

Comparative Study of Physical Architectural Features of Sassanid Period Monuments; Case Study: Ardeshir Babakan Palace in Firuzabad and Kooh-e-Khajeh Fire Temple in Sistan

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ABSTRACT

Study and recognition of historical monuments especially pre-Islam monuments that received less attention is necessary for researchers to understand the architecture of ancestors and find how the architects dealt with architecture in the past. In this lieu, the monuments with similar functions or times located in different places can be examined to find useful answers to building design issues. Kooh-e-Khajeh is important in terms of location regarding location, strategic status, and sanctity, so this mount has been named in most texts. Ardeshir Babakan Palace is similar to Kooh-e-Khajeh in terms of its location nature and some architectural and functional patterns. Therefore, this study chose these monuments of their similar functions and time. For this purpose, this paper conducted a comparative study between Ardeshir Babakan Palace in Firuzabad and Kafaran Castle in Kooh-e-Khajeh to discover and examine similarities between these two monuments regarding location and general profiles, physical specifications of design, and decorative properties. To do this, descriptive-analytical and historical-interopertive techniques, direct observation of studied monuments, field observations, documentary study, and archeology have been used. The examination results show that the mentioned monuments share some similar properties in terms of general features of design and main patterns of design while having considerable differences in some design details, such as decorations and proportions of spaces.

Keywords: Architecture of Sassanid Period, Ardeshir Babakan Palace of Firuzabad, Kooh-e-Khajeh, Kafaran Castle.

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1. INTRODUCTION

The Sassanid period is one of the most important periods of Iran's architecture because of the effects and remains of ruined large cities of this period and remained numerous embossed motifs next to communication roads, caravanserais, and staircases, as well as other industries indicating the power focus and political, social, and economic stability of that Iranian era (Mehrafarin et al. 2013, 108; Porada 1976, 277). Despite the long age of this period, unfortunately, there are not many architectural works left for that period; hence, some problems exist in stylistics and historiography and the study of different architectural aspects of this period (Reuther 1939, 492-493). Firuzabad is one of the strategic cities of the Sassanid period and the unique monument of Ardeshir Babakan is located there. Ardeshir Babakan Palace is one of the monuments of the Sassanid period that though is one of the early monuments built by the Sassanid government but a huge part of it has remained after these long years indicating its glory during those days. There are also numerous architectural works of the Sassanid era in Sistan that Kooch-e-Khajeh the most outstanding monument remained from that period. Unfortunately, these monuments do not have original patterns of Persian architecture, and lack of attention in recent years has led to some damage to these buildings without any attempt to renovate them. Maintenance and renovation of these monuments are necessary for people, officials, and relevant managers. In this way, available studies contribute to preserving and reviving these valuable patterns of Persian architecture; hence, a comparative study of general and architectural features of the Sassanid period in two different areas of Iran helps to find considerable similarities, common points, and differences of the architecture in this period. In available comparative studies, monuments of two different climates from two periods are compared. This paper, therefore, provides a novelty by investigating two important historical monuments in the same period and climate located in two different areas. Therefore, two popular monuments of the Sassanid period in two different cities in Iran were selected to be studied. The first selected monument is Ardeshir Babakan Palace, which is a popular architectural monument left from that era. Although Kazeroon and Sarvestan cities and important monuments of the Sassanid era in other cities of Fars Province could be examined as a suitable sample, the second sample was chosen based on its geographical destination from the first sample to prevent similarity between architectural designs and

patterns. This study aims to compare major similarities and differences, contrasts, and commonalities in the body of two important monuments of the Sassanid era in two different areas of Iran.

Hence, the main questions of this study are as follows: What are the architectural and physical properties of the studied monuments?

Does the difference between two cities with similar climate has any effect on the structure and body of monuments of the Sassanid period in these two cities?

What are the differences and similarities between these two monuments' architectures in terms of physical aspects?

According to early studies, a research hypothesis was designed: there are various physical differences between these monuments despite their similarities and the same time.

2. BACKGROUND

According to the research background, the available studies can be classified into three scopes based on the research topic. The first category includes studies that examined Ardeshir Babakan Palace and its different properties. The second category comprised studies that investigated Kooch-e-Khajeh, its architecture, and its importance. The third category includes studies that compare some properties of monuments of the Sassanid period.

Studies of the first category are as follows: MehrAfarin et al. (2013) carried out a study entitled "Ardeshir Khorreh; the Capital of Ardeshir Babakan" to study the importance of urbanism in the governance of Ardeshir Babakan particularly Ardeshir Khorreh introducing properties and history of its monuments. Noroozadeh Chegini et al. (2014) conducted a study under the title "From the Palace to the City: Survey the Watering System of Ardeshir Khowarah During Sassanid and Islamic Period" and tried to find the water transfer techniques from Ardeshir Khowarah to its deployment periods based on archeological results. They concluded that the Firuzabad River plays a vital role in the construction of monuments of the Sassanid era. In another study under the title "an introduction to Recognition of Ardeshir Khowarah gardens during Sassanid Period and Early Islam," Ahmadi et al. (2016) studied the area of Ardeshir Khowarah Gardens during the Sassanid Period and Early Islam. The studies conducted on Kooch-e-Khajeh are archeologic and the most important of them are reported in Table 1.

Table 1. Archeological Studies and Excavations in the Kooh-e-Khajeh Area

Author	Year	Theory	Result	Reference
Goldsmith, the border affairs officer in Sistan Baluchistan	The second half of the 19th century	-	Providing geologic aspects	(Stein 1916, 221)
Aurel Stein, Hungarian-born British archaeologist	1915	He measured and mapped the Ghale Sam and concluded that this monument is the remain of a Buddhist temple and monastery, which linked the Buddhist architecture of central and far east Asia	Measuring, mapping, and taking photos of the murals that remained from the walls of the castle and taking a part of it to the National Museum of Delhi; Printing initial results in 1916;; Publishing full results entitled "In the Depth of Asia" in 1928	(Mousavi 1995, 69; Stein 1916: 221; Ghanimati 2013, 880-881)
Ernst Herzfeld, a German archeologist	In 1925 and again in 1929	Believe in two Sassanid periods in this location (the first era related to local satrap in the first century)	Publishing studies in 1932 in the book Sistan and final publication of studies in the book "Iran in ancient east" in 1941; ; Preparing Ghale Saam Plan; ; Removing motifs in the southern corridor of the fire temple and transmitting them to Berlin	(Kawami 1987; Herzfeld 1941; Mohammadifar 2008, 90)
Italian group with "Luca Mariani" and "Domenico Fasna"	1974	Studying and doing some preservative and renovative measures in the Kooh-e-Khajeh collection (discovering new pieces of painting after the destruction of the arch of the southern gate due to rain)	Printing Fasna Report in 1981 in Journal of East & West; Transferring Doyari pieces to Ancient Iran Museum	(Tucci 1966, 143; Gullini 1964)
Giorgio Gullini, the board with archeologist	1961	Correcting Herzfeld's dating and presenting new stratigraphy from residence periods in Ghale Saam	Presenting six layers of residence from the Achaemenid to Islamic period in Kooh-e-Khajeh;; Publishing the results of stratigraphy in the book "Giorgio Gullini"	(Tucci 1966, 143; Gullini 1964)
Seyyed Mahmood Mousavi and some boards of archeology students in the faculty of cultural heritage	1991-1993		Discovering two new plaster works ; Discovering the stone staircase at the end of the painting hall	(Mousavi 1996)
Seyyed Mansour Seyyed Sajjadi Archeology group of Shahr-e Sukhteh and Dahane Gholaman	1977		Discovering the remains parts of an old mural with the face of a man in the corridor of fire template next to the stone tower of the western fence of Kohan Dej	(Seyed Sajjadi 2003)

