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The Water Supply Systems in the Region of Udhruḥ

Introduction

In the 1980s an archaeological research project was initiated by Alistair Killick in the region of Udhruḥ. Kellick's study included excavations at Udhruḥ and a survey in the adjacent areas (1983, 1986, 1987a and 1987b); however, little information can be derived from that study as it was not fully published. Since that time, no archaeological research project has been initiated in the region of Udhruḥ. However, useful information regarding the study area is available from studies concerning other topics and broader areas (i.e. 'Amr *et al.* 1998; 'Amr and al-Momani 2001; Parker 1986; Fiema 2002 and 1991; Graf 1995). The water supply systems in the region of Udhruḥ have never been the topic of any previous scholarly research study.

Analysis of the water supply is part of a comprehensive archaeological study initiated by the author for his postgraduate studies (PhD). The research will consider the settlement patterns and the military arrangements in the region of Udhruḥ from the second century up to the seventh century AD. This study incorporates evidence gained from both recent field survey and from the published literature. The data on the water supply presented here was collected together with information on the settlement patterns, road network, military structures and other finds from the field during a two-month survey between 15/10/2003 and 15/12/2003 in the region of Udhruḥ (Abudanh forthcoming). This paper will consider the evidence for the water supply systems in the study area from pre-Roman times until the present day.

Rainfall

The study area falls within two topographical regions; the mountains of ash-Sharā (in the north?) and the steppe or arid area (in the south?). Official records for rainfall in the region of Udhruḥ ar not available. However, the map (FIG. 1) show that the annual rainfall of the area around Ma'ān including the study area, does not exceed 300mn and is usually ≤100mm. These figures underlin the effort required by people in ancient times t overcome the lack of water resources or the lo level of rainfall by the invention and utilisation o many water supply strategies.

Springs (FIG. 2)

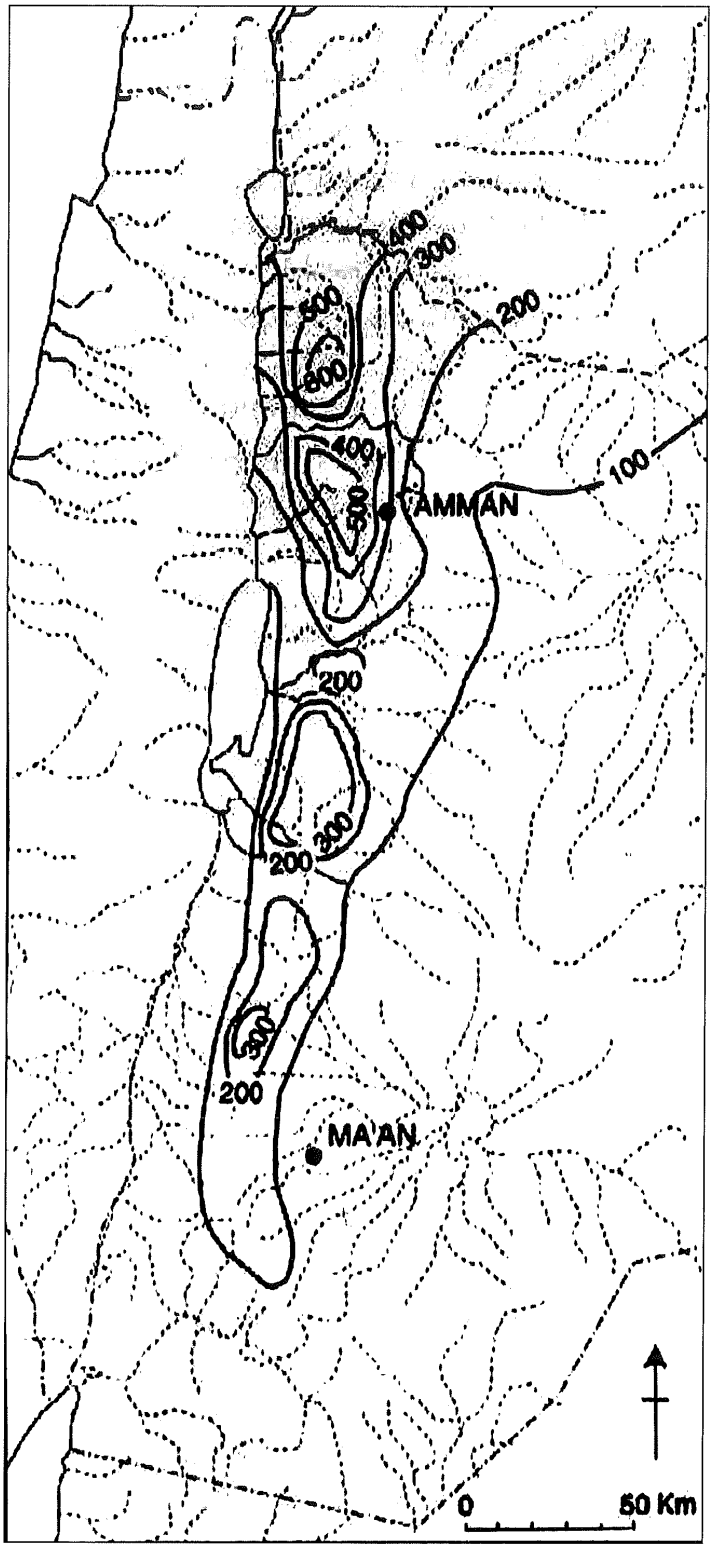
Two types of spring were identified in the stud area:

A- Springs not associated with any water distribu tion or storage techniques such as reservoi and channels.

