



LIFE
ON THE
WATERSHED / EVA KAPTIJN

RECONSTRUCTING SUBSISTENCE IN A STEPPE REGION USING
ARCHAEOLOGICAL SURVEY: A DIACHRONIC PERSPEC-
TIVE ON HABITATION IN THE JORDAN VALLEY

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*Reconstructing subsistence in a steppe region using
archaeological survey: a diachronic perspective on
habitation in the Jordan Valley*

Eva Kaptijn



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1 Theoretical framework and research questions

1.1 Introduction: the Settling the Steppe-project

Large parts of the Near East consist of arid regions. Today these regions are far from deserted. Many people inhabit them; sometimes for lack of a better option, sometimes by deliberate choice. Throughout history such arid regions have existed and throughout history they have been frequently occupied. The large quantity of archaeological remains discovered in marginal areas clearly shows that many communities in several different time periods inhabited these drylands for some reason. To study this phenomenon of habitation in drylands the project ‘*Settling the Steppe. The archaeology of changing societies in Syro-Palestinian drylands during the Bronze and Iron Ages*’¹ was started. The aim of this project, of which the present study is a part, has been to understand the reasons for the habitation of the arid steppe regions and the manner in which people were able to accomplish this habitation. These aims have been translated into the following research questions:

- Why did people come to live in the steppe zone and why did they abandon it?
- How did people maintain a successful and stable society and what was its character?
- What was the relationship between the societies in the steppe zone and their neighbours in the more favourable Mediterranean zone?

The Settling the Steppe-project was funded by the Netherlands Organisation for Scientific Research (NWO) and carried out at the Faculty of Archaeology of Leiden University. The project was initiated based on issues that had come to the fore in two Leiden University fieldwork projects, i.e. the Tell Deir ‘Allā (Jordan) and Tell Hammām al-Turkmān (Syria) projects. The excavations of Tell Hammām al-Turkmān were started by Amsterdam University in 1981 by Van Loon, and were continued from 1992 onwards by Leiden University under direction of Meijer (Van Loon 1988; e.g. Meijer 1996). The site is located in the Syrian Jezīrah on the Balikh River and was occupied during the Ubaid, Uruk, Early, Middle and Late Bronze Ages and the Roman or Parthian periods. In the Settling the Steppe-project the Early and Middle Bronze Ages (2500-1700 BC) were of interest. The occupational remains at the site are characterized by a fluctuation in emphasis placed on either pastoral or agricultural aspects of subsistence (Meijer 2007). A similar fluctuation between relatively short periods of occupation alternated by phases of abandonment that have been linked to fluctuations between pastoralism and agriculture was also discovered at Tell Deir ‘Allā during the Iron Age (IA). The excavations at Tell Deir ‘Allā in the Jordan Valley were started by Franken of Leiden University in 1960, continued from 1978 as a joint project with the Department of Antiquities of Jordan and since 1980 also including the Yarmouk University from Irbid, Jordan under direction of Van der Kooij, Ibrahim and Kafafi (Franken 1969; Van der Kooij and Ibrahim 1989; Franken 1992; Ibrahim and Van der Kooij 1997; Van der Kooij and Kafafi in press). The rapid oscillation between habitation and abandonment of sites located in arid steppe regions required further study and for this reason the Settling the Steppe-project was initiated.

To investigate the situation in these two separate regions, i.e. the Jordan Valley and the Syrian Jezīrah, the project incorporated individual research in two regional clusters. The Syrian cluster was headed by Meijer and incorporated research by Wossink, which explores human social responses to environmental change in northern Mesopotamia during the late third and early second millennium BC (Wossink 2009, in press). The present research is part of the Jordanian cluster directed by Van der Kooij and focussing on Tell Deir ‘Allā and its vicinity, i.e. the Zerqa Triangle. The geographical situation and the research already undertaken at Tell Deir ‘Allā make the Zerqa

1 NWO project number 360-62-020.

Triangle a suitable region to investigate the general questions of the ‘Settling the steppe’-project. The almost half a century of excavations at Tell Deir ‘Allā have revealed that the site was characterized during the later IA by a settlement cycle in which the tell was settled, occupied and abandoned at relatively short intervals of time. Within *c.* 500 years this cycle occurred 5 to 6 times (Van der Kooij 2001: table 1). These cycles form a good starting point to study the main questions of the Settling the Steppe-project. The specific research questions of the Deir ‘Allā regional component can be phrased as follows;

- What were the reasons for settling in this marginal area and how was this accomplished?
- Why did people return to Tell Deir ‘Allā over and over again, and why was it abandoned each time?
- Is the settlement cycle of Tell Deir ‘Allā also visible in the rest of the region and in other periods?

Some of the answers to these questions are to be found at Tell Deir ‘Allā itself, research which is in the process of being published by Van der Kooij. The aim of the ‘Settling the steppe’-project was to uncover the information present in the surroundings of Tell Deir ‘Allā. The Deir ‘Allā cluster of the Settling the Steppe-project consists of several lines of investigation. Besides the present study, research was undertaken by Petit who investigated the IA tell sites located in the Zerqa Triangle. This study investigated whether the settlement cycle of Deir ‘Allā is also present at other sites in the Zerqa Triangle and what the social and chronological connection between these sites was (Petit in prep.). To achieve these aims three small and already damaged tells were excavated, i.e. Tell ‘Ammata, Tell ‘Adliyyeh and Tell Dāmiyah.²

The three main studies were complemented by two smaller investigations. A study into the geological development of the region during the Holocene and the post-depositional processes that acted on (parts of) the region was carried out by geomorphologist Hourani. One of the aims of his research was to gain insight into the geomorphological processes that acted on the landscape. Additionally, deposits from Petit’s excavations were analyzed to establish in what manner they had been deposited (Hourani in prep.). The other auxiliary research was carried out by archaeobotanist Grootveld who investigated the macro-botanical remains found in Petit’s excavations in order to establish which plants were cultivated during the Iron Age and in what manner. Additionally it was attempted to reconstruct the natural vegetation in the Zerqa Triangle during this period (Grootveld in prep.). The Settling the Steppe-project was emphatically interdisciplinary in design as ancient society, environment and landscape were interrelated and their study should, therefore, also be carried out in an integrated fashion.

1.2 This research

Complementarily to the tell site study of Petit, the present study is concerned with the environment and landscape of the Zerqa Triangle. The aim of this study within the larger project was to detect and explain synchronous patterns of human activity in the landscape together with their diachronic changes. All people live in and with their environment and in so doing they often leave behind remains that can be detected by archaeologists. It has been the task of this study to detect these remains and interpret them as to what activity caused them. The aims of the landscape sub-project of the Deir ‘Allā cluster together with the general aims and questions of the Settling the Steppe-project at large have been translated into the following research questions:

- What remains of human activity are visible in the Zerqa Triangle and what caused them?
- How intensely was the Zerqa Triangle inhabited in the different periods?
- How did people in different periods create a livelihood in this arid steppe zone?

Two lines of investigation were followed in attempting to answer these questions. To answer the first two questions an intensive pedestrian surface survey was conducted. By surveying a representative sample (10%) of the research area with a relatively fine sampling mesh an attempt was made to discover different types of human remains in the countryside and not only large and prominent

2 See also chapter 2 for more information on the tell site project.

settlements. In this way it was attempted to come to a better understanding of the way different societies interacted with the landscape and the variation in intensity over the periods. The details of the survey methodology and design are described in chapter 3.

The question regarding the way people in different periods were able to create an existence in this region was tackled by reconstructing the agricultural practices in the different periods and comparing these practices to the possibilities and restrictions of the Zerqa Triangle as a region. Through a simplified method used by hydrologists, the possibilities of cultivation under different agricultural regimes in the various periods are calculated. Although archaeological use of such models will remain very general and subject to many uncertainties, they can help to give a better understanding of differential agricultural potential. These models can, furthermore, help to evaluate the intensity of habitation in the region as the number of people that can be sustained by a region is highly dependent on agricultural techniques and the crops that are cultivated.

Detailed and systematic surface survey has received much attention in Mediterranean archaeology in recent years (e.g. Barker and Mattingly 1999/2000; Alcock and Cherry 2004; Bintliff *et al.* 2007). Parts of Jordan and neighbouring countries have also been investigated in the same rigorous manner of detailed pedestrian surface survey (e.g. Wilkinson 2004; Philip *et al.* 2005; Barker *et al.* 2007). Although in recent years several detailed non-site oriented pedestrian surface surveys have been started in Jordan, publication is often still in the form of preliminary reports. The research area has received attention from previous surveys, but the emphasis of these studies lay on the investigation of a large region, e.g. Jordan or the Jordan Valley as a whole (Glueck 1951; Ibrahim *et al.* 1988a, b). As a result these surveys were only able to focus on the more conspicuous remains in the area, which generally meant they primarily centred on tell sites. The focus in this region has, therefore, for a long time been on tells. All tells in the Zerqa Triangle have been studied and several have been excavated, but little is known about the surrounding countryside. However, settlements do not stand in isolation from their surroundings. People lived in the Zerqa Triangle as a whole and not only in their tell villages. They interacted with their environment and human beings altered the landscape, but the landscape will also have influenced man. People in the past will have used the land surrounding their villages for agriculture, routes will have connected places, burials may have existed outside the settlements and certain places may have been recognized as having special significance. These phenomena all play an important role in a society and cannot be ignored. This survey, therefore, aimed to pay attention to all aspects of human society located in the landscape without focussing on settlements or more specifically on tell site settlements.

The focus was deliberately placed on the rather small region of the Zerqa Triangle that encompasses only about 15 by 5 km. In this way a detailed image of the region and the diachronic changes therein could be gained. Although wider perspective studies are also extremely important and comparisons between regions provide very important insights into the specific regional characteristics and similarities, it was clear that it was impossible to carry out both lines of investigation within the present research. Given the lack of detailed regional landscape studies in this area, a decision was made to focus on this small region to be able to understand the possibilities and restrictions of this region in detail and evaluate the place different communities took in the landscape together with possible changes over time. The focus on this relatively small area was possible because the Zerqa Triangle can be regarded as a *Siedlungskammer*. The presence of a water source, in this case wadis, is very important for habitation in an arid region like this. The large-scale surveys covering the entire Jordan valley clearly demonstrate a link between the presence of a perennial wadi and settlements in most periods (Glueck 1951; Ibrahim *et al.* 1988a, b). In the area south of the Zerqa larger side-wadis are absent and this part of the Jordan Valley is almost devoid of (ancient) settlement remains. The Zerqa river can, therefore, be regarded as a determinative factor; the areas that are able to benefit from its water can be regarded as a unity bounded by arid regions to the south or by other wadi systems in the north. A *Siedlungskammer* in the Jordan Valley is, therefore, not bounded on a north-south axis by clear physical features like mountain ranges, but by less conspicuous but very influential lack of water. In the east the Zerqa Triangle is bounded by the rather steep and rocky foothills of the eastern plateau that are unsuitable for agriculture. To

the west the Zerqa Triangle *Siedlungskammer* is limited by the Jordan River, which was a large and dangerous river that, especially during winter, could only be crossed at a few fords, before irrigation and water diversions reduced it to its present state.

1.3 The structure of this book

This book is divided into eight chapters including the present chapter. In chapter 2 an overview of the Zerqa Triangle will be given. The physical aspects of the region, including its topography, geology, past and present climate, are discussed. Furthermore, the previous archaeological research in this region is succinctly discussed to provide a framework of archaeological knowledge already available on the area. In chapter 3 the design of the survey and the assumptions and theoretical framework that form the basis of the methodology are discussed. Special attention is paid to the biases that influence the recovery of ancient remains. This chapter closes with a description of the type of remains and distribution patterns that are expected to stem from some of the more common types of human activity. These expected distribution patterns can then be compared to the actual distribution pattern discovered in the survey and through this comparison the survey data can be interpreted. This identification and interpretation of distribution patterns will be attempted in chapter 4 in which the results of the survey are described. After a short description of the overall results of the survey, the distribution patterns will be described and interpreted per individual period. In chapter 5 the manners in which people were able to create a livelihood in this arid region over time are discussed. It will be demonstrated that the arid conditions in this region necessitated the use of some form of irrigation during many of the periods of habitation. This chapter contains a discussion on whether there was a need for irrigation and the manner in which this was realized. Focus is by necessity placed on the periods for which a lot of information was available. For periods from which few remains were discovered by survey or excavation, the lack of artefacts often prohibits conclusions to be drawn on the manner of subsistence. In chapter 6 the type of agriculture that was practised during these periods for which irrigation could be demonstrated is discussed. By making a few inherently very general calculations regarding the water demands of the cultivated crops an indication of the potential carrying capacity is gained. Comparing these to a yet again very rough estimate of the population density per period, provides an indication of the level of habitation intensity. In chapter 7 the social implications of the irrigation system are related to the different societies and it will be discussed that a similar form of irrigation system can have very different social outcomes under dissimilar cultural and political circumstances. Chapter 8 brings the conclusions of the separate chapters together and relates them to the specific research questions of this study and the more general questions and aims of the Settling the Steppe-project as a whole.

The basic survey results are not attached as appendix as this would take up too much space, but can be consulted in the online repository EDNA (E-Depot Nederlandse Archeologie).

2 The Zerqa Triangle

2.1 The physical context

2.1.1 Topography and geology

The region that has been demarcated as the research area of the Settling the Steppe-project is enclosed by the Wadi Rajib in the north, the river Jordan in the west, the river Zerqa in the south-east and the foothills in the east (see figure 2.1). The boundaries of this area are artificial. Although rivers and wadis are often regarded as natural boundaries dividing territories, in this area they are a unifying factor. As will be described in the chapter 5 the wadis and rivers running from the plateau form the basis for irrigation. Water courses are, therefore, central points in the landscape rather than boundaries. Nevertheless, the research area had to be demarcated and the Wadi Rajib and Zerqa river were chosen as borders because they are roughly equal distant to the north and south from Tell Deir 'Allā. Taking these rivers as boundaries, the research area incorporates the assumed territories of Tell Deir 'Allā and its direct neighbours.³ Furthermore, the areas that could be irrigated by two different water courses, i.e. the Zerqa and the Wadi Rajib, are incorporated in the research area in this way. As these rivers have different drainage systems and hence a difference in timing in discharge it is valuable to compare both regions. The research area is, therefore, a modern construct and not a historical entity. Occupation similar to the examples discovered in the research area was present in the areas to the north and south and people living in the research area will undoubtedly have engaged in some form of interaction with these neighbouring regions.

The research area encompasses roughly 72 km² and is also referred to as the Zerqa Triangle (e.g. Helms 1992d). When the name Zerqa Triangle is used here it denotes the entire area between the points where the Zerqa enters the valley and merges with the Jordan (see figure 2.1). Other writers have occasionally used this term to refer only to the eastern part of this larger region, i.e. from Tell Deir 'Allā to the east, as this area also roughly takes the shape of a triangle. This smaller area will be referred to here as the al-Rweihah fan, after the fan-like deposits of the wadis immediately north of the modern village of al-Rweihah.

The Zerqa Triangle is subdivided into three topographic zones, i.e. the ghor, katār and zor. The ghor is the Arabic name for the flat valley plain in which most modern villages, like Deir 'Allā, Sawalha, and 'Abū al-N'eim, are located. This zone forms the largest part of the research area and most surveyed fields were located in this zone. Over time, the meandering Jordan cut its way through the soils of the ghor resulting in the formation of a narrow valley located much lower than the ghor, called the zor in Arabic. The zor denotes the actual streambed of the Jordan River. In the Zerqa Triangle the zor is located c. 50 to 60 m below the ghor. The eroded area that bridges the altitude difference between the ghor and the zor is known in Arabic as katār. Here the soil layers cut through by the Jordan are exposed. This katār area is an erosive area of badlands consisting of small hillocks created by the erosive force of wadis. Very little vegetation is present here due to the marls and high salinity. To a much lesser extent similar erosive areas have developed along the Zerqa. These areas are also referred to as katār.

3 It is assumed that Tell Deir 'Allā as a farming village had an activity radius of about 4 to 5 km or one hour walking, which is ethnographically the maximum distance farmers will travel to their fields. However, the distance between contemporary tell sites in this area from the IA is significantly smaller (c. 1.5-2 km), which suggests territories were smaller during at least this period (see also Petit in prep.). Many other periods show the same distances (see chapter 4).



Figure 2.1 The research area

The character of the *katār* as a badland area is a result of the Late Pleistocene history of the Jordan Valley. The cold and moist conditions of the last glacial led to the formation of many large lakes, among which Lake Lisan that at its maximum extent stretched from the present-day Lake Tiberias to Hazeva, south of the Dead Sea. It is generally agreed upon that Lake Lisan was formed *c.* 70,000 BP. From then until about 27,000 BP the level of the lake fluctuated, but remained more or less centred around -300 m asl. Sometimes the level dropped, e.g. reaching -340 m asl around 48,000 BP, but it also rose around 33,000, to -265 m asl (Bartov et al. 2002: 18,19). Towards the end of the Pleistocene a major lake level change occurred when the lake started to rise to a maximum level of over -164 m asl (Bartov et al. 2002: 19). Such a high level caused the entire research area to be submerged. The edge of the *ghor* is located around -170 asl, meaning that at that time the shore of Lake Lisan reached into what are today the foothills. The precise date at which this rise occurred is, however, much debated. Bartov and colleagues position the start of the rise around 27,000 BP and argue that a maximum was reached at 25,000 BP, after which Lake Lisan fluctuated around this high level for about 2000 years before dropping again to -270 m asl between 23,000 and 19,000 and to -300 m asl after 15,000 (Bartov et al. 2002: 19). Others, however, think that a high level persisted until 18,000 BP or just after (Goldberg 1994: 94; Klinger et al. 2003: 135). Neev and Hall suggest that drier conditions prevailed until 15,000 BP, followed by a wetter period that lasted until 12,000 BP during which the lake level rose again. Begin, Ehrlich and Nathan, however, argue that a wet pluvial period followed that lasted until 12,000 BP (Goldberg 1994: 94). Recent studies on sedimentological and archaeological sequences in areas away from the Dead Sea shores have provided data in favour of Begin et al's interpretation. Investigation in the Wadi al-Hammeh, located just north of the archaeological site of Pella, show a steady rise of Lake Lisan levels un-

til 11,100 BP, the lake reaching heights of at least -160 asl (Macumber and Head 1991: 172). The fluctuating shore of Lake Lisan is reflected in the location of archaeological sites. Sites of a similar age are located at more or less the same height (Macumber and Head 1991: 169). A similar study in the Salibiya basin on the western side of the Lower Jordan Valley provided comparable results. The location of archaeological sites corresponds to the expected level of the Lake Lisan at that time. Kebaran and Geometric Kebaran sites dated between 17,000 and 13,500 BP are, for example, not found below -203 m asl. Younger Natufian sites are located at a minimum level of -215 m to -230 m asl, thereby suggesting a high lake level as late as 17,000 BP and a declining shoreline after this date (Goldberg 1994: 92). After this period of high lake levels, drier conditions prevailed during the Younger Dryas and Lake Lisan rapidly declined. The rapid lowering of the lake resulted in relatively flat valley bottom known today as the Ghor (Goldberg 1998: 45). Some argue that this desiccation was so severe that the lake level retreated to -700 m asl, after which moister conditions caused it to refill (Klinger et al. 2003: 136). After this dry spell, higher lake levels of what is now called the Dead Sea were identified for several periods, e.g. the Pre-Pottery Neolithic, Early and Late Bronze Age, the Roman period and Early Islamic periods, but these fluctuations were never so intense as to affect the research area in a direct way (Bruins 1994). The presence of Lake Lisan clearly prohibits the presence of archaeological remains from the Palaeolithic period at surface level.⁴ Only once the lake had retreated would people have moved into the ghor. As noted above, the exact date at which this retreat happened and people moved into the valley is debated, but it can be safely stated that remains from before the Natufian period are not to be expected in the Zerqa Triangle under normal conditions.

The presence and retreat of Lake Lisan resulted in the deposition of so-called Lisan marls. In the Zerqa Triangle these Lisan marls consist of laminated beds of calcareous silt loams and true loams that are intertwined with chemical precipitates and highly saline (Anonymous 1969b: C I-6). These Lisan Marls surface at several locations in the research area and have been widely used for pottery production, for example, in the IA (Franken 1992: 107). The largest part of the research area, i.e. the ghor, consists of fluvial-colluvial sediments with residual Lisan Marls below 90 cm (Anonymous 1969b: C 1-14). These soils are moderately fine-textured and quite fertile, although salinization can become problematic when intensive irrigation without sufficient leaching is practised (Anonymous 1969b: c I-43ff). Bordering on the foothills colluvial deposits eroded from the hills can be found. These areas have seen the most soil accumulation in recent times and, therefore, pose a problem for the recovery of artefacts in the survey. These areas are, however, of limited size and generally only encountered along the foothills. In all it can be stated that the ghor is essentially a fertile area subjected to little deposition and erosion and therefore offering good chances of artefact recovery. The processes leading to this situation and their implications for the survey are analyzed and described in detail for the research area by Hourani (Hourani 2002, in prep.).

The Jordan Valley is an active geological zone, which has some implications for its inhabitants today and would have had in the past as well. The Jordan Valley is part of the much larger rift valley stretching from the Red Sea through the Wadi 'Arabah and the Jordan Valley, the Huleh Valley into the Beqa' valley in Lebanon and continuing into Syria, ending at the east Anatolian fault in south-east Turkey. This rift valley forms the boundary between two tectonic plates, i.e. the Arabic plate in the east incorporating the Transjordanian plateau and beyond, and the African plate of which the Cisjordanian plateau forms a part. Both plates are moving towards the north-northeast but at different speeds which causes friction. This movement occurs in sudden shifts that are accompanied by earthquakes (Horowitz 2001). Earthquakes are a frequent phenomenon in the Jordan Valley and several devastating earthquakes have been documented over the past few centuries (Russell 1985; Amiran et al. 1994). Although identifying earthquakes on the basis of archaeological remains is difficult, there is no doubt that severe earthquakes occurred throughout the history of the Zerqa Triangle.

4 Where erosion has removed the Lisan deposits older occupation remains can be discovered, as was shown for example by the discovery of Ubeidiya (Bar Yosef and Goren-Inbar 1993).

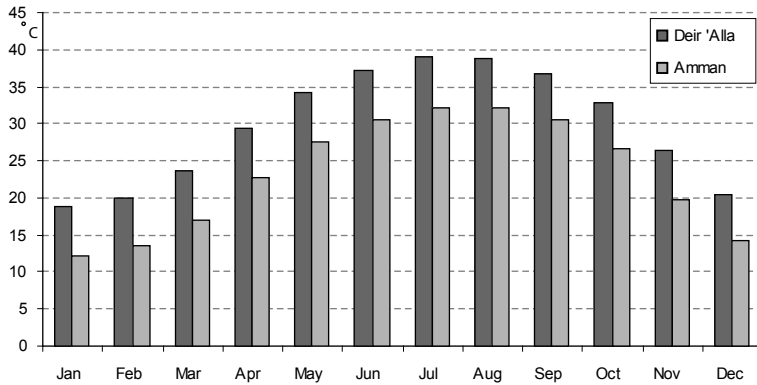


Figure 2.2 Average monthly day temperatures measured between 1976 and 2005 at Deir 'Allā and Amman⁵

2.1.2 Modern climate

The Jordan Valley being a rift valley has a very low altitude. While the fault between these plates has caused the edges of both plates to rise, the valley in between is moving downwards. This process has made the Dead Sea the lowest place on earth. The Zerqa Triangle is located slightly higher, but still well below sea level. The lowest point of the research area, i.e. at *Dāmiyah* where the Zerqa joins the Jordan, starts at *c.* -350 m asl. The highest point of this part of the ghor where the Wadi Rajib enters the plain is located at -200 m asl. This low altitude has serious consequences for the climate of the Jordan Valley. Temperatures in the valley are high. Areas located on the plateau that are horizontally only a few kilometres away are located *c.* 1000 m higher which results in a lower temperature of *c.* 6° C. In figure 2.2 the average day temperatures per month of Deir 'Allā and Amman are depicted.

These high temperatures result in a high potential evaporation, which means that plants need a lot of water to grow. The precise degree of potential evapotranspiration and the water requirements of plants will be elaborated upon in chapter 6. The unique topography of the rift valley also influences the precipitation in this region. The entire region is characterized by dry summers and humid winters. The predominant westerly winds coming in from the Mediterranean Sea in the winter bring humid air to the southern Levant. Along the coast of Cisjordan the air is forced to ascend in order to cross the hills that rise up to 800 m flanking the rift. When ascending the air temperature drops and the air can contain less moisture causing rain to fall when the humidity is sufficiently high. Continuing to the east the air is able to descend again when it reaches the Jordan Valley. With this descent the temperature increases and rainfall stops. However, almost immediately after the descent the air again has to climb, this time to ascend the Transjordanian plateau. The air is often not able to hold the remaining moisture and precipitation occurs. As a result it is common that rain clouds cover both the hills to the east and west of the valley, while the valley itself remains dry. This rainfall pattern together with the lower temperatures in the hills makes that both areas are part of the Mediterranean climate, whereas the Zerqa Triangle is generally considered to be part of the steppe zone. There are different definitions by which the climate of a certain region can be calculated, e.g. Köppen, Thornthwaite, Trewartha, Griffiths and Bailey. According to all these different calculations the Zerqa Triangle falls safely within the climatic steppe zone (e.g. Cordova 2007: 45-47).

In figure 2.3 the average precipitation per month calculated over the last 30 years is depicted. It is clear that precipitation is very limited during April, May and October and next to non-existent between June and September. The mean annual precipitation of 291 mm lies above the minimum amount of rainfall generally regarded as the minimum needed for dry farming, i.e. 250 mm (Wirth 1971: 92). However, the possibilities for dry farming are much more restricted in this area due to a number of environmental and climatic conditions. First, the potential evapotranspiration is very high (see figure 2.3). Secondly, there is almost no rainfall during a period of six to seven months.

⁵ Based on data collected and published by the Jordan Meteorological Department (<http://met.jometeo.gov.jo>)

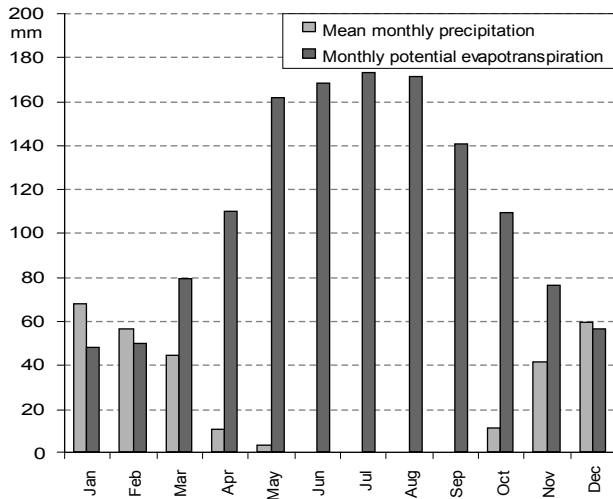


Figure 2.3 Potential evapotranspiration per month at Deir 'Allā according to Penman-Monteith Equation⁶ and mean monthly precipitation⁷ at Deir 'Allā in mm

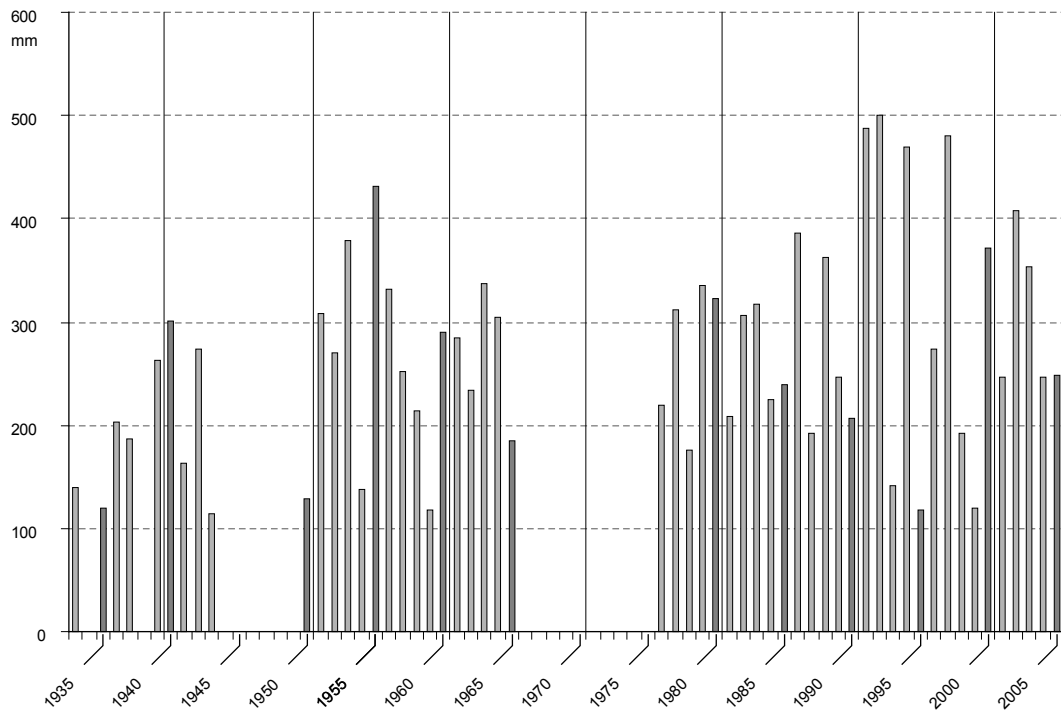


Figure 2.4 Mean annual precipitation at Deir 'Allā between 1933 and 2005⁸

Furthermore, the timing of precipitation is essential; if, for example, it comes too late plants will fail to germinate. Equally influential is the type of precipitation. In the Zerqa Triangle rain generally falls in short heavy showers, resulting in a large amount of direct runoff that cannot be used by plants. At Deir 'Allā the rainfall is, furthermore, very irregular over the years. Figure 2.4 shows the high yearly variability between 1933 and 2005. Between 1990 and 2000, for example, the mean annual rainfall fluctuated heavily and ranged from 118 mm in 1995 to 501 mm in 1992. It will be

6 Based on the National Center of Agriculture Research and Technology Transfer (NCART) of Jordan
 7 Based on data from the Jordan Meteorological Department (<http://met.jometeo.gov.jo>).
 8 Based on data from the Jordan Meteorological Department (1976-2005) (<http://met.jometeo.gov.jo>) and Jordan Valley Project report (1950-1966) (Anonymous 1969a: table B-4) and (Ashbel 1945) made public by the National Oceanic Atmospheric Administration Central Library, Environmental Data Rescue Program (1933-1945) (http://docs.lib.noaa.gov/rescue/data_rescue_palestine.html).

clear from these data that stable dry farming agriculture is very difficult or even impossible in this area. Modern practices show that when there is sufficient water the high temperatures and alluvial soils make the Zerqa Triangle a very fertile area where crops can be harvested more than once a year. In chapters 5 and 6 the possibilities of agriculture in combination with irrigation will be demonstrated.

In this region agriculture benefits little from groundwater except for the mouths of wadis where there is usually a subsurface flow which plants are able reach. Away from wadi's the groundwater table is very low in the Zerqa Triangle. In 1966 the groundwater was only reached at *c.* 31 m below the surface (Anonymous 1969a: table B-40). Although motorized pumps have lowered the groundwater table severely in recent years, it is clear that the groundwater table was low in the past as well. At Tell as-Sa'idiyeh, located in the zor where the groundwater is much closer to the surface than in the ghor and which is only a few metres away from the Wadi Kufrinji, a large well and staircase leading to the water table was dug during the LBA. This well extends to 6 m beneath the surface (Pritchard 1985: 58; Tubb 1993: 1299). In the ghor the groundwater will have been at an even deeper level below the surface making it almost impossible to reach from the surface.

2.1.3 Past climate

The question remains, however, whether the present-day climate also pertains to the past. The reconstruction of past climates is a widely debated topic (e.g. Issar and Zohar 2004; Rosen 2007). One of the problems of using climatic reconstructions in archaeology is time. Climate is typically a long-term phenomenon as it denotes the 30-year average. Reconstructions of ancient climates are, moreover, generally more imprecise. Human beings and their agriculture are, however, concerned with the short term. Extremely dry conditions in a single year will probably not appear in climatic proxy data on which climatic reconstructions are based, but the individual farmer will be faced with very significant problems during that particular year. However, at the scale of the larger society, short-term fluctuations could be insignificant if these are exceptional occurrences. Communities rarely change or collapse due to one failed harvest. However, if harvest failures occur more frequently society may react in some way (Halstead and O'Shea 1989). Although this stimulus and reaction debate is very interesting it goes beyond the scope of this study. Survey data generally do not have sufficient chronological detail to enter into such debates and the research area is not very suited to detect these wider processes. The present study therefore touches on this topic only succinctly.

Especially chapter 6 will deal with the possibilities of creating and maintaining a livelihood in this arid area, and in this regard, the climate and its development over time are important. A study into climatic development is, however, a study in itself and will therefore not be attempted here. For a detailed overview of the climatic proxy data available for the southern Levant, their problems and possibilities, one is referred to Rosen (2007). This book gives an excellent overview of the data that are presently available on climate in the southern Levant.

The period concerned here, ranging from the Late Chalcolithic to the present day, is generally characterized by a gradual drying and warming up of the climate. During the Late Chalcolithic and EBA, i.e. the 4th and 3rd millennia BC, the region experienced moister conditions than at present. This is visible in $\delta^{18}\text{O}$ levels from the Soreq cave that indicate moister conditions alternated by a few short dry episodes (Bar-Matthews et al. 2003: 3196; Rosen 2007: 82). Geomorphological research into the presence of low-velocity overbank deposits beside rivers from this period supports this view (see also section 5.5) (e.g. Rosen 2006: table 21.1; Cordova 2007: 189; Hourani *in prep.*). At the end of the EBA, around 2000 BC, conditions became more arid, which is visible in higher $\delta^{18}\text{O}$ levels (Bar-Matthews et al. 2003: fig.13), streambed incision of rivers (Donahue 2003: 55; Cordova 2007: 190), the decrease of arboreal pollen (Rosen 2007: 85), and lower Dead Sea levels (Frumkin et al. 2001: 1184).

The period dating from 2000 BC until today is characterized by less variation, although some wetter and drier episodes occurred. It is problematic that several climatic proxy data cannot be as precisely dated as is necessary to see the impact of climatic change on human societies. Furthermore, different types of climatic proxy data sometimes provide contrasting results. Three

different types of isotopic data are available for this period. Land snail shells from the Negev show a gradual drying and warming trend between 2000 BC and 1500 AD (Rosen 2007: 89). Modelled rainfall and temperature levels based on the Soreq speleothems show levels similar to those of the present day between 4000 and 3000 BP (c. 2000-1000 BC), followed by a drop in rainfall and rise in temperature culminating around c. 400 BC. After a short return to earlier conditions rainfall dropped again around the year 1 and temperatures rose, returning to the present condition only around 1800 AD (Bar-Matthews et al. 2003: fig.13). In all, rainfall lessened by just 150 mm while temperature fluctuation varied only a few degrees. Cores from the Eastern Mediterranean Sea show humid periods peaking around c. 1200 BC, 700 AD and 1300 AD, while dry episodes peaked around 100 BC, 1100 AD and 1700 AD (Schilman et al. 2001: 172; Rosen 2007: 90). Pollen evidence is more difficult to use during the later periods as the influence of humans is more pronounced and difficult to distinguish from natural change. Dead Sea lake levels show a minor fluctuation between 1000 and 550 BC indicating minor climatic variations followed by a drop of the lake which rises again from c. 370 BC to 350 AD (Frumkin and Elitzur 2002: 337; Rosen 2007: 94). This high level in the Hellenistic and Roman period contrasts with the dry conditions concluded from the isotopic data. After the Roman period the levels dropped to rise again rapidly to a maximum in 400 AD. Until 1100 AD there was another drop after which the level of the Dead Sea rose again (Rosen 2007: 94). Enzel et al. have also studied Dead Sea levels and see several small fluctuations during the IA, but a general increasing trend that culminates in a high peak around 100 BC. Around 300 AD there is a sharp and drastic drop followed by an equally rapid rise that reaches its peak around 450 and falls sharply after that. After a period of low levels there is a low peak around 1200 AD followed by a small drop and a sharp peak around 1850 AD (Enzel et al. 2003: fig. 2a). The high Dead Sea levels around 100 BC do not match the dry spell visible in the isotopic data of the Mediterranean Sea but are comparable to the Soreq cave data. The same holds true for the wet maximum around 700 AD interpreted from the isotopic data and the low Dead Sea levels in that same period. However, there is a very general trend detectable showing that conditions before 2000 BC were considerably moister and different from today. After 2000 BC, however, conditions became drier and more like the modern climate. The IA climate seems to have been more or less comparable to the modern climate although it was characterized by frequent small fluctuations. Later moist periods seem to have occurred at least around 100 BC and 1100 or 1200 AD but precise dating remains problematic.

2.2 Research context

2.2.1 Surveys

Over the past two centuries this part of the Jordan Valley has been surveyed a number of times with varying intensity. The earliest reports that have come down to us are the travel journals of 19th century adventurers and scholars traversing the region. Their descriptions are generally not specifically concerned with archaeology, but cover a wide range of topics like topography, botany and ethnography. In many cases archaeological information can only be read between the lines. Around 1900, however, the first purely archaeological surveys were undertaken. Some focussed specifically on remains that could be linked to the Old Testament and the identification of places mentioned in the Bible. Other scholars, however, were less restricted and documented remains from all periods. As time progressed, surveys became increasingly detailed. However, the site oriented approach remained dominant.

The first written reports describing this area are by Arab geographers like Idrisi (1154 AD), Ibn Battuta (1326) and Yakut (1225 AD) (Gibb 1958: 82, 83; Le Strange 1965: 31, 393). Although these reports are very valuable to us in that they provide a contemporary description of the region in the late Islamic period, they are unfortunately extremely general and give a description of the topography and particular physical or cultural features without making reference to archaeological remains.

A second source of information are the reports written by Crusaders, early pilgrims and merchants travelling through what they called the Holy Land (e.g. Foster 1931; Phelps 1974). These authors generally regarded the region from a Biblical background and often tried to identify the stories mentioned in the Bible with places they encountered. Unfortunately, tells were not often recognized as such. Additionally, the Crusaders and pilgrims travelled mainly in the Biblical heartland and only rarely ventured into the Jordan Valley or Transjordan. In later chapters a few references will be made to this type of report, but no detailed descriptions of the research area have been discovered in them.

Another source of written information can be found in administrative documents of the Ottoman government. Especially the Early and Late Ottoman periods have yielded several documents from the district in which the Zerqa Triangle is located (e.g. Le Strange 1965). The available Ottoman records will be discussed when treating specific topics in later chapters.

The first topographic reports that are sufficiently detailed to recognize the Zerqa triangle as a separate entity stem from the 19th century. Western travellers came to the region with a Biblical focus once again, but this time usually with an academic background. Again the main desire was to identify the places mentioned in the Bible, but now the geography, climate, vegetation, and the manners and customs of the local population were also given attention, as these could potentially provide a better insight into the general setting of the Biblical stories. Many of these descriptions remain valuable today, especially because these scholars encountered the archaeological remains in a much better state of preservation than they are at present.

The first report describing sites in the Zerqa Triangle is by Burckhardt, who crossed the region during the summer of 1812 on his way from Damascus to Cairo (Burckhardt 1822). When entering the Zerqa Triangle he described that his group passed the ruins of an ancient city still bearing its ancient name Amata (Burckhardt 1822: 346). This site is located on the northern bank of the Wadi Rajib and is today known as Tell 'Ammata. Burckhardt was informed that several columns and some large buildings were still standing, but did not visit the site himself. Half an hour later his group reached the tomb of Mazār 'Abū 'Ubaydah where they rested. A few houses were present, but their inhabitants were at that time all absent except for the tomb keeper and his wife (Burckhardt 1822: 346, 347). On the third of July they left 'Abū 'Ubaydah, passing a working mill 15 minutes later. Parts of this mill are still standing today and proved to be much older than expected (see section 4.6.2). Burckhardt continued towards the south to cross the Zerqa and ascended the plateau immediately afterwards.

A second early itinerary written by Buckingham describes the situation in 1816. Buckingham also passed Tell 'Ammata, which he described as a 'site of considerable ruins, where we saw foundations of buildings, outlines of streets, blocks of hewn stone, and other fragments, evidently marking the position of some considerable town. This place still bears the name of Amatha' (Buckingham 1825: 11). Buckingham identified this Amatha with the Amathus known from Classical writers. He subsequently visited 'Abū 'Ubaydah where he encountered more or less the same situation as Burckhardt (see a more detailed description in section 4.6.3). After 'Abū 'Ubaydah he traveled in a south-easterly direction noticing 'several artificial mounds, which had the appearance of ancient tumuli, and many hewn grottos in the rocky cliffs on our left' (Buckingham 1825: 15). The ancient tumuli are undoubtedly tells and probably represent Tell al-Mazār and al-'Adliyyeh. Buckingham continued past Dhirār where he mentioned the presence of an aqueduct (Buckingham 1825: 15). At the place where they forded the river Zerqa Buckingham noticed walls and buildings on the banks. Like Burckhard, Buckingham and his companion ascended the hill in the direction of es-Salt (Buckingham 1825: 16). Both travellers took the same route and noticed the same places like Tell 'Ammata, 'Abū 'Ubaydah and Dhirār. Both were aware of the antiquity of some of the sites and show an interest in them. They were, however, not able to openly profess an interest from a western scholarly point of view as travelling was dangerous at that time and both were disguised as Arab travellers. Assaults by groups of Bedouin occurred regularly and especially Buckingham reported on these frequently and vividly.

The first report of a professed western traveller with a scientific aim is the narrative of the 1848 river Jordan expedition by Lynch (1849). This expedition of the American Navy travelled down the river Jordan both over land and in boats. The expedition was published as a descriptive

report accompanied by a map. From this description it is clear that this was a perilous undertaking as is evidenced by an earlier expedition that had been killed by the Bedouin. Especially the land south of the wadi 'Ajlun was considered to be extremely dangerous. The expedition was published as a descriptive report accompanied by a map. Lynch mentioned the Wadi Rajib and described that the team could see the village of 'Abū 'Ubaydah, where the tomb of one of the generals of Muhammed lay. Lynch added that others said the great sultan of Yemen, was buried there (Lynch 1849: 230). The team camped at ford Tell Dāmiyah and where the road from Nablus to Salt crosses the river (Lynch 1849: 248). Lynch described that they visited the ruins of a bridge just north of the ford and remarked that to their knowledge no one had ever reported its existence (Lynch 1849: 250). Based on its construction they dated the bridge to the Roman period. However, later studies have shown that it should be dated to the Mamluk period (LaGro 2002: 16). Parts of this bridge are still present at Dāmiyah ford, or Jisr Dāmiyah in Arabic.

In 1864 Honoré Théodore Paul Joseph d'Albert, Duc de Luynes travelled through this region. He mentioned 'Abū 'Ubaydah. Like Buckingham he considered tells to be tumuli that had been erected at some great event in history. He and his group camped along the banks of the Zerqa near two of these tumuli. De Luynes examined these and discovered some pottery sherds on their top supposedly belonging to the Roman Period (Luynes sd: 133). The duke and his companions continued through the ghor to the south and eventually arrived at a place which they called Ala Saphat where they discovered numerous dolmens (Luynes sd: 135). This area can be positively identified with the Dāmiyah Dolmen field located in the foothills to the east of Dāmiyah.

A decade later, Selah Merrill, a former congregational minister and the later US consul in Jerusalem, is the first to report of tells while realising their archaeological significance. He travelled through modern Jordan from 1875 to 1877 as part of the Survey of Eastern Palestine by the American Palestine Exploration Society. The aim of the Survey of Eastern Palestine was to investigate the land east of the Jordan and produce a detailed map that could be published alongside the Survey of Western Palestine of the British Palestine Exploration Fund (Cobbing 2005: 9). Besides maps, reports on the archaeological and natural historical phenomena the team encountered were produced. Merrill was put in charge of the archaeological report. The survey was never published because the resulting map proved to be less detailed and accurate than had initially been envisioned. Merrill, however, revised his archaeological report into a separate publication entitled *East of the Jordan* (1881). Of Tell Deir 'Allā he wrote; 'There is every evidence that the mound is artificial; indeed, so far as it has been examined beneath the surface, it is a mass of debris. The Arabs living in that region have a tradition that this mound was once occupied by a city' (Merrill 1881: 388). He further described the location and form of Tell Dāmiyah and noted that when they travelled from south to north they passed Tell al-Munta, Tell Atwal, west along Tell Deir 'Allā, came across Tell Mizat and the tomb of 'Abū 'Ubaydah (Merrill 1881: 426). Tell al-Munta is probably the same as Tell Mīntah, now completely overbuilt by a modern village, while Tell Atwal is probably one of the tells located in the vicinity of the modern village of Tiwal, today known as Tiwal N, Tiwal S and 'Abū al-N'eim, Tell Zakarī, Tell al-Bashīr, or Tell al-'Arqadat.

Merrill recognized tells as archaeological phenomena, but he was not an archaeologist by training. Therefore, his publication was not aimed at describing the archaeological features of the country, and was more a general overview of his travel experiences. The first person to describe the region from a purely archaeological point of view was Schumacher. He travelled across the Zerqa Triangle in 1898 and letters written from his camps were almost directly published in the journal of the Deutschen Palästina-Verein (Schumacher 1899). In 1925 Steuernagel used the more detailed diaries of Schumacher in his publication on 'The 'Ajlun' in the same journal (Steuernagel 1925). Schumacher identified several tells and his notes will be revisited on several occasions in the following chapters. Only a short overview of the archaeological remains he mentioned will, therefore, be given here. For example, he mentioned the artificial hill of 'Ammata with remains of several mills located in its vicinity, 'Abū 'Ubaydah, and Tell al-Hammeh, the ruins of which did not seem very important to him (Schumacher 1899: 19, 21). He further described Tell Deir 'Allā, where he found two column bases and some sherds, and he mentioned Tell Zrar (Dhirār) which is

probably Tell al-‘Adliyyeh and reported that he has heard the name Tell al-Khsās being mentioned (Schumacher 1899: 21, 23). Further south he noted Tell Dāmiyah and the bridge which he identified to be Islamic in date (Schumacher 1899: 35).

Only three years later, in 1901, Abel visited the region. In the southern part of our research area he identified Tell Dāmiyah and the bridge. Further to the east and therefore outside the research area he discovered what is probably the Mamluk mill called Tawahin es-Sukkar located west of the Dāmiyah Dolmen Field and Tell al-Dōlānī, located 1 km south-west of the modern village of al-Ma‘addī. He crossed the Zerqa and passed Tell Mintah, Tell Deir ‘Allā, Tell al-Khsās, Tell Dhirār (probably Tell al-‘Adliyyeh), ‘Abū ‘Ubaydah and Tell ‘Ammata (Abel 1910, 1911).

A report by Hölscher published in 1910 relates his travels in this area. Hölscher mentioned tell Muntār and tell Alwāl, which is probably the same as Merrill’s Atwal, and described them as small tells that lie in the valley where the Zerqa enters it (Hölscher 1910: 20). He also referred to tell ‘Amate that is located at the Wadi ‘r-Rudschēb (Wadi Rajib) and is said to have neighbouring tells (Hölscher 1910: 21). Later in his article he again mentioned this area and this time he stated that in this area and in the vicinity of a hot spring, near Tell al-Hammeh, three tells were situated; i.e. closest to the Jordan tell Malaha, at the foot of the hills Tell Deir ‘Allā, and Tell al-Hammeh (Hölscher 1910: 21). Tell Deir ‘Allā is mentioned to be the biggest and as having yielded Roman and older sherds.

In the early 20th century several research institutes had been founded in Jerusalem, for example the Deutsches Evangelisches Institut für Altertumswissenschaft des Heiligen Landes, the American School of Oriental Research (today known as the Albright Institute) and École Biblique et Archéologique (see also Drinkard et al. 1988). These institutes were manned by a permanent staff and specifically aimed to study the history and archaeology of the Levant. These institutes undertook several trips into the Jordan Valley and the Zerqa Triangle with both scientific and more recreational aims (e.g. Seeger 1915; Albright 1926, 1929). During this period archaeologists excavating in the vicinity tried to get a better understanding of the larger region by surveying the neighbouring region. In this way Mallon, for example, while excavating on Tuleilat Ghassul, visited this region and documented archaeological remains (Mallon 1934; Mallon et al. 1934: 156).

The start of the First World War led to the detailed mapping of this area. More general maps had already been created, for example, by Van de Velde in 1858. The American Palestine Exploration Society attempted to map the land east of the Jordan on a detailed scale, but the result showed very little detail and was deemed too imprecise by the British (Cobbing 2005: fig. 4). The first maps showing the Zerqa Triangle in great detail stem from 1918 and were created by both the Germans and the British. The first aerial photographs of this area stem from the same period and were taken by the German air force (Dalman 1925: pl.84). The Second World War renewed the same interest in maps and a special division of the New Zealand Army was sent to the region to draw a new and detailed map. At the same time, the British Royal Air Force (RAF) took detailed aerial photographs.

The first person of many to use these aerial photographs specifically for the recognition of archaeological sites was Nelson Glueck. In the 1930’s and 1940’s he surveyed Transjordan in great detail, the results of which were published in his four volume series *Explorations in Eastern Palestine I-IV* (1934-1951). Judging from some footnotes in Glueck’s text he travelled in this part of the Jordan Valley roughly between the 18th to the 21st of December 1942. The few tells he located on the west side of the Jordan River were visited at the 23rd of October 1946 (Glueck 1951). Glueck did not state in what manner he carried out his survey. From remarks throughout the text it is known that he started with a study of the RAF aerial photographs of the 1940’s. Furthermore, Glueck actually flew over the region in January 1945. He stated that tells were recognizable as light, whitish spots in the landscape while flying over and they showed up in a similar way on aerial photographs (Glueck 1951: 311). Additionally, he collected material and took it with him to be drawn at a later moment. Glueck described the tells he visited and their locations. The location of the sites is also illustrated on the aerial photographs. He further provided information on the periods he identified by means of the collected pottery. A selection of the sherds was drawn and photographed. For a long time this has been the most valuable archaeological inventory of Transjordan.

Shortly after Glueck had finished his enormous survey project, in 1953, Mellaart and De Contenson conducted a smaller scale survey in the entire Jordan Valley and the Yarmouk valley. They were instructed by the Department of Antiquities of Jordan to make a site inventory listing the periods of occupation that were represented and the state of preservation. The government was at that time devising plans for large-scale, controlled irrigation in the Jordan Valley, referred to as the 'point four irrigation scheme'. A team of archaeologists was, therefore, asked to prepare a list of endangered sites together with suggestions for conservation. In the period from January 1st to March 30th 1953, despite losing 3 weeks due to the weather, the team was able to cover the entire Jordan Valley and Yarmouk Valley (de Contenson 1964). No mention is made of how large their team was, but irrespective of its size it is impossible that much time was spent in each region. Mellaart and De Contenson published the results in separate volumes of the Annual of the Department of Antiquities of Jordan (Mellaart 1962; de Contenson 1964).⁹ Both reported on the same area and the same tells. Their results, regarding the number of tells discovered and their chronological context, differ so much, however, that it seems almost impossible that they collected the material together. Whereas Mellaart reported more sites and described them in greater detail (Mellaart 1962: 146-149), De Contenson's chronological determinations have turned out to be the more accurate (de Contenson 1964: 38). The results of Mellaart's soundings were later published by Leonard (1992).

The first survey that specifically focused on the vicinity of Tell Deir 'Allā was carried out in 1960 and 1961 by Kirkbride as part of the excavations by the Leiden University at Tell Deir 'Allā. The main aim of this survey was to test the hypothesis that a large Iron Age settlement, like Tell Deir 'Allā, must have had a cemetery. The absence of a cemetery suggested that it was probably located in the direct vicinity. In the excavation documents Kirkbride and her assistant and workmen are referred to as the 'tomb search party'. In the course of two seasons she investigated the vicinity of Tell Deir 'Allā, (re-)examined some of the nearest tell sites and excavated small test trenches at a few locations. Although Franken mentions her presence in his publication of IA I levels of Tell Deir 'Allā and refers to her work in the preliminary reports of the first two seasons and in the publication of the Late Bronze temple, the results of the survey itself have never been published (Franken 1960, 1961, 1969: xvii, 1992). Fortunately, Kirkbride's original notebook, some photographs and part of the collected material reside in the Deir 'Allā Archive at Leiden University. The material collected by Kirkbride has been studied and part of it will be described later. Unfortunately, an overview of the locations of sites is absent and descriptions are often very succinct. The exact location could, therefore, not be reconstructed for all of the sites. Combining photos and descriptions helped to position all sites in a general but restricted region.¹⁰

In 1975 and 1976 the East Jordan Valley Survey (EJVS) of Ibrahim, Sauer and Yassine surveyed the entire Jordan Valley (Ibrahim et al. 1988a, b). Within the Zerqa Triangle they surveyed 40 sites including several new sites that had not been identified before. In contrast to most other surveys they also identified a few flat surface or non-tell sites. This is, however, difficult to validate as the individual sites are not described. Moreover, they give no account of what artefacts were collected and provide no drawings or photographs. The Neolithic remains discovered by the EJVS have been analyzed in detail by Kafafi (1982). This study shows that the identification of the periods was sometimes based on only very few artefacts. For example, only 1 sherd and 5 flint blades were sufficient to ascribe Tell al-Qa'dān to the **Pottery Neolithic B**. **No information is given on the manner in which the survey was carried out.** It is, however, stated that within a time span of 3 months they were able to cover the entire Jordan Valley with a team of 10 people. It is, however, known that they attempted to draw on local knowledge in discovering new sites (Ibrahim et al. 1988a: 192).

In 1980 and 1982 Gordon and Villiers conducted the Telul edh-Dhahab and environs survey. While being primarily interested in Telul edh-Dhahab they also conducted a survey in a radius of c. 4-5 km to the east, west and south of the site. The westernmost area they surveyed overlaps with the eastern part of the Zerqa Triangle. Although Gordon and Villiers' results were only very pre-

9 Due to an error of the journal Mellaart is spelled Melleart.

10 The results of Kirkbride's survey will be separated published.

liminarily published, it is clear from their map of the surveyed sites that their research extended into the foothills south of the Zerqa reaching as far as Handaqq S and on the northern side they included the foothills of al-Rweihah. They do not seem to have included the valley plain, as for example Tell al-Hammeh was not identified (Gordon and Villiers 1983: fig. 1). Details on the surveyed sites are limited and only provisional dates are provided (Gordon and Villiers 1983: 285ff).

The next survey carried out by Muheisen was initiated by Yarmouk University as a follow-up to the results of the EJVS. The EJVS did not focus on the earlier prehistoric periods like the Palaeolithic and the Epipalaeolithic, but nevertheless discovered and recorded a number of these early sites in the caves of the eastern foothills. In 1985 a survey was, therefore, conducted whose main aim was the investigation of these caves and shelters as well as the fluvial and lacustrine deposits along the valley sides (Muheisen 1988). The covered area consisted of the foothills between the Wadi Kufrein and the Wadi Jirm. The team of 4 persons worked between the 15th of January and the 2nd of February 1985. The large size of the research area, the small team and the short project duration likely prohibited a detailed examination of the caves. Muheisen mentioned, however, that they visited 168 caves and shelters, but that many had already been emptied of all soil and sherds. As a result only 52 of them were recorded as sites (Muheisen 1988: 504). In the foothills between the Wadi Rajib in the north and tell Dāmiyah in the south 15 sites were identified, but none of these contained Palaeolithic remains. A list of the sites showing a number, a name and periods of which material had been found is given (Muheisen 1988: 519). However, none of the artefacts post-dating the Palaeolithic periods have been depicted or described in detail.

Between 1987 and 1989 Palumbo, part of the time assisted by Mabry, conducted a survey in search of pottery from EB IV sites in the Jordan Valley (Palumbo 1990: 83). During these investigations they investigated two sites in the Zerqa Triangle, i.e. Tell el-Nkheil North and Ze‘aza‘iyeh (Palumbo 1990: 90-92).

During the 1994 season of excavations at Tell Deir ‘Allā, Van der Steen undertook a small tell survey within the scope of the Deir ‘Allā Regional Project (Ibrahim and Van der Kooij 1997: 109). Her aim was to re-examine and re-date the sites discovered in the earlier surveys (Van der Steen 2004). She stated the method she used as follows; ‘during a given time a specified number of people walked over the site and collected all the sherds they found’. In total they surveyed seven sites in this way, i.e. Tell al-Buweib, Tell ‘Ammata, Tell al-Khsās, Tell ‘Asiyeh, Tell Zakarī, Tell al-Bashīr and Tell ‘Umm Hammād. In addition to this fieldwork she re-examined the pottery collected by both Glueck and the East Jordan Valley Survey. Her main chronological focus was on the Late Bronze Age (LBA), the Early Iron Age, and especially the transition between these two. Nevertheless the Iron Age II material, if available, was reinterpreted as well. She also illustrates of the location of the sites she describes. Unfortunately there are some differences in location of tells when compared to Glueck and the EJVS.

Within the Settling the Steppe-project the tell sites were also surveyed. This was not carried out by the survey under discussion, which was restricted to the countryside away from tells, but by Petit as part of the tell site project (Petit in prep.). During the Deir ‘Allā season of spring 2004 and the field seasons of the ‘Settling the Steppe’-project Petit surveyed the IA tells in order to determine which tells were candidates for small-scale soundings within the scope of the Settling the Steppe-project. The results of these surveys are occasionally referred to in the following chapters. For a detailed description of the condition of these tells and their periodization one is referred to Petit (in prep.).

Many surveys have incorporated this area. From the 19th century reports that repeatedly mention the same tells it is clear that some ancient remains were more obvious and have been known for a long time because of their size or their setting along a popular route. Other sites were only identified by more modern and specialized archaeological surveys like Glueck’s survey and the EJVS. The majority of sites discovered by these surveys nevertheless take the form of tells. Concluding it can be stated that the site-oriented nature of these surveys and the limited time spent in the research area resulted in a focus on tells.

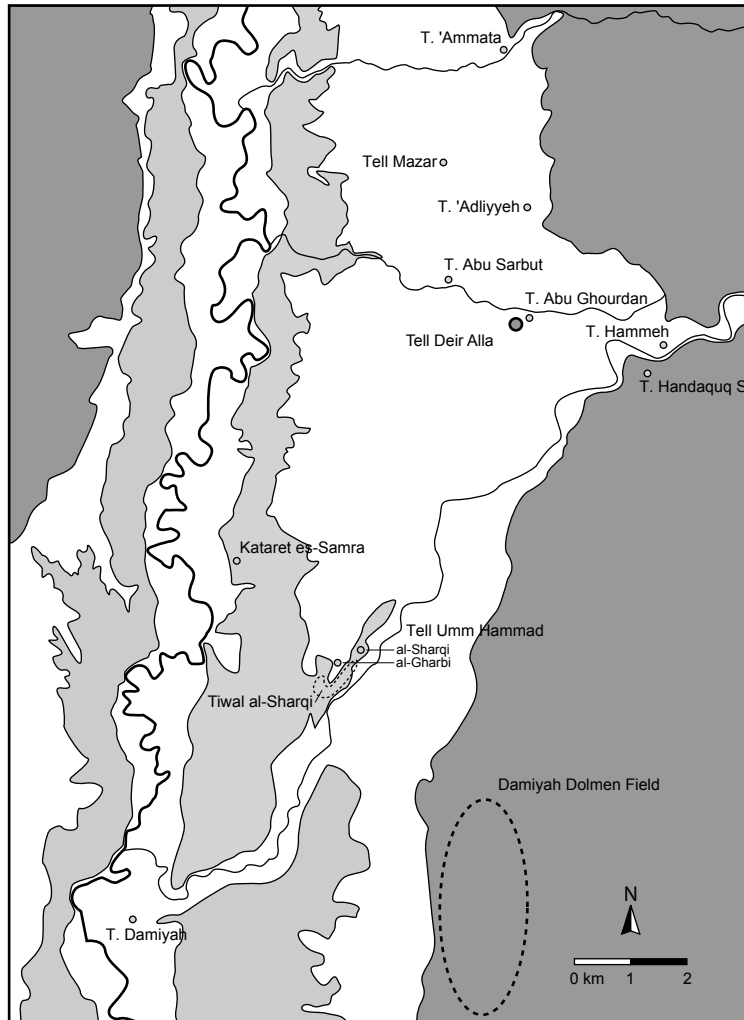


Figure 2.5 Map showing excavated sites in the Zerqa Triangle

2.2.2 Excavations

Surveys were, however, not the only archaeological activity in this area. Several excavations have taken place in the research area. To complete the overview of archaeological research in this region and to provide the framework against which the surveys are usually set, a short description will be given of the excavations that have been conducted until present. The sites investigated by the surveys and excavations discussed above have been listed in appendix II together with the dates attached to them by the various researchers. The different dates given by the various investigators clearly shows the changes in archaeological dating over the decades as well as differences in the pottery present at the surface at any one time.

Tell Deir 'Allā

The first archaeological excavation that was undertaken in this area is the still on-going field-work at Tell Deir 'Allā. In 1960 Henk Franken conducted the first field season on behalf of the Leiden University. In 1976 the excavation became a joint project of the Leiden University and the Department of Antiquities of Jordan in Amman and in 1980 the Yarmouk University, Irbid (Jordan) joined the project. This cooperation still exists at present. Over the decades the project has stood under the (joint) direction of Franken, Ibrahim, Kafafi and Van der Kooij. The excavations were initially started to get a better insight in the at that time dark periods of the Late Bronze Age, Early Iron Age and the transitional period between them. Tell Deir 'Allā was chosen to fill

the occupational gaps at Jericho, to provide archaeological links with the West bank, and to generate until then unfamiliar local Transjordanian pottery types (Franken 1964: 3). Since 1980 special focus has been placed on the analysis of the 'use of space' (Van der Kooij 2002). Several decades of excavation at Tell Deir 'Allā have revealed occupation deposits from the Middle Bronze Age II (MBA, *c.* 1700 BC) until the Hellenistic period (*c.* 400 BC), supplemented by an Islamic cemetery on top of the tell. Specific occupation phases of Iron Age Tell Deir 'Allā will be discussed in greater detail in the following chapters. For more information on the results of the Tell Deir 'Allā excavation one is referred to among others (e.g. Franken 1969; Hoftijzer and Van der Kooij 1976; Van der Kooij and Ibrahim 1989; Franken 1992; Ibrahim and Van der Kooij 1997; Van der Kooij 2001, 2002).

Tell Abu Gourdan

A small distance to the north-east of Tell Deir 'Allā, nowadays on the other side of the main Jordan Valley road, a smaller occupation mound is present, i.e. Tell Abu Gourdan¹¹. Today the modern village of Deir 'Allā completely covers this area. In the 1960's, however, only a few houses were present. Pottery on the surface of this mound suggested a date in the Islamic period and Abu Gourdan was thought to be the settlement connected to the Islamic burials found on top of Tell Deir 'Allā. As the pottery of the Islamic period was at that time largely unknown it was hoped detailed stratigraphic excavation would provide information on the Islamic pottery sequence of the Jordan Valley. Secondly, a study of the methods employed in Islamic pottery production was envisioned. Departing from these aims, excavation was started in 1967 as part of the Tell Deir 'Allā project of the University of Leiden led by Franken. The excavation was supervised by Jamarah, representative of the Department of Antiquities of Jordan. In two 5x5 m squares an accumulation of 6.5 m of mainly courtyard layers was uncovered, which could be subdivided into 20 phases (Franken and Kalsbeek 1975: 406). These phases were dated from the 8th to the 15th century AD with two occupational breaks (Franken and Kalsbeek 1975: 1). The courtyards proved to reveal little information on the type of habitation, but were littered with pottery. This provided ideal conditions to fulfil the aims of the excavation. Shortly after the final publication in 1975 Sauer already pointed to some problems in the dating of the site (Franken and Kalsbeek 1975; Sauer 1976). Today, Sauer's concerns are fully acknowledged and it must be concluded that the occupation hiatuses seem to be much wider than Franken initially assumed. Despite the said errors in dating and the lack of an absolutely dated pottery chronology, the resulting publication served as very useful local reference work for the study of the Islamic pottery discovered during the survey (Franken and Kalsbeek 1975).

Tell al-Hammeh

Within the scope of the Deir 'Allā Regional Project trial excavations were conducted in 1996 at Tell al-Hammeh by Van der Steen (2004). The excavation was initiated at that specific moment because the site was under threat of destruction due to levelling activities to create agricultural land. This small site is located 2.5 km to the East of Deir 'Allā on the northern bank of the Wadi Zerqa. The aim of the excavation was to investigate the change in settlement patterns in this part of the Jordan Valley during the transition from the Late Bronze Age to the Early Iron Age (Veldhuijzen and Van der Steen 1999: 195). A second question was whether a route existed connecting the middle Lower Jordan Valley via the Wadi Zerqa to the Baq'ah Valley (Van der Steen 2004). In this first season remains dating from the Middle and Late Bronze Age and the Early and Late Iron Age were found. Astonishingly, layers of mixed ashes, charcoal and slag were discovered. Analysis at the Yarmouk University in Irbid proved that these remains stemmed from iron production. This prompted a

11 Tell Abu Gourdan appears under a variety of names in the literature. It is often referred to as 'Tell Deir 'Allā II or Deir 'Allā village as it is located at the foot of Tell Deir 'Allā and was excavated within the scope of the University of Leiden Tell Deir 'Allā excavation project, e.g. JADIS, EJVS or the Point Four Irrigation Scheme survey (Melleart 1962; Ibrahim et al. 1988a). The name Tell Qa'dān has also erroneously been used for Abu Gourdan. Tell al-Qa'dān N and S are located *c.* 200 to 300 m to the north-east of Abu Gourdan. Combinations of these names also occur, e.g. Tell Abu Qa'dān (Strange Burke 2004: 113; Walmsley 2007: 111).

second season of excavation in 1997. In this season remains of the actual iron smelting furnaces were discovered. These furnaces were associated with pottery provisionally dated to the early 8th century or IA II period (Van der Steen 2004: 196). In a square on the southernmost part of the tell earlier material was found possibly dating to the Chalcolithic and Early Bronze Ages (EBA) (Van der Steen 2004: 195). Detailed analysis of the iron production material by Veldhuijzen led to the realisation of the importance of these finds as they are among the oldest remains of the actual process of iron production (Veldhuijzen and Van der Steen 1999). This conclusion led to new excavations in the spring of 2000, this time under the supervision of Veldhuijzen. Many remains of iron production were found including furnace wall fragments, numerous *tuyères*, burned mud-brick, and large quantities of slag and charcoal. Detailed research and high precision radiocarbon dates led to the conclusion that the remains indeed represented iron production of considerable scale from raw ore mined at nearby Mugharet al-Warda dating to the 10th century which makes it the earliest known iron production centre in the world today (Veldhuijzen and Rehren 2007: 191).

Tell al-Mazār

Tell al-Mazār and Tell Deir ‘Allā are by far the largest tells in the area. Especially Tell al-Mazār’s height of 24 m above the surface and steep slopes make it a remarkable feature in the landscape. In addition, a low mound of 1.8 m above the surface and measuring *c.* 40 m N-S and 53 m E-W is located 220 m NNW of the main tell. This lower tell is mostly referred to as cemetery A. Four seasons of excavations have been carried out at the main tell between 1977 and 1979 and in 1981. The cemetery was excavated in 1977, 1978 and 1979. The excavations were carried out by the University of Jordan, later joined by the Department of Antiquities of Jordan. In all four seasons Yassine directed the fieldwork. Yassine states in the publication on the cemetery that the excavation of both the main tell and the cemetery had started with the aim to train students, increase the field experience of employees of the Department of Antiquities, and acquire archaeological materials for the University of Jordan laboratory for the purpose of further training. The archaeological aim was to develop a ‘... chronological-historical sequence of material artefacts in accordance with the sites excavated in the Jordan Valley ...’ (Yassine 1984b: 1).

Two areas have been excavated on Tell al-Mazār itself, i.e. the southern slopes and the summit. At the summit, an area of *c.* 15x35 m was excavated, while on the southern slopes an area covering *c.* 15x15 m was excavated. The excavations at the summit have been published in a preliminary report (Yassine 1983). Occupational remains discovered in this area have been divided into five phases dated from the IA II, 8th century (phase V), until the early Hellenistic period in 4th century (phase I) (Yassine 1983: 498-510). In some general remarks on the periods discovered on the tell, Yassine states, however, that the tell was occupied since the LB II (Yassine 1983: 497). On the nearby cemetery mound an area of *c.* 20 x 25 m has been excavated. Besides a cemetery dating to the 5th century or Persian period a building has been excavated that was interpreted as an open court sanctuary (Yassine 1984a). Three rooms with a large courtyard in front of them were discovered whose seven phases stretched across the IA I period (Yassine 1984a: 109-111). Yassine argued that the pottery was comparable to the pottery of Tell Deir ‘Allā phases F to K and tentatively proposed that the earliest phase of the complex dated to the end of the 11th century and proposed an end date somewhere in the late second half of the 10th century (Yassine 1984a: 115).

Tell ‘Abū Sarbūt

Tell ‘Abū Sarbūt is a 7 m high tell located *c.* 1.5 km NW of Tell Deir ‘Allā. It measures 250 m from east to west and 125 m from north to south (LaGro 2002: 4). After a preliminary test season in 1988, three seasons of excavations have taken place in 1989, 1990 and 1992 carried out by De Haas, LaGro and Steiner (De Haas et al. 1989, 1992; Steiner 1997, 2008). The excavations were carried out in cooperation with the Institute of Pottery Technology at Leiden University. The main objective of the excavation was to collect stratified ceramic material to assemble a typochronology of decorated and non-decorated pottery of the Islamic periods discovered at the site (De Haas et al. 1989: 323). The owner’s intention to level the tell and plant an olive grove was in fact the reason to prioritize excavation. Since the excavations the tell has indeed been partly levelled and today

harbours an olive plantation that has seriously damaged the site. Five squares covering 400 m² were opened up on the western part of the tell while smaller soundings and trenches were made on other parts of the tell to attain a better understanding of the site as a whole (De Haas et al. 1992; LaGro 2002: 5). The excavations revealed 9 phases of occupation (Steiner 2008). The oldest phase dated to the Byzantine period and was probably built on virgin soil. After this phase, 4 phases exhibiting remains in some way connected to cane sugar production were discovered. Occupation of the tell continued in the following layers although no traces were found of sugar cane producing activities in these phases (LaGro 2002: 7). The sugar pottery, which is generally regarded as an indicator of cane sugar production, continues to make up part of the pottery assemblage, although it decreases in number. Furthermore, a rise in the amount of Arab Geometric ware and glazed wares is attested. As no traces of sugar production itself were found the sugar pottery was probably used in the normal household activities during these later phases (LaGro 2002: 153). Radiocarbon samples of both the first phase after the sugar production centre and the last excavated phase of the tell were taken to establish an absolute chronology. The samples date somewhere within the Mamluk period and to the very end of the Mamluk or Early Ottoman period respectively (LaGro 2002: 10)(see section 7.3).

Tell 'Umm Hammād¹²

Tell 'Umm Hammād is located above the at this place deeply incised Zerqa river. It is not a pronounced settlement mound like many other tell sites in the area. The archaeological significance of Tell 'Umm Hammād lies not in its vertical but in its horizontal extension. The 1940's survey by Glueck and some preliminary trenching in 1953 by Mellaart had revealed that Tell 'Umm Hammād contained very significant EBA deposits distributed over a large area. This horizontal distribution can be subdivided into two distinct concentrations, i.e. Umm Hammad al-Sharqi (East) and Umm Hammad al-Gharbi (West). In 1982 the first season of excavations started at Tell 'Umm Hammād concentrated on Tell 'Umm Hammād al-Sharqi, while in the second season in 1984 both parts of the tell were investigated (Betts 1992). Both seasons were directed by Helms (Helms 1984: 3). There were several reasons to excavate the site. The first objective for the initiation of the project and its continuation in a second season were the threats posed to small tell sites by the rapid development of industrialised farming. Secondly, the excavation was used to test whether the use of computerized equipment would speed up excavation methods to such a degree that more endangered small sites could be investigated at relatively low costs and with little time investment (Helms 1984: 39). A third reason to excavate at this location was to check whether the supposed ceramic connection with the urban site of Jawa located 150 km northeast of Tell 'Umm Hammād could be corroborated. Finally, one of the aims was to achieve a well stratified pottery sequence that would shed light on the transition between the Chalcolithic and EB periods and between the EB and MB periods (Helms 1986: 25, 26).

The excavations revealed several phases of occupation. The first phases are restricted to Tell 'Umm Hammād al-Sharqi. The earliest phase, referred to as stage 1, dates to the Late Chalcolithic period and consists of a small amount of surface pottery. It is possible that one small wall fragment belongs to this phase (Helms 1992a: 31). In the following phase, the EB Ia stage 2, Tell 'Umm Hammād grew into a large unfortified village extending over an area of 16 ha. In the EB Ib (stage 3) a similar village was built on the ruins of the EB Ia settlement, while in the EB II (stage 4) period the village shrank drastically to 2 ha (Helms 1992b: 10). In the following EB III period no habitation of significant size was present at the site. Only a few sherds from this period were discovered (Helms 1992: 10). At the end of the EB III or the very start of the EB IV period Umm Hammad was re-established as a village. This time both al-Sharqi and al-Gharbi were occupied. An extensive village was present in the EB IV covering the entire area of both al-Sharqi and al-Gharbi (Helms 1992b: 11). After centuries of abandonment this area was again settled in the IA IIc pe-

12 The spelling of Tall Umm Hammad differs between sources. The excavators (Betts 1992), the English version 1:50,000 1960's map, 2nd ed. K737 series and the Arabic version 1:25,000 map of 1991 all write the name as Tall Um Hammad. JADIS refers to the site as Tell Umm Hamad (Palumbo 1980: 2.30). The EJVS, however, gives the name as Tell 'Umm Hammād (Ibrahim et al. 1988a: 191). The EJVS transcription is used here.

riod when a fortified farmstead was located here (Helms 1992b: 11). Only the early assemblages covering the EB I and II have been published, while the EB IV and IA strata are still awaiting final publication (Betts 1992). Several preliminary articles have, however, been published (Helms 1984, 1986, 1987, 1992d). Apart from the important archaeological findings for the southern Levant as a whole, the publication is very valuable as it provides a detailed pottery typology linked to stratigraphic data (Helms 1992c). This publication has proven very valuable for the analysis of the EBA survey pottery because it provides a local pottery chronology for the Zerqa Triangle.

Tiwal al-Sharqi

During the first season of excavations at Tell 'Umm Hammād in 1982, several rock-cut shaft tombs containing burials and grave goods were exposed during the construction of a new road. The tombs were located just south of the tell in a katār area presently referred to as Tiwal al-Sharqi (Tubb 1990: 7). During the 1982 season the Tell 'Umm Hammād excavation team cleared several of these tombs which proved to be mainly EB IV in date and belonged to a large cemetery. Following these discoveries a small-scale rescue excavation was carried out in early 1983 by the Department of Antiquities together with both Helms and Betts (Helms 1983: 55). A total of 25 burials was discovered in this first season (Helms 1983: 35ff). Based on the promising results of this first rescue season the British Museum launched a second season of excavations carried out by Tubb in 1984 (Tubb 1990). In the 1984 season 37 tombs were investigated, and the excavator judged this to '[...] represent an almost insignificant proportion of the potential total [...]' (Tubb 1990: 11). The majority of these tombs dated to the EB IV period, only one burial was dated to the EB I or Proto-Urban A culture as the excavator labels it (Tubb 1990: 89). A surface survey was conducted that succeeded in establishing the boundaries of the cemetery in the North, East and South. The western edges of the cemetery could not be defined as most of the land in this direction was under cultivation (Tubb 1990: 8). The portion of the cemetery investigated extends over 1.5 km in a north-south direction. As the western edge could not be established, the cemetery may continue over a considerable length in this direction following the contours of the katār hills (Helms 1983: 55). The recent discovery of three more shaft tombs of which at least one dated to the EB IV period in the katār hills north-west of Tell 'Umm Hammād as-Gharbi might be an indication of the large size of the cemetery. These tombs were also discovered during road construction works.¹³

Katāret es-Samra

During the EJVS of 1976 the site of Katāret al-Samra was discovered. Located at the western edge of the katār, it spreads over several promontories. Next to surface scatters dating to the Chalcolithic, EBA and LBA, a LBA shaft tomb was discovered (Ibrahim et al. 1988a: 197). The tomb clearly showed recent illegal digging. A small rescue excavation was decided upon in an attempt to save as much information as possible. The tomb was dated to the LB II period based on a large assemblage of both local and imported pottery, e.g. LB II Cypriote pottery, and a collection of bronze weaponry. In order to establish whether this was just a single tomb or whether it was part of a cemetery Leonard launched an excavation and survey campaign in 1978 supported by the American Schools of Oriental Research. The aim of the survey was to get a detailed picture of the occupational sequence of this area (Leonard 1979: 53). Cleaning of the tomb excavated by the EVJS revealed a collapsed western annex containing a scattered assemblage of both human and animal bones and pottery. Most of the pottery could be dated to the LB I period, which Leonard interpreted as the result of clearing out the main tomb followed by the collapse of the roof at some point in antiquity (Leonard 1979: 53). The survey discovered a few artefact scatters of the LB I and II periods on nearby spurs of the katār hills, but no direct evidence for other tombs. To the north-west of the LBA tomb an area containing a large amount of both LB I and II material was discovered. This site was named the tell Katāret as-Samra (Leonard 1979: 63).

13 Personal observation. These tombs were discovered in 2004 and documented by the representative of the Department of Antiquities in Deir 'Allā, Mr. al-Jarrah.

North of the LBA tomb two large and three small artefact scatters were discovered in close proximity to each other. The artefacts discovered here dated to a period from the end of the Late Chalcolithic to the beginning of the EB II period (Leonard 1983: 37ff). A small test trench was excavated in 1985 to establish whether these artefacts represented permanent architecture buried within the subsoil or whether they were the remains of a mobile group that seasonally visited the area (Leonard 1986: 167). In the lower two of the five strata evidence for mud-brick walls was found. This settled the question in favour of permanent architectural remains, although whether the occupation was completely permanent or not remained debatable. The pottery that belonged to these strata was dated to the Chalcolithic period (Leonard 1989: 10). The three later strata contained pottery with typical EB I characteristics. No architecture was discovered in these later phases (Leonard 1989: 6). Two further aims of the 1985 season were to discover whether tell Katāret es-Samra indeed existed and to establish beyond doubt whether a LBA cemetery existed in this area. The tell proved to be a tell containing walls that could unfortunately only be partly excavated. A large amount of pottery dating to the transition from MBA to LBA was found. Leonard argues that the large quantity, especially of certain types, strongly suggests that the pottery was produced at or near the site (Leonard 1986: 167). During the 1985 season it was furthermore attested with certainty that there were more LBA tombs in this area than only the one discovered by the EJVS in 1976. North of this tomb a shaft with over 50 pottery vessels and a burial chamber containing about a dozen skeletons was discovered. Amid the skeletons were artefacts like pottery vessels, a scarab, glass beads and bronze fragments. The pottery could be dated to the LBA and the 13th century in particular (Leonard 1986: 166).

Handaquq South/Abū al-Zīghān¹⁴

Located on a low hill in the foothills on the southern bank of the Zerqa Tell Handaquq S is a large walled settlement covering 15 ha, dating to the EBA.¹⁵ Together with Tell 'Umm Hammād this settlement is the largest site in the Zerqa Triangle and is among the largest EBA settlements of the Jordan Valley. The city wall is still visible today at some locations. Three seasons of archaeological investigations have been conducted. In 1993 Chesson carried out a surface survey and some preliminary soundings at the site. Excavation was continued in 1994 and 1996 on a larger scale. The main goal of the excavations was to investigate a domestic context of an EBA urban site in order to get a better understanding of the social and economic structure of this type of settlement (Chesson 2000: 365). The methodological aim was to expose a large horizontal area of this 15 ha site instead of attaining a great stratigraphic depth (Chesson 1998: 22).

The surface survey yielded sherds dating to the EB I, II, III and IV, although the majority belonged to the EB II and III periods. During the excavations a total of 18 5 x 5 m squares was opened, covering an area of roughly 33 x 40 m. Four phases were discovered, all dating to the EB III (Chesson 1998: 20). Not all phases were represented in each square. The lowest phase I was only reached in a limited area of about 10 x 10 m. Instead of the common broad room architecture with separate buildings, blocks consisting of several adjoining stone built rooms with courtyards were discovered in all occupational phases. The orientation and composition of these blocks was similar in all these phases, although this was difficult to ascertain for the earliest phases due to their limited exposure (Chesson 2000: 367). Apart from artefacts often associated with domestic contexts such as pottery vessels and architectural features like silos and ovens, the excavations revealed two features that are not normally part of EB III domestic assemblages. These features are a clay cylinder seal with an anthropomorphic representation and part of a stone built water channel (Chesson 1998: 26-27). These finds suggest that a complex range of activities was carried out at this site.

14 Tell Handaquq South is also known by the name Abu Zighan or tell Abu Zighan, derived from the nearby eponymous village.

15 The EJVS has identified two sites in this area, i.e. Tell Abu Zeighan (no. 159) and Tell 'Alla or Handaquq (no. 163) (Ibrahim et al. 1988a: 191).

The Settling the Steppe-project

Petit, responsible for the tell site subproject of the Settling the Steppe-project, has made small soundings at three tell sites. The aim of the excavations was to **investigate whether the settlement cycle of IA Deir ‘Allā is also present at other sites and what the connection between these sites was**. In order to reach this aim three sites with clear IA remains on the surface were excavated, i.e. Tell ‘Ammata, Tell al-‘Adliyyeh and Tell Dāmiyah (Kaptijn et al. 2005; Petit et al. 2006, Petit in prep.). It was decided to excavate only sites that had already been damaged as these sites are usually in danger of being disturbed even more. Additionally an attempt was made to destroy as little as possible. A more practical reason was that damaged sites, especially if bulldozers were employed, often have a considerable stratigraphic sequence exposed that would take a long time to achieve in a normal excavation. In this way an insight is gained into the periods in which a tell existed without the need for extensive excavation. For the results of these soundings and wider conclusions on the tells’ positions in the Zerqa Triangle one is referred to Petit’s volume in the Settling the Steppe-project series (Petit in prep.).

