New Findings on Shah Ismail's Royal Garden and Shams-e-Tabrizi Minarets in Khoy Based on the Historical Sources, Architectural Remains and Osteological Studies

Reza Bayramzadeh
Senior Expert of Directorate General of Cultural Heritage, Tourism and Handicrafts of West Azarbeijan, Teacher of Shams Tabrizi University, Khoy, Iran
rezabayramzadeh@yahoo.com

Seyyed Hossein Hassanzadeh
Chairman of the board and Director of Zaryab House of Knowledge and Culture (NGO), Member of the Khoy Cultural Heritage Association (GA), Khoy, Iran

Received: 2019/12/06 - Accepted: 2020/05/04

Abstract

Geographical and political position of Khoy, one of the most ancient and eventful cities in the northwest of Iran, has brought this city to be considered important by the kings and local rulers. Moreover, on account of having suitable climate and fertile soil, Khoy has been appropriate for constructing governmental and private gardens, including Shah Ismail Safavid Royal Garden and its nearby places, documents of which have been cited in the historical sources. The research method was based on the collection of documents, maps and historical resources and their correspondence with the findings of field and library studies. In the first stage, the location of Khoy in historical times from Safavid period to present day is restored based on existing maps. Then architectural features and the recovery of different parts of Royal Garden and its nearby spaces including Maydan-e-Shahi (Shahi Square) and Shams-e- Tabrizi Minarets were noted. The core of this study focuses on correspondence between features of these spaces with documents, maps and historical resources, including Metraqchi's miniature, Francesco Romano's travelogue, Pascal Cost's drawing map and extraction of new findings. It has been attempted to determine the plans and the positions of Royal Garden Buildings, Maydan-e-Shahi, and Shams-e-Tabrizi mausoleum in the current city through graphical reconstruction and corresponding with existing maps. In addition, according to James Morier's report and painting, and Field and

Library Studies, architectural features of Shams-e- Tabrizi Minaret and osteology of the skulls used in it were examined and the way of planting the skulls and biometric features were determined. These findings corrected some existing historical reports. Overall findings of this study provide a clear image of the relocation of Khoy in the last 500 years, position of Royal Garden, architecture of Safavid governmental palace and features of Shams-e- Tabrizi Minarets in early Safavid period.
Keywords: Shah Ismail, Royal Garden, Shams-e- Tabrizi Minaret, Metraqchi, Khoy

Introduction

Fertile lands, abundant groundwater and surface water resources of Khoy have all contributed to the vast green area, including gardens. All the historical gardens built by the kings and local rulers of different eras in Khoy have been destroyed by Ottomans invasions, natural disasters and human interventions. The royal garden of Shah Ismail I is considered as one of the most important gardens which has been documented in some historical records. This garden included royal palace (Dawlatkhaneh) and garden (Bagh-e- Shahi).

Safavid kings built a large number of gardens by applying the strategies of their ancestors. They leveraged gardens as a way to show off their power, provide new facilities for the citizens and hold various ceremonies (Bellan, 1932: 75). For this purpose, in some cities, Safavid kings built new gardens on the outskirts of the capitals, royal gardens and Square (Maydan-e-Shahi) (Babayan, 1996: 119).

Safavid historical gardens are regarded as paintings which combine the pristine nature with art and architecture. Despite the fact that most Safavid gardens were located on the outskirts of the central cities prone to hot and dry weather, it is possible to find some evidence supporting the fact that some Safavid gardens were built during the reign of Shah Ismail I in cold mountainous areas. The historical images and documents have helped shed light on this finding. Mahvash Alemi has carried out some research on Safavid gardens, making a brief reference to the royal garden of Shah Ismail in Khoy. She has released Pascal Coste's[1] plan of the garden.

After the Battle of Chalderan, Shah Ismail refused to go into wars. Instead, he spent the rest of his life playing polo, Qabaq-andazi[2], hunting and feasting (Alemi, 2008: 48). Having settled in Khoy in 907 AH, Shah Ismail chose Khoy as his winter destination and made considerable attempts to improve the city. He built his palace next to the tomb of Shams-e- Tabrizi which was located near Shahi

Square (Riahi, 1996: 28-29). The minarets of Shams-e-Tabrizi can be regarded as parts of the architecture of this tomb located next to the Shahi square and the royal garden of Shah Ismail. The field studies in this paper were based on the only remaining minaret from this complex.

Objectives of the Study: So far, no comprehensive studies have been carried out on the Shah Ismail royal garden complex and its surroundings, including the Shahi square (Maydan-e-Shahi) and the minarets of Shams-e-Tabrizi. As the first study investigating the minarets in detail and with seriousness, the present study has focused on exploring this topic by collecting existing facts and evidence. The authors of this study rely on historical records, existing evidence, the architectural structure of the minarets of Shams-e-Tabrizi, especially the skulls on the minaret and their arrangement. This minaret is of great scientific and practical importance. First, this is the only remaining minaret of this type across the country, turning it into one of the unique structures. On the other hand, according to the documents and evidence of the past 500 years, it is clear that the tomb of Shams-e-Tabrizi has been cited along with its minarets. Therefore, it would have been impossible to discover the tomb of Shams-e- Tabrizi if the minarets were destroyed. It is necessary to study its architectural and archeological features. Furthermore, attempts need to be made in order to restore the structure scientifically.

Questions of the Study: Comparing the past and the current era, the present study attempts to address the following questions. What are the characteristics of the royal gardens, Shah Ismail's Dawlatkhaneh (Royal Palace) and the Shahi square located in Khoy based on the existing documents, records and maps? Where exactly are the located currently? What are the architectural and osteological characteristics of the Shams-e- Tabrizi minarets?

Methods: Analytical-historical methods were used to carry out this research. Accordingly, library-based and field studies were used to collect the data. Furthermore, semiotic patterns and historical semantics were used to analyze the Metraqchi miniature in line with the natural elements, facts and other existing evidence. The historical studies include identifying various traditional architectural elements represented in the miniature as historical evidence, focusing on the identification of the school of painting and the characteristics of the drawings depicted in Metraqchi's book and matching miniature architectural spaces compared to other city paintings in the same book. The different urban maps of Khoy in different eras were also compared, highlighting the development of urban spaces. Finally,

Venetian merchant[3]'s travelogue and Pascal Caste's plan was used to simulate the royal palace.

In addition to investigating the background of the construction of the minarets in the Safavid period, the present study focuses on the architectural and osteological characteristics of the skulls used in the minarets of Shams-e-Tabrizi. Therefore, field observations, imaging and sampling methods were used to collect the data. Moreover, computer simulations helped pursue the objectives of the study. Field observations and necessary measurements were used to investigate the arrangement of skulls in the minaret. An attempt was then made to analyze the data. Osteological studies focused on examining the various characteristics of the skulls in the minaret. It should be pointed out that the age, compositions and some other biometric characteristics were also studied.

Research Background: No comprehensive research has been conducted on this subject so far. This research has collected the necessary data from multiple sources, some of which include documents, records, paintings, inscriptions, historical maps and travelogues. Some of the most prominent sources include Metraqchi's miniature on Khoy's Castle, Pascal Coste's plan of Safavid royal palace, the travelogue of Francisco Romano, and the travelogue of James Morier.

