Water-supply infrastructure of Byzantine Constantinople

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Modern water-supply systems — hidden beneath the ground, constructed, expanded, adapted and repaired intermittently by multiple groups of people — are often messy and difficult to comprehend. The ancient water-supply system we consider here is no different — and perhaps even more complex as it was developed over 1200 years and then had a modern city built on top. Despite this, we are beginning to understand how one of the Roman world's most important cities provided its population with water.

The remains of water infrastructure in Constantinople attest to a complex system of water-management and distribution, one that developed from the colony of Byzantium, through the growth and eventual decline of the new capital of the Roman empire, until conquest by the Ottomans. Aqueducts — the system of channels, bridges and tunnels designed to carry water through the landscape — were the focus of infrastructure investment in earlier periods, but cisterns for the storage and distribution of water were constructed throughout the time of Byzantine Constantinople. While recent archaeological studies have ensured a better understanding of the key elements of the system,[1] they have not investigated how the water was distributed within the city. The present study, part of the research programme "Engineering the Byzantine water supply: procurement, construction and operation", aims to apply contemporary civil engineering techniques to elucidate the city's hydraulic infrastructure.[2] Much of our knowledge of hydraulic delivery and distribution in ancient urban settings derives from cities such as Pompeii and Ephesos where the infrastructure is accessible,[3] rather than from Rome or Istanbul where modern development obscures the ancient city.[4] By adopting an engineering perspective, we aim to counter the fragmentary nature of the archaeological evidence, integrating the scattered evidence into a functional whole.

The water supply in Constantinople had three distinct elements: two aqueducts (the Hadrianic Line and the Valens Line) and cisterns of varying sizes throughout the city;

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1 C. Mango, "The water supply of Constantinople," in id. and G. Dagron (edd.), *Constantinople and its hinterland* (Aldershot 1995) 9-18; K. Çeçen, *The longest Roman water supply line* (Istanbul 1996); J. Crow, J. Bardill and R. Bayliss, *The water supply of Byzantine Constantinople* (London 2008).

2 A parallel study is considering the application of construction management techniques to determine the processes of construction and issues concerning procurement and the workforce; see J. R. Snyder, L. C. Stephenson, J. E. Mackie and S. D. Smith, "Agent-based modelling and the Byzantine: understanding the construction of antiquity's largest infrastructure project," in P. W. Chan and C. J. Neilson (edd.), *Proc. 32nd Annual ARCOM [Assoc. of Researchers in Construction Management] Conference* (Manchester 2016) vol. 2, 963-72.

3 Cf. D. Keenan-Jones, "Somma-Vesuvian movements and the water supply of Pompeii and the Bay of Naples," *AJA* 119 (2015) 191-215 for a recent study of Pompeii; for the ceramic pipe network from Ephesos and how distribution changed over time, cf. J. Pickett, "Temples, churches, cisterns and pipes: water in late antique Ephesus," in G. Wiplinger (ed.), *De aquaeductu atque aqua urbium Lyciae Pamphyliae Pisidiae* (BABesch Suppl. 27) 297-312 — in contrast to other more traditional aqueduct studies in S Turkey reported in the same volume.

4 See the integrated study from Barcelona, albeit on a lesser scale: H. A. Orengo and C. Miró i Alaix, "Reconsidering the water system of Roman Barcino (Barcelona) from the supply to discharge," *Water History* 5 (2013) 243-66.