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A Study of Qanάt and Gabarbands in Balochistan

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Abstract:

The accumulation of recent findings from an archaeological standpoint observed from different parts of Balochistan necessitates a new overview of a prehistoric irrigation system of this region. It was assumed that 4,000 years ago the population of Balochistan was sparsely distributed and the catchments covered with lush green forests. However, agrarian settlements in different areas during the post and mature Harappan periods exhibited a tremendous anthropogenic pressure on fragile ecosystems that resulted in metamorphic changes in past climate of these regions. The presence of gabar-bands, intended for the control of flooding surface water, and constructing Qanãt, in different parts of Balochistan are clear evidence of climatic changes from subtropical to semiarid desert. In this paper the prehistoric climate of Balochistan will be discussed in the light of gabar-bands and Qanãt. Similarly, the history of these ancient technologies will also be discussed.

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Key words: *Balochistan, prehistoric climate, gabar-bands, Qanãt.*

Introduction:

With the emergence of agricultural system, fundamental changes occurred in social organization and cultural ecology in ancient societies, particularly the human perception of the landscape in which they inhibited (Fuller 2006). The archeological evidence of flora and fauna of an area as outlined by Childe (1936) should be regarded as food production, which indicated the evolving attitude of a society from "hunter gatherer" to permanent settlement (sedentary). Therefore, water not only important for basic survival, but also helped in shaping the social structure of the primitive societies world. The availability of permanent sources of water flourished these primitive societies and turned them from a hunter gatherer society to well established agrarian societies. According to Childe (1953) the agricultural surplus enabled the Indus Valley Civilization into a "single "empire" among a number of smaller sites — provincial townships, fortified villages, and possibly frontier posts and factories… That a "ruler" dwelt in the citadels is clear, and the attachment thereto of the great granaries concretely expresses his economic power". The Indus Civilization and its peripheries including the scattered urban settlements in Balochistan derived their wealth from a combination of agriculture and trade; however, total dependence upon perennial sources of riparian water also exposed the vulnerabilities of these systems. For instance, the flow of these rivers is sensitive with frequent movement of sand dunes which are dominant around the banks of rivers. Working on the ruins of Mohenjódaro, Ernest J.H. Mackay (1948) accidently discovered the river sedimentations far away from the present flowing site River Indus and he concluded that Mohenjo-Daro might have been abandoned because of asunder of the Indus River. Hence the avulsion of the River Indus not only triggered the process of abandonment of Mohenjo-Daro at the turn of the third millennium but also transformed the Indus Civilization into different regional dominions such as Sindhi Domain, Kulli Domain *etc.*, (Possehl 1997).

Once the importance of dynamic factor of the River Indus in the process of Indus Civilization were well established; new hypothesis that the waters of the River Indus were impounded by a

natural dam across the river presented by Robert Raikes and G.F. Dales in their collective (Raikes and Dales 1977, Dales and Raikes 1968) and independent work (Raikes 1964, 1967 a,b; Dales 1965 a,b). However, critique to these findings Wasson (1987) observed that these little structural dams could not have withstood the pressure exhibited by water flow of the Indus River. Therefore, it is believed that forming of a large natural dam across the Indus, might be results of natural earthquakes occurred in the prehistoric periods (Possehl 1997). To review different paradigms on decline of the Indus Civilization is beyond the scope of this paper, the only point which we are raising is, the construction of dams and channeling the subterranean water sources for the irrigation purposes was not evident in any stages of (pre- mature and post) Harappan periods in the Indus Valley and surrounding areas of Balochistan. Therefore, these irrigation technologies were originated elsewhere in later periods and eventually imported into Balochistan and surrounding areas.

The Pre-historic climate of Balochistan:

Today, climatically, Balochistan is classified as an arid zone with the lowest rainfall 20-30 cm (average 22 cm) per annum. The precipitation in Balochistan is noticeably unpredictable and erratic. When Balochistan came under the indirect rule of British Empire they started recording the precipitation of this region and according to these data 1902 was the year with the lowest recorded precipitation (11 cm) and the lowest average precipitation for two consecutive years was 12 cm in 1901-1902. The highest recorded precipitation was 59 cm in 1890, and the highest average for two consecutive years was 47 cm in 1889-1890. Similarly the weather documentations for the past 100 years show that only 30% of the time the precipitation has been more than 25 cm and for 10 % of the time in excess of 35 cm. However, based on archeological findings it is generally suggest that there has been a considerable decrease in the rainfall of Balochistan since antiquity (Stein 1931). The assumption of lush green forests in prehistoric Balochistan due to mild climatic conditions is subjected to constant critical review in the light of recent findings.

