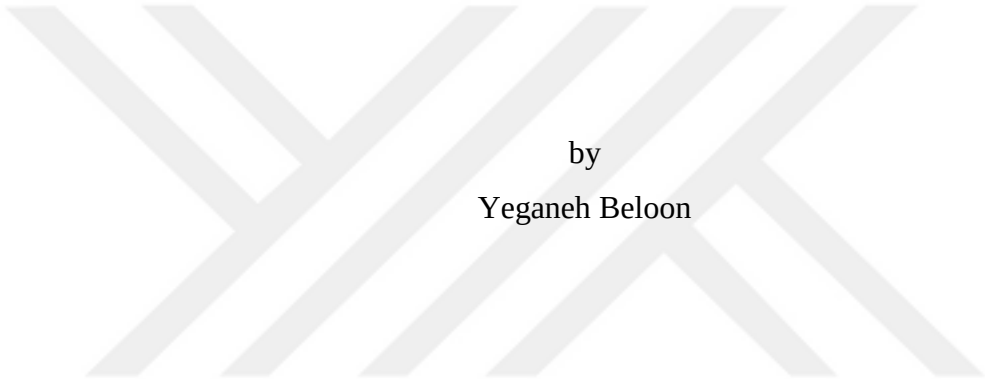


CONSERVATION OF THE KANDOVAN NATURAL HERITAGE SITE, IN IRAN



by
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CONSERVATION OF THE KANDOVAN NATURAL HERITAGE SITE, IN IRAN

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ABSTRACT

CONSERVATION OF THE KANDOVAN NATURAL HERITAGE SITE, IN IRAN

Kandovan is a small town in Iran, in the south of Azerbaijan. It has a unique geological structure; the bedrock is of volcanic origin and consists of pyroclastic (tuff, lapilli, volcanic bombs, etc.). Its natural appearance has partially changed over time and a cultural landscape has emerged.

As in Cappadocia, which is located in Turkey and is on the world heritage list, individual volcanic hills called "karan" have been carved by people to create architectural spaces (housing, barns, warehouses, etc.) and a vernacular architectural identity that local people have organized with local building materials over time in Kandovan, and contributed to this geological formation. Its natural appearance has partially changed over time and a cultural landscape has emerged. However, due to rapid and uncontrolled urbanization and tourism, structural and functional deteriorations are observed in areas used as hotels and residences and gaining a local architectural identity, today. Kandovan should be planned and protected with priority conservation policies.

One of the main areas of work of UNESCO is protecting and promoting cultural and natural heritage. Natural areas, monuments, and historical sites of international importance can gain "World Heritage" status. The missions of these global and national organizations, such as UNESCO's world heritage, encourage countries to protect their natural and cultural heritage, provide technical assistance and training to their countries, and establish international cooperation. This thesis aims to examine the issues related to the protection of natural heritage in the world and to comparatively examine whether the Kandovan nature reserve in Iran can be listed in the UNESCO Cultural / Natural Heritage List.

The thesis aims to examine the geological and architectural values of the Kandovan Natural Heritage area, explore the problems, and develop conservation solutions.

ÖZET

DOĞAL MİRAS ALANININ KORUNMASI İRAN'DAKİ KANDOVAN

Kandovan, İran'da, Azerbaycan'ın güneyinde küçük bir kasabadır. Eşsiz bir jeolojik yapıya sahiptir; ana kaya volkanik kökenlidir ve piroklastikten (tuf, lapilli, volkanik bombalar vb.) oluşur. Doğal görünümü zamanla kısmen değişmiş ve kültürel bir manzara ortaya çıkmıştır.

Türkiye'de bulunan ve dünya mirası listesinde yer alan Kapadokya'da olduğu gibi, "karan" olarak adlandırılan tek tek volkanik tepeler, insanlar tarafından mimari mekanlar (konut, ahır, depo vb.) ve yerel bir mimari kimlik oluşturmak için oyulmuştur. Kandovan'da zamanla insanlar yerel yapı malzemeleri ile örgütlenmişler ve bu jeolojik oluşuma katkıda bulunmuşlardır. Doğal görünümü zamanla kısmen değişmiş ve kültürel bir manzara ortaya çıkmıştır. Ancak günümüzde hızlı ve kontrolsüz kentleşme ve turizm nedeniyle otel ve konut olarak kullanılan ve yerel mimari kimlik kazanan alanlarda yapısal ve işlevsel bozulmalar görülmektedir. Kandovan, öncelikli koruma politikaları ile planlanmalı ve korunmalıdır.

UNESCO'nun temel çalışma alanlarından biri de kültürel ve doğal mirasın korunması ve tanıtılmasıdır. Uluslararası öneme sahip doğal alanlar, anıtlar ve tarihi alanlar “Dünya Mirası” statüsü kazanabilir. UNESCO'nun dünya mirası gibi bu uluslararası ve ulusal kuruluşların misyonları, ülkeleri doğal ve kültürel miraslarını korumaya teşvik etmek, ülkelerine teknik yardım ve eğitim sağlamak ve uluslararası işbirliği kurmaktır. Bu tezin amacı, dünyadaki doğal mirasın korunması ile ilgili konuları incelemek ve İran'daki Kandovan tabiatı rezervinin UNESCO Kültürel / Doğal Miras Listesi'nde listelenip listelenemeyeceği konusunu karşılaştırmalı olarak incelemektir.

Tezin amacı Kandovan Doğal Miras alanının jeolojik ve mimari değerlerini irdelemek sorunlarını incelemek ve koruma çözüm önerileri geliştirmektir.

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LIST OF SYMBOLS/ABBREVIATIONS

HCAUP	Higher Council for Architecture and Urban Planning
HUDO	Housing and Urban Development Organization
MHUD	Ministry of Housing and Urban Development
NHL	Natural Heritage List
SVR	Surface Volume Ratio
UN	United Nations
UNESCO	United Nations Educational Scientific Cultural Organization
WH	World Heritage
WHL	World Heritage List
XRD	X-Ray Diffraction

1. INTRODUCTION

International and national organizations, such as UNESCO's world heritage, have missions that encourage countries to protect their natural and cultural heritage, provide technical assistance and training, and promote international cooperation. Kandovan Village is a distinctive geological heritage site with conical rocky hills at the foot of Sahand Mountain, west of Nur Mountain, 50 km south of Tabriz (18 km from Üskü) and north of Arshad Mountain in East Azerbaijan. Local people settled in the area during different time periods, using it as a residential area. The Urmia River, which forms green recreation zones on both sides of its banks, flows in front of the village. Kandovan is an eroded plateau located in a previously active volcanic region. The topography is a result of erosion by wind and water on volcanic tuff sediments. Examples of natural formations are pillars, columns, towers, and spires. Within these rock formations, people have carved caves that served as refuges, residences, storage, and places of worship dating back to the 11th century. Local people carved houses from easy-to-carve tuff conical structures they called "Karan" that were comfortable to live in. Sites of international cultural and environmental significance are eligible for World Heritage status. The preservation and promotion of cultural and environmental heritage is among UNESCO's primary pursuits.

1.1. AIM OF THE THESIS

Kandovan Natural Heritage Site in Iran, which has a high density of natural features, is deteriorating due to alterations and uncontrolled tourism growth. This thesis will investigate the protection of natural heritage sites by UNESCO, providing a general overview. The thesis will then focus on the conservation values and decisions made for the Kandovan national heritage site in order to outline a policy for its conservation. This thesis aims to define goals for conserving the natural significance of Kandovan. Short and long-term issues will be addressed through scientifically analytical conservation planning for future generations.

The objective of this thesis is to examine issues related to the protection of natural heritage in general, and to comparatively explore whether the Kandovan nature reserve in Iran is eligible for listing in the UNESCO natural heritage list.

2. NATURAL HERITAGE AND CONSERVATION

Heritage conservation involves actions or procedures that aim to preserve the defining elements of a cultural resource, retain its heritage value, and extend its physical lifespan. Heritage conservation does not entail freezing a building in time, turning it into a museum, or restricting property owners from using their properties. Rather, it aims to maintain and enhance the value of buildings by preserving their original construction form and architectural elements. Restoration is preferred over replacement or demolition, and if restoration is infeasible, scale, period, and character are respectfully recreated [1].

Heritage conservation provides tangible benefits for property owners, businesses, developers, and the entire community [1].

- Heritage conservation and designation can increase property values, both for the restored building and the surrounding properties.
- Heritage conservation can encourage tourism and help local businesses attract customers. Communities can create the image of their town or city around the historical elements they retain. Retaining the historic integrity of a neighbourhood or town creates an ambiance that can attract people, which can, in turn, attract businesses. A small town without a heritage main street may attract only a few people.
- Conservation practices stimulate the local economy by reducing external material procurement and increasing labor-intensive work by local trades.
- With appropriate programs and policies in place, businesses, and building owners can leverage government support to preserve and renovate heritage buildings, despite the limited incentives available in New South Wales.
- Conservation minimizes waste from construction and demolition activities while utilizing less than half of the energy required for new construction. Thus, conservation practices are sustainable.

- Conserving heritage buildings leads to investment in local communities. Investments produce benefits in the present while providing future generations with invaluable resources.
- Heritage conservation enhances urban environments and imbues them with their unique character.

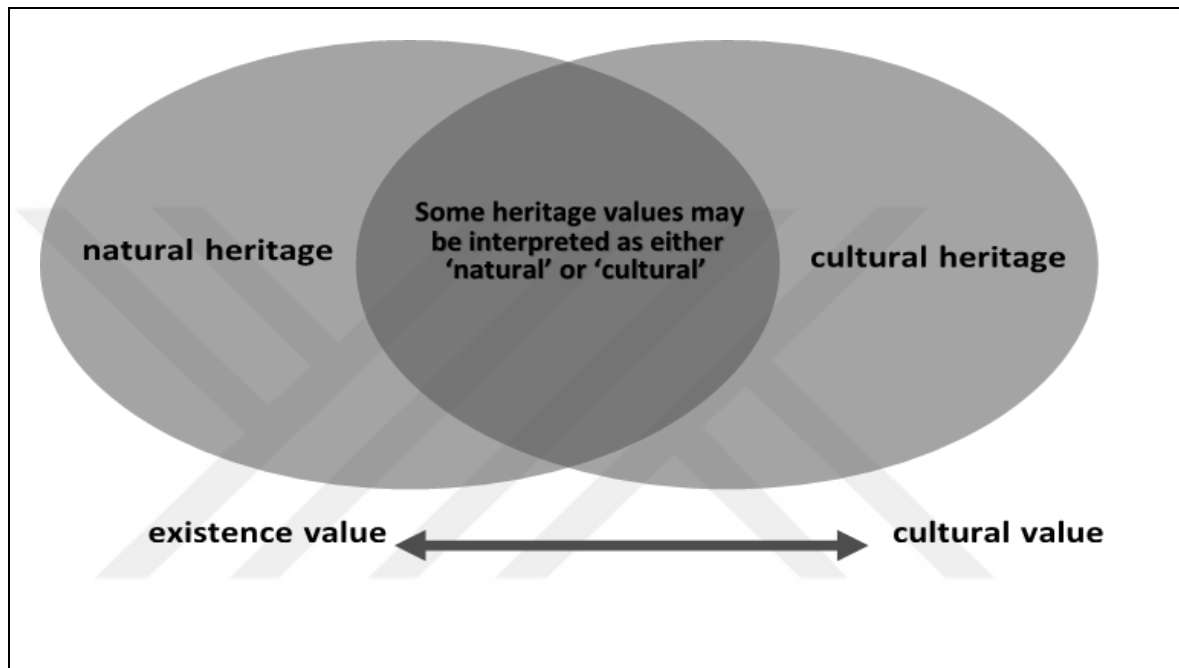


Figure 2.1. Relationship with cultural and natural heritage [1].

2.1. NATURAL HERITAGE AND CULTURAL LANDSCAPE

World Heritage Sites are areas or landmarks that receive legal protection under an international convention administered by UNESCO (the United Nations Educational, Scientific, and Cultural Organization). It is considered to be of exceptional value to mankind because of its significance in terms of culture, history, science or another form. They are unique landmarks that are identifiable geographically and historically and hold significant cultural or physical value.

World Heritage Sites encompass diverse locations, ranging from ancient ruins and historical structures to cities, deserts, forests, islands, lakes, monuments, mountains, and wilderness

areas. These sites can serve as evidence of remarkable human achievements or exceptional natural beauty.

As of January 2023, UNESCO has designated 1,157 World Heritage Sites across 167 countries. UNESCO selects and designates these sites, which receive legal protection to ensure their conservation and safeguarding for future generations. These sites are vulnerable to risks such as trespassing, unmonitored access, neglect, or lack of proper management without proper recognition and protection.

The UNESCO World Heritage Program is responsible for maintaining the list of World Heritage Sites, and the World Heritage Committee oversees it. The committee comprises of 21 elected 'states parties' who are responsible for cataloging, naming, and conserving sites with exceptional cultural or natural significance. The program operates within the framework of the "Convention Concerning the Protection of the World's Cultural and Natural Heritage" adopted by UNESCO in 1972. With ratification by 194 states, this convention has become one of the most widely recognized international agreements and the world's most popular cultural program.

2.1.1. Natural Heritage Sites

Natural heritage refers to the earth's natural features, ecosystems, and landscapes that possess outstanding universal value and are considered essential to humanity. It encompasses the diversity of biological, geological, and ecological systems and the interplay between them. Natural heritage includes a wide range of elements, such as [2]:

Biodiversity: this refers to the variety of living organisms found on earth, including plants, animals, fungi, and microorganisms. Biodiversity encompasses genetic diversity, species diversity, and ecosystem diversity, all of which are crucial for the functioning of ecosystems and the survival of species.

1. Protected areas: these are designated areas of land or sea that are managed to conserve nature and its associated cultural values. Protected areas can include national parks, wildlife reserves, nature reserves, marine protected areas, and other similar designations.

2. Landscapes: natural landscapes with exceptional scenic, ecological, or cultural value are considered part of the natural heritage. This includes diverse landforms, such as mountains, forests, deserts, wetlands, rivers, and coastal areas.
3. Geological and geomorphological features: these include unique geological formations, such as mountains, canyons, caves, volcanoes, geysers, and other landforms shaped by natural processes over time.
4. Ecosystems and habitats: natural heritage comprises various ecosystems, such as forests, grasslands, coral reefs, mangroves, tundra, and freshwater or marine ecosystems. Each ecosystem supports a unique assemblage of species and plays a vital role in maintaining the overall balance of nature.
5. Natural phenomena: extraordinary natural events and phenomena, such as waterfalls, geysers, meteor showers, eclipses, and migrations of animals, can also be considered part of the natural heritage [2].

2.1.2. Cultural Landscape Sites

The cultural landscape concept covers the interaction between humans and their natural environment, whereby human activities and cultural practices shape and influence the physical land features. It refers to the combined effects of nature and culture and how they have been shaping the landscape over time [2].

According to UNESCO, a cultural landscape is the combined works of nature and humans forming a dynamic and evolving landscape, resulting from the interaction between people and their environment. A cultural landscape includes not only tangible elements like buildings, structures, and monuments but also intangible aspects such as customs, traditions, and spiritual values [2].

An example of a prominent cultural landscape is the historic city of Venice, Italy. The city's rich cultural heritage and long history are reflected in its unique urban layout, intricate canal system, and architectural marvels. The interaction between humans and the natural environment, along with the adaptation to the water-based topography, have created a distinct cultural landscape that attracts millions of visitors annually [3].

The cultural landscape approach acknowledges that landscapes are not static entities but are dynamic systems that undergo evolution and transformation over time. There is an emphasis on a holistic and integrated approach to landscape management that considers the cultural, social, economic, and environmental aspects [3].

This study will examine the transformation of Kandovan, a small town in Iran, into a cultural landscape. The study aims to analyze the evolution of Kandovan into a cultural landscape over time by examining its geological structure, historical development, and the interaction between human activities and the natural environment [4].

Scholarly articles, books, and relevant studies on cultural landscapes and their conservation will be referred to in support of this research. Furthermore, the principles and guidelines set forth by international organizations like UNESCO, committed to protecting and enhancing cultural and environmental heritage sites worldwide, will be consulted [5].

2.2. NATURAL HERITAGE SITES IN THE LIST OF UNESCO'S WHL

Its establishment aim on November 16, 1945, was to promote international collaboration in the fields of education, science, culture, and communication. UNESCO's main objective is to facilitate peace and security by promoting cooperation among nations in these fields. 193 member states or countries that have ratified or acceded to its constitution operate along with UNESCO, which has 12 associate members. Furthermore, UNESCO partners with different organizations, including non-governmental organizations, intergovernmental organizations, and the private sector, to execute its programs and initiatives. The organization, headquartered in Paris, France, has a decentralized structure with 53 field offices located around the world. Regional and cluster offices allow UNESCO to work closely with member states and carry out activities at regional and national levels. Additionally, UNESCO relies on 199 national commissions established by member states to serve as a link between the organization and national governments. UNESCO promotes education, protects cultural heritage, supports scientific research, fosters freedom of expression, and encourages intercultural dialogue through its diverse programs and initiatives. Its goal is to enhance global understanding and cooperation to build inclusive and sustainable societies [2].

That statement is accurate. The responsibility of identifying and designating sites of exceptional universal value as World Heritage Sites lies with the World Heritage Committee of UNESCO. These sites, whether natural or cultural, are acknowledged for their remarkable importance to humanity as a whole. As of March 2012, UNESCO had listed 936 World Heritage Sites. Out of those, 725 sites were cultural ones, representing locations of historical, architectural, or cultural significance. Cultural sites of such nature may entail ancient ruins, historic towns, religious monuments, or other human-made structures that bear meaningful cultural value [2].

2.2.1. Examples for the Listed Natural Heritage Sites in the World

2.2.1.1. *Tassili n'Ajjer*

This location is situated in a peculiar lunar terrain with immense geological significance and harbors one of the most significant assemblages of ancient cave art globally. The depictions and etchings, documented over 15,000 times, show shifts in the climate, animal migrations, and the development of human existence on the fringes of the Sahara. The span ranges from 6000 BC to the early centuries of the current era. The remarkable scenic allure of this location lies in the eroded sandstone formations that give rise to captivating rock forests [6].

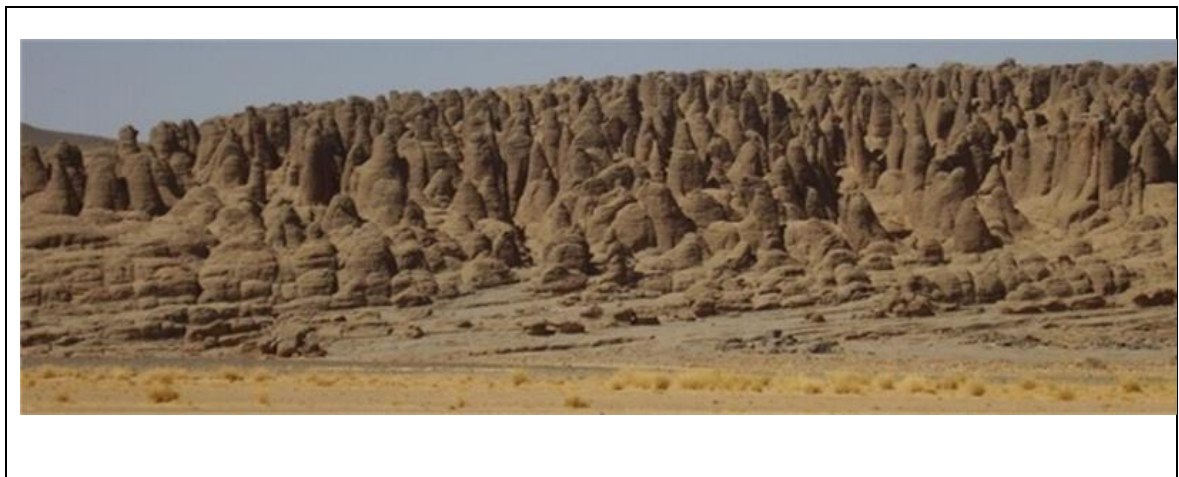


Figure 2.2. Natural and Cultural Heritage of the Ohrid region [6].

2.2.1.2. Mount Emei Scenic Area, including Leshan Giant Buddha Scenic Area

The first Buddhist temple in China was built in the picturesque surroundings of Mount Emei, situated in Sichuan Province, during the 1st century A.D. With the addition of numerous temples over time, the site has evolved into one of the most sacred places in Buddhism. As centuries passed, the collection of cultural treasures expanded, with the Giant Buddha of Leshan being the most remarkable among all. The colossal sculpture, overlooking the convergence of three rivers, was meticulously carved into the side of a hill during the 8th century. The statue holds the distinction of being the world's largest Buddha statue, standing at a height of 71 meters.

Mount Emei is famous for hosting a diverse range of vegetation, ranging from subtropical to subalpine forests. The mountain hosts a diverse range of plant species. It is noteworthy that some of the trees in the region have prospered for more than a millennium, enhancing the area's inherent magnificence [6].

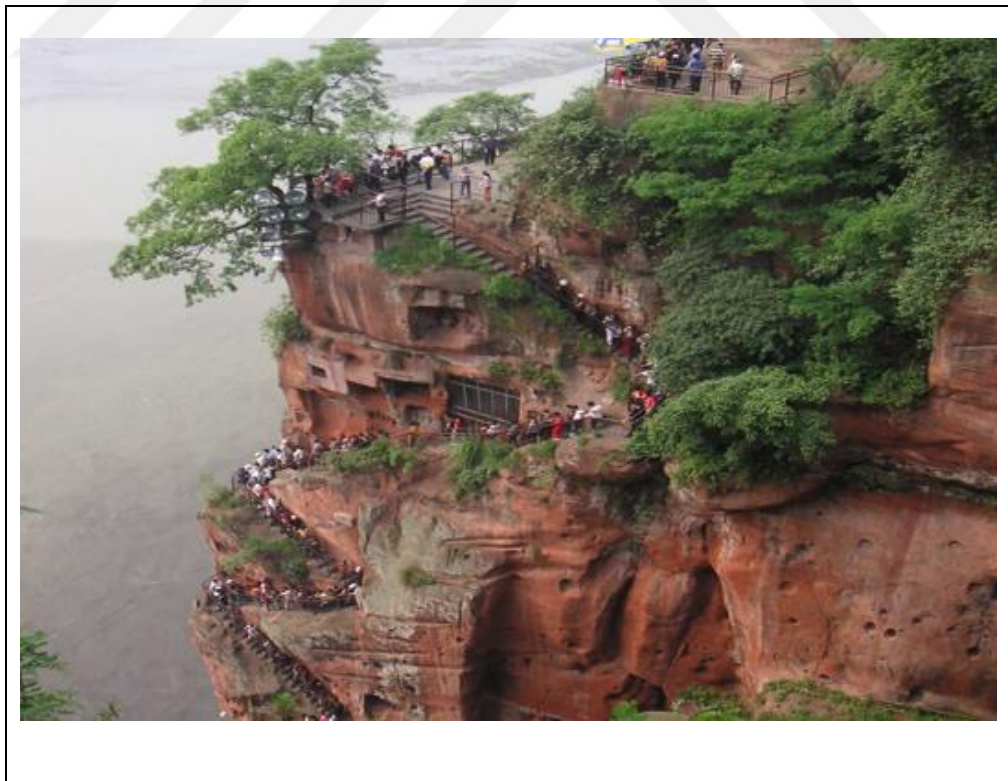


Figure 2.3. Mount Emei Scenic Area, including Leshan Giant Buddha Scenic Area [6].

2.2.2. Examples for the Listed Natural Heritage Sites in Iran



Figure 2.4. Google Earth, Iran [6].

2.2.2.1. *Lut Desert*

The Lut Desert, also referred to as Dasht-e-Lut, is situated in the southeastern region of the country and is a significant natural phenomenon. From June to October, this dry subtropical region is subject to significant aeolian erosion caused by strong winds carrying sediment. The result of these winds is the remarkable display of aeolian yardang landforms which feature enormous undulating ridges and create stunning vistas. The region also includes vast areas of stony deserts and dune fields.

The Lut Desert provides evidence of the ongoing geological processes that shape our planet. The desert is an outstanding example of natural forces at work, demonstrating the captivating dynamics of wind erosion and the formation of exceptional landforms. The exceptional combination of these geological features makes the Lut Desert a truly captivating and unique destination [6].



Figure 2.5. Lut Desert [6].

2.2.2.2. *Hyrceanian Forests*

The Hyrcanian forests form a unique wooded landmass that extends for 850 kilometers along the southern shore of the Caspian Sea. These deciduous forests have a rich history dating back 25 to 50 million years when they once covered a significant portion of the Northern Temperate region. Over time, these ancient forested areas experienced retreat during the Quaternary glaciations and later spread as the climate became milder.

The Hyrcanian forests are notable for their remarkable floristic biodiversity. About 44% of Iran's vascular plant species are present in the Hyrcanian region, despite it only covering 7% of the country's total land area. The ecological importance of the Hyrcanian region is due to its diverse range of plant life.

Additionally, a diverse variety of wildlife is supported by this forested region. The Hyrcanian region has been documented to have 180 bird species that are typical of broad-leaved temperate forests, along with 58 recorded mammal species. The Persian Leopard (*Panthera pardus tulliana*) is among these species and is considered iconic, adding further to the region's ecological importance and allure. The Hyrcanian forests have great significance

both locally and globally due to their ancient heritage, exceptional biodiversity, and the presence of unique animal species. As a valuable natural treasure, the Hyrcanian forests demand preservation and conservation efforts [6].



Figure 2.6. Hyrcanian Forests [6].

2.3. CONSERVATIONS TECHNIQUES FOR THE NATURAL HERITAGE SITES

These conservation practices and techniques can indeed be applied in Natural Heritage Sites to ensure the protection, maintenance, regeneration, restoration, and enhancement of their natural significance. Let's briefly discuss each of these practices [2]:

- A. **Protection:** This involves implementing measures to prevent or minimize impacts that could degrade the natural significance of the site. It aims to safeguard the site and facilitate its regeneration.
- B. **Maintenance:** Maintenance activities should be in line with the conservation processes adopted for the site, ensuring that they do not detract from its natural significance. This includes ongoing management to preserve the site's ecological integrity.
- C. **Regeneration:** Regeneration relies on natural processes to facilitate recovery from disturbance or degradation. It does not involve physical intervention but should be

accompanied by monitoring and protection measures that avoid creating further degradation.

- D. Restoration: Restoration is appropriate when there is sufficient evidence of an earlier state that can guide the conservation process. It involves returning the biodiversity, geodiversity, or habitat of the site to a previous state consistent with its natural significance.
- E. Reinstatement: Reinstatement is applicable if there is evidence that certain species, habitat elements, or geodiversity features previously existed naturally at the site. Returning them contributes to maintaining the site's natural significance and discontinuing processes threatening their existence is crucial.
- F. Enhancement: Enhancement is suitable if introducing additional habitat elements, geodiversity elements, or individuals of an organism is necessary for retaining the natural significance of the site. However, it should not alter species diversity, genetic diversity, or geodiversity in a way that diminishes the site's natural significance.
- G. Preservation: Preservation is suitable when the natural significance of a site is fully manifested in its existing stage of natural succession or geodiversity. It involves minimal intervention necessary to suspend natural processes or succession without adversely affecting surrounding ecosystems.
- H. Modification: Modification is acceptable when a site needs to accommodate non-conservation uses, as long as the natural significance is retained, and it doesn't adversely affect the significance of other places. The modification should be limited to what is essential for the intended use, aligned with conservation policies.
- I. Presentation: Presentation involves interpreting the natural significance of the site to visitors and fostering appreciation, respect, and support for the conservation objectives; it may not be appropriate for all sites, considering factors like security, privacy, or cultural significance.
- J. Monitoring: Monitoring is essential for assessing the effectiveness of conservation programs, re-evaluating decisions, and improving conservation practices. It involves keeping adequate records and allows for ongoing review and adjustment of conservation efforts.

These practices and techniques collectively contribute to the dynamic conservation of Natural Heritage Sites, ensuring their protection, preservation, and sustainable management for future generations.

2.4. CONSERVATION AND MANAGEMENT OF THE CULTURAL AND NATURAL HERITAGE IN IRAN

In Iran, there are various national and international laws and regulations in place to safeguard and preserve cultural and natural heritage. These laws and regulations fall into the following categories [7]:

1. Legislation governing general cases in the country, including cultural and natural heritage: Iran has overarching laws and regulations that apply to the protection of cultural and natural heritage within the country. These laws may encompass broader aspects of heritage preservation and conservation.
2. Legislation specifically concerning cultural heritage: Iran has specific laws and regulations dedicated to the preservation and conservation of cultural heritage. These laws may cover areas such as the identification, documentation, restoration, and management of cultural sites, monuments, artifacts, and intangible heritage.
3. International legal instruments and recommendations: Iran adheres to international conventions, treaties, and recommendations related to the protection and conservation of cultural and natural heritage. These international agreements provide guidelines and frameworks for the preservation of heritage and may include aspects such as site management, heritage tourism, sustainable development, and community involvement.

By having a combination of national legislation and adherence to international legal instruments, Iran aims to ensure the effective protection, conservation, and sustainable management of its cultural and natural heritage. These laws and regulations play a crucial role in safeguarding the country's rich heritage for future generations and promoting responsible tourism and sustainable development practices.

2.4.1. National Laws for the Conservation of Cultural and Natural Heritage

Examples of the national laws and regulations relevant to cultural heritage are [8]:

1. Article 83 of the Constitution Law of Islamic Republic of Iran (1920) recognizes the importance of cultural properties. Transferring the ownership of public monuments and properties considered to be part of the national heritage is forbidden, unless approved by the Parliament. However, transfer of ownership of monuments and cultural properties officially recognized as insignificant is possible.
2. Article 26 of the Iranian Civil Law (1939) prohibits private ownership of significant cultural property.
3. The Islamic Penal Law is an effective law for practical protection of cultural heritage. A full chapter deals with crimes regarding cultural heritage (from Article 588-569) in the Islamic Penal Law (1996).

Iran has implemented several key laws and regulations to protect and conserve its cultural and natural heritage. Here are some notable examples [8]:

1. The Law for Protection of National Heritage (1930): This law is the first comprehensive legislation concerning various aspects of cultural heritage. It outlines procedures for identifying cultural heritage properties, mandates the creation of a National Heritage List, establishes criteria for legal protection of listed properties, and provides provisions for archaeological excavations.
2. The By-law Concerning Prevention of Unauthorized Excavation (1980): This regulation imposes penalties for unauthorized excavation or purchase of excavated historical objects. It is complemented by provisions in the Islamic Penal Law. Additionally, there are regulations that restrict the production, purchase, use, or advertisement of metal objects.
3. The Law Concerning Acquisition of Land, Building and Premises for Protection of Historic Properties (1969): This law provides further regulations for acquiring properties of historic or cultural significance, ensuring their protection and preservation.

4. The Law for Establishing the Iranian Cultural Heritage Organization (1979): This law plays a crucial role in managing the country's cultural heritage comprehensively. It establishes the Iranian Cultural Heritage Organization as a powerful institution responsible for overseeing and safeguarding cultural heritage across Iran.

