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RESEARCH ARTICLE

Rescue Archaeology Survey in the Reservoir Area of Azaroud Dam, Mazandaran: A Look at Environmental Capacities and Tourism Attractions

Soraya Elikai Dehno[1], Babak Shaikh Baikloo Islam[2]

Abstract

This study aimed to identify and document archaeological sites within the catchment area of the Azaroud Dam and to prepare an archaeological map of the region. The primary research question was whether there is evidence of historical human settlements in the Azaroud Dam reservoir area and how environmental and geological factors have influenced the formation or absence of such settlements. The methodology was based on a field survey of the region. The results indicate that there is no evidence of historical human settlements within the Azaroud Dam reservoir area. Only scattered fragments of eroded pottery were found along the riverbanks, likely transported to the area by seasonal floods from upstream regions. Environmental and geological analyses also reveal that factors such as dense forest cover, steep slopes, difficult terrain, and annual torrential rainfall have created unfavorable conditions for the establishment of permanent or even temporary settlements in this area. However, these findings are limited to the reservoir area, and the possibility of human settlements in adjacent areas, particularly in upstream regions with gentler slopes and flatter terrain, cannot be ruled out. Despite this, the significant tourism potential of the studied area, both naturally and due to the construction of the Azaroud Dam, can play a prominent role in attracting investment and promoting sustainable development in the region.

Keywords: Archaeological Survey; Azaroud Dam; Human Settlements; Environmental Conditions; Geology.

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Introduction

Rescue or emergency archaeological surveys and excavations in dam reservoir areas are essential measures in archaeology aimed at preserving and documenting cultural heritage at risk. The construction of dams and the creation of reservoirs bring about extensive changes to the natural environment, which can lead to the destruction or severe damage of archaeological sites. These changes include the submergence of large areas of land, alterations to river courses, soil erosion, and hydrological changes that can completely obliterate archaeological sites that have developed over thousands of years. Therefore, conducting archaeological surveys before the implementation of infrastructure projects such as dam construction is not only a necessary step for preserving cultural heritage but also an integral part of the environmental and social impact assessment process (Khosravi, 2020; Daei-Chini et al., 2020; Marchetti & Zaina, 2023).

Rescue archaeology is of great importance not only in Iran but also internationally. In Iran, dam construction has been considered one of the primary solutions for water resource management and energy production. However, many of these projects are carried out in regions with rich historical and cultural backgrounds. This has necessitated archaeological surveys and excavations to preserve historical sites at risk of destruction (Saatsaz & Rezaei, 2023). The Iranian government has recognized the need for such measures, although challenges such as budget constraints and misprioritization persist (Abedi, 2017).

For example, in the provinces of Mazandaran, Lorestan, and Khuzestan, the construction of dams has led to the submergence of numerous archaeological sites. In this context, rescue archaeology surveys in the areas of dams, such as the Seymareh Dam, Sardasht Dam, and Kani Sib Dam in Piranshahr, have led to the discovery and preservation of valuable historical artifacts (Niakan, 2015; Fallahian, 2021; Mosadeghi Amini & Mafi, 2022). These studies have not only contributed to the preservation of cultural heritage but have also provided valuable data for a better understanding of the history and culture of various regions in Iran.

In neighboring countries, rescue archaeology surveys in dam areas have also been widely conducted. For instance, in Turkey, large dam projects such as the Atatürk Dam and the Ilısu Dam have led to emergency excavations in important archaeological sites such as Hasankeyf and Zeugma. These excavations have not only helped to rescue archaeological artifacts but have also led to the discovery of significant findings from different historical periods (Özdoğan, 2000). In Iraq, the construction of numerous dams on the Tigris and Euphrates rivers has necessitated rescue archaeology surveys in sites such as Nimrud and Nineveh (Altaweel, 2008).

Internationally, rescue archaeology has become an important topic in scientific and developmental discussions. For example, satellite-based methodologies have been proposed to enhance rescue archaeology efforts in dam construction areas, indicating a move towards more

advanced techniques in cultural heritage preservation (Zaina & Tapete, 2022). Additionally, efforts to document and preserve cultural heritage in regions such as southeastern Turkey demonstrate the high potential for improving rescue archaeology projects through modern technologies and strategic planning (Marchetti et al., 2020).

