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ROMAN DAMS IN ASIA MINOR

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Abstract: In this brief paper we will focus on six dams of the Roman period in Asia Minor, respectively Böğet, Örükaya, Seleucia Pieria, Ancyra, Aezani and Sardis, which are presented here in some outlines. The aim of this article is to introduce these ancient engineering monuments all together.
Keywords: Dams, Asia Minor, Turkey, Böğet, Örükaya, Aqua Sarvenae, Seleucia Pieria, Ancyra, Aezani, Sardis, Roman engineering, Roman architecture, Roman archaeology in the East.

Riassunto: Le dighe romane in Asia Minore. In questo breve articolo il focus è su sei dighe in Asia Minore di epoca romana, rispettivamente ubicate a Böğet, Örükaya, Seleucia Pieria, Ancyra, Ezani e Sardi, che sono squi illustrate in generale. Lo scopo di questo articolo è di presentare tutti insieme questi antichi monumenti dell'ingegneria romana.
Parole chiave: Dighe, Asia Minore, Turchia, Böğet, Örükaya, Aqua Sarvenae, Seleucia Pieria, Ancyra, Ezani, Sardi, ingegneria romana, architettura romana, archeologia romana in Oriente.

Özet: Anadolu'da Roma Dönemi Barajları. Bu kısa yazıda, Anadolu'da bulunan, Roma Dönemi'ne ait sırasıyla Böğet, Örükaya, Seleukeia Pieria, Ankyra, Aizanoi ve Sardeis olmak üzere, altı adet baraj ana hatlarıyla sunulmaktadır. Makalenin amacı, bu antik Roma mühendislik anıtlarını bir arada tanıtmaktır.
Anahtar Kelimeler: Barajlar, Anadolu, Böğet, Örükaya, Aqua Sarvenae, Seleukeia Pieria, Ankyra, Aizanoi, Sardeis, Roma Dönemi Mühendisliği, Roma Dönemi mimarisi, Doğu bölgelerinde Roma arkeolojisi.

Introduction

The study of Roman dam-building has received little scholarly attention in comparison to their other civil engineering activities. Their constructions began in an earnest way in the early imperial period and were concentrated on the semi-arid fringe of the empire, namely the provinces of North Africa, the Near East and Hispania. The relative abundance of Spanish dams is partly due to more intensive field work there. The most frequent dam types of the Roman period were earth- or rock-filled embankment dams and masonry gravity dams. The impermeability of Roman dams was increased by the introduction of waterproof hydraulic mortar and especially Roman concrete in the Roman architectural revolution. Formerly unknown dam types introduced by the Romans include arch-gravity dams, arch dams, buttress dams and multiple-arch buttress dams.

Asia Minor is considered one of the most outstanding open-air museum of the world with respect to ancient hydraulic structures.[1] In Anatolia the first regulation of water dates back to the Hittite era in the second millennium B.C.; in this regard, the Gölpınar Dam and Çakır Köy Dam in Alaca in central Turkey, which have survived to the present day, should be mentioned (**Map 1**). In this short paper we will focus on some dams in Asia Minor, believed to date back to the Roman era, although there is not always archaeological evidence for their dating.

The attention to ancient dams in modern Turkey began with the accounts of the first travelers, as far back as the eighteenth century. Especially in the twentieth century some scholars, including Hans Stark (1957), Friedrich Naumann (1982), Niklaus Schnitter (1978 and 1987) and Günther Garbrecht (1991) examined some of them in detail and formulated important observations. In recent years, numerous Turkish researchers have generally dealt with the supply of water and subsequently with dams; for this reason some recent excavations focused only to the goal to analyse these structures. Among these new studies an important master's thesis should be mentioned, completed by Ömer Torun and submitted to the University of Ankara in 2020.

[1] Alkan – Öziş 1991, 353.

Map 1. Main places in Asia Minor referred to in the text (Sami Patacı, 2022).