5. The Law for Establishing the Higher Council for Architecture and Urban Planning (1987): This law pertains to both cultural and natural heritage. It focuses on architectural and urban planning aspects and contributes to the preservation and management of cultural and natural heritage sites.

These laws and regulations, among others, provide a legal framework for the protection, conservation, and management of Iran's cultural and natural heritage. They demonstrate the country's commitment to safeguarding its rich historical and natural treasures for present and future generations [8].

2.4.2. National Organisations for the Conservation of Cultural and Natural Heritage in Iran

The process for the approval of physical plans by the Higher Council for Architecture and Urban Planning (HCAUP) in Iran involves several steps. Here is a summary of the procedure:

1. Commissioning and Preparation: A qualified consultant is appointed by the provincial Housing and Urban Development Organization (HUDO) to prepare the physical plan for a specific urban area.
2. Provincial Planning Council Review: The prepared plan is first reviewed and evaluated by the Provincial Planning Council, which consists of relevant local authorities and stakeholders. Their input and feedback are taken into consideration.
3. Concurrent Review: The plan undergoes concurrent review by two entities: the technical committee of HCAUP and the office of Physical Plans at the Ministry of Housing and Urban Development (MHUD). These entities assess the plan's compliance with urban development policies, zoning regulations, and other relevant criteria.

4. Final Submission: After the concurrent review process, the plan is submitted to the HCAUP for final approval. The HCAUP consists of various ministers, including the Minister of MHUD, as well as voting members such as the heads of the Management and Planning Organization, the Cultural Heritage, Handicrafts, and Tourism Organization (ICHHTO), and the Department of Environment.

5. Approval Decision: The HCAUP reviews the plan and makes a decision regarding its approval. They consider factors such as overall urban development policies, by-laws affecting zoning and land use, and adherence to urban criteria, regulations, and by-laws.

The diagram mentioned in the information provides a visual representation of the procedure for the approval of physical plans by HCAUP. It's important to note that this information is based on the provided text and might not reflect any recent updates or changes to the process.

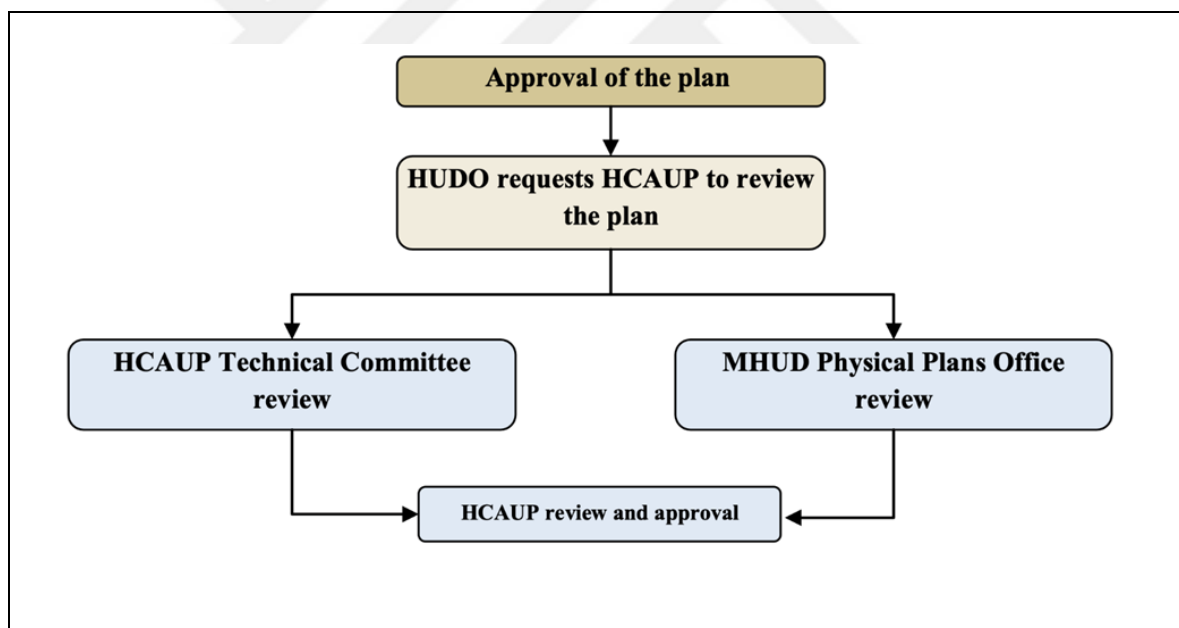


Figure 2.7. The procedure for approval of development plans by HCAUP [7].

2.4.3. Adapted International Charters for the Conservation of Cultural and Natural Heritage in Iran

In the I.R., international conventions regarding the conservation and protection of cultural heritage are incorporated into national legislation upon accession to those conventions. Once

Iran becomes a party to an international convention, it becomes obligatory to adhere to the requirements outlined in that convention. Iran has acceded to several important UNESCO conventions and other international charters concerning the preservation of cultural heritage. Some notable conventions that Iran has acceded to include:

1. Convention Concerning the Protection of the World Cultural and Natural Heritage (1972): Iran is a party to this convention, which aims to safeguard and preserve cultural and natural heritage sites of outstanding universal value.
2. Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property (1954) and its Protocol I (1954) and Protocol II (1999): Iran has acceded to this convention and its protocols, which aim to prevent the illicit trafficking of cultural property and ensure the return of stolen or illegally exported cultural artifacts.
3. Convention for the Safeguarding of the Intangible Cultural Heritage (2003): Iran is a party to this convention, which focuses on the safeguarding and promotion of intangible cultural heritage, such as traditions, rituals, performing arts, and oral traditions.

By acceding to these conventions, Iran demonstrates its commitment to international cooperation and collaboration in the preservation and protection of cultural heritage. These conventions provide guidelines and frameworks that support the efforts of Iran in safeguarding its cultural treasures and promoting cultural diversity [8].

3. KANDOVAN VILLAGE AS A NATURAL HERITAGE SITE IN IRAN

Kandovan village, located in East Azerbaijan province, Iran, is a unique troglodyte village that stands out from similar structures around the world. While there are other rock houses like those in Cappadocia, Turkey, and cliff dwellings in Mesa Verde, Colorado, USA, Kandovan village has its own distinct features. The village has a history of more than 850 years and is known for its houses and barns carved directly into the pyramidal cliffs. The architectural techniques employed in Kandovan village are practical and innovative, utilizing the natural dome-shaped cliffs to create habitable spaces. The village is nestled in the Sahand mountains, known for their fertile pastures, which attract nomadic tribes in search of food for their livestock. Archaeologists David Roll and Peter Martini suggest that Kandovan village dates back to ancient times, indicating its historical significance and long-standing presence in the region. The village stands as a testament to the ingenuity and adaptability of human settlement in challenging environments. It's worth mentioning that the provided information is based on the given text and may not include the latest developments or research regarding Kandovan village [9].



Figure 3.1. The Map of Iran And The Location Of The Kandovan [9].

Kandovan's unique and breathtaking natural environment has always been a magnet for humans, especially during times of turmoil and the search for refuge. The village's strategic location near the main summit of the Sahand mountain range has provided it with several advantages. The Sahand mountain range is known for its 17 peaks that exceed 3000 meters in altitude, and it is a source of numerous rivers and streams that flow through the area, providing irrigation for nearby farming communities. Furthermore, the Sahand mountains with their abundant natural beauty have become a significant tourist attraction, offering opportunities for mountain climbing and winter sports. This potential for tourism development can be a valuable source of income for the village of Kandovan. The continuous flow of water from the volcanic Sahand mountains has played a significant role in shaping the landscape of Kandovan. Over time, the running waters have eroded parts of the cliffs, resulting in distinct pyramidal formations that have been transformed into dwellings. These dwellings are often interconnected by wooden bridges that span the gaps created by ancient streams, adding to the unique charm and character of the village. Kandovan's natural setting, with its proximity to the Sahand mountains and the resources they provide, has not only shaped the village's architecture but also offers opportunities for agricultural activities, tourism, and outdoor recreational pursuits [9].

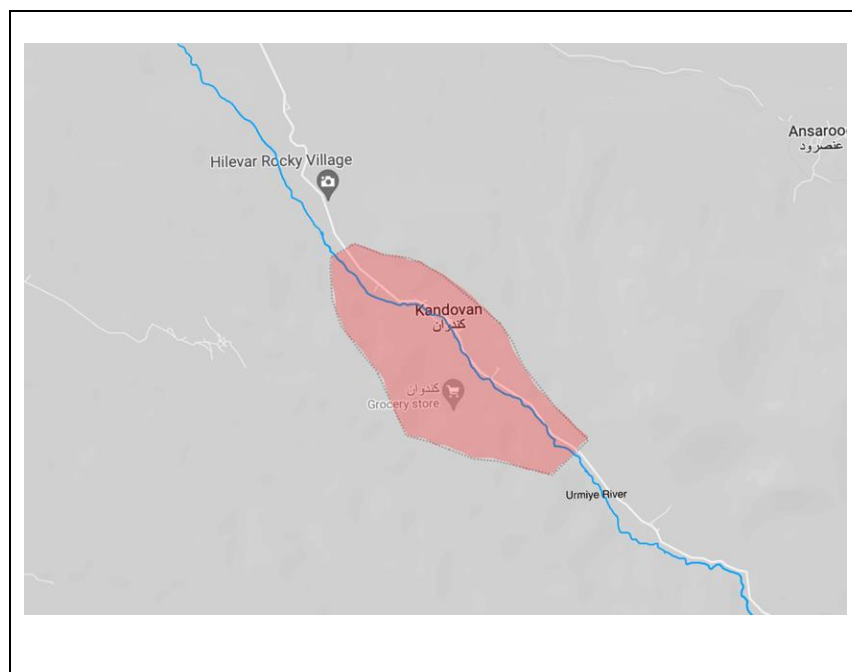


Figure 3.2. Location of the Kandovan village [9].

3.1. GEOLOGICAL FORMATION OF KANDOVAN HERITAGE SITE

Situated approximately 60 kilometers from Tabriz, Kandovan is positioned on the northern side of a valley that leads to the Sahand Mountain. The region experiences cold weather for around nine months of the year. The fertile soil in this area provides an excellent opportunity for the residents of Kandovan to engage in agriculture and cultivate crops. The favorable climate and fertile soil create a conducive environment for agricultural activities. The residents can take advantage of the natural resources and engage in farming to sustain their livelihoods. Cultivating crops not only provides food for the local community but also contributes to the overall economy of the village. The combination of cold weather and fertile soil in Kandovan offers a unique setting for agriculture, allowing the residents to harness the natural resources and cultivate various crops throughout the year [6].

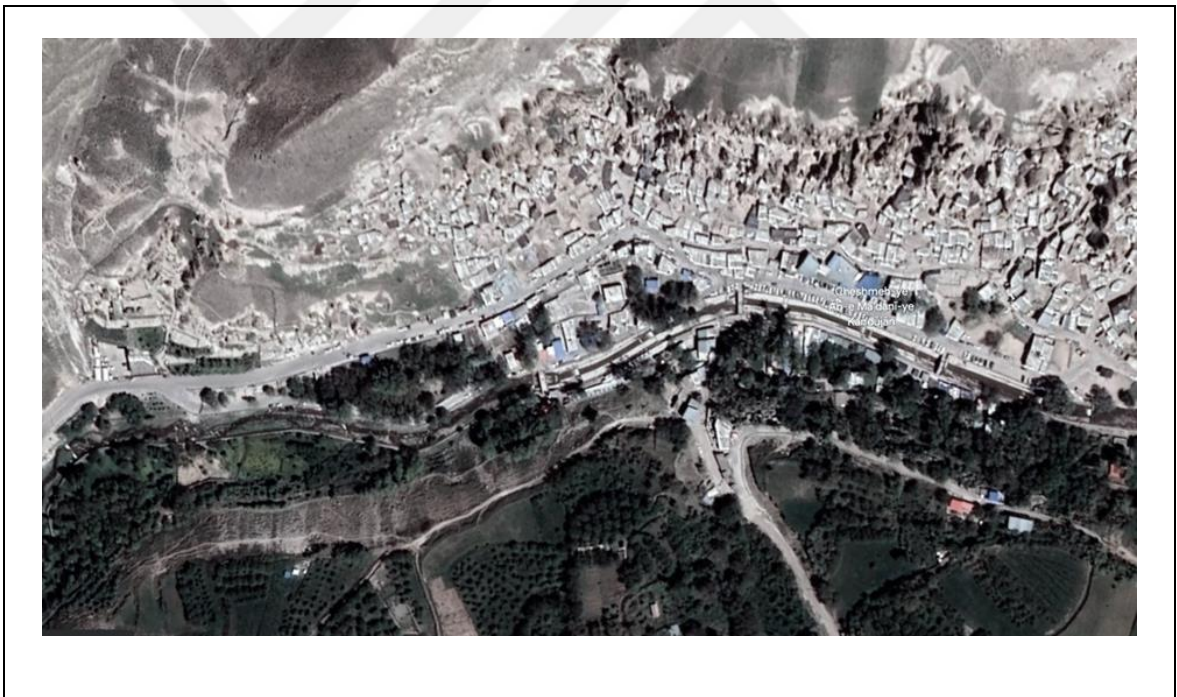


Figure 3.3. Aerial Map of The Historical Village of Kandovan, Google Earth.

Being in a valley and the organic placement of the village have yielded marvellous conditions that complement the architecture of Kandovan. The most important peaks of the Sahand mountains are:

- Metal: 3024 meters high
- Bez Dag: 3605 meters high
- Jam Daghi: 3722 meters high
- Square: 3412 meters high
- Ghanshar: 2596 meters high
- Sultan Daghi: 3472 meters high
- Sahand: 3562 meters high
- Qibla: 2500 meters high
- Olya: 2862 meters high
- Noor Daghi: 1313 meters high
- Arwana: 2954 meters high
- Darvish: 3175 meters high
- Girouh: 3596 meters high
- Agh Dag: 2942 meters high

The volcanic activity of Sahand started during the Paleo's period and ended 140 thousand years ago. Scientists have estimated the absolute age of different lavas of Sahand to be 12 million to 140 thousand years. According to them, the emergence of the Sahand volcanoes is most likely related to the renewal of activity of the Soltanieh Tabriz fault that passes through the Sahand region. According to the type of formation, Sahand soils are formed from two main groups.

The first group is the soils that were created in the same place by the disintegration of the main rock through chemical decomposition.

The second group of non-native soils that have been transferred to the place of soil formation due to secondary factors. These materials include slope deposits and alluvial cones, river alluviums, and glacial morons [10].

By studying the geological map of Sahand and Skou region and examining the physical structure of the earth, we realize that as well as field observations, this fact is also proved In

the end, the main units of Kandovan and its surrounding areas are mainly pumice lahars and volcanic ashes of Bablock, lahars and step-type fractures [9].

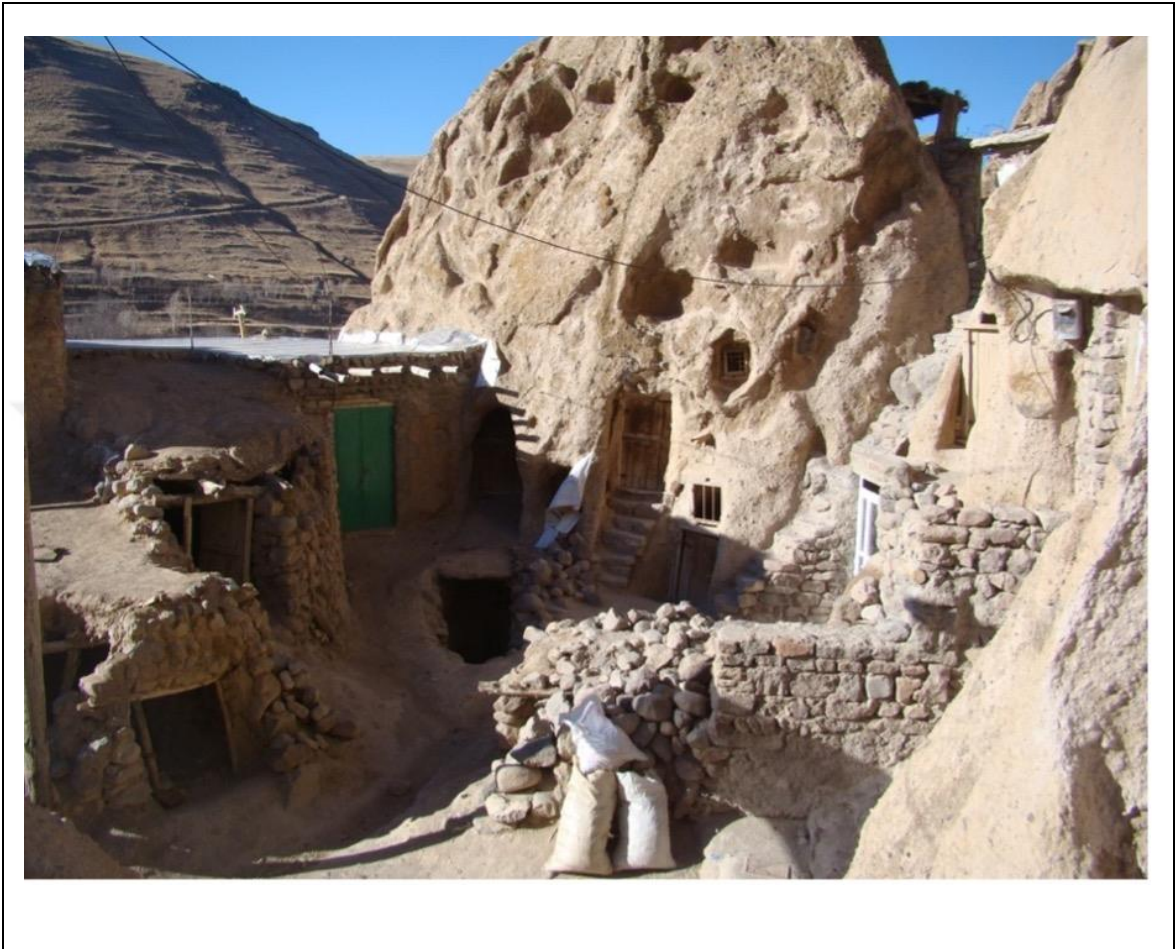


Figure 3.4. Example of a Karan available after many years.

According to the 1/100000 geological map of SCO, there is a main fault line at about 3 kilometres west of Kandovan, and it is necessary, taking into account that the region is one of the earthquake disaster areas, in the plans and construction of buildings, earthquakes and the consequences of the fault with the coefficient High reliability should be calculated and observed.

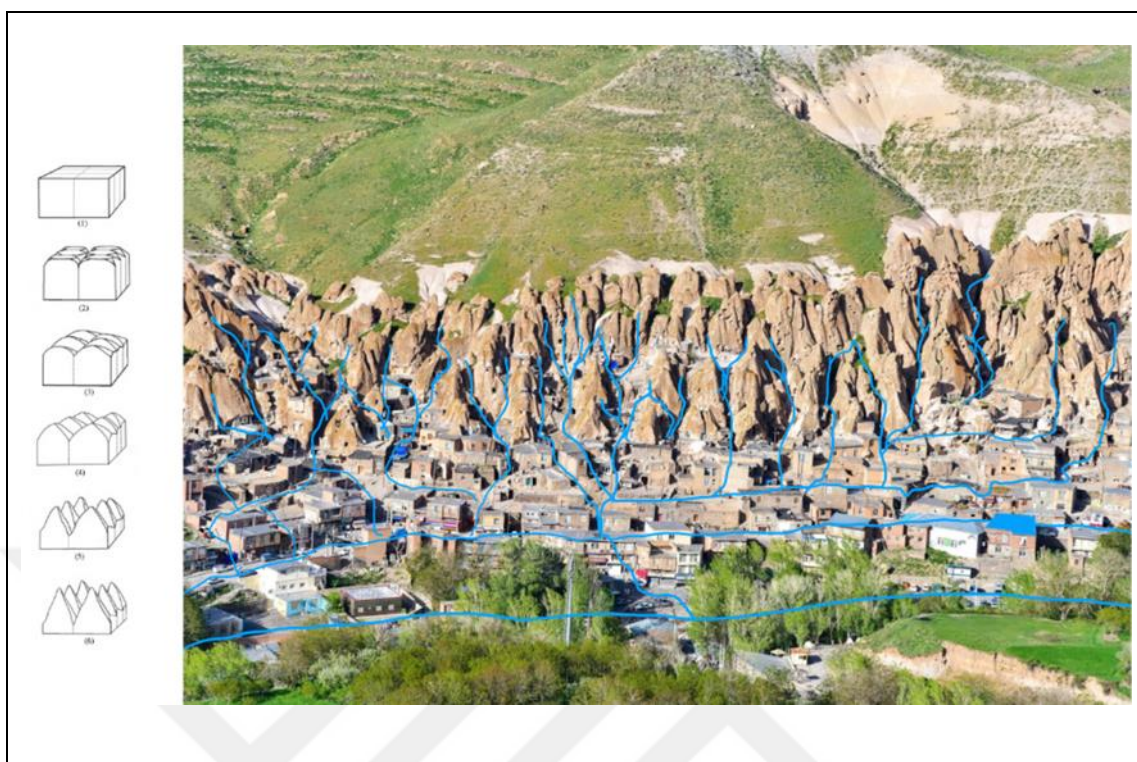


Figure 3.5. Chemical weathering reactions are largely controlled by access to water [10].

In general, the catchment area of Lake Urmia is one of the most important catchment areas in Esko City and East Azerbaijan province. This area can be divided into two parts, northern and southern. In the northern part of the Aji Chai River, which is the main artery of the northern part, originates from the heights of Sablan, Qeshadag, Aynaghli, Aghdash, Bezgosh, and the northern slopes of Sahand. Buyuk Chai, Razlig Chai, Dojan Chai Sarand, Page, Karmoz and Liqvan rivers are important branches of Aji Chai in this area. Varkash, Sufian, Darian Esko and Azarshahr rivers are also among the other rivers of the Urmia watershed in this area. which originate from the Qasba, Moro, and Misho mountains and the north-western slopes of Sahand and flow towards Lake Urmia.

Among the rivers that originate from the northwest of Sahand and flow into Lake Urmia is the Sko or Sko Chai River. Esco Chai itself is born from the confluence of two rivers, Kandovan Chan and Sermud. Kandovan Chai passes through the village of Kandovan like a life-giving stream and separates the agricultural lands from the rocky residential areas [10].

3.2. EVOLUATION OF THE CITY FORMATION OF KANDOVAN

Investigating The Cultural Situation Including Ethnic Structure, Language, Cultural and Religious Customs and Traditions [9]: There is no accurate and documented history of the age of Kandovan village and the age of Kandovan has always been in an aura of ambiguity.

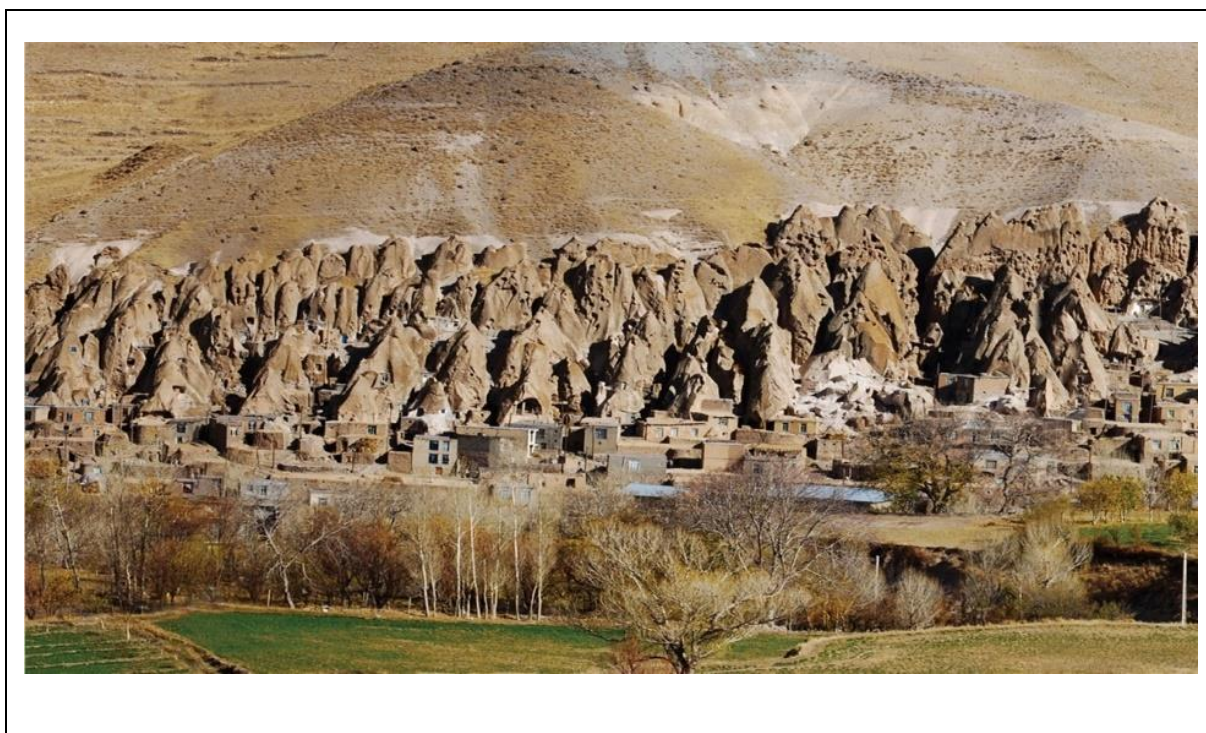


Figure 3.6. Kandovan Photo; By Parisa Karmnejhad [9].

Dr. Gholam Ali Homayoun: He believes that the people of Kandovan were originally residents of Halywar and took refuge in Kandovan to protect themselves from enemy attacks and natural disasters. He considers the historical record of Kandovan to be in the 7th century of Hijri, parallel to the invasion of the Mongols. This place was inhabited until the time of Ilkhans. At first, these places were used to deal with foreigners and to be safe from their attacks, but gradually in winter and summer, they chose this favourable place to deal with the cold and heat.

Behrouz Khamachi: He believes that the rock formations of Kandovan date back to the 7th century Hijri and even to an ancient period before Islam.

Dr. Gholamhossein Mojtahedzadeh: He believes that about 800 years ago, some warriors who passed through this area chose this place as their base because of the conditions of Souq Al-Jishi, which later became a village [9].

Residents' opinion: Most of the nobles are unaware of their past and consider their ancestors to have lived in Kandovan since ancient times, and some others consider themselves to belong to a tribe that migrated from around Lake Urmia (Royal Island) about 200 to 300 years ago due to ethnic differences and they settled in Kandovan. mythological account of the people of Kandovan believes that these people lived on the royal island of Lake Urmia, but the snakes of the island killed their children, and they sought refuge in the village of Kandovan to escape from the snakes of the island [11].

Kandovan is a unique geological formation consisting of conical rocky hills in an eroded volcanic area located at the foot of Sahand Mountains. Kandovan Village was settled by the local people and refugees as a residential area by different civilizations. The Urmia River, which forms green recreation zones on both sides, passes in front of the village [12].

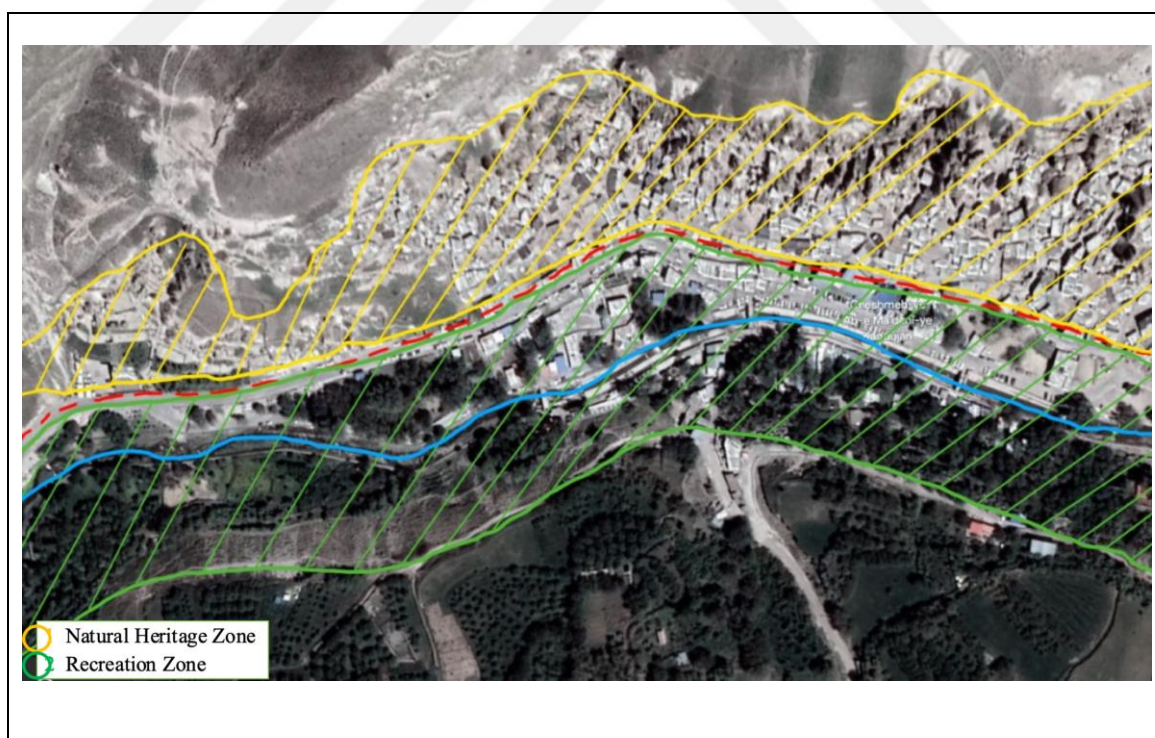


Figure 3.7. Google Map of Kandovan Village - Urmia River (Kandovan Chai) passes through the village of Kandovan like a life-giving stream and separates the agricultural lands from the rocky residential areas (2023).

3.2.1. Population And Building Densities of Kandovan

By examining the scope of the physical structure of the village, we realize that according to the existing map, the area of Kandovan is about 12 hectares. Therefore, considering the population of 592 people in 2019, the population density of the village has been calculated as 49 people per hectare. Kandovan village has an area of about 12 hectares. Therefore, considering the village population of 592 people in 2019, the population density of the village was calculated as 49 people per hectare.

On the other hand, the building densities of Kandovan village according to the field studies and survey of the upstream units, and even though due to the presence of height in the borders, sometimes we see height in the residential units (type of borders), nevertheless, Kandovan village has an almost identical building density. It is generally one floor and only in new constructions that are mainly built along the main axis of the riverbank, it has a maximum of 2 floors [4].

