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## The Character of the Wadi Araba

### Introduction

I should like to thank the Director General of Antiquities for the opportunity to address the Conference on the fascinating subject of the Wadi Araba. I have spent more than five years closely involved with this region, at a time when, due to the penetration of modern ideas, and in particular to the construction of the Safi–Aqaba Highway, the pattern of human activity in the valley is changing very fast.

In the course of these five years, it became slowly forced to one's attention that, though this latest series of imposed changes may be the most extensive that has happened, it is not the first. Everywhere that one turns, in what at first sight appeared to be an almost deserted region, occupied only by Bedouin and their camels and goats, traces are found of previous organised and settled occupation. Evidently the valley is much less inhospitable and unsuitable for human life than it appears, but it is nonetheless marginal land in that drought is never far away and this and/or any other factors that cause the breakdown of organisation, even for short periods, are sufficient to extinguish organised activity. The latest demonstration of this was in 1968 when, in the period following the 1967 war, it proved impossible to continue construction of the road, and cultivation of the irrigated areas of the Ghor Safi was brought to a standstill. Fortunately this time the setback was temporary.

The history of the area over the past twenty or thirty thousand years, most of which can never be known in detail, is of very long static periods, during which first hunters and later herdsmen have moved about the valley following their unchanging ways of life; and of much shorter more dynamic intervals during which, from the early neolithic period onwards, people have settled down and made the best of the available resources.

Due to the peculiar physical conditions in the area, most of the evidence of these periods of more intense activity is there on the ground, awaiting investigation.

### Note concerning locations

References in kilometres relate to distances along the Safi–Aqaba Highway, measured from a zero point 700 metres

south of the Wadi Hasa crossing near Safi<sup>1</sup>. The end of the road, at Magas Junction about 3 km. from Aqaba, is at Km 187<sup>2</sup>. Appropriate map references are given in footnotes on the Palestine Grid taken from the 1:250,000 maps, NOT the International grid shown on the 1:50,000 maps which do not, or did not until lately, cover the whole area.

### Description

The Wadi Araba is a valley about 190 km. long between Aqaba and the Dead Sea which forms part of the Great Rift System, extending from Mozambique in Southern Africa to the Bekaa in Syria. Several million years ago Arabia started to move gradually northwards relative to Africa and Palestine. This movement has been accompanied by extensive faulting, shattering, uplifting and sinking of the rocks of the earth's crust along its boundary, leading to the formation of the valley. The rift is considered to be still active, and the movement to date is about 107 km.<sup>3</sup>

Once the valley was formed, the natural processes of erosion started to fill it with alluvial and wind-borne deposits. The floor of the valley, from 10 to 30 km. wide, is thus covered by deep deposits of alluvium—gravels, sands and silts—the fine portions of which are continually blown about by the winds, with the formation of sand dunes in certain areas<sup>4</sup>. The dominant movement of active dunes is from south to north, due to occasional southerly gales in the opposite direction to the prevailing moderate northerly winds. Here and there in the valley, outcrops of the original crustal rocks are found projecting above the alluvium<sup>5</sup>.

There is no record of major earthquake in modern times but there are many indications of earth movements in the valley floor which are very recent in the geological sense, say

<sup>1</sup> Zero point: 195,051

<sup>2</sup> Magas Junction: 153,886

<sup>3</sup> *Handbook of the Geology of Jordan, and Geological Map* (Burdon and Quennel)

<sup>4</sup> E.g. Gharandal-Rakiya area, 160 to 170 east, 930 to 950 north, Ghauba area 180 to 190 east, 015 to 024 north.

<sup>5</sup> E.g. Jebel Er Risha, coralline limestone, 170, 958 to 167, 953. Fidan range, granite/metamorphic 187,014 to 184,003.

within the last 100,000 years. The book of Numbers, Chapter XVI, seems to record one such incident.

The rate of infilling of the valley near Magas Junction has been about 0.4 mm. per year on average over the past 6,000 years. This is exceptionally high, due to special conditions at this location on the alluvial fan of the Wadi Yutum. Over most of the valley the rate has been far less, and in many areas the surface has remained unchanged throughout the period of human occupation.