B- Springs associated with water diffusion an storage techniques such as reservoirs and char nels.

Ten springs of type A were documented by GP points in the study area. However, it is conceivabl that other springs of this type were missed eithe because they are no longer active or due to the topographic locations. One might argue that sinc this type of spring was not associated with an ancient water distribution or supply strategies, cannot be safely considered as an ancient wat resource as springs may start discharging at an time. Such an argument can be easily disregarded a all of these springs were either directly associate with ancient human activity or located near a ancient settlement site (Oleson 2001: 604). In fac ancient structures were recorded even near spring in remote areas.

Springs of type B are the most important typ as they were found near most, if not all, of the sit that had evidence of ancient settlements. It is als interesting that all the modern settlement cluste



1. Map shows the mean annul precipitation in Jordan (after Kennedy, 2000).

were located near this type of spring. Very good examples are the modern settlements at al-Jarba, Udhruḥ, Basṭa, Ayl, al-Fardhakh and aṣ-Ṣadaqa. At each of the abovementioned sites there is an ancient settlement cluster or *khirbat*.

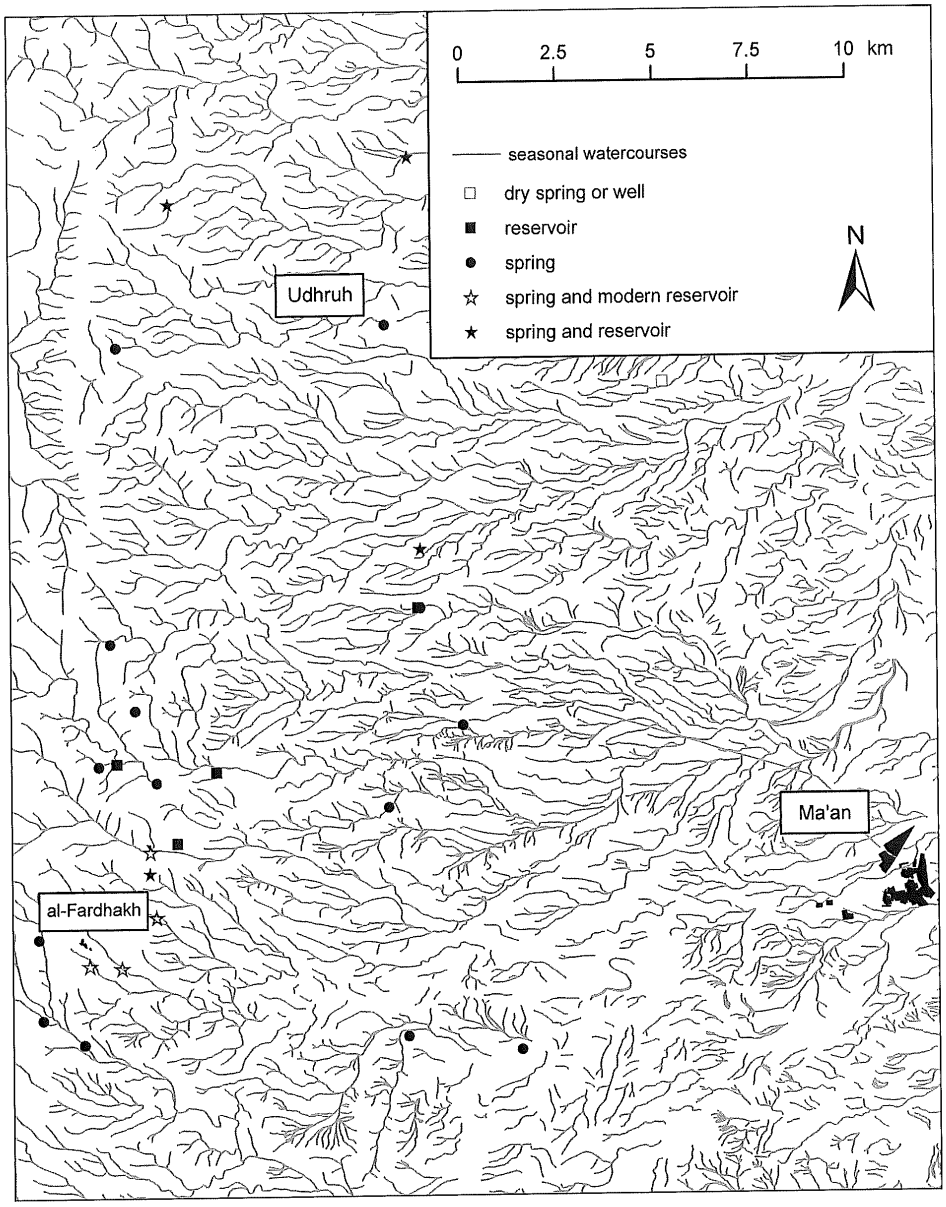
This type of spring was associated with reservoirs and channels, both surface and ground-level channels. Well-preserved tunnels were reported by workers in Ayl, Basṭa and al-Fardhakh during a campaign of maintenance and rehabilitation for the water resources in the district of Ma'ān in the 1990s (pers. comm). The construction of these water supply, storage and distribution features was necessary to fulfill the needs of the population. Reservoirs can store water for a long time and release it through channels to the nearby fields. At the same time people can obtain fresh water at the point where the water flows into the reservoir. One more reason that might have made it essential to build reservoirs is the fact that the source of water or the spring usually lies somewhere in the mountains.

