul, Turkey.
Email: binancb@gmail.com

To cite this article: Şenalp, H. S., & Binan, C. Ş. (2023). Transformation of Transitional Elements with Muqarnas from Early Ottoman Period to Classical Ottoman Period. *ICONARP International Journal of Architecture and Planning,* 12 (1), 463-503. DOI: 10.15320/ICONARP.2024.292

INTRODUCTION

Muqarnas is an architectural feature that enables the transition from one geometric plane to another in three dimension. This is achieved via a two-dimensional plan that is raised to the third dimension. Muqarnas has been present in Islamic architecture since the 10th century and has been used across a vast geographical area, spanning from the Iberian Peninsula to the Indian subcontinent. Muqarnas exhibits varying geometric principles depending on the material in use and can be constructed from stone, brick, wood, plaster, and tile for both structural and ornamental purposes. The muqarnas acts as a console or niche and assists in the formation of the covering of a dome as a transitional feature within the structure.

Given the scope provided, Hillenbrand's (1970) study of Seljuk domed chambers in northwestern Iran highlights the significance of tri-lobed squinches in the construction of Seljuk dome chambers. Camilla and David Edwards (1999:88) provide crucial evidence that the opening up of tri-lobed arches initiates the framework forming muqarnas.

Later on, there are important studies that contribute to the literature on the evolution and changes of transitional elements in Ottoman architecture. Notable works include Batur's (1980) catalogue research, which helps us understand the nature of curvilinear structures and transitional zones of Ottoman mosques. The significance of Ekrem Hakkı Ayverdi's four-volume corpus (1989) on the early stages of Ottoman architecture cannot be overstated. The corpus is a valuable contribution to the field of study as it is based on photographic evidence and primary sources.

Ottoman baths provide valuable information on transition elements. After examining Murat II Hammams and the muqarnas domes in Edirne, Büyükdığan (1989:275) concludes that there is an effort to evenly distribute the muqarnas elements throughout the entire structure. Say's (2011) significant catalogue study explores the hammams of the early Ottoman period, from the beginning of the 14th century up to the 16th century. The study concludes that muqarnas became prevalent in this typology from the second half of the 14th century. Akyildiz (2018) expands on this literature by delving into the construction techniques of Ottoman baths in Edirne in detail, providing valuable information on how muqarnas were built according to the building typology.

Furthermore, the architecture of the Western Anatolian beyliks shows how the construction techniques of East and West were combined to create unique elements and building techniques in relation to classical Ottoman architecture. According to Kolay (2017:133-138) during this period, certain architectural elements emerged as experimental features and were only used in this region and time period before being abandoned. However, many of these elements were also applied in contemporary Ottoman architecture and played a role in the formation of Classical Ottoman architecture. In doing so, the arrangement of pendentives, squinches, and triangular elements as

DOI: 10.15320/ICONARP.2024.292

turkish triangles developed in previous cultures has been experimented with in various ways (Figure 1 and 2). It is noted that the tradition of muqarnas decoration, which was also applied in Iranian, Anatolian, Syrian and Egyptian Mamluk architecture in the 14th century, can be considered as an extension of the tradition in the region.

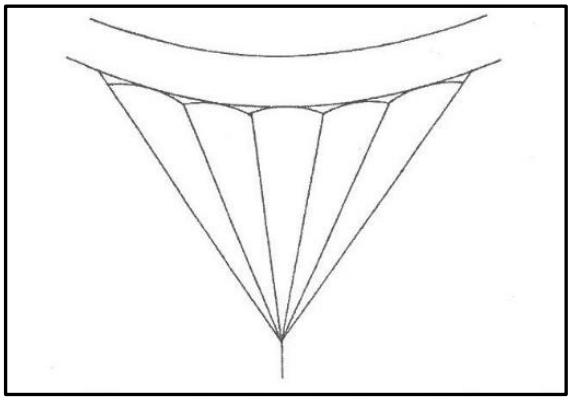

Figure 1. Pendentive fragmentation of Karatay Madrasa as Turkish triangles in Seljuk Anatiolia. (Kolay, 2017 p. 55)

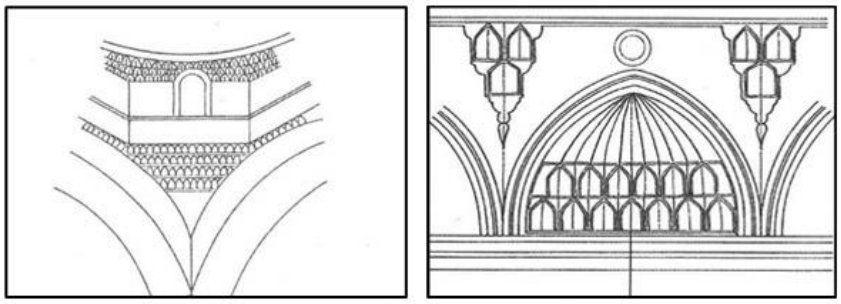

Figure 2. The convergence of East and West in Western Anatolia. Muqarnas pendentive of Selçuk Isa Bey Mosque (left) and muqarnas squinch of Milas Firuz Bey Mosque (right) Source: Kolay, 2017 p. 60 and p. 76

Indeed this view highlights the significance of local construction traditions and the development of muqarnas squinches and pendentives in the region. In this regard, Fukami's (2017) study of the transitional zones in the Egyptian Islamic architectural tradition is significant in drawing parallels between two different architectural traditions, as the Egyptian tradition, along with Ottoman architecture, has at least two centuries of experimentation in the history of transitional zones.

When analysing studies on transitional elements in Ottoman architecture, the subject of transitional elements with muqarnas is only mentioned in general terms, without sufficient detail. Therefore, this study aims to determine the process of change regarding the transitional elements with muqarnas during the Ottoman period through literature research and field studies. To shed light on this transformation process, it is crucial to scrutinise the basic elements of transitional architecture with muqarnas including squinch, pendentive, Turkish triangles, as well as the use of brick and plaster materials in the surrounding area and their evolution over time.

ICONARP – Volume 12, Issue 1 / Published: 30.06.2024

TRANSITIONAL ELEMENTS BETWEEN THE DOME AND THE WALLS AND THEIR DIVISION INTO LEVELS OF MUQARNAS IN THE ISLAMIC ARCHITECTURE THROUGHOUT HISTORY

According to Edwards and Edwards (1999:72) architects have developed two solutions for accommodating a circular dome above a square or rectangle-shaped space throughout history. The first solution is the pendentive, which illustrates the traditional Roman approach. The second solution is the squinch, an architectural feature of Sassanid origin. Over time, squinches have been divided into smaller squinch vaults in the transition zone to the dome, and then transformed into muqarnas, which may serve both structural and decorative purposes.

The incorporation of the squinch in Sassanid tradition involved transitioning to a dome with a single arch. However, the Ismail Samani Mausoleum (943 AD) in Bukhara marked the first instance of dividing the squinch into two parts. As one of the most significant structures in early Islamic Architecture, this marked the initial step in transforming the squinch into muqarnas elements. The Arab-Ata Mausoleum (978 AD), another erected tomb during the Samanid period, is situated in the village of Tim, approximately 200 km from Bukhara and 80 km from Samarkand. It uncovered the foremost multi-layered structural muqarnas vault in the transition zone to the dome. Therefore, it is possible to posit that Samanid architecture is important in terms of squinch fragmentation into muqarnas (Figure 3).

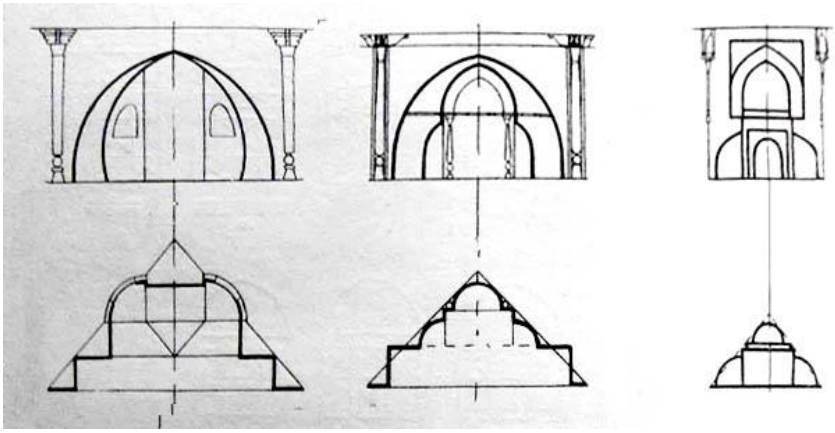

Figure 3. Squinch fragmentation of Samanid buildings. Squinches of Ismail Samani Tomb (Left) followed by the Afrasiyab Palace (middle) and then the Arab-Ata Mausoleum (Right) Source: Akhrarov and Rempel (1971).

During the Great Seljuk period, from the 11th century until the Mongol invasion, muqarnas was commonly utilized in the construction of buildings in Central Asia, Iran and Khorasan. In particular, the muqarnas squinch was extended horizontally in the transition zone in the Friday mosques of Ardistan (Figure 4) (1058-60 AD), Isfahan (1080 AD, south dome) and Barsian (1098 AD). The squinch was partitioned into four muqarnas rows with the construction of the Gulpaygan Friday Mosque (1118 AD). This innovation of the 11th century spread to the rest of Great Seljuk lands in the 12th century.

DOI: 10.15320/ICONARP.2024.292

Figure 4. Masjid-i Jami Ardistan: Squinch in the transitional zone. Source: Camilla and David Edwards (1999) p:73

Following the division of squinch, the dome was also divided into muqarnas elements after the 11th century. Kılıçoğlu (2017:70) states the nature of this division lies in the achievement of continuous muqarnas units in the form of transitional elements, such as squinches and pendentives. This means that the juxtaposition of transitional elements in the muqarnas form, as in the Arabata Mausoleum, paved the way for the creation of muqarnas domes. Again, there are muqarnas domes using brick material in the hypostyle harim area of the Great Mosque of Isfahan (1088 AD) (Figure 5). Tabbaa (1985:63-4) in listing the first examples of muqarnas domes, notes the importance of the muqarnas dome of the Imam Dur Mausoleum in Samarra, completed in 1090, which is one of the first known examples in which the structure is constructed of brick and the finishing material is plaster (Figure 6). In Maghrib, during the repairs of the Al-Qarawiyyin Mosque in Fez between 1135-40, the domes along the qibla axis were decorated with plaster muqarnas, and in Syria the Bimaristan Nur Al-Din in Damascus in 1154, at the main entrance to the building muqarnas portal, and in the interior muqarnas dome were used.

Figure 5. Muqarnas dome in the Great Mosque of Isfahan. Source: MIT Libraries, Aga Khan Visual Archive, photograph by Khosrow Bozorgi n.d. https://dome.mit.edu/handle/1721.3/67524

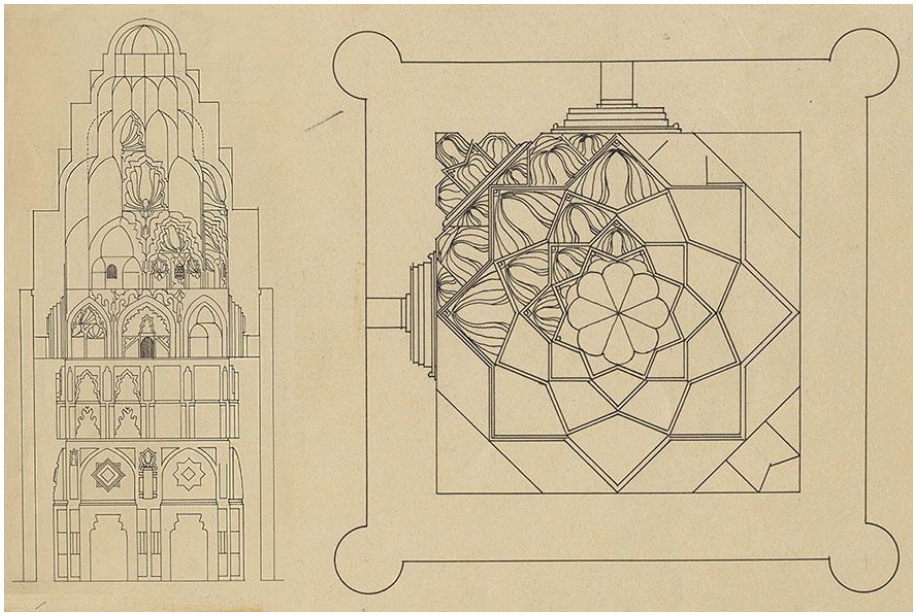

Figure 6. Section and plan of the Imam Dur Mauseloum. Source: Guide to the Ernst Herzfeld Papers in the Department of Islamic Art, Metropolitan Museum of Art: Harris Brisbane Dick Fund, 1943 OCLC Number: 962019803 Drawing: Ernst Herzfeld. https://libmma.contentdm.oclc.org/digital/collection/p16028coll11/id/7176/rec/3

DOI: 10.15320/ICONARP.2024.292

ANATOLIAN GEOGRAPHY AND BUILDING TRADITIONS AROUND

To analyze how the materials and design of the muqarnas evolved during the early Ottoman period to the Classical Ottoman period, we must examine how local building traditions impacted each other in Anatolia (Figure 1). Brick served as both a structural and finishing material in Mā Warāʾ al-Nahr, Khorasan and Iran, where the first Seljuk monuments were situated, during the 11th and 12th centuries.