The problem with the gradual inclination of weather pattern from wet to dry or arid climatic conditions in Balochistan is stability in distribution of prehistoric and present-day populations (Raikes, and Dyson 1961). Working on ruins of Killi Gul Mohammad (Quetta) Fairservis (1956) noticed that "…sites occur almost everywhere in the valley where fertile soil and water exist today, indicating that climatic conditions and the ecology of the modern Quetta valley are comparable to those of prehistoric times." The inhospitable climatic conditions from antiquity to modern time are the main driving force to obliterate the possibilities of permanent settlement of a large population in different parts of Balochistan. Therefore, Piggott (1950) concluded that the largest mound of the Quetta region was more or less a small village and average size of the Amri-Nal mounds did not exceed two acres. Although on the ruins of Nal area Piggott (1950) estimated 100 burials chambers which are possibly as suggested by Raikes, and Dyson (1961) "represent a communal burial area serving more than one village.

From these examples if we assume that in antiquity the way of life of inhabitants of Balochistan due to similarity in weather pattern was same with present-day inhabitants then the survival of ancient populations is entirely conditioned by the supply of water (Raikes, and Dyson 1961). Similarly the water as a limiting factor also supports a nomadic way of living and their living pattern similar to that of today. During reconnaissance surveys of the Bolan and Mula Pass areas De Cardi noted the similar seasonal migratory pattern. In summary, there is a paucity of scientific findings, due to which it is hard to conclude a clear picture on the ancient climatic condition of Balochistan.

Qanáts and *Gabarbands:*

From antiquity till modern time in Balochistan, water in the form of rain and snow are not sufficient for an extensive agricultural activities therefore, the local inhabitants of these regions invented some unique methods of irrigation system to inundate their crops. These are *qanáts* and *gabarbands*.

A *qanát* is defined as an underground channel created to connect an underground water source (aquifer) situated into the deeper layers of soil and brought it up to an agricultural land lower in the valley (English, 1968). This method requires a much higher

level of technological attainment compared with canal irrigation system found in other provinces of Pakistan. Compared with the Iranian plateau, Balochistan is the home of relatively few *qanát* and it is believe that none of them were dug by Baloch people. The *gabar-bands* considered to be storage dams or check dams (Stein 1931). Once floodwater passed through these stone built structures, silt to be deposited gradually upstream (Raikes, and Dyson 1961). The construction of *qanáts* and *gabar-bunds* required large quantities of manpower as well as engineering skill (Fig. 1).

Etymology:

The Persian, term *Qanát* used for underground canals. Qanát (Ghanat) is in fact an old Semitic term and ancestor of word *xavva* (Greek), *conna* (Latin) channel and canal. In Balochi, "*kahan*" is synonym of *Qanát*. In Afghanistan, Pakistan, northern China, Sinkiang, and Soviet Central Asia, the underground water channel system is known as *káréz*. In Yemen and Saudi Arabia it is known as *sahzidg* and in the United Arab Emirates and Oman as *falej* (Lambton 1953). On the other hand, *gabar-bands* or *gaurbands* stone-faced walls or "dams" attributed to the *gabar* or *gaur* (the worshiper of fire, Zoroastrians, Old Persians,) intended for the control of surface water, and usually presumed to be prehistoric (Raikes, 1965).

The history:

The history always started with a myth which becomes a legend and legend becomes a part and parcel of history same happened with origin of *Qanát*. According to *Ibn-i-Faqih*, the 10th century Iranian historian, that one of the Kings of Iran arrested a group of scholars and philosophers and ordered their imprisonment in Kerman. At the prison there was no surface water but there was water fifty meters underground. Realizing the hardship of prison, these philosopher and scholars invented *qanats* and brought water to the surface and so eventually converted barren areas of Kerman into a lush green forest. They taught this principle to the people (Beaumont, *et al.,* 1989).