Most of the ancient reservoirs were either replaced by modern reservoirs or abandoned due to the dehydration of the spring itself. In some areas, where a modern reservoir was constructed on a different location, the ancient reservoir is still fairly well preserved such as at Ayl, Basṭa and Muḥaydhrāt. The latter were not previously reported However, modern reservoirs seem to have overlapped or replaced ancient reservoir at al-Jarba, Udhruḥ, Abū al-'Idhām, al-Dirbāsī, al-'Unayq and al-Fardhakh. Traces of the ancient reservoir can still be seen near these structures. Moreover, the local people confirm the presence of ancient reservoirs in the areas where modern reservoirs were constructed.

Reservoirs (*Birkat*) (FIG. 3)

The reservoirs mentioned here are not associated with springs; a different water supply system was used to provide them with water. Very good examples of this type are the three reservoirs in the area between Ma'ān and Udhruḥ. The source of water for the three reservoirs has not been firmly identified.

1- *Birkat Udhruḥ* (site no. 048): the reservoir of Udhruḥ is approximately 5km to the southeast of Udhruḥ. It was built on a very low hill between two valleys. This reservoir cannot be definitively linked to a particular water source. The closest source is the spring of Udhruḥ, 5km to the northwest. No channel linking them was found between the two sites; thus the reservoir was fed from somewhere else. A potential source was speculated to the west of the reservoir, about 1km to the south of Udhruḥ on the east base of Tall 'Abara (Abū ar-Ru'a) (site no. 055) (see below, the qanat system).