Author	Year	Theory	Result	Reference
Korush Mohammadkhani and an archeology board of archeology faculty of Iran	2009	Study of Parthian, Sassanid, and Islamic structures of the area	Discovering 7 outdoor areas related to the Paleolithic era; ; Discovering not-broken pottery objects and containers and one Sassanid coin in Kohan Dej	(Mohammadkhani 2009)
Moslem Mishmastnehi and researchers of Khorasan Heritage Socianet Company	2009		Initial preservative and pathological studies on Kohan Dej of Kooh-e- Khajeh	(Mishmastnehi 2009)
Toroudi Kawami	1981		Publishing the results of Kooh- e-Khajeh paintings based on the Hertzfeld evidence and device tests on painting pigments in a metropolitan journal (based on manuscripts, slides, and a booklet of Hertzfeld designs under the authority of Ferber Gallery in the Smithsonian Museum)	(Kawami 1987)

Some other studies have been conducted on Kooh-e-Khajeh: Ghanimati (2000) carried out a study under the title "A look at the time and functional horizon of Kooh-e-Khajeh in Sistan." Mehrafarin et al. (2011) conducted a study entitled "archeological study of Kooh-e-Khajeh in Sistan," and Banijamali et al. (2016) carried out a study entitled "Review of the Chronology of Kooh-e-Khajeh (Kuh Khajeh) Palace (Kaferron Ghalee) relying on surface pottery" to examine chronology and history of this area. The book "Oxford Handbook of Iran's ancient architecture" examined the chronology and function of this monument in a chapter named "Kuh Khajeh and religious architecture of Sassanid in Sistan." Moreover, a part of the results was about the global project of the cultural heritage of the Silk Road published in the Journal of "Iran Studies" in Britain (2001) that examined monument function (Ghanimati 2001). Casegh Abbasi et al. (2019) carried out a study entitled "Analysis, typology, and Historiology of Kuh Khajeh Palace plaster work" to study the types of plaster works and their dates.

The third category of studies was as follows: Tahmasebi carried out a study under the title "The Comparative Study of the Sassanian Palaces and Manor Houses Architecture" in which, they examined maps of palaces' architecture and historical documents to address the relationship between religious ceremonies of Sassanid palace and studied monuments. In this study, three types of life manor, private and religious were found in Sassanid palace. Rezaie and Vosough Babaie (2015) conducted a study entitled "Comparative study on murals of Kooh-e-Khajeh and murals of Dura-Europos City" to compare the techniques used in motifs and its theme in the paintings of Kooh-e-Khajeh and Dura-Europos

City in Syria. Rahmani et al. (2017) carried out a study entitled "Comparing Ancient Wall Paintings of Kuh-e Khwaje Zabol and Shahr-e Gur, Firouzabad" to compare two samples of Parthian murals of Kooh-e-Khajeh in Sistan and the unique sample from the Sassanid era in Firuzabad, Fars. This study examined the theme of paintings and the techniques used in them and the results showed that samples were consistent with the practical format or shape of architecture based on the climate conditions and diverse culture of Iran.

According to the reviewed three categories of studies, a research gap was found between the architectures of two popular monuments of the Sassanid era because the studies of the first category considered urbanism and general assessment of monuments in the urban fabric pointing to Ardeshir Babakan Palace. Studies of the second category included field and archeological studies without architectural aspects or comprised research papers that examined the chronology and function of the descriptive study of the Kooh-e-Khajeh monument. The third category of studies consisted of a comparison between monuments without examining Kooh-e-Khajeh or Ardeshir Babakan Palace and focused on artistic aspects or decorative details of these monuments in terms of their contents and techniques without paying attention to architectural aspects.

3. METHOD

Regarding the topic nature, a part of the study recognizes the monument and its historical background using the historical-interpretive method while another part of it uses field techniques to analyze the obtained data through the descriptive-analytical method. The

data collecting was done based on documentary and historical-interpretive methods. A party of data was gathered through observations and interviews. The observations were recorded by camera and data were inserted in observational cards; the open-ended questions were asked in interviews with experts and researchers of architecture and archeology who had studied these areas. It is worth noting that the old pictures and maps found in first-hand authenticated resources were used due to the absence or lack of accessibility to some details of the studied monuments caused by worn-out and destruction during excavation or moving them to museums since authors wanted to find the original architectural points of monuments before they were changed, destroyed or renovated.

4. SASSANID STATE AND ITS ARCHITECTURE

Unlike Parthian Empire governed by clans, the Sassanid dynasty founded a powerful and central force, so they could control an aristocratic and rebellious government. They also could enhance the political importance of their government in the East and West by enacting an efficient plan and administrative organization for irrigation and urbanism, architecture and industry, and even defeating the Rome Empire (Porada 1976, 277). Sassanid dynasty founded a national government, which relied on the national and civilization religion that its Persian nature had no corresponding version over history (Girshman 1976, 345). Stabilization of the Sassanid government during the Artaxerxes I kingdom was a significant factor in the construction and expansion of cities, which led to the advent of 8 cities (Momeni et al. 2018; Tabari 1989, 109). Over this time, some cities appeared, renovated, or revived based on different thoughts of economic, cultural, religious development, and military views. The Sassanid government was created based on two pillars: official religion and central government, and Zoroastrianism became the formal religion of the country. Human, undoubtedly, has a special and important position in the process of world development from the viewpoint of the Zoroastrianism religion and philosophy¹ (Mehrafarin 2013; Varjavand 1987, 5). Sassanid architecture includes a wide range of residential buildings, palaces, religious