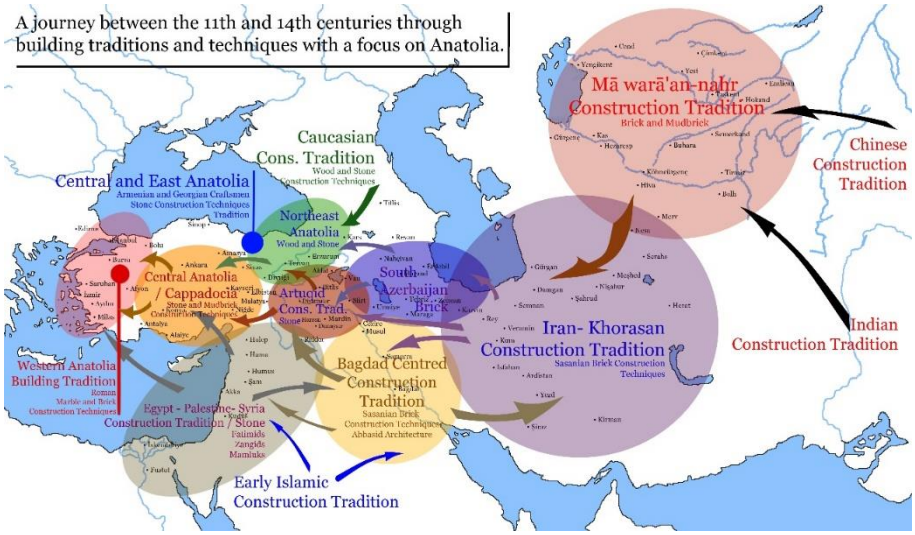

Figure 7. 11th - 14th century Anatolian geography-specific journey of construction traditions and techniques. Source: Authors.

In Northeastern Anatolia, the dominant building traditions were that of Armenians and Georgians, utilising stone and wood. On the other hand, in Western and Central Anatolia, the Romans mostly employed brick and stone. These two vast regions were linked by the Black Sea region and as stated by Rogers (1969:154) characterised by the prevalence of Christian architecture. Cappadocia extended from Southeastern Anatolia, Syria, and Egypt where Islamic stone traditions, represented by Zangids, were common. To the south of the stone tradition lies Mesopotamia, where the Sassanid approach to brick building techniques was employed and built upon by the Umayyad and Abbasid architectural traditions (Arce, 2006). Figure 7 gives the account of these interrelated geographical relationships between the building traditions.

Immediately to the west of Iran and Khorasan, to the north of Mesopotamia and to the east of Anatolia lies the region known as South Azerbaijan. Within this region, there are centres such as Van, Marand, Urmia, Nakhchivan, Maraga, and Qazvin. The Qazvin school of architecture stands out from the rest of the Seljuk architecture. This building tradition is formed through the fusion of various building styles. The Friday mosques of Urmia and Marand (Figure 8) can be considered pioneering as in these buildings the transitional zone is divided into courses of muqarnas, distinguishing them from another Great Seljuk works (Hillenbrand, 1976:96). Specifically, plastered muqarnas utilized over brick in the transition zone towards the Urmia Friday Masjid's dome serves as an example.

Figure 8. Transitional zone over mihrab in Great Mosque of Marand. Source: Anisi A. (2023) p.318

Plaster, as finishing material also utilised in the Timurid tradition, mainly in cities such as Shahr-i Sebz, Samarkand, Herat, and Shiraz. This tradition had an important role for the plaster adorned muqarnas work that started during the Early Ottoman period in the fourteenth century. The documentation of craftsmen from this region in various art forms substantiates their presence in other branches of art (Samkoff, 2014:204).

The handling of brick traditions in the building practices of Eastern Anatolia differs from those in the West, where stone material predominates. This creates a distinct form of architecture in the Artuqid region, where the Great Seljuk brick building tradition is replaced by a limestone building tradition. Notably, the city of Ahlat showcases this new architecture. Pancaroğlu (2012:41-42) asserts that the signatures of craftsmen and architects from Ahlat can be observed on numerous works of Anatolia's earliest significance, and that Ahlat was the inaugural centre in Anatolia to materialize the muqarnas into stone.

DOI: 10.15320/ICONARP.2024.292

Figure 9. Muqarnas squinch in Great Mosque of Niğde. Source: Öney (1976) p.29

Figure 10. Transitional zone with muqarnas in Great Mosque of Divriği. Source: www.divrigiulucamii.com/tr/Sivas_Divrigi_Ulu_Camii_2.html

This Artuqid tradition was introduced to Central Anatolia through Divriği and underwent a significant transformation in the Niğde Alaaddin Mosque. The interior design of both the Great Mosque of Niğde and Divriği are unique (Figures 9 and 10). Consequently, the use of muqarnas in the transition zones was restricted. The muqarnas tradition, however, was chiefly manifested through the main portals. However, it is important not to underestimate the role of the Ayyubid stone tradition of Aleppo and Damascus. This tradition has more examples in transitional zones compared to the Anatolian Seljuks. The Syrian stone tradition has always been highly regarded as much as the Anatolian counterpart.

When we look at the developments related to muqarnas in Egypt in the 14th century, we see that the technique of stone muqarnas transition elements in Syria began to influence the examples in Egypt. The

transition zone of the Kubbet al-Muazzaf Alaeddin Sanjar (1322 AD is similar to the Syrian examples: The stone dome of the Firdaws Madrasa (Aleppo, 1235 AD), the east room of the Mashhad Husayn (Aleppo, late thirteenth century), and the muqarnas of the entrance half-dome of the khānkāh of Baybars al-Jashnakīr (Cairo, 1306-10 AD). These examples suggest that the Syrian stone muqarnas technique was brought to Cairo in the early fourteenth century, and it has been noted that this technique was used in Cairo not only for the muqarnas of the crown door, but also for the transition zone of the dome (Fukami, 2017:111).

TRANSITIONAL ELEMENTS WITH MUQARNAS IN ANATOLIA UNTIL END OF ANATOLIAN SELJUKS

When analyzing Anatolian transitional elements with muqarnas, it becomes evident that Artuqid works are the most prominent. A prime example of this tradition in the northwestern region is the Silvan Great Mosque, which was completed in 1157 (Figure 11). The dome above the mihrab, measuring 13.50m in diameter and featuring muqarnas squinches, is a unique instance in the western world that incorporates the principles used in the dome constructed by Melikşah in the Isfahan Friday Mosque of the Great Seljuks (Altun, 1991). Muqarnas was utilized in the transition from the drum to the squinches and also inside the squiches in the main dome of Kızıltepe Dunaysır Ulu Camii, dated 1205. It is apparent that all of these features were constructed by using stone techniques.

Figure 11. Figure 11 Great Mosque of Silvan, stone muqarnas squinch. Source: https://gertrudebell.ncl.ac.uk/p/gb-3-1-19-1-156

The Great Mosque of Malatya, completed in 1224, continues the principles of the Great Seljuk school regarding brick construction techniques (Figure 12). The muqarnas structure in the transition area to the dome and other decorative programme demonstrate the continuation of the same architectural style.

DOI: 10.15320/ICONARP.2024.292

Similarly, the construction of original examples from the Anatolian Seljuk period continues with the Niğde Alaeddin Mosque, completed in 1223. In all three domes on the qibla side, the transition to the dome is supported with muqarnas squinches. The dome situated above the mihrab of the Divriği Great Mosque, which was built between 1228 and 1243, represents a significant example with regards to the separation of the squinch into muqarnas and the creation of a muqarnas belt within the dome. These examples are also crafted using stone material, serving as a continuation of the examples found in both Artuqid South-east Anatolia and Syria.

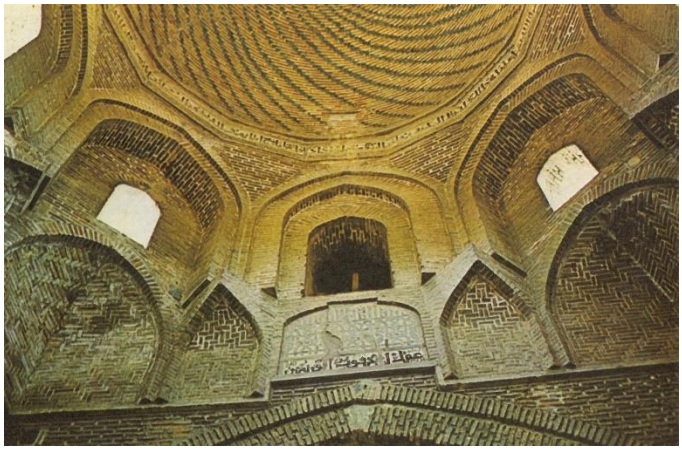

Figure 12. Great Mosque of Malatya, built in the style of Great Seljuk School Source: Öney (1976) p.82

Upon analysis of other Anatolian Seljuk works from this era, a noteworthy observation regarding muqarnas arises. During the onset of the period of Islamic Architecture in Central and Western Anatolia under the Anatolian Seljuks, Konya in particular, which boasts a considerable number of works, abstained from utilizing muqarnas in the transition to the dome and instead implemented Turkish triangles - an interpretation of pendentive tradition unique to the Seljuks. Many Seljuk works in Konya feature Turkish triangles (refer to Table 1).

Table 1. The use of transitional elements in Seljuk monuments in Konya.

DATE	MONUMENT	SPACE	TRANSITION TO	TRANSITIONAL ELEMENT	LOCATION IN THE SPACE
1251	Karatay Madrasa	Harim	Main Dome	Turkish Triangle	Pendentive
Before 1265	Ince Minareli Madrasa	Harim	Main Dome	Turkish Triangle	Pendentive
1220	Alaaddin Mosque	Harim	Dome over the mihrab	Turkish Triangle	Drum with Trianges
13. c. 3. quarter	Tahir and Zühre Masjid	Harim	Main Dome	Turkish Triangle	Drum with Trianges
1283	Sahip Ata Complex	Khangah	Main Dome	Turkish Triangle	Pendentive
		Tomb	Main Dome	Turkish Triangle	Drum with Trianges
13. c. 2nd half	Hoca Hasan Masjid	Harim	Main Dome	Squinch	Squinch

13. c.	Aksinne Masjid	Harim	Main Dome	Turkish Triangle	Drum with Trianges
13. c. 2. half	Sırçalı Masjid	Harim	Main Dome	Turkish Triangle	Drum with Trianges
1215	Taş Masjid	Harim	Main Dome	Squinch	Squinch
13 c.	Beyhekim Masjid	Harim	Main Dome	Turkish Triangle	Drum with Trianges

In this example, the Turkish triangles are shaped in two different ways. In the first one, the squinch is extended by spreading the load transfer undertaken by the squinch to the triangular belt. This belt divided into triangles which connect the walls and the dome at the level of drum (Figure 13). In the second one, the pendentive was divided into triangles and a different design was obtained from the Roman-Byzantine tradition (Figure 1).

