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A Glimpse Into the Water Architectural Heritage of Marrakech: Artistic Forms and Functional Dimensions

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Abstract

This research paper sheds light on the pivotal role of water in shaping the architectural identity of Moroccan cities, with a particular focus on Marrakech. It emphasizes the aesthetic dimensions of this architecture and the emotional responses it elicits, while also analyzing the semiotics of a distinctive architectural style that has developed through a significant cultural history. This research paper highlights how water has functioned as both a catalyst for construction and an emblem of tranquility and prosperity throughout Marrakech's urban development, particularly during the influential Almoravid and Almohad periods. These epochs not only contributed to the city's architectural heritage but also largely shaped a cultural identity that persists today. The study further explores the significance of water architecture in Islamic civilization, showcasing its beauty and artistry, and examines the intricate relationships between water facilities and urban planning, tackling their roles in religious, economic, environmental, health, and aesthetic contexts. Ultimately, this study reveals how the integration of water architecture has shaped the urban landscape of Marrakech, adhering to engineering principles that harmonize natural and artistic elements.

Keywords: Water Architecture, Marrakech's History, Aesthetic Dimensions, Urban Development, Almoravid Dynasty, Almohad Dynasty

Introduction

This research paper explores the fundamental role of water in shaping the architectural art of Moroccan cities. It primarily sheds light on the aesthetic aspects of this architecture, highlighting the range of emotional sensations it evokes. Other aspects such as semiotics of this architectural style, which has developed through a unique cultural accumulation with distinct characteristics, are going to be analyzed. The city of Marrakech exemplifies a distinctive civilizational model for contemporary scholars, showcasing significant urban development over an extended period.

Water has served not only as a catalyst for construction but also as a symbol of serenity and prosperity. During the medieval period, Marrakech, along with other major cities in the western Islamic world, constructed a cultural identity that endures to this day. The Almoravid and Almohad eras were particularly influential, transforming Marrakech into a haven for the architectural and cultural elite of the western Islamic world. These periods infused their experiences into the urban heritage, with water architecture becoming a central element of this cultural legacy.

Water architecture is one of the most striking aspects of Islamic civilization, showcasing its beauty and artistry. It epitomizes the elegance and lavish culture that flourished in the Islamic world during its peak. This is especially true for Marrakech, where water was crucial in shaping

the city's layout and architectural design. Like many ancient cities, Marrakech's plans featured water-centric designs in homes, palaces, and other structures, along with the creation of gardens and efficient water drainage systems.

Undoubtedly, water has imparted a scientific character to the urban network of Marrakech, evident in the design of urban facilities and the flow and branching of water channels. This aspect has resulted in an integrated spatial distribution within the urban fabric. The study of water architecture components focuses on the structure and functional content that shape Marrakech's urban fabric. It also examines the spatial distribution of water facilities based on religious, economic, environmental, health, and aesthetic purposes.

Fountains, basins, gardens, and water channels are particularly important in this context. The coordination of water architecture adhered to engineering, technical, and cognitive principles in planning, ensuring the preservation of natural, urban, and artistic elements (Yang & Wang, 2022). This approach maintained an overall architectural style that harmoniously combines pleasure and utility in the urban geography of water facilities.