buildings, military fortifications, bridges, and others but most remained monuments are palaces, religious buildings, and few bridges and military fortifications (Mohammadi et al. 2011, 84). Palaces are the most outstanding remains of Sassanid architecture and the most important works of architects in that era. These kinds of monuments have diverse designs with regular layouts, symmetric axes, and the porch as the dominant element (Mohammadi et al. 2011, 85-86). In Sassanid architecture, the maps with the dominant element of the porch are common. These maps appear as a large porch or hall that affects the whole map or façade (Qal'eh Dokhtar, Takht-e Soleyman), while sometimes appearing as a two-porch map (Taq Kasra, indoor space of Firuzabad Palace), three-porch and four-porch shape² (Rother 2008, 659). In general, the most popular plans included architectural plans with the dominant element of the porch, plans with the porch-dome mixture, and plans with a Sahn (courtyard) in the middle part surrounded by porches (Mohammadi et al. 2011, 91). In the Near East, the use of Sahn in the middle part of the building has a long history. This plan was popular until the end of the Sassanid era (Rother 2008, 684-685). Carcass stone with Saroj mortar is the most prominent material used during the Sassanid period, which can be seen in most monuments built in this period (Firuzabad Palace, Firuzabad Tower, Qal'eh Dokhtar) (Huff 1987, 329). The stones were put together without Ragchin using a mortar that rapidly became hardened (Rother 2008, 642-643). Brick, mud, and chine (brick) were also used in that era (Damghan, Estakhr, Haji Abad, Tisfoon, Kuh Khajeh) (Azarnoush 1994, 39). Brick was mostly used to construct domes and arches but some monuments are seen that are fully brick-constructed (Schippmann 2005, 129; Mohammadi et al. 2011, 91-92). As mentioned in the Introduction section, Ardeshir Babakan Palace and Ghale Kaferoon of Kooh-e-Khajeh were selected among monuments of the Sassanid period as case studies in Firuzabad County because the first monument has a considerable position among monuments of this area and the latter has a special function among monuments located in Sistan. The following sections investigate these monuments. Figure 1 depicts the region divisions of the place corresponding to each sample from the whole to the part.

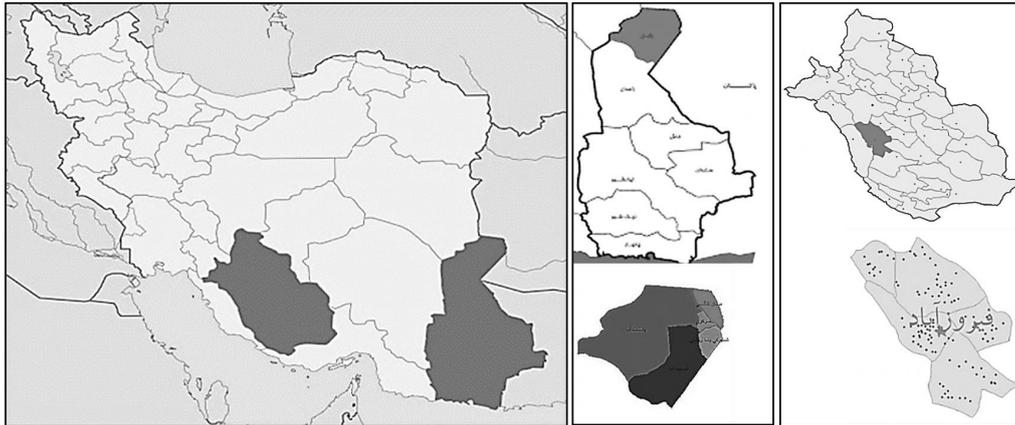


Fig. 1. From the Left Side: Location of Fars and Sistan and Baluchistan Provinces in Iran; Map of Hamun County in Sistan and Baluchistan Province; Map of Firuzabad County in Fars Province

5. HISTORICAL AND PHYSICAL INVESTIGATION OF ARDESHIR BABAKAN PALACE

Firuzabad is now a place where ancient ruins of old Shahr-e-Goor exist, and the main construction of this city is attributed to Ardashir Babakan (National Antiquities Protection Organization of Iran 1966, 102). There are remaining pieces of Ardashir Babakan Palace, which is the most beautiful monument of the Sassanid period of the city (Fig. 2). The building of this palace has several porches with arched ceilings and several rooms with dome ceilings and a courtyard (Sahn). This palace is square-shaped with 140m length and 55m width (National Antiquities Protection Organization of Iran 1966, 102-103). After expanding his kingdom in Pars and Kerman and before defeating Ardavan in Firuzabad, Ardashir built a palace and fire temple. Firuzabad Palace is the first arched monument in the Persian style built by Iranian architects and engineers remaining from the ancient era. In this palace, a ceiling with a semicircular arch is at the top of porches with a square-shaped dome on it and its design is a nice mix of dining rooms and private buildings. The large hall of this palace has a roofed dome in the central part and four porches (Bayat 1986, 254). In his travelogue, Flandin 1986 writes about his visit to Firuzabad, "one of Sassanid kings has built a palace here. A fountain with fresh and clear water comes out from the mountain, which its water pours into the pond around which, stairs reached under the ground surrounded by long grasses. Remained parts of a squared and arched monument are located close to this fountain. The shape and details of monuments indicate that this has been a residential building but I do not understand why Iranians use similar names for different monuments that are not alike. I think that all Iranian people know fire rituals and how to build a fire temple but I do not know why they do not distinguish these buildings and why call

the mentioned place a fire temple. This square-shaped monument is 100m in length and 50m in width. Its front is toward the north but its axis is long with the pond diameter. Because the area has a hot climate, they have chosen the best areas to use coldness. A portico (Ravagh) is connected to this frontage (Jolokhan) that had an arch in the past; two other rooms are on each side of this portico. The building design indicates that arches were constructed symmetrically. All walls are decorated with quadrangle and a door is at the end of the portico through which, they could enter the square-shaped courtyard; this hall is dome-shaped. There are three doors on the other three sides and each has two niches. From the endpoint, a way enters a corridor (Dehliz) reaching a courtyard in which, two doors exist and a hall like the first one. If we judge these arched halls in terms of beauty and volume, we should note that these halls were used for ceremonies. The halls are square-shaped with the same level. The upper part of doors and niches are crescent-shaped" (Flandin 1986, 388). "One of them is concaved. The motifs and murals are inspired by Persepolis. Four windows towards four sides are installed on the top of a small Shadoran made of stone and brick. There are small protruded ceilings on the top of corners and angles with the same level as the upper area of these windows, and a big hole is seen at the top of the arch. Details of this monument are alike the other three other roofed halls. There are three small rooms behind the halls with dome ceilings that are not important in terms of size and decorations; their doors reach a corridor that is opened into a courtyard. A courtyard is a courtyard in the middle area and surrounding buildings are almost symmetric. Two rectangular and roofed halls are located on the left and right hands; there is also a corridor in the southern front through which, they could enter two similar roofed rooms. This monument has remained unchanged, which was surprising for us how this building could remain without any fracture for 14 centuries. We

