

Persian translation of this paper entitled:

پیوند آب، معماری و شهر پیش از مدرنیزاسیون آبرسانی در منطقه لارستان
is also published in this issue of journal.

Original Research Article

The Integration Between Water, Architecture, and the City Before the Modernization of Water Supply in the Larestan Region*

Abdolvahid Ostadzadeh¹, Ghazal Keramati^{2**}, Vahid Ghobadian³

1. Ph.D. Candidate, Department of Architecture, Faculty of Architecture and Urban Planning, Central Tehran Islamic Azad University, Tehran, Iran.
2. Asst. Professor, Faculty of Architecture and Urban Planning, Central Tehran Islamic Azad University, Tehran, Iran.
3. Assoc. Professor, Faculty of Architecture and Urban Planning, Central Tehran Islamic Azad University, Tehran, Iran.

Received; 09/07/2023

accepted; 11/09/2023

available online; 01/10/2023

Abstract

The bilateral connection between water and Iranian cities has made development and continuity of settlement possible over many centuries; In the contemporary period, the water supply system was dominated by technology, and as a result, the relationship between settlements and this vital element underwent a fundamental change. The great challenge of water shortage, which is the result of breaking the biological-cultural relationship of several thousand years of Iranian people with the territorial component of water and the methods of obtaining it, is now the most critical situation in the territory. Residents of the south of Fars province (Larestan) have found sustainable solutions for obtaining water according to geographical and climatic conditions, which are being forgotten in the contemporary era.

Recognizing the link between the components of the water access cycle and the formation of the urban fabric in old Larestan is the operational goal of the research. For this purpose, the traditional water techniques and structures before the modernization of the water supply system of the Larestan region were investigated using a qualitative method.

The main result of this research shows the structure of the ancient cities of southern Fars province has been influenced by natural and artificial hydrography and underscores the development of the fabric. The information obtained showed that the settlement in this area was based on the two principles of flood water storage using traditional water structures and its distribution method and created a balance between the city and nature.

Keywords: *Urban water supply system, Water extraction, Urban structure, Larestan.*

Introduction

In the history of Iran, water alongside its functional aspects had a conceptual and aesthetic value and has been viewed from both material and spiritual perspectives. With the

spread of urban water piping and disconnection from the traditional methods of accessing water in the 1950s, the water supply system that included aqueducts, wells, cisterns and even buying water from carters was forgotten.

* This article is an extract taken from the doctoral dissertation "Abdolvahid Ostadzadeh" entitled "Lifestyle and Architectural Trends in Fars Province Southern and central regions as Explained by Exploring Water Harvesting Systems: A comparative study of Larestan, Sepidan, Shiraz, and Marvdasht

counties", This study is being conducted under the supervision of Dr. Ghazal Keramati and advisement of Dr. Vahid Ghobadian at Central Tehran Islamic Azad University.

** corresponding author: gh.keramati@iauctb.ac.ir; +98 9122056174

At the same time, technological changes removed the chain of direct access to water sources, and the balance among components that played a role in this chain was disturbed.

achieving a comprehensive conceptual-functional approach and recognizing the current status of water in the theoretical and practical fields - which may be the main problem of contemporary man (Keramati, 2006, 294) and the need to fundamentally revise water accessing methods, as well as using the current and predictable capacities in plans seems necessary. The traditional mechanism of accessing water in the southern settlements of Fars province, which, despite the limitations of technology, could create a balance between the ecosystem and urban context, may help urban planners in their future actions.

Research Conceptual Framework

This study aims to answer the following question:

What effect have the traditional water extraction methods had on urban planning and architecture and the physical expansion of cities in the Larestan region?

In the past, the process of obtaining water, transferring, and maintaining it was affected by factors such as climatic conditions, economy, scientific advances, technological limitations and advances, cultural and religious factors, and finally, the direct relationship between the consumer and the water cycle. After the modernization of the water

supply system, the availability of water in any place and the lack of effort in providing water, not directly observing the fluctuations of water resources and not worrying about the lack of water resulted in issues related to water, which by applying the term consumer to People caused a kind of change in the cultural concepts related to water. Attempting to provide piped water to every house through the construction and operation of huge dams digging deep wells and establishing water treatment plants by government agencies, led to a decrease in the respect and degradation of the status of water; In the course of this change in the method of obtaining water and transferring and supplying water, all the experiences of several thousand years (of any kind and in any climate) were ignored and did not leave an impact on modern water supply (Fig. 1).

Research Background

The background of this study can be examined from three general perspectives.

- **The effect of water on the establishment of settlements and the economy of communities**

Sandalak believes that “There was an internal logic in the initial evolution of every city which is often related to landscape, topography, and hydrography, as well as social, political and economic forces.” (Ahari, quoted by Sandalak, 2015). Previous studies in several cities in hot