The Dāmiyah dolmen field

Slightly outside the Zerqa Triangle, the important Dāmiyah dolmen field can be found. This large field of dolmens stretches over *c.* 4 x 2 km in the foothills opposite Jisr Dāmiyah. First described in 1817 by Irby and Mangles, most of the travellers passing through this region since have noticed and described these structures (Irby and Mangles 1868); Abel 1910; Glueck 1951; Luynes sd). Several archaeological studies have centred on this dolmen field. For example, Swauger surveyed the field in 1962 and counted as many as 164 dolmens, while Belmonte recorded the orientation of the dolmens for astronomical purposes and mentioned that there were at least 150 structures in 1996 (Swauger 1965; Belmonte 1997). Already in 1942 and 1943, Stekelis undertook the largest survey and excavation project until recently. He listed as many as 164 dolmens, 14 cists, 2 circular tombs, 3 rock-cut tomb structures, 2 tumuli and 12 stone circles (Stekelis 1961: 52-53). Apart from measuring and describing 190 of these structures, several were excavated and 17 yielded artefacts, predominantly in the form of pottery (Stekelis 1961: 62ff). During later decades more small-scale excavations took place like those by Dajani in 1964 and Yassine in the 1980’s (Dajani 1967/68; Yassine 1985). In 2005 the Jordanian Department of Antiquities, in reaction to the imminent threat of destruction from the advancement of a large stone quarry, carried out a large-scale survey that located over 300 man-made structures consisting predominantly of dolmens.¹⁶

16 Personal observation, final report is to be published.

3 Survey Design

3.1 Survey methodology

Methodology and research design greatly condition the results of an archaeological surface survey. Much attention should, therefore, be paid to the questions the collected material should answer. Equally important are the local circumstances that limit the choices in research questions and survey design. Each question and each design is foremost dependent on local circumstances. A standard design for data collection and analysis often forces data into a predetermined descriptive framework without fully taking the specific local situation into account (Boismier 1991: 11). Each survey is therefore unique, but not isolated. Although full comparability between surveys will probably never be attainable, a flexible 'best practice' that guarantees some standard methodological guidelines should be sought after. To ensure comparability surveys should obey some ground rules, like clearly stating which method was used and what selection decisions were made, allowing the possibility to calculate surface densities, being able to identify and document the many different types of archaeological remains that can be encountered and being able to recognize the type of remains that is needed to answer the research questions. There is a clear relation between sample intensity and identifiable site size (Bintliff 2000a, b).

The main aim of the 'Settling the Steppe' project was to elucidate how and why people were able to live in this arid region in the past and why they repeatedly chose to do so. The investigation of modes of subsistence and hence agriculture and irrigation was resultantly central to answering these questions. The objective of the survey was, therefore, to detect all remains of human activity in the landscape, rather than be restricted to the identification of settlements. An attempt was made to gain information on the countryside in which these settlements lay. Questions, like did isolated farms or farmsteads exist in specific periods, were small depots for crops or tools located between the fields, is it possible to detect which fields were under cultivation, can the use of irrigation be identified and which type of irrigation was used, were asked concerning the landscape. In the last paragraph of this chapter the type of artefact distribution expected to result from a certain type of activity discussed. These expected distributions allow the interpretation of artefact distributions discovered on the surface that will be discussed in chapter 4.

Irrespective of the focus on the previously largely neglected countryside, settlements are of course also important in this and other surveys. Within the Settling the Steppe-project they were part of the study carried out by Petit (Kaptijn et al. 2005; Petit et al. 2006; Petit in prep.). The tells were, therefore, not incorporated in this survey. One of the tell-related questions with which this survey was concerned, was whether non-tell settlements were present in this region. The previous surveys in the region had all been rather extensive, which resulted in a focus on the more conspicuous sites like tells. The present survey, therefore, focussed on detecting less obvious remains including small artefact scatters.

To meet these objectives a survey methodology was developed that made no distinction between so-called site and off-site material during collection. Everything was collected and processed in the same manner regardless of the artefact density on the surface. In this way areas with very high artefact densities on the surface can be compared directly to areas where only one or two sherds have been found. The type of activity that underlay the distribution has no bearing on the survey technique. The survey can, therefore, be regarded as employing a non-site methodology.

Another essential point in survey methodology is the mesh size of a survey. A survey is always a sample. Full coverage of the surface is simply too time consuming. Each survey must find a balance between the level of detail to be attained and the area that needs to be covered to answer the questions posed. The factors that have influenced the artefact distribution on the surface are manifold and often little understood, although many intensive survey projects are increasing the

number of known factors rapidly (e.g. Bintliff and Howard 1999; Attema et al. 1999/2000; Barker and Mattingly 1999/2000; Bintliff 2002; Bintliff and Howard 2004). It is, therefore, imperative that artefact collection is as detailed and controlled as is possible within restrictions like time, locality and research questions. In this case the research questions described in chapter 1 necessitate an understanding of the archaeological remains present throughout the research area. As described in chapter 2 the research area is divided in three areas, the ghor, zor and katār, comprising a total of 72 km². After a trial survey of a few days in the zor around Tell Dāmiyah it was clear that the repeated overflowing and meandering of both the Jordan and Zerqa rivers had severely disturbed artefacts on the surface by both erosion and sedimentation (see also Hourani in prep.). A trench made by Hourani beside Tell Dāmiyah discovered IA pottery that had rolled from the tell onto the original surface that lay at a depth of 3 m below the modern surface (Hourani in prep.). This shows that as much as 3 m of sand and silt have been deposited since the IA. Due to the high degree of deposition and poor trial results it was decided to exclude the zor from the survey area. The katār was also excluded from the survey area. This area of badlands has a high level of erosion and its steep slopes made the use of the standard survey method impossible, while the surveying itself was sometimes quite dangerous. Only the ghor was, therefore, systematically surveyed. The ghor of the Zerqa Triangle encompasses *c.* 42 km².

The survey region is clearly a small area. The nature of the research questions asked necessitates an intensive survey methodology and the physical characteristics of the region itself further restricts the area that can be investigated. Critics of intensive surveys have argued that these are so costly that only small areas can be surveyed (e.g. Blanton 2001: 628). These scholars have cast doubt on the usefulness of small survey regions stressing that this makes landscape surveys unsuitable for regional research as the areas are too small to cover a regional interaction system. Blanton, for example, states that Mediterranean archaeology has lost an interest in large-scale social and demographic processes (Blanton 2001: 629). He argues that an 'extensive survey using a grab sampling method can be done systematically such that it facilitates both full coverage and

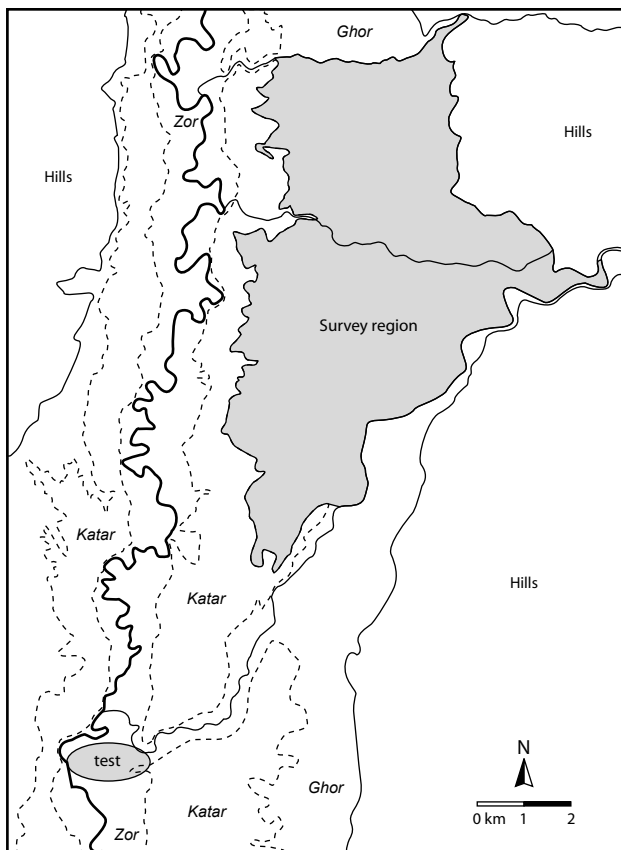


Figure 3.1 Location of survey region in research area and location test survey in the zor

cross-regional comparison' (Blanton 2001: 629). It is, first of all, difficult to imagine how grab sampling can be done systematically. Putting this aspect aside, the assertion about the possibility to conduct a full coverage survey remains. As stated before, the many distorting factors mean that a survey can never detect all artefacts on the surface. The lower the sampling intensity, the more archaeological remains will be missed. This means that in an extensive survey the entire surface of the region may well be seen, but it does not imply that all archaeological remains present will be detected. It is, furthermore, doubtful whether cross-regional comparison is actually possible in this way. The number and type of artefacts on the surface depends on the geomorphological history of the region. This history should be well understood and sampling strategy should be adapted to it. Artefact distributions from geomorphologically distinct areas can therefore not be compared at face value. The surveys that focus on intensive high-resolution sampling strive to collect more than the obvious archaeological remains and understand the processes that caused the artefact distributions to be as they are. To go beyond the simple identifying and dating of conspicuous remains that Blanton seems to advocate and that has long been the norm in this region, high resolution intensive survey is a necessity. Several extensive surveys have been conducted in the research area and its neighbouring regions (see chapter 2). A general understanding of the archaeological remains in the Jordan Valley at large and the neighbouring hill countries therefore already exists. A more detailed view of smaller, less conspicuous remains is needed to fully understand the diverse character of human activity over time. This implies an intensive survey and hence a small region. A less intensive survey in a larger region would only replicate the results of previous surveys. The present intensive survey aims to detect a wider range of archaeological remains that will provide an understanding of the diverse nature of human activity in this region over time.

3.1.1 Field walking

To survey a representative sample of this area, yet still be able to attain the level of detail needed to detect small activity areas, it was decided to survey lines located at intervals of 15 m from each other. This distance has been proven effective in other surveys (e.g. Given 2004; Bintliff et al. 2007). Each field-walker surveyed 50 cm to either side of the line. In order to detect changes in artefact density each line was divided into stretches of 50 m referred to as a plot. Each plot, therefore, covered 50 m² and formed the basis to calculate densities per area. The plot was thus the basic unit of artefact collection and documentation and formed the basic spatial unit in artefact density

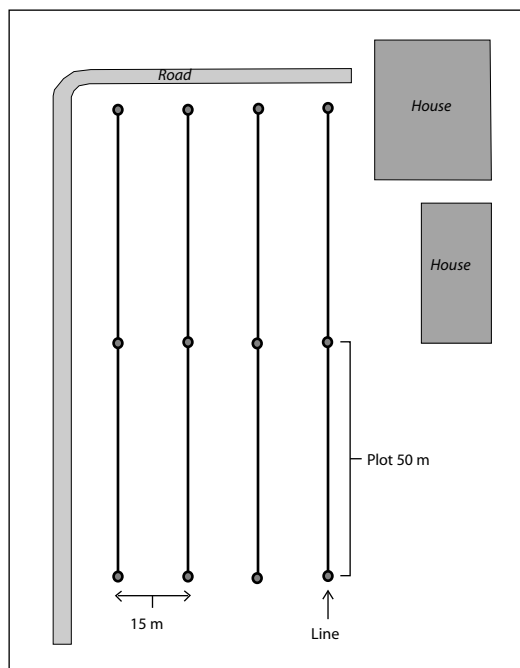


Figure 3.2 Sketch showing a hypothetical field with lines and plots



Figure 3.3 Example of a survey tag

calculations. This level of detail means that one hectare is covered by seven lines consisting of two plots. Given the line spacing of 15 m, all concentrations with a diameter larger than 15 m should be touched upon, while in a longitudinal way the collected finds have a precision of 50 m.

Over the length of one plot all artefacts detected on the surface were collected. Artefacts included everything that was man-made, portable and pre-dating the Mandate period. Pottery sherds were collected irrespective of their age. The average number of artefacts, mainly sherds, on the surface allowed a total collection policy. In this way the bias inherently present in assemblages that, for example, randomly collected each fifth sherd or gathered a representative selection is overcome.

As both experimental studies and our own experience in the field have shown that it is very difficult to search for more than one artefact category at the same time, each plot was surveyed twice. While walking the line the first time attention focussed on pottery, while on the way back other categories like flint, stone and glass were searched for. It was too time consuming to survey each line separately for each of the small artefact categories. Flint, glass, stone tools and other artefact types were, therefore, sought after at the same time. In small fields it could happen that there were more field-walkers than there were plots. To keep everyone employed two people would sometimes survey one plot together by walking in opposite directions from each other. One person would focus on pottery, while the other searched for all other categories. If, however, artefacts other than the category focussed on were detected these were collected and added to the correct bag at the end of the plot. Diagnostic finds that were discovered by accident outside a line were collected but were labelled 'stray find' and were located with reference to the nearest plots. On concentrations that contained insufficient material to provide a secure date stray finds were often purposefully searched for.

After each plot was surveyed, the field-walker would fill out a tag to go with the finds, which would uniquely identify this group of finds. On this tag the surveyor would document his or her name, the field, line and plot from which the finds originated, the date of discovery, the type of finds and the visibility of the surface (see figure 3.3). The visibility that was scored by each participant denoted the percentage of the surface that was visible combined with the ease with which artefacts could be discerned on the surface. Artefacts are often obscured by vegetation covering part of the surface. In the ghor of the Zerqa Triangle that is almost completely used for agriculture today the plant cover is generally not a problem. Only in rare cases were unused, overgrown fields encountered. There are, however, other factors that influence the chance an artefact will be spotted on the surface as well. The consistency of the surface together with the type of soil also determines the visibility of artefacts. For example, a field that was coarsely ploughed for the first time contains many large lumps because of the clayey nature of the Jordan Valley. Artefacts like sherds or flint are very difficult to spot because many finds are hidden inside the lumps or have fallen in between the cracks. Contrastingly, it became clear during the survey that a finely harrowed field was equally problematic as the aridity of the soil turned the fine clay into dust that fell as a fine veil over the entire surface obscuring especially sherds as these were generally of similar colour as the soil. Another factor that contributed to poor visibility was the rising sun and the long shadows it casts. The sun, however, rises quickly at these low latitudes and stands relatively high in the sky making floodlight only a minor distortion. In some other cases manure or old strips of plastic that once covered vegetables obscured the surface. All these factors combined amounted to a visibility score given by each field-walker to his or her plot. The score ranged from 1 to 5 with 5 being perfect visibility and 1 being extremely low visibility. A tarmac road would be scored as 0 because nothing of the soil is visible.

This scoring of the visibility was carried out consistently throughout the survey. The evaluation of these scores and the translation into a bias that can be corrected for is, however, problematic. It is difficult to quantify the amount of bias caused by a reduced visibility, especially because bias was primarily caused by soil consistency and not by vegetation cover. In areas where vegetation cover is the greatest obscuring factor the collected artefact can be corrected relatively simply for the percentage of the surface that could not be seen (e.g. Bintliff et al. 2007: 21). To be able to correct for these factors specific tests comparing artefact recovery rates under controlled circumstances should be carried out. Unfortunately, this is very time consuming and lies outside scope of

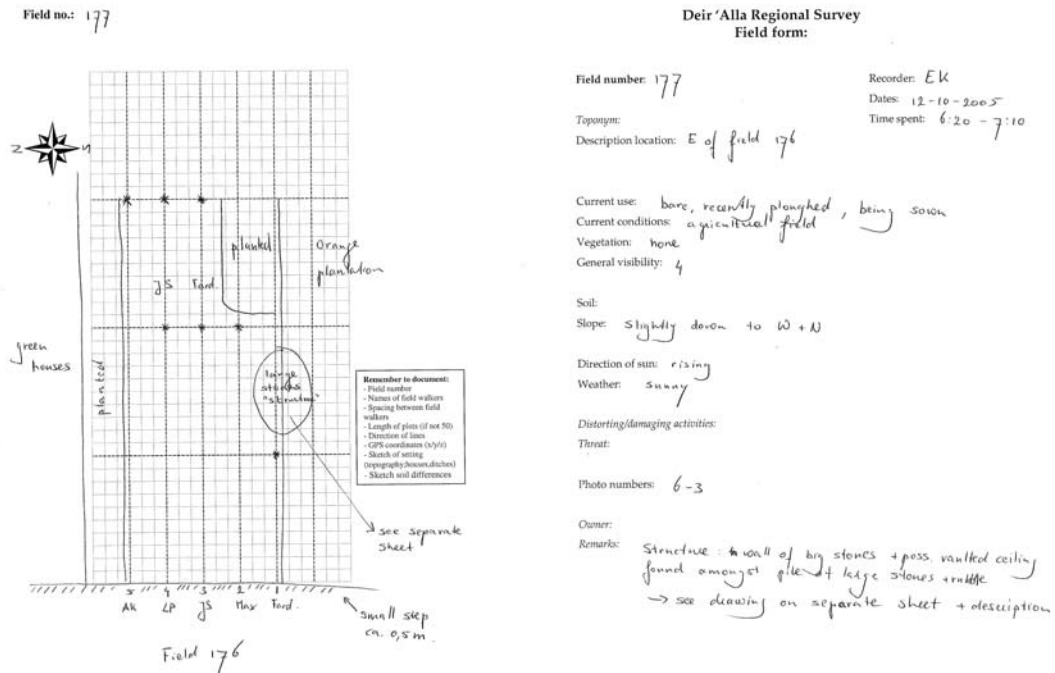


Figure 3.4 Example of a field form

this research. Overall, however, the visibility of the fields was very good. The agricultural use of the fields and the consistent season of survey, i.e. autumn, had a homogenizing effect on the visibility. Only in rare cases was the visibility less than extremely good. Comparisons with surveyors from other surveys have shown that in these instances surveyors of this survey scored the visibility overly low as they were used to almost perfect conditions. Rare conditions that were scored as poor to moderate visibility (2 or 3) by our team were considered as good (4) by surveyors with experience elsewhere (i.e. Greece). In only a few fields were the overall visibility scores low, e.g. in 2006 only six fields had scores of 2 or below. However, as these fields in which visibility had created a bias were so few and they were mostly located in almost empty areas where correction would have made little difference to the general distribution pattern no correction was carried out.¹⁷

Visibility of the field as a whole was also scored on the field form. On this form the field is the main unit of registration. The boundaries of a field were largely determined by the modern circumstances making that a field generally corresponded to a modern agricultural field. All characteristics of an individual survey field were documented on a specific form. Factors that influenced survey bias and surface visibility, like present-day use of the field, the characteristics of the surface and a visibility score for the field as a whole were recorded. On the reverse a sketch of the layout of the field was drawn showing the location of lines and plots supplemented with the names of the field-walkers. This formed an extra control against which the data entered by the individual surveyors could be checked if necessary.¹⁸ Figure 3.4 illustrates such a field form. Apart from the current state of the field, the time that was spent surveying the field was recorded to compare whether the time spent on a single plot differed between fields. The time spent on plots did indeed differ, but this was mostly related to the number of sherds present and depended less on factors like accessibility or visibility. Furthermore, the toponym could be entered, but this was seldom available. The same holds true for entries like the owner or immediate threats. Extensive and deep ploughing are continuous threats to which virtually all fields are subject. The high construction rate of new houses is another problem to which especially the fields in the vicinity of existing houses are susceptible. Other documented factors included the slope of a field and thus the degree

17 A test with different correction rates was carried out, but the low densities in the fields with poor visibility meant that the effect was negligible. Because of the limited change in distribution and the difficulties of finding the most suitable correction factor, it was decided to abstain from correcting for visibility altogether.

18 This proved to be no unnecessary precaution and had to be resorted to on numerous occasions.

to which artefacts were liable to movement down the slope. In general the research area is more or less flat, only near wadis and the foothills do differences in elevation exist. The amount of movement along slopes is, therefore, very restricted. Other entries that showed little variability were the direction of the sun and the weather. Most days the weather was sunny, sometimes alternated by clouds of dust coming from the eastern or southern deserts. Only at the end of the survey seasons did the occasional rainy day occur. Rain made surveying very difficult and the visibility deteriorated rapidly. These days were, however, rare and rain hardly influenced the results of the survey. The position of the sun was generally high or rising, but this only affected the visibility during the first half hour of the day. In the first season two GPS readings were given for each field, but these proved less precise and much more time consuming than simply drawing the location on the aerial photograph. This was done in the following seasons complemented by the occasional GPS reading. A final recording method was the taking of one or more overview photographs showing the extents of the fields and one photograph of the surface of each field showing the vegetation and character of the soil. The complete database of all field forms and photographs is available at the E-Depot Nederlandse Archeologie (EDNA).

3.1.2 *Processing of the finds*

After each day's survey work the finds were brought to the Deir 'Allā Station for Archaeological Research and were further processed in the afternoon. Processing included cleaning, counting, describing and provisionally dating, procedures which will be described in detail below. The method of processing the pottery in 2004 differed slightly from the later seasons. The 2004 field season was the first season of surveying and, therefore, a test season. During this season it was decided that the main aim during field-work should be the surveying of fields and that processing of the finds should be carried out during the rest of the year at Leiden University where a ceramic reference collection and libraries are available. The collected pottery was, therefore, only counted, separated into feature and non-feature sherds, and numbered. In Leiden it was, however, soon realized that the processing of all pottery by a single person was not feasible. As a result only the high density concentrations have been processed for the 2004 season. The remainder of the pottery still awaits analysis and will be published separately at a later date. The division between collection and processing was adjusted in the later two seasons. A shorter period was spent surveying, while the processing of the finds took up a larger part of the workday. The other artefact types were processed in the same way over all the seasons.

When the finds had been processed and checked the results were entered into the database. Data, i.e. artefacts, do not directly provide information. The way in which data are gathered and the manner in which they are analyzed determine the questions that can be asked and the answers these provide. The database documents and arranges the data and is, therefore, an important determinant in the information archaeological material can provide. It should, therefore, always be clear from the outset what categories are to be identified and what the motivations are to distinguish these from the mass of possible categories.

In this survey the main unit of identification is the plot. Each plot is unique through the combination of field, line and plot numbers. In the database all other units of analysis are related to this plot table (see figure 3.5 for the database layout). In the plot table the entries 'field', 'line' and 'plot' refer to the geographical position of the specific plot while the subsequent items like 'person' and 'visibility' further register the data entered on the find tag. The other categories of the plot table database are entered after initial processing and give a total of the discovered artefacts per category and provide a link with the more detailed finds analysis databases. The totals of discovered artefacts per category give an overview of the distribution of finds over the fields but do not as yet provide any relevant information concerning the nature of these finds, i.e. to what period they belong or their function. This table was especially designed to function during the survey season itself. The aim was to process the finds and enter them into the database as quickly as possible upon discovery. In this way it was possible to get a better founded idea of the quantitative artefact

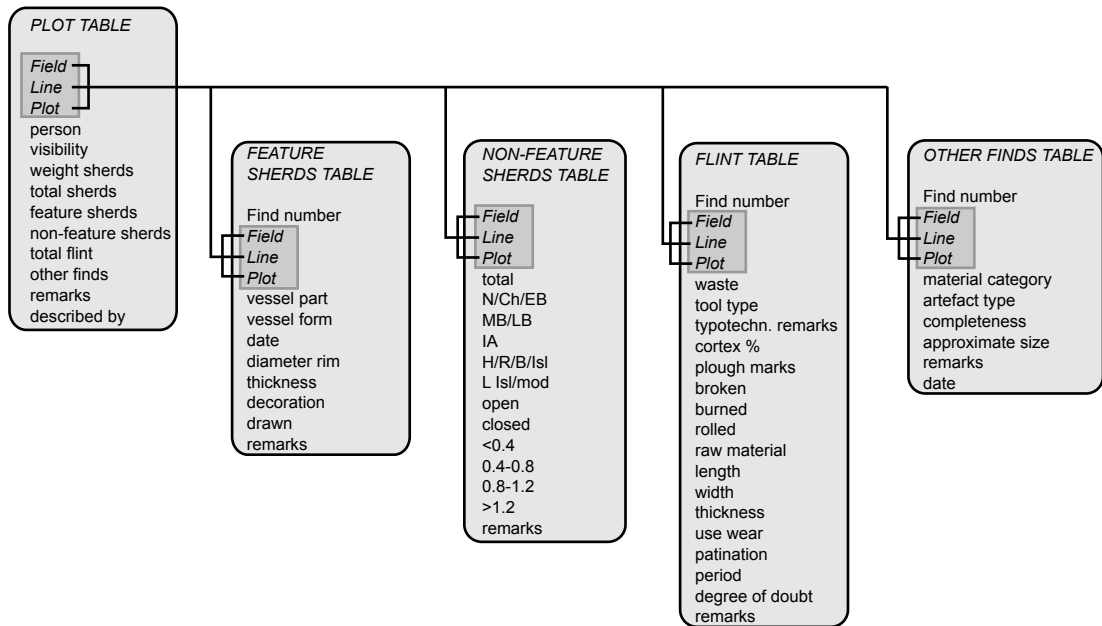


Figure 3.5 Relationships between the different databases

distribution across the fields than could be deduced from the personal opinion of the field-walkers during the survey itself. Areas that stood out in one way or the other could in this way be identified and returned to if necessary.

Apart from the counting of the pottery, flint and other finds, the weight of the total number of sherds was given. Combined with the number of sherds this gives information about the weight of individual sherds and hence their size or thickness. Size and thickness are partly dependent on the period. Mamluk sugar pots or Chalcolithic vessels are, for example, on average thicker and break into larger fragments than e.g. Roman vessels. When related to the period from which the sherds originated the degree of fragmentation can point to the post-depositional processes operating upon the material. More fragmented sherds will have been subject to more post-depositional processes like e.g. ploughing than sherds that have recently been ploughed up from a previously sealed context in the subsurface. The use of this weight category in the pottery analysis proved to be rather limited, however. In most fields pottery from several different periods was found together. As these periods had all been subjected to different post-depositional processes and a large part of each pottery collection consisted of body sherds that could not be precisely dated it was often impossible to use this category.

The surveyors always worked in pairs to minimize mistakes, as people actively checked each other, and make discussion and evaluation a vital part of the process. Entering data in the plot table is fairly straightforward and objective, but for the interpretative feature and non-feature databases discussion was essential (see below). The category 'described by' was added to be able to retrace which pair processed the finds. Although the sherds processed by each pair were always checked before being filed, small mistakes or illegible writing did occur and surfaced when entering the data into the computer database. In this way the writer could be tracked down and explain his scribbling.

Already in the plot database the pottery was divided into two groups; i.e. the feature sherds and the non-feature sherds. Feature sherds are sherds that contain an in theory distinguishable type-feature like a rim, a handle, a base or a type of surface decoration like slip, burnishing or impressions. This does not, however, imply that each of these feature sherds is necessarily diagnostic. Certain types of bases for example occur in so many periods that they can hardly be regarded as diagnostic. The non-feature sherds are simple body sherds lacking any distinguishing features apart from their ware and temper. Both were counted in the plot table and further elaborated on in their specific tables.

The feature sherd table

All artefacts containing features that in theory distinguished them, i.e. the feature sherds, flint pieces and 'other finds', which comprised all non-pottery or flint artefacts, were given a find number. The find number consists of the field, line and plot number separated by dots. This is followed by a letter, in the case of pottery this is a p, for flint an f and for all other finds this is an m. A serial number for the number of artefacts of that type discovered in one plot was added after the letter. The find number 16.3.5p12 thus denotes the twelfth sherd discovered in the fifth plot of line 3 in field 16. Stray finds were labelled according to their position between the lines or plots. For example, a sherd labelled 18.2-3.1p1 denotes that it was discovered in field 18, between lines 2 and 3 in plot 1. Although the find number already contains all locational information the field, line and plot data are again entered to link the table to the plot table and make cross-referencing in the database itself possible.

After the locational information specific characteristics of the artefact itself were listed. For example, which part of the vessel was present was entered, e.g. a rim, base, loop or ledge handle or carination. The next category denotes the form the original vessel once had. This was often problematic as only a small part was present. On the basis of a small piece of rim it is often impossible to determine whether the vessel was a krater or a bowl. When no further information could be given the distinction was simply open versus closed. If, however, the sherd was sufficiently large and/or diagnostic, denominations like jar, holemouth jar, Late Roman 5/6 amphora, bowl, shallow bowl, hemispherical bowl or mansāf bowl were accorded. The specific forms could, however, seldom be assigned to sherds. The most commonly assigned forms were jar and bowl, sometimes with the addition small or large. Finding unambiguous terms for shapes, e.g. when does a certain rim constitute a jar and when a bowl, proved difficult, because of the many different periods to which it should be applicable and the fragmented nature of the pottery. Standard terminologies that have been formulated often depend on the presence of near complete vessels. Hendrix, Drey and Storfjell, for example, have devised a standard for the Transjordanian pottery from the Late Neolithic to the Mamluk period, but they characterize a jar as a closed form of which the minimum diameter of the mouth is less than 50 % of the maximum diameter of the body (Hendrix et al. 1997: 45,46). This is impossible to ascertain in the case of survey finds. The characteristics used here were, therefore, necessarily very broad and non-specific. The position of the sherd, diameter of the rim and thickness of the body together are generally indicative of the shape of vessel. Nevertheless, undeterminable shapes did occur especially when sherds were small. A thin rim or a rim with a very diagonal position that had a small diameter was taken to be a small bowl. However, a small rim sherd with diameter of 10 cm and a vertical position, can equally well belong to the neck of a jar or be part of a bowl. Categorisation also depended on the period from which the sherd stemmed. The Early Bronze Age flaring necked jars, for example, have large diameters of often more than 20 cm while the upper part of the rim has a diagonal position normally characteristic of a bowl (see section 4.2). The classification of shapes is, therefore, necessarily non-specific and flexible when dealing with survey pottery stemming from many different and chronologically diverse periods.

The next category in the feature sherd table is the supposed age of the sherd. Although this table only contains the feature sherds, these could not necessarily all be dated. Several handles, bases and even rims were simply too nondescript or common to date them to a specific period. Others could only be dated to a broad range of time. The ribbing on the body of vessels was occurred in the Roman, Byzantine, Umayyad, Abbasid and Fatimid periods. This broad group of sherds was, therefore, entered as dating to the 'Roman or later' period.

Of rims the diameter was taken, which sometimes proved difficult as sherds were too small to provide an unambiguous diameter or because the position was not certain. The early periods, furthermore, often had irregularly shaped rims, which complicated taking positions and diameters. Additionally the thickness was documented to provide a very general idea about the size of the sherd and the original vessel. Initially the length and width of sherds were also scored as size gives an indication of the level of fragmentation and hence post-depositional processes. This category was, however, dropped as it proved too time-consuming in relation to the results it would provide. Too many other factors like age, type of vessel, and modern use of the field, affected the

size of sherds. Similarly categories like the level of abrasion, hardness on the Mohs scale, colour, production technique and ware classification were abandoned after initial testing. Most of these categories mainly provided information useful in a specific pottery analysis. Hardness and level of abrasion are useful analytical categories that yield information on post-depositional processes. The pottery collected was, however, very diverse due to the many different periods present, which made it difficult to determine which characteristic was responsible for an observed phenomenon. An approximation of these processes can undoubtedly be reached, but this kind of analysis is too intensive and time consuming to be part of this study.

Initially, additional categories recorded the amount of abrasion and the hardness of the pottery. The level of abrasion can provide information on the post-depositional processes the sherd was subjected to like tillage, lateral movement, and time spent on the surface. This information can aid in the interpretation of artefact distributions and the identification of sites (Burgers et al. 2002: 14). As the degree of abrasion is dependent on the durability of the artefact, the hardness was measured on the Mohs scale. Recording these two categories was very labour intensive and results were disappointing. The level of abrasion was, as expected, mainly related to the type of pottery and thus its hardness. Byzantine ribbed sherds were generally very well preserved, while the thin orange ware was often heavily abraded. Unfortunately, little differentiation within these categories was visible. Given the time-consuming nature and disappointing results of this approach these categories were abandoned after a trial period. Documentation was restricted to general remarks if abnormal abrasion levels were encountered, e.g. in the concentration centring around field 128 (see chapter 4.1.2).

Unfortunately, a detailed ware analysis also lay outside the scope of this study. An extensive attempt was made to incorporate this kind of information as it can considerably help the dating of poorly preserved survey sherds. Several surveys have gained impressive results with ware analysis (e.g. Degeest 2000; Poblome 1999; Van de Velde 2001: 32). It proved to be impossible to benefit from this kind analysis given the present level of research in this part of the Jordan Valley. Although detailed ware descriptions have been provided for the excavated pottery of Tell Deir 'Allā, these detailed data are restricted to the Late Bronze and Iron Ages (Franken 1969, 1992; Vilders 1992; Groot 2007; Groot in prep.). For the other periods no ware analyses are available from the immediate vicinity of the research area. The identification of temper and clay type of the survey finds was very time consuming, but would have been worthwhile had a standard been available to compare the results against. Although not entirely impossible it was too difficult and labour intensive to develop a standard on the basis of well datable survey pottery and detailed ware analyses from farther away. Ware type is, therefore, only used in a very general fashion in dealing with the non-feature sherds (see below).

The remaining categories that were treated were a description of the type of decoration, like burnishing, slip, incisions and/or ribbing. When a sherd was drawn and thereby touched upon in the description of the following sections this was indicated. The final category 'remarks' allowed information to be added that could not be accommodated elsewhere fell outside the normal description possibilities.

The non-feature sherd table

The non-feature sherds, that had no distinguishing features, were also further described in a table. The majority of the collected pottery consisted of non-feature sherds. On average feature sherds made up only 27 % of the total assemblage. This figure, however, includes the ribbed body sherds that are so ubiquitous at sites from the Roman, Byzantine and Islamic periods. Because of the ribbing most body sherds from these periods were feature sherds, resulting in a much lower percentage of non-feature sherds at sites from these periods. When ribbed sherds are excluded the number of feature sherds drops to 18 %. The survey would have been very inefficient if no information could have been retrieved from more than three quarters of the collected pottery. Nor was this the case, as a body sherd from the Chalcolithic period could generally be distinguished from a nondescript sherd stemming from the Roman period. Although aspects like ware analysis, hardness and colour could not form part of the standard processing procedure of the survey pottery, non-feature sherds did contain this kind of information, which could not be ignored.

Based on well-dated feature sherds it was for example noted that (Late) Chalcolithic sherds were commonly tempered with very considerable amounts of large fragments of purposefully crushed calcite. The clay used generally resulted in a pale yellow to buff colour after firing and included very few other inclusions. Early Bronze Age sherds were generally more pinkish to orange in colour and had a more diverse range of inclusions of which some were purposefully added as temper. In most of the sherds these inclusions incorporated more or less rounded ironoxide fragments of variable size. Iron Age body sherds were generally recognisable as they were usually highly fired resulting in an outer surface showing small holes where fragments of calcite had been expelled by the heat. Furthermore, Iron Age pottery often contained a certain level of salt, probably through the use of salty Lisan clays, which combined with high firing temperatures formed a whitish or even light greenish scum layer on the surface. Late Roman or Byzantine sherds could be recognized by their hardness, the small inclusions, and the common black coating on the surface of the sherd caused by a final short episode of reduced firing. Mamluk sugar pottery was also very distinguishable, even at the body sherd level, as they were thick, light pinkish, orange or buff, had small inclusions and broad rolling ribs.

These general characteristics combined with some smaller but recognisable groups allowed the division of the non-feature sherds into broad chronological categories. The early prehistoric periods, i.e. Late Neolithic, Chalcolithic and Early Bronze Age, were grouped together. The Middle Bronze Age formed a separate group and the Late Bronze and Iron Age formed a separate category. The fourth group was a combination of the Hellenistic, Roman, Byzantine and Early and Middle Islamic periods. The last group contained the Late Islamic or Ottoman and Modern sherds. The sherds assigned to the categories by no means provide a firm date, nor could all sherds be assigned to such a category. Several sherds remained undated, irrespective of the use of such broad periods.

Another category of the non-feature sherds table scored whether a vessel was open or closed. In some cases a reduced inner surface of the sherd, while the outside was oxidized showed the vessel had originally been a closed shape. Traces of throwing sometimes allowed the position of the sherd to be ascertained, which could give an indication of the vessel's shape. Although theoretically possible the abraded nature of the sherds and the often high level of fragmentation meant that this kind of information was seldom available.

A category that was scored for all sherds was thickness. To process large numbers of sherds quickly and because of the generally low level of precision needed it sufficed to measure only a few sherds from each bag. The remainder was while the others were grouped by comparison to the measured sherds. Four groups were identified, i.e. less than 0.4 cm in thickness, between 0.5 and 0.8, between 0.9 and 1.2 and larger than 1.2 cm in thickness.

The flint table¹⁹

Like the feature sherds the flint artefacts were given a unique find number and described individually. This description was not restricted to the tools but was carried out for all artefacts including debitage. This was possible because flint artefacts were not as numerous on the surface as sherds. The artefacts were entered into the flint database, which, like all tables, included the primary keys find number, field, line and plot. These identifiers were followed by a column called 'waste'. If a flint artefact was not a tool this column provided the space to enter the type of artefact, e.g. whether it was a blade or a flake. When possible the type of tool was described in the next column, for example scraper or borer. In the column typotechnological remarks further specifics could be added, e.g. whether it was an end- or a side-scraper. The next field documented how much cortex was present grouped in four percentage groups. Cortex was regarded as denoting not only traces of the limestone in which the flint had been embedded, but also the rounded outer surface of

19 The original database designed before the first survey season and extensively adapted during the season was modified before the 2005 season. The database of the first season is, therefore, slightly different from the following two seasons. Comparison is, nevertheless, possible, as the important categories are present in both databases although in slightly different layouts and orderings. The initial database was devised in the 2004 season by Luc Amkreutz and Floris van Oosterhout, both experienced in lithics research. The modifications were carried out in 2005 by Jonathan Sela in consultation with Steven A. Rosen of Ben Gurion University of the Negev.

flint pebbles brought to this area from elsewhere. It was then registered whether the artefact was broken, burned and rolled or not by simply ticking a box. The category rolled was added because this provided information on the provenance of the flint. During the first season a distinction was noted between ad hoc tools made from small rolled cobbles amply available on the surface and more elaborate formal tools made from large boulders of higher quality flint. To be able to fully detect and record this distinction this category was added. The next category allowed entering specifics about the raw material used. Not only flint, but also compacted limestone was used to produce flaked tools. Furthermore, the category allowed specifics of the flint to be registered, for example the use of Eocene flint. After entries recording the dimensions of each item, the presence and type of use wear, like sickle gloss, could be entered. The following category recorded whether patination was present and whether this was single or multiple patination, providing information on the exposure history of the artefact and the possible time lapse between different retouch or uses on a single piece. In case of some tools a date could be given, followed by a level of doubt for problematic specimens. The last field allowed additional remarks to be made.

The 'other finds' table

Given the diverse nature of the 'other finds', an internally less homogeneous table was created. Categories allowed a lot of different information to be added and were essentially descriptive instead of enumerative like the other tables. First the type of raw material used was listed, followed by the type of artefact concerned. Then a level of completeness was given in five percentage categories. The approximate length, width and height dimensions, if applicable, were given. If possible a date was given and a remarks field was present to enter all additional data. Furthermore, all finds from this category were photographed and if necessary drawn. Irrespective of its diverse nature this category was not very ubiquitous and large parts were made up by tesserae and fragments of glass. In total the survey collected 762 'other finds', which is rather insignificant when compared to the 109,669 fragments of pottery picked up from the surface.

All the finds were processed and entered into the databases during the fieldwork by the surveyors. These surveyors were with one exception all advanced BA-students, MA-students or recently graduated MA-students in archaeology or heritage studies from Leiden University and Yarmouk University in Irbid. The surveyors had different amounts of field and artefact experience. To ensure comparability and to avoid mistakes, all pottery, both feature and non-feature sherds, as well as all flint tools were checked before being entered into the database. The 'other finds' database was the responsibility of a single person and was checked at intervals.

Already during the fieldwork the spatial information of the plots was entered into a GIS program.²⁰ Based on the UTM, ed. 1950 Egypt, zone 36, coordinate system all plots were located on aerial photographs taken in 2000 by the Royal Jordanian Geographic Centre in Amman. Subsequently the database tables were linked to the geographical information. In this way all artefacts can be plotted on the map. The relationships between the different analytical tables allows queries to be generated that can, for example, show in which plots, surveyed on even days and with a visibility score between 1 and 3, a certain person collected both a flint artefact and Early Bronze Age sherds that had a thickness of 0.4 cm. The resulting distribution of this rather meaningless query can subsequently be plotted on the map.

The feature sherds, flint and a selection of the 'other finds' were shipped to Leiden University to allow further study. This included the drawing of a representative selection of these artefact categories, the comparison to stratigraphically sound excavation assemblages to attain a more precise dating and general checking and further elaboration of the description with regard to areas of special interest. If a more precise date could be given to a feature sherd, this usually allowed a more precise morphological identification of the original vessel form. Artefacts were subsequently plotted per period. The artefact distributions attained in this way were subsequently evaluated, interpreted and compared to other periods. The interpretations of the survey finds per period that were reached in this way are discussed in the next chapter.

²⁰ The GIS program used was Mapinfo.

Period	Abbreviation	Dates in cal. BC	Remarks
Neolithic	PPNA	9700-8500	
	PPNB	8500-6250	
	PNA	6250-5400	
	PNB	5300-5100	(Blackham 2002)
Chalcolithic	Early Chalcolithic	5100-4900	
	Middle Chalcolithic	4900-4600	
	Late Chalcolithic	4600-3800	Terminal Chalc. 3800-3500
	Intermediate Chalc/EB	3800-3400	
Early Bronze Age	EB I a/b	3600-3050	a 3600-3350, b 3350-3050
	EB II	3050-2700	
	EB III	2700-2300	
	EB IV or EB/MB	2300-2000	
Middle Bronze Age	MB I	2000-1800	
	MB II	1800-1550	
Late Bronze Age	LB I	1550-1400	
	LB II	1400-1200	
Iron Age	Iron I	1200-1000	
	Iron Age IIa/b	1000-725	
	Iron Age IIc	725-539	
	Iron Age III/Persian	539-332	
Hellenistic	Hellenistic	332 - 63	
Roman	Roman	63 BC –324 AD	Mid 1 st BC - early 4 th AD
	Late Roman	324-661	Early 4 th to mid 7 th AD
Islamic	Umayyad	661-750	Early Islamic (600-1000)
	Abbasid	750-969	
	Fatimid	969-1171	
	Crusader	1099-1187	Middle Islamic (1000-1400)
	Ayyubid	1171-1260	
	Mamluk	1260-1516	
	Ottoman	1517-1917	Late Islamic (1400-1800)
Pre-modern/modern	Mandate/Jordanian	1918-present	Early 20 th – early 21 st AD

Table 3.1 Absolute dates of periods used in this study²¹

An attempt was made to date all collected finds, but this was of course not always possible. Several artefacts were too common or contained too few distinguishing features to allow dating. Sometimes it was only possible to attach a very broad general date to an artefact. A common date, for example, was ‘Roman or any of the periods after that’. In table 3.1 the absolute dates attached to most periods are given. For many periods the most commonly accepted dates are given, although arguments for alternative dates can also be put forward. Especially the dates for the later periods are based on historical events and therefore have a precision that can never be attained in the survey. It was decided to use the term Late Roman instead of Byzantine period. Although Byzantine is the common term in the southern Levant to denote this timeframe, in other parts of the Mediterranean the term Byzantine refers to an entirely different period. To avoid confusion and to underline the social and cultural connection to the Roman period the term Late Roman period is used here.

21 Based on among others Stern (1993), Whitcomb (1998), Walker (1999) Philip (2001: table 5.1), Blackham (2002: fig. 41), Kuijt and Goring-Morris (2002: table 1), Walmsley (2007), Petit (in prep).

Dates are attached to artefacts, especially pottery, by comparison with parallels from excavated sites. Pottery dating is, however, a relative dating method and while dating of sealed stratigraphic layers is often difficult due to the long continuation of certain pottery traditions, the dating of out of context survey finds is even more hazardous. While the presence of certain vessel types and the absence of others can be used as *terminus post* and *ante quem* indications in closed stratigraphic deposits, this is impossible when all artefacts stem from the surface. Nevertheless, in some tightly bounded high density concentrations that stem predominantly from one period a similar line of reasoning can be used to suggest one date is more likely than another, theoretically also possible date. For example, if a concentration dates predominantly to the Late Roman period, but a few examples have been found that can date to both the Late Roman and the Umayyad periods while no artefacts from the Umayyad period proper have been identified, the chances are higher that these Late Roman/ Umayyad sherds date to the Late Roman period. However, this cannot be proven and the fact that the Jordan Valley is a large palimpsest where remains from several periods are scattered throughout the region severely hampers precise dating. In the original databases the date of individual artefacts can be found, whereas the interpreted, more general dates of the artefact distributions are discussed in the following chapter.

Space-borne remote sensing

Several surveys have greatly benefited from the use of satellite imagery in the identification of sites on the surface (e.g. Wilkinson et al. 2006). Given the potential results this line of investigation could yield an attempt was undertaken in a specific cooperation programme between the Faculty of Archaeology of Leiden University and the Faculty of Aerospace Engineering of Delft University of Technology in 2007. This investigation resulted in a M.Sc.-thesis and article by Dentz (Dentz 2007, 2008). In this research different types of satellite sensor data were analyzed and compared to spectrometric data collected in the field in order to establish whether certain remains, e.g. tell sites, had a unique spectral profile. Three multi- and hyperspectral satellite sensors were used, i.e. Quickbird, Hyperion and Aster, together with three radar satellite sensors, i.e. ERS, Envisat and SIR-C/X-SAR (Dentz 2007: 90-97). These different sources were analyzed individually and as a combination of optical and radar data (Dentz 2007: 73-79). Although the study definitely showed results and holds good potential for less well studied regions, the Zerqa Triangle has been studied in such detail that little new information was provided. However, the already known tells were clearly recognizable. The former location of an erstwhile tell could, furthermore, be detected. Additionally, aspects like erosion of tells, the main geological formations, the location of modern built up areas and elevated parts in the landscape could all be identified (Dentz 2007: 81). However, most of these rather visible remains have already been documented for this region. Furthermore, it had especially been hoped that the radar data would be able to detect buried features. Although images from the driest period were chosen, modern agriculture and irrigation, unfortunately, resulted in vegetation cover and so much water in the soil that the radar was unable to penetrate the soil (Dentz 2007: 83). The high degree of agricultural activity and the good knowledge of the more conspicuous archaeological remains in the Zerqa Triangle meant that no new sites were discovered through this way of analysis. However, this analysis has shown that in less intensively studied areas space-borne remote sensing can be a valuable tool in archaeology.

2.2 Biases

Before the collected sherds can be plotted on maps and their distribution patterns interpreted, a number of biases that affect the collection and dating of artefacts should be evaluated. Several distorting factors have acted on the material residue left by past societies. These biases take many forms; post-depositional factors like erosion, sedimentation, bioturbation, seismiturbation, have all acted on the material in the hundreds to thousands of years that have elapsed between their deposition and their collection by the survey. These factors have resulted in the distortion of the archaeological residue through differential movement and disappearance of part of artefactual assemblage. There are, however, also several factors that are the direct results of the archaeological

techniques employed. Archaeologists are human beings with different abilities and the capacity to make mistakes. Furthermore, archaeological research always entails making choices as total investigation of all aspects of past societies is simply impossible. The entire range of biases that act or have acted on the archaeological record is too large to fully discuss here. A small selection of the most important biases and those that are specific to this research are discussed here. However, most of the biases and distortion described and investigated by others apply to this survey and this region as well, even though no special focus is placed on them (e.g. Haselgrove et al. 1985; Shennan 1985; Schiffer 1987; Schofield 1991; Bar-Yosef 1993; Bintliff and Howard 1999; Bintliff et al. 1999; Francovich et al. 2000; Johnston 2002; Van Leusen 2002).

3.2.1 Differences between field-walkers

Pottery

A survey is always a sample, in more ways than one. A survey is firstly a sample because areas are seldom completely covered due to research questions and time constraints. A survey is also a sample because it is carried out by humans. No person can discover all artefacts on the surface over a prolonged time period. People get distracted, become tired, get bored and consequently lose their concentration, which is reflected in their collection rate. Furthermore, not all persons have the same eyesight, ability to recognize artefacts, level of concentration and endurance. All these factors meant that despite the policy of collecting all artefacts visible on the surface, no total recovery was achieved in this, or any other, survey.

The East Hampshire Survey concluded from the tests they carried out on the so-called field-walker effect that 'inter-walker variability is a fairly minor source of variation in fieldwalking results' although it is definitely present (Shennan 1985: 43). Although the variation in survey ability among field-walkers is widely recognized, it is seldom statistically calculated and taken into account. Given the participation of person A in all three seasons, it was possible to compare the results of all field-walkers. By taking the overall results of person A as an index figure the field-walkers can be compared. Person A only surveyed half of the season in 2005 and 2006. This problem was, however, overcome by the presence of person B who joined the 2005 and 2006 surveys when person A was away.²²

To compare the different collection rates of field-walkers the average number of sherds discovered per plot was calculated. Person A or B was then taken as index figure and the average number of finds per plot of the other people was plotted against the index figure. For this calculation the differences in artefact density on the surface should be equal between the people in order to compare the personal discovery rate. This is of course impossible to achieve, as two persons cannot walk the same plot collecting the same sherds. To overcome this problem averages were only calculated over a large number of plots. Averages based on fewer than 50 plots were excluded and total numbers of plots that amounted to well over a hundred were aimed at. Furthermore, only people who surveyed the same fields were compared. If a person was, for example, absent during the first few days of the 2005 season, when the 'Ammata concentration was surveyed, his or her average would be much lower as the plots with very high densities of up to 1812 sherd per 100 m² were missed. Therefore, only persons who surveyed the same fields were compared. The surveying of a single plot by a duo also affected the average per person. Duo plots were, however, not very common and completely random. These were, therefore, regarded to have only slightly influenced the averages.

When the sherds collected in 2004 are considered, it is clear that the differences between people are substantial (see table 3.2). For people surveying in the same season the average number of sherds recovered per plot given in column two can of course be considered, but this does not

²² Person A and B participated for half a season in the Settling the Steppe-project excavations conducted by Petit and joined the survey during the other half of the season. Persons A and B swapped functions.

2004, fields 1-34	Av. no. sherds per plot (50 m ²)	No. of plots	Indexed level of collection
Person A	28	129	100
Person C	29	161	105
Person D	34	153	123
Person E	22	151	79
Person F	41	139	147
Person G	17	63	59

Table 3.2 Sherd collection during the 2004 season

2005 fields 93-144	Av. no. sherds per plot (50 m ²)	No. of plots	Indexed level of collection
Person J	18	67	68
Person A	27	100	100
Person N	15	73	55
Person O	16	89	57
Person P	19	88	71

Table 3.3 Sherd collection during the first part of the 2005 season

2005, fields 145-204	Av. no. sherds per plot (50 m ²)	No. of plots	Indexed level of collection
Person J	12	90	67
Person B	17	115	100
Person L	22	119	125
Person M	13	99	74
Person N	10	123	56
Person O	9	75	54

Table 3.4 Sherd collection during the second part of the 2005 season

allow comparison between the seasons. The indexed figures are, therefore, shown in the last column. The number of plots considered has been added to give an indication of the reliability of the sample.

During the second season of fieldwork the general discovery rate was lower than that of the first season as person A collected the most pottery by far whereas in the first season others exceeded the index figure considerably. In the 2005 season person B joined the team for the first time. He succeeded person A in the second half of the season. Judging from persons J, N and O whose indexed figures changed little there is only a minor difference in collection rate between person A and person B.

In 2006 persons A and B were again present in the survey. During the survey season the differences between the field-walkers were quite large. Some people had a collection level of 136 while others collected significantly less, e.g. 45. Remarkable is the difference in collection rate between the first and the second half of the season for persons S and U. While person T remains more or less consistent during the season, the collection rate of persons S and U reversed.²³ Person S had a good start with a relatively high collection rate, but apparently lost concentration or interest during the second half resulting in a drop in collection levels. Person U, however, started off slowly with low collecting rates, but became better at collecting as the survey progressed and almost doubled his or her collection rate.

23 The difference in collection rate of person R as well between first and second half remains more or less the same when they are indexed on person T or over a shorter interval on person R, demonstrating that the change is not a result of the difference between the two index persons.

2006, fields 205-247	Av. no. sherds per plot (50 m ²)	No. of plots	Indexed level of collection
Person S	4	194	80
Person B	5	178	100
Person T	6	182	131
Person U	2	146	45

Table 3.5 Sherd collection during the first part of the 2006 season

2006, fields 248-330	Av. no. sherds per plot (50 m ²)	No. of plots	Indexed level of collection
Person R	24	181	135
Person S	12	173	68
Person A	18	176	100
Person T	24	150	136
Person U	14	174	79

Table 3.6 Sherd collection during the second part of the 2006 season

When all the indexed figures per person are plotted in a single graph, the differences are very clear. The persons collecting most pottery discovered almost three times as much as the person collecting the least sherds. It is unfortunate that persons A and B cannot be compared. It is uncertain whether person A collected more than person B or whether it was the other way round. The position relative to person A and B is not the same for all field-walkers. In two of the three cases where the figure indexed on person B was considerably higher the difference can be explained by the fact that both persons were relatively inexperienced and needed more time to get acquainted with surveying and the material than the other team members. Over the course of a few weeks their performance and collection rates improved. Furthermore, both persons had fallen ill during the very first days of the season, which may have hampered their collecting in the days after they returned to the field. The result of person U who collected significantly less when indexed on person B can be explained in the same way as in this season person B joined the survey in the first period. Additionally, the low number of sherds collected in certain parts of the survey area may have distorted the indexed results. When only three sherds are collected on average a difference of one sherd makes a large difference in indexed numbers.

The difference in general collection rate, irrespective of changes during the season, would logically be related to survey experience and familiarity with the artefact types. However, this hypothesis was proven to be untrue. Person F, for example, was new to surveying and had little experience with pottery. Person T, however, was experienced in both survey and pottery analysis, but in very different regions. Persons R, D and L were again inexperienced in survey and in pottery with D and L being flint specialists. Person O, however, probably had more experience with pottery and this specific region than anyone else in the survey, and person N had more excavation experience in this region than several other people. Still persons O and N on average discovered less than half as much as the more inexperienced people F, R and D. Collection rate, therefore, seems to be more connected to personal characteristics than to experience. It would, however, be interesting to test whether survey experience makes a large difference in collection rate. Only person T had previous survey experience and in the later seasons persons A and B had gained some experience. The growing experience of persons A and B makes comparison problematic, but the limited change between the indexed persons and several of the learning field-walkers over the season shows survey experience may not have been a determining factor in all people, although it certainly was in some.

It can, therefore, be concluded that field-walkers differed in general ability to collect artefacts. However, all field-walkers, also those with the highest collection rate, will have missed artefacts. Furthermore, all field-walkers will have experienced biases due to e.g. variable concentration and getting accustomed to the work, although to different degrees and with different consequences.

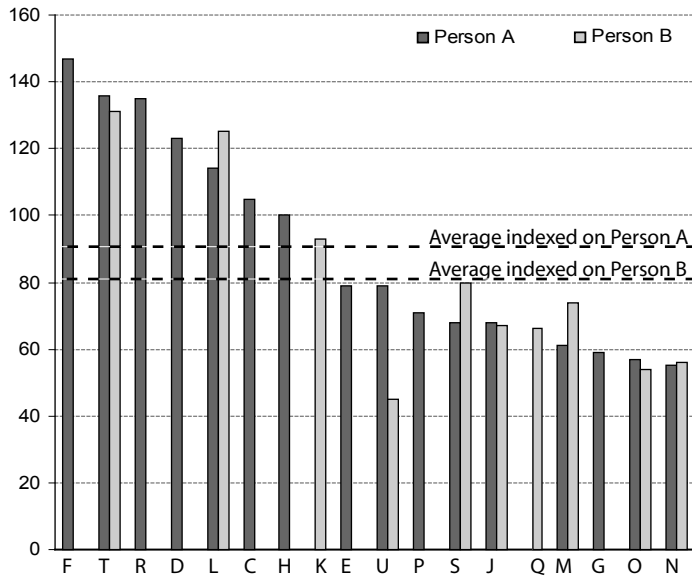


Figure 3.6 Number of sherds collected by the field-walkers as indexed on persons A and B

Flint

The relative numbers of flint artefacts discovered can be calculated in the same way as the pottery. Problems of small sample size that occasionally affected the pottery are much more extreme in the case of the flint artefacts. The average number of flint artefacts discovered on the surface by individual team members amounted to 0.56 in 2004 and was only 0.29 and 0.05 in 2005 and 2006 respectively. These numbers are much lower than the pottery averages and hence the differences between the persons are larger. Figure 3.6 illustrates this vividly. The extreme difference between the first column that had an indexed figure of 313 compared to person A and the last which amounted only to 6 compared to person A are skewed by the low numbers. In the season that produced this low flint number person A collected only 16 flint artefacts. This means that each piece of flint that is found amounts a difference of 6.25 on the index figure. In the same time period person A collected 3125 sherds, which means that each individual sherd makes up 0.032 of index figure. The theoretical chance of discovery is of course as high for the first piece of flint as it is the fiftieth. However, if the psychology of the person collecting is incorporated the chances are no longer similar. Flint artefacts were sparse on the surface. Generally only a single artefact was discovered in a plot and this plot was, furthermore, often followed by several plots in which no flint artefacts were discovered. Flint artefacts were more often absent than present, causing people to lose concentration, and, furthermore, people will often have devoted less attention to searching for flint artefacts. Sherds on the other hand were almost always present. Even in the 'empty' fields covered in the 2006 season one or two sherds were usually discovered per plot. People even paid more attention to find what they jokingly called the one 'mercy' sherd in an otherwise empty plot. Whether a person is expecting something or not subconsciously makes a difference to his concentration and attention. Sherds were deemed to be recoverable everywhere, whereas flint artefacts were so scarce people unwittingly lost their concentration and paid less attention in the anticipation of finding nothing.

In figure 3.7 the first column shows extremely high indexed numbers in comparison to the other figures. This person L was especially interested in flint and remained focussed on flint until the very last day despite its sparse distribution. The difference between person A and B is greater regarding the flint. The survey season of 2005 was person B's first intensive encounter with flint. Person A, however, developed a real interest in flint analysis during the survey. The general decline in flint collection over the season can be clearly demonstrated. During the season in which persons J, N, O and M participated, person A joined the first and person B the second half of the survey. Collection rates decreased significantly during the presence of person B, even while person

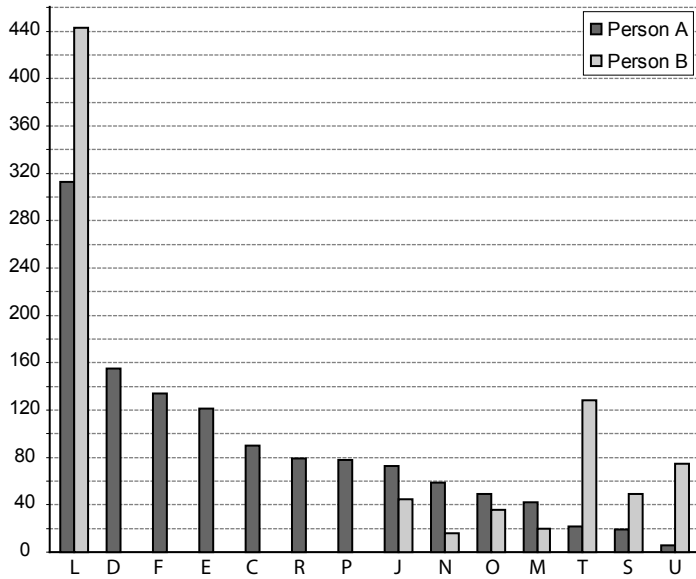


Figure 3.7 Number of flint artefacts collected by the field-walkers as indexed on persons A and B

B probably collected less flint than person A and collection rates of persons J, N, O and M should have been higher just like those of person L. The season that persons T, S and U joined, person B was the first to join the survey and this is clearly expressed by the significantly higher rates than during the later weeks when person A joined.

There seems to be a connection between experience and collection rate of flint artefacts versus pottery for at least some field-walkers. Figure 3.7 shows the difference in flint and pottery recognition between field-walkers. Persons C, D and E all participated in the first season. All three had finished their MA degree at Leiden University, but Person C was a Near Eastern archaeologist with more ceramic than flint experience, while persons D and E were specialized in the lithics of the Palaeolithic and Meso-/Neolithic periods of north-western Europe. These differences in experience are clear from the numbers as indexed on person A. Person C collected relatively more pottery than flint, whereas the opposite holds true for persons D and E.

The number of flint artefacts collected in 2004 was almost three times higher than that discovered in the 2005 season, which was in turn almost four times higher than the number discovered in 2006 (see table 3.8). This seems an extremely sharp decrease in numbers observed on the surface and poses the question whether these numbers reflect a difference in the ability of the field-walkers to recognize flint or whether it reflects an actual diminished number of flint artefacts on the surface.

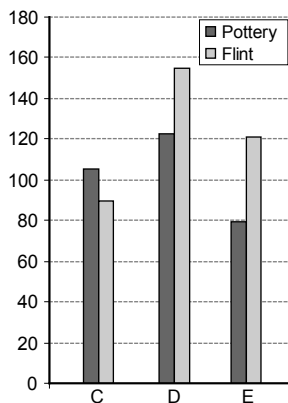


Figure 3.8 Indexed pottery and flint artefact collection of persons C, D and E during 2004

This question can be evaluated by comparing the results of persons A and B to the total flint finds per season. To make the flint artefacts discovered in the seasons as a whole comparable to the collections of persons A and B, the finds have been translated into number of flint artefacts discovered per plot (see table 3.7). It is clear that although no absolute match, the decline in number of flint artefacts discovered per plot is very similar in all three cases. The severe decline in number of flint artefacts collected is therefore not a result of decreasing flint recognition over the seasons, but reflects an actual decreasing presence of flint artefacts on the surface.

Season	Total no. flint	Flint per plot	person A No. flint	Person A flint/plot	Person B no. flint	Person B flint/plot
2004	1458	0.68	75	0.58	-	-
2005	554	0.33	50	0.47	17	0.15
2006	155	0.08	16	0.09	13	0.07

Table 3.7 Decreasing numbers of flint artefacts discovered in the three seasons by persons A, B and in general

The decreasing amounts of flint discovered by persons A and B can be regarded as representing an actual lower number of flint artefacts on the surface. The total flint assemblage is evidently heavily influenced by the capacity of the individual field-walkers to recognize flint. Efforts were undertaken to acquaint every field-walker with flint by means of a short introduction before survey and by assigning everyone to flint processing for a period of time under the guidance of someone more experienced. This period and intensity was, however, too limited to be fruitful for some of the persons who had no experience with flint at all. It is, however, not the case that the survey was severely biased by the lack of experience of its field-walkers. If only people experienced with flint research would have joined the survey the differences would probably been equally diverse. One of the people collecting only 50 % of the number collected by person A was a professional archaeologist with several years of hands-on experience in flint research. Although the level of experience undoubtedly influenced the ability to detect artefacts, this relationship was not absolute and the general ability to detect objects on the surface seems to have been equally determined by factors like eyesight, concentration, and perseverance.

A possible way to correct for these differences in collection rate is to multiply the discovered number of artefacts in order to reach the number collected by the person with that season's highest recovery rate. In the 2006 season, for example, this was person T. The indexed number of person T as plotted against person A was 136 or alternatively, person T collected on average 24 sherds per plot. Person S, however, had an indexed figure of 68 and collected 12 sherds per plot on average. Person T collected twice as much as person S. Although there is no information on the percentage person T collected from the number of sherds that was actually present on the surface, it is clear that person S gathered only 50 % of what was demonstrably possible to collect. Given the wide number of plots over which the average was taken and the different positions of the field-walkers in each field the possibility that person S consistently surveyed plots that contained fewer sherds than person T is negligible.

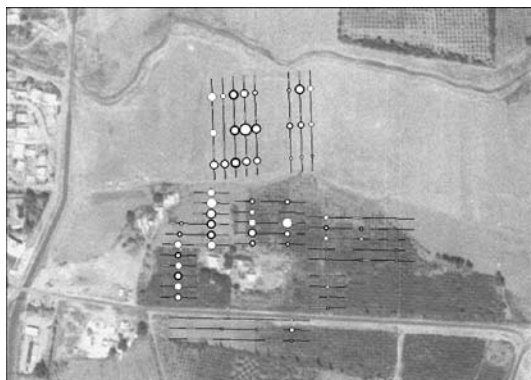


Figure 3.9 White is original number of sherds, black recalculated number of sherds (n = max 570, calculated 770)

An example of the result gained when all sherd numbers are treated in this way is given in figure 3.9. Here both the original and corrected numbers of total sherds are shown for a concentration just east of Deir 'Allā. The white dots show the original numbers, while the surrounding black rings show the corrected number of sherds that should have been collected had everyone had the same survey capacities as person T. The differences between the original numbers and the corrected numbers are clear. In certain cases the differences between neighbouring plots have become smaller, but in other examples the differences have only increased.

Although the benefits of this corrected view are clear on the detailed level of the single concentration, the added value for the identification and interpretation of concentrations remains low with respect to the relatively labour intensive recalculation procedure. As none of the field-walkers collected less than half the number collected on average by person T the values by which the total sherd numbers should be multiplied do not exceed 2. In areas where densities are low multiplication causes few changes. With denser concentrations the differences can increase but person T and persons who have similar collecting rates would already have collected high densities. These higher densities would, therefore, already be identifiable. For the identification of areas with higher densities of some size the corrected figures, therefore, provide little added value. Correction might, however, prove worthwhile for small areas of slightly higher than average density that are only touched upon by one plot that was accidentally surveyed by a person with a poor collection rate. However, these very small and hardly denser concentrations that are not detectable in other plots are rare and would be impossible to date or interpret further as artefact numbers would be too low and corrected numbers contain no qualitative information. For the interpretation of artefact densities, the artefacts should furthermore be separated into separate periods. It is, however, very likely that people have variable collection rates for different periods. People specialized in Late Roman pottery are more likely to find Late Roman than Late Neolithic pottery. In order to come to trustworthy corrections that have an interpretative value the difference in collection rate between the periods should also be analysed. However, the large time investment and the relatively limited interpretative return argues against carrying out such calculations. However, one can conclude that it is clear that differences in collection rate between field-walkers definitely exist and that rates are influenced by several factors that should be understood before any useful corrections can be made.

3.2.2 Pottery and dating biases

The study of pottery is another facet of research in which biases occur. It is clear that the study of survey pottery is different from that of excavation pottery. Different factors are at play on surface assemblages and different problems arise during the processing (see e.g. Bes et al. 2006). Although the biases in pottery analysis are manifold, both in the case of excavation and survey assemblages, only a few aspects that were specifically clear in this survey will be touched upon here. The differential ability of the archaeologist to date certain types of pottery forms another bias. It is immediately obvious that certain periods are more easily identified than other. The green glazed pottery, for example, is easily recognized on the surface and can without difficulty be broadly dated to the Islamic period and further subdivision is often possible. The same applies to the ubiquitous ribbed body sherds dating predominantly to the Late Roman period. These sherds are relatively easily spotted on the surface as their straight lines and the shade their grooves generate distinguish them from the surrounding soil. Furthermore, the ribbing, like the glaze, usually extends over the entire body of the vessel. This ensures that parts of the body of such vessels can easily be dated, whereas body sherds from undecorated vessels often remain undiagnostic.

Another bias in the dating of pottery stems from the differential amount of research archaeological periods have received. In the southern Levant archaeological research has for a long time focussed primarily on Iron Age tells that were identified with places mentioned in the Old Testament. The ability to identify Iron Age pottery and the internal chronological resolution of this period are, therefore, relatively high. In this respect the Iron Age stands in contrast to the Hellenistic or Islamic periods. Remains from especially the Islamic period have only recently received more attention and well published excavation reports and elaborate studies stem primarily

from the past two decades (e.g. Avissar and Stern 2005). The difficulty of identifying pottery from these periods is not entirely due to a research bias, but also stems from a relative scarcity of finds from these periods in the research area. Habitation in the Middle and Late Islamic periods, with the exception of the (Ayyubid/) Mamluk and early Ottoman periods, was very limited in the Jordan Valley.

Another difference in datability between periods is the ware of the pottery. A detailed ware analysis was not included in this study as local stratified reference collections were absent for many periods. Nevertheless, some broad ware groups could be related to a period. Several pottery groups, especially of periods that were amply discovered in the survey, were relatively easily recognized on the basis of their wares. The pale coloured calcite tempered Late Chalcolithic pottery, for example, was highly recognizable as were the wares from the EBA, IA and some of the Mamluk period wares. Especially the wares of the later periods are less characteristic and making the non-feature sherds more difficult to date. As a result of their distinctive temper or clay use, often aided by a ubiquitous presence, certain periods were more easily identifiable than others.

Taking the above into consideration, the Iron Age pottery of the Zerqa Triangle should be well datable. The well defined pottery chronology in combination with the detailed stratigraphy of Tell Deir 'Allā and other excavated sites in the region (see chapter 2) provide a good framework (Franken 1969; Van der Kooij and Ibrahim 1989; Groot in prep.). More or less the same applies to the LBA pottery, which was even less commonly encountered in the survey. The MBA pottery is less ubiquitous in the region and hence less well known, but extensive remains have been excavated at Tell Deir 'Allā, which provides a good framework for initial comparison. No sherds could, however, be positively identified as stemming from the MBA. The EBA, however, was one of the most well-represented periods in this survey. The EBA lasts for *c.* 1.5 millennia and incorporates some poorly understood episodes. Regional differentiation in the early part of the period makes supra-regional ceramic comparison problematic (Philip and Baird 2000). Nevertheless, the material from this period was identified with relative ease and some internal differentiation could even be achieved. EB IV pottery was scarce in the survey but has been identified at two already known sites, i.e. Nkheil and Ze'aze'iyah. It is distinct from the earlier EBA pottery as iron oxide inclusions were rare, but most sherds were characterized by many small chalk inclusions. Besides the morphological characteristics the pottery would, therefore, probably have been recognized on the basis of its ware had it been present in significant quantities. Distinguishing between EB II and III pottery proved nigh impossible with this survey assemblage. On the whole, it resembled the EB I ware, but with smaller inclusions, entailing a greater levigation of the clay. The overwhelming majority of the EBA pottery collected in the survey was, however, made up by the EB I pottery. As stated this ware was very distinctive which resulted in a large proportion of dated non-feature sherds. Similar considerations apply to the Late Chalcolithic pottery which was, however, slightly more fragile as it had been less highly fired.

Of the periods postdating the Iron Age the Hellenistic period is one of the most enigmatic. In several regions its pottery is usually encountered in very limited quantities (e.g. Bintliff et al. 2007: fig. 4.5). Other surveys in the southern Levant have encountered similarly low numbers of datable Hellenistic pottery as did the Zerqa Triangle survey. The Wadi Faynan survey, for example, identified only 38 sherds from a total of 25,241 as dating to the Hellenistic period (Barker et al. 2007b: 166 + CDrom). This may be due partly to a research bias regarding this period in this region and partly to the less unique nature of diagnostic sherds hampering the ability to date these sherds. The Roman and Late Roman periods are well studied, both in the greater Mediterranean as in the Jordan Valley, and can often be very precisely dated. Particularly the imported Late Roman tablewares, i.e. Phocaean, Cypriot and African Red Slip Ware sherds that were discovered at some concentrations dated to this period, can often be dated with a precision of only a few decades (Hayes 1972). The production of local wares can of course not be as precisely dated, especially because no remains from this period had been excavated in the Zerqa Triangle prior to the 'Settling the Steppe'-project. The nearby excavations at Pella have, however, unearthed many remains from this period. The published pottery assemblage from this excavation has many parallels with pot-

tery discovered in the survey. By comparing the survey pottery to the Pella collection and other stratified assemblages in the wider region the locally produced pottery can also be given a relatively precise date.

In contrast to the Roman and Late Roman pottery, the Umayyad period pottery is more difficult to date. This is mainly caused by the continuation of several pottery traditions from the Late Roman into the Umayyad period (Hendrix et al. 1997: 251). The political and religious distinction between the Late Roman and the Umayyad period that started with the Islamic conquest of these Christian territories by the Arab armies is unambiguous. The social change is, however, less clear. Pottery changed little during the early years of the Islamic period. Late Roman vessel shapes like the cooking casserole continued with minor or no alterations into the Umayyad period (Magness 1993: 211-214). However, new shapes, wares and decoration techniques, like pie-crust impressed rims, appear in the Umayyad period (Sauer 1982: 332). Given the limited presence of these distinctive Umayyad vessels the Late Roman and Umayyad sherds are, therefore, by necessity often grouped together. Only in a few isolated instances could sherds be restrictedly dated to the Umayyad period ($n = 9$, see chapter 4).

Only a few sherds could be identified from the other early and middle Islamic sub-periods. In part, the lack of sherds datable to these periods is probably due to the relatively recent interest in Islamic period remains on the part of archaeologists of this region. The late Islamic Ottoman pottery has also received little attention. Publications dealing with stratified pottery from these periods are lagging behind the number of volumes published on excavated pottery from other periods. During recent years several excavation reports presenting pottery from these periods have been made available to the public, e.g. Yoqne'am (Avisar 2005), Tiberias (Stacey 2004), Ottoman Ti'innik (Ziadeh-Seely 2000) or the general reference work of Avisar and Stern (Avisar and Stern 2005). The almost complete absence of pottery from these periods in the survey can, therefore, not be entirely accounted for by the lack of publications. Furthermore, many of the vessels from these periods are rather distinct and well recognisable, e.g. cut-ware bowls, Coptic glazed ware, drinking jugs or Barbortine ware (Stacey 2004: 93, 104, 130, 136). Had these periods been amply present in the Zerqa Triangle, then these characteristic vessels would undoubtedly have been identified in the survey. Although a large part of the Islamic pottery could not be identified or precisely dated as is shown by the relatively large group of sherds dated to the Islamic period in general, the lack of Abbasid, Fatimid and Ottoman pottery is not entirely due to research bias.

Two sherds of Crusader pottery have been identified by parallels in territories that were under Crusader control at that time. The Zerqa Triangle, however, lay beyond the control of Crusaders. The pottery parallels for the two survey sherds are, however, probably vessels that were manufactured in Crusader regions and later moved to the Zerqa Triangle through trade or by other means. In this way it is possible to have Crusader pottery outside the sphere of Crusader dominance.

A distinction between Ayyubid and Mamluk pottery is hard to make, even in excavations, and the pottery from these periods is, therefore, often grouped together (e.g. Hendrix et al. 1997: 289). Although other sources suggest the majority of the sherds discovered in this survey in all likelihood dates to the Mamluk period (see section 6.3), an Ayyubid period date cannot be ruled out on the basis of the pottery. Furthermore, Mamluk period pottery is also difficult to distinguish from Early Ottoman period pottery. Historical sources show that occupation in the Zerqa Triangle was present around the first century of Ottoman rule. Pottery from the early Ottoman occupation is predominantly a continuation of Mamluk shapes like the hand-made geometrically painted ware (Ziadeh-Seely 2000: 83, 86). Sherds from this period may unwittingly have been grouped among the Ayyubid/Mamluk pottery. However, while in other areas of the southern Levant the hand-made geometrically painted ware continues until today, no comparable pottery tradition has been recorded for this part of the Jordan Valley (Ziadeh-Seely 2000: 86). The modern and pre-modern pottery of this region is characterized by plain ware with large quantities of small angular mineral inclusions. This ware had been termed 'gritty ware' in the survey. There are no references to the age of this type of ware, but the differences in temper and morphology encountered in the survey suggest it is of some antiquity and may well date to the 19th century resettlement. This pottery has been labelled Late Ottoman/modern.

Summarizing, certain periods in the settlement history of the Zerqa Triangle are better recognizable than others. This is the result of previous archaeological investigations that have caused research biases, the character of the pottery itself that sometimes has more or more easily distinguishable features and the amount of pottery from a certain period that was encountered during the survey, i.e. the more frequently a type was encountered the more familiar the local variability of the pottery became and hence the more easily recognized. Uncommon pottery types were less easily recognized. More detailed analysis focussing on specific periods would undoubtedly enable the identification and dating of more vessel types. This research is, however, aimed at providing an overview of all periods. In-depth studies of specific periods are, therefore, something to be carried out in future research. In this detailed, period-specific study less common pottery types and periods would probably also be identifiable. However, their low number means that they probably have little impact on the broad trends discussed here.

3.2.3 Post-depositional processes and geomorphological biases

A range of different post-depositional processes can cause artefacts to move away from their original place of deposition. This movement means that there is no direct correlation between the artefacts archaeologists discover on the surface and the actual distribution pattern left by human activity in the past. Evidence for these processes is the very fact that non-modern artefacts are discovered on the surface while their mother population has long ago been buried by later sediments. Post-depositional processes that cause artefacts to move away from their original location include erosion and deposition, tillage, animal and plant movement of soil, trampling, and seismiturbation. Some of these processes are more influential in this region than other. Trampling, the movement of soil by plant roots or animals living in the soil and seismiturbation are not likely to move artefacts over large distances, although they definitely contribute to the movement of artefacts within the soil and to the surface. Moreover, if a small phenomenon occurs over a long period of time or on a large scale the result can be great. For example, the distorting capacity of a single earthworm is small, but because of their large number, earthworms can have considerable effects on the archaeological objects in the topsoil (Darwin 1989: 79). A brick patio, for example, was completely buried under a layer of worm-worked top soil after a period of 20 years (Wood and Johnson 1978: 328).

A distorting process that has more influence in this region than in many other places on earth is seismiturbation. The Jordan Valley as a tectonic rift zone is susceptible to earthquakes. Large cracks caused by earthquakes have been detected in the excavations at Tell Deir 'Allā (Van der Kooij and Ibrahim 1989: 82). However, earthquakes are most likely to affect structural remains and tells, but are not very influential in horizontal movement of artefacts. Similar influences pertain to both animal and plant activity in the soil. Tree falls, plant growth, rodents and worms heavily transform the topsoil, but only in a localized fashion. The horizontal movement exerted by these processes is very limited.

The transporting ability of erosion is much larger, however. Different types of erosion exist and have different transport capacities. Wind erosion is not likely to move artefacts, for example, but it can remove overlying soil by which the embedded artefacts become exposed. The most common culprits in artefact movement are water and gravity. Studies have shown that both forces can cause artefacts to move from their original location. Allen (1991), for example, documented the number of artefacts and distance over which they moved down a moderate slope after some small storms. Given the topography of the Jordan Valley, most gravitational movement of artefacts will have taken place in the foothills with the valley plain acting as a recipient. The Qatar hills, however, are heavily influenced by erosion. In the ghor itself the absence of large elevation differences makes this type of movement unlikely. In the Zerqa Triangle, overflowing streams and floods or surface run off after torrential rainfall account for most erosional movement. During the wetter climatic conditions of the EBA the river Zerqa overflowed regularly as is evident by the deposits of red alluvial soil (Hourani in prep.). These episodes of overbank activity of the Zerqa may very well have buried artefacts lying on the surface. However, the movement of artefacts as a result of these probably very gradual and low intensity overflowings is unlikely. The effects of overbank

deposits will only have been felt in areas along streams, i.e. along the Zerqa river and the Wadi al-Ghor. Overbank deposits, however, probably ended during the later EBA and only the earlier periods will have been affected by it (Cordova 2007: 190). At the end of the EBA and after rivers became increasingly incised, erosion became restricted to inside the streambed. A full account of the erosional and depositional processes that have acted on this region is given by Hourani and one is referred to his report for more detailed information on these important factors (Hourani in prep.). The geomorphological information generated by Hourani's study has been incorporated in the choice for areas to be surveyed and, if influential, the interpretation of survey finds.

Ploughing or tillage is another influential factor in the movement of artefacts in and on the soil. The plough and movement of the soil cause artefacts to move both vertically through the soil and horizontally across the surface. Several studies and simulations concerned themselves with this phenomenon. One of the conclusions advanced in several of these studies is the phenomenon that large artefacts move upwards through movement while smaller ones stay within the soil (e.g. Boismier 1991). This implies that larger artefacts have more chance of ending up at the surface than others. This phenomenon had been realized for some time and has been termed the size effect (Baker 1978: 288ff). An archaeological surface collection is, therefore, biased towards larger artefacts. With each tillage event artefacts move in the direction prescribed by their size. This will only happen so many times until an equilibrium is reached (Boismier 1991: 18). After this equilibrium vertical movement is significantly reduced, unless of course the mother population in the subsoil is opened up again and new objects start to become affected by plough movement.

There is no evidence that horizontal movement is affected by the size of the artefacts (Boismier 1997: 236). Each time a field is ploughed the artefacts are moved further from their original position without any bias towards a certain class of artefacts. The direction of ploughing is another important factor governing artefact movement. If ploughing occurs in alternating directions the distance artefacts move remains restricted to a mean of 5 m (Boismier 1991: 17). Case studies have shown that horizontal dispersal of artefacts due to ploughing is generally more limited than is often imagined (Roper 1976: 372). During the many that centuries agriculture has been practised in the Jordan Valley fields will have been ploughed in all directions and manners possible. This perpetual movement of artefacts means that a level of dispersal stability is never reached. Artefacts move each time they are subjected to ploughing. This everlasting dispersal of artefacts does bring about a homogenisation of the artefact scatter (Boismier 1997: 236). However, the actual horizontal movement as a result of each ploughing event is very restricted and the long-term movement is restricted by field boundaries that remain constant over long periods of time.

These post-depositional processes cause artefacts that are buried in the subsoil in a mother population to move upwards at different speeds and with differential likelihood according to the character of the artefact. These varying capacities of artefacts result in a biased distribution on the surface. The subsequent horizontal movement across the surface results in a halo of decreasing artefact densities around the location where the mother population is buried in the subsoil. If there are no biases or restrictions present the halo will have a similar extension in all directions. A circular site would in theory result in a circular halo. The layout of the halo is, however, dependent on factors like the dominant direction of ploughing, slope, and the presence of wadis, roads or buildings that restrict movement of artefacts. In the discussion of the discovered artefact distributions below, these factors will be considered in the interpretation of the location of each site.

Not every high density, therefore, represents a site, i.e. a mother population buried in the subsurface. Nor does every low density area represent the absence of a mother population in the subsoil. Post-depositional processes may obscure features buried in the subsurface, but through deposition may also create artefact concentrations on the surface. A surface distribution of artefacts is, therefore, not necessarily an archaeological entity. The Zerqa Triangle as a whole and the surveyed areas in specific were, therefore, investigated geomorphologically by Hourani (Hourani in prep.). In this way areas that had been subjected to large-scale erosion or deposition could be omitted from the survey.