In general, the necessity of rescue archaeology in dam construction areas is emphasized by the need to balance technological advancements with cultural heritage preservation. These efforts are not only important for conservation purposes but also for a deeper understanding of the cultures, activities, and subsistence systems of past human societies. Rescue archaeology serves as a bridge between development and heritage preservation, playing a key role in ensuring the survival of historical artifacts for future generations.

Research Methodology

The Azaroud Dam, located in the political boundaries of Mazandaran Province, had not been archaeologically studied prior to this research, making this survey the first of its kind in the region. Given that archaeological studies in this area are typically rescue-oriented due to construction activities and are not usually accompanied by research objectives, the archaeological team began by visiting the study area and gathering information about the geographical and environmental conditions from the residents of Lat Siah Moshteh village, the closest village to the dam site. The survey was conducted based on a 1:25,000 map, and local residents accompanied the team throughout the research, providing necessary guidance.

Due to the region's rugged terrain, lack of access roads, and dense forest cover, the team used an intensive survey method with parallel lines to examine and identify the reservoir area. The valley where the dam is located has an asymmetrical V-shape. The slopes on both sides are nearly vertical up to a height of 15 to 20 meters. At higher elevations, the slope decreases to 25-35 degrees on the right side and 35-45 degrees on the left side.

The archaeological survey of the Azaroud Dam catchment area was conducted with two main objectives:

1. Identification and documentation of archaeological sites within the dam catchment area.

2. Preparation of an archaeological map.

Background of Archaeological Research in Mazandaran

Mazandaran Province, with its unique geographical location, has always been one of the most important archaeological regions in Iran. Archaeological studies in this region began in the late 19th century and continued over the following decades. The first surveys were conducted by Jean-Marie Jacques de Morgan, who identified stone tools from the Paleolithic period in the Lar Valley (Vahdati Nasab & Aryamanesh, 2015: 69). Subsequently, researchers such as Carleton Coon, Charles McBurney, and Iranian archaeologists like Ezzatollah Negahban, Mohammad Jafar Nikokhah, and Yazdan Norani

Table 1. Background of the Most Important Archaeological Studies in Mazandaran Province.

Site Name	Location	Findings	Dating	Source
Pardameh	Lar Valley, Larijan, Mazandaran	Stone tools	Paleolithic	Vahdati Nasab & Aryamanesh, 2015
Belt Cave	Mazandaran	Four cultural horizons, Neolithic and Iron Age remains	Epipaleolithic to Iron Age	Coon, 1951
Huto Cave	Mazandaran	Artifacts from Epipaleolithic, Neolithic, and later periods	Epipaleolithic, Neolithic	Coon, 1951, 1952, 1957
Keyaram Cave 1	Gorgan Highlands	Mousterian cultural assemblages	Paleolithic	McBurney, 1964
Ali Tappeh Cave	Around Behshahr	Human settlements	8,000 to 10,000 years ago	McBurney & Payne, 1969
Alborz and Southeast Neka	Mazandaran	Epipaleolithic sites, Pleistocene layers	Pleistocene	Keraudren & Thibault, 1973
Kelardasht	Mazandaran	-	Iron Age	Negahban, 1997
Komishan Cave	Mazandaran	Archaeological survey	Epipaleolithic	Sarraf, 1990
Between Haraz and Babol Rivers	Mazandaran	Identification of historical artifacts	-	Nikkhah, 1991
Tehran-North Freeway Route	Mazandaran	Identification of historical artifacts	-	Nikkhah, 1999
Kajur Region	Mazandaran	Archaeological survey and identification	-	Lazardousti, 2000, 2001
Rashak Cave 3	Kelardasht	Archaeological excavation	Neolithic	Vahdati Nasab et al., 2013
Qaleh Kesh Dabou Dasht	Amol	Archaeological excavation	Bronze and Iron Age	Amirkolaee, 2009
Archaeological Survey from Neka to Galugah	Mazandaran	Test excavations	-	Mahforouzi, 2001
Qaleh Gangleh	Savadkuh	Archaeological excavation	Buyid period	Sourtiji, 2007, 2010
Historical City of Natel Nour	Mazandaran	Archaeological excavation	Islamic period	Mohajeri Nejad, 2008