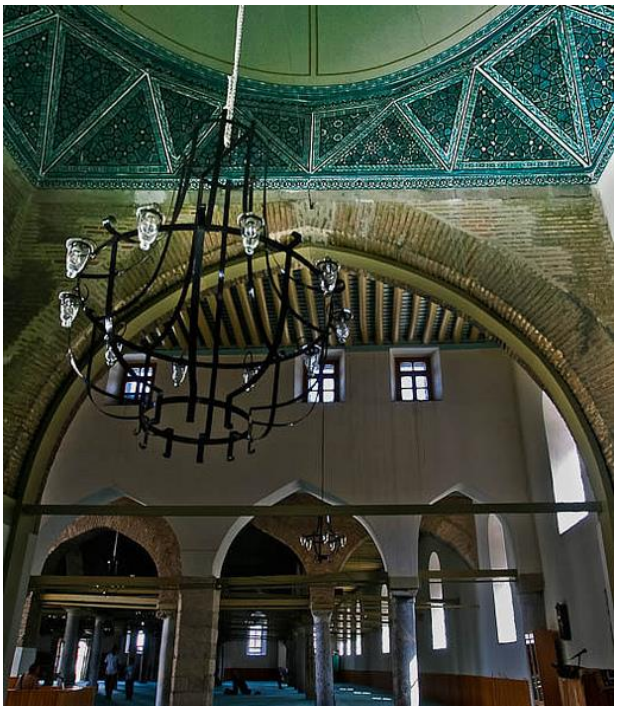

Figure 13. Turkish triangle transition in Alaaddin Mosque, Konya. Source: Senalp H.S. (2012)

The utilization of muqarnas in the transition zone of the Anatolian Seljuk era is remarkably rare. In the restricted occurrences where it is observable, stone is the favored material, with restricted instances found solely in the eastern region of Anatolia.

ANATOLIAN GEOGRAPHY AND BUILDING TRADITIONS AROUND

From the use of stone muqarnas in the transitional zone during the Anatolian Seljuk period, to the utilisation of brick muqarnas tradition by the Anatolian Beyliks and Ottomans, an individual examination is required. Initially, we must investigate how the brick muqarnas tradition arrived in Anatolia as a decorative form.

There are indications that the brick muqarnas tradition in the Great Seljuks was transported to Anatolia in the second half of the 12th century. Brickwork on the pishtaq of the Ishak Nur Tomb in Gürgan,

DOI: 10.15320/ICONARP.2024.292

Iran, the muqarnas consoles of the Kılıçarslan II Pavilion in Konya, and the Bekar Sultan Tomb in Gülağaç all date back to the 12th century and suggest the tradition's presence in the Great Seljuk domains. After conducting dendrochronological examinations on the wooden beams supporting the muqarnas consoles of Kılıçarslan Pavililon, the results indicated that they date back to the Kılıçarslan II period in 1173 and 1174 (Kuniholm, 2002:133). It is worth noting that the minaret balcony of the Iranian Giyasiye Madrasa (1133) are repeated in the Great Mosque of Sivas (1213) and Aksaray Eğri minarets (McClary, 2014).

Likewise, as stated by McClary (2014) the Nahcivan Mümine Hatun Tomb features similar muqarnas niche application, which is also observable in the Sifahane of Izzeddin Keykavus. Although these applications are sparse and not employed in the transition area to the dome, they suggest the presence of brick muqarnas tradition in Anatolia. When examining the use of plaster material in other areas during this time period, discoveries were made in archaeological excavations at Konya Alâeddin Kosk, Kubadabad Palace, and Felekabad Palace. Gpysum material was also utilised as a mihrab border in Sahib Ata Khangah apart from these examples (Öney, 1992:73).

When studying Turkish triangles in terms of materials, the transition elements to the dome during the Seljuk period were either left as bricks or covered with tile mosaics applied onto plaster.

Portals were the most commonly used muqarnas element during the Anatolian Seljuk era. Although they appear to have a monolithic structure when viewed from the front, there is a hidden order in the background. Figures 14 and 15 reveal exposed stone blocks resulting from the deterioration process of the 1st portal of Afyon Sultandağ İshaklı Han.

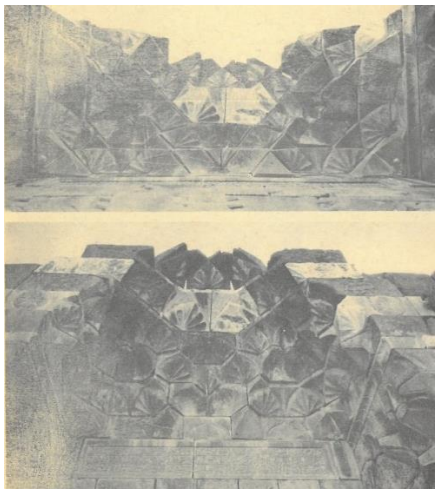

Figure 14. Afyon Sultandag Ishaklı Han 1st Portal, Ödekan, A. (1977) p.252

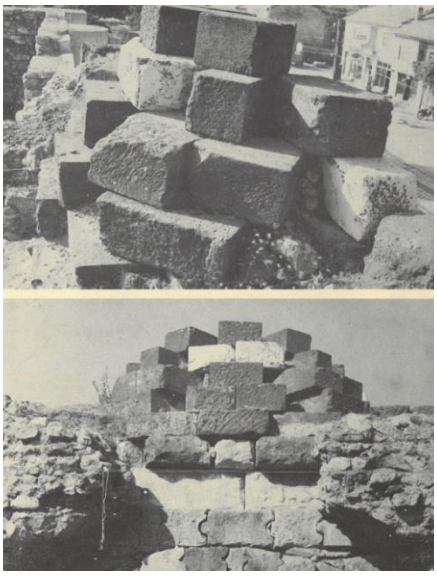

Figure 15. Afyon Sultandag Ishaklı Han 1st Portal, Ödekan, A. (1977) p.252

The use of stone material continued in the Ottoman period. In the Anatolian Seljuk period, stone blocks were fixed with mortar from the back, while in the Ottoman period, the blocks were both fixed to each other with clamps and constructed with relieving arches since the load of the building was placed on them (Figures 16 and 17).

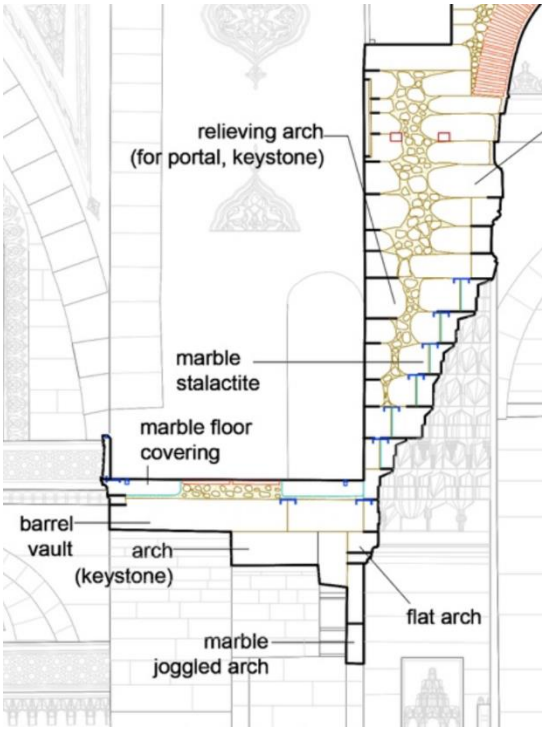

Figure 16. Section of the portal muqarnas in Lüleburgaz Sokollu Mosque. Source: Etyemez Çıplak, L. (2017) p.340

DOI: 10.15320/ICONARP.2024.292

Figure 17. Portal relieving arch seen in cross-section (centre left) Source: Mustafa Cambaz

The conclusion to be drawn from this is that since the muqarnas material was placed on top of each other in an overlapping manner, a structural perspective on other materials will also be required. It can be said that this type of overlapping was also developed in this period in the form of making muqarnas by using courses of bricks on top of each other with mortar.

ANATOLIAN BEYLIKS AND EARLY OTTOMAN PERIOD

During the time of Anatolian Beyliks and Early Ottoman period, muqarnas took over from Turkish triangles as a preferred transition element to the dome in mosques, baths, and madrasas. While the Anatolian Seljuk period mostly utilized muqarnas in stone portals, tile mihrabs, and brick minarets, its use in transitional zones became prominent in the Anatolian Beyliks and early Ottoman period.

The principalities of Aydınoğulları, Saruhanoğulları, Menteşeoğulları, and Osmanoğulları, established following the decline of the Anatolian Seljuks, encountered the building practices of Western Anatolia during their conquests (Kolay, 2017:11). This led to the emergence of exceptional examples, resulting in a distinct material and design in the muqarnas tradition.

Moving on to the Anatolian Beyliks period, it is clear that there was an increase in the use of muqarnas. Particularly the abovementioned Beyliks, who favoured experimenting with various styles over the Anatolian Seljuk works, initiated the usage of plaster as a coating material on bricks. During that era, mihrabs, crown doors, and transitional areas to the dome had muqarnas with brick structure and plaster finishing material applied (Senalp, 2012:50).

At the portal of Manisa Ulu Cami, a 1366 AD Saruhanogullari structure, the brick muqarnas is visible with the plaster stripped away. The Aydınoğulları constructed Selçuk İsa Bey Mosque, where the mihrab's dome transitioned from the drum using pendentive muqarnas. Half of the pendentive was embellished with tile muqarnas and the other half with plane triangles. Furthermore, the minaret balcony features a plaster finish on a brick muqarnas base.

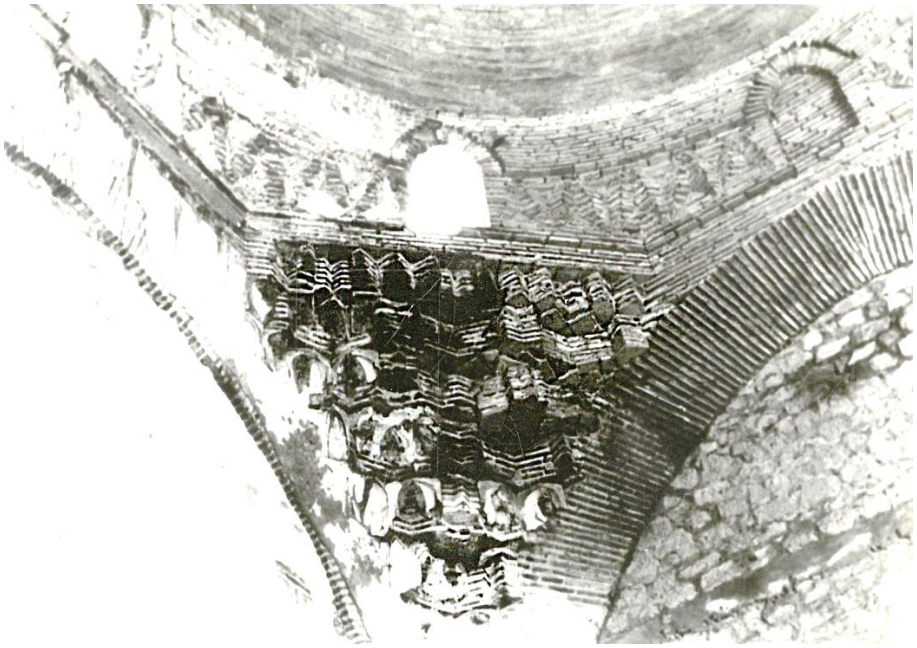

Figure 18. Muqarnas pendentive at Karacabey Mosque. Remnants of plaster details over muqarnas are remarkable. Source: Hassa Mimarlik Archive.

In the early Ottoman mosques, the process of dividing the transition zone into parts can be traced from the earliest periods. In the Alaaddin Bey Mosque, the oldest datable Ottoman mosque, as well as in the Karacabey Mosque in Bursa, triangular elements made of brick can be easily seen, above the muqarnas pendentive in the latter (Figure 18 and 19). This transitional element, called the triangular belt, which emerged as a structural division of the transitional zone, continued up to the corner domes of the courtyard portico of the Istanbul Bayezid II Mosque (Table 2).