considered all details of the building's design and shape. The decorations are plaster works and I should mention that its construction materials are small like other Sassanid palaces because these small materials facilitated the process of construction. These small materials might explain why these monuments have remained without any change. Foreign parts of the building, including the walls of Jolokhan and the hall have tall arches as decorations and ornaments, not any other thing. Concavity of doors and niches is crescent-shaped while domes and ceilings are oval-shaped" (Flandin 1986, 389).

Palaces of Artaxerxes I in Firuzabad and Qal'eh Dokhtar have dining halls with deep porches with side rooms located in front of the central dome. A courtyard with porches and halls behind is a part of the residential parts of the palace. The private rooms and spaces probably are located on the second floor (Mohammadi et al. 2011, 86). The dome room is repeated in Firuzabad Palace and Qal'eh Dokhtar Monument with a different design of course. The central core of Firuzabad Palace includes three domed rooms. The most important space of this palace is the middle-domed room that is located on the main axis of the building and behind the porch. This design includes a porch and domed room behind it that appears in Firuzabad for the first time and achieves an important position in the Islamic architecture of Iran. In this monument, the porch plays the role of an entrance hall in general ceremonies. Firuzabad Palace has a hall in the middle part with two porches in the middle of the main fronts, symmetric rooms, and a staircase around it (Rother 2008, 675-677).

6. IDENTIFICATION AND HISTORICAL-PHYSICAL ASSESSMENT OF KOOH-E-KHAJEH PALACE (KAFARAN CASTLE)

Sistan land with its ancient history goes back to the mythical era of Iran as mentioned in Shahnameh. Sistan has been mentioned from far pasts in travelogues and other historical references written by travelers, consultants, and professional and property owners (Heidari and Davtalab 2022, 33). The Sistan region which was developed in the past could not recover from the devastations of the Mongol attack in the 13th century. The Basalt Black Mount in Koohe-Khajeh might be the most prominent area in Sistan that originated from the waters at that time and now from the Hamun Lake Marsh in southeast Iran within 30km distance from south of Zabol. The remains of

multiple clays from different periods are the only signs of the previously developed version of this area indicating variation in the architecture of this area over time (Ganimati 2000, 138). Koohe-Khajeh is a small 2km mount that plays a vital role in Sistan Plain and is located in Hamun Lake within 20km distance from Zabol (Mehrafarin, Vasagh Abbasi, and Saadatiyan 2013, 309; Mehrafarin Mousavi Haji and Bani Jamali 2011, 44). Koohe-Khajeh is the single natural feature in Sistan with a specific sanctity by having three Zoroastrianism, Christianity, and Islam religions³ (Mehrafarin 2012, 167). In the past, the Mount was surrounded by water and indigenous people used small reed-made boats called "Tootan" to come to this area. As seen from far distance, the mountain does not have a simple and flat conical form but has harsh black and white cliffs with striped body, while its environmental access is not possible (Banijamali et al. 2016, 44; Afshar 1933, 538). The proper conditions of Koohe-Khajeh led to the glorious architecture of clay mud that is located in the southern range and is known as Kafaran Castle, She Majous Castle, Rostam Castle, or Ghahghaheh Castle⁴. Herzfeld believes that a castle is composed of a palace and temple naming them royal monuments (Banijamali et al. 2016, 44; Herzfeld 2003, 299). He believed that Gandofer, the king of Saka (from the Parthian tribe that governed in the first century east of Iram and northwest of India), and Rostam are associated with the remains of Koohe-Khajeh in Sistan (Herzfeld 1941, 291). The remains of 14 ancient monuments are seen around this mount: 1) Kohan Dej (Kafaran Castle), 2) Kak Kahzad Castle, 3) Chehel Dokhtaran Castle, 4) Tomb of Eunuch Kulkan, 5) Asiaban Tomb, 6) Pargandom Brian Shrine, 7) House of Evil, 8) Chalipai Building, 9) Water Storage, 10) Stone Mines, 11) remains of architecture monuments, 12) Paleolithic sites, 13) tombs, and 14) fences. Among these monuments, the most important and outstanding of them is Koohe-Khajeh or Kafaran Castle which is located in the southeast range of the mountain. No document is available for the exact and finite date of construction of Koohe-Khajeh monuments (Mohammadifar 2012, 139). Some researchers introduce Kafaran Castle as a royal palace, some call it a military fort, and others name it a temple or place for worship (Kawami 1987, 153). Kohan Dej (Kafaran Castle) is located in the high part of the castle and is constructed as a three-story (Three Ashkoobeh) due to the mountain range and environmental conditions (Waqas Abbasi, Mehr Afrin, and Mousavi Haji 2019, 5).



Fig. 2. An Old Painting of Ardeshir Babakan Palace in Firuzabad drawn by Eugène Flandin in 1840-1842 (Flandin 1851)



Fig. 3. Old Picture of Kooh-e-Khajeh in Sistan drawn by Herzfeld in 1925-1929 (Herzfeld 1946)

7. COMPARISON BETWEEN THE PHYSICAL ARCHITECTURE OF ARDESHIR BABAKAN PALACE AND KAFARAN CASTLE OF KOOH-E-KHAJEH

This part of the study has been done based on the available studies and analyses and what was investigated in the previous section; information and characteristics related to studied monuments have been analyzed and compared within three parts: general situation and information, physical characteristics of design, and ornamental features.

