

## Water Collection in a Dry Farming Society

The climate of Jordan can be divided into three main zones according to the topography of the land. The most western zone is the Ghawr or Jordan Valley depression where the weather is very hot in summer with usually little rainfall. The middle zone is the hilly region known ash-Shafa or Plateau which enjoys a pleasant Mediterranean climate and may receive during a cool wet winter (mid November - mid March) an annual rainfall varying between 200 and 700 mms. The eastern zone is the steppe or the Bādiya which lies east of the Hījāz Railway and is characterised by hot summers and cold winters with very little precipitation. The land has "four magnificent rifts or wadis that traverse it from east to west and cleave it into four divisions".<sup>1</sup> These are clearly outlined on the map reproduced herewith (FIG. 1), which also shows the major catchments as well as the Isohyets of estimated average rainfall for the period 1901-1930. Notwithstanding the four wadis, however, the topography of the land around them did not make it possible for people to cultivate more than a few fields that were suitable for irrigation.<sup>2</sup>

No wonder, therefore, that rainfall — the ultimate source of water — has been since time immemorial the most important element for the population living on the Jordanian plateau. The presence of wadis or rivers, as they seem to be during winter, was no guarantee against the shortage of water. This fact has been a basic element in the livelihood of Jordanians all throughout their history. The good management of their water resources, by necessity, has been a very important aspect of their lives. All throughout, the collection of water was a most essential part of their endeavours to raise crops from land that could be only cultivated for dry farming.

### Archaeological and Historical Background

Although the subject is basically a socio-economic study,

it is of interest and benefit to present the findings of archaeologists in the Jordanian Plateau because they are of great importance with regard to water collection during the different historical periods. Naturally we have to be aware that as we go further back into the past and our knowledge becomes more scanty, we have to deal with bigger time units.<sup>3</sup> Therefore, the archaeologist may have to lump together the collected information and say that it illustrates a period of several centuries.

To start with, reference can be made to the Neolithic settlement at 'Ayn Ghazāl north of 'Ammān with an area far exceeding twelve hectares, making it the largest Neolithic (5700-5000 BC) village in the Near East.<sup>4</sup> The period before that, "The Mesolithic Period (14000-8000 B.C.) is considered as the time in which the first successful attempts were made by man to produce his food by primitive agriculture and probably also by breeding animals."<sup>5</sup> By the start of the Neolithic period (8000-4500 BC) some groups of people were capable of living in one spot such as the site near 'Ayn al-'Umayrī south of 'Ammān. During this period people were by no means numerous, but they had a much better chance of survival when they succeeded in growing their food and breeding animals on a larger scale. A water procurement policy had to be organised, however, so that both agriculture and animal husbandry could be maintained.

The following stage in human development was during the Chalcolithic period (4500-3000 BC), when villages must have been rather prosperous and apparently people did not feel the need to build walls around themselves for defensive purposes. There was still plenty of water, land and forests on the slopes which prevented erosion of the soil.<sup>6</sup> The Early Bronze Age (3000-2100 BC) witnessed the continuation of the development and progress which took place during the Chalcolithic. Implements made of copper were used on a larger scale,<sup>7</sup>

<sup>1</sup> Libby and Hoskins, *The Jordan Valley and Petra*, 1905, p. 32.

<sup>2</sup> R. S. Abujaber, *Pioneers over Jordan*, 1989, p. 8.

<sup>3</sup> L. Woolley, *Digging up the Past*, 1930, p.105.

