

# The Water Supply of Constantinople 2002

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## Introduction

This research project, incorporating fieldwork as a major component, seeks to advance our understanding of urbanism in Constantinople throughout its history by investigating the provisions for water supply. Completed by the emperor Valens in AD 373 and supplemented by additional channels in the 5<sup>th</sup>-6<sup>th</sup> centuries, this is the longest known Roman water supply system, the main branch from Vize being in excess of 250km. Archaeological and hydrogeological research is being carried out on the channels and bridges outside the city and the cisterns and reservoirs within.

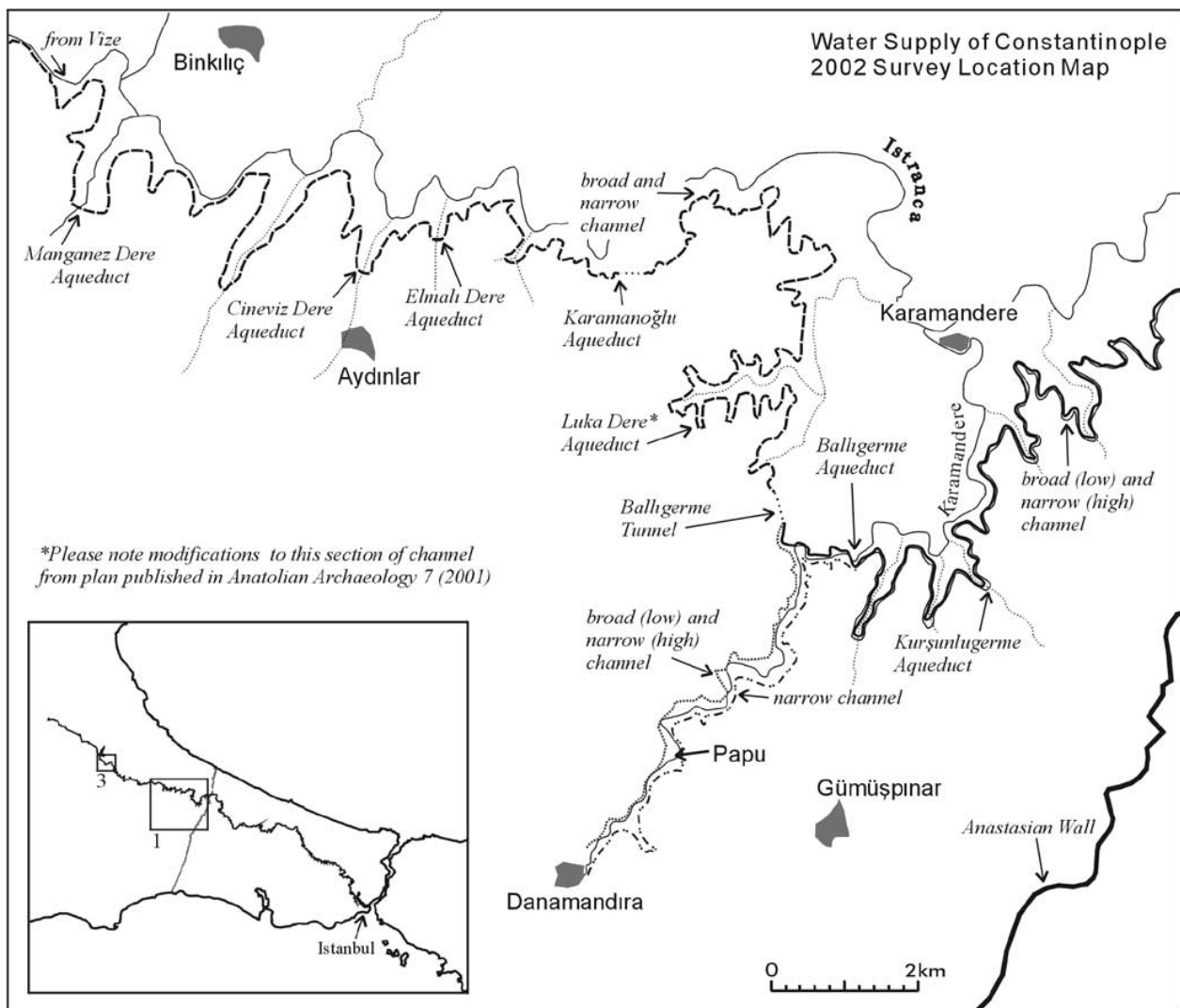


Fig. 1. 2002 Survey Location Map showing principal aqueduct routes.

Our fieldwork in 2001 had focused on the channel from the Balligerme Aqueduct eastwards and also on the major Danamandira (Papu) tributaries (Fig. 1). We were able to establish the physical relationship between this source and the main supply line and demonstrate that the springs of Danamandira had provided a substantial source for the original supply line in the 4<sup>th</sup> century (Bayliss, Crow, Bono, 2001). East of Balligerme two principal phases of the system have been identified: a c.1m wide channel representing the primary 4<sup>th</sup> century phase and a slightly lower and larger (1.6m wide) channel representing a massive supplement to the system, probably dating from the 5<sup>th</sup> century. The lower channel required new bridges to be built and in many cases the old bridges were abandoned, with both wide and narrow channels subsequently carried across the new, larger structures. In September 2002 we undertook our second full season of fieldwork on the aqueducts outside the city, in addition to a short investigation of the city's cisterns earlier in the Spring.