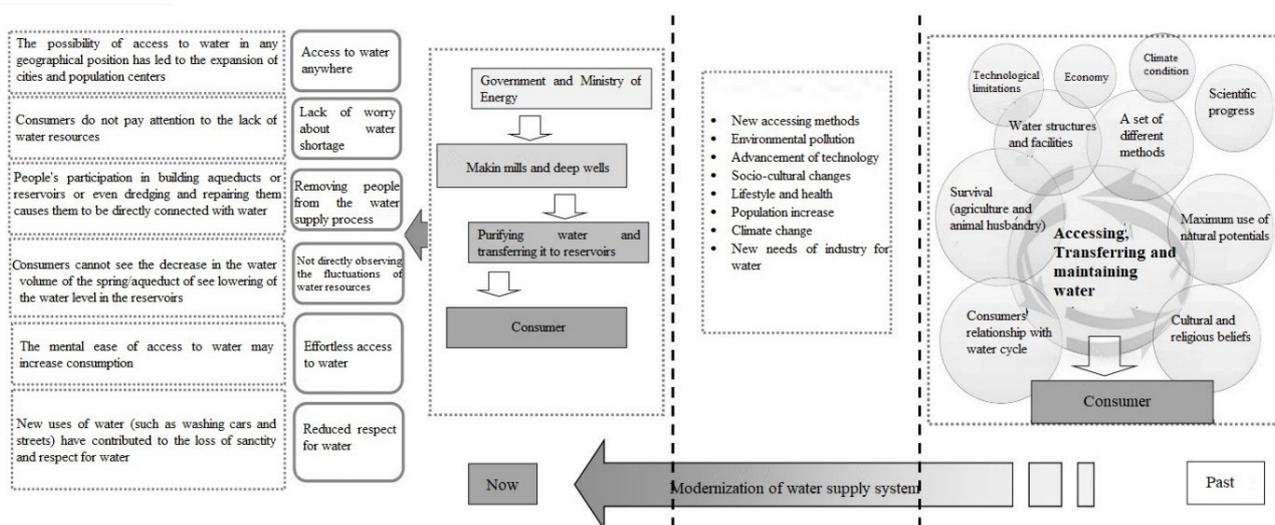


Fig. 1. Research conceptual framework: Changing the consumer-water relationship and the degradation of respect for water after the modernization of the water supply system. Source: Authors.

and dry regions before modernization have shown the strong role of topography in affecting the path of flowing water in the formation of their structure in Iran (Bonine, 1979). For the first time, Carl Wittfogel in 1957, by presenting the theory of oriental tyranny, related the formation of early governments to the development of irrigation and drainage methods, which could be used to provide more food in limited lands (Majidzadeh, 1989).

• **The effect of water and water infrastructure on the urban planning system and architectural elements of cities**

On a macro scale, water as an independent element in nature inserts the greatest effect on shaping other elements that make up the city, i.e. communication network, parts system, and building system (Conzen, 1960), while on a micro-scale, water shapes the spaces that make up traditional houses. Roaf investigated (Roaf, 2003) the ways water elements were established in the city of Khoranaq, and Edward English (English, 1968) studied the distribution of aqueducts in historical cities of Iran.

Regarding the investigation of the place of water in the urban planning system of Iran, you can refer to the book “The Esfahan School of Urban Planning”, the chapter on the role of “Madi” in the formation of the city and its spaces (Ahari & Habibi, 2001).

In the last ten years, many dissertations have been compiled regarding inner-city waterfronts and the morphology of cities. There are also many books about the importance of water in Iranian culture and architecture and buildings related to the water cycle.

Kheirabadi has examined the effect of natural factors such as water, topography, and radiation in “Cities of Iran” (Kheirabadi, 1997). In an article entitled “The role of water in the morphology of the historical city of Qazvin (Qajar period)” (Iran Manesh, Pourjafar, Khatibi & Ziari, 2021), the authors have investigated the effect of water on the system of passages, buildings and parts in the city of Qazvin. In another research (Alehashemi, 2020), the two-way link between the city and the water infrastructure in Semnan has been identified as related

to the social, economic, and cultural structures of the city. In a research titled “Boukhara water network as the landscape infrastructure of the city”, the researchers discuss how the water network of Bukhara has become a Landscape infrastructure for the city and has played a multifaceted role in the city and the lives of the citizens. (Mansouri, Alehashemi & Jamshidian, 2015) in “The influence of historical irrigation canals on urban morphology in Valencia, Spain” examining the structure of the city based on the influence of the network of water channels, concluded that Before the modernization of the water supply system, the expansion of the urban fabric was in accordance with the topography and slope of the areas and affected by the network of canals, but after that, the urban growth was different and ignored the traditional infrastructure (Ikemoto, Sakura & Astaburuaga Adrián, 2021, 1-28).

• **Traditional methods of the water supply process and water usage culture in the studied area**

In the three-volume book “The Solution of Water in the History of Fars” (Javaheri & Javaheri, 1999, 2001, 2004), historical water methods, devices, and structures in Fars, as well as issues related to water in Persian culture and civilization, have been examined in detail. In “Mirab” (Houshmand, 2004), these topics are briefly examined in Larestan. “Revenue in the culture of using water in the geographical environment of South Fars” (Salari & Nouri, 2015) has studied the formation of water structures and the methods of water use in Galeh Dar (Fars).

In “Introduction of a corner of the unknown architecture of Iran: the construction of cisterns”, Memarian (2009) examined the structure of cisterns in different regions of Iran from a structural point of view. In “Recognition and exploitation of the historical water structure of the pond in Qeshm Island” (Badreh, Sajjadi & Farzaneh, 2018), have introduced Qeshm cisterns. However, no research has been found that examines the characteristics of urban planning and architecture of Larestan from the point of view of water before the introduction of modern water supply technology.

Methodology

This is qualitative research and the data was collected from historical documents using library and documentary studies, field investigations, local and specialized interviews, and field observation. The physical structure of the cities and their relationship with the traditional water supply system are shown in the form of tables and analytical maps.

In this study, four cities in the Larestan region were selected due to the presence of a large number of traditional water supply facilities beside modern water supply. The city of Lar was the center of Laristan and had a larger area and population than its subordinate parts. The three old settlements of Khounj, Evaz, and Gerash represent the Larestan region. Climatic, geographical, and cultural conditions are similar in all four cities. In the earthquake of April 24, 1960, the level of destruction of Lar city was such that a decision was made to build a new city 3 km from the damaged site (Soleimanzadeh & Fallahi, 2017), in the other three cities, the expansion of urban areas has taken place in the vicinity of the old context.

Since qualitative studies aim to discover subjective descriptions of the environment and interpret personal concepts (Hafez Nia, 2006, 15), traditional water supply facilities, including main channels for directing seasonal water and secondary channels and cisterns have been identified through the field and in-depth interviews and made marked on maps of all these areas. In the current study, the qualitative method has been used in drawing cognitive maps, and photos related to each area have been taken for a better understanding of the issue. Interviews have also been performed to record an oral history since oral history can make insights about non-written subjects not available in writing (Given, 2008).