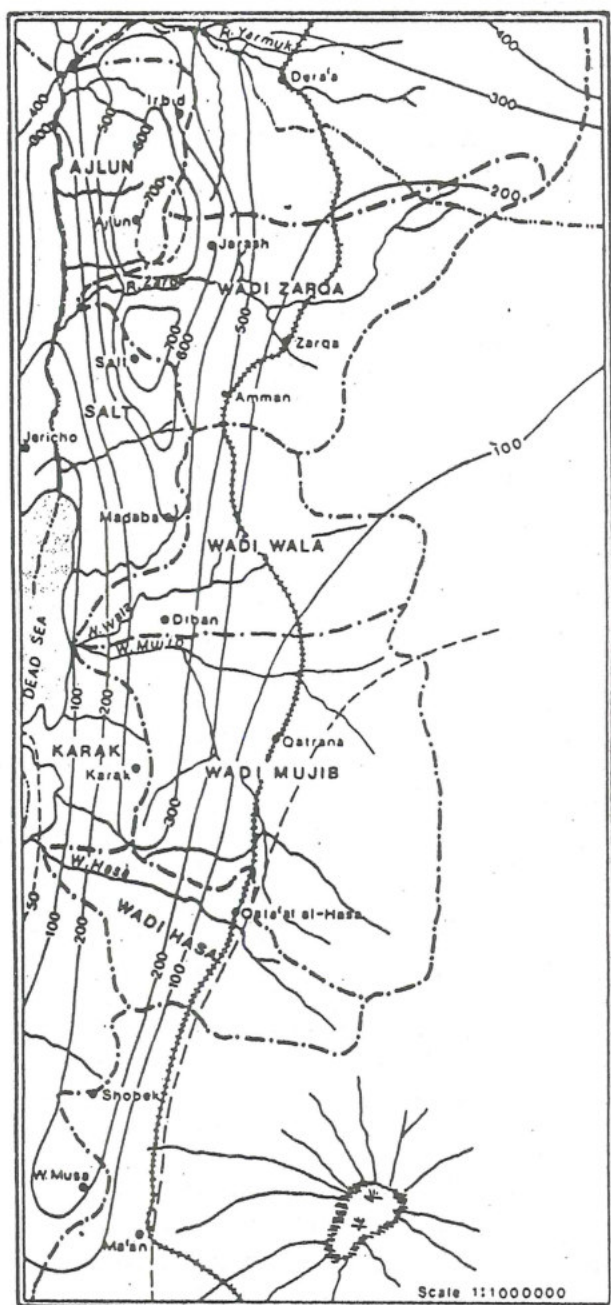
<sup>4</sup> G. Rollefson and A. Simmons, Excavations at 'Ain Ghazal 1984, *ADAJ* 29

(1985), pp. 11-30.

<sup>5</sup> H. Franken, *Yadoudeh. The History of a Land*, 1979, p. 3.

<sup>6</sup> Franken, *Yadoudeh*, p. 4.

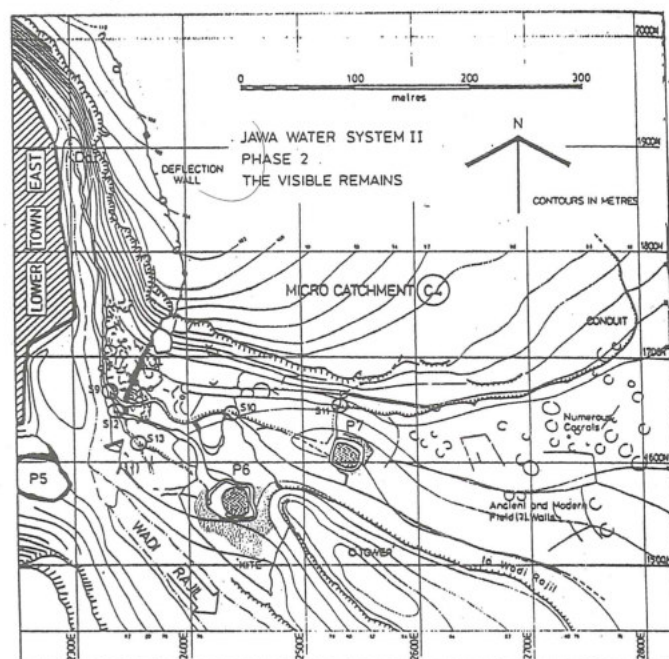
<sup>7</sup> G. Lankester Harding, *The Antiquities of Jordan*, 1990, p. 31



1. Map of Jordan showing the four main wadis and their catchments as well as the average rainfall in the years 1910-1930 (source: Abu-jaber, *Pioneers over Jordan*).

however, "the forests began to disappear and with it the erosion of the land started on a large scale. As a result permanent streams became seasonal wadis. Invasion of nomadic warriors who are often associated with the Amorites put an end to the cycle of habitation at 'Ain Emairi in the lands of Yadoudeh. As far as we know every town in Palestine and Jordan was destroyed and abandoned for centuries at about 2300 B.C."<sup>8</sup> Truly a vivid example of what happens when nomads, in large num-

<sup>8</sup> Franken, *Yadoudeh*, p. 5.



2. The Jawa water system (source: Helms, *Jawa*).

bers, destroy the natural balance existing in a certain area between the number of people and their basic requirements of water and crops. A similar event took place during the eighteenth and early nineteenth centuries when waves of Bedouin tribes from Najd caused Jordanian farmers and villagers on the plateau to abandon the countryside and move westward.