A new look into the city of Khoy during the Safavid period based on Metraqchi's miniature

Nasuh-al-Salahi Metraqchi, historian and painter of Sultan Soleiman Qanooni, oftentimes depicted the Ottoman army's trajectories in his paintings from 940 to 942 AH. All his works are recorded in a book titled Baian-e-Manazel-e-Safar-e-Aragein which was exclusively written for the king (Yurdaydin, 1976: 13). Researchers believe that this book is a kind of illustrated history of the expedition, an illustrated travelogue and a map which serves as a kind of atlas (Metraqchi 2000, 76-77).

Metraqchi has depicted the spatial structure of Khoy and the royal garden of Shah Ismail by adapting the schools of Tabriz, Herat and Venice, in the form of the Istanbul school (Balilan-Asl, 2016: 50). Researchers believe that the images depicted in his paintings are based on observation, meaning that the painter has given special attention to the original versions as much as possible. Moreover, Franz Tashner noted that the images of buildings are more symbolic, rather than exact images of the buildings (Metraqchi, 2000: 77). Overall, the depictions and images of the book are of considerable

value since they demonstrate the style and composition of the city through architectural examples. The book also attempts to examine the history of architecture in the region.

The miniature depicted by Metraqchi shows a garden on the northern flank of the city (right side of the image). The river runs from north to south and the bazaars can be distinguished along the same direction. The miniature also demonstrates inside the great garden to north of the city, a splendid dome, buildings and minarets (or the turrets made of the bones of the prey hunted by the king). (Alemi, 2006: 64). Preliminary review of Khoy's miniature shows that it was oriented west-eastward (slightly inclined to the northwest-northeast) and Nasuh's view of drawing it was westward (inclined to the northwest). A great body of evidence and historical documents confirm that the magnificent dome in the painting belongs to the tomb of Shams-e-Tabrizi, in front of which the triple minarets can be clearly observed. The dome is decorated with green tiles and a yellow background. The tholobate[4] of the dome is inclined inward in a way that it is somehow inverted with a dome base curvature. The distance between the base and the helm, which served as a coffering decoration space, indicates the use of a disc or a long neck (drum[5]) between the pterion and the outer dome. At the top of the dome, a flag with a golden sphere is seen with a pear-shaped end. The height of the tomb is also one of the architectural features of the Ilkhani period (Figure 1).

As one of the oldest sources, Mujmal-e- Fassihi Khafi (845 AH) provides a detailed information about the tomb of Shams-e-Tabrizi in Khoy as he narrates the historical events from 672 to 698 AH. This confirms the fact that Shams-e- Tabrizi used to live in Khoy after separating from Rumi in 645 AH. His life did not come to an end as an unknown dervish. Nevertheless, he had gained so much respect and prestige during his stay in the city that he was buried respectfully in a magnificent tomb. People visited the tomb for centuries. As Fereydoun Beig points out in his book Munshaat al-Salatin, Sultan Suleiman paid a visit to the tomb of Shams-e-Tabrizi in Khoy while returning from Tabriz in the summer of 942 AH (Riahi, 1999, 528- 529).

Looking from the center of the castle to the left, one can see the winter palace of Shah Ismail Safavid called Dawlatkhaneh, around which is a hexagonal wall resembling a mansion. In fact, the Shahi square and the triple minarets are located in front of the western gate of the palace (slightly to the northwest). Metraqchi depicts a long rectangular north-south corridor, which connects the palace and

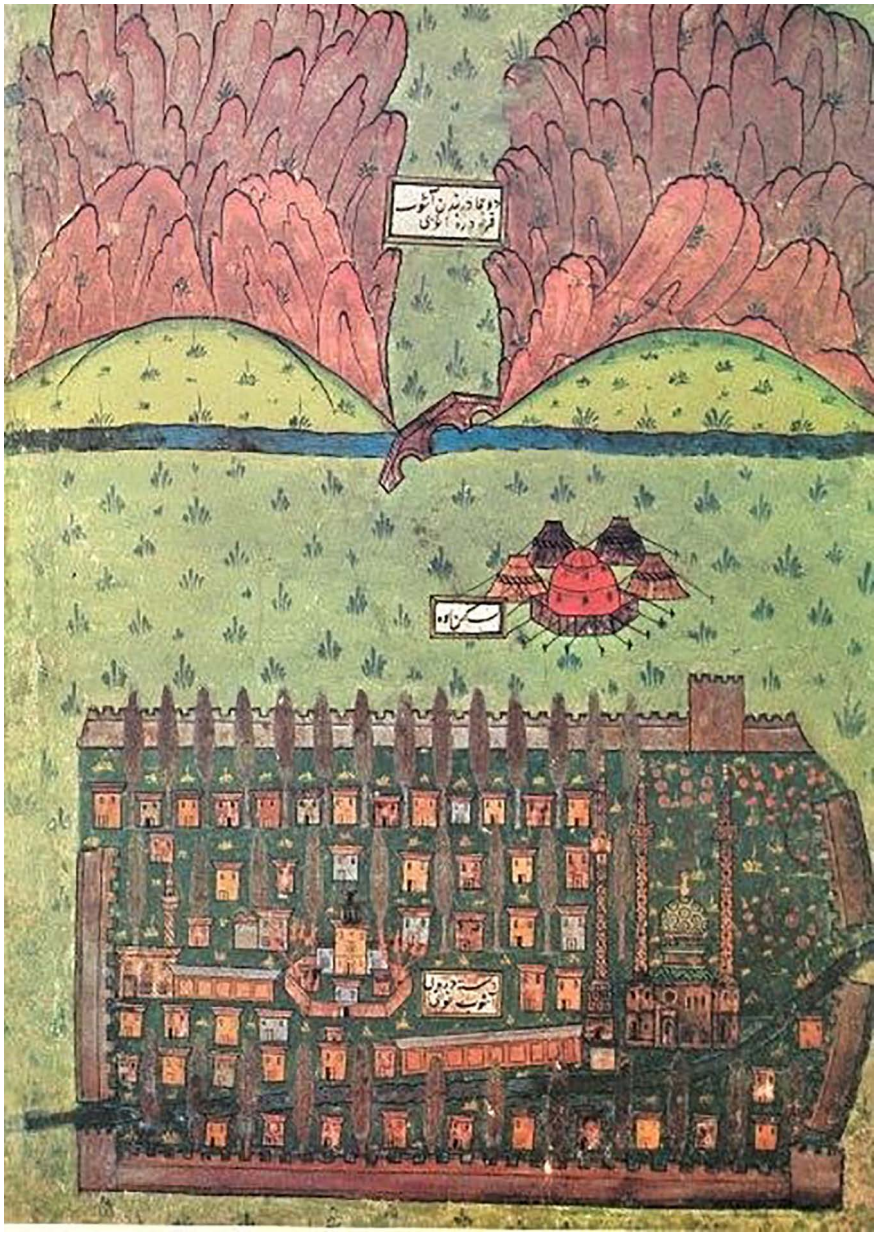
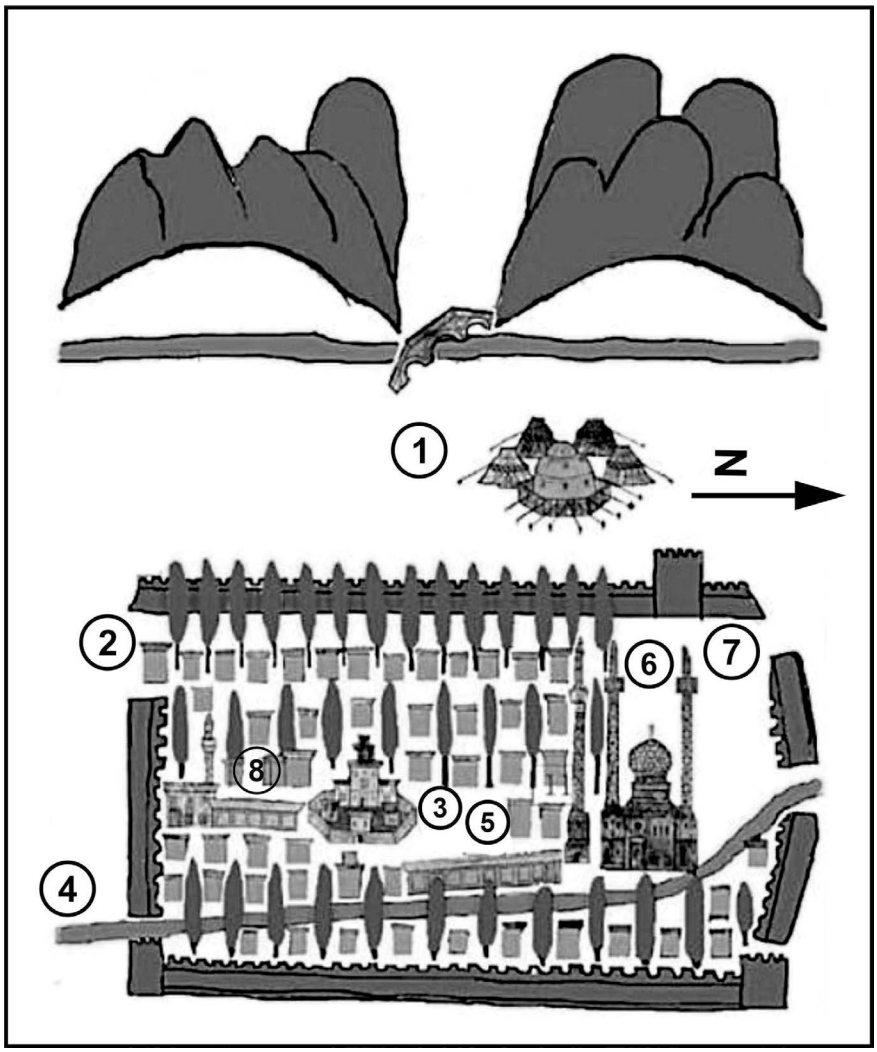