DOI: 10.15320/ICONARP.2024.292

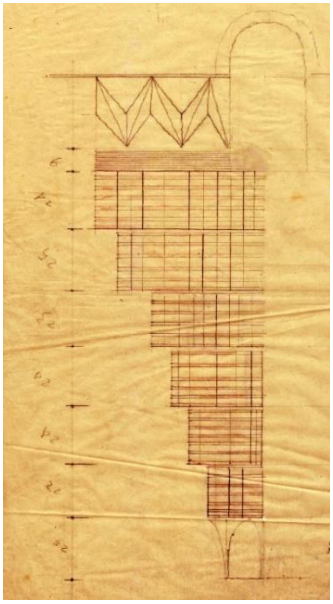

Figure 19. Drawing of the brick structure of the transitional zone and muqarnas pendentive in Bursa Karacabey Mosque. Source: Salt Research Ali Sami Ülgen Archive, Inventory No: TASUDOC0226039

Table 2. Use of Muqarnas in the Transitional Zone in the Early Ottoman Period

THE USE OF MUQARNAS IN THE TRANSITION ZONE IN THE EARLY OTTOMAN PERIOD						
DATE	**LOCATION**	**BUILDING NAME**	**SPACE**	**TRANSITION BETWEEN**	**TRANSITIONAL ELEMENT TYPE**	**LOCATION IN SPACE**
1377	BURSA	TIMURTAS PASA MOSQUE	HARIM MAIN DOME	OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
1377	IZNIK	YEŞİL MOSQUE	ENTERANCE PORTICO CENTRAL DOME	OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
1382	MUDURNU	YILDIRIM HAMMAM	HOT ROOM	OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
1388	BOLU	ORTA HAMMAM	HOT ROOM	OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
1388	IZNIK	IMARET OF NILUFER HATUN	EASTERN ROOM	OCTAGONAL DRUM - WALLS	PENDENTIVE	AT TWO SIDES ASSIMETRICALLY
1389	BERGAMA	DEBBAGLAR HAMAM	HOT ROOM	THE WHOLE DOME - PIERS	PENDENTIVE	CIRCULAR
1394	MILAS	FIRUZ BEY MOSQUE	HARIM MAIN DOME	SQUINCH - WALLS	SQUINCH	AT DIAGONAL CORNERS
1395	BURSA	YILDIRIM BAYEZID COMPLEX - MADRASA	MAIN ROOM	UNDER OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS

1404	BALAT	ILYAS BEY COMPLEX HAMAM	HOT ROOM	DOME - SQUINCH	PENDENTIVE	AT EIGHT CORNERS
1413	EDIRNE	ESKI MOSQUE	HARIM CENTRAL DOME	SQUINCH - WALLS	SQUINCH	AT FOUR CORNERS
1419	BURSA	YEŞİL MOSQUE COMPLEX - MOSQUE	EASTERN DOME	UNDER OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
			SOUTHWESTERN DOME	UNDER OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
			SOUTHEASTERN DOME	UNDER OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
			NORTHWESTERN DOME	UNDER OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
1421	BURSA	MAHKEME HAMAM	ENTERANCE ROOM	SQUINCH - WALLS	SQUINCH	AT FOUR CORNERS
1422	EDIRNE	GAZI MIHAL HAMAM	HOT ROOM	UNDER OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
1435	EDIRNE	TAHTAKALE HAMAM	HOT ROOM	UNDER OCTAGONAL DRUM - WALLS	PENDENTIVE	CIRCULAR
			WARM ROOM	UNDER OCTAGONAL DRUM - WALLS	PENDENTIVE	CIRCULAR
			CAMEKAN	ABOVE UNDER OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
1444	SELANIK	BEY HAMAM	SICAKLIK	ABOVE UNDER OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
1445	PLOVDIV	SEHABETTİN PASA MOSQUE	HARIM	DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
			SEMI DOME OVER THE MIHRAB	SQUINCH - WALLS	PENDENTIVE	AT TWO CORNERS
1448	EDIRNE	UC SEREFELI MOSQUE	HARIM	DRUM - PIERS	PENDENTIVE	CIRCULAR
1457	BURSA	KARACABEY MOSQUE	HARIM	OCTAGONAL DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
1468-	SKOPJE	DAVUTPASA CİFTE	MEN'S HOT ROOM	DRUM - PENDENTIVE	PENDENTIVE	CIRCULAR

DOI: 10.15320/ICONARP.2024.292

97		HAMAM				
1453 - 1481	ISTANBUL	TAHTAKALE HAMAM	ENTERANCE ROOM	SQUINCH - WALLS	SQUINCH	AT FOUR CORNERS
			HOT ROOM	DOME - DRUM	DRUM	CIRCULAR
			PRIVATE CUBICLE (HALVET)	SQUINCH - WALLS	SQUINCH	AT FOUR CORNERS
1472	ISTANBUL	RUM MEHMET PASA COMPLEX - MOSQUE	SEMI DOME OVER THE MIHRAB	SQUINCH - WALLS	UNDER SQUINCH ARCH	AT TWO CORNERS
1473	ISTANBUL	MURAD PASA COMPLEX - MOSQUE	HARIM	SQUINCH - WALLS	PENDENTIVE	CIRCULAR
1478	ISTANBUL	TOPKAPI PALACE FATIH PAVILLION	SOUTHERN DOME	DOME - DRUM	PENDENTIVE	CIRCULAR
				SQUINCH - WALLS	SQUINCH	AT FOUR CORNERS
1485	ISTANBUL	DAVUTPAŞA COMPLEX - MOSQUE	HARIM	SQUINCH – PENDENTIVE - WALLS	SQUINCH AND PENDENTIVE	AT FOUR CORNERS
1488	EDIRNE	DARUSSIFA OF THE BAYEZID II COMPLEX	CENTRAL DOME	HEXAGONAL DRUM - WALLS	PENDENTIVE	CIRCULAR
1505	ISTANBUL	BAYEZID II COMPLEX MOSQUE	HARIM	MAIN DOME DRUM	UNDER CATWALK	CIRCULAR
1505	ISTANBUL	BAYEZID II COMPLEX - HAMMAM	MEN'S COLD ROOM	SQUINCH - WALLS	PENDENTIVE	AT FOUR CORNERS
			MEN'S WARM ROOM	DOME - WALLS	PENDENTIVE	AT FOUR CORNERS
			WOMEN'S HOT ROOM	DOME DRUM	DRUM	CIRCULAR
			MEN'S HOT ROOM	DOME DRUM	DRUM	CIRCULAR
1510	ISTANBUL	ATIK ALI PASA MOSQUE	SEMI DOME OVER THE MIHRAB	DOME - WALLS	PENDENTIVE	AT TWO CORNERS
			SIDE DOMES	DOME – DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS
1520	ISTANBUL	TOPKAPI PALACE	PRIVY CHAMBER	DRUM - WALLS	PENDENTIVE	AT FOUR CORNERS

ICONARP – Volume 12, Issue 1 / Published: 30.06.2024

The transformation of the transition elements to the dome from brick to muqarnas in a short period of time may be attributed to the widespread use of plaster material, which is relatively easier to shape (Figure 18). As a matter of fact, in this period muqarnas were either carved out of plaster or cast into molds made of wood (Senalp, 2012:49) For example, when we look at the examples of muqarnas made of marble and plaster from the same period, while the plaster examples capture the quality of Seljuk stonework, the marble examples remain relatively large and simple in the mihrab of Iznik Yeşil Mosque. The reason for this is the difficulty of carving the muqarnas in marble with fine details and the ease of application brought by plaster (Senalp, 2012:84).

Since plaster is a perishable material, there is a need to examine which examples in which buildings are unique in this period. Bursa Orhan Bey Mosque (1339) mihrab with muqarnas and Timurtaş Pasha Mosque (1377) portal muqarnas are two examples from the same period (Senalp, 2012:52).

Considering these examples, it can be assumed that the Timurtaş Pasha Mosque example was built towards the end of the 14th century, while the Orhan Mosque mihrab was actually built later, given that its ornamentation is quite advanced. However, Ayverdi, who visited the ruins of the early Ottoman buildings, wrote about the mihrab of the Orhan Mosque as follows:

"Gabriel has stated that it is from the original; since there is no evidence that it was newly made, it is absurd to think otherwise. The 14th century was a period when plaster work in Anatolia was very sophisticated and rich. In addition, fragments of the mihrab plaster can be found in the ruins of the Orhan Mosque in Iznik, the ruins of the Samsa Çavuş Mosque in Genbenuz village and the magnificent mihrabs of the Hüdavendigar, Şehadet and Çekirge Mosques in Behram Kal'e village."
(Ayverdi, 1989:80)

The evidence for Ayverdi's view is the mihrab of the Iznik Hagia Sophia mosque, which was converted into a mosque by Orhan Gazi in 1331. From the plans of this mihrab, it can be seen that the places where the bricks protrude are decorated with plaster muqarnas, as in the Orhan Mosque, because one of the construction methods is to use plaster muqarnas on a brick base. The accuracy of this assessment is apparent upon comparison of the mihrab plans (Senalp, 2012:52).

During the initial stage of Ottoman Architecture, muqarnas were first employed as a pendentive in the transition zone to the dome at Bursa Timurtaş Paşa (Figure 20) and İznik Yeşil Mosque (Figure 21). It is apparent that the transition to the dome using pendentives in the form of muqarnas began with the Mudurnu Yıldırım Hamam among the baths constructed during this era. The Bolu Orta Hamam, constructed in 1388, features muqarnas elements displaying exceptional design and craftsmanship including badem, yaprak, kazayagi, and fitil. Plaster was used to decorate the bath interiors.

DOI: 10.15320/ICONARP.2024.292

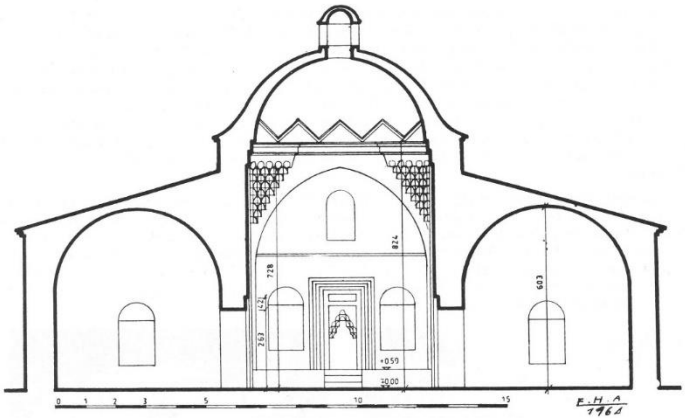

Figure 20. Bursa Timurtaş Paşa Mosque (1377) section. Source: Ayverdi (1989) p. 389

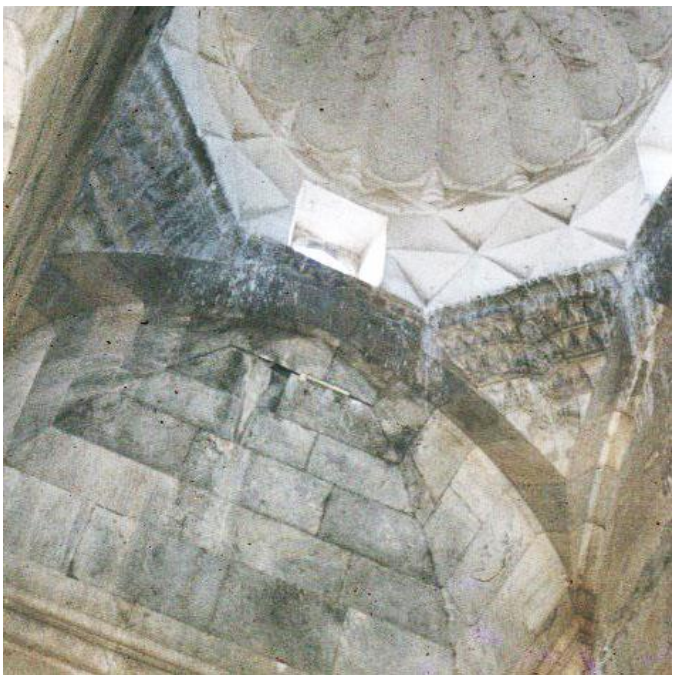

Figure 21. İznik Yeşil Mosque Central Portico Dome, stone muqarnas pendentive. Source: Salt Research Kemal Söylemezoğlu Archive, Inventory No: TSOH253

At the Debbağlar Hamam in Bergama, a significant advancement was achieved in the implementation of muqarnas during the transition to the dome (Figures 22 and 23). From the centre of the dome to the drum, pendentives, and piers, the dome over the hot room section is adorned with muqarnas. This instance exemplifies the ease and speed with which plaster muqarnas can be created in the presence of skilled craftsmen. Other significant baths constructed during this time include the Iznik İsmail Bey Hamam and the Palace, Gazi Mihal, Topkapı, Yeniçeri, and Beylerbeyi Hamams in Edirne. These baths form a part of the Murad II period.