A unique example of water collection was the settlement at Jawa (FIG. 2) in the black desert or Ḥarrat ar-Rājil in the northern part of the country, south of Jabal ad-Drūz. Built during the later part of the fourth millennium BC: "Its technical excellence of the support systems and the high level of the kind of science inherent in them, as well as the geographical location of the site, lead to the hypothesis that the people of Jawa came from a developed urban tradition. It is now understood that towns in the more arid regions relied on surface water resulting from winter rains which was collected and stored in man-made reservoirs or cisterns".<sup>9</sup>

The Iron Age (1200-550 BC) was the period when the three Jordanian kingdoms of Edom, Moab and Ammon flourished, and had wars amongst themselves as well as with the Israelites. Writing about this period, W. F. Albright dwelled on the importance of cistern construction and their lining with water-proof material. Although later excavations and studies have brought different views about the population composition in Palestine and Transjordan, it is still interesting to read what he wrote about water collection and the role it played in the life and de-

<sup>9</sup> S. W. Helms, *Jawa, Lost City of the Black Desert*, 1981, p. 9.

velopment of the area: "Thanks to the rapid spread of the art, then recent, of constructing cisterns and lining them with waterproof lime plaster instead of the previously used limey marl or raw-lime plaster, the people were able to settle in any site where there was rain".<sup>10</sup> It was during the Iron Age, and probably around the year 890 BC that Mesha the King of Moab, ordered the royal and impressive inscription be carved on what has become to be known as the Moabite Stone (presently displayed at the Louvre Museum, Paris). Its special importance for this study is in the fact that Mesha, in his moment of victory, did not forget water collection and the vital role it played in his realm. He had recorded: "And I built Ball Meon and made therein the water pool (ditch). And there was no cistern in the wall in Korcha and I said to all the people, make for yourselves every man a cistern in his house and I dug the ditch for Korcha with the chosen men of Israel."<sup>11</sup>

Since good ideas, such as the one ordered by no less than King Mesha himself, are contagious, it is fair to assume that the construction of cisterns and wells spread out to Edom and Ammon as well. The great number of wells that we have in the Plateau is evidence that the construction of wells developed into an obsession which continued through the following Hellenistic, Roman and Byzantine periods. After all the Arab proverb says "Need is the mother of invention" and water was needed by everybody.

Writing about the kingdom and the land of the Nabataeans, Nelson Glueck stated that: "Long experience has taught us that wherever there are springs or wells of sweet water in this semiarid part of the world, human beings have invariably built permanent places of dwelling, political conditions permitting. In many instances, Nabatean settlements were established on top or by the side of earlier ones and in most instances they in turn were superseded by Byzantine ones."<sup>12</sup> This continuous chain of settlement on the land has been the common trend as far as the plateau was concerned. The Edomite rulers were followed by the Nabataeans who were followed by the Romans and the Byzantines and the Arabs. Dry Farming dictated living conditions by its need for a water supply near fields that were fit for cultivation with rain water. No wonder therefore that settlements were built in these areas on top or by the side of earlier ones. The ruins of old settlements had wells and pools as well as stones for building. This gave to new settlers an assurance that, with an average rainfall, a crop could be grown and harvested.

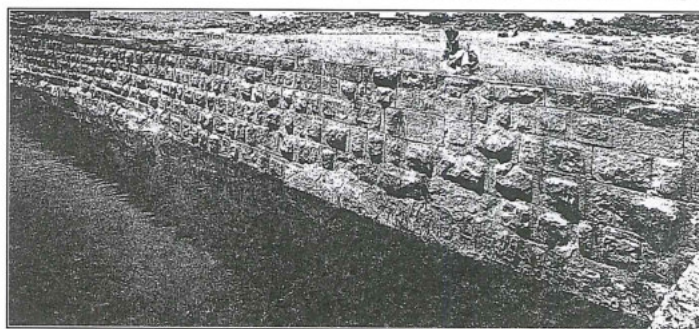
An outstanding example of Nabataean ability in the

field of water collection is the town of Umm al-Jimāl at the edge of the desert.<sup>13</sup> Surveys have revealed that every house had at least one well and the population collected, during winter, all the rainwater they could in pools, as they did not have one single spring. They developed a network of water canals with which they channelled the rainwater to these large pools which were open to free use by the inhabitants (FIG. 3).