Fig. 1. The old castle of Khoy in 942 AH. Source: Baian-e-Manazel-e-Safar-e-Aragein (Metraqchi, 2000: 83). ▶

the tomb. It seems that this corridor served as a market for people's social and economic activities. The city of Khoy is demonstrated in a rectangular bulwark with corners enclosed by circular towers and gateless entrances in the north and south. Methraghchi believed that they were important entrances of the city. On the left side of the Shah Ismail's palace near the southern wall of the castle, there is a building with minaret, representing a religious building (probably the tomb of Imamzadeh Seyyed Bahlool) (Figure 2).



◄ **Fig. 2. Reviewing the miniature of Khoy and the royal garden of Shah Ismail from the perspective of Metraqchi (Metraqchi, 2000: 83). The places are numbered as follows: 1. Sokmanabad (northwest of Khoy) 2. Khoy Castle 3. Dawlatkhaneh 4. River 5. Bazaar 6. Tomb of Shams-e-Tabrizi 7. Shahi Square 8. Imamzadeh Seyed Bahlool (Authors, 2019).**

An investigation into the position of Khoy from the Safavid period to the contemporary era

The new castle of Khoy was designed in 1223 AH by one of the French officers of the engineering delegation of General Gardan. The castle was built a few years later led by Mirza Baqir Mohandes and was completed by 1229 AH. Once Khoy was occupied by Russian troops at the end of the second round of wars, the map of Khoy and its suburbs was drawn in the autumn of 1243 AH / 1828 AD by two Russian engineers, Kolokov and Yayishnikov for military purposes (Riahi, 1999: 603) (Figure 3). An investigation of the historical development maps of Khoy from the Safavid to Qajar periods indicates that in the Shah Ismail period, the castle was outside the Qajar castle mainly inclined westward. Moreover, the royal garden complex was located on the eastern side of the Safavid

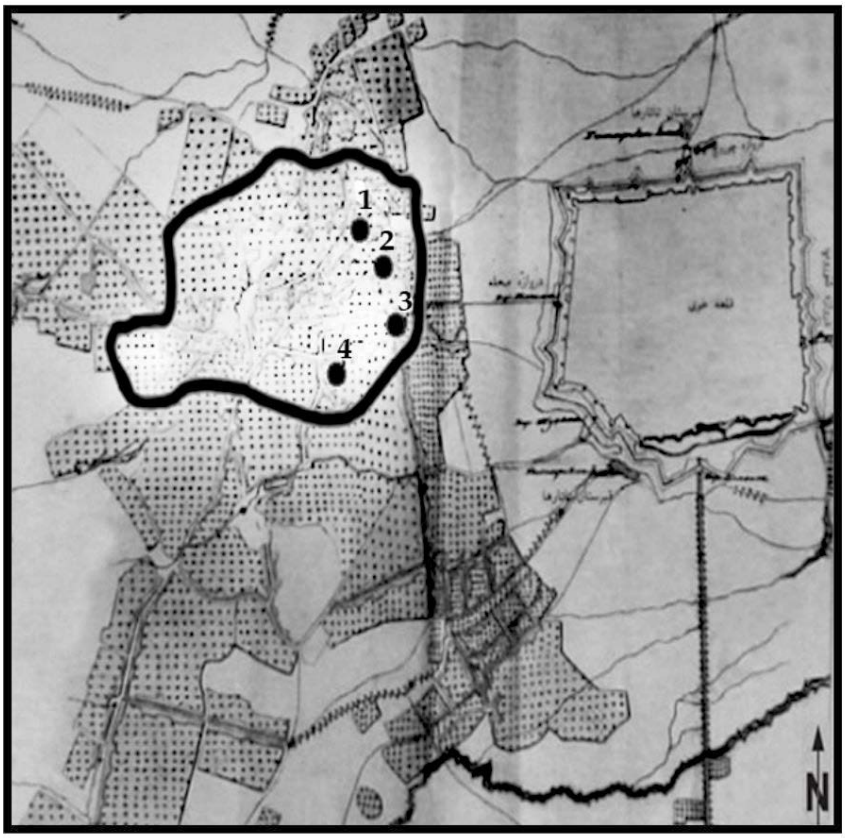


Fig. 3. The map of Khoy and its suburbs, drawn by Kolokov and Yayishnikov in 1243 AH / 1828 AD. The castle of Khoy in the Qajar period is depicted in the eastern side of the map. (Mehryar et al., 1999: 82). The castle of the Safavid period, the minarets and the tomb of Shams-e Tabrizi (1), Bazaar (2), Dawlatkhaneh (3) and Imamzadeh Seyyed Bahlool (4) were tracked in terms of location (Authors, 2019). ▶

castle (Figure 4). The location of the castle matches the details provided by Metraqchi. Meanwhile, the old castle of Khoy in the Safavid period and Shah Ismail's royal garden complex are depicted in the current map of Khoy in recent studies based on Metraqchi's miniature (Figure 5).