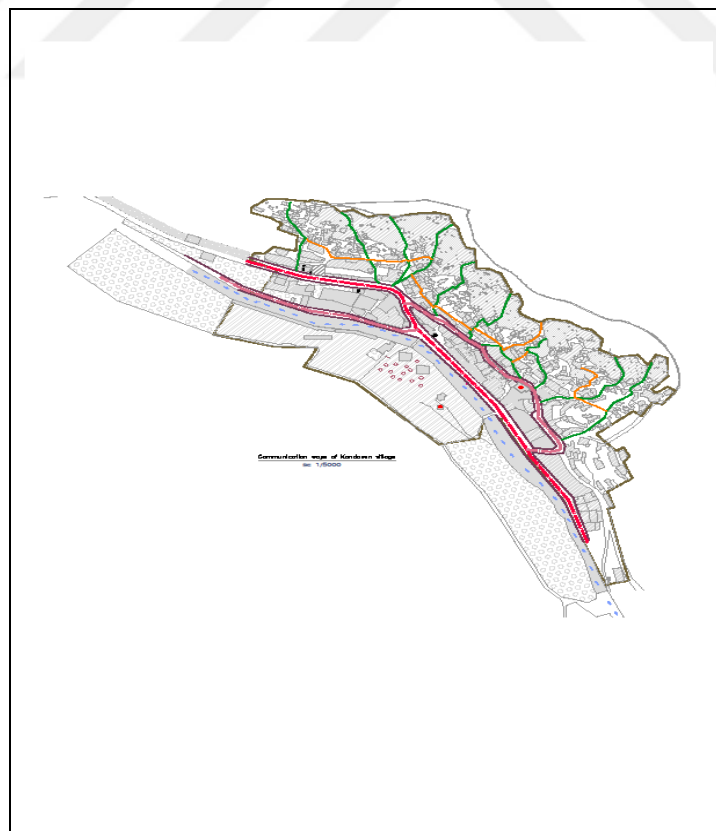


Figure 3.8. Communication ways of Kandovan village [4].

Building Materials Used in The Village In The Past And Present:

As explained earlier, three types of architecture with different materials can be distinguished in this village, which was formed in the first period of the rock age architecture by digging the rocks, and in the later periods to provide living spaces made of river stone and Flower straw has been used in the walls and wooden beams with a final coating of flower straw on the roof, and finally, in recent years, for commercial and sometimes residential activities, a combination of brick and metal and cement sand mortar has been used.

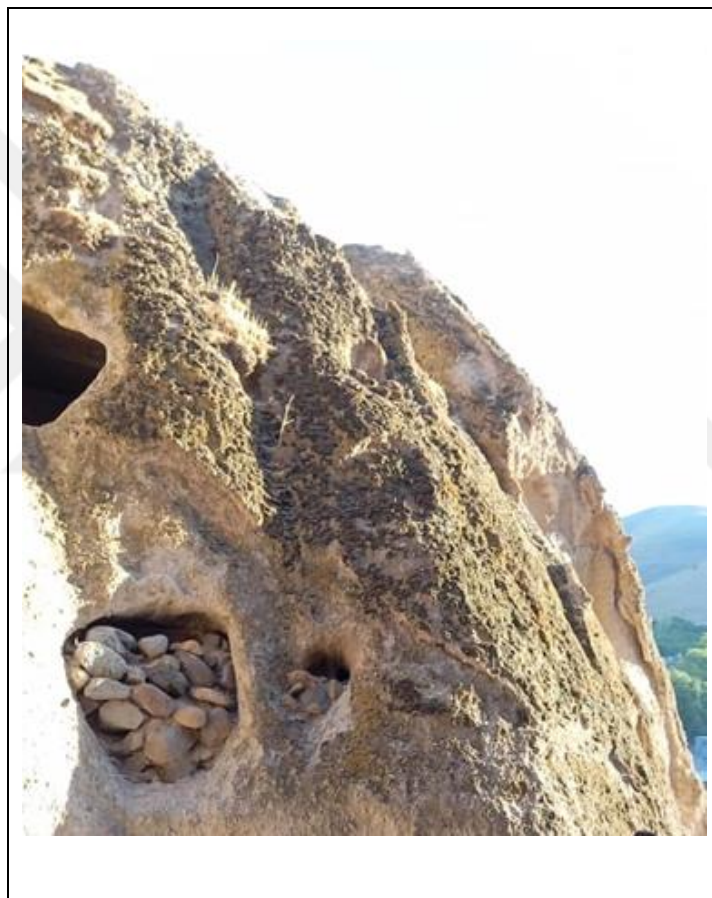


Figure 3.9. Old Material.

And mainly due to the lack of familiarity with the relevant implementation techniques, they have bad conditions in terms of construction quality. The materials used in the old structure are stone rubble from the village and wooden beams and construction materials used in recent constructions are bricks, iron, plaster, sand and cement, which are mainly supplied from Esko.



Figure 3.10. New Material [13].

4. VARNECULER ARCHITECTURE IN KANDOVAN NATURAL HERITAGE SITE - MORPHOLOGY OF KARANS

4.1. ARCHITECTURAL ELEMENTS AND SPACES

Karans: Karans which have been created by volcanic eruption of Sahand Mountain form the foundation of Kandovan. They are 10-15 meters high and 5-8 meters in diameter. These Karans made of igneous rocks and have prepared appropriate accommodation to reside in the cold climate of Kandovan [6].



Figure 4.1. Grand floor plan of a Karan [6].

They spread in the west-east orientation; however, the west Karans, due to the inadequacy of sunlight, are empty and residents don't show any interest to live in them, therefore owing to lack of adequate protection, they have gradually got ruined. The east Karan profit from adequate sunlight so they are utilized by residents more [6].



Figure 4.2. First floor plan of a Karan [6].

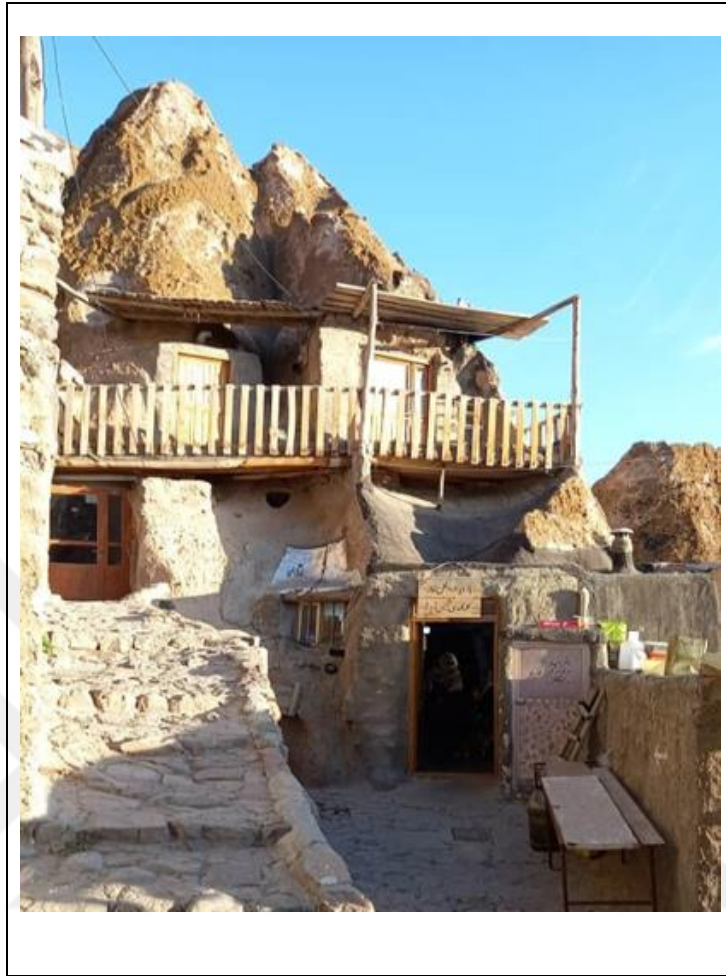


Figure 4.3. Vernacular Architecture in Kandovan.

The main interior spaces of Karan: It is used both as a living and sleeping room and as a reception room. In some areas, the sleeping place is built in the form of a stone platform with a relatively short height and furnished with carpets and rugs in a part of the main room, and family members sleep on it. When entering most of the main rooms, there is a special place for placing containers of water, milk, and dairy products in the side part, and a hole has been dug in it to divert the wastewater from it. On the side walls, there are niches and shelves where things like lamps, books, mirrors, etc. are placed. In order to install lights, clips are installed in the middle of the ceiling in some corners.

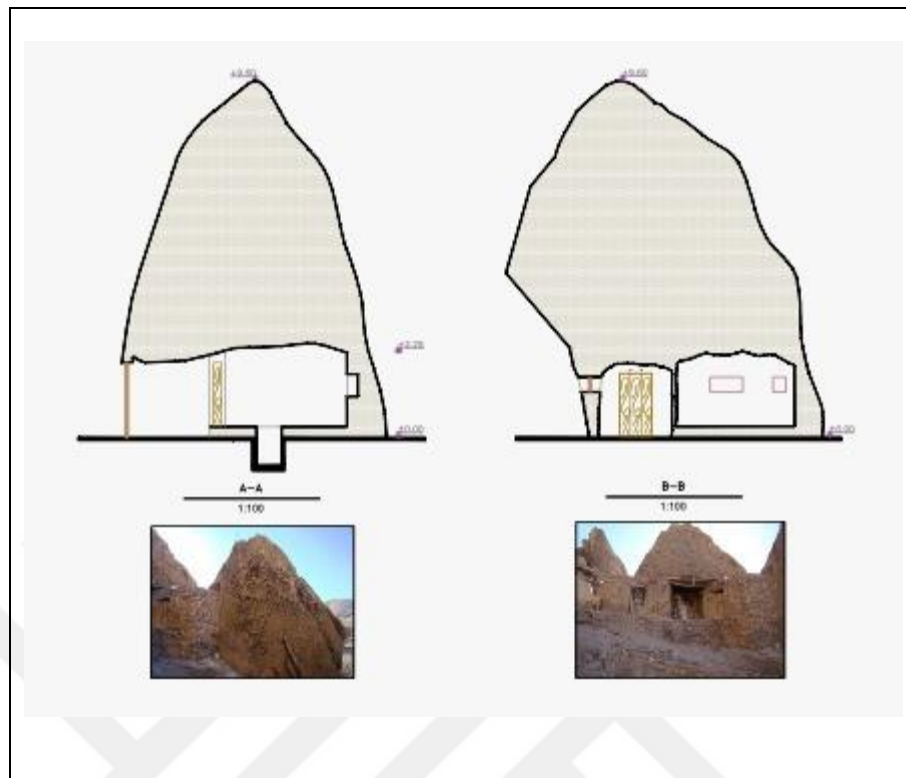


Figure 4.4. Residential sample of Karan from two direction [4].

The floors of the main rooms are furnished by Pallas and rugs and local handwoven carpets. In most of the main rooms, there is a bread oven, which in the past had heating properties in addition to cooking in winter, but now due to the use of oil by the residents in heating the main rooms, the internal ovens are out of order, and for cooking, use the ovens inside the kitchen or the ovens outside. The borders are used and as a result of not creating smoke from the oven inside, the walls of the borders have been whitewashed. In the past, whitewashing was done with white soil that was available in the place, but now it is done with plaster that is brought from Esko.

The ovens are generally in the form of round holes that are dug in the stone floor of the borders and mostly lead to natural funnel-shaped holes to ventilate the smoke from cooking. The bread needed by families is cooked every two or three days in these ovens, and the types of bread that are commonly cooked are lavash and komaj bread, which is a dough and is thrown on the bottom of the oven, and Koke, which is topped with sesame and eggs. And oil is added and it is cooked from time to time [13].

Main Area It is used both as a living room and as a bedroom. In some houses, it was also used as a guest room. In some houses, the sleeping area was raised with a stone platform and covered with rugs. A corner of the room is also reserved for family members to sleep. On the right side of the houses, I observed during the research, there are water containers, milk, and dairy products. A road and a channel for their waste are provided outside the house [14].

On the interior side walls, niches and shelves have been carved to hold items such as books, mirrors, and candles. some rock houses have a clamp on the ceiling for hanging lights (bulbs or chandeliers). The floor of the house is covered with rugs and hand-woven carpets.

Almost all the main rooms have a bread oven. In the past, these ovens played a major role in heating rock houses as well as baking bread, but nowadays, with the arrival of the natural gas network, these ovens are out of use. In the past, white earth from the surrounding area was used to whiten the walls, but nowadays plaster is used.



Figure 4.5. A living room for the gest people in a karan.

Yuk Yeri: It is a relatively large and flat place on the wall of the main room, which is used for placing quilts, mattresses, blankets and clothes. And it is separated from the main space by a curtain [15].



Figure 4.6. the Nish in a Karan (Yuk Yeri)

Kitchen (Matbakh): It is usually outside the main room and in the area adjacent to it, but in some cases, cooking is also done in the main room. Cooking in the kitchens is also done using an oven, which is mostly used to cook bread, because like most villages in Iran, the main food of the residents of Kandovan is mostly bread and milk products, and food is rarely cooked [15].

Sandog Khane (nettle, Gazne): There are small warehouses of Duran Karan where the household's weekly necessities such as pulses, wheat, barley and flour are kept. In addition, a special place called "Edutlog" has been built in the vicinity of some borders to keep cattle and sheep and firewood and use them as fuel. Basically, there are three other types of storage in Kandovan, except nettle, as follows.

- I. Peas and wheat warehouses, etc., which have a special covered space.
- II. Soldier fodder warehouses that collect the product in flat and military places and stack them in such a way that water does not penetrate into them.

Covered fodder warehouses:

both man-made warehouses and warehouses dug in the borders are often located outside the residential context and are used to store straw and fodder. The stone warehouses below the

banks are in the west of the village and the warehouses inside the banks are located in the separate banks and are located in the west of the village. Each warehouse is privately owned and used by a household [15].

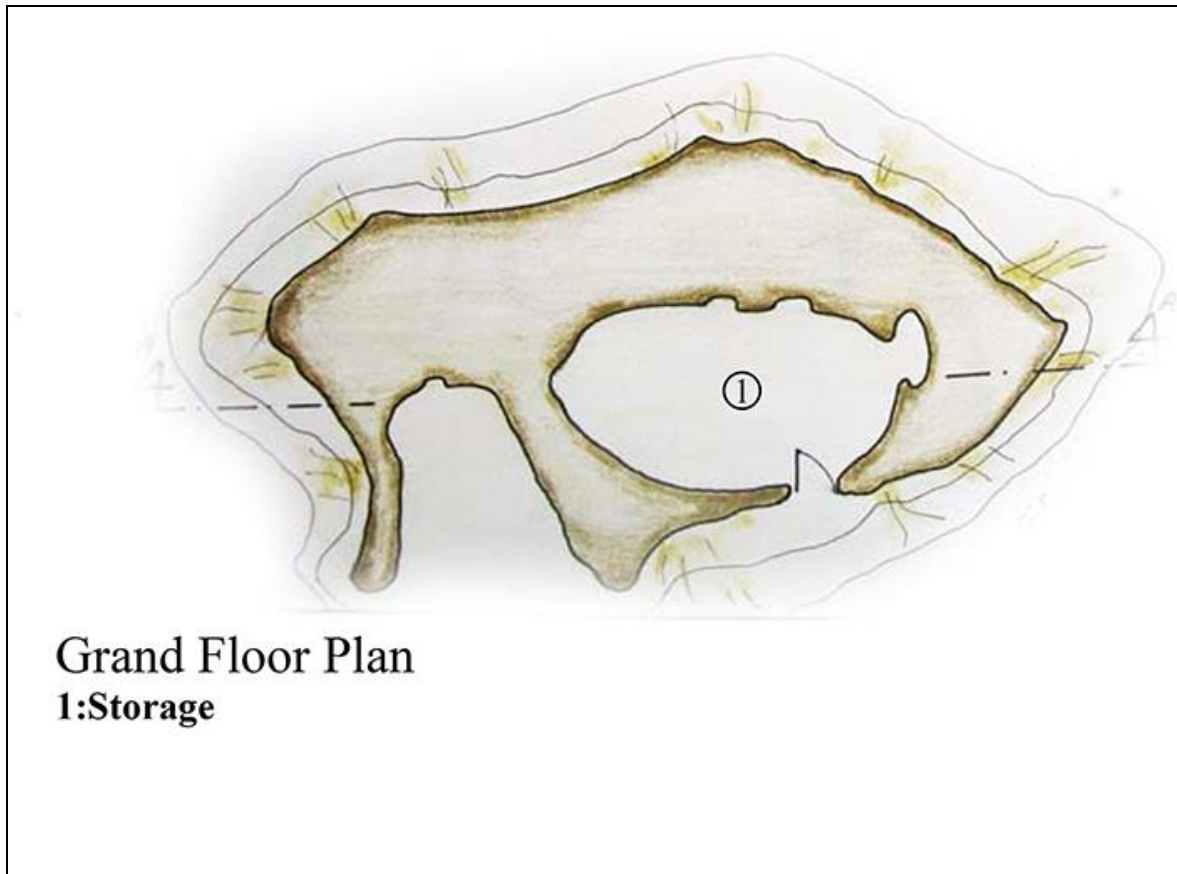


Figure 4.7. Storage in Karans [6].

Windows: Due to the increase in the diameter and thickness of the lower parts of the borders, the skylights are placed in the upper floors of the borders and every space has a minimum level of light absorption. The windows are mostly made of wood and are often checked with small pieces. To prevent snow and rain from entering the spaces, they are embedded inside the walls. Recently, very few of them have become iron [15].

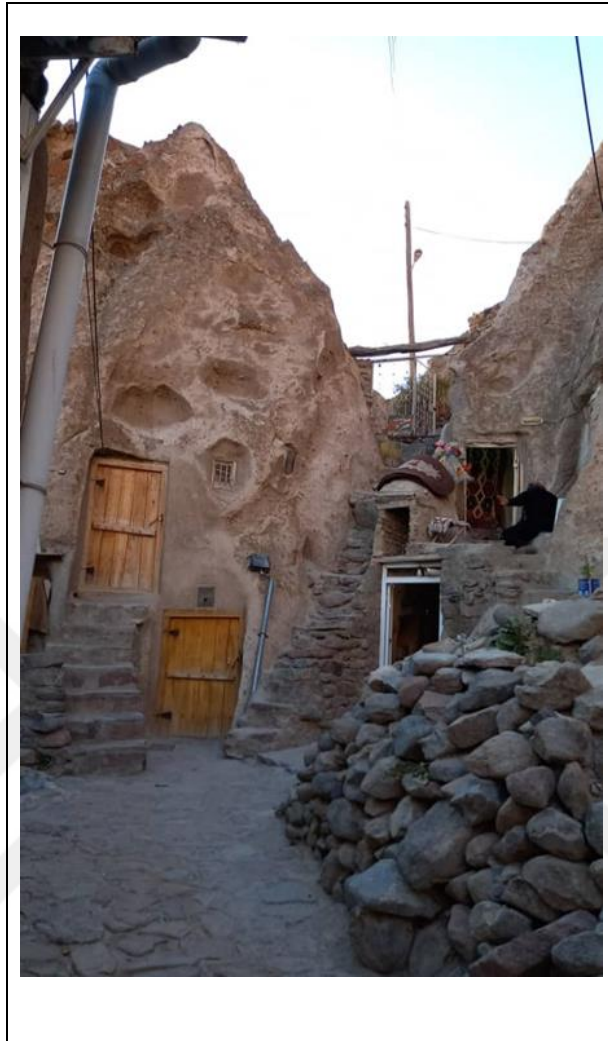


Figure 4.8. Example of windows [16].



Figure 4.9. Placement of windows inside the interior space.

Drainage: In Kandovan, due to the calcareous nature of the soil and the problems of sewage disposal, as well as the need and consumption of human waste, it is not customary to dig sewage wells, so the drains are mostly located next to the roads and outside the residential borders and are made in the form of manual chambers. And there are two floors, the lower floor is in the form of waste storage. Some reservoirs have two wells, and if one of them is full until it dries up and its waste is used, the other well is used. These wastes are mixed and dried with ash obtained from ovens and used as fertilizer to strengthen the soil of fields and gardens and grow crops. Previously, although the household used a common catchment, but now due to the warnings of the health House, everyone is forced to build a private catchment within their borders, but rarely in places where there are space restrictions, a catchment is shared by two households.

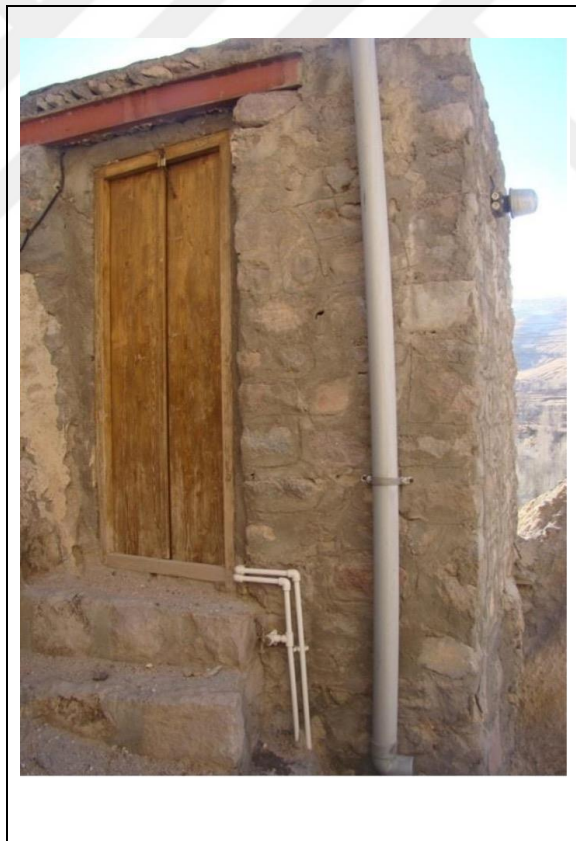


Figure 4.10. Additions that spoil the original look [4].

Astana: The entrance part of each border is called (astana) in the local term and it can be seen in two ways. In large areas where there is no space limit, sometimes it is done as a separate inlet filter and washing dishes and clothes and even the residents themselves are

also done in this area. But in smaller borders, to prevent water from entering the living area, the threshold is separated from the main living area by a short stone wall, and washing is done in a part of the living area itself. The washing place is in the form of a small cement basin that is connected to the village tap water and has a hole outside to dispose of wastewater.



Figure 4.11. Kandovan houses astana [16].

Entrance doors: Mainly due to the difficulty and limitations of digging, they are with a height of (1.50~1.60) cm and a width of (1~1.30) meters and to protect the borders from snow and rain as much as possible. They are embedded inside the walls. Most of them are made of wood. In recent years, very few of them have become iron.



Figure 4.12. Example of entrance doors [15].

Waterways (Abrizgah): Due to the calcareous soil and flow problems of wastewater in Kandovan, digging wells cannot be used to discharge wastewater. Instead, waterways are commonly constructed. Waterways are usually built next to pedestrian crossings and outside the houses, and sometimes they consist of two floors, the lower floor for faces and wastewater from the houses and the upper floor for rainwater.

Some roads have two wells, when one is full, the other well is activated until it dries up, and the dried animal dung is mixed with coal ash from tandoors and ovens and used as fertilizer in agriculture and farms. In the past, families used to share one abrizgah, but nowadays each family and household uses one abrizgah and one well.

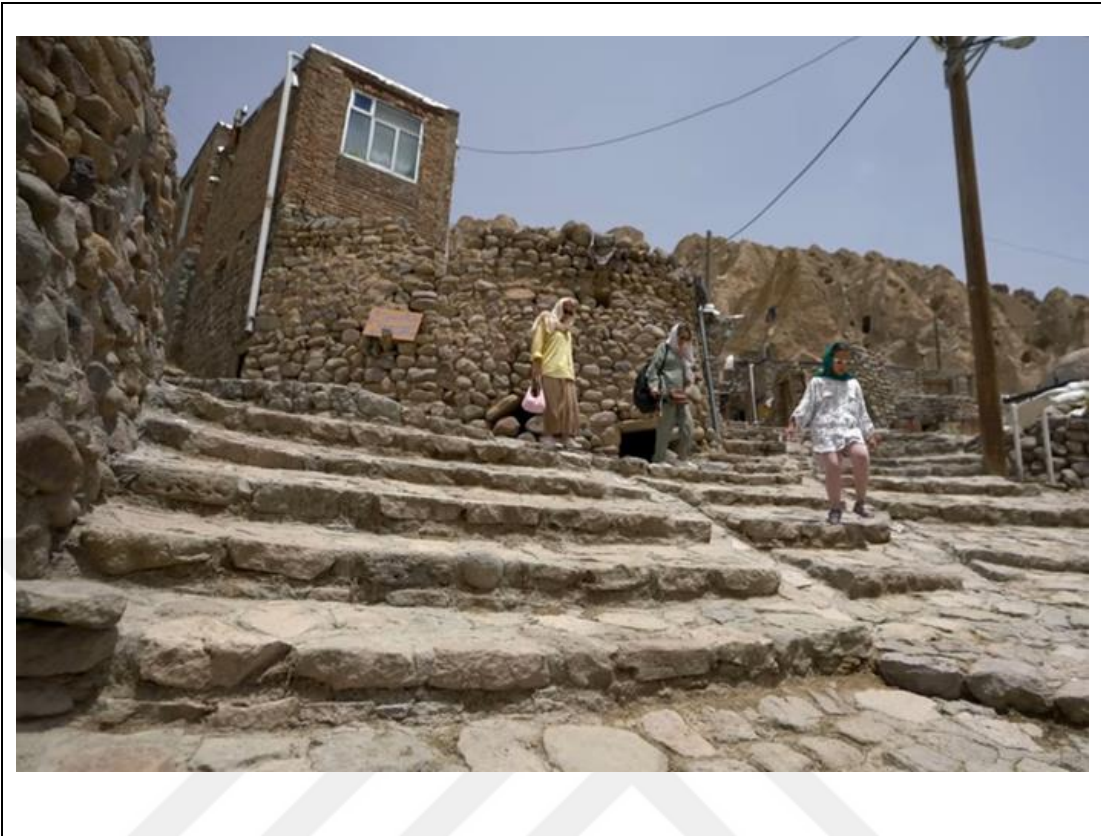


Figure 4.13. Example of waterways.

Semi-open spaces: In residential units, it is often in the form of porches, which are removed from the body of the borders by means of wooden beams, and also in new constructions, which are currently made of iron beams, it is debatable, and considering the cold climate of the village, most of the activities daily activities are done inside the spaces and the verandas are not very functional and the verandas have a shade which is effective in controlling the entry of sunlight and excessive radiation into the interior space in the summer. In rare cases, it is also for communication and the ease of access between borders have created wooden bridges that cannot be categorized as semi-open spaces.

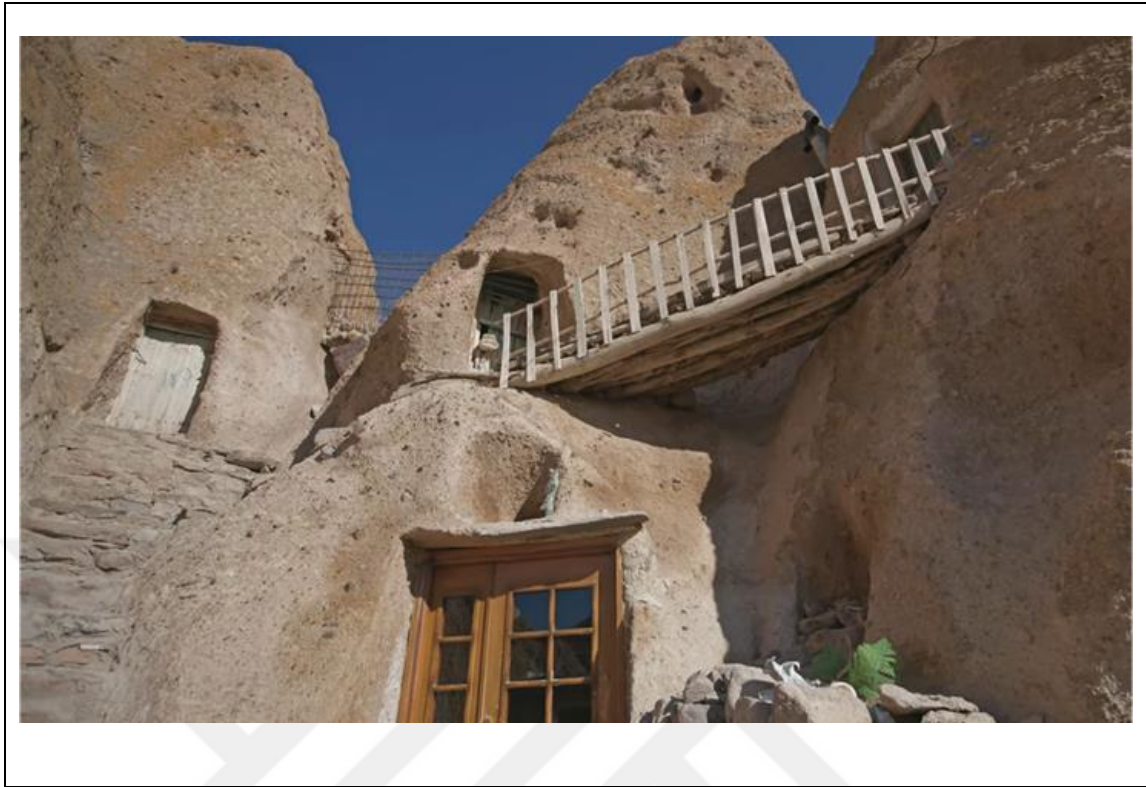


Figure 4.14. Examples of semi-open spaces.

Texture classification and available housing: In the analysis of the texture classification of the existing housing, considering the texture of Kandovan village and the conducted studies, we conclude the texture classification and according to that type of residential units in the form of existing borders, which mainly have the same type of granularity as the investigated border. Therefore, the separation or definition of the graining of different texture is not seen in such a way that they are fundamentally different from each other, unless in recent years, the graining of a different type and made with brick materials, etc. has been seen recently. So, finally, two types of texture and housing can be identified in Kandovan village.

Open Spaces: Open spaces are also discussed in the subject of courtyards and access hierarchy. In the old context, there are no open spaces due to the shape of the land and the location of the borders, but in the later stone constructions, in cases where the space allowed, a very small courtyard was formed. and in new constructions that have been formed in the body of the main axis of the village, there are sometimes courtyards.

In general, in the discussion of the relationship between open, semi-open and closed spaces, it can be said that residential units are mainly connected to the public and open spaces of the village through the network of roads, and what is discussed in this village is the relationship between open and closed spaces. It is that due to natural conditions, sometimes individual closed spaces in a border have directly connected to public open spaces. One of the borders has been investigated from the perspective of spatial relations.