Of course human modification also has large-scale effects on the distribution of artefacts. Humans have been actively involved in soil movement, nowadays with heavy machinery but also in the past with human or animal force. People have furthermore constructed boundaries like walls,

roads, canals, terraces, etc, that limited the movement of artefacts away from their place of origin or, alternatively, may have favoured movement in specific directions. The Boeotia survey has very clearly evidenced this type of specific movement in Greece, where for example haloes around sites are cut off by the presence of roads (e.g. Bintliff et al. 2007: 202). Like human behaviour these types of human induced modifications are very diverse and will be stressed when encountered in the following sections.

3.3 Distribution analysis

The main objective of many surveys is to identify sites through the analysis of artefact concentrations on the surface. A site is defined in different ways, e.g. as a settlement, a burial ground, religious places, storage loci or more widely all foci of human activity in the landscape. The present survey had the aim to locate all traces of human activity away from the tell sites, so including non-tell settlements, burials, storage facilities, artefact production workshops, sheds, but also traces that would often be regarded as off-site, e.g. agricultural fields, irrigation channels, dams and terraces. Put differently, all human modifications present in the landscape can be regarded as a site.

Because the survey collected and processed all artefacts on the surface in a uniform manner, the methodological distinction between site and off-site has disappeared. Furthermore, the dichotomy site - off-site or waste is perhaps more reflective of our modern perspective on the landscape and indirectly on the archaeological landscape. Van de Velde has stressed this point by making a distinction between the idea that the archaeological record is continuous, i.e. a continuous distribution of artefacts with denser and sparser areas, and the idea that individual sites are located within nature, i.e. restricted artefact distributions surrounded by a thin carpet of waste. Van de Velde argues that the latter view understands the landscape as a passive entity that functions as means of subsistence base of the settlements. This view is based on the western urbanized perception of landscape that is connected to the nature – culture dichotomy (Van de Velde 1996: 27).

Interpretation has followed the same principles as collection and site identification. All distribution patterns need to be explained independently of their being of high or low density. This may seem straightforward, but proved to be difficult especially for the low-density areas. In the low-density areas the number of artefacts was low and the number of datable and functionally identifiable artefacts was even lower. The interpretation of how and why artefacts ended up at a specific place on the surface proved very difficult when the artefacts themselves contained hardly any information. Furthermore, artefact numbers for these low-density areas are so low that statistical tests become impossible. As a result of these problems a bias in interpretation towards the areas with higher artefact densities seems inevitable, despite being recognized and undesired.

Once the survey finds have been processed, the biases realized and the results per period plotted on a map the next step in the analysis starts, i.e. the interpretation of the distribution patterns. The past human activity has left artefactual remains. These remains have undergone several processes over time that have modified their original character and distributions. These post-depositional biases are exacerbated by the biases caused by archaeology. The outcome is a spatial distribution pattern that is by no means a direct reflection of the human activity that once generated it. The distribution pattern, therefore, requires interpretation before it can be understood. Interpretation evidently requires an understanding of the distorting factors that have affected the remains. This is, however, not enough. It should also be understood how human actions in the past translate into material residue. There are two possible lines of investigation to answer this question. One of these involves the study of modern activities that resembles activities of the past. A problem with this line of investigation is the fact that human activity is dependent on many factors. In other words, it is embedded in society. This means that there are almost always differences between modern activity and that of the past. To be able to compare the two, these activities should be reduced to the determinative factors of the activities and their results. If these factors are the same, old and new activities can be compared along broad lines. A second way is the investigation of the remains

of ancient activities themselves through excavation and their distribution on the surface. Based on these lines of investigation assumptions will be formulated in the following paragraphs describing the likely remains resulting from a selected range of human actions.

The success in reaching a functional interpretation of an artefact distribution discovered on the surface is dependent on the available research. For the southern Levant the available information on the function of different artefacts and pottery types is very good. The many excavations have provided a fairly sophisticated idea regarding the function of artefacts and which artefacts are to be expected at what type of site. The connection with surface collections is, however, much more problematic. Surveys have been conducted for several decades now, but their focus has mainly been restricted to finding settlements or sites in general. Even when surveys have been conducted in a statistically sound fashion by walking large transects or randomly located sampling blocks, the subsequent publication usually only gives rather general information on the sites. The remains discovered in the landscape away from sites are usually not reported on and details on the spatial variation of artefact densities at the site are often absent. Modern intensive surveys paying attention to overall sherd distributions and using GIS techniques to spatially document their results are being conducted, but have at present usually only been published as preliminary reports (e.g. Philip et al. 2005). Spatial data on the density and distribution of finds at a certain type of site to which the results of this survey can be compared are, therefore, seldom locally available (Barker et al. 2007b). Ideal are studies in which the interpretations of the function of surveyed sites have been tested by remote sensing techniques, like ground penetrating radar or electric resistivity measurements, and, ideally, excavation. In other regions this type of research is occasionally being conducted (Van Dommelen et al. 2008). In the southern Levant no specific studies linking artefact distributions discovered in surveys to buried mother populations in the subsoil have been undertaken at present. The interpretation of the distribution patterns in this survey is, therefore, for a large part guided by the functional characteristics of the pottery and other artefacts. Testing of the assumption and interpretation proposed in this study through remote sensing techniques and excavation is, therefore, of great importance and should be a focus of future research.

Based on excavations and ethnographic research some general guidelines have been proposed as to what remains are to be expected from certain types of sites. Naturally, the characteristics vary between periods and regions. Description of the density distribution per period will, therefore, be compared to information that is characteristic for the period and the region. Regardless of period, however, there are some general considerations that distinguish the site types from each other. The differences between the types of sites have been translated into assumptions on which remains discovered in the survey are likely to represent a certain site type. In the following paragraphs a few commonly occurring features that are present in most regions and that have been proven to exist in the Zerqa Triangle during certain periods through excavations will be discussed. These are by no means the only types of sites that may have left remains, but they are the most common ones.

3.3.1 *Distinct areas*

Settlement sites

The most common interpretation of archaeological remains is undoubtedly that of a settlement. A settlement is often regarded as a place where people reside with a certain degree of permanence. Usually, but not necessarily, a wide range of activities by which people make a living is carried out at this location. Another characteristic is some kind of construction to provide shelter. It might, therefore, be possible to discover remains of domestic structures. In the Jordan Valley, however, the attested use of mud-brick as a construction material over millennia makes that remains from housing are unlikely to be identified on the surface. However, people usually cluster together in settlements. The excavated remains in the Zerqa Triangle have shown that settlements were highly clustered during several periods. Settlements, therefore, denote the co-occurrence of several habitation structures in a restricted area surrounded by largely empty tracts of land. An ancient buried settlement would, therefore, be represented on the surface as a bounded area of higher densities that contrasts with empty or low density areas surrounding it.

At most settlements a diverse range of activities is carried out. These range from human necessities like cooking and eating to activities carried out in relation to community subsistence, like sheep shearing or butchering by pastoralists or processing of cereals by agriculturalists. Most of these activities necessarily took place within the settlement. Butchering, though, is often done outside the settlement as this is a messy job. Nevertheless, the settlement as the home base of the inhabitants is and was characterized by a wide range of activities and the results of activities carried out elsewhere may have ended up in the settlement, e.g. stored grain or the meat from the butchered animals. Remains expected at settlements are, therefore, typically of a diverse nature. After the invention of the pottery different types of vessels are to be expected. The most commonly identified vessels are probably those related to cooking and serving, i.e. cooking jars, casseroles and tablewares. Cooking vessels are often tempered differently than other vessels as they need to be able to resist thermal shock and thermal stress, which makes them easy to identify. Other expected functional pottery groups are e.g. storage containers and water receptacles. Other artefacts related to food consumption often present at settlement sites in this region are grinding implements (e.g. Van der Kooij and Ibrahim 1989: 102). In most periods, people in the Jordan Valley ground their cereals themselves. The hand querns used for this task were usually made of basalt or coarse sandstone. Basalt is not locally available and each discovery of basalt could, therefore, be treated as an artefact (Petit 1999). Basalt artefacts, especially the larger well identified fragments were mostly found in the same fields as high density artefact distributions that may be interpreted as settlements. Apart from implements for grinding large quantities of cereals, smaller mortars and pestles for crushing or grinding a diverse range of commodities are also a common constituent of a settlement's artefact assemblage.

Another artefact category often associated with settlements is flint tools. Flint tools have been used for a range from activities from harvesting cereals to butchering animals. Although flint tools were often made and used away from the site, the more formal tools were not discarded after use but were retained and brought back to the settlement. In excavations many flint tools have been found including sickle blades that were clearly used for harvesting cereals away from the settlement (e.g. Van der Kooij and Ibrahim 1989: 103). Although flint artefacts pointing to the production of flint tools occur throughout the region, the distribution of tools discovered in the survey has a high association to high density concentrations (see chapter 4). A long list of activities and their related artefacts that are often associated with sites can be given, but these will be discussed when the concentrations in question are considered. Essential for the interpretation of sites as settlements is that a diverse range of activities represented by an array different artefact types is to be expected.

A settlement is, therefore, regarded to be characterized on the surface by a bounded concentration of artefacts that demonstrates a clearly higher density than the surrounding areas. The artefact assemblage is furthermore characterized by a wide range of artefacts as it can be assumed that several different activities were carried out at the settlement. Archaeological excavations in the region have suggested a range of artefacts that are likely to be expected, like cooking, serving and storage pottery, grinding implements, and flint tools, but these are by no means the only artefact types possible. As the range of ways in which humans live together is rather variable, so are the types of activities carried out and the artefacts one expects to remain.

Different types of settlements

The interpretation of a site as representing a settlement is, however, not sufficient. There is a wide range of forms in which people can live together. The different possibilities are here restricted to a few artificially demarcated main types, but in reality there is a sliding scale representing a myriad of possibilities. The differentiated types are taken to be a single house or farmstead occupied by one household (which is not necessarily a nuclear or extended family or even a group linked by family relations), a village consisting of several habitation units, and a town or city understood as a large-scale conglomeration of habitation units. Based on this division the distinction between the three types of settlement would simply seem to be a difference in size of the artefact concentration. However, things are not that simple. A short-lived village, for example, can be reflected by the same density and extent of surface material as a single farm that existed for a long period of time and was rebuilt several times. To identify between these two types of surface distribution a

detailed pottery analysis, especially regarding dating, is indispensable. In this way broad trends like the distinction between single-period occupation or over several different phases can be identified. The dating of survey pottery is, however, as a whole too imprecise to identify repeated short-term occupation within one period.

The phenomenon of short periods of occupation alternated by equally short periods of abandonment has been amply demonstrated for the IA in this region. Both Tell Deir 'Allā and the three sites excavated by Petit show that phases of occupation and abandonment follow each other rapidly (Van der Kooij 2001; Petit in prep.). Within the IA II, which spans *c.* 500 years, five phases of occupation and disuse have been identified at Tell Deir 'Allā (Van der Kooij 2001: table 1). From excavations it is known that settlement occupation was, at least during the IA, typically short-lived, while resettlement of the same site after only a short period of time was widespread. However, most pottery types from a surface concentration do not allow such detailed dating. Such short-term distinct phases of occupation during the Late Chalcolithic period, for example, would not be identifiable on the basis of survey pottery alone. It should, therefore, always be realized that although survey concentrations are dated to broad periods, e.g. IA and Hellenistic period, there is often no evidence for continuous occupation. Survey sites from the same period are, therefore, not necessarily contemporaneous. Moreover, contemporaneity between sites is already difficult to determine by means of excavation, but seems to be impossible based on survey data only.

Difference in extent and density is, however, not the only differentiation between the different types of settlement. Apart from size there is also a social hierarchy between settlements. As a rule large cities have more facilities than small farmsteads. Although a central position regarding facilities will often not translate into material remains that are identifiable in a survey - e.g. the Bileam text excavated at Tell Deir 'Allā is unlikely to survive on the surface - some features, like marble slabs from a bathhouse, might end up on the surface. Identification of these phenomena in a survey will be rare, but the possibility should be considered.

Temporary settlements

Besides the permanent or almost permanent settlements discussed above, there will also have been mobile forms of habitation, at least during some periods. The environmental and topographic nature of the Jordan Valley and its adjacent hills makes a partly mobile way of living involving a seasonal movement over the different elevations and hence vegetation zones very profitable. A mobile component probably linked to pastoralism is likely to have been present during several periods. From historical sources it is known that during the Ottoman period this way of living was indeed practised by the Bedouin. A temporary settlement is basically similar to a permanent one as people are living together carrying out a diverse range of activities. The most important difference for survey archaeology, however, is the fact that the complete household, including people and their material culture, must be transported. Material possessions are therefore usually light, shockproof, and limited in number as everything has to be carried when moving. Large vessels are impractical as these are heavy and break easily. Many items are, therefore, made of organic materials like wood, leather or straw, which are lightweight and more durable. Groups returning to the same location repeatedly or who stay at one location for a long period of time often possess artefacts that cannot be transported or more permanent building constructions. These are all variations possible on the continuous scale between completely mobile and completely sedentary communities as proposed by Cribb (Cribb 1991: fig.2.1). Remains of groups further towards the sedentary end of the scale will more closely resemble the surface distributions from formal settlements described above. The range of functions involved in living at a place are, however, the same in a mobile community as in a permanent one; i.e. sleeping, cooking, eating and tasks related to the way of subsistence. The problem is not so much that mobile communities execute fewer activities or use fewer artefacts. The main difference is the use of different raw materials for their artefacts that are more often of a perishable nature. Secondly, the mobile nature of the group results in a shorter period of existence of a site and, therefore, less accumulation of artefacts.

Some ethnoarchaeological studies on modern mobile groups in the Near East have shown few of the remains that are left behind after abandonment of the site are likely to be recognized by archaeologists. Cribb, for example, has studied some camps with the specific aim of detecting pat-

terns of spatial organisation, which would be detectable in archaeological contexts of any age and independent of any ethnographic analogy (Cribb 1991: 123). Although there are of course differences between camps of mobile groups depending on their degree of mobility and their mode of subsistence, certain common aspects stand out from the different ethnoarchaeological studies.

The character of the Jordan Valley with its history of sedimentation, absences of stones and intensive agriculture makes that several aspects that point to the presence of abandoned campsites of mobile groups in other regions are absent. In the Wadi Faynan in southern Jordan for example abandoned Bedouin camps are clearly visible by the absence of surface stones on the inside of the former tent. Outside the tent large stones can often be found that used to hold down the tent cloth thereby forming an outline of the tent. Other structural features that can be found include platforms and hearths on the inside of the former tent and stones that used to hold the tightening ropes (Palmer et al. 2007). Similar fixed constructions pointing to nomadic campsite have also been documented in other regions (Banning and Köhler-Rollefson 1992: 195; Eldar et al. 1992: 211). In the Negev, Rosen was able to identify similar features that could be dated to the Roman period (Rosen 1993). All these relatively permanent features will not have survived in the Jordan Valley. Furthermore, these features will have been less distinctive as stones are not abundant and modern Bedouin tents left hardly any of the remains.²⁴

Fortunately, there are other types of remains left by modern mobile groups that will be present in the Jordan Valley, i.e. portable artefacts. Several of the studies that surveyed a campsite very carefully documented all artefacts often to nearest 1 m². In most surveys the number of finds was limited. In the Wadi Faynan the highest density of a recently abandoned site for example lay between 13 and 15 artefacts per square metre, but the average was much lower, at 1.9 artefacts per m² (Palmer et al. 2007). In a related study concerning recently abandoned camps of the Bedul the number of artefact per square metre was scored. Over an area of 61 m² a total of 443 artefacts were collected, which were relatively evenly distributed, averaging 7.2 artefacts per m² and with a median of 6 (Banning and Köhler-Rollefson 1992: fig.13). These assemblages, however, included artefacts that will not be present in ancient campsites, i.e. perishable materials and modern materials. In the Wadi Faynan sites perishable materials included bone, cloth, tent fabric, rope and worked wood with densities ranging between 0.01 and 0.6 artefacts per m² at a site abandoned only a few weeks before (Palmer et al. 2007). These artefacts will clearly all have been lost in surface assemblages of some antiquity. The rapid decline of perishable artefacts was also evidenced by the Wadi Faynan survey. Their survey included campsites that had been abandoned at several different moments in time. One of the camps had been abandoned 15 years ago. Although most categories of perishable material were still present their density had decreased considerably compared to the only recently abandoned camp. Cloth density for example had averages of 0.6 /m² on the recently abandoned site and only *c.* 0.06 on the 15 year old site (Palmer et al. 2007). The durable material included glass, plastic, food cans and other metal. Their densities did not exceed an average of *c.* 0.3 /m² (Palmer et al. 2007). In a study among an unrelated mobile group camping in the Taurus Mountains at Sariaydin Yayla, Cribb documented similar results. He scored the items of refuse he collected in an area of *c.* 165 m² (Cribb 1991: 174). Bone and textile scraps were the most ubiquitous (n=118 and 113), followed by plastic (83), rubber (34), glass (31) and metal (18). Pottery was the least discovered category and only 8 sherds were collected (Cribb 1991: table 9.1). Even though densities are already low it is likely that the past densities were even lower.

Although most material categories were known during the largest part of history, their manufacturing process did not resemble the mass production of today. The ability to procure these items will have been much more restricted and their value was undoubtedly much higher. The cheap production techniques of the present day have resulted in the use of glass and metal as cheap containers that are designed to be discarded after use. Furthermore, motorized vehicles have entered the desert as well and local Bedouin can procure and transport artefacts much more easily than ancient societies could. The documented campsites are the remains of groups that are part of our consumer economy, even though their manner of subsistence and habitation is different from the standard urban life way.

24 Personal observation in 2004 near Tell al-Hammeh

In an ancient mobile camp general artefact densities will probably have been lower. Furthermore, one could expect a larger percentage of pottery. As metal and glass were most likely precious materials that were less accessible than today it is likely that items made of glass and metal today would once have been made of both pottery and perishable materials like leather and wood. An artefact type that was not recorded by most ethnographic studies as it is today mostly replaced by metal is flint. In antiquity many tools for e.g. cutting, scraping, and boring were made of flint. In areas where flint of some quality is locally available, tools are often quickly made in an ad hoc fashion and readily discarded as well. Only more formal tools that took more effort and time to manufacture were treated more carefully and used over long periods of time. However, the transition from flint tools to metal tools already started with the more widespread availability of metal in the Chalcolithic and EBA, suggesting that the difference in flint use between the later archaeological periods and modern mobile groups may have been limited (Rosen 1997: 153).

Another line of investigation most of the ethnoarchaeological studies have taken involves the spatial organization of the campsite. A study similar to the Wadi Faynan survey was undertaken by Simms among the Bedul semi-nomadic pastoralists living near Petra (Simms 1988). He studied the vicinity of one goat hair tent that had been at that location for two months (Simms 1988: 201). Most activities were carried out in the tent itself. The inside of the tent, however, was swept regularly leaving an average of 5 artefacts per m² that ranged in size between 0.5 and 3 cm. The sweepings accumulated in an area around the tent that consequently had a much higher density of 10-50 artefacts per m² ranging between 1 and 10 cms in size. This area was, however, mainly a disposal area and few activities were carried out here. A second ring around the tent contained the largest debris, between 1 and 50 cm. In this zone the density was variable (1 to 15 /m²) and discrete activity and refuse areas were visible (Simms 1988: 204). The last zone was farthest removed from the tent and consisted of distinct areas of special activities that were mostly of a dirty nature, e.g. butchering, herding of animals or human defecation (Simms 1988: 205). A similar differentiation in different activity areas was present in other studies as well. In Cribb's study in south Anatolia of a camp that had been in place for c. 5 to 6 months he witnessed that activities like food preparation, consumption, cleaning and domestic refuse disposal were restricted to the dwelling itself and its immediate surroundings. Pastoral activities were more dispersed and took place in the inner corral, the butchering zone and the outer corral (Cribb 1991: 124). Other peripheral activity areas included a chicken coop, areas for cutting rubber and plastics, a bone refuse disposal area and a threshing floor (Cribb 1991: fig.1.9).

A similar zoning is very likely to have existed around permanent settlements as well. Especially dirty activities will have been conducted at some distance from the living area, but as close by as comfortable because it would be a distance that required crossing several times a day. Survey archaeologists would, therefore, have the best chance to locate the zone immediately outside the living unit or one of the special activity areas. The modern densities of durable artefacts on the surface are, however, already low and when the post-depositional processes and other biases acting on a buried mother population are taken into account, the problem of poor visibility of this type of site in survey archaeology becomes clear.²⁵

Based on these ethnoarchaeological studies temporary encampments of nomadic groups will typically have an artefact distribution consisting of different zones with variable densities, artefact types and sizes. However, given the already limited numbers of artefacts in modern camps, which still include perishable materials and are not covered by later sediments, the expected number of artefacts to be identified by survey archaeologists is very low. This low density makes it unlikely that the zoning identified in ethnographic situations will be visible in survey distributions. The

25 Studies have shown that in long-cultivated, geomorphologically stable soils, like the Jordan Valley, only 16 % of the artefact assemblage present in the ploughsoil is likely to be located on the surface. In different circumstances even lower percentages were documented, i.e. 5-15 % (Bintliff et al. 1999: 154).

general pattern of bounded low density areas that are only slightly different from the surrounding artefact distribution may, however, be recognizable in areas like the Jordan Valley under favourable circumstances.²⁶

It should, however, be realized that these patterns depend on the degree and type of mobility of a group. Artefact densities will for example be higher the longer people remained at a given location. Alternatively, people may have returned to the same location several times. The type and the number of artefacts used will differ according to the group's level of mobility. Groups that move around only little will generally have more belongings, which may be more like the material culture of sedentary groups, e.g. pottery. This is, however, not necessarily the case. Summarizing, it can be stated that, given the continuum between fully sedentary and fully nomadic, the material residue differs accordingly. The many possibilities preclude a strict definition of what a habitation site would look like. The remains expected at both ends of the scale can, however, be suggested (see above). Where a specific site is located on the continuum between sedentary and mobile should be evaluated in each specific case and with regard to region and period.

Agricultural/pastoral features

In the settlements described above both agriculture and pastoralism are often practised by the community to sustain a living. Communities only practising one of the two do exist, but excavated settlements in the southern Levant as a whole and the Jordan Valley in particular have generally practised a combination of both since the Neolithic period. The relative importance of the two components varied, but even the Bedouin, who are generally regarded as pastoral nomads, incorporated agricultural products in their diet. Artefacts used in these subsistence practices include for example flint and metal knives used in butchering and sheep shearing or both flint and metal remains of ploughs, sickle knives and the containers in which the products were stored. Most of these artefacts will have been brought back to the settlement, but may also have been hidden for later use, lost or discarded in the fields away from the settlement.

Apart from these portable artefacts, permanent features were undoubtedly also present in the landscape. Ethnographic analogies suggest these features include animal pens often using stone walls, irrigation canals, small wooden lookout posts used to guard the crops and small buildings used to store implements or sometimes spend the night. As these features generally have only a restricted number of functions, a limited range of artefact types is to be expected. However, the identification of such structures in archaeology predominantly depends on the remains of stone construction visible on the surface. Although many such features, even stemming from several millennia ago, have been identified in other areas, this type of remains is not to be expected in the Jordan Valley. These finds have generally been discovered in areas where stone dominates and that have seen little modern development, i.e. desert areas. In the wadi Faynan, for example, a large system of field walls, animal pens and irrigation features has been discovered dating back to at least the EBA (Barker et al. 2007b). Similar stone constructions have been identified in the Eastern Desert of Jordan, for example the irrigation system at Jawa or the so-called jellyfish houses and animal pens scattered throughout the desert (Helms 1981; Betts 1991; Kennedy and Bewley 2004).

This type of construction remains is unfortunately not to be expected in the research area. The ghor is today heavily farmed, often using heavy-duty motorized ploughs. Fields are systematically cleared of the few stones that are present. Furthermore, stones are not available in large quantities in the Jordan Valley. All stones have to be brought from the foothills, which makes it likely that other ways of constructing such features were probably practised, probably using wood or mud-brick which will not survive on the surface. These kinds of structures, which were undoubtedly once present, are not expected to be recovered in the survey. The artefacts that may be connected to such installations, e.g. a water jar in a shed where labourers spent the night during harvest

26 For some regions it has been argued that mobile groups use a type of pottery that is distinct from that of sedentary people, for example in the Eastern Desert of Egypt (Barnard 2008). There are, however, no indications that such a distinction was present in the Jordan Valley.

or to guard the crops, can, however, be discovered. However, their number will not be very large. Yet, small areas with low densities and a restricted number of artefact types might be regarded as indicative of some of these features.

Industrial sites

Sites that had a specific function, namely the production of something on a large scale have also been recognized in this region in several periods. These sites are referred to here as industrial sites, but this does not imply an industrialized mode of production. The excavations at Tell al-Hammeh, for example, have revealed that during one of the IA phases this tell was intensively used for iron production from ore (Veldhuijzen and Van der Steen 1999). On the surface of the tell this industrial activity is reflected by the presence of iron slag in large quantities. Slag is a by-product of the transformation of iron ore into pure iron. The slag was of no use and, therefore, left behind. Besides the slag, no other indications that iron was produced at this site are visible on the surface of the tell.

A second example of an industrial activity that took place in the Zerqa Triangle is Mamluk sugar production. During the Mamluk period sugar was produced on a large scale in the Jordan Valley by crushing sugar cane and boiling down the juice to a thick syrup high in sucrose (see chapter 6). This syrup was then poured into pottery moulds that were left to dry until raw sugar remained. In the process of taking the solid sugar cake out off the mould many of these vessels were broken. Locations of sugar production are, therefore, characterized by high numbers of sugar mould sherds (Photos-Jones et al. 2002). The large amount of sugar pottery excavated at Tell 'Abū Sarbūt and Tell Abu Ghourdan suggest that sugar related sites were present in this area (Franken and Kalsbeek 1975; De Haas et al. 1989, 1992)(see chapters 4 and 6). Comparable to slag, broken sugar pottery was of no value to the producers and, therefore, left at the site.

Both examples illustrate that industrial sites will in most cases be identified by the presence of some sort of by-product that was not valued and, therefore, left behind. Essential to the identification as an industrial site is the large scale on which production took place. In this way industrial production is contrasted to small-scale domestic production that takes place in the settlements. A second characteristic is the lack or small scale of other types of activities. Some domestic activities like eating may have taken place at these sites, which can be reflected in the material remains on the surface. The industrial production, however, is the dominant activity. The examples highlighted above concern activities at an isolated location. This is, however, not strictly necessary. Industrial production of some sort can also be carried out at a specific location within a settlement. There are many archaeological and ethnographic examples of larger settlements that have special suburbs where industrial activities are carried out. Nevertheless, the same characteristics apply to these industrial areas, the only difference being that on the surface these remains border and, through post-depositional process, probably overlap with settlement remains.

Cemeteries

Death is of all ages and communities in each period must have had a way of dealing with the deceased. From some periods remains have survived until today, while in other periods the dead were disposed of in a way that has left no traces. The most common way of disposing of the dead that has left traces visible to us today is burial. Especially, when the grave is marked or constructed of durable material there is a chance that traces of it will be found during a survey. These traces can range from simple stone slabs used to cover a grave to elaborate surface constructions like the dolmens of the EBA. Another possibility of identifying graves is the practice - carried out in many cultures - of burying the deceased with certain artefacts. These are often pottery vessels that probably contained foodstuffs, items of personal adornment or artefacts of daily use associated with the deceased. If grave gifts are the same artefacts as are used in daily life, distinguishing a cemetery from a small settlement might be problematic on a qualitative basis, but quantitatively these remains are generally less numerous than in settlements. Sometimes even industrial products are found in graves, like in the Mamluk graves excavated at Tell Deir 'Allā where sugar pottery was found in graves (Borsboom 2001). On other occasions, however, artefacts placed in burials are of a

special type not found in mundane contexts. The Boeotia survey discovered another way in which burial pottery differed from domestic pottery. In this case, the same type of vessels occurred in both domestic and burial contexts. The vessels placed in burials, however, were specifically made for this purpose and did, therefore, not show traces of use wear in contrast to the same vessels used in a household context that were usually considerably worn. The most common identifier of cemeteries, however, is the character of the entire assemblage of artefacts. Although most types of artefacts are often also used in other contexts, the proportions of the categories generally differ in burial contexts (e.g. Commenge 2005: fig.6.38).

3.3.2 Low densities distributions

Sherds and other artefacts are, however, not restricted to small areas with dense concentrations that can be interpreted as sites. Although the percentage of sherds that has been discovered within concentrations is high, there are large areas where low artefact densities have been recorded. On the overall density map showing the total amount of pottery this is not very clear, but when dated sherds are depicted per period the difference between high density sites and large areas of low density away from sites becomes clear (see next chapter). These low densities occurring over large parts of the countryside are usually referred to as off-site. The distinction between site and off-site is not a rigid boundary that can be expressed as an absolute number that forms the border or a formula. The distinction is a relative difference between bounded areas with a certain density and other areas with less dense distributions. A number of sherds that is considered a site in one period can be as high as the average off-site density in another period, e.g. the Hellenistic remains identified as a site are often lower than the Late Roman off-site distribution in this area. A similar distinction between site and off-site has been used by Attema *et al* who state that on average off-site density will be less than 10 % of the typical site density (Attema et al. 1999/2000: 154).

The term off-site has been rightly criticized to be affirming the unwanted focus on sites (e.g. Van de Velde 1996). By referring to site and off-site, all low density areas are negatively identified by the site, i.e. they are no site, but everything away from the site. This stands in contrast to efforts by recent survey projects to document the continuous distribution of artefacts over the landscape by using non-site methods (Van Leusen 2002: 18-6). Besides off-site distribution, low density distributions have also been referred to as background noise or waste. Today, it is widely realized that low density areas should not be ignored and can provide a lot of information. Low density areas are not a uniform blanket overlying the landscape, but they have slightly higher and lower density patches as well. It is very likely that low density areas contain sites that are not detectable with the present recording and dating techniques. However, if more intensive sampling techniques are used and/or artefacts can be dated with more chronological precision it is very likely that more differentiation will emerge within low density areas that today appear homogeneous and 'off-site'.

Irrespective of the sites that are potentially recognizable through better survey techniques, the low-densities off-site areas are a fact and should be understood. Like all distribution patterns the nature of these low-density distributions should be interpreted per period. Other surveys have proposed explanations for similar low density distributions they encountered. Furthermore, there are some region specific phenomena that may have resulted in such distribution patterns. By evaluating these explanations the distribution to be expected when the discussed phenomenon is at play will become apparent. Similar to the expected remains from the different sites types discussed above, these expectations may help the interpretation of the distributions per period discussed below.

Manuring

The post-depositional processes described above have undoubtedly contributed to the dispersal of artefacts over the landscape. It is unlikely, however, that these are the only factors that have contributed to the distribution of the low so-called off-site densities discovered over large areas often at considerable distances from identified sites. A phenomenon that has been identified elsewhere as the cause of low density off-site distributions of artefacts away from sites is manuring. This phenomenon has been encountered in several areas of the eastern Mediterranean, e.g.

Greece (Bintliff et al. 2007), the Jezira (Wilkinson 2004), Iran, and Oman (Wilkinson 1982) and in the southern Levant, i.e. the Wadi Faynan (Newson et al. 2007: 169). Refuse from the settlement, which is high in organic matter, is collected and brought to the fields to be used as fertilizer. This refuse contains many artefacts from the settlement, which are spread out over large regions in this way. Characteristic of this type of artefact distribution is that the pottery is often badly worn and includes the whole range of vessel types used in a settlement (Wilkinson 1982: 323). Furthermore, artefact spread over the landscape in this way extends over considerable distances away from the site depending on the size of the settlement (Bintliff et al. 2007: 24). This carpet does not necessarily have a uniform density. Areas of higher density caused by longer or more intense manuring are present (Bintliff et al. 2007: 26). However, the artefact distribution generally extends in a continuous fashion over a large area. The best recognizable feature, however, is the obvious fact that the distribution is chronologically restricted to the period in which the site was occupied. Commonly, this form of intensive manuring was practised only in periods when large densely occupied settlements existed because a lot of refuse is needed to manure an area of some size, e.g. Classical Thespiiai and EBA Tell Sweyhat (Wilkinson 2004: 68; Bintliff et al. 2007: 26).

In the southern Levant manuring has been suggested as the reason behind extensive artefact scatters in the Wadi Faynan (Newson et al. 2007: 169). Although settlements have been discovered, their size is not comparable to the large tells in Syria like Sweyhat. The amount of refuse that these settlements would have produced is much smaller and will not have been sufficient to manure comparably large areas. Habitation and agriculture have, however, been concentrated in the small valley plain where a system of field walls and irrigation channels and dams has been identified that dates back to at least the EBA (Barker et al. 2007a: 268). It is assumed that the prolonged act of manuring the same fields has caused the accumulation of considerable artefact densities in some periods, e.g. the EB I period, IA and early Roman/Nabatean periods (Newson et al. 2007: 169). If manuring was practised during any period in the Zerqa Triangle it is likely to be of similarly restricted extent as large sites like Sweihiat or Thespiiai are absent from the Zerqa Triangle.

A related form of manuring will result in a different distribution pattern. Small villages usually do not have sufficient refuse to manure large tracts of land. They are, however, able to manure specific plots of more demanding crops, usually vegetables. This was for example the practice at the start of the 20th century (Dalman 1932: 139). These small vegetable gardens often surround villages in the modern and pre-modern Near East (Dalman 1932: 187). This practice would, therefore, create a zone of higher artefact densities surrounding the village containing artefacts that are similar in character and chronology to the artefacts in the village. It might well be that similar practices were carried out during other periods as well.

Sabakh

Another phenomenon that may cause relatively low artefact densities away from sites is *sabakh*. Sabakh is the Arabic word for a phenomenon that is widely known in the Near East. It refers to the act of removing occupation layers of tell sites that are relatively high in organic content and spreading them out over the fields as fertilizer (Wilkinson 2003: 117). In this way artefacts are distributed over a large area. Usually such an artefact distribution is characterized by an even but not very dense spread of artefacts over an area surrounding the tell and containing the same periods as the tell. There are no indications from the tells in the Zerqa Triangle that this practice was carried out in the recent past and local villagers also asserted that no such practices had been carried out in recent years. The phenomenon should, however, be kept in mind as people in the past may have used this technique as well while it will be difficult to identify traces of it on tells. The large irregular pit that was discovered in phase II of Tell Deir 'Allā might have been the result of this practice (Van der Kooij 1989: 90).

Low intensity shifting occupation

Another hypothesis proposed to explain wide areas with relatively low densities is the presence of shifting occupation of low intensity. In this hypothesis activities that leave a limited amount of remains took place at several locations throughout the landscape. When this occurs over a long

period of time the landscape can become covered by a low density artefact distribution in a semi-continuous way. This type of shifting activity has for example been tentatively proposed to explain the distribution of coarse impasto ware of the south Italian Bronze Age (Burgers et al. 2002: 11:14). The repeated temporary encampment by mobile groups like the Bedouin is an example of this phenomenon (see section 4.7).

The hidden landscape

An explanation that has been put forward for low density distributions in periods where dense concentrations are absent argues that remains from certain periods can become hidden through distorting processes, like poor archaeological recognition, difficulties in dating, sedimentation and poor preservation (Bintliff et al. 1999). The number of artefacts discovered on the surface is only a fraction of the total amount that was once present. In this way low densities discovered on the surface may be representative of much larger numbers and a single sherd may be taken as representing considerable activity or, in other words, a site (e.g. Van Leusen 2002: 18:7).

Pitcher irrigation

Pitcher irrigation can also be considered a source of low sherd densities spread out over large parts of the landscape. In pitcher irrigation large permeable vessels are buried in the soil and filled with water every few days. The dry soil causes the water to be drawn through the walls of the vessel and released slowly into the soil. In this way soils can be irrigated in warm arid environments without high water loss as a result of evaporation. A second advantage is the purification of the water as it percolates through the walls of the vessel. In this way salinization, which is often a considerable problem of irrigation in arid regions, is considerably reduced. This type of irrigation has been recorded for Iran, India and large parts of Africa and South America (Barrow 1987: 240,241). Although no studies or experiments have been undertaken into this type of irrigation by survey archaeologists, it is likely that such a system would result in a continuous low density distribution of pottery. A characteristic of such a distribution would be the similarity in ware as all pots had to have a specific permeable quality and probably also a similarity in vessel type.

3.4 Conclusions

The research questions described in the first chapter have shaped the survey methodology employed and the methodology in turn has shaped the results received. The many biases that act on the artefact once left by living communities of which some have been described in this chapter mean that the entire ancient landscape can never be recovered. However, through careful collection, the recognition of the many biases and the development of models as to how certain activities will be reflected in the archaeological record on the surface, the ancient landscape with its many different components can be approached. Yet, every period will have specific characteristics making an individual and period-specific evaluation necessary. In the next chapter the distribution patterns will be described and evaluated per period.

4 The survey results

Following the survey methodology described in the previous chapter, the fields were surveyed covering a total area of 4.42 km². This is just over 10 % of the area suited for this kind of archaeological survey, i.e. the ghor which covers an area of *c.* 42 km². Although a sample of 10 % is often considered representative, this was simply the highest attainable field coverage given the available time and resources. Had it been possible to investigate a larger area, this would certainly have been done. These 4.42 km² were, however, not integrally surveyed. Only 1/15th of each field was actually examined as lines were spaced 15 m apart from each other. The total number of plots surveyed, in other words the amount of surface actually seen, amounted to 5896 plots or 29.5 ha. It was attempted to survey the land in a continuous fashion. The presence of houses, roads, covered greenhouses and planted fields meant that occasionally a field had to be skipped.²⁷ This inaccessibility of some fields resulted in the fragmented surface coverage visible in figure 4.1. By choosing a different season in future survey seasons the system of crop rotation used in this area makes it likely that inaccessible fields could be covered as well.

The decision as to which regions were to be surveyed in the sample was guided by the general questions of the Settling the Steppe-project and the research questions of this study in particular. As Tell Deir 'Allā was the focal site of the project, the area surrounding it was surveyed intensively. All available fields in a zone of *c.* one kilometre around Tell Deir 'Allā were surveyed. The Rweihah fan to the east of Tell Deir 'Allā is agriculturally the most profitable region as terra rossa soils and watercourses are both available. Another reason to investigate this region in detail was the need for irrigation canals crossing this area when a large part of the ghor was to be irrigated (see chapter 5). The Rweihah fan was, therefore, also surveyed as extensively as possible. As Petit made soundings at three tells the vicinities of these tells were surveyed in order to gain some understanding of the relationship between these tells and the landscape. For this reason the areas around Tell 'Ammata, Tell al-'Adliyyeh and Tell Dāmiyah were investigated. When surveying the surroundings of Tell al-'Adliyyeh a decision was made to try to establish a spatial link between the surroundings of this tell and the second largest tell in the region, Tell al-Mazār and nearby Tell al-Ghazāleh. In this way the change in artefact density could be monitored with regard to different periods over a more or less continuous stretch of land. A fourth region around the modern village and Tell 'Abū al-N'eim was investigated because of intended soundings by Petit at Tell Zakarī and because of the intensive occupation of this region during several periods identified by previous surveys. The area located on the edge of the katār hills and the ghor to the west of Tell Deir 'Allā was surveyed in order to investigate the remains of human activity in a downstream area along the Wadi al-Ghor, that proved to be so intensively occupied along its upper reaches. It remained to be determined whether the lower quantity and quality of the water and the poorer soil quality resulting from the proximity of the katār hills affected the ubiquity of human remains. The low artefact densities discovered in this area indeed suggest a correlation with poorer soils and lower water availability (see figure 4.1). The other small groups of surveyed fields located in the western area of the ghor yielded the same results. The middle section was surveyed to investigate the formation and age of the salt plain of Mallaha, but the low number of finds hampered the formulation of clear conclusions. The group of fields in the south-western area, west of the 'Abū al-N'eim cluster was surveyed for the same reason of investigating the border areas. It was, however, located at this specific place because a pre-modern main irrigation channel ran across this area and the size and depth of the wadis cutting through the katār suggest this had been an area of water drainage for a prolonged period of time. As can be seen figure 4.1 this area revealed even lower artefact densities

27 As all three survey seasons took place during late summer and autumn the number of planted fields was low. The crops planted in this part of the valley are mainly vegetables planted in beds or furrows instead of wide-sown crops like cereals. In general farmers allowed us to examine the surface between the plants in fields cultivated in this fashion.

than the area further north. Some isolated fields scattered throughout the region were investigated either to check the presence of sites reported by previous surveys or to solve geomorphological questions of chronology. These fields, however, form only a small proportion of the entire area that was surveyed. Apart from the considerations mentioned above it was attempted to investigate different areas of the region.

While the research area of the survey was restricted to the valley plain, it was on certain occasions necessary to incorporate the fringes of the foothills. In certain periods, especially the EBA, people used the lower foothills intensively. Remains of this activity have also been found in the Zerqa Triangle, e.g. in the form of the large settlement of Handaquq S. As it was known that the lower foothills formed an integral part of the settlement pattern of the valley, those remains that were located within 100 m of the valley plain could not be ignored. The foothills were, however, not surveyed in the same rigorous fashion. They were simply visited and when clear remains were encountered these were documented. The survey of the lower foothills was by no means exhaustive and future research may discover additional remains.

The number of sherds collected was very diverse and ranged between 0 and 906 sherds per plot (1812 sh/100 m²).²⁸ A total of 109,673 sherds was collected during the three survey seasons. This gives an average density of 38 sherds per m² (19 sh/plot). The pottery is, however, not evenly distributed over the landscape as figure 4.1 shows.²⁹ Fields located in the zor in the south, the western part of the ghor near the katār hills or to the north-east of Tell Deir 'Allā generally have low densities between 0 and 8 and never over 20 sh/100 m². In the vicinity of Tell Deir 'Allā, 'Abū al-N'eim and Tell 'Ammata densities are much higher. Areas with densities over 200 sh/100 m² occur regularly and densities of *c.* 1000 sh/100 m² are not uncommon. These areas are a significant contributing factor to the average regional density of 38 sh/100 m².

The Jordan Valley as a palimpsest

These total densities, however, give little information on what these densities represent, as sherds of all periods are grouped together. When the pottery of the 2005 and 2006 seasons is separated according to period different distributions emerge (see following sections). It becomes clear from these figures that the Jordan Valley is a large palimpsest with remains from distinct periods adjoining and overlapping each other. In figure 4.2 this is illustrated for the area surrounding Tell Deir 'Allā. From north to east of Tell Deir 'Allā a zone extends where very high densities of over 200 sh/100 m² and sometimes even 1000 sh/100 m² were collected. When the pottery is grouped according to period it is clear that five distinct sites are incorporated in this high density zone, sometimes overlapping each other.

Located furthest to the north a concentration of finds dating to the Late Chalcolithic period has been discovered (no. 2 on figure 4.2). Adjoining it to the south is the small Tell al-Qa'dān North (no. 3). Previous surveys have dated this tell to the LB, IA, Roman, and Ayyubid/Mamluk periods (Petit in prep.; Ibrahim et al. 1988).³⁰ Tell al-Qa'dān south was located *c.* 50 to 100 m further south (no. 4). Today, this tell has largely been bulldozed, leaving only a small section of the tell standing. The levelling of the tell probably accounts for the high number of sherds collected in the surroundings of the tell. Material from the Late Bronze, Roman and Ayyubid/Mamluk periods has been discovered (Ibrahim et al. 1988).³¹ To the south of the Wadi al-Ghor the survey encountered the remains of a Mamluk sugar production site (no. 5), partly overlapping with Hellenistic to Umayyad remains (no. 6). Both sites probably were connected in some way to the occupation remains excavated by Franken at Tell Abu Ghourdan (no. 7) (Franken and Kalsbeek 1975). At this low tell remains from Late Roman/Umayyad and Ayyubid/Mamluk village occupation have been

28 In contrast to many survey reports from other Mediterranean areas densities are reported here in sherds per 100 m² instead of per hectare. Numbers become confusingly large when expressed in sherds per hectare.

29 NB: no differentiation has been made between e.g. feature or non-feature sherds, or dated or non-dated sherds.

30 Both the EJVS and Petit report to have found Late Chalcolithic and/or EBA remains. As quantities are low it is assumed that these sherds are connected to the contemporary site at the northern foot of the tell. It can of course not be excluded that the Chalcolithic sites extends further south underneath the tell.

31 Glueck reports on Tell Qa'dan, but does not specify between north and south. He collected material from the LB II, IA I and II, Byzantine and Islamic periods (Glueck 1951: 311).

THE SURVEY RESULTS

found (Sauer 1976). Immediately to the west of Tell Deir 'Allā in situ wall remains and pottery from the Islamic period have been attested during small-scale construction work in 1993 (no. 8; Ibrahim and Van der Kooij 1997: 109). To the north-west of Tell Deir 'Allā the survey encountered an EBA I/II concentration (no. 1), while Hourani discovered Neolithic pottery during his geomorphological investigation in the section of this part of the Wadi al-Ghor (Hourani in prep.).

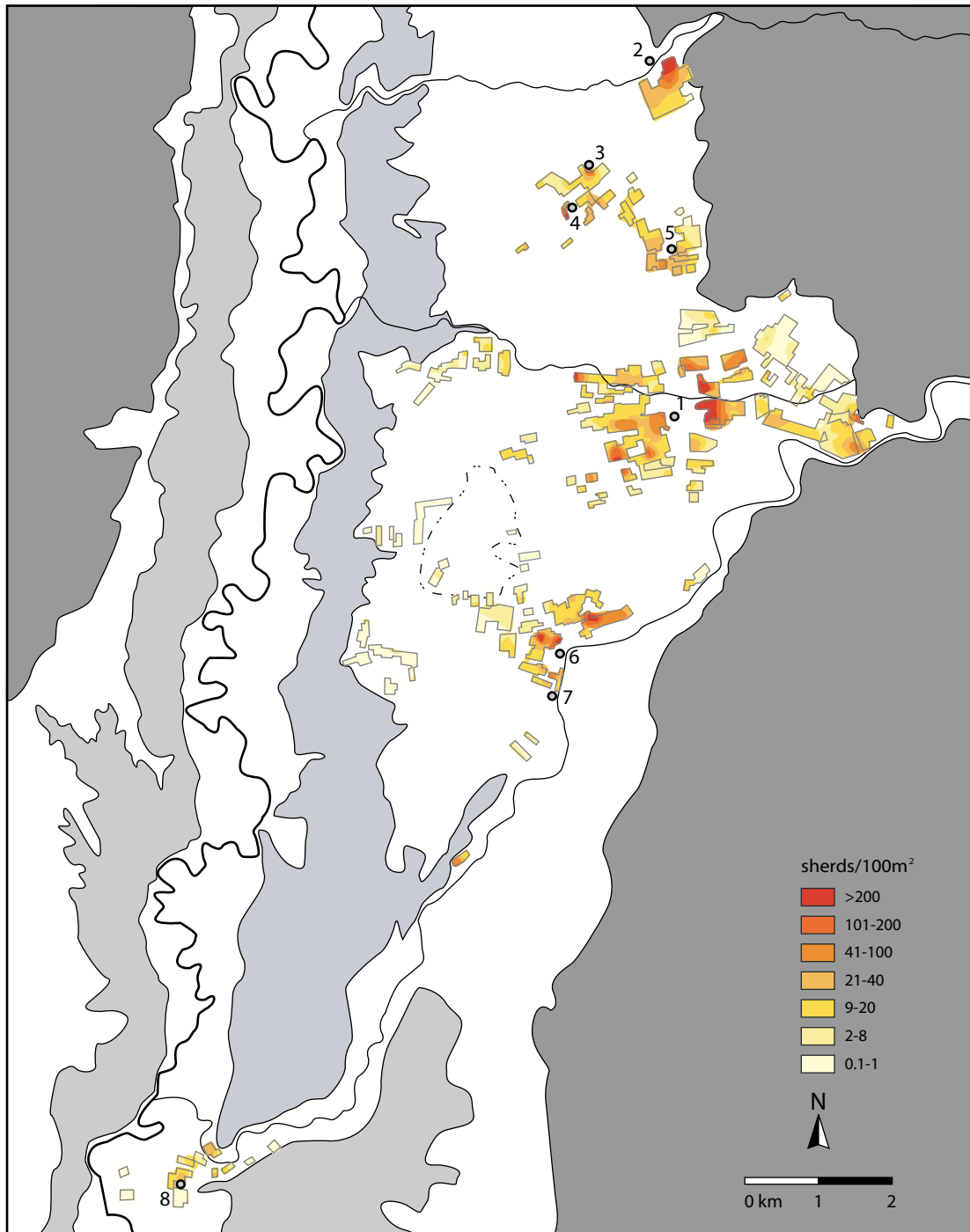


Figure 4.1 Total sherds discovered in the survey and sites mentioned in text (1 -Tell Deir 'Allā; 2 - Tell 'Ammata; 3 -Tell al-Ghazāleh; 4 -Tell al-Mazār; 5 -Tell al-'Adliyyeh; 6 -Tell 'Abū al-N'eim; 7 -Tell Zakarī; 8 -Tell Dāmiyah)

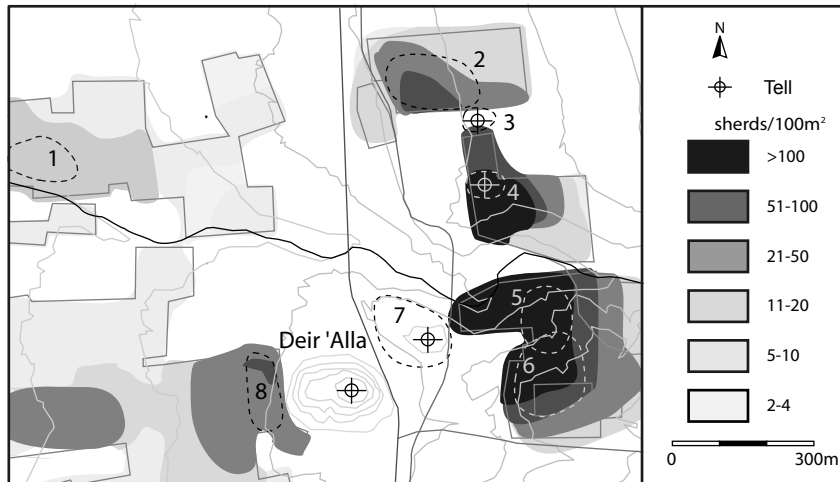


Figure 4.2 Total sherd densities around Tell Deir 'Allā

Within a circle of 500 m around Tell Deir 'Allā at least eight discrete sites and some more elusive remains of Pottery Neolithic activity have been discovered. To the east of Tell Deir 'Allā these sites all abut or overlap each other. To be able to discriminate between these sites, pottery needs to be collected with a high level of spatial precision. Broad transects divided into entities of 100 m or more are insufficient. The practice of surveying whereby detailed collecting is started at the moment a 'site' is recognized in the field or where a random selection of isolated survey units are investigated are equally inadequate.

The periodisation of the several sites discovered in this small area point to a phenomenon that is present in the area at large as well. The tells located in this small area date predominantly to the LBA and IA, while the flat surface sites stem from the Late Chalcolithic, EBA, Late Roman and Mamluk periods. These are also the predominant periods discovered in the survey as a whole. The problems of recognition and dating of periods, discussed in the previous chapter, of course create a bias towards certain periods. However, there is a certain division in periods discovered that cannot be fully ascribed to dating biases. The well known IA, for example, that has been amply documented at the tell sites was barely encountered in the survey. In table 4.1 the dated feature sherds and their relative frequencies are listed. It is clear that several periods have left only very small quantities of remains, e.g. the MBA, Hellenistic, Abbasid and Fatimid periods. The almost complete absence of MBA sherds is remarkable as a considerable number of remains from this period have been excavated at Tell Deir 'Allā. Occupation was thus present during this period, the pottery has been well studied and it is durable and well recognizable. Had this pottery been present in significant numbers, it would have been identified. Similar reasoning applies to the LBA and to a lesser extent also to the IA. In theory these are well identifiable periods, but remains dating to these periods discovered in the survey are few. The Late Chalcolithic and EBA are less likely to be identified as these sherds are often less durable and post-depositional processes have affected them for longer. Nevertheless, the number of EBA sherds is especially high and must represent significant activity in the Zerqa Triangle during this period. Another episode of which many remains have been collected in the Zerqa Triangle is the Roman to Umayyad period. The individual periods do not show such high frequencies as the EBA, but this is mainly due to the fact that many sherds could only be dated to a combination of periods like Roman/ Late Roman as pottery shapes from both periods are part of the same tradition. Together these periods take up a large part of the pottery assemblage. In this calculation the sherds that could not be dated more precisely than 'Roman or later' and sometimes 'Hellenistic or later' are not included because of their imprecise date. It is, however, likely that many of these sherds stem from the Roman to Umayyad period. The ribbed sherds are also left out of the equation because despite being dated they would not be regarded as feature sherds in most of the other periods and would, therefore, distort the frequencies. The same reasoning applies to the Mamluk sugar pottery. These sherds are the result of an industrial activity and can, therefore, not be compared to the predominantly domestic pottery of the other periods.

Furthermore, due to their large number most of the sugar pot sherds were only counted and not collected, making it impossible to distinguish between feature and non-feature sherds. However, even without the large number of sugar industry sherds the remains from the Ayyubid/Mamluk period are more ubiquitous than several of the other periods. The large number of sherds dated to the overall Islamic period is, however, predominantly due to the inability to date more precisely. A large proportion of these remains will date to the Ayyubid/ Mamluk period and to a lower extent to the other sub-periods. The link between a large proportion of the general Islamic sherds and the Ayyubid/ Mamluk periods will become clear in the following sections when the spatial distribution patterns are discussed per period.

The spatial distribution patterns presented in the following sections and their interpretation will attach further meaning to this rather static overview. Although some information can be gained from this frequency overview, it mainly concerns the periods that are absent. Although the periods that are well represented suggest that human activity in this area was considerable, there is no direct relationship with respect to the amount of human activity, nor is it immediately clear what kind of activity is represented. Different types of pottery have, for example, different fragmentation rates. Similarly, pottery use can vary according to period or activity. In the following sections the artefact distributions per period are, therefore, discussed in detail and an interpretation of the type of human activity that is responsible for the remains is proposed.

Dated pottery	No.	%
Late Neolithic/ Chalcolithic	4	0.1
Late Chalcolithic	125	3.7
Late Chalcolithic/ Early Bronze Age	112	3.3
Early Bronze Age	947	27.7
Middle Bronze Age ?	1	0.03
Late Bronze Age	15	0.4
Late Bronze Age/ Iron Age	15	0.4
Iron Age	233	6.8
Hellenistic	32	0.9
Hellenistic/ Roman	18	0.5
Hellenistic/ Iron Age	6	0.2
Roman	318	9.3
Roman/ Late Roman	356	10.4
Late Roman	302	8.9
Late Roman/ Umayyad	335	9.8
Umayyad	9	0.3
Abbasid	1	0.03
Fatimid	1	0.03
Crusader	2	0.06
Ayyubid/ Mamluk ³²	258	7.6
Islamic	337	9.9
Late Islamic/ Modern	64	1.9
	3491	100
Hellenistic/ Roman/ Late Roman	2792	
Ribbed (Late Roman)	7712	
Sugar pottery	2638	

Table 4.1 Dated sherds from the 2005 and 2006 campaigns complemented by analyzed concentrations from the 2004 campaign.

³² Excluding pottery related to the sugar industry.

Flint distribution

Compared to the pottery densities, the collected flint artefacts form only a small assemblage. However, in absolute numbers the collection is still considerable ($N = 2167$) and comprises 355 tools. A large proportion of the tools represent simple ad hoc tools. However, more formal tools that show elaborate and careful production techniques have been found, especially in areas where sites from the Late Chalcolithic and EBA have been identified on the basis of pottery finds. The sites from these early periods are often clearly visible in both the debitage material as well as the tool distribution. The centre of the flint distribution in the southern area is located at exactly the same location as a concentration of pottery from the EBA (i.e. in field 81, see following section). This correlation shows up in most of the other concentrations as well. Detailed information concerning the pottery discovered in these concentrations will be discussed in the following sections.

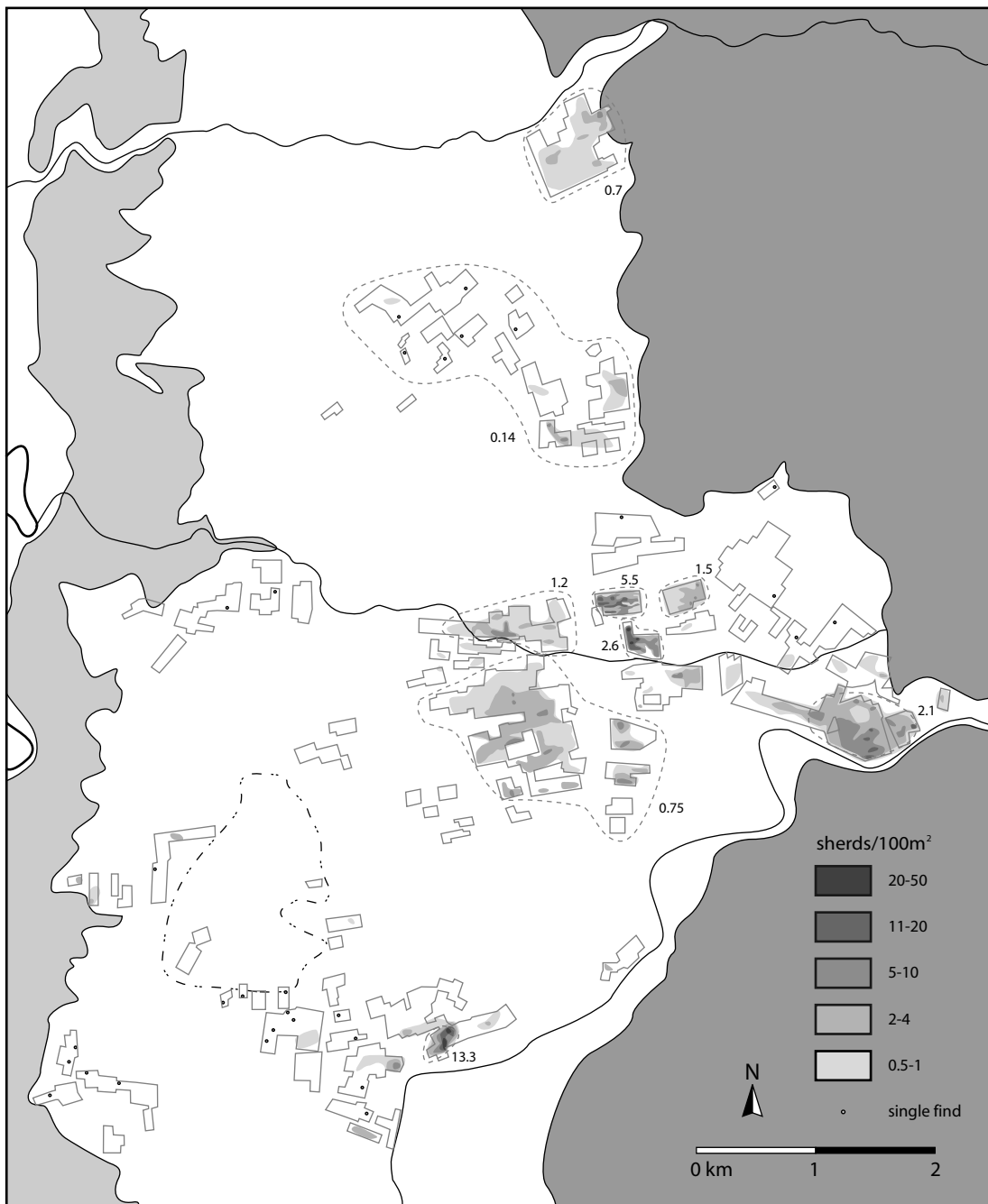


Figure 4.3 Distribution of flint debitage (numbers represent the average density in encircled area)

THE SURVEY RESULTS

The concentration in the eastern part of the research area where the Zerqa enters the valley plain is problematic in this respect. Both the debitage and the tool distribution show a clear concentration centering more or less on the location of Tell al-Hammeh. The flint debitage is difficult to date. Among the tools, however, there are examples that cannot be related to the occupation activity at Tell al-Hammeh as they do not stem from the periods during which Tell al-Hammeh was predominantly occupied, i.e. the Late Bronze Age, Iron Age or Roman periods (see appendix II). Characteristic tools from the Late Bronze and Iron Ages like the geometric sickle blade are absent in this area. The collected assemblage consists of some generic tools like simple blades and flakes with partial retouch that are difficult to date. Some of the retouched blades, i.e. the few Canaanean blades, may be linked to the EBA sites located just beside this area, i.e. Tell Handaquq S and Tell al-Rweihah (see next section). However, the majority of tools from this area that can be dated represents celts. Celts are generally regarded to stem from the Late Neolithic and Chalcolithic periods



Figure 4.4 Distribution of flint tools (numbers represent the average density in encircled area)

(Rosen 1997: 98). However, apart from these celts no other remains from this period have been discovered in this area. Moreover, the majority of all the celts discovered in this survey stems from this area. It therefore seems that the flint distribution in this area forms a mix consisting of EBA remains related to the sites to the north and south, Late Bronze, Iron Age and later remains originating from Tell al-Hammeh and a Late Neolithic/Chalcolithic assemblage of celts. These celts are discussed in a separate paragraph in the following section.

Overall, it can be stated that during the Chalcolithic and EBA people used a lot of flint and sites can be relatively easily detected on the flint distribution map by the high densities of both tools and waste. The Late Bronze and Iron Age tells or sites from later periods do not show similar haloes of high flint densities. The vicinity of Tell Deir 'Allā may, however, be an exception in this respect. Relatively high densities of both debitage and tools have been detected in the area to the south-west of Tell Deir 'Allā. The flint discovered here is of a very ad hoc nature and no convincing date(s) could be attached to the collection of tools. These high densities can therefore not be positively related to Tell Deir 'Allā or any of the other known sites in this area. A similar relatively high flint artefact density was discovered in the vicinity of Tell 'Ammata. Again tools consisted predominantly of simple ad hoc tools like retouched lateral sides, a bit of end retouch or a small expedient notch making dating extremely difficult. These densities may be related to the intensive agricultural activities carried out in this area during the Roman, Late Roman and probably Umayyad periods (see section 4.4). They can, however, also be connected to activity from one or several other periods as agriculture has probably always been practiced quite heavily in this area. As clear centres of higher densities are absent the flint artefacts may reflect the accumulation of centuries of expedient tool making from the ubiquitous flint cobbles lying around in these fields.

4.1 The Late Chalcolithic period and Early Bronze Age

4.1.1 The Late Chalcolithic and Early Bronze Age distributions

Off-site

In figure 4.5 the areas with low pottery densities have been encircled by a dotted line. Within this region the average density is 0.15 sh/100 m² which represents an absolute number of 164 feature and non-feature sherds. These areas have a relatively even distribution. The only clearly different patterning is the absence of finds in the western areas. The area located in the south-west is almost empty except for two sherds. The other area located in the west, where the Wadi al-Ghor enters the katār, is also relatively empty. In the central fields of this sub-region, however, a small number of sherds has been collected. In all other areas, however, a low density without clear clustering is visible.

Of the possible explanations for off-site concentrations proposed in section 3.2 several can be easily refuted, but other might be relevant. The argument that ploughing has resulted in a halo around the locations where sites are buried in the soil is without a doubt applicable in this situation. A halo with densities of 1-4 and occasionally even 5-10 sherds per 100 m² is present around most sites (see figure 4.5). This halo might have been caused by dispersed of the sherds by ploughing or through the manuring of gardens at close proximity to the village.

The large areas with a low density can, however, not be explained by these two phenomena (dotted areas in figure 4.5). These areas are located throughout the region and are covered in a relatively homogeneous low density blanket of sherds. Several explanations for such a distribution have been proposed in section 3.2. Manuring of fields with domestic refuse can, for example, create such a homogeneous distribution of artefacts over large parts of the countryside. It is, however, unlikely that this distribution is caused by manuring. The manuring of the entire region, as should be concluded by the artefact distribution, implies that large quantities of domestic refuse were available. The sites discovered in the Zerqa Triangle are, however, mainly small villages that are unlikely to have produced the large amounts of organic refuse needed. The EBA II/III sites

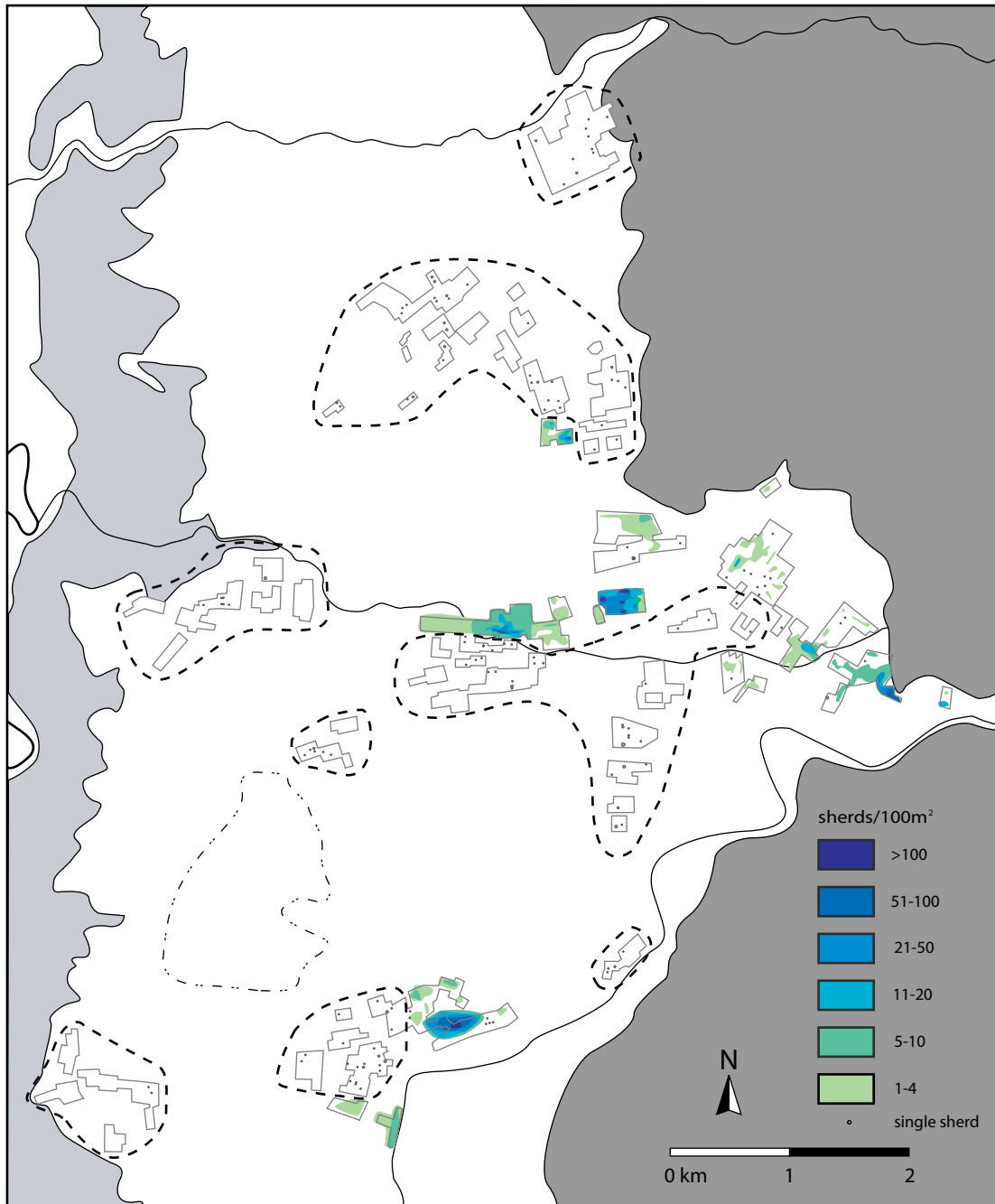


Figure 4.5 Late Chalcolithic/Early Bronze Age pottery; areas encircled by dotted line have low densities (0.15 sh/100 m²)

of Tell Handaqq S and Tell al-Qōs are indeed much larger settlements with sizes up to 15 ha. However, these sites were probably also the only settlements in the region making that the total refuse production was still relatively marginal (Chesson 1998; Petit in prep.). Furthermore, although precise dating of these low numbers of sherds was difficult most indications suggest that the majority of the pottery should be dated to the EBA I period instead of later parts of the EBA. A larger problem, however, is the absence of easy ways of transporting the rubbish. During the EBA all transport took place on the backs of donkeys or men, in the absence of carts and wheels. To make large scale manuring of an entire region worthwhile, an efficient means of bringing the rubbish to the fields is essential. As there was none, manuring of fields with domestic refuse was most likely limited to small tracts of land and not carried out in the entire countryside.

Nevertheless, the much more localized higher densities of 1-4 sh/100 m² in the easternmost area, i.e. in the al-Rweihah fan, might be linked to an intensification of agricultural activities and possibly manuring in this region. As will be elaborated on in later chapters, there is evidence that in the later parts of the EBA agricultural production was strained by increased population numbers, exhaustion of the soil and climatic deterioration. EBA communities may have tried to maintain sufficiently high agricultural returns by investing greater effort, possibly in the form of manuring. As said, it is unlikely that manuring was carried out throughout the entire region. The most likely recipient is the bay of al-Rweihah. As a result of a different hydrological regime, this area probably received more water than other parts of the region and through repeated overflowing the soil would have been more fertile than areas not reached by alluvial deposits (see chapter 5.5). Moreover, it is the nearest agricultural area to the only site in these parts, i.e. Tell Handaquq South. Taking all these aspects together with the higher off-site densities in this area the hypothesis that this smaller region saw manuring seems quite likely.

Another explanation for low density distributions is the presence of erosion and/or sedimentation distorting the surface distribution. Regarding the Late Chalcolithic and EBA distribution the areas most heavily affected by these processes are the banks of rivers and wadis where overflowing occurred occasionally and where soil was removed in later periods (Hourani in prep.). Further deposition of soil took place in the areas that border the foothills. These areas on the banks of the Wadi al-Ghor and the Zerqa as well as the entire area in the bay between al-Rweihah and Dhirār show the densest artefact deposition discovered with sites seeming to be specifically located here. The explanation that distorting factors allow us to see only a small part of an otherwise much denser past landscape is in this case negated by the presence of several sites with high artefact densities. These would have been subject to the same distorting factors. Their presence and the ease with which these sites can be identified shows that the EBA landscape is far from hidden. The low densities are generally found in areas that have not been affected by either erosion or deposition, i.e. the area between Tell al-'Adliyyeh and Tell al-Mazār or west of 'Abū al-N'eim. It is therefore unlikely that the isolated sherds occurring over wide areas actually represent sites with many more artefacts albeit hidden by a range of geomorphological factors.

The explanation of low intensity activity shifting through the entire region has few counter arguments. However, there is the risk that these arguments are lacking because of the wide range of possibilities that would fit this description. Possible examples of such activity can be the temporary encampments of nomadic people, the occasional staying in the fields by agriculturalists to guard the crops or save on travelling time. This wide range of possible activities creates the danger that this explanation becomes a last resort, applicable when all else fails. However, irrespective of the difficulties in testing it this is not an unlikely explanation. It is very likely that societies in the Jordan Valley had a pastoral component throughout all periods. Irrespective of whether this was in the shape of specialized separate groups like the modern Bedouin or animals being managed by people from the villages, these flocks needed to be herded to prevent them from damaging crops and to guide them away during summer when the valley was completely dry and flocks needed to move up into the hills in search of water and pastures. These herders will have stayed with their flocks and by doing so left traces in the landscape. For the EBA it has been argued by several people that groups of pastoral nomads seasonally moved in and out of the Jordan Valley in search of pastures just as the Bedouins did in pre-modern times (e.g. Prag 1995: 78). Although this is difficult to prove it is very likely that groups of people roamed the countryside and left few but widespread traces in it. Together with remains left by people living in settlement and working the land surrounding it these remains may have resulted in a low density off-site scatter.

Sites

Sites are considered to encompass all surface distributions representing some archaeological feature buried in the subsoil. In order to make them identifiable they are considered to be generally bounded areas of higher than average density. Several of such areas can be distinguished on the Late Chalcolithic/EBA distribution map (see figure 4.5). Maximum densities of EBA sites are of-

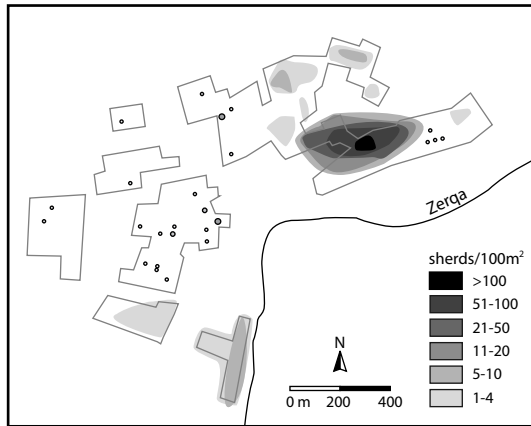


Figure 4.6 Area around the 'Abū al-N'eim village

ten high, with over 100 or even 200 sherds per 100 m². In the southern part of the research area shown here a very clear concentration has been discovered (see figure 4.6).³³ This concentration has an almost textbook-like layout with a centre of high densities which decrease gradually in concentric rings radiating out from the centre. Especially towards the north an increasingly low density discontinuous halo is present around the site. The river Zerqa in the south has prevented a halo from developing in this direction. The discontinuity of the halo is more likely to be the result of the low densities concerned than an actual reflection of the buried features. The difference between one or two sherds per plot and no sherds is not very big, but in the drawing it makes the difference between being drawn as a special density area and being left empty. Had broader density groups been used, the entire area around the site would have fallen within the lowest density category. All density areas are however depicted with a relatively high level of detail, which often yields several separate density islands that are subsequently interpreted. In this specific case the separate islands are regarded as forming a halo around the site. This halo is undoubtedly affected by the ploughing out of the concentration, but might partly be due to the manuring of gardens around the settlement.

A second but much less dense concentration has been discovered further to the south on the western bank of the Zerqa. Densities are low and this area would not unconditionally have been identified as a site had *in situ* occupation deposits not been discovered in the Zerqa section immediately to the east below this site (Hourani *in prep.*). Again a relatively wide area is covered by low densities, possibly representing a halo caused by ploughing artefacts away from their original location.

The other area with high density concentrations is located in the central and eastern part of the research area where the Zerqa enters the ghor. In this area six clear sites and two more enigmatic smaller concentrations have been discovered (see figure 4.7). The largest and densest concentration was discovered in field 27. This is the only concentration that stems entirely from the Late Chalcolithic period. Its high density, patchy distribution and the large difference in density with the field bordering it to the west are a result of the specific agricultural history in this field. From old photographs in the Deir 'Allā Archive it is known that a citrus plantation was established in this field in 1960 or slightly after. Until 1960 all ploughing was done by simple wooden ard-ploughs that only scratched the surface and never reached below 15-20 cm in depth. Distortion was therefore relatively limited, although undoubtedly present by millennia of ploughing in this fashion. During the presence of the orchard little or no mechanic modification of the soil occurred, while vertical movement of artefacts through the soil as a result of animals, drought cracks or seismiturbation favouring large artefacts in their rise upward, continued undisturbed. In the year before the survey took place the orchard was felled and the soil was deep ploughed for the first time. This resulted in a high density of often very large sherds that had weathered little. The plough had, however, not touched upon the buried mother population as geomorphological soundings showed this was

33 An overview of the locations of the detailed maps of the concentrations is given in appendix 4.

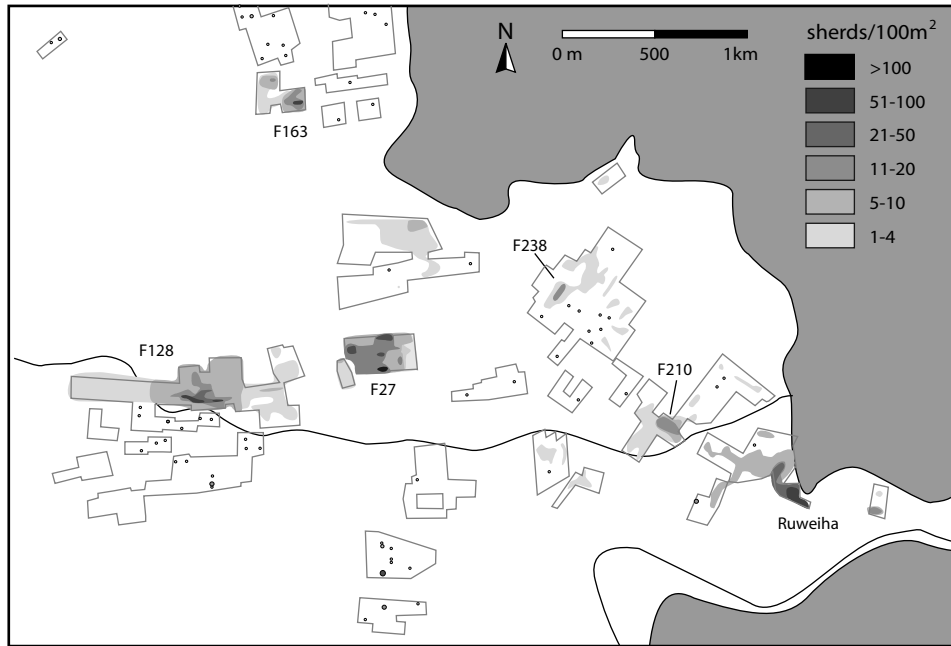


Figure 4.7 EBA sites in and around the al-Rweihah fan

located at a depth of *c.* 1.8 m below the surface and buried under 1 m thick alluvial deposits from the al-Rweihah fan (Hourani in prep.). It is envisioned that through the natural movement in the soil large sherds had moved upward and a sort of depot of sherds had built up just below the surface that was covered in grasses. It is expected that once this field is ploughed more often densities will decrease significantly, be distributed over a larger region, the size of the sherds will decrease and sherds on the surface will be more abraded. In other words, the concentration in field 27 will more closely resemble other sites.

A concentration neighbouring that of field 27, but much more widely dispersed was discovered in field 128 and vicinity. In contrast to field 27 this concentration dating to the EBA is surrounded by a wide halo probably caused by ploughing. Sherds were much more abraded, even compared to other EBA sites in the region. The low density area to the west of the centre of the concentration is most likely a result of recent ploughing, for this area was located on the other side of the river. Today, the Wadi al-Ghor runs south of this area, but this part has been canalized in recent years. In the 1940's the Wadi-al-Ghor ran slightly further north and cut through the halo of field 128's concentration in the south-west. In figure 4.7 the old course of the wadi is depicted. The Wadi al-Ghor is also the reason for the sharp distinction in density between the centre of the concentration and off-site densities of less than 1 sherd per 100 m² only a few metres to the south. Had the wadi al-Ghor not existed, at least recent mechanized ploughing would have distributed the artefacts more widely.

A smaller and less dense concentration of EBA pottery was discovered in fields 163 and 164 located further to the north. In the east this concentration borders on the East Ghor Canal and the main Jordan Valley road, which may have cut it. The concentration is spatially restricted and does not extend into the fields to the north and on the other side of the East Ghor Canal and road. Densities away from the concentration are low (av. 0.15 sh/100 m²).

Al-Rweihah in the easternmost part of the research area where the Zerqa enters the Ghor, is the location of another dense concentration of EBA remains. This site had already been discovered in 1960/61 by Diana Kirkbride. Later surveys by Helms, excavating at Tell 'Umm Hammād, and the EJVS also discovered EBA remains and Helms described a small tell that has been badly damaged. Today, a small part of an indeed badly damaged tell remains. The survey covered the vicinity of the tell and discovered high densities near its centre and decreasing densities in a halo surrounding the tell. Unfortunately the dimensions of the original tell and the degree of levelling and redistribution of tell soil and hence artefacts could not be established. The relatively large area

with high densities suggests levelling activity may have been extensive, but this might also have been caused by prolonged ploughing of part of the tell. It is unfortunate that the degree of levelling could not be established as this would have been a good case study to record the effects of prolonged agricultural activity directly at the edges of a tell. The higher density in the eastern field 263 is probably a result of the proximity of Tell al-Rweihah.

Small but clearly bounded concentrations of low densities have also been discovered. In field 229 and extending into fields 210/211 a small number of sherds of clearly EBA date was discovered. Densities were not very high, especially not when compared to some of the sites that had maximum densities of over 200 sh/100 m². However, the density between 11 and 20 sh/100 m² that was collected at the centre formed a clear distinction with the lower densities surrounding the concentration. The interpretation of this concentration as a site representing a buried mother population was corroborated by Hourani who discovered EBA sherds in reworked Lisan deposits at 2.5 m below the surface (Hourani in prep.). A very similar concentration was discovered in field 238. Although no hard evidence like geomorphological soundings is available the concentration is interpreted as a site based on its similarity to the field 229 concentration.

The distribution in field 234 has even lower densities and less spatial restriction than concentrations in fields 238 and 263. The low density distribution that lacks a clear centre most closely resembles a ploughed out halo surrounding a site. No detailed information exists, but Muheisen has reported two large caves containing Neolithic/Chalcolithic remains in the foothills bordering on these fields (Muheisen 1988: 519). It might be that the different time period in which the survey was conducted and the difference in focus, which lay on the Palaeolithic period, are reasons for this discrepancy in date. Be it as it may, the foothills in this area harbour many caves and several have proven to contain EBA remains. Even when the caves referred to by Muheisen are not the origin of the halo discovered in field 243, it is not unlikely that another cave used in the EBA exists whose artefacts were washed down the slope of the foothill by erosion and resulted in the halo attested in the valley plain.

Another site was discovered in the south of the research area at **Katār Dāmiyah**. **This site was**, however, not discovered by the survey, but by Hourani during his geomorphological research. Due to its location in the katār hills the site could not be surveyed in the normal way. Densities and distribution patterns can therefore not be compared to the other sites. Given the practically empty nature of the katār hills, the presence of considerable quantities of sherds from the same chronological timeframe warrants the interpretation of this area as a site.

