DOI: *10.51493/egearkeoloji.1597890*

ADerg 2025/1, Nisan/ *April;* XXXIV: 131-146

Araştırma/Research

Recommendations for the Restoration and Conservation of Early Christian Period Rock-Cut Settlements in the Reservoir Area of Karakurt Dam (Kars, Türkiye)

[KARAKURT BARAJI REZERVUAR ALANINDAKİ ERKEN HRİSTİYANLIK DÖNEMİ KAYA OYGU YERLEŞİMLERİNİN RESTORASYON VE KONSERVASYON ÖNERİLERİ (KARS, TÜRKİYE)]

Oktay DUMANKAYA – İrfan TUĞCU – Mesut YILMAZ

Keywords

Underwater Archaeology, Restoration and Conservation, Kars, Karakurt Dam, Cultural Heritage

Anahtar Kelimeler

Sualtı Arkeolojisi, Kaya Oygu Yerleşimi, Restorasyon, Konservasyon, Karakurt Barajı, Kültürel Miras, Kars

ABSTRACT

There are four Early Christian rock-cut settlements located in different areas affected by the Karakurt Dam reservoir. It has been determined that these Early Christian Period rock-cut settlements and church have been exposed to tidal effects and wave movements following the filling of the dam reservoir. Archaeological studies have revealed that during the summer months, when the water level of the reservoir decreases, some rock-cut settlements emerging from the water exhibit collapses and surface erosion on the rock face. Three distinct restoration and conservation proposals have been suggested: 1. Coating the entire surface with dilute ethyl silicate to reduce contact with water. 2. Covering all rock surfaces with geomembranes to completely block water interaction. 3. Protecting the rock masses from the effects of water using rock bolts, wire mesh, and shotcrete. Each of these proposals has its advantages and disadvantages. However, regardless of the chosen method, conservation efforts must commence urgently to prevent the irreversible loss of our cultural heritage.

ÖZET

Karakurt Barajı rezervuar alanından etkilenen farklı bölgelerde, Erken Hristiyanlık Dönemi'ne ait dört kaya oygu yerleşimi tespit edilmiştir. Barajın dolmasıyla birlikte bu yerleşimlerin ve kilisenin, gelgit etkileri ve dalga hareketlerine maruz kaldığı belirlenmiştir. Yaz aylarında su seviyesinin düşmesiyle su yüzeyine çıkan bazı kaya oygu yapılarında ise çökmeler ve yüzey erozyonu gözlemlenmiştir. Bu tespitler doğrultusunda üç farklı restorasyon ve konservasyon önerisi sunulmuştur: (1) Seyreltilmiş etil silikat ile yüzey kaplaması, (2) geomembran örtülerle su temasının tamamen kesilmesi, (3) kaya bulonları, tel ağ ve püskürtme beton uygulamalarıyla fiziksel koruma sağlanması. Bu yöntemlerin her birinin avantajları ve dezavantajları bulunmakla birlikte, hangi yöntem tercih edilirse edilsin, kültürel mirasın geri dönüşü olmayan kayıplarını önlemek adına koruma çalışmalarının vakit kaybetmeden başlatılması gerekmektedir.

Introduction

The human history of the Kars region in northeastern Anatolia dates back to the Paleolithic Age.[1] Surveys conducted in the plains of Kars have revealed numerous mounds that indicate settlements established from the Late Chalcolithic Age onwards. Evidence of the Karaz Culture, which has been observed in eastern Anatolia, Nakhchivan, northwestern Iran, Syria, Palestine, and the Levant, underscores the intense cultural interactions in the Kars and Sarıkamış regions.[2] In particular, the extensive plains of Sarıkamış, located at a key

1 Kökten 1943; 1944; Bingöl 2011: 22.

2 Korucu 2009; Bingöl 2016.

junction between the Caucasus and Anatolia, have historically fostered both agricultural and pastoral activities as well as sustained cultural exchange (Fig. 1). The Karakurt Dam Rock-Cut Settlements, the focus of this study, are situated 80 km from the center of Kars and 27 km from Sarıkamış district center. Researches were carried out in 2021 and 2022 on the registered cultural heritage affected by the reservoir of the Karakurt Dam, as per Decision No. 2710, dated January 30, 2020, by the Kars Regional Conservation Board of Cultural Heritage under the Ministry of Culture and Tourism. Detailed studies were conducted on four distinct rock settlements along the sloping banks of the Aras River, designated as "Akkoz Rock Church," "Rock-Cut Settlement-II," "Rock-Cut Settlement-III," and "Rock-Cut Settlement-IV" (Fig. 2).

The rock settlements in the research area were carved into volcanic tuffs on slopes with inclinations reaching up to 90°. The malleability of the volcanic tuff allowed for the creation of multiple overlapping rooms of various sizes. Transitions between rooms were facilitated by staircases carved into the rock. Similar rock settlements, known to have emerged in eastern Anatolia during the Late Iron Age, were utilized by the local population for security purposes. These rock-carved spaces served various functions such as shelters, residences, tombs, storage areas, and stables.[3] While it is known that Urartian rock tombs were later converted into living spaces and churches during the Christian era, no architectural elements characteristic of Urartian rock tombs (e.g., niches, benches, sarcophagi, or burial beds) were identified in these settlements.[4] Furthermore, no nearby Urartian settlements or fortresses were discovered, suggesting that these rock-carved sites were likely used as residential areas from the early Christian period onward.[5]

During the Early Christian Period, early Christians seeking refuge from Roman persecution often retreated to remote, isolated places such as deserts, mountains, and caves. Similar rock settlements and religious structures such as churches, chapels, and monasteries, used as sanctuaries, were also utilized in Anatolia, Syria, Egypt, and Palestine until the Middle Christian Period.[6] Early Christian rock settlements and churches, predominantly carved into soft volcanic tuff, are particularly abundant in Cappadocia, Phrygia,[7] and parts of Eastern Anatolia, including Kars, Van, and Erzurum.[8]

The rock settlements and the Akkoz Church near the Karakurt Dam were also carved into volcanic tuff (Fig. 3). Located on slopes with inclinations between 60° and 90°, these rock-carved settlements provided strategic advantages for defense against potential threats. In addition to independent rock-cut rooms, interconnected spaces with staircases were also present. Rooms closer to the ground level were used as stables, while higher and larger rooms served as shelters, residences, tombs, or storage spaces (Fig. 4).Over the centuries, the structural integrity of these early Christian rock-cut settlements and religious structures has been preserved. However, following the filling of the dam reservoir, it has been determined that the structures are now exposed to the effects of water fluctuations and wave movements. Archaeological research conducted during the summer, when the water level recedes, has revealed collapses and erosion on the surfaces of some of the rock settlements that emerge above the water (Figs. 5-6).