Recognizing the Components of the Traditional Water Supply System in Old Larestan

The early man knew the low water areas, but this period of gathering and hunting was not important to him, because due to the way of living, he did not care for the planned

water control. Several thousand years after settling and farming near water resources, the people living in the dry and semi-dry areas of the Iranian plateau came across fertile lands which made them design an irrigation system to transfer water to these lands through canals to make them fertile (Qolipour, 2005, 104). Transferring water from one place to another is an initiative of Iranians in agriculture. Iranians call the movement of water, whether it is on or under the ground, “Parou” or “Farou” (Javaheri & Javaheri 1999, 12). Most residents of Fars and Qeshm call the aqueduct, which carries water from one place to another, “Fari O” or “Farou”. The aqueduct of Faryab Anweh in the city of Evaz in Larestan, which consists of three series of aqueducts from the Sasanian period, is an example of this category (Keramati, 1955). Where these main resources failed to meet the residents’ needs in terms of quality and quantity, inevitably, for the continuation of life, various methods have been used to find the best way of obtaining, storing, transferring, and controlling water power (Javaheri & Javaheri, 1999, 5-30). Traditional knowledge relied on various systems for exploiting flowing waters through gravity or collecting rainwater that helped to replenish and sustain water sources (Laureano, 2001). These methods ranged from creating collection networks or building dams, or other less expensive but effective methods, including small aquifers, based on human ability and knowledge, as well as available facilities. With stone and soil and relying on local knowledge, structures were built that not only helped to take advantage of the flood but reduced the flood intensity, sedimentation, and erosion (Arab & Dehviri, 2010). For example, “Romzah” consisted of several two-meter-high earth dams to be more prepared to control the flood and direct it to the grove during the rainy season. “Gavbasts cisterns”¹ were useful both for the better growth of agricultural products and for the enrichment of underground water tables (Houshmand, 2004). In the region of Larestan, there are various examples of buildings related to water. In (Fig. 2), examples of them are shown in two general categories “water facilities” and “water consumers”. In the first

category, the result of the connection among different elements and facilities in the cycle of “accessing”, “transferring” and “maintaining” water is the provision of water for the residents of the settlements in Larestan. Water access facilities in Larestan are divided into three groups: “dams”, “aqueducts” and “gav chah”. Goly Gampo Fedagh dam (Fig.2, No.1), Tangab dam in Gerash (Fig.2, No. 2), one of the Faryab aqueducts (Paryab, Parvo) in Evaz city (Fig.2, No. 3), Bairam stone aqueducts (Fig.2, No. 4), and a gav chah in agricultural land (Fig.2, No.5) are examples of this category. Water transfer facilities in Larestan include “Savareh” (Aqueduct bridges), “Korshomah” (Shotor Galou), “channels and streams (Faryabs)” and “Watermill”. Muzaffar aqueduct bridge in Lar (Fig.2, No. 6), Dashto aqueduct bridge (Zahed Mahmoud) in Lar (Fig.2, No. 7), Korshomah Tang Daloon (Fig.2, No. 8), Mamar³ of cisterns in Lar (Fig.2, No. 9), channel (Bigh⁴) in the old city of Lar (Fig.2, No. 10), a stream in a grove in Lar (Fig.2, No. 11), Fedagh mills (Fig.2, No. 15) and Nasir Abad Arad (Fig.2, No. 16) are examples of these water transfer facilities. The third category of water facilities was used to store water. In (Fig. 2), the Motamed water cisterns in Lar (Fig.2, No. 12) the collection of water tanks in Evaz city (Fig.2, No. 13), and an example of Bardi⁵ in an agricultural field in Lar (Fig.2, No. 14) are of this type.

Water consumers in traditional cities are established in such a way that they have optimal access and minimal waste. Houses, baths, caravansaries, religious places, gardens, and Romzahs are included in this category. In (Fig. 2), Biglari’s house in Lar (Fig.2, No. 17), Soudagar’s house in Evaz (Fig.2, No. 18), Fathi’s house in Gerash (Fig.2, No. 19), Imam Ali Nazargah (Anahita Temple) in Lar (Fig.2, No. 20), Sheikh Muhammad Abu Najm’s tomb in Khouj (Fig.2, No. 21) Grand Mosque in Khouj (Fig.2, No. 22), Khouj bath (Fig.2, No. 23), Khonj bath (Fig.2, No. 24), Bath in Neshat Garden in Lar (Fig.2, No. 25), New caravanserai in Lar (Fig.2, No. 26), Neshat Garden in Lar (Fig.2, No. 27), Romzah in Lar (photo 28) are examples of this category.

Physical Survey of Cities Before the Modernization of the Water Supply System

Given the hot and dry climate of the Larestan region, the

role of water in shaping the urban context is worthy of study from the perspective of water supply and facilities, as well as ways of water access. In the Larestan region, surface and underground waters are mostly salty, alkaline, and heavy due to Mishan formation, Gachsaran and Miocene marls containing gypsum and salt, as well as infra-Cambrian salt domes (Servati, 2004). Therefore, it was common to collect water from wells with the help of cattle for agricultural purposes (Fig. 3). The aqueduct water that reached settlements was also salty, and people had to store the running water from seasonal showers and storms⁸.

In the traditional water supply system of Lar city, the network of channels (Bighs and Mamars) while controlling and diverting floods safely, stored water in cisterns and finally distributed among groves and agricultural lands around the city. This network follows the natural slope of the earth, which is shown in (Fig. 4) with red arrows.

By using unique techniques in the construction of domes and arches, water reservoirs have provided a suitable temperature for long-term storage of water in the climatic conditions of this region (Najafi & Yaghoubi, 2015). The location of cisterns depended on the proximity to watercourses. Examining the course of Lar City development shows that cisterns existed before this development and whenever it reached a water cistern, it became coordinated with the water cistern space (Arasteh & Taghvaei, 2011). The effect of cisterns and secondary waterways locations (Mamars) on the Lar city context caused the formation of buildings in a radial way. Therefore, with the spatial expansion of the city, some waterways had to pass through houses⁹. With their low slope, these Mamars caused large objects to settle on the path, and by reducing the water speed, they prevented damage to cisterns. In photos number 1, 2, and 3 (Fig. 4), three examples of these corridors are shown with yellow arrows. Cisterns in low-density environments or outside the city are directly drained by natural channels that direct surface water and usually, the sediment catch basin is built to prevent the entry of suspended objects before the water enters the cisterns (Kazemi, 2011) In (Fig. 4) the route of the main water channels the place of construction of cisterns and the schematic route of the Mamars in the old