In all, the high density areas are generally clearly bounded concentrations. In a few cases geomorphological and previous research has clearly shown that buried features are present in the sub-soil. These bounded high density areas are, therefore, interpreted as sites and, as will become clear from the next section, most sites can be interpreted as settlements. Between these high density areas large tracts of land with only low densities have been recorded. Little patterning is visible in these areas, except for even lower densities in the western areas and higher off-site densities in the al-Rweihah fan. Explaining these low densities is difficult. Part of it may be connected to remains left by people working or temporarily staying in the fields while mobile groups temporarily camping in this region possibly connected to herding of sheep and goats may also have accounted for some of the off-site density. The higher densities in the al-Rweihah fan may be connected to the intensification of agriculture during the later EBA possibly involving manuring of the fields with domestic waste material.

4.1.2 Late Chalcolithic and Early Bronze Age concentrations

Fieldno.: 27

Coordinates: 747,250/3,566,100 (center)

Size: *c.* 300 x 175 m

Days and time surveyed: Oct. 19th 2004,
c. 30 man-hours

Periods discovered: Late Chalcolithic

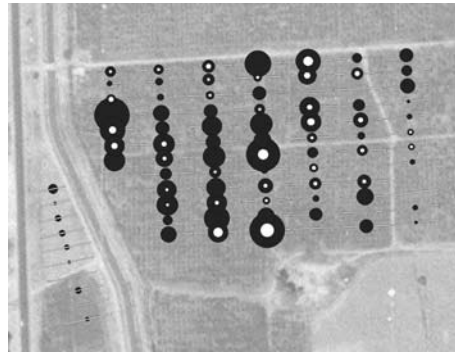


Figure 4.8 Chalcolithic pottery of field 27 with feature (light N max = 12) and non-feature sherds (dark N max = 104)

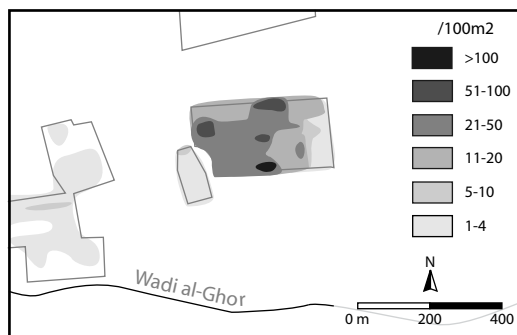


Figure 4.9 Distribution of feature and non-feature sherds

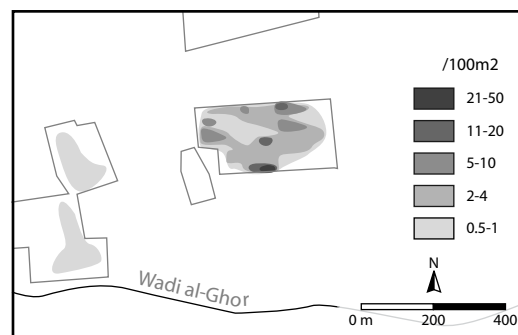


Figure 4.10 Distribution of feature sherds

Description

During the first survey season a large concentration of what appeared to be Chalcolithic sherds was discovered immediately north of Tell al-Qa'dān North. The concentration stretched from the East Ghor Canal to the east for about 300 m with densities decreasing significantly before the eastern end of the field. In the north a dirt road and an overgrown field bordered the concentration. Due to the vegetation this field could not be surveyed. In following years further attempts also failed due to vegetation cover and the soil being unploughed for too long which solidified the surface and left no artefacts to be found. Tell al-Qa'dān marks the southern end of the concentration. In the field between Tell al-Qa'dān N and S no Chalcolithic sherds were discovered. The other areas in the south were planted and could not be surveyed. The concentration, however, probably extends in southern, western and northern directions.

Until at least the year 2000 the land of Muasher's farm was a citrus plantation that had been planted shortly after 1960. During the forty years in which farming in this region became mechanized this land was not ploughed. After the trees were felled, the field was deep ploughed for the first time. This happened only a single time before the field was surveyed as could be seen by the large lumps of tilled soil that still contained an intact soil profile. The lack of high-impact agricultural activities meant that the artefacts were relatively well preserved even though they were generally of a very fragile nature. It is clear that heavy machinery was used as small irrigation canals made of concrete were simply ploughed over and in the lower parts of the field large stone boulders of about half a metre in diameter were ploughed up. Stones of this large size are not present in the Jordan Valley and they were probably brought to the site as building material. Among these stones larger numbers of artefacts were discovered. In higher areas it was also noticed that sherds occurred in patches instead of in an even distribution. It seems that the layers containing much Chalcolithic material were just disturbed by the plough, which can reach as deep as 50 or sometimes even 60 cm below the surface.

The distribution map shows no clear centre of the concentration where high densities prevail. In the west, north and at the foot of Tell al-Qa'dān areas of higher sherd density are visible. This uneven distribution might, however, primarily be the result of the plough that touched richer layers in some areas than in others. In the southern dense area, for example, large parts of a single vessel had come to surface. This was probably a chance hit by the plough. However, there seemed to be a correlation between soil layers as represented by different colours and patches of high artefact densities. These peaks in distribution are, therefore, interpreted as the occasional opening up of archaeological layers by the plough.

Geomorphological soundings made by Hourani in 2005 confirm that the plough has disturbed the upper 60 cm of the soil. After the discovery of the concentration in 2004 Hourani returned to the site in 2005 to investigate the geomorphology to determine under which environmental circumstances the site was founded and existed. A small trench of *c.* 1 x 2 m was dug to a depth of 4 m. At a depth of 1.8 m below the surface he discovered the occupation layers from the Chalcolithic period. These Late Chalcolithic occupation remains contained in situ wall sections and several layers with what seemed to be in situ pottery fragments (Hourani in prep.). The pottery fragments were exclusively of Late Chalcolithic date. A selection of the pottery and flint tools has been drawn and is discussed below.

There have been previous reports pointing to Chalcolithic remains in this vicinity. In his description of the LBA temple of Tell Deir 'Allā Franken mentions the presence of a very shallow Chalcolithic tell situated on banded clay to the north-east of Tell Deir 'Allā. Clay was presumably taken from this tell to construct the platform on which the LBA temple of Tell Deir 'Allā was constructed as many Chalcolithic sherds were discovered within the platform. He describes the location of the tell as just north of the Wadi el-Ghor and being cross cut by a north-south trench probably dating to the end of the Ottoman period and running immediately north of the aqueduct of the East Ghor Canal (Franken 1992: 10). In his publication on the Islamic Tell Abu Ghourdan Franken writes that this tell is founded on the remains of an Chalcolithic village (Franken and Kalsbeek 1975: 200). This description suggests a location near Tell al-Qa'dān South and not to the north of Tell al-Qa'dān North and possibly continuing on the southern bank of the Wadi al-Ghor. Nothing of this low tell or the trench is visible today.

Other reports of Chalcolithic material discovered in this area include the EJVS. The EJVS included Tell al-Qa'dān North and reported the discovery of a few Neolithic/Chalcolithic sherds at this tell (Ibrahim et al. 1988: 190). Kafafi studied the Neolithic material collected by the EJVS and reports that one sherd from Tell al-Qa'dān North can be dated to the Late Neolithic 2 (PNB) (Kafafi 1982: 163) However, his drawing shows a rim sherd of a bowl with red paint on the rim and drops of paint trickling down (Kafafi 1982: fig.33:1). This sherd is very similar to the Late Chalcolithic sherds discovered in 2004 and given the resemblance with the larger collection available today a revision of Kafafi's dating should be considered. Glueck also surveyed Tell al-Qa'dān, and although he does not distinguish between Tell al-Qa'dān North and South, on his aerial photograph he marked Tell al-Qa'dān South as being surveyed (Glueck 1951: fig.101). He makes mention of a few sherds which he dated to the (Middle?) Chalcolithic period (Glueck 1951: 310, 311). Based on the EJVS and Glueck's explorations many scholars have dated Tell al-Qa'dān North to the Chalcolithic period and considered it a small open village (e.g. Helms 1992a: 31). Given these new data the Chalcolithic settlement should not be positioned on Tell al-Qa'dān but immediately to its north. The biggest implication of this concentration is, however, not its slightly different location but its size. Based on the dispersal of considerable numbers of Chalcolithic sherds over a large area and the architectural remains discovered in Hourani's sounding, it can be concluded that the concentration represents a site containing permanent architecture probably forming a rural village of considerable size.

Threat

Although the site has until now been preserved rather well, its conservation is under threat. The tree cover of the orchard had protected the site from deep ploughing, but its removal suggests the fields will be put to some other (agricultural) use. As of autumn 2006 this task had not been undertaken and the fields still lay fallow. When the area is, however, cultivated again, the threat of deep

ploughing is considerable as this area is part of the Mu'asher estate where mechanized farming equipment, like tractors, is available. The small local farmers or sharecroppers often lack tractors and still use horse or donkey drawn ploughs that only reach *c.* 20 cm into the soil.

Hourani's sounding has, however, shown that at least in some parts of the site the occupation remains are not threatened by deep ploughing as they only start at a depth of 1.8 m below the surface. The presence of many non-local stones and large objects like grinding stones in the western part of the field which is slightly lower, however, suggest that the layer of soil covering the occupation deposits might not be equally thick in all parts of the field.

The occupation deposits may, therefore, be at risk to deep ploughing in some parts of the field, but not everywhere. The Chalcolithic sherds that are present in the soil reachable by plough are severely threatened as they are very softly fired and will not withstand winter rains for long.

Other finds

The non-pottery or flint artefacts that were discovered mainly took the form of grinding stones. Excluding finds of a clearly later date a total of 21 artefacts were collected. Most of these finds ($n=9$) were small basalt fragments of which no original shape could be determined. Often they did not even have one original exterior surface. In three instances, however, lower grinding stones were discovered that were largely complete or easily identifiable (27.1.6m1, 27.1.6m2 and s27.3.7m1). All three examples were made of coarse sandstone. A fragment of an upper grinding stone made of basalt (27.10.5m1) and a complete cup-shaped pestle (s27.x.xm1) have also been found. These grinding stones suggest food processing, probably in a domestic context, took place at this site.

Other artefacts discovered are less easily identified. A small fragment of fine grained basalt (27.10.5m2) might be a fragment of the top of a macehead. It has a circular shape and a hole through the centre, although only a quarter is present. Another basalt fragment is a small pillar of which top and bottom are broken off (27.12.5m1). This might be one of the pillars of a fenestrated stand. A limestone boulder featuring a central cupmark might have functioned as a door socket (s27.9.6m1).



Figure 4.11 Pestle s27.x.xm1



Figure 4.12 Lower grinding stone s27.3.7m1

Pottery

The entire pottery assemblage fits perfectly within Late Chalcolithic assemblages discovered at other sites in the region, e.g. Pella, Abu Hamid and Tuleilat Ghassul (see tables below). The pottery collection from this site is dominated by typical Chalcolithic V-shaped bowls and simple hole-mouth jars. However, more regionally restricted vessel shapes have also been identified, e.g. the Jordan Valley pithos. A sample of the collected assemblage has been drawn. An attempt was made to show the diversity within the assemblage. Not all bowls, hole-mouth jars and especially loop handles were therefore depicted, but each deviating shape has been incorporated. The often very small fragments regularly precluded a detailed identification of vessel form. The class simply referred to as bowl is therefore overrepresented, while more specific categories are underrepresented. An evaluation of the relative proportions of vessel categories within this assemblage is of little value and was, therefore, not undertaken.

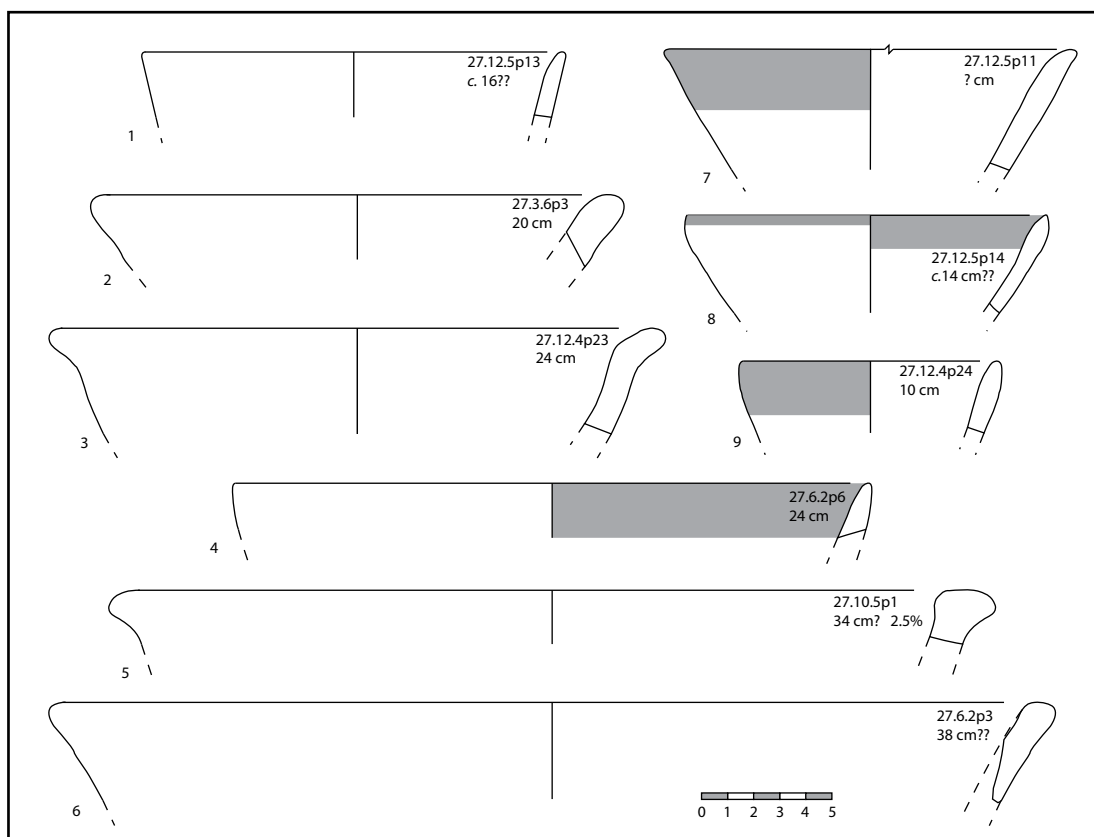


Figure 4.13 Bowls

No.	Sherd no.	Parallels	Date	Remarks
2	27.3.6p3	T. Ghassul (Lovell 2001: fig.4.31:8)	L Chal	
3	27.12.4p23	c. Shuneh N (de Contenson 1960: fig.3:5)	L Chal	
5	27.10.5p1	Pella (Bourke et al. 1994: fig.4:8)	L Chal	

Table 4.2 Bowls

Chalcolithic bowls are commonly of the V-shaped bowl type containing a band of red slip on the inside and/or outside of the rim. Although the pottery is slightly abraded, as is to be expected from a surface assemblage, red slip could in some cases be attested. Very similar jars have been excavated at for example Never Ur, Abu Hamid, Tuleilat Ghassul and Arad (Perrot et al. 1967: fig.15; Amiran et al. 1978: pl.1; Dollfus and Kafafi 1986: fig.7; Lovell 2001: fig.4.31,32). Vessels 27.3.6p3, 27.12.4p23 and 27.10.5p1 are less typical, though parallels for these bowls can be found among Late Chalcolithic assemblages (see table below).

The holemouth jars are very similar to the bowls in that they belong to a shape that is very common at most (Late) Chalcolithic sites. Parallels for the vessels discovered here are present amongst the excavated assemblages of Tuleilat Ghassul (Lovell 2001: .36:1-10, 4.37:1-7) and Arad (Amiran et al. 1978: pl.3:3-12) among others.

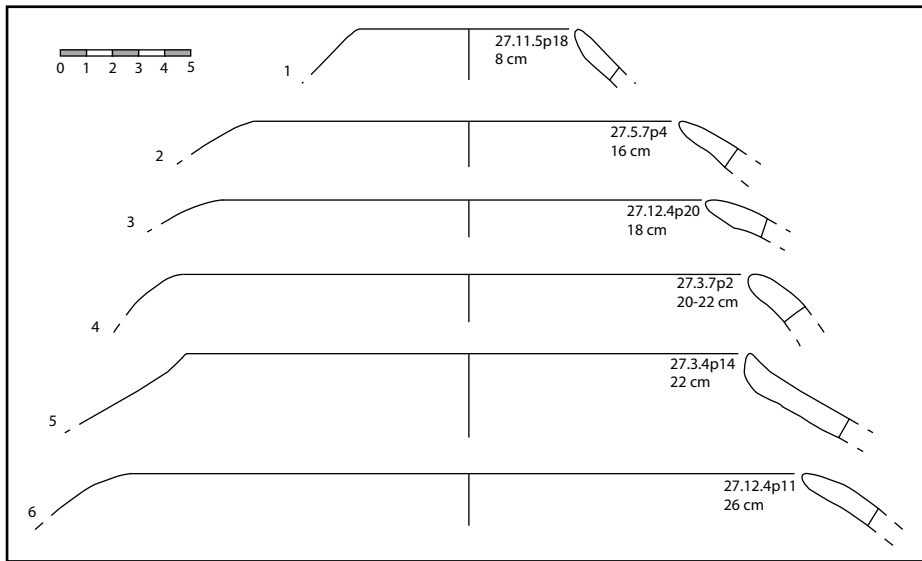


Figure 4.14 Holemouth jars

The flaring rims depicted in figure 4.15 are more difficult to identify. Their morphology and size makes several vessel shapes possible candidates to have been fitted to these rims. Bowls with a rim that slightly flares to the outside have, for example, been excavated at several sites. Rims 27.6.3p2 and 27.5.4p11 may belong to such bowls. Some of these rims may, however, also have been part of the foot of fenestrated stands. These have generally more or less the same diameter and their foot flares out slightly. From these small fragments it cannot be distinguished whether these sherds are rims or footed bases. The third option for these rims is that they belonged to necked jars. Necked jars with a diameter of *c.* 12 to 18cm occur in Late Chalcolithic assemblages, e.g. at Tuleilat Ghassul and Gilat (Mallon et al. 1934; Commenge et al. 2006: fig.10.22:3,7). Rim 27.3.3p2 is likely to have been part of such a jar (see table).

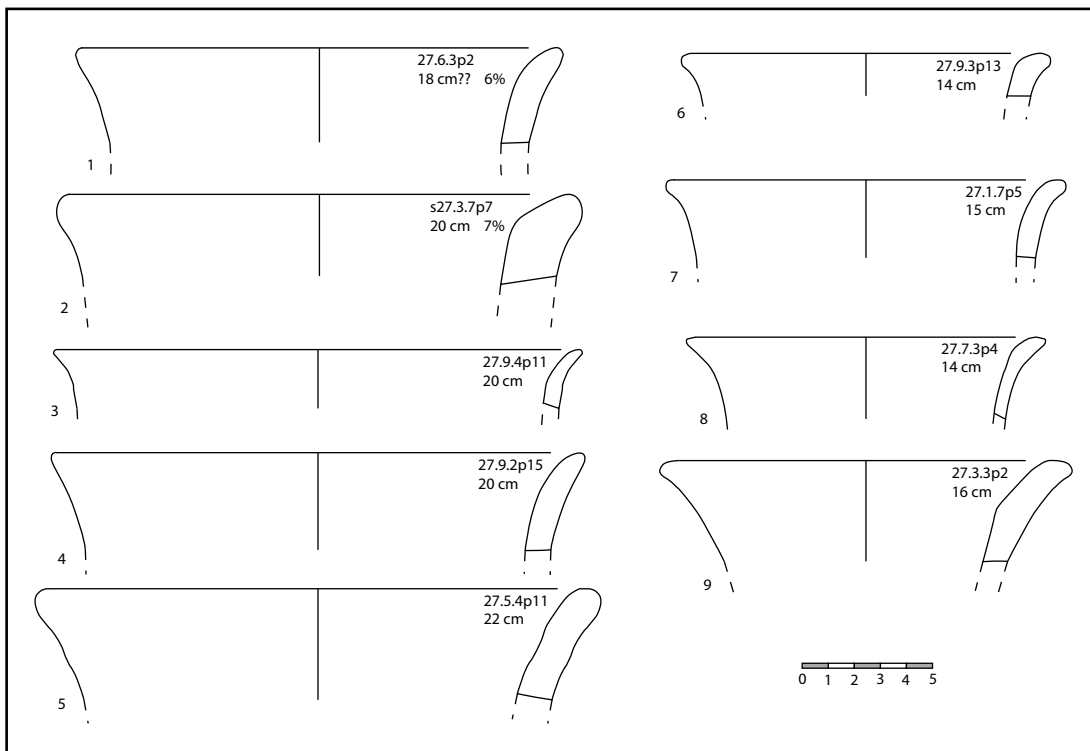


Figure 4.15 Flaring rims

THE SURVEY RESULTS

No.	Sherd no.	Parallels	Date	Remarks
1	27.6.3p2		L Chal	
2	s27.3.7p7	Gilat level IIc (Commenge et al. 2006: fig.10.28:2)	L Chal	
3	27.9.4p11		L Chal	
4	27.9.2p15		L Chal	
5	27.5.4p11	Abu Hamid (Dollfus and Kafafi 1986: fig.7:6)	L Chal	Bowl+red slip rim
6	27.9.3p13	W. al-Rayyan (Lovell 2007: fig.81:6)	L Chal	
7	27.1.7p5	e.g. Gilat, T-Ghassul, W. al-Rayyan (Lovell 2007: fig.81:6)	L Chal	Necked jar
8	27.7.3p4	e.g. Gilat, T-Ghassul	L Chal	Necked jar
9	27.3.3p2	e.g. Gilat (Commenge et al. 2006: fig.10.22:3,7)	L Chal	Necked jar

Table 4.3 Flaring rims

Loop handles in different sizes form a large part of this assemblage. Only two examples have been drawn to give an idea of the diversity in size present among them. A few very large examples, bridging *c.* 15-20 cm, have been discovered on thick body sherds which contain impressed band decoration. These large handles were most likely attached to the special type of large storage jars present in the Jordan Valley (e.g. Tsori 1967: 103). Other indications that this type of Jordan Valley jar was present at the site can be found in the rims described below. The ledge handle (27.3.3p7) is an exceptional find in this concentration. Ledge handles are not common in the Chalcolithic period and have long been regarded a hallmark of the EBA. Examples from Late Chalcolithic contexts have been discovered and it is today acknowledged that ledge handles occasionally occur in the Late Chalcolithic period. Ledge handles can, for example, be found on the interior of the Jordan Valley jar (Tsori 1967: 103). The curve in the wall of this ledge handle, however, clearly shows this specimen was attached to the exterior of a vessel.

Sherd 27.1.4p6 was broken on three sides and is hereby the only direct evidence for the presence of pedestalled bowls possibly containing windows in its foot as many Chalcolithic examples do (see table). There might of course be many more of such vessels present in the concentration, but only the area where foot and bowl intersect is diagnostic for such a vessel, whereas rims and bases will have been classified among the bowls.

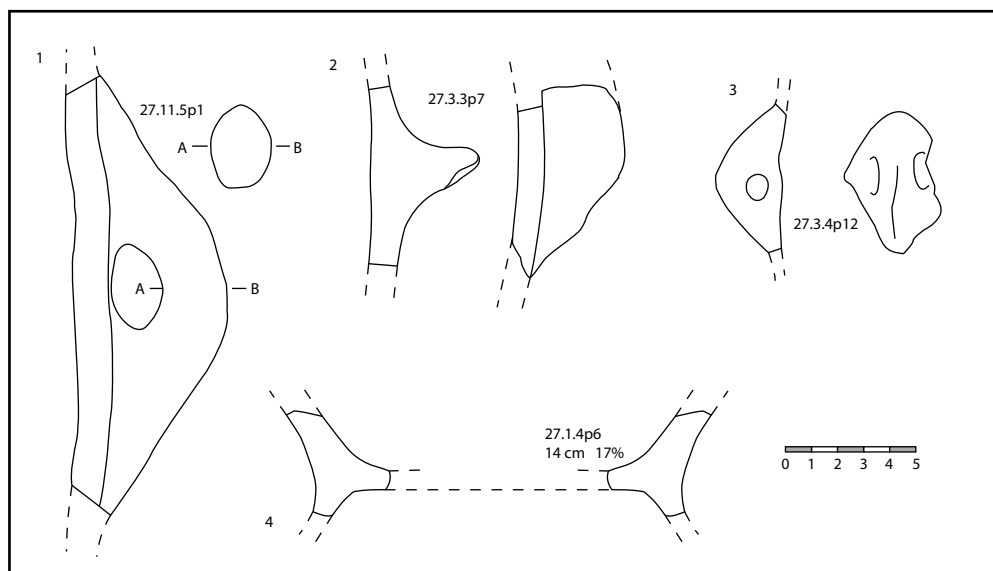


Figure 4.16 Miscellaneous

No.	Sherd no.	Parallels	Date	Remarks
1	27.11.5p1	e.g. Arad (Amiran et al. 1978: pl.4:7,8)	L Chal	
2	27.3.3p7	T. Ghassul (Koeppel 1940: pl.91:4,5)	L Chal	
3	27.3.4p12	e.g. T. Ghassul (Lovell 2001: fig.4.43:5) Abu Hamid (Dollfus and Kafafi 1986: fig.9:7)	L Chal	
4	27.1.4p6	e.g. Bir al-Safadi (Commenge-Pellerin 1990: fig.20:2) Abu Hamid (Dollfus and Kafafi 1986: fig.7:20)	L Chal	

Table 4.4 Miscellaneous

The Jordan Valley Jar

The rims depicted below have extremely large diameters (note the difference in scale). They most likely belong to a large jar that is unique to the Jordan Valley, hence its name 'Jordan Valley jar'. This type of jar can reach body diameters of 110 cm with rim diameters of 65-75 cm (Garfinkel 1999: 156). Examples of this type of jar have been excavated at, for example, Abu Hamid, Pella, and Dalhamiyah (Tsori 1967; Dollfus and Kafafi 1993: 246; Bourke 1997: 98; Garfinkel 1999: fig. 249). At Abu Hamid a well preserved example has been excavated. From this and other contexts it is clear that these jars were placed into pits dug into the ground leaving only their necks exposed (Vaillant in Anonymous 1988: 32, 46). These jars differ in vessel and rim shape. Some are more bowl-like, while others have distinctive and pronounced rims. The rims discovered here are not as large as some of the jars excavated elsewhere and the shape of their rims differs considerably. The fragments discovered are small and it can, therefore, not be excluded that some of these rims simply represent large bowls (e.g. 27.7.4p6). Only rim 27.2.4p14 undoubtedly belongs to a large jar that falls within the size range of the Jordan Valley jar. There are, however, more indications that this type of specific Jordan Valley jar was present amid this concentration. All of the Jordan Valley jars have bands with impressions on their body. Apart from the rims a few sherds were collected in this concentration, which point to the presence of this type of jar. They are thick (*c.* 1.5 cm) body sherds with impressed bands on their exterior and a very large diameter. It is unknown whether they represent the maximum diameter of the body, but their diameter and the limited vertical curvature of their body suggests that very large jars unknown outside the Jordan Valley were present in the field 27 concentration.

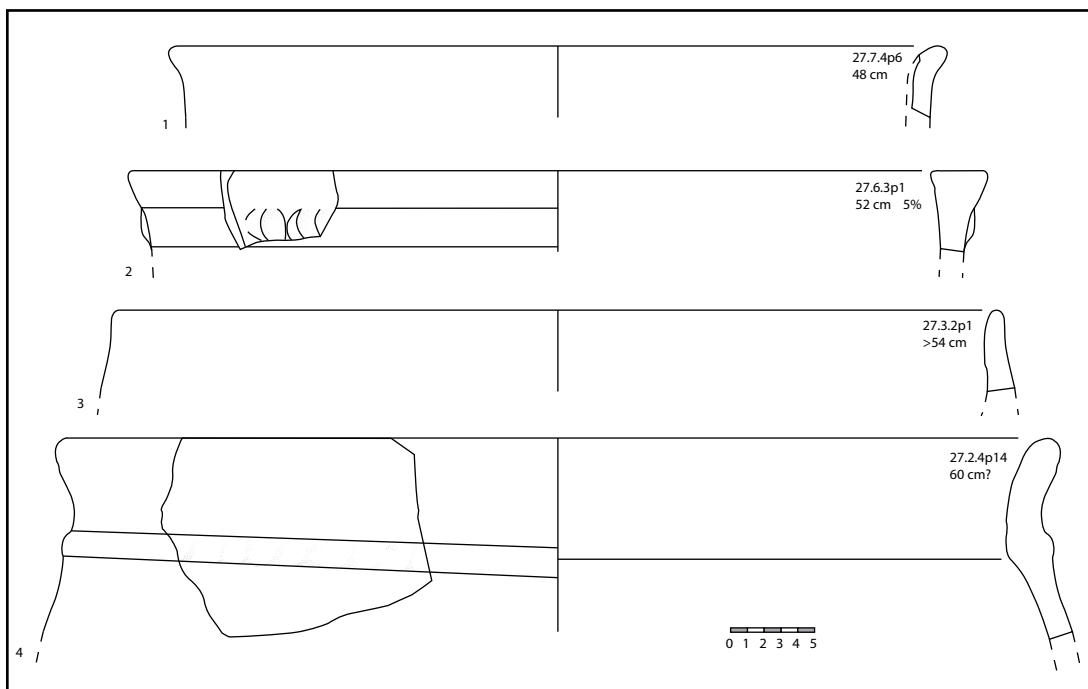


Figure 4.17 Jordan Valley jars

No.	Sherd no.	Parallels	Date	Remarks
1	27.7.4p6	T. Ghassul (Lovell 2001: 4.35:5)	L Chal	
2	27.6.3p1	c. Neve Ur (Perrot et al. 1967: fig.17:6)	L Chal	
3	27.3.2p1		L Chal	
4	27.2.4p14	W al-Rayyan (Lovell 2007: fig.8a:8) c. Pella (Smith 1973: pl.34:730)	L Chal	

Table 4.5 Jordan Valley jars

Bases

All bases discovered in this concentration are of the flat base type. At many sites mat impressions were identified on the surface of bases (Kerner 2001: 90). The level of abrasion of this surface assemblage did not allow such detailed identifications. Figure 4.18 shows that fragments of small vessels like base 27.11.5p14 have occasionally been preserved, although their number in the present assemblage must be considerably lower than their original quantity. The same lower chance of preservation and movement to the surface will be the reason for the absence of cornet and to a lower extent also the churns and fenestrated stands. Apart from their size, which hampers their preservation, these vessels normally occur only in small numbers, which makes the odds that they will occur in a sample of a surface collection rather low (Kerner 2001: table 5.7). Further comparison of frequency of form classes is both meaningless and impossible as the sample is too small and too much uncertainty is present in the identification of vessels. Too many factors like size, durability and original context of deposition determine whether a certain sherd or vessel is detectable on the surface, while only a sample has been collected from that surface collection.

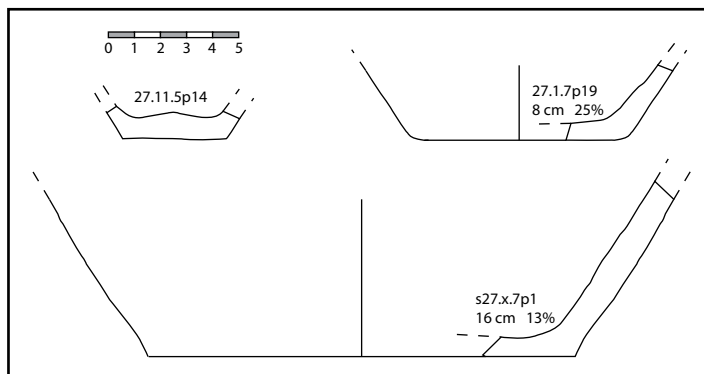


Figure 4.18 Bases

Test pit

As was to be expected, the pottery discovered by Hourani in the trench is identical to the pottery collected in the survey. No occupation deposits dating before or after the Late Chalcolithic period have been excavated. Given the small size of the trench the number of sherds is also limited. Although the pottery discovered on the surface was relatively well preserved considering its fragility, the excavated pottery is of superior conservation, especially where decoration in the form of red slip is concerned. In the surface collection the red colour had mostly faded and was often barely recognizable. Several sherds that will have once contained slip will now have been classified among the undecorated vessels.

The number of sherds discovered in each layer was insufficient to identify changes in the pottery assemblage. The trench was, furthermore, too small to establish the exact nature of the layers and their stratigraphic connection. A sample of the available pottery is, therefore, depicted here showing the similarities with the total collection and small variances within the Late Chalcolithic pottery assemblage.

Holemouth jars (no. 1+3) are, for example, of the standard type discovered in this concentration and many other Chalcolithic sites in the southern Levant. Necked jars no. 4 and 5 are almost identical to a few examples discovered on the surface. The large bowl depicted as number 6 is, however, exceptional in this concentration and not very common in Chalcolithic pottery assemblage of the southern Levant as a whole. Several (rim) fragments of this vessel have been found, making its position and thereby identification as a large bowl very clear. A similar but far from identical bowl has been discovered at Pella (McNicoll et al. 1982: pl.104:1). This bowl has a similar diameter and form, but its rim is thicker and more pronounced. Notwithstanding these differences, the general shape of the vessels and thereby function was probably very similar.

In conclusion, it can be stated that the pottery discovered in the excavated occupation layers is well preserved. This suggests that future excavation of this site would be very fruitful and valuable for the understanding of the Late Chalcolithic occupation and pottery production in this area.

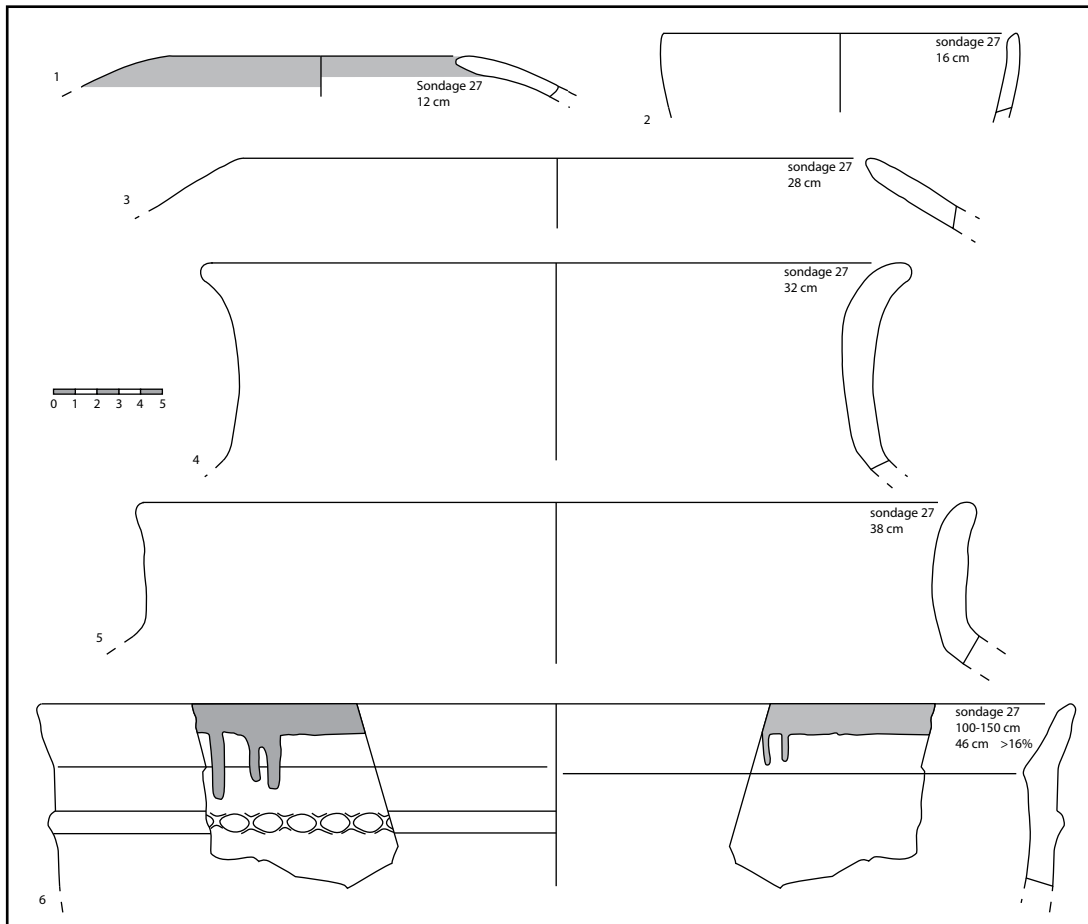


Figure 4.19 Pottery from the test pit

No.	Sherd no.	Parallels	Date	Remarks
1	Sondage 27	e.g. T Ghassul (Lovell 2001: fig.4.37:1)	L Chal	
2	Sondage 27			
3	Sondage 27			
4	Sondage 27	Pella	L Chal	
5	Sondage 27	Pella/J. Sartaba (Smith and Hanbury-Tenison 1992: pl.15:4)	L Chal	
6	Sondage 27	c. Pella (McNicoll et al. 1982: pl.104:1)	L Chal	100-150 cm, shape same, rim slightly diff.

Table 4.6 Pottery from the test pit

Fabric

The temper of a sample of the collected sherds was investigated macroscopically. This revealed that the overwhelming majority of the sherds was tempered with crushed calcite of varying size. Fragments larger than 3 mm were not exceptional in thick sherds. Only in two examples was angular shaped flint attested. Pieces of iron oxide standard in EBA pottery and most of the later periods is largely absent in this assemblage. The vessels are, therefore, yellowish to grey instead of orange to reddish. This coarse calcite tempered ware was used for most of the pottery. Only a few small vessels were made from a finer ware. Refiring tests performed on two sherds from this assemblage have shown that the vessels were originally fired at somewhere around 700° to 750° C.³⁴ Intensive petrographic or fabric analyses were beyond the scope of this research, but the interpretation of this concentration and the Chalcolithic pottery in the Zerqa Triangle as a whole will undoubtedly benefit could such research be carried out in the near future.

East Ghor Canal Franken

Among the collection of Franken in the Deir 'Allā Archive at Leiden University a group of sherds is present that was discovered during a survey of the banks of the East Ghor Canal near Tell Deir 'Allā in 1976. Although it is uncertain from which stretch of the East Ghor Canal in the vicinity of Tell Deir 'Allā the sherds collected by Franken derived, the similarity of part of the assemblage shows it may have been located nearby field 27. The bag of sherds collected by Franken contains diagnostic sherds of different periods including clear Islamic sherds. These may have derived from Tell Abu Ghourdan that was grazed by the East Ghor Canal or from a location even closer to field 27 as several probably Islamic period sherds were discovered in field 27 as well. The few clearly Chalcolithic sherds discovered are depicted in figure 4.20. They are very similar to the pottery collection in this concentration in shape and ware. All three vessels are very large and probably derive from the large jars or pithoi typical for the Jordan Valley (Garfinkel 1999: 156).

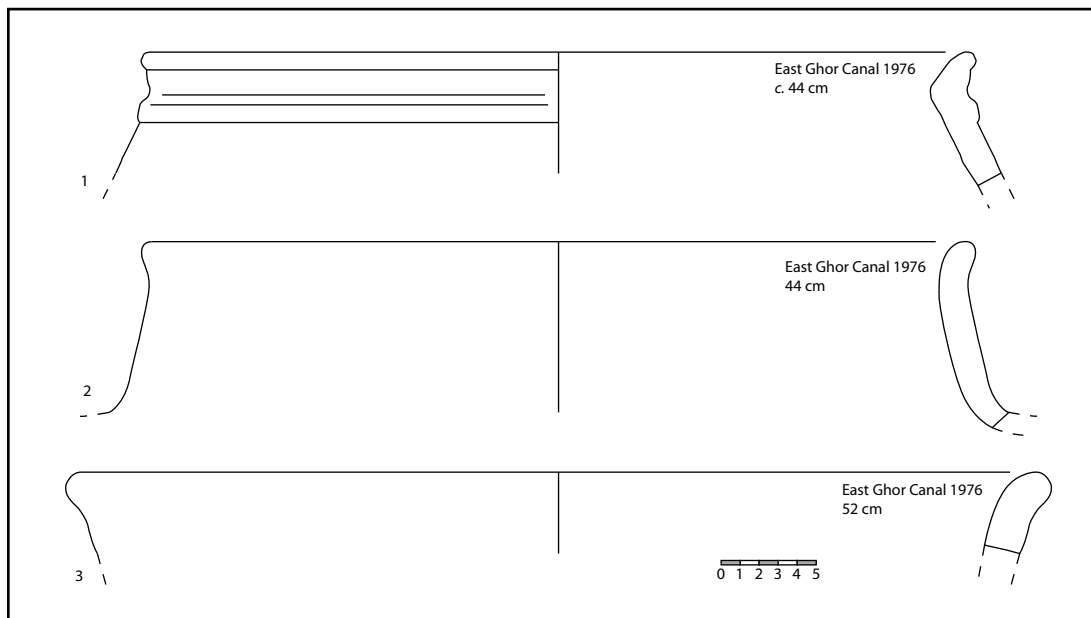


Figure 4.20 Pottery discovered on the bank of the East Ghor Canal

34 Thanks must be expressed to Michel de Vreeze and Lou Jacobs (Institute of Pottery Technology, Leiden University) for conducting these tests.

No.	Sherd no.	Parallels	Date	Remarks
1	E.Gh.C. '76-1	Site 235 near Beth Shean (Tsori 1958: fig.4) Pella (Smith and Day 1989: pl.34:717; Bourke et al. 1994: fig.6:6) c. Abu Hamid (Dollfus and Kafafi 1986: fig.9:8-10) c. Pella (McNicoll et al. 1982: 104:1)	L Chal	
2	E.Gh.C. '76-2	Pella/J. Sartaba (Smith and Hanbury-Tenison 1992: pl.15:4)	L Chal	
3	E.Gh.C. '76-3		L Chal	

Table 4.7 Pottery discovered on the bank of the East Ghor Canal

Lithic assemblage

The lithic material collected in field 27 is quite diverse. The waste consists for the largest part of flakes (71 %), supplemented by a lower number of blades (29 %) and a few cores. The lithic waste has a density of 5.5 artefacts per 100 m² in this field. This is quite a high density compared to the rest of the research area. The high density agrees well with the high flint artefact density visible at all sites with an early date like the Late Chalcolithic and EBA discovered in this area (see figures 4.22 and 4.23). The tools show a lower density of 0.5 artefacts per 100 m², which is still very high compared to other areas. The tools comprise equal numbers of flakes and blades (see table 4.8). The blades and bladelets consist of three backed blades of which one is bitruncated, one is a backed sickle blade and one is a bitruncated backed sickle blade. One of the backed blades is truncated on one side, the other end having been broken off, while the non-backed side contains a notch (27.6.6f1). Furthermore, one retouched sickle blade (see 27.1.7f7 on figure 4.21) and two unretouched sickle blades of which one is bitruncated were found. Other finds are a simple retouched blade and a retouched blade that is too fragmented to determine whether it belonged to a large notch or was a large denticulate. The Canaanite blades that are typical of the EBA are absent from this assemblage, although retouched sickle blade 27.1.7f7 demonstrates some Canaanite features. The backed blades that are well represented at this site are more or less restricted to the Chalcolithic period (Rosen 1997: 65).

Blade	10
Backed blade	1
Backed bladelet	2
Backed sickle blade	1
Backed sickle bladelet	1
Unretouched sickle bladelet	2
Retouched sickle	1
Retouched blade	1
Notch/denticulate	1
Flake	10
Drill	1
Tabular scraper fragm.	3
Retouched flake	6

Table 4.8 Flint tools from field 27

The flake tools consist of six simple retouched pieces, one drill (see figure 4.21) and three fragments of tabular scraper, although one of these might also belong to a bifacial knife (27.10.6f3). Tabular scrapers were long seen as the hallmark of the Chalcolithic period. Recent discoveries have, however, shown that they are present in EBA assemblages as well. Drills and retouched flakes, of which the last group contains artefacts that might also be classed as scrapers, occur in several periods and are hence difficult to date specifically (Rosen 1997: 86, 92, 71).

THE SURVEY RESULTS

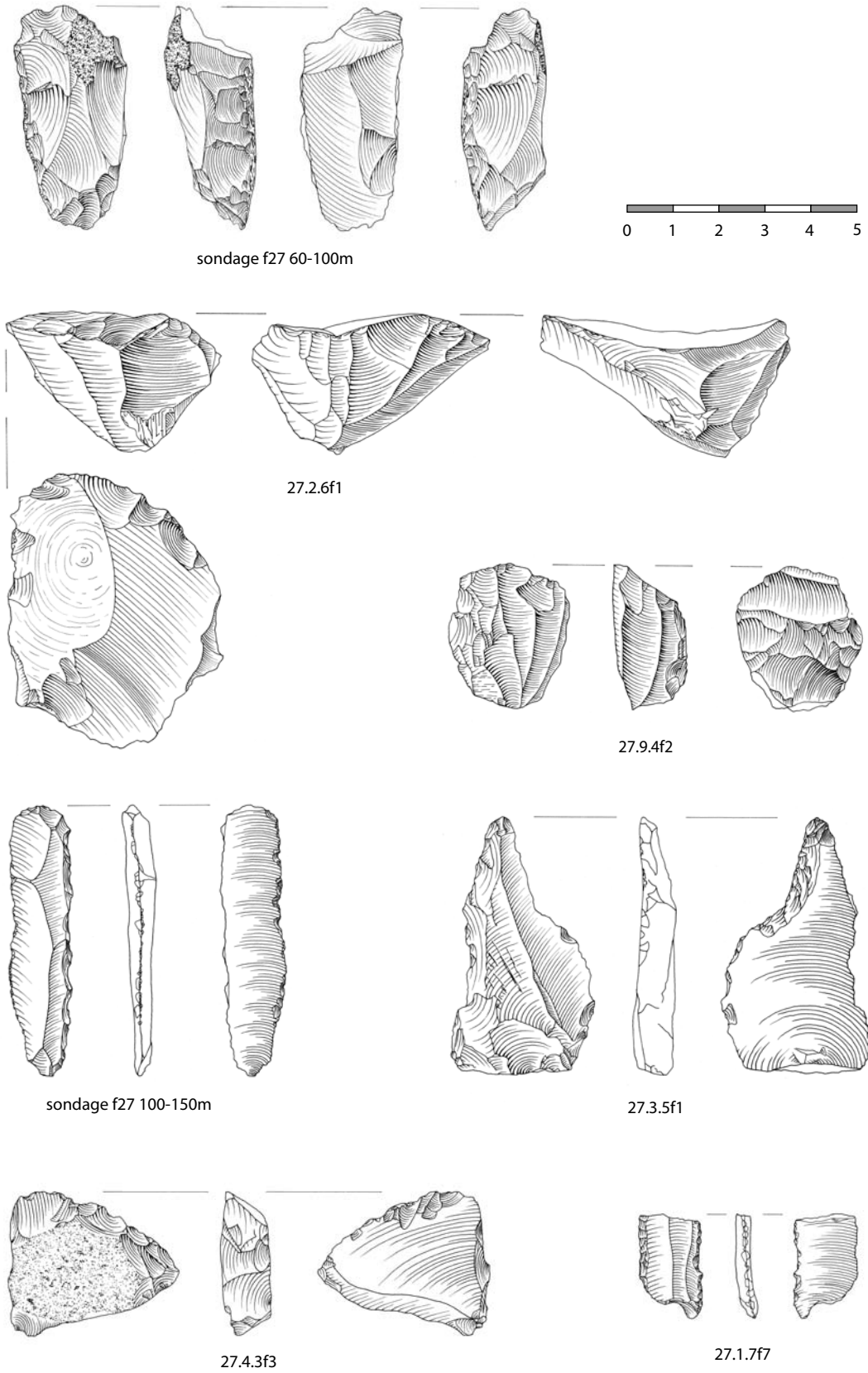


Figure 4.21 Selected flint tools from field 27

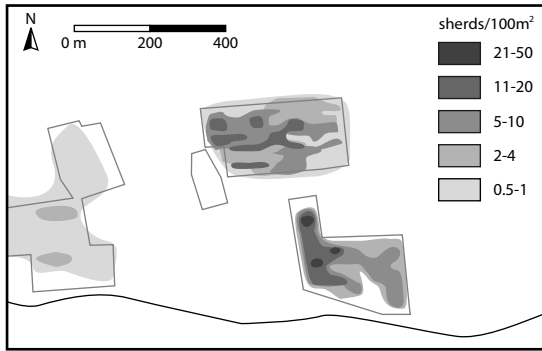


Figure 4.22 Distribution of flint debitage

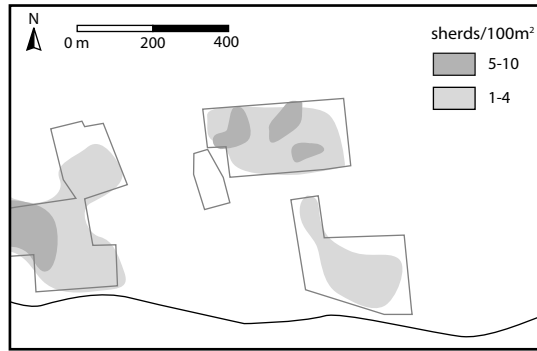


Figure 4.23 Distribution of flint tools

Together with the bladelet tools discovered, the presence of bladelet cores (or micro blade cores) shows that this type of artefact was manufactured at this location (see figure 4.21). Bladelet technology was used until the EB I period. Bladelet tools dating to the Chalcolithic period show a diverse distribution. They are common in the northern Sinai and Wadi Gaza sites, but are rarely found at Shiqmim, Abu Matar, Safadi, and Horvat Beter. They are absent from the Golan and at several sites in the Jordan Valley, but are common in the Jerusalem area and Tuleilat Ghassul (Rosen 1997: 67). The number of cores that has been collected shows that at least some proportion of the assemblage was manufactured locally.³⁵

Within the test pit executed by Hourani in this field a chisel was discovered between 60 and 100 cm below the surface. In a layer below it that extends from 100 to 150 cm below the surface a backed sickle blade with clearly visible gloss was uncovered (see figure 4.21). Other tools from the test pit included a simple retouched flake and two cores.

The tools that can be quite precisely dated like the tabular scrapers and the backed blades are consistent with the pottery assemblage regarding a date in the (Late) Chalcolithic period. However, among the less precisely datable tools and the waste, artefacts might be present that belong to other periods and are part of the general off-site scatter or halo of other sites like the damaged Tell al-Qa'dān S and its widely distributed remains. This proportion is, however, low as a large number of artefacts dating to such different period would be reflected in the datable tools as well. In all, the distribution of the lithic artefacts is very similar to that of the pottery in that it shows a very irregular density distribution with areas of high density alternating with low density patches.

Fieldno.: 500

Toponym: Katār Dāmiyah (Naghmeh)
 Coordinates: 741,400/3,556,250 (centre)
 Size: c. 250 x 100 m
 Days and time surveyed: Oct. 14th, 2006, c. 20 man-hours
 Periods discovered: Late Chalcolithic/EBA I

Description

On the last days of the 2005 season this concentration was discovered by Fouad Hourani during his geomorphological fieldwork. About 1.5 km north-east of Tell Dāmiyah on top of the katār hills overlooking the River Zerqa immediately to the south he discovered an area with many sherds on the surface. As he made his discovery on one of the last days of the 2005 season the site was not surveyed in detail until 2006. The concentration stretched over several bluffs of the katār hills. The katār hills are largely devoid of vegetation and at present not cultivated. The concentration was divided into several blocks that were chiefly demarcated by the natural topography. These blocks are shown in figure 4.24. The areas were surveyed until a representative number of sherds was collected. There was no fixed time to survey a block as their sizes differed. In a non-statisti-

³⁵ The cores discovered consist of two mixed flake/blade cores, seven blade cores and eleven flake cores including two micro blade cores and two micro flake cores.

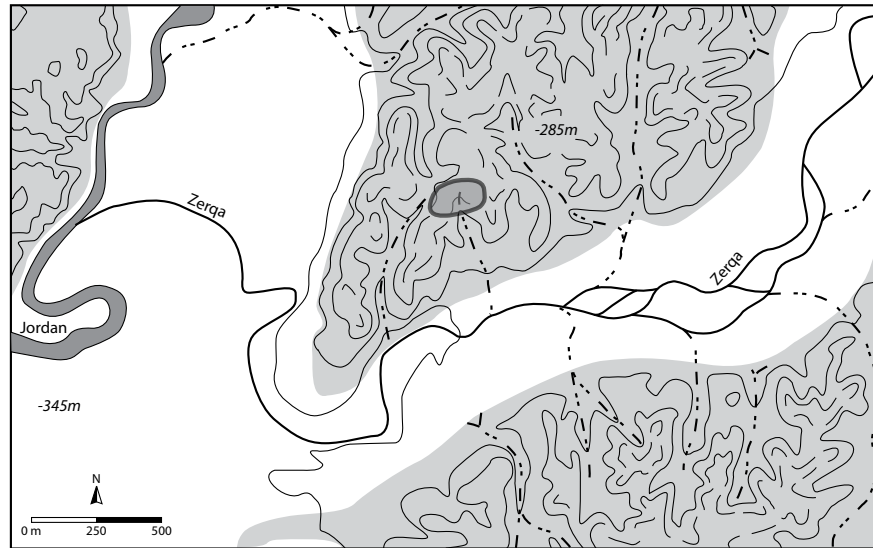


Figure 4.24 Location of Katār Dāmiyah

block	1	2	3	4	5	6	7	8
No. sherds	34	27	25	12	9	8	18	6

Table 4.9 Sherds discovered per block at Katār Dāmiyah

cal manner the relative densities per block were documented. The highest densities were observed in blocks 1 and 2, while much lower numbers were collected in blocks 4 and 5. Densities on the south-western bluff were significantly lower with a sharp decrease in block 8. Although not statistically sound the number of sherds collected in the blocks does give an impression of the relative densities in the blocks.

The present situation with steep wadi gorges separating the bluffs on which the concentration is situated is evidently not the same as the original appearance of the site. The geomorphological research of Hourani in this part of the Jordan Valley has shown that the major erosional episodes that contributed to the formation of the katār hills have largely taken place after the EBA and thus after the development of the site (Hourani in prep.). A similar phenomenon of post-EBA erosion has also been identified in other regions (Rosen 2007: fig. 5.7). It is likely that the site was once a normal homogeneous flat surface site and that only later did wadis cut through the site. During the survey work Hourani carried out a geomorphological sounding on the edges of one of the bluffs. Although he did not discover any in situ occupation layers, he was able to determine that soil formation occurred just before or contemporarily with the site. From the presence of soil formation it can be concluded that stable conditions with a high groundwater table and growth of vegetation prevailed (Hourani in prep.). The high groundwater table will be the result of a much less incised Zerqa than today. From overflow deposits intertwined with EBA deposits at TUH and near Tell Zakarī Hourani has established that the Zerqa was flowing at a much higher level during this period and overflowed regularly (Hourani in prep.). At Katār Dāmiyah no overbank deposits were discovered (Hourani in prep.). The proximity to the Jordan will probably have meant that the Zerqa was already somewhat incised near field 500 rather than further upstream. However, although the Zerqa was more incised, its valley cannot have been located much below the site judging by the high groundwater table necessary for soil formation.

Threat

As this area is part of the restricted military zone along the river Zerqa and part of the katār hills there is no human interference and no agricultural activity. The most serious threat to the site is the rapid erosion rate. It is uncertain whether there are occupational deposits left at the site, and if so how extensive they are. They have not been attested in the geomorphological sounding, but admittedly this trench was located on the edge of one of the bluffs.

Other finds

Compared to the amount of pottery discovered the number of other finds was quite meagre. Of the seven artefacts that were collected two are fragments of glass and evidently of later date. Their turquoise colour and air holes show that it is pre-industrial glass, possibly of Roman or Byzantine age.

Three fragments of stone bowls that are probably contemporary with the ceramic and flint assemblages have been found. One (500.x.7m2) is the rim of a fine-grained basalt bowl with a diameter of *c.* 14 cm. Both the inside and outside are carefully worked. In the same block (no. 7) the rim of a sandstone bowl, probably used as mortar, was found (500.x.7m1). The inside is smooth and carefully worked, the outside, however, is coarse and some parts show pecking traces. The diameter could not be determined as the rim is irregular and rather square. In the middle of the wall a round hole is visible. The largest part of the hole is natural and was present when the bowl was in use. This is clear from the amount of abrasion around the hole. The edges of the hole are worn away much deeper than other parts of the wall. It seems that originally, the hole was closed on the outside by a thin wall. At some moment in time the thin wall of the hole was broken through. This could either have occurred accidentally while the mortar was still in use or alternatively could have been purposefully done after the mortar had broken into the now visible fragment in order to use the stone as a weight. The amount of wear on the outside of the hole, though limited, might argue in favour of the latter hypothesis.

The third stone bowl (500.x.1m1) is a fragment representing almost 50 % of the original artefact (see figure 4.26). It is a sandstone mortar with a rim diameter of 12 cm and a diameter at its base of 16 cm. Pecking traces are visible on both the inside and outside. Inside, on the bottom, grinding and/or pounding traces of use have obliterated the pecking traces of its production.

In block one a shell was also found. This bivalve is a marine *glycymeris* originating from either the Mediterranean or Red Sea.³⁶ A hole is present in the umbo of the shell, which might indicate that it was once strung on a wire. Shells of the *glycymeris* species have also been excavated at Tell 'Umm Hammād (O'Tool 1992: 134), Megiddo (Bar-Yosef Mayer and Baruch 2006: 500/501) Azor (Bar-Yosef Mayer in Golani and Van den Brink 1999: 33), and Tell Far'ah N (de Vaux and Steve 1949: pl.6).



Figure 4.25 Fragment of fired clay with reed impressions (500.x.2m1)



Figure 4.26 Sandstone mortar (500.x.1m1)

36 Thanks must be expressed to Wim Kuijper for identifying this shell.

In block 2 a piece of soft, irregularly fired clay with many reed or straw impressions was discovered (500.x.2m1) (see figure 4.25). Most likely this is a piece of roof material that was accidentally fired and hence preserved.

Pottery

The ceramic material from this concentration has parallels in both the Late Chalcolithic period and the Early Bronze Age (see below). As this was a rather small assemblage where only well identifiable feature sherds had been collected and for which precise dating proved difficult, all sherds were drawn.

The majority of the pottery is handmade and rims are often irregular. Some sherds exhibit traces of a slow turning wheel but as sherds are small and often badly eroded it is impossible to say whether these are the result of secondary wheel finishing, the production on a turntable of specific parts or of the entire vessel. Likewise the abrasion on most vessels was often too extensive to discern other traces of production, like string-cut bases. In one case (500.x.2p20), however, the base did show that it was made from a flat disc of clay on which the wall was built up by coiling. Only in two instances were vessels probably red slipped, but burnishing was not visible on any of these vessels. The level of post-depositional wear is, however, relatively high in this concentration and the outer surfaces of many sherds have degraded heavily. Especially the leaching of chalk from the clay matrix is common, causing the sherds to crumble more easily. Unfortunately, survey pottery in general and pottery from the katār hills specifically is often not well suited to this kind of technological analysis.

Holemouth jars

The 13 holemouth jar sherds discovered in concentration 500 make up 18 % of the total assemblage. The majority of the jars have either straight or rounded walls, while rims are rounded or slightly tapered. This type of holemouth jar occurs in Late Chalcolithic contexts like Tuleilat Ghassul (Lovell 2001: fig. 4.36), Gilat (Commence et al. 2006: pl.10.13-17), and Jiftlik (Leonard 1992: pl. 1-18/19). Late Chalcolithic shapes are very similar, although in certain assemblages the tapering rims seem to predominate over the rounded rims (Lovell 2001: fig. 4.36/37). There are, however, also parallels of this type of jar in the Early Bronze Age. The plain holemouth jars of Ashqelon Afridar are, for example, very similar (Braun and Gophna 2004: fig. 20-1,2,4). These have been dated to the early part of the EBA Ia. At tell Shunah N, which has both Late Chalcolithic and EB Ia deposits, the same type of holemouth jar has been discovered in strata dating to both periods (Gustavson-Gaube 1986: fig.11-32-36). In the settlement of Bab edh-Dhra' these jars occur in both the EB Ia stratum V and the EB Ib stratum IV (Rast and Schaub 2003: 5.1 and 7.1). In other EB I contexts holemouth jars are often thickened inside the rim. At Tell 'Umm Hammād, for example, there are only a few holemouth jars that have the plain thin rims described here (Helms 1992c: fig.141-3-6). Most of the holemouth jars from the EB Ia layers have a thickening on the inside of the rim and sometimes an additional flattening of the top of the rim (Helms 1992c: fig. 143-150). In the EB Ib and II layers of Tell 'Umm Hammād the simple rim does occur but the tops of the rims have been purposely squared (Helms 1992c: genre 10 fig. 155-157). At Tell Iktanu both the EB Ia and EB Ib pottery assemblages contain the plain squared as well as the thickened rim type (Prag 2000: 92-93). The settlement layers at Jericho show a combination of the squared, the thickened, and the plain rounded rim types encountered here during the Proto Urban period (Kenyon and Holland 1982: fig. 39). The re-evaluation of the pottery and stratigraphy of Kenyon's and Garstang's excavations by Sala shows these types are present in the EB Ia and Ib periods (Sala 2005: fig. 33,34).

The differences between the rounded, squared and thickened rims can be considered regional variations. The proximity of Tell 'Umm Hammād, located only 3.5 km to the north-east, however, shows there might also be a chronological difference. As already noted by Philip, it is uncertain where chronologically the EB Ia starts at Tell 'Umm Hammād (Philip 1995: 166). The earliest three phases consist mainly of pits and fill layers, and only in phase 4 do the first occupational

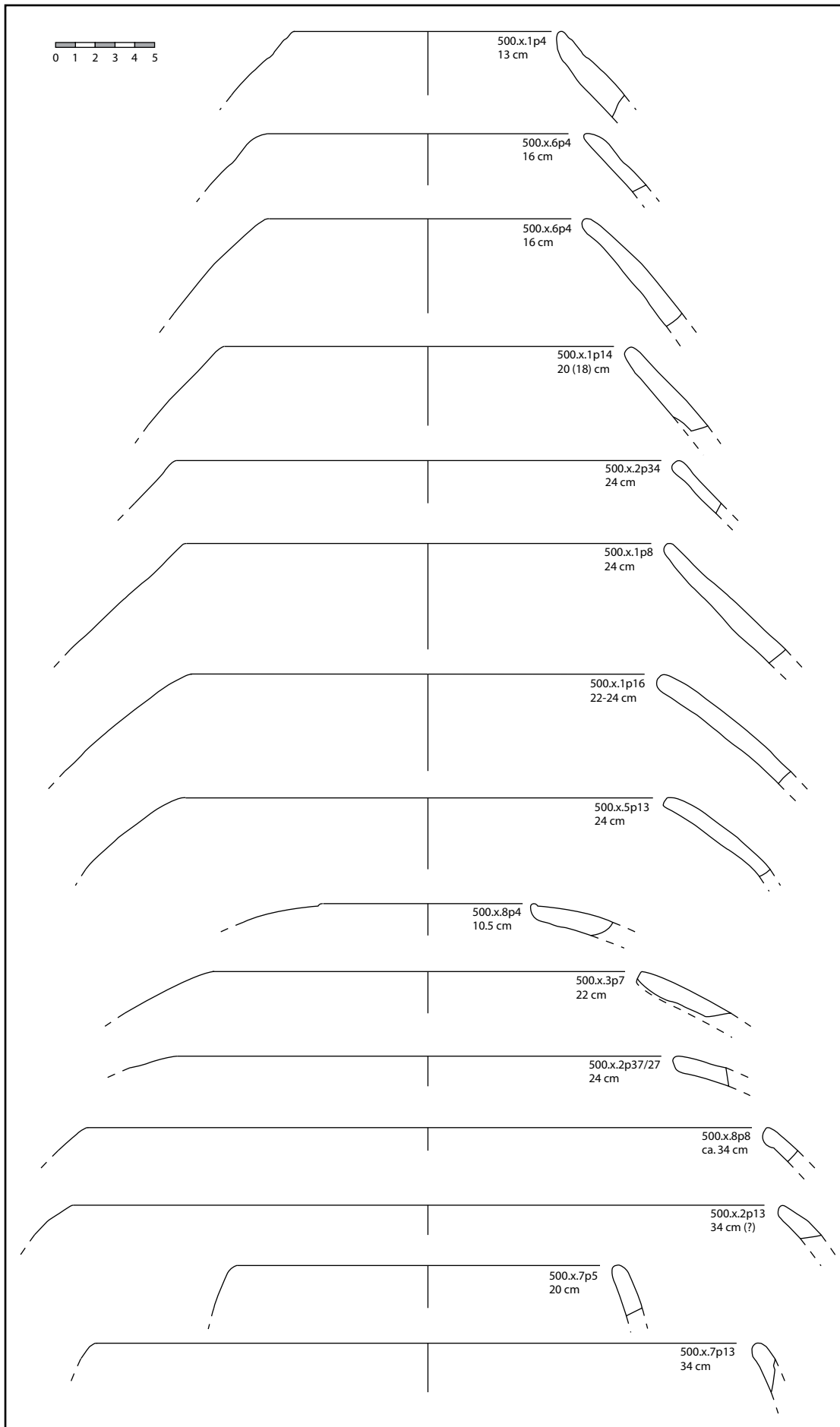


Figure 4.27 Holemouth jars

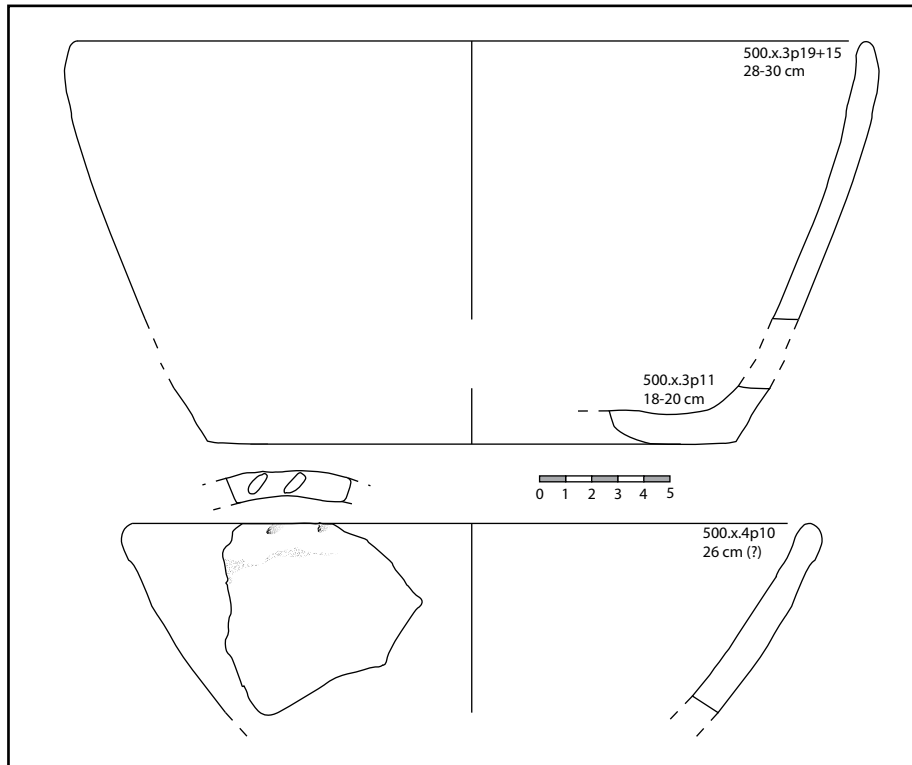


Figure 4.28 Bowls

surfaces appear, though these are still very small-scale (Helms 1992d: 17-18). The limited amount of pottery from these early levels has been dated to the EB Ia period. It is, however, impossible to say on the basis of the excavation whether these date to the very beginning of the EB Ia or somewhat later. The information gained in other concentrations of this survey, however, suggests more clearly that Tell 'Umm Hammād should be considered as starting in the later part of the EB Ia period (see next section). It therefore seems plausible that concentration 500 predates the EB Ia levels of Tell 'Umm Hammād.

Bowls

The bowl sherds of the Naghmeh concentration (26 % of the total assemblage) show similar parallels as the holemouth jars; they resemble both Late Chalcolithic and EBA bowls. During the Late Chalcolithic period the most common bowl type was the straight sided or V-shaped bowl. This shape continues into the EBA, but bowls with more rounded walls that had always been present start to gain in importance. The present assemblage shows both types. Parallels can be found in Late Chalcolithic sites like Tuleilat Ghassul (Lovell 2001: fig.4.31,33,34), Gilat (Commence et al. 2006: pl.10.1, 5, 7), Neve Ur (Perrot et al. 1967: fig.15-1-8) and Abu Hamid (Dollfus and Kafafi 1986: 364). Most Chalcolithic bowls have a band of red slip at their rim, which are absent from the concentrations assemblage. It is possible, however, that bands were present once, but have worn off. Good parallels can, however, also be found in EB I assemblages, for example of Ashqelon Afridar (Golani 2004: fig.22), and Tell ash-Shunah N (both the Late Chalcolithic and the EB I strata) (Gustavson-Gaube 1986: fig.8). Regarding the bowls the Bab adh-Dhra' assemblage does not fit closely. In the EB Ia stratum V bowls usually have tapered and slightly flaring rims and 51 % of the bowls has a band of punctuations below their rims. In the EB Ib period the punctuations disappear but virtually all bowls have rounded walls (Rast and Schaub 2003). At Tell 'Umm Hammād most bowls are of the hemispherical type that rises only in the later part of the EB I period (Helms 1992c). These bowls postdate the Naghmeh concentration.

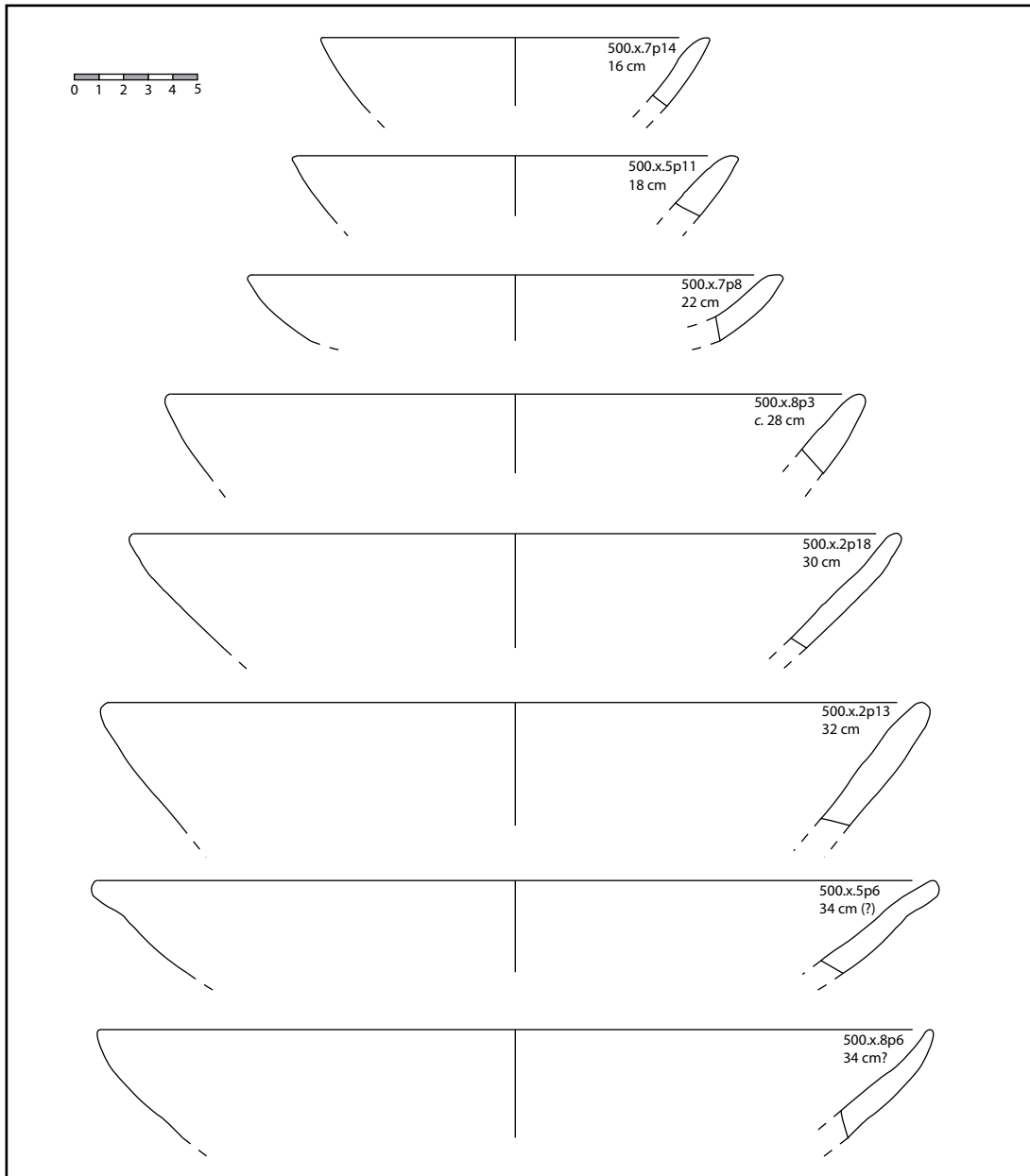


Figure 4.29 Bowls

One bowl (500.x.3p19+15) is almost complete. Within block three several rims of apparently the same vessel were discovered (500.x.3p4, 7, 8, 15, 18, 19). Some of the collected rims turned out to fit to each other, while others were so similar in ware that they in all likelihood belong to the same vessel. About 50 % of the rim diameter was present. A base (500.x.3p11) in the same ware did not fit, unfortunately, but its diameter shows that only a few centimetres of wall are missing. The largest rim sherd that stemmed from this single vessel has a quite rounded, inward turned rim. Other parts of the rim are less rounded. This is exemplary of the large degree of irregularity visible in several sherds.

Two bowls (500.x.7.p11 and 500.x.4p10) have impressions on top of their rim. These impressions are not present in either the Late Chalcolithic or the EB I strata of Tell esh-Shunah and they are equally lacking at 'Tuleilat Ghassul, Bab edh-Dhra', and Tell 'Umm Hammād. Bowls with impressions on their rim have been discovered at Late Chalcolithic Tell Abu Hamid (Dollfus and Kafafi 1986: fig. 7-11,16), Arad (Amiran et al. 1978: pl.2:5,6) and Pella (Bourke et al. 1994: fig. 6:1). Impressed bowls have also been found at early EB Ia Ashqelon Afridar in Area E (Golani 2004:

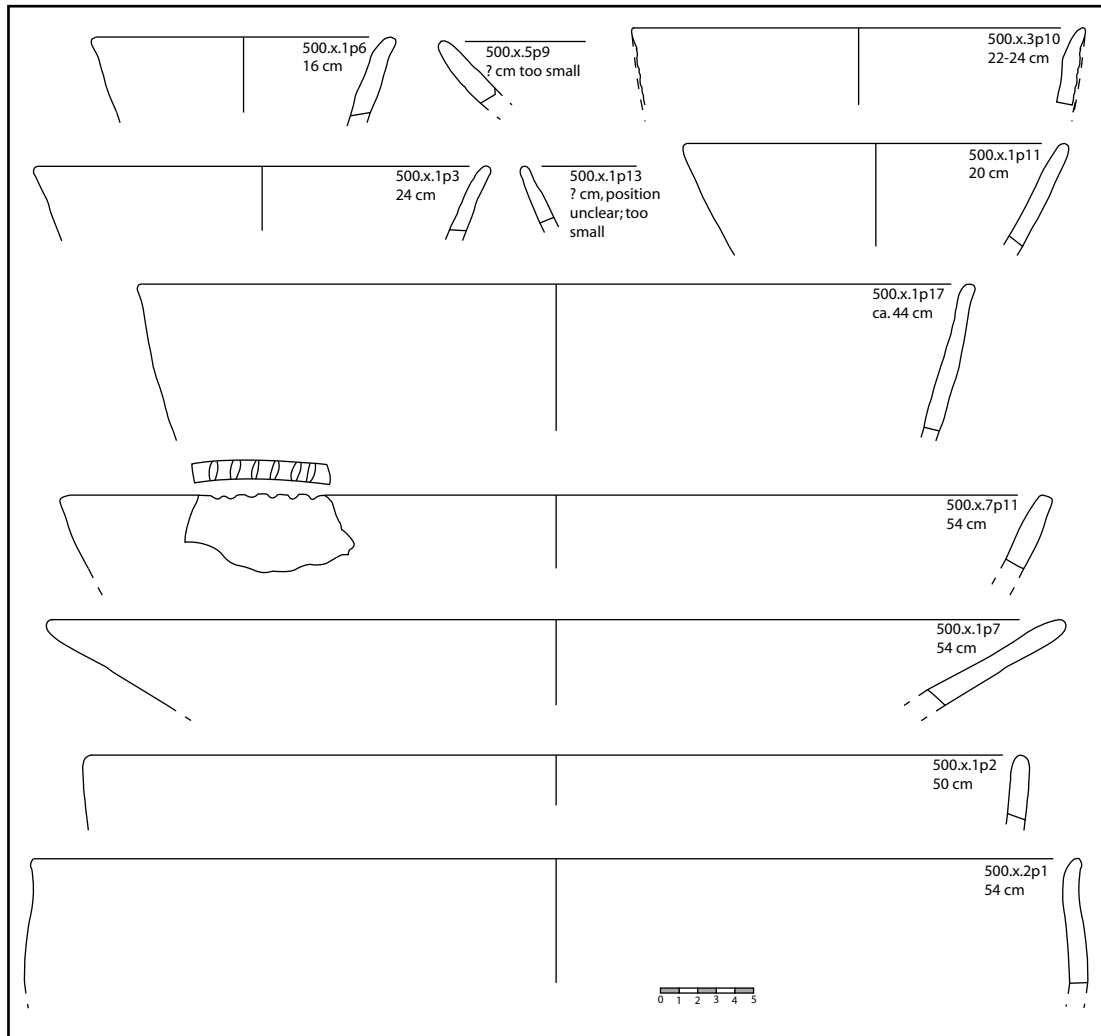


Figure 4.30 Bowls

fig.23:9,10), area F (Khalaily 2004: fig.12:2,4,5), and Area G (Braun and Gophna 2004: fig.17:11-13). A very good parallel for impressed bowl 500.x.4p10 has been discovered at Hujayrat al-Ghuzlan dating to the transition between the Late Chalcolithic and Early Bronze Age periods. The impressions on bowl 500.x.7p11 are very similar to those on a cup discovered in the concentration in field 81, which has been dated to the early part of the EB I period (see next section).

Cups

A total of 17 cups has been discovered. The cups in this concentration all have a diameter that ranges between 7 and 10 cm. The cups can be divided into three groups. There are straight-sided or V-shaped cups (500.x.1p15/500.x.2p5/500.x.2p7/500.x.8p2). These cups are essentially small bowls of the type described above. Two cups were classified as round cups on the basis of their round base and more or less concave walls (500.x.2p25/500.x.7p15). Base 500.x.1p22 has rounded sides, but like base 500.x.1p23 it has a small, flat base. The other cups can be considered as more or less vertically walled cups. Cups 500.x.1p21, 500.x.1p9 and 500.x.4p11 exhibit a flat or slightly rounded base. Cup 500.x.2p26 stands out in that it is the only cup, and one of the few vessels in the assemblage, that contains traces of red slip on its interior wall. Cup 500.x.5p2 is also exceptional in that it has a round impression on its exterior below the rim. Unfortunately the fragment is too small to determine its position with certainty.

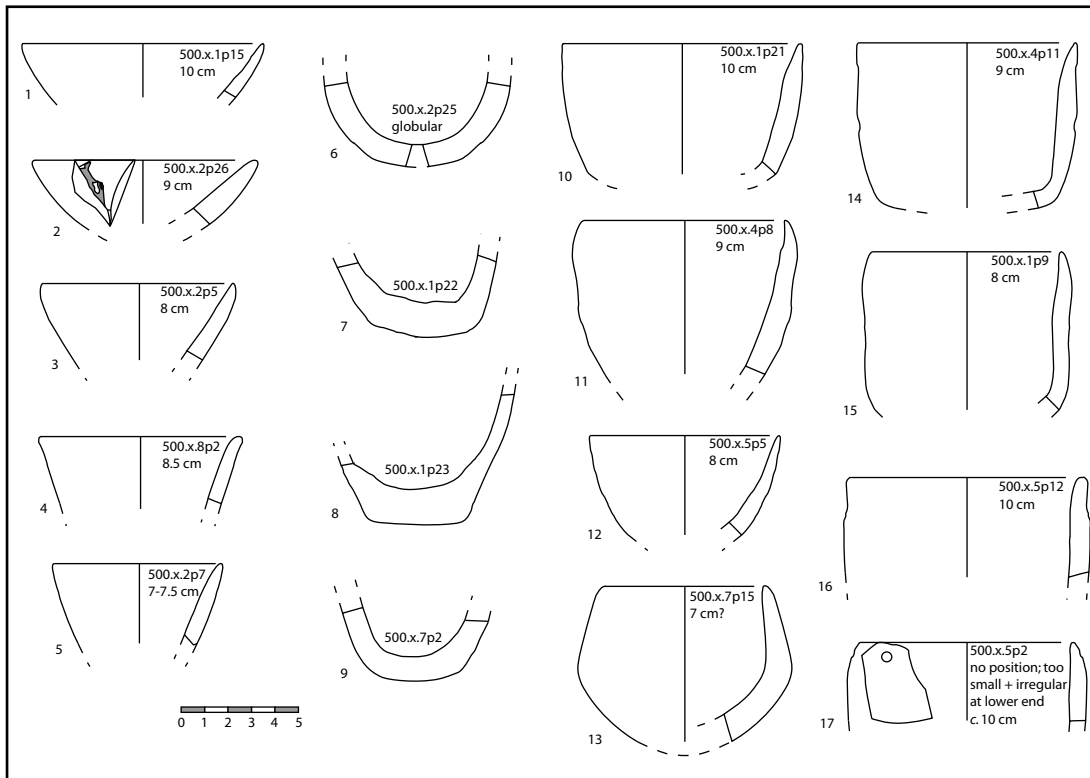


Figure 4.31 Cups

Cups occur quite regularly in EBA contexts in this region. Examples have, for example, been discovered at Bab edh-Dhra' (EB Ia), Tell 'Umm Hammād (EB Ib), and Lachish (early EB Ia). In general they form only a small percentage of the pottery assemblage in settlements. Larger numbers of cups have been discovered in burial contexts. They are sometimes interpreted as lamps based on regular occurrence of soot on the rim, e.g. at Tell Iktanu (Prag 2000: 98) or Lachish (Tufnell 1958: 145-146; see also section on al-Rweihah). In an excavated dolmen near Tell 'Umayri on the Transjordanian plateau 20 interred individuals have been discovered accompanied by 20 complete vessels dating to the EB Ib of which nine were cups (Dubis and Dabrowski 2002: 171). The many cups discovered at EB Ia Lachish virtually all stem from burial caves (Tufnell 1958: pl.56, 57). The large number of cups in this assemblage, i.e. 24 % of the total assemblage, seems to suggest a burial context. However, other ceramic vessels usually discovered in graves of the EBA I period, like juglets with a large handle or typical necked jars, are completely absent. Furthermore, the remainder of the assemblage discovered here has none of the characteristics expected in a burial context.