Underwater archaeological researches have also identified layers of mud deposited by the reservoir on the floors of the rock settlements, as well as erosion and surface cracks on the structures (Fig. 7).

This study aims to assess the extent of the damage to the rock settlements in the research area and to propose restoration and conservation measures for the preservation and stabilization of the cultural heritage affected by the reservoir.

3 Bingöl 2011: 22.

4 Çevik 1997; 2000; Talbot 1999.

5 Sevin 1987; Karaosmanoğlu 2004; Topaloğlu 2012; 2016; Topaloğlu and Kılıç 2021: 548.

6 Sağdıç 1987; Ötüken 1987; 1990; Talbot 1999; Koch 2007; Mergen et al. 2010; Pekak 2014.

7 Sağdıç 1987; Ötüken 1987, 1990; Mergen et al. 2010; Pekak 2014.

8 Özkan 1998; Gündoğdu 1999; 2009; Başak et al. 2018; Yiğitpaşa 2021.

The Necessity of Conservation Proposals for Submerged Immovable Cultural Heritage

Cultural heritage, encompassing both tangible and intangible elements, serves as a vital indicator of the socio-political and socio-economic identities of societies and their geographical contexts. Importantly, this heritage does not belong solely to the past; it constitutes a valuable legacy for future generations. For this reason, the preservation and transmission of cultural values represent one of the fundamental responsibilities of States. Conservation proposals aim to define the necessary interventions and practices required to safeguard registered immovable cultural heritage, whether submerged or located within water boundaries, and to ensure its designation as "*Cultural Heritage*" for future generations.

Türkiye has committed to numerous international conservation programs aimed at protecting and transferring cultural heritage. For instance, the country ratified the Valletta Convention[9] in 1999 and became a member of UNESCO (United Nations Educational, Scientific and Cultural Organization) in 1982[10]. According to Article 1.3 of the Valletta Convention: *"The archaeological heritage shall include structures, constructions, groups of buildings, developed sites, moveable objects, monuments of other kinds as well as their context, whether situated on land or underwater".*

These agreements have provided Türkiye with a robust framework to take significant steps toward protecting both tangible and intangible cultural heritage and transforming it into a shared asset of humanity. In the past two decades, global economic changes have necessitated large-scale infrastructure projects requiring international collaboration. Among these projects, dams stand out as significant endeavors. By 2023, Türkiye had completed 1,018 dams and 589 irrigation reservoirs[11] (Figs. 8-9). The country's mountainous terrain has historically directed settlements to river valleys, where fertile plains offer ideal living conditions. These same river valleys, particularly those surrounded by deep gorges, provide the optimal locations for dam and reservoir construction[12]. Large-scale projects such as the Keban, Karakaya, Atatürk, Birecik, and Karkamış dams on the Euphrates River, as well as the Kralkızı, Dicle, Devegeçidi, Ilısu, Batman, and Cizre dams on the Tigris River, have led to extensive archaeological excavations and research in these regions.[13] Notable examples of these efforts include the Yortanlı Dam[14] (Allianoi) and Ilısu Dam (Hasankeyf) projects, which serve as exemplary models for both Türkiye and the international community.[15]

Globally, other successful cases of archaeological research in dam reservoir areas can be highlighted. For instance, the archaeological inventory studies conducted in the Missouri Dam Reservoir in the United States in 1945 and the Aswan Dam Reservoir Project on the Nile River in Egypt stand out as benchmark examples.[16] Among the most notable achievements of the Aswan Dam Project was the relocation of the Abu Simbel Temples[17] from the reservoir basin to a new location, ensuring their preservation as a shared cultural heritage for humanity. This effort has since served as a role model for numerous subsequent projects.

Archaeological excavations and research conducted in dam reservoir areas play a critical role in creating comprehensive cultural inventories. However, the scale of archaeological sites in Türkiye often surpasses the territorial boundaries of many European countries, and the depth

9 The "European Convention on the Protection of the Archaeological Heritage – Valletta," signed in Valletta, Malta, in 1992 by member states of the Council of Europe, was adopted in Türkiye through Law No. 4434, dated August 5, 1999. See: https://www.coe.int/en/web/conventions/full-list?module=treaty-detail&treatynum=143; https://rm.coe.int/168007bd25. For more information, see: https://teftis.ktb.gov.tr/yazdir?3EA54E14CFDEA6AF7EAF2AA1606B46C0.

10 https://teftis.ktb.gov.tr/TR-263665/dunya-kulturel-ve-dogal-mirasin-korunmasi-sozlesmesi.html.

11 SHW 2023.

12 Özdoğan 2015: 45.

13 Özdoğan 2000a; 2006.

14 Arısoy et al. 2011; Hamamcıoğlu-Turan et al. 2013.

15 Bilgin et al. 2012; ES Project 2014; Akgönül and Eliüşük 2016; Uluçam and Eliüşük 2018; Ünal and Beyaz 2019; Yılmaz et al. 2020; Sevgi and Yılmaz 2022.

16 Unesco 1961; Hassan 2007; Özdoğan 2021.

17 Unesco 1961.

of settlements can reach dozens of meters. This reality creates an inherent conflict between the need to protect cultural heritage and the imperative to complete state-led infrastructure projects within tight schedules.[18] For example, research on the Atatürk Dam Reservoir indicates that only 39% of the area has been surveyed, with 14% subjected to intensive exploration, leaving the majority of the area unexplored. Similar patterns are observed in the Karkamış and Birecik dam reservoirs, where numerous archaeological sites remain either uninvestigated or only partially studied. It has been documented that after the dam reservoirs are filled, archaeological sites are subjected to gradually increasing erosion year by year.[19] In many cases, excavations and research are not completed before the sites become submerged, as archaeological studies often require decades to conclude.[20] Furthermore, archaeologists are frequently involved only after a dam project has been planned, contractors have been hired, or construction is on the verge of commencing. Consequently, proposals to adjust reservoir areas or modify designs are often dismissed due to the financial implications of such changes. Monitoring the preservation and deterioration of submerged cultural heritage has increasingly become an integral part of dam projects and has even been institutionalized as state policy. For instance, in pilot studies conducted by the World Commission on Dams (WCD) at Lake Alajuela in Argentina, it was revealed that the fluctuating water levels in dam reservoirs, coupled with wave activity, rapidly erode and damage cultural heritage, exposing thousands of artifacts to surface conditions. Additionally, bottom currents and fish nesting in the softer cultural layers cause further degradation.[21] Similarly, in the United States, dam projects like those on the Mississippi River include continuous monitoring programs, that periodically collect artifacts washed ashore by waves.[22] In Türkiye, such practices have begun to be implemented in projects like the Karakurt Dam, where the impacts of the dam's reservoirs on cultural heritage are monitored over time.