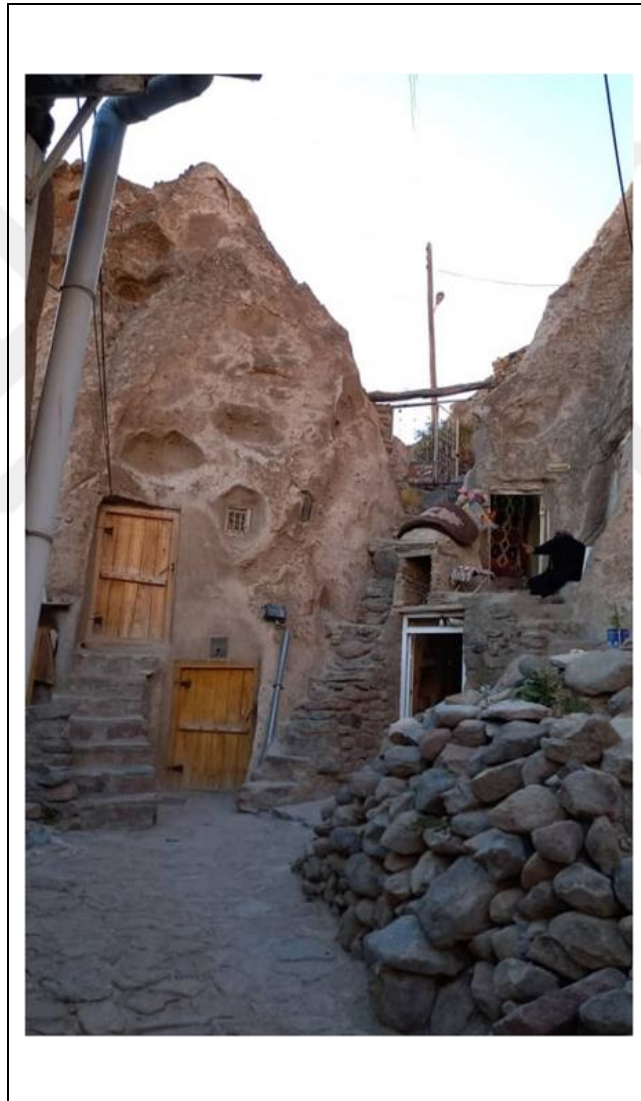


Figure 4.15. Examples of an open spaces in the vernacular architecture.

How to communicate with transit: In villages with organic growth, such as Kandovan village, the way residential units are connected with communication passages does not follow any principles that can be discussed in practice, but it is defined according to the shape of the borders from the empty natural spaces between the borders and depending on the level. And the location of the entrance to the space (stable - warehouse - or residential unit or...) if they are on the same level, it is done directly, and if the entrance is on a level higher than the passage, it is done indirectly and through the stairs.

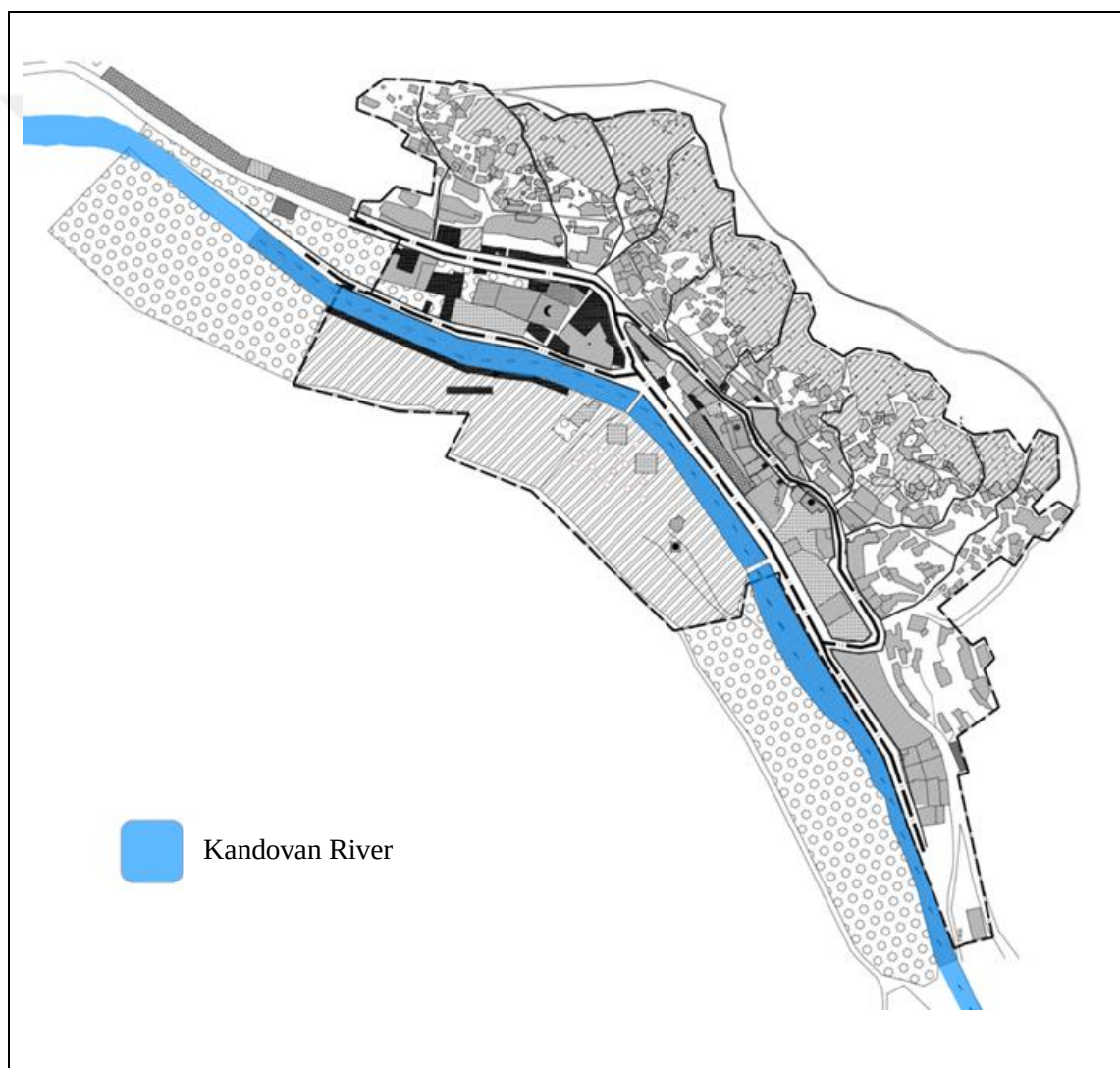


Figure 4.16. Kandovan river [4].

Investigating the neighbourhood spaces in the old context: The whole village of Kandovan is formed in the form of 10 neighbourhoods in a customary way without physical planning, and in the meantime, the natural conditions of the land have played an essential role in the structure and shape of the neighbourhoods. Usually, the access roads to the residential units form the whole neighbourhood. As neighbourhood units and neighbourhoods can be defined from the point of view of urban planning, and its characteristic is the centrality of the neighbourhood and proper access to services of the neighbourhood and neighbourhood unit, in Kandovan village due to the existence of a fundamental difference in the neighbourhood system and in fact the lack of The possibility of defining the neighbourhood system is formed by the shape of the land and the physical structure of those neighbourhoods, and the main principles discussed in the neighbourhood system are not seen in the desired neighbourhoods of Kandovan village. Rather, there is only the access road that results from the main axis of the riverbank. It has established the neighbourhood with each other. Therefore, the services of the neighbourhood unit and the neighbourhoods are mostly located in the main axis of the side of the village. The pictures below show the location of the neighbourhoods and how to establish public uses.

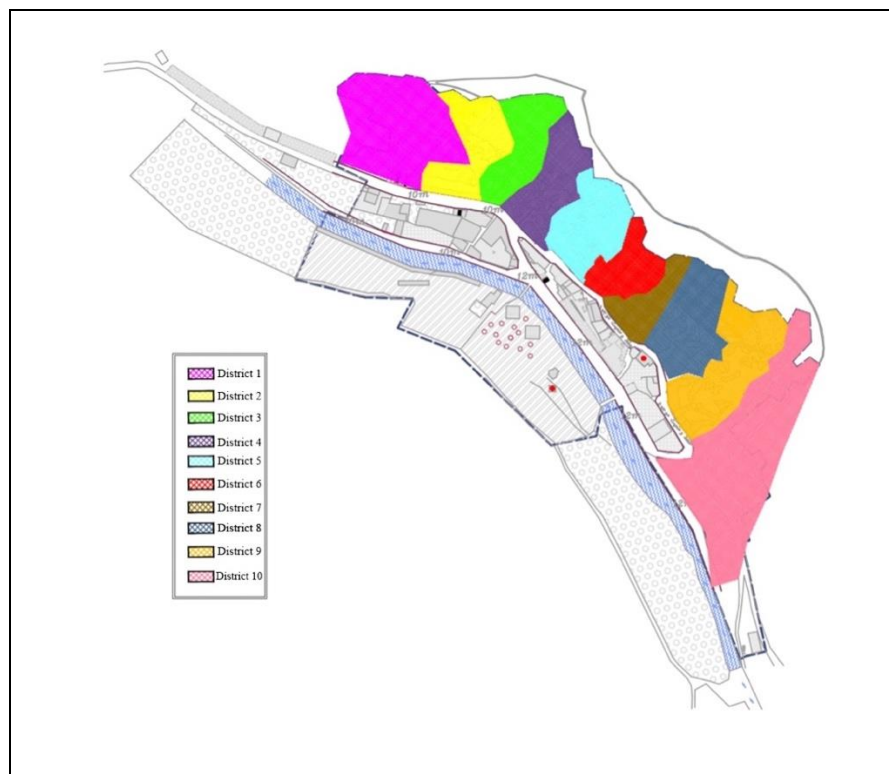


Figure 4.17. Kandovan Village District planning [4].

The amount and manner of tissue permeability: The permeability of any system of public spaces depends on the number of potential ways to pass from one point to another. These potential ways must be legible, because otherwise people unfamiliar with the place will not benefit. Then both physical and visual aspects of permeability depend on how the network of public spaces blocks the environment. Physical permeability between public and private spaces occurs in the hallways or entrances of buildings and courtyards or yards. What is important is that there should be many entrances around the edges of public spaces.

With this introduction, by examining the fabric of Kandovan village and its road network, the issue of permeability has its own problems, just like the physical structure of the village. Since it was mentioned before, the road network has a low permeability, depending on the shape of the land, so that sometimes, except for the main axis by the river, there is no permeability into the tissue, although in some places it is possible to connect from a point other than The main axis can be moved to another point, but access and penetration to the borders (neighbourhoods) and within the village context are not possible only through specific networks.

Residential use: Residential use has a total area of 10,841.6 square meters, which is divided into two parts, border, and non-border. The per capita residential area is 18.31 square meters. There are 9237 square meters of residential space in the Karan section and 9475 square meters of residential space in the non-Karan section. It is necessary to explain that damaged and uninhabited buildings are also calculated in these calculations.

Educational use: This use includes two educational units including elementary and middle school levels, the educational units for the middle school level are in the west of the village and the total area of the educational space is 797.41 square meters. The educational per capita of the village is 1.34 square meters.

Administrative use: The village has a rural unit, whose area is 207 square meters, and the administrative per capita is 0.34 square meters.

Health use: Roshta's health services include an old bathroom and a public toilet of 251.24 square meters which gives 0.42 meters of sanitary space per capita.

Therapeutic use: This use includes a health house unit with an area of 436 square meters. Treatment per capita is 0.72 square meters.

Religious use: This use includes two mosque units inside the village and one prayer house unit in the green area, which have a total area of 553.7 square meters. The per capita of this section is 0.9 square meters.

Business space: Commercial uses are spread on the side of the main road of the village, and in the bazaar area, there are units in the form of commercial use. The total area of commercial uses in the current situation is 2997.75 square meters and the per capita use is 5.06 square meters.



Figure 4.18. The nish inside the Karans that they use for shopping [13].

Warehouse space: This use has been spread in the form of fodder storage and equipment storage in the entire village, both within and outside borders. The total area of the village warehouses is 12789.6 square meters.

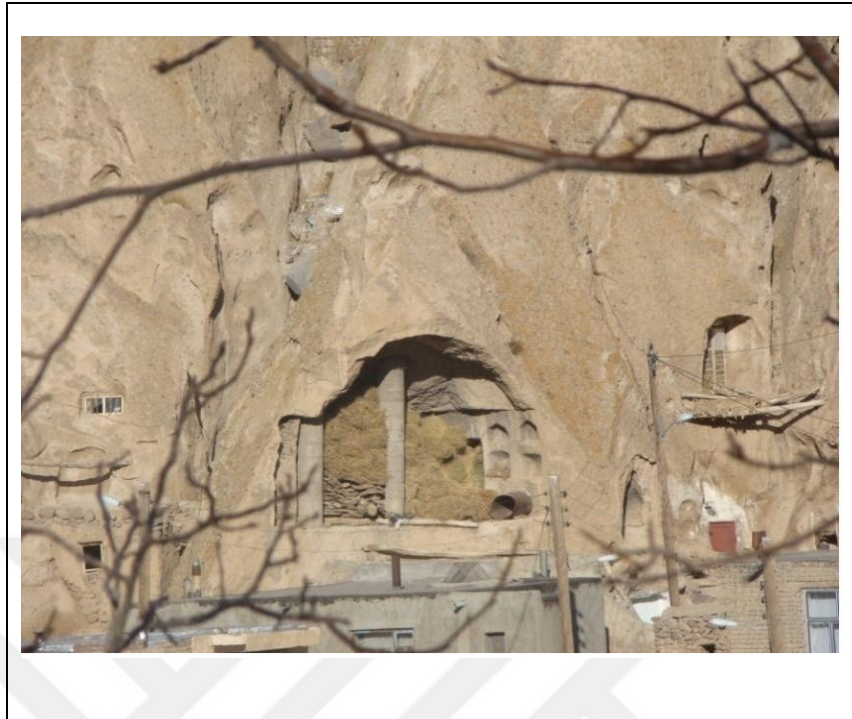


Figure 4.19. Warehouse for storing animal fodder [4].

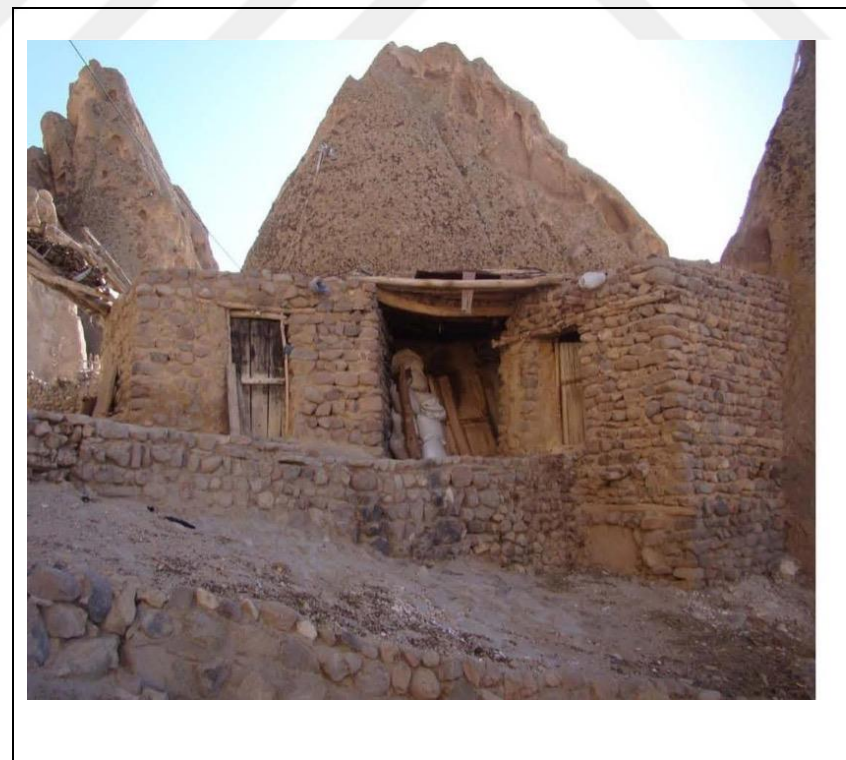


Figure 4.20. A Karan that is used for grass deposition [4].

Special use of the stall: This use is usually located in the lower floors of residential houses, and the predominant materials are stone. The area of the barns is 8168.9 square meters.

Sports use: This land is located at the entrance of the village and its area is about 450 square meters. Per capita sports for each person are 0.76 square meters.

Gardens: This land use is located in the south of the village and on the sides of Kandovan Chai River and has an area of about 1310 square meters [4].

4.2. GENESIS OF THE CONE-SHAPED ROCKY HOUSES

The cone-shaped forms found in Kandovan Village were created as a result of weathering and erosion along the discontinuities formed by joints within the thickly bedded non-welded ignimbrite. The orientations of these joints were determined through field measurements using a geological compass.

A total of 72 joint orientation measurements were taken for analysis. To determine the dominant joint sets, the collected joint orientation measurements were evaluated using a computer program called "Dips." This program helps analyze and interpret the data to identify the prevailing joint orientations. A Schmidt diagram with a lower hemisphere projection was adopted to create pole plots representing the joint orientations. From these pole plots, a contour diagram was generated. The analysis of the joint orientation data revealed the presence of three dominant joint sets in the area.

These sets are characterized by their respective angles: $65^{\circ}/228^{\circ}$, $60^{\circ}/350^{\circ}$, and $75^{\circ}/132^{\circ}$. These angles represent the orientations of the joints within the non-welded ignimbrite. The weathering and erosion processes acting along these discontinuities, or joints, have contributed to the formation of cone-shaped forms in Kandovan Village. Over time, the differential weathering and erosion of the rock material along these joints have sculpted the distinctive cone-shaped structures that are characteristic of the village's landscape. Kandovan Architecture Is Divided into Three Major Groups: Natural Architecture, Man Made Architecture, And Brick Architecture [17].

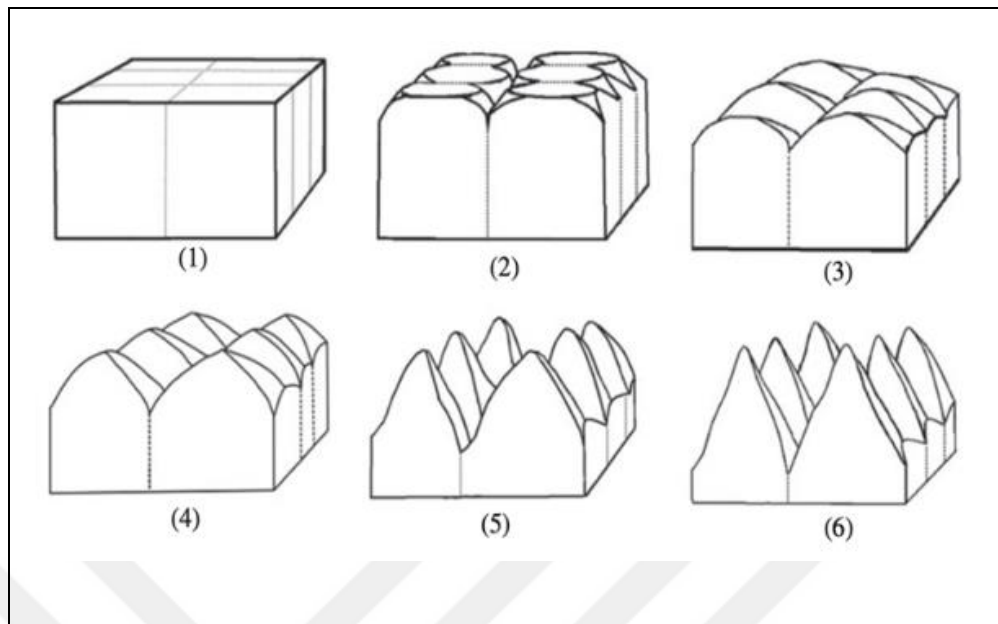


Figure 4.21. Schematic steps of formation of cone shaped rocks in the Kandovan [8].

4.2.1. Natural Carved Karans

The dominant architecture is rock architecture that has crystallized in the form of rocks that have been carved with primitive tools and tools throughout history and turned into spaces such as residential spaces, warehouses, stables, religious and sanitary spaces. In different periods, the way of digging the rocks often has a fixed shape and it is dug by master craftsmen with a pick, and only in different periods, according to the needs of people, new spaces have been formed. In terms of the distribution of spaces, the residential uses of barns and stables of each family are attached to each other as much as possible, and often each rock (border) contains residential uses, stables, and barns [15].



Figure 4.22. Rock architecture (NATURAL) [16].

4.2.2. Man-made Stone Karans

this type of architecture complements rock architecture to provide suitable living spaces in the following periods, which is a combination of local river stone and mud straw (in the past) and cement sand mortar (currently) in the walls and beams. They are wooden with the final coating of mud on the roof. Most spaces such as tandir (bread baking place), kitchen, toilet, and storage, and sometimes residential spaces are built with these materials. In parts of the damaged borders, it was also used in the past to restore the damaged part or to fill unusable spaces inside the residential borders. The studied border sample is in Agha Jabasi neighbourhood (Agha neighbourhood) where the formation and development of the residential unit in the period of rock and stone architecture can be seen in it. According to the functional needs of the residential unit, a warehouse with stone materials has been built [15].



Figure 4.20. New and Old Karans [16].

4.2.3. New Modern Buildings

This type of architecture, which has nothing to do with the native architecture of Kandovan, is often built on the side of the main road for the purpose of commercial activities and sometimes residentially using materials such as brick and metal in a disproportionate and non-homogeneous manner with the native architecture. Mainly due to the lack of familiarity with relevant implementation techniques and non-compliance with standards, they have very poor conditions in terms of construction quality.



Figure 4.23. A new construction [16].



Figure 4.24. An example of a residential unit in which the effects of the architecture of all three periods can be seen [16].

5. CONSERVATION OF KANDOVAN NATURAL HERITAGE SITE

The conservation of Kandovan Natural Heritage Site focuses on protecting and preserving its unique natural and cultural attributes. Kandovan, located in Iran, is renowned for its distinctive cone-shaped rock formations and cave dwellings that have been carved into the volcanic tuff. The site holds significant historical and cultural value, as it has been inhabited for centuries and represents a traditional way of life. Conservation efforts at Kandovan Natural Heritage Site aim to safeguard its natural environment, geological formations, and cultural heritage for future generations. This involves addressing various aspects:

Preservation of Geological Features: The extraordinary rock formations and volcanic landscape of Kandovan are preserved through measures such as erosion control, monitoring, and geotechnical assessments. Steps are taken to ensure the stability and integrity of the cone-shaped dwellings, as well as the overall geological features of the site.

Protection of Cultural Heritage: The cave dwellings and traditional lifestyle of the local community are safeguarded. Efforts are made to raise awareness about the cultural significance of Kandovan, promoting pride and appreciation among both residents and visitors. Documentation and research are conducted to better understand the site's historical context and its links to the local culture.

Sustainable Tourism Management: As Kandovan attracts a significant number of tourists, sustainable tourism practices are implemented. This involves developing visitor guidelines, promoting responsible behaviour, and managing visitor flows to minimize the impact on the natural and cultural assets. Local communities are often involved in tourism development, benefiting from economic opportunities while preserving their traditional way of life.

Environmental Conservation: Conservation initiatives encompass protecting the natural environment surrounding Kandovan. This includes conserving biodiversity, preserving native plant species, and maintaining the ecological balance of the region. Measures may include habitat restoration, reforestation, and the establishment of protected areas.



Figure 5.1. Expansion of uncontrolled buildings in Kandovan [17].

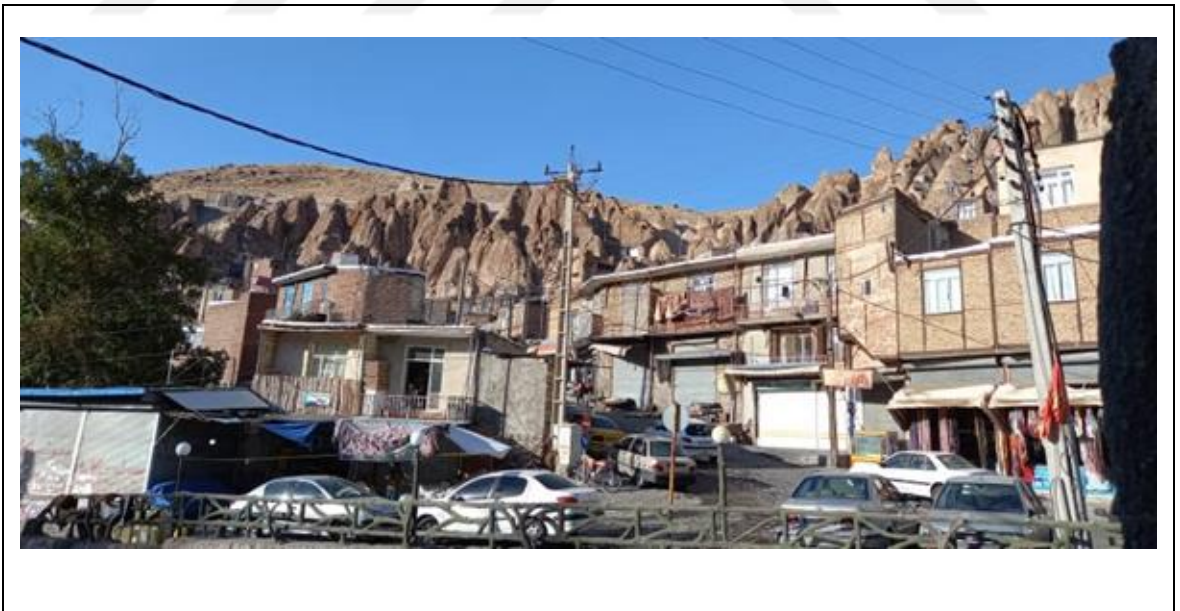


Figure 5.2. New constructions among Karans [15].

Original geological texture changed because of the new buildings with un-control planning. With the increase in tourism, in recent years, travel to and from Kandovan has become easier and the importation of new factory product construction materials such as door-window

panels and new metal roof coatings, from outside the village has increased. Vernacular elements produced with local materials have lost their original architectural features. New constructions among Karans; Combining the Karans to create a larger usable area degenerates the original geological structure. Trying to enlarge old spaces, carve new spaces, damage the structure, and degenerate the originality can be also dangerous for structural resistance and thermal comfort. Because of the thin walls, the place is hot in the summer and cold in the winter. At the end of this, it was seen that the windows were enlarged, and heat-proof windows made with new technology were installed [8].

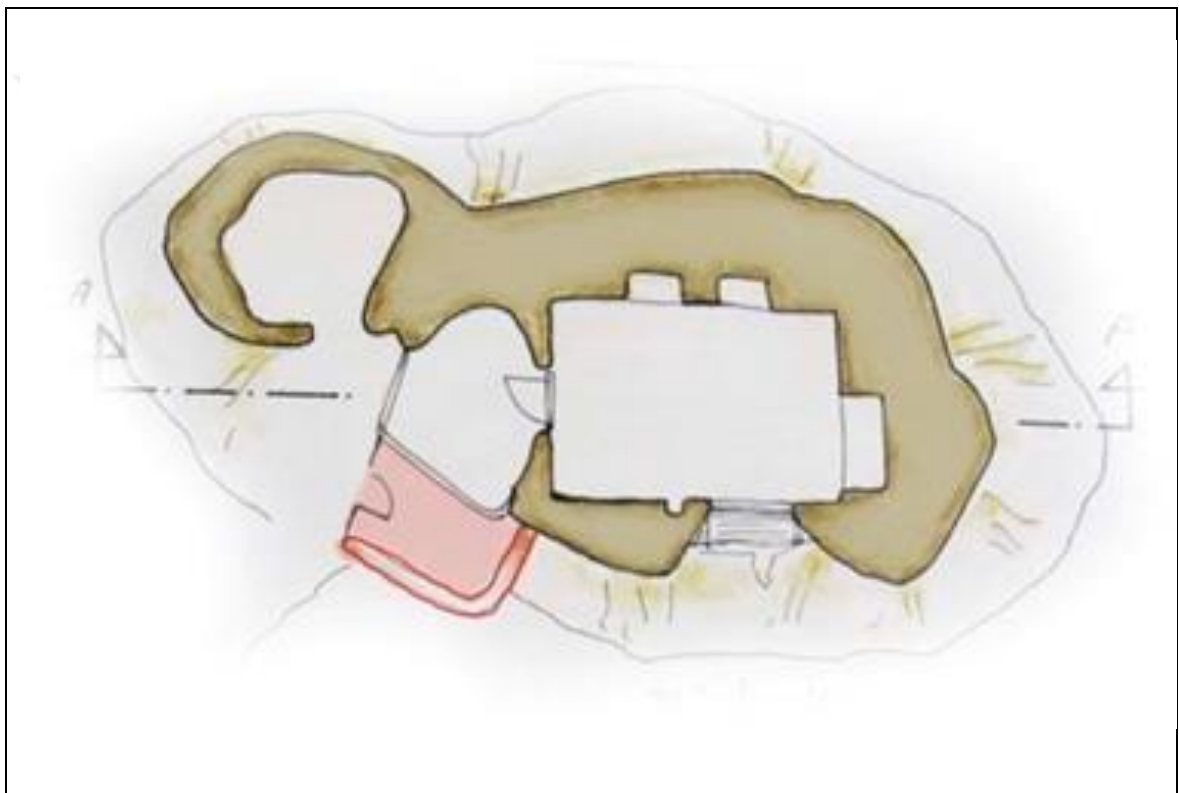


Figure 5.3. Enlarge spaces.

5.1. DESTRUCTION FACTORS OF THE CONE-SHAPED ROCKY HOUSES

5.1.1. Weathering

The destruction of rocks in Kandovan Village is influenced by several factors, with physical and chemical weathering being the most significant. Physical weathering refers to the breakdown of rocks into smaller fragments through physical processes without any change

in chemical composition. One important process of physical weathering is rock consecutive freezing-thawing, where the expansion of water during freezing exerts pressure on the rocks, potentially exceeding their tensile strength [19].

Crystallization processes, such as freezing-thawing weathering, can be particularly damaging to rock materials even over short periods. These physical weathering processes have led to the weathering and exfoliation of the surface cones in Kandovan [19].

Chemical weathering, on the other hand, involves the breakdown of minerals in rocks through chemical reactions with the atmosphere or hydrosphere. The extent of chemical weathering is influenced by factors such as access to water, the nature of gases, and the presence of acid components dissolved in water. Minerals in rocks are altered and converted to new minerals with lower strength through chemical weathering, which further exacerbates physical weathering.

Chemical weathering is often associated with the presence of clay minerals, as they indicate the weakening of the stone due to low-energy bonds in their structures. However, the absence of clay minerals and chemical weathering was found in the rocks of Kandovan through X-ray diffraction analysis of surface samples. This suggests that chemical weathering has not significantly affected the rocks in Kandovan. Overall, while physical weathering processes, such as freezing-thawing, have played a significant role in the weathering and exfoliation of rocks in Kandovan Village, the presence of clay minerals and extensive chemical weathering is not apparent based on the XRD analysis [20].