7.1. General Situation and Information

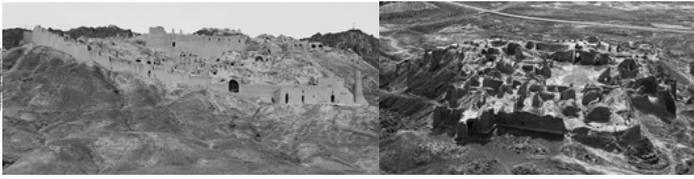
In the section on the general situation and information of two compared monuments, the connection between monuments and the surrounding natural and built environment was studied. Both of the studied monuments are constructed outside the city in a

mountainous area based on the natural slope of the land. Regarding the function of monuments that have been palaces or fire temples based on the historical texts and references (Waqf Abbasi, Mehr Afrin, and Mousavi Haji 2019, 237; Mehrafarin et al. 2013, 114; Porada 1976, 81-280; Kawami 1987, 153), four elements of wind, water, soil, and fire have been used in the design of monuments and its spaces. The most considerable difference between these facades mentioned in various references is that Ardeshir Palace has a Persian style inspired by the architecture of Achaemenid and Persepolis (Bayat 1986), while the Kafaran Castle of Kooh-e-Khajeh has a Hellenic and Greek architectural style (Rayati Moghadam 2010, 21). The whole environment of the building in Kooh-e-Khajeh introduces it as a place where pilgrimage plays a key role. The physical measures that remained, forced pilgrims to pass through a severely closed residential area in the downtown area along with an ancient path before entering the upper

religious area that is well sorted. After that, pilgrims might gather together in the central court (or in large porches when it was cold rain or sand storm) for different ceremonies before passing through a fire

shelter from the northern gate towards the mountain peak (Ghanimati 2001, 183-93). Table 2 reports further information about the situation and general profile of these two monuments.

Table 2. General Situation and Information of Ardeshir Babakan Palace and Kafaran Castle of Kooh-e-Khajeh Monuments

Monument	General Situation and Information												
	Profile			Communication with the Built Environment	Type of Communication with Nature and using Natural Factors	General Plan	Main Front of the Monument	Use					
	Location Towards the City		Surrounding Elements					Political	Service	Public	Ceremonial	Administrative	Ritual and Religious
	Inside	Outside											
Arcdeshir Babakan Palace		In the north of Shahr-e-Gur	Pond with a staircase around it, a fireplace for religious ceremonies, and a close distance between Shahr-e-Gur and its monuments (Qal'eh Dokhtar, ...)	In the mountain outside the city, next to the fountain and a pond full of water in the foothill of Tangab, the presence of four elements: water, fire, soil, and wind	By Iranian architects, a completely Iranian plan and inspiration source for Achaemenid Architecture	Towards north	Royal palace, hall, and king's throne	Room of servants	Northern part	Dining rooms and arched halls for ceremonies	Northern part	Fire temple	*
Image													
Source	(Flandin 1851)												
Kooh-e-Khajeh fire Temple		Within 30km distance from southeast of Zabol	Proximity to 13 historical monuments, including Kak Kahezad Castle, Chehel Dokhtar Castle, Tomb of Eunnuch Kulkan, etc.	Taking advantage of the natural slope and matching it, located on the basaltic lava at a height of 120 meters above the plain, in the middle of the Hamon river; the presence of 5 elements: sky, water, fire, earth and wind	Based on Hellenic and Greek	Towards south	Room of religious men, rooms for the accommodation of pilgrims	Around central courtyard	Painting hall, a large hall with columns	A place for keeping the religious book	Fire temple		*
Image													
Source	Drawn by Savage Landor in 1902 (Savage Landor 1903)												

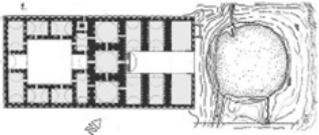
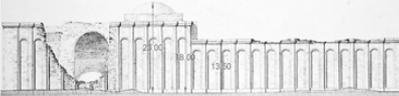
7.2. Physical Characteristics of Design

In the case of examining the physical characteristics of Ardeshir Babakan Palace and Kafaran Castle, three categories are considered: "geometric structure," "dimension and size," and "spatial organization." geometric structure of these monuments is important because it addresses the form of these monuments and their design direction. The dimensions and size are substantial factors because they specify height, the number of floors, general proportions of the building, and modulation of buildings, and spatial organization is important because it investigates how to use filled and empty spaces in the monuments, arrangement, layout, and sequence of spaces, the connection between spaces and outside through permeability and visual continuity. Therefore, these indicators can be examined in all three levels of the building (plan, façade, and volume or size) to find critical points about the design of these monuments. The sequence of spaces in Ardeshir Babakan Palace is as follows: one raised porch, three domed interconnected halls, and one courtyard with two porches and some halls beside it. The main porch is connected to a pond close to the palace through a stairway. In the northern part of Ardeshir Babakan Palace, a tall porch with a hall behind it that has three domes with a Squinch design that has highlighted the northern façade of the building. The ceiling of domes is implemented in an open circle with a 1m diameter.

Kooh-e-Khajeh, the building of the palace is located on top of the castle and its main entrance gate is on the southern side. The arch of the gate is relatively tall with 7m height. The gate has unfortunately been destroyed and the remains are just columns and parts of the arch's base. The central courtyard is located after the gate with 19×31 dimensions. On the north side, some chambers or cells with arched ceilings are seen, and two Porticos are seen on the east and west sides. The main part of the palace is located on the

north side of the courtyard behind the porches like a wide corridor with 50×250 dimensions, which is known as a painting gallery since there are murals in this place. A staircase exists in the northeast of the gallery that is constructed as a pathway to the upper floor on the terrace. Herzfeld believes that this space is a temple, particularly due to the fire existing on the highest north floor of structure and the beneath the ceiling of sanctuary bases (Banijamali et al. 2016, 45; Herzfeld 1975, 120). The worn-out brick structures in the southeast range of the mountain shape a wide labyrinth of cells, rooms, and courts. The only path reaching the religious area or "central region" at the top part of the castle is destroyed but is observable through the real spiral route between buildings. The remains of the central area are not easily accessible due to the sloped cliff nature of the mountain. The narrow path that winds through them starts from the southeast corner of a long slope and finally reaches the base of a tall wall that holds a rectangular-shaped entrance terrace right beneath the religious area. The southern entrance of the central area Herzfeld called the southern gate is located on the north side of this terrace (Ganimati 2000, 138- 139). The external fence called the first fence has a half-circle shape and is located on the slope of the mountain within 100m distance from the internal fence surrounding the whole monument. The internal fence or first fence is seen in which, towers and installation rooms exist. A roofed and long corridor exists behind it that is the way to reach the terrace on the upper floor. This corridor has been designed to reach Kohan Dej and the southern gate. Remains of many residential houses exist within the distance between this corridor and the entrance gate of Kohan Dej (old castle). The organization of the central courtyard is surrounded by Porticos and symmetric porches exist on the east and west fronts of the courtyard, so this is one of the first monuments with two porches.