Site Name	Location	Findings	Dating	Source
Jahannama Palace	Farahabad, Sari	Archaeological excavation	Safavid period	Sharifi, 2012
Espahbod Khorshid Cave	Doab, Savadkuh	Documentation and survey	Sassanian and early Islamic periods	Tofigh, 2016
Zarinabad Cemetery	Sari	Test excavations	Iron Age	Sharifi, 2011
Gerdkuh Tappeh	Qaem Shahr	Archaeological excavation	Iron Age	Sharifi, 2010
Toq Tappeh	Neka	Archaeological excavation	Prehistoric to Islamic periods	Abbasnejad, 2020
Valiki Mound	Neka	Archaeological excavation	Neolithic	Abbasnejad, 2021
Archaeological Survey of Mazandaran	Mazandaran	Survey of various counties	-	Mousavi Kouhpar, 2007a
Survey of Kelardasht Region	Kelardasht	Archaeological survey and identification	-	Mousavi Kouhpar, 2007b
Kelar Mound	Kelardasht	Archaeological excavation	Bronze and Iron Age	Mousavi Kouhpar, 2007c

conducted surveys and excavations of caves, mounds, and ancient settlements. These studies revealed evidence from the Paleolithic, Neolithic, Iron Age, and historical and Islamic periods. The most important findings and studies are summarized in Table 1 to provide a comprehensive overview of archaeological excavations in Mazandaran.

Dam Construction in Mazandaran Province

Mazandaran Province, due to its unique geographical location, high rainfall, and numerous rivers, is one of the key regions in Iran for dam construction (Table 2). The dams in this province not only help manage water resources and provide drinking and agricultural water but also have significant potential in energy production, flood control, and tourism development. Based on the list of Mazandaran dams, important dams such as Shahid Rajaei Dam, Alborz Dam, Haraz Dam, Golvard Dam, and Lar Dam have been constructed in this province, each playing a significant role in regulating water resources and promoting sustainable development in the region (Davoudian et al., 2023). The Azaroud River Dam, around which the archaeological survey of this article is centered, is also capable of meeting the needs of the local population.

The Shahid Rajaei Dam, with a height of 138 m and a reservoir capacity of 158

Table 2. Specifications of the Most Important Dams in Mazandaran Province.

Dam Name	Type	River	Location	Construction Period	Height (m)	Crest Length (m)	Normal Reservoir Volume (million m³)
Shahid Rajaei Dam	Earthfill with clay core	Tajan River	40 km south of Sari	1991-2002	138	430	158
Alborz Dam	Concrete gravity	Babolrud River	45 km southeast of Babol	1995-2002	78	838	150
Mejran Dam	Concrete double arch	Nesarud River	20 km southeast of Ramsar	1996-2002	59	186	65.7
Azaroud Dam	-	Sefidrud and Haraz Rivers	15 km southeast of Tonkabon	-	-	-	40
Lar Dam	Earthfill with clay core	Lar River	Amol	1974-1982	105	150	960
Apoon Dam	Earthfill	Talar River	Qaem Shahr, Apoon Village	2010-2012	-	-	-
Haraz Dam	Earthfill with clay core	Haraz River	20 km south of Amol	2010-2012	150	376	650
Golvard Dam	Concrete gravity	Neka River	42 km southeast of Neka	2008-2012	113	270	115
Kesliyan Dam	Concrete gravity with concrete face	Kisehliyan River	South of Qaem Shahr	2002-2004	127	490	120
Abbasabad Dam	Stone masonry	Rud-e Alpeh (Ali Tappeh) River	Behshahr	2000-2002	12	197	6.0