The Nabataean performance in the transfer of water from one place to another has been a special feature of their water policy. At as-Sādah, located about 15 kms south-southwest of Petra, Manfred Lindner described this performance in an article about the site: "Where no channel could be attached, due to a bend in the rock, two aqueduct arches were built. One of them is still standing. With its height of 5 metres, it is a noble monument of Nabatean enterprise in the middle of a now forlorn Valley of Southern Jordan. The building of temples, cisterns, caravan pathways, terrace walls and other communal projects allow us to draw conclusions about some kind of centrally organized building programme of aqueducts in Nabatea."<sup>14</sup>

The period of Hellenistic Roman influence started with Alexander's campaigns in 333 BC and came to end after the Muslim conquest of the land in AD 636. During this millennium, there were uprisings especially in neighbouring Palestine, but the general trend in Transjordan was one of relative stability. This was due to stronger government control especially "after Pompey restored around the year 64 B.C. all the Greek Cities which had been destroyed by the Jews, and laid the foundations for the commercial league known as the Decapolis. The general level of security and prosperity during the next few centuries was higher than it had ever been. During the second and third centuries, villages and towns sprang into being all over the country."<sup>15</sup>

Undoubtedly the stability in the countryside encouraged settlement all around and it seems that the large



3. Large pool at Umm al-Jimāl (source: Glueck, *Deities and Dolphins*).

<sup>10</sup> W. F. Albright, *The Archaeology of Palestine*, 1949, p. 113.

<sup>11</sup> W. Pakenham Walsh A.M., *The Moabite Stone*, 1873, p. 21.

<sup>12</sup> N. Glueck, *Deities and Dolphins*, 1966, p. 55.

<sup>13</sup> Harding, *The Antiquities of Jordan*, pp. 149-152.

<sup>14</sup> M. Lindner, Es-Sadeh, An Important Archaeological Site in Southern Jordan, in S. Kerner (ed.), *The Near East in Antiquity*, vol. 2, 1991, p. 104.

<sup>15</sup> Harding, *The Antiquities of Jordan*, pp. 49-51.

number of wells and cisterns in the old *khirab* or ruined villages, was constructed during this period. Writing in his *A Handbook for Travellers in Syria and Palestine*, J. L. Porter reported in 1958 about his visit to Ḥisbān. He stated that: "Below the city to the east are the remnants of water courses, and an enormous cistern or fishpond. The old wells are so numerous that we had to ride with great care to avoid them".<sup>16</sup> Another more recent survey was obtained during my work at al-Yādūda, an estate of nearly 22,000 dunums of good dry farming land, 10 km south of 'Ammān (FIG. 4). Elders there in 1965, confirmed that at the start of this century it had more than 300 used wells and cisterns in its domain. In addition there was a *birka* or large pool which, in good years, provided water for all the estate's animals, as well as those of the guests' passing flocks. Water was stored in the wells and it was not unusual to drink from them, during drought years, water that was three years old.<sup>17</sup>

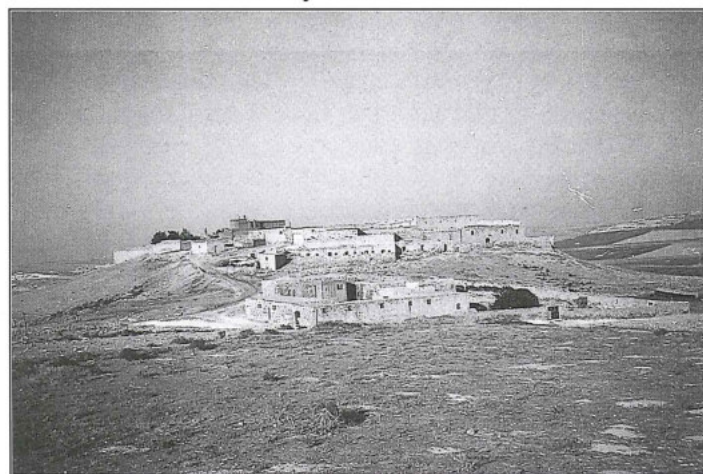
However, there were many times during these one thousand years when the sedentary population had to push back the waves of nomads who attempted to encroach upon the settled regions. In years of drought or in times of weakness of the government, these nomads tried to move from the desert border zones into the plateau seeking pasture for their herds and flocks as well as water. The strength of the authorities determined the result of these attempts. If it was strong, they were forced back into the desert to meet more hardship until the rain came, or they were allowed to make use of the facilities in the settled areas after coming to terms with these authorities. The Romans and Byzantines realized the importance of protecting the sedentary population from the havoc that would befall them if the nomads had their way and entered the countryside by force. The Romans therefore developed an elaborate frontier fortification system when they created the Provincia Arabia after the annexation of Nabataea.<sup>18</sup> The Byzantines inherited the Limes Arabicus after AD 325 and continued to station their forces in the forts on the borderline, such as al-Lajjūn, which was most likely constructed during the reign of Diocletian (AD 284-305).<sup>19</sup> The system seems to have continued until Abbasid times. Khaṭṭ Shabīb in the Rās an-Naqab area could have been one of the devices executed by the authorities to regulate nomadic incursions into the settled plateau. The name probably refers to the Governor of Jordan Shabīb al-'Uqayli at the time of the Ikhshidis just before the end of the tenth century. However, further excavations and studies will have to be made to ascertain the true background.