Results and Discussion

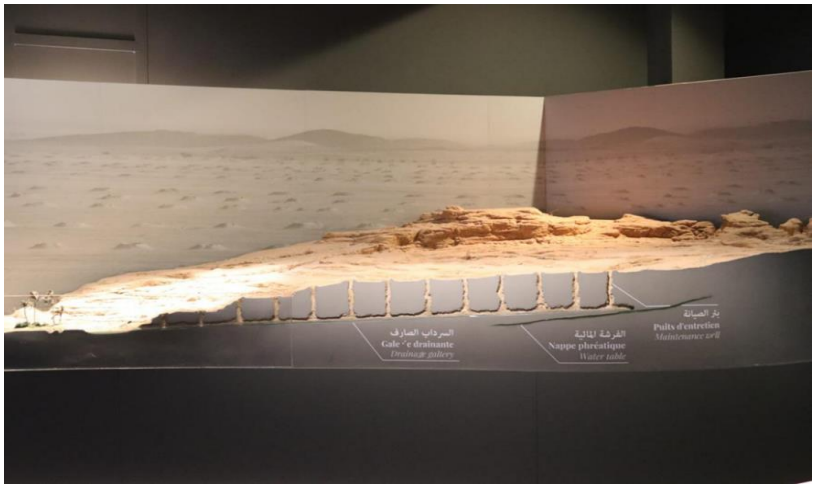
The System of Khettara

A khettara is an underground channel that connects groundwater to the surface, featuring a gentle slope relative to both the surface level and the water table. Along this channel a series of wells are aligned perpendicularly to facilitate the flow of water towards irrigated areas (Larkin & Sharp (1992). The khettara system mobilizes groundwater through a passage or tunnel, allowing it to flow towards the surface. This irrigation system provides multiple water points both outside and within the city, as exemplified by Marrakech (Funnell & Binns, 1989). Despite different opinions about the historical emergence of the Khettara system, some accounts suggest that the first appearance of this technique was in Iran by the Assyrians over 3000 years BC (Boucharlat, 2016).

However, its introduction to North Africa and particularly to Morocco is characterized by mystery, and its names vary. In Iran and Andalusia, it was called "qanat," in Algeria, it was known as "foggara," while in Morocco, it became famous as "khettara," according to Al-Sharif Al-Idrisi, who reported that the first khettara in Morocco was built during the Almoravid era (5th century AH / 11th century AD). At that time, the water resources in the city of Marrakech were barely sufficient to meet the irrigation needs of the military garrison (De Tarde, 1919). However, with the construction of the khettaras, the city could continuously supply water to support its agricultural activities. These factors were a necessary condition that enabled Marrakech to become the capital of the Islamic West.

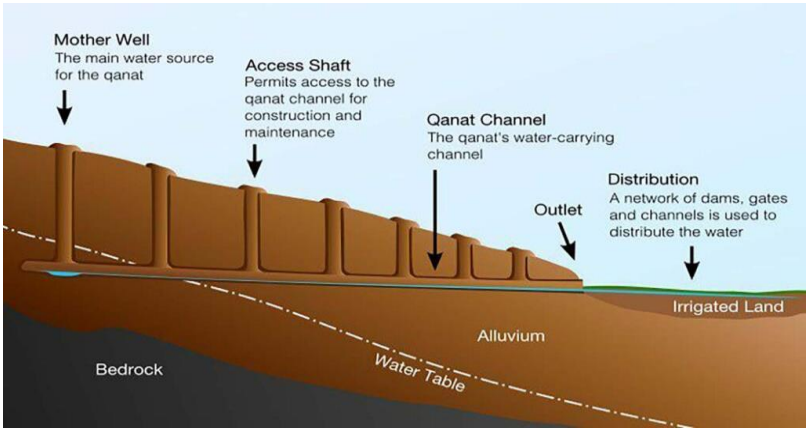
The Khettara system exploits groundwater by transporting it through an underground channel from a higher area to a lower one, benefiting from the natural topographical gradient of the region. The underground channel provides ventilation and maintenance for the Khettara, preventing the accumulation of sand and silt due to sandstorms. The khettara consists of three sections: (1) The supply area, referred to as the head of the Khettara, includes the first and deepest wells that contain the springs feeding the Khettara; (2) The watercourse, which is the channel where water flows from the head of the Khettara towards the lower area; (3) The distribution channels, which are small channels and surface drains that separate the Khettara from the palm groves and farms.

Figure 1: A Model Illustrating the Khettara System



Source: Museum of Water Civilization Mohammed VI

Figure 2: An Ilustrative Drawing for the Khettara Techniques



Source: https://trekinatlas.co.uk/ldecouvrez-es-khettaras-du-maroc

The Khettara system played an important role in serving large arid spaces, rendering it an economic and cultural component in various districts of Morocco. It has essentially contributed to the establishment of social organizations in the areas where it was prevalent. Obviously, the underground Khettara channels within the city of Marrakech and its surroundings resembles a spider web network with different directions. Some channels pass beneath houses and gardens, some enter the city from the south, some originate deep underground and exit to the north, and others run parallel to the eastern and western walls to irrigate the adjacent orchards.