Dam Name	Type	River	Location	Construction Period	Height (m)	Crest Length (m)	Normal Reservoir Volume (million m³)
Alimalat Dam	Earthfill	Shamirud (Alimalat) River	14 km south of Nur County	1987-1992	26	235	8.0
Nur Dam	Earthfill	Vaz-rud-Lavi River	Chames-tan	2008-2012	-	-	-
Shyadeh Dam	Earthfill with clay core	Bazarud and Che-lim Rivers	32 km southwest of Babol	1994-2002	8.32	450	5
Zarmrud Dam	Earthfill	Zarmrud River	35 km southeast of Sari	2002-2004	90	-	83
Farim Desert Dam	Earthfill with clay core	Arus and Damad Rivers	60 km southeast of Sari	1996-2002	5.48	397	3
Sonbol-rud Dam	Earthfill with clay core	Sanblarud River	10 km west of Shirgah	1987-1992	2.22	197	4.1
Ber-enjes-tanak Dam (Zam-zam)	Homo-geneous earthfill	Baranjes-tank (Toji) River	18 km south of Qaem Shahr	1987-1992	8.31	248	3.3
Salahud-din Kola Dam	Concrete gravity	Kajur River	33 km east of Nowshahr	1988-1992	6.16	350	1.2

million m³, is one of the most important dams in Mazandaran, providing agricultural water and helping to control seasonal floods. The Alborz Dam, with a height of 78 m and a capacity of 150 million m³, is a key project in the Babolrud catchment area, playing a significant role in regulating water resources and preventing damage from water shortages. On the other hand, the Lar Dam, with an impressive capacity of 960 million m³, is one of the largest dams in northern Iran and, in addition to hydrological uses, has extensive ecotourism potential.

Dam construction in Mazandaran has not only met water needs but has also facilitated tourism development. Many of the province's dams, including

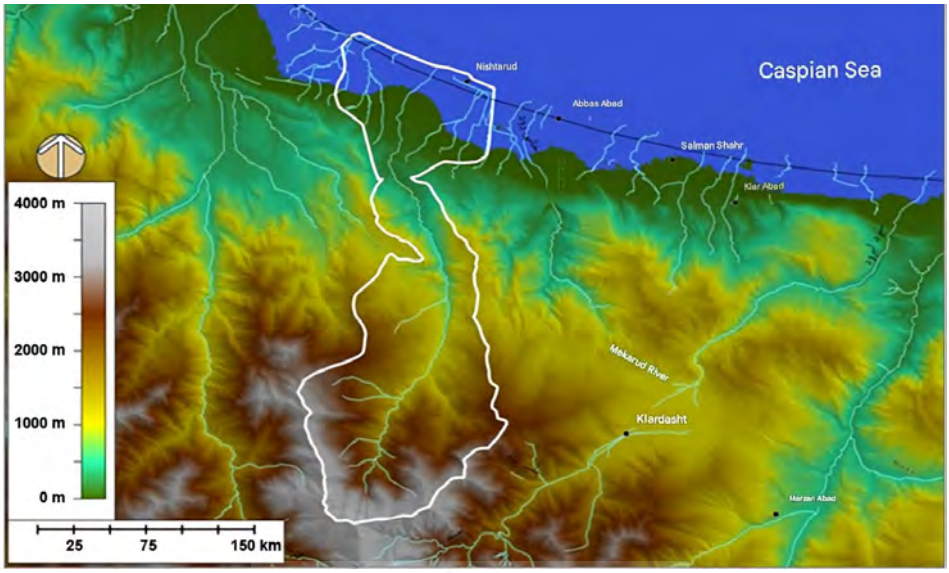

Fig. 1. Streams and Rivers on the 1:25,000 Map of the Region.

the Alimalat Dam and the Mejran Dam, have become tourist destinations due to the creation of beautiful artificial lakes, attracting many visitors each year. These areas provide excellent opportunities for recreational activities such as boating, fishing, and nature tourism. For example, the Kajur region in Mazandaran holds promise for rural tourism and sustainable ecotourism, requiring careful planning, local community participation, and private sector investment (Amini Kashani & Alialhesabi, 2021). Studies have shown that tourism development around dams can boost the local economy while also presenting environmental management challenges that require careful planning (Monshizadeh et al., 2020).