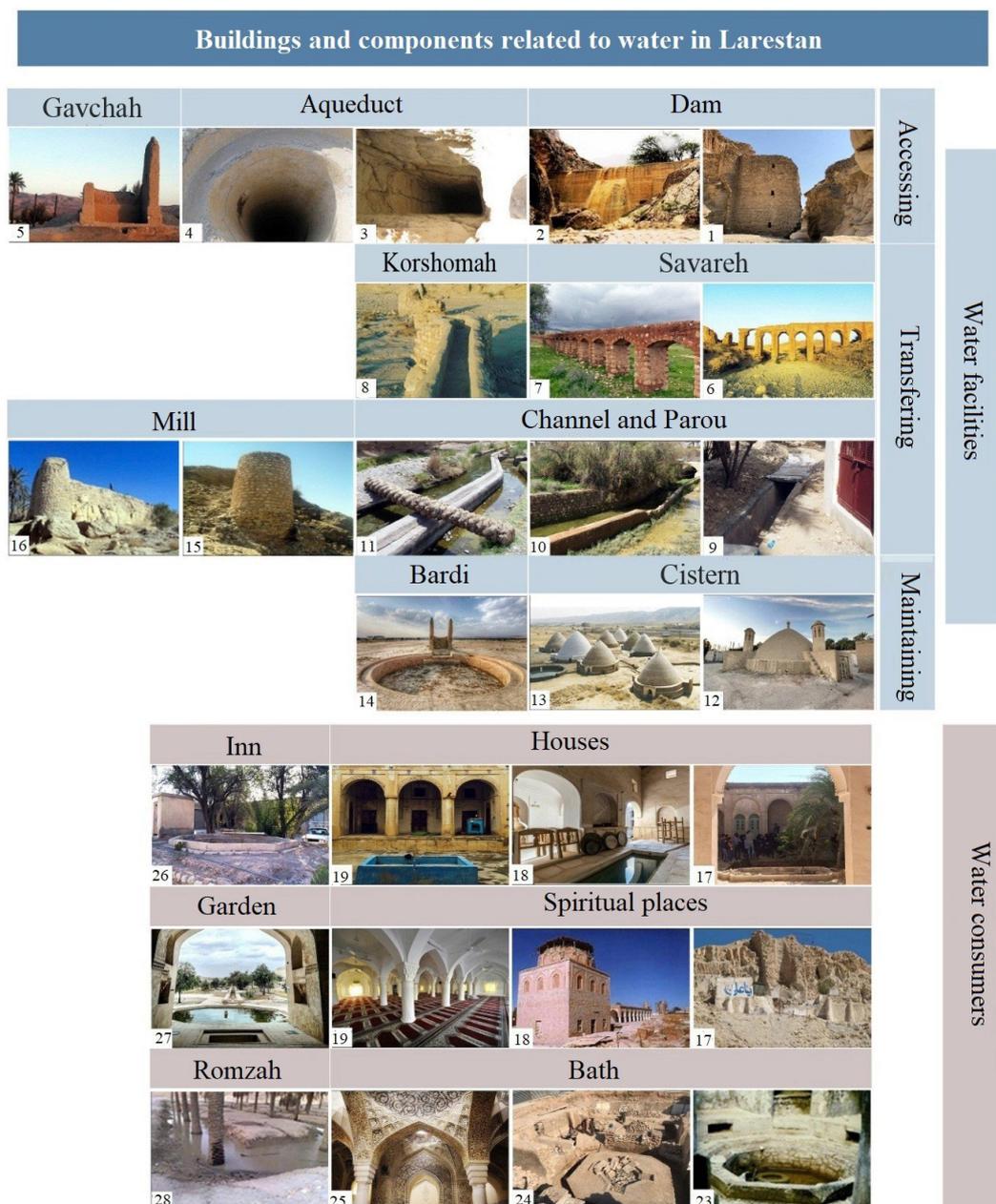


Fig. 2. Examples of water facilities and water-consuming elements before the transformation of the water supply system in Larestan (Source of photos 8, 9, 10, 11, 12, 14, 17, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28: Personal archive from 2010-2020; Photos 1, 2, 15, 16: Public Relations of Gerash Cultural Heritage Organization; Photos 3 and 4: Kamal (2004); Photos 6 and 7: Houshmand (2004); Photo 13: the archive of Hamshahri newspaper, (7/5/2018).

context of Lar city are shown. The people of the region have spread the branches of the rivers in such a way that water is distributed and cisterns are fed in almost all the neighborhoods of the city. The volume of water directed to these branches has been different depending on the density of the area and the number of required cisterns. For example, after the earthquake of 1952 in Lar, in 1602

by the order of Shah Abbas Safavi, Qanbar Ali Beyg was assigned to rebuild the damaged areas, in addition to the repair and restoration of the Qaysarieh bazar and the Ghanbarbeygi cisterns, he builds or repairs a place called Heydar Khaneh. The above-mentioned facilities were used to divide the water of big seasonal rivers that flow towards Lar (Kamjoo, 2020).



Fig. 3. Right: agricultural wells in Larestan Source: aerial photo 1977; left: remains of a Gav chah and water storage tank (Bardi) Source: Author's Archive.