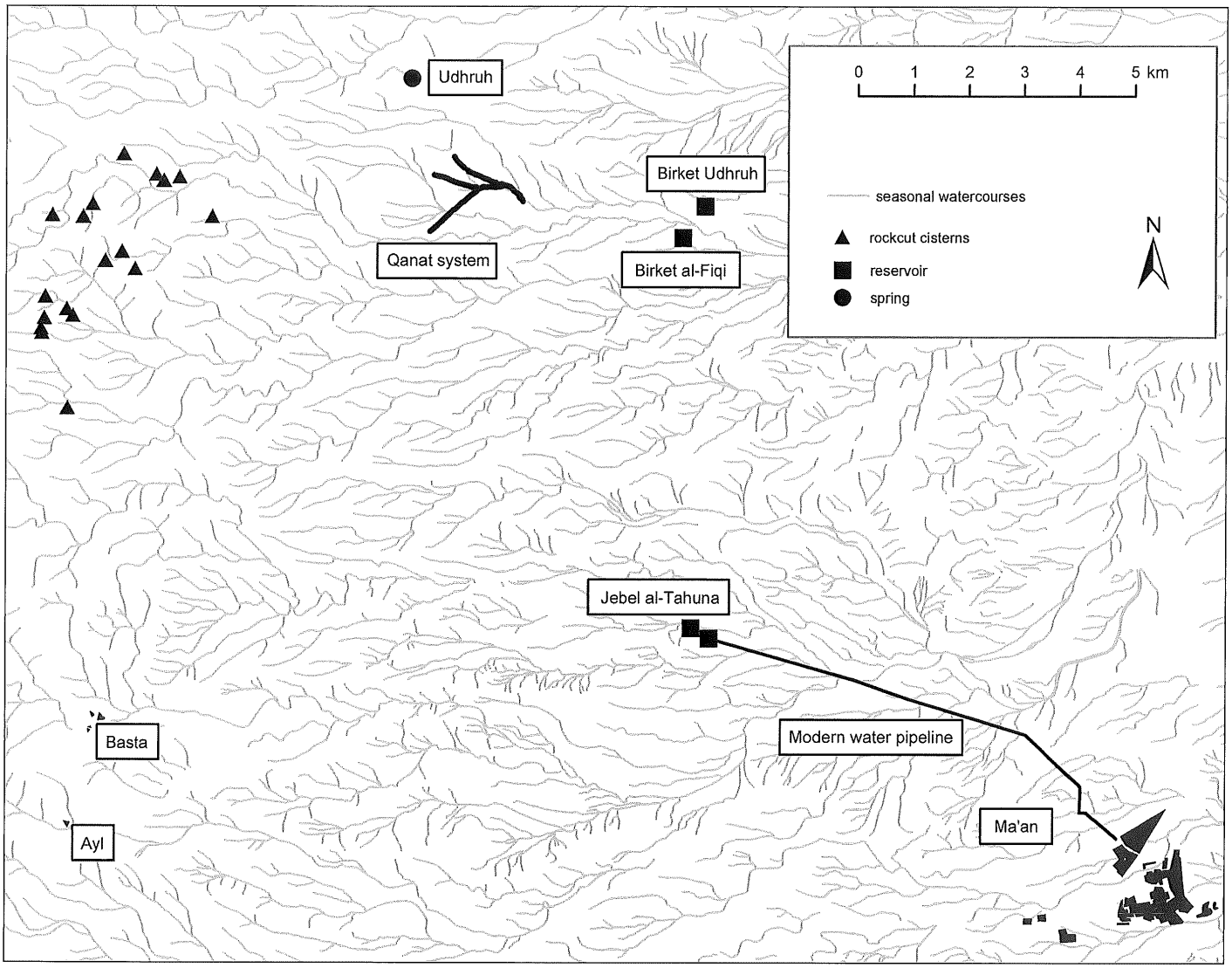


2. Map shows the springs (type A & B) in the study area.

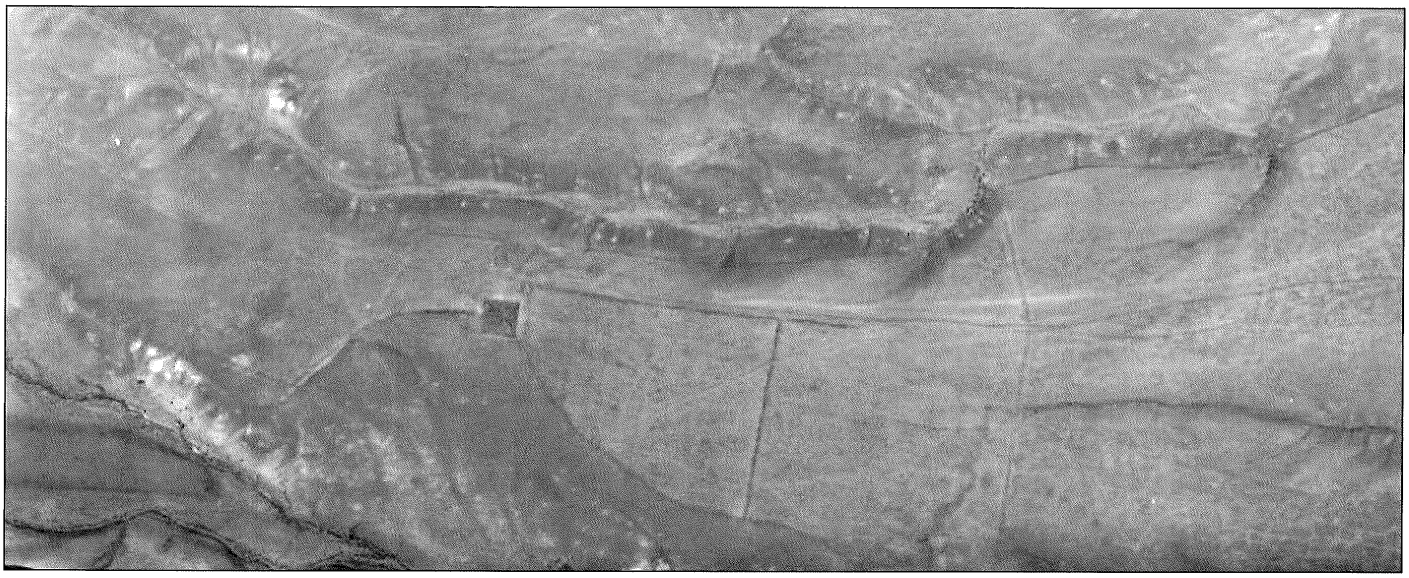
The reservoir is still relatively well preserved and measures 50 x 50m. However, it is not a freestanding structure. A huge hole was probably dug into the ground and then the walls were built. The interior face can be clearly seen and is still standing up to 120cm. The walls however seem to have been elevated above the ground — this would decrease the risk of erosion. The walls are about 1m thick as they are built of two rows of hewn limestone blocks. The gap between the two rows was filled in with small stones and ancient concrete. The interior faces of the walls were coated with a white layer of hydraulic concrete. The water flowed into the reservoir through the west side; a settling basin was found 1.5m away from the wall. A channel running west to southwest must have brought the water to the site (see channels below).

An aerial photograph (FIG. 4) clearly shows the function of this reservoir. It was constructed to irrigate a huge cultivated area to the east of it. The field walls are still in a good state and can be easily recognised in the aerial photograph. The northern field wall runs east-west, in a straight line, and starts a few metres from the northeast corner of the reservoir. The area between the north and south field walls seems to have been organised into two areas by horizontal walls.

To judge from the ceramic evidence, the site appears to have been utilised from the first century AD until the Ottoman period. The following periods were predominantly well represented by the ceramic evidence: the Nabataean, Roman, late Byzantine and early Islamic, and the Ottoman. A precise date for the reservoir cannot be given



3. Map shows the reservoirs in the area between Maʿān and Udhruḥ and the rock-cut cisterns.



4. Aerial view shows the reservoir of Udhruḥ and the agricultural fields to the east of it.

without further analysis by excavations. How ever Killick (1987b: 28) dates it to the Nabat ıean period. This date is logical, since the Nabat ıean remains are common in the region, and Nabat ıean settlements are well attested in neighbouring a eas, particularly at Udhruḥ (Killick 1987b: 7-9). In later periods, especially the late Byzantine and early Islamic period, the reservoir seems to have been in use and received some maintenance.

2- *Birkat al-Fiqiyy* (site no. 042): the reservoir of al-Fiqiyy lies about 1.5km to the southeast of Birkat Udhruḥ. It was located just on the eastern base of a very low hill. The architectural material and the way in which it was laid out are similar to Udhruḥ's reservoir. The structure was built of quarried limestone blocks. Two rows of stones in each course made the walls very thick (1m), and the space between the stones was filled in with small stones and concrete. The walls measure 33m north-south and 40m east-west. Their exterior faces are buried except for the eastern wall, where the wall was elevated. It is therefore believed that part of the hill was dug out to prepare the area to construct the reservoir; a big mound, probably of the excavated soil, was seen outside the northern side. A channel runs west to northwest providing the reservoir with water.