Therefore, given the key role of dams in regulating water resources, meeting energy needs, controlling floods, and promoting tourism, the need for optimal management of these water structures is increasingly felt. Sustainable development of these areas requires constructive interaction between management institutions, researchers, and local communities to ensure optimal utilization while preventing potential environmental damage.

Geographical Location of Mazandaran Province

Mazandaran Province, with an area of 23,771.2 km², covers 1.46% of Iran's total area (Mazandaran Province Management and Planning Organization, 2021: 39). The province is bordered by the Caspian Sea to the north, Golestan Province to the east, Gilan Province to the west, and Tehran and Semnan Provinces to the south. Its geographical coordinates range from 35°46′ to 36°58′ north latitude and 50°21′ to 54°08′ east longitude (Armed Forces Geographical Organization, 2005: 51).

Table 3. General Characteristics of the Azaroud Catchment Area.

River Length	40 km
Catchment Area	220.7 km^2
Highest Elevation	4,300 m
Lowest Elevation	140 m
Catchment Slope	44.7%
Net Slope	7.9%
Average Elevation	1,985 m

Table 4. Geographical Coordinates of the Surveyed Area.

Location	East Coordinate (E)	North Coordinate (N)
Northeast Corner	500381 m E	4057868 m N
Northwest Corner	499426 m E	4058017 m N
Southwest Corner	499589 m E	4055801 m N
Southeast Corner	500411 m E	4055812 m N

Mazandaran is bordered by the Caspian Sea along its entire northern strip. Given the presence of five countries around this sea, it can be considered a border province. The closest foreign neighbor is Turkmenistan to the east of the Caspian Sea. Other foreign neighbors include the Republic of Azerbaijan to the west of the sea, the Republic of Kazakhstan to the north and east, and Russia to the northwest and west of the Caspian Sea. Among the counties of the province, only Kelardasht, Amol, Babol, Qaem Shahr, and Savadkuh lack coastal borders (Poshtkouhi et al., 2003: 6-7; 22-23).

Azaroud River Basin

Azaroud, in the local dialect of the Azaroud region, means "thousand rivers." The river originates from the Pit-Ghar Mountains at an elevation of 4,339 m and the Gardeh Mountains at 3,648 m. After flowing approximately 40 km in a general south-to-north direction, it empties into the Caspian Sea in Nashtaroud County. Villages such as Julan, Shirvar, Girr, Lat Siah Moshteh, Dinarsara, Chalu, Moallem Kuh, Kastra, and Azaroud benefit from this river. Along its course, the river also receives water from the Magas-Khani River. The general slope of the river is about 5.8%. The highest point in the catchment area is 4,300 m, and the lowest is 140 m above sea level. The river has a steep slope in mountainous areas, which decreases as it enters the plains. Large rock blocks along the riverbanks indicate the river's strong flow and high velocity. Like other rivers in the province, Azaroud has limited terraces on both sides. One of the notable features of this river is its relatively wide bed, which reaches a maximum width of 250 m in some areas. The main factors contributing to the widening of the river include the loose and collapsible materials of the

Fig. 2. Satellite Image of the Asymmetrical V-shaped Azaroud Valley and the Dam Site.

terraces, which quickly erode upon contact with runoff. Additionally, excessive exploitation of the river has accelerated the widening process (Table 3; Fig. 1).

Study Area: Around the Azaroud Dam Reservoir

The predicted study area covers approximately 2 km², but only 1 km² was accessible for survey and identification purposes. Half of this area was inaccessible due to steep cliffs and rugged terrain, making surveying impractical. The Azaroud River flows through a relatively narrow area with steep cliffs and a steep bed. Given the geological and topographical conditions of the region, only half of the reservoir area was surveyed. This area includes downstream regions, from the riverbanks to near the cliffs, covered with forest. However, all these areas were subjected to field surveys. Surveys were conducted on alternating days, and necessary images were taken of the surveyed areas, which will be presented later (Table 4; Fig. 2).