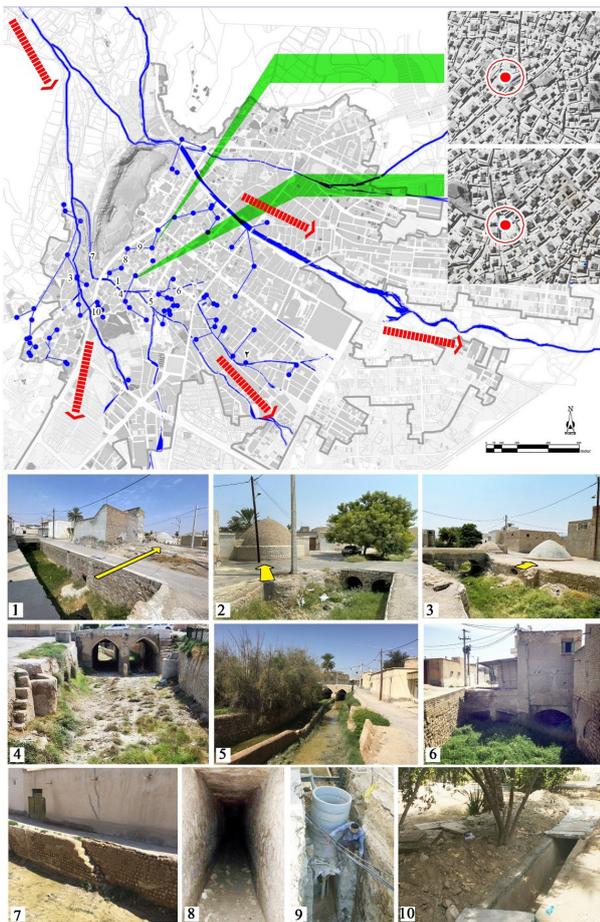


Fig. 4. Adaptation of accesses and the place of construction of cisterns and the passage of water supply channels in the old context of Lar city. (Source of preliminary maps: Larestan Road and Urban Development Department; Collection and analysis: the authors) Source: Author's Archive.

Cisterns were built privately or by benefactors as vows for public use. Dredging, restoration, and maintenance of cisterns, and monitoring water rights were subject to regulations (Fig. 5) and the people of each neighborhood participated in this ceremony (Zia Tavana, 2013). Certain

beliefs about the importance of keeping water clean and building water facilities, especially water storage, all point to the value of water among people. The people who were constantly facing drought had created a unified system of collective thought and contract to collect rainwater; Polluting and wasting water was obscene, and the trespasser was warned. The implementation of rituals related to water until now, which is rooted in religious beliefs, indicates the importance of water. When it rains, the residents congratulate each other and when farmers wait for rain, they go where water enters the city (Qibla-ye Dua) and they all raise their pants to their knees and sing local poems about the rain. In the city of Gerash, after praying, women pour the water they have prepared in a copper pot into the gutter facing the mosque's Qibla. Cooking pottage and lighting a fire under the gutter and then pouring water in the gutter to put out the fire is also one of the customs of the people of southern Persia when asking for rain.

By analyzing the maps of the existing condition of the cities of Gerash, Khonj, and Evaz, the influence of water elements on the formation of the old urban fabric can be seen. Although the natural and artificial components of the traditional water supply system are still scattered in some areas, they have not been taken into account in the macro-planning and urban development policies and do not have a defined place. Urban canals (Bighs) in the traditional contexts of the cities of Larestan region are among the most vulnerable components, which have been filled due to lack of treatment and dredging, or have been gradually removed due to a general change in



Fig. 5. Right: dredging of water storage next to the Qaisarieh market in Lar by the residents Source: archive of the news site of Milad Larestan newspaper, date: 15/9/2020. Left: holding prayer for rain in Larestan . Source: archive of the news site of Khabar online, 2/1/2017.

the route of water entering the city, and finally the crisis of drying. It will result in the failure of cisterns in these urban areas (Fig 8, 7, 6).

Discussion

The data of settlements in the region of Larestan throughout history has an endogenous character and is affected by social and cultural structures, and natural and artificial factors, in accordance with the unique climatic and economic components.

In the region of Larestan, the structure of the cities was affected by the topography and the slope, the cisterns defined the center of the neighborhoods. Traditional water supply in Larestan included methods such as identifying underground water tables to dig wells and aqueducts and build dams to control destructive river floods, building waterways and water transmission networks, and building water storage in various forms, especially cisterns which shows the ancients' deep understanding of climatic conditions and the importance of water. They just by changing how the stone and soil are placed together had tamed the water and built structures that played a role in the cycle of obtaining, transporting, and storing water. in combination with other buildings (which were water consumers), they created the physical structure of the city. With their social participation, the people of this region, in addition to benefiting from the functional aspects of this system, reflected their beliefs and worldviews in the form of norms and patterns. Various customs related to water and storage and cleaning and

draining cisterns, as well as the various forms and shapes of ponds, cisterns, bridges, baths, and gardens... confirm this content. People's participation in the construction

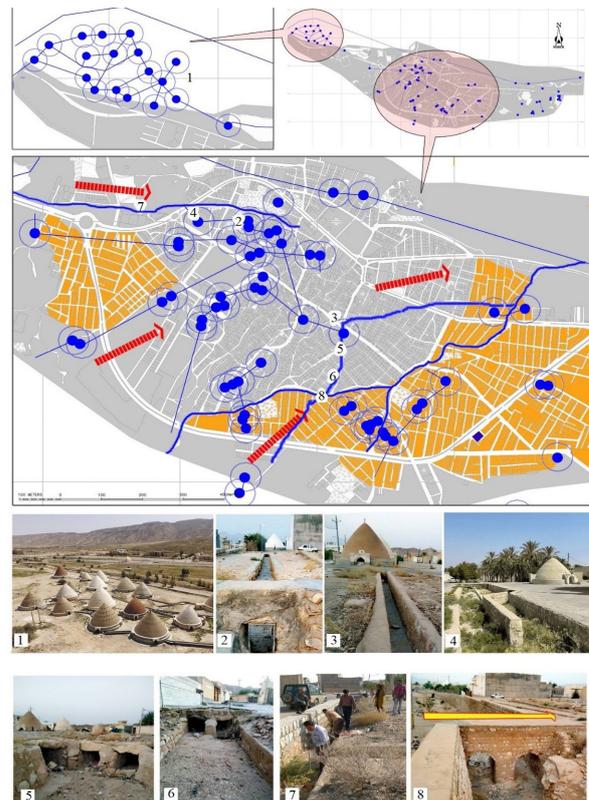


Fig. 6. (above): Adaptation of the accesses and the place of construction of cisterns and the passage of water supply channels in the old and new context of Evaz city. Areas of the city expanded in recent decades are shown in orange color. (Source of primary maps: Larestan Road and Urban Planning Department; Collection and analysis: the authors); Photo 1- The collection of water tanks in front of Payam Noor University; Photos 2 and 3: Open corridors; Photos 4, 5, 6: Underground corridors; Photo 7: Clearing the channel water transfer path by the residents; Photo 8: A stone bridge built to transfer water from the channel (Source of photo 1: Personal archive of Mohammad Reza Rahimi; Photos 2, 3 4, 5, 7, 8: Author's Archive.;