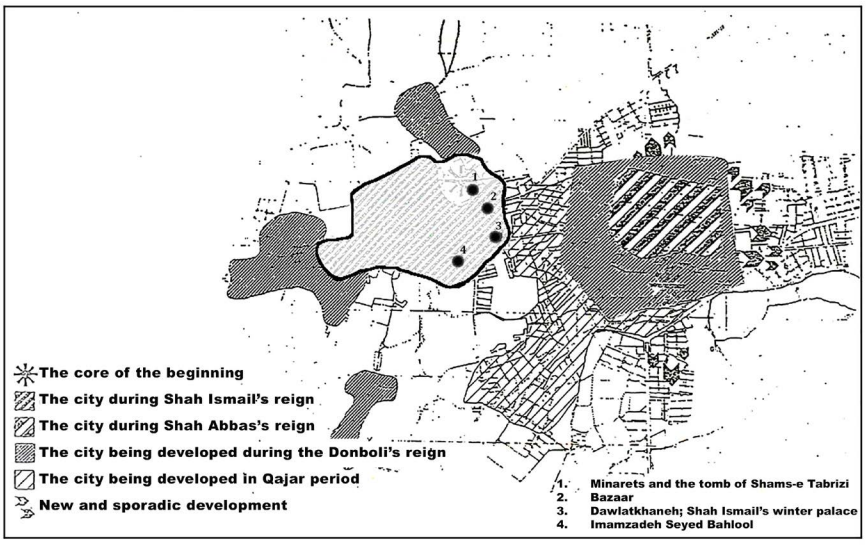
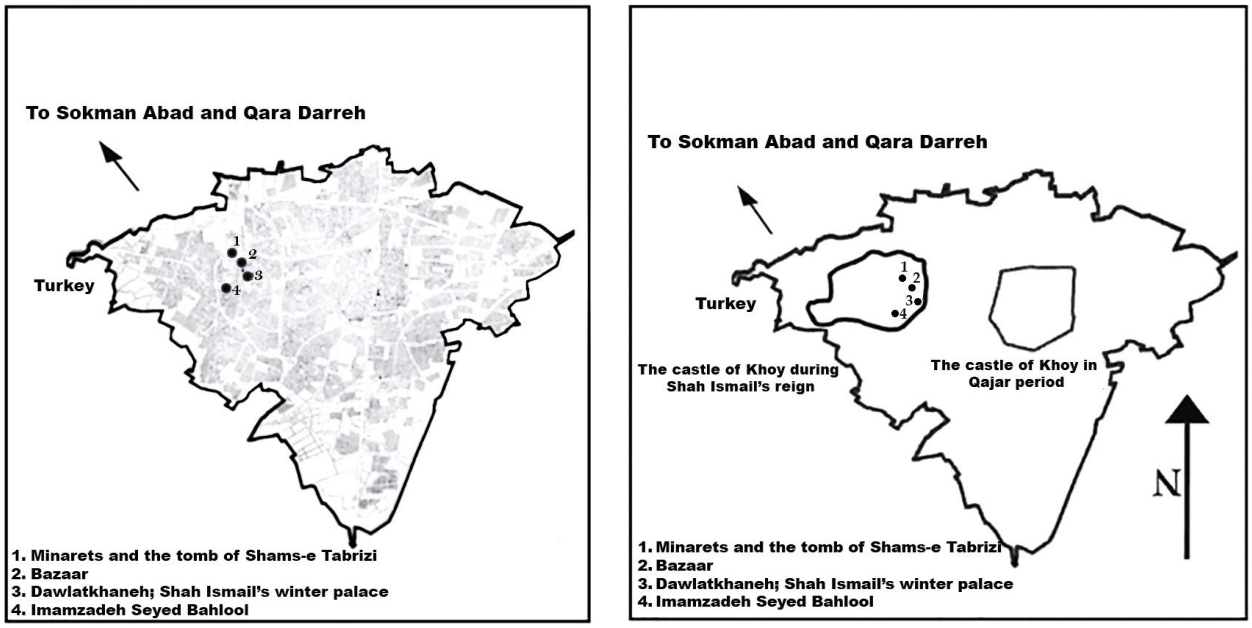


Fig. 4. The location of the castle of Khoy in the Safavid period, minarets and the tomb of Shams-e -Tabrizi, Bazaar, Dawlatkhaneh and Imamzadeh Seyed Bahlool in the map of historical development, from Safavid period to Qajar period (Authors, 2019). (Original map was derived from Shahid Beheshti University Archive and Cultural Heritage Organization, 2000). ▶



▲ **Fig. 5. The matching features regarding the location of the castle of Khoy in the Safavid period and Qajar period on the current map of Khoy. The map represents the tomb of Shams-e Tabrizi, Bazaar, Safavid Dawlatkhaneh and Imamzadeh Seyed Bahlool (Authors, 2019), (satellite map from Google Earth).**

The retrieval of Shahi Square and the Safavid Dawlatkhaneh based on the historical records

The Shahi square in the right side of Metraqchi's drawing is depicted (slightly to the northwest) next to the minarets. Therefore, the square's orientation was towards the northwest-southeast in the urban space. Given the fact that it is located beside other architectural elements, it seems that the Shahi square of Khoy is smaller than the royal squares built in the Safavid capitals, with an indefinite geometric ratio. Given the historical developments of the other Safavid squares, the orientation and perspective of the squares were not disrupted. It should be pointed out that the sidewalls have not been paid much attention, like Tabriz Square. The historical development of other Safavid squares indicates the squares have remained unchanged to a great extent throughout the history. The properties of natural elements used in the royal squares and sidewalls have had an evolutionary process (Dizani, 2014: 82-84). It is thought that the natural elements such as plants and trees used in the Royal Square of Khoy were not completely systematic, highlighting the argument that they were not designed in advance (Metraqchi).