Archaeological Survey

The village of Lat Siah Moshteh is located deep within the forest, and access to it requires traversing a difficult dirt road. This route is particularly challenging during rainy days, posing significant difficulties for the survey team. To reach the village, one must cross the Azaroud River. A new wooden bridge, built over the old one, is located at the southern end of the village, and crossing it is the first step in entering the area (Fig. 3). After crossing this 30-meter bridge and passing the tourist area, eco-lodges, and rural accommodations, the path continues along the Azaroud River, passing a fish farm. Eventually, the narrow path leads to the forested area and ends at the main road with low dry-stone walls. The villagers' lands are located beyond these walls.

Fig. 3. New Wooden Bridge over the Old Bridge in Lat Siah Moshteh village.

In this survey, the study area was first gridded (Fig. 4); then, it was studied in terms of geomorphology, erosion, environmental conditions, and the potential for human settlement. One of the notable features of this area is its dense vegetation. The forest is home to various species of trees and plants that play a significant role in biodiversity. Along the survey route, very large rocks were observed on the ground, likely transported to this area by floods or fallen from the mountains. The surfaces of these rocks are covered with moss, and the ground is densely covered with plants, thorns, and debris. A few heavily eroded pottery fragments were found on the surface of the surveyed area, which could not be dated (Fig. 5).

Environmental Factors and Their Impact on Human Settlements

Access to water resources and the ease of their exploitation have always been determining factors in the establishment of human settlements. Today, most villages are located near water sources. However, along the banks of the Azaroud River, the unfavourable topographical conditions have made settlement impossible. Frequent floods have eroded the riverbanks, and annual floods have affected large parts of this area. Field surveys also indicate that no human-made structures were observed in this area (Fig. 6).

The large rock masses observed in the survey area indicate the power of flood currents in the region (Fig. 7). This phenomenon suggests that the flat riverbanks of the Azaroud River, due to constant exposure to floods, were not suitable for settlement. The river terraces also indicate continuous changes in the riverbed over time. Additionally, river currents have transported large amounts of sediment, which, after deposition, have formed sedimentary layers in the riverbed.