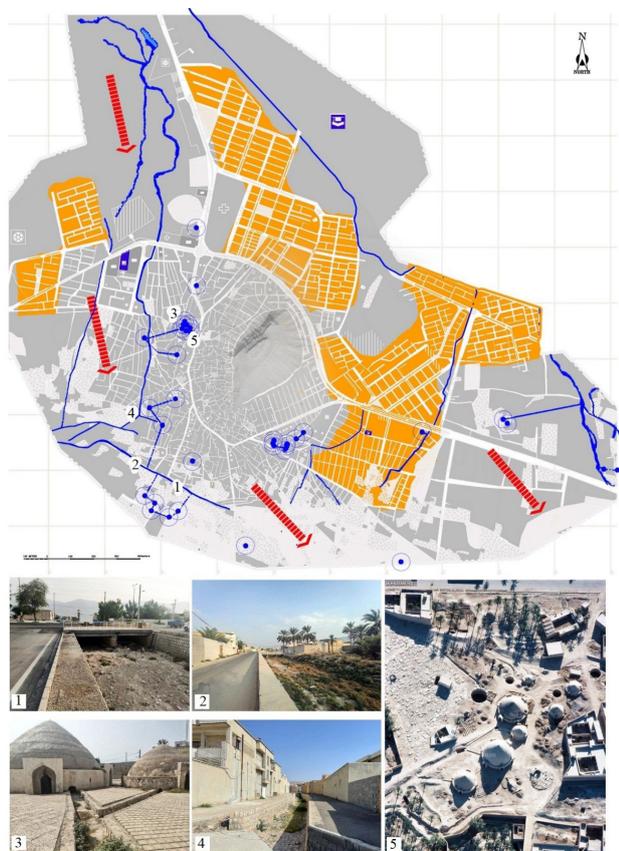


Fig. 7. Adaptation of accesses and places of construction of cisterns and the passage of water supply channels in the old and new context of Gerash city. Areas of the city expanded in recent decades are shown in orange. (Source of preliminary maps: Larestan Department of Roads and Urban Development; Collection and analysis: the authors); Photos 1, 2: Main roads of Gerash city; Photo 3: An open Mamar; Photo 4: A secondary channel; Photo 5: 7 current ponds photographed in 1977 by Georg Grester (Source of photos 1, 2, 3, 4: the authors; Photo 5: Archive of Grishana news site).

and maintenance of aqueducts and cisterns the various stages of dredging and water collection and the direct communication between consumers and this valuable element caused a sense of respect and sanctity towards water. In (Table 1), the functional characteristics of the components of the traditional water supply system of old Larestan are given.

Conclusion

This research shows the ancient connection between the city and water, during the past centuries until the modernization of the urban water supply system. In the cities of old Larestan, the access routes to water, as well as the way and type of access to it, created the shape of



Fig. 8. Adaptation of accesses and places of construction of cisterns and the passage of water supply channels in the old and new context of Konj city. Areas of the city that have expanded in recent decades are shown in orange.

(Source of preliminary maps: Larestan Road and Urban Development Department; Collection and analysis: the authors) Source of photos: Authors.

the city.

The mechanism of the traditional water supply system in the settlements of this region is similar, and due to its vital importance, it has the greatest impact on the urban structure and the way the tissues are developed, which is in accordance with the distribution of the main elements such as Bighs, cisterns.

In the old context of the four main cities of the Larestan region (Lar, Evaz, Khonj & Gerash), Bighs, as the backbone of the city, direct and reduce the speed of water caused by seasonal rainfall in the city. The canals branched from the Bighs are responsible for feeding the reservoirs and reservoirs have been considered as centers for the formation of various uses and houses

(Fig. 9). Because the distribution and way of placing the components of this system to transfer water depends on the gravity and the slope of the land, it creates limitations in the expansion and dispersion of urban elements which

has caused the expansion of the city according to the topography and the slope of the land. The commonality of this way of accessing water in different cities of this region has created similar urban textures.

Table 1. The status of natural and artificial components of the traditional water supply system in the Larestan region. Source: Authors.

	Type of Process	Natural or artificial components of the traditional water supply system	Features and Functionality
Accessing water	Collecting rainwater		Directing rainwater from the roofs of houses and yards to deep gardens to make optimal use of rainwater.
		Fountains	Due to the high hardness and salts, spring water was mostly used for agriculture and washing, and hot springs were used for therapeutic purposes.
	Using overflow water	Watercourses	Directing and restraining the destruction power of the canals towards the main canals (bighs) and then distribution towards agricultural lands and cisterns of the city.
		Rivers	Directing seasonal river water to agricultural lands.
Transferring water	Using underground water	Wells and Gavchahs	Obtaining water from the well using handwheels or by using quadrupeds and use for agricultural and sanitary purposes
		Aqueducts	Being active in many aqueducts in different areas and using their water for sanitary purposes due to the high amount of water salts.
		Streams, channels, and Mamars	The main task of urban canals was to guide the water in a controlled manner and to reduce their destructive power in the urban environment, which eventually could be transferred to corridors and streams to fill cisterns. In other cases, streams were made in open form to transfer water from aqueducts or Fountains.
		Abareh, Savareh, Korshomah, and Nar o Laas ⁶	Different parts of the water supply system in the old days were built to divert water from the unevenness and the river bed. "Abareh" or "Savareh" were bridges that had a channel on them to guide water, and "Korshomah" or "Nar o Laas" or "Shotor galou" were underground channels that had two wells with different levels on both sides.
		Na'al and Maghsam or Marv ⁷	They were responsible for distributing the water of the river and waterways or aqueducts to the gardens and city, which included ponds and branches for water distribution.
	Marinating water		Dams
		Cistern	They were responsible for maintaining the drinking water of cities and villages in different seasons, which were built in different shapes and dimensions according to the type of function and place of construction.
		Romzahs and Bardis	Bradis were built to store water in wells for a short period for optimal irrigation of trees and agriculture.
		Domestic cisterns and ponds	Underground roofed ponds and tanks were present in houses and other places for short-term storage of water for daily use at the endpoint of the water consumption chain.