The escarpment on the east, at about 1,500 metres above sea level (maximum 1,727 metres near Taiyiba village)<sup>6</sup> is about 800 to 900 metres higher than that on the west. The valley floor rises to just over 200 metres north west of Gharandal<sup>7</sup> and falls to -400 m at the Dead Sea.

There is no indication that, at any time since the formation of the valley began, the climate has been other than semi-arid. It would however be most surprising if there has not been considerable variation within the semi-arid range, and reference is made to this later. The present average rainfall is about 40 to 50 mm. per year at Aqaba, and rather more at the Dead Sea. Most of this rain is brought by westerly winds during the winter; average precipitation (rain and snow) on the eastern (higher) escarpment is much greater—over 300 mm. at Karak in the north, and about 160 mm. in the centre at Wadi Musa. A high proportion of this falls in storms, producing a very high run-off from the eastern slopes (mostly of bare rock), violent floods in the wadis discharging into the Wadi Araba, the formation of temporary lakes, and recharge of ground water. The vegetation in the valley is thus much denser than would be expected in so dry a region. There are also a number of springs, some very large, at the foot of the escarpment, especially near the south end of the Dead Sea. Both Qa (flat silty areas subject to winter flooding) and Sabkha (salt marsh) are found, the latter particularly near the Dead Sea<sup>8</sup>.

Due to the high run-off from the mountains on the east, the ground water is, in some areas, near enough the surface for water to be obtained from shallow wells. Near Wadi Rakiya, damp sand (moisture content 4.5%) was found two metres below the surface in July 1967; this explains the luxuriant growth of deep-rooted bushes.

The climate is hot but with a definite winter; temperatures in the daytime are around 40°C or higher from April to October (maximum over 50°C) but fall as low as 5°C in the winter nights with daily maxima of 16°C to 24°C. Except for some uncomfortable days in summer these conditions are favourable for human occupation wherever there is an assured water supply. The winters, in particular, are extremely pleasant, especially for north Europeans.

### Present use of the Wadi Araba

Conditions are now changing very rapidly, due to the com-

<sup>6</sup>Jebel Mubrak: 196,958; Taiyiba: 194,963

<sup>7</sup>Gharandal: 169,945; high point in valley: 165,956

<sup>8</sup>Genesis 14 verse 10: 'And the vale of Siddim was full of slime-pits; and the kings of Sodom and Gomorrah fled and fell there; and they that remained fled to the mountain.'

bination of government investment and private enterprise, following completion of the road in 1978.

The Wadi Araba has always formed a convenient route for north-south communication, but this had hardly been used since Roman times until 1977, when it was interesting to see that the transport of fresh vegetables from Ghor Safi to Aqaba started the moment the first trace had been cut for the new road. All lateral routes from the valley up to the more populated areas on the high plateau to the east are difficult; only one at the north leading from the Ghor to Karak, has so far been turned into a two-lane modern road. Others will probably be constructed when the circumstances justify the expense; a few of the many paths and tracks can be used by 4-wheel drive vehicles and the others only by people on foot or camels.

Mineral exploitation at present is limited to the extraction of potash from the Dead Sea water; a large new plant is nearing completion on the east side south of the Lisan. That on the west has been in operation since 1933, long before partition. Copper was mined until a few years ago about 30 km. north of Aqaba on the west. The corresponding deposits occur in the eastern escarpment 107 km. further north, and there is a wide distribution of copper generally throughout the northern part of this escarpment. Manganese is also found, particularly near Wadi Hasa. The completion of the road means that the working of much smaller deposits is now a commercial proposition than would otherwise have been the case, and some development may reasonably be expected.

There is nothing new about the idea of leading water from the sea into the Dead Sea and using the drop, of about 400 metres, to generate electric power. This could certainly be done, at a price. However there are many valid objections. The proposal which has recently emanated from the other side makes no sense commercially or politically, and it is most unlikely that it will be carried out. There are other cheaper and less destructive ways of generating electricity.

