2020 Scienceline Publication

Journal of Civil Engineering and Urbanism

Volume 10, Issue 3: 32-34; May 25, 2020 ISSN-2252-0430

DOI: https://dx.doi.org/10.29252/scil.2020.jceu5

Historical Water Conveyances to Aphrodisias and the Yeşilköy-Kayapinar Water Tunnel

Rasoul Daneshfaraz[1] and Ahmet Alkan[2]

[1]*Department of Civil Engineering University of Maragheh Maragheh, Iran*
[2]*Faculty of Engineering, Civil Engineering Department, Dokuz Eylul University, Izmir, Turkey*

Corresponding author's Email: ahmet.alkan@deu.edu.tr

Short Communication
PII: S2252043020000005-10
Received: March 30, 2020
Revised: May 20, 2020

ABSTRACT

Anatolia is considered as one of the foremost open-air museums of the world with regard to historical hydraulic works. The antique city Aphrodisias, near the settlement Geyre at the Karacasu District in the Aydın Province of Turkey, was supplied from two regions by long-distance water conveyance systems: (a) the 22 km long Yenidere (Timeles) water conveyance supplying the springwater near the village Güzelköy of the Tavas District in the Denizli Province, from the south-east (the conveyance from Sekiköy joined probably this system); (b) the 9 km long Işıklar water conveyance supplying the springwater near same-named village of the Karacasu District of the Aydın Province, from the north-west (the conveyance from Derindere springs joined probably this system). The Yenidere (Timeles) water conveyance is one of the rarely encountered historical example of water transfer between adjacent basins; and moreover, the length of the tunnel, of roughly 1% slope and 1m^3/s capacity, digged with the 'qanat' system, is about 5 km from the entrance in the south-west of Yeşilköy and the outlet in the north-east of the village Kayapınar, and ranks among the longest ones of its kind in the antique world. This water conveyance system, especially the above mentioned tunnel section, which has a special place among the historical water works in Turkey, should be carefully investigated, duely repaired, and preserved for the future according to its international relevance.

Key words: Aphrodisias, Yenidere dam, Timeles, Waterways

INTRODUCTION

Turkey in terms of historical water structures is one of the world's leading open-air museums (Öziş et al., 2014; Öziş, 2015 a, b). In this context, the waterways of the ancient city of Aphrodisias (Aphrodisias), located near the Geyre settlement in Karacasu District of Aydın Province, are also of international interest in the context of many historical water structures in the Karya region (Tanrıöver, 2002).

The first study on systems that transmit water to Aphrodisias and to determine passes is the diploma project prepared by Meral Çakır, Özcan Verim and Refik Afşar under the direction of Turhan Acatay in 1978 (Çakır et al., 1978). In this study, two waterways were identified, one from the north of Aphrodisias, from the springs in the north of Işıklar village, which transmitted water to the city, and the other from the Derindere springs in the east, reaching the water reservoir a few km north of the city.

Ayhan Atalay found a tunnel mouth in the east of Kayapınar village in the early 1990s; In the book of Ünal Öziş (Öziş, 1994) in 1994 (Öziş, 1994) summarizing the findings of Çakır et al. (1978), due to his studies on Ephesus waterways, Ünal Öziş's 1994 book (Öziş, 1994), this tunnel, known as the Tunnel region tunnel, is a flood control that will ensure the discharge of closed reservoirs. It was also noted whether it was part of another system that could transmit water to Aphrodisias.

A second study is a diploma study prepared by Oktay Gündoğdu and Ö.Özgü Süleymanoğlu in 2001 under the direction of Orhan Baykan and Ersel Tanrıöver (Gündoğdu and Süleymanoğlu, 2001). In this study, more detailed information about Işıklar and Derincedere waterways were found. The passage of Işıklar waterway was given partially differently from the first study (Çakır et al., 1978).

A summary statement of this study was presented to the preparatory conference of the 5th World Water Forum of DSI in 2008 (Süleymanoğlu et al., 2008).

In the work of Angela Commito and Felipe Rojas published in 2012 (Commito and Rojas, 2012), a very different pass was given for Işıklar waterway; The possible passage of the waterway close to 25 km called Timeles (Yenidere) waterway, which compiles and transmits the spring waters from Tavas region from the southeast to the city, was also given. Angela Commito

summarized similar findings in her report (Commito, 2015) to the symposium in Antalya in 2014.

The last study on this subject is the finishing project prepared by Yüksel Taşer under the management of Ahmet Alkan in 2015, examining the Yenidere waterway (Taşer, 2015). In this study, the last 6 km long section of Yenidere (Timeles) waterway before reaching the city passes significantly more southwest.

In these waterways, there are many interesting water structures such as open canal, masonry gallery, transportation gallery, tunnel, transportation shaft, aqueduct, reverse siphon.