This reservoir irrigated a huge area in Wādī al-Fiqiyy below it. The valley seems to have been fertile and cultivable in antiquity. A well-defined area (site no. 41) was probably divided into small agricultural units by many horizontal and vertical field walls in the valley; about twelve units were counted there. Random sampling measurements for some of the units gave roughly the same dimension of about 90-60m. Having calculated the whole area of the units, a total of 64,800 square metres would have been cultivated. In 1940 Sir Aurel Stein described this site:

"Near the small oasis of Ma'an, the last place which the Hejjaz Railway, derelict farther south, still reaches, a close plane-table survey allowed us to determine the true character of an interesting and extensive old irrigation scheme which had puzzled former observers. A large area of flat desert ground between two wadis (*valleys*), some 4 miles in circumference, had been enclosed with rough walls and laid out into fields. They were to be watered from a canal brought with great labour and skill from the distant hill above the ruined Roman cantonment of Odhrah (Udhruh)". (1940: 435).

3- *Birkat(s) Jabal aṭ-Ṭāḥūna* (at site no. 216): the site of Jabal aṭ-Ṭāḥūna is significant in the region — it is unique in its components and location. It consists of a huge enclosure, settlement structures, agricultural fields, water supply and storage systems. Most of these features, including the two reservoirs, were located within the enclosure (Killick 1987a: 176; Kennedy and Bewley 2004: 210-211).

Two reservoirs were documented at Jabal aṭ-Ṭāḥūna; the first, the biggest, lies at about 300m northeast of the base of the mountain whereas the second is just on the northern base of the mountain. The main reservoir is still in a very good state, and it measures 26m north-south and 24m east-west. The walls were built of hewn limestone blocks; the blocks in the eastern wall are dressed (FIG. 5). The blocks were laid down in two rows filled in with small stones and concrete. A white layer of hydraulic concrete coated the interior face of the walls. This reservoir was first reported by Killick (1987a: 176). The second reservoir is much smaller and not as well preserved as the first. Only one course of the limestone walls is visible on the surface, and it measures approximately 10-5m. This reservoir was not reported before.

Both reservoirs seem to have been supplied by a qanat system to the west of Jabal aṭ-Ṭāḥūna (below); a surface channel connected them with the qanat system. The construction of these cisterns was necessary not only to supply the inhabitants of the village at the site, but obviously to irrigate the agricultural fields to the east and southeast of the main reservoir. The fields are well organised, and have such precise rectangular shapes that David Kennedy (2000: 173), from an aerial photograph, speculated one of them was a buried *castellum*. The

5. The main reservoir at Jabal aṭ-Ṭāḥūna; view to southeast.

reservoirs were also the best features for storing unused water.

Channels and Aqueducts

Long channels and aqueducts are not common in the study area. A few sites display this system of water supply. Surface channels were seen in Wādī Basṭa, and below the reservoir at Malghān, and were most likely for irrigating crops. The channel system in Wādī Basṭa is remarkable. Traces of three separate channels were seen there, two on the edge of the valley and one in the bed of the valley. The channels that run along either side of the valley meet at a certain point in the valley bed. What looks like part of a channel was found further down in the valley, and may have been constructed to carry the water that flows from the two or three channels in the valley to a yet-to-be-determined place. A channel carried on a solid wall (an aqueduct) was found in Wādī al-Fiqiyy, a few hundred metres to the north of Khirbat al-Fiqiyy (FIG. 6).

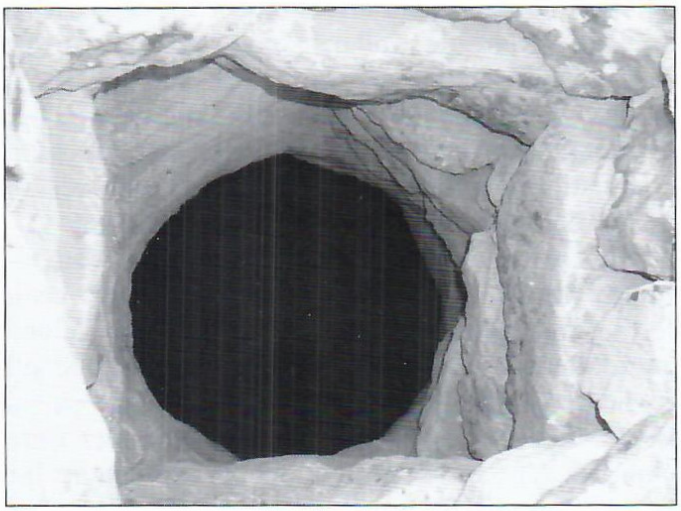
Rock-cut cisterns (FIG. 3)

Using rock-cut cisterns to supply and store water was probably one of the earliest techniques used in the region. They were found in key Nabataean key, e.g. Petra and Hawra' (modern al-Ḥumayma) (Oleson 2001: 606). Two factors seem to have played a role in choosing a place to make a rock-cut cistern; topography and geology. Topography is important since rock-cut cisterns cannot be fed from anywhere; it has to be at a point where collecting run-off water by earth channel is indeed possible, and this can occur on gentle upper or lower slopes of hills.

6. Part of the aqueduct in Wādī al-Fiqiyy southeast Udhruḥ.

Geology is also important as only certain types of bedrock can be easily cut and shaped. Shapes vary from one cistern to another, but most of them have a bottle-like shape, however, some of them are rectangular or of irregular shape. Rock-cut cisterns are abundant in the area southwest Udhruḥ. About twenty eight cisterns were recorded in the area west and northwest of the modern settlement at Rāshid (al-Qā'); both the topography and geology of that locality seem appropriate for this system. The vast majority of them open vertically, end with shafts (FIG. 7) and seem to have had covers or doors. Some of them have settling basins in front of the cistern (FIG. 8). One other common feature is the layer of plaster which covers their internal walls. Some cisterns were still in use in the last fifty years.