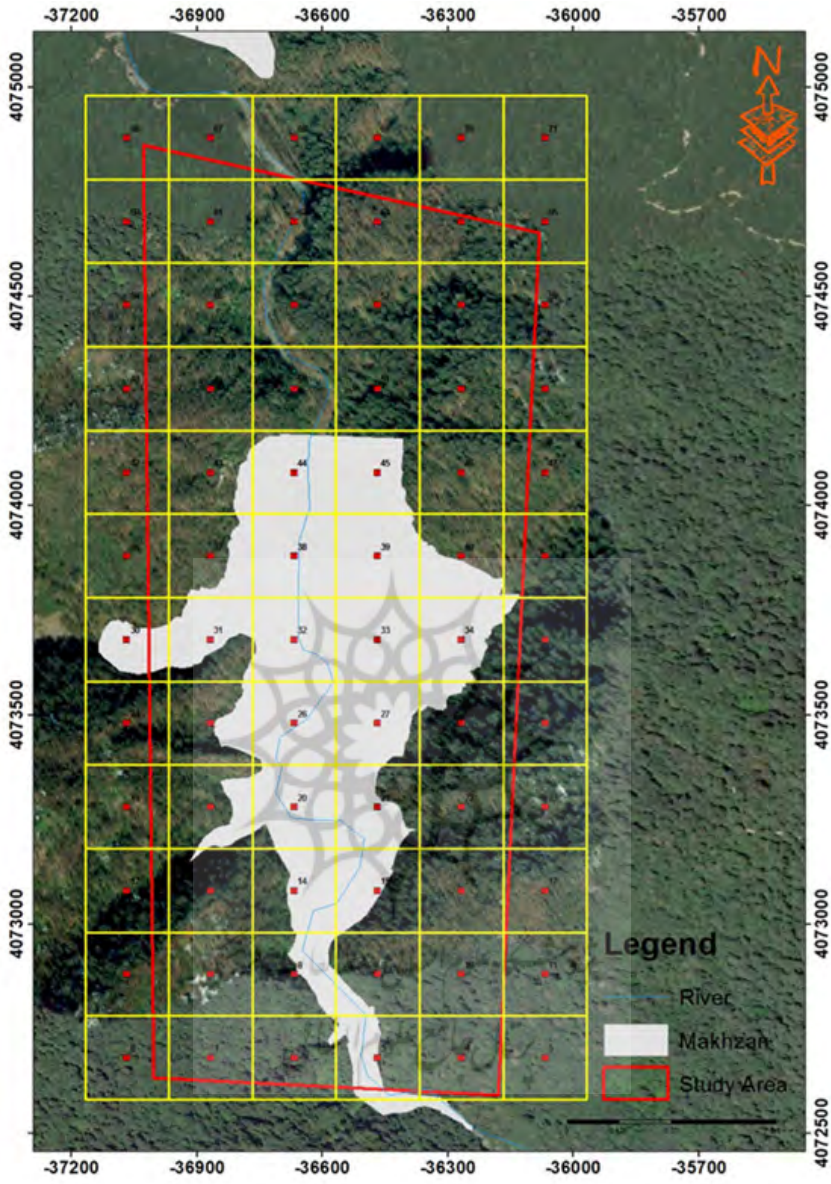

Fig. 4. Gridding of the Archaeological Survey Area.

Morphological Characteristics of the Azaroud River

The gentle slope of the land in some parts of the river has created a meandering path. The Azaroud River in the reservoir area has repeatedly shifted left and right, creating numerous bends, a natural phenomenon in the limestone valleys of the region. These bends make passage difficult and, in some areas, cause sudden changes in direction over short distances. Additionally, temporary bridges

Fig. 5. Sample of Eroded Pottery Fragments in the Survey Area.

Fig. 6. View of the surface, looking north. As seen in the image, the survey area has steep slopes and rugged terrain with semi-dense forest cover. Dry tree roots and tangled dry grass cover the ground, making it difficult to see the surface. The lower part of the river is affected by the Azaroud River floods. These factors do not provide favourable conditions for settlement.

have been built for crossing the river, or horses are used for transportation.

The riverbed is rocky and steep, which limits the possibility of human

Fig. 7. Large Rock Masses Along the Azaroud River.

settlement. In the downstream area, due to the reduced slope, the river takes on a meandering path, influenced by the soil composition and other natural factors. The density of cobblestones in the riverbed indicates frequent flooding. During floods, the water level rises, submerging the riverbanks and eliminating the possibility of settlement.

Another characteristic of the Azaroud River is its torrential flow during certain seasons. The river's slope in this area is measured at 1.4%, and its flow direction is north-south. The steep slope, combined with severe erosion, has led to the transport of materials and sedimentation, significantly contributing to flooding. On the mountain slopes, due to the steep gradient, water flows at high speed, causing severe erosion of the riverbanks and the displacement of boulders. Over time, this process has widened the river and formed a V-shaped valley (Fig. 8).

Geological Factors and Their Impact on Human Settlements

Field surveys indicate that fossils are observed on some rocks in the river area, suggesting ancient geological phenomena and rising water levels in the past (Fig. 9). Currently, the water level in the reservoir does not exceed 2 meters. Additionally, the accumulation and collapse of clastic rocks indicate upstream floods and debris flows in the region.

The region's topography, with its numerous irregularities, has directly impacted human settlements. Steep slopes, rocky terrain, and dense vegetation make passage difficult and do not provide favorable conditions for permanent settlements. Parts of the region, especially

Fig. 8. Rock Outcrop Due to Upstream floods. The Waterfall Resulting from the Vertical Flow of Water on the Steep Slope Has Gradually Terraced the Rock Surface.

in downstream areas, are prone to landslides and cracks due to reduced vegetation cover (Figs. 10 and 11).