Excavations, research, and restoration efforts in dam reservoir areas aim to protect cultural heritage and transmit them to future generations. These efforts are further supported by international agreements. Consequently, striking a balance between development and the preservation of cultural heritage remains a critical obligation for all countries that are parties to such conventions. While some argue that archaeological settlements, especially mounds, could remain undisturbed beneath dam waters and be excavated once the dams are decommissioned, studies like those conducted by the World Commission on Dams have demonstrated otherwise.[23] Fluctuating water levels and wave activity cause significant erosion and damage, underscoring the urgency of simultaneous conservation and monitoring efforts in dam projects.

Restoration and Conservation Recommendations

The Rock-Cut Settlement areas impacted by the Karakurt Dam reservoir, including "Akkoz Rock Church, Rock-Cut Settlement-II, Rock-Cut Settlement-III, and Rock-Cut Settlement-IV," are located in various positions within the Karakurt Dam Hydroelectric Power Plant (HPP) Project. Over a period of two years, observations were conducted at these sites, revealing the erosive and abrasive effects of fluctuating water levels in the reservoir. The geological properties of the region, where the rock settlements are situated, are particularly vulnerable to cyclic wetting and drying, freezing and thawing, and salt crystallization. These factors contribute to significant internal weakening of the rock mass.[24]

Studies revealed that, considering the moisture and temperature gradients between the surface and the interior of the rock, the wetting-drying and freezing-thawing effects are most pronounced in the outer layers, causing fragmentation and detachment of the rock.[25] Due to the fragility of the rock structure, cracks and

18 Özdoğan 2001: 4; 2013.

19 Marchetti et al. 2020: Figs.3-7.

20 Özdoğan 2000b; 2015.

21 Norr and Faught 2000: 46-47.

22 Özdoğan 2015: 47.

23 Özdoğan 2013: 2015.

24 Bozkuş 1999: 996-998.

25 Ghobadi and Babazadeh 2015; Karaman and Bakhytzhan 2020; Çakır et al. 2022.

separations have developed over time, resulting in collapses caused by accumulated stress. Observations also indicated that, in addition to superficial soil erosion, localized collapses and mass soil movements have occurred on the slopes where the rock settlements are located. Based on these findings, it is recommended that damaged areas be filled in a manner that maintains the structural integrity of the surrounding rock, particularly in areas where continuous erosion and cracking have weakened the rock-cut settlement. This approach will ensure that the walls of these spaces retain their stability.

Preserving the intrinsic and aesthetic values of these cultural heritage sites, along with their surroundings, is of utmost importance. The primary objective is to protect these immovable cultural heritages in their original locations, ensuring that their aesthetic integrity is maintained. The preservation efforts are based on a preventive conservation approach. The relationship between the environmental factors contributing to degradation and the resulting damage was identified through continuous monitoring. This process enabled the formulation of recommendations for preserving these cultural heritages on-site. The specific geological characteristics of the Karakurt Dam Reservoir have facilitated the identification of the most suitable conservation methods for these rock formations. Minimizing intervention while offering alternative solutions underscores the importance of previous studies and the value of adaptive conservation strategies. Our recommendations not only focus on protecting these sites from the effects of fluctuating water levels but also aim to strengthen the weakened soil and rock structures in preparation for potential seismic activity. This is particularly significant given the presence of active left- and right-lateral fault lines along the Aras Valley,[26] between Horasan and Narman, which significantly influence the region's morphology.[27] In the event of an earthquake, it is highly likely that the rock-cut settlement, already weakened by the water from te dam, will be completely destroyed.

The Akkoz Rock Church, along with Rock Settlement-II, Rock Settlement-III, and Rock Settlement-IV, are located in different areas but share the same geological characteristics. Therefore, applying the same preservation methods to the rock-cut rooms in all four areas would be appropriate. In this context, reinforcing and filling the human-carved rock-cut rooms with mortar-based stone infills is essential to ensure the overall structural stability.

Implementation:

- Before starting the filling process, the spaces should be cleared of mud layers, accumulated soil, and detached fragments from the surface.

- Cracks and voids within the rock mass should be filled and reinforced with non-salty mortar injections. If necessary, alternative reinforcement methods and materials can be considered. Prior to implementation, the strength and suitability of cement-based and lime-based materials should be tested. The most appropriate material for reinforcement should be selected.

*After cleaning the caves, 2-inch injection pipes, as shown in the detailed drawings, should be installed and secured within each cave.

*Subsequently, the rock-cut rooms should be filled with rubble stones of varying sizes that match the lithological properties of the bedrock, and the entrances to the spaces should be sealed with mortar-based stone walls. Using rubble stones that match the lithology of the bedrock will ensure a consistent environment, preventing further fragmentation and degradation of the internal structure.

*Once the filling of the rock-cut rooms and the sealing of the entrances are completed, mortar injections should be carried out through the 2-inch injection pipes that were previously installed (Fig.10).

The first of these similar practices was successfully implemented in the Ilısu Dam archaeological site, in the Upper City of Hasankeyf, along the Tigris Valley, and in the surrounding areas. In these regions, approximately 225 rock-cut rooms were identified and preserved (Fig. 11-12). The rock formations in the Karakurt rock-cut settlements of the Aras Valley,[28] composed of volcanic tuff, claystone, and limestone, share similar characteristics with the thick

26 Bayrak et al. 2020.

27 Bozkuş 1999: 998.

28 Bozkuş 1999: 994-995.

sandy limestone of the Tigris Valley.[29] Both geological structures are vulnerable to external factors such as water and humidity. The implemented measures aim to mitigate the effects of wetting-drying and freeze-thaw cycles on the rock formations.

