

COMPARATIVE STUDY OF TROGLODYTIC ARCHITECTURE IN KAL-E JENNI REGION OF TABAS WITH OTHER SIMILAR STRUCTURES OF TABAS CITY, IRAN

Mohammad KESHAVARZ DIVKOLAEI¹ and Hamid ZOGHI MARANDIZ²

¹ Member of ISMEO, Rom, Italy, /ICTA- ICOMOS, Iran, (Corresponding author: mohamadkeshavarzdivkola@gmail.com).

² Member of ICOMOS, Iran.

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Abstract: After introducing the examples of the ‘Troglodytic caves’ architectural structures in Iran and paying more attention to this type of ancient architecture, two valuable examples of which are Kandovan and Meymand village, studies on this type of architecture became common in all parts of Iran. We see different types of Troglodytic architecture from north to south and east to west of Iran due to the geological structure. The authors of this article provide a structural study of the Troglodytic caves in the Kal-e Jenni area of Tabas city. This structure, known among the locals as Gabri House and also as Mehr Kadeh, was carved out of a very cohesive sand bed of the river wall that dried up millennia ago, conveying a kind of principles of architecture that are still in use with different functions in our modern world. Regarding the library and field studies on this area, there are similarities and differences in the architectural structure of this edifice with others found around the city of Tabas. It is a building with a corridor entrance attached to a vertical corridor moving upwards and then in the building a corridor ending in five small rooms on both sides. The existence of a well in this building is important.

Keywords: Troglodytic architecture (Dast-Kand), Tabas, Kal-e Jenni.

چکیده: در حوزه معماری دست‌کند بعد از معرفی بسیاری از سازه‌های ایران و توجه بیشتر به ساختارشناسی این گونه معماری که دو نمونه ارزشمند آن روستای دست‌کند کندوان و دیگری روستای میمند هستند، مطالعات بر روی این گونه به تمام نقاط ایران رسیده است. از شمال تا جنوب و شرق تا غرب ایران با توجه به ساختار زمین‌شناسی شاهد گونه‌های مختلف معماری دست‌کند هستیم. نگارندگان این مقاله به بررسی سازه‌های در منطقه کال جنی در شهرستان طبس می‌پردازند. این دست‌کند که در بین مردم به خانه گبری و همچنین به مهرکده معروف است در بستر ماسه‌ای بسیار منسجم در جداره دیواره رودخانه‌ای که هزاره‌ها قبل خشک شده است حفر شده و به نوعی اصولی از معماری را رعایت کرده که در دنیای مدرن نیز با کاربری مختلف ساخته شده‌اند. این بنا با توجه به مطالعات کتابخانه‌ای و میدانی در این منطقه، تشابهات و تفاوت‌هایی در ساختار معماری این دست‌کند با دیگر دست‌کندهای موجود در اطراف شهرستان طبس وجود دارد. سازه‌ای با یک ورودی دالان شکل و در ادامه یک راهرو عمودی رو به بالا و بعد در ساختمان یک راهروی کشیده که در دو ضلع آن پنج اتاق کوچک تعبیه شده است و وجود یک چاه در این دست‌کند حائز اهمیت است. می‌توان با مقایسه ساختار معماری و تطبیق آن با سازه‌های مشابه در منطقه به این امر دست یافت.

کلمات کلیدی: معماری دست‌کند، طبس، کال جنی.

I. Introduction

The life of cavemen and the existence of natural cavities in their environment were certainly the first ideas to build the first houses as primitive shelters that gradually became means of advanced architecture. Early humans used natural spaces for temporary residence or even permanent life. The existence of natural caves in prehistoric and Neolithic periods and later in historical periods and the continuation of this process to the contemporary world to human life today has shown the stability of these settlements and ideas suitable for humans. The word Dast-kand in Persian means digging with hands applied to the underground building created or expanded by human hands. We use the Troglodytic Cave or Hand Made Cave with the same meaning. There is also another term in English spelled Troglodytic. A similar term in French is Troglodytique. The main root of this word is taken from Greek literature, which is Troglodyta, with two parts: the first part means pit, and the second part means penetrating the ground by human hands (Bloch and Wartbutg, 1989). The word Troglodyta is also used in Italian literature but is better known by the word Rupesre. Another term used for such buildings is rock architecture. A similar term in English is Rock Cut

Architecture (Kempe, 1988), in French Architecture Rupesrtre, and in Italian Architettura Rupesre.

This type of architecture is mentioned in the studies conducted by Iranian researchers as creating a hole in the rock and expanding it for the use of human life, both during life and after death, and is a kind of human struggle against the rock (Homayoun, 1975: 65). These cavities are formed in the heart of the rock in the form of tombs or perhaps temples used for rituals, along with the real-life function as habitat in parallel (Shekari Nairi, 1992: 19). In the Islamic period, especially in the 6th to 8th centuries, special attention was given to the rock architecture for two reasons (Shekari Nairi, 1992: 22): 1- Dervishes and mystics resorted to the natural and artificial caves in order to choose seclusion and purify their souls, following the cave-dwelling times of the Prophet of Islam. There was a sect of Sufis called Ashkaftiyeh, who lived in caves and mountain crevices (Kiani, 1992: 86). 2- There are obvious references in the history book written by Yamini that indicate the expansion of rock architecture from the 6th century onwards. It is narrated in this book that in the year 582 AH, a great terror had taken over the people's minds, stating that the resurrection would be promised in these years, and a terrible storm would sweep across the earth.