ICONARP – Volume 12, Issue 1 / Published: 30.06.2024

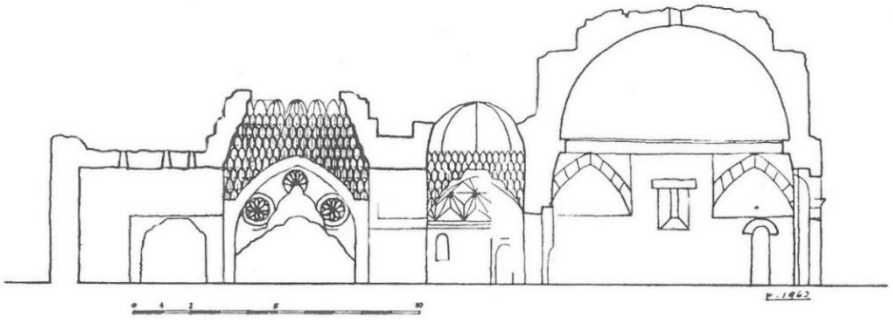

Figure 22. Bergama Debbağlar Hamam. Source: Kula-Say S. (2011) p:148

Figure 23. Bergama Debbağlar Hamam. Source: Kula-Say S. (2011) p:151

Deteriorated parts of these hamams gives account for the construction technique of the plaster. Once brick base is formed, iron nails are driven into the joint mortar so that their heads protrude 2-3 cm in order the plaster to hold on the muqarnas substructure, before the plaster layer is applied (Akyıldız, 2018:346-347).

As a consequence, plaster was used as a coating material on brick muqarnas, and this technique was continuously refined from the time of Orhan Gazi. The 1370s saw the inception of an extensive programme of brick and plaster muqarnas, which continued until the Battle of Ankara in 1402. The Fetret Period then resulted in the discontinuation of these practices for a period of time.

The Bursa Yıldırım Complex (1395 AD) represents the first group of buildings just before this period where muqarnas were extensively employed. The mosque utilized prismatic Turkish triangles in the transition areas to the dome, applying them as plaster on brick. Marble material was selected for the muqarnas niches on the entrance facade. A muqarnas-shaped pendentive, similar to the one in the Timurtaş Pasha Mosque, was appropriately used to transition to the dome in the main hall of the madrasa building. Furthermore, a muqarnas dome adorns the enterance hall of the madrasa, which is first of its kind along with the one in Debbağlar Hamam (Figure 24).

DOI: 10.15320/ICONARP.2024.292

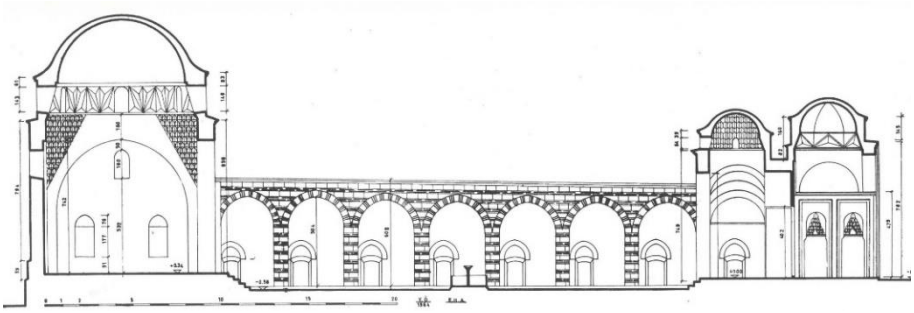

Figure 24. Bergama Debbağlar Hamam. Source: Kula-Say S. (2011) p:151

The Great Mosque of Edirne, namely Eski Cami, which is the first major structure of the Ottoman Empire, features a muqarnas-shaped squinch in its central dome, while the remaining domes are Turkish triangles. The Yeşil Mosque complex in Bursa has Turkish triangles spanning the main area, with the four zawiya domes taking on a pendentive-shaped muqarnas design.

During the reign of Murad II, the emergence of bath construction programs led to a rise in the implementation of muqarnas. The craftsmen involved in these programs were skilled in both prismatic Turkish triangles and muqarnas elements, which were used in their repertoire of materials. This trend would persist rapidly until the end of the reign of Mehmed II. During the early Ottoman era, a custom of using muqarnas in the baths led to the creation of a squinch in the enterance room section of the Bursa Mahkeme Hamam and a pendentive from the bottom of the drum to the walls of the Gazi Mihal Hamam. It is noteworthy to mention the Tahtakale Hamam in Edirne as well. In the hot room and warm room sections, the octagonal drum passes beneath the dome in the form of a pendentive, while in the enterance room section, the muqarnas ornamentation extends up to the upper level of the pendentive dome drum and forms a circular design.

During this time period, the tradition of transitioning to the dome with muqarnas began to emerge in the Balkans, with it being used as a pendentive in the harim and the dome above the mihrab in Şihabettin Pasha Mosque in Plovdiv. Selanik Bey Hamam, along with its hot room section, and Davutpaşa Hamam in Skopje, implemented the muqarnas transition programme in almost all of its areas during the reign of Mehmed II.

Transitional elements with muqarnas began to be utilized in Istanbul after the city's conquest. The Tahtakale Hamam in Eminönü was constructed as a continuation of the program initiated during the reign of Murad II. The enterance room, hot room, and khalvet sections are equally sophisticated as the muqarnas present in the Edirne Tahtakale Hamam. Additionally, the south side domes of the Fatih Pavilion in Topkapı Palace feature a circular transition from the drum to the dome (Figure 25), mirroring the design seen in the Selçuk İsa Bey Mosque and Firuz Bey Mosque (Figure 2). A squinch was also used to transition from the drum to the walls at a lower level (refer to Figure 13).

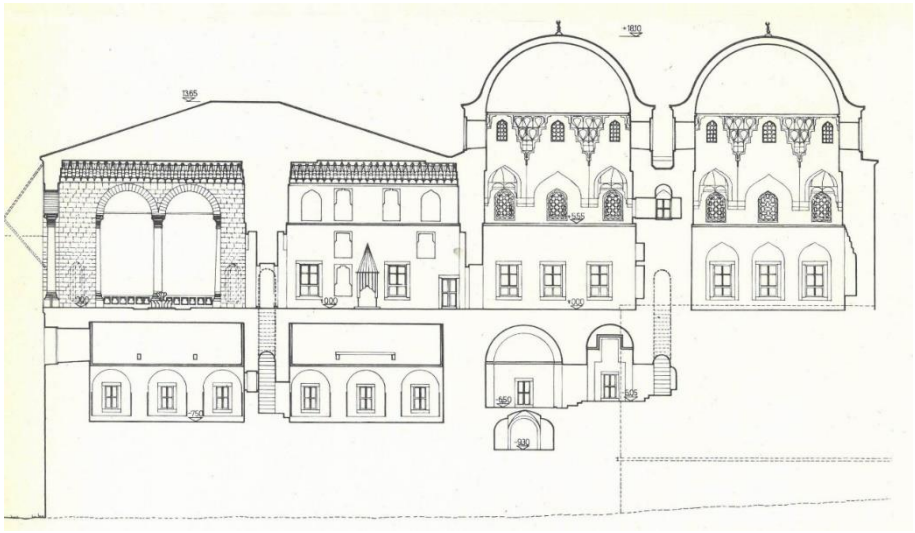

Figure 25. Topkapı Palace Fatih Pavililon. Eldem ve Akozan (1981) Pl. 73

The Davutpaşa Mosque in Istanbul introduced a novel transition design utilizing muqarnas. The large muqarnas situated at the four corners commence as a squinch and then connect to the walls as pendentives, as shown in Figures 26 and 27. This mode of application was likewise utilised in the Sekibaşı Hammam located in Muğla.

Figure 26. Corner muqarnas is presented in the form of both squinch and pendentive in Davutpasa Mosque. Senalp, H. S. (2012)

DOI: 10.15320/ICONARP.2024.292

Figure 27. Corner muqarnas plan view, Davutpasa Mosque. Senalp, H.S. (2012)

During the 2015-2019 restoration of Davutpaşa Mosque, a brick muqarnas structure was revealed from below after the plaster on these muqarnas was removed. In addition, there are stone courses between the rows of brick muqarnas, revealing a stone-brick alternation technique (Figure 28 and 29).

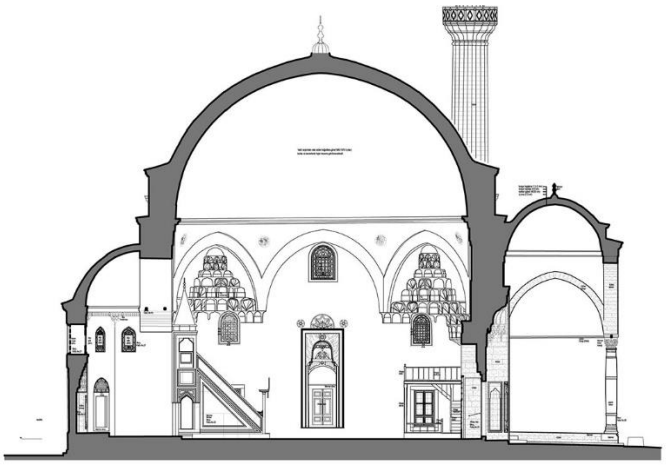

Figure 28. Transition to the dome in Davutpaşa Mosque. Source: https://www.avundukmimarlik.com.tr/tr/istanbul-fatih-davutpasa-camii-2030/

Figure 29. After removing the plaster layer on the muqarnas at Davutpaşa Mosque, the underlying brick structure is revealed. Author : Can Şakir Binan (2017)

Another instance similar to the dimensions of the Davutpaşa Mosque muqarnas can be observed in the half dome positioned above the mihrab of the Atik Ali Paşa Mosque in Istanbul (Figure 30). During the transition to the dome in this case, the lower part of the muqarnas actually need to terminate at the corner conforming to the shape of the pendentive. However, in the final stages, the muqarnas acquires a squinch shape, departing from the corner and then concluding on the wall surface. A comparable implementation was also utilized in the enterance room section of the Edirne Tahtakale Hamam.

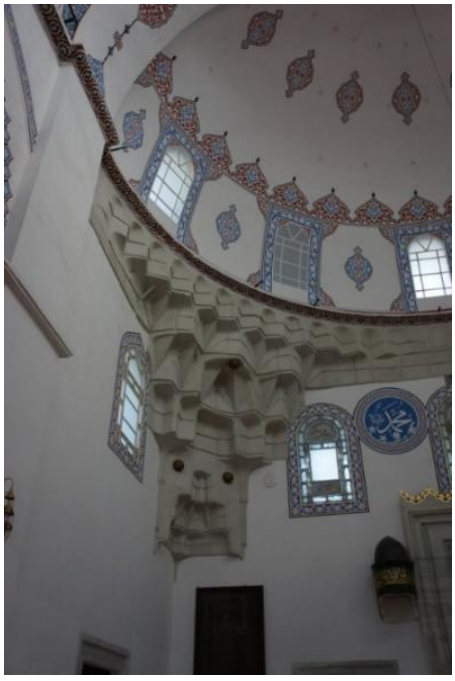

Figure 30. Atik Ali Paşa Mosque transition to the dome above mihrab. Senalp, H.S. (2012) sf: 88.