However, the aforementioned recommendations will primarily protect against the erosive effects of stagnant reservoir water. The potential impact of natural disasters such as landslides, collapses, earthquakes, and floods, as well as their effect on the conservation of these spaces, is not yet fully understood. Therefore, while filling the rock-cut rooms will maintain their spatial integrity, preventive measures must be taken to avoid further erosion of the bedrock surfaces. In this regard, it is also advisable to carry out improvements on the bedrock where the rock-cut settlements are located. The preventive measures and suggestions specific to the geographical and physical conditions of the Karakurt Dam have been provided below, with attention to both their advantages and disadvantages.

Bedrock Improvement Methods	Advantages	Disadvantages
Coating the entire surface with diluted ethyl silicate to reduce contact with water	• Prevents direct water interaction with cultural heritage • Ensures prolonged protection • Relatively easier application compared to geomembranes • Shields against environmental factors such as rain and snow • Does not promote mold or fungal growth	• Challenging to implement on large surfaces • May require periodic reapplication (e.g., annually) • High application costs
Covering all rock surfaces with geomembranes to completely block water interaction	• Prevents direct water interaction with cultural heritage • Ensures prolonged protection • Shields against environmental factors such as rain and snow	• Risk of mold and fungal growth • Requires anchoring on steep cliff faces • Can cause mechanical stress on the rock surface • Effects of solar radiation on geomembranes are difficult to predict • Water accumulation behind the membrane can lead to pressure-related issues
Protection of Rock Masses from Water Effects Using Rock Bolts, Wire Mesh, and Shotcrete	• Ensures prolonged protection • Completely isolates the rock surface from water • Shields against environmental factors such as rain and snow • Prevents direct water interaction with cultural heritage	• Potential issues with bonding to the rock • Corrosion may occur within an estimated 50-year lifespan • Additional weight from systematic anchoring can strain the structure • Drilling may cause localized damage to the rock • Maintenance is highly challenging once the reservoir is filled • Requires robust scaffolding for application

Table 1. Comparative assessment of the advantages and disadvantages of three proposed methods for the preservation of rock-cut settlements in the Karakurt Dam reservoir area.

Evaluation and Conclusion

Archaeological researches carried out in the Karakurt Dam reservoir area have clearly demonstrated the region's importance in terms of cultural heritage. The rock-cut settlements and the Akkoz Rock Church, carved into volcanic tuff along the banks of the Aras River, stand out as residential and religious spaces, particularly associated with the Early Christian period. These structures are significant not only for their architectural features but also for reflecting the traces of early Christian communities who sought refuge from Roman persecution, thereby holding substantial historical and cultural value.

However, following the impoundment of the dam, these cultural assets have begun to deteriorate physically due to wave action and water-level fluctuations. Observations made during low water periods revealed signs of erosion, collapses, and surface cracking on the rock faces. Underwater surveys further identified sediment accumulation at the base of the rock-cut structures and the formation of erosion-related surface damage. These findings emphasize the necessity of long-term protection measures to ensure the preservation of these vulnerable sites. Within this framework, proposed preventive conservation strategies aim not only to mitigate ongoing damage but also to establish a sustainable preservation model for cultural heritage sites potentially affected by similar dam projects in the future.

29 Bilgin et al. 2012; ES Project 2014; Ünal and Beyaz 2019.

Accordingly, long-term monitoring, regular documentation, and interdisciplinary collaboration are essential components for the protection of the cultural heritage surrounding the Karakurt Dam. Moreover, such monitoring systems offer the potential to develop effective response strategies not only against the impacts of dam-related changes but also in the event of natural disasters such as earthquakes and floods. In conclusion, the Karakurt Dam example underscores the need for and the relevance of preventive conservation approaches for safeguarding cultural assets under environmental threat.

ACKNOWLEDGEMENTS

We would like to express our sincere gratitude to the experts of the Kars Regional Board of Conservation of Cultural Heritage for their invaluable support during the research process, to Mr. Lokman Kemaloğlu, Director of the Erzurum Regional Laboratory for Restoration and Conservation, and to the students of the Department of Archaeology at the Institute of Social Sciences, Kahramanmaraş Sütçü İmam University — Çağlar Akdağ, Ümit Yıldırım, Ozan Dalgıç, Serdal Tüzün, and Selçuk Aslanyürek — for their valuable contributions.

References

Akgönül and Eliüşük 2016: M.S. Akgönül, M. Eliüşük, "Hasankeyf İmam Abdullah Zaviyesi Konservasyon ve Restorasyon Çalışmaları", *Batman Üniversitesi Yaşam Bilimleri Dergisi* 6 (2.1): 193-227.

Arısoy et al. 2011: Y. Arısoy, M. Hamamcıoğlu-Turan, A. Nuhoğlu, Y.P. Erturan, "Protection of Archaeological Remains in Yortanlı Dam Lake", *Proceedings of the 6th International Conference on Dam Engineering*, C.A.B. Pina, E. Portela, J.P. Gomes, J.S.Y. Tan, T. (eds.), Lisbon, Portugal, February 15-17, 2011, Lisbon, Portugal: Dam Engineering Conference, 153-166.

Başak et al. 2018: O. Başak, D. Yiğitpaşa, N.T. Yiğitpaşa, "Üçpınar Kaya Kiliseleri", *Arkeoloji ve Sanat* 159: 117-130.

Bayrak et al. 2020: E. Bayrak, C. Ozer, S. Perk, "Stress Tensor and Coulomb Analysis for Erzurum and Its Surroundings", *Turkish Journal of Earthquake Research* 2(1): 101-114, https://doi.org/10.46464/tdad.737222.

Bilgi et al. 2012: A. Bilgin, S. Arslan, Y. Şenay, S. Polat, "Hasankeyf ve Yöresindeki Kayaçlardaki Ayrışma ve Bu Ayrışmanın Yerleşim Alanına Olan Etkisi", *Batman Üniversitesi Yaşam Bilimleri Dergisi* 1(2): 43-55.

Bingöl 2011: A. Bingöl, "Kars ve Çevresinde Demir Çağı Yerleşmeleri", *Kafkas Üniversitesi Sosyal Bilimler Enstitüsü Dergisi* 1(8): 21-41.

Bingöl 2016: A. Bingöl, "Kars ve Çevresinde Karaz Yerleşmeleri", *Kafkas Üniversitesi Sosyal Bilimler Enstitüsü Dergisi* 18: 487-502.

Bozkuş 1999: C. Bozkuş, "Karakurt (Kars) Yöresinin Jeomorfolojik Evriminde Volkanizma ve Tektoniğin Etkisi", *Pamukkale Üniversitesi Mühendislik Bilimleri Dergisi* 5(1): 993-1000.

