

Distinctive Aspects of Vernacular Architecture of Wakhan Valley in Afghanistan; Influencing the Crossing Cultures and Adapting to the Harsh Climate

Hossein Medi ^{a,*}, Sayed Fridoon Fedelle ^a

^a Department of Architecture, School of Architecture and Urbanism, Imam Khomeini International University, Qazvin, Iran

Received: 11 May 2021- Accepted: 22 August 2021

Doi: 10.22094/SOIJ.2021.1930277.1420

Abstract

Many scientific sources agree that indigenous architecture is best suited to its environment in terms of shape and function. In this architecture, climatic conditions, access to materials, culture, and residents' beliefs play an important role in the formation of the outer wall, the arrangement of ancillary spaces, and decorative features. This architecture has a unique feature in the Pamir Mountains of Afghanistan in the face of wildlife, different cultures, and harsh climatic conditions. The approach of the two Wakhi and Kyrgyz immigrant communities in the region is quite different in their adherence to traditions. However, in the Wakhan Valley, the transfer of experiences between farmers and herding nomads has created a new kind of architecture that is still introverted. The descriptive-analytical method has been studied on library resources, maps, statistical data, reports, and field images to study the formation of this architecture. This study showed that in a wise introverted way, indigenous architecture is based on maintaining the internal warmth of the house and socio-cultural relationships. Symbols are influenced by neighboring civilizations' nature, history, and culture and have evolved. However, this architecture plays an important role in creating interaction and social stability in this region. Communities in residential, religious, and burial buildings have also paid attention to available materials and adaptation to landform. Despite efforts to adapt to very cold climates in both homes, buildings, and tents, there are limitations to receiving lighting and ventilation.

Keywords: Vernacular, Introversion, Cold Climate, Mountain, Symbols, Cross Culture

1. Introduction

The vernacular architecture of Latin origin included "Vernaculus," which in English is meant as any subject matter with a local origin and architecture derived from a subculture and environmental interactions at the regional scale. It is designed and built in an empirical process without the involvement of professionals and includes houses, monuments, and tombs. This architecture focuses on the needs of the individual and society based on harmony with the environment and is subject to cultural, economic, and environmental conditions (Medi, 2015: 34). Indigenous architecture is a type of construction, adaptation to the environment learned through unprofessional experience and passed on to future generations (Gil Crespo et al., 2015). Vernacular architecture has resulted from years of evolution from human experience to provide a comfortable home in adaptation to the local climate using available materials and the creativity needed to build (Ardebili and Shafiei, 2016).

Architecture is influenced by the environment and culture of its inhabitants, and over time it becomes creative and artistic. Using local materials, this architecture has created cost-effective methods for erecting a building. This architecture on a human scale has created neighborhood

cohesion, tribal ties, and social security (Oliver, 2006: 3-4). Construction experience in this architecture can be seen in a wide range of countries that have adapted to each region's changing cultural and geographical conditions (Szabo, 1991).

In the indigenous architecture of mountainous areas, the thermal compatibility of buildings and their inhabitants in very cold climates is important for the design of buildings with energy savings. Using a thick stone and brick wall and immersing a part of the house in soil is the most important measure to reduce the impact of cold wind and heat loss. Studies on comfort conditions have shown that with proper clothing, residents adapt well to the heating environment of traditional indigenous homes, and need less heat to provide heating (Rijal, 2021).

Indigenous architecture in mountainous areas has been formed in harsh climatic conditions, and despite the beautiful water resources and landscapes, it has always challenged the residents to continue living. This is a concern for migrants living in the Pamir region of Afghanistan, between Pakistan and Tajikistan and bordering China. Most of our knowledge about the people and the Pamir region, and the Wakhan Valley is based on travelogues and narrations published by travelers and

* Corresponding Author Email Address: medi@arc.ikiu.ac.ir

tourists from the nineteenth century to the present day. Travel to this area is difficult due to lack of access, high altitude, and long cold. However, the people living in the region have a great deal of cultural originality and richness that has remained intact despite time and political developments in China and Central Asia. The study and understanding of the traditional way of life in each study area are of great importance because it increases human knowledge about the impact of natural mountain environments on socio-economic relations. (Kreutzmann, 2003).

Most of the information reported from the Wakhan and Pamir regions by tourists and orientalists is about the economic and social conditions of the Wakhan and Kyrgyz people. However, these studies do not provide any new information on the interaction between the two cultures of farmers (of Iranian descent) and Kyrgyz nomads (of Turkish origin) in forming their vernacular architecture in very cold climates. In the last three decades, following the importance of environmental sustainability, how humans interact with difficult environments has been considered traditional architecture and only in passive ways. For one study, the confrontation between the Wakhi and Kyrgyz communities was somewhat isolated and required social stability in the face of climatic conditions and the existence of multiple cultures in question. So, the purpose of this paper is to study the impact of climatic conditions, historical background, and beliefs in the rural community of the Pamir region and Wakhan Valley in Afghanistan and the emergence of unique vernacular architecture resulting from human interactions with the natural environment and various socio-cultural factors.

1.1 Vernacular architecture in mountainous areas

Mountainous areas are geographically divided into valleys, foothills, slopes, and climates, which rapidly increase in frequency, and climatic disturbance as the altitude rises to 1,600 meters above sea level. In these areas, the temperature and humidity decrease with increasing altitude, and, despite the intensity of sunlight, the pressure of cold air and wind plays an important role in climate. For example, at an altitude of 1600 to 2000 meters, the average temperature in winter reaches -10 degrees Celsius, and residents feel relatively cool summers (Matikeev et al., 2020).

In the mountainous regions of the Pamirs, long winters and severe cold on the one hand and lack of access to urban areas, lack of food and medical facilities are very painful. Despite drinking water resources, agriculture and rangelands are limited, and most livestock-focused activities vary within a few months in a valley with a climate. As part of the population, residents spend their summers in the highlands and bring their livestock to the valleys in the winter, keeping them in caves or stone buildings. The inhabitants of these areas live as tribes in small, scattered, or clustered settlements along rivers or springs. In the microclimate of the plains, they build houses in dense conditions, attached, away from the cold wind and exposed to the sun. According to the diagram in

Figure 1, the vernacular buildings in mountain climates need to pay attention to the compactness of the dimensions, openings, color, access to materials, and environmental performance. It should also have durability against snowfall, strength against seismicity, security against wild animals, invaders, and having thermal comfort and necessary facilities for life (Molinar-Ruiz, 2017: 22-23).

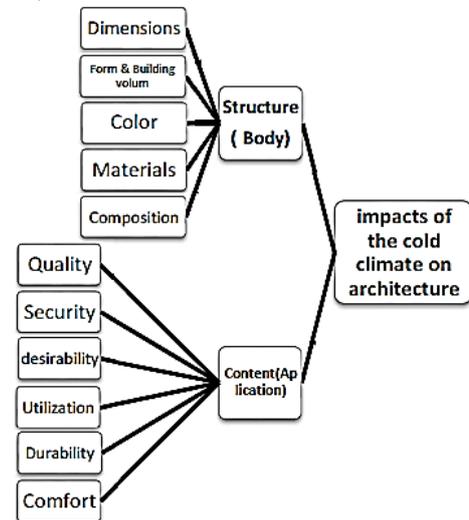


Fig. 1. Scio-cultural and environmental factors on vernacular mountain architecture (Mehmani and Nakhaii, 2017)

1.2. Wakhan Valley in Pamir region

Pamir is a mountainous region located in central Asia, between the northern latitude 37.4 to 38.5°N and the eastern longitude 72.7 to 75.3°E. It is surrounded by Tajikistan in the north, Pakistan in the south, and China in the east. In the eastern highlands of Afghanistan, in the southwest of the Pamir region, with an altitude of more than 3,500 meters, there is a large valley with an area of 11,000 square kilometers (Geography, 2003). This valley has been inhabited due to alluvial plains and abundant water, extending some 360 kilometers from the city of Ishkashim towards the Chinese border. Wakhan, which means freedom and opening, at the end of the Hindu Kush and Tibet Mountains, consists of three main areas: main Wakhan, Little, and Great Pamir. Great Pamir, with a length of 60 km and an altitude of more than 3500, is located in the northeast of the valley and includes the central peak of the Pamir. The small Pamir, 100 km long and 10 km wide, with an altitude of 5290 m, extends into China and Pakistan, Figure 2.

The highest peak of the Wakhan region is Noshaq Mountain, with a height of 7492 meters, which is located in the continuation of the Hindu Kush mountain range. The area also includes flood rivers, local lakes, and permanent glaciers. The currents of the valleys join the Wakhan River and then turn into the Panjo River. The river eventually flows into the Amu Darya (Mock and O'Neil, 2005). The Pamir Valley has unique landscapes, rich indigenous biodiversity, and unique history and culture. In 2014, the Pamir region was registered as the second protected national park in Afghanistan and World Heritage.