Böğet

In the district of Eskil, located ca. 50 km west of Aksaray and ca. 227 km south-east of Ankara, there is a dam 2 km south of the village of Böğet, near the *höyük* site of Böget or Böğet, built with limestone rocks and volcanic tuffs (gabbro).[2] It blocks a valley with about 250 m width. Its surviving structure is 4 m high and 300 m long (**Figs. 1–2**). It leaks from the springs located between Böğet and Eşmekaya. Like the Aezani and Örükaya Dams, it was first identified in 1957 by Hans Stark (1957, 14). Some parts of the blocks that are disassembled and damaged, allow understanding the main elements of the dam's architectural structure (**Fig. 1**). Stark noticed that there were small drains in some parts of the wall bases (1957, 14–15). There are also stone gutters that allow the drainage of excess water accumulated in the dam. This system is a feature that can only be seen in the Böğet Dam. This dam would have arisen for agricultural purposes

[2] Gabbro is an intrusive magmatic rock with a granular structure, consisting mainly of plagioclase and pyroxenes. It is the intrusive correspondent of basalt, an effusive igneous rock, and of diabase, a sub-volcanic or phylonian igneous rock. The name of this rock was given by the geologist Christian Leopold von Buch in 1809 from the name of the homonymous locality in the province of Livorno in Tuscany, Italy.

and above all to satisfy the water needs of Misthi or Misti (modern Konaklı) in ancient Graeco-Roman Cappadocia, situated 82 km southwest of the regional capital of Caesarea (Καισαρεία in ancient Greek), nowadays Kayseri. The nearby *höyük* site, i.e. a *tell* in Arabic and mound in English, has phases of the third, second and first millennia B.C., so that this dam could also be an earlier structure before the Romans.

Fig. 1. The Böğet Dam (after BİLDİRİCİ 2009, 103).

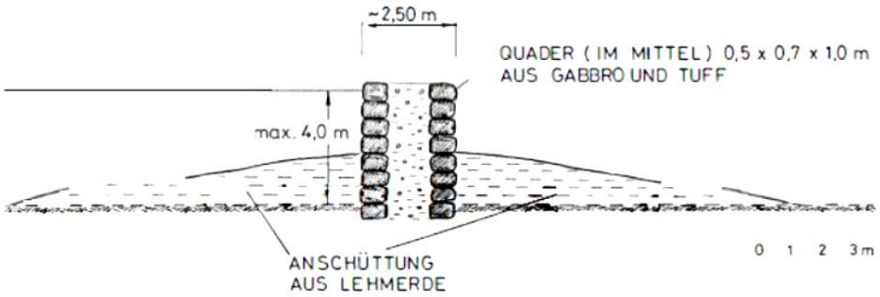

Fig. 2. Section of the Böğet Dam (after GARBRECHT 1991, 98).

Örükaya

This arch-gravity dam is located in the village of Örükaya (literally "walled rock"), in the district of Alaca which is primarily known for its Hittite and Phrygian archaeological sites, in the province of Çorum in central Anatolia (James,

Chanson 2002). It positions on top of a *höyük* site and situates c. 100 km north of Tavium, a large Graeco-Roman city in eastern Galatia. The Örükaya Dam was built on the narrow valley floor of a stream. In winter times water reaches uncontrollable levels, while in summer it is scarce due to evaporation. To ensure waterproofing between the upstream and downstream walls, the internal *opus caementicium* (Roman concrete) that was based on a hydraulic-setting cement, was strengthened with clay. The frequent illegal excavations and the continuous reuse of its architectural material by the surrounding villages have required urgent intervention. Therefore (rescue) excavations began in the Örükaya complex in 2017 (**Figs. 3–4**).

Fig. 3. The Örükaya Dam after the excavations (after İPEK, SÖKMEN 2018, 234).

Fig. 4. The Örükaya Dam after the excavations
https://artofwayfaring.com/destinations/the-roman-dams-at-orukaya (accessed 1 January 2022)

The dam, 16.59 m high, is arranged in an east-west direction, with a length of 35.79 m, a width of 4.90 m. There is a drain for excessive water, perhaps built at a later time. Blocks of the structure are smoothly cut and measure 1 to 2 m wide and 60 to 70 cm high. They were deriven from the local bedrock. Especially the upstream side was built with great care sealing to ensure waterproofing. The exposed side was 2.50 m high and 2.10 m wide. Downstream, within a space with a barrel vault, there was probably a lever system inserted in the central hole, which could allow the control of the water level and determine its discharge. In front of this system five steps were discovered along the valley side, which served perhaps as a buttress. In 1976 an irrigation dam was built at the upper level, about 150 m south of the same stream, to meet the water demand of the surrounding area.

Generally, the Örükaya Dam is dated into the second century A.D. The baths of Yozgat, Aqua Sarvenae, date from the same period, which recall important water pipes in their external appearance and certainly needed imposing water structures (**Fig. 5**).