Çakır et al. 2022: A.O. Çakır, K. Karaman, A.O. Yılmaz, "Kayaçların Fiziksel Özelliklerinin Islanma Ve Kuruma Etkisine Bağlı Değişiminin Belirlenmesi, *BAUN Institute of Science Journal* 24(2): 770-778.

Çevik 1997: N. Çevik, "Urartu Kaya Mezarlarında Ölü Kültüne İlişkin Mimari Elemanlar", *Turkish Journal of Archaeology* 31: 419-459.

Çevik 2000: N. Çevik, *Urartu Kaya Mezarları ve Ölü Gömme Gelenekleri*, Ankara.

ES PROJECT 2014: Final Project Report on the Geological and Geotechnical Investigation and Strengthening Project of the Ancient City of Mardin-Hasankeyf" (Unpublished report), Ankara: ES PROJE Mühendislik Müşavirlik LTD. ŞTİ.

Ghobadi and Babazadeh 2015: M.H. Ghobadi, R. Babazadeh, "Experimental studies on the effects of cyclic freezing-thawing, salt crystallization, and thermal shock on the physical and mechanical characteristics of selected sandstones", *Rock Mechanics and Rock Engineering* 48(3): 1001-1016.

Gündoğdu 1999: H. Gündoğdu, *Sarıkamış ve Çevresindeki Tarihi Kalıntılar*, Erzurum.

Gündoğdu 2009: H. Gündoğdu, "Sarıkamış'tan Birkaç Kaya Kilise Örneği", *X. Ortaçağ-Türk Dönemi Kazı Sonuçları ve Sanat Tarihi Araştırmaları Sempozyumu Bildirileri*, 385-400.

Hamamcıoğlu-Turan et al. 2013: M. Hamamcıoğlu-Turan, Y. Arısoy, A. Nuhoğlu, Y.P. Erturan, "Protection of Archaeological Remains in the Yortanli Dam Reservoir in Turkey", *International Journal of Architectural Heritage* 7: 653-672.

Hassan 2007: F.A. Hassan, "The Aswan High Dam and the International Rescue Nubia Campaign", *The African Archaeological Review* 24 3(4): 73-94.

ICOMOS 1987: International Council on Monuments and Sites (ICOMOS), *Charter for the conservation of historic towns and urban areas*, Washington. http://www.international.icomos.org/charters/towns_e.htm.

ICOMOS 1990: International Council on Monuments and Sites (ICOMOS), *Charter for the Protection and Management of Archaeological Heritage*, Lausanne. http://www.international.icomos.org/charters/arch_e.htm.

ICOMOS 1996: International Council on Monuments and Sites (ICOMOS), *Charter on the Protection and Management of Underwater Cultural Heritage*, Sofia.http://www.international.icomos.org/charters/underwater_e.htm.

ICOMOS 2010: International Council on Monuments and Sites (ICOMOS), "Heritage at Risk," April 6, 2010.http://www.international.icomos.org/risk/index.html.

Karaman and Bakhytzhan 2020: K. Karaman, A. Bakhytzhan, "Prediction of concrete strength from rock properties at the preliminary design stage", *Geomechanics and Engineering* 23(92): 115-125.

Karaosmanoğlu 2004: M. Karaosmanoğlu, "Urartu Kaya Mezarlarının Kökeni Üzerine," in: H. İşkan and G. Işın (eds.), *Anadolu'da Doğdu-60. Yaşında Fahri Işık'a Armağan*, İstanbul, 419-423.

Koch 2007: G. Koch, *Erken Hıristiyan Sanatı*, transl. A. Aydın, Arkeoloji ve Sanat Yayınları, İstanbul.

Kökten 1943: İ. K. Kökten, "Kars'ın Tarihi Öncesi Hakkında İlk Kısa Rapor", *Belleten* VII: 601-613.

Kökten 1944: İ. K. Kökten, "Orta, Doğu ve Kuzey Anadolu'da Yapılan Tarih Öncesi Araştırmaları," *Belleten* VIII: 659-681.

Korucu 2009: H. Korucu, "Kars'ta Erken Tunç Çağı ve Karaz Kültürü İzleri", *Türk Arkeoloji ve Etnografya Dergisi* 79: 43-60.

Marchetti et al. 2020: N. Marchetti, G. Bitelli, F. Franci, F. Zaina, "Archaeology and Dams in Southeastern Turkey: Post-Flooding Damage Assessment and Safeguarding Strategies on Cultural Heritage", *Journal of Mediterranean Archaeology* 33(1): 29-54. https://journals.equinoxpub.com/index.php/OLDJMA/article/view/42345.

Mergen et al. 2010: Y. Mergen, S. Evcim, G.K. Öztaşkın, "Bölgedeki Kaya Kiliseleri", in: O. Uçkan, B.Y. (ed.), *Frigya (Phrygia) Bölgesinde Bizans Dönemi Kaya Mimarisi*, Eskişehir, 37-129.

Norr and Faught 2000: L. Norr, M. Faught, "Archaeological Site Location and Assessment in Lake Alajuela, Panama," in: S. Brandt and F. Hassan (eds.), *Dams and Cultural Heritage Management: Final Report August 2000*, 46-47.

Ötüken 1987: Y. Ötüken, *Göreme*, Ankara.

Ötüken 1990: Y. Ötüken, *Ihlara Vadisi*, Ankara.

Özdoğan 2000a: M. Özdoğan, "Cultural Heritage and Dam Projects in Turkey: An Overview". In: S. Brandt and F. Hassan (eds.), *Dams and Cultural Heritage Management, Final Report August 2000 (Working Paper Submitted to the World Commission on Dams)*, Cape Town, South Africa: World Commission on Dams Secretariat, 58-61.

Özdoğan 2000b: M. Özdoğan, "Türkiye'de Yok Olan Kültürler ve Baraj Gölleri: Sorunlar ve Öneriler", *GAP Bölgesinde Kültür Varlıklarının Korunması, Yaşatılması ve Tanıtılması Sempozyumu*, Ankara, 71-84.

Özdoğan 2001: M. Özdoğan, *Türk Arkeolojisinin Sorunları ve Koruma Politikaları*, İstanbul.

Özdoğan 2006: M. Özdoğan, "Keban Projesi ve Türkiye'de Kurtarma Kazıları". In: V. Tolun and T. Takaoğlu (eds.), *Sevim Buluç Anı Kitabı*, Çanakkale, 13-19.