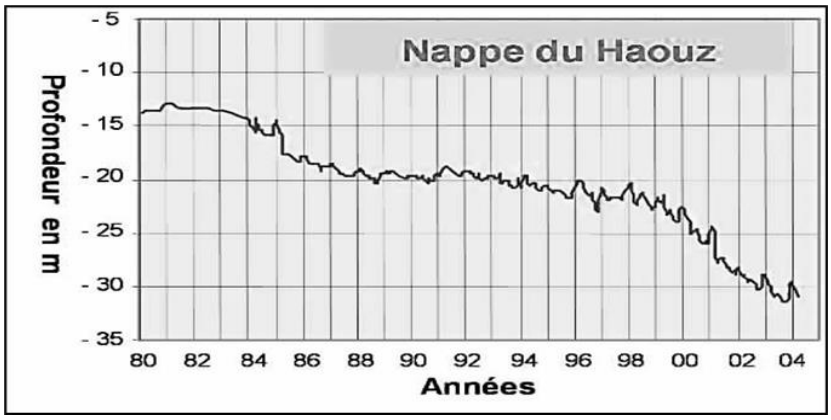
Figure 3: The Remaining of an Old Khettara in the Izidhar Quarter in Marrakech

Source: Personal Lens Taken on September 2022

The Khettara system in Marrakech remained resilient against the ravages of time up until the twentieth century. Until recently, most of the city's water needs were met by this system. The French protectorate authorities did not abolish it but rather adopted it by establishing many new ones (such as those in Agdal and Boulemriss) and constructing modern canals, this time using new materials like reinforced concrete. The information provided by historical sources about the Khettara system in Marrakech is characterized by a scarcity, appearing mainly in the context of recording and narrating events.

According to Lightfoot & Miller (1996), the same thing can be said about the archaeological research that could reveal the number of Khettaras built during the Almoravid era, as well as by the Almohads and Saadians who followed. This issue is difficult to resolve definitively because these Khettaras have undergone frequent maintenance and restoration. The same applies to the Khettaras in "Agdal Al-Barrani," many of which have dried up and disappeared, raising the issue of continuity. Apparently, all the Khettaras in "Agdal Al-Barrani" have been destroyed, and their water levels have dried up due to the decline in the water table in Marrakech in recent years. The chart below clearly illustrates this decline.

Figure 4: Chart Illustrating the Groundwater in Marrakech and Elhouez



It is obvious from the above chart that the rate of decline has been significant over a short period of less than a quarter of a century (Leskovec et al., 2005). The water table level dropped by more than thirty meters in 2004, whereas it was less than fifteen meters in 1980. This massive decline led to the disruption and disappearance of most of the Khettaras, not only those in "Agdal Al-Barrani" but also the majority of those in the city. Several factors contributed to this, including the excessive exploitation of the groundwater for agricultural irrigation purposes, the increasing demand for water due to the city's population explosion, and its emergence as a major national and international tourist hub, which further increased the demand for this resource (Page, 2001).

Additionally, urban sprawl expanded over the areas of the Khettaras. In conclusion, if contemporary researchers of urban water history believe that water architecture has been sufficiently studied, the city of Marrakech remains a fertile ground for research, especially if we rely on archaeological excavations and other non-news sources such as endowment records, legal cases, property deeds, leases, and more. The city of Marrakech was equipped with an extensive network of channels and underground drains used for water distribution, including to public fountains, mosques, schools, houses, hammams (baths), tanneries, markets, and inns.

All of this was done with great coordination and skill, giving the Red City a radiance that extended beyond the borders of Morocco. Overall, this section has provided an artistic insight over water architecture of the city of Marrakech. It concisely highlights its most famous water architectural complexes, some of which still assert their cultural presence today. Such

architectural elements have enriched its heritage, significantly contributing to making Marrakech a huge hub for researchers and one of the most visited cities of the country (Steenbruggen et al., 2019).

Fountains and Water Troughs

Fountains are considered to be one of the pivotal components of water architecture in the city of Marrakech (Selkani, 2021). They were mostly located in the courtyards of mosques, palaces, and houses, making them a prominent feature of Moroccan culture, reflecting both the lavish and religious devotion for Moroccans. Household fountains, in particular, were notable for their technical, artistic, and aesthetic qualities, featuring a robust architectural style. They typically consisted of an inclined rectangular surface over which water flowed through a series of cascades. Fountains have been associated mostly with mosque courtyards, surrounded by trees, like the case the famous Koutoubia Mosque, which was built during the Almohad period in the 12th century. The open courtyard of the mosque serves multiple functions such as providing water, light, and air to the surrounding facilities.