Water was no less important during the centuries that

witnessed the rule of the Umayyads, Abbasids, Crusaders, Mamluks and Ottomans. However, the countryside seems to have been gradually depopulated which in turn led to the neglect of the water collection system as a whole. This neglect explains why practically all the wells and reservoirs were filled by sand and dirt over the years. It is therefore not surprising that the conclusion derived from the survey held recently in the Ḥisbān area and supported by historical studies of such scholars as Hitti, Lewis, Seetzen, Burckhardt and Buckingham, is not very favourable to the Ottomans: "The 400 years of Ottoman rule was a time of very meagre settled population."<sup>20</sup> However, these water collection facilities of antiquity have been of great assistance to the settlers who started moving eastward during the second half of the nineteenth century. With these wells, *birak*, and reservoirs, the newcomers to al-Yādūda, the Banī Ṣakhr *khirab*, Mādabā and Saḥāb<sup>21</sup> in al-Balqā', could start a new life during these difficult times. Likewise the newcomers to Nu'ayma and other villages on the border of the Bādiya in the north, were able to consolidate their existence on the land with the help of these facilities. The same trend happened in the south at Ḥmūd, Smākiyya and the villages on the fringe of the arid lands although at a later stage. Since the extension of agriculture in the eastern part of the al-Karak district had to await the arrival of the Ottomans in force, some forty years later in 1894.

### The Pilgrimage Caravan

The Ottoman sultans were very attached to the privileges and responsibilities of their exalted posts as Caliphs of Islam and defenders of the two Holy Shrines. They did not spare money or effort to see that the Pilgrimage Caravan crossed all the way from Damascus to Makka and



4. Al-Yādūda from the northeast (photo: Abujaber, 1985).

<sup>16</sup> Published by J. Murray, London 1858.

<sup>17</sup> Abujaber, *Pioneers over Jordan*, p. 8.

<sup>18</sup> I. Shahid, *Rome and the Arabs*, 1984, p. 20.

<sup>19</sup> S. T. Parker, *Limes Arabicus Project*, 1985, p. 132.

<sup>20</sup> R. D. Ibach Jr., *Archaeological Survey of the Hesban Region*, 1987, p. 195.

<sup>21</sup> Abujaber, *Pioneers over Jordan*. Please refer to the five chapters about these villages.

al-Madina and back without mishap. A strong escort was usually attached to the caravan and every precaution was taken to insure the comfort and safety of the pilgrims whose number sometimes exceeded thirty thousand. Therefore it is not surprising that the Ottomans gave a great deal of money and attention, whenever they could, to the water supply during that long and arduous journey over a period of two months. They constructed, in addition to forts, a good number of *birak* in practically all the caravan stations south of al-Muzayrib, just north of the modern Jordanian border with Syria.

During the ten years of Egyptian presence in Syria between 1831 and 1841, Muhammad Ali Pasha and his son, the commander of the Syrian Expedition Ibrahim Pasha, did not lose any opportunity to improve the services during the caravans' journey. This was very important for them as it placated all Muslims and gave their regime in Syria a much better image than that achieved by the Ottomans. In 1835, a team of Egyptian engineers at the direct orders of the Pasha surveyed all the caravan stations and submitted a report under number (27) 1251 AH of their findings. They also recommended that measures be taken as follows:

*Ar-Ramtha*: The pool is half full of silt and must be cleaned. This can be effected in a few days by employing 200 labourers, so that repairs on the bottom can be carried out in preparation for the season.

*Az-Zarqā'*: The river here has very sweet water but the fort, Qaṣr Shabīb, is in need of immediate repairs.

*Al-Balqā' (Zizia)*: Has a well inside the fort, in addition to two pools outside it. These two were full to the brim but nevertheless needed some cleaning after the return of the caravan. The size of the smaller pool was 50 x 10 yards and 5 yards deep and will provide the caravan with its needs of water. Evidently the larger pool was measured some 30 years later by Tristram who mentioned in 1872 that it was 140 x 110 yards and 17 feet 6 inches deep.<sup>22</sup> The larger pool was in good shape and full of water at the end of December 1991 when visited by the author (FIG. 5).

*Al-Qaṭrāna*: Has a large pool 100 x 100 yards and is in good shape but needs lining. Here also, the water is so abundant that the caravan cannot have any water shortage when the pool is full. However, a dam is urgently needed to stand as a breaker between the pool and the strong inundation of water when the wadi pours down after rain.