Many of the people of wisdom and companions of blessings and wealth thought to take shelter and shelter in the caves and some of them built strong avenues and arranged strongholds in the gorges and entrances of the earth (Jorfadghani, 1978: 421). In this way, some, thinking they would be safe from the terrible storms of the Day of Judgment, started digging in rocks to build houses (Shekari Nairi, 1992: 22).

The importance of this type of architecture can be considered in its diversity and primitiveness. Architecture is defined by the volume used to build and search for empty spaces. This kind of architecture is a kind of returning to the caves and enduring the cave-dwelling lifestyle. However, this is true only for the rural contexts of primitive civilizations, and the rest of the cave dwellings were either a kind of refuge or the use of tombs or shrines. The special shape, breadth of the structure, and the difficulty of digging the rocks multiply the value of these buildings.

Also, a kind of Troglodytic architecture called Taq Tavileh is very common in Iran. These usually are hovels that shepherds spend hours in. These structures also provide shelter for livestock and poultry in severe climatic conditions like heavy rain and snow. In some works, the structure of the caves is in the form of the Byer (Momeni, 2015: 703). The special attention given to this type of architecture in different periods indicates the constant use of this building style. The existence of rural habitats, such as Kandovan near Tabriz (Osuli Mahmoudi and Baybordi, 2012) and the village of Meymand in the city of Kerman, shows the value, importance, and familiarity of Iranians with this type of architecture. So far, limited studies have been done on the Troglodytic architecture in Iran. Sarokhani (Sarokhani, 2006) and Ashrafi (Ashrafi, 2011) analyzed the typology of Troglodytic architecture. Ashrafi dealt with the protection of these sites (Ashrafi, 2015). Soleimani also considered Bumkan (underground Barn) as a kind of Troglodytic architecture (Soleimani, 2015). Kabiri also introduced the aqueduct as a type of HCC (Kabiri *et al.*, 2015). Among the architectural collections, we can mention Meymand Rock village in the northeast of Babak city of Kerman (Homayoun, 1972, 1975), Lanjroud Cave, an artificial cave or Dastkand, which has been dug as a shelter in times of insecurity (Gharib, 1990), Kija Kerchal Cave in Doab Savadkooh (Dan *et al.*, 2016: 81-88; Pazouki, 1997: 154), Darab Fars Stone Mosque (Khanipour, 2019), Kandovan Rock Mosque, Imamzadeh Hashem Rock Mosque, Varjudi Rock Shrine Near Maragheh city, and Abazar temple in Nair city of Ardabil province (Shekari Nairi, 1992: 13). Most of these buildings can be used as places of worship and other buildings can be used as temporary living and shelter. The focus of this article is on Iran and the special context of Troglodytic architecture in one of the hottest regions of Iran called the Tabas desert.

Given the importance of the subject of this research, the question is what are the architectural features of Kal-e Jenni? Compared to all the similar structures and compositions, what function can be attributed? What we have identified from this Troglodytic construction in Tabas city, which is popularly known as Mehr-kadeh or Gabri House, displays a simple structure that, according to its architectural elements, can be a shrine or temple that needs further study. Conducting the comparative study as the first approach to investigating all the constructions they display being parts of old facilities functioning as an aqueduct, this structure should be part of the regulating system within the water path in the aqueduct.

II. Geography and the history of Tabas city

The city of Tabas, based on official documents and historical evidence, is called "Tabas Khorma", "Tabas Gilaki", "Tabas Golshan", "Tabasin", or Tabas alone, located in the west of South Khorasan province of Iran. This city was previously part of Yazd Province, which joined South Khorasan Province in 1912. Before 2001, Tabas was part of the Great Khorasan Province. The city of Tabas, with an area of 55,461 square kilometers, includes a large area, most of which is formed in the desert environment. Kavir-i Namak and Dasht-i Kavir in the northeast to northwest direction, and Lut desert in its southeastern neighborhoods. There are mountain ranges called Camel Mountains in this city. These mountains are the highest barrier against more or less seasonal rainy clouds that come from the southwest, and as a result, many floods flow on their eastern and western sides. These waters give rise to settlements that exist on both sides of this mountain range. The most important of them are Tabas, Crete on the western slope, and Boshrouyeh on the eastern slope. The city of Tabas is located at a distance of about 30 km on the western slopes of the Camel Mountains (Fig. 1). The city of Tabas is located in the hot and dry regions with regard to its annual climatic conditions. However, due to its proximity to the Camel Mountain range and the present moisture in the winds and short-lived rainfalls, it has become a special part and its climate has become much more moderate than the holes and depressions around it, so its rainfall was recorded in a 16-year census between 1975—1960 at 73.6 mm (Daneshdoost, 2017: 6).