DOI: 10.15320/ICONARP.2024.292

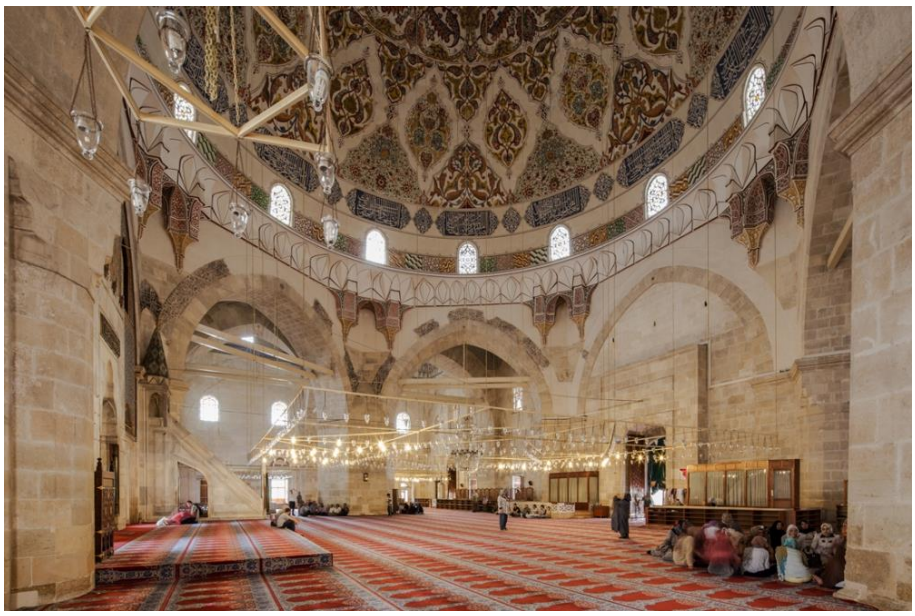

Figure 31. Circularly arranged muqarnas belt in Uc Serefeli Mosque. Source: https://www.kulturportali.gov.tr/turkiye/edirne/gezilecekyer/uc-serefeli-cami

One advanced stage in the transition with muqarnas involves surrounding the inner wall while making the transition. The circular utilization of muqarnas, initially implemented in the Bergama Debbağlar Hamam, was subsequently deployed in the hot room and warm room areas of the Edirne Tahtakale Hamam dating back to 1435. One of the primary applications of muqarnas in dome transition is facilitating the passage between the hexagonal drum, arches, and piers in Edirne Üç Şerefeli Mosque (Figure 31). This approach was similarly employed in the central area of Darussifa of Bayezid II Complex, which also features a hexagonal drum. Muqarnas are circularly arranged from the dome drum in the Murat Pasha Complex Mosque in Istanbul, connecting the dome with pendentives.

At the Bayezid II Complex situated in Istanbul, muqarnas applications are prominently featured on the courtyard portal and domes. Within the mosque's interior, muqarnas were exclusively applied to the main and half dome catwalks in the transition areas leading up to the domes. Additionally, the squinch located in the men's cold room section of the hamam, which is also part of the complex, was segmented and decorated with muqarnas underneath the squinch and squinch arches. An earlier instance of a niche adorned with a segmented muqarnas can be discovered in the muqarnas portal of Davutpaşa Mosque (1475 AD) (Figure 32).

Figure 32. Segmented muqarnas portal, Davutpaşa Mosque. Source: Sav (2021) p.285

Another employment of muqarnas in Istanbul is its use below the squinch and squinch arch. The use of muqarnas on the half dome situated above the mihrab of Rum Mehmed Pasha Mosque is one of the earliest examples, and was subsequently incorporated in Gebze Çoban Mustafa Pasha, Üsküdar Mihrimah Sultan, Kazasker İvaz Efendi, Nişancı Mehmet Pasha, and Cerrahpaşa Complexes constructed by Sinan.

TRANSITIONAL ELEMENTS IN THE CLASSICAL OTTOMAN PERIOD

During the Classical Period, the tradition of transitioning to the dome with muqarnas was expanded with new techniques following Sinan's appointment as chief architect. Analysis of the enrichment in the transition space revealed mainly circular applications forming a belt (Table 3).

Table 3. Use of Muqarnas in the Classical Ottoman Period

THE USE OF MUQARNAS IN THE TRANSITION ZONE IN THE CLASSICAL OTTOMAN PERIOD						
DATE	**LOCATION**	**BUILDING NAME**	**SPACE**	**TRANSITION BETWEEN**	**TRANSITIONAL ELEMENT TYPE**	**LOCATION IN SPACE**
1529	GEBZE	COBAN MUSTAFA PASA COMPLEX - MOSQUE	HARIM	SQUINCH - WALLS	UNDER SQUINCH ARCH	AT FOUR CORNERS
1547	ISTANBUL	USKUDAR MIHRIMAH SULTAN COMPLEX - MOSQUE	HARIM	SQUINCH - WALLS	UNDER SQUINCH ARCH	AT THREE CORNERS
1548	ISTANBUL	SEHZADE	HARIM	QUARTER	PENDENTIVE	CIRCULAR

DOI: 10.15320/ICONARP.2024.292

		COMPLEX - MOSQUE		DOMES - WALLS		
1551	ISTANBUL	HADIM IBRAHIM PASA COMPLEX - MOSQUE	HARIM	SQUINCH - WALLS	PENDENTIVE	AT FOUR CORNERS
1556	ISTANBUL	AYASOFYA HASEKI HAMMAM	SICAKLIK	DRUM - WALLS	PENDENTIVE	CIRCULAR
1558	ISTANBUL	SULEYMANIYE COMPLEX - MOSQUE	HARIM	HALF DOMES - WALLS	PENDENTIVE	AT FOUR CORNERS
			SIDE DOMES	DOME - DRUM - WALLS	PENDENTIVE	CIRCULAR
1565	BABAESKI	ALI PASA MOSQUE	HARIM	HEXAGONAL DRUM – HALF DOME AND PIERS	PENDENTIVE	CIRCULAR
			HARIM	HALF DOMES - WALLS	PENDENTIVE	CIRCULAR
1572	ISTANBUL	KADIRGA SOKULLU MEHMET PASA MOSQUE	HARIM	HALF DOMES - WALLS	PENDENTIVE	CIRCULAR
1574	EDIRNE	SELIMIYE COMPLEX - MOSQUE	HARIM	OCTAGONAL DRUM - SQUINCH AND PIERS	PENDENTIVE	CIRCULAR
			HARIM	SQUINCH – PIERS AND WALLS	PENDENTIVE	CIRCULAR
			THE DOME OVER MIHRAB	DRUM - WALLS	PENDENTIVE	AT TWO SIDES SIMETRICALLY
1586	ISTANBUL	KAZASKER IVAZ EFENDI MOSQUE	HARIM	HALF DOMES - WALLS	PENDENTIVE	AT TWO SIDES SIMETRICALLY
			THE DOME OVER MIHRAB	HALF DOME SQUINCH - WALLS	UNDER SQUINCH ARCH	AT TWO SIDES SIMETRICALLY
1589	ISTANBUL	NISANCI MEHMED PASA COMPLEX - MOSQUE	HARIM	HALF DOMES - WALLS	PENDENTIVE	CIRCULAR
			HARIM	HALF DOME	UNDER	CIRCULAR

				SQUINCH - WALLS	SQUINCH ARCH	
1594	ISTANBUL	CERRAHPASA COMPLEX - MOSQUE	HARIM	HALF DOMES - WALLS	PENDENTIVE	CIRCULAR
			THE DOME OVER MIHRAB	HALF DOME SQUINCH - WALLS	UNDER SQUINCH ARCH	CIRCULAR
1620	ISTANBUL	SULTAN AHMED MOSQUE	HARIM	QUARTER DOMES - WALLS	PENDENTIVE	CIRCULAR
1665	ISTANBUL	YENİ MOSQUE AT EMINONU	HARIM	QUARTER DOMES - WALLS	PENDENTIVE	CIRCULAR
1711	ISTANBUL	YENİ VALİDE COMPLEX AT USKUDAR- MOSQUE	HARIM	SQUINCHES - ARCHES	PENDENTIVE	AT FOUR CORNERS
			HARIM	DRUM	UNDER CATWALK	CIRCULAR
1735	ISTANBUL	HEKİMOGLU ALI PASA COMPLEX - MOSQUE	HARIM	HALF DOMES - WALLS	PENDENTIVE	CIRCULAR

Within the Şehzade Mehmed Mosque's harim during this era, muqarnas are arranged in a circular manner around the inner shell of the building at the transition from the quarter domes, which serve as squinches, to the walls. Previously, the muqarnas positioned beneath the squinch were unable to create a united inner shell due to their insufficient size. The ongoing ornamentation of these muqarnas rows on the piers, mihrab top, and exit portal reveals a deliberate attempt to construct a band at the point of transitioning to the domes (Figure 33).

DOI: 10.15320/ICONARP.2024.292

Figure 33. The transition zone with muqarnas in Şehzade Mosque leading to the domes. Source : https://upload.wikimedia.org/wikipedia/commons/f/f3/Sehzade_mosque_Istanbul_2009_04_21.jpg

Batur (1980:137) illustrates the structure-decoration relationship achieved by Sinan in the Şehzade Mosque by explaining how the dome-to-wall transition is divided into three stages. In the first stage pendentives connects the dome with four piers and four large bearing arches. The second stage occurs in a belt situated at the edge of the half domes. The belt comprises three arches and the pendentives connecting them. These arches open onto small, half dome-shaped squinches. In the third stage, the circular base of these squinches connects with the structural elements (walls or arches) filled with muqarnas.

It can be stated that the notion of muqarnas filling, as given above and stated in numerous literary sources as well, does not constitute a filling per se, particularly for the transitional zones of the classical Ottoman structures. The restoration project spanning from 1986 to 1999 at the Şehzade Mosque revealed that the muqarnas pendentive was created using a series of alternating stone and brick. A comparable technique was also detected in the central portico dome of the Hadım İbrahim Paşa Mosque which also incorporates iron reinforcement elements. One reason for constructing such a muqarnas could be viewed as a way to reduce the weight of the pendentive (as shown in Figures 34 and 35).

Figure 34. Below : Exedra no. 9, deteroirated muqarnas pendentive in Şehzade Mosque. Courses of stone and brick muqarnas structure is observed. Source: Şen, Y. (2019) p:284 Above: The borders showing the below picture muqarnas pendentive after restoration Source : https://www.turkiyenintarihieserleri.com/?oku=412

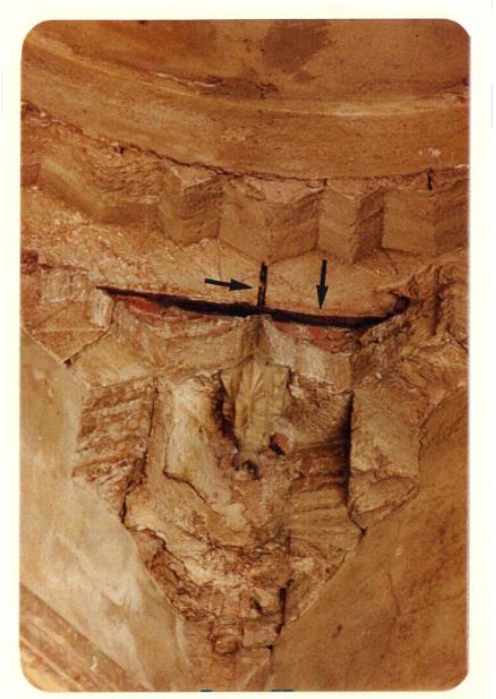

Figure 35. Stone and brick pendentive with iron element at the central portico dome of the Hadım İbrahim Paşa Mosque. Tanyeli, 1990 s:242

Following the Şehzade Mosque, Sinan proceeded with the implementation of pendentives under the segmented domes, which function as squinch. This feature, classified as a squinch in the men's cold room section of the Bayezid II Hammam, was also utilized in the Haseki Hürrem Complex Mosque and the Hadım İbrahim Paşa Complex Mosque (Figure 36). The sliced squinch design resolved its connection with the wall through the use of a muqarnas pendentive.