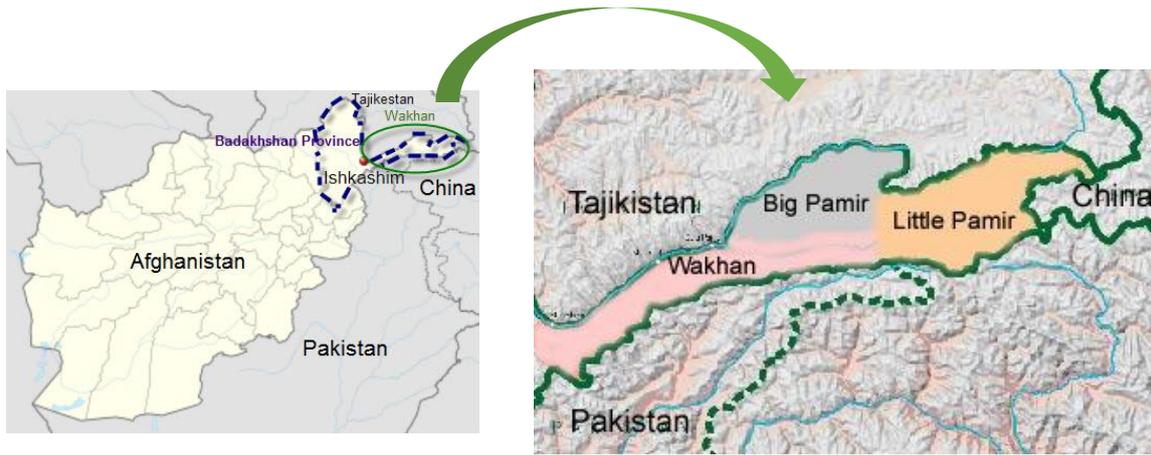


Fig. 2. Geographical layout of Wakhan Valley in Afghanistan map and between Hindukush and Pamir Mountains (Aich et al., 2017)

The plain region in the Wakhan Valley from Ishkashem to the Sarhad-e-Broghil contains numerous farmlands and villages, and due to heavy snowfall and landslides, there is no car access to Little Pamir and Great Pamir valleys. Getting to the first villages in the valley takes five days on foot or horseback. As there is no permanent meteorological station in the Wakhan Valley, in this study was used the information of the station is the same altitude and latitude in the Pamir region of Tajikistan (4736m and 38°N, 73°E). According to Figure 3, winter in this region lasts for about eight months (early November to late June), and the average temperature in the coldest month is -15 °C, while the temperature in the Pamirs can drop as low as -40°C. The average rainfall is 65 mm, mostly in snow. The temperature in the hottest month of the year does not exceed 10 degrees. The direction of the wind is dominant from the southwest, and its intensity within the valleys follows the shape and

effects of the earth form. The precipitation is rare and falls at the end of spring and the beginning of summer. In this area, the vegetation is very poor and often in scattered shrubs, and the pastures are often spread in the valleys and around the streams. According to temperature, rainfall, vegetation, and soil conditions, in Koeppen-Geiger climatic classification, Wakhan Valley is placed in Dsa and Bwk types (Clipartmax, 2019). So, in just two to three months, residents are in the thermal comfort zone and then quickly need to be in buildings and wear thick clothes. In these areas, there is a permanent glacier of snow reduced by the volume of ice due to climate change (Shahrani, 2002). The Pamir's grasslands and semi-deserts act as a major biogeographic barrier between Mediterranean-influenced middle Asia, monsoonal South Asia, and the continental expanses of central Asia (Olson et al., 2001).

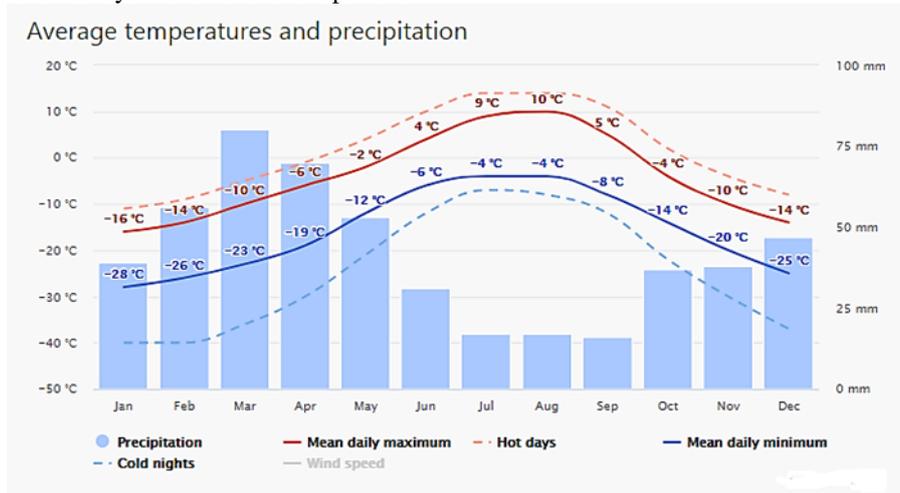


Fig. 3. Average monthly temperature, precipitation in Pamir mountain region for 30 years (Meteoblue, 1989-2019)

The Wakhan valley is important for several reasons. The first is historically a Silk Road and a link between China, Iran, and Europe. The second is that it is amazingly intact and original, and the third is the intersection of the three great religions of Buddhism, Zoroastrianism, and Islam. Therefore, these factors can be expected to affect its inhabitants for thousands of years profoundly. In this area, complete studies on the evolution of indigenous

architecture and ethnography, geology, vegetation, and animals of mountainous areas, and the impact of climate change on glaciers. Despite all these advantages, its unique beauty is indescribable for tourists and climbers. In 1895, political problems between China, Britain, and the Soviet Union besieged the valley, leaving its inhabitants in multiple poverty (Özgun, 2021)

1.3. Human Settlements

Some documents showed that this valley was a human settlement 100,000 years ago, and the history of the Silk Road, which connects western China to the Mediterranean, extends for 1,700 years from 329 BC~1400 AD (Cassar. and Noshadi, 2015). Therefore, this valley has been an important passage for trade, cultural exchange, and the promotion of religions. Socio-cultural factors influence its inhabitants due to the crossroads of Zoroastrianism, Buddhism, and Islam rituals. On the other hand, they were learning from the interaction with the mountain environment has also made its rural architecture essentially unique (Badakhshan, 2018, 6). The Wakhan Valley's demographic context includes settled Wakhies and tent-dwelling and semi-nomadic Kyrgyz people. The Wakhi people live in small, scattered villages, farming in the plains and adjacent to the rivers, sending their livestock to the highlands in late spring and returning them in early fall. They are of Iranian origin and are Ismaili Shia, while Kyrgyz people, as primitive societies, are Sunnis. After the collapse of the Soviet Union and the formation of new borders, Kyrgyz tribes were forced to settle in this region. They migrate to the Pamirs with their livestock in the spring for suitable rangelands, return to the snowy valleys in fall, and keep their livestock in stone-made shelters (Kassam, 2010). Most of Wakhan's settlements are located in the valley of Wakhan and the vicinity of farmland. Lower Wakhan forms an area along the route of the Panj River between Ishkashim and Panj Castle. On the other side, the upper Wakhan, an area Gazkhoon (where the northeast Panj turns into the Great Pamir), is formed along the Wakhan River to the border of Broghil, the westernmost before the small Pamir area. Both the upper and lower parts are between two and three kilometers wide (although

narrower in parts of the upper Wakhan) and are mainly settled by the Wakhi communities, which are thought to form sixty-seven villages in the size of three to 138 households, Figure 4 (Badakhshan, 2018, 12). The Wakhi are originally Persian people with ethnic ties to Tajik society. They speak Wakhi, a branch of Dari Persian. However, they have been culturally and historically influenced by India, China, and Iran. Because they were first Zoroastrians and then subjects of the Ismaili sect, they were somehow excluded from other Muslims and isolated. Wakhi farms in limited mountainous lands grow wheat, barley, potatoes, beans, and peas in the valleys, and oak, sheep, and goat crops on high pastures above 4000m highlands. Their houses are made of stone and mud walls, usually built around ponds and springs. In an interview with Tolo News, "...In 1925, after the borders of the Soviet Union, Pakistan, China and Afghanistan were formed, a small number of Kyrgyz nomads got stuck in the Pamir region. They were forced to continue farming in a limited area between the Hindu Kush and Pamir mountains and in very cold and unfavorable conditions Today, Kyrgyz take their nomadic route, in a special order and direction, twenty kilometers long, between winter settlements and summer pastures....", Professor Shahrani said (Amini, 2017). The communities of Kazakhstan are sparsely populated and tribal, with 600 inhabitants in the Great Pamir and 900 in the Little Pamir, which are formed in 250 families. On average, each family has six members. The Pamir region is 4400 square kilometers and has a population density of 3 people per square kilometer. One in two children dies before reaching the age of five. However, they have balanced their population by consecutive marriages and reproduction attempts (Callahan, 2019).



