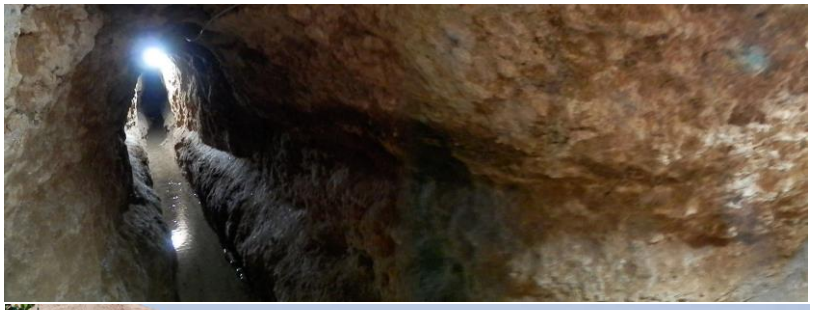
QANATS FROM IRAN
AN ANCIENT SOLUTION PROVIDING WATER FOR HUMAN SETTLEMENTS AND AGRICULTURE IN HOT CLIMATES

By Antonello Sacchetti



Qanats are still very much in use today. For instance, in Iran there are still 37,000 Qanats in use that are providing water to millions of people.

Iran's territory has two great deserts, most rivers are seasonal and have never not been able to supply the needs of human settlements. Major rivers like the Arvand, Aras, Zayandeh, Sefid and Atrak were few and far between in the vast lands of Persian antiquity. Summers are very hot and even in winter the weather is very dry. So, how could the famous Persian gardens developed in a so harsh climate?

The answer is the *Qanat.* The word is Arabic, but the idea is Persian. Qanats are underground channel with a series of vertical access shafts, used to transport water from an aquifer under a hill. Qanāts create a reliable supply of water for human settlements and irrigation in hot, arid, and semi-arid climates.

Qanats have been included in the Globally Important Agricultural Heritage Systems GIAHS promoted by the Food and Agriculture Organization of the United Nations (FAO). The GIAHS Initiative was launched for the conservation and adaptive management of the world's agro-cultural heritage systems.

Persian people created Qanats sometime in the early 1st millennium BC, and spread from there slowly westward and eastward. Many Qanats are still in use not only in Iran but in many countries all over the world, from China on the east to Morocco on the west, and even to the Americas. In Italy, it's still possible to visit ancient Qanats in Palermo's undergrounds.

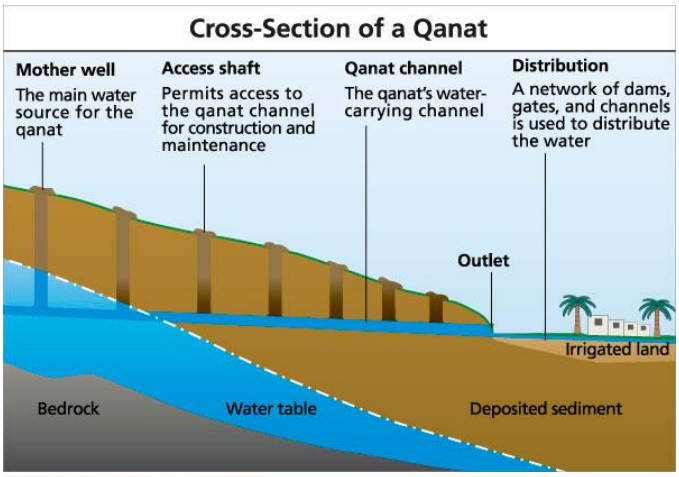
Qanat tunnels were hand-dug, just large enough to fit the person doing the digging. Along the length of a Qanat, which can be several kilometers, vertical shafts were sunk at intervals