Although cups are generally associated with the EBA they occasionally occur in Late Chalcolithic contexts. For example, in the Late Chalcolithic phases of Tuleilat Ghassul a few cups have been found (Koeppel 1940: pl. 83-1). Although cups are not common in Late Chalcolithic assemblages, they do occur in a few instances. At Halif Terrace site 101 many cups, or straw tempered beakers as the excavators call them, have been found. As much as 24.9 % of the entire assemblage consists of cups (Dessel 2009: 102). The cups are in shape very similar to the ones discovered in this concentration (see table 4.10). Cups are already present in the oldest layers of the site that date to the Terminal Chalcolithic, when they form 19.1 % of the entire assemblage from that phase, they continue into EB Ia (36.4%) and early EB Ib (29.4 %). In phase 7/6 which dates to the late EB Ib cups are rare (1.7 %) (Dessel 2009: fig. 24). At this site cups therefore clearly date to the transitional period from Late Chalcolithic to the EB I period. Little is known about the function of these vessels, but residue analysis conducted by McGovern has revealed traces of tartaric acid which indicates products of grape. This shows that at least some of these cups contained wine or

THE SURVEY RESULTS

No.	Sherd no.	Parallels	Date	Remarks
1	500.x.1p15	Neve Ur (Perrot et al. 1967: fig. 15:1) Halif terrace 101 (Dessel 2009: pl.12:10-27)	L Chal L Chal+EB Ia	Halif: red slip on rim
2	500.x.2p26	Halif terrace 101 (Dessel 2009: pl.12:10-27)	L Chal+EB Ia	Traces red slip inside
3	500.x.2p5	Halif terrace 101 (Dessel 2009: pl.12:10-27)	L Chal+EB Ia	
4	500.x.8p2	Halif terrace 101 (Dessel 2009: pl.12:10-27)	L Chal+EB Ia	
5	500.x.2p7	Halif terrace 101 (Dessel 2009: pl.12:10-27)	L Chal+EB Ia	
6	500.x.2p25	T-Ghassul (Koepfel 1940: pl.83:1) Afridar area J (Baumgarten 2004: fig.12:4) Afridar area J (Baumgarten 2004: fig.13:4) Lachish (Tufnell 1958: pl.11:11,12) W Faynan 100 (Wright et al. 1998: fig.9:1)	L Chal EB Ia EB Ib EB Ia(?) EB I (early)	
7	500.x.1p22	T-Ghassul (Koepfel 1940: pl.83:3) Azor (Perrot and Ladiray 1980: fig.75:12) H. al-Ghuzlan (Khalil et al. 2003: fig.16:2)	L Chal L Chal Trans Chal/EB	
8	500.x.1p23	Afridar Area E (Golani 2004: fig.29:4) Ben Shemen Cave 510 str.3 (Perrot and Ladiray 1980: fig.125:9,13) H. al-Ghuzlan (Khalil et al. 2003: fig.16:2) Shoham cave 4 (Commence 2005: fig.6.10:16,17)	EB Ia Chal/EB Trans Chal/EB L Chal	
9	500.x.7p2	H. al-Ghuzlan (Khalil et al. 2003: fig.16:2)	Trans Chal/EB	
10	500.x.1p21	H. al-Ghuzlan (Khalil et al. 2003: fig.16:1) Lachish (Tufnell 1958: pl.56:34, 57:52) Wadi Burma NTU102 (Fujii 2005: fig. 21-42) Halif terrace 101 (Dessel 2009: pl.13:13, 8)	Trans Chal/EB EB Ia1 EB Ia EB Ia+early Ib	
11	500.x.4p8	Lachish (Tufnell 1958: pl.56:34, 57:52) Ben Shemen Cave 510 str.2 (Perrot and Ladiray 1980: fig.125:11) H. al-Ghuzlan (Khalil et al. 2003: fig.16:2) H. al-Ghuzlan (Khalil et al. 2003: fig.16:3) Halif terrace 101 (Dessel 2009: pl.13:12, 14:7, 16)	EB Ia1 Chal/EB Trans Chal/EB L Chal+EB Ia	
12	500.x.5p5	H. al-Ghuzlan (Khalil et al. 2003: fig.16:3) Halif terrace 101 (Dessel 2009: pl.14:14)	Trans Chal/EB L Chal	
13	500.x.7p15	En Besor Site H. (Gophna 1990: fig.3.2)	EB Ia	
14	500.x.4p11	W. Fidan site 4 (Adams and Genz 1995: fig.3:4) Ben Shemen Cave 510 str.3 (Perrot and Ladiray 1980: fig.125:10) H. al-Ghuzlan (Khalil et al. 2003: fig.16:1) Halif Terrace, stratum III (Alon and Yekutieli 1995: fig.23:17,20)	L Chal Chal/EB Trans Chal/EB EB Ia1	
15	500.x.1p9	W. Fidan site 4 (Adams and Genz 1995: fig.3:4) H. al-Ghuzlan (Khalil et al. 2003: fig.16:1) Ben Shemen Cave 510 str.3 (Perrot and Ladiray 1980: fig.125:10) Halif Terrace, stratum III (Alon and Yekutieli 1995: fig.23:17,20)	L Chal Trans Chal/EB Chal/EB EB Ia1	
16	500.x.5p12	W Faynan 100 (Wright et al. 1998: fig.9:1)	EB I	Also thinned rim
17	500.x.5p2	W Faynan 100 (Wright et al. 1998: fig.8:4)	EB I	same impression outside

Table 4.10 Cups

grape juice (Dessel 2009: 102). Their morphological and technical uniformity suggests a similar use for all cups. The presence of grape in the Terminal Chalcolithic period would, however, be surprising (Rowan and Golden 2009: 25).

The standard type of EB I cup is, however, different from the examples discovered here. Although good parallels are rare, some very similar cups have been found. These parallels have mainly been dated by their excavators to periods bordering on either side of the transition from the Late Chalcolithic to EB I period. Good parallels were discovered amongst the group of sites in the south-western coastal plain that are claimed to belong to a very early phase of the EBA Ia (Braun 2000; Yekutieli 2001). A group of six similar cups has for example been found in the early EB Ia stratum of the Tel Halif terrace ‘silo site’. This is one of the sites where there is a stratigraphic continuity from the Late Chalcolithic to the Early Bronze Age I period (Alon and Yekutieli 1995: fig.23:16,17, 20:23). Another group of cups that demonstrates some close parallels has been found in the upper strata of burial cave 510 at Ben Shemen (Perrot and Ladiray 1980: fig. 125:6-16). In these strata holemouth jars with impressed ledge handles, which would seem to date to the EBA, have been found together with typical Chalcolithic fenestrated stands and jar ossuaries.

Judging by the pottery, the upper layers of cave 510 might either be very late Chalcolithic or they form a mixed Late Chalcolithic – EBA assemblage. Almost identical cups have been discovered in the excavation of Hujayrat al-Ghuzlan in the southern Arabah Valley near ‘Aqaba. This site has been dated by the excavators to the transitional period from the Late Chalcolithic to the EBA I period (Görsdorf 2002: 336; Khalil et al. 2003: 159). A similar assemblage with two cups has been discovered in the Wadi Faynan at site 100 (Wright et al. 1998). This site has been generally dated to the EB I period, but considering the similarity to the more extensively excavated and radiocarbon dated sites near ‘Aqaba it is likely that this site should be dated to the early part of the EB I period as well.

Circular necked jars

This type of rounded or circular necked jar also occurs in both the Late Chalcolithic and the EB I periods. Late Chalcolithic examples have been found at Gilat, Ben Shemen, and Abu Matar (see table 4.11), while EB I examples occur at neighbouring sites like Tell ‘Umm Hammād or Handaqq N or further away e.g. Afridar area J or Azor. They are well represented in Proto Urban (EB Ia+b) Jericho (see table 4.11).

This type of flaring necked jar occurs in both the Late Chalcolithic and the EB I periods. It is however not the common type in either period. Many Late Chalcolithic short necked jars have a thickening inside the neck, whereas EB I jars tend to have a carination between the flaring neck and the shoulder, often referred to as necked jar, instead of a round curve between neck and shoulder, e.g. at Bab edh-Dhra’.

During the later part of the EB I period this type of circular neck is slowly superseded by other types of necked jars, although this type continues to occur occasionally. This type of jar seems to be most common during the Late Chalcolithic and EB I periods, although these are not the only periods in which it occurs. Apart from a chronological demarcation there may also be a

No.	Sherd no.	Parallels	Date	Remarks
1	500.x.1p5	H. al-Ghuzlan (Khalil et al. 2003: fig.19:7) Afridar area J str.4 (Baumgarten 2004: fig.11.8:11)	Trans Chal/EB EB Ia	
2	500.x.2p9	H. al-Ghuzlan (Brückner et al. 2002: fig.20:13) Handaqq N bulldozer cut str.V (Mabry 1996: fig.8:3)	Trans Chal/EB EB Ia/b	
3	500.x.2p14	H. al-Ghuzlan (Brückner et al. 2002: fig.20:9) Halif terrace Silo site str. III (Alon and Yekutieli 1995: fig.23:3)	Trans Chal/EB EB Ia	
4	500.x.7p17			
5	500.x.2p4	Gilat (Commenge et al. 2006: fig.10.22:4) Shoham cave 4 (Commenge 2005: fig.6.27:4-7,9) Azor Instal. C (Perrot and Ladiray 1980: fig.74:11) Tell ‘Umm Hammād stage 2+3 (Helms 1992c: fig.179:3+206:1-4) Afridar Area J str.4 (Baumgarten 2004: fig.11:7)	L Chal L Chal EB Ia EB Ia+b EB Ia	
6	500.x.4p12?	Shoham cave 4 (Commenge 2005: fig.6.27:4-7,9) Tell ‘Umm Hammād 2/7-9 (Helms 1992c: fig.179:3)	L Chal EB Ia	
7	500.x.3p1			
8	500.x.5p8	Nahal Qanah (Gopher and Tsuk 1996a: fig.4:4) Shoham cave 4 (Commenge 2005: fig.6.27:4-7,9) Azor Instal. C (Perrot and Ladiray 1980: fig.74:11) Tell ‘Umm Hammād stage 2+3 (Helms 1992c: fig.179:3+206:1-4) Afridar Area J str.4 (Baumgarten 2004: fig.11:7)	L Chal L Chal EB Ia EB Ia+b EB Ia	
9	500.x.3p3	H. al-Ghuzlan (Brückner et al. 2002: fig.20:9)	Trans Chal/EB	
10	500.x.6p8	Shoham cave 4 (Commenge 2005: fig.6.27:11) Afridar area J str. 8 (Baumgarten 2004: fig.10:8) Tell ‘Umm Hammād 2/7 (Helms 1992c: 177:8+179:5)	L Chal EB Ia EB Ia	
11	500.x.1p1	c. Handaqq N bulldozer cut str. VII (Mabry 1996: fig.8:1)	EB Ia	Not exact
12	500.x.1p10	Abu Matar (Commenge-Pellerin 1987: fig.50.1-6) Shoham cave 4 (Commenge 2005: fig.6.27:4-7,9) Azor Instal. C (Perrot and Ladiray 1980: fig.74:11) Tell ‘Umm Hammād stage 2+3 (Helms 1992c: fig.178:3+206:1-4) Afridar Area J str.4 (Baumgarten 2004: fig.11:7)	L Chal L Chal EB Ia EB Ia+b EB Ia	

Table 4.11 Circular necked jars

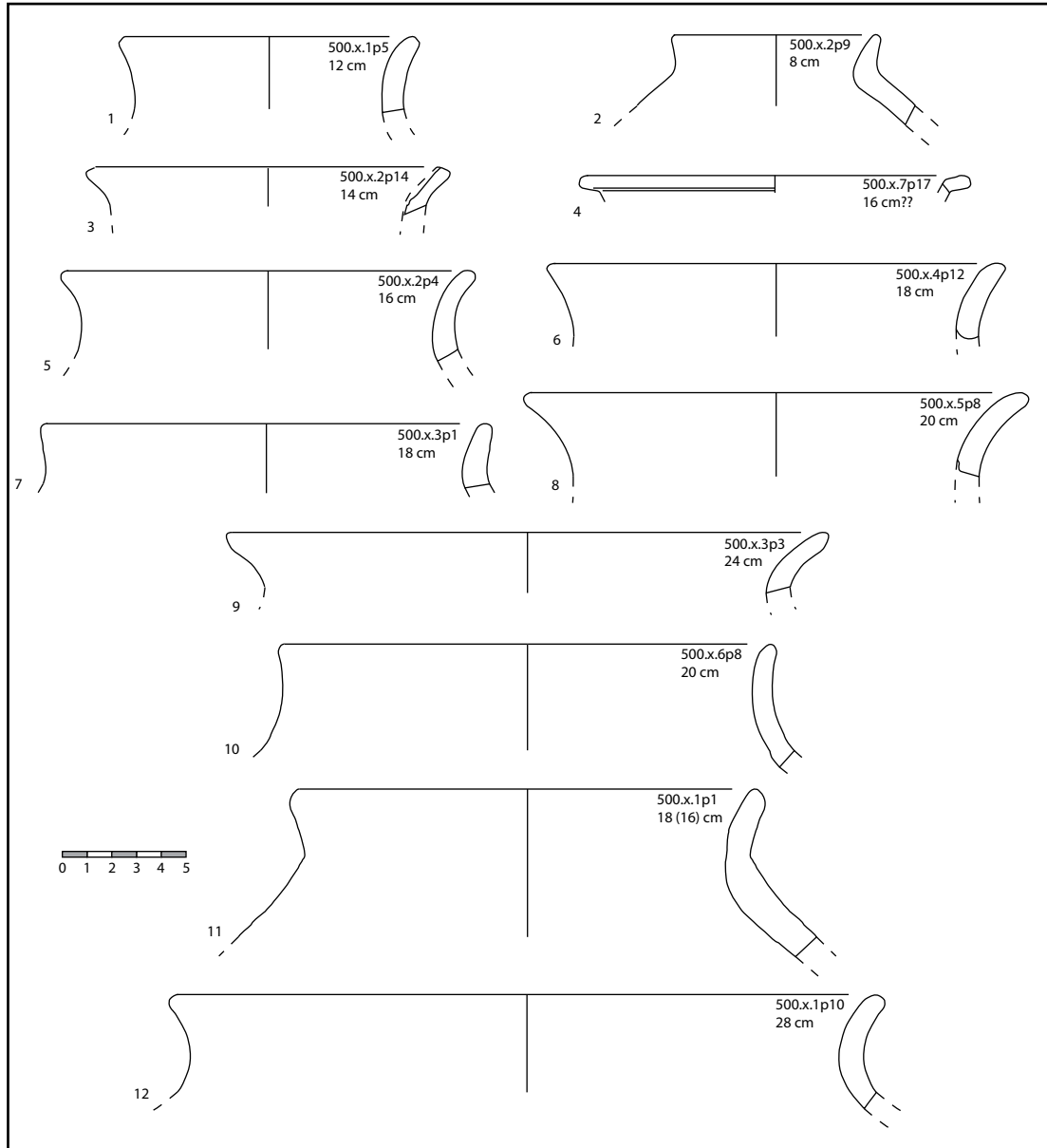


Figure 4.32 Circular necked jars

regional difference. At the Late Chalcolithic site of Tuleilat Ghassul no flaring necked jars have been found (Lovell 2001). Furthermore, some Early Bronze Age sites that have revealed parallels for other categories, like Bab edh-Dhra', Pella, Afridar areas E, F, G and Azor, lack this category (e.g. Bourke 1997; Golani and Van den Brink 1999; Rast and Schaub 2003). At tell Shuneh N the rims are often so fragmented that it is impossible to say whether they belong to the flaring necked type or the common EB I necked jar type. Only two examples are sufficiently complete and these show a round flaring rim similar to examples from this concentration. These sherds date to the transition from Late Chalcolithic to EB I and the EB I period respectively (Gustavson-Gaube 1986: fig.16:58d+g).

Impressed jars

The general shape of these jars resembles the flaring necked jars. This type is distinguished from the previous necked jars by impressions on top of the rim. Eleven impressed jars have been found at this site, forming 15 % of the total assemblage. This type of jar is not commonly found at Late Chalcolithic or EB I sites in the southern Levant, but it does occur in isolated examples. When

published pottery assemblages from excavations were systematically browsed it turned out that many sites, especially those from the Late Chalcolithic but also from the EB I period, contained this type of vessel. However, it generally occurred only in isolation or sometimes in pairs.

One jar, for example, has been found in the Late Chalcolithic phase of Horvat Hani (West) on the western fringes of the Samaria hills (Lass 2003: fig. 18:8). Two examples have been discovered in ossuary cave 510 at Ben Shemen (Perrot and Ladiray 1980: fig. 126:2,3). Single occurrences have been reported from Gilat and Abu Matar

and the Late Chalcolithic strata of Gezer also yielded one vessel (Commége-Pellerin 1987: fig.33:6,8; Commége et al. 2006: pl.10.20:11). Another isolated example has been published for Tuleilat Ghassul (Mallon et al. 1934: fig.52:6). At Tell 'Umm Hammād a single rim of this type has been depicted under the unclassified pottery (Helms 1992c: fig.255:4). This rim stems from one of the earliest layers (phase 7-9 of stage 2) of the site dated to the EB Ia. At Jericho one impressed flaring necked jar was excavated in square M phase XIX and another in phase Qi, both dating to the Proto Urban period (Kenyon 1981: fig.9:25; Kenyon and Holland 1983: fig.113:7). In the southern coastal plain several of the early EB Ia sites have yielded this jar type, e.g. Taur-Ikhbeineh and Nizzanim (Yekutieli 2001). These are, however, all unique examples.

In the entire southern Levant only two sites contained a larger collection of this type of impressed jar. Several examples of this type of impressed jar rim have been found in burial cave 4 at Shoham on the coastal plain. At Shoham several burial caves containing ossuaries have been excavated that date to the Late Chalcolithic period. In cave four several necked jars with finger impressions on the rim have been found. The depicted impressed jars all fall within the category of the large jars (diameter 20-23cm) and pithoi (diameter av. 25cm) (Commége 2005: 54). One of the characteristics of the pithoi is that they always have finger impressions on the rim (Commége 2005: 54). Unfortunately it cannot be deduced from the excavation report how many of these jars from cave four had a finger impressed rim, but nine impressed rims of large jars and four of pithoi have been depicted (Commége 2005: fig.26,28). The depicted examples already show the difference in number with other Late Chalcolithic sites. Cave four, in contrast to the other caves that have been dated to the Chalcolithic period, is suggested to stem from either a later phase of the Late Chalcolithic period or from the interface between the Chalcolithic and the EBA (Commége 2005: 60).

The second site where numerous impressed jar fragments have been found is Ashqelon Afridar located along the southern coast of Cisjordan. In most of the different excavation areas several examples of this type of impressed jar have been found. In area E this category makes up 16.4 % of all storage jars. A different, but related category consists of large jars with a vertical neck and an impressed flaring rim forming 27.3 % of the storage jars. This specific type of rim is absent in concentration 500. At Afridar these different types of impressed necked jars together form 60 % of the 55 storage jars. Seen from the perspective of the total ceramic assemblage the impressed jars discovered in field 500 constitute only 2.4 % of the total. Nevertheless, the total of 9 impressed jars represent a marked difference with the presence of only one or two vessels in most other excavations that are of equal size or larger. The other excavation areas of Ashqelon Afridar give no exact information on how many specimens of this jar type were found. Baumgarten, describing area J, speaks of 'many storage jars' and states that 8 of 13 depicted necked jars from area G have impressions on the rim. However, several of these jars have a vertical instead of an everted neck (Baumgarten 2004: 169; Braun and Gophna 2004: fig.19). The strata from which these jars from Afridar derive were all dated to early or even initial phases of the EB I period (Baumgarten 2004: 179; Braun and Gophna 2004: 191; Golani 2004: 48).

The only two sites where considerable numbers of impressed jars were found were dated either to the final Chalcolithic or to the transitional Chalcolithic/EB period in the case of Shoham cave 4 or the initial EB I period in the case of Ashqelon Afridar. Radiocarbon dates gave a terminus ante quem of 4040-3810 cal. BC for cave 4 at Shoham (Van den Brink and Gophna 2005: 170). Stratum five of area J at Afridar was dated to 3759-3658 cal. BC (Baumgarten 2004: 179). Golani concluded from the radiocarbon dates of Afridar area E that this occupation should be dated between

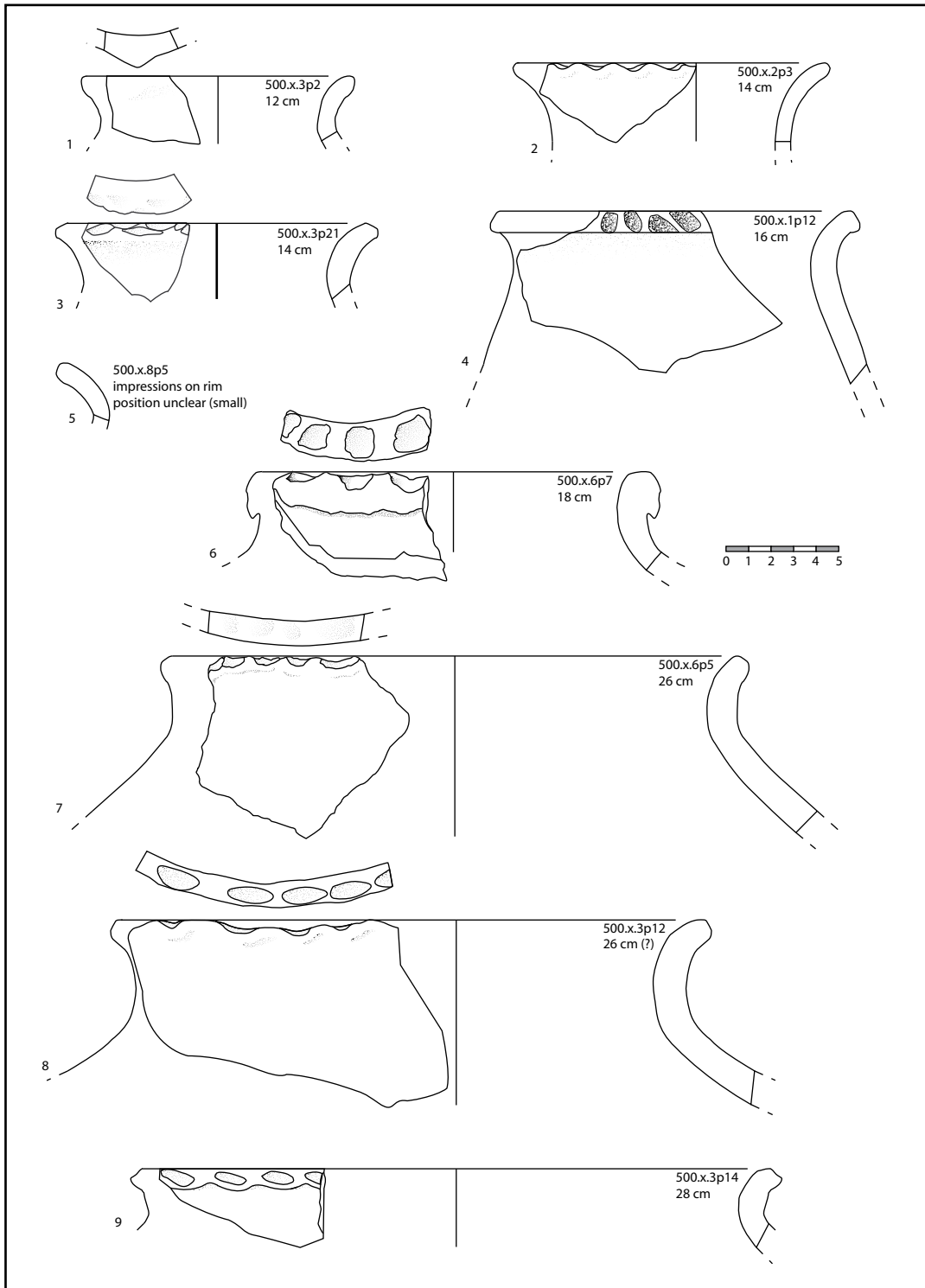


Figure 4.33 Impressed jars

No.	Sherd no.	Parallels	Date	Remarks
1	500.x.3p2			1 protuberance; not impr rim
2	500.x.2p3	c. Afridar E (Golani 2004: fig. 27:8)	EB Ia	
3	500.x.3p21	Afridar J2 str.5 (Baumgarten 2004: fig.10:7)	EB Ia	
4	500.x.1p12	c. Shoham cave 4 (Commence 2005: fig.6.26:2) Tell 'Umm Hammād 2/7-9 (Helms 1992c: fig.255:4) Afridar J1-str 5 (Baumgarten 2004: fig.16:3)	L Chal EB Ia EB Ia	
5	500.x.8p5	Afridar E (Golani 2004: fig. 27:9)	EB Ia	
6	500.x.6p7	Shoham cave 1 (Commence 2005: fig.6.2:10) Taur-Ikhbeineh (Yekutieli 2000: fig.8.6:8) Nizzanim (Yekutieli 2000: fig.8.4:1)	L Chal EB Ia2 EB Ia1	Indents are on side
7	500.x.6p5	Ben Shemen Cave 510-3 (Perrot and Ladiray 1980: fig. 126.2/3) Horbat Hani ph.1 (Lass 2003: fig.18:8) Shoham cave 4 (Commence 2005: fig.6.26:3,4, 28:1) Afridar J2 str.6 (Baumgarten 2004: fig.9:11) Jericho phase Qi (Kenyon 1981: fig.9-25)	L Chal L Chal L Chal EB Ia EB I	
8	500.x.3p12	Abu Matar layer IIa (Commence-Pellerin 1987: fig.33:6,8) Gilat topsoil (Commence et al. 2006: pl.10.20:11) Shoham cave 4 (Commence 2005: fig.6.26:3,4, 28:1) Afridar G (e.g. Braun and Gophna 2004: fig.19:13) Afridar J2 str 5 (Baumgarten 2004: fig.10:7) Azor stratum I (Golani and Van den Brink 1999: fig.5:5) Jericho phase Qi (Kenyon 1981: fig.9-25)	L Chal L Chal L Chal EB Ia EB Ia EB Ia EB I	but ridge inside
9	500.x.3p14	Shoham cave 4 (Commence 2005: fig.6.26:9, 28:1) Azor tomb 510 layer 3 (Perrot and Ladiray 1980: fig. 126.2/3)	L Chal EB Ia	

Table 4.12 Impressed jars

3800 and 3500 cal BC (Golani 2004: 46).³⁷ Three ¹⁴C dates taken from stratum 1 and 2 of area G dated between *c.* 3900 and 3540 cal BC (2 σ) and most probably date between 3800-3630 cal BC (Braun and Gophna 2004: table 1).³⁸ It is at least remarkable that both sites that yielded this type of pottery in higher than average numbers date to the time period around the transition from Late Chalcolithic to EB I period. Nevertheless, it should not be forgotten that examples of this type of jar have been found in proper Late Chalcolithic and EB I contexts as well. It should, furthermore, be noted that this type of jar is absent at Hujayrat al-Ghuzlan near 'Aqaba, which was also dated to the transitional period, i.e. 4040-3640 cal BC (Görsdorf 2002: 336). This may suggest that the occurrence of this type of jar was a regional phenomenon that did not reach all areas of the southern Levant. However, similar impressions on other jar types and on bowls were very common in this southern area (e.g. Wright et al. 1998; Brückner et al. 2002; Khalil et al. 2003).

Jar 500.x.6p7 stands out from the other jars. It has a short neck and folded rim with impressions on top of the rim. At Taur-Ikhbeineh a storage jar has been found that has a folded rim and impressions not on top of the rim but on its side (Yekutieli 2001: fig.8.6:8). A very good parallel is, however, present at Shoham in cave 1, which was dated to earlier phases of the Chalcolithic period (Commence 2005: fig.6.2:10). This stands in contrast to most of the other parallels at Shoham that all stem from cave 4 (Commence 2005: 60).

Ledge handles

Ledge handles are of course one of the hallmarks of the EBA. However, they sometimes already occur in the Late Chalcolithic period. In field 27 one ledge handle (27.3.3.p7) has, for example, been found among many loop handles (see figure 4.16). Morphologically one of the discovered handles (500.x.7p4) is of the simple unimpressed type that occurs in the Late Chalcolithic pe-

37 The uppermost date of Afridar area E dated between 3405-3385 cal BC with 11 % probability and within the range 3629-3507 with 89 % probability (RT-2219). The lowermost date stemmed from the period between 4081 and 3805 cal BC with 96 % probability (RT-2634) (Golani 2004: 46).

38 The 2 σ probability ranges of the three samples from area G were; RT-2644 38-93-3881 (1.9 %) and 3799-3644 (98.1 %), RT-2645 3725-3725 (0.1 %) and 3711-3638 (99.9 %), RT-2647 3704-3632 (89 %) and 3559-3539 (11 %) cal BC (Braun and Gophna 2004: table 1).

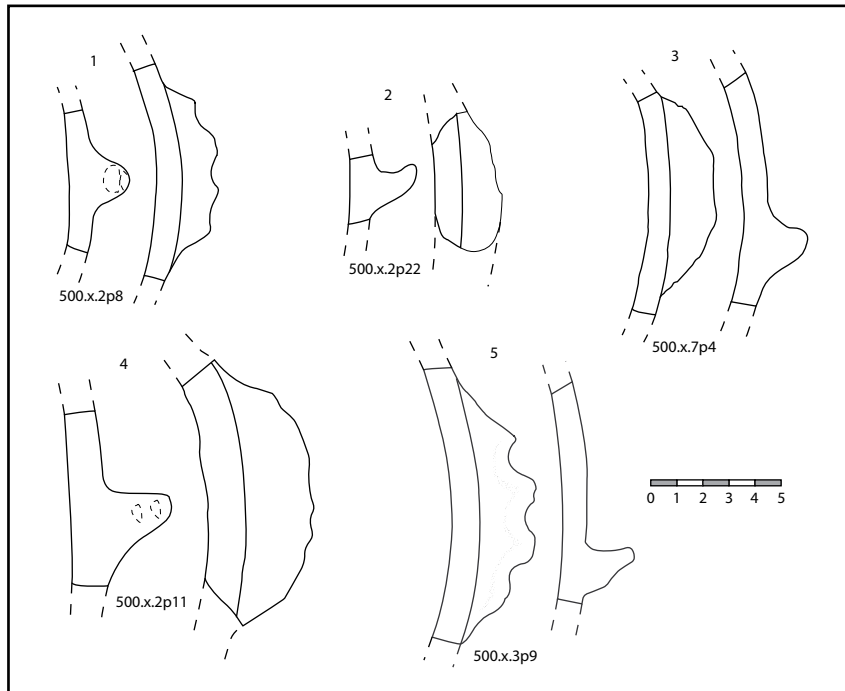


Figure 4.34 Ledge handles

No.	Sherd no.	Parallels	Date	Remarks
1	500.x.2p8	Shoham cave 4 (Commence 2005: 6.29:1) H. al-Ghuzlan (Khalil et al. 2003: fig.18:2,6) Afridar area G (Braun and Gophna 2004: fig.22-7/9) Beth Shean str. XVII (Braun 2004: fig.3.9-11,13,14)	L Chal/trans Trans Chal/EB EB Ia Early EB I	
2	500.x.2p22	Afridar area E (Golani 2004: fig 29-9/10) Jericho (Kenyon and Holland 1983: fig.12:19)	EB Ia EB I (PU)	
3	500.x.7p4	H. al-Ghuzlan (Khalil et al. 2003: fig.18:1,4,5) Field 27	Trans Chal/EB L Chal	
4	500.x.2p11	H. al-Ghuzlan (Khalil et al. 2003: fig.18:5) Lachish cave 1537 (Tufnell 1958: pl.11-14/15) Afridar area G (Braun and Gophna 2004: fig.22-8)	Trans Chal/EB EB Ia EB Ia	
5	500.x.3p9	Azor Inst. C (Perrot and Ladiray 1980: fig 75-2) Afridar area G (Braun and Gophna 2004: fig.22-6)	EB Ia EB Ia	

Table 4.13 Ledge handles

riod. The complete lack of loop handles prohibits a dating to the Late Chalcolithic period based on these handles. The other ledge handles have either large or small impressions on their edges. The Tell 'Umm Hammād publication shows several ledge handle types excavated from EB Ia layers. The five ledge handles collected from site 500, however, do not bear any resemblance to these types. Better parallels can be found in the very early EB Ia of Tell Afridar, Lachish or Azor Installation C, Shoham cave four and Hujayrat al-Ghuzlan (see table 4.13).

Bases

Bases in both the Late Chalcolithic and the EB I period are flat based like all the examples found in this concentration. Bases are notoriously difficult to date. The bases depicted here would all fit within both periods. Braun has defined some technological distinctions between the Late Chalcolithic and EB I bases (Braun and Gophna 2004: 202). The bases described here are, unfortunately, too small or too badly worn to show the features described by Braun. Only base 500.x.2p10 shows that the wall was built up on a flat base by adding coils.

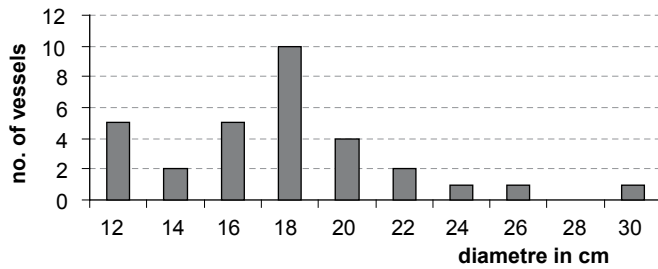


Figure 4.35 Diametre distribution of the bases

A total of 31 bases has been discovered of which the majority has been depicted. In figure 4.35 the diameter of the bases has been scored. Although in some instances the edge of the bases was sufficiently sharp to establish its diameter to the nearest centimetre, in general diameters had a lower precision. From this table it is clear that there is a group of small bases with a diameter of 12 cm followed by a decrease in number. A second and larger group of vessels has a diameter around 18 cm which decreases slowly until the largest base discovered in this concentration which has a diameter of 30cm. This distribution indicated that the difference in size of the bases is not very large. Moreover the group of small bases consists for the largest part of vertically walled bases that are uncommon in the standard Late Chalcolithic and EB I assemblages (e.g. 500.x.4p3, 500.x.8p7 and 500.x.7p9) (see below).

What is noticeable is that about half of the bases have a small heel at the border between base and wall, while others have a straight corner. In the sherds without a heel an additional step in the manufacturing process was taken to purposefully remove the heel. All walls stand at an angle of between 55° and 72° to their base. The majority of walls are straight, only three have a rounded profile (500.x.5p1, 500.x.7p1, 500.x.7p12). Good parallels for this base type have been found at Hujayrat al-Ghuzlan, but can undoubtedly be found at additional sites (Brückner et al. 2002: fig.21:7, 10). Apart from these small differences the bases are all very similar.

The four vertical walled bases (500.x.4p3, 500.x.8p7, 500.x.7p9 and 500.x.2p16) form an exception (see figure 4.36). These bases are rare in pottery assemblages from this period. The only parallel can be found in the pottery assemblage of al-Rweihah as published in the Tell 'Umm Hammād volume. Unfortunately, this is a surface collection. The pottery from this site has been dated to the EB I period, a date that is corroborated by the present survey (see below). Base 500.x.7p9 has slightly incurving walls. The only two sherds uncovered with a similar position have been found in Afridar area F. These vessels are, however, open cylinders that have no base. It is possible that they were closed by separate ceramic discs discovered in the same stratum (Khalaily 2004: 142). Further parallels have not been found.

Miscellaneous

Equally vertically walled is rim 500.x.5p7. It bears some resemblance to a stand from Tell Shuneh N (Gustavson-Gaube 1986: fig.17:77), dating to the EB Ia period. A second parallel was found in the assemblage of Shoham cave 4, but this is also only a rim without indications of the shape of the rest of the vessel (Commence 2005: 6.1:3). No other parallels have been found. It can, however, be easily imagined that this is the rim of the vertical walled type bases. Apart from the shape of the wall there is however no evidence to prove this idea.

No.	Sherd no.	Parallels	Date	Remarks
1	500.x.5p7	Shuneh N (Gustavson-Gaube 1986: fig.17:77) Shoham (Commence 2005: 6.1:3)	EB Ia L Chal	
2a-b	500.x.4p3/500.x.8p7	al-Rweihah (Betts 1992b: fig.260-10)	EB I	
3	500.x.7p9	Afridar area F (Khalaily 2004: 16-1/2)	EB Ia	these are cylinders without base.
4	500.x.2p16	al-Rweihah (Betts 1992b: fig.260-10)	EB I	

Table 4.14 Parallels for the vertically walled bases

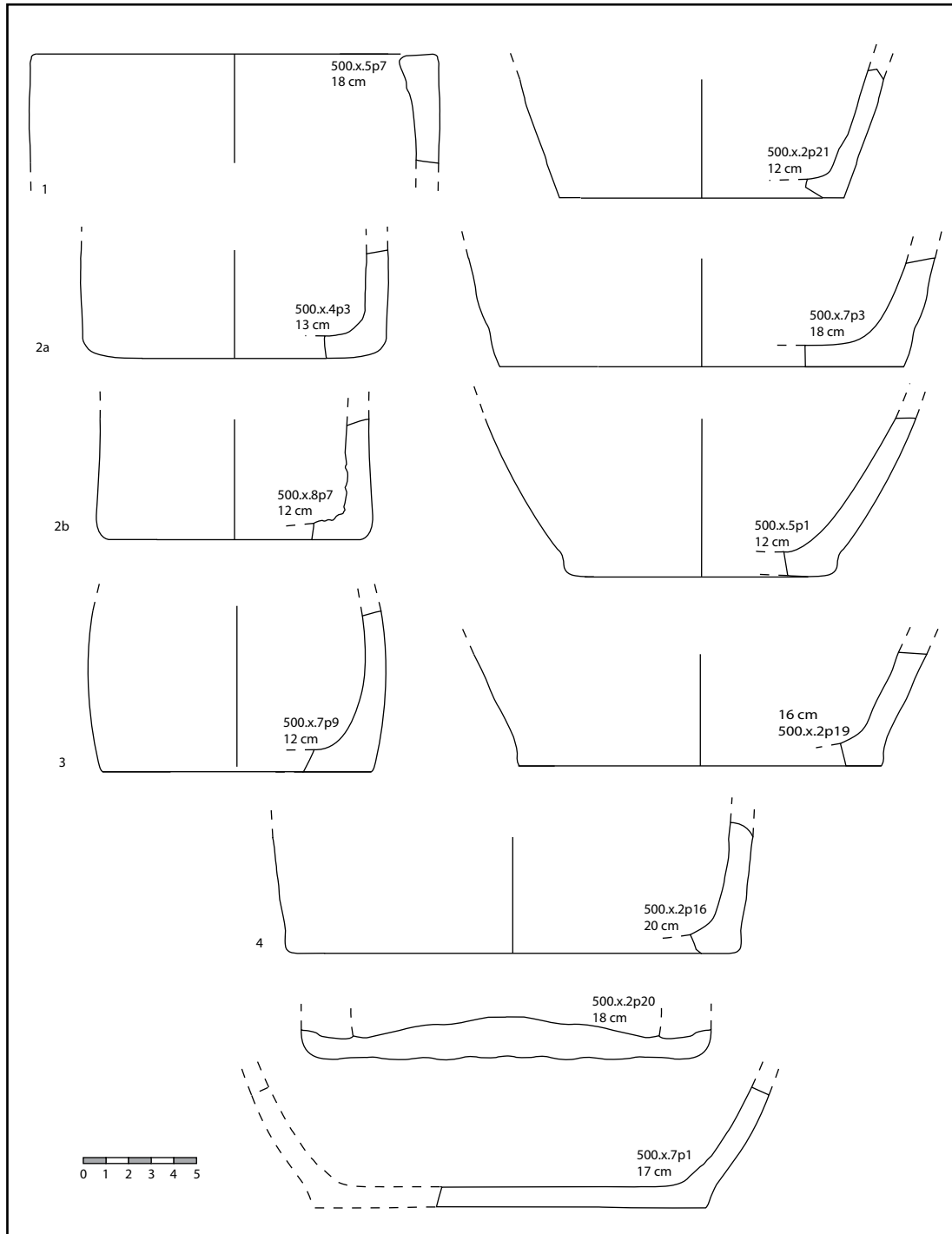


Figure 4.36 Bases

Pottery production

Michel de Vreeze examined the fabric of a sample of 18 sherds (internal report 2008).³⁹ This small sample seemingly incorporated four different ware groups together with a few unique examples. The first group consists of a light yellowish clay with calcite as dominant temper. This ware resembles the Late Chalcolithic pottery of field 27. The second group is light greenish yellow, has a poor sorting and was tempered with mainly iron-oxide, limestone and quartz sand. Group three

³⁹ A modified version of this report is published in the *Leiden Journal of Pottery Studies* 24 (Kaptijn and De Vreeze 2008).

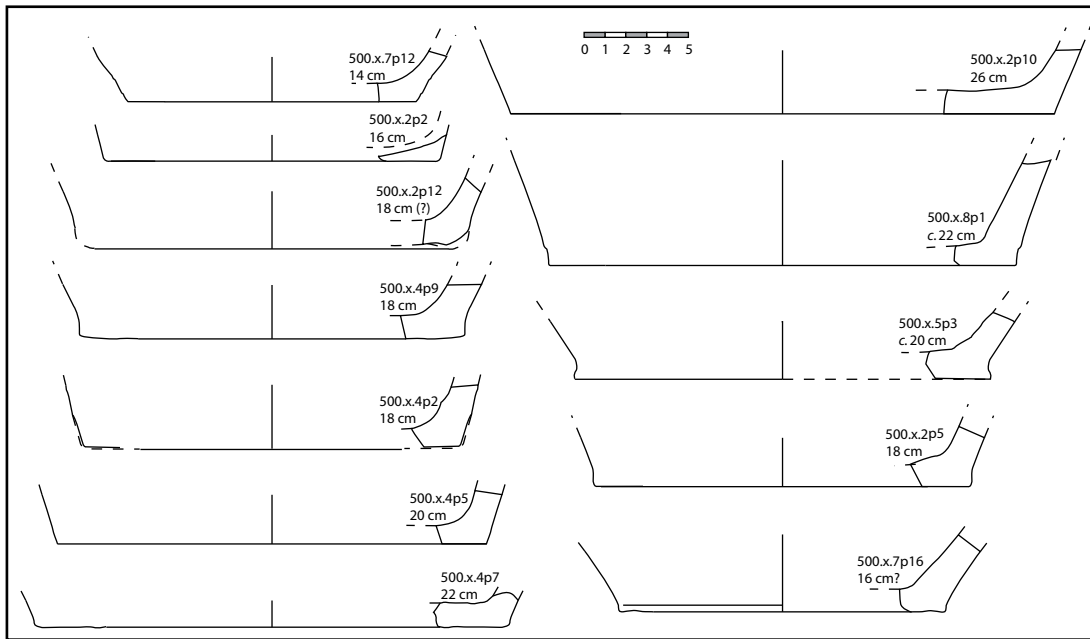


Figure 4.37 Bases

is made of a reddish clay with limestone as predominant temper and lower quantities of iron-oxide, calcite and quartz sand. Organic temper is consistently present in this group. The last group, number four, is more heterogeneous and consists of a deep red to purplish clay that is highly ferruginous. Iron-oxide and limestone are the dominant types of temper in this poorly sorted matrix. Three of the four main groups, one, three and four, showed further subdivisions (Kaptijn and De Vreeze 2008).

Many sherds, especially of group 4, had a purple, overfired, almost sintered appearance suggesting high firing temperatures. Refiring experiments showed that the vessels were originally fired under a reduced atmosphere at temperatures around 900° C. or even slightly higher. This is high, especially as refiring of a few sherds from the concentration in field 27 showed that these Late Chalcolithic sherds were fired at temperatures between merely *c.* 700° and 750° C. The purple, brittle, almost sintered appearance of the field 500 sherds can be explained by the presence of iron-oxide. Iron-oxide might start to flux at temperatures around 800° to 900° C. under reducing circumstances (Rice 1987: 94). The calcite tempered wares of group 1 that resemble Late Chalcolithic pottery of field 27 were not fired under such high temperatures as lime-spalling would cause vessels to break. The potters of the field 500 assemblage were aware of the fact that these wares required different firing techniques, as both are well fired for their specific ware.

Group four was the most ubiquitous group forming a third of the entire assemblage, followed at some distance by the calcite tempered group 1. The distribution of the different ware groups over the various vessel forms generates a few general remarks. However, for a detailed overview of the correlations between form and ware one is referred to the forthcoming article. The cups are characterized by several unique fine tempered wares ($n = 10$), although a few examples are made of wares two ($n = 2$), three ($n = 1$) and four ($n = 2$). This high number of unique wares stands out compared to the other vessel forms that only have one or two wares that did not bear resemblance to the identified ware groups. The holemouth jars had a large proportion of ware 1 vessels ($n = 6$) compared to three vessels of ware four and one of ware 2. The bowls on the other hand consisted mainly of ware 4 vessels ($n = 11$), but there were also three vessels of ware 1, four of ware 3 and one of ware 2. In the necked jars the ware 4 also predominated, while the other groups only had one or two specimens. The same applies to the impressed necked jars: group 4 contained four vessels, but here a similar number was found in group 3, i.e. three. The ledge handles were more or less equally distributed over the ware groups. However, numbers were low in all categories and conclusions must therefore be treated with great care. Some vessel forms seem to demonstrate a

slight preference for a certain ware group, e.g. half of the bowls belonged to ware group 4 and a large proportion of the holemouth jars belonged to group 1. However, in general all ware groups were present in a certain form category. Sometimes a certain ware group was absent but this seemed to be more related to the low sample size than to a clear avoidance of a ware for a certain vessel category. Ware group three was for example absent among the holemouth jars but it was represented by only a single sherd in the necked jars, cups and ledge handles. If future research allows more sherds to be analyzed these classes will undoubtedly change.

Ware group	No. sherds
1	20
2	6
3	14
4	34
individual	15
?	13
total	102

Table 4.15 Distribution of ware groups

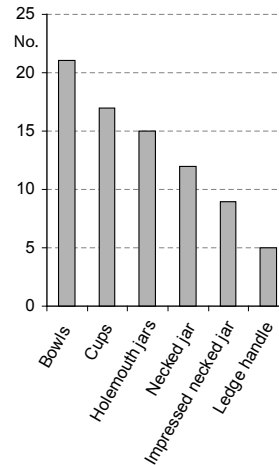


Figure 4.38 Distribution of vessel types

Flint

The flint assemblage lags far behind the ceramic assemblage in size. A mere 27 flint artefacts were found.⁴⁰ As the blocks were surveyed in a random fashion collecting only diagnostic artefacts, the flint artefacts consist only of tools (n=21), except for a few mistakes in the field. It is remarkable that of the 21 tools 18 are blades and only three non-blade tools were found. The non-blade tools were all tabular scrapers. The few (n=6) non-tool flint artefacts collected are blades. A large number of the blades belongs to the Canaanite type (14 Canaanite vs. 10 non-Canaanite blades). Canaanite blades are generally considered to be the hallmark of the EBA (Rosen 1997: 46). They appear in significant quantities during the EB I period and continue as the dominant form of sickle blade into the MB I period after which they disappear. Recent excavations have, however, revealed that a sort of proto-Canaanite blade already existed in low numbers in the Late Chalcolithic period at e.g. Gilat, and Gat Guvrin and in several burial caves (Van den Brink and Gophna 2005: 170; Rowan 2006). This shows that the technological change needed to produce longer and wider blades already started before the EBA pointing to another aspect of material culture where continuity between the two periods is visible.

Figure 4.39 shows that the blades discovered can be divided into non-retouched blades, retouched blades and blades with sickle gloss. Given that there is no direct evidence that the non-retouched blades were used, they are grouped under the heading debitage, but that does not mean they might not have been used. Non-retouched blades with sickle gloss do occasionally occur. The retouched blades have received additional finishing and were hence probably used. Without microscopic use wear analysis, use can only be evidenced by heavy gloss present on the working edge visible to the naked eye. The artefacts that have this gloss are referred to as sickles.

There is only one non-Canaanite blade with sickle gloss. This is a long, non-truncated knife with gloss and retouch on one lateral side, partial retouch on the other lateral side and an intact striking platform. Given its length it was probably not hafted. The Canaanite sickles break up into sickle segments, meaning they are truncated, and long reaping knives. The sickle segments were hafted into a larger composite sickle, while the reaping knives were used without modifications.

⁴⁰ A detailed description of the flint artefacts can be found in the EDNA databases.

Tools	No.	
Blades	Retouched blade	6
	Canaanean retouched blade	5
Sickle blade	Sickle blade	1
	Canaanean sickle segment	4
	Canaanean reaping knife	2
Scraper	Tabular scraper	3
Debitage	Blade	2
	Canaanean blade	4

Table 4.16 Numbers of flint tools and debitage discovered

The non-Canaanean retouched blades are a diverse group. No backed blades typical for the Chalcolithic period have been found. Within this diverse group there is for example a small fragmented blade with large denticulates on one side and cortex on the other lateral side (500.x.6f5). There is also a slightly rounded blade with regular retouch on one side and irregular retouch on the other (500.x.6f4). A third tool is a thick blade with abrupt retouch (500.x.8f1). This tool can also be considered as a bifacial knife or a borer similar to examples found at Jawa, but both ends have broken off leaving only a small fragment of the original tool (Helms 1981: fig.B7:8). Three blades retain cortex on one of the dorsal sides. On two of these the lateral side with cortex has been retouched exposing the flint underneath (500.x.1f6 and 500.x.1f1). The other blade has been retouched on the non-cortex side (500.x.6f3). The retouch on this blade is quite deep and it seems that the cortex was intentionally thinned leaving only the remnant visible (see figure 4.39).

Retouch on both lateral sides occurs on one blade, four Canaanean blades, one Canaanean sickle segment (see figure 4.39) and one Canaanean reaping knife. Retouch on both sides suggests that both faces were at certain moments in time used as working edge. Rosen notes that up to 40 % of the Canaanean sickle segments show such a reversal of the flint segment in its haft (Rosen 1997: 49). One blade, a Canaanean sickle segment (500.x.5f1), also shows gloss on both lateral sides directly evidencing its actual use in cutting grasses.

No cores have been discovered at the site. A lack of Canaanean blade cores is typical for excavated EBA sites. This points to a non-local production of these blades, but the low number of artefacts discovered at this site prohibits a definite conclusion. The majority of Canaanean blades in the southern Levant is made from high quality fine-grained Eocene flint (Rosen 1997: 107). Almost all blades discovered in this concentration are made from this Eocene type of flint. It differs markedly from the small nodules of spotted brown or grey flint that are widely distributed throughout the research area and used for ad hoc tools (see later sections). These small flint nodules originate from Cretaceous rock found in the hills on both sides of the Jordan Valley. The Eocene flint, however, is not as abundant in the valley. The nearest outcrop of Eocene rock is found nearby at the mouth of the Wadi Far'ah on the other side of the river Jordan. Other sources of Eocene flint are located much further away, e.g. in the hills to the south-west or along the Yarmouk River in the north (Horowitz 2001: fig.3.2.2).

Rosen concludes from the absence of cores in settlements, the almost exclusive use of Eocene flint occurring in a restricted number of areas, and the discovery of caches of unfinished blades from the same core that Canaanean blade production was a specialized activity (Rosen 1997: 107). Specialized villages produced blank Canaanean blades that were distributed throughout the region and retouched by the user. Several of these distribution systems existed extending outwards from the regions where large Eocene flint nodules could be found (Rosen 1997: 108). If this view is accepted it is likely that Naghme and other EB sites in the Zerqa triangle fell within the distribution area of villages west of the Jordan where the Wadi Far'ah enters from the hills. However, no excavated sites have been sufficiently published to verify this hypothesis.

The only non-blade flint artefacts recovered are three tabular scrapers. Tabular scrapers are large flat scrapers with cortex on the dorsal face. They first appear during the Pottery Neolithic period but are most dominant during the Chalcolithic and the early part of the EBA. They disap-

THE SURVEY RESULTS

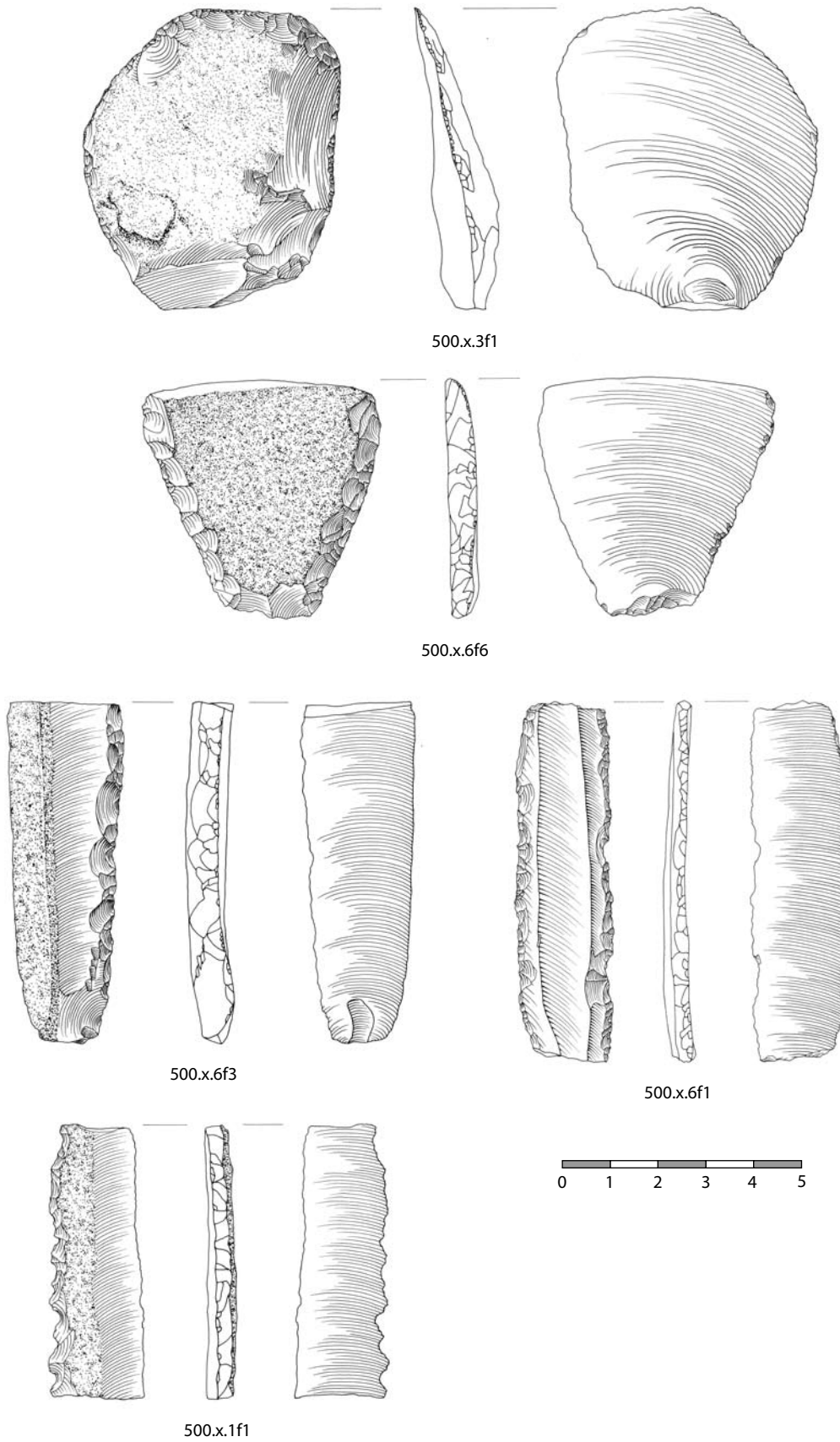


Figure 4.39 Selection of flint tools

pear from the assemblage in the EB III period (Rosen 1983b: 80). These tools are made from large tabulated Eocene flint boulders occurring in a restricted area in the Negev and Sinai. The only production sites of tabular scrapers have been found in this southern region, e.g. Har Qeren 15 (Rosen 1983b: 80). Recently a group of large production sites of blanks for fan scrapers, e.g. tabular scrapers, has been discovered in the al-Jafr basin of south-eastern Jordan (Quintero et al. 2002). This discovery has filled the long sought-after gap in south-eastern Jordan, where the specific type of flint needed was available but where until this discovery no production sites had been located. At the Gaza A site evidence of secondary tabular scraper production has been discovered. A total of 77 tabular scrapers in various stages of the production process have been found. Cores and core waste were, however, absent. This site should probably be considered as a workshop where tabular scraper rough-outs were finished (Rosen 1997: 105). The percentage of tabular scrapers in flint assemblages at settlements decreases towards the north in the EBA. It has been suggested that this distribution is the result of simple indirect or 'down the line' trade of tabular scrapers from their production centres located in the western Negev and Sinai (Rosen 1983b: 82).⁴¹ The high percentage of 20-25 % tabular scrapers discovered at Jawa in northern Transjordan does not fit Rosen's falloff curve (Betts 1991: 141, 143). This exception shows there is more differentiation than often supposed and might argue for other production sites in areas with Eocene flint.

Two of the three tabular scrapers collected at site 500 were complete. Tool number 500.x.6f6 is a carefully worked triangular tabular scraper. Although most tabular scrapers are round or oval, other shapes like e.g. triangular do occur. The cortex on scraper 500.x.6p6 seems to have been intentionally thinned leaving a very regular smooth surface. Scraper 500.x.3p1 is less prototypical. The cortex on the dorsal side has a slightly irregular surface and the flake itself is much thicker than 500.x.6p6. Furthermore, its retouch is not as evenly spaced as on other tabular scrapers and does not extend along the entire edge of the tool. The common removal of the bulb of percussion has not been carried out on this item and the striking platform is still present. Nevertheless, its oval shape, dorsal cortex and type of retouch make that this scraper definitely belongs to the tabular scrapers. This irregular, non-typical scraper does not stand alone, however. Several examples that do not fit the general categories have been discovered (Rosen 1997: 74). The third tabular scraper (500.x.1p5) is broken. Nevertheless, two opposed working edges have been preserved showing that this was originally a narrow tool given the limited distance of 3.2 cm between the fairly parallel edges. Apart from its small size this fragment has all the characteristics of a typical tabular scraper; a flat surface with dorsal cortex, limited thickness, regular semi-abrupt retouch and fine-grained brown Eocene flint. In contrast to what their name suggests, these tools were probably not used as scrapers, but as butchering knives. Microwear analysis on artefacts from EBA Bab edh-Dhra' have demonstrated this (Rosen 1997: 74). At some Chalcolithic sites there was a connection between tabular scrapers and religion, as several were discovered in areas interpreted as having a religious significance (Rosen 1997: 74; Kaptijn 2003, 2005). There are no indications of such a use at site 500.

Conclusion

As a whole the find assemblage and especially the pottery of this concentration is enigmatic. The holemouth jars, V-shaped bowls and tabular scrapers perfectly fit the Late Chalcolithic. The ledge handles, cups and Canaanian blades, however, seem to suggest a date in the EB I period. Other pottery classes, like the impressed necked jars, have their best parallels at transitional period sites, but are present in both the Late Chalcolithic and EB I period proper. This double occurrence holds true to a certain extent for all finds. The holemouth jars, V-shaped bowls and tabular scrapers continue into the EB Ia period. Ledge handles, cups and Canaanian blades have occasionally been found in securely dated Chalcolithic contexts.

This would suggest that this concentration dates to either one or both of these periods. The problem is, however, that for both the Late Chalcolithic and the EB Ia period very common vessel types are missing. This is clear when the concentration under discussion is compared to the Late

41 The same mechanism has been supposed for the Chalcolithic period (Rosen 1983b: 82), but the number of tabular scrapers discovered is too small to infer such a system.

Chalcolithic concentration in field 27 elaborated on in the previous section or the EB Ia concentrations of the following two sections. Chalcolithic types like churns, pedestalled bowls, cornets, loop handles or the large pithoi with several bands of coarse impressions are missing. Comparably, EB Ia vessels, like the everted rim bowl, grey burnished ware, and more diverse range of ledge handle types are absent. This makes it impossible to interpret this assemblage as a classic example of either of these periods.

A possible cause for the divergent assemblage is a different use of the site. The other concentrations discovered in the survey have all been interpreted as villages where domestic activities took place. The site might, for example, represent a grave context. Late Chalcolithic graves took several different forms. In the coastal plain burials were placed in natural or artificially hewn caves in the kurkar ridges, e.g. Kissufim road, Hadera, and Azor (Perrot and Ladiray 1980; Goren and Fabian 2002). Multiple secondary burials in clay ossuaries were found in these caves. Further to the east in the foothills and the central hill country burials were placed in deep natural caves, like the Nahal Qanah or Peqi'in (Gopher and Tsuk 1996b; Gal et al. 1999). Again several secondary interments in ossuaries were discovered. In the Beersheba area the only formal open-air cemetery was discovered at Me'ad 'Aluf near the Chalcolithic village of Shiqmim (Levy and Alon 1982). Here stone line cists devoid of any bones and single course stone circles with multiple secondary burials were discovered. There is, however, also evidence of a primary burial from the Chalcolithic period. In the Nahal Hemar the so-called cave of the warrior was discovered in which the articulated remains of the deceased were discovered wrapped in a linen cloth (Schick 1998). Burials in Transjordan are rare. These different types of Late Chalcolithic burial, however, have a range of grave goods in common. Similar to this concentration the most common type of artefact was the V-shaped bowl followed at some distance by the holemouth jar. However, both vessel types are also the most ubiquitous in settlement contexts. Other artefacts found were the pedestalled bowl, cornet, and churn, all missing from this concentration. Commenge has compared the relative frequencies of pottery classes of the Shoham caves to that of Chalcolithic settlement sites. It became clear that especially cave 4 has a great many necked jars (>60 %), while the number of holemouth jars is very low (<5 %). Furthermore, pedestalled bowls and churns are present in small numbers (Commenge 2005: fig.6.38). At the settlement sites, similar to this concentration, the bowls are the most dominant group (c. 40-80 %) and the holemouth jars outnumber the necked jars. It seems unlikely, therefore, that the concentration under discussion represents a Chalcolithic cemetery.

EBA graves are equally distinct. The closest EB Ia burials have been excavated at Jericho (e.g. Kenyon 1960). The EB Ia tombs are rather homogeneous and were established in natural caves that were modified by among others the addition of a shaft to facilitate the entrance (Polcaro 2005: 129). Like in the Chalcolithic period, tombs contained multiple secondary burials supplemented by grave gifts. The largest difference with the pottery assemblage of this concentration is the complete dissimilarity of the pottery classes. Bowls and cups at Jericho are all of the hemispherical type (Kenyon 1960: fig.9-11). Holemouth jars are absent and jars take the form of small jugs with either a spout or a large loop handle (Kenyon 1960: 12, 14). At the large cemetery of Bab adh-Dhra' EB Ia graves were man-made shaft tombs containing similar interments as the Jericho tombs (Schaub 1973; Chesson and Schaub 2007: 255). The pottery assemblages of the EB Ia tombs are comparable to that of Jericho. Several bowls of different sizes were discovered including the V-shaped bowl type discovered in this concentration. Other classes included tall necked jars, small jugs, and carinated bowls and jars, all types missing from the field 500 concentration (Schaub and Rast 1989: 234ff, fig. 148). The holemouth jar present in the Naghme' concentration is, again, absent in the graves of Bab adh-Dhra'.

It seems, therefore, that the composition of the assemblage has no good parallels in either burial or domestic contexts of the Late Chalcolithic or EB Ia periods proper. Given the combination of aspects common to either period and because its best parallels are found in sites dated to the transition between the two periods, it is suggested that this concentration should also be dated at the interface between the Late Chalcolithic and the EB Ia period. The affinities with the Late Chalcolithic period are perhaps slightly more clear-cut, but the presence of EB Ia elements cannot

be negated. The nature of this site, domestic, funerary or otherwise, remains problematic by the lack of comparison. The presence of sickles knives and mortars argues in favour of a domestic context, but more information is needed to allow the drawing of firm conclusions.

Fieldno.: 81, continues in fields 299, 300, 307 and 308

Coordinates: 745,890/3,562,575 (centre)

Size: shown in figure

Days and time surveyed: Nov. 20th, 2004, c. 9 man-hours

Oct. 11th-12th 2006; 12 man-hours

Periods discovered: EBA I



Figure 4.42 Field 81 (taken towards the west on November 20th, 2004)

Description

During the 2004 season this concentration was discovered on one of the last days of the season. It is located on a high section of the northern Zerqa bank just before the river makes a 90° turn towards the south. The centre of the concentration is located c. 250 m north of the Zerqa and the area as a whole slopes down towards the river in the south. Glueck positioned Tell al-Rkābī on the eastern edge of field 81 on the 1940's aerial photograph. A small hillock is present at this location, but a recent cut shows that this is a natural hill. As argued elsewhere it is likely that both Glueck and the EJVS mistook this natural hill for a tell. Three concentrations of differing age and location overlap at this location. The mix of pottery from different periods has led surveyors to infer the presences of a multiperiod tell (Hourani, *et al.* in prep.).

In 2004 12 lines were surveyed containing either one or two plots. As is visible in figures 4.38 and 4.39 the densest concentration of EB sherds is located in the northern plots. At this location a very slight rise on top of the ridge was visible. In the field it was noticed that this rise seemed to yield the highest sherd density. This rise may be the result of accumulated occupation deposits.

As the number of feature sherds collected was insufficient to draw any definite conclusions about the date and function of this concentration the area was resurveyed in 2006. This time the field was divided into 8 blocks of 34 m E-W and the whole N-S length of the field.⁴² Blocks 2 to 8 were surveyed for 15 to 20 minutes in a random way collecting only feature sherds and flint tools. The highest number of sherds was discovered in block 4. The lower numbers in the eastern blocks 5 to 8 might, however, be somewhat distorted by the fact that the lettuce planted in these blocks had already been covered by plastic strips resulting in a smaller exposed surface between the beds. Allowing for this distortion the centre of the concentration seems to be located in blocks 4, 5 and 6. The centre of the 2004 concentration is slightly different from that of 2006. This may, however, be due to the agricultural activities being carried in the eastern part of the area during the 2006 survey.

⁴² The width of the blocks was determined by the width of lettuce beds that workmen were at that moment covering with plastic strips of 34 m length.

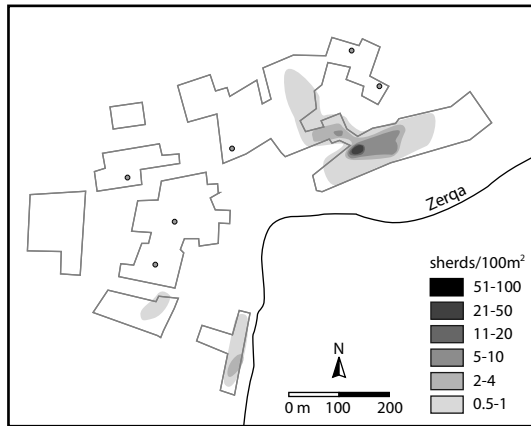


Figure 4.40 Distribution of EBA feature sherds

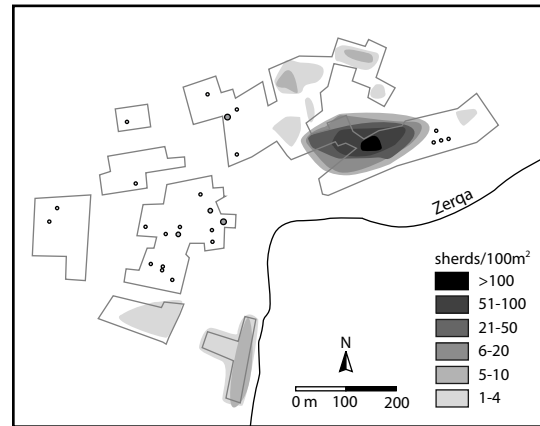


Figure 4.41 Distribution of EBA feature + non-feature sherds

In 2006 the vicinity of field 81 was also surveyed. EBA sherds were discovered both to the north-west in fields 307/308 and to the north-east in fields 299/300. The houses and road that separate these fields also bisected the artefact distribution making it difficult to determine whether these high densities area to the north and west are representative of buried remains or belong to the halo around the site. However, the high sherds density in field 300 plots 7 and 8 and field 307 lines 4 and 5 and the rapid decrease in density further to the north and west suggest that these areas are still part of the site as these plots form a clearly bounded high density area. The diverse nature of the finds discussed below leads to the interpretation of this site as a settlement.

Threat

Apart from the ongoing agricultural activity on these fields there is no immediate threat. The permanent risk of house construction to which the entire Jordan Valley is subject is present here as well. However, the general construction rate in this area is lower than in for example the region around the village of Sawalha. Normal agricultural activities like ploughing can have large effects on such an early site that most likely has only shallow in situ occupation layers. Furthermore, the location of the concentration on top of a ridge means a heightened degree of erosion obtains. Ploughing, especially perpendicularly to the contour lines, will exacerbate this process by loosening the soil and dragging objects away after which erosion can impact them more severely.

Other finds

Three basalt grinding stones have been found. It is however difficult to distinguish which belong to the Mamluk concentration centring immediately to the south-east and which to the EBA site. Given the interpretation of the Mamluk concentration as a sugar production site with little or no habitation and the general morphology of the stones, two of the (hand) grinding stones are classified as EBA and discussed here. The other has a distinctly different shape and is undoubtedly of later date. As the two stones are fragmentary and small it is impossible to say with certainty whether they are of EBA date. One of them (81.7.1.m1) is a flat slab with an intact grinding surface. It has a maximum thickness of only 6 cm and is made of very coarse basalt. Although none of the outer edges have been preserved its overall shape suggests it was a lower grinding stone. The other grinding stone (81.6.1.m1) is made from finer-grained basalt and has one outer edge apart from its grinding surface. It is, however, only a small piece that allows no further interpretation.

Basalt is also the material of which find 81.2.1.m1 was made. This is a small fragment of the rim of a fine-grained basalt bowl. The bowl was carefully worked and had a diameter of 44 cm. Basalt bowls are quite common at EB settlements, e.g. Tell 'Umm Hammād (Leonard 1992: pl.33-18/19; O'Tool 1992: 133), and Ashqelon Afridar (e.g. Braun and Gophna 2004: 217; Khalaily 2004: 153; Rowan 2004).



Figure 4.43 Stone disc s81.7-8.1m1

A small disc (s81.7-8.1m1) with a diameter of 4.2 cm and made of limestone was also found. It has a central hole manufactured by perforation from both sides. Similar discs have been found at many other EB sites, where they have usually been classified as spindle whorls, e.g. Ashqelon Afridar (Shamir 2004), Megiddo area J (Sass and Cinamon 2006: 381) and Tell 'Umm Hammād (O'Tool 1992: 132). A second pierced disc (s81m1) is broken in half and is significantly larger (outer diameter 7.7 cm). The central hole was perforated from both sides resulting in a clear hourglass shape. The limestone of which it is made is carefully smoothed, yet several scratches are visible, especially at and near the edges. The scratches are predominantly located on its edges and not so much at the centre of the disc and could represent either use-wear or post-depositional damage. These larger discs are less common and a functional interpretation remains difficult.

During the 2006 survey of this field a perforated stone of calcified limestone with a diameter of *c.* 9 cm and a height of 4 cm was found. Doughnut-shaped stones are common in several periods including the EBA and are usually thought to have functioned either as weights or as digging sticks. They have been found at Tell al-Maflūq (Leonard 1992: pl.36-18), Tell Handaqq N (Mabry 1996: fig. 15-4) and at nearby Tell 'Umm Hammād where they are described as large pierced limestone pebbles (O'Tool 1992: 135).

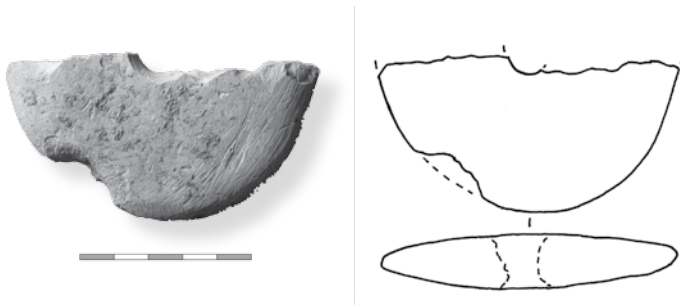


Figure 4.44 Stone disc s81m1

Pottery

The classification of survey pottery from such an early period as the EBA is difficult as the pottery is often rather fragmentary. When a rim was large enough to allow its position and vessel form to be ascertained it was drawn. Rims that were too small to allow unambiguous classification were not drawn. When a sherd did not allow a more detailed classification than open or closed it was entered in the database as a bowl or a jar, but no further subdivision was made. A small open shape, however, can belong to either a bowl or a necked jar. As there are too many of these uncertainties in the general database an evaluation of the frequency of certain form categories is, therefore, not undertaken. The fragmentation of the assemblage and the effects of post-depositional processes are too large to allow such calculations or comparison to assemblages at other sites.

Bowls

The majority of the bowls is of the V-shaped bowl type (see figure 4.45 large bowls and figure 4.46 small bowls). As described for concentrations 27 and 500 the V-shaped bowl is the typical bowl of the Chalcolithic period but continues into the EB I. Over the course of the EB I period the more rounded or hemispherical bowl becomes the dominant type. At nearby Tell 'Umm Hammād the majority of the bowls has curved walls. Only seven unclassified bowls have straight walls. All of these unclassified bowls have been dated to EB Ia period, i.e. phase 2 (Helms 1992c: 231:1,2,4-7). As these sites are located only three kilometres apart this difference in bowl shape must have a chronological instead of geographical cause. A regional difference can, however, not be excluded when other published EB I sites are concerned. The settlement and cemetery of Bab edh-Dhra' have not revealed any V-shaped bowls (Rast and Schaub 2003). This absence corroborates the idea that Bab edh-Dhra' was not founded at the very start of the EB Ia period but probably somewhat later during this period. At Shuneh N, which has both Late Chalcolithic and EBA occupation levels, many V-shaped bowls have been found. From the EB Ia period a few hemispherical bowls have been depicted, but the V-shaped bowl also occurs during this period (Gustavson-Gaube 1985: fig.7, 1986: fig.8,9). The pottery at Shuneh N seems to suggest that both bowl types occur during the early EB I period. A similar combined presence is attested at Jericho. Here hemispherical bowls like s81.5.xp15 or 307.5.1p2 have been dated to the EB Ia period (phase IIIa1). V-shaped bowls of a larger diameter do, however, also occur and continue in phase IIIa2, dated to the EB Ib period (Nigro 2005: fig.31:1-10, 32:1-6). Within the V-shaped bowl category of site 81 most bowls have a rounded rim. Three bowls, however, show a tapering rim. Both tapering and rounded rims occur at Tell Shuneh N and at Jericho during the EB Ia and Ib periods (Gustavson-Gaube 1986: fig.8,9; Nigro 2005: fig.31,32). Several bowls are quite small, but as none has a diameter smaller than 10 cm they are categorized here as small bowls and not as cups.

Several hemispherical bowls have been found (s81.5.xp15, s81.4.xp33, 300.2.8p12, s81.3.xp3). The first of these, i.e. s81.5.xp15, is a small bowl or cup with an angular rim. A similar example has been found in EB Ib layers of Tell 'Umm Hammād (Helms 1992c: fig.214:4). S81.3.xp3 is a simple hemispherical bowl that has many parallels. At Tell 'Umm Hammād similar bowls have also been discovered in the EB Ia period, but this type of hemispherical bowl is most common in the EB Ib period (Helms 1992c: fig.213:2). Bowl s81.4.xp33 has red slip inside and a rounded open profile with a flaring rim. A very similar example has been found in Tell Shuneh in a late EB I context (Philip and Baird 1993: fig.9:2)⁴³. EB Ib layers at Tell 'Umm Hammād also yielded a similar bowl (Helms 1992c: fig.226:27). At Jericho red slipped bowls mainly occur in phase IIIa2, i.e. the EB Ib period (Nigro 2005: fig.35:1-3). Red slipped vessels do occasionally appear in the EB Ia contexts, but only during the EB Ib do they become more abundant (Sala 2005: 171-172). Bowl 300.2.8p12 has red slip on both the inside and outside and a rounded, slightly closed profile with small up-turned rim. No similar bowls could be found in the Tell 'Umm Hammād publication. At Bab edh-Dhra' inclining hemispherical bowls do, however, occur as early as the EB Ia (Rast and Schaub 2003: fig.5.2:15). No good parallels could be found for the red slip and the small upturned rim.

Two bowl sherds belong to plates rather than bowls given their shallow nature. Shallow bowls have been reported for both the Late Chalcolithic period and the EB I period. A few shallow bowls have been reported from the Late Chalcolithic and the EB Ia layers of Shuneh N (Gustavson-Gaube 1986: fig.8). At Arad this type of bowl has been found in both the Late Chalcolithic loci of stratum V and in EB Ib deposits of stratum IV (Amiran et al. 1978: pl.1,7). At Tell 'Umm Hammād shallow bowls have also been found in EB Ia layers, but most were red slipped on at least the outside (Helms 1992c: fig.211:20).

In the southern Levant large V-shaped bowls, red slipped vessels, and hemispherical bowls occur during both the EB Ia and Ib periods. Their frequency differs, however, across the region and from site to site. Judging by the almost complete lack of V-shaped bowls at neighbouring Tell

43 Philip and Baird regard the EB I chronology as too imprecise and uncertain to distinguish sub-periods, so instead of EB Ia and EB Ib they describe their dates as either early or late in the EB I period. As dating survey material completely relies on parallels with excavated material the periodization as proposed by the excavator was utilized, which usually meant EB Ia and Ib.

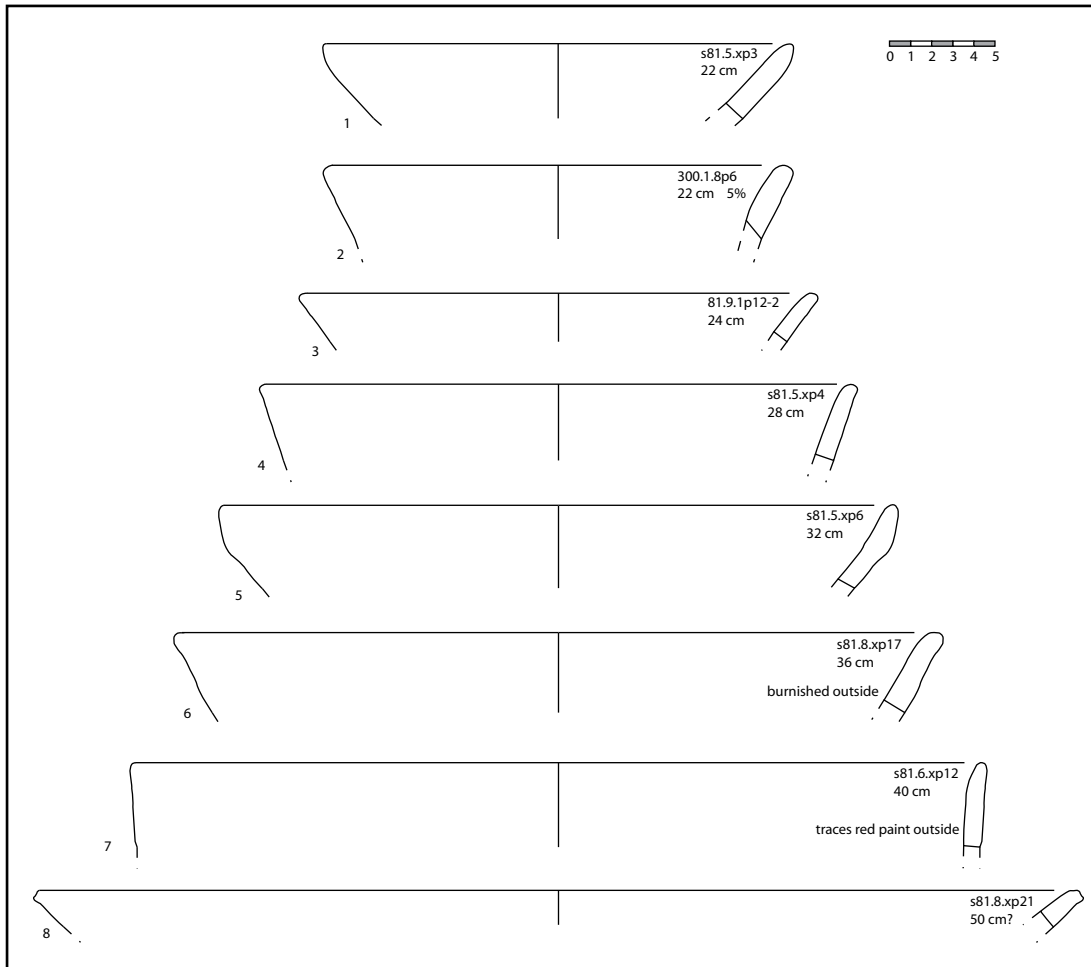


Figure 4.45 Large bowls

No.	Sherd no.	Parallels	Date	Remarks
1	s81.5.xp3	e.g. Jericho (Nigro 2005: fig.31:7+32:5) Arad (Amiran et al. 1978: pl.1:6) H. al-Ghuzlan (Khalil et al. 2003: fig.16:9-12)	EB Ia+b L Chal Trans. Chal/EB	Simple bowls common in L Chal/EB. Only 2 poss. examples in Arad EB Ib (str. IV), common shape
2	300.1.8p6	Like s81.5.xp3	Chal/EB I	
3	81.9.1p12-2	Like s81.5.xp3	Chal/EB I	
4	s81.5.xp4	Like s81.5.xp3	Chal/EB I	
5	s81.5.xp6	Shuneh N str.37 (Gustavson-Gaube 1986: fig.9-18)	EB Ia	Poss. very slight impress. below rim Parallel has impress.
6	s81.8.xp17			
7	s81.7.xp12			
8	s81.8.xp21		EB ?	