Fig. 4. A Wakhi family inside the house in the stone kitchen with children (left) and children next to Yurt (right) (Secretcompass, 2021)

2. Methodology

This research has used bibliographic sources and field studies analytically-descriptively. The relationships between sites, ethnicity, architecture, and culture are studied. In order to gather information about these items in the region of the Wakhan and Pamir valleys, it is necessary to collect and categorize maps, documents, and

photographs and conduct remote interviews with experts in Afghanistan and Tajikistan. Field studies are limited to the main Wakhan due to the outbreak of Covid-19 disease and insecurity in the southern regions of Badakhshan province. Due to the lack of a permanent meteorological station in Wakhan, the study of the region's climatic conditions is carried out with the information of the Pamir meteorological station in Tajikistan. This study is based

on a descriptive analysis of architectural climate adaptation in a very cold and mountainous region and a comparative study on the simultaneous impact of culture and beliefs on the vernacular architecture of the Wakhan Valley and Pamirs.

3. Vernacular Architecture in Wakhan Valley

Vernacular architecture in mountainous areas is often dependent on stone and clay materials. However, due to climatic, security, and lack of available materials or lack of construction experience, caves dug in the hills are seen in countries such as China, Mexico, the USA, Iran, and Turkey. The compactness of the buildings, the continuity, following the contour lines of the ground, and the sinking of the building into the ground or the thickening of the walls have protected the building from the cold wind. In many cases studied, openings are minimized, and light penetrates the building through the roof. The heat source in the center of the building is used not only for baking bread and food but also for radiating heat into the room. The main room is multipurpose, surrounded by barns, cages, and entrance halls. Also, a bioclimatic study shows that a significant part of human comfort conditions in the months of the year require sunshine in the region and is created only in the summer months due to wind. In these areas, adaptation between building form, clothing, and type of activity with environmental conditions has wisely been an important factor for survival. Immigrants who

came to the Wakhan Valley in the past centuries had experience in construction and were familiar with using stone tools and materials inside load-bearing walls. These residents have no experience building stone arches, and due to the extreme cold and the lack of trees, they provide the wood needed for construction from remote areas (Kreutzmann, 2003).

In Wakhan Valley, the shape and construction techniques used in Afghanistan's indigenous interior architecture are influenced by environmental conditions, the availability of building materials and skills, and specific social and cultural practices. The most common form of living in the Wakhan region is a series of rectangular rooms grouped around it. However, residents remain in the area and have resisted extreme colds and snowstorms. They have wisely adapted the architecture of their homes to conserve heat in the building despite the scarcity of fuel. As their square or rectangular buildings have only one room and through the hallway, the entrance to the room is connected. This vestibule prevents penetrating the outside cold air and the view inside. This room is multipurpose, and in the colder months with a freezing temperature of -40°C , all day and night activities are carried out around the home's warm oven. Additionally, it also provides access to the store, forage, and grocery. There are five distinct and adjacent areas in this room: family living, cooking, sleeping/working, guest reception, and the middle area where the first four areas are on the platform (Dukan), Figure 5 (Miller, 2007).

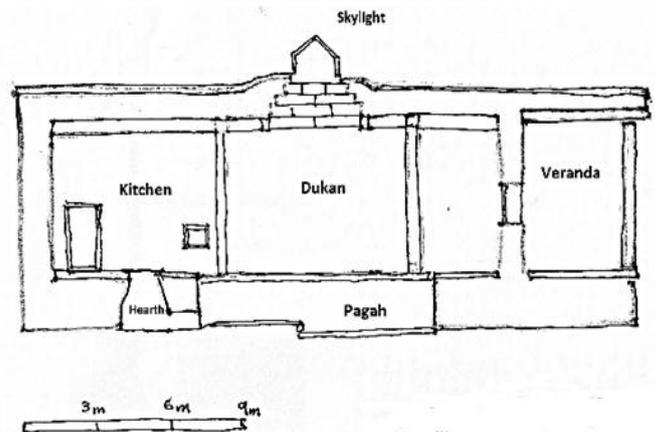
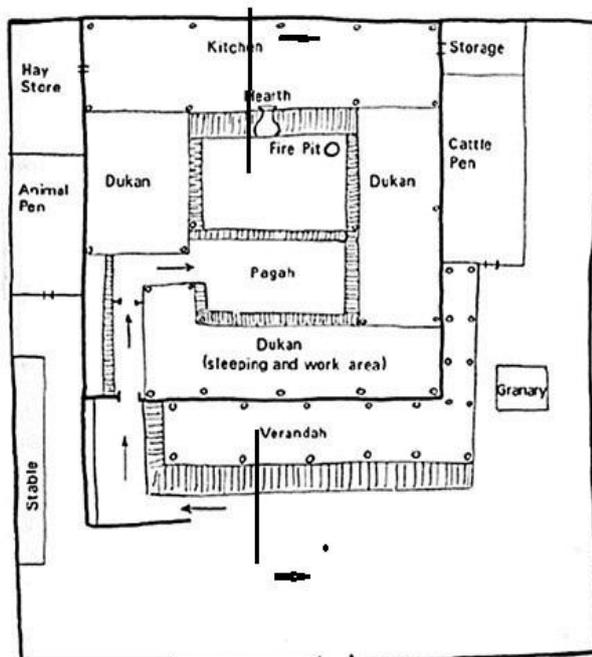


Fig. 5. Typical schematic arrangement of the Wakhi House's introverted plan and section in Khandud is placed around a middle space (Pagah) with four platforms (Miller, 2007) Section drawn by authors.

Wakhan residents deliberate in maintaining heat, such as reducing the number and area of the window, utilizing thermal mass in the form of thick stone or adobe walls, reducing room height as much as possible, and utilizing an oven's radiating heat in space, and make a hole for smoke discharge and daylighting on the roof. Earth oven (Tanour), as the heat source in the center of the house,

plays an important role in providing the residents with thermal comfort. The oven is 60 to 80 cm deep and connects to a well at the bottom of the chamber through a short duct through which air enters and discharges the ash. In the eight months of freezing air and cold, the only place to bake bread and cook is the oven that radiates heat into the room. It uses the heat capacity of the earth deep in the

earth and does not waste heat. The oven door and small air well are covered when not needed and hidden under the carpet (Shahrani, 2002, 11-13).

In some houses, the air well has been removed and is limited to a hole in the oven platform. The hole of the roof opening is crucial for smoke and light emission, yet the home space is sometimes full of soot and requires constant cleaning. The single window on the south side - small in size - provides light and ventilation. So, these houses are dark and dim; it is very depressing with the cloudy mountain climate. Spaces such as the grocery store and firewood are connected to the baking platform, and the stables can be monitored from the same room. These adjoining spaces separate the main house from the cold environment as a buffer. The platform is 40 to 60 centimeters above the ground and provides a good distance from the cold floor and the proximity to above warm air. In all mountain regions, the veranda on the sunny side of the building is very functional and has a shading role if there is a window on the south wall (Mock and O'Neil, 2005). In cold climates, it is not only necessary for walls to be made of materials with long heat storage but also for earthwork or embankment use. Clay and stone are two important materials available in the area that can reduce temperature fluctuation. In summer, these materials can keep the interior cool. Also used on the roof are wooden beams (from poplar trees) covered with bamboo, straw, and straw mud cover, which greatly affects heat transfer to the outside (Keshtkaran, 2011).

In another example, in the village of Wark at an altitude of 2600 meters with cool summers and the average

minimum winter temperature reaches -15 degrees Celsius. According to Figure 6, residents have attached the house to a rock to keep warm to protect the house from cold winds better. Its volume is compact, and the house is partially buried in the soil. As in the previous example, the living room is arranged in the main room around the large stove with benches made of stone and cuttings and skylights. Heavy materials used in the stove allow heat to radiate after the fire is extinguished. The facade of the building is made of stone and stone, which is characterized by a suitable heat capacity (heat storage). Against the cold wind, there is a little opening in the building, and all daylight and smoke are only possible through the roof.