It is believed that the origin of *Qanát* techniques took place in the old kingdom of Urartu around late Urumiyya in north-western Persia. A *Qanát* was built by Assyrian king Sennacherib

(705-681 BC), whose father Sargon II claims to have learnt the secret of *Qanát* system in his campaign against Urartu. According text found in a tablet, Sargon's eight campaign (714 BC) deal with the flourishing civilization in and around the town of Urartu which was devastated by invading Assyrian army. The text started with an introduction of new drainage and irrigation methods used by Urartu and relieved the drought which had previously affected the country and its population (Laessøe, 1951). The text reads (lines 202-204): "Following [his inge] nious inspiration Urartu, their king and lord [….text missing…] revealed the water-outlet(s). He du(g) a main ditch (*palgu*) which carried flowing waters, [and….;waters] of abundance he caused to flow like the Euphrastes. Countless ditches (atappus) he led out from its interior [and….] he irrigated the fields" (Laessøe, 1951). With the help of Qanát system the waste land converted into a fertile province.

From this text it is clear that *Qanát* system is originated in ancient Persia because Persia unlike ancient Iraq is lacking any major perennial source of water (*Siyáháp*). Therefore it is obvious that the necessity of uninterrupted flow of water for irrigation purposes were the main reasons behind the induction of *Qanát* system in Persia. However, once the Assyrians realized the importance of *Qanát* system in the life of Persian life they used this system against them by destruction of *Qanát* system. The text read:

"I blocked the outlet of the canal (hiritu), the stream (which was) his reservoir, and turned the fresh water into mud" (Laessøe, 1951)."

Therefore, once Sargon learned the secret of tapping water from underground tunnels supplying the city of *Urartu* (Ulhu) and destroyed that system of water supply. He thus forced the city to surrender.

After the death of Sargon his son, Sennacherib, became the Assyrian ruler, he built his palace in Nineveh about 700 BC and supplied it by *Qanáts*. Moreover, the king of Babylon, Nebuchadnazzar, supplied his palace by *Qanát* because his wife, an Iranian Princess, did not like the turbid, silty and dusty water of the Euphrates River (Beaumont, *et al.,* 1989). Although, there is paucity of archaeological findings that irrigation system by means of *Qanáts* was ever adopted in Assyrian civilization, but excavations undertaken in early 20th century at Erbil showed that

Sennacherib surely built a constructional system having similarity between a tunnel and a *Qanát* (Laessøe, 1951). Sennacherib's inscription reads:

"Three rivers …
The water from springs to the right and left
At the sides of these rivers-
I dug and added (it) to them.
I dug a tunnel and....." (Laessøe, 1951).

With the advent of Achamenian Empire *Qanáts* appear to have spread in the different parts of Middle East which were conquered by Persian Empire and it is probable that during the Achamenian dynasty the *Qanát* system may also arrived in Balochistan (Laessøe, 1951). The Greek travelers were the first people who reported the presence of *Qanát* system in Balochistan as early as 300 BC—provide irrigation to entire inhabitants (van Steenvergen 1995).

Although some researchers, (Rahman, 1981) had an opinion that Indus valley civilization as the origin of this irrigation system. According to Rahman (1981) in the Indus Valley Civilization site at Moenjo Darò in Pakistan, the water was drained through such gently covered drains from the source areas to desired outlets about 5,000 years ago. However, these covered canal systems are not categorize as "*Qanát*", as main sources of these aquifer was the Indus and tributaries rather subsurface water sources which required for *Qanát* system.

Therefore, the authors of this paper have an agreement with authorities who credit Persians for the *Qanát* technology and place its origin between 2-3,000 years ago. The exact period of this system was estimated 500-600 B.C (Laessøe, 1951). It is because as a matter of fact that during the Achamenian rule (6th century BC to 321 BC) the *Qanát* system was widely used in Iran.

Qanát system in Balochistan:

In Pakistan *Qanát* irrigation system is endemic only in Balochistan province. The major concentration is in the north and northwest along the Pakistan - Afghanistan border and oasis of Makkurán division.