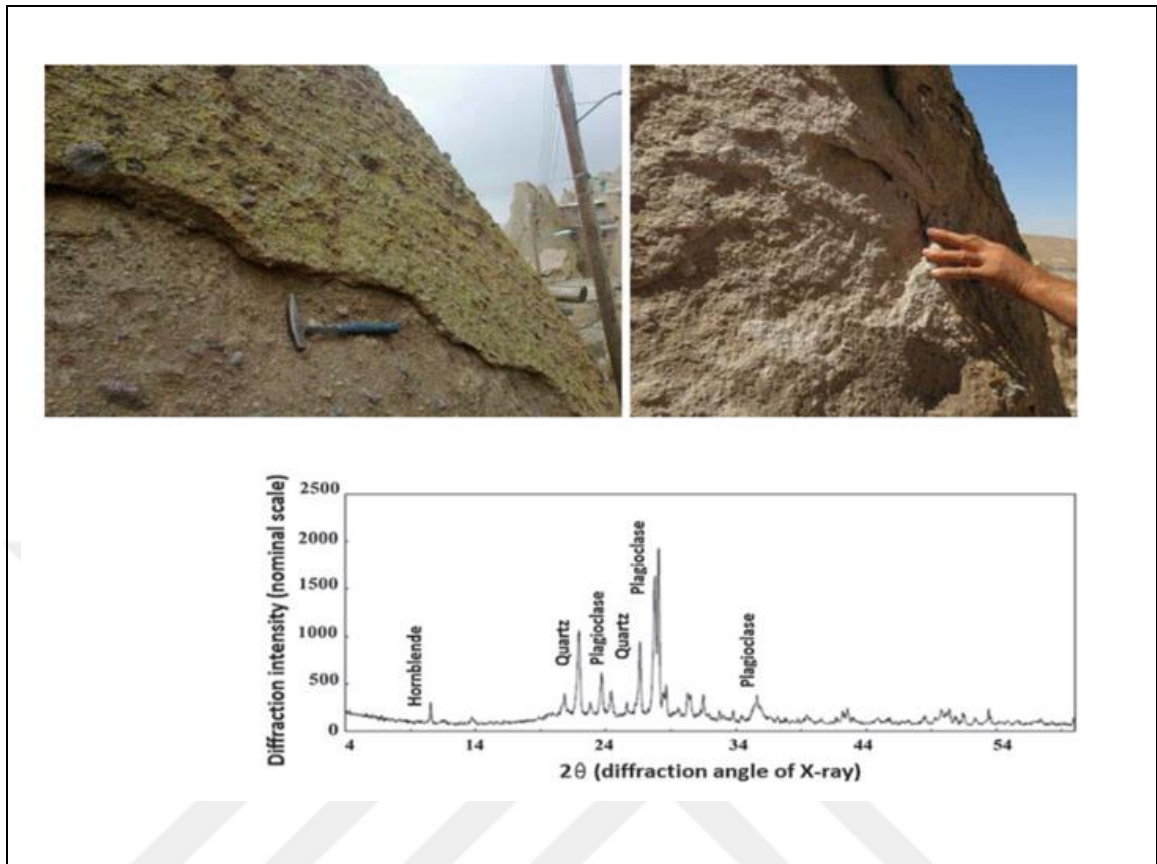


Figure 5.4. Typical results of XRD analyses on samples obtained from surface of Kandovan rocks [20].

5.1.2. The Human Presence in The Kandovan

The presence of human activities in Kandovan Village contributes to the damage of the cone-shaped rocky houses, in addition to natural factors like weathering and erosion. Several human destructive factors have been identified as significant contributors to the deterioration of these unique structures:

Excavation: Excessive excavation inside the old houses for enlargement purposes can weaken the walls and increase their vulnerability to damage. The removal of material from the rocky houses compromises their structural integrity.

Sewage Disposal: Improper and unsanitary disposal of sewage can have detrimental effects on the rocks. When sewage penetrates into the rocks, it can cause degradation and further weaken the structures.

Use of Modern Materials: The use of modern construction materials, such as concrete or inappropriate coatings, for improving living spaces or repairing damaged units can alter the natural characteristics of the rocks. This can disrupt the balance between the original rock material and the new elements, potentially leading to accelerated deterioration.

Non-compliant Construction: Construction activities that do not adhere to rules and regulations specific to the area of cone-shaped rocks can have negative impacts. Improper construction practices may introduce structural weaknesses, compromise stability, or disturb the natural balance of the rocky houses.

These human activities, when combined with natural factors, contribute to the degradation of the cone-shaped rocky houses in Kandovan Village. To preserve these unique structures, it is crucial to raise awareness about proper construction practices, implement regulations and guidelines, and encourage sustainable development that respects the natural and cultural heritage of the area [8].

5.1.3. Biodeterioration

Plants have developed various strategies to defend themselves against cold weather, and one such strategy is the ratio of surface to volume (SVR). The sections of plants tend to be thick and bushy, which results in a reduced exposed external surface. As a consequence, the marginal surface of the plant, which is more susceptible to intense coldness, is minimized, providing protection to the internal parts of the plant. The SVR, or the ratio of surface area to volume, plays a crucial role in this defense mechanism. In cold climates, forms of plants with a lower SVR are more effective in minimizing heat loss and withstanding the cold temperatures. These forms have a relatively smaller surface area compared to their volume, reducing the exposure of their vulnerable parts to the cold environment. In the specific case of Karans, it has been observed that their SVR is lower compared to other plant forms. This indicates that Karans have evolved a shape that optimizes their ability to withstand cold weather. The reduced surface area relative to their volume allows Karans to minimize heat loss and protect their internal structures from the harshness of the cold climate [21].

By adopting a form with a lower SVR, plants like Karans demonstrate their adaptation to cold climates and their ability to thrive in such conditions. Understanding these adaptive strategies can help in the development of plant-based solutions for cold climate environments or inspire architectural and design approaches that take inspiration from nature's efficient defense mechanisms [8].

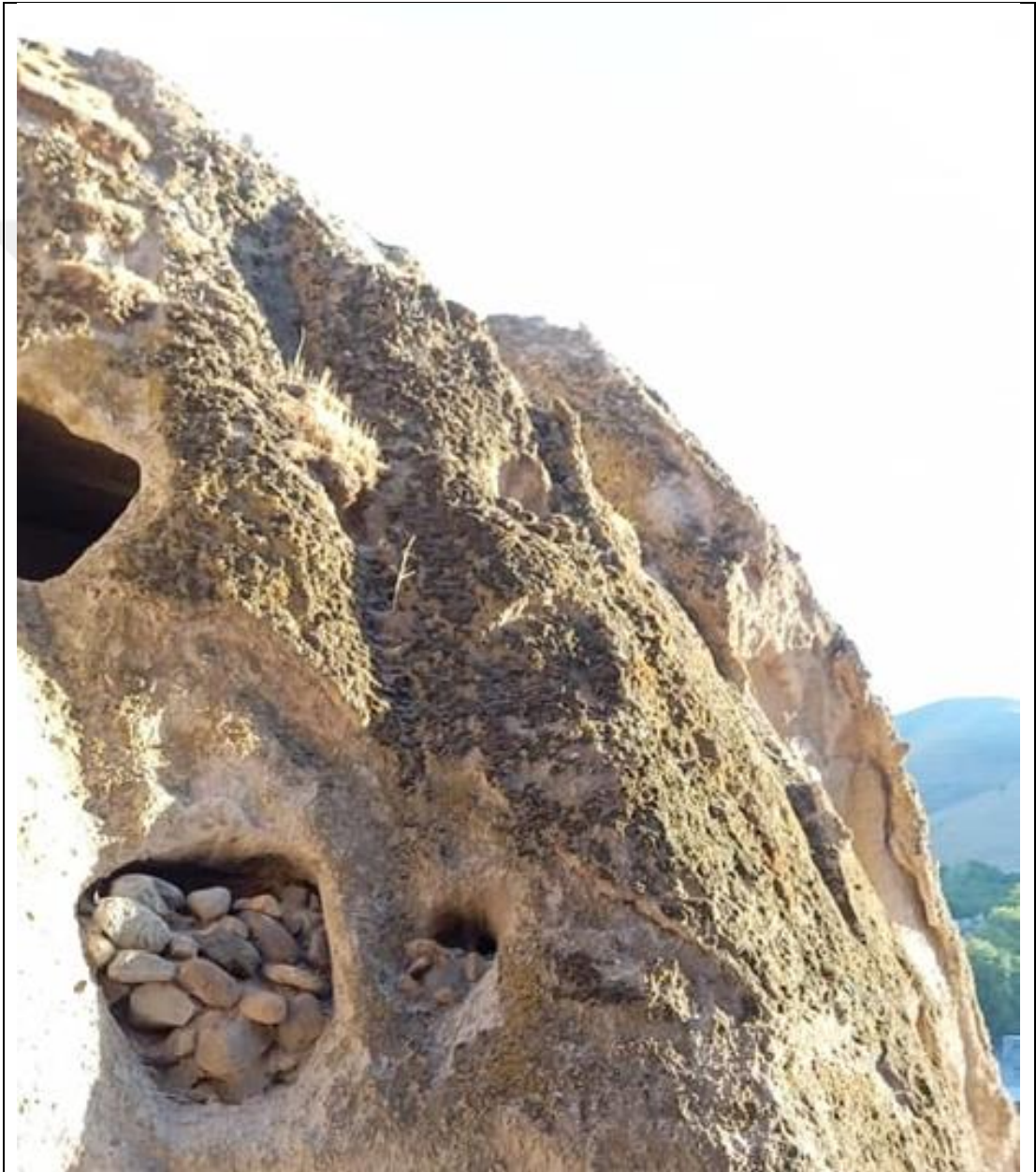


Figure 5.5. A view of the material on the Karans [8].

5.1.4. Internal Capacity of Kandovan Stone

Karans in Kandovan have been formed as a result of the eruption of Sahand Mountain. Over time, the weaker and less resistant parts of the Karans have eroded, leaving behind the hard and porous sections. These hard and porous parts have developed a sturdy outer shell in response to the cold climate of Kandovan. Natural holes within the Karans indicate that there were air and gases trapped inside during their formation, but over time, these gases have dissipated, leaving hollow spaces within the Karans. In the context of accessing a comfortable living environment in cold climates, two important factors come into play: thermal capacity and thermal resistance of the building material. The thermal capacity of a material depends on its specific gravity and specific heat [8].

Materials with higher specific gravity have greater thermal capacity. Additionally, the thermal capacity is influenced by the thickness and density of the material. For example, a piece of iron can retain the heat from sunlight for only a few minutes, whereas stone can retain it for several hours. This time lag allows the heat to penetrate the material during the day and release it into the interior atmosphere during the cold nights. Therefore, using materials with high thermal capacity is suitable for the cold and dry climate of Kandovan, where there are significant temperature fluctuations between day and night. The igneous rock that forms the primary component of Karans has high thermal capacity, allowing it to absorb sunlight during the warm daytime hours and release the stored heat inside the Karans at night. Furthermore, the porous nature of the Karans, resulting from the percolation of gases, contributes to the material's high thermal resistance. This combination of high thermal capacity and thermal resistance in the igneous rock plays a crucial role in creating a comfortable living environment within the Karans. It is worth noting that recent developments in Kandovan have focused on the southern area near the village entrance. However, this deviation from traditional architecture has resulted in inhomogeneous development, which has adversely affected the traditional texture and aesthetic of the village. Traditional houses in Kandovan typically allocate the ground floor, with its spacious and dimly lit environment, for use as barns where the heat generated by animals is utilized. The upper floors are reserved for human residence, providing a more comfortable living space [8].

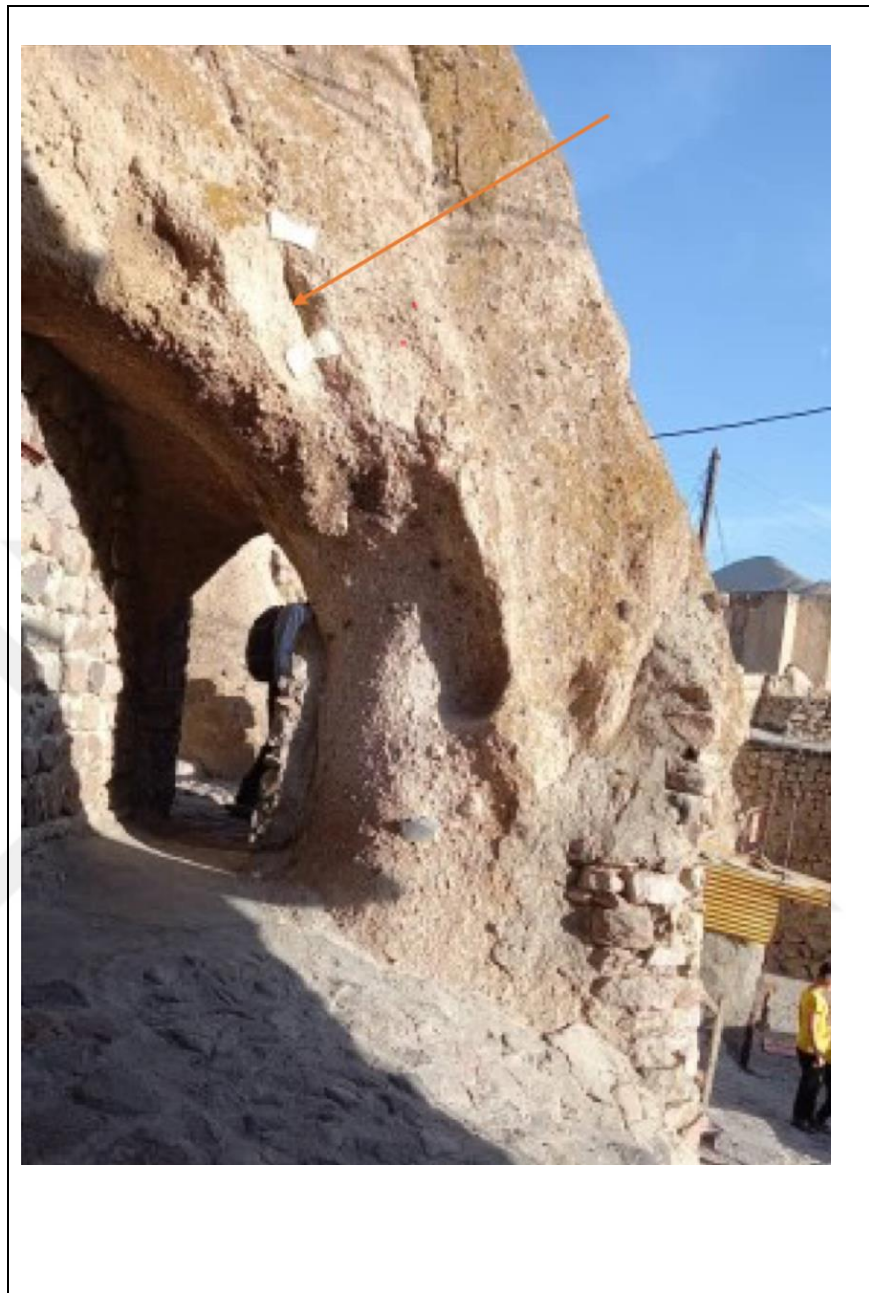


Figure 5.6. A man-made passage between Karans and deep and dangerous cracks and previous consolidation work. (it is seen that a dirty crust formation on a karan, possibly caused by lichens, and a deep crack caused by thermal expansion are fixed with tapes against the risk of detachment. It is possible that a consolidated material was injected into this crack. These type tapes may also be placed to monitor how wide the crack has grown) [8].

5.1.5. Human factor in deterioration

Entrances to these residential units are through open-air steep alleyways with stairways extremely difficult to climb. have different floors that access these floors in specific ways which are built next to the borders and are accessible (ground floor: barn, first floor: Residential, second floor: guest room, third floor: if there is storage (and from the inside none)).

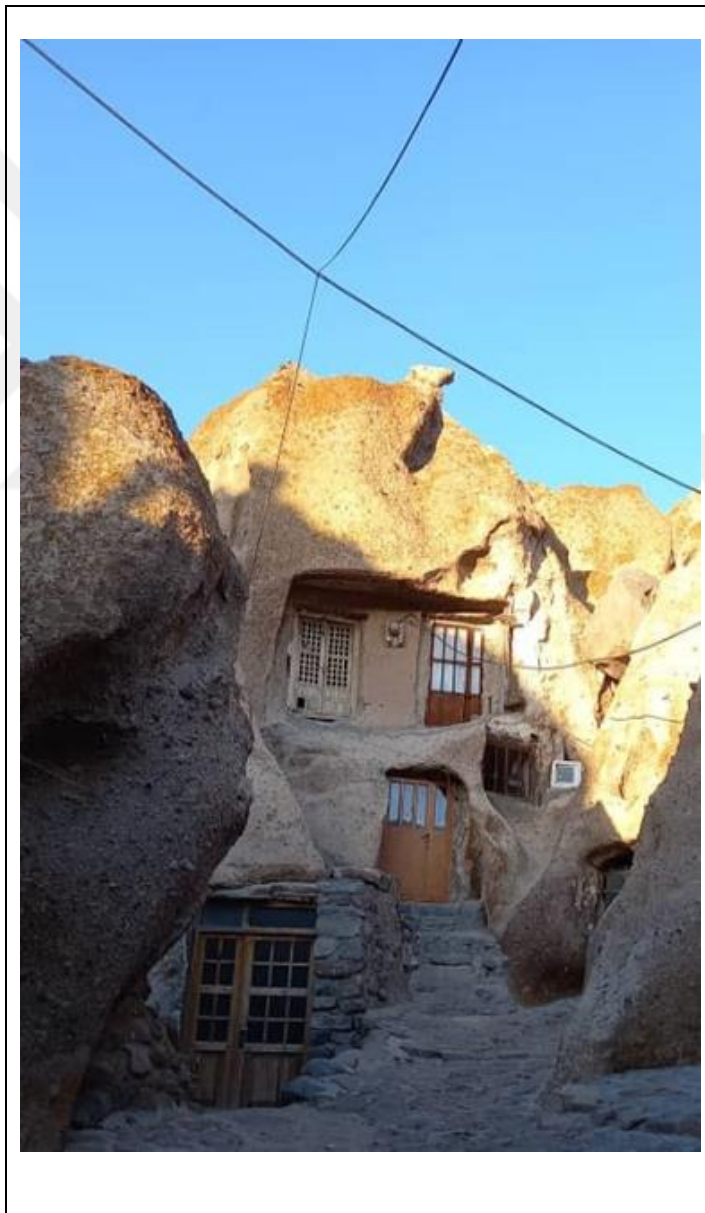


Figure 5.7. The three-story Karan always has a different entrance.

They are not related to each other. Varieties of different borders are very diverse in terms of appearance due to geological processes and they exist in multiple, paired, single, conical and spindle forms, the height of these borders are more than 60 meters from the village road level. Regarding the age of Kandovan, there is a need for archaeological studies and verification of existing assumptions. It is felt as necessary but now there are three existing theories regarding the beginning of settlement in Kandovan, which are as follows [21]:

- About 700-800 years ago, with the Mongol attack on this place, people from Hilhavar [village 2 km west of Kandovan which is underground] to Kandovan Kuch and have built houses on stone borders.
- Another theory of the settlement of a few warriors and the establishment of Kandovan headquarters due to the situation. Its topography is facing the place that they prepared as their shelter.
- The residents were nomads who used Kandovan as a camp before. They use the digging of rocks as a temporary home to stay in one place have been.

Karans are divided into two categories in terms of appearance and number of layers [19]:

- In terms of appearance: in the village of Kandovan, we can see diverse, multiple, paired, single, cone-shaped, and spindle-shaped Karans, the type of these Karans and cones.
- is innumbrated and lahar, the height of these Karans is more than 60 meters.

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Figure 5.8. Man-made stairs and new building material

The number of floors and the form of the spaces inside the borders depends on their size and shape. Borders are generally two-story, but in some cases, three- and four-story borders are also observed. The connection between the borders of the upper floor is and there is no connection from the inside, the only internal connection can be seen in the border of the late Motamed, where the internal staircase connects the threshold of the ground floor to the basement (warehouse) [19]. The dimensions of the roofs are relatively small due to their safety and stability, and in cases where larger spaces are needed, such as mosques and barns, in the middle of the roofs, thick columns are carved out of stone to support the roofs. Berry School. Indeed, the abundance of agricultural land, availability of food for livestock, and access to water from the Kandovan River have played significant roles in the continued functionality and habitation of the village. These natural resources have provided the necessary sustenance for the residents, allowing them to maintain their livelihoods and support their community. One remarkable aspect of Kandovan is the harmonious relationship between humans, nature, and architecture. Unlike traditional architectural practices where structures are built within nature, in Kandovan, the inhabitants have

skillfully utilized the existing natural formations to create living spaces. Instead of constructing buildings, they have extracted habitable spaces from the heart of nature itself. This unique approach to architecture demonstrates the adaptability and resourcefulness of the residents. By carving dwellings into the pyramidal cliffs formed by erosion, they have integrated their living spaces seamlessly into the natural landscape. This not only showcases the ingenuity of the community but also highlights the deep connection between humans and their environment. The village of Kandovan stands as a testament to the intimate relationship between man, nature, and architecture, where the natural formations have been transformed into functional and sustainable living spaces [19].

With industrialization and the convenience of transportation, the tourism potential in the region has increased, the buildings used as residences have started to be used for commercial purposes, and the Kandovan has now become a tourist location. As a result of uncontrolled urbanization, the vernacular architecture that the local people produced with local materials began to deteriorate with the bad additions that are seen almost everywhere and spoil the authenticity of the region.

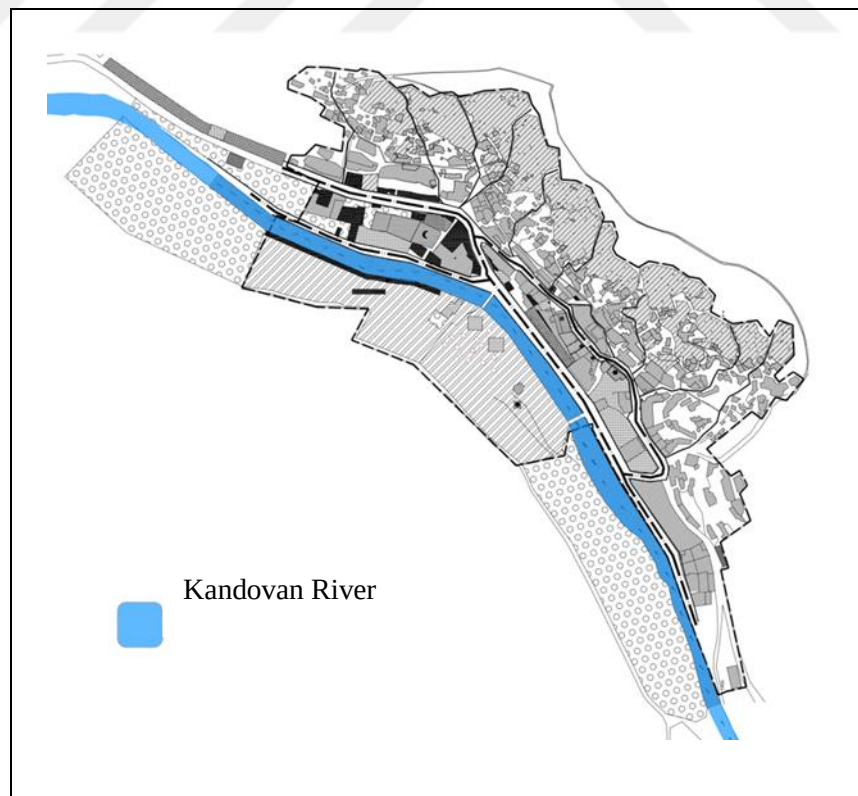


Figure 5.9. Site map of Kandovan natural heritage site and access routes and Kandovan river [4].

At present, a new urban texture has come to the fore, integrated with this magnificent natural environment, poor quality construction work, and unplanned man-made additions. The effects of uncontrolled tourism are also worrying. Although the area has been heavily used and modified by humans in the last century, the harmony with the emerging landscape and life and the inherent values of the unusual natural landforms are a phenomenon that naturally converges. To solve the problems, tourism development, and conservation master plans should be prepared for the Kandovan.

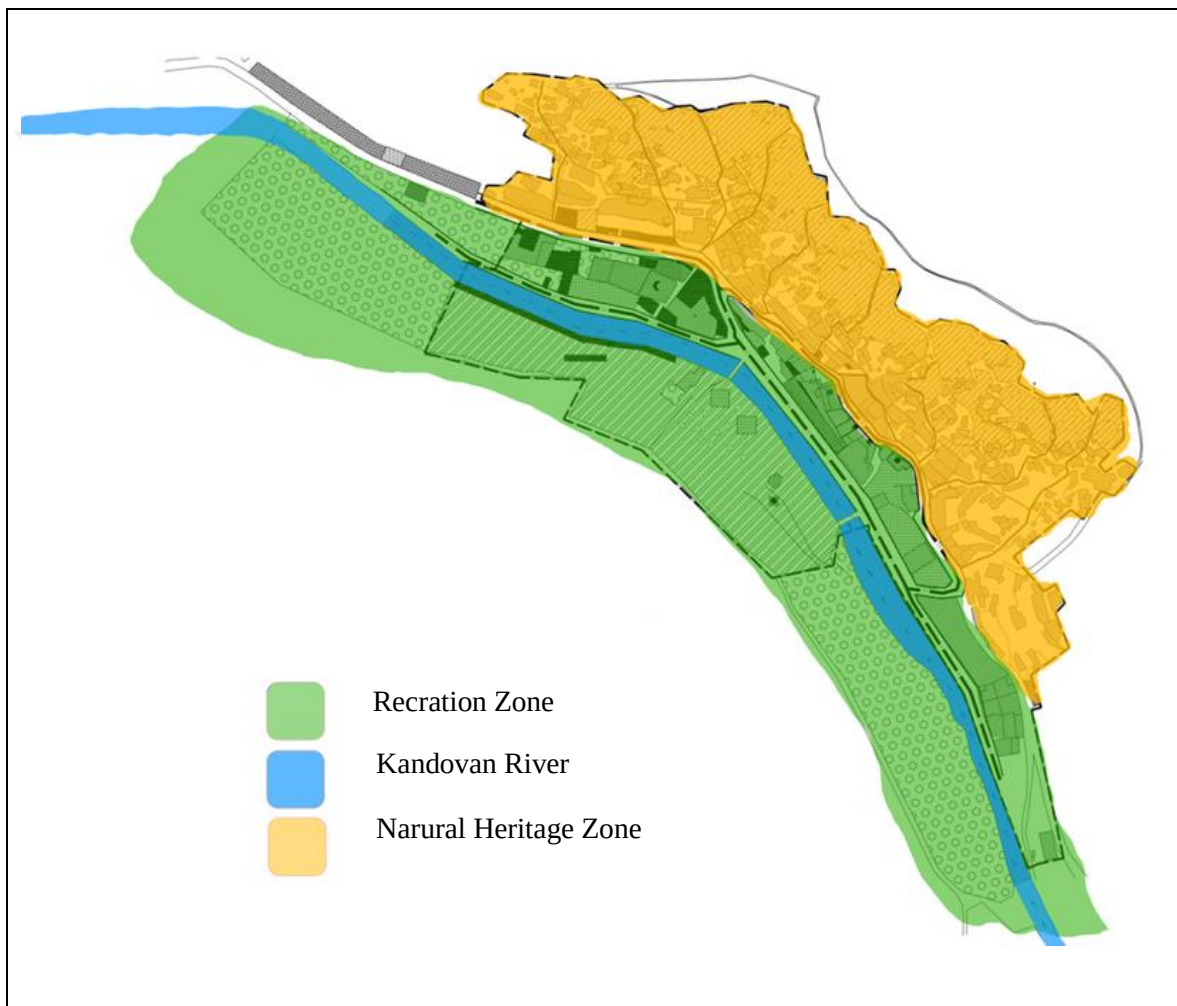


Figure 5.10. Analyses zones of Kandovan Village.

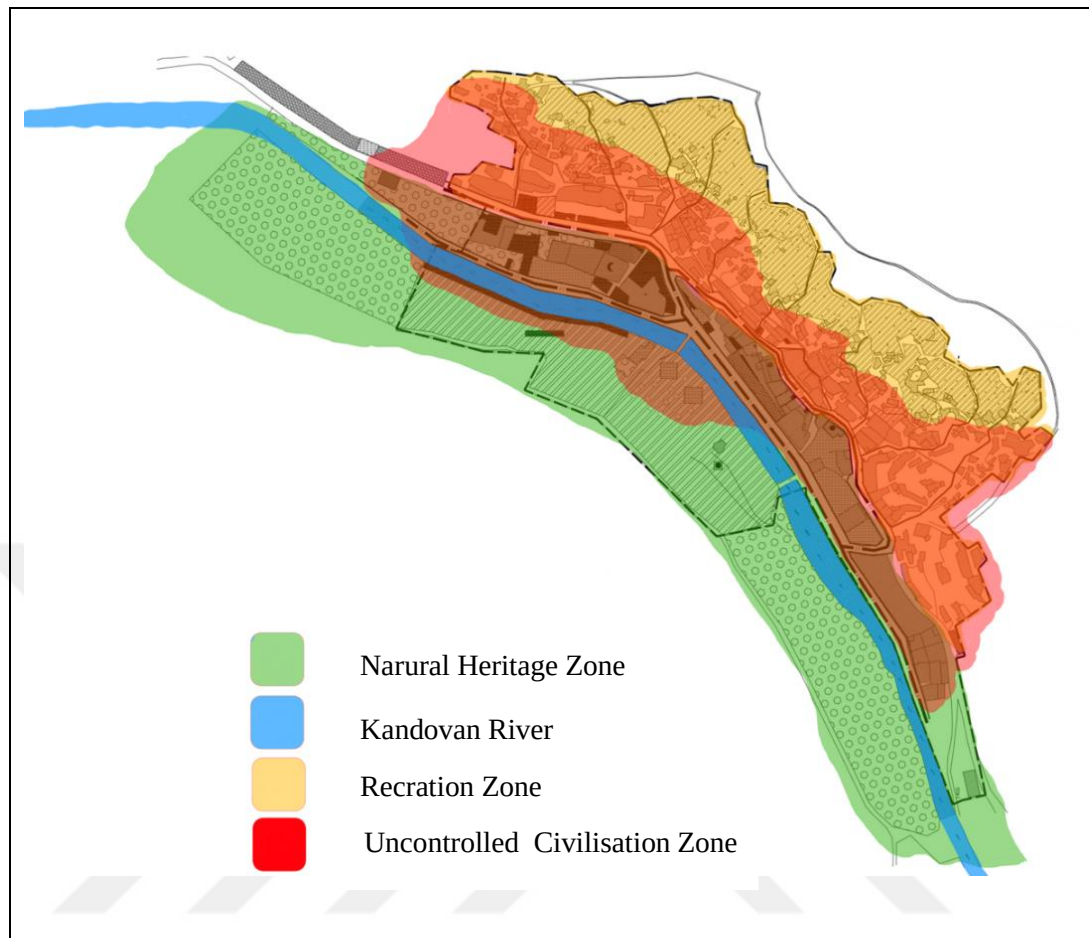


Figure 5.11. Analyses uncontrolled zones of Kandovan Village.