*Al-Ḥasā*: Has a pool outside the fort which is 40 x 40 yards and 20 yards deep, and is in good condition.

*'Unayza*: Has a pool which is a short distance from the fort. It is 50 x 50 yards and is 6 yards deep. However it is half full with silt and needs cleaning.



5. The pool at Zizia (photo: Abujaber).

*Ma'ān*: There are few springs around the two hills and in the valley between them there is a pool that is 35 x 25 x 15 yards, which is filled by water from wells by using the *shādūf* system.

*Al-'Aqaba ash-Shāmiyya or Baṭn al-Ghūl*: Next to the fort there are two pools (*birkatān*) each measuring 40 x 40 yards with a depth of ten yards. They are half full of silt and need cleaning which is only possible by bringing labour from Ma'ān.

*Al-Mudawwara*: Has two pools (*birkatān*), the one nearer to the fort being 50 x 30 yards in which there are few springs. The second one is around 400 steps away and derives water from a canal that connects between the *birkatān*. The repair work was estimated to require four canal skilled hands, 10 lime operators for the liming and fifty labourers.

The report continues to mention all the stations until arrival at Makka. At the end it concludes by saying "should this project receive the favour of our lord the great Khedewi, he shall receive the great reward in the after-world. It will also make all the pilgrims acclaim his deed and pray for his long life and the dominance of his regime, as it is known that water on the pilgrimage route is the greatest necessity for the pilgrims who travel on it every year" – Ṣafar 1251 AH or May 1835.

### Activity in Modern Times

During a visit to Irbid some forty years ago, I expressed my interest in agriculture which was then the source of livelihood for perhaps 95% of the inhabitants. An elderly farmer amongst my hosts kindly volunteered to give me a brief idea about farming in the area. He stressed the fact that the region did not have any irrigated fields and that the dry farming system forced every farmer to depend on a secure water supply so that he, his family and his animals may not go thirsty. He said that this aspect of

<sup>22</sup> H. B. Tristram, *The Land of Moab*, 1873, p. 183.

daily life was very important, so much so that the six oldest clans of Irbid were associated with their having a well each. These six were generally referred to as al-Kharazāt (well-collars) and the environs of Irbid then was known as Irbid al-Kharazāt. Stories now have raised the number to seven and differ about who these clans were.<sup>23</sup> However, it is now safe to assume that they were amongst the following known families: al-Tlūl (Tell), Hījāzāt (Hijāzi), Irshaydāt, Jūdiḥ, Dalāqmih (Dalqamūni), Kharazāt (Khrais), Ḥatamlīh and 'Abandāt.

The time during which the prominence of the well-clans started is not known now and cannot be ascertained anyway. However, records of the Ottoman fiscal census of 1595/1596<sup>24</sup> mention Irbid as being then a village of 72 *khānāt* or households and 35 *mujaradat* or bachelors. By Ottoman standards this meant a total population of nearly 400 people, which was the largest village in the Banī Juhma *Nāhiya* or district. It seems also to have had the highest production of wheat and barley, the two main dry-farming crops, as the taxes paid by the village on these two crops totalled 31,500 *akcas* or *aspers* which was then equivalent to about 800 Ottoman Gold Pounds. This evidence of agricultural activity at the end of the 16th century, does not seem to have continued due to instability in the countryside. Little improvement, however, took place during the second half of the 18th century during the relative stability of Dhāhir al-'Umar's short period when his son Aḥmad was governor at Tibna.<sup>25</sup>

The countryside seems to have continued the same pattern when Burckhardt visited Jordan in 1812. Ar-Ramthā had one hundred families and two pools which supplied water to the yearly pilgrimage caravan. The villagers had also in the neighbourhood a number of wells of fresh water.<sup>26</sup> Bilād Irbid or Bilād Banī Juhma in his time had as its principal villages Irbid which is the Shaykh's residence, al-Barha, Kufr Jāyiz, Tukbul, al-'Āl, Kufr Yūba and Jamḥa.<sup>27</sup> These and most of the other villages in the north, lived on dry farming and had to drink from wells.