This made it the most representative model of water architecture in the Moroccan city, embodying customary and symbolic dimensions to the extent that the channels of other structures were inspired by its features. Water troughs are public architectural structures whose primary function is to be collected to be used later (Selvaraj et al., 2022). They represent the endpoint of a network of mechanisms and structures that supply the city with water and make it consumable. This process starts from natural extraction sources, continues through canals and the collection and storage of water in cisterns, and finally distributes it across the city via channels and canals to reach the troughs, where consumers access this vital natural resource. Since its founding by the Almoravids, Marrakech witnessed the construction of large water troughs.

Although some have disappeared, each era has been marked by the construction of new groups to supply the population with water. Ensuring that everyone in a hot city like Marrakech has access to water is a duty imposed by religious values. The historical significance of the water troughs bestows prestige and respect on those who commissioned their construction (Klaufus, 2012). They are considered necessary and beneficial, reflecting the aesthetic and water management artistry of their time. It is no wonder that Marrakech is renowned for its numerous water troughs, which benefited from the waters flowing from the High Atlas Mountains, permeating the city and winding through its alleys and houses. The following are examples of the water troughs that have adorned the architectural landscape of the city and added a special charm to it:

Shreb ou Shouf Water Fountain

Figure 5: A Conceptual Model of Shreb ou Shouf Fountain

Source: Museum for Water Civilization Mohamed VI

Figure 6: Shreb ou Shouf Fountain Which was Taken in 1921

Source: Museum for Water Civilization Mohamed VI

The name "Saqaya Shurb wa Shouf" (literally "drink and look fountain") became famous among the people of Marrakech, indicating their perception of the dual enjoyment it offers—pleasure for the mouth in tasting the water and delight for the eyes. Such a pleasure is manifested in admiring the exquisite decorations of this unique fountain. It was built at the beginning of the Saadian period (16th century) and is considered one of the most beautiful and ancient fountains in the history of Marrakech.

The fountain consists of a terrace that includes a stone-built basin, with its upper part featuring a sloped roof covered with green tiles. The structure is richly adorned with carvings on palm wood and plaster, with inscriptions in Andalusian script. All of this contributed to its classification as a national heritage site since 1921. It is worth noting that the fountain still retains its stunning decorations, which continue to captivate passersby, especially foreign tourists.

Figure 7: Mouassine Fountain

Source: Source: museum for Water Civilization Mohamed VI

Figure 8: Mouassine fountain early 20th century

Source: Postcard Dating to the French protectorate

The above-mentioned fountain was built during the period of the Saadi Sultan Abdallah al-Ghalib (1562-1563) and is part of the social-religious facility in the Mouassine neighborhood, located in the heart of the medina of Marrakech. This compound includes the Grand Mosque and nearby sanitation facilities, which still contain a rare and unique reservoir. The Mouassine fountain is located on the norther side of the ablution hall belonging to the above-mentioned mosque.

It features a rectangular design measuring 10.18 meters in length and 4.70 meters in width. It is consisted of three water basins, each serving its purpose: the central basin is used for water storage, while the two side basins were used to supply livestock and provide water for the inhabitants. The fountain is provided by water through the Mouassine spring and undertook restorations during the reign of the Alaouite Sultan Muhammad Ben Abd al-Rahman in 1867, as evidenced by a verse inscribed on a frieze inside the fountain.

This excerpt can be translated into English as follows:

"Glad tidings, for the awaited arrival has been accomplished, and the star of splendor has risen in the horizon of greatness." It is considered as one of the principle historical fountains in Moroccan urban centers, both in terms of size and decoration, and serves as a model for later fountains. Therefore, it has been classified as part of the national heritage.