In Ptukh village, in the same valley at 3200 meters, the temperature conditions are more severe than in the previous example. Despite heavy radiation and low rainfall (90 mm per year), the air is dry and cold winds blow in most months of the year. Due to geology, it is not possible to shelter the house in the ground. Hence, the houses were facing cold storms, and there was no choice but to thicken the wall or berm. In the form of a multi-purpose, the main room is a place to sleep, eat, and work. The heat radiated from people's bodies is also needed to heat the room. In this situation, the main room ceiling is short, and people similarly sit on Dukan. Each door also has a high threshold to prevent cold air from entering. As described earlier, the compactness of the building form and the radial arrangement of the interior, along with the use of barns and cages to withstand cold winds, are vital, Figure 7 (Supic, 1982, 43-54).

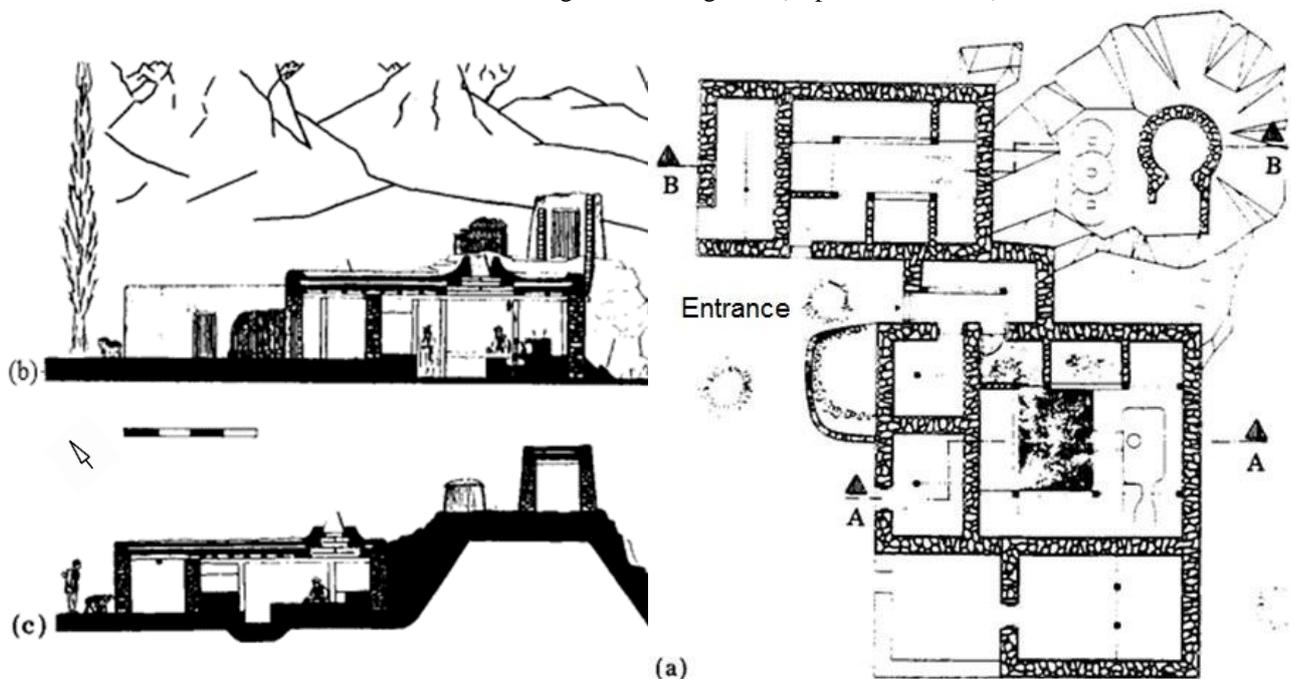


Fig.6. A house in Wark village in Wakhan Valley, a) Plan (b) section A-A (c) section B-B (Supic, 1982)

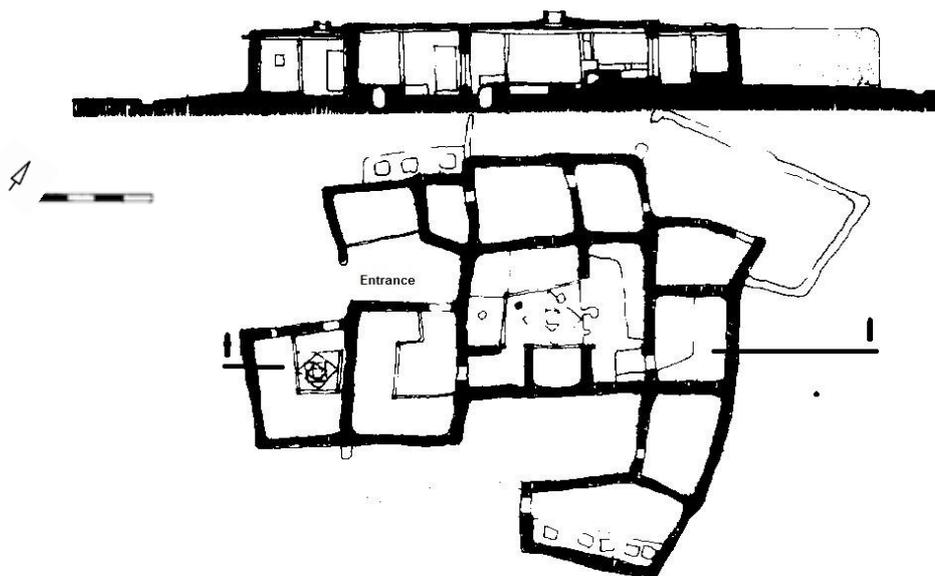


Fig.7. The integrated houses in Ptukh village in Wakhan Valley, Up: section, Down: plan (Supic, 1982)

4. Kyrgyz Tents and Interaction with Nature

The Kyrgyz are not accustomed to settling down, and on this journey, they carry and build their own style house, called the Yurt. Yurt is an important part of the culture of the ancient Turkestan region, and today about three million people in Central Asia still live in Yurt (Mauvieux et al., 2014). The detachable structure of Yurt is made of willow wood, which is produced and brought from remote areas, but the Kyrgyz themselves produce its tent cover. To cover the Kyrgyz tents, camel hair and goat hair in the kilim and felt are used. This coating with light and dark colors is waterproof and reduces heat transfer. This means that it stays cool in summer and warm in winter. These pieces are attached to a multi-part wooden structure and a network of reeds ventilated flexibly in winter and summer by removing some of them. The number of coating layers varies depending on environmental conditions. Despite the roof cavity, which is responsible for providing low light and emitting smoke and polluted air, the temperature inside the tent increases between 3 and 7 degrees Celsius in winter and decreases in summer. Kyrgyz nomads also add soil walls around Yurts at higher altitudes to better resist water, wildlife, and cold winds. Yurt cover consists of a heavy cover (Kiz or Namad), which rests on the radial handles on the roof and the surrounding netting that make up the walls and is fastened by tight woolen straps. The cover extends to the ground in winter and creates an impermeable wall against the cold wind on a layer of straw and straw. In summer, the outer felt cover is retracted, but the wooden retaining structure and the inner cover remain to protect the occupants' privacy and allow ventilation inside the Yurt. However, Yurts were used in the spring migration of Kyrgyzstan to the highlands, and in winter, they took refuge deep in the valleys and built a stone structure for their families and cows (Shkolnik et al., 1980).

Although the shape of the Yurts varies slightly in each area, they all include three basic elements: a wall, a roof

structure, and a cover. The walls are made of a mesh frame made of straw, which is easy to assemble and openly and attached to the door frame to complete the cylindrical shape of the wall. In this work, eight grids are used, each of which has two layers. Leather and wool straps strengthen the wall and attach to wooden gloves - pounded on the ground - while enabling the structure to be pressed. The lattice is attached to a series of wooden poles pounded into the ground and is stretched using woven strips of wool around the cylinder and helps resist lateral pressure from the roof and wind straps. The door frame (eshik or Darwaza) is up to one meter wide and 1.50 meters high, with grooves at the outer edge of the lattice frame. Wooden doors appear to be rare, and usually, like gauze tiles, reed-reinforced wood is used. It is commonly used to cover the main opening. In the Pamirs, the doors are placed to the south and away from the cold sunset. A Yurt is a compatible system. The structure is made of a ring (tonuk) in which 40 to 60 handles are involved. The bent willow poles are connected to the gaps in the roof ring and are connected in a V-shaped network framework at their base. The wooden roof ring is reinforced by placing a maximum of two timber bars to withstand the internal resistance of the roof axes (Miller, 2007).

The tent door may be decorated with symbols of family or tribe. Despite the very limited space in the Yurt, a similar layout pattern seems to be used in most homes. For example, to the left of the entrance, there is a kitchen and storage area covered with a fabric cover or curtain with colorful decorations. Opposite the entrance, decorated wooden boxes contain property and family clothing. These boxes are also used in large and small sizes to make the Yurt more stable against the wind. A variety of bedspreads, in addition to local hand-woven rugs, are a sign of the status and wealth of the tribe and family. The Kyrgyz tent system conceptually resembled the thatched stone houses of the Wakhi people, as the cooking oven is located in the middle of the Yurt interior, under the tent. All men's belongings, from horse saddles to winter coats

and firearms, hang on the retaining wall to the right of the Yurt entrance. The stove is an important point in the Kazakh tent so that all activities start from it and terminate next to it at the end of the night (Messerli et al., 1997 and Forster et al., 2011).