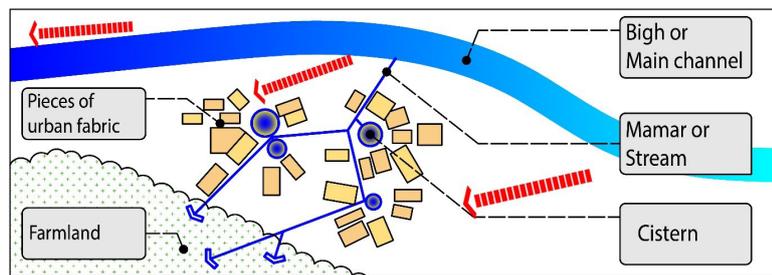


Fig. 9. Schematic plan of the overall structure of the traditional fabric of Larestan cities, the red arrows show the direction of the land slope. Source: Authors.

Endnote

1. Gavbast: the traditional method of leveling and piling soil around the culverts for better use of rainwater and better absorption in agricultural lands.
2. Korshomah: Shotor Galou, a structure consisting of two wells on both sides of the river and an underground path that connected the two wells and transported water based on the law of connected pipes.
3. Mamar: A sub-channel that transports water to the reservoir,
4. Bigh: The main channel was created to guide and control the rivers in the city.
5. Bardi: An open water storage tank next to cow wells in agricultural lands, which was mostly built in a circular shape.
6. Nar o Laas: The other name of Shotor galou in southern Fars. Ibn Balkhi called it "jewel water". (Javaheri & Javaheri, 1999, 271).
7. Na'al and Maghsam or Marv: called Marv in Lar, and Na'al and Maghsam in Gerash, it was a structure where the water of the aqueduct or canal entered it from one side and exited from the other side to the water streams that led to different fields and lands (Houshmand, 2004).
8. Don Garcia de Silva Figueroa, the Spanish ambassador, and traveler of the 17th century wrote about this in his travelogue: "...there only a few salty- if not said useless – water wells used to irrigate a few small gardens, very lovable for them. In addition to these wells, their water was drawn by cows, water comes from the plain to the city every day through a relatively large canal. Although this water is better than well water, it is not suitable for drinking (Vosoughi, Taqavi, Rahmani & Abedi Rad, 2006).
9. Pietro Della Valle, an Italian traveler of the 17th century AD, in his observations of the old city of Lar, says: "One day when I was walking around the city to buy an Arabic book, I saw relatively large streets with ditches in the middle of them. When it rained, the water could flow from the nearby mountains and pass through these ditches. The ditches had large and small channels or waterways compared to the houses on both sides, through which the water flowed the houses (ibid).

References list

- Ahari, Z. (2015). Taammoli bar Mafhoom-e Sakhtar va Chegoonegi-e Shenasaee-e An dar Shahre irani-e Pish az doran-e Modern [A contemplation on the concept of structure and how to identify it in the Iranian city before the modern era]. *Firuzeh Islam*, (2), 45-68.
- Ahari, Z. & Habibi, S. M. (2001). *Maktab-e Isfahan dar Shahrsazi (Zabanshenasi-ye Anasor va Faza-ha-ye Shahri, Vajhegan va Ghavaed-e Dastoori)* [The Isfahan School of Urban Planning (Linguistics of Urban Elements and Spaces, Vocabulary and Grammatical Rules), Tehran: University of Art.
- Arasteh, M. & Taghvaei, A. A. (2012). *Barresi-e Tatbighi-e Jaygah-e Ab-Anbar Dar Sazman Fazaee-ye Shahrha-ye Tarikhi-ye Iran (nemoone-ye Moredi: Shahrha-ye Yazd va Lar)* [Comparative Analysis Of Ab-Anbar in Spatial Structure of Iranian Historical Cities (Case of Study: Yazd and Lar Cities)]. *Journal of Studies on Iranian Islamic City*, 3 (10), 97-107.
- Alehashemi, A. (2020). Interconnection of Traditional Water Substructures and Neighborhood System in Iranian Cities: Urban Structure and Water Substructure in Semnan City. *Journal of Art & Civilization of the Orient*, 8 (27), 5-16.
- Arab, A. R. & Dehvari, A. A. (2010). *Khoshab Raveshi Sonnati dar Modiriyaat-e Ab va Khak-e Ostan-e Sistan va Baloochestan* [Khoshab a traditional method in water and soil management in Sistan and Baluchistan provinces]. Proceedings of the International Conference on Traditional Knowledge of Water Resources Management, Yazd.
- Badreh, M., Sajjadi, H. & Farzaneh, M. R. (2018). Indigenous Knowledge of Constructing and Utilizing Historical Water-storing Construction of Burka in Qeshm. *Iranian Indigenous Knowledge*, 6 (12), 538-581.
- Bonine, M. E. (1979). The Morphogenesis of Iranian Cities. *Annals of the Association of American Geographers*, 69 (2), 208-224.
- Conzen, M. R. G. (1960). *Alnwick, Northumberland*. London: George Philip & Son.
- English, P. W. (1968). The origin and spread of Qanats in the old world. *Proceedings of the American Philosophical Society*, (3), 170-181.
- Given, L. M. (Ed.) (2008). *The SAGE encyclopedia of qualitative research methods*. SAGE Publications, Inc., <https://dx.doi.org/10.4135/9781412963909>.
- Hafez Nia, M. R. (2006). *Moghaddame-i bar Ravesh Tahghigh dar Olum-e Ensani* [An introduction to research methods in human sciences]. Tehran: SAMT Pub.
- Houshmand, H. (2004). *Mirab, Negareshi Ejmali be Tasisat-e Kohan va Novin-e Abi dar Larestan* [Mirab, an overview of old and new water facilities in Larestan]. Tehran: Louza Pub.
- Ikemoto, F., Sakura, K. & Astaburuaga Adrián, T. (2021). "The Influence of Historical Irrigation Canals on Urban Morphology in Valencia, Spain." *Land. MDPI*, 10 (7), 1-28.
- Iran Manesh, N., Pourjafar, M. R., Khatibi, M. R. & Ziari, K. A. (2021). The Contribution of Water to the Morphology of the Historic Qazvin City (Qajar Era). *Bagh-e Nazar*, 18 (96), 31-46.
- Javaheri, P. & Javaheri, M. (1999). *Chare-ye Ab dar Tarikh-e Fars* [Solution of Water in the History of Fars]. the first

volume, first edition. Tehran: Publication of Iran's National Irrigation and Drainage Committee.