Fig. 5. The baths of Yozgat, Aqua Sarvenae (photo by E. Laflı, 2002).

Çevlik Dam in Seleucia Pieria

Çevlik Dam is located 35 km southwest of the township of Samandağ, in the province of Hatay in southeastern Turkey. It is situated in the territories of the ancient city of Seleucia Pieria, a Hellenistic town and the seaport of Antioch-on-the-Orontes. The city was built slightly to the north of the estuary of the river

Orontes, between small rivers on the western slopes of the Coryphaeus, one of the southern summits of the Amanus Mountains. The Kapısuyu stream, originating from the Amanus, connects the lagoon which later became an inland port of the city of Seleucia. Thanks to this inland harbour, the Graeco-Roman city of Seleucia Pieria was an important port city from the second half of the first century A.D. onwards.

During the Roman period an engineering project was prepared to preserve the operation of the port which provided a system consisting of embankments, open canals and tunnels (**Fig. 6**). The tunnel and river diversion system at Çevlik dates back to the Roman period. It was aimed to prevent the silting of the harbour of Seleucia Pieria to the northwest of Samandağ near Antakya. Although hundreds of years have passed, these structures are still working. The Roman emperor Vespasian began the construction of these embankments and canals in the first century A.D., which was completed by his son Titus (reigned between A.D. 79–81). Alexander Drummond, a Scottish consul who visited Seleucia Pieria in 1754 and died in 1769, mentions the existence of the ancient inner harbour, but gives no information on the dam and the canals (Drummond 1754, 222).

This 875 m long system has a capacity of 70 m^3/s. It encompasses two tunnel stretches with a length of 90 m and 30 m. The cross sections are of simple horseshoe or trapezoidal form with dimensions in the order of 6–7 m, being the largest of its time.

The dam has a length of 49 m, a height of 16 m and a width of 5 m. It can be seen that geologically the blocks of the structure differ from each other. The upstream wall was built with rectangular limestone blocks, while the downstream walls were built with less refined stones (**Fig. 7**).

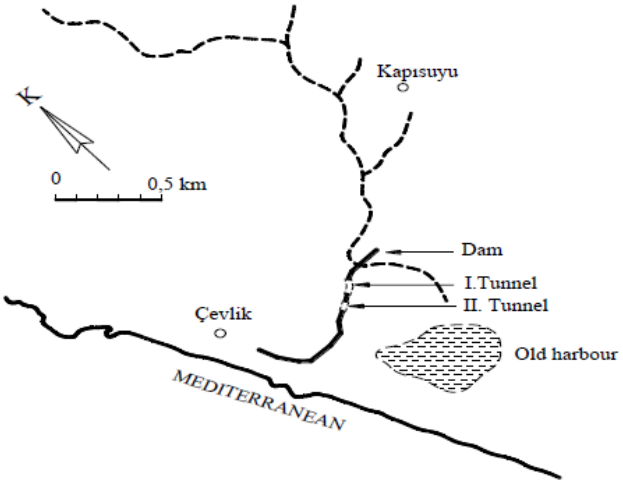

Fig. 6. The location of the dam of Seleucia Pieria (after TORUN 2020, 148, fig. 58).

Fig. 7. The Seleucia Dam (after TORUN 2020, 150, fig. 61).

The dam has typological similarities to other dams in other parts of the Roman Empire, such as the one located south of Leptis Magna in Libya or the Alcantarilla Dam which supplies water to the city of Toledo on the Guajaraz River in Spain or, again in Spain, the Proserpina Dam which is located 5 km from Merida, built on the Pardillas river for water supply during the Trajan period.

The Ancyra Dam

Another recently destroyed dam is Örükaya which was the dam of ancient Ancyra (modern Ankara), the capital of Roman Galatia, built on the Hatip (or Bent) stream in a place considered one of the few green areas in today's Bentderesi (literally "barrage stream") in Altındağ in the city centre of Ankara and measuring 50 m long and 7.75 m wide (**Figs. 8–9**). Guillaume de Jerphanion, a French Jesuit who travelled through Anatolia at the very beginning of the 20th century, states that the dam was used as a bridge during the Roman period, at least when the additional walls were built.[3] The upstream and downstream walls were built in andesite blocks with a pseudo-isodomic technique, i.e. with blocks of different heights in the different rows. A filling in *opus incertum*, a Roman construction technique, using irregularly shaped and randomly placed uncut stones or fist-sized tuff blocks inserted in a core of *opus caementicium*, was used to reinforce the external walls. Today it is almost completely destroyed.

