

# Studying The Architecture of Kandovan Rocky Village in Iran

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## Abstract

Human being has always met his physical needs in architecture and urbanism using compatibility to the environmental factors and also has paved the foreign hard condition creating different factors. One of these samples, rocky architecture, is a kind of stable architecture which is the result of the human habitats and the nature. In other words, rocky architecture is not created by the free and general materials and it is made by a natural rock and operates as free and general architecture for photographing. In this paper the architectural specifications of Kandovan rocky architecture like the causes of creation of the bounds and the kinds of it are studied. Also, the arrangement of the architectural elements at the bounds beside to each other and their knotting to nature and how the village habitats use the natural facilities and the natural resources for creating a life with favored conditions are studied.

Keywords: Kandovan, Bound, rocky architecture, native architecture

## 1. Introduction

Whenever we create a hole in a rock and expand it to create spaces like home or tomb it is called rocky architecture (Asadi & Meymand, 2008). Native architecture of Kandovan village is the rocky one. This village is registered in the national monuments contents because of its rocky architecture and special texture. Kandovan is one of the three rocky villages of the world which has made it be so attractive. Kandovan village architecture and the current life of the people in its old texture format is an exception in the world. Because no one lives in Cappadocia in Turkey in Turkey and Dacota in USA (both have rocky architecture). In fact what give Kandovan the old and historical identity are the 117 families and the homes inside the cone masses and pyramid rocks. It is possible to say that the appellation of Kandovan is because of the houses looking like hives which are placed inside of these cone rocks.

## 2. Rocky architecture

2-1. We classify the rocky architecture into two types from space and physics points of view:

1. The buildings which are totally freed; it means that first a part of mountain is cut and separated and different spaces are created in them. In these buildings it is possible to provide window and brightening gates. The external façade of them could be sculptures like many Indian temples or the tombs near Jerusalem.

2. The buildings which are provided inside the mountain. Here we just mean the internal space in the rock and the building cannot have any window or façade. The architecture of Kandovan village in Iran and capadokyain Turkey is of this type. It means that the rocks are not freed but the builders have created different spaces inside the mountain and no external façade or any changes on the mountain face have happened (Ayin and Kor Jamshidi, 2005)



Image 1: Cappadocia in Turkey



Image 2: Kandovan in Iran

### **3. The general specifications of Rocky Architecture**

- a. Openers and the brightening gates limited to the residential units
- b. Creating external access among the different applications of a residential unit
- c. Creating a simple space form as a room and creating a total combination beside arranging the units next to each
- d. Trying to minimize the human made walls
- e. Creating compact village texture
- f. The volcanic harsh layer stays as the main cover of the collection
- g. Following the natural physic
- h. Using the materials with high thermal capacity where it is needed to structure a wall
- i. Utilizing the stone dry arranged walls besides the natural bed and walls (Ataei Hamedani and Nik Nafs, 2012)

#### 4. Introducing the Kandovan

Kandovan is one of the unique and magical rocky villages in the world. (Ebrahimi Asl & Sattarzadeh,2013 ) Some of the historians relate the history of this village to the era before Islam. Inside these high hills the height of some of which reach 40 meters are folds, depositories and the rooms which are very beautiful. The thickness, quality and the stores of the hills and the cones are lahars which are created because of combination of the volcanic materials of Sahand mount with the mud of the torrential rain. The height of these cone and pyramid hills is more than 60 meters. The whole collection is located on the old alluvium and the Kandovan river has delved more than 10 meters of it and has made it go down.



Image 3: Aerial photo of Kandavan (Feyzi&Khakzad,2016)



Image No. 4: Aerial photo from Karans Kandovan area



Image No. 5: Kandovan ( Karami & Sharifi, 2017)

## 5. Bound

During thousands of years lavas are mutated out from the volcanic peaks of Sahand mount and the other volcanoes. These lavas are accumulated during the centuries and as time has passed a tuff stone layer is created in different layers. Tuffs and the lavas have changed in form by the wind, rain and snow during the thousands of the years and are changed into bounds and gradually the low resistant and less hard parts of it are gone and the current situation which resembles a miracle is created.