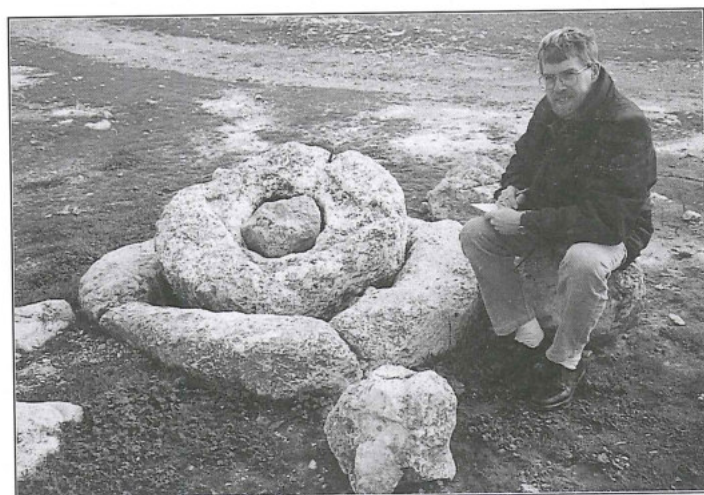
However, in al-Balqā', the situation was less developed as there were only three or four inhabited villages. Likewise in the al-Karak district and in the south, dry farming was being carried out on a small scale. It was towards the 1860s that people of as-Salt started moving eastwards to till the fields and this movement only gained force in the south towards the turn of the century. Farmers realised in these times the importance of cleaning the old wells and cisterns and using them for water storage so that the needs of the inhabitants and their animals could be satisfied.

## Water Storage

Water storage took place in containers of different types and size. In Arabic there are a few words such as *bi'r* (well), *birka* (pool, often used to refer to reservoirs as well), *qī'* (pond or ditch), *sīḥ* (large well), *khazzān* (reservoir or tank), *sadd* (dam). However the most commonly used in Jordan during the last 150 years were:-

### 1. Bi'r or Well

Which was a relatively small rock-cut cistern with a narrow neck leading to a round bulb-like bottom. The shape of these wells was described as an *Ijāsa* or pear and when one went down into them they truly had the shape of a pear. A good example is the one at the threshing ground at al-Yādūda called Bi'r al-Baydar. The opening on the surface was 156 cms in diameter and to cover it precisely a collaring of 170 cms diameter was placed on it. It is in four pieces of hard white rock with a hole in the middle, that has a 70 cms diameter. The purpose of this ring is to allow the passing through of men for cleaning when necessary. A smaller collar, square of hard white rock that is 95 cms by 75 cms, was imbedded on top of the lower ring. Through the hole of 38 cms diameter in this smaller square collar one could bail out water in a *dalū* or bucket. This elaborate system of well collars is not common and I have not seen many of it around, but it undoubtedly is excellent for safety and cleanliness (FIG. 6). The neck of the pear on the other hand, went straight down for 3.5 m whilst opening up gradually to connect with the main body of the well. The total depth from the surface to the bottom was 7.5 m, and the total quantity of water that could be stored in a well of this size may exceed a hundred cubic metres. Under the lower ring a



6. Elaborate well collar at al-Yādūda (photo: Abujaber, 1991).

<sup>23</sup> It is a pity indeed that, like in other places, folklore in Jordan becomes mixed up with time, and research therefore becomes less certain and more difficult concerning dates, localities and people.

<sup>24</sup> Hütteroth and Abdulfattah, *Historical Geography of Palestine, Transjordan and Southern Syria*, 1977, p. 203.

<sup>25</sup> T. Muaamar, *Dhaḥir al-Umar*, 1979, p. 274.

<sup>26</sup> J. L. Burckhardt, *Travels in Syria and the Holyland*, 1822, p. 247.

<sup>27</sup> Burckhardt, *op. cit.*, p. 287.

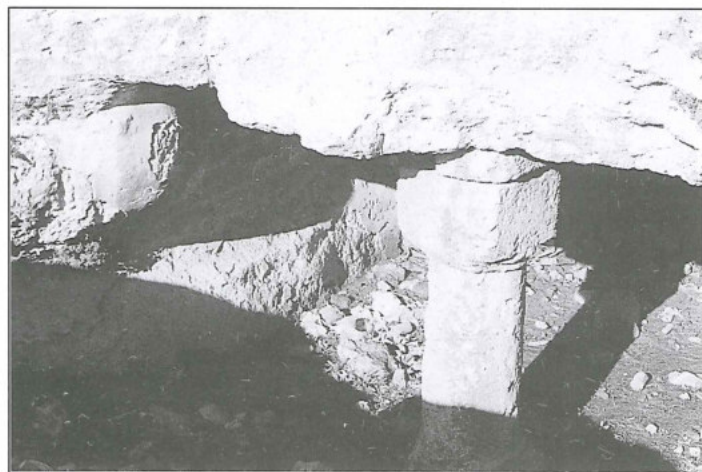
*fatha* or opening of 30 x 20 cms was kept open during the winter months for passage of water into the well.