Table 3. Physical Characteristics of Ardeshir Babakan Palace and Kafaran Castle of Kooh-e-Khajeh Monuments

Ref-er-ence	Image	Physical Characteristics of Design																
		Volume	Façade	Plan	Profile													
					Geometric Structure	Size	Spatial Organization											
Monument	Orientation	Main axis	Curve	Broken and Straight-Corner Lines	Non-Geometric and Organic	Composite	Pattern	Number of Floors and Characteristics	Overall Area and Dimensions	Height-Proportions	Empty-to-Fill Space (%)	Hierarchy and Spatial Sequence	Privacy and Introversion	Number of Entrances	The Connection between Open, Semi-Open, and Closed Spaces	Permeability, Fluidity, and Dynamism	Visual Continuity	Prominent Feature
(Flandin 1851)		Northern-southern	-	Northern-southern	-	-	-	The central courtyard, external porch, and two secondary porches, symmetry	104x55, 85m2	Rooms with an area larger than 100m2 (non-human)	Almost 30%	Outdoor area, porch, entrance hall	Entrance hierarchy	Three entrances, main southern entrance	1. external courtyard, 2. main porch, 3. hall, 4. porch, 5. the central courtyard, 6. all-around rooms	Movement paths on the main axis, planning and connecting it to secondary axes, the level difference between different parts, three main entrances, and three secondary entrances	Creating niches, porches, stair arches	Indentations of the outer edge of the perimeter wall, lighting from the porch's window, and four small windows in the arched Sekonj area
(Flandin 1851)	 	Northern-southern Northern-southern Squinch, dome, Ahang Arch of the porch Perimeter wall, main volume, a peripheral form of the courtyard, and rooms	Creating vertical axes by elongation of façades' arches and porch's form in the northern façade, columns, and arch of vertical façades in eastern and western façades Internal and external façades' arches, dome, Gahvareh ceiling, Squinch Karbandi around the niches and beneath the ceiling, ornaments of columns' head and bases	Northern-southern	-	-	-	Parsesh's architecture, symmetry, similarity, congruence, opposition, rhythm, and repetition	13.5m, 18m, 23m height hierarchy, glorious proportions (non-human)	Almost 25% (in the northern façade, ratio or the empty part of the porch to rigid walls of the façade)	Height hierarchy of external walls Without the external hole, fewer external ornaments rather than internal ornaments, Margard (corridor) in height level of the window beneath the dome	Three entrances, main southern entrance Framing around the holes	Creating shadow through protruded columns from the façade without holes, broken skyline in the wall of external façade Creating dome, Gahvareh ceiling, niches in different height levels, tall columns, arch façades in different height levels, numerous vertical rooms, ornaments around arches Sequential columns and crescent-shaped arches in-between spaces, create transparency through dematerialization, (evacuating arch façades), and indentation of shelter					

Reference	Image	Volume	Façade	Plan	Monument	Physical Characteristics of Design		
						Profile		
						Geometric Structure	Size	Spatial Organization
(Herzfeld 1946)		<p>Northern-southern</p> <p>Northern-southern</p> <p>Squinch, dome, Araghchin dome, Taq and Toizeh (narrow arch), layer arch, Chahartaq</p> <p>External fence. The main volume of the building, the surrounding form of the courtyard, and the rooms</p> <p>Northern fence</p> <p>*</p> <p>Vestibule, porticos around four sides, central courtyard, two eastern and western porches, Chalipa rooms, long room of the painting gallery, Hellenistic architecture</p> <p>2</p> <p>7*627*9m</p> <p>-</p> <p>Around 10% (ratio of space of courtyard, portico, and porches to rigid mass)</p> <p>Open space outside, open space of entrance terrace, semi-open portal, closed vestibule, semi-open portico, open space of central courtyard, semi-open space of eastern-western porches, closed space of T-shaped room</p> <p>Surrounding tall walls with few holes, the central courtyard</p> <p>2 entrances, the main southern entrance</p> <p>The sequence of open, semi-open, and closed spaces</p> <p>Stair and stair-shaped motion, diversity of height levels in volume, fracture of spaces, transition paths without coverage</p> <p>Multiple domes, sequential columns and semi-columns, ornaments beneath the dome, Squinch, staircase arch, horizontal framing of space beneath the ceiling, tall arch of the central courtyard, Araghchin dome, Taq and Toize</p> <p>Promoted columns, semi-circular towers, Doric half-columns</p>	<p>Creating vertical axes using crescent-shaped ornaments on top of the castle's fence, holes inside the walls, elongation of arches and porticos, and form of the porch in east and west façade</p> <p>Arches, internal and external arch façades</p> <p>Framing around the porticos, porches, niches, beneath ceiling, columns and column bases, lattice motifs of columns, internal and external shelves, framing around the doors and holes on the façade and fence</p> <p>Wall of the northern natural fence (mountain features and cliffs)</p> <p>*</p> <p>Hellenistic Greek architecture</p> <p>2</p> <p>-</p> <p>Height hierarchies of 8m, 7m, 4.5m, and glorious proportions</p> <p>Almost 14% (in the northern façade, the ratio of the empty part of the porch, portico, and central courtyard to rigid walls of the façade)</p> <p>Height hierarchy of external walls</p> <p>Tall walls, few holes, and high height</p> <p>Two entrances, the main southern entrance</p> <p>Framing door, portico, porch, arches, hoes, and lattice windows</p> <p>Creating shadow through protruded columns from the façade without holes, broken skyline in the wall of external façade, creating small holes on the walls, framing jags on the top of wall based on stair hierarchy</p> <p>Creating dome, Gahvareh ceiling, niches at different height levels, tall columns of façade, arches and arch façades at different height levels, multiple vertical arches, ornaments around the arches, changing the form and thickness and height, visual continuity using odd numbers in northern façade of the central courtyard</p> <p>Sequential columns and in-between crescent-shaped arches, porches, plan symmetry, transparency creation through dematerialization (evacuation of arch façades), indentation shelter, murals, form richness</p>	<p>Northern-southern</p> <p>Southern-northern</p> <p>Towers and Battlements</p> <p>rectangular-Chalipa</p> <p>-</p> <p>combination with mountain bodies in north</p> <p>central courtyards, 2 porches-4 Porticos around the courtyard, large columned hall</p> <p>2</p> <p>62*79m</p> <p>Rooms with small areas (human use)</p> <p>Almost 20%</p> <p>The external part, entrance terrace, portal, vestibule, portico, central courtyard</p> <p>Entrance-central courtyard hierarchy</p> <p>Two entrances, the main entrance on the southern side</p> <p>1. Entrance terrace, 2. Portal, 3. Vestibule, 4. Portico, 5. The central courtyard, 6. Porch, room, 7. Staircase, 8. Portico, 9. Painting gallery, 10. fireplace</p> <p>Movement path on the main axis of the plan and connecting it to secondary axes, the level difference between public space and ceremonial room and worship place</p> <p>Creating multiple porticos, and porches. The central courtyard, arches, and stair form</p> <p>Indentations and holes of the external edge of the wall fence and surrounding tower and battlement</p>	<p>Orientation</p> <p>Main axis</p> <p>Curve</p> <p>Broken and Straight-Corner Lines</p> <p>Non-Geometric and Organic</p> <p>Composite</p> <p>Pattern</p> <p>Number of Floors and Characteristics</p> <p>Overall Area and Dimensions</p> <p>Height-Proportions</p> <p>Empty-to-Fill Space (%)</p> <p>Hierarchy and Spatial Sequence</p> <p>Privacy and Introversion</p> <p>Number of Entrances</p> <p>The Connection between Open, Semi-Open, and Closed Spaces</p> <p>Permeability, Fluidity, and Dynamism</p> <p>Visual Continuity</p> <p>Prominent Feature</p>			