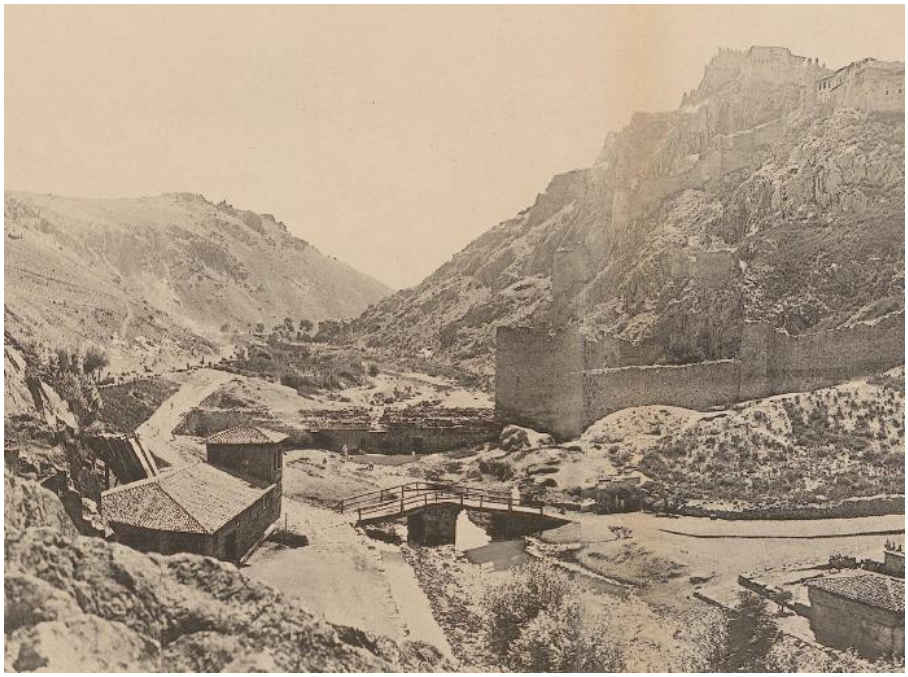

Fig. 8. The Ancyra Dam in 1890 (after HUMANN, PUCHSTEIN 1890, pls. 4–5 panorama).

[3] De Jerphanion 1928, 202.

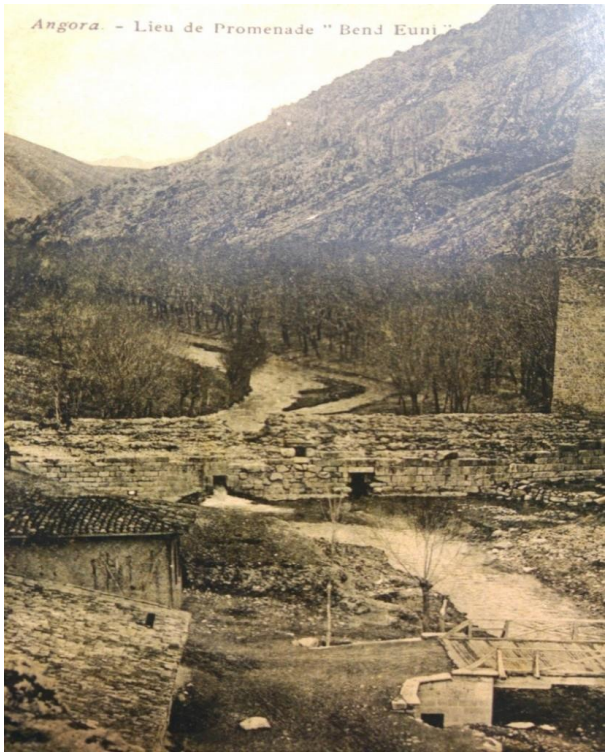

Fig. 9. The Ancyra Dam at the very beginning of the 20th century [a postcard with the description "Lieu du promenade "Bend Euni" (i.e. Bentönü – literally "in front of the barrage" – in Turkish)"].