## 2. *Qī'* or Ditch

This is an excavation in hard rock when no retaining walls were necessary, or in soft soil when walls were built as needed. Since many of these were originally natural caves. It is common to find in many of them pillars that were inserted to support the natural roof that had shown signs of weakness (FIG. 7). The disadvantage of this system of water storage is that it is open to contamination and severe pollution as a result of dirt falling in them. Therefore they were mainly used for watering animals but even then, I have seen animals that refused to drink from them because of the stench (FIG. 8).

## 3. *Khazzān* or Reservoir (also called *birka* or pool)

Generally these were the outcome of collective work amongst the villagers, or the initiative of the landlord of an estate. They were either built in the bottom of a valley



7. Pillar support in *qī'* or ditch (photo: Abujaber).



8. Pollution inside a *qī'* (photo: Abujaber).

or depression after a large excavation is made like at *Zizia* and *al-Qaṣṭal* (FIG. 5), or were built all around, after the lower side on the rock floor was blocked by a sand barrier or built masonry as at *al-Yadūda* (FIG. 9). The size of these *khazzānāt* (*birak*) permitted their use by the whole community living around them as well as by visitors or passers by. Generally the water in these *khazzānāt* became unfit for human consumption in April or May of every year and therefore ended up being used for building requirements and watering of animals. The communal spirit and organisation behind the building and unavoidable maintenance of *khazzānāt* is clear from their being in neighbouring villages. The records of the Lands and Survey Department in 'Ammān confirmed that there were twenty nine sites in the Governorate of *al-Mafraq*, in each of which there was an old *birka*. Most of these now are located on the fringe of or in the northern *Bādiya* stretching from *Khirbat Umm Ṣurrah* to *al-Mukfita* in the north and to *al-Mafraq* itself and *Rihāb* in the south.

The cleaning of wells and cisterns was carried out by the villagers themselves, or hired labour. In the thirties and the forties, labourers from *al-Jawf*, in *Wādī as-Sirhān*, were supposed to be the experts in this field. Coming from an old oasis and a relatively established society which had to handle all matters related to water collection and distribution, they were better informed about the construction and maintenance of wells and their internal lining.<sup>28</sup> Besides they accepted wages that were not acceptable to the local villagers.

To assist them in their work, they resorted to rope ladders, wooden shafts and pulleys. After cleaning a well, a thorough inspection of the bottom and the sides was carried out. Necessary repairs were administered and then the actual lining work was started. Lime was usually produced in some villages by burning limestone rocks in locally improvised lime kilns. This was turned into slacked lime after mixing it with water and was then



9. *Birka* at *al-Yadūda* (photo: Abujaber).

<sup>28</sup> G. A. Wallin, *Travels in Arabia*, 1843-1848, p. 148.

used to plaster the inside of wells. Rarely was a defect discovered in these wells because the workmanship was good and the elders used to maintain that some wells did not need any maintenance or repair during a stretch of fifty years. Rainwater was collected during the winter months over the watershed area through the digging of barriers and canals that directed the water to the *fatha* or opening of the well. This whole area was called in Arabic "dā'i al-bīr" and if it was rocky, the water in the well was pure and more durable. People on the plateau often drank water that may have been over three years old in draught years. If at the end of the season, larvae of black and red colours were floating in the bucket, that did not disturb drinkers and kufiyas were then used to filter the water before drinking.

### Conclusion

The geography of the Jordanian plateau has undoubtedly forced the population to learn about hydrology and the importance of water storage as well. Since time immemorial they had to construct wells and reservoirs of different shapes and capacities. Their main aim was to insure that they had enough water for their needs when the draught years came. This is why one is really astounded by the large number of these storage facilities all over the plateau. At the village of al-Yādūda, the early pioneers in or around 1860 started the building of their primitive walls to make caves fit for habitation hand in hand with the clearance of silt from wells. At the top of the hill, which must have been the site of a prosperous large settlement during the first century AD, there were over forty wells in an area of one hectare. When one of the households became the property of my father, a third generation landlord, in 1917, it had seven wells which

one could see at a glance. Building in the last seventy years has changed the nature of the site, but the photograph shown here (FIG. 10) reveals the presence of four wells within a few metres from each other. All the rainwater that reached the roofs was directed through pipes to the openings of these wells and therefore the water quality was cleaner than usual. Furthermore these wells evidently were cleaned, maintained and well kept because they were the source of life for a dry farming system at such a very short distance. What the older generations of antiquity provided, was put to good use indeed by farmers of the same system a few thousand years later. People living on the plateau have given water collection all the attention that it deserved. That was indeed the only way to guarantee the survival of the system and the people living by it.



10. Four wells next to each other at al-Yādūda (photo: Abujaber).