Reference has already been made to the use of the new road for transporting agricultural produce. The approximate value in 1977/78 of the crop from the irrigated area of slightly under 30 km.<sup>2</sup>, in the Ghor between Feifa<sup>9</sup> and Haditha<sup>10</sup> opposite the Lisan, was around 12 million J. D. This did not use all of the available water. The cultivated areas were rapidly being extended in 1978/79 both using the surplus water from the sources already in use and bringing other springs, not recently used, into operation. The lower slopes along the side of the Dead Sea and south to Wadi Khunizeira<sup>11</sup> are alive with running water, mostly fresh. Other sources further south can also be used. In 1978 cultivation had re-started in a small way at the Roman farm at Wadi Tlah<sup>12</sup>, and in 1976, the moment that road access was

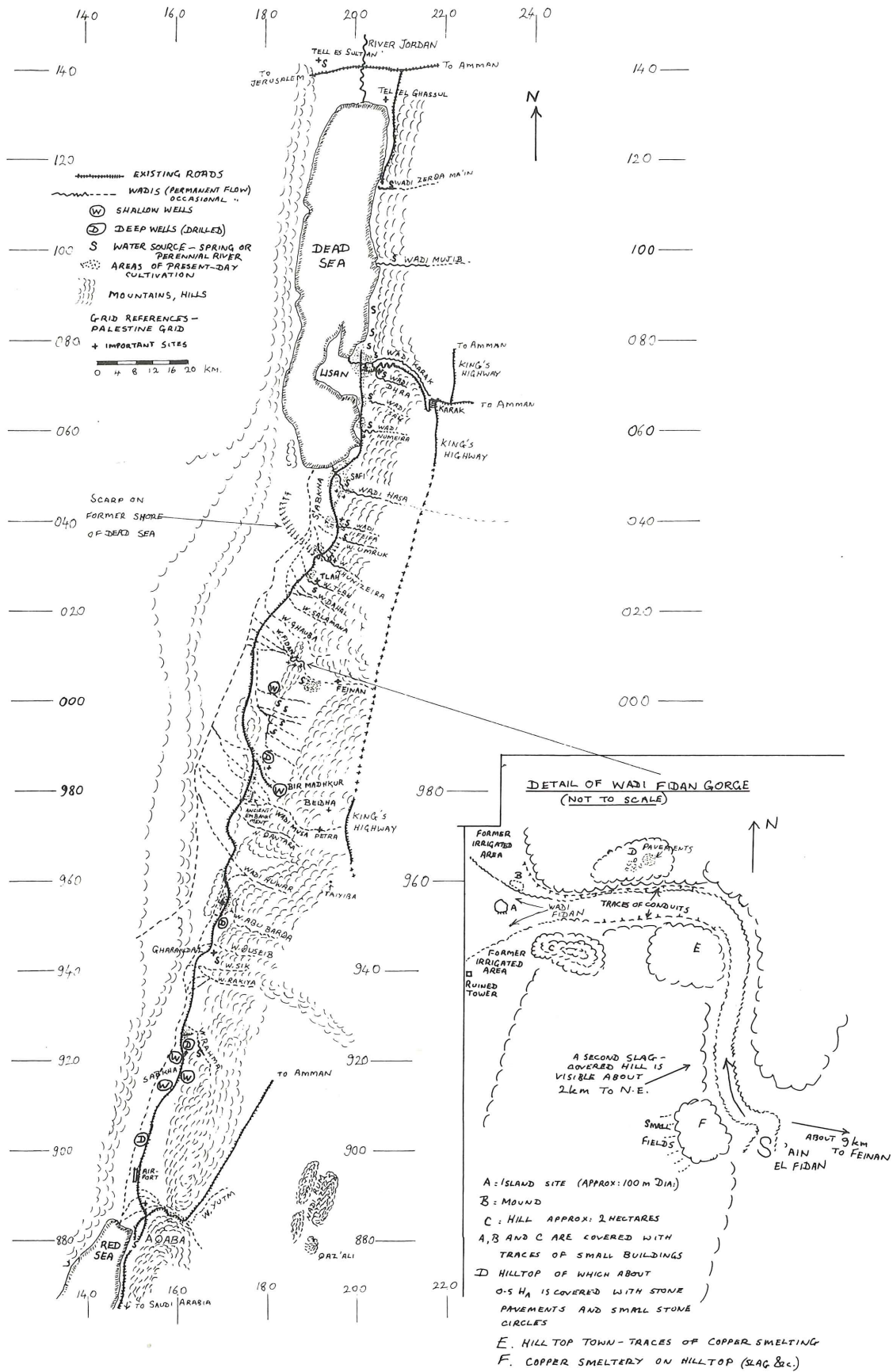
<sup>9</sup>Feifa, 193,038

<sup>10</sup>Haditha, 203,077

<sup>11</sup>Khunizeira, 191,035

<sup>12</sup>Wadi Tlah, Roman farm: 190,026





possible for heavy vehicles, construction began of a large farm using the very important spring at Wadi Fidan, last used on a large scale in the Bronze Age.

Water sources not yet in use, but which might be developed, are at Wadi Mujib<sup>13</sup>, capable of irrigating about 20 km.<sup>2</sup>, if a way can be found of leading the water south; at Wadi Umruk<sup>14</sup>; and a number of large springs<sup>15</sup> south of Wadi Fidan, at some of which the water is brackish but might be usable for certain crops or trees.

Wheat is traditionally grown on the Qa es Sayedin<sup>16</sup> using the flood waters from Wadi Huwar and Wadi Abu Barqa. In 1976 a bulldozer was hired by the farmers from sub-contractors working on the road to divert all of the flood-water south from Wadi Huwar (most otherwise turns north towards the Dead Sea). Provided the diversion works are kept in repair, this will more than double the area that can be cultivated in a good year, already well over 1 km.<sup>2</sup> There are other places, particularly at Wadi Musa, where similar use could be made of floodwater, but this is a risky affair; floods may come two years out of three on average, but this does not preclude the chance of several dry years together.