III. Historical background of Tabas city

We know little about the historical past of the pre-Islamic city of Thebes or Tabas, to the extent that it is impossible to have a clear depiction of its background. Tabas in the post-Islamic era, when the historiography was silenced by many rulers for three centuries. From the third century onwards, first, the historical events of the beginning of the Islamic era considered important were documented. Then the other narratives gradually

were written in Arabic. In Post-Islamic periods, too, not all events were recorded, perhaps due to the remoteness of Tabas, the fact that historians remained unaware of the historical events of Tabas, and the lack of historians in Tabas due to its small size and lack of large population. Thus, there is not enough recorded data relating to the history of this city (Daneshdoost, 2017: 18).

In the book *Fatuh al-Baldan* Blazeri, written in the third century AH, the following lines mention Tabas: Tabasin has two forts, one called Tabas and the other Crane. It is tropical and has many groves, and those two forts are on the way to Khorasan.

The Iranian geographer Jeyhani, in his book called "*Ashkal al-Alam*" written in the second half of the fourth century AH, to introduce Tabas, calls it Krete Tabas in his description; this is a part of Tabas located near Krete. "Crete is a city smaller than Qaen and is one of the tropical regions. There are many palm trees, it is fenced and old forts and their water comes from the aqueduct. There are more groves there than in Qaen Gardens".

Heinrich von Poser is the first European whose traveling route to the eastern parts of Iran can be traced back to Tabas, passing through the Birjand region located in the eastern neighborhoods of Tabas. Fan Poser mentions Tabas as the "royal castle", and the goodness of this place made him stay there for a few days (von Poser, 1621 AD = 1031 AH). Major General Sir Charles Metcalfe MacGregor, after describing the citadel and the city wall, writes: "Neither this wall nor the city itself matters as a military fortress because it is surrounded by trees and houses that cannot fire from and its walls are made of a fragile material that cannot withstand three hours of artillery". "The most pleasant part of Tabas is Khizaboon (street). This wide boulevard continues from Golshan Gate to the hills" (Fig. 2).



Figure 1. Location of Tabas city (Google Earth 2021).

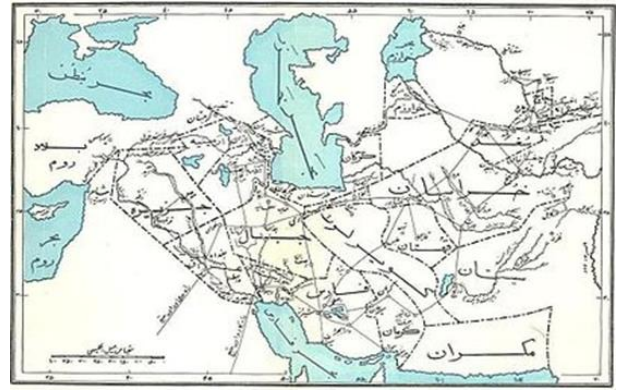


Figure 2. The position of Tabas on the map of Iran during the Abbasid caliphs (Le Strange, 2011).

IV. Troglodytic Architecture in Tabas

Unfortunately, comprehensive accurate information on the architectural structures in this area is not yet available, except for the research done by Mr. Daneshdoost, who has studied the architecture of these structures in the book "*Tabas was a city*" (Tabas Historical Monuments). According to previous studies on these structures, we encounter two relatively different types of Troglodytic architecture. The first species are cavities that are scattered and irregularly located perpendicular to the surface of the Kal-e Jenni area and seemingly created to move and transfer river water to the other side of the mountain or to direct water through the aqueduct to human settlements. By examining some of these structures that were easier to access, the movement and flow of water inside them were known. On the other hand, examining the aerial photo of the trajectory of the aqueducts created from the valley to the city strengthens this theory (Fig. 3). The second type of these structures has a regular pattern, and in almost all of them, there is an entrance near the riverbed, and the second hole is located at a distance of about 9 to 12 meters above the entrance, which seems to be an opening window or observation post. As a case study, one of the Gabri houses on the eastern side of the mountain was studied, where the Ghalaat peak is located. To enter the Gabri house, you have to enter a tunnel that is about 1 meter above the riverbed, and this high altitude is probably due to the natural erosion of the riverbed. The route of access to these structures is not clear, but what is available from the available evidence, such as the presence of palm logs in both this valley and in Kal-e Jenni, as well as stepped cuts in the vertical body of the walls can be how to access the entrance (Fig. 4). After the entrance of the structure, there is a horizontal channel that is carved to a depth of 4.4 meters and a height of about 1.2 meters inside the mountain. There is a vertical well at the end of this tunnel, and it is completely similar in structure to the wells created for digging aqueducts.

In order to access the space above the well, cuts are made in the wall, and by placing the foot inside these

points, it is possible to move upwards. In the middle of the well, a belt with a depth of about 2 meters and an angle of nearly 90 degrees has been dug into the entrance tunnel axis, which induces a recessed space. It is probable, except for the security of the occupants inside the structure, who had full control over the well; it is a recess space for temporary rest and then continuing to move throughout the path of the well. After climbing up the well, there is a corridor 11.5 meters long. The arched roof of the corridor is more similar to the arches of the Sassanid period in terms of form. There are four ledges on both sides of the corridor, and the door of some rooms opens to it. A room is located at the end of the corridor. The height of the corridor in the middle of the arch is about 3 meters. The gates lead to 6 rooms and a narrow corridor with holes. Some rooms have niches and closets, and two rooms have pre-entrance edges that may have been used to store food. The type of the roof and some niches are the same as the forms of the Sassanid period. In the main corridor and next to the vertical well, a narrow corridor is separated from it in a curved shape, which has a lower height compared to the main corridor, and its use cannot be determined correctly. The provision of natural light inside the corridor is mainly by means of a hovel that has been cut in the vertical surface of the wall, which has also been used as a window and place for observation (Daneshdoost, 2017: 295-298).