Image No. 6: Kandovan, a sample of the karans ( Karami & Sharifi, 2017)

### 5-1. Karan Types

Karans which have been created by volcanic eruption of Sahand Mountain form the basic foundation of Kandovan. They are 10-15 meters high and 5-8 meters in diameter (Ghobadiyan,2006)

The Karans are classified into two groups from the appearance form and the number of the floors.

a- From the appearance form

In Kandovan village we witness tens of the different karans, multiple ones, the couple ones, single ones, cone form and fusiform. The karans and the cones are in lahar form. (Gorji and Sanaei, 2008).

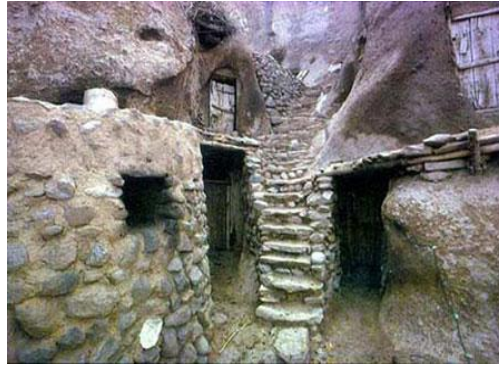


Image No. 7: stone steps

b- From the number of the floors

The number of the floors and the form of the internal spaces of the bounds are dependent to the volume and the form of them. The bounds are generally two floors but in some cases the karans are seen in three and four floors. The connection of the karans of the upper floors is possible by the beautiful steps made by the body of the karans and no connection exists in any other form. The only internal connection is seen in the late karans in which the internal stairway connects the ground level to the basement (depository) (Gorji & Sanaei, 2008).

## 6. The specifications and the characteristics of the rocky architecture of Kandovan

Explaining the rocky architecture of this village it is possible to say that all bounds are located in the southern skirts of Sahand Mountain. They are very intensified in texture and so the contact surface of any of the bounds with the external space is minimized. It is possible to access them via stairway and the ramps which go through the bounds. The bounds contain different spaces taking into consideration their dimensions and their height and they generally include 3-5 floors. The lower floors include the fold and the depository and the upper floors include the residing areas; this residing area includes living room, bedroom and kitchen. The surface of these bounds differs from 10 to 70 m<sup>2</sup> and in average they consist of 50 m<sup>2</sup>. The height of these areas from the ground to the ceiling is 2-220 m and their thickness is 1-2.5m.



Image 8: Ground Floor Plan -First Floor Plan

(Gorji, & Sanayi ,2008)

The needed light for these bounds is provided by the 1.5x1.2 m<sup>2</sup> windows; so, the light rate in the space is very low and the inner space is relatively dark. It is very difficult to create light in the lower floors because of the thickness and the high diameter of the bounds. The windows are made of wood and they are often in plaid form and little glass pieces are provided in them. First when the rocky houses formed, the windows were very small and this was because of providing the security. The windows are built in a form that no one can see inside the house but the habitats are able to see the environment (Pourmohammadi & Nasrollahzade, 2014). The internal surface of the walls are covered with the 2 cm plaster which helps the space be more lighter and also prevents the fall of the particles and the soil from the stones. The catchments are located on the passages and outside the bounds and the residence environment and some families have a common catchment. The catchments have some living rooms and depositories which depend on the slope of the ground.



Image No. 9: Internal space ( Karami & Sharifi, 2017)

## 7. Thermal operation of Rocky architecture of Kandovan village

1. The thermal swinging is minimized by increasing the depth of the building location in the ground or using the thermal germ as a resource of saving energy and the time delay factor.
2. The bounds hold suitable thermal operation in comparison to the brick houses of the same area and it provides the possibility of saving in average 4 percent.
3. Although there is no heating tool at the coldest month of the year (January) in some of the bounds, the degree of the inner space is affected by the thermal germ in 30 percent of the situations which is the thermal comfort and in 70 percent of the situations the houses use the inactive solar energy to provide the thermal comfort limits; in other words the need for thermal energy to reach the thermal comfort is very low (Ayin and Kord Jamshidi, 2005).