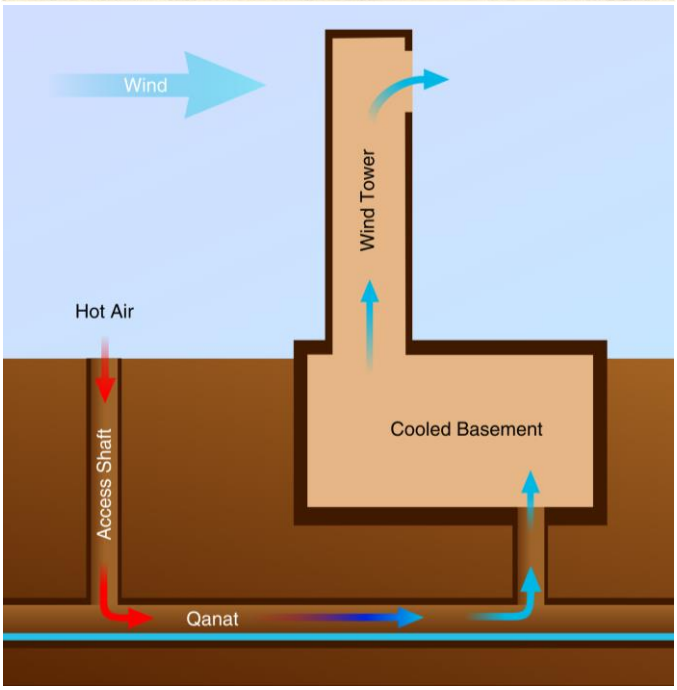
of 20 to 30 meters to remove excavated material and to provide ventilation and access for repairs. The main Qanat tunnel wells (up to 100 meters deep) sloped gently down from pre-mountainous alluvial fans to an outlet at a village. From there, canals would distribute water to fields for irrigation. In this way Persian farmers could resist despite long dry periods when there was no surface water to be had. Although a Qanat was expensive to construct, it was very important for the development of many communities in the Persian area first and then in the Middle East.

Qanats used in conjunction with a wind tower can provide cooling as well as a water supply. A wind tower is a chimney-like structure positioned above the house; of its four openings, the one opposite the wind direction is opened to move air out of the house. Incoming air is pulled from a Qanat below the house. The air flow across the vertical shaft opening creates a lower pressure (Bernoulli effect) and draws cool air up from the Qanat tunnel, mixing with it. The air from the Qanat is drawn into the tunnel at some distance away and is cooled both by contact with the cool tunnel walls/water and by the transfer of latent heat of evaporation as water evaporates into the air stream. In dry desert climates this can result in a greater than 15 °C reduction in the air temperature coming from the Qanat; the mixed air still feels dry, so the basement is cool and only comfortably moist. Wind tower and Qanat cooling have been used in desert climates for over 1000 years.

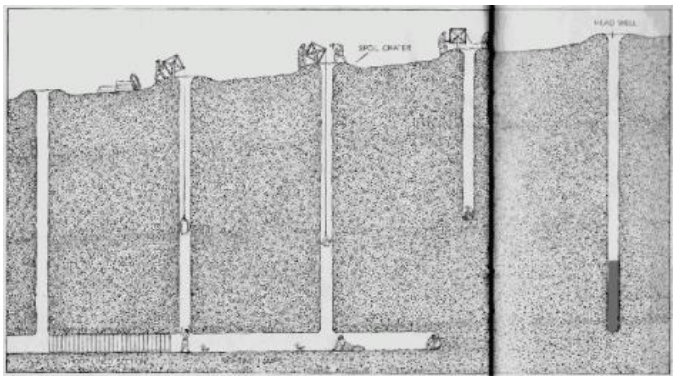
By 400 BC, Persian engineers had mastered the technique of storing ice in the middle of summer in the desert. The ice could be brought in during the winters from nearby mountains. But in a more usual and sophisticated method they built a wall in the east–west direction near the yakhchal (ice pit). In winter, the Qanat water would be channeled to the north side of the wall, whose shade made the water freeze more quickly, increasing the ice formed per winter day. Then the ice was stored in yakhchals - specially designed, naturally cooled refrigerators. A large underground space with Qthick insulated walls was connected to a Qanat, and a system of wind-catchers or wind towers was used to draw cool subterranean air up from the Qanat to maintain temperatures inside the space at low levels, even during hot summer days. As a result, the ice melted slowly and was available year-round.

Today a new international attention to revitalize these ecological solutions, in view of a more sustainable development is recorded. In Tehran the ancient underground water network was abandoned in the sixties, at the wake of modernization. A project started by HydroCity - an international research and design platform - is





studying how the reappraisal of this ancestral infrastructure could serve to fertilize public space, create productive landscapes, and bring creative oxygen for a highly polluted metropolis.



To know more

Kashan-Iran Qanat in GIAHS-FAO website

Kashan-Iran proposition in GIAHS-FAO website

Article in hydratelife.org

Article in destinationiran.com

Article in hydrocity.ca

Article in waterhistory.org

Article in users.bart.nl

Article in deccanheritagefoundation.org

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