As an important historical example belonging to the 'water transfer between basins' of Yenidere waterway, it is a rare historical example, the tunnel section opened between the tunnel entrance in the southwest of Yeşilköy and the tunnel exit in the northeast of Kayapınar, 5 km. It is one of the longest examples of its kind with its length in the order.

AN OVERVIEW OF THE HISTORICAL SUITES OF AFRODİSYAS

Waterways from Işıklar district

The passage of the waterway starting from the sources 2-3 km north of Işıklar village continues differently in three studies after a few km in the southwest of the village; in the first two studies (Çakır et al., 1978; Gündoğdu and Süleymanoğlu, 2001), with small differences, they head towards the Derincedere valley in the southeast; In the third study (Commito and Rojas, 2012; Commito, 2015), it turns to the southwest and reaches the city with a curvature. In the first study, the waterway (Çakır et al., 1978), whose waters were collected from springs around Fığla hill, which stretches along the eastern shore of Derincedere but ends in a water tank before reaching the city, is not mentioned in the following studies, two water structure remains are mentioned (Commito and Rojas, 2012; Commito, 2015).

Işıklar waterway gorge has been more westward than the first two studies and more eastward than the third study; By joining the arm from Derincedere springs, it seems highly probable that a single waterway has come to the city.

Waterways from Tavas direction

The crossing of the Yenidere (Timeles) waterway, which transmits the waters of the springs near Güzelköy to Aphrodisias from the Tavas closed basin, was largely determined in the first comprehensive study (Commito and Rojas, 2012; Commito, 2015). However, in a second study (Taşer, 2015), it was determined that the crossing towards the northwest, Aphrodisias, in a second study (Taşer, 2015), instead of a curvature directed to the northeast and Seki region after Kocadere valley in this passage (Figure 1). In this case, the length of the waterway, which is around 25 km, decreases to the order of 22 km.

It is highly probable that the waterway that transmits spring water around Seki village has also joined the Yenidere waterway in the plain.

The length of the transmission line from the Yenidere Dam, which has left the initial section of the Yenidere waterway under water to the tunnel exit point near Kayapınar Village, is 11 km and the slope of the channel is close to one thousandths according to the elevation difference of 10.1 meters between these two points. On the arch located at the passage of a small stream bed just downstream of the Yenidere Dam, there is a channel ruin in the view of an open canal, approximately 0.85 m high and 1.70 m wide. Considering the manning medium roughness coefficient n = 0,025, it is possible for the system to transmit a flow rate of 1.0 m3 / s according to this slope and size.

The transition from the Tavas closed basin to the Kocadere branch valley of the Büyük Menderes basin was provided by a 5 km long tunnel. Some intermediate chimneys of the tunnel, which was built with the 'Kanat' method, were encountered during the possible passage.

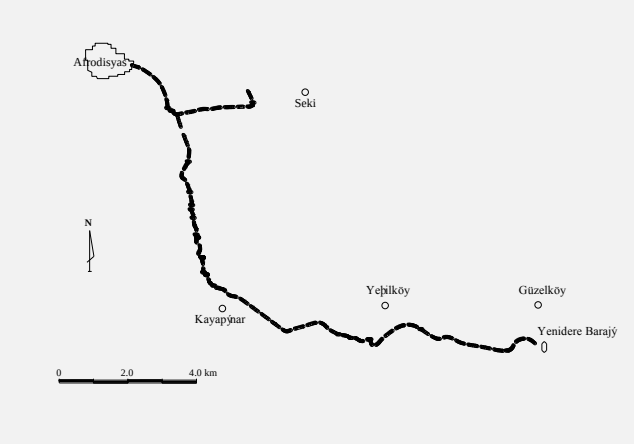

Figure 1. Possible passage of the Yenidere (Timeles) waterway that transmits water to Aphrodisias from the southeast, Tavas closed basin.

YEŞİLKÖY-KAYAPINAR WATER TUNNEL

The tunnel section (Commito and Rojas, 2012; Commito) on the Yenidere waterway between the tunnel entrance in

the southwest of Yeşilköy and the tunnel exit in the northeast of Kayapınar by the 'kanât' method (Grewe, 1998, 2014; Atalay et al., 2003; Öziş et al., 2005. 2015; Taşer, 2015) is one of the longest examples of its kind with its height of 5 km.

The size of the tunnel as it is in the nature of the long history of water tunnel in Turkey, is sized to be counted among the world's leading long history of water tunnels.

CONCLUSION

The Yenidere (Timeles) waterway, which has transmitted water to the ancient city of Aphrodisias, is to be examined, thoroughly preserved, carefully protected, and one of the rare examples of water transfer between the basins, as well as the international quality of the tunnel section. is important.