Among other things, a large palace has been built, which in the Persian tongue is called Dawlatkhaneh, signifying "pleasant abode'. This palace is all walled round with bricks, and is of great extent, with an Haram[6] all together; within there are many halls and chambers, and it is built in one vault- that is to say, with one flooring; and it has a large and magnificent garden. It has two gates, with two fine courts, beautifully decorated, and these entrances are like two

cloisters of a convent of friars. Before the gate which looks west are three round turrets, each of them eight yards in circumference, and about fifteen or sixteen high. These turrets are built of the horns of Namphroni stags, and it is considered that there are none like them in the world. (Barbaro, 1873: 165). Dawlatkhaneh has special mansions for men and women, each with its own green space. The royal garden (Bagh-I- Shahi) is located in front of the men's and women's sections on the east side and the middle building that connects the two buildings. It should be mentioned that each section of the royal garden (Bagh-I Shahi) is separated by a wall. All buildings and spaces inside Dawlatkhaneh are symmetrical. The stables are built at the right side of the western gate of the palace.

Pascal Coste drew the Dawlatkhaneh's plan in 1840 (Figure 6.1). Francisco Romano and Pascal Coste have agreed upon the details of the plan (Alemi, 2006: 65). The engineering analysis of this plan shows that the palace measures about 80 by 123 meters and covers an area of about one hectare. The palace was simulated using Venetian merchant information, Coste's plan and their correspondence with the early Safavid architecture. This marvelous palace can be viewed from both western and eastern sides (Figure 6.2).

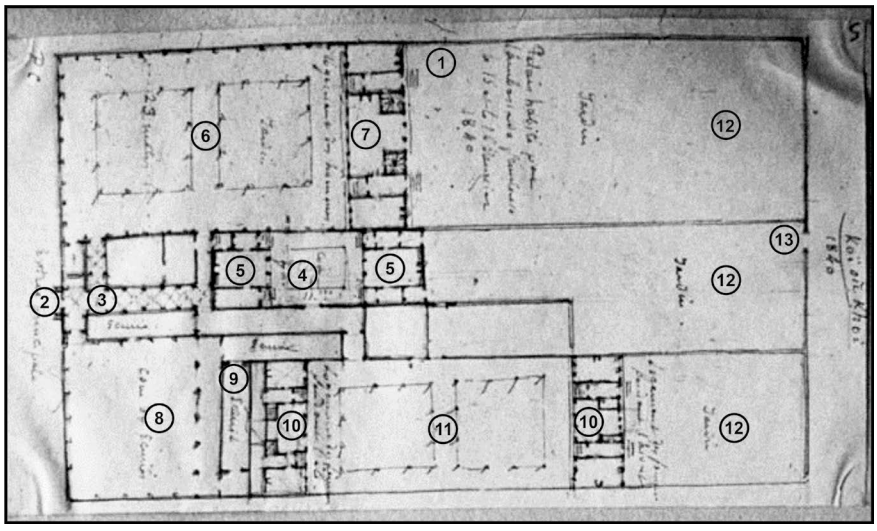


Fig. 6.1. Details of the plan of Shah Ismail's Dawlatkhaneh in Khoy, drawn by Pascal Coste. The structures in the figure are numbered as follows: 1. Dawlatkhaneh walls 2. West gate 3. Covered corridor with domed cover 4. Garden of the central part of Dawlatkhaneh 5. Central halls and rooms 6. Men's residence with garden 7. Men's residence 8. Stables 9. Threshold 10. Women's residence 11. Women's residence with garden 12. Gardens of each section of Dawlatkhaneh (Royal Garden) 13. East gate (Authors, 2019), (Alemi, 2006: 65). ▶

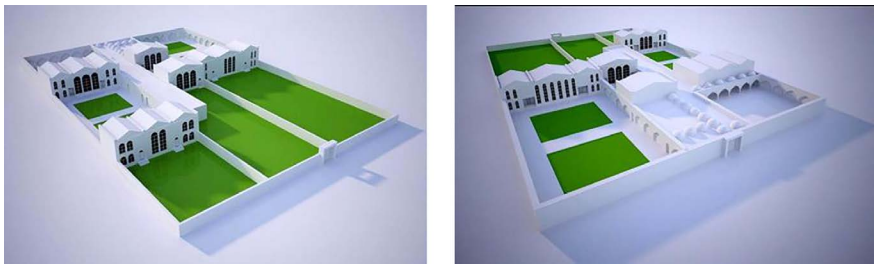


Fig. 6.2. Simulation of the plan for Shah Ismail's Dawlatkhaneh drawn by Pascal Coste. The image on the right shows the royal palace from the west view and the image on the left shows the east view (Authors, 2019). ▶

Reviewing James Morier's report on the tomb and minarets of Shams-e-Tabrizi

The minaret of Shams-e-Tabrizi situated near the tomb are currently located in the northwest of Khoy. According to Metraqchi's miniature and Francisco Romano's report, there were three minarets during the reign of Shah Ishmael, two of which were destroyed over time, leaving only one. The fact that the minarets were decorated with skulls and they were built next to the royal garden (Riahi, 1996: 28-29) shows that these minarets symbolized power and victory.

James Justinian Morier, secretary of the British embassy during the reign of Fath Ali Shah, visited and recorded the tomb and minarets of Shams-e Tabrizi. In his first report on the events of June 4, 1809, Morier writes:

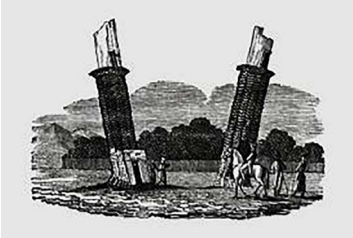
"Scarcely two miles from Khoy, is a very large collection of houses and gardens, which is a mahale or parish of the town, and is well inhabited. A steam from the mountains runs through it; and on the skirts to the N. are two pillars of brick, which are described either as the tomb or cenotaph of a famous poet and learned mullah of Tabriz, called Shemse." (Morier, 1812: 300).

Morier's report on the geographical location of the Shams-e Tabrizi minarets (from Khoy to Pera, aslo known as Firouraq) is consistent with the characteristics of the tomb of Shams-e Tabrizi. Accordingly, the only remaining minaret was in the northwest of Khoy in a neighborhood called Imamzadeh and an alley called Shamish-Dibi. Meanwhile, he mistakenly considered Shams-e-Tabrizi as a poet according to the hearsay.

During his second voyage on June 1, 1814, James Morier once again arrived in Khoy. Fascinated by the unique features of Khoy, Morier describes his visit to the minarets of Shams-e-Tabrizi as follows:

"We rode in the evening to see two Kelleh Minar (pillars of skull), which are the memorials of an extraordinary hunt of Shah Ismael, who in one day is said to have killed a multitude of wild goats, the heads and horns of which were arranged in thick lines around two pillars of brick.

Some less credulous, affirm that these heads were the produce of sport of one year, which I think most likely; although it is allowed that the flocks of goats and antelopes[7] on the mountains to the northward of Khoy, are more numerous than it is easy either to count or conceive. Both these pillars are now thrown considerably from their perpendicular, and the next earthquake will most likely complete their fall." (Morier, 1818: 305-306).



▲ Fig. 7. The minarets of Shams-e Tabrizi, drawn by James Morier (Morier, 1818: 305).