Kandovan should be included in the World Heritage List based on its geological formations as a natural heritage site. When the vernacular architectural characteristics of the local people living in this area and the originality of their lifestyle are evaluated; The first-degree protected area should be accepted as a cultural/natural site. The 2nd-degree zone surrounding it together with the recreation zone should also be protected, and new formations that close the original formations and threaten the original appearance should be cleared, or these formations should be revised, and a new conservation plan should be created.

5.2. CONSERVATION PROBLEMS OF KANDOVAN NATURAL HERITAGE SITE-SWOD ANALYSIS

5.2.1. Investigating The Climate (Strengths, Opportunities, Weaknesses, And Threats)

- Strengths (s)

- Cool weather in summer
- Low temperature in summer
- Effectiveness of weather in attracting tourism
- Suitability of air humidity
- Suitability of wind speed in summer
- Appropriateness of seasonal rains according to the advantage of the place
- Positioning in the geographical direction of sunlight
- Suitability of air pressure in the place
- Being a villa
- Lower temperature in the lower parts of the valley at night than during the day

- Weaknesses (w)

- Cold weather in winter
- Effectiveness of weather in reducing tourism in winter
- The place is covered with snow in winter
- Possibility of blizzard in winter
- The existence of glaciers in the cold season
- The need for mechanical heating in winter
- High wind intensity in winter
- Low temperature at night
- Temperature difference between night and day
- Lower temperature in the lower parts of the valley at night than during the day

- Threats: (t)

- Low seasonal rainfall in recent years

- Opportunities (o)

- The possibility of holding winter games, especially skiing

- Use of passive solar heating
- Take advantage of natural cooling in summer in buildings
- The possibility of creating entertainment and tourism centres
- The possibility of using free energy after the necessary investigations

5.2.2. Examining The Natural Environment in Terms Of (Strengths, Opportunities, And Threats) Kandovan Village In Terms Of Climate

- Strengths (s)
 - Presence of water resources and rich mineral waters in the place
 - The existence of a green valley suitable for leisure time
 - Existence of Sahand mountain and the recreational area of Sahand range
 - Environmental health of the region
 - The land has adequate resistance in terms of soil stability
 - The possibility of ease in disposal of sewage
 - The possibility of directing and disposing of surface water
 - Having suitable plant cover in the upper pastures
 - Unique views in the natural landscape
 - Optimum area for bee breeding
 - The presence of indigenous stone materials in the region
- Weaknesses (w)
 - The slope of the land is high
 - Lack of flat land for settlement development
 - The place is mountainous
 - Placement in the high earthquake zone depending on the entire region of Azerbaijan
 - Lack of proper control of environmental issues
 - The possibility of flooding in the valley and the need to observe privacy
- Threats: (t)
 - Destruction of the environment in case of weakness in providing services to tourists

- Destruction of the environment in case of non-compliance with environmental issues in the implementation of projects
- Opportunities: (o)
 - The possibility of benefiting from the suitable natural landscape of the region
 - The possibility of creating attractive tourism spaces
 - The possibility of benefiting from the blessing of water to increase the attraction of tourism
 - The possibility of establishing water treatment centres
 - Benefiting from native materials in the construction of buildings, especially stone

5.2.3. Examining Economic, Social and Cultural Issues In Terms Of (Strengths, Opportunities, Weaknesses And Threats)

- Strengths (s)
 - The existence of retail and market environment in the place
 - Existence of bank and bank ATM system
 - There is a restaurant for tourists
 - The existence of a hotel for tourists
 - The existence of an anthropology museum for tourists
 - The presence of rich pastures for raising sheep
 - Access to transportation routes in the region
 - Having an asphalt communication network
 - Hardworking of residents
 - The existence of a field to separate the place where cattle are kept from the residential unit
- Weaknesses (w)
 - Weakness in accommodation and reception centres
 - Lack of planning for investment in the place
 - Weakness in providing travel services for tourists
 - Lack of a strong plan to attract tourism
 - Weakness in accepting the relocation plan by the villagers
 - Absence of accommodation centres with reasonable prices for tourists

- Lack of attention to the culture of the people in the place in line with the touristic role of Kandovan village
- Lack of familiarity of residents with the culture of tourism
- Lack of grounds for non-natives to provide tourism services
- Threats: (t)
 - The possibility of failure of the project in the absence of cultural formation and readiness of the local people for change and transformation
 - The possibility of social and cultural problems due to the distance between two settlements in the future
- Opportunities (o)
 - The possibility of creating economic activities related to accommodation services
 - The possibility of creating activities related to recreational and cultural services for tourists
 - Providing the basis for the use of local manpower in the direction of the development of tourism services
 - Ability to provide educational services
 - Ability to organize recreational, educational and cultural camps
 - Ability to develop medical services in order to create mental and spiritual peace
 - Providing a residential environment with high goals of development in the region, considering the separation of humans and livestock

5.2.4. Examining Physical Issues in Terms Of (Strengths, Opportunities, Weaknesses and Threats)

- Strengths (s)
 - The existence of unique historical context and famous architecture of Kandovan
 - The existence of unique and beautiful buildings in Kandovan
 - The presence of electricity in the village
 - Existence of telecommunications
 - Presence of city gas
 - Having a suitable asphalt road
 - Access to the historical metropolis of Tabriz

- Access to Tabriz airport
- Access to Tabriz railway station
- Stone cutting is the main road of the village
- Weaknesses (w)
 - Weakness in waste collection and disposal
 - Absence of a written program in the construction of new buildings
 - Failure to construct a building according to rural culture due to the slope of the land
 - Lack of smooth and suitable land for the future development of the village
 - Weakness in public transportation to provide services to tourists
 - Absence of cultural and religious centres worthy of the attention and needs of tourists
 - The inappropriateness of the village road network in its physical context
 - Absence of recreational and sports centres
 - Lack of car parking
 - Lack of suitable health services for tourists
 - Absence of sewage collection and disposal system
 - Absence of accommodation centres for tourists
 - Lack of suitable reception centres
 - The existence of a distance between two settlements as one settlement in terms of providing social services, especially education, considering the existing population threshold.
- Threats: (t)
 - Destruction of the image and general landscape of Kandovan in the absence of a strong management plan
 - The possibility of failure of the plan and destruction of the building built in the new place if the people do not accept the plan
 - The possibility of loss of life and destruction of borders in the old structure in case of poor management and non-use of them in the future.
- Opportunities (o)
 - Access to transportation routes in the region
 - Access to the city of Tabriz
 - Creation of tourist spaces for domestic and foreign travellers

- The possibility of disposing of sewage and surface water according to natural conditions
- The possibility of preserving the buildings and texture of the village due to the existence of life in the place

5.3. KANDOVAN CITY FORMATION

The damages of the border which is in the Aghajabasi neighbourhood and near the border of the old Kandovan mosque, are as follows. These disturbing factors are in two parts, human and natural factors [22].

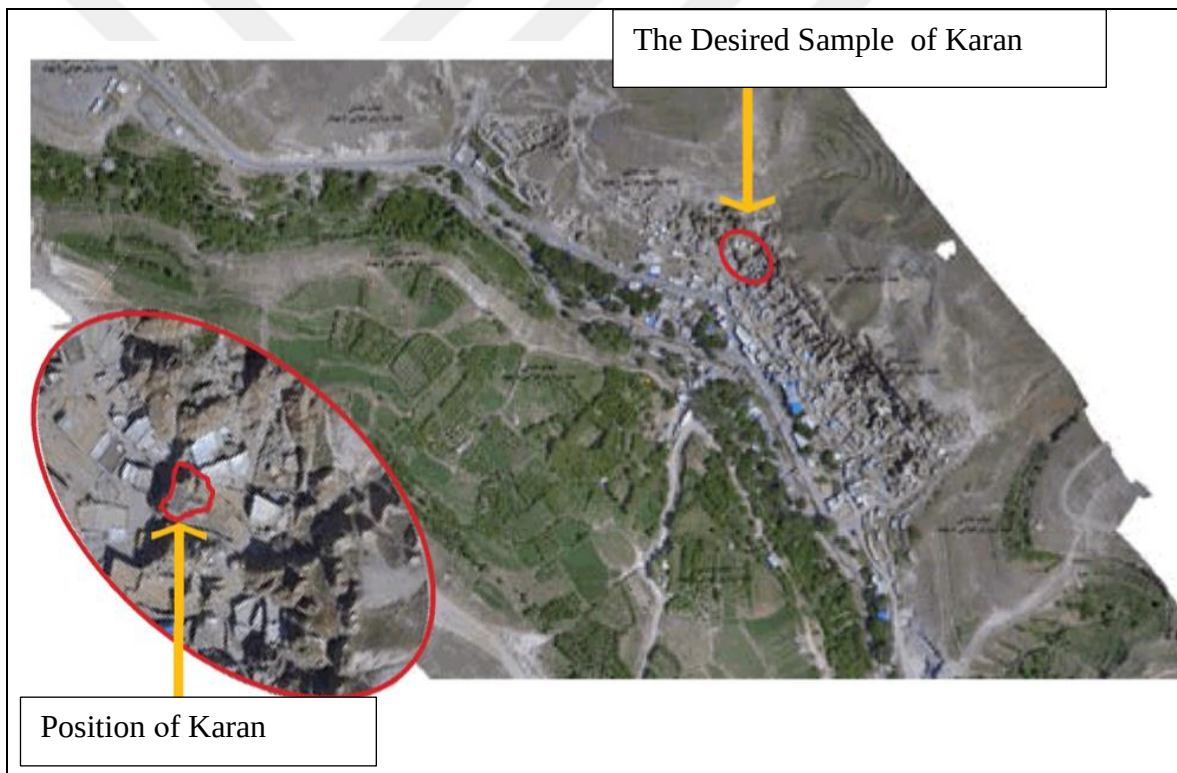


Figure 5.12. Position of Karan Sample [22].

A. Human disturbance factors:

A.1. Unauthorized excavations and emptying of part of the foundations below the border transfer the main load to the soil.

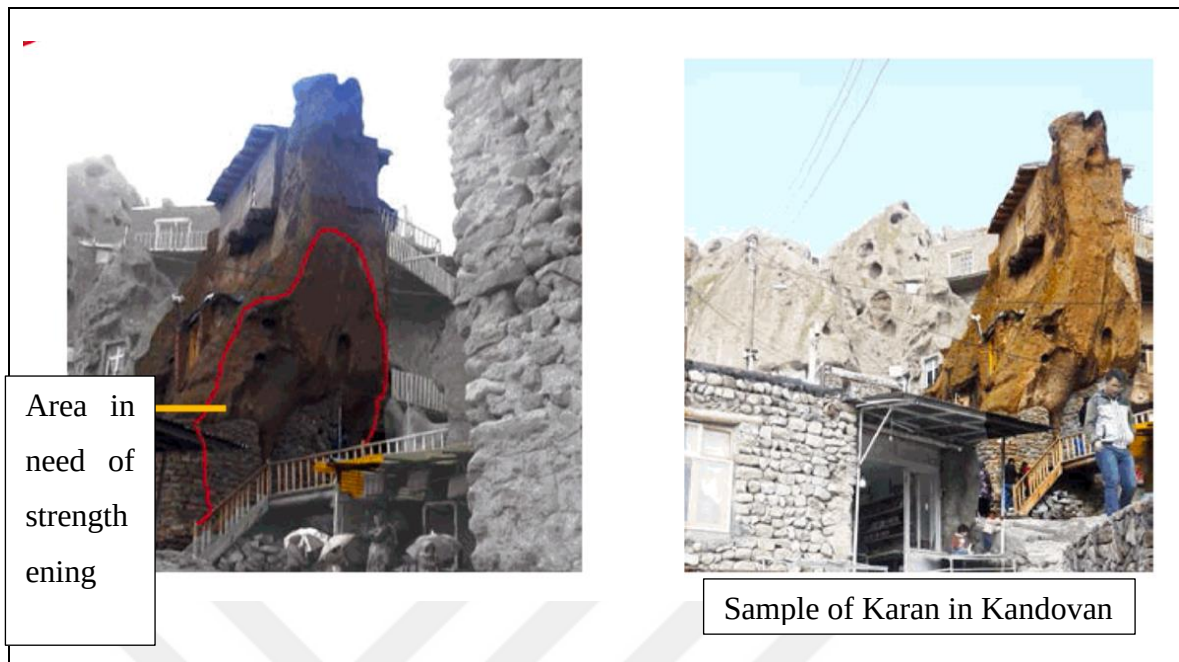


Figure 5.13. part of human disturbance factors in Karan [22].

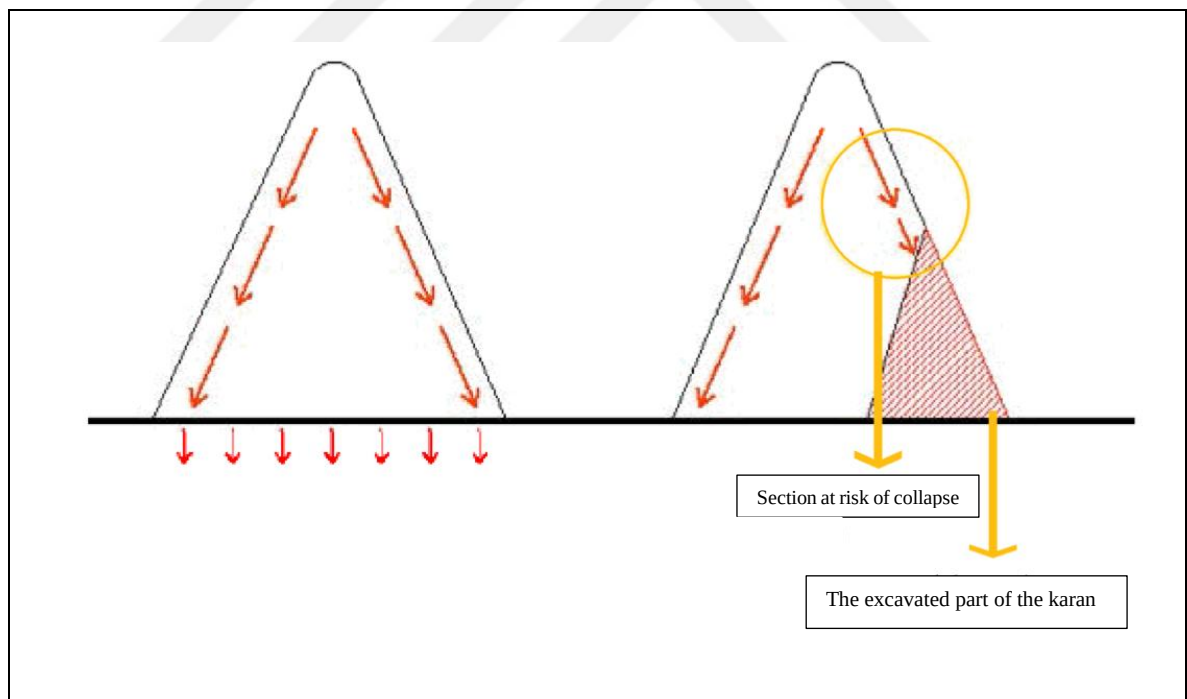


Figure 5.14. Disturbance in the transmission of compressive forces due to the removal of a part of its bases [22].

A.2. The addition of an extension that on the one hand changes the main face of the building and landscape of the village and on the other hand puts an additional force on the Karan.

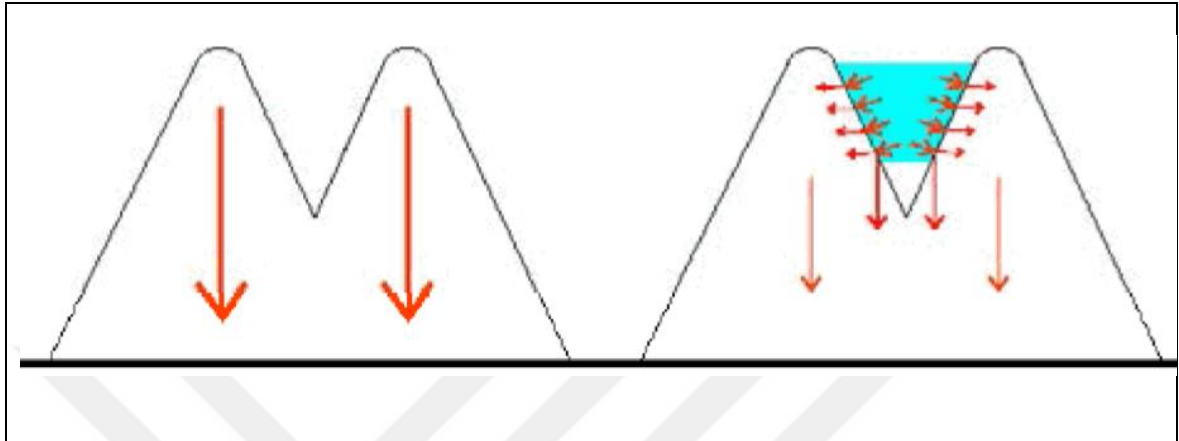


Figure 5.15. Adding an additional part and increasing the horizontal forces on the building.
[22].



Figure 5.16. Back of the Karan and the additional part on the Karan [22].

A.3. Expanding the dimensions of light entry holes and turning them into large windows, which weakens the wall and disrupts the direct path of compressive forces.



Figure 5.17.Karan's window [22].

B. Natural disturbance factors

The factors of physical erosion and its effects on the outer layers of the borders in the form of flaking and creation of holes and penetration of water to the depth of the crust, the growth of living microorganisms such as lichen on the border wall, which gradually causes the erosion of the outer layer of the Karan.

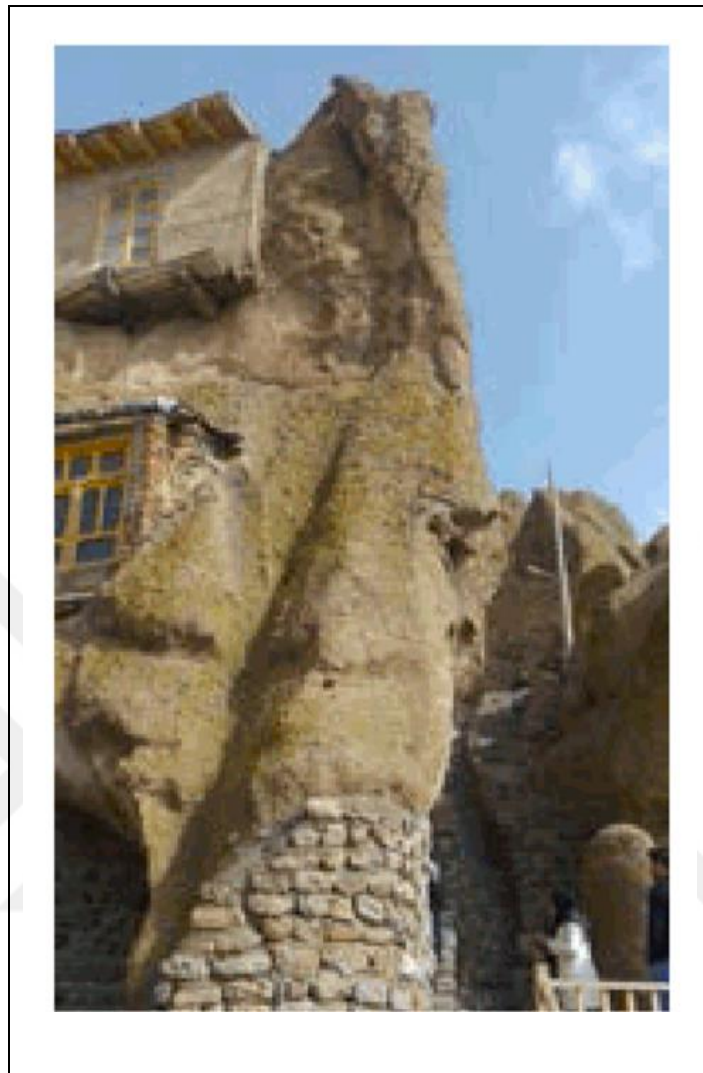


Figure 5.18. Outer layer of the Karan [22].

C. Identification of Complications Caused by Disturbing Factors

Complications caused by human factors as result of unauthorized excavations, increasing additional loads on the Karan due to the addition of non-homogeneous additions to the village fabric and weakening of the walls in order to increase the dimensions of the windows. horizontal cracks have appeared on the edge surface.

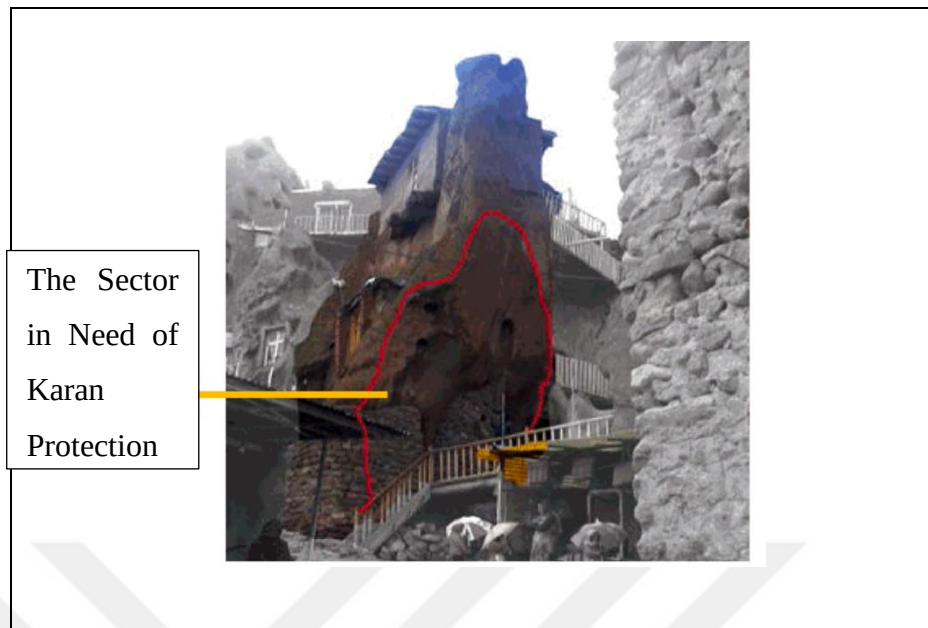


Figure 5.19. The sector in need of Karan protection [22].

D. How to Approach Treatment

In order to start the restoration of model number one Karan, it is suggested that according to the stated principles and the emergency of this border and borders with similar conditions, first prevent their destruction by using temporary protective structures such as wooden piles, then strengthening operations according to the type of border. and the state of its damage is removed.

Measure Of Immediate :Temporary protection. In the first stage, according to the placement area of sample, which is on a busy road, we need a temporary protection measure so that the permanent protection structure can be added at the right time and prevent the risk of its collapse. The minimum diameter of the pile head is 30 mm, and wooden cushions are also needed at the place where the pile is connected to the Karan and the ground to create a better connection to prevent it from falling [22].

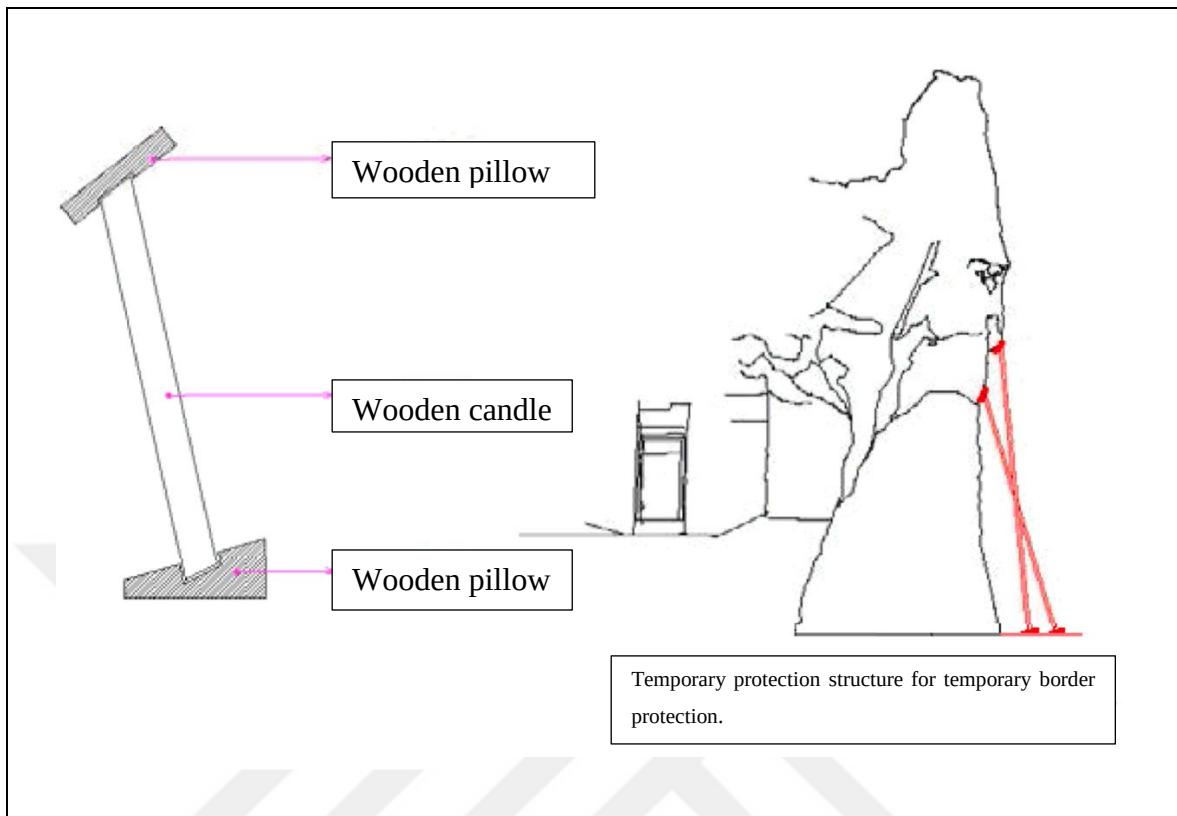


Figure 5.20. Schematic details of how to implement the temporary wooden protective structure and the wooden cushions at the end and the beginning [22].

Cleaning The Surface of The Karan from Pollution: In the next step, after placing the wooden piles and removing the danger temporarily, in order to implement the structural foundation, it is necessary to remove the surface of the Karan from all types of pollution such as soil and microorganisms [22].

Remove Inhomogeneous Additions: Considering the location of the border at the entrance of the old Kandovan mosque neighbourhood and completing the skyline and landscape of this part of the village in connection with the old mosque, it is better to preserve the original form of the border [22].

Based on this, it is recommended to remove the additional building behind the border, which, in addition to the morphological change of the border in the view of the village, puts additional pressure on the border [22].

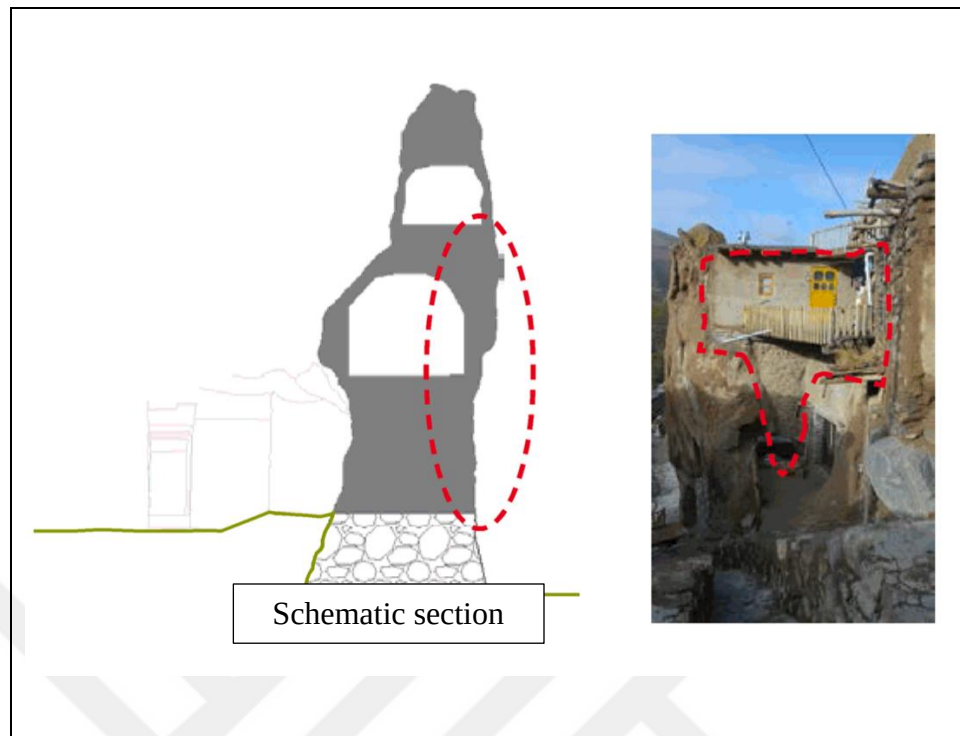


Figure 5.21. Removal of an annex building that is not homogeneous with the fabric of the village [22].

Building A Structural:

Stone foundation, after performing the temporary protection operation, we will implement the stone structure as a foundation for strengthening. At this stage, a stone base is laid using mountain stones and mortar, and according to the height of about 10 meters of the fracture created in the area at risk of falling, the instruction is that the native stones should be immersed in the mortar and according to the method described in It will continue to be checked and arranged [22].

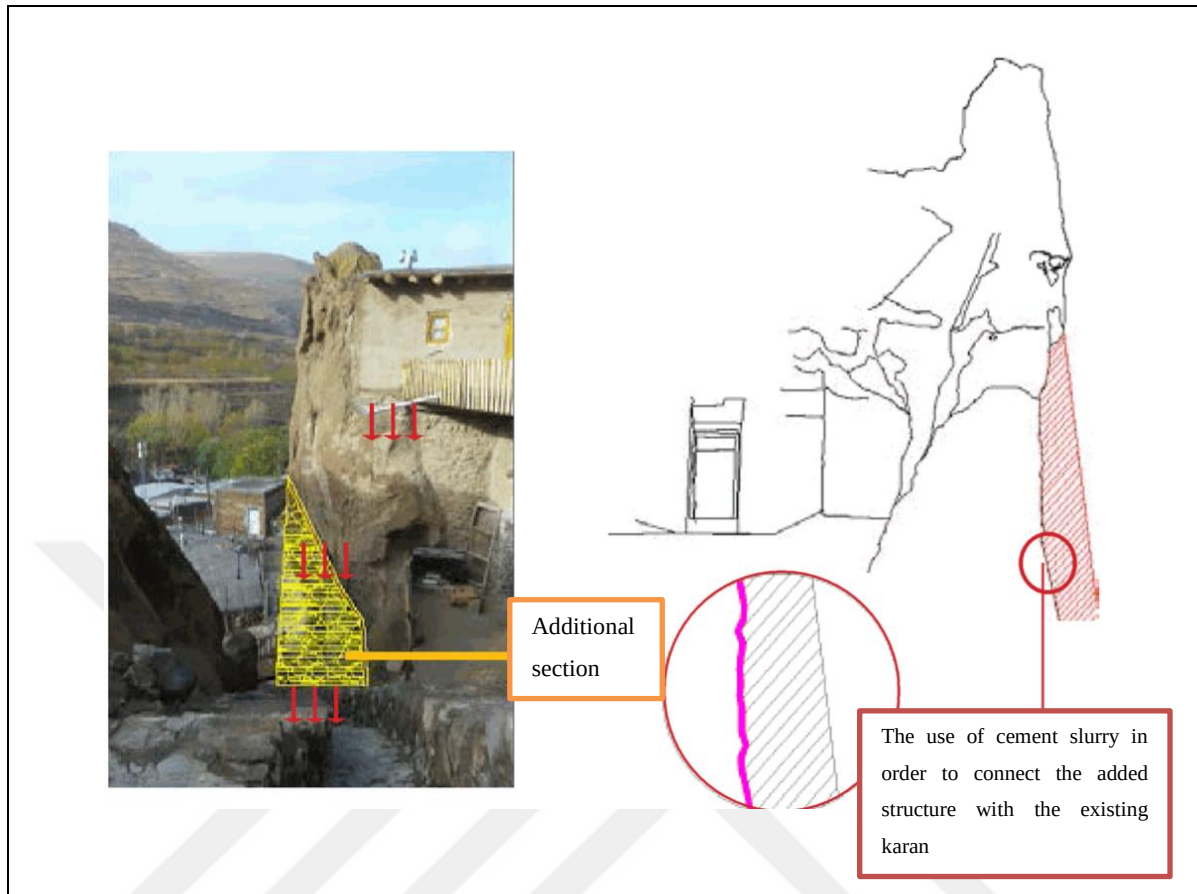


Figure 5.22. The use of cement slurry in order to connect the added structure with the existing Karan [22].