As mentioned earlier the acute shortage of water resources give water a decisive role in the regional conflicts arose in the course of history of Balochistan. Therefore, in Balochistan, the possession of water resources is more important than ownership of land itself. Hence afterward a complex system for the collection, channeling and distribution of water were developed in Balochistan. Similarly, the distribution and unbiased flow of water to different stockholders also necessitate the importance of different societal classes in Balochistan in general and particularly in Makkurán. For instance, *sarrišta* (literally, head of the chain) is responsible for administration of channel. He normally owns the largest water quota. Under *sarrišta,* there are several heads of owners (*hissadár*) who also possessed larger water quotas. The social hierarchy within Baloch society of Makkurán depends upon the possession of largest quotas of water. The role of *sarrišta* in some cases hierarchical and passing from generations within the family and he must have the knowledge of the criteria of unbiased distribution of water among different *hissadár* (Figs. 2-3).

The sharing of water is based on a complex indigenous system of measurement depends upon time and space particularly to the phases of moon; the *hangáms*. Based on seasonal variations and share of water the *hangám*s are apportioned among various owners over period of seven or fourteen days. However, in some places, instead of *hangám, anna* used which is based on twelve-hour period for each quota. Therefore, if a person own 16 quotas it means that he is entitled for water for eight days in high seasons and 16 days in winter when water level went down as well as expectation of winter rain (*Baharga*) in Makkurán region. The twelve-hour water quota again subdivided into several sub-fractions of local measuring scales such as *tás* or *pad* (Fiorani and Redaelli 2003).

Gabarbands:

Another important aspect of irrigation system in Makkurán and Balochistan is development of *Gabarbands* or *Gohrband*. Hughes Buller was the first person who scientifically worked on these *Gabarbands* and published his comments in the form of research article in Archaeological Survey of India: Annual Report 1903-1904. He notes the existence of level silty areas above the

gabarbands and that the level of the silt is nearly that of the top of the band. In his article he described three different methods of construction of *gabarbands:* firstly, a stepped (both sides) construction consisting at each step of two corresponding masonry walls of dry-stone construction with earth and rubble infilling between; secondly a solid masonry wall; and thirdly, the same as the second but with supports on both faces. According to Hughes Buller these *gabarbands* must have been built by other than the present inhabitants of Balochistan because, "are only now emerging from barbarism and have no notion of the use of stone in building... Even in cases in which small breaches have occurred in ancient dams, and where they are still useful for purposes of irrigation and raising crops, the existing inhabitants only fill up the breaches with earth and not with stones". This statement showed the European biasness, and several modern anthropologists including Roberts Raikes (1965) did not agree with him, particularly his notion of "emerging from barbarism."

Hughes Buller concludes by deducing that Persian Zoroastrians, Buddhists or Arabs were the builders and decides that the weight of evidence favors the first. In *Balochi* and *Bráhui* languages, *Gabarbands* stands for "Dams of the Zoroastrians". Although, stereotypic belief of these *Gabarbands* as dams or bunds is not totally true and Sir Aurel Stein, (1931) was of the opinion, that these structures served a variety of purpose and that only a few were dams.

Working on *Sur-damb* at Nál in 1925, Hargreaves, writing about his excavations: "the conclusion can hardly be avoided that when this Nál Culture flourished physical conditions were more favorable than to-day, not necessarily because the rainfall was markedly heavier than now, but because the then inhabitants by concerted action more carefully conserved and controlled the water supply and, in so doing, assisted in the formation of alluvial soil over the dry and rocky sub-stratum... and it is, in all probability, to this stone-using race that should be attributed the ancient *gabarbands* so numerous in Jahláwán and other parts of Baluchistan" (Hargreaves 1929).

It is important to clarify some etymological misconception regarding the word *Gabarband* because it sounds that in prehistoric time the climate of Balochistan was wetter and afforded a lush

green ecosystem. Therefore, these *Gabarbands* were constructed as water reservoirs. However in Balochi, "*bund*" does not only have the meaning of dam: it is used to describe any bank or wall used for the seizing, diversion or guiding of flood or perennial water as well as for the very lows banks used for the retention of shallow flood water or local run-off in *sailápag* fields. Similarly, the prevailing weather patterns of Balochistan did not change from antiquity to modern time and it remains same as modern time (Raikes, 1965).