## 8. The climatic solutions in Kandovan architecture

1. The bounds directions are toward south and the arrangement of the bounds next to each other causes wind to be broken and as the doors and the windows are located at the internal space of the wall, they prevent entrance of snow and rain into the bounds.
2. The habitats of the Kandovan area have tried to create a calm environment and have structured their houses on the first and second floors and have allocated the ground floor to folds.
3. Also they have allocated the ground floor or basement to the folds to use the heat of that space for heating their house.

4. The windows are located mostly on the south side of the bounds to make the houses use the natural light and heat of the outer space during the day and there is no hole in northern sides.

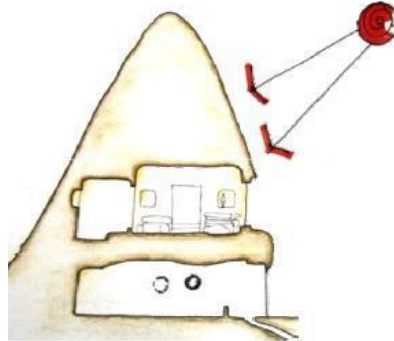


Image No. 10: South facing window (Gorji, & Sanayi ,2008)

5. The bounds operate well from thermal point of view in comparison to the brick houses of the same area and in average they provide the possibility of 60 percent savings.

6. In some of the houses the bounds have not only created the rooms but also have created a vast balcony before the windows. The doors and the thin windows open to these balconies. Women have decorated the balconies with the flower pots and sometimes they thread between them and hang colorful clothes on them to dry them. The shapes of the balconies are different and they mostly follow the mountain shape dug from and they are seen just on the southern side (Gorji & Sanaei, 2008).



Image No. 11: Balcony

6. There is an intense noon sun at the southern bounds of the village which makes the troughs appear more.

7. There is no light in the lower floors so they are not selected as living areas and they are also humid places because of the said reason. Also alga has grown in these spaces.

9. The environmental threating factors in Kandovan village

1- The current new structures which lack harmony beside the exclusive rocky architecture, the limitless interferences which are not pre-programmed in cultural heritage organization not only encroaches the urban heritage, original textures and the exclusive rural and native texture but also go through elimination of these not returnable deposits (Masoud and Beigzadeh Shahraki, 2012).



Image No. 12: Combination of the rocky architecture with the modern structures

2- The light and heavy cars are in traffic in this area and the vibration caused by their movement lead to serious physical damages to the bounds and they also free a large amount of the chemical, acidic and poisonous compounds and elements which cause bounds be sensitive to the environmental factors.

3- Studying the change diagram of the population in the late decades in this village proves that the family growth rate in the village is a negative ratio which says that the habitats of the village are on emigration to the adjacent urban areas and this leads to elimination of the potential work forces of this area and this also leads to non-compensable damages (Pirouzfard & Pirouzfard, 2002)

## 10- Conclusion

Climate was one of the important effective factors in the pre-modern architecture. This is the point which is forgotten in the modern architecture and is replaced by the physical and applicative approaches. In post-modernism period this field is not studied although some post-structuralism abstraction theory bases are created but the climatic and native approaches are attended in identification of the stable development and referring the past time and checking the native ancestors architecture it is possible to know how the ancestors have defeated the elements like climatic problems, weather and security totally or semi-totally. In the Kandovan rocky structure subject it is clear that houses are formed according to the needs of the habitats and is an economic interesting replacement in environment. Besides, no costs are needed to maintain these structures. In rocky structure the physical elements are selected from the totally natural factors and a special combination is made by the physical form and the behavior of the human being. Here we have to pay attention to this point that security is the most important factor in formation of the rocky structure and is under effects of the geographic factors. This means that without the geographic conditions of the village the habitats would not be able to meet their own security needs.

## 11. Resources

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