Özdoğan 2013: M. Özdoğan, "Dilemma in the Archaeology of Large Scale Development Projects: A View from Turkey", *Papers from the Institute of Archaeology* 23(1): 1-8, DOI: http://dx.doi.org/10.5334/pia.444.

Özdoğan 2015: M. Özdoğan, "Barajlar ve Arkeoloji", *İstanbul Teknik Üniversitesi Vakfı Dergisi* 70: 43-48.

Özdoğan 2021: M. Özdoğan, *Fırat'la Doğan, Barajlarla Yok Olan, Kurtarma Kazılarıyla Geri Kazanılan Kültür: FIRAT 1964-2004 - 40 Yılın Öyküsü*, İstanbul.

Özkan 1998: H. Özkan, "Gölören Köyü Kaya Kilisesi", *Güzel Sanatlar Enstitüsü Dergisi* 4: 119-127.

Pekak 2014: M.S. Pekak, "Ürgüp Kiliseleri / The Churches of Ürgüp", *Journal of Faculty of Letters* 31(2): 173-203.

Sağdıç 1987: O. Sağdıç, *Kapadokya*, Ankara.

Sevgi and Yılmaz 2022: S. Sevgi, M. Yılmaz, "Hasankeyf Artuklu Hamamı Koruma ve Kurtarma (Taşıma) Uygulama Çalışmaları", *Türk Arkeoloji ve Etnografya Dergisi* 84: 39-61.

Sevin 1987: V. Sevin, "Urartu Oda-Mezar Mimarisinin Kökeni Üzerine Bazı Görüşler", in: A. Çilingiroğlu (ed.), *I. Anatolian Iron Ages Symposium, İzmir,* 24-27 April 1984, İzmir, 35-42.

SHW/General Directorate of State Hydraulic Works (SHW) 2023.

https://www.dsi.gov.tr/Sayfa/Detay/1847.

Talbot 1999: M.A. Talbot, "Bizans Manastır Sistemine Giriş", *Cogito* 17: 161-176.

Topaloğlu 2012: Y. Topaloğlu, "Yeni Buluntular Işığında Kuzeydoğu Anadolu Kaya Mezarları", *Kafkas Üniversitesi Sosyal Bilimler Enstitüsü Dergisi* 1(10): 131-163.

Topaloğlu 2016: Y. Topaloğlu, "Kuzeydoğu Anadolu'da Yeni Bir Kaya Mezarı: Karapınar", *Journal of Turkish Studies* 11(1): 175-196.

Topaloğlu and Kılıç 2021: Y. Topaloğlu, M. Kılıç, "Doğu Anadolu Demir Çağı'nda Ölüm ve Ahiret İnancı", in: L.G. Gökçek, E. Yıldırım, O. Pekşen (eds.), *Anadolu'nun Eski Çağlarında İnanç Olgusu ve Yönetim Anlayışı*, İstanbul, 533-562.

Uluçam and Eliüşük 2018: A. Uluçam, M. Eliüşük, "Hasankeyf Kazıları 2004-2017", *Batman Müzesi Ilısu Barajı Kurtarma Kazıları*, Batman, 263-290.

Ünal and Beyaz 2019: M. Ünal, T. Beyaz, "Hasankeyf Kireçtaşlarının Suda Dağılmaya ve Tuz Kristalleşmesine Karşı Direncinin Araştırılması", *Engineering Sciences* 14(2): 55-62.

UNESCO 1961. "Abu Simbel: Now or never", *The Unesco Courier*, October No.10, 1961.

Yılmaz et al. 2020: M. Yılmaz, S. Sevgi, B. Eskici, Y. S. Şener, M. Eliüşük, "Kısmen Baraj Gölü Suları Altında Kalacak Olan Hasankeyf Yamaç Külliyesinin Sağlamlaştırılması, Korunması ve Sergilenmesine Yönelik Uygulamalar", *Amisos* 5(9): 413-439. https://doi.org/10.48122/amisos.755550.

Yiğitpaşa 2021: D. Yiğitpaşa, "Van/Üçpınar Örneği Işığında Doğu Anadolu'da Kilise Olarak Kullanıldığı Düşünülen Urartu Kaya Mezarları", *Van Journal of Humanities and Social Sciences* 1(1): 61-76.

WCD 2001. WCD/ The World Commission on Dams, Heritage at Risk 2001-2002: Dams and Cultural Heritage. https://www.icomos.org/public/risk/2001/dams2001.htm.

Makale Gönderim Tarihi: 07.12.2024

Makale Kabul Tarihi: 10.04.2025

OKTAY DUMANKAYA

Orcid ID: 0000-0001-9007-0536

Kahramanmaraş Sütçü İmam University, Faculty of Humanities and Social Science, Department of Archaeology

Kahramanmaraş/TÜRKİYE.

oktaydumankaya@gmail.com

İRFAN TUĞCU

Orcid ID: 0000-0002-7502-8417

Osmaniye Korkut Ata University, Faculty of Humanities and Social Science, Department of Archaeology

Osmaniye/TÜRKİYE.

irfantugcu@osmaniye.edu.tr

MESUT YILMAZ

Orcid ID: 0000-0001-7143-4349

Restorer/Architect/Art Historian,

Ankara/TÜRKİYE.