As it is mentioned earlier that subsurface water channels were diverted with the help of *Qanát* system but these underground rivers are unfortunately not present everywhere in Balochistan therefore, it is one of reasons that we do find frequent occurrence of *Qanát* system in Balochistan. The majority of farmers of Balochistan depend upon the rain-fed agricultural system which is based on partial diversion of intermittent flood flows during rain. For this purpose, a small temporary bank of brushwood, *Tamarix aphylla* (*Gazz*), and/or *Acacia nilotica* (*čiš*) boulders, soil-whatever is available is used to construct a dam across part of a normally dry torrent bed in order to divert a part of a flood into a previously dug channel. Therefore the direction of flood water with the help of these *bund*s was diverted and allowed to feed the agricultural lands. Even though the general perception, as far as the construction of *Gabarbands* is concern is that, took place during the Achamenian and Sassanid dynasties, but this ancient technology to some extent is still in use in different parts of Balochistan for diverting the flood water (Raikes, 1965). The preparation of these bunds consists of constructing, by hand or with the help of bullocks and scraper boards. Again the construction of these bunds is depending upon the involvement of local communities which bound them together due to their mutual interests. These bunds are infrequent in rain-fed (*ázmán gindén zamín*) agricultural systems of Makkurán and other parts of Balochistan.

Conclusions:

As it says in English "necessity is the mother of all inventions" the extreme climatic conditions and unpredictable rainfall influenced the local populations of Balochistan to

borrowed or developed indigenous technology for sustaining their survival in this harsh climate. The history as a graveyard of events of past, helps us in our understanding the problems of present and provides the solution of these problems. In conclusion, the local people of Balochistan in course of history learned how to survive in this desolate and inhospitable environmental condition by adopting state-of-art technologies and were ahead of their times. The both, *gabarband* and *qanat* irrigation system survived from early history to modern times in Balochistan largely due to consistency in the environmental condition, i.e. harsh and unfavourable.