With the onset of cold weather and the end of the green pasture season, Kyrgyzes migrate to the lower ground, on the way from Langar to Kashch Goz between 3660-3900m altitudes. At the bottom of valleys, cold and snowy winters occur for 5 to 7 months, so they have to sell their livestock to the Wakhi people and wait for spring with a small number of livestock and fodder depots. They build small masonry rooms and use existing river rocks naturally, and although they place large rocks at the bottom of the wall, they do not consider the order in the alignment. Nevertheless, they use it only to create an

envelope. The exterior walls are mostly decorated in the southern part, which is exposed to the sun. The house has small openings for ventilation and lighting inside by placing a lintel. The simple room is divided into three cooking spaces, a bedroom-living room, a bathroom, and storage. The warehouse is used for animal feed, house fuel and is stored at the beginning of autumn and emptied at the beginning of spring migration. The roofs of the houses are covered with branches, leaves of trees, and mud cladding which they destroy at the beginning of the migration. The erosion rate is very high due to the severity of weather conditions and temperature fluctuations, and buildings need to be repaired every time they return from the mountains, and they are used by tourists and passengers-by when they are empty, Figure 8 (Middleton, 2020).



Fig. 8. Typical Kyrgyz tent in Pamir region, Top: the yurt house, Down: winter masonry house (Miller, 2007)

Wakhan and Kyrgyzstan live side by side in the Wakhan and Little Pamir valleys and are economically interdependent. This has created a cultural connection and transfer of experience in building houses, as Kyrgyz has used Wakhi housing to spend the winter, while Wakhi has used Yurt's form to build and set up tents in summer pastures. However, the results of these efforts seem very clumsy.

4. Religious and Burial Buildings in the Wakhan Valley

The Pamir region, and especially the Wakhan Valley along the Silk Road, has faced Zoroastrianism, Buddhism, and Islam. The influence of the Buddhist presence can only be seen in the carvings on the red rocks throughout

the Wakhan and Pamir valleys during the Tibetan rule over the region (Mock, 2018). Nevertheless, this effect is not seen in the houses of the Wakhis and Kyrgyz people. Some experts in Afghanistan and Tajikistan believe that Islam was introduced to the region by Nasser Khosrow Ghobadiani after Mithraism. Since then, the Ismaili sect has found many followers in this region. Mosques are very important because they are places of worship, thought, and gathering for Muslims. Mosques have a simple shape, rectangular plan with porches on one or both sides.

The wooden roof of the nave and porches are supported by decorated wooden columns. The walls are load-bearing and on each side, except the side of the Kiblah. The small openings have been inserted inside them to receive daylight and cross ventilation without high heat loss.

These shaded porches are suitable for sitting or praying in the warmer months. In Figure 9, the Mullah Barat Mosque, built in the 1940s in an indigenous style, has a nave, an altar, and niches for the Quran and religious books. The roof structure has wooden beams, shingles, and mud cladding, and the interior walls are made of brick with a gypsum coating. The facade of the exterior walls is made of limestone, and there is no skill or desire for tiling and arabesque motif. The paintings on the interior and exterior walls are influenced by the color and pattern of

plants in mountainous areas and have a primitive composition. There is no use of black in these motifs as a symbol of ignorance and evil (Miller, 2007 and Mock, 2013). The same structure can be seen in the Ismaili Mosque of Khandood village with a nave with dimensions 9.40 by 6.40 meters, a two-sided porch, and a flat roof. This mosque is built next to an old mausoleum and has carved decorations as lotus flowers in the capital and base of columns, inspired by Iranian patterns (Figure 10).



Fig. 9. Typical ornamentation on the exterior walls in Mullah Barat Mosque (Miller, 2007)

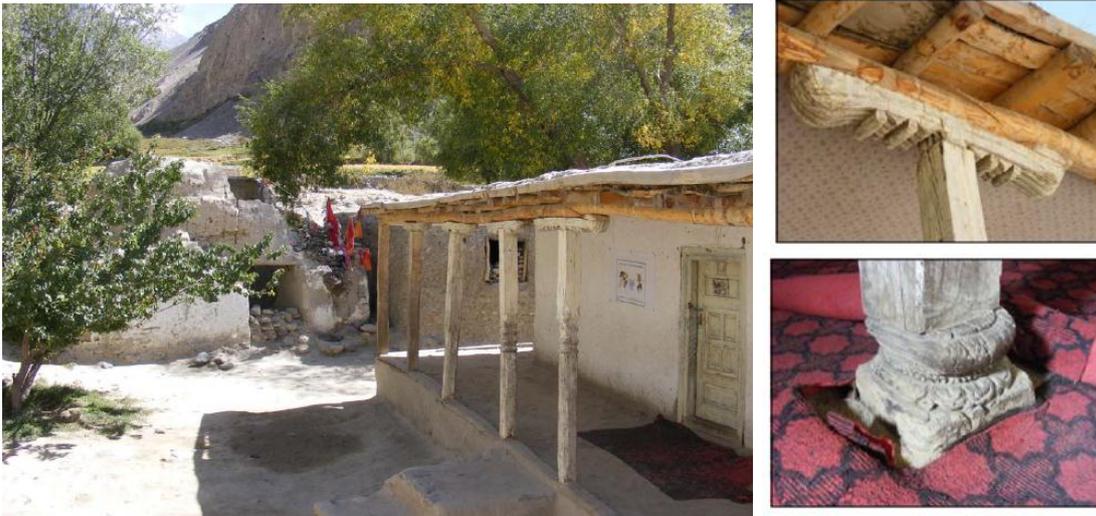


Fig. 10. Ismaili Mosque in Khandud village with a lotus carving on the columns (Miller, 2007)

Tombs (Gombaz) and cemeteries are located along the roads and sometimes at the heights overlooking the river. Throughout Wakhan and the Pamirs, these places are important in terms of Islam and the position of social traditions and, in most cases, through the expression of symbols and signs of past religions. They also report the dependence of the Wakhi and Kyrgyz people on the natural environment and its interaction with it at the time of death and the afterlife. To identify the tombs (Mazar), Kyrgyzes mark them with river platforms or rubble in the form of short platforms and place colored flags and mountain sheep horns on them. The Wakhi built the Gombs on a stone pedestal with simple brick walls without a roof, and the walls are made of stone and clay, and the top of the wall is decorated with a triangle of clay or stone. The walls of tombs are sometimes covered with

white mortar or simply mud. The doors of all the tombs are on the northeast side, and the threshold is about 40 cm because they do not enter the burial site from the side of the tomb, Figure 11 (Kreutzmann, 2003).

The construction of tombs is usually simple and made of local stone and clay materials with a thickness between 60 centimeters to 1 meter. Sometimes the interior is whitewashed. These buildings are built facing the Kiblah and, on a high point, overlooking the road or river. Sometimes the buildings are of the traditional flat roof, which is made of wooden beams, branches and leaves, and thatch. For example, in the village of Ptukh, the tombs of family or tribal elders are built in the form of village houses containing one or more tombs. Usually, the wooden door faces the wind, and small holes are installed in the south or east walls for indoor lighting. From the

construction method, it seems that there was haste in the construction of the tombs, and at a low cost, they only determined the location of the tombs and protected them from wind, rain, and wild animals. Most of these tombs

have been destroyed due to climate change and the passage of time or the family's poverty; less has been done to repair it. (Duncan, 2018).



Fig. 11 Typical tomb (Gombaz) in Wakhan Valley (left) and Kyrgyz's tomb (right) (Miller, 2007)

6. Symbolism in Wakhan and Kyrgyz'S House

One of the most important reservoirs of Pamir culture is the traditional Pamir house, known locally as "Shughni" or "Ched." This house is an example of vernacular architecture created by untrained people in the building profession. Conceptually, in addition to the primitive structure of these houses, it is full of religious and philosophical meaning for the people who live in them. According to the Anglo-Hungarian explorer Aurel Stein, who visited the area in 1915, symbolic elements in the architecture, structures, and decorations of houses and mosques reflect ancient Aryan values and possibly Buddhist philosophy - absorbed into the Pamiri tradition and in the environment. Hard and cold mountainous are expressed. The symbolism of the special structural features of the Pamiri house dates back to more than two and a half thousand years, and its distinctive architectural elements can be found in buildings in several other areas close to the Pamiri area (Mock, 2018). The cultural symbols and values give important meaning to the interior of Wakhan houses. These symbols have strengthened intellectual and social relationships in this difficult environment. In building a well-groomed house, they seek good fortune with astrology. They pray and sacrifice to

build the house, and then neighbors and relatives help the homeowner set up the house for free (Eduljee, 2017).