yilmazmesut10@gmail.com

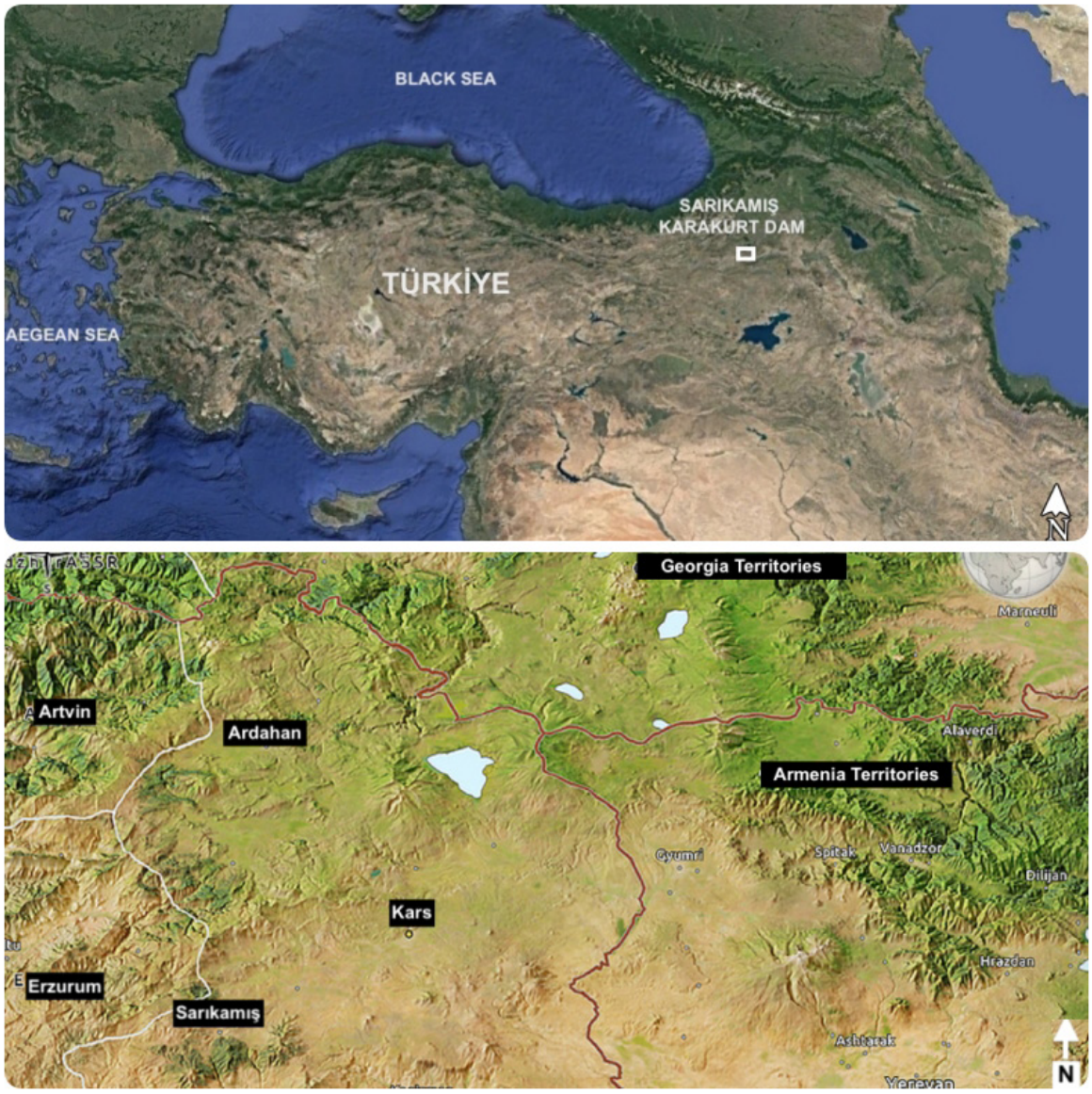

Fig. 1. Location map.

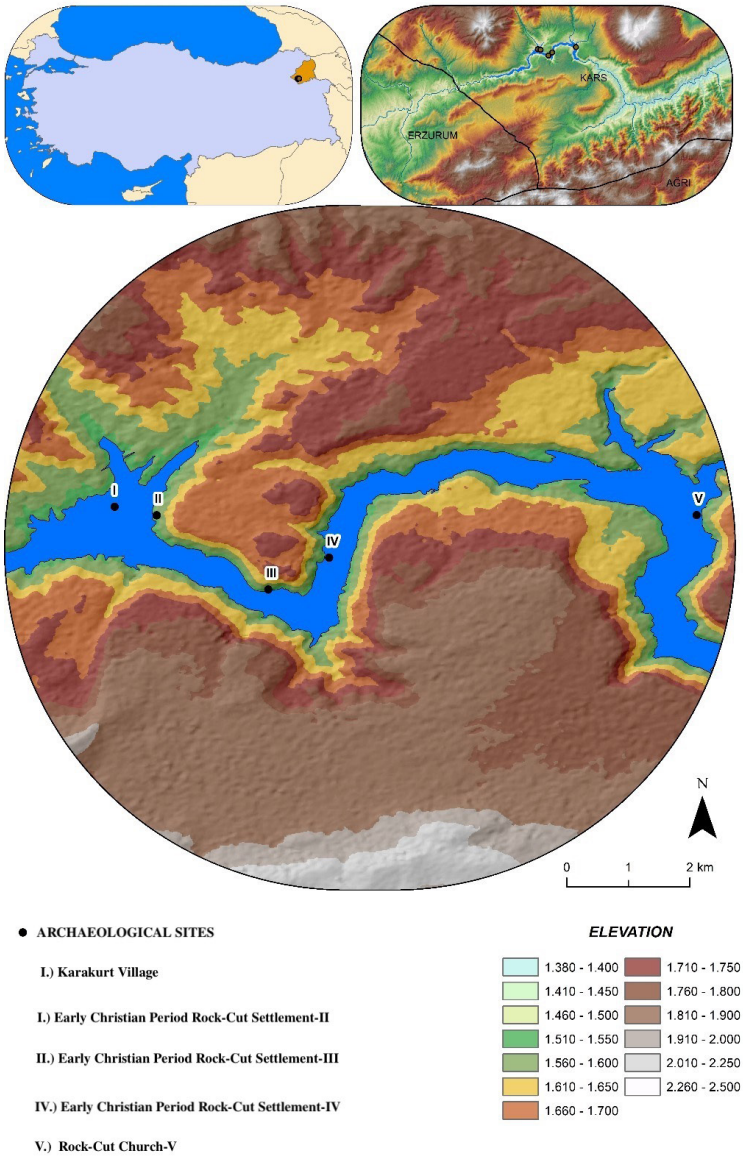

Fig. 2. The locations of the rock-cut settlements in the reservoir area of the Karakurt Dam.