Interior Space		Exterior Space	
<p>Ceiling</p> <ul style="list-style-type: none"> * In the ceiling's arches Implementing layered arch, ceiling brickwork, three-part arches of the eastern room in the southern gate Framing surrounding environment of ceiling arches - Half-circular, domed form Leaf and flower painting beneath the ceiling of the painting hall Plant and human motifs on the ceiling - Painting Gallery Remains of mild color and plaster Plaster work, thatch, mud Murals, color, plaster Lighting holes Squinch, framing 	<p>Door and window</p> <ul style="list-style-type: none"> Symmetry in the painting gallery's windows Arch façade around the door and window Repeating holes in the body of rooms Door surrounding the environment, an arched form of window - Repeating the general form of frame around the door and window - - - - - No remains Clay, thatch, and sometimes brick * - Promoted half-columns around doors and windows Greek style 	<p>Body</p> <ul style="list-style-type: none"> In niches of arch façades Arches and niches in two heights with varying dimensions in each height row Arches, niches Shelf under the dome, arches, and niches - Western room of painting hall Circular plasterwork of Bishopoori Carving leaf motif on ornamental date leaf Painting with a human face, king and queen, soldier, flute player man - Paintings of 'gallery', the rooms on the left side of the porch, the northern corridor behind the courtyard, the corridor next to the fire temple and hall wall, the room of the southern gate Color red in the plasterwork of the western room of the painting gallery Plaster work, mud straw, mud Murals, color, plaster Holes on the interior wall plasterwork in the west of the painting gallery, Relievo motif Hellenistic Greek paintings 	<p>Reference</p> <p>Kooh-e-Khajeh Fire Temple</p>
<p>Image</p>	<p>Image</p>		
<p>Floor</p> <p>The only available information about the floor of the exterior space of this building is that this courtyard has been paved around the pond in front of the palace</p>	<p>Reference</p> <p>(Flandin 1851)</p>		
<p>Ceiling</p> <ul style="list-style-type: none"> Domes, Mard Gard, and surrounding spaces of the central courtyard, Taq'Alhang of Porches - Domes - Contrast of domes The spherical form of domes, Taq'Alhang of porches - - - - - Colorful plaster works Stone, plaster - - - - 	<p>Body</p> <ul style="list-style-type: none"> Arch, shelter, column façade, external body Repetition of columns' ornaments, stair-shaped arches, and sequential shelves. Arches' jigs Framing arches, number of façade's columns, number of façade's arches Stair-shaped arches around shelves The contrast between the two height levels of eastern façade Stair-shaped arches and jigs between them doubled reliefs of the external façade and half-column on it - - - - Using colorful plaster works Plasterwork in external columns, plasterwork, stone - Carving on columns Relievo on columns of facade Persepolis' Tachar palace 		

Ref-er-ence	Image	Ceiling	Exterior Space	Body	Ref-er-ence	Image
					(Herzfeld 1946)	
						
						
						
						
						

8. RESULTS

According to assessments of previous parts about the Kooh-e-Khajeh and Ardeshir Babakan Palace monuments, some differences and similarities were seen in the architectural body of these monuments. Despite the similar climate and approximate same time of construction between Ardeshir Babakan Palace and Kafaran Castle of Kooh-e-Khajeh, some differences exist between these monuments. According to examinations reported in Tables 1, 2, and 3, architectural features and characteristics of

each monument are reported for each part. The results showed that both similarities and differences can be seen in these two monuments. Table 5 compares the architectural-physical characteristics of these two popular monuments in the Sassanid era based on the studies conducted in previous parts. As seen in the table, the major differences are between "ornaments" and some "physical characteristics of plan" in the monuments, while the underlying similarities between the two monuments are seen in "general situation and characteristics."

Table 5. Comparison between Architectural-Physical Characteristics of Ardeshir Babakan Palace and Kafaran Castle of Kooh-e-Khajeh Monuments and Reasons for using these Features

Feature	Similarities			Differences			
	Floor	Ceiling	Body	Floor	Ceiling	Body	
1 General Situation and Characteristics	Relationship with Nature and Built Environment	Due to temple use, the monuments are located close to the water and sacred element. Kooh-e-Khajeh is located between Hamun Lake and Ardeshir Palace next to the pond, outside the city, and follows the natural features of the environment like the slope			-		
	General Plan	Persian architecture style and central courtyard pattern			Kafaran Castle is influenced by Hellenic and Greek architecture, while Ardeshir Babakan is influenced by Achaemenid architecture		
	Use and Micro-Space	Both have a temple and ceremonial uses			More micro-spaces exist in Kafaram Castle, while more painting galleries and governmental uses exist in Ardeshir Babakan		
2 Physical Characteristics of the Plan	Geometric Structure	Using Gahvareh (Cradle) arch and domed ceiling	Using tall walls	-	Using a cradle arch in the staircase shape of Kafaran Castle	Jags and half-columns of walls outside Ardeshir Palace	
	Size	-	Using tall walls in the external part	Large-scale size of spaces in Ardeshir Palace	Non-human sizes of domes in Ardeshir Palace	High height of the walls in Ardeshir Babakan Palace, the more human-based size of the arches in Kafaran Castle	
	Spatial Organization	Staircase	Privacy and spatial hierarchy in both monuments	Arch and niche in several height levels	Lattice floor around the pond in Ardeshir Babakan Palace	Gholam Gard next to the domed ceiling of Ardeshir Babakan Palace	Using the wall in the main axis of Ardeshir Babakan Palace
3 Ornaments	Plan and Motif	-	Geometric plans	Using some architectural patterns of Achaemenid and Parthian	-	-	Divers plant designs in Kafaran Castle compared to geometric designs in Ardeshir Babakan Palace, partial columns in the external wall of Ardeshir Palace
	Design Patterns	-	Application, repetition, symmetry, rhythm, framing	Application, repetition, symmetry, rhythm, framing	-	-	Symmetry is the dominant pattern of Ardeshir Palace and repetition is the dominant element of Kafaran Castle
	Color	-	-	-	-	-	Using painting and ornaments with diverse plans in Kafaran Castle, using color to decorate the monument
	Material	-	Using plaster work	Using plaster work	-	Using micro-scale stones in the brickwork of the dome of Ardeshir Palace	Using stone work in Ardeshir Babakan Palace, colorful plaster work in Kafaran Castle
	Technique	Lattice flooring	Squinch, brickwork, using carving in niches and reliefs in columns	Using brickwork around arches	-	Layard cradle arche in Kafaram Castle	Empty and filled volume with a portico in Kafaran Castle and reliefs in columns of Ardeshir palace