Table 4.17 Large bowls

Umm Hammād the majority of site 81 bowls can be dated to the early part of the EB Ia. The red slipped and hemispherical bowls can date to both the EB Ia period as is shown by examples at Tell Shuneh N and Jericho and to the EB Ib period. The bowls, therefore, suggest a date somewhere in the early part of the EB I period (the EB Ia), but some continuation into the EB Ib period cannot be ruled out.

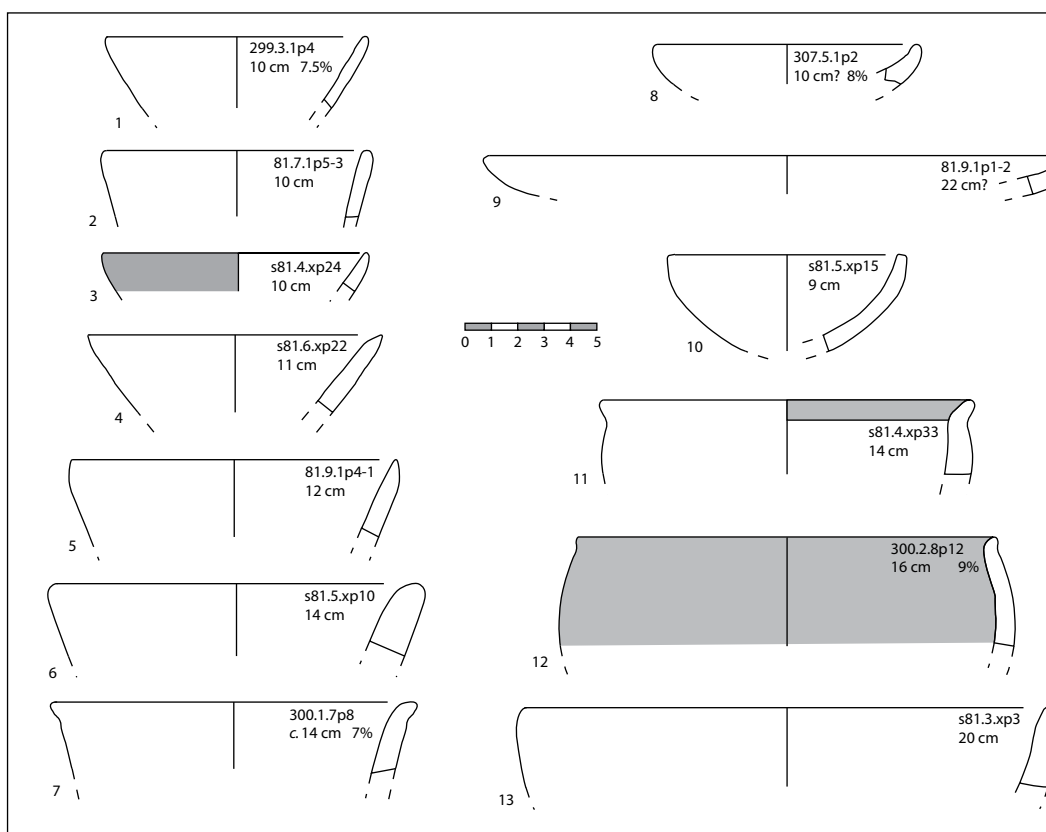


Figure 4.46 Small bowls and cups

No.	Sherd no.	Parallels	Date	Remarks
1	299.3.1p4		L Chal/EB	V-Shaped bowl
2	81.7.1p5-3		L Chal/EB	V-Shaped bowl
3	s81.4.xp24		L Chal/EB	V-Shaped bowl
4	s81.6.xp22		L Chal/EB	V-Shaped bowl
5	81.9.1p4-1		L Chal/EB	V-Shaped bowl
6	s81.5.xp10		L Chal/EB	V-Shaped bowl
7	300.1.7p8		L Chal/EB	V-Shaped bowl
8	307.5.1p2	Shuneh N str.88 (Gustavson-Gaube 1986: fig.8-1) Arad (Amiran et al. 1978: pl.1:19,20) Jericho (Nigro 2005: fig.31:4) Arad (Amiran et al. 1978: pl.7:16)	L Chal L Chal EB Ia EB Ib	
9	81.9.1p1-2	Shuneh N str. 43, 88 (Gustavson-Gaube 1986: fig.8-2b,c) TUH (Helms 1992c: fig. 211:20)	L Chal + EB Ia EB Ia	Parallel smaller diam (13 cm) Like 307.5.1p2 but larger
10	s81.5.xp15	c. TUH 3/11 (Helms 1992c: 214-4) Jericho (Nigro 2005: fig.5)	EB Ib EB Ia	hemispherical
11	s81.4.xp33	Shuneh N (Philip and Baird 1993: fig.9:2) TUH 3/11 (Helms 1992c: fig. 226-27)	EB Ib EB Ib	Parall red slip on rim.
12	300.2.8p12	Bab edh-Dhra' (Rast and Schaub 2003: fig.5.2:15)	EB Ia	Hemispherical
13	s81.3.xp3	TUH 2/9 (Helms 1992c: fig.213:2) Bab edh-Dhra' str. IV (Schaub and Rast 2000: fig.4.5:18/21/22)	EB Ia EB Ib	Many poss examples

Table 4.18 Small bowls and cups

Bowls with impressed decoration

Some of the V-shaped bowls show a band of impressions on the exterior *c.* one to three cm below the rim. Their ware suggests a close link to the other EBA bowls. Simple open bowls with impressions, whether rounded or V-shaped, do not occur at Tell 'Umm Hammād (Helms 1992c). Simple bowls with impressions have been found at both Bab edh-Dhra' and Tell Shuneh N. At Bab edh-Dhra' 51 % of the medium and large bowls of stratum 5 have a line of impressions.⁴⁴ These impressions are small and round and are somewhat widely spaced (Rast and Schaub 2003: fig.5.2). The impressions of field 81 are more rectangular and abut each other. At Shuneh N the impressions seem larger and deeper, although it must be stressed that the type of impressions is notoriously difficult to identify from drawings.⁴⁵ To mitigate this problem some photographs have been added in this publication. The impressions of this concentration seem to resemble most closely the Shuneh N impressions closest, although they might be slightly smaller (Gustavson-Gaube 1986: fig.9:16).

Sherd 81.12.1p8-2 stands out in that it has a raised band immediately below its rim in which the impressions are pushed. The only parallel for this bowl could be found at Hujayrat al-Ghuzlan in the Wadi Arabah near Aqaba. This site has been dated to the transition between the Late Chalcolithic and the EB I periods. Several bowls, jars and holemouth jars containing rows of impressions at or near the rim have been excavated here (Khalil et al. 2003; Khalil and Eichmann 2006). Despite the large distance from the Zerqa Triangle this site provides the best parallels for field 81. It is, furthermore, together with Shuneh N, one of the few sites with a proportion of impressed vessels comparable to the assemblage under discussion (see also the holemouth and vertical holemouth jars below).

A unique bowl is 81.10.1p5, which has almost 2 cm long vertical incisions below its rim. A smaller bowl from Shuneh N has similar but diagonal incisions below its rim. In contrast to the other impressed sherds this rim is dated to the EB Ib period (Gustavson-Gaube 1985: Fig.8:20b). Similar incisions have been collected in the surface survey at Katāret es-Samra (Leonard 1983: fig. 8:18). Sherd 81.12.1p5-1 is part of an exceptional bowl or cup; it has straight sides, but is slightly carinated and on top of the rim small but relatively deep impressions have been made. No exact parallels could be found. A similar bowl with impressions on its rim can be found among the finds from EB Ia 'En Besor site H, but this bowl has more impressions, a wider diameter and ledge handles (Gophna 1990: fig.3:3). A line of impressions on top of a rim has been discovered at Hujayrat al-Ghuzlan. This is, however, a much larger bowl and the impressions seem to be more punctuation-like. No parallels could be discovered for the large bowl or basin with impressions on its thickened rim. The slightly different ware suggests the possibility that this sherd does not date to the EBA, but stems from the overlapping Mamluk concentration (see section 4.6).



Figure 4.47 Example of impressions on a bowl (81.9.1p13-2)



Figure 4.48 Sherd 81.8.x.p4 with impressed ridge

44 At Bab edh-Dhra' medium and large bowls have a diameter of over 17 cm (Rast and Schaub 2003)

45 Especially the shading that is used to render the depth of an impression is highly personal and, therefore, difficult to interpret.

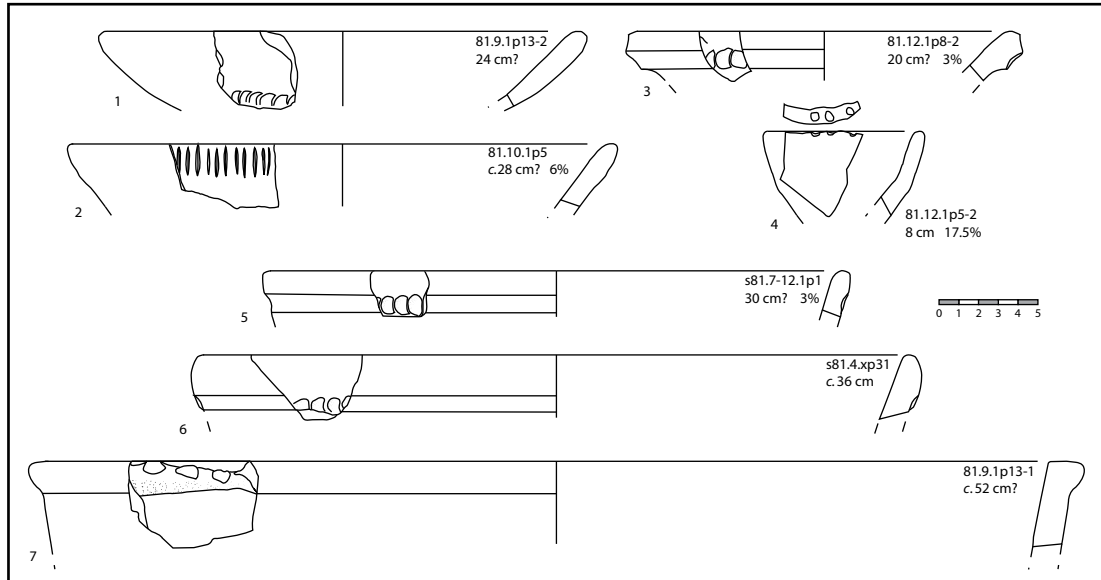


Figure 4.49 Impressed bowls

No.	Sherd no.	Parallels	Date	Remarks
1	81.9.1p13-2	Shuneh N str. 42 (Gustavson-Gaube 1986: fig. 9:16)	EB Ia	B. edh-Dhra'V-like impr
2	81.10.1p5	Shuneh N str.13 (Gustavson-Gaube 1985: fig.8:20b)	EB Ib	Long vertical incisions
3	81.12.1p8-2	c. H. al-Ghuzlan (Khalil et al. 2003: fig.18:6,8)	Trans. L.Chal/EB Ia	raised band, impr. like hlm jar
4	81.12.1p5-2	En Besor (Gophna 1990: fig.3:3) H. al-Ghuzlan (Khalil et al. 2003: fig.18:13)	EB Ia Trans L.Chal/EBI	En Besor has more impr. Impr. more like punctations
5	s81.7-12.1p1	Shuneh N str. 42 (Gustavson-Gaube 1986: fig. 9:16)	EB Ia	
6	s81.4.xp31	Shuneh N str. 42 (Gustavson-Gaube 1986: fig. 9:16)	EB Ia	
7	81.9.1p13-1	?	?	Very large: EB?

Table 4.19 Impressed bowls

Holemouth jars

Several holemouth jars have been discovered in this concentration. Some holemouth jars like 81.9.1p6-1 have a shape that is common at several EB I sites, but that also occurs in Late Chalcolithic contexts like Tulaylat Ghassul (see table). Several of the holemouth jars have an upward turned rim. This phenomenon is unknown at sites like Bab edh-Dhra', Jericho, Pella, Handaquq N or Ashqelon Afridar. Uprturned rims do, however, occur at Tell 'Umm Hammād in genre 16. Genre 16 is a very diverse category though and only a small portion of the vessels resembles the jars depicted here. The genre 16 jars with some resemblance all belong to stage 2 which is the EB Ia (e.g. Helms 1992c: fig.179,180). This type of holemouth jar is also present at Shuneh N in layers dating to Late Chalcolithic and EB Ia periods (Gustavson-Gaube 1986: fig.14:49-51). Similarly shaped holemouth jars can, moreover, be found at the transitional Late Chalcolithic/ EBA site of Hujayrat al-Ghuzlan and in Late Chalcolithic levels at Tulaylat Ghassul (Lovell 2001 fig.4.38:4; Brückner et al. 2002: fig.21:3).

The simple straight-sided or slightly rounded holemouth jar, to which several of the holemouth jars found in field 81 probably belong (e.g. 81.9.1p9-2, s81.6.xp16), have parallels in both the Late Chalcolithic and the EB I periods. The upturned holemouth jars like s81.4.xp34 seem to belong to the Late Chalcolithic and early part of the EB I period. It is, furthermore, noteworthy that the inside thickening of the rim, which is common during the EB Ib and EB II at nearby Tell 'Umm Hammād is completely absent (Helms 1992c: 51,54). These parallels suggest that the holemouth jars of field 81 mostly date to the last part of the Late Chalcolithic period or the EB Ia period.

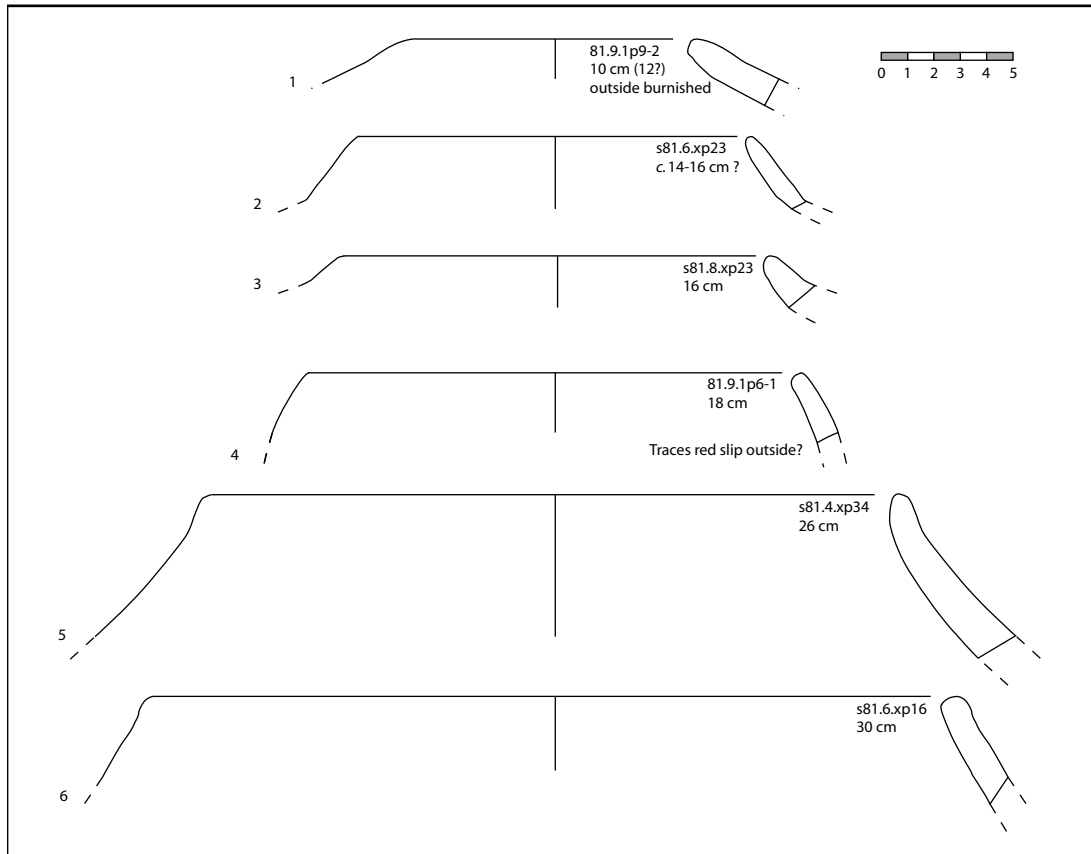


Figure 4.50 Holemouth jars

No.	Sherd no.	Parallels	Date	Remarks
1	81.9.1p9-2		L Chal/EB	
2	s81.6.xp23			
3	s81.8.xp23	Bab edh-Dhra' str. V (Schaub and Rast 2000: fig.4.2-3) c Tell 'Umm Hammäd 2/6 (Helms 1992c: fig.178:1)	EB la EB la	
4	81.9.1p6-1	Tulaylat Ghassul (Lovell 2001: fig.4.38:3) Shuneh str.37, 72 (Gustavson-Gaube 1986: fig.11:33a) Jericho Alla,b (Kenyon and Holland 1982: fig.3910,11)	L Chal L Chal + EB la EB I	Several examples
5	s81.4.xp34	T Ghassul (Lovell 2001: fig.4.38:4) Shuneh N str.109, 84(Gustavson-Gaube 1986: fig.14:49,51e) H. al-Ghuzlan (Brückner et al. 2002: fig.21:3) c. Tell 'Umm Hammäd 2/1 (Helms 1992c: fig.177:3)	L Chal L. Chal Trans Chal/EB EB la	
6	s81.6.xp16	TUH 2/4 (Helms 1992c: fig.177.4)	EB la	

Table 4.20 Holemouth jars

Four holemouth jars have a row of impressions below the rim. Two examples (s81.6.xp13 and s81.8.xp24) have small, somewhat rectangular, shallow impressions similar to several of the bowls. Jar 300.3.8p11, however, has much deeper impressions and s81.4.xp28 had shallow v-shaped impressions. The only excavated parallel for the latter impressions is found on the carination of a necked jar from Ashqelon Afridar (Baumgarten 2004: fig.10:6). Similar impressions have, however, been found on a body sherd from this concentration (see figure 4.52). These impressions are, however, not identical as those of jar s81.4.xp28 also exhibit a low depression between the deep v-shaped impressions. They are, however, very similar to the impressions from Afridar. This difference implies that dissimilar impression devices were used.

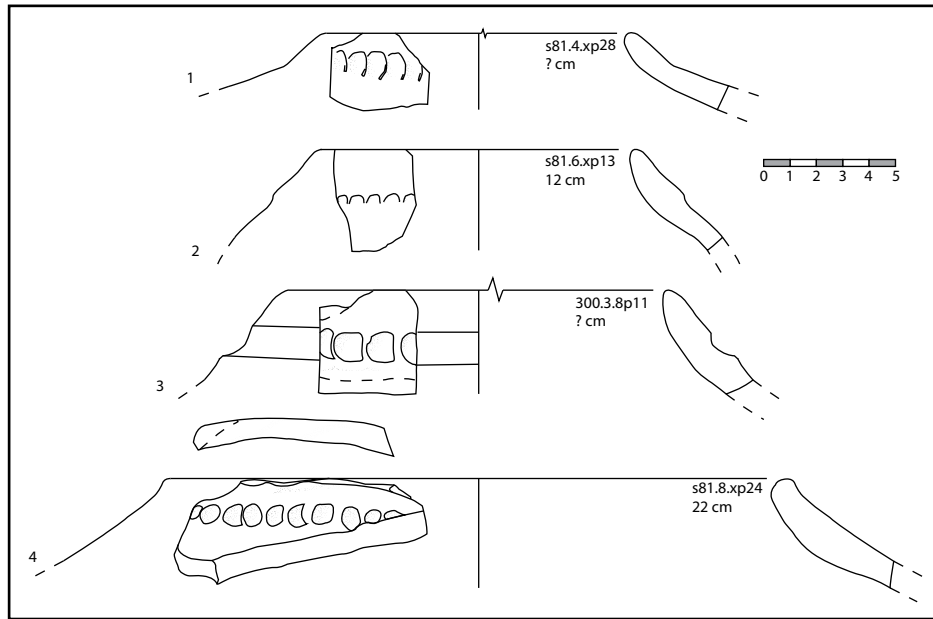


Figure 4.51 Impressed holemouth jars

No.	Sherd no.	Parallels	Date	Remarks
1	s81.4.xp28	Impressions = c. Afridar Area J (Baumgarten 2004: fig.10.6)	EB Ia (early)	Herring bone in Afridar on neck
2	s81.6.xp13	c. TUH 2/7-9 or 2/1 or 2/7 (Helms 1992c: fig.169-7 or 141:7 or 171:10)	EB Ia	Impressions
3	300.3.8p11	H. al-Ghuzlan (Khalil et al. 2003: fig.19:10) c. Wadi Faynan 100 (Wright et al. 1998: fig.8:1, 9:6-8)	Trans. Chal/EB EB I	Large impressions Faynan is larger, no upturned rim
4	s81.8.xp24	c. Shuneh N str.42 (Gustavson-Gaube 1986: fig.15:53) c. Tell 'Umm Hammād 2/6 (Helms 1992c: 180:1) c. H. al-Ghuzlan (Brückner et al. 2002: fig.21:2)	EB Ia EB Ia Trans. Chal/EB	Straight sided hlm jar, impr below rim

Table 4.21 Impressed holemouth jars

Lines of impressions on holemouth jars occur at a few EBA sites in the region. At Tell 'Umm Hammād jars of Genre 2 and 16 often have a line of impressions below their rim (Helms 1992c: fig.143-146, 180). The shape and position of the rim are, however, markedly different. The only parallels, though not perfect, at Tell 'Umm Hammād stem from unclassified shapes and once from a genre 1 vessel, all dating to the earliest layers of the tell (see below). Other imperfect parallels can be found at Shuneh N stemming from both Late Chalcolithic and EB Ia layers (Gustavson-Gaube 1986: fig.12, 15). The Shuneh N jars, however, mostly have applied strips of clay in which the impressions have been made. The impressions are, furthermore, in general larger than those from field 81.

The best parallels at least for the large impressions of jar 300.3.8p11 stem from Hujayrat al-Ghuzlan. The large, 45cm high pithos depicted in figure 19:10 shows a rim largely identical to the rim depicted here (Khalil et al. 2003: fig. 19:10). At Wadi Faynan site 100, also located along the Wadi Arabah, additional holemouth jars with impressions below their rim have been found that form good parallels for jar 300.3.8p11, but to a lesser extent also for the other holemouth jars of this assemblage.

Impressions on holemouth jars are, however, absent from most other EB I sites, like Bab edh-Dhra', Pella, Handaquq N or Jericho (Kenyon and Holland 1982: 39:24,25). At Jericho only large impressed bands occur on holemouth jars. Impressions are missing on all other types of vessels.



Figure 4.52 Body sherd s81.4.xp6 showing similar (although not identical) impressions to jar s81.4.xp28

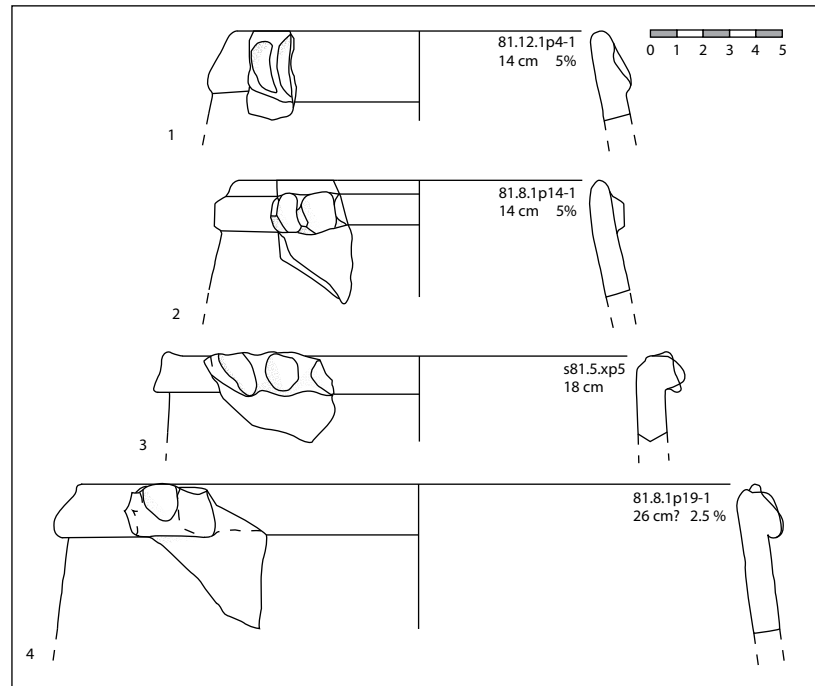


Figure 4.53 Vertical holemouth jars with an impressed band

No.	Sherd no.	Parallels	Date	Remarks
1	81.12.1p4-1	Shuneh N str.41,42 (Gustavson-Gaube 1986: 12:37b,c)	EB Ia	
2	81.8.1p14-1	Wadi Burma N TU102 (Fujii 2005: fig. 21-40/41) H. al-Ghuzlān (Brückner et al. 2002: fig.20:5) H. al-Ghuzlān (Khalil et al. 2003: fig.18:11) c. Wadi Faynan 100 (Wright et al. 1998: fig.8:3)	EB Ia Trans Chal/EB Trans Chal/EB EB I	Ghuzlan slightly more inverted
3	s81.5.xp5	H. al-Ghuzlān (Khalil et al. 2003: fig.18:11)	Trans Chal/EB	Ghuzlan more inverted
4	81.8.1p19-1	Wadi Faynan 100 (Wright et al. 1998: fig.8:2)	EB I	Faynan is more inverted + larger impressions

Table 4.22 Vertical holemouth jars with an impressed band

Vertical holemouth jars with an impressed band

The four almost vertical rims with impressed bands have very few parallels. At Tell Shuneh N two other somewhat vertically walled jars were found that have a band immediately below the rim and thin vertical impressions. Both jars stem from EB Ia strata (Gustavson-Gaube 1986: fig.4). This shape and type of impressions are paralleled in rim 81.12.1p4-1. Two very similar jars have been found among the excavated finds from a cist enclosure in the south Jordanian Wadi Burma (Fujii 2005: 26,28). These jars have a band just below the rim and fairly large impressions, just like sherd 81.8.1p14-1. The two other rims (81.8.1p19-1 and s81.5.xp5) find their best parallels at the aforementioned Hujayrat al-Ghuzlan and Wadi Faynan site 100. All parallels, therefore, date to the transition Late Chalcolithic/EB and the EB Ia period. Apart from the two examples at Shuneh N, the parallels stem from the southern part of Jordan and are located at a great distance from the research area.

Necked jars

The necked jars are difficult to classify as none of the sherds is so large as to have retained the shoulder. Only 300.2.8p11 shows the start of a carination. Strictly speaking all other rims could belong to bowls, but flaring bowls are practically absent from the timeframe to which the other

vessels of this concentration belong. Flaring rims are most common on small or (very) large jars (see references below). All flaring or clearly outward curving rims have, therefore, been classified as necked jars.

Due to the lack of shoulders it is impossible to say whether these jars were tall necked or short necked, although s81.6.xp17 and s81.4.xp29 tend towards long necks. Tell 'Umm Hammād or Jericho have not yielded long necked flaring jars (Kenyon and Holland 1982; Helms 1992c). These jars are, however, very common at Bab edh-Dhra'. In stratum V the majority (c. 80 %) of the large and medium jars is of the flaring neck type (Rast and Schaub 2003: 87). This shape continues into stratum IV but is less common and accompanied by straight, angled, and cylindrical necks (Rast and Schaub 2003: 145). Cylindrical or clearly angled necks do not occur in the site 81 assemblage. It is, however, possible that necked jars with straight walls were present but have been classified as bowls. As none of the necks is complete and as this type of necked jar continues from EB Ia into EB Ib it is impossible to precisely date this category. The uniformity of the flaring necks and the absence of cylindrical and short angled necks would suggest, using Bab edh-Dhra' as reference, that a date in the EB Ia is more likely, but this remains speculative.

Another argument in favour of an EB Ia date for some of the jars is found in the decoration. Three of the necked jars show a line of impressions on the outside below the rim. Similar to most bowls and holemouth jars these impressions are shallow, small and more or less rectangular in shape. In their appearance they neither resemble the punctate decoration of Bab edh-Dhra nor the larger impressions of Shunch N (Gustavson-Gaube 1986). The presence of impressions on necked jars is, however, only paralleled in Bab edh-Dhra' stratum V where they occur on 14 % of the jars (Rast and Schaub 2003: table 5.1). In EB Ib stratum IV punctate design has almost disappeared (Rast and Schaub 2003: 134).

Two jars have red slip decoration on the inside and outside, which is more common in Bab edh-Dhra' stratum IV than in V (Rast and Schaub 2003: 134). At Jericho red slip is also predominant in the EB Ib period, but it does occur during the previous EB Ia period (Sala 2005: 171, 172). Notwithstanding the common use of red slip in Chalcolithic assemblages it is not found in combination with this type of rim shape. Shapes that would fit a Late Chalcolithic assemblage are 81.11.1p9, 307.5.1p5, 81.12.1p7-1 and 81.8.1p15-1. Parallels for these vessels can, however, also be found in EB I and intermediary contexts (see below). A vessel that can be similarly dated is rim 307.4.1p2. This rim has impressions along its top and is very similar to several rims discovered in concentration 500 at Katār Dāmiyah. Parallels have been found that dated to both the Late Chalcolithic and EB Ia periods (see previous section).

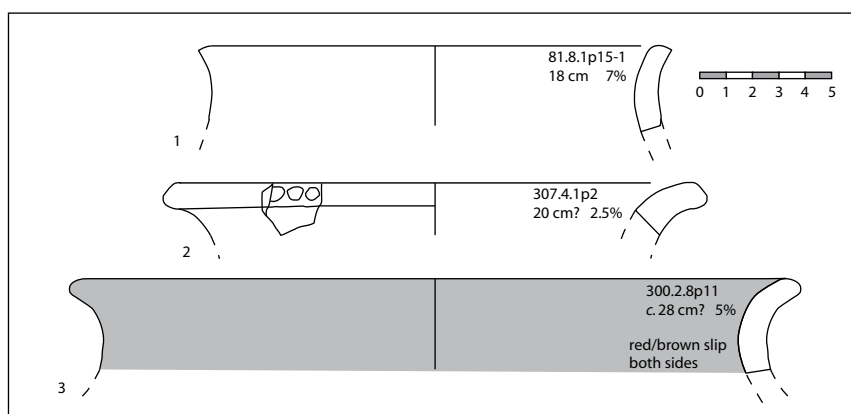


Figure 4.54 Necked jars

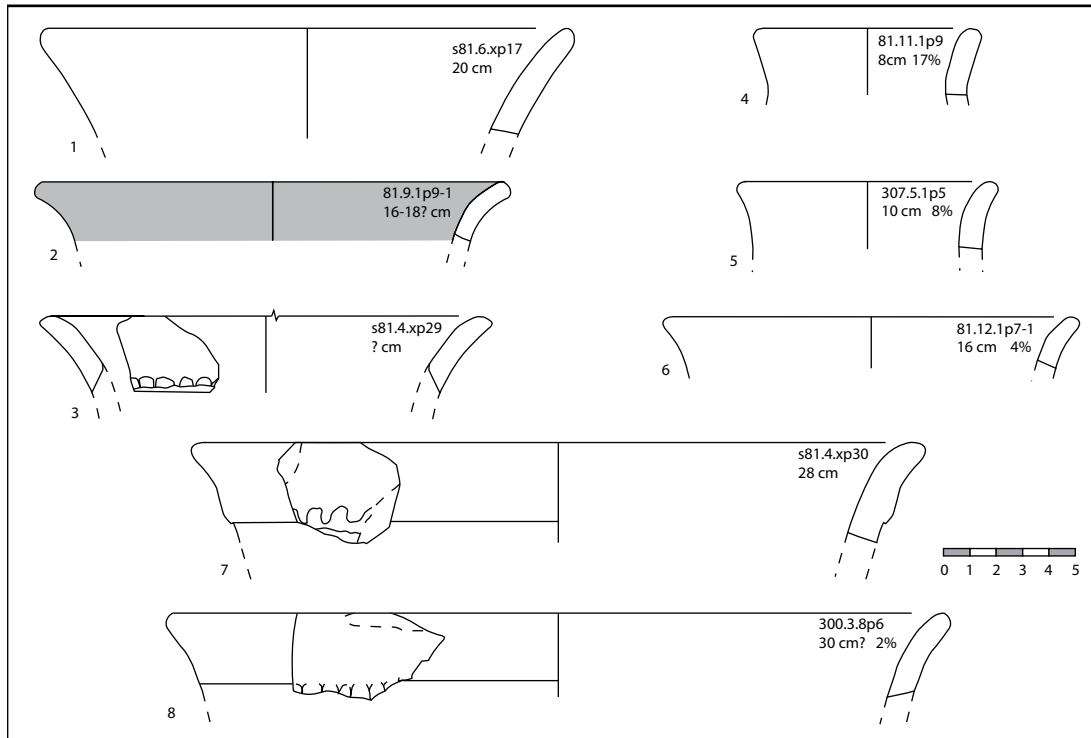


Figure 4.55 Necked jars

No.	Sherd no.	Parallels	Date	Remarks
1	s81.6.xp17	Bab edh-Dhra'str. V (Rast and Schaub 2003: pl.1-35)	EB Ia	Concave sides (or flaring rim jar?)
2	81.9.1p9-1	Arad str. IV (Amiran et al. 1978: pl.12:8, 18) Babe dh-Dhra' str. IV (Rast and Schaub 2003: fig.7.2:6)	EB Ib EB Ib	
3	s81.4.xp29	Bab edh-Dhra' str.V (Rast and Schaub 2003: fig.5.1:18,20) Jericho (Nigro 2005: fig.33: 2)	EB Ia EB Ia	impressions Impressed points
4	81.11.1p9	c. Jericho (Nigro 2005: fig.31:16) c. H. al-Ghuzlan (Brückner et al. 2002: fig.20:10-13)	EB Ia Trans Chal/EB	
5	307.5.1p5	c. Jericho (Nigro 2005: fig.31:16) c. H. al-Ghuzlan (Brückner et al. 2002: fig.20:10-13)	EB Ia Trans Chal/EB	
6	81.12.1p7-1	Bab edh-Dhra' str.V (Rast and Schaub 2003: fig.5.1:17) See field 27	EB Ia L Chal	
7	s81.4.xp30	Bab edh-Dhra' str.V (Rast and Schaub 2003: fig.5.1:18,20)	EB Ia	Impressions
8	300.3.8p6	Bab edh-Dhra' str.V (Rast and Schaub 2003: fig.5.1:18,20)	EB Ia	Impressions
1	81.8.1p15-1	c. Jericho (Nigro 2005: fig.33:7) T. Ghassul (Lovell 2001: 4.40:4)	EB Ia L Chal	Jericho has impressions
2	307.4.1p2	c. H. al-Ghuzlan (Brückner et al. 2002: fig.21:1)	Trans Chal/EB	Like concentration 500, see also that section
3	300.2.8p11	Halif terrace Silo site str. III (Alon and Yekutieli 1995: fig.23:3)	EB Ia	Few already in L Chal but no slip

Table 4.23 Necked jars belonging to figures 4.54 and 4.55

Everted rim bowls

Only three rims of this type have been found. No bowls of this type have been found at Handaqq N, Jericho or Bab edh-Dhra'. Very good parallels have, however, been found at Tell 'Umm Hammād, Shuneh N, Tell al-Maflūq and Beth Shean (see table). All these examples date to the EB I or, in cases where more precision is possible, to the EB Ia. At for example Tell 'Umm Hammād this type of bowl (genre 48) disappears after stage 2, which has been dated to the EB Ia period.

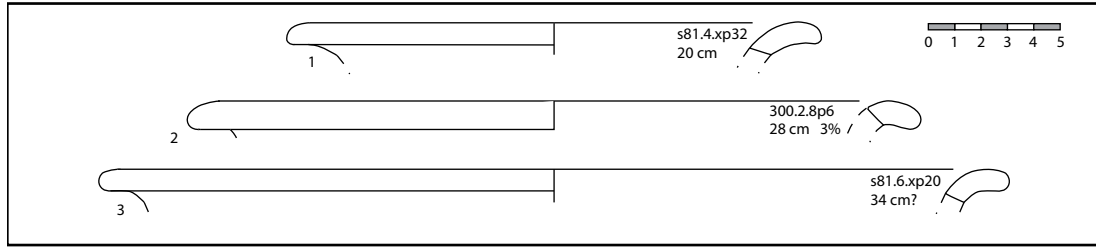


Figure 4.56 Everted rim bowls

No.	Sherd no.	Parallels	Date	Remarks
1	s81.4.xp32	Beth Shean str. XVI (Braun 2004: fig.3.10-4) TUH 2/4 (Helms 1992c: fig.183-7/8) al-Mafūq (Leonard 1992: pl.36-11)	EB I EB Ia EB I	Ware A but towards TUH ware
2	300.2.8p6	Tell 'Umm Hammād 2/4 (Helms 1992c: 283:7) Shuneh N str. 48 (Gustavson-Gaube 1985: fig.15:72a)	EB Ia EB Ia	burnished
3	s81.6.xp20	Tell 'Umm Hammād 2/7-9 (Helms 1992c: 218:6) Shuneh N str. 48 (Gustavson-Gaube 1985: fig.15:73) Dāmiyah dolmens (Yassine 1985: fig.6:1)	EB Ia EB Ia	burnished

Table 4.24 Everted rim bowls

Ledge handles

In contrast to the other form categories, which are internally quite homogeneous, the ledge handles belong to several different types. Few ledge handles belong to the same type. There are examples of the plain type (s81.3.xp5) that occur at several different sites and occur in both the EB Ia and Ib periods. Furthermore, there is handle s81.4.xp22 that more closely resembles one of the typical Bab edh-Dhra' types dating to both the EB Ia and Ib (Rast and Schaub 2003: 149). This type seems to be missing from the Jericho, Tell 'Umm Hammād, Beth Shan and Shuneh N assemblages. A more or less square ledge handle with small incisions (81.8.xp13) also finds its best parallel at Bab edh-Dhra' in a layer dated to the EB Ib period (Rast and Schaub 2003: pl.22:6). Jericho also has a few parallels not present or depicted at other published sites. The small but quite elongated ledge handles with shallow impressions and slightly upturned ridges (81.12.1p1-3, s81.5.xp28) have been discovered at Jericho (Kenyon and Holland 1982: 41:16,18). The problematic folded ledge handle 81.3.xp6 also has a parallel at Jericho in the EB I period (Kenyon and Holland 1982: 41:17). Folded ledge handles are usually associated with the later EB II-IV periods. This example at Jericho and similar specimens at Lachis and Halif Terrace show it already occurs from the very start of the EB I period (Yekutieli 2000: fig.8.5:2,3). Another ledge that possibly dates to the EB II period is s81.6.xp2. This handle is paralleled in Tell 'Umm Hammād genre 76 dating to stage 4 (Helms 1992c: 90). A similar example has, however, been found in a Late Chalcolithic layer at Tell Shuneh N (Gustavson-Gaube 1986: fig.17:75). The flat oval ledge handle with many large impressions, s81.4.xp20, however, dates to the EB Ia period at both Tell 'Umm Hammād and Beth Shan (FitzGerald 1935: pl.II:3; Helms 1992c: fig.236:8). Helms classifies this ledge handle amongst Genre 64 (Helms 1992c: 88). Also belonging to Genre 64 is the only parallel for handles 307.5.1p6 and s81.4.xp23 (Helms 1992c: 236:3). These are thick, more or less square handles with clear largely circular impressions on their edges. They are made of a dark red cracked clay resembling the matrix of the so-called Tell 'Umm Hammād-ware. Similar examples have been found at Tell Far'ah, but these are oval in shape and often triangular in section (de Vaux and Steve 1947: fig.5:22,24 + 2:18). This type of ledge handle has also been found in field 229 (229.2-3.3p1, see below). They do not resemble s81.4.xp20 either in shape or ware, despite stemming from the same Tell 'Umm Hammād genre. The diverse nature of this category suggests genre 64 should perhaps have been subdivided further.

Furthermore, it must be noted that the type of ledge handle with three, five or more large impressions at some distance from each other, which is so ubiquitous at many EB I sites like Tell 'Umm Hammād, Jericho, Bab edh-Dhra', and Beth Shan, is completely absent in this concentra-

tion (FitzGerald 1935: pl.VI:12,13,16; Kenyon and Holland 1982: fig.41:12-14,20; Helms 1992c: 241:7-10, 242:9,11-14; Rast and Schaub 2003: 94). Except for Bab edh-Dhra' where this type occurs already in stratum V, this type of ledge handle stems from late EB I contexts, e.g. Tell 'Umm Hammād and Beth Shan (Helms 1992c: 255,256; Braun 2004: 51,53).⁴⁶

Summarizing, the many different types of ledge handles from the field 81 concentration seem to date to the EB I period with some being restricted to the EB Ia, others to the EB Ib and several occurring in both periods. Two ledge handles possibly date to the EB II period, but both have also been discovered in EB I contexts. Parallels occur at several sites throughout the Jordan Valley and some types like the plain ledge handle occur over a much wider region. In some publications only a very limited number of ledge handles has been drawn, making the presence of further shared, but not drawn, types likely. The difficulty of interpreting drawn impressions also pertains to the renderings of ledge handles.

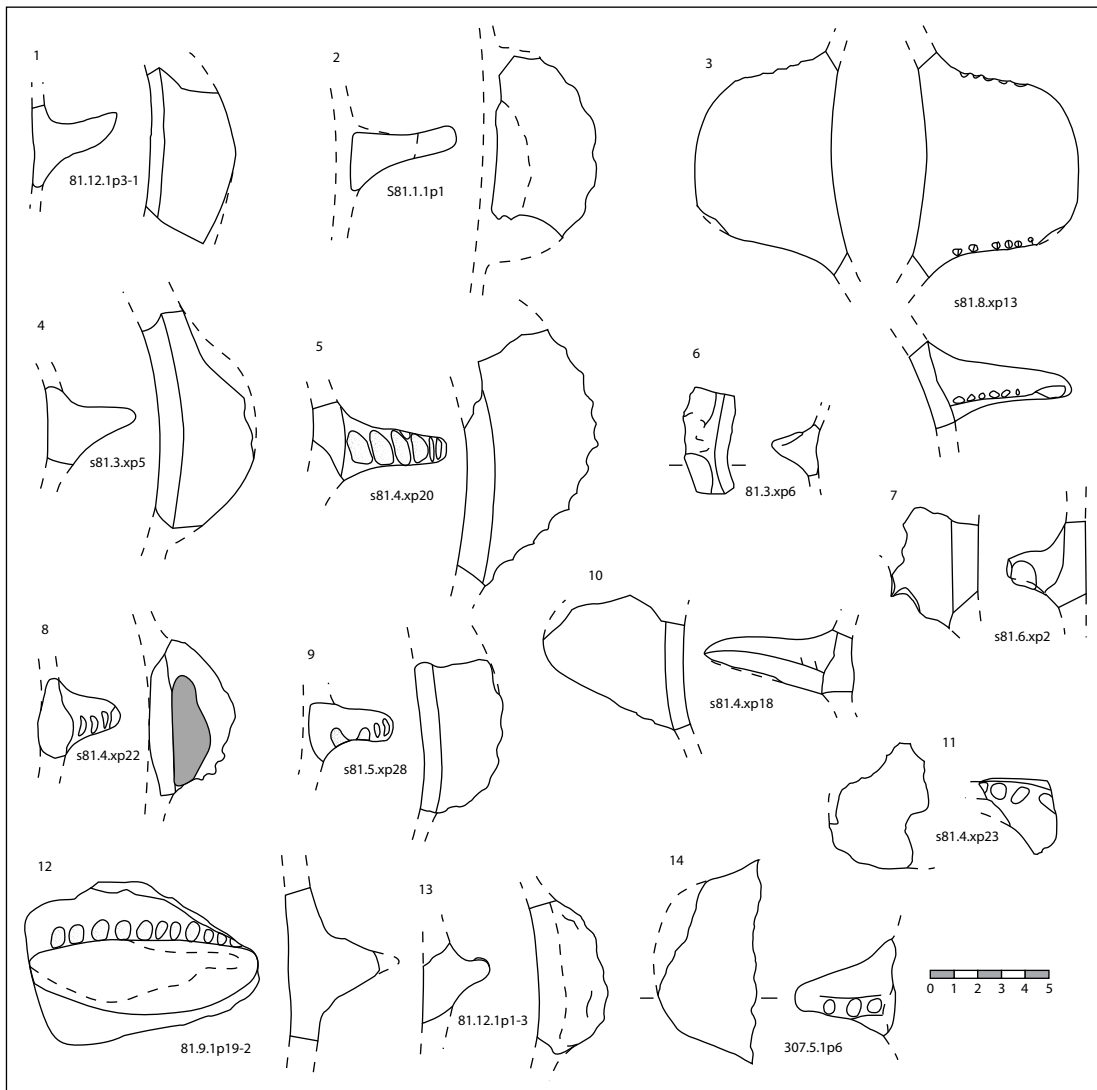


Figure 4.57 Ledge handles

46 The Jericho phasing makes no distinction between early and late EB I.

THE SURVEY RESULTS

No.	Sherd no.	Parallels	Date	Remarks
1	81.12.1p3-1	Tell 'Umm Hammād 2/7-9, 2/8 (Helms 1992c: fig.137:1,2,4) Jericho (Kenyon and Holland 1982: fig.41:21) Far'ah N (de Vaux and Steve 1947: fig.2:17)	EB Ia EB I EB I	
2	s81.1.1p1	Shuneh N str.42 (Gustavson-Gaube 1986: fig.17-74b)	EB Ia	
3	81.8.xp13	Tell 'Umm Hammād 2/2 (Helms 1992c: 237:6)	EB Ia	But no slip/paint
4	81.3.xp5	Bab edh-Dhra' str. V (Rast and Schaub 2003 pl.5-16) Jericho (Kenyon and Holland 1982: fig.41:8) Dāmiyah Dolmen (Stekelis 1961: fig.19:166)	EB Ia EB I EB I	
5	81.4.xp20	TUH 2/9 (Helms 1992c&fig.236:8) Beth Shan level XVI (FitzGerald 1935: pl.II:3)	EB Ia EB Ia	
6	81.3.xp6	Jericho (Kenyon and Holland 1982: fig.41:17) Halif terrace + Lachish (Yekutieli 2000: fig/8.5:2,3)	EB I EB Ia(1)	Folded often EB II
7	81.6.xp2	Tell 'Umm Hammād 4/14 (Helms 1992c: 241.10) Shuneh N str.60 (Gustavson-Gaube 1986: fig. 17-75)	EB II L Chal	
8	81.4.xp22	Bab edh-Dhra' str.V + IV (Schaub and Rast 2000: fig.4.3:7)	EB Ia+b	
9	81.5.xp28	Jericho IV (Kenyon and Holland 1982: 41:18)	EB I	
10	81.4.xp18	TUH 3/11 (Helms 1992c: fig.241-1) Beth Shean (Braun 2004: fig.3.33) Beth Shean str. XV (FitzGerald 1935: pl.6-17)	EB Ib EB EB I(b)	Photo FitzGerald
11	81.4.xp23	Tell 'Umm Hammād 2/5 (Helms 1992c: fig.236:3) Far'ah N (de Vaux and Steve 1947: fig.2:18, 5:22,24)	EB Ia EB I	
12	81.9.1p19-2	Tell 'Umm Hammād 2/4, 2/6 (Helms 1992c: fig.239-5-7)	EB Ia	
13	81.12.1p1-3	Jericho (Kenyon and Holland 1982: fig.41:16)	EB I	PU
14	307.5.1p6	Tell 'Umm Hammād 2/5 (Helms 1992c: fig.236:3) Far'ah N (de Vaux and Steve 1947: fig.2:18, 5:22,24)	EB Ia EB I	
	81.4.xp4	TUH 2/9 (Helms 1992c: 239-5-7)	EB Ia	Like 81.9.1p19-2
	81.4.xp19	TUH fig.237.7 0000		
	81.4.xp21			
	81.5.xp27	Tell 'Umm Hammād 2/9 (Helms 1992c: 239-5-7)	EB Ia	Like 81.9.1p19-2
	81.5.xp29	Iktanu ((Prag 2000: 5.3-11)	EB Ia	Like 81.3.xp5
	81.7.xp5	Tell 'Umm Hammād /7-9 (Helms 1992c: fig. 238-8)	EB Ia	Long incisions edge
	81.8.xp14	Iktanu (Prag 2000: 5.3-11)	EB Ia	Less elongated

Table 4.25 Ledge handles (small fragments that were identifiable but did not merit drawing have been added to this table)

Miscellaneous pottery

A few pottery finds do not fall within the categories discussed above, but are worth mentioning. A remarkable find was the cylindrical bowl s81.6.xp10. This large rim fragment was very coarsely manufactured and showed some large (iron oxide) inclusions. A loop handle was probably once attached to at least one of its sides, but has long since broken off. Parallels proved very difficult to find. An example of a handle possibly similar to the one once attached to this vessel has been published from Late Chalcolithic layers at Arad (Amiran et al. 1978: pl.2:10). A comparable vessel has been excavated by Mellaart in Late Chalcolithic layers at Khirbet Mafjar (Leonard 1992: fig. pl.2:23). Very good parallels have been found at Ashqelon Afridar in area G and in cist enclosure 101 in the northern qairn field of the Wadi Burma in southern Jordan (Braun and Gophna 2004: 18:2) (Fujii 2005: fig.6:15). At Afridar this rim shape has been interpreted as the long neck of a small jar, whereas the Wadi Burma example is complete and shows it is a small bowl (Braun and Gophna 2004: 208). The Wadi Burma remains are dated to the EB Ia period, while the excavators of Afridar area G are even more specific and date their findings to the earliest part of the EB Ia period (Braun and Gophna 2004: 226; Fujii 2005: 50).

Knob handles are generally associated with the Late Chalcolithic period, but they occur in the EBA as well. This example (300.1.8p16) has been red slipped and burnished carefully, which suggests it should be dated to the EBA, rather than the Late Chalcolithic period. Bowls with red

slipped and burnished knob handles have been discovered at Tell 'Umm Hammād, where they occur in the EB Ia and possibly the start of the EB Ib period (Helms 1992c: fig.130). They are, however, not ubiquitous.

Sherd 81.9.1p1 has a painted pattern of red lines on its outer surface. Unfortunately this sherd is too small to provide any information on its original vessel form or the painted pattern. Nevertheless, it has been drawn, as paint or slip is rare in this concentration. This is probably not down to the absence of this type of decoration at the site, but is more likely a result of the survey nature of the assemblage.

The last sherd (s81.7-8.1p1) is not very remarkable in itself as bands with impressions occur regularly. This specific type of band located in what seems to be a carination with relatively shallow impressions on only one half of the raised band is, however, noteworthy as an exact parallel has been discovered by Helms in his survey of al-Rweihah (Helms 1992c: fig.256.3/4). These two sites are located at less than five kilometres distance from each other and share a very similar pottery assemblage (see next section). Given the similarity between pottery assemblages they may, at least for part of their existence, have been contemporary and there will have been contact between these two sites.

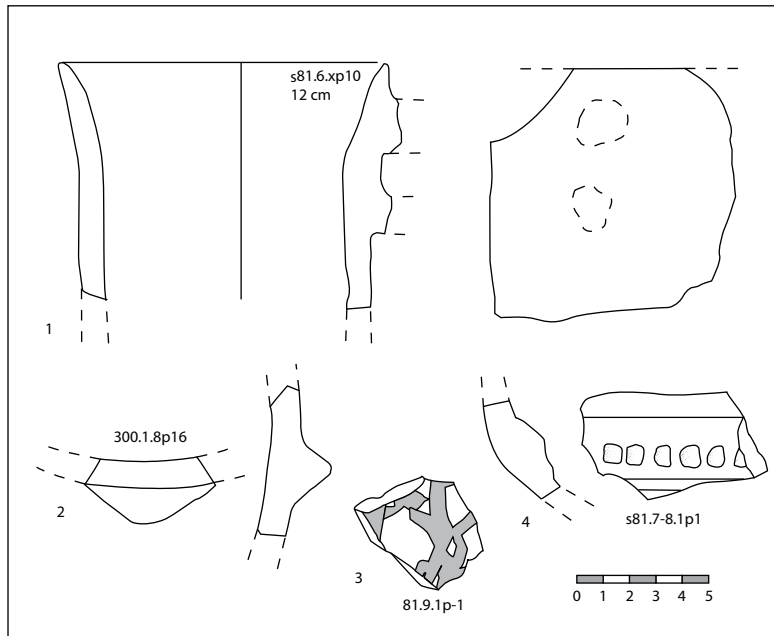


Figure 4.58 Miscellaneous pottery

No.	Sherd no.	Parallels	Date	Remarks
1	s81.6.xp10	Afridar area G (Braun and Gophna 2004: 18:2) W Burma (Fujii 2005: fig.6:15) Handle Arad (Amiran et al. 1978: pl.2:10) Mafjar (Leonard 1992: fig.pl.2:23)	EB Ia EB Ia L Chal L Chal	Dissimilar in shape
2	300.1.8p16	Tell 'Umm Hammād (Helms 1992c: fig.217:4-7)	EB I	Knob handle
3	81.9.1p1			Red paint pattern
4	s81.7-8.1p1	al-Rweihah (Helms 1992c: fig.256.3/4)	EB Ia	Parallel is survey Impr band in carination

Table 4.26 Miscellaneous pottery

Bases

Only a very small selection of the bases has been drawn. All bases are of the flat base type. Bases s81.5.xp23 and s81.6.xp9 are examples of the typical types of the concentration. This type of base has either straight walls extending from the base (s81.5.xp23) or a small heel (s81.6.xp9). Both types are examples of typical EBA bases discovered throughout the southern Levant. Heeled bases with a rounded wall also occur (81.9.1p5-1) and are paralleled at Tell 'Umm Hammād (Helms 1992c: fig.246:2-5). The very thick base s81.8.xp5 has several counterparts in the assemblage. Similar large bases have been found at Tell 'Umm Hammād and at al-Rweihah both during the survey by Helms as well as the present survey (Helms 1992c: fig.246:1). Exceptional in this assemblage, but not in itself, is the combed base 81.12.1p1-5. Comb decoration is very common in EB II, III and IV assemblages, but has also been found at Late Chalcolithic Shoham. Base 81.9.1p12-1 belongs to a small rounded bowl and has a line of impressed circles on its interior. It is likely that these impressions were made with a piece of reed that must have grown next to the site on the banks of the Zerqa. No parallels were found.

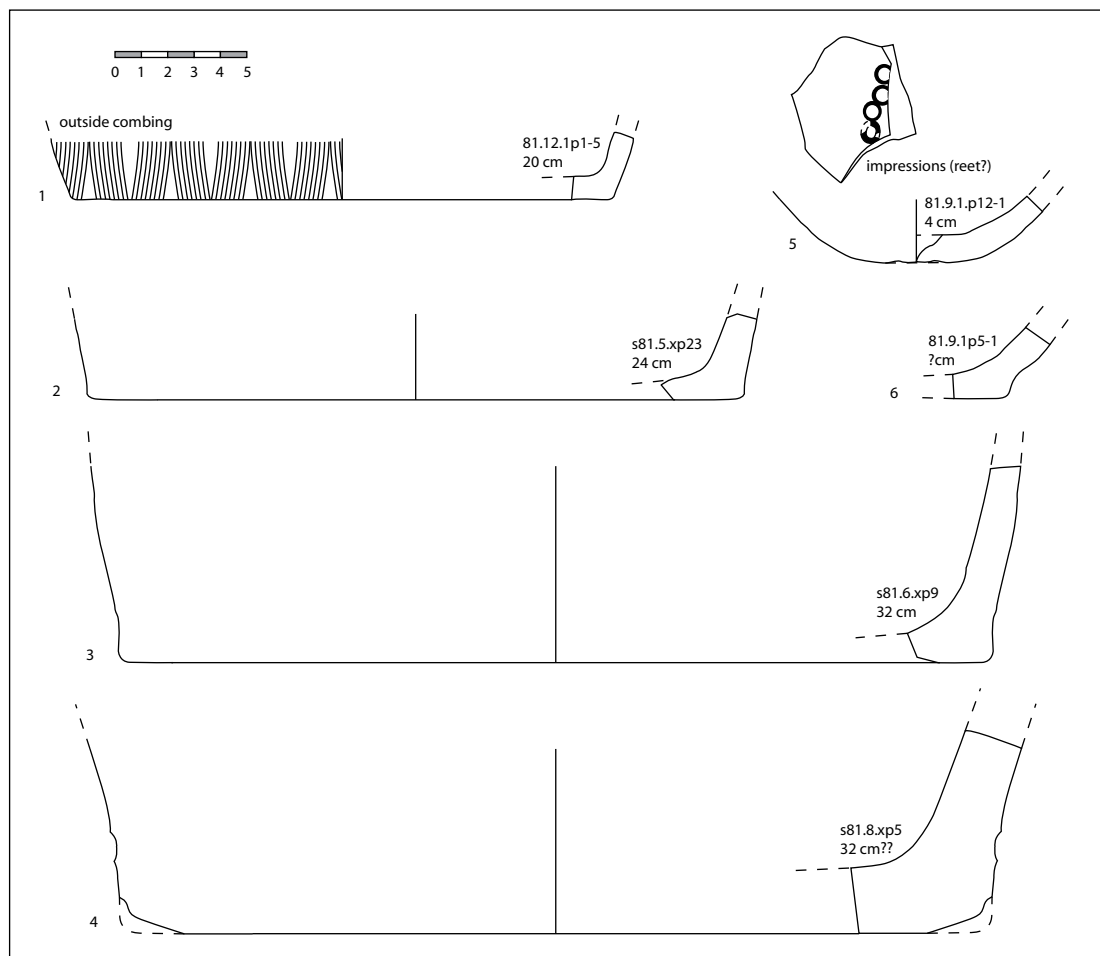


Figure 4.59 Bases

No.	Sherd no.	Parallels	Date	Remarks
1	81.12.1p1-5	Shoham (Commence 2005: fig.6.19) Handaquq S (Chesson 2000: 20.4-5)	L Chal EB II/III	combing
2	s81.5.xp23	several	L Chal/EB	
3	s81.6.xp9			
4	s81.8.xp5	Tell 'Umm Hammād 2/7-9 (Helms 1992c: 246:1)	EB Ia	Very thick
5	81.9.1p12-1			Reed impressions
6	81.9.1p5-1	Tell 'Umm Hammād (Helms 1992c: 246:2-5)	EB Ia + 1x Ib	

Table 4.27 Bases

Conclusions pottery assemblage

Given the parallels with excavated pottery the majority of the field 81 assemblage seems to date to the EB Ia period with some continuation into the EB Ib period. The good parallels with the transitional Late Chalcolithic/EBA site of Hujayrat al-Ghuzlan near Aqaba are remarkable and suggest that part of the assemblage may date to the very early part of the EB Ia. The abundant presence of parallels at Shuneh N, even for seemingly rare vessels, is another indication for a possible early EB I date for the concentration. Shuneh N is one of the few sites in the Jordan Valley that was occupied during the earliest part of the EB I period or the transition between Late Chalcolithic and EBA (Blackham 2002: 99).

The hypothesis of an early EB I date is strengthened by the presence of EB Ia vessels that are not present at Tell 'Umm Hammād. Tell 'Umm Hammād was occupied during the EB Ia period, but only in the later part of that period (e.g. Blackham 2002: 100). Grey Burnished Ware, generally considered to be the hallmark of the EB I period, is completely absent in this concentration (Philip 2001: 203). At nearby Tell 'Umm Hammād Grey Burnished or Esdraelon Ware (genre 45) has been discovered (Helms 1992c: fig.129). The many vessels discovered, including those discovered at Tell 'Umm Hammād together with Grey Burnished Ware, firmly date this concentration to the EB Ia and even EB Ib period. An explanation for the absence of Grey Burnished Ware can perhaps be found in Philip's suggestion that scholarly attention has overemphasized the colour and surface treatment of the Grey Burnished Ware and neglected the similar shape and function of other everted rim bowls, like genre 48 at Tell 'Umm Hammād (Philip 2001: 205). This type of bowl is present in the field 81 concentration and might be a functional alternative for the Grey Burnished Ware.

There are, however, also vessel shapes in this concentration that are absent at nearby Tell 'Umm Hammād.⁴⁷ The many similarities, nevertheless, make it likely that both sites were contemporaneous for part of their existence. Their close proximity, i.e. less than 4 km apart, makes it unlikely this absence is due to a regional difference. The uniformity and rural nature of most excavated EB I sites, furthermore, makes it unlikely that this dissimilarity is due to functional differences. It is, therefore, concluded that this concentration centring in field 81 predates the first EBA occupation at Tell 'Umm Hammād and should be dated to a very early part of the EB Ia period or possibly even to be transitional Late Chalcolithic/EBA. It is likely that both sites were occupied during the later part of the EB Ia period. Although the majority of the vessels has parallels in the EB Ia period, the concentration probably continued into the EB Ib period as several shapes occur during the entire EB I period. The occasional red slipped and burnished surface treatment argues in favour of a continuation of the concentration in the EB Ib period. There is no indication of significant human activity at this location during the EB II or later Bronze Age periods. The pottery chronology of the EBA is, however, not sufficiently refined to allow these very detailed divisions into EB Ia, EB Ib or even more specifically the early part of the EB Ia period, especially not on the basis of surface finds. An attempt is, nevertheless, made to compare this assemblage to that of other sites and position this site in a relative chronological especially with nearby sites like

47 It should be noted that several of the vessel types absent at Tell Umm Hammad are present in the survey assemblages of Katāret es-Samra and Ruweiha (Leonard 1983).

Tell 'Umm Hammād. However, the only manner to gain a more detailed chronology and establish whether the differences in assemblages are indeed chronological, or functional, and not a result of post-depositional processes is to excavate the site stratigraphically and obtain a series of radiocarbon samples providing absolute dates.

Lithics

The flint concentration in fields 81 and 82 is by far the densest flint concentration discovered in the survey (see figures 4.3 and 4.4). The discovered tools had a density of 2.1 lithics per 100 m², while the waste had a density of as much as 13.3 artefacts per 100 m². In contrast to the pottery distribution, the flint concentration, despite having its centre at the same location, extends to field 82 closer to the river. Another contrast with the pottery concentration is the diversity of the lithic material. While the diagnostic pottery dates solely to the EB I period the flint category harbours a number of tools that are regarded typical for Late Neolithic/ Chalcolithic periods and do not occur in the EBA. These tools predating the EBA are very similar to flint artefacts first discovered by the EJVS at Qatār Zakarī, located south of the village of 'Abū al-N'eim (Ibrahim et al. 1988: 191). Kafafi, who examined the Neolithic material from the EJVS, described the discovered remains, which were limited to lithics, more carefully and assigns a date in the Late Neolithic /Early Chalcolithic period (Kafafi 1982: 170). During his geomorphological studies on the section cut by the Zerqa at this location Mabry also found flint artefacts dating to the Late Neolithic or Early Chalcolithic period (Mabry 1992: figure 2.11). These discoveries show that human activity of some sort was present nearby during this period. Some of the discovered artefacts are very similar to those of Qatār Zakarī. Kafafi shows they discovered borers, scrapers, a bifacial knife, a chisel, an adze with polished edge and a few cores (Kafafi 1982: 170-172).

Similar to the finds at Qatār Zakarī fields 81 and 82 have revealed a chisel (81.12.1f1), two drills (81.11.1f3), bifacial and unifacial knives and several scrapers (see figure 4.60 and table 4.28). The denticulated blades (e.g. s81.bl3.xf1) are very similar to the denticulated blades discovered by Mabry, although no sickle gloss was present on the blades discovered here (Mabry 1992: fig. 2.11:1). The same applies to the small retouched bladelet, which is almost identical to s81.bl3.xf4 (Mabry 1992: fig.2.11:3). At least part of the assemblages seems to be very similar and to share a common date. However, not all tools can be precisely dated. Drills, for example, occur in most periods, continue into the MB II period and can, therefore, not be precisely dated (Rosen 1997: 71). The same applies to the scrapers, retouched flakes and blades and notches, as these are all relatively simple expedient tools (e.g. Rosen 1997: 87, 90, 92).

There are, however, also tools present in the assemblage that can be more precisely dated. The most typical and easily recognisable type is probably the arrowhead s81f6 (see figure 4.60). The arrowhead, which had been burned, belongs to the so-called Harpasa point type, which is generally dated to the Pottery Neolithic period (Gopher 1994: 41, fig.4.7). The chisel (81.12.1f1) is found in the Late Neolithic period, but occurs in the Chalcolithic period as well (e.g. Gilead et al. 1995: table 5.8; Rowan 2006: 512). The backed sickle blades (e.g. 81.9.1f2) can also be dated to the Late Neolithic and Chalcolithic periods, while the denticulated blades stem from the Late Neolithic period only (see figure 4.60) (Rosen 1997: fig. 3.1). Slightly west of field 82 a geometric bitruncated sickle blade with gloss on both lateral sides was discovered (s82f1). Geometric sickle blades were in use from the MB II period to c. 700 BC (Rosen 1997: fig. 3.19).

In contrast to neighbouring Katār Zakarī the assemblage of fields 81 and 82 also contains tools that date to the Chalcolithic and/or EBA only. These artefacts are more in agreement with the date of the pottery assemblage and have been found in other Late Chalcolithic/ EBA concentrations discovered in the survey as well (see sections on Katār Dāmiyah and al-Rweihah). The tabular scrapers are very typical for the Chalcolithic period, although it has been evidenced that they continue into the EBA. Three tabular scraper fragments have been collected, e.g. 81.12.1f10 (see figure 4.60). Typical for the EBA are the Canaanite blades, although proto-Canaanite blades have been attested in the Late Chalcolithic period as well. A few very typical Canaanite sickle blades have been discovered in this concentration, e.g. 81.7.1f3 (see figure 4.60). This finds show that the flint assemblage clearly contains Late Chalcolithic and EBA tools as well and does not date merely to the Late Neolithic and (early) Chalcolithic periods.

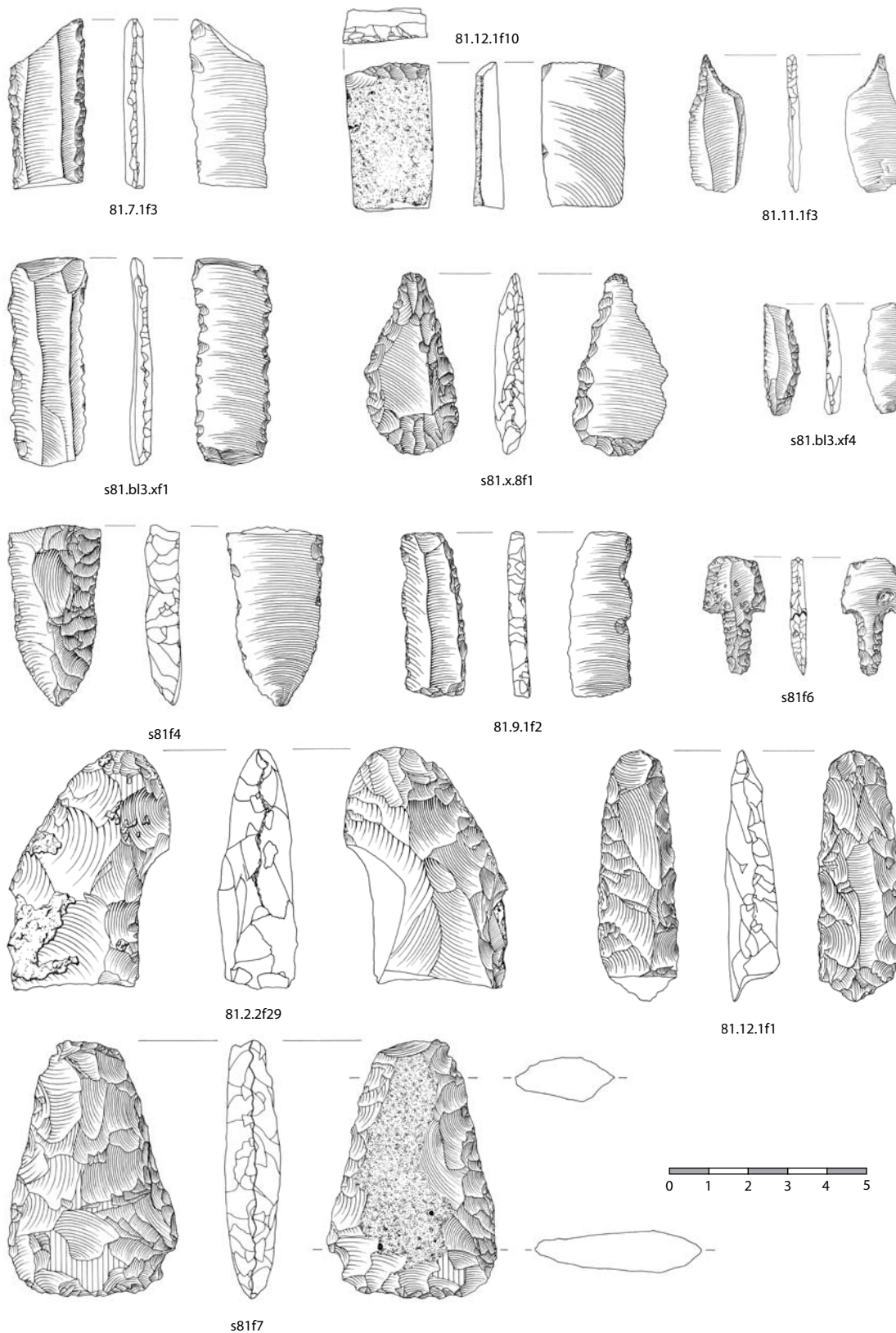


Figure 4.60 Selected flint tools

Besides its high density this flint concentration also stands out for a few remarkable finds. One of the more remarkable discoveries was a bifacial knife (s81f7) whose intact condition, careful and detailed execution and quite heavy use polish made it an exceptional find (see figure 4.60). A very similar example has been excavated at Gilat (Rowan 2006: fig. 11:19). A second uncommon artefact is s81.8.xf1. This pointed tool, which has been carefully retouched on all edges, may originally have been a drill, but was reused as a sickle judging by the thick gloss present along one edge. S81f4



Figure 4.61 Distribution of flint debitage

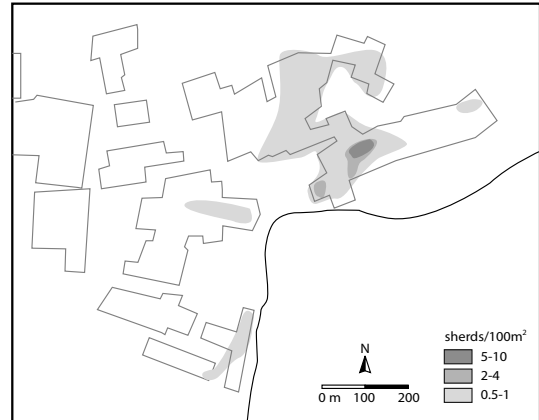


Figure 4.62 Distribution of flint tools

is a thick blade of high quality translucent flint with long, carefully executed flaking on one edge (see figure 4.60). Also remarkable is 81.2.2f29 (see figure 4.60), a heavily worked crescent-shaped bifacial tool.

Concluding, it can be stated that the flint assemblage both agrees with and deviates from the pottery assemblage from this concentration. It accords with the pottery in the EBA date of the Canaanite blades and possibly also the tabular scrapers. However, the lithic assemblage also contains artefacts that clearly have an earlier date somewhere in the Late Neolithic and/or Chalcolithic periods. Similarly, the flint assemblage shows a clear spatial concentration at the same location as the centre of the pottery concentration, but a second centre is visible, located slightly further to the south-west in field 82 and the south-western part of field 81. The distribution of the different flint tools shows that the EBA Canaanite blades are all found in the north-eastern cluster, while the artefacts that date to the Late Neolithic and Chalcolithic, like the denticulated blades, arrowhead and celts, centre in the south-west of field 81 and west of field 82. Instead of one multi-period site, this area seems to harbour two separate sites that slightly overlap. Due to this overlap it is impossible to determine the character of the waste of both sites.⁴⁸

Flint tools	No.
Retouched blade	10
Denticulated blade	3
Backed blade	2
Sickle blade	9
Geometric sickle blade	1
Backed sickle blade	3
Canaanite sickle blade	3
Scraper	9
Tabular scraper	3
Retouched flake	1
Bifacial knife	2
Adze	1
Chisel	1
Notch	1
Arrowhead	1
Drill	2

Table 4.28 Flint tools

48 Calculated per field, the distribution of blades, bladelets and flakes is 23 %, 10 % and 80 % in field 81 versus 27 %, 20 % and 60 % in field 82. The overlap means that little significance can be attached to these differences.

Fieldno.: 131-133 (al-Rweihah)

Coordinates tell: 749,496/3,565,343
 Size: tell largely destroyed,
 halo *c.* 150 m radius
 Days and time surveyed: Oct. 19th-20th 2006,
c. 17 man-hours
 Periods discovered: EBA I



Figure 4.63 Al-Rweihah with fields 130-133 (dark = non-feature sherds, white = feature sherds, n = 50)

Description

The site of al-Rweihah was first discovered in 1960 by the ‘tomb search party’ led by Diana Kirkbride (see section 2.2). Kirkbride’s notebook and the finds present in the Deir ‘Allā archive at Leiden University show the team discovered three sites in the vicinity of Tell al-Rweihah, i.e. site 6, 17 and area E.

Site 6 has been labelled Rashafiyeh. It is described as south of Trought’s road and extending round the base of Trought’s mountain. Trought was the first director of the Agricultural station at Deir ‘Allā. He built some houses on the slopes of the plateau due east of Deir ‘Allā on the north side of the Zerqa and constructed a road running towards them. Although it is not certain which road Trought actually constructed, it is likely that the road the ‘tomb search party’ referred to as Trought’s road is the one leading from Deir ‘Allā to al-Rweihah. Al-Dbāb, site 5, is located to the south of Trought’s road and site 6, at the foot of the mountain, is also found to the south of this road. Kirkbride describes the finds as ‘a steady scatter of flints spread all over [the] talus and at [the] foot of the mountain [and] some sherds, Byzantine, etc.’. She continues that they found some ruins of dolmens at the foot and on the lower slopes of the mountain. Furthermore, a shaft tomb and a large fallen rock were identified. The latter had a circle of 1.5 m in diameter with a smaller circle in its middle carved in it. The shaft tomb is described as a long rectangle with a small round enclosure, which supposedly was cut into solid rock.⁴⁹ Unfortunately no photographs or drawings could be found to elucidate these puzzling statements.

Site 17 is the last of the sites discovered by the ‘tomb search party’. Kirkbride only wrote down ‘site 17 Rusheifeh – Chalcolithic’. Franken, however, added more information about the location of the site. According to him it was located due east of Tell Deir ‘Allā at the foot of the mountain below the beehive houses built there for the Agricultural station by Trought. Franken also refers the reader to the description of ‘tomb area E’ later in the notebook. The flint and pottery of this site were both recorded as being kept. However, while the pottery is still present at Leiden University, the flint had been lost as early as in 1971 as we can gather from a note by Franken to that effect dating to August 10th 1971.

Kirkbride’s description of tomb area E gives a similar description to that of site 6. It is referred to as the area at the foot of Trought’s mountain, but on the western side of the road. She mentions that it is located close to site 17. Based on this close proximity she concludes that it is probably Chalcolithic in date. At some point in time the date Early Bronze Age III has been added in a different handwriting (Franken’s?). A general remark mentions that this area consists of dolmens and stone foundations of large blocks. Four or five trenches were excavated and a short description of the unearthened layers was given.⁵⁰ A few photographs were made of the excavation trenches which show they were located just east of the domed mud brick houses built by Trought. The pottery encountered in these trenches is still available in the Deir ‘Allā Archive and can be dated to the EB

⁴⁹ These remarks on the shaft tomb are, however, difficult to read and the order of words is grammatically confusing.

⁵⁰ The trenches are numbered one to four, but number two occurs twice.

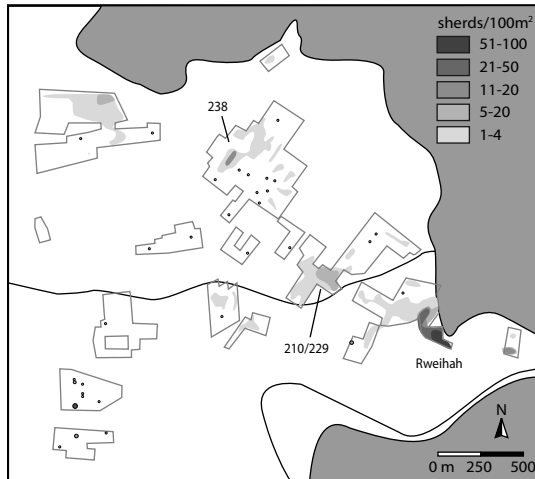


Figure 4.64 Distribution feature and non-feature sherds



Figure 4.65 Distribution feature sherds

III period. Notwithstanding the geographical proximity of area E and site 17 the pottery indicates there is no chronological link between the two sites or between tell al-Rweihah and tomb area E. The trenches excavated by Kirkbride are, therefore, described elsewhere (see section 4.2.3).

None of the finds from site 6 were encountered in the Deir 'Allā Archive. The pottery from site 17 was, however, still present. The material from site 17 is consistent with a date in the EB I period, as described in detail below. Franken probably referred to this site in his preliminary excavation reports of the first two seasons when he mentioned a large Late Chalcolithic/EB village 3 kms due east of Deir 'Alla (Franken 1960: 392, 1961: 371). Furthermore, some sherds from this site were put on display in the 'Pottery and Potters – Past and Present' exhibition of 1986 in Brussels, but apart from these succinct disclosures Kirkbride's findings have never been published (Homes-Fredericq and Franken 1986: 65).

The site was surveyed and reported by the EJVS in 1976 (Ibrahim et al. 1988: 190,194). They dated the site to the Late Chalcolithic/EB period and listed it as among the major sites from that period, but no further information was provided. During the excavations at Tell 'Umm Hammād Helms visited the tell and he and Betts published some of the collected material in the Tell 'Umm Hammād excavation report (Helms 1992c: fig.256-260). He encountered the tell in a heavily degraded state describing it as a 'small, now virtually destroyed, settlement' (Helms 1992c: 95). Only a small part of the tell remained, the rest seems to have been ploughed away leaving only sparse remains on the surface. On its western side the tell was dissected by a modern track revealing occupation layers to a depth of about one meter (Helms 1992c: 96). The collected pottery was linked to the excavated Tell 'Umm Hammād genres. Based on this comparison Helms dated the majority of the al-Rweihah pottery to the EB Ia and to a small share to the EB Ib period. In contrast to Franken and the EJVS, Helms interpreted the site as a small open village (Helms 1992c: 97).

In order to determine the link between Kirkbride's area E, site 6 and site 17 and Tell al-Rweihah and to ensure the present day existence and condition of the tell it was decided to revisit the location. Nothing of area E could be recovered as the domed houses have been removed and built over by several other houses. The situation encountered at and around Tell al-Rweihah was almost exactly as described by Helms. A small part of the tell was still present although some shallow holes had been dug and a few child's graves were visible. The road was still a dirt track showing occupational layers of the tell in its section. Although finds on the tell itself were indeed sparse the survey examined all accessible areas surrounding the tell attesting a lot of pottery, some flint tools and a stone macehead (see figure 4.66). The location description of site 17 and the pottery present in the archive suggest that this site and Tell al-Rweihah are one and the same or were located close by each other. Site 6 seems to have been located at more or less the same location, but it is strange that Kirkbride did not mention this. The slightly varying description of south and east of Trought's road and 'extending around the base' and 'at the foot' of Trought's mountain, suggests site 6 might

have been located slightly to the southeast of site 17. The toponyms of Rashafiyeh and Rusheifeh, clearly containing the same root, show they cannot have been located far apart. Figure 4.63 shows the proposed locations of Kirkbride's sites 6, 17 and Tomb Area E.

The present survey's finds

The macehead is one of the non-pottery few finds collected at the site. It is made at fine grained basalt, carefully worked and perforated from both ends. Maceheads are one of the hallmarks of the Chalcolithic period, but continue into the EBA. A few meters to the west, a piece of limestone with a circular depression was found evidently fallen down the slope of the bulldozer cut. Clear regular grooves are visible on the walls of the depression. As these are likely caused by a regular and repeated turning movement a function as door socket seems probable. A third stone artefact was found within field 232 and consists of a reddish block of coarse sandstone with a shallow depression (232.4.1m1). This stone artefact has been interpreted as the lower stone of a pounding device.



Figure 4.66 Macehead (s232.2-3.2m1)



Figure 4.67 Hole with circular grooves

Flint

The number of flint artefacts discovered at and near tell al-Rweihah is very limited. This probably does not reflect absence of flint implements, but is likely caused by the present-day use of the site. As few as four flint tools were collected, all sickle blades with gloss on the working edge. Three of these sickle blades were of the Canaanean type, one was a backed blade. Canaanean blades date from the EB I until the MB II period, while backed blades occur mainly during the Chalcolithic period (Rosen 1997: 65). The backed blade also had a little retouch on the non-backed lateral side. The sickle gloss on this non-backed side clearly suggests grasses of some sort were cut with this tool. The three Canaanean blades also exhibited clear sickle gloss on one or in two cases on both sides. The two Canaanean sickles that show retouch and gloss on both lateral sides demonstrate that sickles were a carefully treated commodity reused on the other side once one working edge was exhausted. The raw material from which the three Canaanean blades were made is very similar and the artefacts may even stem from the same core (see below). This brown fine-grained flint with a few faint darker stripes is probably of Eocene origin. It differs from the Eocene flint discovered in field 500 in that it is less grey and slightly finer-grained.

The amount of flint waste was as limited as the tools; two flakes, one Canaanean blade and a core were discovered. The Canaanean blade is made from fine-grained, striped, greyish brown flint. This is possibly of Eocene origin. The flakes and core are made from the small Cretaceous flint nodules abundantly available in this area. It is not likely that this small collection represents the total flint assemblage of an EBA village. It is more probable that the cultivation of cucumbers in one part of the area and the heavy ploughing of the other part causing the soil to break into big lumps were not advantageous for the recovery of the generally small flint artefacts.

