

WATER & CITY

HYDRAULIC SYSTEMS AND URBAN STRUCTURES

editors

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TYPICAL HUMAN SETTLEMENTS, CITIES AND RELATED ANCESTRAL HYDRAULIC SYSTEMS: A COMPARATIVE APPROACH THROUGH EXAMPLES FROM THE MENA REGION AND EUROPE

Fairouz Megdiche-Kharrat
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Rachid Ragala

Introduction

In arid and semi-arid ecosystems, sedentism and the emergence of cities were first made possible due to water ancestral techniques and practices that defied the scarcity of the resource and insured its availability over time. These are typical hydraulic systems commonly encountered in the MENA region (Middle East and North Africa) and in some European countries where they are still operational, in most cases. It appears that these systems build and animate human and non-human lives in countries as diverse as Iran, Oman, Tunisia, Algeria, Morocco, Spain and Switzerland where they present a rich and diverse terminology, respectively, *qanat*, *falaj*, *mkoula*, *foggara*, *khettara*, *galeria* and *bisse*.

Mechanism of the Systems

These ancestral systems provide water to communities of users by means of underground drainage of aquifers or by channeling water from neighborhood wadis, torrents or springs. A typical qanat has a tunnel that goes under the ground, at depths that vary from one system to the other depending mainly from the topography and watertable's depth, from the first surface emergence until it reaches the aquifer. Series of shafts are visible on the ground surface, they allow the access to tunnels and provide air for workers; and are used above all for spoil removal.

All adopted water acquisition procedures, as shown in Fig. 1, relay on gravitational techniques which are in harmony with local water availability. Their management works through organized distribution scales that serve local beneficiaries and large communities of users.

Origin of the Systems

P. W. English¹ asserts that *qanat* technology was first adopted in the high plateaus of Western and Eastern Iran and in Northern Iraq, about 2,500 years ago. H. Goblot confirms also this hypothesis and mentions precisely “Urartu”, about 800 to 600 BC, as the origin of *qanat* technology; he asserts that it was exported to other regions, toward the West, through Islamic conquests and Arabic expansion, then by the discovery of the new world, and toward the East through the silk road². But P. M. Costa³ believes that the technique was invented in Southern Arabia, specifically Oman, where they took advantage from their expertise in copper mining in the middle of the third millennium BC. However, other scientists, based on some historical systems dating in various regions else than the Middle-East, suggest the hypothesis that this technology was developed simultaneously and independently as a mean of local environments adaptation⁴. However, the oldest evidence of the existence of *qanats* consist of the 430 lines tablet illustrating the eightieth military campaign of Sargon II, the king of Assyria, against the Urartu Kingdom in Northwestern Iran in 714 BC⁵. *Qanats* are mentioned in the tablet’s text which describes, among others, the itinerary of the king leading his army and the geographical contexts and the cities he passed through, such as “Ulhu”⁶. According to this report, it was a city situated at the foothill of a mountain in a dry region which became prosperous due to irrigation. Indeed, the lines 199 to 210 describe the city of “Ulhu” and mention that their Urartu king “Ursa” had made the water gush out by digging a canal conveying the flowing water thus irrigating farmlands in all seasons; the text describes the hydraulic works (canal, gorges in large number, dikes, dams or reservoirs, etc.) and the types

of crops (fruits, grapes, cereals, grasslands and pastures, etc.)⁷. This depiction corresponds perfectly to the city of Marand, in Northeastern Iran, described by travelers like Tavernier, Chardin and Henri Binder as an oasis implemented by a network of watercourses that bring water from the mountain⁸.

The Scope of the Study

This research presents these ancestral hydraulic systems in different geographical contexts and highlights their implication in the genesis of specific anthropogenic landscapes that vary from green spaces and agricultural areas to domestic habitat and urban infrastructure. This research intend to explore those landscapes in various regions through a spatial comparative approach.