Ablution Facility of Mouassine Mosque

The ablution fountain of the Mouasine Mosque is located near the mosque, specifically on the southern side of the water basin of the Moussine neighborhood, which was founded by Abdullah al-Ghalib al-Saadi. The fountain features a spacious section equipped with toilets and an open area that provides ventilation for the ablution area. Its geometric shape is quite similar to the Almoravid dome, and in this context, Gaston Dufourdan has not ruled out the influence of Almoravid architecture on the construction of the fountain

Figure 9: The Ablution Fountain of Mouassine After Restoration

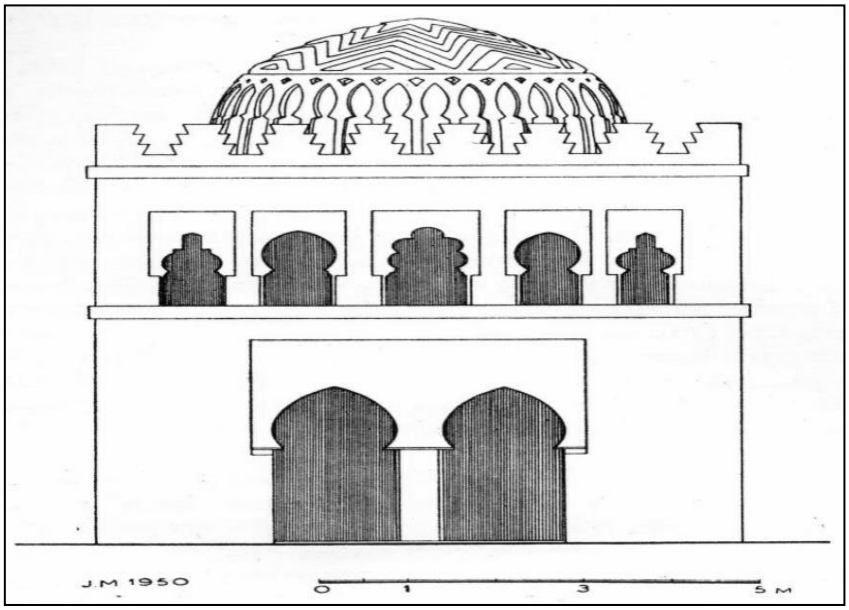
Source: Personal shot from September 18th 2022

The Water Fountain of Bab Doukala or Sidi Hassan Ouali

It was built during the Saadian period by Abdullah al-Ghalib (1554-1574). It serves as a similar model to the Mouassine water fountain, as part of a social and religious complex that includes the Grand Mosque, a Quranic school, a public bath, a bakery, and sanitary facilities. It still contains a rare cistern, reflecting the affluent social status that prevailed in the Bab Dkala neighborhood during that time.

The Almoravid Dome or the Fountain of Ben Youssef

Figure 10: An Illustration of The Almoravid Dome (Al-Qubba)



Source: Meunié (J), Terrasse (H), Deverdun (G), Nouvelles Recherches Archéologiques a Marrakech; P.I.H.E.M, Tome LXII, Paris, 1957, p.21.

The term "Al-Qubba Al-Murabitiyya" stands for the archaeological complex located in the heart of medina of Marrakech, in the southern part of the Ibn Yousef neighborhood. It was excavated by Henri Terrasse and Jacques Munié, who supervised the French archaeological mission in 1948. The Qubba is the only surviving witness of the beauty of Almoravid architectural art.

According to the archaeological excavations conducted in the area, the date of the establishment of such dome goes back to the era of Ali ibn Youssef Al-Murabit (12th century AD). What backs this claim are the inscriptions on its outside facade, which describes shapes and arches in the form of a hectogram that adorn its entrance, inscribed with the name of Sultan Ali ibn Youssef. It is a part of the Ibn Youssef complex, which includes the Great Mosque and the adjoining school, taking a rectangular shape and distinguished by its unique design.

Figure 11: A Recent Photo of Almoravid Dome After Restoration

Source: Personal shot September 18th 2022

This compound is named the Almoravid Dome (Al-Qubba Al-Murabitiyya) because it features a dome that is the main element of the complex. Although the presence of the dome suggests a funerary structure, it was actually built to serve as a place of ablution for worshippers heading to the mosque. The Almoravids adopted the Andalusian Umayyad style in constructing such a dome, obvious in its architecture and decorations. It rests on articulated and surpassing arches that are placed directly on a frieze forming the dome's base. This arrangement allows for the interlocking of these arches, transitioning from a square base to an octagonal shape, with rich floral motifs adorning the interior.