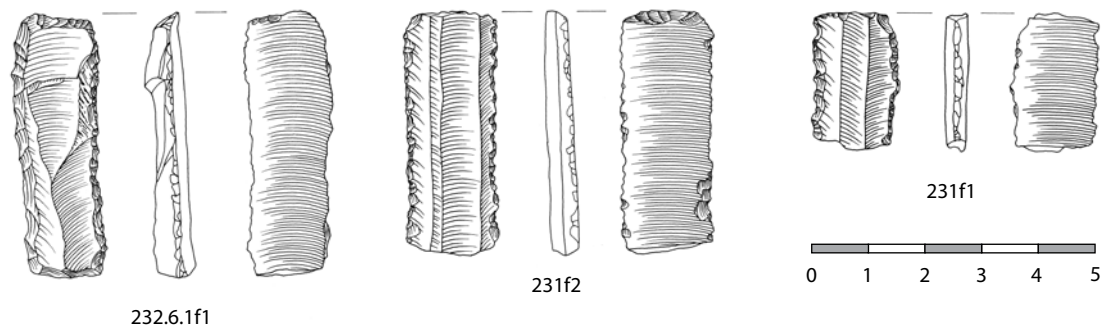


Figure 4.68 Sickle blades discovered in survey

A find that was not done during this survey, but already in 1960 changes the al-Rweihah flint assemblage completely. During the first season of excavations at Tell Deir 'Allā, a villager presented what Franken describes as a handful of Chalcolithic flint knives apparently stemming from the same core (Franken 1960: 392). The tomb search party led by Kirkbride surveyed the find location described by the man and discovered tell al-Rweihah (site 17). Once again the Deir 'Allā Archive at Leiden University did not fail us, as it held the flint knives brought to the foreigners who were interested in old things, now almost 50 years ago. Inside a paper bag at least 23 different Canaanite blades were found. It is certain that these blades are the flint knives discovered by the man at al-Rweihah as they have been marked with the site number Kirkbride gave to the site, i.e. site 17.

None of the blades is retouched. They are all of a very similar brown, fine-grained flint with some darker stripes. Some are slightly spotted and sometimes demonstrate both stripes and small patches of a different colour. This type of flint, especially in such large nodules, is not locally available. The blades appear to stem from not more than 2 or 3 different, but related cores of the same flint type, and might even all derive from one single core. Of this group of 23 separate Canaanite blades as many as 10 are complete. A further three are almost complete (no more than one or two cm of the distal end has broken off) and 5 blades, though broken, present the largest part. In four cases only a fragment of a few centimeters is present. On 14 blades the proximal end including the striking platform and bulb of percussion are present. The largest complete blade is 17.3 cm long. Two almost complete blades could be refitted and the colour pattern on some others shows they were located very close to each other in the original core. The sizes of the blades and the different amount of hinging at the distal ends shows the relative position the blade occupied within the core. The shorter or more hinged blades were located more towards the outside, while the large straight ones were closer to the centre of the core. Most remarkable however is that two of the Canaanite sickle blades discovered at al-Rweihah during the 2006 survey are of exactly the same flint as these blades. The colour patterning is so similar that a refit would have been feasible had more than a length of 2 and 4 cm been preserved. The third Canaanite sickle blade discovered is made of the same brown coloured flint, but would be less easy to refit as it has much less patterning.

Canaanite sickle blades have been found at almost all EBA sites in the southern Levant. Cores are however notably absent. Only at a limited number of sites have cores been found either individually or in pairs, e.g. at Tel Halif, Har Haruvim, Gat-Guvrin, Gezer, and Saida-Dakerman (Rosen 1997: 108). Only at the first three sites have greater numbers of cores been found. Apparently the ubiquitous Canaanite blade was manufactured only at a restricted number of sites. This distribution and the shape of the blades suggests a certain level of specialisation as the technique of knapping these long blades seems not to have been at everyone's disposal. Furthermore, these blades were made from special high quality fine-grained Eocene flint that is not locally available in all parts of the southern Levant. A third indication that a low level of craft specialisation was present is the great technological contrast that Rosen describes between the blade tools and the flake tools from which most other domestic flint tools are made. The flakes are always made of local flint and often in an ad hoc fashion (Rosen 1983a: 28). The long and careful use of the sickle blades evidenced by resharpening and haft reversal, furthermore, shows they were valued com-

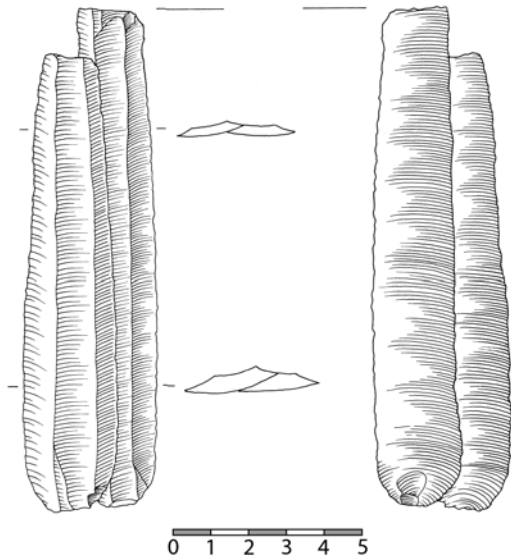


Figure 4.69 Refitted Canaanite blade blanks from Kirkbride's collection

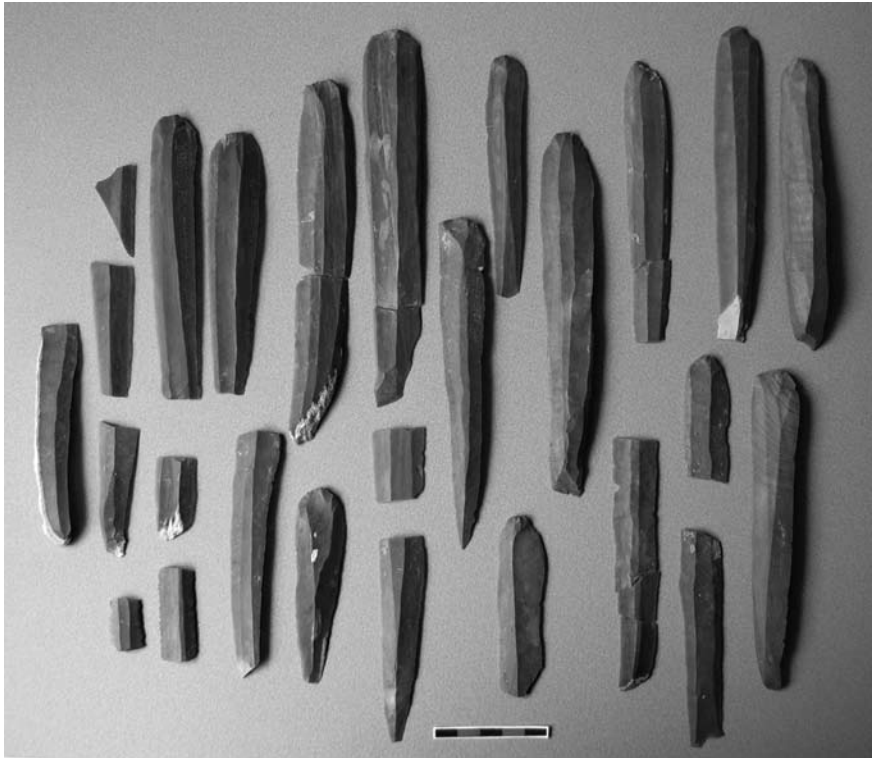


Figure 4.70 Assemblage of Canaanite blade blanks from al-Rweihah

modities. The other tools made from local flint in an ad hoc fashion seem to have been discarded and replaced more easily, cf. most of the flint assemblage from the EB concentration around field 128 (see next section).

The knapping of the Canaanite flint blades from a core was thus probably a specialized activity. The subsequent modification of these blades into sickles, however, was most likely not. At a few sites caches of unmodified Canaanite blades, exactly like the blades discovered here, have been found. At the early EB I sites of Nizzanim on the coast and Motza in the central hill country of Cisjordan unretouched sickle blades have been found in groups of eight and five blades respectively. At Nizzanim the eight blades were discovered on a floor in such a way that the excavators

note they seem to have been wrapped or tied together. All were of good quality flint (Yekutieli and Gophna 1994: 176). At Motza the blades were found in situ together with a bowl, a krater and a bone point on a floor next to a sunken curvilinear house. They are of high quality, non-local flint and probably stem from the same core (Eisenberg 1993: 42). Rosen mentions two more caches discovered at Beth Yerah and Lower Horvat 'Illin (Rosen 1997: 107). He concludes that, given the absence of cores, these unmodified blades were probably traded from the site of blade production to villages where they were finished into sickle blades (Rosen 1997: 107). The discovery of this very large group of blades seems to lend additional strength to this theory, especially if it is accepted that the finished sickle blades with gloss discovered in 2006 derive from the same core. The type of flint is not local and the blades are therefore certainly imported. The find context is admittedly far from ideal being a surface find by an unknown non-archaeologist 50 years ago and with all archaeologists involved having passed away. Nevertheless, the general location of the findspot seems certain and the uniformity of both the raw material and the blades themselves evidences their close association. This find is, therefore, interpreted as a cache imported to Tell al-Rweihah to be finished by the EB I villagers themselves when needed.

Pottery

The pottery collected near Tell al-Rweihah is in general similar to the assemblages collected by Kirkbride and Helms. The EB I date proposed by Helms is, therefore, accepted without hesitation. On a more detailed level there are, however, some differences between the different survey assemblages.

Holemouth jars

The standard simple holemouth jars with a rounded rim, e.g. 233.2.1p18+19, that continued from the Late Chalcolithic period onwards are missing from the assemblage published by Helms. They are also largely absent from Tell 'Umm Hammād and the field 81 assemblage.⁵¹ They are, however, the norm in the field 500 assemblage at Katār Dāmiyah. They are generally dated to the early part of the EB I period (see site 500), but they are of a very simple archetypical shape and an existence in different periods can, therefore, not be ruled out. Two differently shaped holemouth jars (s232.x.xp19 and 232.6.1p2) have a parallel in the jars depicted by Helms (Helms 1992c: fig. 256:8). Similar jars have been classified by Helms among the very diverse genre 16. This portion of genre 16 dates consistently to the EB Ia layers of Tell 'Umm Hammād (Helms 1992c: fig.177, 178). A very similar jar has been found in field 81 (s81.4.xp34). There is one holemouth jar for which parallels were not readily available, i.e. 232.3.1p10. The deep impressions on the rim resemble impressions on a holemouth jar in the field 81 concentration (300.3.8p11). An almost exact parallel has been found among the transitional Late Chalcolithic/EBA assemblage of Hujayrat al-Ghuzlan (Brückner et al. 2002: fig. 20:2).

No.	Sherd no.	Parallels	Date	Remarks
1	s231.x.xp19	Tell 'Umm Hammād 2/6 (Helms 1992c: fig. 178:1)	EB Ia	Like s81.4.xp34
2	232.6.1p2	Tell 'Umm Hammād 2/2 (Helms 1992c: fig. 177:6) H. al-Ghuzlan (Brückner et al. 2002: fig.21:3)	EB Ia Trans Chal/EB	Like s81.4.xp34
3	233.2.1p18	e.g. T. Ghassul (Lovell 2001: fig.4.37:1) H. al-Ghuzlan (Brückner et al. 2002: fig.22:7)	L Chal Trans Chal/EB	Like 500.x.2p27 + 7p7, many poss parallels in Chal + EB I
4	233.2.1p19	e.g. Arad str V (Amiran et al. 1978: pl.3:4)	L Chal/EB Ia	Like 500.x.2p27 + 7p7
5	s231.4.2p4	e.g. Arad str V (Amiran et al. 1978: pl.6:1-3)	L Chal/EB Ia	Like 500.x.2p27 + 7p7
6	232.3.1p10	H. al-Ghuzlan (Brückner et al. 2002: fig.20:2)	Trans Chal/EB	c. 300.3.8p11

Table 4.29 Holemouth jars

51 Tell Umm Hammad has yielded a few specimens among its unclassified pottery (Helms 1992c: fig. 172:6-8).

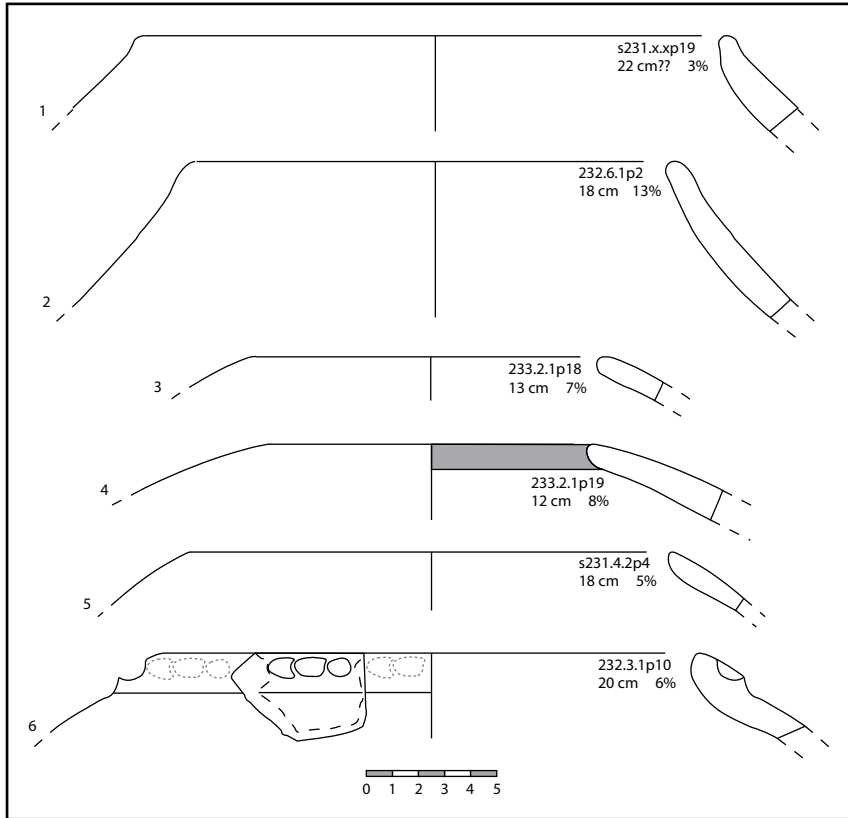


Figure 4.71 Holemouth jars

Straight necked jars

The necked jar 232.7.1p3 resembles an al-Rweihah jar depicted by Helms but is larger and has impressions on its neck (Helms 1992c: fig. 258:1). It bears some resemblance to vessels within genre 16, but these are not exact parallels although similar impressions are present (Helms 1992c: 182:3,5,7). These vessels stem from EB Ia layers. Comparable jars that lack this type of impression stem from both Late Chalcolithic sites like Tuleiat Ghassul and EB I sites like Jericho (see references in table). Similar vessels that are, however, not real parallels are found in both the EB Ia and Ib layers of Handaquq N (Mabry 1996: fig.12). The impressions of jar 232.7.1p3 are best paralleled in the EB Ia assemblage of Bab adh-Dhra' (Rast and Schaub 2003: fig.5.2:5-9). Rim 232.6.1p7 has its best morphological parallel in a vessel within Tell 'Umm Hammād genre 32 dating to the EB Ia period (Helms 1992c: 206:17). This vessel, however, has a very different surface treatment. The small and rather deep needle-like impressions are unparalleled so far.

No.	Sherd no.	Parallels	Date	Remarks
1	232.6.1p7	TUH 2/2 (Helms 1992c: fig. 206:17)	EB Ia	No exact parallel; similar shape
2	232.7.1p3	c. T. Ghassul (Lovell 2001: fig. 4.40:4) c. Iktanu (Prag 2000: fig. 5.3:7-9) Jericho (Nigro 2005: fig. 33:2,7) Tell 'Umm Hammād 2/7 + 2/9 (Helms 1992c: fig. 182:3,5,7)	L Chal EB Ia EB Ia EB Ia	No exact parallel, genre 16 Also indentations

Table 4.30 Straight necked jars

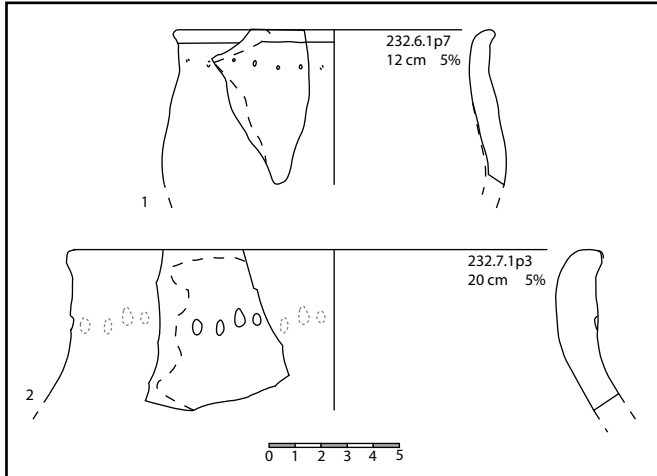


Figure 4.72 Straight necked jars

The necked jars

The relatively large number of necked jars discovered in this survey is completely missing from Helms' al-Rweihah collection. Kirkbride's assemblage does contain a few specimens. The jars discovered are of both the round everted neck type dominant at field 500 (e.g. 232.5.1p4/ s232.x.p1) and the flaring necked type common in the field 81 concentration (e.g. s231.x.p4/ 232.5.1p6). However, none of the jars has the impressions common in the other concentrations. Both types occur in both the EB Ia and b periods. The small jar s231.x.2p11 has parallels in stage two and three of Tell 'Umm Hammād (Genre 19) and in stratum IV of Bab edh-Dhra', both dating to the EB Ia and Ib (Helms 1992c: fig. 192:7,19; Rast and Schaub 2003: fig.7.2:13).

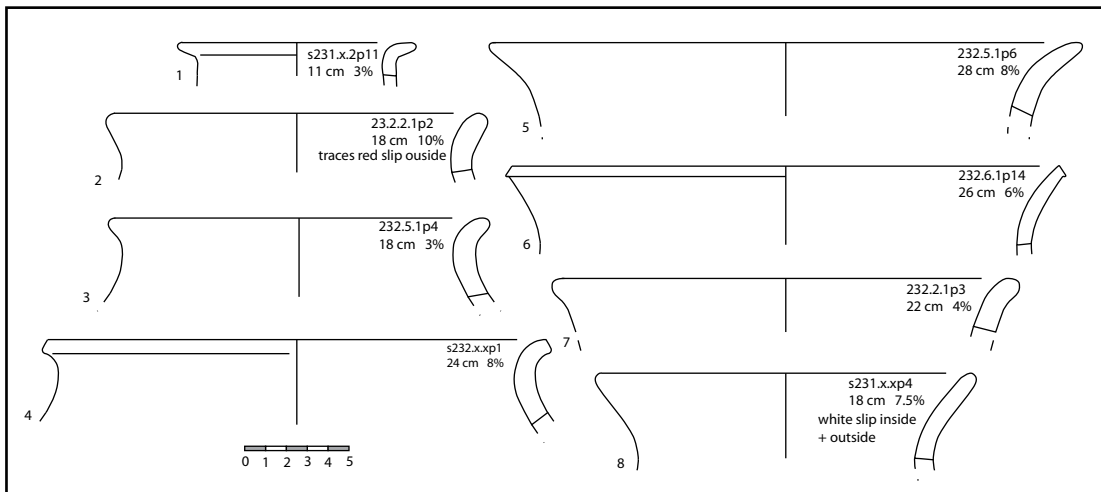


Figure 4.73 Necked jars

No.	Sherd no.	Parallels	Date	Remarks
1	s231.x.2p11	Tell 'Umm Hammād 3/11 (Helms 1992c: fig. 192:7,19) Bab edh-Dhra'str. IV (Rast and Schaub 2003: fig.7.2:13)	EB Ia+b EB Ib	Mostly stage 2, few stage 3
2	232.2.1p2	Tell 'Umm Hammād 2/6 (Helms 1992c: fig. 206:6) Jericho (Nigro 2005: fig.33:3-9, fig.36:10)	EB Ia EB Ia	Traces red slip outside Stratum IIIa1
3	232.5.1p4	Tell 'Umm Hammād 2/6 (Helms 1992c: fig. 206:6) Jericho (Nigro 2005: fig.33:3-9)	EB Ia EB Ia	Stratum IIIa1
4	s232.x.xp1	Tell 'Umm Hammād 2/5, 3/11 (Helms 1992c: fig. 206:1, 4) Jericho (Nigro 2005: fig.33:3-9)	EB Ia+b EB Ia	Stratum IIIa1
5	232.5.1p6	TUH 2/7, 3/11 (Helms 1992c: fig. 183:5, 184:11) Bab edh-Dhra'str. V (Rast and Schaub 2003: fig.5.1:20) Jericho (Nigro 2005: fig.34:,2,3,6)	EB Ia+b EB Ia EB Ib	Stratum IIIa2
6	232.6.1p14	TUH 2/6 (Helms 1992c: fig. 196:6)	EB Ia	
7	232.2.1p3			
8	s231.x.xp4			White slip

Table 4.31 Necked jars

The cups and small bowls

The small bowls and cups that have been collected by this survey partly show the same shapes as depicted by Helms. The shallow bowls (231.9.2p9, 232.6.2p1, 232.3.1p6) are very similar to those collected by Helms (Helms 1992c: 260:4-6). Kirkbride's collection did not feature this type of bowl. The bowl type with red lines (323.5.1p5), the so-called band slipped ware, had not been discovered before at al-Rweihah. Several specimens have been excavated at Jericho dated to the EB Ib period and it also occurs at Tell 'Umm Hammād from both the EB Ia and Ib layers (Helms 1992c: fig.226; Nigro 2005: fig.38:1,2). Two simple bowl types (232.3.1p1 and 231.9.2p1) have patches of soot on their rim. One of the shallow red slipped and burnished al-Rweihah bowls published by Helms also exhibited soot remains. These bowls were most likely used as lamps. The small cup s232.5-7.1p2 is the best parallel for the cups discovered at the Katār Dāmiyah/field 500. The ware is very similar to some of the field 500 cups and it is the best morphological parallel of a cup with a slight carination near the base and showing clear pinch marks related to the production process. Two other good parallels stem from the transitional Late Chalcolithic/EBA site of Hujayrat al-Ghuzlan (Khalil et al. 2003: fig.16:1,2). A similar cup had been found at Jericho and dated to the early part of the EB Ia (Kenyon and Holland 1982: fig.36:12). One other example has been excavated at EB Ia Wadi Burma North (TU102) located in southern Jordan (Fujii 2005: fig.21:42).

No.	Sherd no.	Parallels	Date	Remarks
1	s232.5-7.1p2	c. Jericho (Kenyon and Holland 1982: fig.36:12) H. al-Ghuzlan (Khalil et al. 2003: fig.16:1,2) W Burma N (Fujii 2005)	Early EB Ia Trans Chal/EB EB Ia	Like 500.
2	232.3.1p1	Jericho (Kenyon and Holland 1982: fig.34:12-14,16,20) Jericho (Kenyon and Holland 1983: 126:20,21) Tell 'Umm Hammād 3/11, 4/15 (Helms 1992c: fig.214:4,6,11), genre 36 2/8 (Helms 1992c: fig.211:12)	PU EB Ia EB Ia (to II)	Sooth on rim Nigro: IIIa1 Genre 39 mostly stage 2
3	231.9.2p1	c. Jericho (Kenyon and Holland 1982: fig.34:7) Tell 'Umm Hammād 2/1 (Helms 1992c: fig.213:7)	PU EB Ia	Sooth on rim
4	232.5.1p5	Jericho (Kenyon and Holland 1982: fig.34:25) Jericho (Kenyon and Holland 1983: 131:10,11) Tell 'Umm Hammād 3/11, 2/7-9 (Helms 1992c: fig.226:3,6,7)	PU EB Ib EB Ia+b	Band slip ware Nigro: IIIa2
5	231.9.2p9			
6	232.6.2p1	Bab edh-Dhra'str.IV (Rast and Schaub 2003: fig.7.3:13) c. Tell 'Umm Hammād (Helms 1992c: fig. 260:4)	EB Ib EB Ia+b	Genre 37 mainly st. 2+3
7	232.3.1p6	Bab edh-dhra'str.IV (Rast and Schaub 2003: fig.7.3:13) c. Tell 'Umm Hammād (Helms 1992c: fig. 260:5) Jericho (Kenyon and Holland 1983: fig.27:1)	EB Ib EB Ia+b EB Ia	Genre 37 mainly st. 2+3 Nigro: IIIa1

Table 4.32 Cups and small bowls

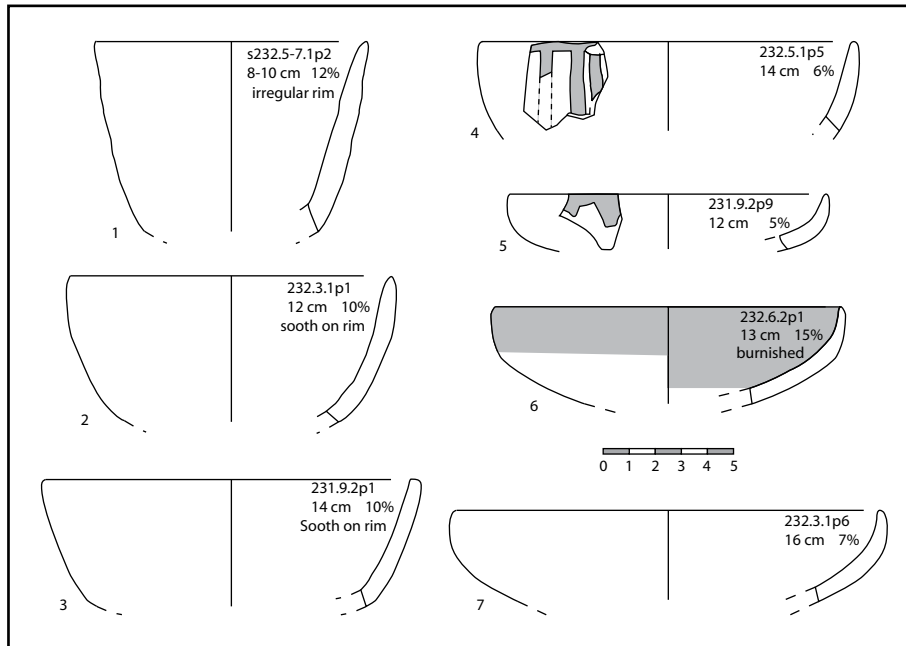


Figure 4.74 Cups and small bowls

Large bowls

Of the larger bowls discovered the two everted rim bowls are well represented in Helms' collection (Helms 1992c: 259:2-5). Several examples have been collected at al-Rweihah. At Tell 'Umm Hammād they are also quite ubiquitous and are mainly dated to the EB Ia period. This bowl type was, however, much less common in field 81. The other two bowls (231.1.1p1 and 232.6.1p3) are much less common and paralleled only in a few similar forms at al-Rweihah itself or in unclassified vessels from Tell 'Umm Hammād (Helms 1992c: 259:6).

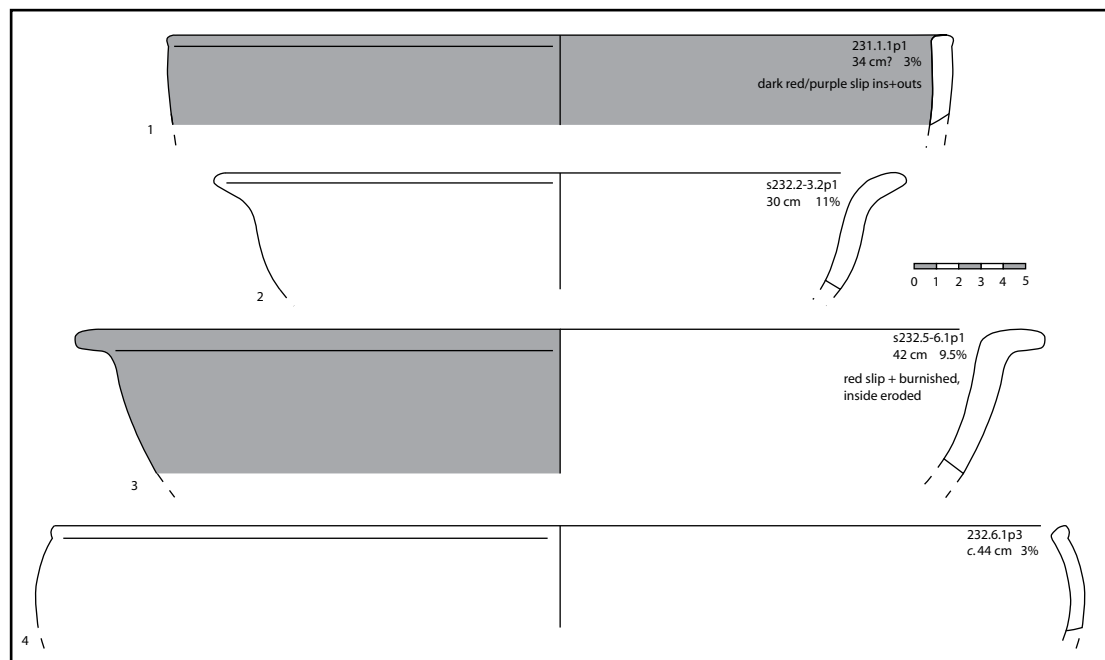


Figure 4.75 Large bowls

No.	Sherd no.	Parallels	Date	Remarks
1	231.1.1p1	Tell 'Umm Hammād 2/7-9 (Helms 1992c: fig.232:1)	EB Ia	Unclassified at TUH
2	s232.2-3.2p1	Tell 'Umm Hammād 4/15 (Helms 1992c: fig.218:5)	EB Ia	Genre 48 mostly st. 2, but 2x st. 4
3	s232.5-6.1p1			Genre 48
4	232.6.1p3	c. Tell 'Umm Hammād -/-- (Helms 1992c: fig.230:12)		Unclassified + 232.6.1p3 has larger diameter.

Table 4.33 Large bowls

Impressed bowls

The last group of bowls is again large, but their most distinguishing feature is a band of either large and deep (s232.5-7.1p5/ 233.2.1p3) or small and shallow impressions below the rim (231.6.1p1/ 232.2.1p1). Only a few good parallels could be found. One of the Tell Shuneh N bowls shows similarities, but has a much smaller diameter (Gustavson-Gaube 1986: fig. 9:18). Large bowls with large impressions just below the rim have been found at Hujayrat al-Ghuzlan (Khalil et al. 2003: fig.18:1,2). A large bowl with small impressions that resembles 232.2.1p1 from Bab adh-Dhra' stratum V (EB Ia) has been published (Rast and Schaub 2003: fig.5.2:7). The type of impressions is, however, very similar to the field 81 concentration impressions. Both the long crescent-shaped impressions and the small shallow impressions occur in this concentration, albeit on different vessel types, e.g. smaller bowls, necked jars and jars (81.9.1p13-2/ 300.3.8p6/ 81.12.1p4-1). Similar impressions, but on different types of vessels, have been found at Tell Shuneh N and Bab adh-Dhra' (Gustavson-Gaube 1986; Rast and Schaub 2003).

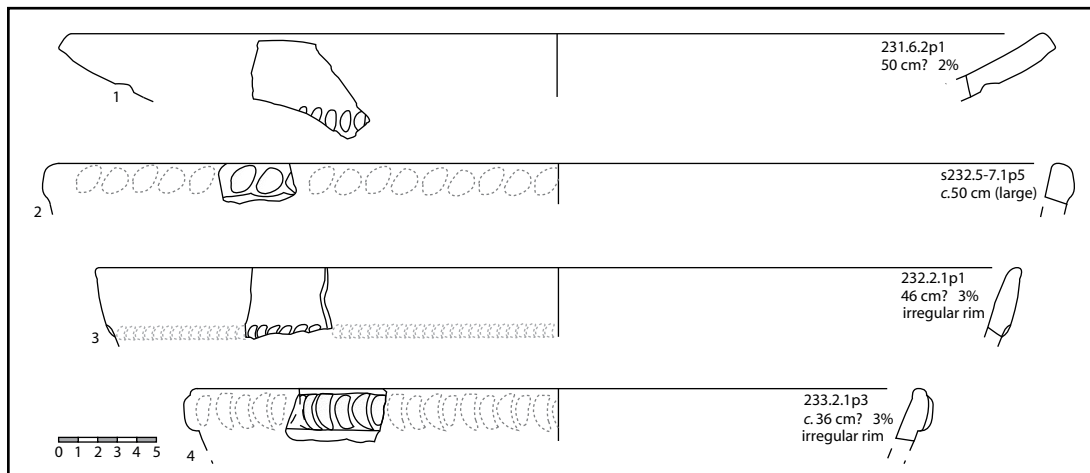


Figure 4.76 Impressed bowls

No.	Sherd no.	Parallels	Date	Remarks
1	231.6.2p1			Impr. like s81.7-12.1p1
2	s232.5-7.1p5	Shuneh N str. 37 (Gustavson-Gaube 1986: fig.9:18) but Ø22 cm H. al-Ghuzlan (Khalil et al. 2003: fig.18:1,2)	EB Ia Trans Chal/EB	Impr. like s81.8.1p19-1
3	232.2.1p1	c. Bab edh-Dhra' str.V (Rast and Schaub 2003: fig.5.2:7)	EB Ia	Like s81.4.xp31/81.9.1p13-2
4	233.2.1p3	H. al-Ghuzlan (Khalil et al. 2003: fig.18:1,2)	Trans Chal/EB	Impr. like s81.12.1p4-1

Table 4.34 Impressed bowls

Handles and spout

Ledge handle s232.x.xp7 and possibly also 231.7.1p3 are similar to specimens discovered by Helms. They are, furthermore, similar to artefacts discovered in the concentration in field 81 (see previous section). Like in field 81 a folded ledge handle was also discovered here. This handle may be

connected to the pottery Kirkbride discovered in the trenches of Tomb Area E where several similar handles were discovered. Alternatively, it may be one of the exceptionally early folded ledge handles discovered elsewhere as well (see references in table). The thick, deeply impressed ledge handle 232.6.1p4 is very similar to 500.x.2p8 (see figure 4.34). Almost identical handles were attached to bowls at Hujayrat al-Ghuzlan near Aqaba (see table 4.35). This type probably represents an early form of ledge handle as they quickly disappear during the later part of the EB I period. The spout 232.5.1p1-1 and loop handle 232.5.1p1 were both red slipped and burnished and probably date to the EB Ib period.

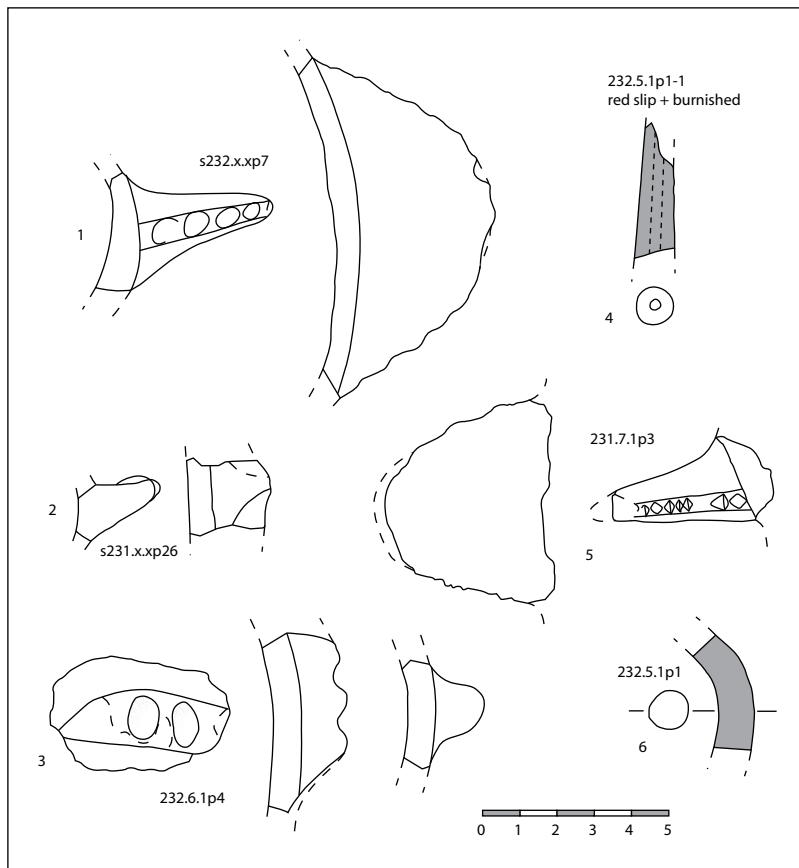


Figure 4.77 Handles and spout

No.	Sherd no.	Parallels	Date	Remarks
1	s232.x.xp7	Tell 'Umm Hammād 2/1, 2/9, 3/11 (Helms 1992c: fig.236:6,8,9)	EB Ia/b	Genre 64
2	s231.x.xp26	Jericho (Kenyon and Holland 1982: fig.41:17) Halif Terrace + Lachish (Yekutieli 2000: fig.8.5:2,3)	EB I EB Ia (1)	Like 81.3.xp6, folded ledge is often EB II-IV
3	232.6.1p4	H. al-Ghuzlan (Khalil et al. 2003: fig.18:2,6)	Trans Chal/EB	Like 500.x.2p8
4	232.5.1p1-1	e.g. Tell 'Umm Hammād 3/11 (Helms 1992c: fig.235:4,5)	EB Ib	Genre 63
5	231.7.1p3			Like s81.8.xp13
6	232.5.1p1	e.g. Tell 'Umm Hammād 3/11, 4/15 (Helms 1992c: fig.236:6,8,9)	EB Ib(II)	Genre 35

Table 4.35 Handles and spout

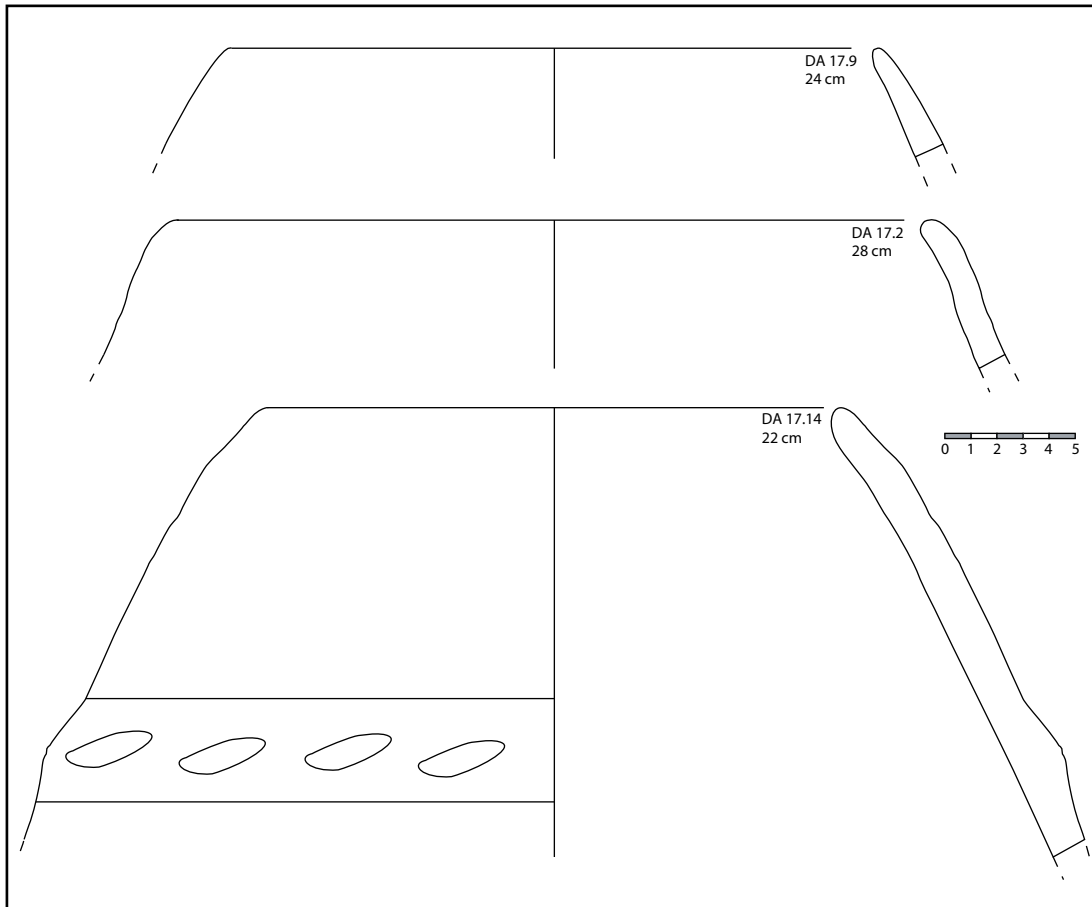


Figure 4.78 Holemouth jars from site 17

The Kirkbride assemblage

Only a sample of the assemblage collected by Kirkbride has been drawn representing the most common and some exceptional types. Very large fragments of holemouth jars are among Kirkbride's finds. They appear to be of the plain ware type, but the large part of DA17.14 shows that ridges of impressed decoration may have been present that have not been preserved.⁵² A very similar example to DA17.14 is found in Helms' al-Rweihah assemblage (Helms 1992c: fig.256:1). For parallels in excavated assemblages one is referred to the description of the present survey pottery above.

Many of the vessels depicted by Helms show small regular impressions below the rim. Very similar impressions were present in Kirkbride's assemblage, although the shape attested by vessel DA17.7 seems to be absent (see figure 4.79). The large bowl with brownish red smoothed slip on both the inside of the rim and the entire outside has not been identified in the present survey, nor in the Helms' survey.

Helms discovered or depicted very few curved necked jars similar to those depicted below. The present survey did, however, collect several, showing that they are a relatively common vessel type at this site. Several parallels can be found for this type of vessel, both with and without slip (see description above).

In contrast to the present survey Kirkbride did collect a piece of typical Grey Burnished Ware (DA17.1). Helms also discovered one fragment, which unfortunately did not feature a rim (Helms 1992c: fig.259:1). The Grey Burnished Ware rim discovered by Kirkbride is very similar to exca-

⁵² The numbering on the sherds stems from Kirkbride and denotes Deir 'Allā survey, site 17 and a serial number.

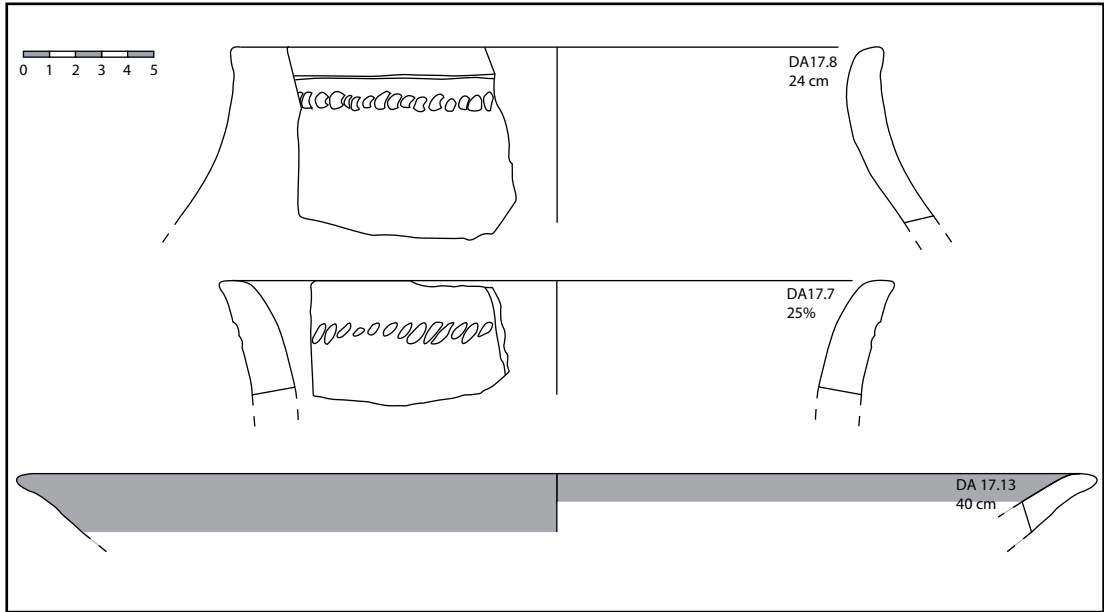


Figure 4.79 Pottery from site 17

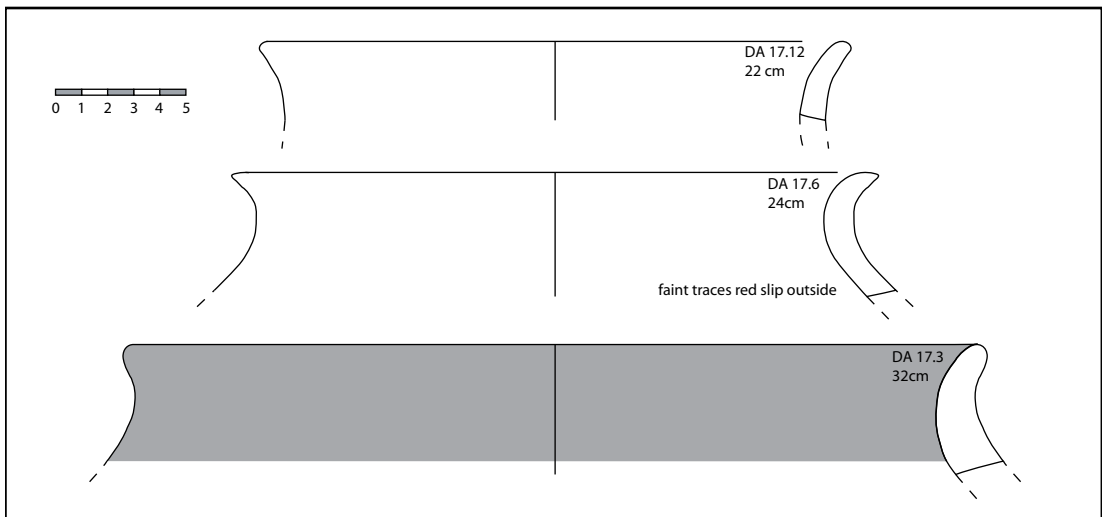


Figure 4.80 Curved necked jars from site 17

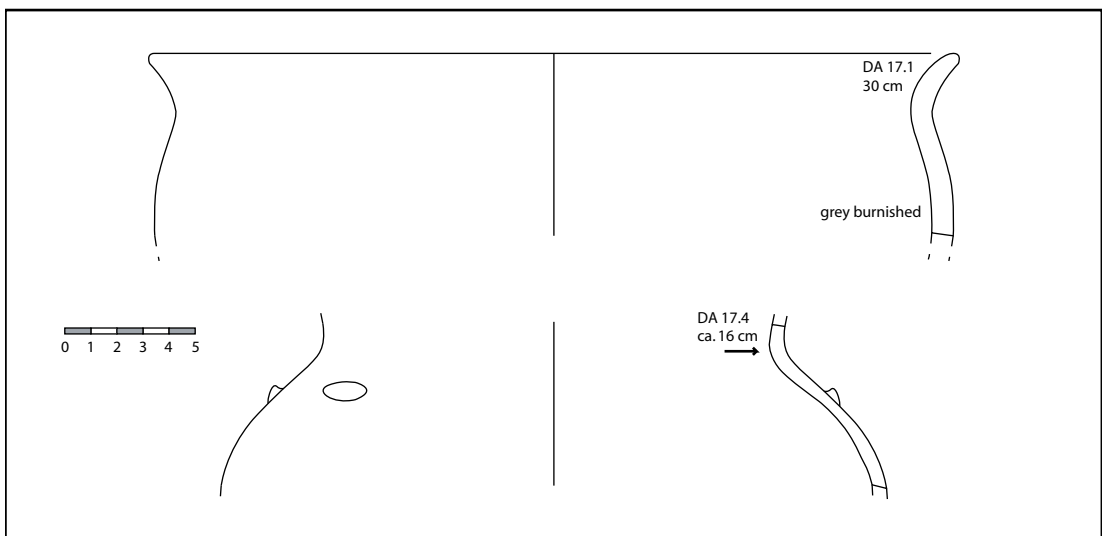


Figure 4.81 Pottery from site 17

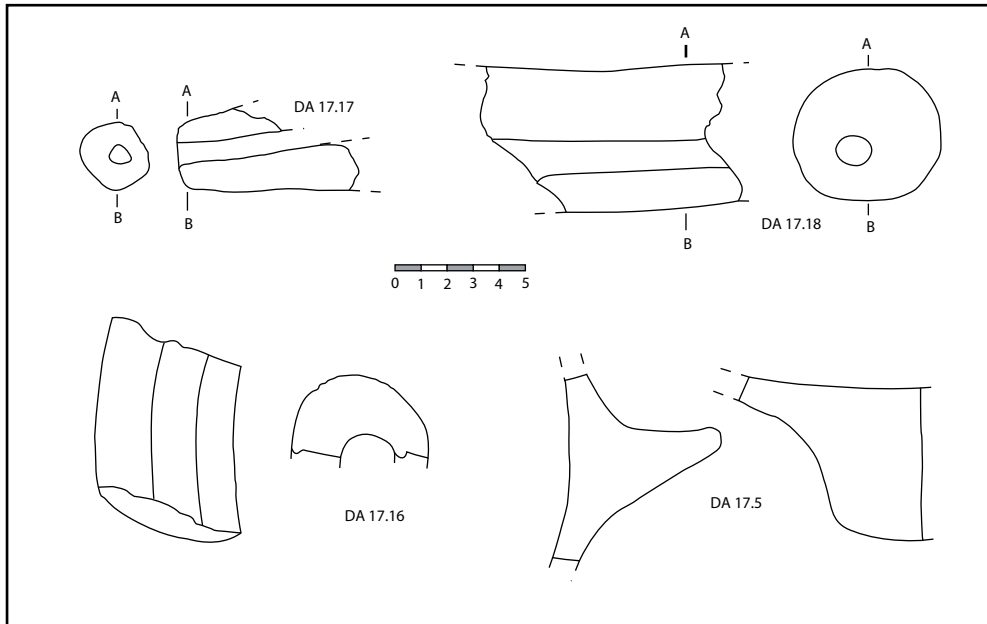


Figure 4.82 Miscellaneous finds from site 17

vated examples (e.g. Helms 1992c: fig.219:3-4). No good parallels could be found for the rounded jar DA17.4 exhibits a small knob. Slightly similar, though clearly larger applications were present on some jars from Tell 'Umm Hammād, genre 26 (Helms 1992c: fig.202: 3, 4).

Plain ledge handles like DA17.5 were not discovered in the present survey, but one rounded example has been depicted by Helms (Helms 1992c: 258:6). Remarkable finds present within Kirkbride's collection are three pieces of a clay cylinder that has clearly been fired. A central hole runs through all three pieces. One of the fragments is slightly curved (DA17.16), while another ends in a small nozzle (DA17.17). The fragments are numbered and therefore clearly stem from the same assemblage as the other finds. The ware from which the fragments are made is, although coarse, also similar to the EBA ware from which most of the other vessels are made. This comparison is however only based on macroscopic examination and can therefore not serve as evidence. However, the ware does not immediately discount an EBA date. All three artefacts resemble a tuyère most closely. No similar tuyères have been discovered from EBA contexts. It can, moreover, be concluded that if these strange objects are indeed part of one or more tuyères, they were not used or only under very low temperatures as no traces of melting or overfiring are visible. A connection between these items and the tuyères discovered at the IA iron production site of Tell al-Hammeh E located *c.* 200 m to the south would seem logical (Veldhuijzen and Van der Steen 1999; Veldhuijzen and Rehren 2007). The IA tuyères excavated at Tell al-Hammeh are, however, made of different clay containing much less or no iron oxide. They are, furthermore, square instead of round and they are made of mud-brick that was only fired when the tuyère was used in the furnace. This is visible in the differential level of firing, where the nozzle has often molten away, but where the outer end is still of unfired or low fired mud-brick. These round fragments are completely and evenly fired and the nozzle is fully intact. The purpose of these hollow cylinders therefore remains unknown. Only excavation of what is left of the tell may be able to shed more light on the purpose of these enigmatic objects.

Conclusions

The pottery of al-Rweihah collected in the survey is very similar to the assemblage collected by Helms and Kirkbride some decades earlier and a date in the EB I period seems incontestable. The different assemblages show small variations. In Helms' assemblage, for example, only one impressed bowl was present, while the band slip ware and the holemouth jar with impressions on the

rim were completely absent. These variations show that survey assemblages remain a snapshot of the assemblage on the surface at that moment. A survey is **not a complete representation** of the pottery collection buried in the subsoil.

The tuyère-like objects are undoubtedly the most divergent items in Kirkbride's collection. So far they are unparalleled in EBA assemblages of the southern Levant. Unfortunately, there is no good stratigraphic information on their context. Future excavation might provide the necessary information to come to a better understanding of their function and age, but until then they remain an enigmatic find.

The pottery assemblage has many parallels with the concentration in field 81 and both will have been contemporaneous for at least part of their existence. The number of red slipped and burnished vessels is slightly larger at al-Rweihah as are vessels that date only to the EB Ib period. It is, therefore, likely that al-Rweihah continued slightly longer or on a larger scale in the EB Ib. Alternatively, al-Rweihah has fewer parallels in the transitional Late Chalcolithic/EB I period than are present in field 81. This might suggest it was settled slightly later or in a more limited fashion. However, the differences between the assemblages of the three al-Rweihah surveys show that this kind of detailed conclusion is not warranted on the basis of only surface finds. However, it seems reasonable to state that, like field 81, al-Rweihah was founded before the first EB I occupation at Tell 'Umm Hammād started.

Fieldno. 126-142

Coordinates: 746,350/3,565,850 (centre)
 Size: densest (n > 20) 250 x 150/200 m
 larger concentration 500 (NE-SW) x 200
 Days and time surveyed: Sept. 26th-29th, 2005, 23 man-hours
 Periods discovered: EBA I (b)/start II



Figure 4.83 Concentration in fields 126-142, max. non-feature sherds = 98 (dark), max. feature sherds = 16 (white)

Description

The concentration in fields 126-142 is located on the northern bank of the present day Wadi el-Ghor, *c.* 550 m east of Tell 'Abū Sarbūt. From RAF aerial photographs taken in 1940 it is known that the course of the Wadi el-Ghor was altered after that time. At the western end of field 142 the old Wadi el-Ghor ran towards the north-west only to turn due west at the present-day road, running past the northern side of Tell 'Abū Sarbūt. This modification did not affect the concentration dramatically though. The densest sherd distribution is located to the east of the modified section of the wadi in fields 128, 141 and part of 129, while lower densities were found in fields



Figure 4.84 Distribution of EBA feature sherds

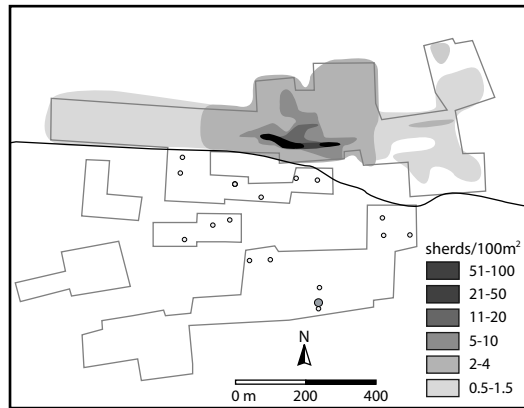


Figure 4.85 Distribution of EBA feature + non-feature sherds

126, 127, 130, 131 and 142. Compared to other EBA concentrations the area over which low sherd densities have been found is quite large. This suggests that processes causing lateral movement of artefact over the soil, like ploughing, affected this area considerably. Additional strength is lent to this hypothesis by the fact that most of the pottery was quite worn. The restricting effect of the Wadi al-Ghor is clearly visible in the lower densities and smaller distribution area to the west and especially south of the concentration.

It is remarkable that no artefacts other than pottery and flint have been discovered at this site. No pieces of grinding stones, digging stick weights or spindle whorls that are common at other EBA sites have been found. It remains to be determined whether this lack of other artefact types is due to post-depositional processes or whether it reflects a difference in site function. Future research in the form of excavation may be able to provide a better understanding of the character of the site. However, based on the diverse pottery and flint assemblage described below, this concentration is regarded to represent a settlement and the lack of other types of artefacts is attributed to the higher level of distortion of the site and its poorer conservation.

Pottery

The pottery of this concentration consists for a large part of the distinctive Tell 'Umm Hammād ware. This pottery group comprises a limited range of large bowls and jars with several bands of impressions usually made from bright red clay with a limited amount of fine temper. It was first excavated by Mellaart at Tell 'Umm Hammād, hence the name, and described as a separate entity by De Miroschedji, who referred to it as Proto-urban D (Mellaart 1962: 146, 147; de Miroschedji 1971: 37). As this group is more a regional ware group than the cultural and chronological entities Kenyon regarded the Proto-Urban A, B and C to be, it is today usually named after its type-site Tell 'Umm Hammād. Glueck's survey and the soundings conducted by Mellaart had already revealed large quantities of this type of pottery, but it was not until the excavations by Betts and Helms that it was fully described as a separated ware category (Glueck 1951: 318-329; Mellaart 1962). In his pottery analysis Helms has divided the Tell 'Umm Hammād ware into five morphological categories called genres. He distinguished bowls (genre 50), holemouth jars (genre 12), necked jars with a round body (genre 27) and two types of necked jars with an elongated body (genre 17 and 18). His division applies to the pottery under discussion as well as the shapes discovered on other sites and has, therefore, been adopted here.

This ware has a red fabric and often either the inside or the outside of the sherd is completely black resulting from a reducing firing atmosphere. Completely oxidized red or orange sherds also occur, however, as do sherds with oxidized outer faces and a dark grey core. It was macroscopically provisionally established that this ware is tempered with small pieces of iron oxide, chalk, sand and organic material. Inclusions are generally small (<0.5 mm), but especially the iron oxide and chalk

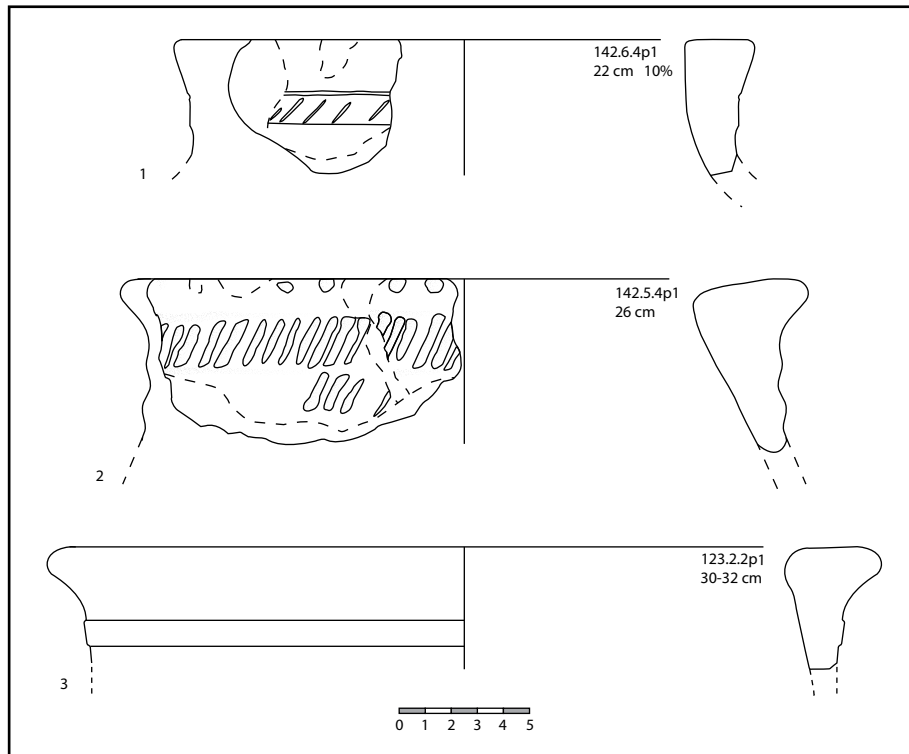


Figure 4.86 Tell 'Umm Hammād ware necked jars

No.	Sherd no.	Parallels	Date	Remarks
1	142.6.4p1	Beth Shean XVI (FitzGerald 1935: pl.I:12)	EB Ib/II	Genre 27
2	142.5.4p1	Tell 'Umm Hammād 3/11 (Helms 1992c: fig.188:5) Beth Shean XVI (FitzGerald 1935: pl.I:3)	EB Ib/II	Genre 17
3	123.2.2p1	Tell 'Umm Hammād 3/11+4/15 (Helms 1992c: fig.187:1,4+188:1,4)	EB Ib/II	Genre 17

Table 4.36 Tell 'Umm Hammād ware necked jars

occasionally have larger dimensions (1 à 2 mm).⁵³ Although Tell 'Umm Hammād ware has been regarded as 'purely deserving the characterization as a ware' that should be classified according to ware as there is no diagnostic morphology (Braun 2004: 47,48), its clay and temper have not yet been described in detail. The pottery of the concentration under study has been compared macroscopically to pottery present today at and near Tell 'Umm Hammād. Although any conclusion is of course extremely preliminary and detailed ware analysis is needed, both wares seem to be very similar, if not identical.

Given the lack of ware analysis and the inability due to time constraints to undertake such a task in the present study the assemblage is described using the form categories identified by Betts and Helms for Tell 'Umm Hammād (Helms 1992c). In the concentration under discussion four of the five Tell 'Umm Hammād ware form categories have been discovered. Only the elongated genre 18 jars are lacking in this assemblage. Characteristic of all vessel groups is their large size reflected in large rim diameters. The necked jars of genre 17, 18 and 27 will have had the largest volume. Only a few necked jars have been discovered in this concentration. Two of the necked jars belong to genre 17 and one was classified as a genre 27 jar. Genre 17 has a thick rim and several impressed bands on rim and body. The few almost complete jars discovered by Mellaart show that there is no neck and that the wall runs immediately down below the rim under a small angle

53 These are, however, very preliminary data as clay and temper analysis could unfortunately not be part of this study. It is, however, one of the aspects earmarked for further analysis in the near future.

forming a high and relatively narrow jar (Leonard 1992: fig.21). The jars of genres 17 and 18 only deviate from each other in the shape of their rim. Their general shape is very similar. Contrary to genre 17, jars from genre 18 have a thin outward flaring rim (Helms 1992c: fig.190). This genre is rarer than the other types and does not occur in concentration 123-142. Genre 27 is constituted by a short-necked jar with a globular body (142.6.4p1). Rims and necks vary in shape and comprise thick vertical necks and rims or thick everted rims with either thick or thin necks (Helms 1992c: fig.203).

The unifying characteristic of the necked jars is their large size. The mean diameter of their mouth is *c.* 17 cm. Three almost complete examples of genre 17 excavated by Mellaart show a maximum diameter of *c.* 55-60 cm with a height of 90 to 100 cm (Leonard 1992: 82). Their opening can easily be sealed off by a piece of skin or cloth tied around their everted rim or simply by a piece of pottery placed on top of the rim. These vessels may have functioned as large containers storing some bulk commodity like cereals. Their elongated size will have meant that they took up relatively little space. The complete form of the genre 27 necked jars is unknown as only small rim parts have been discovered. The position of the body below the rim is almost horizontal and suggests a globular shape. The neck has a similar diameter as genre 17 jars and can likewise be easily sealed off. Although their complete shape is unknown their thick rim and horizontal shoulder suggest that they were large jars probably also used for storage.

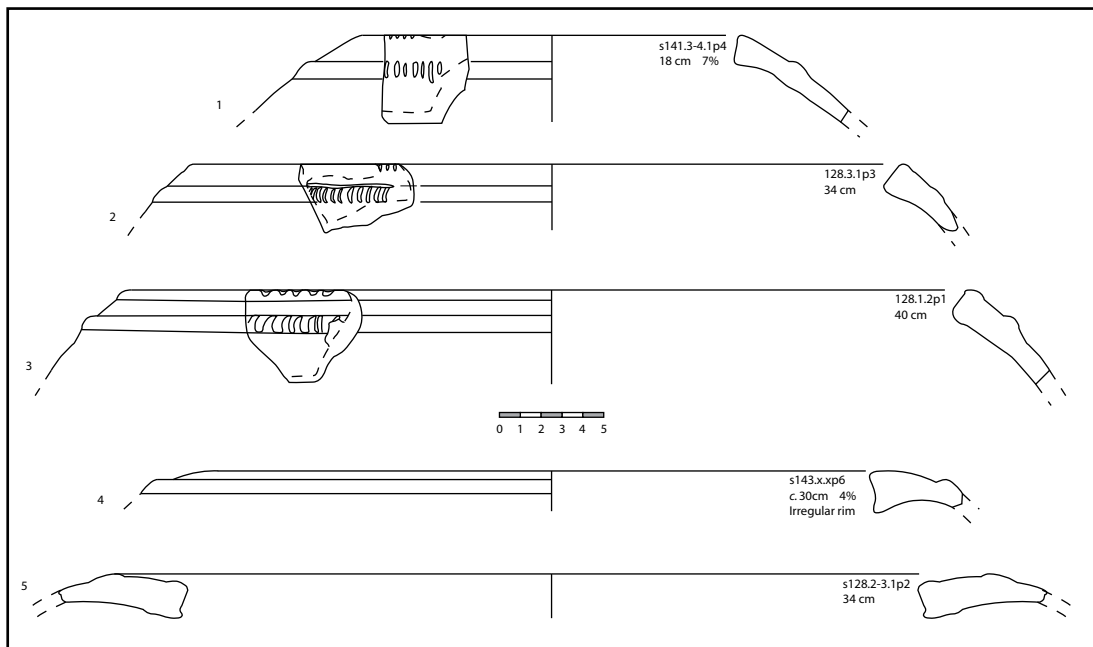


Figure 4.87 Tell 'Umm Hammād ware holemouth jars

No.	Sherd no.	Parallels	Date	Remarks
1	s141.3-4.1p4	Tell 'Umm Hammād 3/11 (Helms 1992c: fig.162:2,4) Far'ah N (de Vaux and Steve 1947: fig.2:5; de Vaux 1955: fig.5:14) Tell 'Umm Hammād tr.I.7 (Leonard 1992: pl.30:8)	EB Ib/II	
2	128.3.1p3	Tell 'Umm Hammād 3/11 (Helms 1992c: fig.162:2,4) Far'ah N (de Vaux 1961: fig.3:14) Tell 'Umm Hammād tr.I.8 (Leonard 1992: pl.30:16)	EB Ib/II	
3	128.1.2p1	Tell 'Umm Hammād 3/11 (Helms 1992c: fig.162:2,4) Far'ah N (de Vaux 1955: fig.5:14,29) (de Vaux 1961: fig.3:15?) Tell 'Umm Hammād tr.I.7 (Leonard 1992: pl.30:6)	EB Ib/II	
4	s143.x.p6	Like Tell 'Umm Hammād 4/14 (Helms 1992c: fig.221:6,8)	EB Ib/II	A lot coarse calcite, little iron oxide; impress. worn
5	s128.2-3.1p2		EB Ib/II	idem

Table 4.37 Tell 'Umm Hammād ware holemouth jars

The holemouth jars of genre 12 have a finely impressed band below the rim and/or indents on the rim (Helms 1992c: 52). In this concentration five Tell 'Umm Hammād ware holemouth jars could be identified. Rim diameters are often large; the smallest rim diameter discovered in the concentration is 18 cm and diameters of 34 cm or larger are not exceptional. More or less complete examples have demonstrated that these jars have a globular shape with a maximum width of *c.* 50 cm. Their height is unknown and they might continue their round shape or have a more elongated flat base (Helms 1992c: fig.265). Either way they are not as elongated as genre 17 and 18 jars and their height will most likely vary between *c.* 45 and 60 cm. Again their large, more or less closed shape points to storage. Their volume is, however, significantly lower than the genre 17 and 18 jars and they cannot be so easily sealed as their mouth is wider and there is nothing to attach a covering cloth to. It might, therefore, be the case that holemouth jars were used for short-term storage or daily use storage in comparison to the long-term storage of the other jars. The inside of the rim of one holemouth jar (s143.x.xp6) is thickened. Instead of the thin elongated profiles of most holemouth jars this profile is short and thick. No parallels were found among the holemouth jars from other sites, but a very similar type of rim is present on a bowl from Tell 'Umm Hammād (Helms 1992c: 221:8).

Holemouth jars s143.x.xp6 and s128.2-3.1p2 form an exception to the standard Tell 'Umm Hammād ware. Their shape perfectly fits the TUH ware vessels, but their temper differs. They primarily have many coarse calcite inclusions with a few smaller iron oxide inclusions. Because they have fewer iron oxide particles their colour is less red and more greyish. As none of the excavations has described the ware in detail to the extent of enumerating the types of inclusions, it is uncertain whether crushed calcite occurs elsewhere as well.⁵⁴ Given their shape, these two holemouth jars are here regarded as a subtype of the Tell 'Umm Hammād ware.

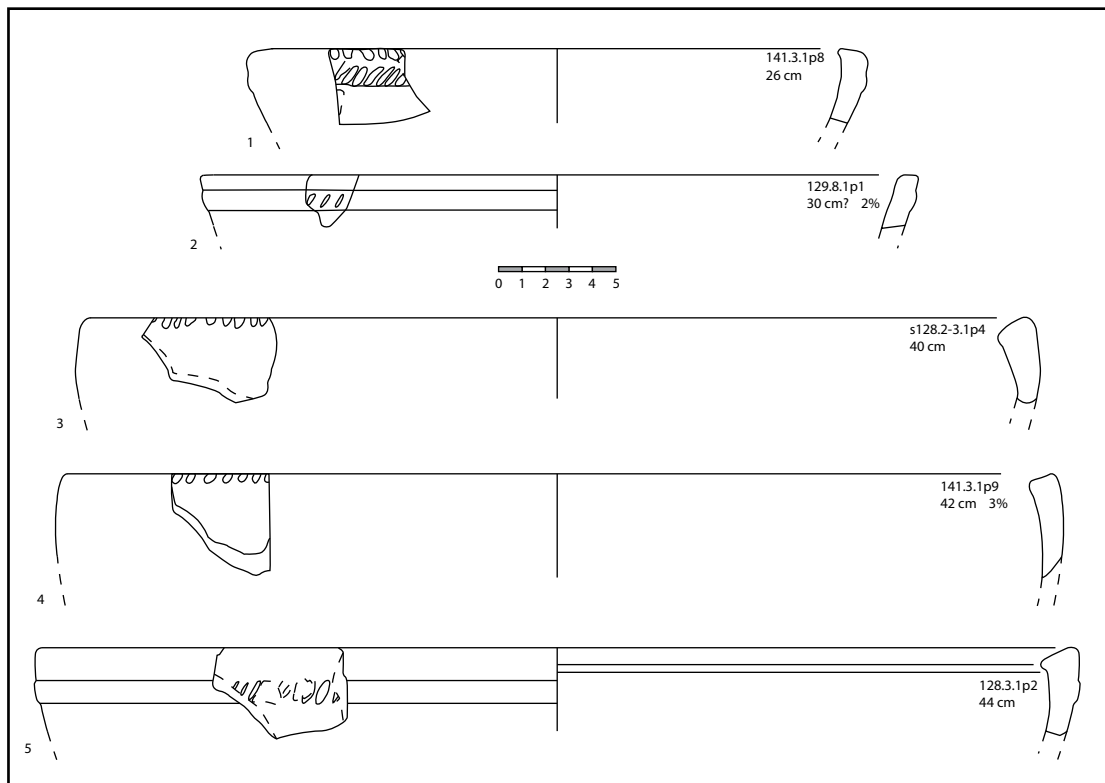


Figure 4.88 Tell 'Umm Hammād ware bowls

54 Morphologically these rims resemble genre 4 holemouth jars of Tell Umm Hammad, which date to the EB Ia period. None of these jars, however, has an impressed band a few centimetres below the rim and it is not known whether crushed calcite is part of the temper of genre 4 (Helms 1992c: 48, fig.149).

No.	Sherd no.	Parallels	Date	Remarks
1	141.3.1p8	c. Tell 'Umm Hammād 3/11 (Helms 1992c: fig.222:5) c. Far'ah N (de Vaux 1955: fig.5:1) Tell 'Umm Hammād I:7 (Leonard 1992: pl.26:8)	EB Ib/II	
2	129.8.1p1	c. Tell 'Umm Hammād 3/11 (Helms 1992c: 223:6)	EB Ib/II	
3	s128.2-3.1p4	Tell 'Umm Hammād 3/11 (Helms 1992c: fig.221:4)	EB Ib/II	
4	141.3.1p9	Tell 'Umm Hammād 3/11 (Helms 1992c: fig.221:4)	EB Ib/II	
5	128.3.1p2	Tell 'Umm Hammād 3/11 (Helms 1992c: fig.222:5) c. Tell 'Umm Hammād I:8 (Leonard 1992: pl.26:2)	EB Ib/II	

Table 4.38 Tell 'Umm Hammād ware bowls

It is remarkable how the rim shape of holemouth jars resembles that of bowls (genre 50). Bowls also have an impressed band below and/or indents on the rim (see figure 4.88). Similar to the holemouth jars the rim can have a plain or a hollow face. Like the holemouth jars the bowls all have a wide diameter: both at Tell 'Umm Hammād and in this concentration none of the bowls has a diameter of less than 26 cm and the Tell 'Umm Hammād bowls have a mean diameter of 35 cm (Helms 1992c: fig.221-222). A few well preserved fragments have generated a reconstruction of these bowls where the rim is also the maximum diameter and where the height is about half the diameter (Helms 1992c: fig.265). These large bowls may have been used as short-term storage or as communal serving dishes. There are no small bowls among the Tell 'Umm Hammād ware.

Several ledge handles have been found that belong to the Tell 'Umm Hammād ware. All five have a rather straight position and have regular and well finished exteriors. Four of them have impressions on their edge, whereas one is plain. The ware and smooth appearance of this ledge handle, however, suggest it should be classed as Tell 'Umm Hammād ware. At Tell 'Umm Hammād the ledge handles belonging to this ware were referred to as genre 73 and are rather thin, oval shaped ledges with impressions on the edge (Helms 1992c: 90).

Two fragments that are Tell 'Umm Hammād ware, but whose shape could not be determined were also incorporated here. Rim 128.3.2p7 is a typical Tell 'Umm Hammād ware rim, but the exterior was so worn that its position could not be established. It could stem from a bowl as well as from a holemouth jar. Sherd 129.4.1p3 is a fragment with two impressed bands and a thickening of the wall. This thickening limits the range of possible forms to which it could belong. Two rims at Tell Far'ah N exhibit a very similar thickening just below the rim. The drawings suggest that one is a holemouth jar and the other a bowl, but as no diameters are given this is difficult to determine (de Vaux and Steve 1948: fig.5,6).

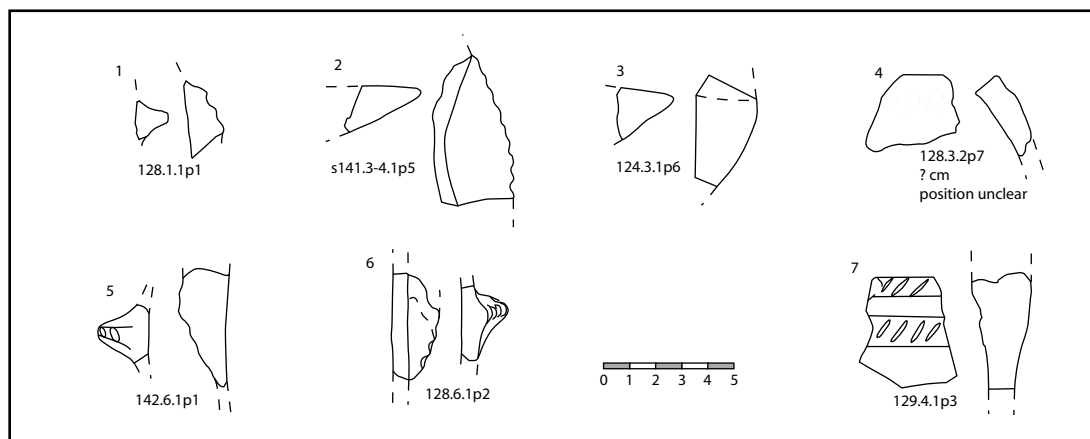


Figure 4.89 Tell 'Umm Hammād ledge handles

No.	Sherd no.	Parallels	Date	Remarks
1	128.1.1p1	Tell 'Umm Hammād (Helms 1992c: fig.240:15) Tell 'Umm Hammād I:9 (Leonard 1992: pl.25:10)	EB Ib/II	
2	s141.3-4.1p5	Tell 'Umm Hammād (Helms 1992c: fig.240:15) Tell 'Umm Hammād III:2 (Leonard 1992: pl.27:7)	EB Ib/II	
3	124.3.1p6		EB Ib/II	Bowl or hlm jar??
4	128.3.2p7		EB Ib/II	
5	142.6.1p1		EB Ib/II	
6	128.6.1p2		EB Ib/II	
7	129.4.1p3	Far'ah N (de Vaux and Steve 1948: fig.5:12)	EB Ib/II	

Table 4.39 Tell 'Umm Hammād ledge handles

Tell 'Umm Hammād ware pottery has only been discovered at a small number of sites located in a restricted area (see figure 4.90). Before this pottery was discovered in large quantities at Tell 'Umm Hammād, it had already been excavated at Tell Far'ah N and Beth-Shean (FitzGerald 1935; e.g. de Vaux and Steve 1947; de Vaux 1955; Helms 1992c). Mellaart's soundings at Tell al-Maflūq had also revealed Tell 'Umm Hammād ware pottery as Leonard's publication shows (Leonard 1992: pl.34,36). In his recently translated Manasseh hill country survey Zertal reports Tell 'Umm Hammād ware pottery at seven sites along the Wadi Farah.⁵⁵ This specific type of pottery has not been discovered at any other sites. This limited occurrence of Tell 'Umm Hammād ware hampers the understanding of its function. At the pioneering excavations of Beth-Shean and Tell Far'ah N the pottery assemblages are mixed and the find contexts are not entirely clear. The 1920's and early 1930's excavations of Beth Shean have long been published only in the form of a preliminarily article from 1935. Recently, the EB I layers have been studied and published in detail by Braun (FitzGerald 1935; Braun 2004). Braun states that several examples of Tell 'Umm Hammād ware were present among the pottery of stratum XVI and younger layers (Braun 2004: 48). Braun dates stratum XVI to the early EB I period, but notes that it probably consists of mixed deposits. The later strata XV, XIV and XIII are dated to the developed and late EB I period, but these are all mixed assemblages (Braun 2004: 62). The EB II layers have not been re-analysed. At Tell Far'ah N, Tell 'Umm Hammād ware has been reported from a range of layers dated by the excavators to the Late Neolithic, Chalcolithic and EB I and II periods (de Vaux and Steve 1947: fig.2,5,7; de Vaux 1955: fig.5). In the revised periodization of De Vaux's stratigraphic sequence by De Miroschedji, the *Énéolithique supérieur* of area I is contemporary with the *Chalcolithique supérieur* of areas II and III (de Miroschedji 1993: 434). Today these layers would be classified as EB I. De Vaux's Ancient Bronze I and II both fall within the present day EB II period (de Miroschedji 1993: 434). Based on the revised chronology the Tell 'Umm Hammād ware of Tell Far'ah N seems to date to the EB I and EB II periods. The exact find contexts, however, remain unknown. The surveyed Wadi Far'ah sites that revealed Tell 'Umm Hammād ware were mostly interpreted as settlements. Tell 'Umm Hammād ware was however also present at Jelamet el-Ahmar (A), site 178, which represents a large cemetery (Zertal 2008: 463). A second non-habitational site where Tell 'Umm Hammād ware was collected is the enigmatic site 148, al-Khelleiyel. It is also referred to as the Kurgan site after the large artificial mound of rubble mixed with ash and burned bones with some structures inside. In its vicinity some stone walls and tumuli were discovered. This site was interpreted as a cultic site where fire played a role in the rituals carried out. As much as 30 % of the pottery assemblage was made up by the Tell 'Umm Hammād ware (Zertal 2008: 410).

The soundings at Tell al-Maflūq were spatially limited and only one published Tell 'Umm Hammād ware sherd stems from an excavated layer, three others are surface finds (Leonard 1992: pl.34:6). The largest share of Tell 'Umm Hammād ware from Tell al-Maflūq was collected in 1983/4 by Leonard after the tell had been bulldozed away (Leonard 1992: 106). Today nothing of the tell or surface concentration remains. A possible southern occurrence of Tell 'Umm Hammād

55 Zertal refers to this type of pottery as Far'ah Family pottery, which he dates to the Late Chalcolithic and EB I periods (Zertal 2008: 50-52). The drawings and succinct ware descriptions, however, show these vessels are undoubtedly the same as the Tell Umm Hammad ware vessels discovered elsewhere.

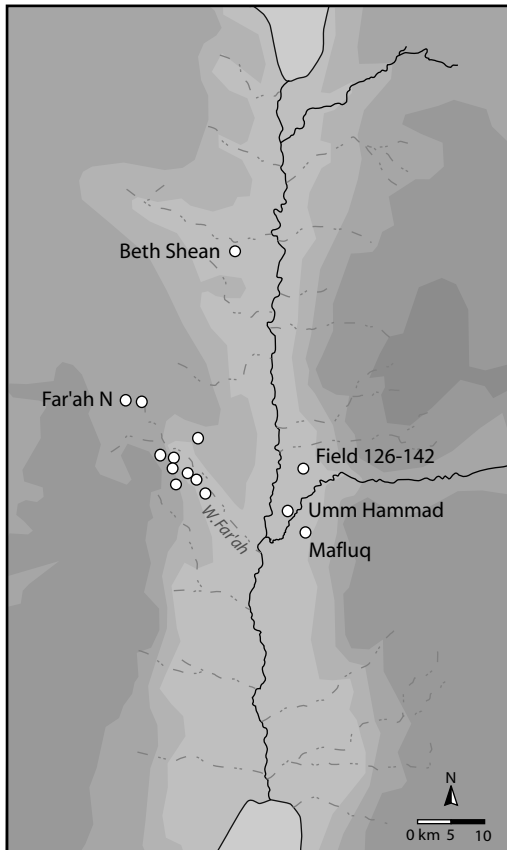


Figure 4.90 Sites where Tell 'Umm Hammād ware has been found

ware may be contemplated given the clear genre 27 jar found in Garstang's excavations (Sala 2005: fig.34:1). This is, however, the only unambiguous Tell 'Umm Hammād ware sherd published. At neighbouring tell Abu Alayiq small trenches were excavated by Pritchard (Pritchard 1958). Both have published only a few pottery drawings, but reports contain several photographs. In both cases some photographs seem to attest Tell 'Umm Hammād ware pottery. As these are photographs and the involved archaeologists themselves have not identified this pottery as Tell 'Umm Hammād ware it remains uncertain whether this ware extended so far south.