### **Vize-Balligerme**

The principal objective of the 2002 summer season was to investigate in more detail the evidence for the water supply system on the long (110 km) stretch between Vize and the junction with the Danamandira tributary (Fig. 1).

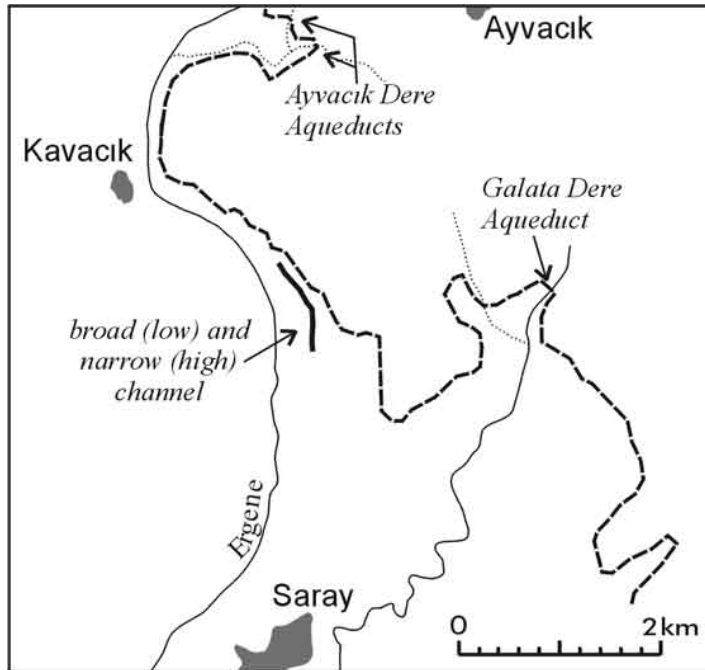
The archaeological remains in this region are more fragmentary than further east where the central region is heavily forested. Nevertheless it is possible on this long stretch to observe the remains of both narrow (0.6-1m) and wide (1.5+m) channels. However, it does not seem that these were separate channels in use simultaneously, as was found to the east of Balligerme. A more likely interpretation is that the broad *and* narrow channels represent two different phases of the same supply line. Numerous bridges were visited along this stretch and several expeditions were made through the forests where new channel observations were made.

Between Binkılıç and the Karamanoğlu Dere the channel was seen on several occasions in tributaries of the İstranca Dere (Manganez Dere, Cineviz Dere, Babadar Dere and Elmali Dere) and was found to be uniformly 1.5-1.6m wide (Fig. 2). Only in the Karamanoğlu Dere can two different gauges of channel be identified: the first, a 1.5m wide channel which passed through the ridge on the east flank of the valley by means of tunnel and the second, a 1m wide channel which was carried on a longer route around the same ridge. It was in no place possible to establish the physical relationship between the two channels.



**Fig. 2. Aqueduct bridge spanning the Elmali Dere near Aydınlar.**

Further to the west, in the catchment of the Ergene Dere north of Saray, reconnaissance revealed a particularly complex series of results on the stretch between the Ayvacık Dere and the Galata Dere (Fig. 3). In the remains of a bridge crossing a tributary of the Ayvacık Dere, samples were extracted for analysis from a section of channel was found with multi-layered sinter deposits and a large sample was extracted for analysis. The channel at this location was only 90cm in width. Slightly further to the south is the main bridge over the Ayvacık Dere. This would have been approximately 85m long and 13-14m high with three arches in a single tier, but now only the abutments and footings of the piers survive. Here, the channel crossing the bridge was a massive and unexpected 2.4m wide, but at a later date appears to have been reduced in width, perhaps to the 90cm gauge.



**Fig. 3. Principal aqueduct channels and bridges located in the region of Saray.**

The channel leaves the Ayvacık Dere and returns to the Ergene Deresi passing by the village of Kavacık. In this vicinity we were able to identify the narrow and a broad channels seen by Çeçen (Çeçen, 1996a). The narrow channel was clearly a continuation of the one seen in the Ayvacık Dere, while the broad channel was 1.6m wide and could be seen in places on a substantial platform (4-5m wide) lying some 22m below the narrow channel. Moving further to the east, the next location that a water channel can be identified with certainty is in the Galata Dere, where it crosses the fragmentary remains of a very substantial bridge which would have been approximately 130m long and 20-25m high, i.e. as long as Büyükgerme and as high as Talas (see Bayliss, 1999). A collapsed section of hillside on the east side of the bridge has revealed traces of the narrow channel (85-90cm wide) and there is no evidence of the broad channel in this vicinity. Hence, the function, origin and destination of the broad channel in this area remains uncertain, and an interpretation cannot be provided until further consideration is made of the regional data set.