Change The Dimensions of The Windows:

In order to strengthen the weakened walls of the borders by expanding the dimensions of their windows, it is necessary to reduce the dimensions of the windows [22].

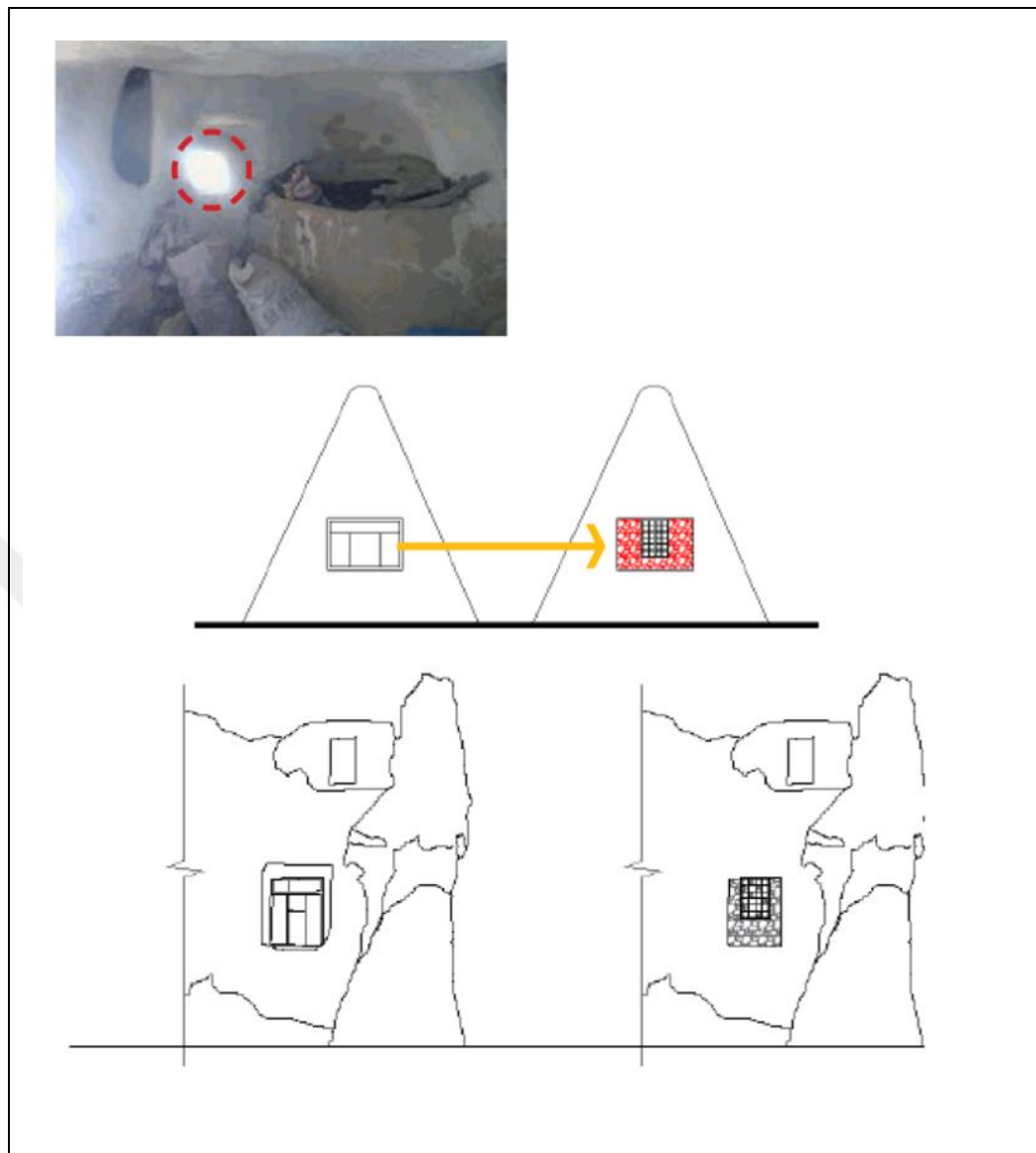


Figure 5.23. The pattern of small light holes in the Karans of the village [22].

Implementation Of Thatch Cover: Thatch cover from the implementation of the stone foundation is suggested to maintain the appearance of the village, the addition of thatch cover on the stone foundation, and in this way, more harmony is created between the colour and texture of the borders and protective extensions. Necessary explanations are given in order to deal with physical and chemical disturbing factors in the restoration approach [22].

State Of Preservation/Conservation: With industrialization and the convenience of transportation, the tourism potential in the region has increased, the buildings used as residences have started to be used for commercial purposes, and the Kandovan has now

become a tourist location. As a result of uncontrolled urbanization, the vernacular architecture that the local people produced with local materials began to deteriorate with the bad additions that are seen almost everywhere and spoil the authenticity of the region.

At present, a new urban texture has come to the fore, integrated with this magnificent natural environment, poor quality construction work, and unplanned man-made additions. The effects of uncontrolled tourism are also worrying. Although the area has been heavily used and modified by humans in the last century, the harmony with the emerging landscape and life and the inherent values of the unusual natural landforms are a phenomenon that naturally converges. To solve the problems, tourism development, and conservation master plans should be prepared for the Kandovan [18].

Kandovan should be included in the World Heritage List based on its geological formations as a natural heritage site. When the vernacular architectural characteristics of the local people living in this area and the originality of their lifestyle are evaluated; The first-degree protected area should be accepted as a cultural/natural site. The 2nd-degree zone surrounding it together with the recreation zone should also be protected, and new formations that close the original formations and threaten the original appearance should be cleared, or these formations should be revised, and a new conservation plan should be created.

Kandovan Village is a unique cultural and natural heritage site (Mix Heritage) with its unique geological structure, local architectural values (Vernacular Architecture) produced by local people with natural materials and local craftsmanship, and it is worth nominating the UNESCO world heritage list. A new conservation plan should be made by controlling both the deterioration in the geological structure of the Karans, and rapid and unplanned growth of the city, and it should be included in the UNESCO world heritage list with an emergency response.

It is seen that the source of livelihood is provided by tourism revenues (hostels, hotels, restaurants, shops), and animal husbandry is applied in the second plan. For this reason, Kandovan should be re-planned by the state as a touristic location and the protection of the natural heritage site should be examined in the foreground.

Inadequate interventions of the local people (such as widening windows and doors, replacing them with modern, compatible old and new materials) can be controlled with awareness.

After a major conservation program, education of local people will be the second important step to protect this unique historical natural heritage.

In the uncontrolled, unplanned growing village of Kandovan, unqualified buildings have disrupted the green recreation zone on both sides of the Urmia River, entering between the natural Karans, making it difficult to perceive the natural heritage formations. The Kandovan Village protection plan should be prepared by the government and take into consideration immediately. New constructions should not be allowed, unqualified additions that cause the original geological formation to be perceived poorly should be removed. Thus, the original natural heritage site will be easily perceived [18].

5.4. ANALYSIS OF THE SIMILARITIES WITH CAPPADOCIA AND KANDOVAN

The first Karans of the region are the Karans of Persian sovereignty, which gave the region its name (Katpatuka). These borders cover a large part of Central Anatolia, extending the Kızılırmak River in the west, the Euphrates in the east, the Taurus Mountains in the south, and the Black Sea in the north. The political borders of the region have been changing over the centuries, but the centre has always developed in the south. This area is bounded on the south and east by the volcanic Erciyes and Hasan Mountains, on the north by valleys opening to the middle reaches of the Kızılırmak River and separated by deep ravines, and on the west by the Salt Lake depression. Within this large geographical area, especially the region known as Rocky Cappadocia, in the triangle of Avanos, Göreme and Ürgüp, where historical and physical geography has shaped hill settlements, includes three hill settlements, Uçhisar, Ortahisar and Bağhisar .

With industrialization and the convenience of transportation, the tourism potential in the region has increased, the buildings used as residences have started to be used for commercial purposes, and the Kandovan has now become a tourist location. As a result of uncontrolled urbanization, the vernacular architecture that the local people produced with local materials began to deteriorate with the bad additions that are seen almost everywhere and spoil the authenticity of the region.

At present, a new urban texture has come to the fore, integrated with this magnificent natural environment, poor quality construction work, and unplanned man-made additions. The effects of uncontrolled tourism are also worrying. Although the area has been heavily used and modified by humans in the last century, the harmony with the emerging landscape and life and the inherent values of the unusual natural landforms are a phenomenon that naturally converges. To solve the problems, tourism development, and conservation master plans should be prepared for the Kandovan [23].

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Cappadocia, known as the Goreme region, is located about 200 kilometres southeast of Turkey's capital Ankara, in Central Anatolia. The volcanic tuff around Mount Erciyes is composed of stone. This vast area has special geological formations and natural deposits of obsidian, i.e., obsidian used as a famous commodity in prehistoric times due to the 3916 m high volcano [24].

During the reign of the Roman Emperor Augustus (63 BC - 14 AD), the borders of the Cappadocia Region were defined as a large region extending to the Taurus Mountains in the south, Aksaray in the west, Malatya in the east and the Eastern Black Sea coast in the north in the 17-volume book -Geographika (Anatolia XII, XIII, XIV) by the ancient writer Strabo (64 BC - 24 AD). Today's Cappadocia Region is known as the area where Nevşehir, Aksaray, Niğde, Kayseri and Kırşehir provinces are located [25].

Cappadocia means -the land of beautiful horses in Persian language. The region emerged 60 million years ago when the soft layers formed by the lava and ashes erupted by Erciyes, Hasan Mountain and Göllü Mountain were eroded by rain and wind for millions of years.

Human settlement in the Cappadocia region dates to the Palaeolithic period. This region, which was inhabited by the Hittites, later became an important region for Christians. It has

come to the present day as a region with a very diverse religious and cultural richness along with its extraordinary nature. In Cappadocia, mankind, who utilized the opportunities offered by nature, has also cultivated cultural richness in every corner of the region. In this way, not only natural beauties but also one of the rare regions where artificial life and natural life respectfully fuse with each other [26].

Geological Structure:

Nevşehir province is in the volcanic region between Erciyes, Hasan Mountain and Melendiz Mountain. Thanks to the eruptions of these volcanoes, the last link of the 3rd geological time, which started in the Upper Miocene (10 million years ago), led to the emergence of the Holocene [27].

Climate: Due to its continental climate, Nevşehir has hot and dry summers and cold and rainy winters. A survey that started in 1980 and lasted until 1997 shows that the average annual temperature is 10.6. The period called the frost season starts when the temperature drops below zero degrees Celsius. In Nevşehir, this period starts approximately on October 26. However, different start dates have been recorded, with the earliest on September 24 and the latest on December 1. The end of this period is between March 28 and May 15. The average date is April 14. The maximum temperature in the city was recorded as 37.6 degrees on July 18, 1962 and the minimum temperature was recorded as -23.6 degrees on February 4, 1960. The minimum temperature 5 cm above the ground was recorded as - 36.7 degrees on February 3, 1992 [28].

The city does not receive rainfall in summer and autumn months, namely July-August and September-October, and is generally dry. According to a 37-year study conducted between 1960-1997, the average annual rainfall in Nevşehir was 429.4 kg/m³. According to the same study, the lowest figure was 289.3 kg/m³. The highest amount of rainfall recorded during the period of this study was 570,1 kg/m³ in 1962. The month with the heaviest rainfall was May 1990 with 141.9 kg/m³ as a result of the evaluations. In the evaluations made in terms of humidity, the humidity ratio of winter and spring months compared to summer months higher than the average humidity. The average humidity was measured as 60.6% during the 37 years of the study [28].

From a general point of view, south and west winds prevail in winter and spring and north and east winds prevail in summer. Therefore, the temperature in summer is not very high. The strongest wind was recorded as a hurricane in May 1968 in the west-southwest direction with a speed of 125.3 km per hour. The sunshine duration rate was recorded as 58%, but this rate covers the period between 1965-1997. The highest snow thickness measured between the same years was recorded as 64 cm on February 2, 1992 [28].

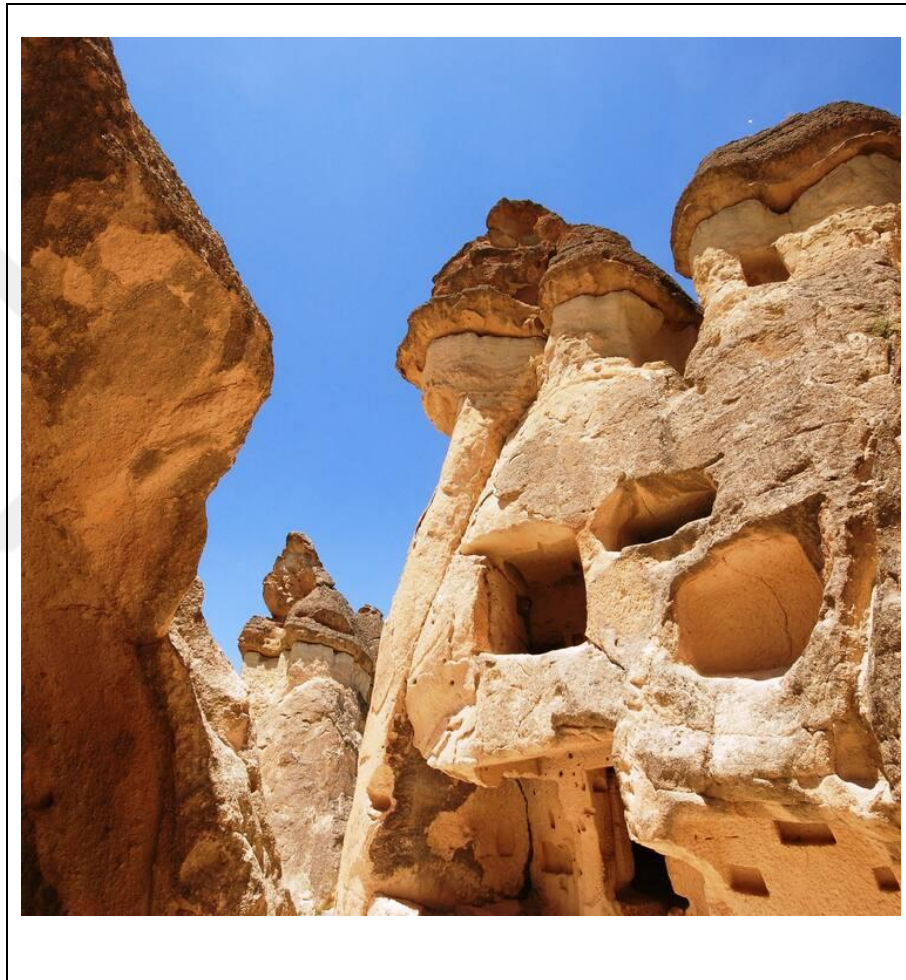


Figure 5.24. Göreme National Park and the Rock Sites of Cappadocia (Turkey) [28].

Fairy Chimneys: The interesting formations known as fairy chimneys are found only in Nevşehir. The area where the fairy chimneys are located is protected by natural barriers. This area, which is surrounded by 18 km of Kızılırmak River from the north, Damsa Stream from the east, Nevşehir Stream from the west, Oylu and Kermil Mountains from the south, is approximately 288 km². In this volcanic origin section, there are tuffs at the bottom and basalt and andesites at the top. The thickness of the tuff layers in the region varies a lot. In

the Damsa Stream Valley, these formations have come to the surface in places. The thickness of the layer reaches up to 100 meters in places. The basalts and andesites, which initially completely covered the tuffs, are encountered only in some parts today. These basalts are either in the form of large blocks on the cones or formed cornices on the tuffs as seen in Ürgüp and its vicinity. Clay and Neogene Lake sediments are also found in the tuffs. The area where the fairy chimneys are located was first covered by myocene basalt lavas. Andesite and basites came to the surface in the Pliocene and in the meantime the tuffs erupted from Erciyes covered the whole area. The region underwent many changes, and its main appearance was formed in the Quaternary. gained. Because the volcanic activities in the region ended in the early Quaternary. Therefore, it could not go beyond minor changes after that [29].

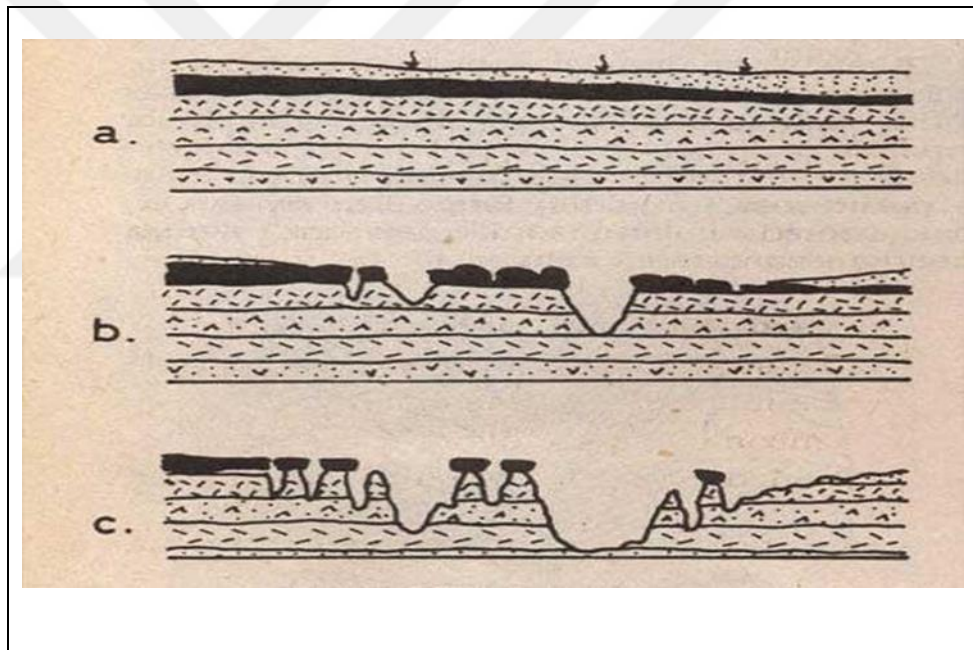


Figure 5.25. Formation of fairy chimneys [29].

In favourable areas, the first fairy chimneys appeared in Time IV. After the extinction of the volcano, the first fairy chimneys were formed on the slopes receded by heavy rains. With the effect of abrasion and crumbling, today's views have emerged. The tuffs, which apparently underwent physical crumbling during the dry and hot summer period, are carried to Kızılırmak through numerous springs [29].

The formation of fairy chimneys was previously explained by the presence of hard and hard to erode basalt rocks on top of the tuff layer. However, in later research, it was determined that in the areas where there were no basalt rocks, the ones without rocks were less developed than the others. As the flood waters and the wind eroded the tuff structure from the valley slopes, interesting formations called Peribacası emerged. As the flood waters found their way up the steep slopes, the hard rocks cracked and broke off. The slope receded as the more easily eroded material in the lower parts was carved deeply, resulting in conical shaped bodies protected from erosion by the cap on the upper parts. The capped fairy chimneys, which are mostly found in the vicinity of Ürgüp, have conical bodies and a rock block at the top. The body is composed of tuff, tuffite and volcanic ash. rocks, while the cap part is composed of hard rocks such as lahar and ignimbrite. In other words, the rock type forming the cap is more resistant than the rock assemblage forming the body. This is the first condition for the formation of a fairy chimney. Depending on the resistance of the rock in the cap, fairy chimneys are long or short-lived. The types of fairy chimneys formed by erosion in the Cappadocia Region are capped, conical, mush-room-shaped, columnar and pointed rocks. Fairy chimneys are most densely concentrated in the valleys between Ürgüp-Uçhisar- Avanos triangle, in the region between Ürgüp-ğahinefendi, around the town of Çat in Nevşehir, in the Soğanlı valley in Kayseri and around the village of Selime in Aksaray Apart from the fairy chimneys, the interesting curves formed by rainwater on the valley slopes add a distinctive feature to the region [29].

The colour harmony seen on some slopes is due to the temperature difference of the lava layers. These formations are observed in Uçhisar, Çavuşin-Güllüdere, Göreme-Meskendir, Ortahisar Kızılçukur and Pancarlı valleys [29].

The lava erupted from the volcanoes starting 10 million years ago in the Upper Miocene and continuing until the Pliocene 2 million years ago, descended to the plateaus and dried up the inland sea, lakes and rivers. A layer of tuff, almost 100 to 150 meters thick, formed on top of the dried ground. The layer was composed of rocks containing volcanic ash, clay, sandstone, clay and basalt, resulting in lava deposits that were hard in some areas and dense enough to be carved in others. This layer has been altered by the floods and winds coming down from the slopes of the valleys, especially the Kızılırmak River passing through the region. The flood waters, which were strengthened by the lack of vegetation and the permeability of the tuff layer, stubbornly tried to make a path between the hard rocks. The

hard rocks cracked and split under the force of the raging waters, leaving deep undulating valleys below. Due to its tuffaceous structure, it has been carved and enlarged a little more in every period, and even the ones used as churches have been engraved with friezes reflecting the stories of the period [30].

History of fairy chimneys: Fairy chimneys have seen many civilizations since their formation. The interior of the fairy chimneys, which are the natural buildings of the region, began to be carved in the Palaeolithic period when the first human settlements were made. After the Hittite period, in the 3rd century, they were used as a shelter, a place of worship and a home for the first Christians to live their faith freely. In the 11th and 12th centuries, Cappadocia witnessed the resistance of Christians against Arab raiders and other invasions until the Seljuks took over [30].

The reason why people live in caves is that they provide protection against hurricanes, tornadoes and fires, and they provide protection from extreme heat and extreme cold. They are easy to move into and no great effort is needed to make them habitable. If we make a general definition while giving information about fairy chimneys, most of them are formed by hard rock caps called hats on conical bodies. The biggest share in the formation of fairy chimneys falls on their caps. Because the harder structure of the cap parts compared to the terrain also protects the relatively softer body, which rises in the form of a cone below. The body parts of fairy chimneys are made of tuffite, volcanic ash and tuff, also known as volcanic debris, while the cap parts are made of hard, durable rocks such as ignimbrite and lahar. Therefore, the hard caps press downwards with their weight, making the conical bodies more resistant to wind erosion. Another feature is that it prevents the erosion of the tuff in the conical body and keeps the height of the fairy chimney under control. It would not be a lie to say that it depends on the resistance in the rocks [29].

When we look at the historical development of the Cappadocia Region, it is observed that different settlement textures were formed for defence and protection purposes due to the attacks and topography in the region. Apart from the underground settlements and fairy chimneys described above, there are settlements carved into the hillside.

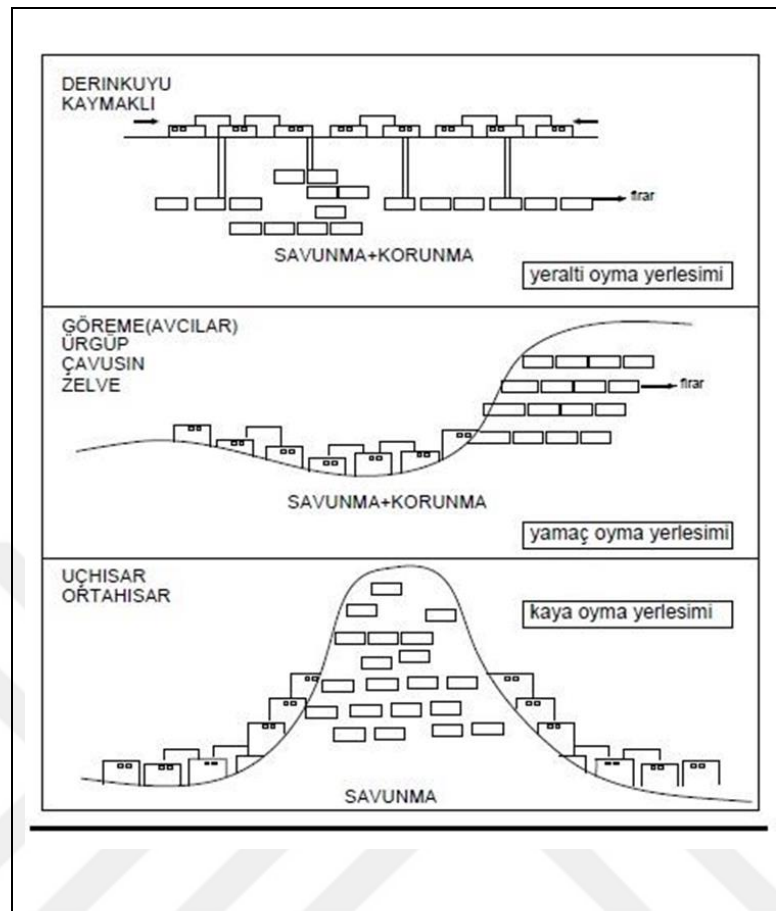


Figure 5.26. Settlement patterns in the Cappadocia region [29].

In this region, the need for defence is seen as the most important factor in settlement formation. In a defended city, in addition to the need for defence, patterns of resource use may also determine the urban morphology.

The differentiation of the groups that process and manage resources and the related different spatial organizations may exhibit different housing patterns. (TEPE, 2007). It is said that lithospaces are spaces with high defence mechanisms, especially where the entrances are well camouflaged. According to this model, cave settlements are well camouflaged dwellings with more depth, less surface area, strong defence mechanisms. On the other hand, spatializations close to the surface (tetraspace) are dwellings with more surface area and are indicators of social status. It is an indicator of social prestige. Both in terms of size and decorative elements, it is an indicator of the status of the owner of the house within that community [31].

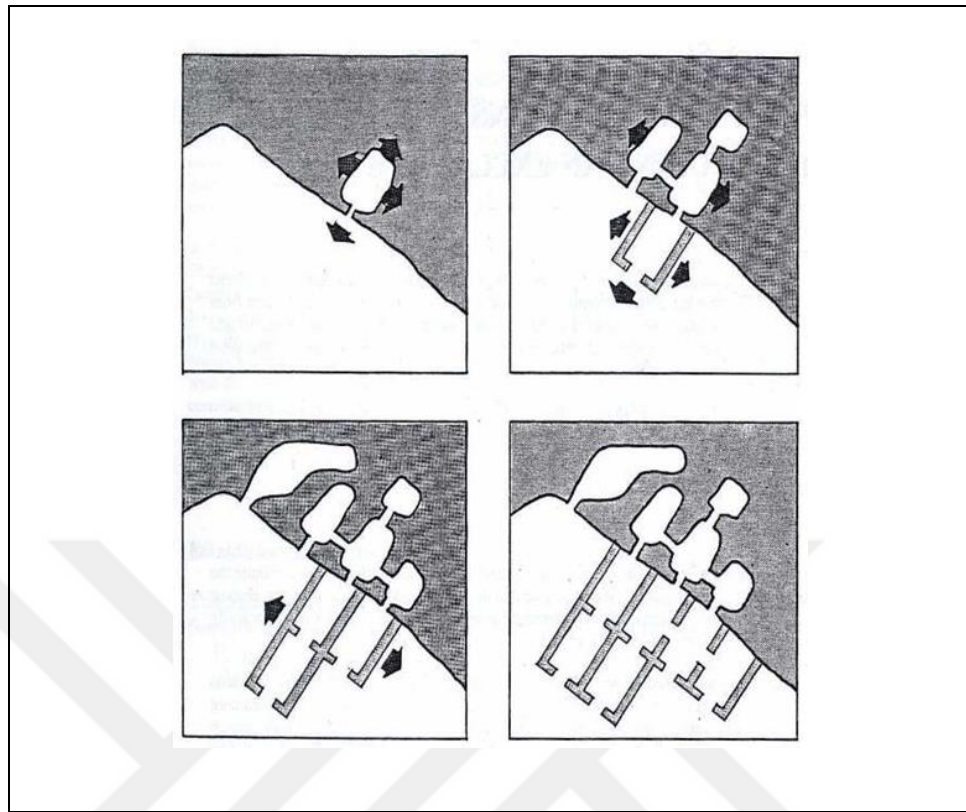


Figure 5.27. Cappadocia Space Organization Schemes [29].

Similarities: Now that you have noticed the situation and characteristics of Gorme, we will make a short comparison between Gorme and Kandovan. There are similar points between Kandovan and Gourme collection It tastes a lot, and of course there are contradictions in this field, which we will briefly analyse in this section. Generally, Kandovan is in a mountainous area. While Gormeh is in the middle of a large plain, he has lost his head. The constituent elements of Kandovan are completely connected and sometimes even several units have formed a larger unit with each other, while in Gorme, the cones are mostly isolated and separated from each other, and in a part of Gorme that is a part of a mountain they have carved the big one, many residential units have been obtained from it, and this integrity is provided only in terms of residential units, not from The direction of the cones may be one of the reasons for the body shape of the gourmet It makes life easier there. It is obvious that open and flat spaces make life easier. Apparently, in Kandovan, more energy is spent to perform normal life activities. The physical form of the environment is not easily accessible and used, and anyway, apparently, life in Kandovan seems more difficult than life in Gorme. From the point of view of the whole collection, the factors that exist in Kandovan, such as

steep slopes and faults, smooth surfaces in front of some groups of places and the unity of organized factors, which give it a special beauty despite being opposite, but are not seen in Cappadocia.