The yield from shallow wells is not generally enough for more than a small garden or plantation. Exploitation of deep wells by pumping had hardly begun in 1979. Such wells tap the groundwater which has been accumulating in the valley for millions of years, of which the surplus eventually finds its way underground either to the Red Sea or the Dead Sea. This reservoir should be used with caution; excessive extraction uses up a valuable capital asset. Nevertheless an indication of the potential can be had from the number and extent of citrus plantations established on the west side. Two points of interest are: first, does the water extracted to supply these exceed the average annual recharge of groundwater; second, how much of the extracted water originates from the eastern escarpment, where the rainfall is more than on the west. A conservative estimate is that at least as large an area can safely be cultivated on the east from deep wells as that already cultivated on the west, and probably several times as much.

All this adds up to a very large potential amount of intensive farming in ideal conditions for winter crops or for citrus fruits, which alone will justify several times over the cost of building the road (required primarily for the Potash project). The market in Saudi Arabia, with its growing population, is assured, and access is easy down the Safi-Aqaba Highway and onwards to Hakl, Tabuk and beyond.

Camel-herding has also become far more profitable. Camel meat was sold at over 1J.D. per kg. in 1979, and the sale of seven or eight camels realised the price of a second-hand Landrover or jeep. Motor transport has already become part of the Bedouin way of life, and the sight, very strange in 1978,

of two camels riding in a small truck, will soon become commonplace. The purchase of an agricultural tractor and ploughing equipment is now well within the range of many camel-herding families.

#### Past occupation of the valley

In the course of five years a great many sites have been noted some of which are clearly of importance. A full list is lodged with the Department of Antiquities.

Flint occurs over nearly all the Wadi Araba in the alluvial gravel and in seams in the limestone rock, on the escarpments.