In his second trip, in addition to describing the minarets of Shams-e Tabrizi, Morier also drew a picture of the minarets (Figure 7).

These findings can be inferred from James Morier's drawing: Given that the main opening of the lantern and the minarets' entrance are visible Which are designed facing south and west, respectively, it seems Morier's point of view was northward and most probably facing southwest - northeast. Morier's drawing confirms that the two minarets were not far apart at the time. Given the height of the minarets and the people drawn next to them, it seems that the distance between the two minarets measured about 5 to 6 meters. Archaeological excavations can be carried out 5 to 6 meters north of the minaret in order to confirm this idea. Both minarets depicted by Morier have deviated from the vertical axis so that the right minaret is inclined to the south and the left minaret is inclined to the north. However, it can be concluded that the left minaret has been destroyed and the right one has survived to this day. Given the angle of deviation drawn by Morier, it seems that the minaret has remained unchanged over the past 205 years in terms of deviation. Morier's prediction regarding the collapse of the minarets due to a possible earthquake is only true about the left minaret.

Morier's drawing indicates that the wild animals' skulls were placed near the middle of the minaret. The skulls were not embedded at the top (above the saucer-like jut) and at the bottom (just above the minaret entrance). As the oldest image of the minaret, the image of Ali Khan Vali also confirms this assumption (Figure 8). In his report, Morier attributed the horns to wild goats and antelopes. The author's studies have examined the validity of this statement. Morier's realism has cast doubt on the story that Shah Ismail hunted thousands of wild animals in a single day. According to some reports, hundreds of horns and deer heads were used in the walls of the minaret (Riahi, 1375: 517). This is much closer to reality in terms of number, but this statement also needs to be examined in terms of the types of wild animals.

Morier mentions the tomb of Shams-e Tabrizi in his first travelogue, but there is no building in his drawing, confirming the idea that, except for the minarets, there were no other buildings of the tomb of Shams-e-Tabrizi at the time. However, Metraqchi's drawing shows the complete structure of the tomb along with triple minarets. His reference to the tomb or cenotaph of Shams-e-Tabrizi also confirms this idea. According to Morier's drawing, there is a wall around the

minarets, behind which there were some gardens. According to the reports, they may be the remnants of the royal garden.

According to James Morier's report in his second journey on June 18, 1814, the two minarets were still there. On the other hand, in his report in 1297 AH, Ali Khan Vali recorded the image of only one minaret and the use of singular pronouns in photo caption highlights the fact that the other minaret was destroyed (Figure 9). Therefore, it can be concluded that the second minaret was not destroyed during the World War I (Riahi, 1995, 531). Jahangir Mirza Qajar also mentions the two minarets in sidelines of the Asar-al-Belad and Akhbar -al-Ebad on 1268 AH. The report shows that the second minaret remained intact 39 years after James Morier's report. The evidence indicates that the second minaret was destroyed sometime between 1268 and 1297 AH.

▲ Fig. 8. The oldest photograph of Shams-e -Tabrizi minaret, which was taken by Ali Khan Vali in 1297 AH. Photo caption: "The famous Shams-e Tabrizi minaret is built with animal heads. A small proportion of the heads and entire horns are embedded outside the minaret, engulfing the building" (Credit: Harvard University; iiif.lib.harvard.edu/manifests/view/drs:6665026$50i).

The architectural features of Shams-e-Tabrizi minaret

The remaining minaret is built in the shape of a cylinder[8] with a diameter of 3.40 meters. The circumference of the minaret is 10.67 meters (12.8 meters along with the circumference of the minaret entrance) and it is 17.25 meters high. Meanwhile, some historical reports mistakenly argued that the circumference of the minaret is 7.31 meters (8 yards) and 14.63 meters (16 yards) high. (Barbaro, 1873: 165; Riahi, 1994: 530). The entrance of this hollow cylinder is connected to its end by a spiral staircase consisting of 40 steps. One door and three other stairs have been embedded on the ground in order to enter the building.

In general, the minaret consists of three parts including base[9], drum[10] or body and cap[11] or crown of minaret (Kiani, 2000: 336). Shams-e Tabrizi minaret has a large opening at the top of the south-facing on saucer-like section, which was most likely used as a louver light and enabling the people to observe long distances. Moreover, two small louver lights are installed on the east side. The bottom light shield is 45 cm high and 17 cm wide, while the upper light shield is 40 cm high, 26 cm wide and 65 cm thick. There is a mast at the middle of the minaret which consists of a circular column built in the center and spiral staircases wrapped around it. This mast or central pillar in the bottom is 50 cm thick. The mast gradually decreases in thickness as the minaret decreases in diameter, proportionate to the decrease in the diameter of the minaret.

The staircases of the minarets are generally built counterclockwise (Kiani, 2000: 340). However, the staircases of the Shams-e-Tabrizi minaret are designed in a clockwise direction, swinging around the

central and extending up to the saucer-shaped section in the minaret. The staircases inside the minaret are shaped like a triangular.

Shams-e-Tabrizi minaret (17.25 meters high) applies a vertical pressure dead load of about 5 kg per square centimeter in the base plane level. It is absolutely impossible to maintain such an effective force in the compact layers of soil close to and below the base support, making it more difficult to harmonize horizontally in the layers. Therefore, apart from the general subsidence in all the base, a different subsidence could be observed with the apparent descent of the fragmented section of the southern and southwestern walls of the minaret. The upper part is about half a meter away from the plumb orientation.

Osteological studies of Shams-e-Tabrizi minaret

In addition to its historical and archeological value, Shams-e-Tabrizi minaret is of great importance because of the fact that if the remaining minaret, of the three minarets, was destroyed by natural disasters based on Morier's prediction, it would have been impossible to prove that the tomb existed. On the other hand, this minaret is the only surviving building of this type. Therefore, it is necessary to investigate the structure of the minaret in terms of architecture and Archaeology. Accordingly, observations and studies of the remaining skulls show that all of the skulls, constituting only 10 percent of the skulls used, belong to a single animal species. There was no significant difference between them in terms of appearance and anatomy.

According to the morphological study of the cross-sectional area of the horns used in the minaret, the horns are composed of a creatine coating which separates airspace between these two layers. In addition to the above-mentioned characteristics and non-branched nature of the horns, these characteristics belong to the family of bovidae which are permanent and only seen in the male animals (Castello, 2016: 8).

According to the clinical observations and morphological studies of the skulls, the horns deviated from the head bowl, turning to the neck in a crescent shape. The horns are oblique, circular and twisted (Figure 12). These studies show that the skulls belong to a species of wild sheep (mouflon). This finding is contrary to some historical reports, which argued that they belonged to wild goat (ibex), gazelle's antelope and deer (Barbaro, 1873: 165; Morier, 1818: 305-306; Eugene Oban, 2012: 102; Riahi, 1996: 517). The horns of the ibex are vertically connected to the skull and they incline towards the

body following a big curvature. The horns are sword-shaped with jagged head. They are smaller than the diameter of a wild sheep's horn, characterized by smooth surface and knurl-shaped bulges in the external edge (Castello, 2016: 9). The horns of the gazelles are thinner than those of mouflon and ibex, inclined upwards with the points looking inward. Given the impermanent, wide and branched horns, the family of deer also has no resemblance to the skulls used in the walls of the minaret. None of the remaining skulls showed anatomical evidence of ibex, gazelles and deer (Figure 9).