The symbols are represented and understood through interior surfaces, colors, structures, skylights, and furniture layouts. Because Wakhi houses have flat roofs and are supported by wooden pillars, the pillars have become important symbols. Each pillar evokes a special status and is associated with religious values. For example, the elderly and special guests are usually placed between the first and last columns. Fresh air also flows in this area near the entrance. In this house, the spatial division in the main room is defined by changes in the height of the surface, structural columns, wall and floor decorations. Women's lockers are located next to the kitchen. Although the skylight structure has a more complex application, how it is installed and implemented and its relationship with the room is completely dependent on Zoroastrian and Islamic teachings. The corridors of these houses also play an important role in creating privacy and controlling heat loss (Kirbas and Hizli, 2016). The circulation in the room is done between the four important points of entry, the guest living room, the stove, and the resident living room, Figure 12.

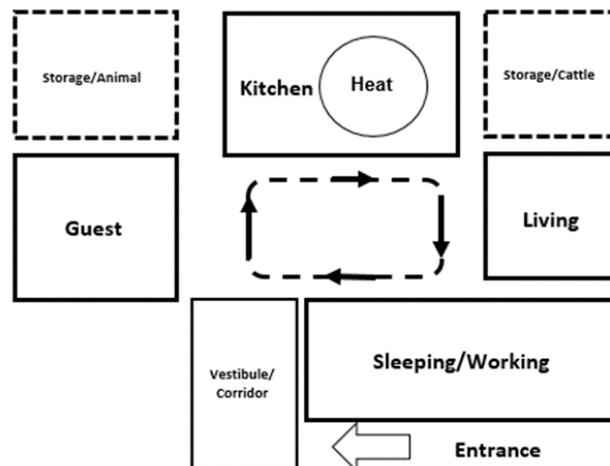


Fig. 12. Conceptual diagram for a typical main room for Wakhan house

In ancient Iran, light has long been known as a valuable and sacred element and has a special place in the life of Iranians, so that the sun in the religion of Mehr, was known as the source of mercy and in the age of Zoroaster, dual light and world darkness formed them. Light has been equivalent to mercy and blessing. The construction of love and its derivatives, meaning goodness, mercy, blessing, friendship, and affection, express their view of the sun. After the fusion of Islam with this culture, the sacred aspect of light continued to maintain its place in Iranian-Islamic culture and found a deeper meaning (Shariatmadari, 2017). According to the history of Zoroastrian religion among the Pamiri communities, which is due to its proximity to India and Iran, the

arrangement of residential houses in the Wakhan Valley can be seen under the influence of Zoroastrian houses in Iran. In these houses, a four-tiered arrangement was common, as the main spaces of the house were connected to the central courtyard through four porches. The dimensions and proportions of the yard have been in accordance with the climatic conditions of the desert areas of Yazd and Kerman. This mental model of house architecture, in accordance with the cold and mountainous climate, has evolved into introverted architecture with porches around the main room, middle space, and lighting with a simplified geometry of traditional Iranian architectural applications, Figure 13 (Farzaneh, 2020).



Fig. 13. Formal and structural comparative of skylights in a Zoroastrian house in Yazd and Wakhan Valley (Farzaneh, 2020 and Mock, 2018)

The building for the Wakhan people, who first brought Zoroastrianism and later Islam, is a metaphor for the earthly and theological worlds. At home, the floor and the wall represent the living and the living world, and the platforms between the pillars are for sleeping and eating. The platforms are a metaphor for the material world and life in nature. The roof of the house is flat and a symbol of the sky, penetrating through the light. Light is a sacred nature in all three major religions in the region and has been given special importance in indigenous architecture. Light enters through a skylight with five rotated square-shaped structures made of wood or flowers. In pre-Islamic

beliefs, light has a Zoroastrian meaning, so that the first square - the place first touched by the sun's rays - symbolizes Ahuramazda (The God) - the next square represents fire; the others are symbols of earth, air, and water. The rich people decorate this structure with high-quality materials and ornaments of Islamic or plant motifs alongside verses from the Quran's Words and cover it with straw mud in the houses of the poor. In the old city of Samarkand and the royal palace, skylights with the same geometry have been created, which is a sign of the presence of Zoroastrianism in government buildings, Figure 14.



Fig. 14. A typical Wakhi's House with a symbolic skylight made by wooden structure (Mock, 2018).

In Wakhan Valley, the architecture of the houses is based on the number seven. This number is a symbol of Zoroaster's ancient religion and values, which represents the seven aspects of divinity, Amesha Spentas, the seven main elements in the creation of the human body, seven symbols of nature in the celebration of Nowruz. On the other hand, the combination of seven symbolic elements in the structure of the building leads to the creation of houses and biological complexes that are adapted to the climatic conditions of the mountainous region and have brought comfort to the inhabitants. Also, these houses are resistant to earthquakes due to their strong wooden framing and load-bearing walls, which is one of the teachings of Jamshid in Zoroastrianism. The walls may come out of the frame during an earthquake, but the frame will remain upright. Despite the hardships of life, the lack of facilities, and the very cold climate, what has encouraged the Pamirs in this environment is the inspiration of ancient traditions and values and the understanding of natural resources in this region.

In preparation for Nowruz, a wreath of willow flowers (in the shape of a circle with a cross pattern) is dipped in flour and used to draw faces and patterns on the walls and columns of the main room. The meaning of this practice is very similar to the plaster designs used by Zoroastrians in India during celebrations.

The five wooden pillars that hold the ceiling are symbolic because they display faith, prayer, charity, fasting, and Hajj. They also refer to the five main members of the Prophet's family. The pillar of Muhammad at the entrance was traditionally made of sacred timber, and the child's cradle is placed here to protect the child. The bride and groom sit next to Ali's pillar during the wedding, as the Zoroastrian love angel accompanies it. The pillar of Fatima, the daughter of Muhammad, is the closest to the stove, and the twin pillars of Hassan and Hossein have been attributed to the corridor and doorway of the house (Mock, 2013).

Throughout the Wakhan Valley, the symbol of the ibex can be seen with an emphasis on its horns, on stone inscriptions and the doors of some houses, and, of course, on tombs. In his trip to the Wakhan Valley, Andy Isaacson writes: "... Small shrines to Ismaili holy men line the roadside. Each has its legend and is ornamented with special stones and curled ibex and sheep horns, symbols of purity under Aryan and Zoroastrian religious traditions, which predate Islam in the region,.... The stone-and-plaster architecture was typical of traditional homes throughout the Pamirs, rich in symbolism that includes ancient Aryan and Buddhist philosophy elements. For Ismailis living here, the home is itself a symbol of the universe and serves instead of a mosque as a place for prayer....." (Isaacson, 2009).

For the Kyrgyz people, like a Mongol and the Turkic tribes, the Yurt symbolizes the center of the world, and the small world itself is the big world. The home of these people is mysterious and has created an eerie mountain atmosphere, indigenous literature, and unique socio-cultural concepts. Their home is arranged in place and time and introduces the audience to a particular type of introversion in a very cold desert climate (Chenevie and Chenevie, 2007). Inside the tent, the seating arrangements are in accordance with the Kyrgyz social system on a large scale. The holiest place is where the fire is located. This is Golomto, the "daughter of Heavenly Father," and therefore should be treated with respect. The vertical axis represents the chimney erupting from the fire; the world's tree shows the shaman ascending to the world. The two pillars that hold the wooden ring of the tent aerator symbolize the earth element that lies between the wind and the sky. The number of radial bases that reach the ground from this ring is less than the Mongolian sample, and yet it is auspicious, Figure 12 (Lacaze and Borel, 2006)

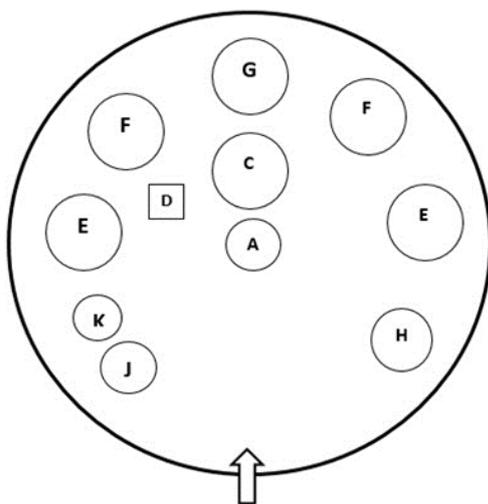


Fig. 15. Spatial organization of Yurts: (A) Stove (B) Firewood storage (C) Dining area (D) Small service table (E) Bed (F) Box for clothes, (G) Place of worship, statues, and family photos (Hoimor) (H) a place for kitchen utensils, (I) a container for water, (J) utensils for household products (K) a place for storing men's personal belongings (Lacaze and Borel, 2006), interior furnishing of Yurt (right) (Carvanistan, 2021)

Due to the rotation and height of the sun, the Kyrgyz tents had the same function as clocks and calendars. For each point of sunrise, a symbol of wild and domestic animals was defined that had a semantic connection with one of the months of the year. Therefore, the Kyrgyz determined the type and time of daily and monthly activity throughout the year based on the sunshine on their father. Although Kyrgyz traveled hundreds of kilometers to find pastures in previous centuries, they now travel only 20 km between their summer and winter pastures. So they stay longer in their tents, and the calendar has lost some of its cultural function.