General Information About the Two Regions: The rock cities of Kandovan and Cappadocia were formed at about the same time in history, although the reasons for their construction are different. In terms of climate, both places are in continental regions, and in terms of water, both regions have low to moderate water content. Although the first human settlement was in Cappadocia during the Palaeolithic period, there is no clear information about the village of Kandovan, but Kandovan has a population of about 800 people today, whereas Cappadocia has become a touristic region and therefore the livelihood of Cappadocia is tourism, while the livelihood of Kandovan is farming and agriculture. In terms of soil structure, both regions are composed of volcanic stones and rocks. Although the settlements in Kandovan and Cappadocia were established in approximately the same period, the reasons for their establishment are different. But use over time The purpose of both was to shelter and protect themselves from enemies, but the Kandovan region has continued this life and has continued until today.

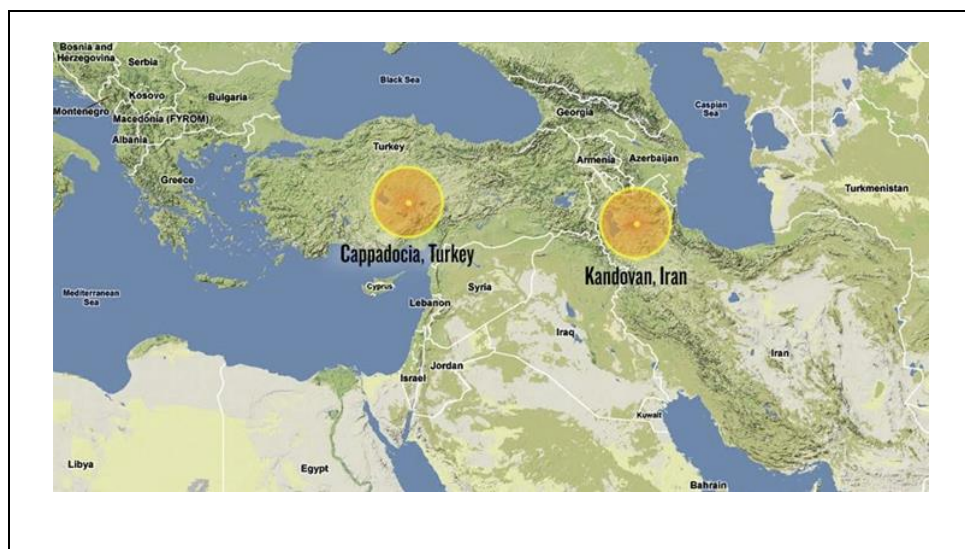


Figure 5.28. Kandovan and Cappadocia map [19].

The history of Cappadocia Village dates back approximately 2400 years and the history of Kandovan Bay dates back approximately 3000 years. Although there is no clear figure on

the date, both regions were established in almost close times historically. Both regions existed under the rule of the Persian Empire at that time.

Although the reasons for the human settlement of the two regions are different at first, geologically they were both built on volcanic mountains and carved by human beings with primitive materials. Although it may seem very difficult to carve and scrape these structures, they were carved with very simple and primitive tools at the time because they were made of volcanic stones and gradually developed over time.

In both regions, people used this method for shelter. In the Kandovan region to take refuge from the Mongols and in the Cappadocia region to take refuge from the Ottomans, Christians made the settlement more habitable and structured. Today, however, life continues in these two regions, which have different uses. Today, the Cappadocia region is mostly used for touristic purposes, but the Kandovan region continues to be a living and touristic place, where 800 people continue to live in these cave houses, just like in the past.

In the Kandovan region, the main source of livelihood is farming, although the existing inhabitants of the Cappadocia region rely on tourism for most of their livelihood, but recently, with the construction of tourist facilities in this region, people have started to make a living in this way. Both regions have a continental climate. Both regions have volcanic permeable brown soils with little water resources, but in recent years, due to the famine in Iran, these water resources and underground resources have almost dried up and have become alarming, and the inhabitants have had to rely on piped water from dams in other cities because of the empty dams. There is modernization in the buildings in both regions, but in Cappadocia, since it is tourism-oriented, the new buildings are more elaborate and built for the taste of tourists, but in Kandovan, since it is a living bay and the people of the bay have little financial power and unfortunately, due to the carelessness of the Iranian state, some areas are damaged by using mudbrick and cottage materials.

in Cappadocia, what I noticed in Cappadocia is that in some regions, just like in Iran. the fabric has been damaged. In the parts where the villagers live, whether they earn from tourism or farming, the spaces have been diversified and changed according to their needs and daily use. These visual damages are very noticeable in Kandovan. The best examples are electricity cables, new roads and shops [16].

Settlement Characteristics: The life that started in Kandovan in ancient times continues in the same way today. To-day, according to the latest surveys, the population of the bay is 766 and consists of 159 families. There are 7 neighbourhoods in Kandovan, and people make their living from agriculture and animal husbandry. Agriculture in this region is very difficult due to the mountainous terrain, but the villagers have managed to produce wheat, barley and roses in these difficult conditions. In their spare time the villagers earn money by weaving carpets. The language of the village of Kandovan is Azeri and they are mainly Muslims. This village is included in the Iranian national heritage.

The rental system is usually called sarghofli, in which a certain amount of money is paid at the beginning and with this money the house is rented for 90 years, but a small amount of rent is paid every month. In Kandovan, rock houses are passed down from family to family and from father to son, and their sale is generally prohibited as they are now under protection. The most important source of livelihood for the people of the village is agriculture and farming. In order to accelerate the development of Kandovan village and to develop tourism, various touristic and shopping areas have been built around the main road. Unlike the Cappadocia region, Kandovan houses are still inhabited today. The fairy chimneys and underground cities in Cappadocia are completely used for touristic purposes. There are certain parts of the houses in Kandovan that are still in use today [16].

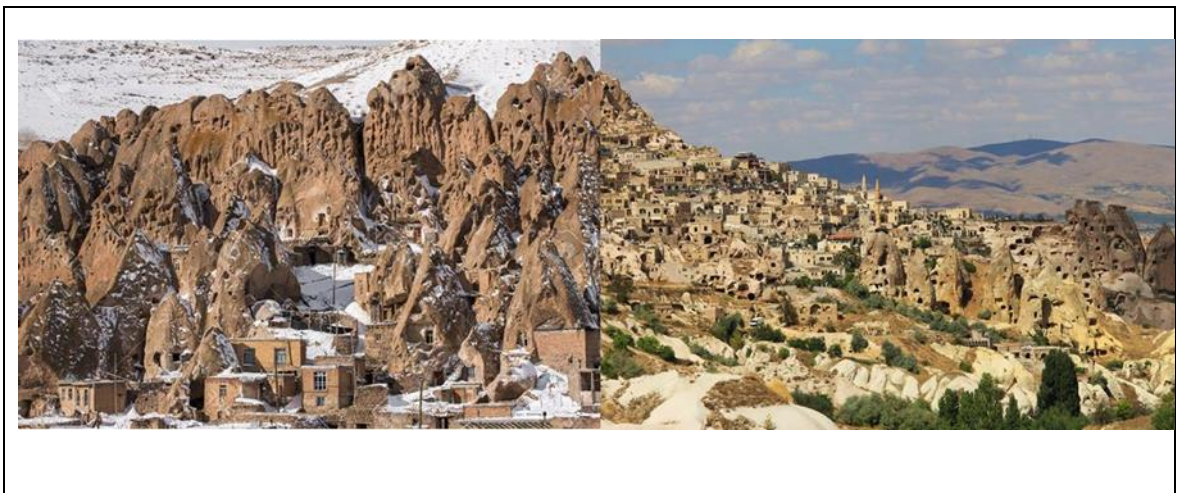


Figure 5.29. Overview of Kandovan and Cappadocia [16].

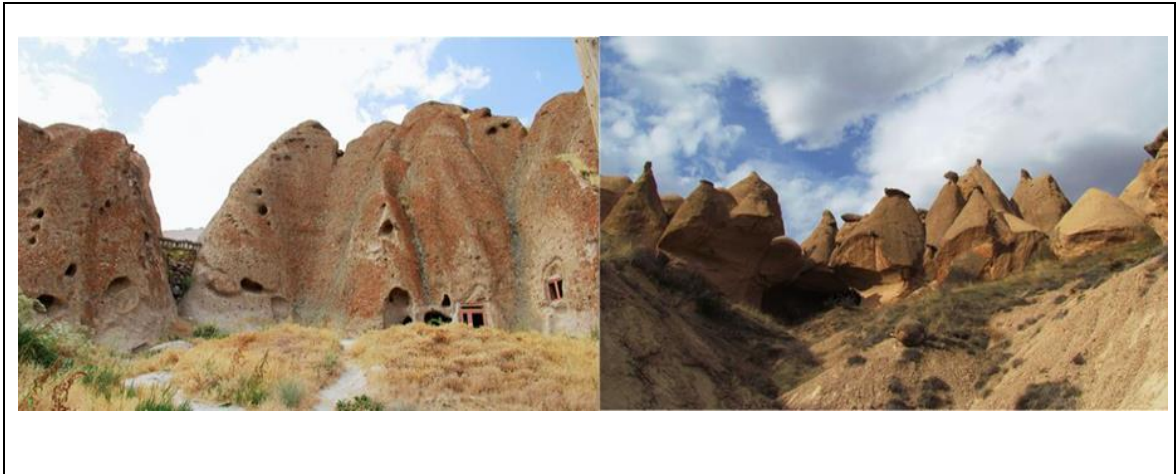


Figure 5.30. Kandovan and cave houses in Cappadocia [16].

General Characteristics of Residential Buildings: In the Kandovan rock houses the square meters vary according to the size of each makhruhi, sometimes a room is 6 meters square, sometimes 20 meters square, sometimes these houses have 4 floors, usually the lower floors are reserved for animals and their feeding, giving them more space and protecting them from cold and heat. In some houses the entrance is through a bridge, but more often they are connected by roofs, so that the balcony of one house is the roof of the other house. In Kandovan, small vents were made at the top of the doors to provide ventilation, these openings were more common where there were animals and were important for the animals to get air.

In Cappadocia, just like in Kandovan, the square meter and size varies from rock to rock, but underground cities and connected living places carved in the form of a labyrinth under the ground do not exist in Kandovan, the relationship and connection of the rock houses in Cappadocia with each other is the same as in Kandovan, but in some parts the connections are provided by tunnels and channels.



Figure 5.31. Kandovan overview photo [16].

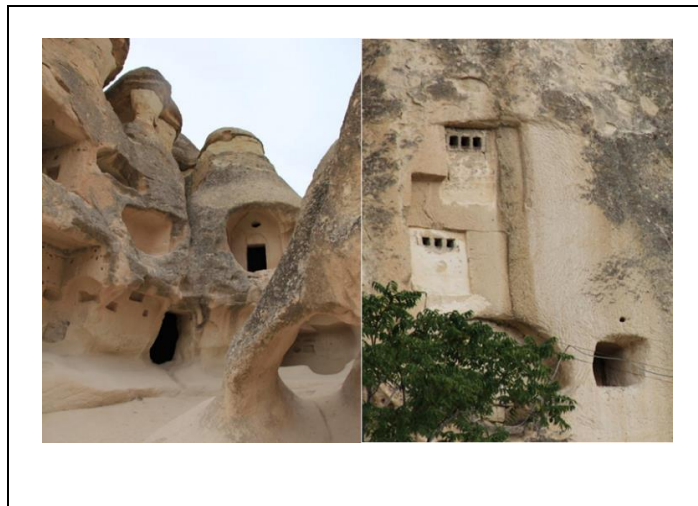


Figure 5.32. Cappadocia overview photo [16].

In Cappadocia, some of these tunnels, which are opened to provide ventilation, provide fresh air and light from the outside. These tunnels are usually built at a height and in a place where the enemy cannot easily access them. they are also useful for letting in light [16].

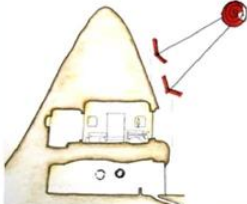
	SPACE ANALYSIS	
	Kandovan	Cappadocia
Space Organization	From the part that we call the main area to the living area and the courtyard.	Through corridors and labyrinthine interconnected tunnels
Daylight Savings	Through holes and windows in the walls 	Candles and fires used in the corridors and holes drilled in the walls in the external structures 
Ventilation	Ventilation sections above the doors and windows 	From hollowed out ventilation ducts and tunnels 
Use of Walls	Carved niches Areas used for light (candle holder) Feed areas in barns Tagche (display of waterware) Countertop in the kitchen Loading area	Carved niches Areas used for light (candle holders - lighting places with torches and fire) Kitchen counters Storage areas (stables) Wine warehouses

Figure 5.33. Spatial analysis about Cappadocia and Kandovan [16].

Interior Features:

When the general formation logic is examined, it is observed that Cappadocia is generally a defensive settlement with limited connection to the outside and attention is paid to the use of resources. In addition, Cappadocia has an underground city structure, which consists of labyrinthine corridors, small rooms and sections that do not receive light. In Kandovan, the living quarters were carved out of the rocks, these rocks and the living quarters are usually above the surface of the earth, and only the living quarters and storage areas for animals were built underground. These structures in Kandovan are usually illuminated by holes in the walls, but in Cappadocia the corridors and rooms are lit by candles and fires. In both Cappadocia and Kandovan, ventilation was of great importance and some methods were

developed to solve this problem. In Kandovan, air is taken in through the openings above the doors, while in Cappadocia ventilation is done through the ventilation ducts and openings in the tunnels [16].

General Evaluation: As a result, it is very important that thousands of years ago, human beings resorted to such a method to protect themselves from enemies and carved rocks to create a shelter for themselves and that these structures are still usable. In this study, I have lived in both regions for weeks and I have seen that the two civilizations have similarities in terms of culture and architecture both from the information I have obtained from the people of the region and from the various sources I have observed and collected. In both Cappadocia and Kandovan, instead of struggling with the climatic conditions, they lived their lives by taking advantage of them. Some of these are the fact that these rock houses are hot in winter and cold in summer, which is an effect of the cave-like properties of these rocks, and the rocks keep the snow on top of it and protect it from harsh cold, and also when it keeps the rainwater moist, when it steams, the inside of the house. In Cappadocia, they solved the problem of light and heating with the use of torches, and in the Kandovan region, they solved the problem of cooking and heating by using tandoor inside the houses. In this study, I have observed that both regions have similar architectural features and practices, and I have also discovered similar characteristics of the inhabitants of the region in terms of daily life and culture. The fact that Kandovan houses are still in use today was a good opportunity for me to analyse the daily life there. The absence of cave dwellings in Cappadocia caused me to obtain information only from written sources. The fact that the places under protection in Cappadocia have information reflecting the life in the old period was among the factors that made it easier for me to obtain information. The fact that these regions, which have a settlement logic unique in the world, are still in use today and that the unused places are under protection is very important for leaving the architectural texture and culture of life here to future generations [16].

5.5. NOMINATION OF KANDOVAN FOR UNESCO WHL

The village of Kandovan represents a unique landscape where human interaction and settlement have harmoniously coexisted with the striking natural landforms. Over the centuries, the village has been extensively used and modified by its inhabitants, resulting in a remarkable blend of human ingenuity and the dramatic geological features of the area. While the village has stood the test of time, it has not been immune to the effects of natural phenomena. Earthquakes, in particular, have caused some damage to the cone-shaped structures and pillars within the village. However, this damage is generally considered a natural occurrence, as earthquakes are inherent to the region's geological dynamics. It is worth noting that some unintentional deformation of the rock structures, known as "Karans," has also taken place due to the actions of the local people. This deformation may have been a result of the residents carving or modifying the rock formations to suit their needs over time. While these modifications may have unintentionally altered the original shape and form of the structures, they are a testament to the ongoing interaction between the people and their environment. Overall, Kandovan Village stands as a living example of the harmonious coexistence between human settlement and the captivating natural landscape, showcasing the dynamic relationship between people and their surroundings [7].

The erosional processes that formed the distinctive conical rock structures will continue to create new fairy chimneys and rock pillars, however due to the rate of this process, the natural values of the property may still be threatened by unsustainable use. The vernacular features, including Karans and related cultural structures, mainly at risk of being undermined by erosion and other negative natural processes coupled with mass tourism and development pressures, can never be replaced [7].

Criteria for the Nomination of UNESCO WHL:

UNESCO World Heritage List (WHL) is a prestigious designation that recognizes and protects sites of outstanding universal value. The nomination process for the inclusion of a site on the WHL involves several criteria. These criteria, as established by UNESCO, serve as guidelines for evaluating the significance and integrity of potential World Heritage sites. It is important to understand these criteria in order to write an informative and accurate

article on the subject. The criteria for the nomination of UNESCO WHL can be summarized as follows [7]:

- **Cultural Significance:** A site can be considered for the WHL if it represents a masterpiece of human creative genius, exhibits an important interchange of human values, or bears unique testimony to a cultural tradition or civilization. This criterion emphasizes the cultural significance and exceptional universal value of the site.
- **Natural Significance:** Natural sites that demonstrate exceptional beauty, represent major stages of Earth's history, or provide habitats for rare or endangered species can be nominated for the WHL. The natural significance criterion focuses on the outstanding value of the site in terms of biodiversity, geological formations, or ecological processes.
- **Outstanding Universal Value:** This criterion requires the nominated site to possess outstanding universal value from the perspective of human civilization, culture, or nature. The site should be exceptional and transcend national boundaries, representing a heritage of all humanity.
- **Integrity:** The nominated site must demonstrate integrity, meaning it should be in a state of conservation that allows for an accurate representation of its outstanding universal value. The site's essential features and characteristics should be intact and well-preserved.
- **Authenticity:** The authenticity criterion emphasizes the importance of the site's genuine nature, ensuring that it accurately represents the values and attributes for which it is nominated. The site should retain its original form, materials, and historical associations.
- **Management and Protection:** A nominated site should have a well-defined management system in place to ensure its protection, preservation, and sustainability. Effective conservation measures, risk management plans, and adequate resources for safeguarding the site are essential.

It is important to note that meeting one or more of these criteria does not automatically guarantee inclusion on the UNESCO WHL. The nomination process involves a thorough evaluation by international experts and committees, considering the significance, integrity,

and management of the site. The decision ultimately rests with the World Heritage Committee, which reviews the nominations and makes the final determination [7].



6. CONCLUSION

Kandovan is an exceptional example of Earth's evolutionary history. The nearby underground city of Hilevar is living proof of past volcanic activity and current geological processes. The eroded landscape patterns resulting from weathering processes and the Karan conical hill deposits showcase extraordinary combinations of natural and cultural elements in a magnificent way. Over time, it developed as a human settlement and acquired a distinct local architectural identity. The term "Karan" originated from this vernacular architectural process.

Karans are formations created by carving conical rock structures resulting from volcanic eruptions over time. They are used as multi-story residential buildings. Karans resemble multi-storey apartments with direct entrances from different levels on each floor, allowing for slope adjustment. There are no internal connections between the floors. Karans have obtained a regional architectural identity over time through the use of local building materials and techniques. Located in Iran, the Kandovan Natural Area is a unique geological formation with cultural landscapes that have evolved over time. Currently, this area is experiencing degradation and change due to several factors. The aim of this thesis is to investigate the causes of the deterioration characterizing Kandovan Natural Area and provide a typology of the changes taking place.

The Effects of Rapid and Uncontrolled Urbanization: As a result of the rapid and uncontrolled urbanization surrounding the Kandovan Natural Area, the natural landscape has been subject to significant intervention and the construction of hotels and residences has taken place. These factors are leading to changes in the original character of the site, as well as increased pressures on its natural resources.

Impact of Tourism: The growth of tourism in Kandovan has brought about both positive and negative effects. Although tourism contributes to the local economy, it also presents challenges to area conservation. The heavy flow of visitors, along with insufficient infrastructure and uncontrolled tourist activities, can result in physical damage and erosion, and can undermine the authenticity of the area.

Absence of Protection Policies: The lack of comprehensive and effective conservation policies tailored to the Kandovan Natural Area has led to its degradation. To balance the needs of development and tourism with the preservation of natural and cultural values, the site needs specific conservation strategies.

Structural Disruption: Buildings with local architectural identity in Kandovan experience structural deterioration when converted into hotels and residences due to factors such as poor construction practices, lack of maintenance, and inappropriate interventions. The factors that contribute to the deterioration of these structures include poor construction practices, lack of maintenance, and inappropriate interventions.

Functional Impairment: The functional deterioration in the Kandovan Natural Area is due to the loss of traditional functions and the transformation of the spaces into commercial areas. Damage to the original functions of residences, barns, and warehouses has reduced the cultural significance and integrity of the site.

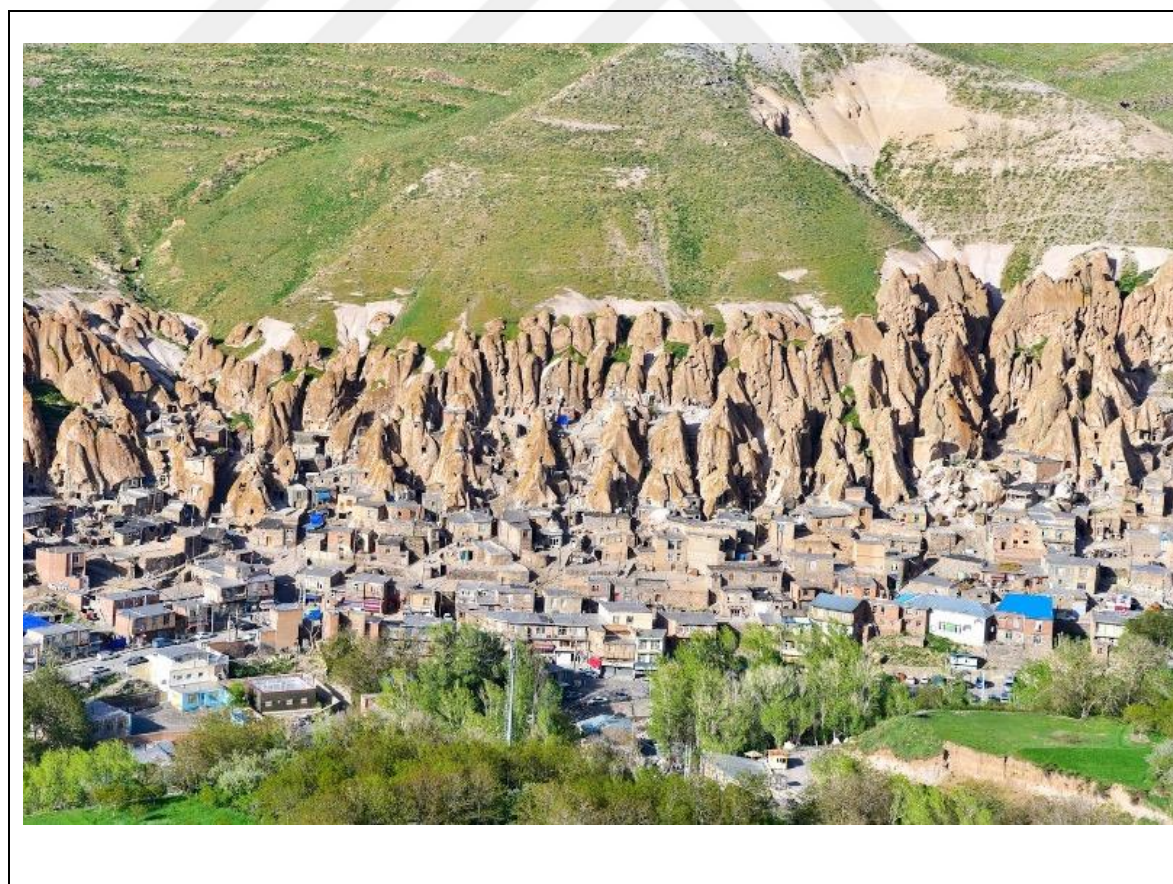


Figure 6.1. Kandovan village [23].

Conservation management measures, both direct and indirect, are crucial in maintaining the natural significance of Kandovan's Natural Heritage site, and facilitating its regeneration. The primary objective of protection is to prevent or minimize activities or impacts that could degrade the unique features and cultural heritage of Kandovan. To ensure the preservation of Kandovan's natural significance, it is important to implement measures that enable natural processes to occur and facilitate recovery from disturbances or degradation. This approach to regeneration emphasizes the inherent resilience of the ecosystem and the self-renewal capacity of the natural environment. It is important to note that regeneration in Kandovan does not involve physical interventions or artificial manipulations of the landscape. Instead, the approach focuses on allowing natural processes to occur without human interference. This approach ensures that the natural features and cultural heritage of the village can regenerate and thrive in their original state. Monitoring and protection measures are essential components of conservation management in Kandovan. Monitoring allows for the assessment of the natural environment and cultural heritage, enabling identification and prompt resolution of any potential degradation or threats. Protection measures aim to safeguard Kandovan Village's natural and cultural values, ensuring its long-term preservation by preventing activities that may harm them. Conservation management measures should prioritize the principle of avoiding any actions that may cause further degradation or harm to the natural significance of Kandovan. By employing conservation strategies that minimize human impacts and promote the regeneration of natural processes, Kandovan can continue to be a remarkable example of the harmonious coexistence of humans and nature, preserving both its cultural heritage and natural beauty for future generations. It is essential to maintain the delicate balance between human presence and the village's unique characteristics.

Kandovan Village is a unique mixed heritage site, combining cultural (vernacular architecture) and natural heritage, with a geological structure that is one-of-a-kind. The village's local architectural values, produced by local people with natural materials and craftsmanship, further contribute to its unique cultural identity. Kandovan Village is certainly worthy of a nomination to the UNESCO world heritage list.

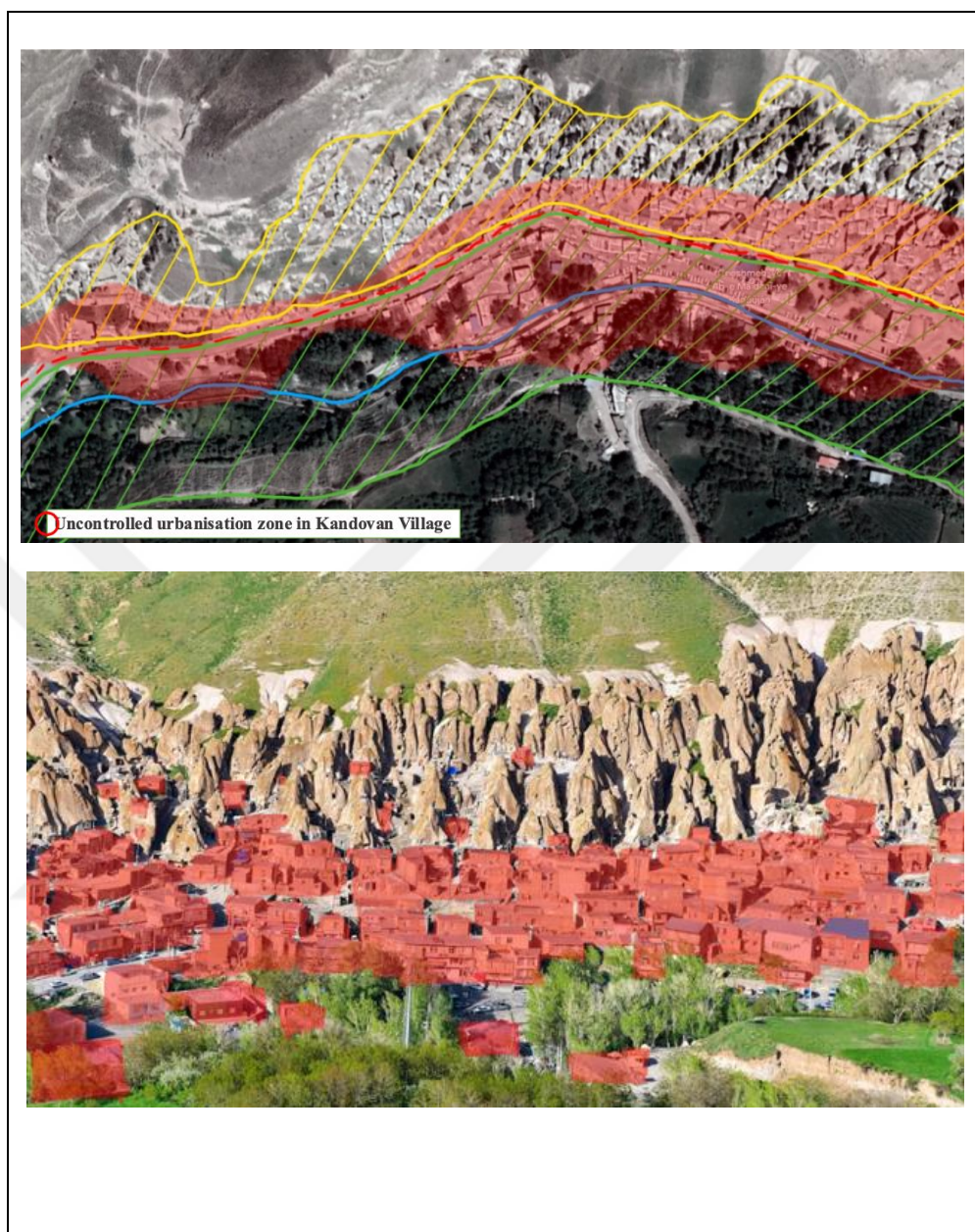


Figure 6.2. Plan shows the unqualified buildings (red) in Kandovan and Overview shows that unplanned growing of the village should be taken in to control for Kandovan.

To effectively conserve the geological structure of the Karans and mitigate the rapid, unplanned urbanization, a new comprehensive conservation plan should be developed and urgently included in the UNESCO world heritage list.

The livelihoods in the area primarily depend on tourism contributions from establishments like hostels, hotels, restaurants, and shops, with animal husbandry playing a secondary role.

Therefore, the state should re-plan Kandovan as a tourist attraction and prioritize the conservation of its natural heritage sites.

Raising awareness among locals can effectively control inadequate alterations to the traditional architecture, like enlarging windows and doors or substituting them with modern materials that are compatible with the old ones. In addition to a major conservation program, educating local residents is the second crucial step in protecting this exceptional historical and natural heritage site.

The Law for the Protection of National Heritage (1930) forms the basis for different aspects of cultural heritage in Iran. It provides guidelines for identifying cultural heritage properties, obliges the establishment of a National Heritage List, defines criteria for the legal protection of listed properties, and outlines provisions for archaeological excavations.

In the particular case of the Kandovan Natural Heritage Site, the legal protection, management, and monitoring of the site fall within the jurisdiction of national and regional government bodies. The State and Regional Conservation Councils maintain the register of monuments and sites. They also carry out tasks related to the legal protection of monuments and listed buildings. Furthermore, they approve works related to restoration.

To ensure the preservation of the Kandovan Heritage Site and village, studies to revise and update the existing land use and conservation plan are crucial. This involves making significant modifications and closely regulating any spatial construction carried out within towns situated in natural conservation areas. In the context of hotel construction, it is essential to comply with predetermined upper limits on room capacities. Moreover, the local authorities must review the land use decisions for the regions specified for tourism establishments in the town plans. The purpose of the review is to ensure that the development is in line with the objectives of maintaining cultural heritage and sustainable tourism practices.

By implementing these measures and regulations, the goal is to protect and sustainably manage the Kandovan Natural Heritage Site. Furthermore, the aim is to ensure its long-term preservation and minimize any adverse impacts on its cultural and natural significance.

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