Due to the relatively large number of the rock-cut cisterns recorded in the study area, a full discussion of every single cistern cannot be presented in this



7. The shaft of a rock-cut cistern; vertical view.

8. Settling basin in front of a rock-cut cistern.

paper, therefore the discussion below focus upon one example:

Site no. 095: this cistern is probably the most significant rock-cut cistern in the study area. It was located on a moderate slope of a rocky hill; the elevation of the hill gradually decreases from southwest to northeast. The cistern was found near the northeastern base of this hill, and the area where it was cut consists of relatively soft limestone layers associated with chalk. A long earth channel running southwest to northeast, along the slope of the hill, directed the rainwater to the cistern. Near the cistern, where the exposed rocks were cut to lead the channel, the course of the channel is very clear. A rectangular settling basin was built at the end of the earth and rock channel, in front of the cistern, to clean the water of sediments and debris, and finally a short, stone channel fed the cistern from the settling basin.

The cistern appears to have been cut between two horizontal bedrock layers from one side. The diggers made a big, round and deep hole in the bedrock partly roofed by the bedrock itself; thereafter, a wall, of approximately 1m height, was built on the edge of the hole to carry the artificial roof. The short stone-channel and the only entrance to the cistern were located in the north side of this wall. The entrance is quite small, approximately 80cm in height and 50cm in width; however, it gives access to the floor of the cistern through 17 steps cut into the bedrock (FIG. 9).

9. Rock-cut steps inside the cistern at site no.095; Umm al-'Awsaj.

The interior of the cistern is roughly round and is approximately 9m diameter including the side, which has the rock-cut steps. The diameter at the bottom of the cistern is approximately 7m. Although some debris has collapsed from the roof and stones were thrown to the floor by local shepherds, it is still 6m in height. Apart from the roof, its entire interior, including the steps, was coated with a waterproof layer. It is therefore highly likely that the water level would have reached a point, close to the entrance, in a good rainy season. The steps must have given access when the water level was low, or during the dry seasons, when the cistern was being prepared for the next season. Finally, a short Nabataean inscription was noted inside the cistern and near the entrance.

Wells

According to Hodge (1992: 51) "the word well should be confined to man's attempts to obtain water from the earth, vertically below the spot where it is required, when it is not obviously present at the surface". Vertical shafts therefore vary in depth, but are usually lined with masonry. The survey of the study area revealed a small number of wells. Two significant wells, the well of Abū Danna and the well of al-Biṭār, were well known in the region for their water quantity and quality. Both of them have circular shafts lined with stones. Ancient tracks and roads approaching the two wells bear witness to their importance in ancient times, and more importantly the settlements they attracted in antiquity ('Amr *et al.* 1998: 543 for al-Biṭār). However, other wells must have existed but either collapsed and became untraceable, or are still traceable but dried up (FIG. 10).

10. Dry built well in Wādī al-Bīr.

Dams

The author did not record any dams in the region of Udhruḥ; however Killick (1987a: 176) located a dam at Jabal aṭ-Ṭāḥūna. Although no traces of the ancient dam can be seen at present, the earth dam which has been recently set up on the south end of the Jabal (mountain) might have overlapped the one seen by Killick. The area to the southwest of the mountain is a very typical natural catchment (FIG. 11).

Qanat system

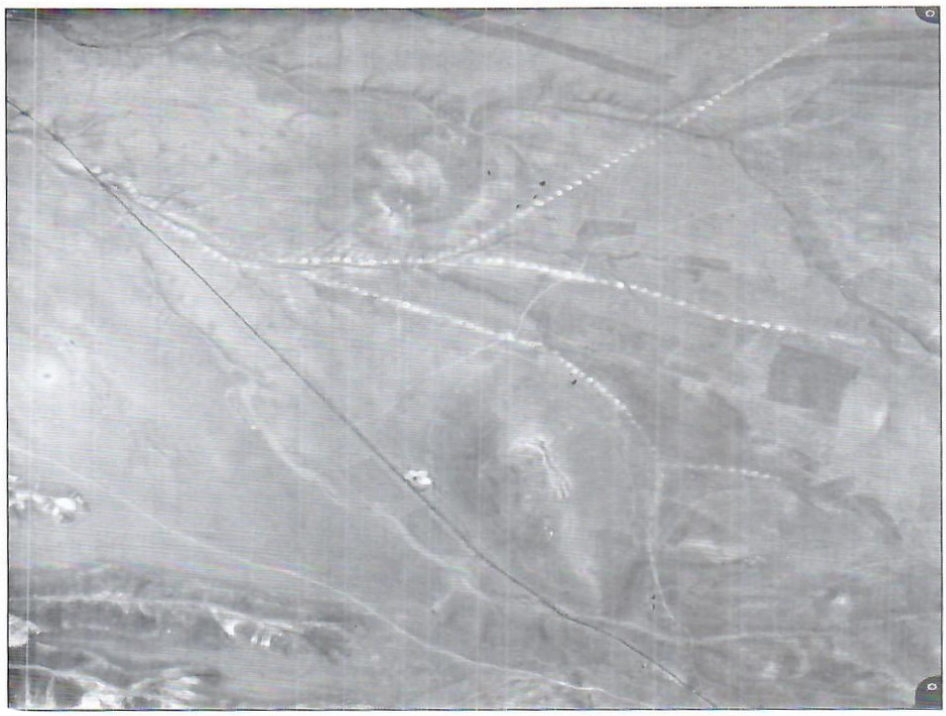
What is the qanat system? The following quotations clearly explain the exact meaning of the term qanat:

11. A catchment area southwest Jabal aṭ-Ṭāḥūna.

"The qanat is a tunnel driven into a hillside to tap an aquiferous stratum deep inside it. The tunnel has just enough of a downward slope for the water tapped to run down it and into the open air by gravity, and is punctuated at intervals of 20m or so by vertical shafts to the surface" (Hodge 1994: 20).