DOI: 10.15320/ICONARP.2024.292

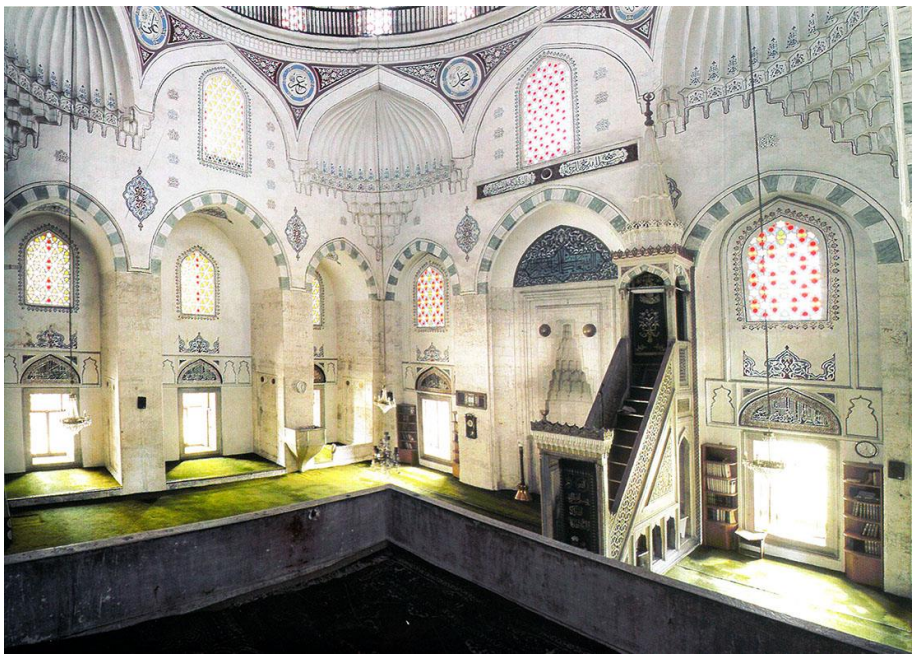

Figure 36. Hadım İbrahim Paşa Mosque, Silivrikapı, Interior. Günay (2007) p.43

Sinan utilized the muqarnas belt element to transition from the octagonal drum to the dome within the sicaklik section of the Hagia Sophia Haseki Hürrem Hammam, constructed in 1556.

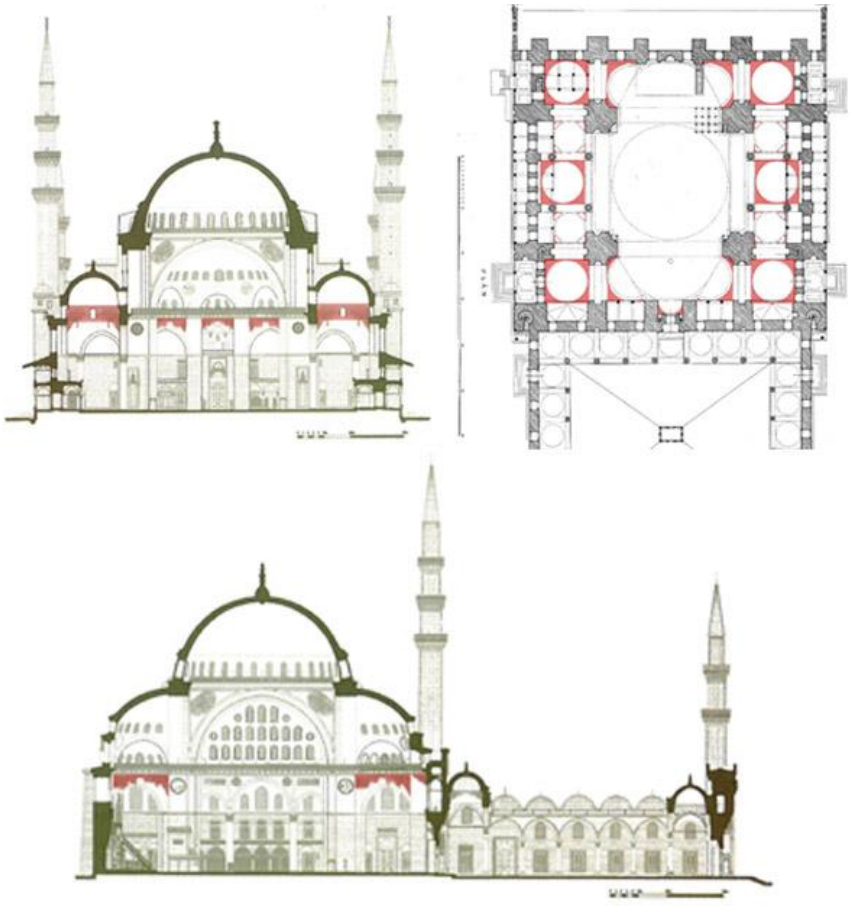

Figure 37. Transitional zone with muqarnas in the Suleymaniye Mosque Sections and Plan: Ali Saim Ülgen. Yenişehirlioğlu and Madran, 1989.

The construction of a muqarnas belt in the Süleymaniye Mosque, opened in 1557, was limited by the plan scheme with two half domes.

However, muqarnas elements were utilized in a circular pattern from the drum to the pendentives in all side domes except the harim, as shown in Figure 37. The resulting muqarnas belt consists of a series of domes that encircle the outer periphery of the building's harim area, which is bordered by piers. On the walls facing the qibla and the courtyard portico, the muqarnas belt circumvents the piers and continues to rotate around the building by passing under the squinches and half domes and its level remains unchanged. Excluding the small gap on the mihrab, it is evident that in Süleymaniye Mosque it is intended to encircle the entire structure with a muqarnas band, albeit featuring a distinct design.

In the Babaeski Ali Pasha Mosque (1565), the muqarnas belt was first applied to two levels of the building. The first level is the transition from the hexagonal drum to the semi-domes and pillars. At this level, it was designed in four muqarnas courses of unprecedented size and scale. The second level is the transition from the semi-domes and pillars to the wall of the building (Figure 38). This example is important because it is the first time that this transition has been achieved on two levels. In the Kadırga Sokollu Mosque (1572), which has a hexagonal drum, the muqarnas band under the semi-domes was again applied in a single stage.

Figure 38. Two levels of muqarnas belt system. Source: https://www.archnet.org/sites/2777?media_content_id=42865

DOI: 10.15320/ICONARP.2024.292

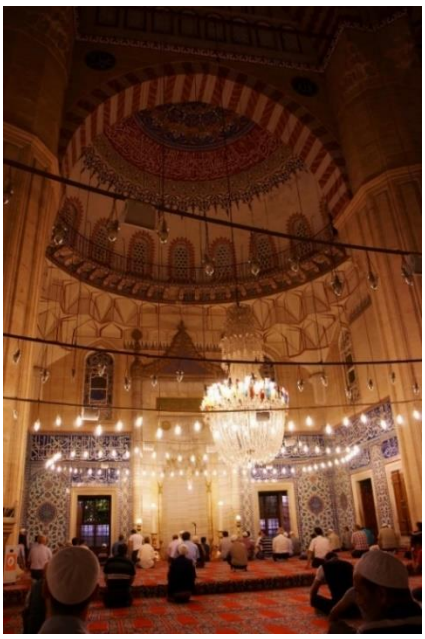

Figure 39. Selimiye Mosque transition to the dome above mihrab. Senalp H.S. (2012)

In the Edirne Selimiye Mosque, completed in 1574, the transition with muqarnas, which had been tried with a hexagonal drum in the Babaeski Ali Pasha Mosque, was this time tried with an octagonal drum. When the hexagonal drum was used, a transition of six semi-domes was required. Since the octagonal drum is used in this building, the domes at the corners act as squinches. Here the transition from the octagonal drum to the squinches and piers was made at the first level, and the transition from the squinches and piers to the building walls and arches at the lower level was made at the second level. There is the third layer just under the mihrab semidome (Figure 39). This example is one of two unique examples of the use of the muqarnas belt at the Ali Pasha Mosque (Figure 40).

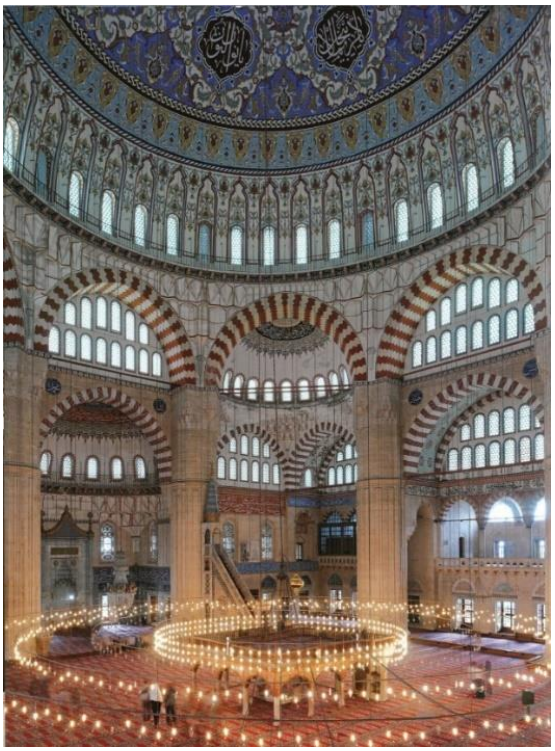

Figure 40. Transition to the dome in three layers of muqarnas starting from the semidome over mihrab in the Selimiye Mosque. Kuban (2007) Fotoğraf: Cemal Emden s:306

An analysis of Sinan's last works shows that he was the first to design small squinches under the semi-domes of medium-sized mosques with hexagonal and octagonal drums and pendentives with muqarnas in different rhythms. This innovation, first tried in the dome above the mihrab of the Kazasker İvaz Efendi Mosque, is in the form of alternating squinches of with and without muqarnas. In the semi-domes of Nişancı Mehmed Paşa Mosque, which sits on an octagonal drum, squinches were applied under the semi-domes on the side axis perpendicular to the qibla and the qibla axis, and pendentives were applied under the other four skipped semi-domes (Figure 41). In these examples, the inner wall of the building is circularly wrapped with muqarnas at a certain level. Davud Ağa, the chief architect after Sinan, continued this circular scheme in the Cerrahpaşa Mosque, which rests on a hexagonal drum, and repeated the formation of the dome over the mihrab in the İvaz Efendi Mosque.

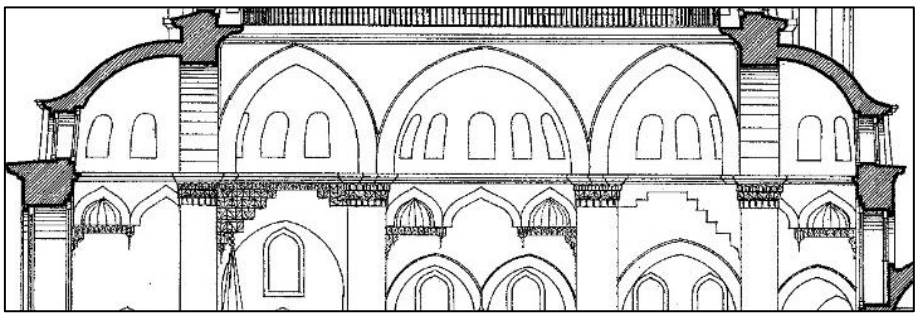

Figure 41. Transitional zone with muqarnas in the Nişancı Mehmet Paşa Mosque. Section: Ali Saim Ülgen. Yenişehirlioğlu and Madran, 1989.

After these dates, it can be observed that the use of muqarnas gradually declined, both due to the slowdown in construction activity and the fact that they were not favoured in the buildings that were constructed.

DOI: 10.15320/ICONARP.2024.292

However, the tradition continued in large buildings such as the Blue Mosque and the Eminönü Valide Mosque. In both buildings, a muqarnas belt was traditionally applied under the quarter domes/squinches, encircling the entire structure. In Üsküdar Yeni Valide complex (1711 AD) pendentives were placed under the squinches, and circular muqarnas were placed under the catwalk in the main dome drum, as in the Bayezid Mosque in Istanbul. The last building in which muqarnas were used as a transitional element is the Hekimoğlu Ali Pasha Mosque (1735 AD), where the semi-domes are connected to the walls by pendentives with muqarnas. An important point to note in these examples is the simplification of muqarnas designs after Sinan and the corresponding reduction in the size of the muqarnas units.

CONCLUSION

The use of materials and structures in different ways in different geographical regions has influenced the architectural designs and construction techniques of buildings, in doing so the materials and construction techniques of muqarnas have also changed. The transition of the muqarnas material from brickwork to stone and then back to brickwork in transitional zones made possible the production of very rich examples. The use of tiles or plaster on brick and the craftsmanship developed on these finishes increased the richness.

One of the reasons for this transition is the presence of brick construction techniques, especially locally in Western Anatolia. This is particularly evident in the works of Menteşeoğulları, Saruhanoğulları, Aydınoğulları and Osmanoğulları, who played a role in the transformation of brick construction techniques from the Roman period to Islamic architecture. The brick muqarnas, together with the plaster finish on them, became a lighter and more practical alternative to the stone material.