The Aezani-Çavdarhisar Dam

A futher dam is located in Aezani (Aizanoi in Greek), 4 km west of Çavdarhisar quarter in the province of Kütahya in the territories of ancient Phrygia in west-central Turkey, for which in the eighties of the last century Friedrich Naumann did some documentation work (1982, 345–371; and James, Chanson 2002). This dam was situated on the Bedir River or Koca Çay, Classical Penkalas, a small tributary of the Rhyndacus (today Adırnas Çayı). It is 7 m high (10 m in Garbrecht 1991, 95–97), 6 m wide and 80 m long (**Fig. 10**). The rectangular blocks used in the construction of the upstream-downstream walls, 1 to 2 m long and 0.6 to 0.7 m wide, are made of meticulously worked limestone.

According to the studies of Naumann, the dam had three construction phases which are datable to the Roman and Late Roman periods. But according to Klaus Rheidt, who examined the dam later, it was built in two phases (Rheidt 1992, 290).

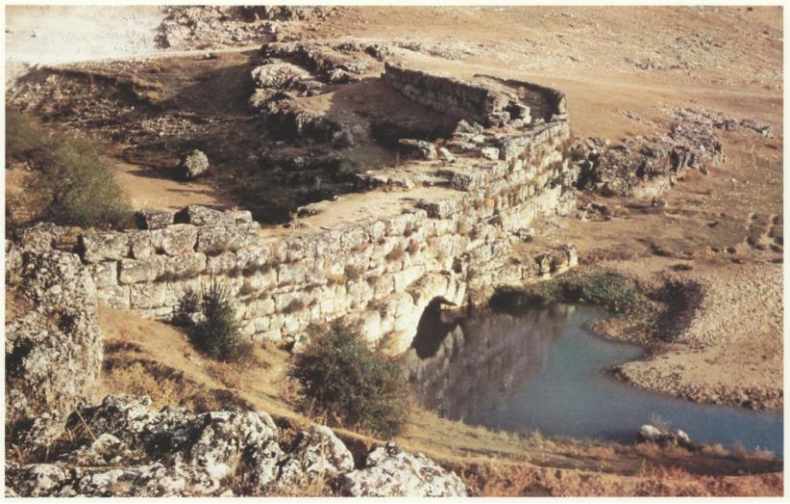

Fig. 10. The Aezani-Çavdarhisar Dam (after SCHNITTER 1978, 27).

The Aezani Dam which was at first built for flood protection, may have also been used as a bridge. There is an arched sluice for draining the collected water that also exists in the Örükaya Dam in central Anatolia. Today the vault of the lock is blocked by the alluvial layer and water.

Thanks to this dam, the river could drain in a controlled way in time of flooding. Naumann believes that the dam was destroyed by floods at different times and therefore repaired each time (Naumann 1982, 345–347). He noticed that the arched structure was never modified in the last two repairment periods. After its collapsing due to the first flood, restorations and renovations took place with reusing of marble blocks from damaged and abandoned buildings in nearby Aizonai as spolia.

As mentioned above, Naumann concluded in his studies that the Aezani Dam was built in three phases (Naumann 1982, 345–347). In the second phase the dam was raised and therefore may have been used as a bridge at this particular period. In the third and last phase, the reparations were carried out with large and well-cut blocks. In this period a new structure was built which was 4 m higher than the previous one. It rested on the rocky floor towards the north which increases the total length of the structure to 92 m.

As said before, the Aezani Dam was dated by Naumann to the Roman and Late Roman periods (Naumann 1982, 345–347). In the first construction phase the blocks were joined without mortar, while in the second and third phase they were connected with a filling of mortar.

Comparisons show that there are typological similarities, e.g. in Italy with buildings dating back to the Neronian period, but it cannot be excluded that further interventions were carried out in relation to the new urban plan of the city of Aezani which was started in A.D. 192.

A Roman aqueduct or dam construction near Sardis

During the Roman and Early Byzantine periods most of the population of Lydia, an ancient region in western Anatolia, was involved in some form of agricultural work and water was possibly the most important variable in the agricultural economy of Lydia. Roman Lydia's natural fresh-water sources – springs, streams, rivers and lakes – were naturally abundant in some places, entirely absent in others. Rainfall was unpredictable and water tended to scarcity when most needed, during the warm, dry summer growing seasons.