DECLARATIONS

Acknowledgment

The authors directed Prof. Dr. Turhan Acatay, Prof. Dr. Orhan Baykan and Civil Engineer. To Ersel Tanrıöver; Meral Çakır, Özcan Verim, Refik Afşar, Oktay Gündoğdu, Özgü Süleymanoğlu, Yüksel Taşer, Angela Commito and Felipe Reyes, who carried out the works; Em. Prof. Dr. for their support in the preparation of this paper. We offer our thanks to Ünal Öziş.

Competing interests

The author declares that he has no competing interests.

REFERENCES

Atalay A, Öziş Ü, Becerik M, Özdikmen K (2003). Efes'i besleyen tarihi Değirmendere suyolunda tüneller (Tunnels in the historical Değirmendere waterway feeding Ephesus). İnşaat Mühendisleri Odası (Chamber of Civil Engineers), İzmir Şubesi - Bülten, 19, 114, 29-33. PDF

Commito A (2014). The Aqueducts of Aphrodisias: A Regional Approach. InDe Aquaeductu Atque Aqua Urbium Lyciae Pamphyliae Pisidiea: The Legacy of Sextus Julius Frontinus, International Congress on the History of Water Management and Hydraulic Engineering in the Mediterranean Region. Antalya, October 31–November 9. Google Scholar

Commito A, Rojas F (2012). The aqueducts of Aphrodisias, *The Aphrodisias regional survey 5* (Eds. C Ratté, HD Staebler) Zabern, Mainz, Almanya, 289-307. Google Scholar

Çakır M, Verim Ö, Afşar R (1978). Antik Afrodisias kenti su yapıları (Ancient Aphrodisias city water structures), Diploma projesi (Diploma Project), Mühendislik Bilimleri Fakültesi (Faculty of Engineering Sciences, Ege University, İzmir, Türkiye.

Grewe K. Aquädukte (2014). Wasser für Roms Städte; der große Überblick-vom Römerkanal zum Aquäduktmarmor. Regionalia Verlag; 2014. Google Scholar.

Grewe K (1998). Licht am Ende des Tunnels: Planung und Trassierung im antiken Tunnelbau", Zabern, Mainz, Almanya. ISBN: 3805324960, Google Scholar

Gündoğdu O, Süleymanoğlu Ö (2001). Aphrodisias tarihsel su iletimi (Aphrodisias historical water transmission)", Diploma Projesi (Diploma Project), Mühendislik Fakültesi (Engineering Faculty), Pamukkale Üniversitesi, Denizli, Türkiye.

Öziş Ü (2015a) Tarihi su yapıları açısından Türkiye'nin dünya'daki önemi (Turkey's importance in the world in terms of historical water structures). *İstanbul Teknik Üniversitesi Vakfı Dergisi (Journal of Istanbul Technical University Foundation)*, 70, 49-51.

Öziş Ü. (2015b). Water works through four millenia in Turkey. Environmental Processes. 2(3): 559-73. https://doi.org/10.1007/s40710-015-0085-3 , Google Scholar

Öziş Ü, Baykan O, Atalay A, Arısoy Y, Alkan A, Özdemir Y (2014). Historische Wasserbauten in der Türkei, *Wasserwirtschaft*, 7/8, 83-86. Google Scholar

Öziş Ü, Atalay A, Becerik M, Özdikmen K (2005). Tunnelstrecken in Qanatbauweise: der Kenchrios-(Değirmendere)-Fernwasserleitung nach Ephesus, *Internationales Frontinus-Symposium 2003 in Walferdange und weitere Beiträge zur Wasserversorgung aus Qanaten - Qanate als Vorbilder im Tunnelbau (Schriftenreihe der Frontinus-Gesellschaft)*, Bonn, Almanya, 26, 293-300. Google Scholar

Öziş Ü (1994). Su mühendisliği tarihi açısından Türkiyedeki eski su yapıları (Turkey oldest water works in the history of water engineering). Devlet Su İşleri (State Hydraulic Works), Ankara, Türkiye. Google Scholar

Süleymanoğlu Ö, Gündoğdu O, Baykan O, Tanrıöver E (2008). Afrodisias (Aphrodisias/Karacasu/Aydın) 1978-2001, *Tarihi su yapıları konferansı bildiriler kitabı (Book of Conference on historical structures of water structures)*, DSİ II. Bölge Müdürlüğü (State Hydraulic Works II. Regional Office), İzmir, Türkiye, 157-160

Tanrıöver YE. (2002). Karia bölgesi (Güney-batı Ege) tarihsel su yapıları. Denizli, Pamukkale Üniversitesi. Fen Bilimleri Enstitüsü, Yüksek lisans tezi. 2002. Google Scholar

Taşer Y (2015). Afrodisias antik kenti Yenidere suyolu (Aphrodisias ancient city Yenidere waterway), Diploma projesi (Diploma Project), Mühendislik Fakültesi (Faculty of Engineering), Dokuz Eylül Üniversitesi(Dokuz Eylül University), İzmir, Türkiye. 293-300.