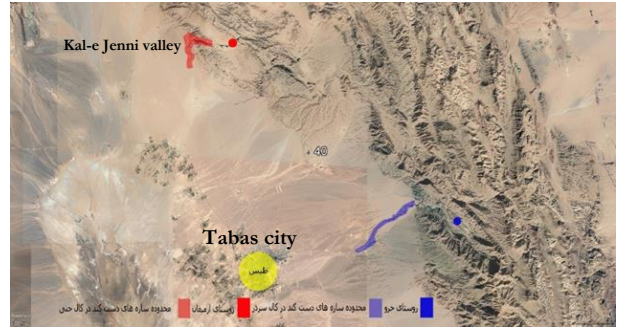


Figure 3. Location of the set of Troglodytic structures (Google Earth aerial photo, 2021).

The Troglodytic caves of Mehr Kadeh in Kal-e Jenni valley are made in a sandy bed on natural walls (Fig. 5). This building has an entrance in the east-west direction. Its main elements include as follows: 1) the entrance, 2) Two corridors, one horizontal and one vertical, 3) A central corridor with a window facing west, 4) A well in the main corridor and near the entrance of the vertical corridor of this building, and 5) At the end, two rows of 10 rooms in the symmetrical position face each other in the north and south of the corridor. Comparing the existence of similar buildings in the Kal-e Jenni area and other areas, such as the Kharo Valley in Tabas and similarities in the type of route design and access to the inside of these buildings, Kal-e Jenni is slightly different in terms of the plan in the symmetries in all existing structures. It can be said that this building is the most symmetrical one in this area.



Figure 4. Kal-e Jenni Valley (Photo by Keshavarz Divkolaee, 2009).



Figure 5. The arrow indicates the location of a Troglodytic building called Mehr Kadeh in the Kal-e Jenni valley. (Google Earth aerial photo, 2021).

V. Architecture

The building known as Mehr Kadeh in Kal-e Jenni has a special design. Although this handicraft is ancient and historical, it appears in a simple, modern, and contemporary architectural structure. The entrance of this building opens to the old riverbed or the Kal-e Jenni valley westwards, about two meters above the ground (Fig. 6). As we were about to climb these two meters, we saw a piece of palm tree stump below the entrance functioning as a staircase.

The structural issue can be considered: First, the sand bed of the western and eastern walls of the valley makes it difficult to understand the existence of stairs in

the past to enter this handicraft building. This may be considered a hypothesis that there may have been several steps below the entrance.

Second, they reduced the height by using escalators or wooden tools such as tree stumps in the area. You have to look carefully at the dense texture of the natural wall of this part of the valley to find the remains of the fallen stair components. The height of the entrance is about one meter and seventy centimeters, which is east of the wall in the heart of the structure and continues in the sand texture of four meters, making a narrow corridor. The height of this narrow corridor, like the

entrance, is about one meter and seventy centimeters. The width is about one meter, which at the end leads to a vertical corridor that leads us upwards, like the design of an elevator in today's world. The width of this section differs from one meter to one meter and twenty centimeters, the height of which reaches ten meters (Fig. 7).

In this corridor, there are places for hands and feet to go up and down, like hollows made for digging wells and aqueducts. In the end, this passageway leads to the main corridor of this structure in the initial part of the building on the western side.