#### *Hunters from the palaeolithic onwards*

Worked flints and many arrangements of large stones (fire-places and bases for shelters) are found on almost every hilltop and vantage point. Evidently small numbers of hunters have roamed over the valley during a very long period, and chipped their flints as they watched for wild game. The flints do not vary much; they are rather large and crude, (though some are well made) and are mostly based on broad flakes. The varying degrees of surface polish and patina show that some are very old indeed, and other may be contemporary with neolithic and bronze age settlements. A typical occurrence is on the north side of the mouth of the Wadi Rakiya gorge<sup>17</sup>. The hill provides a good viewpoint, and was climbed in order to study the behaviour of the river bed. My wife sat on a convenient rock to rest after the climb, and was surprised to find that someone had sat there before her; his flint chippings and two or three finished implements were lying in a shallow rock basin at her feet just as he had left them, perhaps about 6,000 years before.

Wild animals are now scarce; a few gazelles are hunted ruthlessly whenever seen, and there are hares, foxes, a few wolves and hyenas, and hyrax, mouflon and ibex in the mountains. No rock drawings have been seen in Wadi Araba, but those in Wadi Rum about 40 km. east show animals which are not found today; in particular, in a cleft in the mountain called Qas 'Ali, a very old engraving may represent a giraffe.

People who live by hunting cannot afford to remain long in the same place thus while sites may be revisited they are not permanent dwelling-places. One site in the Wadi Fidan gorge<sup>18</sup>, on the gently sloping summit of the first hill on the left, going upstream, may be a meeting place rather than a permanent settlement. There are a number of stone circles from one to four m. diameter (perhaps fireplaces) and some quite large paved areas, all made with selected flat boulders of basaltic rock from the river bed below. Worked flints which seem from their patina to be much older than those at neolithic sites nearby are lying near but not on the pavements.

Other places which may be of interest are:-

A small corbelled chamber, more likely from its location to

<sup>13</sup> Mouth of Wadi Mujib: 204,097

<sup>14</sup> Wadi Umruk: 194,036

<sup>15</sup> Springs south of Fidan: from 185,006 to 180,990

<sup>16</sup> Qa es Sayeddin: around 169,953

<sup>17</sup> Mouth of Rakiya gorge; 167,938

<sup>18</sup> Mouth of Fidan gorge; 186,009



be a grave than a well, about 200 m. east of the road near Km 157. A few flints and many elongated granitic flakes were seen.

About 100 m. east of the road near Km 131, on the bank of Wadi Rakiya, several curved foundations for huts or shelters and a small pavement of pebbles arranged around a porphyry boulder.

At the mouth of Wadi Abu Barqa<sup>19</sup> a gravel covered hill which seems to have been a palaeolithic flint factory.

### *Neolithic*

The oldest permanent village so far discovered near the Wadi Araba is Beidha, halfway up the eastern escarpment near Petra<sup>20</sup>, thoroughly investigated and reported by Mrs Helbaek. People at Beidha grow wheat successfully today without irrigation, and store their drinking water in rock-cut cisterns<sup>21</sup>; doubtless the ancient inhabitants could have done the same. From this point north, dry farming is possible on the sides of the escarpment. It is more likely than not, that there are many other villages contemporary with ancient Beidha, and in Mrs Kirkbride Helbaek's report mention is made of several possible sites seen during a journey to Bir Madhkur, 10 km. away at the foot of the escarpment.

The village at Beidha was occupied roughly from 7000 to 6000 BC, rather later than the first period of irrigated farming at Jericho. All of the large springs east and south of the Dead Sea have the same potential as Jericho—permanent water, perfect winter climate and fertile soil. Two of these were certainly used for irrigation in Neolithic times, one at the mouth of Wadi Dhra<sup>22</sup>, five km. uphill from the chalcolithic city of Bab ed Dhra and the other at the Wadi Fidan gorge. Mrs Bennett carried out a reconnaissance of the Dhra site in 1979 and found pottery sherds of Neolithic A type. Earlier use of the site is indicated by several Natufian arrowheads.