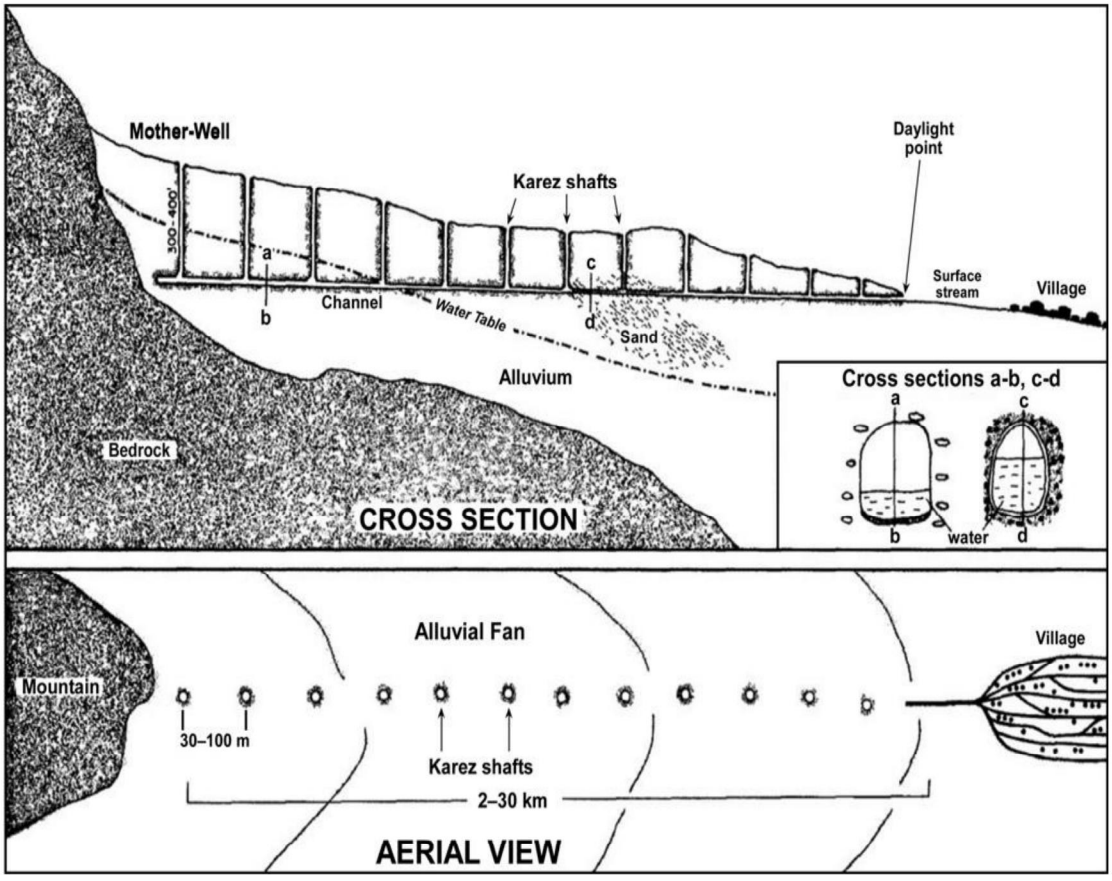

Figure 1. Schematic diagram of a typical *Qanát*. The drawing shows a hill-side in cross-section with *Qanát* and a series of shafts the outflow of water is directed into a main ditch, whence it is utilized for irrigation purposes. Source: English, (1968).