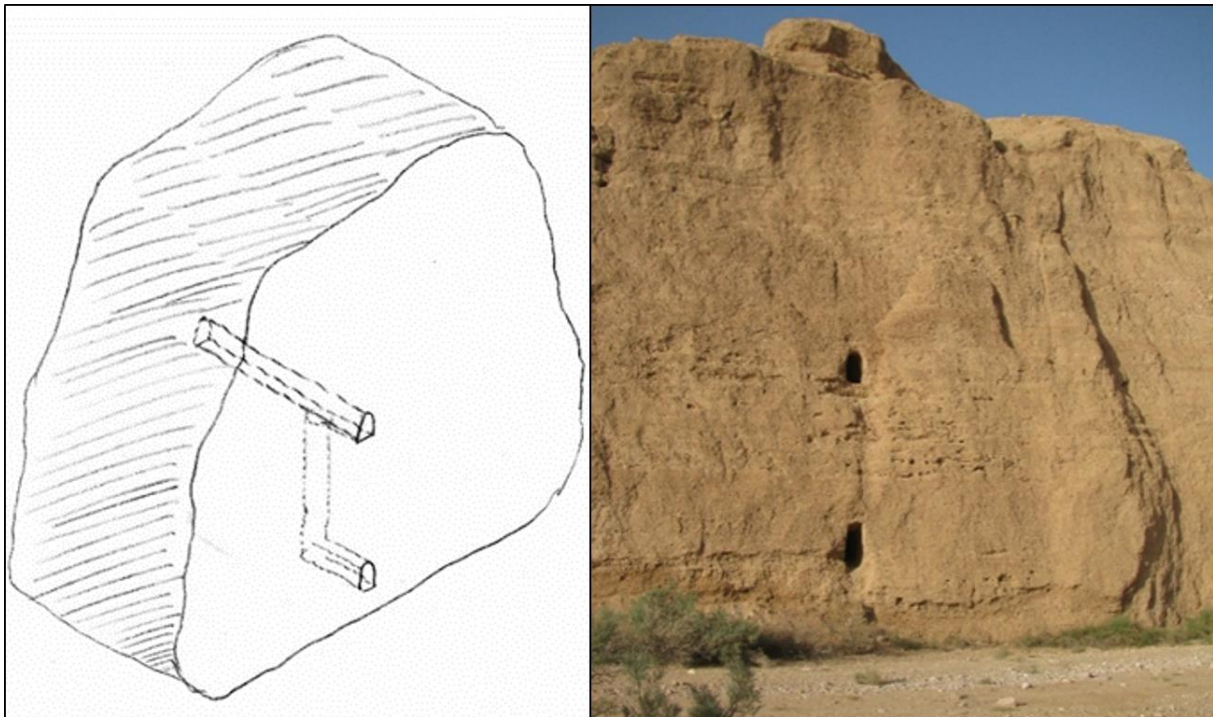


Figure 6. A view of the entrance and window and the three-dimensional image of the access path to the building of Mehr Kadeh in Kal-e Jenni, Tabas (Photo and drawing by Keshavarz Divkolaee).



Figure 7. Two images from the top and bottom of the vertical corridor (Photo by Keshavarz Divkolaee).

After passing through the two mentioned corridors, we reach a corridor that stretches east-west. The width of this corridor is two meters and eighty centimeters, and its length is fourteen meters. On the western side, a

window opens outwards, about one meter in length and width. Like the entrance, the window shows no special order and accuracy in its arch, and it is a little like a curve. This entrance and window can be considered

similar to the maze structure. Next to the circular entrance of this structure, there is a well on the western front, the diameter of which is between sixty centimeters and seventy centimeters.

The existence of this well can be a great help in understanding the use of this building. In this corridor

moving eastwards, the structure in the north and south walls ends in ten rooms divided into two rows. The entrance width of each one is one meter, a small space in which only an ordinary human can be accommodated. The length and depth of each room are about one meter and sixty centimeters.



Figure 8. The right photo shows the window on the western side of the main corridor, and the left photo shows the corridor and some of the rooms at the eastern side of the building (Photo by Keshavarz Divkolaee).

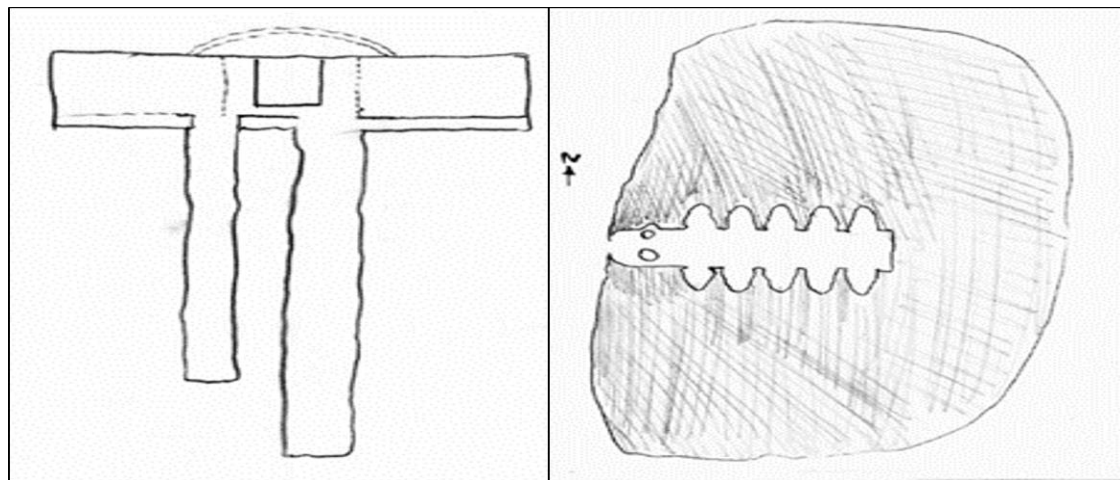


Figure 9. Plan and section of the building of Mehr Kadeh in Tabas (Drawing by Keshavarz Divkolaee, 2009).