Kyrgyz people maintain their traditions, depending on their environment, and strive to balance their lives and the mountain ecosystem. Yurt, meanwhile, remains important as a symbol of time reference among the Pamir Mountains.

7. Comparative Analysis on Vernacular Architecture of Wakhan Valley

In a huge valley between four countries, two peoples live together in very harsh environmental conditions while being away from their homeland and isolated because of their beliefs or livelihood. The Pamirs and Wakhan region have been crossroads of different cultures and have been influenced by the indigenous architecture of these tribes. In the form of introversion, social and cultural conditions along with cold and mountainous climate, the architectural space relies on a heat source, family warm center, and social participation. Access to local materials and products has reduced the architecture of their houses and religious buildings and simplified their form and construction. However, based on their previous experiences, each nation has taken action against the land and buildings against the cold mountain winds and snowy months. Table 1 analyzes and compares the formation of indigenous architecture in this region based on climatic and socio-cultural factors. It is clear that the Kyrgyz people, who live in the farthest reaches of the Pamirs, have fewer opportunities for progress, affecting their population growth. Time has stopped for them.

Table 1
 Comparative study on architectural similarities and differences between Wakhi and Kyrgyz people in housing performance

With respect to	Similarities	Differences
Climate and Environment	Both build their homes introverted from the cold outside. Both houses do not benefit from adequate ventilation and lighting in order to adapt to the mountain environment. The entrance of the building and the tent are made facing the sun and behind the cold wind. Both have interactive behaviors towards the natural environment and species, however, they face tree fuel limitations. Plant species have been severely damaged. Due to the lack of access to fossil fuels and the environmental sensitivity of the Wakhan Valley, both peoples need renewable energy.	Kyrgyz at higher altitudes (small and large Pamirs) face more severe colds and more restrictions. Yurt is suitable for the plain with a minimum temperature of -11 degrees Celsius. Kyrgyz determine the time for sunlight. Wakhi people are more adaptable to environmental conditions. The Wakhi people have an official calendar and carry out their activities according to their traditional and cultural system.
Spatial Configuration in Architecture	Both houses are interior and have the main space. The arrangement of the location relative to the heat source is radial. In both houses, there are deep concepts of beliefs and respect for the past.	The Wakhan House follows the complexity, coherence, and hierarchy of privacy and climatic conditions. This house uses articulation and interior walls to divide the function. In the Kyrgyz house, there is only one felt curtain separating the inside from the outside, and the inside of the house is divided according to the arrangement of the furniture. Tombs are built among the Wakhi people in the form of courtyards and structures. For Kyrgyz, there is no construction of tombs and signs are enough.
Earth	The Wakhan people are land-dependent and have limited agriculture and livestock. Kyrgyz people use plant and mountain resources to graze their livestock.	Kyrgyz historically depend on migration and determine the type and timing of their activities based on environmental and rangeland conditions. The people of Wakhi know more about land use for construction and agriculture.
Activities at home	The activity in the house revolves around the fire and the kitchen space. The settlement system of individuals in the main space is determined by the age, sex, and reputation of the individuals.	In Wakhan houses, there is a possibility of internal connection of spaces (warehouse and Pen). But in the Kyrgyz house, the connection between functions occurs through the open environment.
Neighbourhood Relations	They are interdependent in tribal and ethnic form, and the composition of the building is a function of ethnic	Among the Kyrgyz, the tents are placed side by side and do not follow a specific pattern.

	affiliation and landform.	
Matrial and Structure	Both use local materials in their homes to withstand indoor-outdoor temperature differences. They have experience in construction and by migrating to Wakhan Valley, they have adapted the form of the building to their environment. Based on the climatic constraint, Due to climate restrictions, Kyrgyz people build stone buildings for wintering, but it is primitive.	Heavy materials are used in Wakhan houses, but Kyrgyz depends only on heat-resistant layers (felt) Kyrgyz continue to use their traditional chador. In winter, however, they need buildings with thermal mass.
Symbols!	Both use natural signs at their homes or tombs to connect with their metaphysical world. The symbols are taken from the nature of the mountains and the ancient rituals of the tribes. Both peoples believe in sacred numbers and display them in the structure of buildings and tents. For both peoples, the skylight is a symbol of connection with heaven and the great world.	For Wakhi people, the symbols are engraved on wood, painted on the wall, in Islamic or natural form. For Kyrgyz, it is a natural and geometric pattern on felt. For the Kyrgyz people, the symbols are more original, while the symbols in the culture of the Wakhan people (of Iranian origin) are mixed with Zoroastrianism, Buddhism, and Islam.

8. Conclusion

Vernacular architecture in mountainous areas expresses human wisdom in the face of harsh climatic conditions and respect for that region's beliefs, religions, and culture. In the valley of Wakhan and Pamirs, the confluence of great religions such as Islam, Zoroastrianism, and Buddhism, live people who inherit their original culture and unique environment. This tendency includes a delayed sequence and importance. All Wakhi and Kyrgyz people migrate from their homeland to the region, with different housing experiences in the mountain, which is challenging in terms of environmental and cultural conditions. Meanwhile, the type of architecture and arrangement of interiors is greatly influenced by the cold of the mountains, past experiences, and beliefs of that community. Both architectures include cosmological beliefs that connect men with God and supernatural forces through the mountain environment. Due to the area's remoteness from urban facilities, all construction efforts focus on providing more materials from the site, low cost, and social participation. The interior space represents an important relationship between the heat source, the family center, and heat loss control. Compared to the architecture of the Wakhan people, the Kyrgyz people have to build inexperienced buildings in the snow-capped Pamirs. In both architectures, the presence of the sun inspires work and activity. The symbols of both peoples are rooted in interaction with the environment and their beliefs, and the spiritual values associated with them are seen in structural motifs, facades, and objects. This means that indigenous architecture for human interaction with the mountain environment and creating a sense of belonging to the place is beyond adaptation to the climate reminiscent of the history and landscape of Wakhi and Kyrgyz's people.

Acknowledgment

In this research, Dr. Hagh Nazar Saber and Ezzat Shah NasruddinShahov are thanked for their efforts through video reports of the honorable professors of Badakhshan University. Thanks are also due to the scientific reports of David James, Jeffrey Waalkes, and Dr. Ghorbonidin Alamshoev. Also, I would like to appreciate all valuable

information published and supported by Mountain Unity for the Agha Khan Trust for Culture and the Norwegian Ministry of Foreign Affairs.

References

- 1) Aich, V., Akhundzadah, N. A., Knuerr, A., Khoshbeen, A. J., Hattermann, F., Paeth, H., Scanlon, A. and Paton, N.A. (2017) Climate Change in Afghanistan Deduced from Reanalysis and Coordinated Regional Climate Downscaling Experiment, South Asia Simulations, Climate, 38(5), DOI: 10.3390/cli5020038.
- 2) Amini, K. (2017) Documentary about the Pamir, Tolo News, Available at: <https://www.youtube.com/embed/jlJjWjpmK10>
- 3) Ardebili, M.R. and Shafiei, M. (2016) Lessons from the Past: Climatic Response of Iranian Vernacular Houses to Hot Climate Conditions, Space Ontology International Journal, (5), 4, 15-28, http://soij.qiau.ac.ir/article_526877_57e90a0c189dc434db77a221b02bed16.pdf
- 4) Badakhshan (2018) Physical Conservation and Restoration, Available at: <https://s3.amazonaws.com/media.archnet.org/system/publications/contents/13281/original/DTP105665.pdf>
- 5) Bernensia, on 22 September. Available at <http://www.northsouth.unibe.ch/content.php/publication/id/1705>
- 6) Callahan, T. (2019) The Kyrgyz of the Afghan Pamir Ride On Ted Callahan, Boston University, DOI: 10.3167/np.2007.110103.
- 7) Carvanistan(2021) Wakhan Corridor, available at: <https://caravanistan.com/afghanistan/wakhan-corridor/>
- 8) Cassar, B. and Noshadi, S. (2015) Keep alive History, Safeguarding Cultural Heritage in Post Conflict of Afghanistan, UNESCO, Kabul, Afghanistan.
- 9) Chenevie`re C. and Chenevie`re, A. (2007) Mongolie: Le vent des centaures, Paris, France, Editions Vilo, Terres de passion.
- 10) Clipartmax (2019) Afghanistan's map of climate classification koeppen, Available at:

- https://www.clipartmax.com/middle/m2i8m2i8N4Z5A0b1_afghanistan-map-of-climate-classification-koppen-climate-map-afghanistan
- 11) Eduljee, K. E. (2017) Pamirs Badakhshan, Available at:
<http://www.heritageinstitute.com/zoroastrianism/tajikistan/page4.htm>
 - 12) Farzaneh, A. (2020) How to Cope with Heat and Combined in Hot and Dry Climate in Chahar- Sofe (Four-Sided) Houses of the Zoroastrian Village of Mazraeh Kalantar, Yazd, Iran, The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, HERITAGE International Conference, Valencia, Spain.
<https://doi.org/10.5194/isprs-archives-XLIV-M-1-2020-219-2020>.
 - 13) Forster, H., Pachova, N.I., and Renaud, F. G. (2011) Energy and Land Use in the Pamir-Alai Mountains, Mountain Research and Development.
<https://doi.org/10.1659/MRD-JOURNAL-D-11-00041.1>
 - 14) Geography (2003) Wakhan Mission Report by the UNEP, Available at:
<http://www.juldu.com/Pamir/geography.html>
 - 15) Gil Crespo, I.J., Barrera, M.M. B. and Ramos, L. M. (2015) Vernacular Architecture: Towards a Sustainable Future, Taylor & Francis Group, London.
 - 16) Isaacson, A. (2009) Pamir Mountains, the Crossroads of History Available at
<https://www.nytimes.com/2009/12/20/travel/20Pamir.html>, on Dec. 17.
 - 17) Kreutzmann, H. (2003). Ethnic minorities and marginality in the Pamirian Knot: survival of Wakhi and Kirghiz in a harsh environment and global contexts, *The Geographical Journal*, 169, 3 ,215–235, DOI: 10.1111/1475-4959.00086
 - 18) Kassam, K. S. (2010) Pluralism, Resilience, and the Ecology of Survival: Case Studies from the Pamir Mountains of Afghanistan, *Research. Ecology and Society*, 15(2): 8
<http://www.ecologyandsociety.org/vol15/iss2/art8>.
 - 19) Keshtkaran, P.: 2011, Harmonization between climate and architecture in vernacular heritage, A Case Study in Yazd, Iran, *Procedia Engineering*, 21: pp.428–438, DOI: 10.1016/j.proeng.2011.11.2035
 - 20) Kirbas, B. and Hizli, N. (2016) Learning from Vernacular Architecture: Ecological Solutions in Traditional Erzurum Houses, *Procedia of Social and Behavior Sciences*, 216: 788-799, DOI: 10.1016/j.sbspro.2015.12.076.
 - 21) Lacaze, G. and Borel, C. (2006) *Mongolie: Pays d'ombres et de lumie`res*, Paris, France, Editions Olizane.
 - 22) Mauvieux, B., Reinberg, A. and T., Yvan (2014) The Yurt: A mobile home of nomadic populations dwelling in the Mongolian steppe is still used both as a sun clock and a calendar, *The Journal of Biological and Medical Rhythm Research*, pp. 1525-6073, <http://dx.doi.org/10.3109/07420528.2014.874801>.
 - 23) Medi, H. (2015) Climatic typology of Mountain Housing in Iran (In Persian), Aval va Aakhar Publisher, Tehran: 15-16.
 - 24) Matikeev, M., Sherbaeva, Z., Satybaldiev, B., Isakova1, U. and Abdullaeva, Z. (2020) The Role of the Tenir-Too Relief Steps in the Formation of High-Altitude Belts, *Open Journal of Geology*,(10),12,1164-1172, 10.4236/ojg.2020.1012056
 - 25) Mehmani, R. and Nakhaii, J. (2017) Study of the Cold and Mountainous Climate and Obtaining Architectural Indices of the Effecting Region on the Climatic Design of Housing, *Journal of Applied Environmental Biological. Science*. 25(7): pp. 98-108,
[https://www.textroad.com/pdf/JAEBS/J.Appl.Environ.Biol.Sci.7\(2S\)98-108,2017.pdf](https://www.textroad.com/pdf/JAEBS/J.Appl.Environ.Biol.Sci.7(2S)98-108,2017.pdf)
 - 26) Messerli, B. and Ives, J. D. (1997) Energy resources for remote highland areas: Mountains of the World, A Global Priority, New York, NY: Parthenon: 157–170.
 - 27) Meteoblue (1989-2019) Weather Pamir Mountains, Available at:
https://www.meteoblue.com/en/weather/week/pamir-mountains_tajikistan_1131187
 - 28) Middleton, R. (2020) Symbolism in the Pamiri House, Available at
http://eurasia.travel/tajikistan/traditions/symbolism_in_the_pamiri_house/2020.
 - 29) Miller, A. (2007) Wakhan Heritage Inventory, The Aga Khan Trust for Culture, Available at:
<https://archnet.org/publications/12739>
 - 30) Mock, J. (2018) The Pamiri House: At Home on the Roof of the World, Available at:
<https://theculturetrip.com/asia/tajikistan/articles/the-pamiri-house-at-home-on-the-roof-of-the-world/on-2-January>
 - 31) Mock, J. (2013) New Discoveries of Rock Art in Afghanistan Wakhan's Corridor and Pamir: A Primarily Study,
http://www.silkroadfoundation.org/newsletter/vol11/SilkRoad_11_2013_mock.pdf
 - 32) Mock, J. and O'Neil K. (2005) Wakhan and the Afghan Pamir: In the Footsteps of Marco Polo, Available at:
https://www.akdn.org/akdn/sites/akdn/files/Publications/2010_akf_wakhan.pdf
 - 33) Molinar-Ruiz, A. (2017) Cold-Arid Deserts: Global Vernacular Framework for Passive Architectural Design, Doctoral Dissertation, University of Hawaii: 22-23.
 - 34) Oliver, P. (2006) Built to Meet Needs: Cultural Issues in Vernacular Architecture, Architectural Press of Elsevier, 3-4.
 - 35) Olson, D. M., E. Dinerstein, E. D. Wikramanayake, N. D. Burgess, G. V. N. Powell, E. C. Underwood, J. A. D'amico, I. Itoua, H. E. Strand, J. C. Morrison, C. J. Loucks, T. F. Allnutt, T. H. Ricketts, Y. Kura, J. F. Lamoreux, W. W. Wettengel, P. Hedao and Kassem, K. R. (2001) Terrestrial ecoregions of the world: a new map of life on Earth: a new global map of

- terrestrial ecoregions provides an innovative tool for conserving biodiversity. *Biological Science*, 51: 933-938. <http://dx.doi.org/10.1641/0006-3568>
- 36) Özgun, T. O. (2021) George Hayward's Journey to the Central Asia: The Periphery of the British Imperialist Politics, Hacettepe Üniversitesi Türkiyat Araştırmaları Dergisi, 34, 175-195. <https://dergipark.org.tr/en/pub/turkiyat/issue/62374/800456>
- 37) Rijal, H.B.(2021) Thermal adaptation of buildings and people for energy saving in extreme cold climate of Nepal, *Energy and Buildings*, 230, 1-18 <https://doi.org/10.1016/j.enbuild.2020.110551>
- 38) SecerCompass (2021) In Images: Afghanistan, Expeditions on the Roof of the World, available at: <https://secretcompass.com/in-photos-wakhan-corridor-afghanistan/>
- 39) Shahrani, N. (2002) The Kirghiz and Wakhi of Afghanistan: Adaptation to Closed Frontiers and War, Amazon Press: 11-13.
- 40) Shariatmadari, F. (2017) Mehr to Allah: Studying the place of light and how it continues in rituals, *Quarterly Journal of Art and Eastern Civilization*, 22, 49-54, DOI:10.22034/jaco.2019.81923.
- 41) Shkolnik, A., Taylor, C. R., Finch, V. and Borut, A. (1980) Why Do the Bedouins Wear Black Robes in Hot Deserts, *Nature*, 283: 373-375.
- 42) Supic, P. (1982) Vernacular Architecture: A Lesson of the Past for the Future, *Energy and Buildings*, 6, 43- 54.
- 43) Szabo, A. (1991) Afghanistan: An Atlas of Indigenous Domestic Architecture, University of Texas Press, Austin, USA.