Summary

In general, slope has been a determining factor in the distribution of human settlements, both in the past and present. Settlements have typically formed on gentle, sun-facing slopes, but this rule does not apply to V-shaped valleys like the Azaroud Valley. Observations indicate that the steep slope of this valley has not provided suitable conditions for human settlement. Additionally, the rocky terrain, combined with dry plants and broken branches, makes traversing the mountainous slopes very difficult. Elevation is

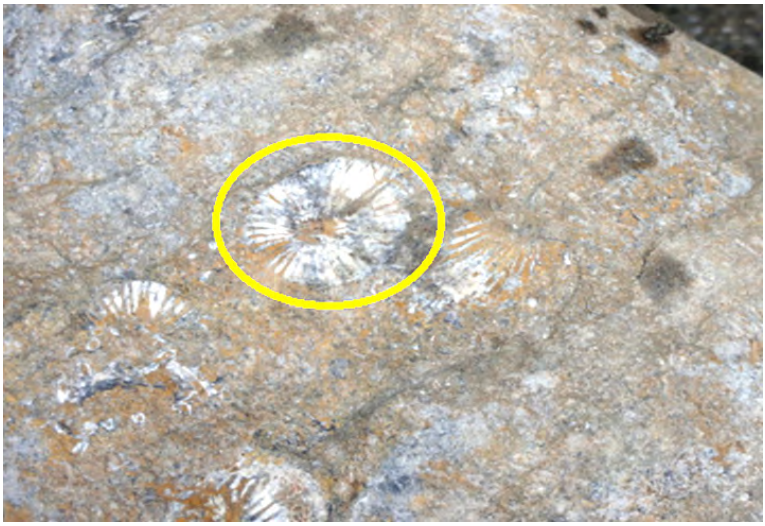

Fig. 9. Sample of a FOSSIL on a Limestone Rock in the Azaroud River Catchment Area.

Fig. 10. Rock Collapse Due to Azaroud River Floods. In Debris Flows, Large Amounts of Rocks and Dense Clay Fragments Are Carried Downstream with the Water. In Such Conditions, Human Settlement Is not Possible.

also a significant factor affecting living conditions and settlement in the region. High elevations, due to steep slopes, lack of suitable soil, difficult communication, and reduced oxygen, minimize the possibility of settlement. Surveys show that on the left side of the river, the slope of the hillsides varies between 30 and 50

Fig. 11. Landslide in part of the Azaroud River Catchment Area. The Left Side of the Image Shows an Accumulation of Small and Large Rocks that have Separated from the Ground. It Appears that Vegetation has Prevented Further land Degradation.

degrees, while on the right side, the slope is gentler, ranging from 10 to 30 degrees. Given the morphological, hydrological, and geological characteristics of the region, it appears that the Azaroud River and its surrounding valleys have lacked suitable conditions for permanent human settlements, and environmental factors have played a significant role in the absence of settlements in this area.

Conclusion

The results of the survey in the Azaroud Dam reservoir area indicate that no evidence of historical human settlements was identified in this region. Only scattered fragments of eroded pottery were found along the riverbanks, likely transported to the area by seasonal floods from upstream regions. Environmental and geological analyses also reveal that factors such as dense forest cover, steep slopes, difficult terrain, and annual torrential rainfall have created unfavorable conditions for the establishment of permanent or even temporary settlements in this area. However, these findings are limited to the reservoir area, and the possibility of human settlements in adjacent areas, particularly in upstream regions with gentler slopes and flatter terrain, cannot be ruled out. Local reports also indicate the presence of current settlements in some of these areas, highlighting the need for more extensive surveys.

One of the most significant factors influencing the distribution of human settlements is the slope of the land. The data

from this study confirm that V-shaped valleys, such as the Azaroud Valley, due to their steep slopes and unfavorable topographical conditions, have not provided suitable conditions for permanent settlements. In contrast, human settlements have typically formed on sun-facing slopes with gentler gradients, where access to natural resources and living conditions are more favorable.

In general, the findings of this study indicate that the absence of human settlements in the surveyed area is directly influenced by environmental conditions. Factors such as severe irregularities, continuous erosion, hydrological changes in the river, and the lack of suitable surfaces for settlement are among the most significant barriers to the formation of human settlements in this region. Based on these results, future archaeological studies can focus on adjacent areas and lower elevations with more favorable environmental conditions.

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