The bones of the eyes, nose, jaw, and teeth in the skull matched the anatomical characteristics of mouflons. Meanwhile, they did not resemble the bones of a ibex (Halstead, 2002: 545-553) (Figure 9). The skulls used in the minaret are 23 cm long on average. The skulls are 13 cm wide and 8 cm deep on average (Figure 10). It should be noted that all the skulls belong to the male wild sheep or so-called mouflons. Female mouflons lack horns or have short horns (Castello, 2016: 8). Therefore, they cannot be used in such structures. According to the biometric characteristics of the horns, they are estimated to be about 5 to 6 years. The fact that the horns are 50-60 cm long with a diameter of 7-8 cm on average in the place where they connect to the skulls, confirms this idea.

There are currently some wild sheep habitat near Khoy. Meanwhile, wild goats are found near Jolfa and Poldasht since they tend to live in the mountains (Dodai and Gulfaraj in the Marakan protected area). If the skulls of wild goats were embedded in the wall of the minaret, it would have been impossible to embed another horn because goat horns tend to grow vertically up to 60-70 cm. It should be mentioned that the skulls used in the column are spaced 5 to 15 cm apart. On the other hand, the exterior of the minaret, which has covered the width of the building in the form of crescents, would practically never be created if the goat and gazelle horns were used (Figure 11).

There is a significant difference between gazelles and mouflon and ibex in terms of anatomy. Moreover, gazelles live mostly in desert and steppe grasslands. Three gazelle species reportedly live in Iran including the Persian gazelles, Jabir and mountain gazelles. The city of Khoy has never served as a habitat for gazelles. Accordingly, the closest places to Khoy which hosted the Persian gazelles are reportedly the Sahrein plain of Zanjan and the Moghan plain (Ghassemi, 2014: 386). Regardless of the significant anatomical differences and according to the information obtained from the Department of Environment, deers are not native to Khoy. Previously, species such as Shoka and Maral lived in the forests of Arasbaran,

▲ **Fig. 9. Top: the skull and horns of the mouflon (https://images.app.goo.gl/LQw8ViBkgCGyswpL8). Center: Persian gazelle (https://images.app.goo.gl/NYEsdeAMwo7XhJde9). Down: the skull and horns of the ibex (https://images.app.goo.gl/fp2hjZofBmsiuASq6).**

whose habitats were 300 km away from Khoy. As mentioned in Morier's travelogue, antelopes are not native to Iran.

The arrangement of mouflon skulls in Shams-e-Tabrizi minaret and their characteristics

Field studies show how the skulls were placed in the wall of the minaret in a row inclined muzzle downward and muzzle upward (Figure 10). The lateral horns lie in front or next to the adjacent skulls. The minaret owes its unique view to the way the mouflon skulls are embedded (Figure 11). The skulls within the columns are arranged in a muzzle-upward configuration, being about 20 cm higher than the adjacent pillars. The skulls in the columns are placed at a distance ranging from 5 to 15 cm (10 cm on average). Accordingly, the rows are 20 cm. The skulls lie at a depth of 5 cm from the wall of the minaret. Given the fact that the skulls are 7-8 cm deep and based on the existing evidence and some historical reports (photo taken by Ali Khan Vali), some of the skulls were outside the wall.

According to studies, skulls are placed in 28 vertical columns with 30 skulls on average. The density of the skulls used in the saucer-shaped section has made it difficult for the total number of skulls used in each column to be fully matched. Accordingly, each skull is 23 cm long on average and the distance between each skull varies from 5 to 15 cm. Therefore, a skull was embedded in every 30-40 cm. Given the fact that the skulls cover an area up to 8.65 meters high, about 25 skulls are used in each column. As 5 mouflon skulls are embedded in the saucer-shaped section, 30 skulls are used in each column on average.

On the one hand, the upward and downward arrangement of the skulls in the adjacent columns and the entanglement of the skulls have provided a special visual rhythm. Also, counting the number of skulls used in the columns is associated with visual error. The tips of the horns are placed in front or next to the neb of the adjacent column inside the wall of the minaret. The skulls are embedded outside the wall up to 40 cm, piercing into the walls of the adjacent row up to 20 cm deep. Moreover, the holes in the side edge of each column were created due to the collapse of the horns in the minaret wall.

Given that there were three minarets, about 840 mouflons were hunted and used in each minaret. In addition, a total of about 2, 520 mouflons were used to build the three primary minarets. Nevertheless, previous studies reported that 15000 to 30000 heads were hunted in order to build these structures. The numbers mentioned above are not confirmed by the existing evidence. The reports exaggerated the

▲ **Fig. 10: A close-up view of the minaret walls, highlighting the placement of mouflon skulls in rows through muzzle downward and muzzle upward, as well as biometric characteristics. (https://images.app.goo.gl/86x9rCyVbxm77Tji7).**

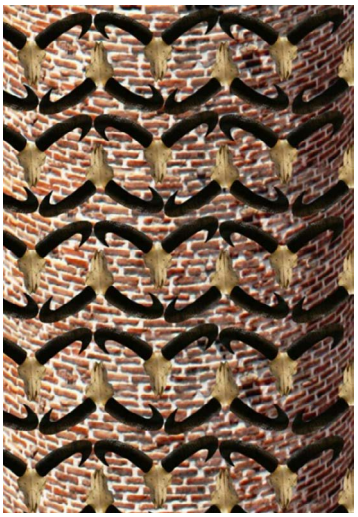
numbers in order to show off power and demonstrate the magnificence of the structures.

Results

The present study tracked the locations of the royal garden of Shah Ismail, Bazaar, Shahi Square, the tomb and the triple minarets of Shams-e-Tabrizi in the castle of the Safavid period in comparison with Qajar period and the contemporary era. These studies show that Shah Ismail's Dawlatkhaneh, like other historical gardens of the Safavid period, had distinct sections. Therefore, efforts were made to create a single structure through the symmetrical sections based on its geographical location, enabling the usage of the gardens and mansions.

Osteological studies of the skulls used in the Shams-e-Tabrizi minarets indicated that, contrary to historical reports of many travelogues which attributed the skulls to ibex (wild goats), gazelle and deer, all of the skulls belong to the Ovis orientalis (mouflon, wild sheep). There was no significant difference between them in terms of appearance and anatomy. Accordingly, the skulls are arranged in a row within the walls of the minaret, highlighting the muzzle upward and muzzle downward configuration. Field studies show the skulls are placed in 28 vertical columns with 30 skulls on average. The density of the skulls used in the saucer-shaped section has made it difficult for the total number of skulls used in each column to be fully matched. Moreover, about 840 mouflons were hunted and used in each minaret. In addition, a total of about 2, 520 mouflons were used to build the three primary minarets. Nevertheless, previous studies reported that 15000 to 30000 wild mouflons were hunted in order to build these structures. Biometric characteristics of skulls and horns were thoroughly investigated in this study. According to James Morier's travelogue, the second minaret was at a distance of approximately five to six meters away from the present minaret, located in the north of present minaret. Moreover, it was inclined to the north.