The Fidan occupation may be of approximately the same date. Flints are found in profusion at both places, and are unlike any others so far found in the valley<sup>23</sup>; mostly small, delicately made, of almost perfect craftsmanship. The commonest shape is a long thin blade. The three sites at Fidan, one of which covers two hectares, are particularly interesting in that they are undisturbed, and sufficient remains of buildings and conduits can be seen to show that the inhabitants were as expert in dry stone masonry as in flint working. Similar flints have so far been noted only at two out of many encampments near Fidan and three occurrences of one blade each, between

Fidan and Dhra. Contemporary traces at other large springs may have been concealed by later occupations.

Other neolithic sites do not seem to have used irrigation. One village is sited near the south bank of Wadi Rakiya<sup>24</sup>, now dry except for a few days in the winter. Another has been reported from a hilltop two or three km. east of Km 65; a most unlikely spot to find water. Many settlements or encampments are found near dry wadi beds. Flints, but no pottery, are found at these. Except for long heavy blades, the flints resemble those found at hunting sites all over the valley, and are completely unlike those at Fidan and Dhra.

It is an obvious inference that these sites were occupied at one or several periods when the rainfall was greater than at present and the rivers ran further from the escarpment for longer at a time than nowadays.

### *Early Chalcolithic*

Early chalcolithic sites can be identified by the presence of Ghassulian scrapers, large, thin and flat. The Ghassulians were copper workers, and their scrapers have so far been found at two sites near the largest copper deposits. One is near Aqaba, one km. from Magas Junction. In 1967 the road was built through a small mound, half of which remains in situ, and the other half is now dumped on the opposite side of the road. As well as the usual debris of human occupation and remains of copper smelting, well-used flint sickle blades are found, and also objects both decorative and useful, made from sea shells. The presence of the sickle blades in a place where agriculture is today impossible may indicate a less dry climate, or perhaps the sickles were used at the Aqaba oasis along the shore<sup>25</sup>. Copper could have been obtained from the deposits at Timna, 30 km. north, later worked by the Egyptians. The ore seems to have been crystalline (malachite), not the sandstone nodules used elsewhere<sup>26</sup>. There is a much larger mound two or three km. uphill, not yet examined.

The other site is 145 km. north in the Wadi Fidan gorge, on the second hill on the right going upstream. This large hilltop contains the ruins of a sizeable town with similar debris, but only a few sea shells. Two Ghassulian scrapers have been found on the hilltop and one at the bottom on the east. It would be surprising if there were not more Ghassulian sites as yet undiscovered.

### *Later Chalcolithic—Bronze age*

There are five well-known sites all suitable for irrigated farming, of the later Chalcolithic-bronze age periods south and east of the Dead Sea at Bab ed Dhra, Numeira, Hasa, Feifa and Khunizeira, and another at Feinan 10 km. east of the Wadi Fidan gorge. At Fidan and Dhra, later occupations

<sup>19</sup> Mouth of Wadi Abu Barqa; 173,593

<sup>20</sup> Beidha; 193,973

<sup>21</sup> The topography consists of steep rocky hills with valleys between. The insufficient rainfall in the valleys is supplemented by run-off from the bare rocks. Direct sunlight is partly intercepted, and evaporation reduced, by the steep cliffs.

<sup>22</sup> Mouth of Wadi Dhra: 205,074

<sup>23</sup> Flint implements at Dhra resemble those at Fidan but are rather longer perhaps because the raw material (pebbles) is larger. Many of the implements resemble those at 'Ain abu Nukheila in Wadi Rum; thin rasps or files have been found also at Guivath Haparsa on the Mediterranean coast north of Gaza.

<sup>24</sup> Wadi Rakiya: south bank at the mouth of the gorge; 167,937

<sup>25</sup> Near the Palm Beach Hotel, fresh water is obtained from shallow wells a short way above the high tide mark.

<sup>26</sup> Copper ore occurs locally in two forms; crystalline metamorphic pre-Cambrian rocks, and concentrated into nodules in beds of white sandstone.



seem to have purposely avoided earlier sites. The same may not be true at the other four, where there is less space.