"Qanats are a form of subterranean aqueduct-or subsurface canal-engineered to collect ground-water and direct it through a gently sloping underground conduit to surface canals which provide water to agricultural fields or oases" (Lightfoot 1996: 321).

The Qanat system is very common in the Mediterranean basin countries, especially in the arid regions (Hodge 1994: 20-24; Lightfoot 1996: 322). According to Lightfoot (www.waterhistory.org/histories/jordan) "ten sites, with thirty-two separate qanat galleries, have been identified in Jordan". One of them lies in Udhruḥ, about 1km to the south of the legionary fortress, and it was first identified by Alistair Killick (Killick 1987b: 28). Three lines of filled-in yellow shafts are still clearly visibly on the ground. At one point the three lines join (FIG. 12). The area where these shafts were dug, at the base of a hilly landscape, is very suitable for tapping the ground water. It is likely that the qanat supplied what he calls a Nabataean reservoir (Birkat Udhruḥ) to the east of the site as (Killick 1987b: 28). The available evidence



12. Aerial view shows the qanat system south Udhruḥ.

indicates that the qanat system may end in the valley below Khirbat al-Fiqiyy. From there a fairly well preserved aqueduct carries the water to Birkat Udhruḥ, and another channel runs southeast to supply Birkat al-Fiqiyy. Notably, a modern water pump station has been located just a few hundred metres to the west of the ancient qanat system.

Another possible qanat system was noted from aerial photographs at Jabal aṭ-Ṭāḥūna (D. Kennedy pers.comm.). However, little data is available for this system. On the ground, the qanat's shafts are not as clear as those of qanat Udhruḥ, and this is probably due to the erosion caused by seasonal floods, in addition to the similarity in colour between the shafts and the ground in which they lie.

The qanat system was located to the west of Jabal aṭ-Ṭāḥūna, and this is naturally appropriate as the reservoirs has to be on a lower elevation since gravity is the decisive factor in the flow of water. Moreover, the area to the west and north of the site is a huge natural catchment area, and is also good for tapping groundwater. At the north base of the Jabal there is a major water pump station providing the city of Ma'ān with water. Many wells have also been recently dug in the area around Jabal aṭ-Ṭāḥūna. Finally, it is worth mentioning that the city of Ma'ān with a population of approximately 30,000 is fed only by the wells of aṭ-Ṭāḥūna.

Watermills

Watermills are quite common in Jordan particularly in the north part of the country (McQuitty 1995: 745-751). In the study area, Alistair Killick (1987b: 28) mentioned an Ottoman watermill at the foot of Tall Udhruḥ. It is a pyramidal structure built of small limestone blocks and still fairly well preserved and stands for about 3m (FIG. 13). At the base, the sides are 3.5m long. This length gradually decreases by approximately 10cm in each course. Although there is no access to the roof of this structure, one can see, from the Udhruḥ-Ma'ān road above, a small hole in the centre of its roof (nozzle). On the west base of the structure, a small ground-level structure can be seen, and it seems to be related to the hole in the centre of the standing structure. Roman pottery sherds were found at the site but further investigations, particularly excavations, are required to determine the function and date of this watermill.

13. Watermill to the south of Udhruḥ.

Others

The following techniques were also used as part of the water supply system in the region:

Natural caves: natural caves with appropriate locations for collecting the run-off water were acquired as cisterns. This type of cave can be easily identified through the layer of plaster and the earth channel leading to the cave. In some cases the area in front of the cave's entrance was elevated and terraced to prevent any run-off outside the cave.

Exposed bedrocks (know locally as *Ṣne'*): in some cases, exposed bedrocks seem to have been used as a rainwater collecting point, either by deepening the bedrock itself wherever it was possible to cut or by surrounding the bedrock with earth and stone walls (FIG. 14). This strategy was definitely useful

14. A water basin (*Ṣne'*) cut into a bedrock to the east of Bīr Abū Danna.

for a few days or weeks after having a great deal of rain, but not for a long period — it was especially beneficial for watering animals.

House-based cisterns: at many of the sites which display remains of ancient settlements, deep and circular masonry holes were observed within the settlements. These features have been tentatively identified as cisterns on the basis of their plans. Directing the run-off water from the roof into a cistern was probably the technique that householders used to collect the rainwater.

Heaps of stones: a remarkable sight in the landscape to the east and southeast of Basṭa and Ayl in particular and in other areas is the heaps of stones ('Amr and al-Momani 2001: 276). Hundreds of piles significantly cover slopes of hills and the relatively flat grounds in the abovementioned areas. Many more heaps can be seen particularly on the slopes; and each heap consists of many multi-sized stones (FIG. 15). It is possible that these piles were formed as a result of a ground clearance for agricultural purposes although Oleson (2001: 606) refers to similar piles in Hawra' (al-Ḥumayma) and notes their importance in keeping the run-off water in the ground to prevent soil erosion.

Chronology

The fact that construction inscriptions are extremely rarely found in association the water supply systems in the study area makes any other dateable archaeological deposits particularly valuable. Hints from historical accounts could also be useful. Evidence comes mainly from ceramics and architectural elements.