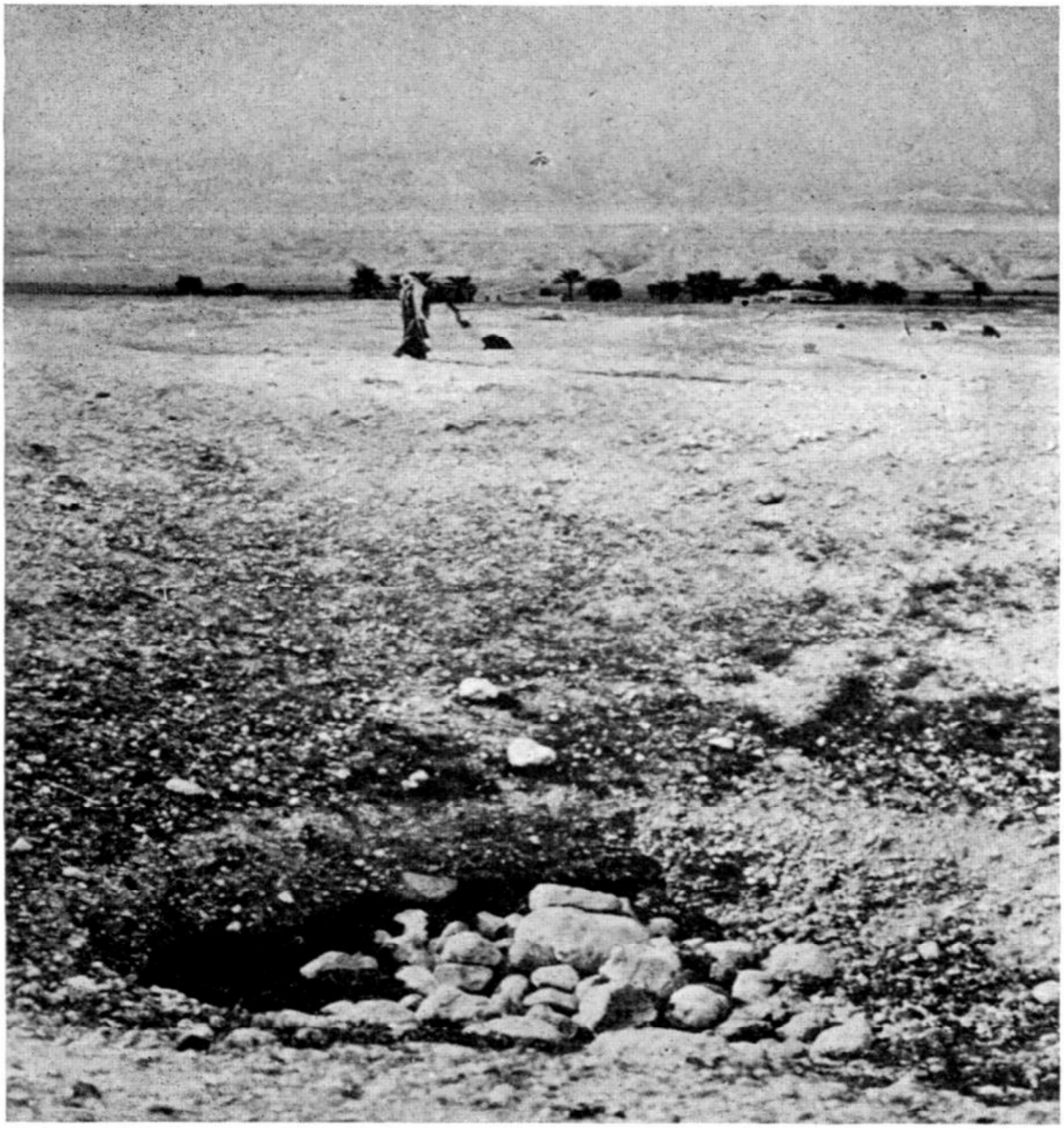

Fig. 2. Caved-in-shaft of *Qanát*.

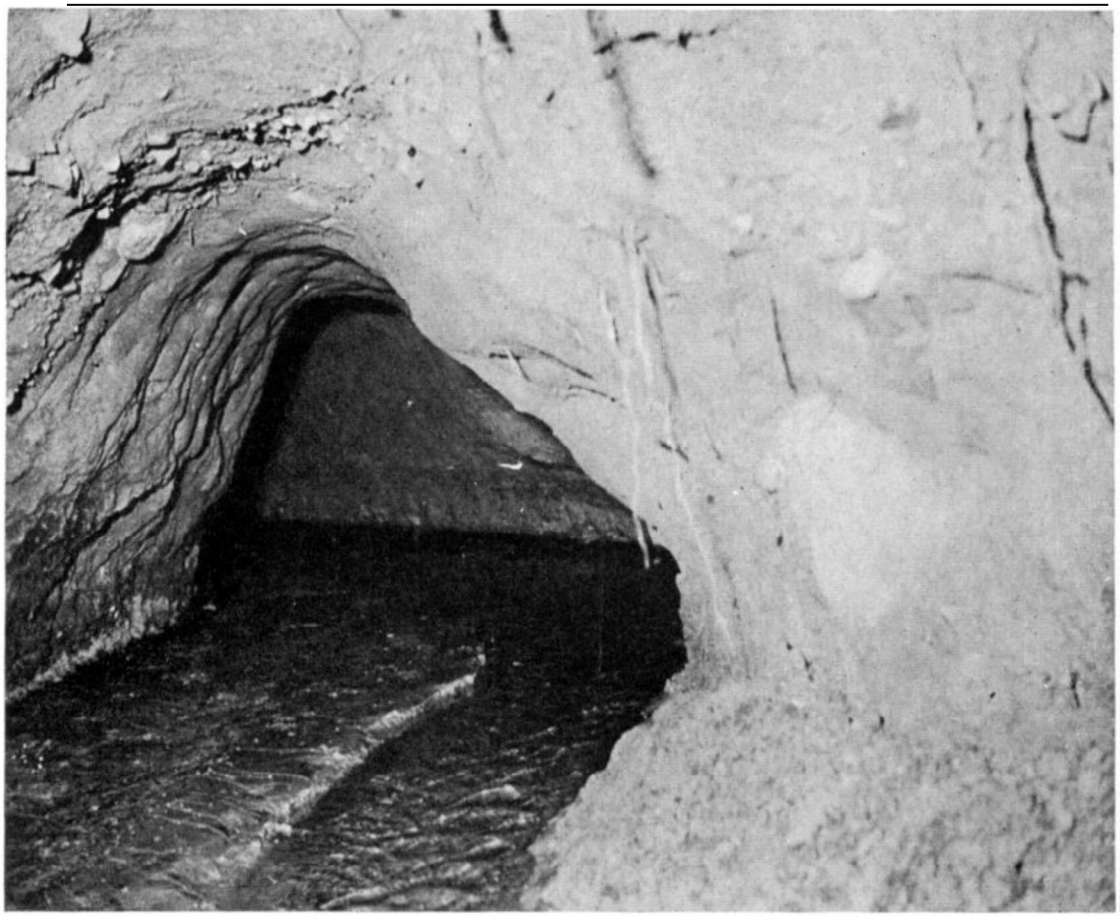

Fig. 3. Water emerging from underground tunnels.

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