The studies on the architecture of the existing minaret would pave the ground to repair and renovate the structure. Therefore, it is necessary to strengthen the minaret and eliminate its distortion using natural mouflon skulls or molding with synthetic materials. Moreover, it is possible to reconstruct the facade, which was decorated with the skulls of hundreds of mouflons. Therefore, researchers and tourists would know how it looked like 500 years ago.



▲ **Fig. 11: Reconstruction of the exterior of Shams-e Tabrizi Minaret (Authors, 2019).**

Acknowledgements

We would like to express our gratitude to Hamid Bayramzadeh, Saber Abbasi, as well as Monir Talabi and Nasrin Jafarloo, members of the Zaryab House of Knowledge and Culture, for their cooperation in writing this article.

Endnote

1. Pascal Coste (1787-1889) was a French painter, architect and orientalist who drew many maps of historical sites in Iran during the reign of Mohammad Shah Qajar.

2. One of the most common games in Safavid period. A great and tall piece of wood was installed in the center of the squares, on top of which was set a ring of gold or silver. The riders used to ride their horses so that they could reach for Qabaq. While riding the horses, the riders were supposed to aim the ring with their arrows. Anyone hitting the ring would own the ring. (Dehkhoda, 1925: 57/139). Qapaq means lid in Turkish.

3. Research has shown that the unknown Venetian merchant was Francisco Romano (Aubin, 1995: 247-259).

4. Tholobate, in architecture, is the upright part of a building on which a dome is raised. It is generally in the shape of a cylinder or a polygonal prism.

5. Drum, in architecture, any of the cylindrical stone blocks composing a column that is not a monolith. The term also denotes a circular or polygonal wall supporting a dome, cupola, or lantern.

6. The term Haram is a generic term for domestic spaces reserved for women in a Muslim family. In English, the term Seraglio is used.

7. Antelopes refer to a large and diverse group of African and Eurasian cows. Antelopes are more similar to deer than cows.

8. This cylindrical minaret decreases in diameter as it rises, with the close-up view of the minaret resembling a partial cone.

9. Elliptical centers; the distance between each of the load-bearing components and the ground through which the load is finally transferred to the ground.

10. The distance between the column and the head; the distance between the saucer-shaped structure and the minaret.

11. The minaret cap, the highest part of the minaret and the roof of the minaret.

References

- Alemi, M., 1997, “The royal gardens of the safavid period: Types and models in gardens in the time of the great muslim empires”, *Theory and design*: 72-96.

- Alemi, M., 2006, “Safavid Gardens, Khiyaban & Maydan as Theaters for Kingship Display”, (In: *Ludovico, Micara; Attilio petruccioli, Ettore Vadini*) eds. Proceeding of The International Seminar of Mediterranean Medina, June 2004. Italy, Pescara: Gangemi Editore. 63-68.

- Alemi, M., 2008. “Princely Safavid Gardens: Stage for Rituals of Imperial Display and Political Legitimacy”, Translated by Maryam Rezaee Poor and HamidReza Jayhani, *Golestan-e Honar, Quarterly on the History of Iranian Architecture*, 12: 47-68.

- Aubin, J., 1995, “Chroniques persanes et relations italiennes: Notes sur les sources narratives du règne de Šâh Esmâ’il Ier”, *Studia Iranica,* 24 (2): 247-259.

- Auben, E.; 2012, *Iran Today: Travelogue of the Memoirs of the French Ambassador to Iran on the Eve of the Constitutional*

Movement (1906-1907), Translated by Ali Asghar Saeedi, Tehran: Nashr-e-Elm Publishing.

- Babayan, K., 1996, *Sufis*, *Dervishes and Mullas in Safavid Persia: The history and politics of an Islamic society, London, I. B. Tauris*.

- Barbaro, J., and Contarini, A., 1873, *Travel to Tana and Persia, a Narrative of Italian Travels in Persia in the Fifteenth and Sixteenth Centuries,* Translated by Charles Grey, London, Hakhuyt Society.

- Bellan, L.L., 1932, *Chah 'Abbas 1er, savie, son histoire,* Paris, Geuthner.

- Belilan Asl. L., 2016. "Spatial structure of Tabriz during the Safavid period with comparative comparison of travelogues and visual documents". *Bagh-e- Nazar Scientific Research Journal,* 38: 47-60.

- Castello, J. R., 2016, *Bovids of the world: Antelopes, Gazelles, Cattle, Goats, Sheep and Relative*s, Princeton University Press: 1-16.

- Chiqni, J., 1983, *Stabilization of Brick Structures - Intervention Fans. Translated by Saeed Iranfar.* Tehran: Urban Development and Improvement Publications.

- Delavale, P., 1987. *Pietro Delavale's Travelogue. Translated by Shoaaddin Shafa.* 1381. Tehran: Book Translating and Publishing Company.

- Dizani, E., 2014, "Explaining the Evolution of the Shah Square in the Safavid Capitals", *Tehran: Hoviiat-e- Shahr,* 2, 2-4.

- Ghassemi Khademi, T., 2014, "Iranian Gazelles", *Journal of Middle East Applied Science and Technology,* 13(3): 385-390.

- Halstead, P., and Collins, P., 2002, "Sorting of sheep from the goat: morphological distinctions between mandible and mandibular teeth of adult Ovis and Capra", *Journal of Archeological Science*. 29: 545-553.

- Kiani, M. Y. 2000. *Iranian architecture of Islamic period.* Tehran: Samt Publications.

- Mehriar, M., 1999. *Visual Documents of Iranian Cities - Qajar Period.* Tehran: Shahid Beheshti University and Cultural Heritage Organization

- Metraqchi, N. 1538. *Baian-e-Manazel.* Translation and suspension of Rahim RaeisNia, 2000, Tehran: National Heritage Organization.

- Morier, J., 1812. *A Journey through Persia, Armenia and Asia Minor to Constantinople in the years 1808 and 1809*, London, Longman, Hurst, Rees, orme and Brown.

- Morier, J., 1818, *A Second Journey through Persia, Armenia*

and Asia Minor to Constontinopole between the years 1810 and 1816, London, Longman, Hurst, Rees, orme and Brown

- Riahi, M. A., 1375. "Where's Shams' Tomb?" *Kelk magazine*, 72-74-75: 28-29.

- Riahi, M. A., 1999. *History of Khoy.* Tehran: Tarh-e-No Publishing.

- "Study of guidelines for preparation of Khoi market restoration plan". 2000. Shahid Beheshti University and Cultural Heritage Organization.

- Wilbur, D., 1963. *Iranian Gardens and their Pavilions'*. Translated by Mahin Dukht Saba. 2008: Tehran: Scientific and Cultural Publications.

- Yurdaydin, H. G., 1976, *Beyan-I Menazil-I -Sultan Suleyman Han,* Ankara, Turk Tarih Kurumu Basimevi.