A water reservoir is adjacent to the dome, of which only remnants of structures linked to a water drainage system remain (André et al., 2005). This reservoir occupies roughly an area of 14.5 meters long and 4.5 meters wide, divided into two basins. The water was brought from the Atlas Mountains via a series of canals designed for this purpose. Several openings in the ceilings allowed rainwater to flow into the two basins. All these architectural characteristics, besides the artistic and engineering features of this edifice, give it an incomparable quality and position. It is thus as an important element of Almoravid architecture in Marrakech alongside the Ibn Yousouf Mosque and the Almoravid school.

Watering System of the Tomb of Sidi Ben Souleiman Al-Jazouli

Founded in 1858 beside the tomb, this features among the prominent sites in the Sidi Ben Souleiman neighborhood, one of the seven saints of Marrakech's history. It has undergone various restorations, that altered to its historical features, and some parts are still in use, serving an important social function for the local population.

The Basins

The basins are a sort of water reservoirs that are used to collect water store coming from the mountains and store it. It is organized to distribute water across the city and its surroundings

through specific channels and conduits (Lei & Lu, 2021). Some historical sources show that Marrakech was surrounded by a network of basins, with diverse opinions on their number and dates of establishment. Despite controversy, there are historical references to the presence of basin technology during the reign of the Almohads. For instance, the author of "Al-Istibsar" mentions the achievements of the Almohad caliph Abd al-Mu'min ibn Ali al-Kumi in Marrakech, stating: "The caliph brought water from the Daraa valley and built two great basins in and outside of it where we used to swim, hardly could the strong person among us who could cross the basin without difficulty" In this context, this study tries to provide an inventory of the most prominent basins in the city of Marrakech, based on references from several sources and historical studies that were conducted in the field.

The Cattle Basin

According to Gaston Deverdun, the Cattle Basin is located in the southwestern part of Marrakech and is believed to be one of the two ponds ordered to be dug by Almohad caliph Abd al-Mu'min ibn Ali al-Kumi for livestock farming in the area. It covers an area of roughly 13,200 square meters, with a capacity infrequently reaching 33,000 cubic meters. The basin served to supply the southern outskirts of Marrakech with water (Ghazi et al., 2018).

Agdal Basin

Abdelouahed Al-Marrakchi, while discussing the structures and facilities built by the Almohads in their capital Marrakech during the time of caliph Abd al-Mu'min, states that: "Then he went until he reached Marrakech, where he began building, planting, and organizing the palaces without ignoring anything necessary for the kingdom in governance, management, justice, and gaining the people's favor". This shows how the water supply facilities were certainly present for the irrigation of plants and gardens, as the state needed basin techniques to handle agricultural affairs or to provide residents with drinking water.

Among the legacies of the Almohads dynasty in the city of Marrakech were the "Dar al-Hana" and "Gharsiya" basins in the Agdal gardens. In this context, Al-Nasiri quoted Al-Kanousi saying: "It was said that the Almohad caliph Al-Rashid drowned in the large pond of Dar al-Hanae in Agdal today... It was called the 'smaller sea' because the caliphs of the Banu Abdelmoumen who built it used to send boats and small vessels there for leisure and entertainment, and Allah knows best"

The Menara Basin

Figure 12: A Recent Photo of The Menera Basin

Source: personal shot, September 19h 2022

Some sources indicate that the construction date of this basin dates back to the time of the Almohad caliph Abdelmoumen, who used it to train soldiers in swimming and naval combat skills to prevent attacks by Christians in Andalusia. Besides, the basin served the purpose of irrigating fields and gardens, as stated by the author of "Al-Istibsar," confirming that Abdelmoumen founded a garden in the western part of Marrakech bordering to Nfis river.

Conclusion

In conclusion, water architecture stands as one of the most prominent expressions of civilization, reflecting the aesthetic and artistic space of Islamic culture. It symbolizes the height of urbanization and the culture of opulence reached by the states of the Islamic world throughout their civilizational development. This undoubtedly applies to the city of Marrakech, where water played a fundamental role in organizing its urban network and architectural planning. Like other ancient cities, its design was based on key features, including the concentration of water in homes, palaces, and other facilities, as well as dedicating gardens and water drainage channels. The study of the components of water architecture depends on understanding the functional structure and content that shape the urban fabric of Marrakech. These elements resulted in a spatial distribution of water structures based on religious, economic, environmental, health, and aesthetic purposes. This importance is evident in the presence of public fountains, drinking fountains, ablution facilities, cisterns, and underground water channels (qanats), among others.

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