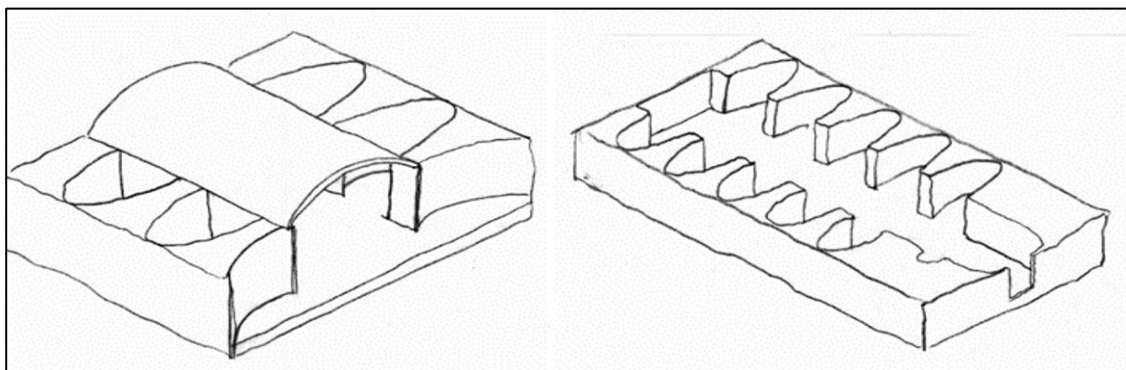


Figure 10. Three-dimensional depiction of the architecture and the curved form of the roof of Mehr Kadeh in Kal-e Jenni (Drawing by Keshavarz Dioklaee, 2009).

VI. Comparative study of the Troglodytic structures in Kal-e Jenni and Kal Darresar regions

In this section, the architectural components of the studied structures are examined, and the differences and similarities between the two structures are introduced.

The entrance of the Kal-e Jenni building is about 2 meters distance from the riverbed, while the entrance of the Gabri house is about 12 meters above the riverbed. This difference in their height may be the lowering of the riverbed at the head of the valley and the natural erosion of the bed (Fig. 11).



Figure 11. Right: Mehr Kadeh entrance, Kal-e Jenni, (Photo by Keshavarz Divkolaee), Left: Gabri house entrance, Kal Darrehsar (Daneshdoost, 1997).

The length of the entrance corridor in the Kal-e Jenni building is 4 meters, its width is about 1 meter, and its height is about 1.70 meters. The length of the entrance hall in the building of the Gabri house is 4.4 meters, and its height is 1.4 meters. In both buildings,

the similarity of the appearance, form, and dimensions of the entrance and the corridor, is evident. The first signs of architectural proportions can be seen in the entrance structure, which in terms of security allows only one person to enter both buildings (Fig. 12).

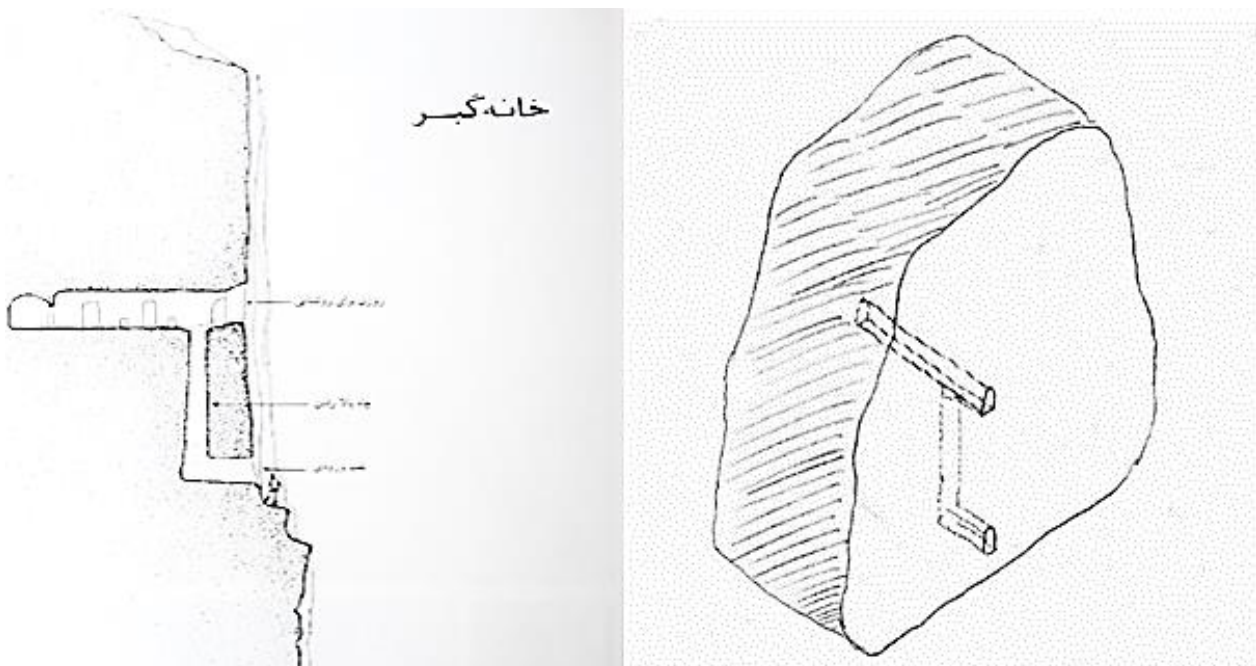


Figure 12. Right: Mehr Kadeh entrance hall (Drawing by Keshavarz Divkolaee), Left: Gabari house entrance hall (Daneshdoost, 1997).

After passing the entrance route, there are ascending wells in both buildings (Fig. 13).

The dimensions of the well in the Kal-e Jenni building are 1.20 meters wide and 10 meters in height. The Gabri house well is about 9.60 meters in height.