The last hilltop on the right, going up the Fidan gorge, is covered by several hundred tons of black slag from copper smelting. This site seems to have been last occupied by the Romans, but the presence of worked flints in and around the slag, and of many sherds of pottery resembling that at Bab ed Dhra suggests that it was used by the inhabitants of Feinan<sup>27</sup>.

Contemporary sites south of Feinan remain to be discovered.

#### *Iron Age*

About 2000 BC there was a shift of human activity from the low ground to the eastern plateau. One reason may have been a climate drier than that of today.

In the book of Numbers, chapter XX there is an account of how the King of Edom refused passage up the King's Highway to Moses and his people, despite assurances that they would turn neither to the right nor the left. Presumably they had reached the neighbourhood of Jebel Haroun and Wadi Musa town by the Wadi Araba route. However good the intentions may have been the result of such a passage would have been the destruction of a wide swathe of crops, disastrous in an area of marginal cultivation. The King had the strength and authority to enforce his decision, and Moses led his people elsewhere.

The area around Karak seems to have supported much the same population around 1000 BC, living in fortified hilltop towns, as it does today. In the valley it remains for experts to identify activities of this period other than of hunters and herdsmen. The only iron age site known so far is the copper smeltery of Ezion Geber near Aqaba<sup>28</sup>.

#### *Nabatean—Roman—Byzantine periods*

The next visible traces noted are of the Nabateans. The best route for men and pack animals from Aqaba to Petra is up the Wadi Araba though in summer the high road might be preferred. The Wadi Araba route was certainly used, and there seems to have been a line of signal stations, each visible from its neighbours, between Aqaba and Petra. There is a Nabatean guard post and a large village respectively west and east of the road at Km 147, sufficiently far from the edge of the Sabkha area for fresh water to be obtained from wells.

In 1976, an embankment two km. long was constructed near Km 77, about 15 km. from Petra, to protect the new road from the floodwaters of Wadi Musa and adjacent rivers. It is strange how in this valley there is a recurring sense of things having happened before. It was found that the new embankment lay directly on top of one built long ago, not to divert, but to impound the floodwaters.

A number of small houses nearby with fragments of pottery like the coarser kinds found in Petra, suggest that the Naba-

teans cultivated the flooded area. A second look at the neighbourhood of the village at Km 147 indicated that the same may have been done there. For this to be practicable, the climate would need to be rather wetter than at present.

There may be Nabatean remains in the Wadi Araba north of Petra along the old track, which runs close to the mountains and joins the new road near Tlah<sup>29</sup>.

The Romans took over the Nabatean kingdom about 100 AD and left their unmistakable mark on the Wadi Araba. There is a fort in the cultivated area of the Qa es Sayeddin<sup>30</sup>, a villa about two or three km. west of the road near Wadi Qantara<sup>31</sup> and a large farm at Wadi Tlah<sup>32</sup> with numerous buildings in the neighbourhood. The Romans also smelted copper on the hilltop in the Wadi Fidan gorge.

Except very occasionally, there is now no water near the Qantara site, and wells would have to be very deep. The present flow at Tlah, of about seven cubic metres per hour, seems very inadequate for the area of nearly one Km<sup>2</sup> enclosed in small rectangular fields, even considering the large masonry tank which would have held about 18,000 cubic metres. Many of the small buildings nearby are on the banks of dry wadis (except for a few days in the year). Small fields near the copper smeltery at Fidan may date from the Roman period. These are too high for irrigation and the present climate is too dry for growing anything without irrigation. The town of Humeima<sup>33</sup>, just at the top of the eastern escarpment, is also on a dry wadi.

There is a large settlement, of late Roman or Byzantine date, a few kilometres north of Tlah which is an inconvenient distance (about 1 hour on foot) from the irrigable areas in Wadi Khunizeira. Other Byzantine sites in the Ghor are all near permanent springs. All of these considerations lead one to suppose that the wetter climate, already suggested for the Nabatean period, extended at least to about 500 AD.