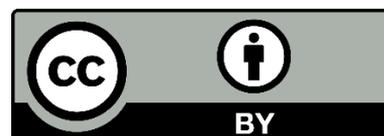
- Javaheri, P. & Javaheri, M. (2001). *Chare-ye Ab dar Tarikh-e Fars* [Solution of Water in the History of Fars], the second volume, the first edition. Tehran: Publication of Iran's National Irrigation and Drainage Committee.
- Javaheri, P. & Javaheri, M. (2004). *Chare-ye Ab dar Tarikh-e Fars* [Solution of Water in the History of Fars], the third volume, the first edition. Tehran: Samar Publications.
- Kamal, H. (2004). *Barresi-e Asare Tarikhi va Honari-ye Evaz (Daroon Shahri va Boroon Shahri)* [Investigating the historical and artistic works of Evaz (inside and outside the city)]. Shiraz: Navid Pub.
- Kamjoo, Y. (2020). *Daneshname-ye Asar-e Tarikhi-e Larestan* [Encyclopaedia of historical works of ancient Larestan]. Tehran: Pirouz Pub.
- Kazemi, A. (2011). *Barresi Abanbar-ha-ye Larestan, Fars Emkan sanji-e Bazsazi va Estefade-ye Mojaddad az Anha* [Investigating cisterns in Larestan, Fars, feasibility study of their reconstruction and reuse (unpublished master's thesis in agriculture, majoring in irrigation and drainage)], Faculty of Agriculture, Islamic Azad University, Marvdasht branch, Iran.
- Keramati, Gh. (2006). *Jaygah-e Ab dar Shahr-e Irani-e Dirooz va Emrooz* [The place of water in the Iranian city of the past and now]. Proceedings of the Third Congress of the History of Architecture and Urban Planning of Iran. Kerman: Arg-e Bam Research Base.
- Keramati, M. H. (1955). *Tarikh-e Delgosha-ye Evaz* [The Cheery History of Evaz], first edition. Shiraz: Navid Pub.
- Kheirabadi, M. (1997). *Shahr-ha-ye Iran* [Cities of Iran] (H. Hataminejad, and E. A. Mafi, Trans.). Mashhad: Nika Pub.
- Laureano, P. (2001). *The Water Atlas: Traditional Knowledge to Combat Desertification* (A. Cirella, and A. Whitehouse, Trans.). UNESCO, Paris.
- Majidzadeh, Y. (1989). *Aghaz-e Shahrneshini dar Iran* [The beginning of urbanization in Iran]. Tehran: Academic Publishing Center.
- Mansouri, S. A., Alehashemi, A. & Jamshidian, M. (2015). Boukhara water network as the landscape infrastructure of

the city the rise and fall of an urban landscape infrastructure. *Bagh-e Nazar*, 11 (31), 94-108.

- Memarian, Gh. H. (2009). Moarrefi-e Gooshe-i az Memari-e Nashenakhte-ye Iran [Introduction of a corner of the unknown architecture of Iran: the construction of cisterns]. *Architecture and Urbanism*, 2 (2), 125-141.
- Mirahmadi, F. & Altan, H. (2018). A solution for future designs using techniques from vernacular architecture in southern Iran. *Sust. Build*, 3 (1).
- Najafi, S. M. A & Yaghoubi .M. (2015). Thermal study of a cistern's dome (the case of Motamed cistern in Lar, Iran). *Energy and Buildings*, 102, 453-466.
- Qolipour, A. (2005). Hidrokraasi ya Borookraasi [Hydrocracy or Bureaucracy]. *Management Knowledge*, 19 (75), 103-123.
- Roaf, S. (2003). *Settlement Form and Qanat Routes in the Yazd Province Qanat, Karez, and Katara*. London: The Middle East Center, school of oriental and African studies.
- Salari, F. A. & Nouri, M. (2015). *Daramadi bar Farhang-e Bahre giri az Ab dar Mohit-e Joghrafiyae-ye Jonoob-e Fars* [An introduction to the culture of water use in the geographical environment of South Fars], first edition. Tehran: Ayin Mahmoud Pub.
- Servati, M. R. (2004). Tangna-ha-ye Tabee-ye Toseeh Shahr-e Lar [Natural difficulties in the development of Lar city]. *Sarzemen Geographical Quarterly*, 1 (4), 1-2.
- Soleimanzadeh, S. & Fallahi, A. R. (2017). Bazkhani-ye Bazsazi-ye Shahr-e Lar Pas az Zelzele-ye Sal-e 1339 [Reviewing the Reconstruction of Lar City after the Earthquake in 1960]. *Journal of Housing and Village Environment*, (161), 17-32.
- Vosoughi, M. B., Taqavi, K. A., Rahmani, S. & Abedi Rad, M. (2006). *Tarikh-e Mofassal-e Larestan* [Detailed history of Larestan]. Tehran: Hamsayeh Pub.
- Zia Tavana, M. H. (2013). Jaygah-e Anasor-e Shahr-e Shargh-e Eslami dar Rikht Shenasi Shahr-e Ghadim-e Lar [State of Components of the Eastern Islamic City in the Morphology of the Old City of Lar]. *Journal of Utopia Architecture and Urban planning*, (21), 365-375.

COPYRIGHTS

Copyright for this article is retained by the author (s), with publication rights granted to the journal of art & civilization of the orient. This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0/>).



HOW TO CITE THIS ARTICLE

Ostadzadeh, A.; Keramati, Gh. & Ghobadian, V. (2023). The integration between water, architecture, and the city before the modernization of water supply in the Larestan region. *Journal of Art & Civilization of the Orient*, 11(41), 74-85.

DOI: 10.22034/JACO.2023.406192.1331

URL: https://www.jaco-sj.com/article_180406.html?lang=en