In both wells, there are holes prepared for hands and feet to climb up, with the difference that in the well of Gabri, in the upper half of it, a pause was dug to a depth of about 2 meters, which was probably for temporary rest.



Figure 13. Right: vertical well in Cal Jeni Mehr Kadeh. (Photo by Keshavarz Divkolaee), Left: vertical well in Cal Darresar Gabri house. (Daneshdoost, 1997).

Crossing the vertical well, we enter the corridor that exists in both buildings, and the access route to the rooms of the building is through these corridors. The width of this corridor in the Kal-e Jenni building is two meters and eighty centimeters, and its length is fourteen meters, while the same space in the Kal Darresar Gabri house has a length of 11.5 meters and a height of about 2.3 meters. On the northern and southern walls of Kal-e Jenni, there are ten rooms divided into two rows of five, which have a regular rhythm and symmetry in terms of construction. The

width of the entrance of every room is one meter, and the length and depth of each room are about one meter and sixty centimeters. The form of structure of the Gabari house is different.

Inside the main corridor, there are four niches on both sides and doors leading to the rooms. There are six rooms in this structure, one of which is located at the end of the main corridor. Some rooms have niches and closets and are different in size. The roof form in both structures is an arch reminding the Sassanid forms (Fig. 14 and 15).



Figure 14. Right: Main corridor of Kal-e Jenni Mehr Kadeh. (Photo by Keshavarz Divkolaee), Left: Main corridor of Kal Daresar Gabri house. (Daneshdoost, 1997).

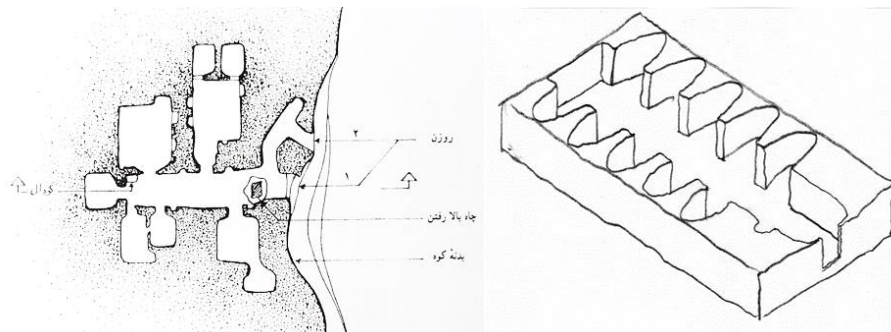


Figure 15. Right: Position of rooms in Mehr Kadeh by provided (Drawing by Keshavarz Divkolae, 2009), Left: Location of rooms in Gabri house (Daneshdoost, 1997).

In both structures, there is a hole in the main corridor as a skylight or window, and in addition, in the Gabri House, there is another hole connected to the main corridor by a narrow corridor.

VII. Investigation of the method and causes of construction and emergence of Tabas Troglodytic structures

Although the name, Troglodytic architecture, is a new term in the archaeological literature and restoration of Iranian architecture, some different definitions, typologies, and analyses related to this form of architecture are presented by researchers. The diversity and dispersion of such structures in the geographical area of Iran require more extensive studies and research to identify, analyze, and introduce these handicrafts. Different hypotheses have been proposed in the analysis to explain the existence and method of these architectural samples. For example: "In the construction of Troglodytic architecture, there is no difference in the way a space is expanded, starting from the floor, the ceiling, or simultaneously from both spaces because in terms of creating the overall body of Troglodytic spaces, there is no systematic approach to produce the carved out spaces. Therefore, in order to construct the necessary space in Troglodytic architecture, only digging and cutting the rocks and emptying the separated masses would provide the new spaces" (Mohammadifar and Hemmati, 2016: 100). At first glance, such descriptions may seem correct generally, but this description is not true about the collection of sites located in Tabas for the reasons that will be mentioned in the following lines. In fact, it seems that the production of residential space was a mindful act and with a previous plan (Fig. 16).

VII. 1. The first reason

As mentioned in the historical background of Tabas, the history of this region has always been involved in various wars and conflicts, and their inhabitants and settlements were the most vulnerable in these conflicts.

It is natural to assume, based on the available archaeological information and historiography of the

region, whether the structures are related to the Sassanid period or the arrival of Islam in Iran, that people have changed their settlement and way of life to avoid the invasion of foreigners. With their inherited knowledge from the creation of residential architectural forms by Sassanid Architects, they began to build this complex in the heart of the mountains and in the valleys to minimize access for invaders.

VII. 2. The second reason

Rituals related to places of worship have always played an important role in the beliefs and lives of the Iranian people. From the times of Mithraism and the ancient Zoroastrian rituals to the Islamic periods, the existence of permanent rivers in this desert region and fertile soil for agriculture has made this location the best place to settle and live. On the other hand, the presence of seasonal floods in this area has not made it possible to create such structures on the riverbed or at low altitudes. The followers of Mithraism believed that "Mehr" was born in a cave or from a rock (Vermaseren, 1963: 91). Also, natural caves were the first temples used to worship "Mehr", and in the absence of a natural cave, they made artificial caves and made their entrances look like natural caves (Razi, 2006: 269).