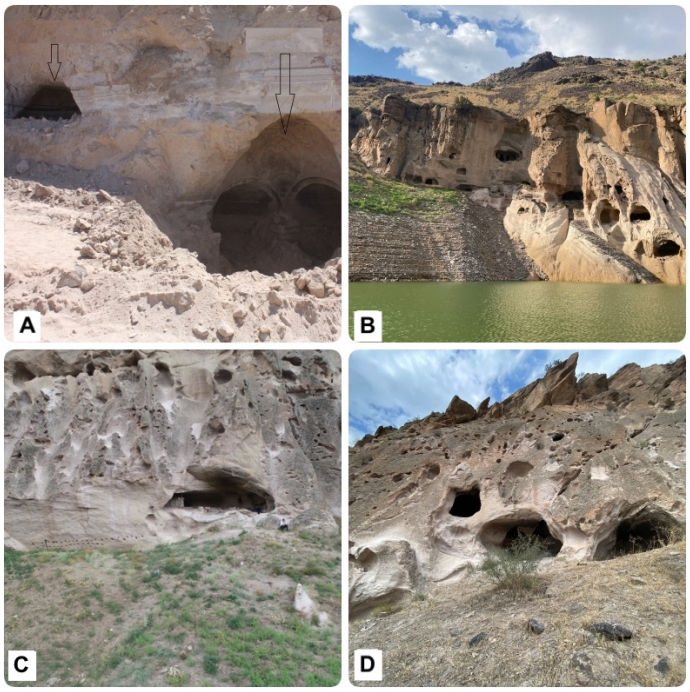

Fig.3. A) Akkoz Church B) Rock-cut settlements-I
C) Rock-cut settlements-III D) Rock-cut settlements-II

Fig.4. General views of the rock-cut settlement-II.

Fig.5. Details of the damage occurred in the rock-cut settlement-III over the years.

Fig.6. Details of the mass soil slide that occurred in the rock-cut settlement-III.

Fig.7. Details of the damage that occurred in the submerged rock-cut settlement-IV.

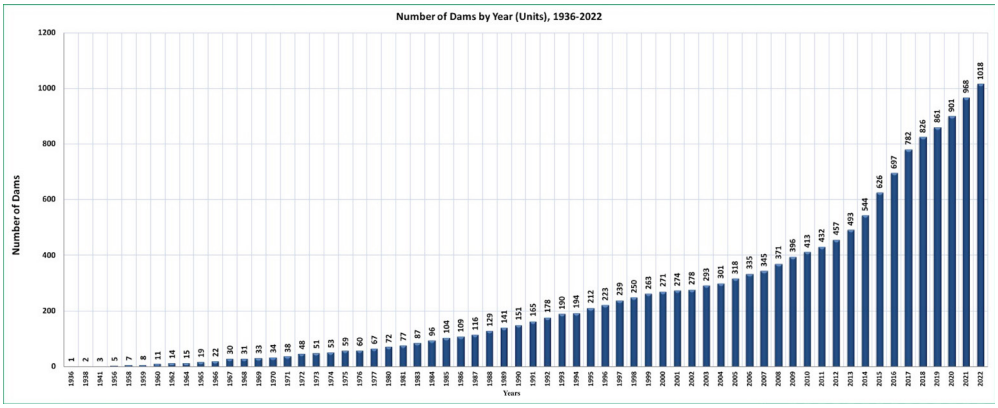

Fig.8. Number of Dam by year (Units) 1936-2022.

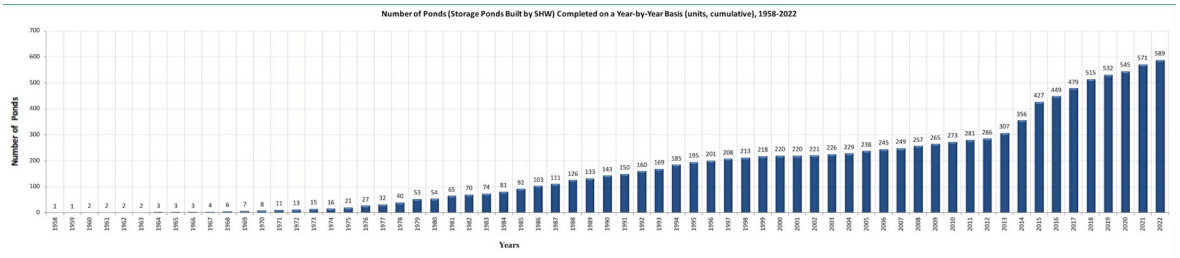

Fig.9. Number of ponds (Storage ponds built by SHW) completed on a year-by-year basis (units, cumulative) 1958-2022.

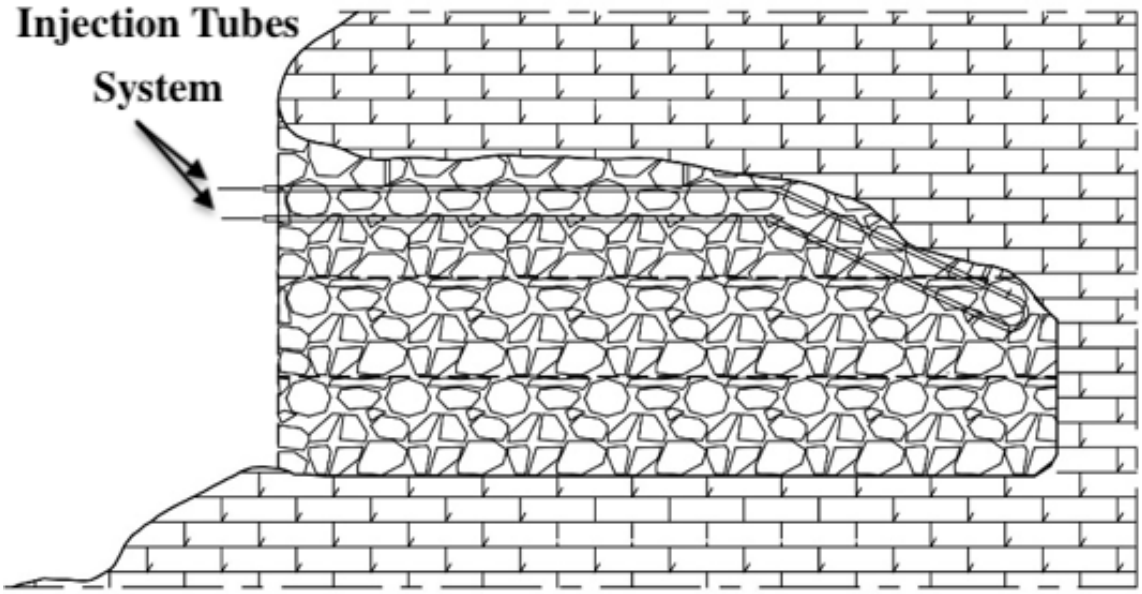

Fig.10. Details of the injection tubes system.

Fig.11. View of the rock-cut settlements of the Ilısu Dam.

Fig.12. View of the rock-cut settlements of the Ilısu Dam.