15. Heaps of stones on hillsides between Ayl and Basṭa.

The availability of the ceramic evidence at the aforementioned water supply systems can be divided into the following:

1- No ceramic evidence was collected, as was the case with most of the rock-cut cisterns.
2- Ceramic evidence was not available at the water supply system feature but available at a neighbouring archaeological site such as a settlement site.
3- Ceramic evidence was found at the water supply system feature itself.

According to Diodorus (Oleson 1995: 709), the technique of making rock-cut cisterns was known among the early Nabataeans. Abundant Nabataean settlements have been long documented in the region of Edom, including the study area. Rock-cut cisterns in the region of Udhruḥ were reused during the first three quarters of the 20th century AD, especially those which were located near a traditional house or village, known as *Qa'īr*. This strategy would have been effective for water supply and storage throughout the first millennium AD.

Ceramic sherds associated with the significant reservoirs to the southeast and south of Udhruḥ predominantly date to Late Byzantine and Early Islamic periods. Similarity in the masonry material was also observed between *Birkat* (reservoir) Udhruḥ and Birkat al-Fiqiyy. The official Byzantine tax archive from Beersheba for the towns of Palestina Tertia puts Udhruḥ the second on the list; paying a tax of sixty five gold pieces (Killick 1983: 231). This archive was referred to as a sixth-century document (Mayerson 1986: 148). In addition, Udhruḥ and al-Jarba submitted to Prophet Muhammad and paid the poll tax in 630AD (Schick 1994: 149). The region was prosperous in the Byzantine and early Islamic periods. As agriculture has long been a very common factor of prosperity in ancient societies, one could claim that the presence of such water supply systems increased the arable lands in the region of Udhruḥ and in return the region's economy would have also improved.

Giving a precise date for the qanat system to the south of Udhruḥ seems to be impossible at this stage. The qanat technology was in use in the ancient Middle East from at least the seventh century BC and continued to be used until the 20th century AD (Lightfoot 1996: 323-325). Lightfoot claims that "every qanat in Jordan is adjacent to Roman and Byzantine settlements or outposts.

Because the supporting evidence is strong, most scholars believe that Jordan's qanats were built by the Romans and used by the Byzantines from the 1st century B.C to the 7th century A.D." (www.waterhistory.org/histories/jordan). This could equally apply to the qanat system at Udhruḥ, as the evidence for Roman and Byzantine settlements in the region of Udhruḥ is abundant. The presence of Roman legionary fortress and Byzantine church at Udhruḥ itself is beyond any speculation. Even so, a thorough understanding of the relationship between the two reservoirs, the aqueduct to the southeast of Udhruḥ and the qanat system would be necessary to support or contradict Lightfoot's assertion.

Ancient surface channels or conduits preserving their original architectural conditions are very rare in the study area due to continuous utilisation and maintenance throughout most of the historical periods. Most of their ancient masonry material was replaced or coated by modern material such as cement. Two ancient channel systems were seen during the survey; one to the southeast of Udhruḥ and the other in Wādī Basṭa. The former seems to have been in use during the late Byzantine and early Islamic periods by association with settlements and agricultural activity in those periods in that area. The significance of this channel lies in the solid wall which carries it across Wādī al-Fiqiyy.

Parker (1986: 99) reported that an earlier traveller mentioned a conduit carrying water from the spring of Basṭa to a Roman site three kilometres to the east of Ma'ān. The topographical location of the spring of Basṭa, at more than 1400m above sea level, is typically suitable for carrying water through a channel to an area like Ma'ān with an elevation less than 1100m above sea level. This strategy of water supply was utilised in Hawra' (al-Ḥumayma), where a 27-kilometre-long conduit provided water for the site from springs on the high mountains to the northeast (Oleson 2001: 608, 1992: 270). Even so, the available evidence does not allow us to claim that such an aqueduct existed.

Springs associated with reservoirs usually exhibit a long history of use. Moreover, this type of water supply system was implemented in the areas where continuous and intensive ancient settlements mark the landscape in adjacent areas to the spring or reservoir. From north to south along the survey area, and at larger settlement sites associated with this type of water supply, the ceramic evidence presents different periods from at least the Iron Age up to the late Islamic period.

Water Consumption

The available evidence from most of the water supply systems in the region of Udhruḥ clearly indicates that agriculture was a central focus throughout most of the historical periods. There are many examples where particular water supply systems were associated with field walls and agricultural fields. Surface channels seem to have been used mainly to supply water for agricultural fields well beyond the main source of water; this type of channel usually carries the overflow water from a reservoir constructed at the end of a ground-level tunnel. Ancient field walls associated with traces of surface channels are clear in Wādī Udhruḥ, Wādī Basṭa, Wādī al-Jarba, Wādī al-Fiqiyy and Wādī Malghān. Water for human consumption could have been obtained from the point where it flows into the reservoir; this running water would have been fresh and suitable for daily life activities including drinking, cooking and washing. Animals could have also been fed immediately from the reservoir if it had a stable level or may have been provided with basins.

In a semi-arid area with scanty precipitation one would expect the existence of water storage strategy. Rock-cut cisterns seem to have been constructed exactly for this purpose. This type of water supply technique was found in association with both ancient settlements and agricultural fields. However, the degree of care which was given to most of the rock cut cisterns indicates that the water was utilised for human use. The walls of most of them and sometimes the floors were carefully coated with a waterproof layer. This layer not only prevented the absorption of the water into the walls or floors, but also kept the water clean and ready to drink. For this particular reason, many rock-cut cisterns continued to be used and even attracted traditional settlements in the study area until the 1960s.

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