VII. 3. The third reason

Remains of ancient aqueducts in Kal-e Jenni and Kal Darresar routes, knowledge of aqueduct digging styles in the historical memory of the inhabitants of these regions, the existence of Troglodytic structures with water conduction function to make the aqueduct, similarity of local structures in the design structure of aqueducts with the architectural plan of the studied complexes, applying the architectural proportions producing these Troglodytic structures and also the regulation of living conditions in them, our current knowledge of how architects and people used to construct their buildings in the past using the reverse plan, prior designing of the arches on the ground and then implementing in the structure and other similar cases can be evidence that Troglodytic structures whether in terms of its function to direct water, being a place of worship or a place of residence; It has a detailed and pre-designed plan (Fig. 17).

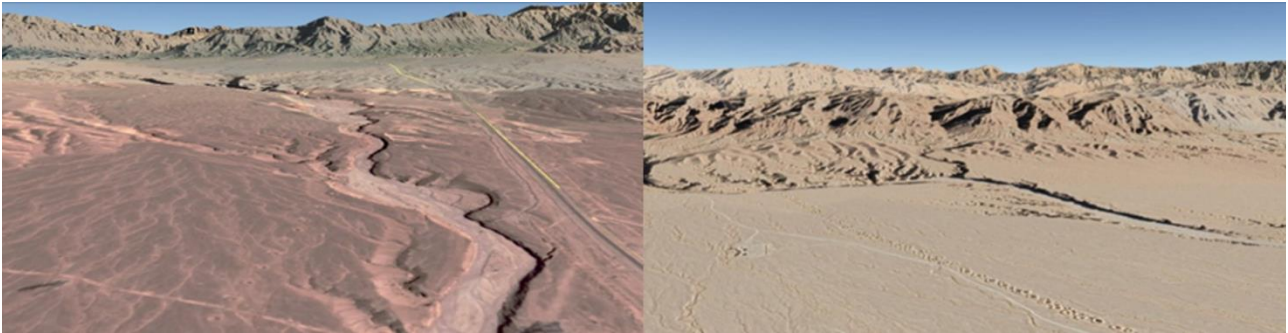


Figure 16. Right: The location of the aqueduct in Kal Darresar, Khoro village, Gabari house structure, and the camel mountains, Left: The location of the aqueduct in Kal-e Jenni, Azmighan village, Mehr Kadeh structure, and the camel mountains (Google Earth, 2021).

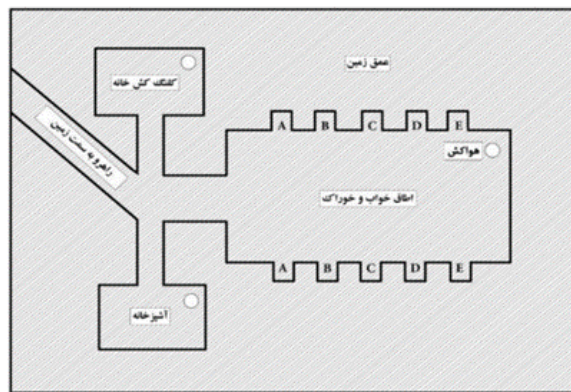


Figure 17. Horizontal section and different parts of a barn along an aqueduct around Yazd (Soleimani, 2015).

VIII. Conclusion:

In line with the research process, there were several issues before the authors, including the distinction and similarity between the building of Mehr Kadeh and the Gabri house. From the chronological point of view, all the Troglodytic caves were built coincidentally. Was the main function of the building residential, ritual, or aqueduct? In order to address these questions, the authors needed a coherent structure for research. Therefore, this descriptive-analytical structure of the research was based on surveying, reviewing, and field studies, referring to documents and related library studies, and attending interviews with experts related to handicraft structures. Considering the vastness and dispersion of the Troglodytic caves in Tabas and also the difficult access route to some of these buildings, a comparative study applied to examining two buildings in two stages. The first building was Mehr Kadeh in Kal-e Jenni, which was picked up and studied by authors, and the second building was known as Gabri House in Kal Darresar. By examining all the data obtained from the sum of the two mentioned places, three types of Troglodytic buildings with different functions were observed in these two locations:

1- The first type is residential structures, most of which are known in Kal Darresar as Gabri houses and are very similar in terms of the type of plans and internal components. Determining the exact chronology requires detailed archaeological experiments. However, to commence the first postulates according to the form and method of cutting, many similarities in both buildings are observable, and the formation of arches is close to the forms of the Sassanid era.

2- The second type is structures with hydraulic function or water transfer and conduction, which are manually drilled in dense sand and scattered along valleys and along the river.

3- The third type is structures with ritual functions related to Mithraism and rites related to the Sun, the case study of which was examined in Mehr Kadeh.

The extraordinary importance of this collection of handicrafts in the Tabas region makes it necessary to create an archeological database focusing on the handicraft samples discovered from the eastern parts of the Tabas region. In order to preserve and introduce them, designing an archaeological museum is a necessary decision. The identified and collected handicrafts can bring prosperity to the region by means of the tourism industry attracting domestic and foreign tourists. This can help researchers in conducting field surveys of all valleys leading to the Camel Mountains, hiding yet unidentified handicrafts of the Tabas region. The recognition, analysis, and providing the pathology of buildings to register, protect, and restore them as a unique heritage is a priority.

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