9. CONCLUSIONS

In this research, two monuments with similar use and climate are selected from two different areas over long distances to find their architectural similarities and differences considering architectural differences caused by the use and climate. Ardeshir Babakan Palace was selected because it was located in one of the important cities of the Sassanid era and Kafaran Castle of Kooh-e-Khajeh was chosen due to the importance of Sistan during the Sassanid period. The architecture of these monuments was not unfortunately examined in previous studies. The available studies have investigated decorative details and ornamental themes of the monuments. According to studies and analyses conducted based on descriptive-analytical methods and a review of historical texts and documents related to these monuments, underlying differences were seen between the bodies of these monuments despite their similarities in terms of physical aspects. The most significant differences included ornamental details of monuments and proportions of micro-spaces, particularly in the height levels of monuments. The similarities included the use of architectural design elements and patterns of previous eras (Parthian, Achaemenid). The obtained similarities and differences were classified into three categories as mentioned herein:

1. General situation and characteristics: in the context of general situation and characteristics, both monuments have used their surrounding natural elements and followed some natural factors, such as natural land slope. In terms of orientation, both monuments have a northern-southern axis and have been constructed towards the south to use sunlight and heat. This indicates that architects of that era paid considerable attention to climate issues in the area. In terms of function and use of buildings, archeologists believe that both monuments have had palace and fire temple use during a specific period, and some places are seen in both monuments for residence with public and ceremonial use. However, Ardeshir Babakan Palace had governmental use and the dominant use of Kooh-e-Khajeh was religious.

2. The physical characteristic of the plan: according to a review of monuments during the Sassanid era,

the architecture of this period has been inspired by original Persian architectural patterns. In Ardeshir Babakan Palace, many physical characteristics of the design are inspired by Achaemenid and Persepolis architecture, while in Kooh-e-Khajeh, many parts of the monument are influenced by Hellenic and Greek architecture. In terms of plan form, straight-corner lines have been used in the design of both monuments, and the Chalipa form is seen in Kafaran Castle. Both monuments have been designed introvertly using central courtyard elements, and a hierarchy of access to all spaces has been observed in both of them. The studied monuments are two-story but the height proportions and size of spaces are more human-based in Kooh-e-Khajeh compared to Ardeshir Babakan Palace.

3. Ornaments: color is seen in multiple spaces of Kafaran Castle. Moreover, a hall exists in this monument that is decorated with colorful murals. The motifs used in Kafaran Castle are influenced by Hellenic and Greek architecture; therefore, many plant and human designs have been used. In addition to plant and human motifs, numerous geometric motifs have also been used. The pattern used in the ornaments of this monument includes symmetry, rhythm, and repetition. In Ardeshir Babakan Palace, however, geometric motifs influenced by Achaemenid architecture and animal motifs with peacock feathers have been used; no color or painting is seen in this palace, and no reference has pointed to these elements. Destruction of monuments' flooring has led to a lack of information, and the only case is lattice flooring around the pond of Ardeshir Babakan Palace. It is concluded that these monuments have used the dominant pattern of the architecture of the Sassanid period (use of dome, Squinch, cradle arch, location of the building regarding its use, glorious and tall monument, etc.), but have followed their indigenous climate in their details. This case can be seen in the difference between the proportions of various parts of the building especially in height, space layout and arrangement, the entrance gate of the building, materials used in the monument, and type of ornaments.

ENDNOTE

1. Religion had an effective role in shaping cities in this period but also in the design of buildings and the type of their textures. Rituals and beliefs of the society play a role in shaping ancient cities in two ways: first, emphasis on urban temples and highlighting their superior position so that other architectural designs of cities and networking have matched themselves with the main center. Firuzabad city where a temple has been constructed in it can be mentioned as an example. Second, the effect of religious symbols and beliefs of society on city design and networking, including heavens and stars and sunrise direction are elements influencing this process so that quadruple gates located in some cities such as Darabgard and Ardeshir Gureh (east of Mehr Gate, west

of Bahram, north of Hormozd, and north of Ardeshir) are of such belief and though (Mehrafarin et al. 2013; Varjavand 1987, 5).

2. Although the design of Taq Kasra has one porch, explorations indicate that a large courtyard (Sahn) is located in front of the Porch and another porch is designed on the other side of Sahn (Rother 2008, 659).

3. Oshirden is the name of a mountain that is mentioned among natural phenomena in Avesta for the first time (Mehrafarin 2012, 38). This is one mount among 2244 mountains named in Yesna, so is sacred; it is said that Susiana (Susians) is a savior in Mazdasna religion and appears from there (Mehrafarin et al. 2013, 54).

4. Stine was the first archeologist that named the remains Ghagha, so researchers called it with this name since then (Stine 1928, 909). However, another term "Cajas City" was introduced by Tate mentioning that "the origin of this name is ambiguous" (Tate 1910, 265). Christensen (1810) is probably a reference based on which, Kinnear calls this city "Kukhozord" also considering the data written in the book "Sistan: memory of Iran's geography" (Christensen 1939).

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6. The distance between the arch of the monument and its wall on which they paint and do plater work serves as the pathway of the arch and ceiling and now is known in general language but is not recorded in dictionaries (Treasury of Ganjavi or Seventh Book of Hakim Nezami, p. 136).

7. Stine states that some remains of plaster columns exist in some halls concluding that these elements are so small for being deployed on small images (Stine 1928, 911).

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