The use of the muqarnas as a transitional element, from the early Ottoman period to the classical Ottoman period, gave architects and craftsmen the opportunity to create a wide repertoire. The most important factor that led to this opportunity is the possibility of detailed muqarnas workmanship using coating materials such as plaster on brick muqarnas, rather than a material such as marble, which is difficult to transport and work with. Undoubtedly, although the examples with muqarnas give the impression of being made of plaster, in many examples the spilled plaster has revealed overflowing rows of bricks in some places (Figure 42). In many examples, these rows of bricks were made with delicate brickwork and were produced as muqarnas ready to be plastered.

ICONARP – Volume 12, Issue 1 / Published: 30.06.2024

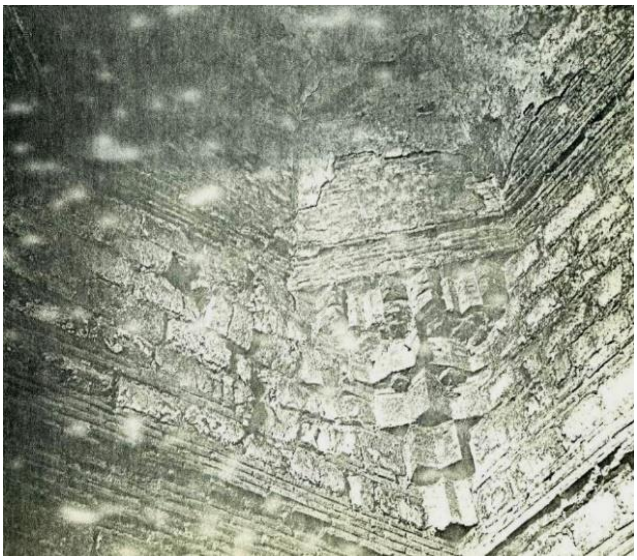

Figure 42. Alternating stone and brick muqarnas is visible on the dome pendentive of the Batı Tabhane in the Edirne Bayezid Mosque, as the plaster muqarnas has fallen off. Batur, 1980. p.84

While the Turkish triangles used in the Seljuk period increased the plastic effect of the transition zone and became a means of better integration with the dome, their use in the early Ottoman period together with muqarnas facilitated geometric transitions and helped to create a richer design. The use of muqarnas in transitional zone did not prevent the use of Turkish triangles, and both Turkish triangles and muqarnas were used together in early Ottoman baths and many other buildings.

In the early Ottoman period, the muqarnas of the 'inner covering space' began to be used, starting with the 'last congregation courtyard' dome of the İznik Yeşil Mosque and the interior pendentives of Timurtas Pasa Mosque. Of course, the slightly earlier tile muqarnas pendentives and the muqarnas belt above those of the Isa Bey Mosque in Selcuk, an Aydinogullari monument, are also worthy of mention. In the Timurtaş Paşa Mosque, muqarnas courses were used in the form of pendentives in the central areas such as the harim. It has been determined that the squinches, which come from the Central Asian and Iranian traditions, are the earliest structures with muqarnas in buildings such as the Milas Firuz Bey Mosque and the Bursa Mahkeme Hamam. In the Davutpaşa Mosque in Istanbul, an innovation was introduced and a single muqarnas element was used as both a squinch and a pendentive.

When we come to the muqarnas belts, the muqarnas transition in the Isa Bey Mosque, from the drum to the dome above the mihrab was transformed over time into a small uninterrupted muqarnas belt in various hamams. The first large-scale example of a muqarnas belt was in the Üç Şerefeli Mosque. This idea led later designers to use it in most of the buildings. The Bayezid II Darüşşifa in Edirne, Sinan's large scale projects such as Şehzade, Süleymaniye, Babaeski Ali Paşa, Edirne Selimiye and Post-Sinan works of Sultanahmed and Eminönü Valide Cami mosques continued to use muqarnas belt. When analysing these examples, it can be argued that the Selimiye Mosque is the most developed example of the relationship between structure and

DOI: 10.15320/ICONARP.2024.292

muqarnas, considering the dimensions of the muqarnas, their level heights and the flow of the muqarnas at different levels of the building.

After Mimar Sinan, the dimensions of the interior muqarnas were reduced, starting with the Blue Mosque. As a result of this reduction, it was possible to have more rows of muqarnas in a pendentive. It can be assumed that this design decision to increase the number of rows of muqarnas is intended to give the impression that the architectural elements are shrinking vertically. This should be a design decision to make the interiors of the buildings appear larger.

The final point in the relationship between structure and ornament is reached in the Selimiye Mosque. Immediately after the threshold of the dome, which rests on an octagonal drum, there is a series of large muqarnas and the entire dome surrounds the base of the dome. After the muqarnas, the arches and squinches are connected to the eight pillars and extend to the ground. At the same time, the huge dimensions of the muqarnas continue under the semidome of the mihrab. It can be said that the relationship between the user and the muqarnas is strengthened here.

It shows that the use of the muqarnas evolved and transformed from an element that provided a structural transition to one that effectively integrated the integrity of the interior space, becoming one of the most important architectural elements of the classical period without losing its structural qualities.

REFERENCES

Altun, A. (1991). Artuklular. Türkiye Diyanet Vakfı İslam Ansiklopedisi. 3: 418-419. Ankara: TDV Yayınları.

Akhrarov, I. and Rempel' L. (1971) Reznoi shtuk Afrasiyaba. Gafur Guljam Publ. House for Literature and Art, Tashkent. 160 pp.

Anisi, A., (2023). "Saljuq Architecture in Iran; Masjid-i Jam'of Marand". Pazhoheshha-ye Bastan Shenasi Iran, 13(37), 313-331.

Arce, I.R. (2006). Umayyad Arches, Vaults & Domes: Merging and Re-creation. Contributions to early Islamic construction history. In: Malcolm Dunkeld et al [eds] Proceedings of the Second International Congress on Construction History: Queens' College, Cambridge University, 29th March–2nd April 2006, pp.195–220. Queens' College, Cambridge University. United Kingdom: Construction History Society, Cambridge.

Ayverdi, E. H. (1989) Osmanlı Mimarisinin İlk Devri-I. Ertuğrul, Osman, Orhan, Gaziler Hüdavendigar ve Yıldırım Bayezid 630-805 (1230-1402). Istanbul Fethi Cemiyeti Yayınları, Istanbul.

Batur, A. (1980) Osmanlı Camilerinde Örtü ve Geçiş Öğeleri I, İstanbul.

Büyükdığan, İ. (1989) "İkinci Murat Çağı Edirne Hamamlarında Alçı Mukarnas Bezeme". Istanbul Teknik Üniversitesi Fen Bilimleri Enstitusu.

Edwards, C. and Edwards, D. "The Evolution of the Shouldered Arch in Medieval Islamic Architecture" Architectural History , Vol. 42, (1999), sf. 68-95 98

Eldem, S. H. and Akozan, F. (1981) Topkapı Sarayı, Bir Mimari Araştırma. Ankara. Kültür veTurizm Bakanlığı Eski Eserler ve Müzeler Genel Müdürlüğü.

Etyemez Çıplak, L. (2017) "Understanding the construction technique of Mimar Sinan's buildings: the case of Lüleburgaz Sokullu Mehmed Paşa Mosque" Middle East Technical University, MA Thesis. The Graduate School of Natural and Applied Sciences.

Fukami, N. (2017) The Use of Muqarnas in the Transitional Zone of Domes in Egyptian Islamic Architecture From the Fatimid to the End of the Mamluk Era, Orient, Volume 52, 93-119.

Günay, R. (2007) Sinan The Architect and His Works. Yem Yayın, İstanbul.

Hillenbrand, R. (1976). Saljūq Dome Chambers in North-West Iran. Iran, 14, 93–102.

McClary, R. P. (2014). "Brick Muqarnas on Rum Saljuk Buildings – The introduction of an Iranian Decorative Technique into the Architecture of Anatolia" Transkulturelle Perspektiven 3/2014 – 1.

Kılıçoğlu, S. (2017) İslam Sanatında Geometrik Bezemenin Kökeni ve Mukarnas Kubbe. Yüksek Lisans Tezi, Yıldız Teknik Üniversitesi, Fen Bilimleri Enstitüsü, 147p.

Kolay, İ. A. (2017) Batı Anadolu 14. Yüzyıl Beylikler Mimarisinde Yapım Teknikleri. Atatürk Kültür Merkezi Başkanlığı, Ankara.

Kuniholm, P. (2002). Dendrochronologically Dated Ottoman Monuments. A historical archaeology of the ottoman empire: Breaking new ground, Edited by Uzi Baram and Lynda Carroll. New York: Kluwer Academic/Plenum Publishers.

Ödekan, A. (1977), Osmanlı Öncesi Anadolu Türk Mimarisinde Mukarnaslı Portal Örtüleri, İstanbul Teknik Üniversitesi Yayınları, Istanbul.

Öney, G. (1992) Anadolu Selçuklu Mimari Süslemesi ve El Sanatları, Türkiye İş Bankası Yayınları, İstanbul.

Pancaroğlu, O. (2012). "The House of Mengüjek in Divriği: Constructions of Dynastic Identity in the Late Twelfth Century". The Seljuks of Anatolia: Court and Society in the Medieval Middle East. Ed. A. C. S Peacock ve Sara Nur Yıldız. New York.

Rogers, J. M. (1969). Recent Work On Seljuk Anatolia. Kunst Des Orients, 6(2), 134–169.

Samkoff, A. (2014). From Central Asia to Anatolia: the transmission of the black-line technique and the development of pre-Ottoman tilework. Anatolian Studies, 64, 199–215.

Say, S. K. (2011) "Kubbeye Doğru: Erken Dönem Osmanlı Hamamlarında Eğrisel Örtüye Geçiş Sistemleri". Tarihçi Kitapevi, İstanbul.

Sav, M. (2021) Davut Paşa Camii ve Restorasyonuna İthaf 2015-2019. Vakıflar Genel Müdürlüğü, İstanbul.

Şen, Y. (2019) Performance assessment of restoration applications and renovations in Prince Mehmet Mosque (1986-1999). Unpublished MA Thesis, Fatih Sultan Mehmet Vakıf Üniversitesi, Lisansüstü Eğitim Enstitüsü, İstanbul.

Senalp, H. S. (2012), The Evolution of Ottoman Muqarnas, (Osmanlı Mukarnasının Evrimi) Yüksek Lisans Tezi, School of Oriental and African Studies / University of London.

DOI: 10.15320/ICONARP.2024.292

Tabbaa, Y. (1985). The Muqarnas Dome: Its Origin and Meaning. Muqarnas, 3, 61–74

Tanyeli, G. (1990). Osmanlı Mimarlığında Demirin Strüktürel Kullanımı. Unpublished Phd Thesis, Istanbul Technical University, Institute of Science and Technology, İstanbul.

Ülgen, A. S. (1989). Mimar Sinan yapıları (Katalog), yay. haz. F.Yenişehirlioğlu, E. Madran, TTK Yayınları, Ankara.

Resume

Hüdai Sırrı ŞENALP graduated from Yildiz Technical University, Faculty of Architecture, Department of Urban and Regional Planning in 2010. In 2012, he completed an MA in Art History and Archaeology at SOAS, University of London. During this course, he started his research in the field of muqarnas with a dissertation entitled "The Evolution of Ottoman Muqarnas". He is continuing his Ph.D. research on the construction techniques, conservation and restoration problems of muqarnas at Yildiz Technical University, Faculty of Architecture.

Can Şakir BİNAN was born in 1956 in Istanbul, graduated from Galatasaray High School in 1976, and graduated from IDMMA Faculty of Architecture, Department of Architecture in 1981. With his thesis titled "A Research on Conservation Criteria of 13th Century Anatolian Caravanserais", he became a Doctor at Istanbul Technical University in 1991, Associate Professor in 1996 and Professor at Yıldız Technical University in 2010. His areas of expertise are History of Architectural Conservation, Conservation and Restoration Technology, World Heritage, International texts in the field of Conservation and Medieval Anatolian Architecture. In addition to his books, articles and research on Architectural Conservation and Restoration, he is a member of ICOMOS Turkey National Committee and served as the Chairman of the Istanbul Cultural and Natural Heritage Conservation Board No. 3 between 2001-2010.