It is to be remembered that only a small long-term change in the average annual rainfall produces a much larger change in the total flow from springs. Rain which falls on the eastern escarpment is partly evaporated back into the atmosphere, partly carried away by floods into the Wadi Araba where it soaks into the alluvium, and only a small proportion percolates underground to re-emerge at springs near the foot of the escarpment.

The result of halving the present small rainfall would not be to halve the flow of the springs but to reduce them perhaps to about a tenth, or very likely dry them up altogether. Conversely, doubling the rainfall would still leave most of the terrain semi-desert, but would far more than double the flow of the springs and bring into being new springs, as well as prolonging in time and distance the winter flows in the rivers.

<sup>29</sup> 190,027

<sup>30</sup> 171,956

<sup>31</sup> Wadi Qantara: 172,976

<sup>32</sup> Qasr et Tlah; 190,026

<sup>33</sup> Humeima: 185,935

<sup>27</sup> There are two such hilltops in the area. One of these was noted by Gluck.

<sup>28</sup> See Lankester Harding *Antiquities of Jordan*.

A possible indication of a period in the past much drier than the present can be seen on the shore of the Dead Sea near Haditha. The water level has recently fallen about seven metres because of increased extraction from the river Jordan for irrigation purposes. On the newly exposed beach just above the present water level, worked flints are found near freshwater springs, as though left behind on the spot by the original makers.

Other large sites in the valley, some of which may be mediaeval, include:-

A reported castle (Qasr) three km. north of Wadi Abu Barqa<sup>34</sup>.

Several constructions at Gharandal<sup>35</sup> including a large walled fort.

A similar fort near the modern well at Wadi Mithla<sup>36</sup>.

A large enclosed area at Mazra'a,<sup>37</sup> near the flow-gauging station in Wadi Karak.

This brief resume shows that, at different times in the past, people have succeeded in doing in the Wadi Araba much the same kind of things as are being done now on a larger scale—using the valley as a trade route, exploiting minerals, and making the best use of the available water for agriculture. More favourable rainfall has almost certainly helped at times.

There are many reasons, most of them just as valid today as in the past, why settled occupations have ceased. One of these is a long-term reduction in rainfall. The safety margin is always small in a semi-desert area, and any circumstance which disrupts a community to the extent of depriving it of one year's crop or trade, is likely to extinguish it altogether, sending the survivors back to a nomadic way of life which

may, if help is not forthcoming from outside, last for centuries.

#### Preservation of sites, due to dry climate and small population

Even in the postulated wetter periods the climate has still been dry. Very large areas of the valley floor have been isolated from the deposition of alluvium for much longer than the whole period of human occupation. Over much of these areas there has been little or no erosion; the rainfall has been insufficient and wind does not erode a surface, once sufficient fine particles have been removed to leave a surface layer of larger objects—stones, potsherds and so on.

During at least five periods, people have maintained permanent settlements in the valley:-

Neolithic

Early Chalcolithic (Ghassulian)

Chalcolithic—early bronze age

Nabatean

Roman—Byzantine

All of these have left behind them the evidence of their existence—rubbish heaps, remains of houses, artifacts and so on. Before, in between, and after these occupations the valley has been inhabited by a very small wandering population of hunters or herdsmen, who have disturbed very little.

Over the next few years, before the latest wave of activity has reached its crest, most of this evidence will still be there to be examined. This will not be so for long. Modern development is already starting at precisely the places which, because of their permanent water supplies, have been most occupied in the past<sup>38</sup>. Access is now very easy to all parts of the valley and communication, supply etc. no problem. Perhaps, following this conference, some of these sites may receive the professional attention that they deserve.

<sup>34</sup> Abu Barqa: 173,953

<sup>35</sup> Gharandel: 169,945

<sup>36</sup> Well at Wadi Mithla: 179,985

<sup>37</sup> Mazra'a: 201,074

<sup>38</sup> E.g. Fidan, and the neighbourhood of Bab ed Dhra