During the Roman period Sardis, the capital of Lydia, today's Sart quarter in the Turkish province of Manisa, had a fairly extensive *chora*, i.e. rural landscape, at the edge of the fertile Hermus plain and at the foot of the Tmolus mountains, as it was the metropolis of the major agricultural, mining, ceramic production, and coinage activities that needed access to a large workeforce. What makes Sardis a suitable land for settlement through the ages, is that the city and its *chora* are situated in the floodplains of the Hermus over a fertile soil cover. The landscape to the southeast of Sardis is dominated by agriculture (especially viticulture), as numerous scatters of ceramic and brick fragments from Lydian, Roman, and Early Byzantine times indicate. To the south of modern district of Çaltılı, a thick-walled construction was discovered dating back to Roman times, especially to the first half of the second century A.D. (**Figs. 11–12**). The district of Çaltılı is located 65 km east of Manisa city center and 7 km west of Salihli.

The architectural construction that was documented here is typologically similar to a bridge and may be related to an agricultural installation that involved the use of water perhaps to support mining operations, milling, farms or gardens. This assumption is especially based on the thickness of this construction which seems either to be carrying fresh water out of the city toward the east as an aqueduct, or a dam. It was constructed using a special technique with its positioning set in the narrowest part of the valley. Several aqueducts were built around Sardis throughout the Roman empire. Many of them have collapsed or been destroyed,

but a few number of intact portions remain. So far very few studies have been devoted to the water systems of Roman Sardis (Yegül 1986, 131–132); therefore, water distribution system and its relation to the urban settlement pattern is not known in detail.

In Roman Asia Minor some aqueducts or storage dams designed to store water for long periods were usually high (ranging between 5 and 20 m) and built at the narrow points of valleys. The water collected behind this dam provided the irrigation needs for the area to the south of the city of Sardis, which had a large population in ancient times. Prior to the construction of the Roman aqueduct or dam, the need for irrigation in the area was also covered by a small lake in the area.

This dam or aqueduct with its typical Roman masonry with conglomerate, concrete and thick, rubble walls with a maximum width of 5.5 m supported by arches, is a rare form of construction in Asia Minor. The maximum height of the walls is 8.7 m and the profile of the construction is in triangular form. The building material is of Roman cement with local stones and the upstream faces were coated with hydraulic mortar. This construction can make an important contribution to the elucidation of historical environmental conditions in Lydia and its archaeological uses. Additional archaeological remains belonging to this construction can be seen in some areas close to the construction, such as many channels, waterways, tunnels and arches, which are probably still hidden underground. It is not possible to date accurately the construction of this system. The ceramic finds indicate that this area has been used for a long time for various purposes.

The area around this aqueduct or dam was part of the agricultural hinterland of the city of Sardis during the Hellenistic, Roman and Early Byzantine periods. Even if water resources were abundant in this part of ancient Sardis, farmers needed an aqueduct or dam to collect the runoff for irrigation and perhaps this dam was ensured a supply of water for drinking and crop-irrigation to the surrounding area. It is possible that the aqueduct or dam went out of use because of the construction of new aqueducts. In any case this construction represents one of the most outstanding example of a water construction in Sardis during the Roman period.

Figs. 11–12. A Roman aqueduct or dam construction near Sardis (photos by E. Laflı, 2022).

Others

In addition to the main dams that we have summarized above, other structures have been studied in Turkey. For instance the structure in "Roxado" on Imbros, an island polis in modern Kaleköy on Gökçeada in northwestern Turkey, was considered as a dam by Carl Friedrich in 1908[4] whose hypothesis was later denied.[5]

Two Early Byzantine dams, namely Löşdüğün in Merzifon (sixth century A.D.) and Dara in Mardin (Anastasiopolis; A.D. 560), are also known from archaeological literature of Turkey.

Conclusions

In this brief article we have dealt in particular with six Roman dams in Asia Minor, respectively Böğet, Örükaya, Seleucia Pieria, Ancyra, Aezani and Sardis. These Roman dams in Anatolia have typological similarities to each other in the construction technique and in the construction systems for controlling the water level. The Aezani Dam is, for instance, very similar to that of Örükaya, due to the construction technique, its section and the presence of a sluice. Aezani lacks a water retention system. Furthermore, this dam is also very similar to other Roman dams built outside Anatolia.

In numerous cases, the abandonment or the reuse and modern reconstructions make it difficult to distinguish whether there is a proper Roman phase of these dams. Sometimes, as in Ankara, the dam has been completely destroyed.

It is certain that the construction of dams as well as other water control and regulation systems in Anatolia were part of an ancient tradition earlier than Roman period, and was then continued by the various civilizations that followed one another in the area.

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[5] Ousterhout – Held 1999, 62–63; and Ousterhout – Held 2000, 123–124.

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