### **Total Station Survey**

In addition to this reconnaissance activity detailed surveys were carried out on the Balligerme and Büyükgerme aqueduct bridges (Fig. 4). The former crucially lies close to the junction between the Vize and Danamandıra lines and both bridges preserve evidence of late repairs. Using a Trimble DR200+ Reflectorless Total station we produced accurate plans and elevation drawings of these two bridges. At the same time Jonathan Bardill (Newcastle University) undertook full study of the mason's marks on the bridges and was able to identify some significant correlations.



**Fig. 4. Reflectorless Total Station survey at Balligerme.**

### **Halkalı and the Maz'ulkemer**

Finally a further investigation was made of the Ottoman supply line which runs 15km to the west of the city to sources in the vicinity of Halkalı (Fig. 5). Here the Maz'ulkemer aqueduct bridge is of particular interest as the only apparent evidence of an earlier Byzantine or Roman system on this line (Mango, 1995). Considerable effort was made to gain access to this bridge, which is located within a military zone. With the support of Dr Alpay Pasinli and the assistance of the Topkule Kışlası personnel we were able to study the water bridge in great detail. We have concluded that this bridge, while showing several phases of modification, is entirely Ottoman in date. It therefore seems less likely now that the Halkalı springs provided the original sources for the Hadrianic water supply of the city, which instead probably originated north of the city in the Cebeciköy valley, on what was later the Ottoman Belgrade Forest line (see (Çeçen, 1996b)). A detailed article on the Maz'ulkemer bridge is currently under preparation to ensure the rapid publication of these results.



**Fig. 5. The Maz'ulkemer aqueduct bridge.**

## **Cisterns in the City**

Following on from our previous work on the open-air reservoirs of the city we spent 10 days in Spring 2002 studying the city's smaller Byzantine cisterns. Many of the cisterns recorded by Forchheimer and Strzygowski at the end of the 19th century (Forchheimer, Strzygowski, 1893) are now either unknown inaccessible or destroyed, making a reappraisal of their work somewhat problematic, but we were still able to study over 30 cisterns in some detail.

A primary objective was to investigate the topographic relationships between the cisterns and to look specifically at water distribution within the city. The main premise of the working model was that Byzantine water channels are known to have entered the city at two different heights. The long-distance supply line from Danamandıra and Vize entered the city near the Edirne Kapı at a height of 63-4m, from where it was able to supply much of the city. In addition, a second channel is known from the Belgrade Forest to the north of the city, which entered the Theodosian Walls near the Eđri Kapı, at a considerably lower level of 33-5m. This model has very significant implications for water provision to different areas of the city in the Byzantine period, particularly relating to the distinctions that can be drawn between the 2nd-century "Aqueduct of Hadrian"(reported in 6<sup>th</sup>-century Byzantine sources) and the 4th-century long-distance water channel completed under Valens. A substantial paper on our discoveries is in preparation and is planned for publication in 2003.

## **Acknowledgements**

It is with much gratitude that we acknowledge the assistance of Mustafa Demirel of the Antalya Museum and Neslihan Güder from the Monuments and Museums General Directorate who acted as representatives of the Directorate for the Spring and Summer seasons respectively. We also wish to thank the Directorate and its Director, Dr Alpay Pasinli for permitting and facilitating the continuation of our research in 2002. Once again we were kindly received by our colleagues at the Istanbul Archaeological Museum and in particular wish to thank the Director, Dr Halil Özek.

Mehmet Akif İşin of the Tekirdađ Museum was as ever an enthusiastic host and we were delighted that he was able to join us on a day of fieldwork in the vicinity of Kavacık. We also thank him for his time in the preparation of the documents for the sinter sample from Ayvacık. Başkanı Selami Deđirmenci and his staff in the Silivri Belediye made us feel most welcome in the city and we particularly thank Mr Özcan Işıklar (Deputy Director) for his great efforts to assist our research. We were fortunate to be joined by Kristin Romey, managing editor of Archaeology Magazine, who was given a three-day, high-velocity introduction to our research.

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## **References**

- Bayliss, R 1999. Anastasian Wall Project. [http://museums.ncl.ac.uk/long\\_walls/index.html](http://museums.ncl.ac.uk/long_walls/index.html).
- Bayliss, R, Crow, J, Bono, P, 2001: 'The water supply of Constantinople' *Anatolian Archaeology* 7: 18-20
- Çeçen, K, 1996a: *The Longest Roman Water Supply Line*. Istanbul
- Çeçen, K, 1996b: *Sinan's water supply system in Istanbul*. Istanbul
- Forchheimer, P, Strzygowski, J, 1893: *Die Byzantinischen Wasserbehälter von Konstantinopel*. Wien
- Mango, C, 1995: 'The Water Supply of Constantinople' in Mango C, Dagron G and Greatrex G (eds) *Constantinople and its Hinterland*. Aldershot: 9-18.