Tell 'Umm Hammād itself is, therefore, the only site with some information on the stratigraphic layers and contexts in which this ware was encountered. Unfortunately, the final publication does not give a locus list describing the precise find context. It is possible to retrieve the square and the general phase in which every depicted sherds was found but not the exact locus. The Tell 'Umm Hammād ware occurs in phases 11 to 15 belonging to stage 3 (EB Ib) and the start of stage 4 (EB II). Phases 11 and 12 are fill layers of one very large pit (Helms 1992d: 22). In a later part of the EB Ib period the floor and walls that make up phase 13 were erected. Three rectangular houses with some in situ interior structures and an outside hearth have been identified (Betts 1992b: fig.40). Phase 14, comprising the earliest EB II layers, contains no structures and is interpreted as 'a non-structural, occupational interface between two major stages (3 and 4)' (Helms 1992d: 23). In phase 15, new walls and floors were constructed on a different plan than phase 13 (Betts 1992b: fig.41).

Additional evidence comes from Mellaart's soundings. In trench III a group of four large Tell 'Umm Hammād ware jars of genre 17 and 27 were discovered next to a large shallow pit cut into the bedrock (Leonard 1992: fig.21). The pits contained two smaller pits harbouring a saddle quern, stone bowl and some pottery vessels. The pit was interpreted as possibly representing a 'place of (seasonal) occupation' (Leonard 1992: 82). The pit was sealed by a trodden floor. Both the layers above and below the floor contained EB I pottery including Tell 'Umm Hammād ware (Leonard

1992: 95). It is stratigraphically impossible to say whether the group of jars is connected to the pit or to the floor. Nevertheless, the fact that four of these large jars were found together suggests a large quantity of something was stored here.

Besides the locational context, the precise dating of the Tell 'Umm Hammād ware also forms a problem. As shown above the reanalysis of Far'ah N dates this ware to the EB I and II periods. The Beth-Shean examples all date to the EB I period, but the EB II material remains unpublished. The excavators at Tell 'Umm Hammād date the Tell 'Umm Hammād ware type vessels, grouped into repertoire 6, to the EB Ib (Helms 1992c: 107). However, at the start of their pottery typology chapter they give a table listing the frequencies of genres per phase for squares 1, 2, 3, 30, and 31. This table shows that Tell 'Umm Hammād ware also occurs in the EB II phases 13 to 15, although phases 13 and 14 only contain bowls. In terms of absolute numbers, the EB Ib phases 11 and 12 clearly contain the majority of the vessels. If the relative frequencies per phase are compared to the relative frequencies of all the genres, however, they turn out to be remarkably parallel. The low number of Tell 'Umm Hammād ware sherds in phases 13 and 14 is matched by the general scarcity of pottery in these phases and, therefore, does not represent a decrease or absence of Tell 'Umm Hammād ware pottery. The increase in phase 15 corroborates this. In spite of the decrease in absolute numbers after phase 12 there is no relative decrease visible in the frequency of Tell 'Umm Hammād ware until its complete disappearance in phase 16. Based on Tell 'Umm Hammād and in accordance with Beth Shean and Tell Far'ah N it can, therefore, be concluded that the occurrence of Tell 'Umm Hammād ware should be dated to the EB Ib and the start of the EB II period.

Genre/phase	11 (EB Ib)	12 (EB Ib)	13 (EB Ib)	14 (EB II)	15 (EB II)	Total
G12	5	3	-	-	-	8
G17	19	3	-	-	5	27
G18	1	1	-	-	1	3
G27	4	3	-	-	2	9
G50	11	4	2	2	1	20
Total	40 / 60 %	14 / 21 %	2 / 3 %	2 / 3 %	9 / 13 %	67
Total all Genres	702 / 58 %	257 / 21 %	76 / 6 %	29 / 2 %	149 / 12 %	2558

Table 4.40 Frequency of genres per phase of Tell 'Umm Hammād ware (after Helms 1992c: table 3)

When the total number of vessels per genre is considered the high numbers of genre 17 jars, and the bowls of genre 50 stand out (see table 4.40). The other classes occur in considerably lower frequencies. Comparing these frequencies to the other excavated sites is problematic. For Beth-Shean, Tell Far'ah N and Tell al-Maflūq, no lists of discovered pottery are given and recognition of Tell 'Umm Hammād ware vessels is entirely dependent on published drawings. The number of depicted Tell 'Umm Hammād ware sherds is very limited in both Beth Shean publications (FitzGerald 1935; Braun 2004). Only four vessels could be identified as Tell 'Umm Hammād ware, attributable to genres 17, 18 and 27 (see table 4.41). Holemouth jars and bowls are absent, but the number of published sherds is too low to draw any conclusions. The same applies to the surface concentration of Tell al-Maflūq. Here, twice the number of sherds from Beth Shean has been found, but a total of eight is still too low to draw any conclusions. Bowls (genre 50) and jars (genres 17 and 27) are depicted, but holemouth jars and genre 18 jars are absent (Leonard 1992: fig.34,36). In the various preliminary articles on the Tell Far'ah N excavations a total of 21 Tell 'Umm Hammād ware vessels representing all genres have been depicted (de Vaux and Steve 1947; de Vaux 1955, 1961). The Wadi Far'ah sites have generally only seen a few of their sherds depicted and a reliable classification of available types can, therefore, not be made. When all sites are, however, considered together, all types identified at Tell 'Umm Hammād are represented. In the concentration under discussion a total of 21 Tell 'Umm Hammād rim sherds has been found. All vessel types have been discovered, except for genre 18.

Site	Number (n=)	Genres present	Genres absent
Umm Hammad	67	12, 17, 18, 27, 50	
Far'ah N	21	12, 17, 18, 27, 50	
f.126-142	21	12, 17, 27, 50	18
al-Maflūq	8	17, 27, 50	12, 18
Beth Shean	4	17, 18, 27	12, 50

Table 4.41 Genres of Tell 'Umm Hammād ware discovered at various sites

When the relative genre frequencies are plotted per site, excluding the sites with only a limited amount of Tell 'Umm Hammād ware, a trend becomes visible (see figure 4.91). The sherds of the concentration under discussion are divided into the group that has been drawn and the total number of Tell 'Umm Hammād ware rim sherds discovered at the concentration. For the drawn sherds the genre is established with certainty, while among the total group there is sometimes a greater level of uncertainty. The general trend for all three sites is very similar regarding genres 18, 27 and 50. In terms of frequency of genres 12 and 17, however, Tell 'Umm Hammād is diametrically opposed to Tell Far'ah N and concentration 123-143. Tell Far'ah N and the concentration under discussion yielded a high number of holemouth jars (genre 12) and a much lower number of the heavy rimmed jars of genre 17. For Tell 'Umm Hammād the exact opposite is the case. Explaining this difference is difficult. Both vessels are large and closed. The mean rim diameter of the holemouth jars (mean = *c.* 25 cms) is larger than that of the genre 17 jars (mean = *c.* 17 cm). Furthermore, the rim of the necked jars of genre 17 could easily be sealed off in contrast to the holemouth jars of genre 12 that have no neck or other features to which a lid or cloth could be more permanently affixed. This smaller opening combined with the larger and more elongated reconstructed size of the genre 17 jars might indicate that the genre 17 jars were used for longer term storage than the more difficult to seal and less efficiently storable holemouth jars (see above). The area of Tell 'Umm Hammād excavated in squares 1 to 3, 30 and 31 might therefore have been dedicated to longer-term storage. This would, however, be specific for this part of the tell as the published pottery from Mellaart's soundings show a distribution of the vessels frequencies that is more in line with the other sites, although holemouth jars are still relatively rare (G12 = 21 %, G17 = 13 %) (Leonard 1992).

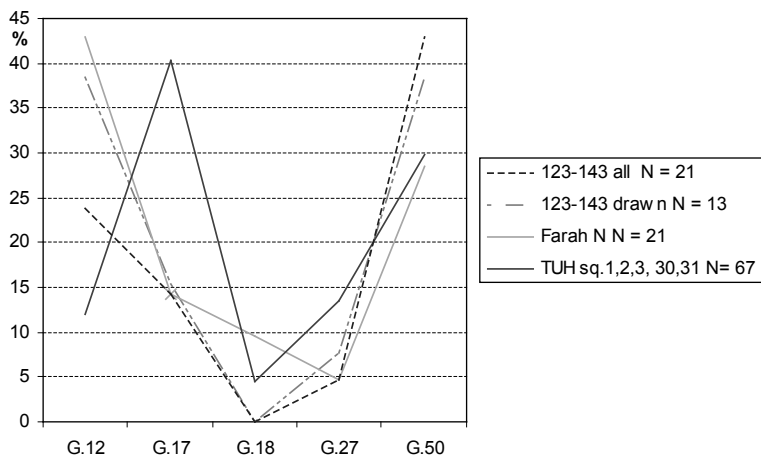


Figure 4.91 Relative frequencies of genres per site

Non-Tell 'Umm Hammād ware pottery of the concentration

About 40 % of the total number of EBA feature sherds collected can with some degree of certainty be categorized as Tell 'Umm Hammād ware. The actual amount of Tell 'Umm Hammād ware may be even higher as sherds lacking the distinctive shape or impressed bands were classified

as normal EBA sherds. Judging tentatively by their ware it is, however, likely that there are several more examples of Tell 'Umm Hammād ware among these sherds. Looking at the type of sherds that were discovered, it is likely that especially several Tell 'Umm Hammād ware bases were classified as non-Tell 'Umm Hammād ware vessels. As bases have few morphological characteristics only the ware can be used to determine whether these were Tell 'Umm Hammād ware sherds. This was less of a problem in the case of rims and some body sherds that often had the typical finely impressed bands as a distinguishing feature.

	TUH ware		Non-TUH ware	
	No.	drawn	No.	drawn
Rim	21	14	27	14
Ledge handle	8	5	14	5
Base	4	2	25	3
Body	34	1	19	0
miscellaneous	1	0	3	2
Handle	0	0	14	2
Total	68/40 %	22	103/60 %	26

Table 4.42 Total number of sherds discovered divided into vessel part and ware

The non-Tell 'Umm Hammād ware sherds of this concentration accord with the date of the Tell 'Umm Hammād ware. They are dated to the EB I period in general, the EB Ib more specifically and in a few cases to the EB II period. Parallels can be found at Tell 'Umm Hammād and several other EB I or II sites. The assemblage belongs to the early part of the EBA period and hence there are general similarities to EB I concentrations like field 81 and al-Rweihah. However, these similarities are not abundant and only a few good parallels could be identified. Especially the ledge handles, that seem to continue over a longer period of time, show correspondence.

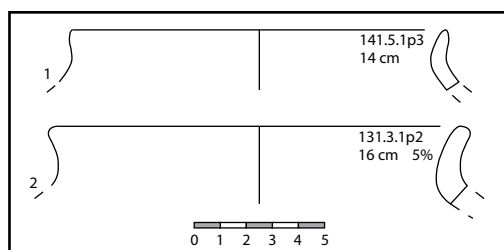


Figure 4.92 Short necked jars

No.	Sherd no.	Parallels	Date	Remarks
1	141.5.1p3	Tell 'Umm Hammād 3/11 (Helms 1992c: fig.210:3,6) Handaqq N (Mabry 1996: fig. 8:3)	EB Ib EB Ia/b	Calcite, iron oxide, chalk
2	131.3.1p2	Tell 'Umm Hammād 2/4+3/11 (Helms 1992c: fig.199:15, 202:8) Jericho (Nigro 2005: fig.33:5,8,9) Handaqq N (Mabry 1996: fig. 8:2-4)	EB Ib EB Ia EB Ia+b	

Table 4.43 Short necked jars

The type of short necked jar found at this concentration is common during the EB I (see concentration field 163). Examples from both the EB Ia and Ib periods are known. The types of holemouth jars depicted above occur in several periods of the Chalcolithic and EBA. Especially the plain rim of jar 141.4.1p1 is common in several periods. The somewhat square shaped rim of jar 126.7.3p2 perhaps resembles some jars of genres 10 and 14 of Tell 'Umm Hammād, but just as many jars from these genres are completely different. Both genres date to the same phases as the Tell 'Umm Hammād ware (see table). Jar 128.3.3p5 has no good parallels that can be well dated. It resembles to some extent some vessels of Tell 'Umm Hammād genre 4 dated to the EB Ia period,

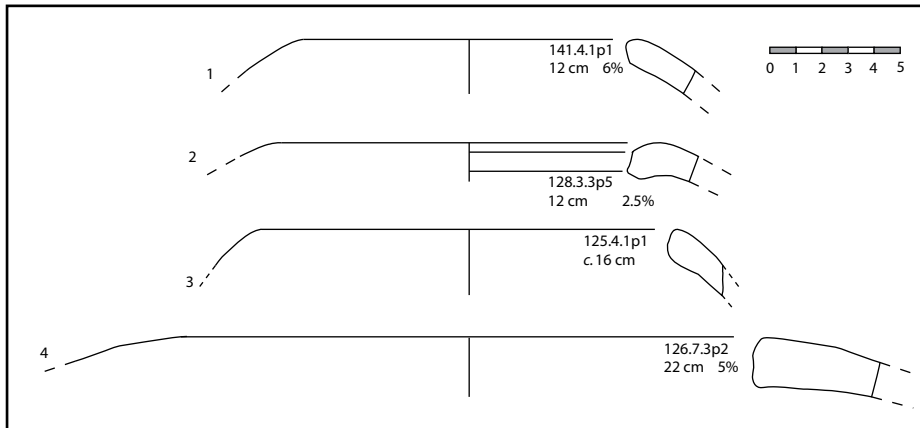


Figure 4.93 Holemouth jars

No.	Sherd no.	Parallels	Date	Remarks
1	141.4.1p1	Tell 'Umm Hammād 3/11 + 4/15 (Helms 1992c: 166:7,156:8,9)	EB Ib/II	
2	128.3.3p5	c. Jericho (Nigro 2005: fig.33:14)	EB Ia	Shape rim but position different
3	125.4.1p1	Far'ah N (de Vaux 1955: fig.13:36) c. Tell 'Umm Hammād 2/7 (Helms 1992c: fig.148:9)	EB Ia	
4	126.7.3p2	Tell 'Umm Hammād I:8 (Leonard 1992: pl.24:18) Far'ah N (de Vaux 1955: fig.5:16, 13:22,42) Tell 'Umm Hammād genres 10+14 (Helms 1992c: 173:3) c. Bab adh-Dhra' (Rast and Schaub 2003: fig.9.1:9)	Tuh ware Idem EB Ib/II EB II	Much calcite, sand, few iron oxide, brown colour Phases 11-15

Table 4.44 Holemouth jars

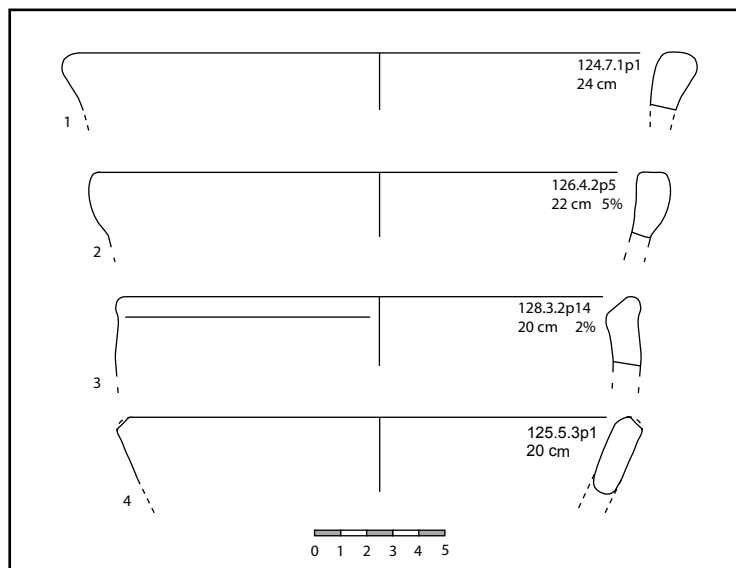


Figure 4.94 Bowls

No.	Sherd no.	Parallels	Date	Remarks
1	124.7.1p1			
2	126.4.2p5			Much large calcite
3	128.3.2p14	c. Tell 'Umm Hammād 2/5, 3/12 (Helms 1992c: 226:10,15)	EB Ia/b	Much calcite
4	125.5.3p1	e.g. Tell 'Umm Hammād 2/7-9,2/3 (Helms 1992c: 231:2,232:3)	EB Ia	V-shaped bowl; Chal + EB I

Table 4.45 Bowls

but these are by no means perfect parallels (see table). At Jericho and Bab adh-Dhra' this type of holemouth jars seems to be absent.

The small bowls are rather difficult to date precisely given their plain rim and worn character. Especially bowl 125.5.3p1 is of a very common type, which occurs from the Chalcolithic into the EBA. Bowl 128.3.2p14 is possibly of the hemispherical type that mainly stems from the EB Ib period, but examples have also been discovered in EB Ia contexts (see table). The other two bowls have thickened rims, but are rather severely worn which makes proper identification difficult.

Of the large bowls especially example s143.x.p3 is very typical and can be well dated. At TUH this type of vessel originated from EB II layers. Similar examples have been found in layers dating to the EB Ib period at Jericho as well (Sala 2005: 32:7). The other large bowls do not have many diagnostic features and could date to numerous episodes of the EBA.

Of the five ledge handles depicted here, three are of same type (no number, s141.4-5.1p3, s128.3-2.3p1). This type has been excavated at several locations, for example at Tell 'Umm Hammād where it was termed genre 67 or genre 69 (see table).⁵⁶ Specimens of this type of ledge handle have been found in EB Ia and Ib layers of Tell 'Umm Hammād. Of a different type is the impressed ledge handle 126.4.2p1. This handle has no good parallels at Tell 'Umm Hammād, but has been discovered at Jericho (see table). It is, furthermore, very similar to a handle collected at the concentration in field 81 (see previous section). No good parallels could be found for ledge handle s143.3-

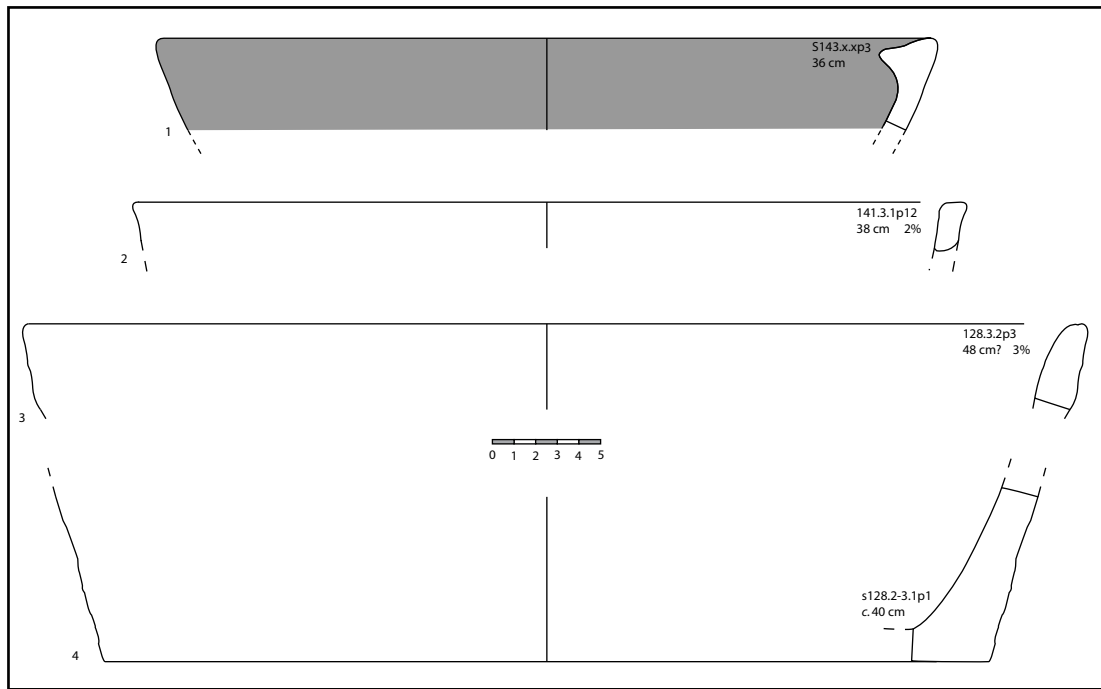


Figure 4.95 Bowls and base

No.	Sherd no.	Parallels	Date	Remarks
1	s143.x.p3	Tell 'Umm Hammād /17 (Helms 1992c: 229:4) c. Far'ah N (de Vaux and Steve 1947: fig.7:2; de Vaux 1961: fig.3:31) Jericho (Kenyon and Holland 1982: fig.35:15)	EB II	G59 also some 3/13 +4/15 With TUH ware
2	141.3.1p12	Tell 'Umm Hammād (?) (Helms 1992c: fig.230:10)	EB Ib/II	Much calcite; rest genre stage 3 +4
3	128.3.2p2	No clear parallels		Much large calcite
4	s128.2-3.1p1			

Table 4.46 Bowls and base

⁵⁶ The differences between the handles of these genres that have no surface decoration are not clear.

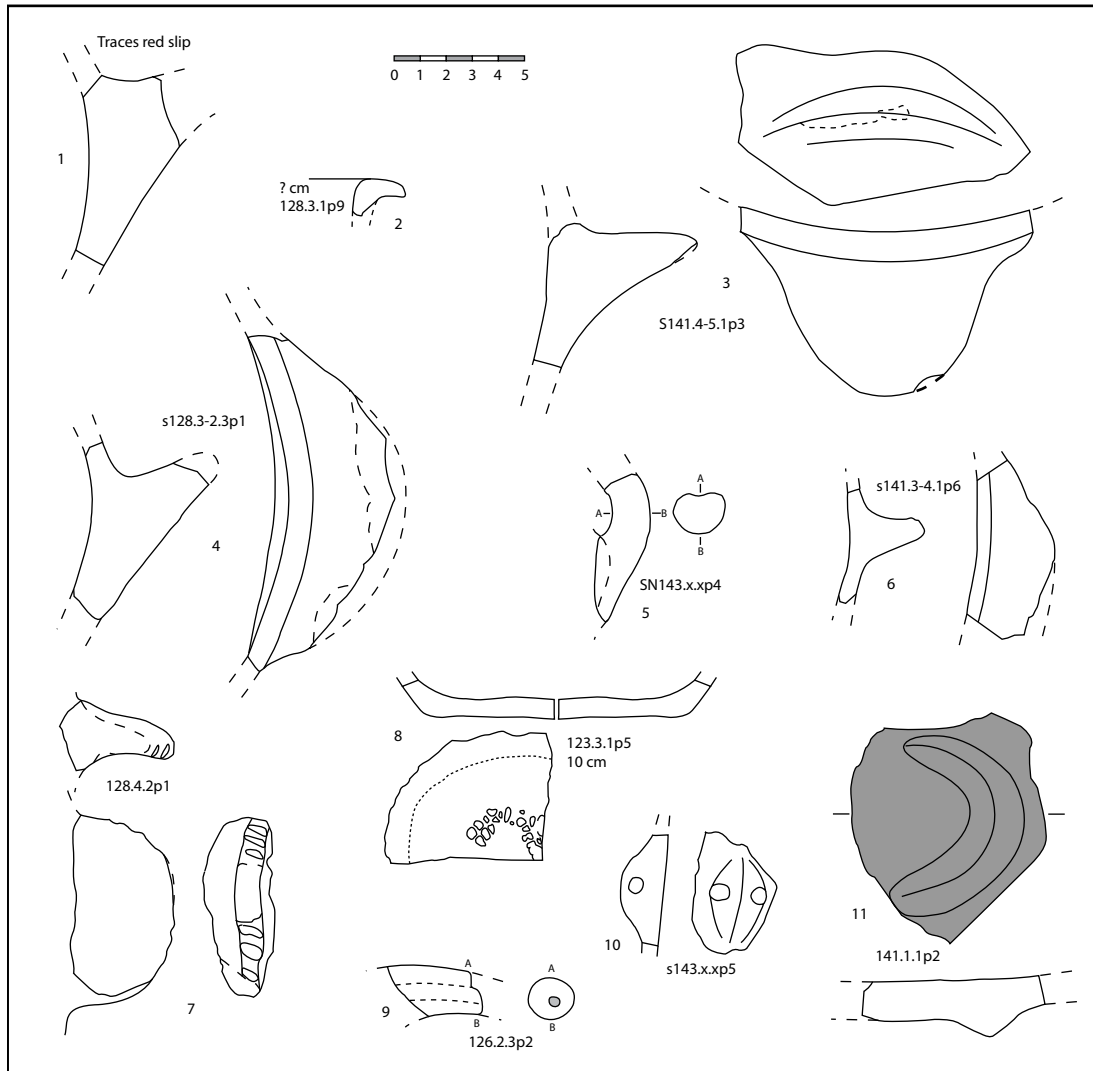


Figure 4.96 Ledge handles and miscellaneous

No.	Sherd no.	Parallels	Date	Remarks
1	No number	Tell 'Umm Hammäd 2/6 (Helms 1992c: fig.239:2)	EB la/b	
2	128.3.1p9			
3	s141.4-5.1p3	Tell 'Umm Hammäd 3/13, 2/7-9 (Helms 1992c: 238:1,2) Beth Shean str.XV (FitzGerald 1935: pl.VI:17)	EB la+b	Iron oxide, chalk calcite?
4	s128.3-2.3p1	Tell 'Umm Hammäd 3/13, 2/6 (Helms 1992c: fig.238:1,9)	EB la+b	Calcite, grog, iron oxide, chalk; pink
5	s143.x.p4	Best: Shean XIV (FitzGerald 1935: pl.VI:2)	Late EB I	Mixed context
6	s141.3-4.1p6		EB I	
7	128.4.2p1	Jericho (Kenyon and Holland 1982: fig.41:18)	PU	Like s81.5.xp28
8	123.3.1p5			
9	126.2.3p2	Beth Shean str.XIV (FitzGerald 1935: pl.V:3)	Late EB I	Mixed context
10	s143.x.p5		Chal	Much crushed calcite
11	141.1.1p2	Abu Kharaz (Feldbacher and Fischer 2008: fig.328b:84-86)	Late EB I	Half base or horse shoe shaped application?

Table 4.47 Ledge handles and miscellaneous

4.1p6. Its plain shape, however, suggests a date in the EB I period. Apart from the ledge handles two loop handles have been discovered as well. Loop handle s143.x.p5 is a very typical example of a Chalcolithic small handle. Its temper, consisting of crushed calcite, is identical to that of the Late Chalcolithic pottery discovered in field 27 (see first section of this chapter). The other loop handle (s143.x.p4) and the spout (126.2.3p2), however, occur regularly in the EB Ib period, but could also date to the EB II period. Base 123.3.1p5 has been included in the drawn assemblage because of the impressions in its base resembling two cereal stalks. The vessel must have been placed on top of two cereal stalks at some stage during its manufacturing process. This is perhaps the best evidence for cereal cultivation attainable in a survey. The last sherd 141.1.1p2 is one of the most enigmatic sherds of the assemblage. It represents a thick sherd of red clay, that somewhat resembles the Tell 'Umm Hammād ware, but is not identical. The outer surface has been red slipped and burnished. The most remarkable feature, however, is the horseshoe shaped applied band of clay attached to the outside. The only parallel found stems from late EB I Tell Abu Kharaz, where it is stated that this type of horseshoe applications, or raised half-moon potmarks as they are called in that publication, are a unique feature (Feldbacher and Fischer 2008: 394).

All discovered bases are flat, which is typical for Late Chalcolithic and EBA pottery. The smallest base depicted here (123.2.2p2) is remarkable in that impressions made by its standing on a sandy surface when still wet are visible on its base. Although not exceptional in itself, it is rarely encountered in surveys, because such traces on the exteriors have often been eroded away. The other two bases are tentatively ascribed as Tell 'Umm Hammād ware. Complete Tell 'Umm Hammād ware vessels are rare and bases are seldom depicted. The Tell 'Umm Hammād ware bases that have been depicted in the Tell 'Umm Hammād publication all have impressed bands near their base (genre 92) (Helms 1992c: fig.250). However, if more attention is placed on ware description, Tell 'Umm Hammād ware bases that lack these impressed bands may also be discovered. Despite the scarcity of information Helms reconstructed most vessel types as having a flat base (genres 17, 18, 50) (Helms 1992c: fig.265). What type of base the holemouth jars and the necked jars of genre 27 had remains uncertain.

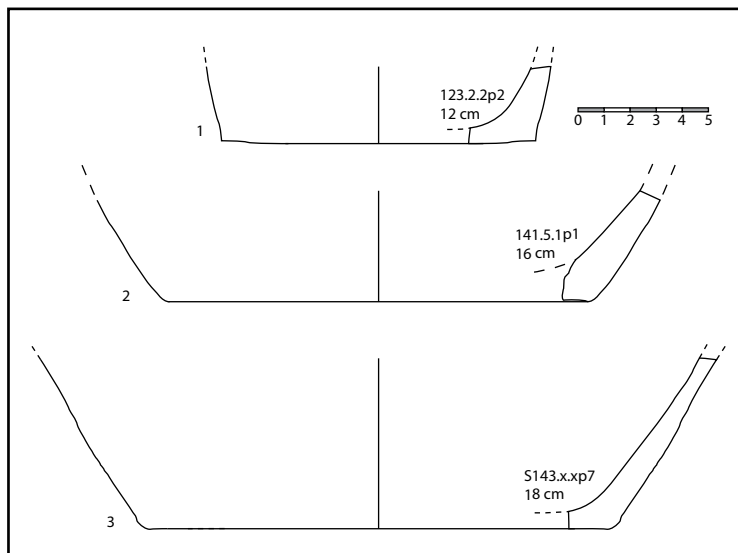


Figure 4.97 Bases

No.	Sherd no.	Parallels	Date	Remarks
1	123.2.2p2			Sand impressions on base
2	141.5.1p1			TUH
3	s143.x.p7			TUH

Table 4.48 Bases

Although it is only a small assemblage and conclusions should, therefore, be treated with care, the general date of most non-Tell 'Umm Hammād ware pottery seems to correspond to the EB Ib and early EB II date of the Tell 'Umm Hammād ware. Some of the vessels occur over a longer period of time, but the more precisely datable vessels, like red slipped bowl s143.x.xp3, correspond with the Tell 'Umm Hammād ware.

A few smaller bowls (min. Ø 20 cm) and jars (min. Ø 12 cm) have been found that complement the large Tell 'Umm Hammād ware vessels. However, none of the cups or finely made small bowls that occur regularly at other EB sites in the region like field 81, al-Rweihah or Tell 'Umm Hammād, have been collected here. Furthermore, few fine red slip and burnished wares, common in EB Ib contexts, have been discovered. This is, however, most likely due to bad preservation at this site. Most of the pottery is badly worn, so small vessels or delicate decoration might not have withstood weathering processes. The high level of abrasion of most of the sherds has also obliterated traces of production techniques that might have been present.

Flint

The distribution of flint artefacts shows a less clear concentration than the pottery. Flint pieces are more dispersed and densities are lower. When the ratio between flint waste and flint tools is considered the concentration becomes clearer (see figure 4.98 and 4.99). The ratio of debitage : tools is much higher for the plots in the concentration than outside it. Tools are rare outside concentrations in this part of the research area. Their higher density in these fields shows a clear link to the pottery concentration. However, the types of tools collected form a less clear link with the EB Ib/II pottery concentration. Most of the tools do not belong to formal tool types, but are of an *ad hoc* nature.⁵⁷ Retouched flakes (n = 15) and simple scrapers (n = 10) constitute the largest part of the assemblage. Both are highly diverse categories with many *ad hoc* flakes and pieces. These types of flint artefacts become abundant in the Late Neolithic, continue to be an important category in the Chalcolithic and EBA period and decline in frequency after the MB I period (Rosen 1997: 87, 92). The *ad hoc* nature of most of the flint in these fields is clear from the common use of flint cobbles and the large amount of cortex that is still present on tools. These cobbles are locally available, but are small in size and usually of low quality. They were retouched, but only in a very minimal fashion often covering only a small part of the artefact. No sharpening or reworking of tools was observed. Small rounded cobbles are abundantly present in this part of the research area and were obviously widely used for quickly manufactured expedient tools and discarded with equal ease. This is completely different from the elaborately worked formal flint tools discovered in the EB concentrations like field 81, al-Rweihah or the excavations at Tell 'Umm Hammād (Betts 1992a).

The retouched blades (n = 6) and the sickle blades (n = 7) inherently show less diversity. All blades are small; the dimensions of sickles average around 2.5 x 1.3 x 0.4 cm. Of the sickle blades three are of the backed types and three of the Canaanite type, for the retouched blades this is two and two respectively. Canaanite blades occur from the EB I until the MB I period, while backed blades are primarily Chalcolithic in origin (Rosen 1997: 65). Two retouched bladelets have been found.

As described above, the flint debitage shows a less clear concentration that can spatially be connected to the pottery concentration. A total of 16 cores was discovered in the area around fields 128, 129 and 141. Flake cores predominate in this assemblage. Cores are the most direct evidence available that artefacts are locally produced.

The debitage shows an even greater predominance of flakes over blades. Flakes amounted to more than 60 % of the debitage, while blades and bladelets only amounted to slightly over 15 % (see table 4.50). Numbers of chunks and especially chips are relatively low, but this is most likely caused by the fact that this is a survey assemblage. The small chips will mostly have been overlooked and some of the more inexperienced fieldwalkers may not have recognized the chunks as artefacts.

57 For the complete database see EDNA.

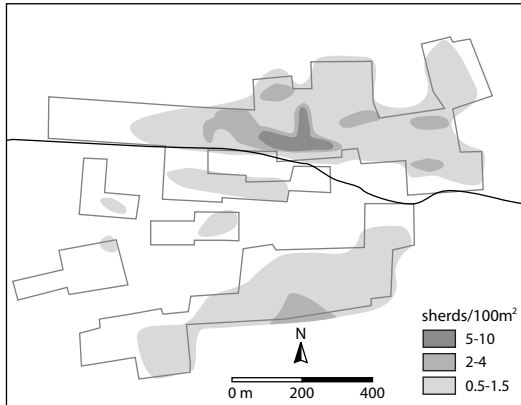


Figure 4.98 Distribution of flint debitage

Tools	
scraper	10
retouched flake	15
retouched blade, including	6
Canaanean	2
backed	2
retouched bladelets	2
sickle of which	7
Canaanean	3
backed	3
Total	40

Table 4.50 Chipped stone debitage from fields 123-143



Figure 4.99 Distribution of flint tools

Cores	16	%
Flake core	7	44
Ad hoc core	4	25
Mixed flake/blade core	2	13
Other cores	3	19
Debitage	125	%
Flake	76	60.8
Blade	16	12.8
Bladelet	3	2.4
Chip	7	5.6
Chunk	5	10.4
Primary flake	13	4
Core trimming element	5	4

Table 4.49 Distribution of flint tools from fields 123-143

The large quantity of debitage centring at the same location as the pottery distribution provides a strong argument that both stem from the same EB I/II site buried here. The smaller numbers discovered to the south of the Wadi al-Ghor are, however, less clearly connected to the site.

Conclusions

All artefacts discovered suggest that a site is buried in the subsurface at this location. The pottery and flint are distributed over a wider area than most of the other concentration discovered in the survey and the pottery is more abraded than similar pottery from other locations. This suggests that this area was subjected to more post-depositional activities, most likely in the form of agriculture and especially ploughing, than other concentrations. The fact that EBA pottery has hardly been found south of the Wadi al-Ghor shows that this part of the wadi has not severely altered its course since the EBA, in contrast to the part immediately to the west that has been redirected in modern times. The Wadi al-Ghor has always formed a boundary that stopped the concentration from moving south, both during the occupation of the site and after its submersed.

Based on the pottery discovered the site can be dated to the later part of the EB I period and the early EB II period. The interpretation of the function of the site is more problematic. The Tell 'Umm Hammād ware vessels are large; they consist of large jars, both necked and holemouth, and almost equally large bowls. Small bowls, jars or jugs are absent. The large jars were most likely used for storage, especially the necked jars that could be easily sealed. The bowls are large and may have been used as communal serving dishes or for short term storage (perhaps in a kitchen context where they held small quantities of supplies that were used daily). All vessels, however, are too large to have been regularly transported. With a height of one meter and maximum di-

iameter of up to 60 cm it seems impossible that they were transported while filled with content. This begs the question why these vessels were found at so few places. The presence of three sites with Tell 'Umm Hammād vessels in the Zerqa Triangle as well as several sites in the Wadi Far'ah suggests a firm link between these two areas. Given their large size these vessels may have been locally produced. The presence of iron oxide in the ware strengthens this hypothesis as iron oxide is common in the local clays and stems from the iron rich layers around Mugharet al-Warda on the northern slopes of the Zerqa. Had the Tell 'Umm Hammād ware consisted of transport vessels, the presence of this ware at Tell Far'ah N, Beth-Shean and perhaps Jericho would have been easily explained. Both sites are accessible by easy routes connecting the Zerqa Triangle with the rest of the region, i.e. the Wadi Far'ah and the Jordan Valley. However, the Tell 'Umm Hammād ware vessels do not seem to have been intended for the exchange of products and were at best not easily transported. It seems likely, therefore, that there was not a physical exchange of vessels between the regions, but rather a social exchange. People will have travelled between these regions and the skill of producing these vessels travelled with them. Only a formal ware analysis and comparison between sites makes it possible to determine whether these vessels were made from local clay at each site or whether the clay or vessels themselves travelled between those sites. A detailed ware analysis including material from all sites should, therefore, be undertaken in the near future. Until such a study has been carried out only tentative suggestions can be made about the similarities of the ware and the nature of the connections between the sites.

The Tell 'Umm Hammād ware seems to reflect the storage part of the pottery assemblage. The other vessels discovered in this concentration are more in line with the standard, domestic EBA pottery assemblage. Unfortunately, the more severe abrasion has left the number of well identifiable vessels rather small. This hampers the drawing of detailed conclusions. The pottery assemblage in general, however, suggests a domestic use. The flint is more difficult to interpret as formal tools characteristic of the EBA are rare and the majority of tools is of an ad hoc nature. Taking all evidence into account, this concentration is interpreted as the remains of a small rural village involved in agriculture from the late EB I and early EB II periods that had a considerable storage capacity and of which remnants possibly still exist buried in the subsoil.

Fieldno.: 163

Coordinates: 746,890/3,567,480

Size: 100 x 100 m

Days and time surveyed: Oct. 9th, 2006,
14 man-hours

Periods discovered: EBA I/II

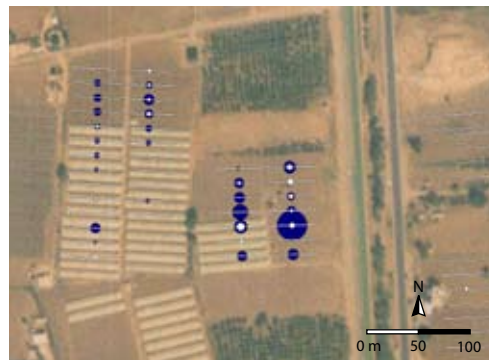


Figure 4.100 Feature sherds (white, N max = 5) and non-feature sherds (dark, N max = 60)

In field 163, considerably higher than average densities of EBA pottery were collected. Lower quantities, but still markedly higher than average were present in field 164. The fields surrounding the concentration revealed very few EBA sherds and the average density was ≈ 0.15 sh/100 m². In fields 163 and 164 33 feature sherds were collected, while the non-feature sherds amounted to as many as 231 sherds. The feature sherds were, unfortunately, more heavily abraded than other EBA concentrations and identification of vessel shape or period was, therefore, difficult. Three small fragments, for example, were discovered that probably stemmed from ledge handles, but these provided no further indications as to type or period. Furthermore, three rims were present in the assemblage, but these were so abraded that it could not be established from which type of vessel they stemmed. However, in four cases rims clearly derived from bowls. Furthermore, nine body

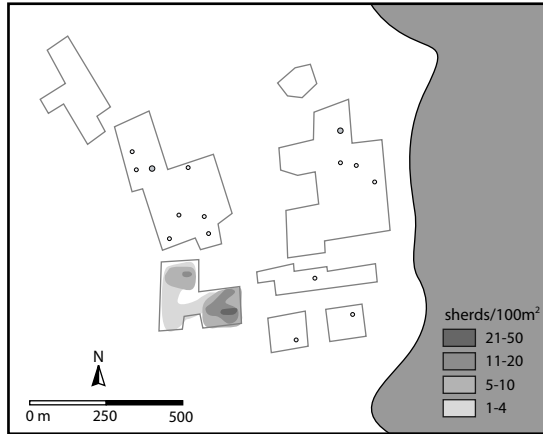


Figure 4.101 Distribution of EBA feature and non-feature sherds

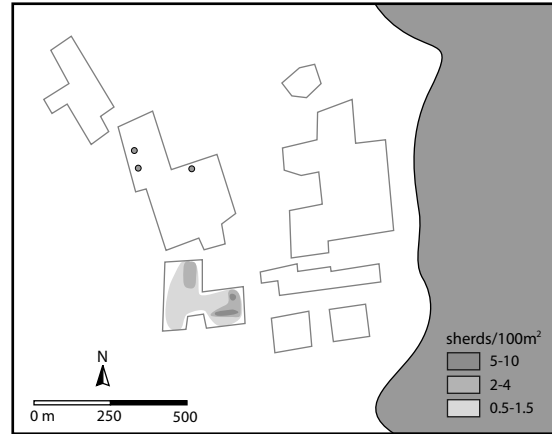


Figure 4.102 Distribution of EBA feature sherds

sherds with impressed bands were collected. The impressions and ware of the sherds resemble the Tell 'Umm Hammād ware of field 128 and surroundings very closely. The marked differences in colour of the sherds, sometimes in the form of a black exterior and red to orange interior, was also reminiscent of the Tell 'Umm Hammād ware. In eight cases, including that of a large bowl, a similarity to Tell 'Umm Hammād ware was noted. Unfortunately, none of these sherds had such clear distinguishing features as to allow a positive identification of the vessel and ware type.

Nevertheless, the few sherds that could be more precisely dated fall within the dating parameters of the Tell 'Umm Hammād ware. Three of the rims belonged to short necked jars that had parallels in several different Tell 'Umm Hammād genres, i.e. genre 22, 26 and the diverse genre 16. Genre 26 vessels derived from only a few layers dated to the end of stage 2, in other words the end of the EB Ia period and to a lesser extent to the first EB Ib phase (Helms 1992c: fig.130). Vessels from genre 22 and 16 stemmed from stage 2, 3 and 4 which has been dated to the EB Ia, Ib and II periods. Bowls of genre 48 predominated in stage 2, i.e. EB Ia, but a few examples were discovered in EB II layers (Helms 1992c: 129). Judging from these few well identifiable vessels this concentration can be dated to the EB I and II periods, but given the low number of sherds a date in other EBA sub-periods cannot be excluded, although it is considered unlikely based on the homogeneity of the ware. All sherds, however, are made of a ware that is dissimilar to EB IV vessels from sites discovered in the research area, e.g. Ze'aze'iyah and Nkheil N. Typical EB II/III features like the envelope handle and combed decoration that have been discovered in other concentrations are absent. The site is, therefore, provisionally dated to the EB I and (early) II period, but with serious

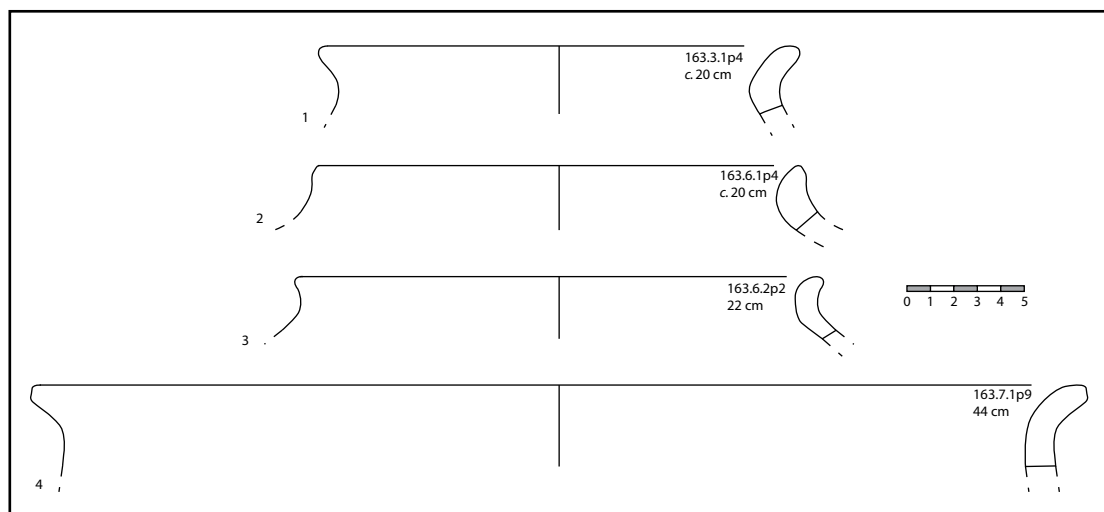


Figure 4.103 Pottery from fields 163 and 164

No.	Sherd no.	Parallels	Date	Remarks
1	163.3.1p4	TUH 2/9, 4/15 (Helms 1992c: fig.202:6,4 or 199:18 or 200:2,3) Handaqq N str. VI (Mabry 1996: fig.8:3)	EB I-II EB Ia/b	G26/G22
2	163.6.1p4	Tell 'Umm Hammād 2/9 (Helms 1992c: fig.202:3,6 or 182:6,7) c. Handaqq N str. V (Mabry 1996: fig.4)	EB I-II EB Ib	G16/G26
3	163.6.2p2	Tell 'Umm Hammād 3/12, 2/7 (Helms 1992c: fig.181:5 or 198:5) Handaqq N str. VII (Mabry 1996: fig.8:1)	EB I-II EB Ia	G16/G22
4	163.71p9	c. Tell 'Umm Hammād 4/15, 2/6, 2/9 (Helms 1992c: fig.217:9, 218:5,6, 184:7,8,10)	EB I-II	G48/G16

Table 4.51 Pottery from fields 163 and 164

reservations due to the size of the assemblage. No other artefact types were collected. Regarding the size of the concentration and the character of the pottery assemblage, as far as could be determined, the site is interpreted as the remains of a small hamlet or large farm.

It is likely that the EBA pottery that both the EJVS and Petit's survey reportedly discovered at Tell al-'Adliyyeh originates from this site located only 150 m to the south-west of the tell (Ibrahim et al. 1988; Petit in prep.). In both surveys only a very low number of possible EBA sherds was discovered. In the excavations conducted by Petit on two locations along the bulldozer cut of the tell no EBA remains were discovered, even though excavations reached the sterile soil. It is likely that solitary sherds of the EBA concentration in fields 163/164 ended up at the tell (perhaps incorporated in mud-bricks), while no substantial EBA activity took place at Tell al-'Adliyyeh.

Fieldno.: 210/ 229

Coordinates: 749,950/3,565,730 (hole)

Size: c. 60 x 80 m

Days and time surveyed: Sept. 12th and 18th, 2006,
4 man-hours

Periods discovered: EBA I and EBA II/III



Figure 4.104 Feature (light, N max = 7) and non-feature sherds (dark, N max = 15)

During the survey of fields 210 and 211 a higher than average number of EBA sherds was noticed. To the south-east of field 210 there was an elevation difference of c. 1 m. This lower area in field 229 was evidently created by levelling activity at some point in time. Some dumped rubble was located at the boundary between fields 210 and 229 and among the rubble a recently dug hole was visible. Some days later the survey team returned to this spot accompanied by geomorphologist Hourani to survey field 229 and inspect the sediments visible in the section of the hole. The hole was dug through a wall made of cobbles fixed in lime-based cement. The top of the wall had probably been visible and attracted people to dig at this location. The wall extended some three metres down into the soil and its base was not reached (Hourani in prep./observation Hourani). The use of lime-based cement leads to suspect that this wall might be of considerable age as this type of cement has been used since at least Roman times but has ceased to be used in the modern era. This quite massive construction might be linked to the ethnohistorically reported basin, called birket al-Fallaj, that was located in this vicinity, but this is hard to verify on the basis of current evidence (see chapter 5.2).

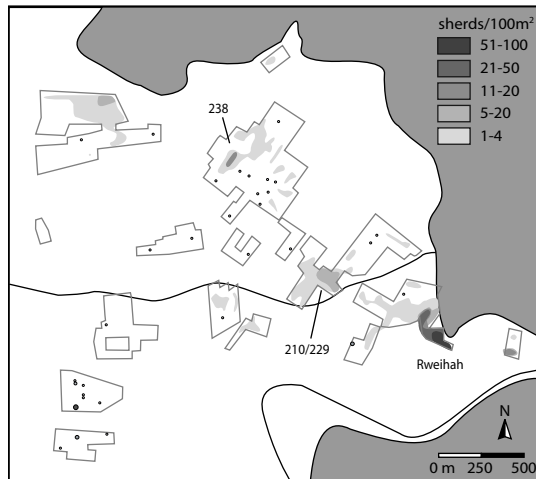


Figure 4.105 Distribution of EBA feature and non-feature sherds



Figure 4.106 Distribution of EBA feature sherds

Moreover, Hourani discovered deposits from an evidently earlier period in the section of this hole besides the wall that are of significance for this concentration however. At 2.5 m below the surface a layer with several EBA sherds was visible. Hourani has concluded that these sherds were amongst older Lisan deposits that had been significantly reworked by (torrential) surface water (Hourani in prep.).

In the surface concentration a total of 24 feature sherds was discovered in these fields. The best preserved ones have been depicted in figure 4.107. Notwithstanding the small size of the assemblage, the sherds suggest this site saw activity during two periods within the EBA. Some sherds like a body sherd with an impressed band and a ledge handle with impressions in the body of the vessel adjoining the ledge have good parallels in the EB Ia assemblage of Tell 'Umm Hammād (Helms 1992c: fig.244: 15, 239:5-7). The ledge handle with impressions on the edge of the ledge, depicted in figure 4.107, can also be dated to this first period of the EBA. The holemouth jar s229.2-3.1p1 with its plain rim would also fit well within this period, although it is a common shape that occurs in several periods.

Other sherds however show typical features of the EB II and III periods. Two body sherds for example were found that show combed decoration on their exterior. Furthermore, two ledge handles with folded edges, also referred to as envelope handles, were collected (see 4.107). This type of decoration and ledge handle would also fit within the EB IV period, but the ware from which these sherds were made makes such a date improbable. The EB IV site assemblages in the Zerqa Triangle like those of Ze'aze'yah and Nkheil N exhibit a temper that includes many small sand and/or chalk particles. The ware from which the sherds of this concentration were made is more in line with the ware of EB I concentrations at field 81 and al-Rweihah, where larger inclusions especially of iron oxide are present. Furthermore, the ware seems similar to pottery on the surface of Handaquq S excavated by Chesson and dated to the EB II/III periods (Chesson 1998). The depicted base (210.3.1p1) could not be dated more precisely than EBA. The number of non-feature sherds in these three fields amounted to 66 sherds, but no distinction could be made between these periods within the EBA on the basis of ware.

Conclusion

The presence of pottery from two sub-periods of the EBA is remarkable. Due to the limits of the assemblage it cannot be ascertained whether there was a continuity from EB I period activity into the EB II/III period or whether two isolated episodes of activities took place at this site. The function of the site is equally difficult to establish given the low number of well identifiable sherds and the absence of other finds. Compared to the pottery of the other concentrations it is likely that this site represents small-scale activity perhaps in the form of a single farmhouse, a small hamlet or shed. This activity might have been temporary or even seasonal, but without more data

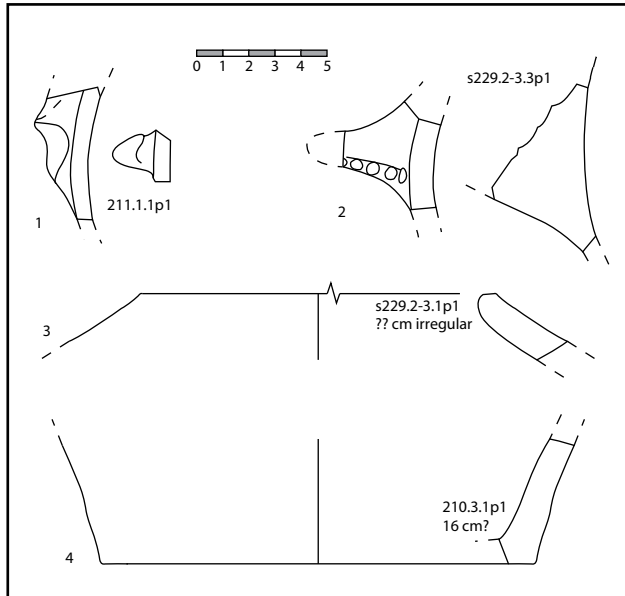


Figure 4.107 Pottery from fields 210, 211, 229

this hypothesis cannot be corroborated or rejected. The existence of activity at this site in two periods is especially interesting given the difference in settlement pattern in the Zerqa Triangle during these two periods (see chapter 5). In the EB I period several small rural villages were present in this area, e.g. at al-Rweihah, Tell 'Umm Hammād, field 81, Katāret as-Samra, fields 126-142 and field 163. During the EB II only Tell 'Umm Hammād and possibly the settlement in field 128 and vicinity continue to exist, although on a much smaller scale (Helms 1992b: 10). Both sites, however, cease to exist after the EB II period. During the EB II period another site was founded that became a large walled town in the EB II and III periods, i.e. Tell Handaqq S (Chesson 1998; Chesson 2000). During the EB III period this was the only settlement in the Zerqa Triangle, but it covered a large area, perhaps as much as 16 hectares, and was enclosed by a thick wall several metres high. The remains from both periods at this site show that there was continuity in location of occupation and probably, if it is correct to interpret these results as connected to agriculture, also of subsistence (see chapter 5 and 6).

Field 238

Coordinates: 748,320/3,566,460
(centre of plot 238.89.1)
Size: c. 90 x 40 m
Days and time surveyed: Sept. 25th, 2006,
c. 1.5 man-hours
Periods: EBA II/III

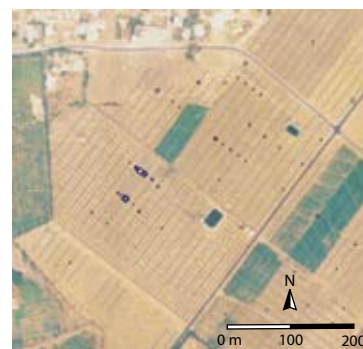


Figure 4.108 Feature (light, N max = 4) and non-feature sherds (dark, N max = 13)

The concentration in field 238 is of comparable size to the concentration in fields 210, 211 and 229. Its centre is located in plots 1 and 2 of lines 8, 9 and line 89 placed in between. A lower number of EBA sherds was discovered in the surrounding plots. A total of 15 feature and 61 non-feature sherds was collected. The feature sherds consisted of six bases that could not be dated more precisely than EBA I to III. Vessel parts that were with more precision datable were three

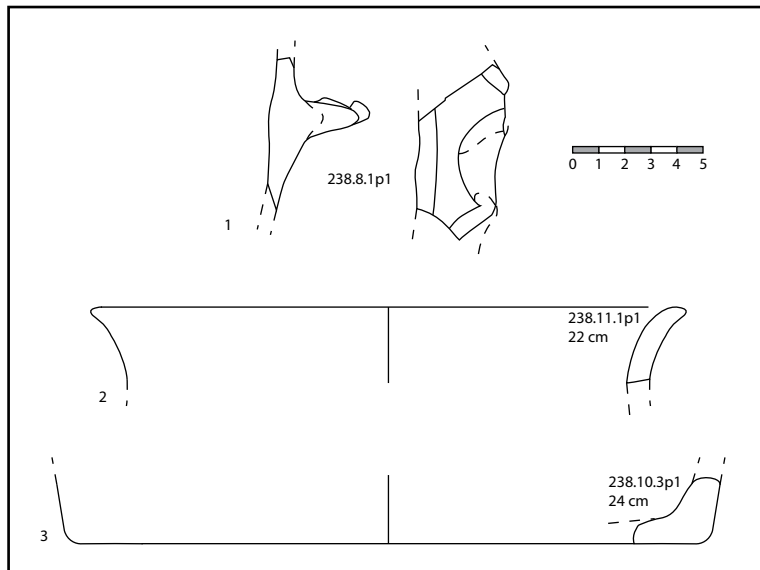


Figure 4.109 Pottery from field 238

ledge handles of the envelope type of which one has been depicted in figure 4.109. Envelope handles are absent from EB I contexts and are missing from EB II layers of Tell 'Umm Hammād. Other sherds of similar date are three body sherds showing combed decoration on their exterior surface. Furthermore, the rim of a holemouth jar was found that could not be dated more accurately than EBA. The rim of the necked jar (238.11.1p1) depicted below could also belong to several EBA periods from the later part of the EB I onwards. Similar to the concentration around field 229 it is the ware which suggests that these sherds predate the EB IV period.

The limited number of sherds and the restricted area over which they are distributed suggest they represent an entity of similar size to that of field 229, i.e. a small farm or hamlet, a shed or storage feature possibly of temporary nature. The slightly higher than average concentration of EBA sherds in field 235 might be the result of ploughing out of this concentration during the course of centuries of agriculture. It is, however, more likely an indication of the higher intensity of use during the EBA because this area was not irrigated by pre-modern and probably Mamluk irrigation systems and therefore saw little agricultural activity.

Celt distribution

A relatively large number of celts was found in the survey area. These tools were mostly found in contexts isolated from sites and hence they are treated separately here. The celts take the form of axes, adzes, chisels and a pick.⁵⁸ Some celts were carefully shaped, whereas the shape of others was very rough, making it difficult at times to establish whether a celt was the finished tool or an unfinished roughout. Careful inspection, however, showed that some coarse examples which had been classified as roughouts exhibit use wear traces in the form of gloss or even polish. One rough example (47.12.2f1) showed areas of gloss on several edges and surfaces over large parts of the body. The working edge is very thick and blunt and shows negatives of a later date, probably of use, that did not leave behind gloss. The form of the celt suggests that its edge hit hard objects repeatedly resulting in pieces flaking off. This resulted in a short exhausted celt with a very blunt working edge. Another remarkable feature of this tool is the presence of pecking traces along the ridges about midway on the object. On the sides and upper and lower edges traces of hammering are visible that have resulted in a general concave shape. It seems likely that the hammering itself

⁵⁸ The characteristics of axes, adzes, chisels and picks as detailed by Rosen have been applied to this material (Rosen 1997: 93).

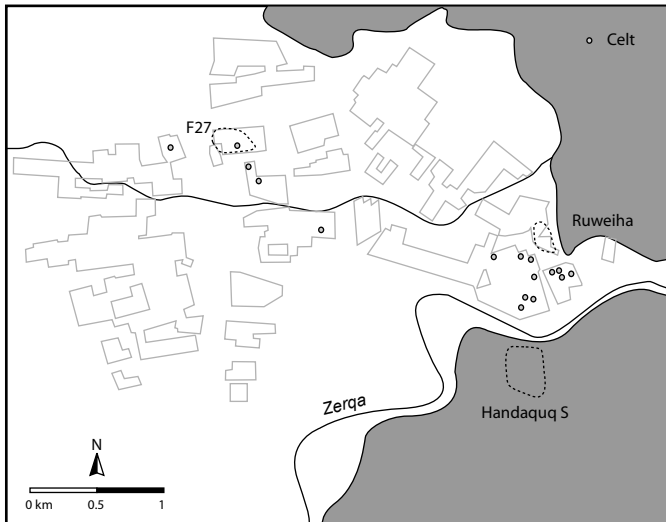


Figure 4.110 Location of celts discovered in survey

was not the cause, but rather that these traces were made intentionally. Had hammering been the reason, then not only the ridges but the entire object would have been used. It seems more likely that the sharp edges were removed to facilitate holding or hafting the object.

Celts are generally dated to the Neolithic and Chalcolithic periods and cease to be used before the start of the EBA (Rosen 1984: 504). Round-ended axes seem to precede straight-ended axes and adzes and Chalcolithic celts appear more formal and standardized than Neolithic celts, but detailed dating on the basis of morphology remains highly problematic (Rosen 1997: 98; Yerkes and Barkai 2004: 124). The celts discovered in the survey can, therefore, not be precisely dated and may stem either from the Neolithic or the Chalcolithic periods. Few Late Neolithic remains have been uncovered in the survey. In the vicinity of fields 81 and 82 some flint tools have been collected that probably stem from this period and in the Zerqa section located nearby Mabry reported the presence of Late Neolithic/ Early Chalcolithic flint tools (Mabry 1992: fig. 2.10). The chisel discovered in field 81 may be connected to these remains, but a date in the (Late) Chalcolithic period is equally probable as the same Zerqa section also yielded (Late) Chalcolithic remains (Hourani in prep.). In the al-Rweihah fan no remains from the Neolithic period have been discovered, but these may well have been covered by alluvial sediments which were deposited on a large scale until the EBA (Hourani in prep.). Field 27 has revealed a large Late Chalcolithic settlement and the celts discovered in its vicinity are very likely connected to this site. The quite substantial concentration of celts at the point where the Zerqa enters the valley, between the EBA settlements of al-Rweihah and Handaqq S, is remarkable. Except for these two EBA concentrations there is no clear concentration of either Neolithic or Chalcolithic artefacts. It has been reported that Late Chalcolithic remains have been uncovered in a sounding at Tell al-Hammeh E, but the detailed surface survey of Petit did not reveal any Chalcolithic remains and the excavation revealed only a few sherds from this period (Van der Steen 2004: 195; Petit in prep.). **Although a high density of lithic waste was recorded in this area, only a few non-celt tools were discovered.** The tools mainly take the form of simple ad hoc scrapers or retouched flakes and blades. These types of tools cannot be dated precisely and differ markedly from the formal tools that are generally also present at Late Neolithic and Chalcolithic period sites. There is, therefore, no convincing evidence to assume that the concentration of celts was connected to a site.

In the absence of other remains from either period in this part of the al-Rweihah fan the large number of celts discovered in this area can only be related to a special activity carried out with celts in this area. The function of these artefacts is, however, not entirely clear. A selection of these artefacts were probably used for wood chopping and finer carpentry work. Microwear analysis on 14 celts from the Chalcolithic site of Givat Ha'oranim located in the hill country of Cisjordan has established that at least 11 were used in wood working with a chopping, scraping or chiselling mo-

THE SURVEY RESULTS

find number	tool type	typotechnological remarks	broken	length	width	thickn.	polish
s29.x.1F1	axe	straight edged, polish on working edge		94	38	28	heavy
30.06.04.F.1	chisel	blunt edge		86	30	21	
s32.9-10.5.F.1	axe	straight edged axe		93	38	28	
34.03.09.F.1	axe	straight edged axe	x	58	43	30	x
34.11.07.F.1	celt?	roughout?		70	32	20	
34.13.08.F.3	celt?		x	40	34	17	x
34.15.06.F.1	celt	roughout?		73	33	23	
s47.x.01.F.1.	axe	straight edged axe		88	32	23	
47.01.01.F.1	axe/adze	bottom part	x	35	35	18	
47.01.02.F.1	adze			119	42	36	
47.12.02.F.1	celt	hammering on middle part		89	44	29	slight
48.03.02.F.2	axe/adze	bottom part	x	41	46	22	
48.07.03.F.2	celt	strong polish on one side	x	23	35	24	heavy
48.10.02.F.1	pick	broken on working edge	x	61	55	33	
48.19.01.F.1	chisel		x	74	30	20	
81.12.1F1	chisel	no polish	x	64	21	12	
97.9.1F1	celt	possible adze?		58	35	29	
123.6.1F1	adze	rounded end		83	32	21	
278.6.1F1	chisel	both sides retouched		62	25	13	
Sondage 27	chisel	found between 60-100 m	x	49	22	19	

Table 4.52 Celts discovered in the survey

tion, while one of them was later reused to scrape hides. The function of three celts could not be determined (Yerkes and Barkai 2004: table 8.1). The microwear analysis combined with the morphology of the celts led to the suggestion that chisels were probably used in light woodworking and carpentry, while adzes were more likely used for the hollowing out of wooden objects (Yerkes and Barkai 2004: 124). Similar traces of wood working were discovered on two adzes from Jericho (Keeley 1983: 759). Microwear analysis on 76 Neolithic axes from Netiv Hagdud in the Jordan Valley also suggested wood or bone working in the majority of cases (Yerkes et al. 2003: table 1). This specific analysis does not conclusively determine for the function of all celts, however. Celts have also been discovered in largely treeless desert areas like the southern Sinai or Negev (Rosen 1997: 97). Although the climate in this period cannot be equated to the modern situation it is not likely the al-Rweihah area was heavily forested. There are some indications that celts were also used for the tilling of soil and digging in silt and may have been used as hoes (Rosen 1997: 97). Use as a hoe would explain the very blunt working edges and presence of negatives resulting from later flaking of the working edge when the celt hit a stone in the ground. Some of the axes and adzes discovered in this area seem too coarse for carpentry work. This is, however, not the case with the chisels discovered within the concentrations of fields 27 and 81 (see figures 4.21 and 4.58). These thin and carefully worked chisels seem too delicate to withstand working soil with cobbles present in it. Not all axes and adzes discovered between Handaquq S and al-Rweihah can be deemed hoes. The gloss on some of the small pieces seems too thick to be caused by working the soil. The stones in the soil would cause the celt to flake too often to develop such thick polish. Only future microwear analysis can solve the function of this enigmatic group of celts.

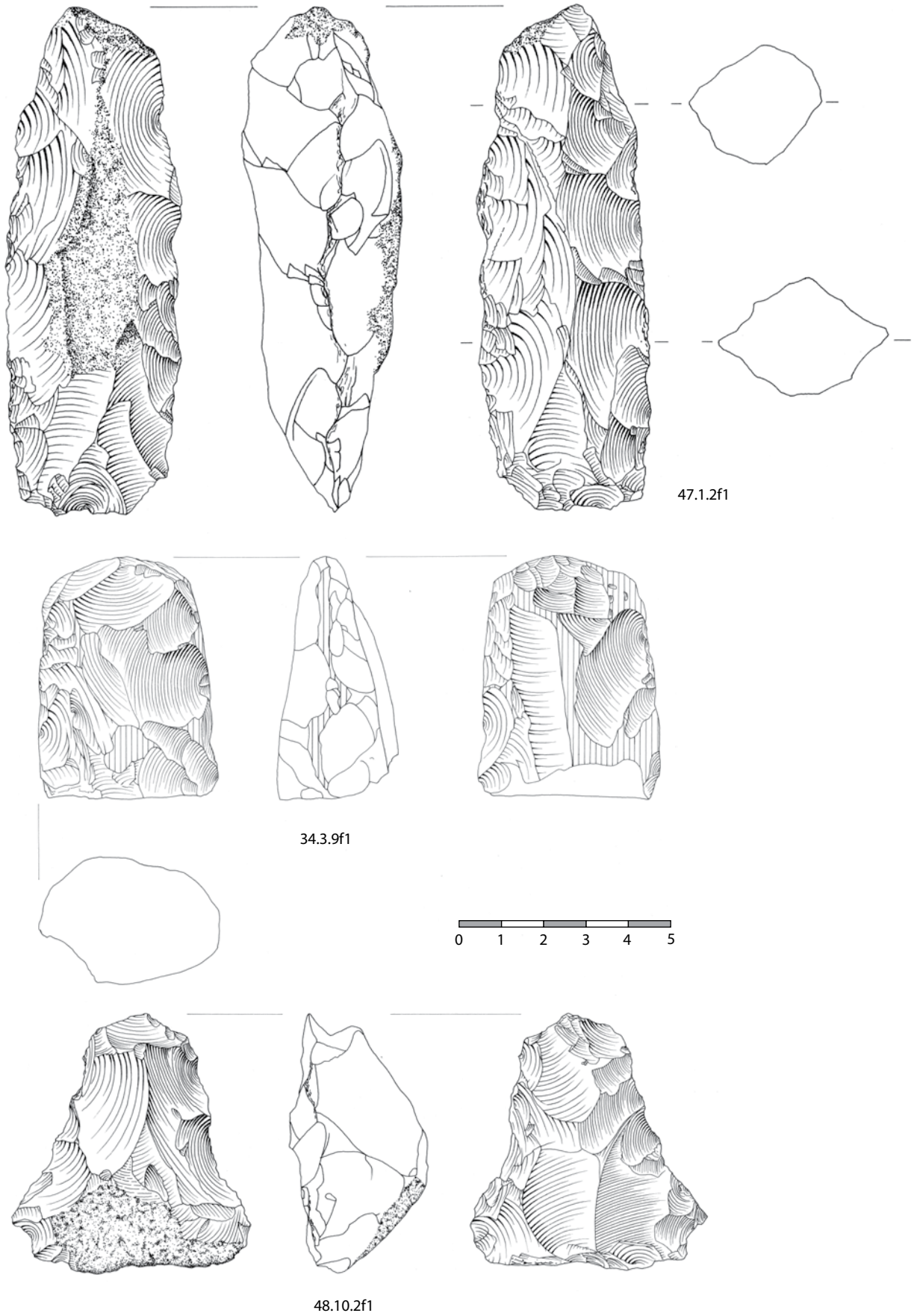


Figure 4.111 Selection of celts discovered in the al-Rweihah fan

4.1.3 Other Late Chalcolithic and EBA discoveries in the region

Dolmen on the northern Zerqa bank

Coordinates: 750,290/3,565,330 (centre)
 Dolmen 1: *c.* 750,275/3,565,335
 Dolmen 2: *c.* 750,287/3,565,345
 Dolmen 3-7: *c.* 750,293/3,565,320

In the foothills on the northern bank of the Zerqa to the east of al-Rweihah a small group of dolmens was discovered (see figure 4.112, 113, 117). Two dolmens (no. 1 and 2) were located on the eastern bank along a small wadi. Dolmen two was located slightly further up hill and was not visible from dolmen one. Some limited digging activity had recently taken place inside both dolmens. Among the discarded rubble two rim sherds were found (see figure 4.115). The sherd found outside dolmen one belongs to a shallow bowl with traces of burnishing on its rim. Parallels for this type of bowl are present among the Tell 'Umm Hammād assemblage. Very similar bowls are present within genre 36 that has been dated to the EB Ia and Ib periods (Helms 1992c: 72, 73). The best parallel stems from an EB Ib layer (stage 3/phase 11) (Helms 1992c: fig.211:27). Other parallels are found among genre 37 (EB I-II). This genre is not ubiquitous, but small amounts have been found in both EB I and II strata (stages 2, 3 and 4) (Helms 1992c: fig.129). The best parallel for this vessel stems from an EB II layer (4/15) (Helms 1992c: fig.212:12,15). The bowl fragment discovered in dolmen two has clear parallels in Tell 'Umm Hammād's genre 39 that dates to the late EB Ib and EB II periods (Helms 1992c: fig.227:11-13).

At the same altitude to the west of the wadi man-made alterations to the rocks were discovered. Besides some weathered, uncertain carvings, two niches cut into a rock face were discovered. These niches are similar to niches discovered in the hills to the south of the Zerqa at the Sabha and al-Zighān caves and to examples in the Dāmiyah dolmen field (see below). These niches measured approximately 45 x 60 m and were *c.* 30 cm deep. In the terrain between these niches and the dolmen two ledge handles and a base were collected (see figure 4.115). All three can broadly be dated

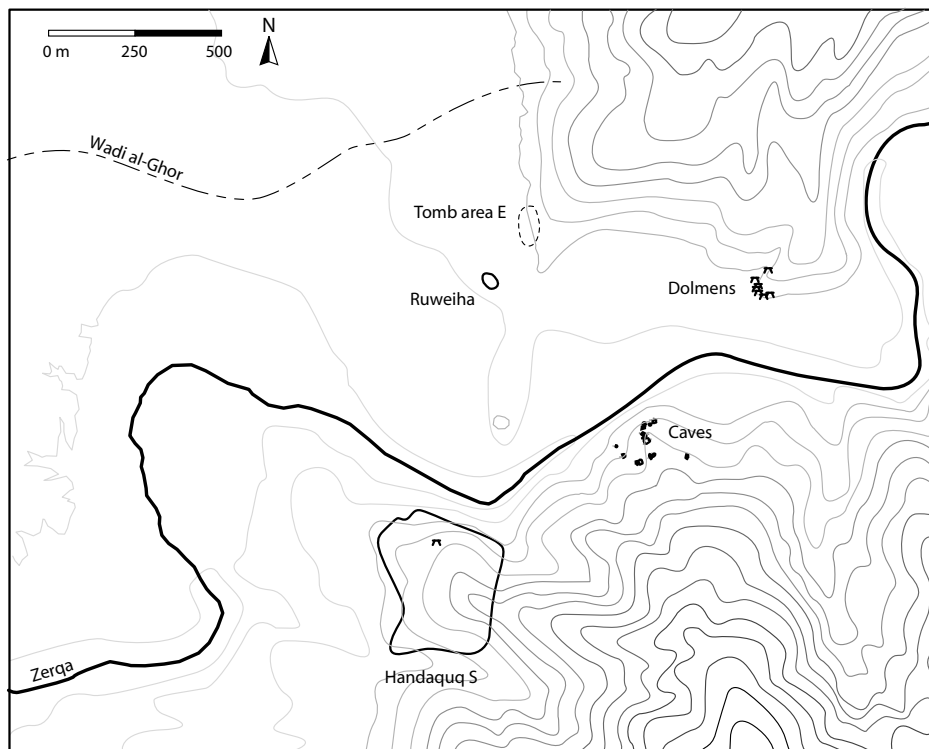


Figure 4.112 Area where the Zerqa enters the Jordan Valley with EBA remains discussed in this section



Figure 4.113 Dolmen 2



Figure 4.114 Niche 1

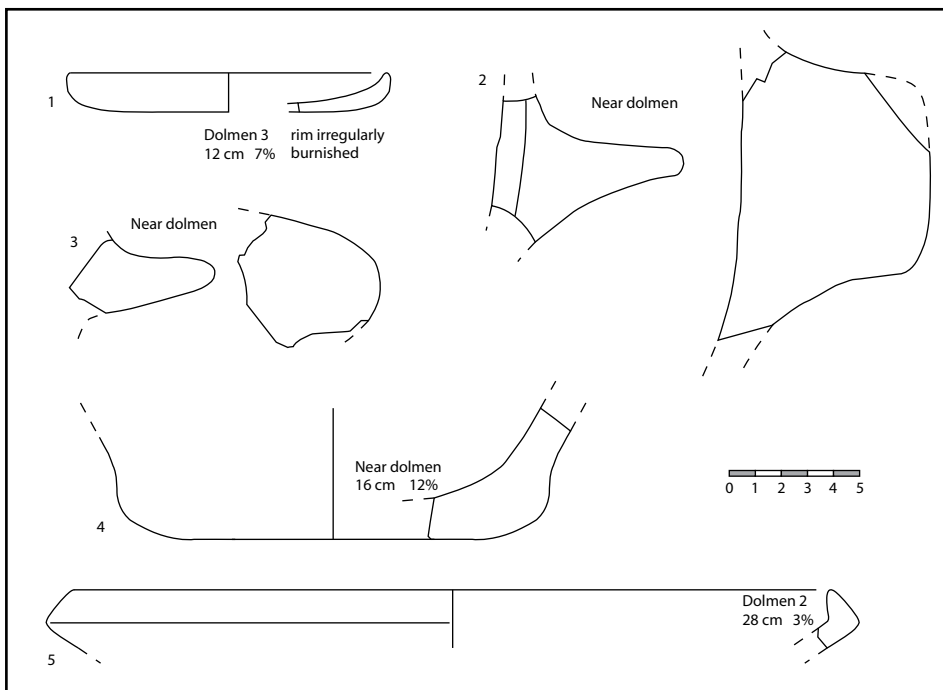


Figure 4.115 Pottery discovered near the dolmens

to the EB I and II periods. The area stretching from this wadi to the west consists of several rock faces, natural caves and fallen boulders. This area is very suitable for the construction of dolmens or rock carvings and might well harbour further man-made remains.

Slightly further up the slope to the east (*c.* 300 m) more dolmens were found. On the edge of a small plateau along the slope a line of five dolmens was located (no. 3-7). Some had severely collapsed and only two were still easily recognizable as dolmens. No earth displacement had taken place here and no pottery was discovered. The dolmens were all made from the surrounding rock. The type of rock present at this specific location naturally fissions in flat slabs ideally suited for dolmen construction. There seems to be a connection in this area between the availability of suitable rock and the presence of dolmens. This holds also true for the Dāmiyah dolmen field located 10-12 km to the south. Here the presence of dolmens overlaps with the availability of travertine. The stone slabs of dolmen do not seem to have been transported.⁵⁹ When rocks or boulders did not easily provide flat slabs it seems that different methods were used to create dolmen-like structures, e.g. south of the Zerqa at the Sabha and al-Zīghān caves.

⁵⁹ Michel de Vreeze has discovered a few locations in the Dāmiyah dolmen field where grooves were carved into the rock, probably in order to split them (MA thesis in prep.).



Figure 4.116 Overview of rock outcrops



Figure 4.117 Dolmens 3-7

Dolmen near al-Rweihah spring

Coordinates: *c.* 749,930/3,567,030

On the north-eastern slope above al-Rweihah three more dolmens were discovered. They were located close to where a wadi resurfaces, that was water bearing at the moment of survey, after having streamed below the rocks for some time. Unfortunately, the area was somewhat disturbed by digging and the construction of some new walls. Only one dolmen (no. 1) was in relatively good condition with only the covering stone being displaced. The other two were made of smaller, less square stones and had collapsed. What was remarkable in comparison to the Zerqa dolmens and many of the dolmens of the Dāmiyah dolmen field was the relatively well preserved circle of stones surrounding dolmens one and three. This circle surrounding the dolmen may once have been at least 1 m high, as two intact examples in the Dāmiyah field show, and may even have completely covered it. The circles were still two courses high. In front of dolmen one the corridor that led from the entrance of the dolmen to the circumference of the circle was still visible (see figure 4.119). The Telul adh-Dhahab survey of Gordon and Villiers refers to two locations they call the 'Abū'Ubaydah dolmens that seem to be located slightly further to the north and west in the foothills of the Rweiha fan (Gordon and Villiers 1983: fig. 1, table 1). Unfortunately no further information is provided on these dolmens in the article. Today no dolmens are visible at the indicated locations.



Figure 4.118 Dolmen 1



Figure 4.119 Dolmen 3 with surrounding stone circle

Both these dolmens and the dolmens north of the Zerqa were located along a wadi and in this case even a spring that might well have been perennial. It has been suggested that there is a link between the availability of water and the presence of dolmens (Kafafi and Scheltema 2005: 13). For this region, including the Dāmiyah dolmen field that is located between two important wadis, this hypothesis holds true.

Sabha and al-Zīghān caves

Coordinates: 749,955/3,564,905

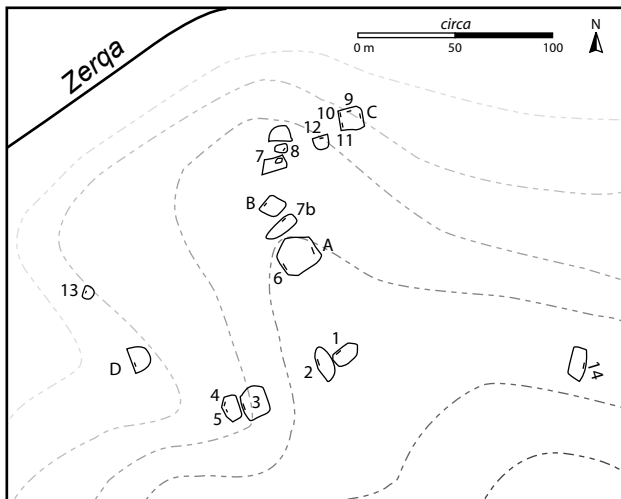


Figure 4.121 Schematic plan view of the location of the caves and niches

In an effort to check the state of preservation, the exact location and dating of some sites reported in previous surveys, a search was undertaken for the Sabha and al-Zīghān caves. In their survey of the vicinity of Telul edh-Dhahab Gordon and Villiers reported a few sites in or near the Jordan Valley plain (Gordon and Villiers 1983). One of these sites is referred to as the Sabha and al-Zīghān caves. Gordon and Villiers note that they discovered Iron Age material and possibly some Chalcolithic sherds, but provide no drawings (Gordon and Villiers 1983: table 1). On their map they positioned this site at two locations. The first mark is placed east of Tell Handaqq S. The second location is slightly west of the site of ‘Ayn Sabha, of the main period of occupation of which they dated to the Chalcolithic period (Gordon and Villiers 1983: fig. 1). No further description of these caves is given. It was hoped to determine the exact location of the caves and whether there was a connection between the caves and either ‘Ayn Sabha or Handaqq S.

In the slopes immediately behind Handaqq S an almost vertical rock face extends to the north-east. Within this rock face several seemingly man-made holes are visible. Without mountaineering equipment it is today impossible to reach these caves. These openings might form part of Gordon and Villiers’ Sabha and al-Zīghān caves. Muheisen also mentions caves in this area, calling them the al-Zīghān tombs, which he dates to the EB and Byzantine periods (Muheisen 1988: 519). As early as 1933 Mallon already mentioned the presence of these openings which he described as tombs (Mallon et al. 1934: 156). He continued by stating that what he called the necropolis extended towards the east onto the plateau of Hammeh, which may well be the same area as is described below. At this location the ‘famous window of Fatima’ is located which is an ancient tomb of which the entrance was widened, painted red and venerated by the Muslim population of that time (Mallon et al. 1934: 156). Mallon described that there are additional rock-cut tombs on this plateau supplemented by several megalithic structures including a tumulus with a diameter of 10 m and a height of 1.5 m (Mallon et al. 1934: 156). No traces of the red painted window of Fatima or the tumulus were found but the rock-cut tombs were probably relocated (see below).

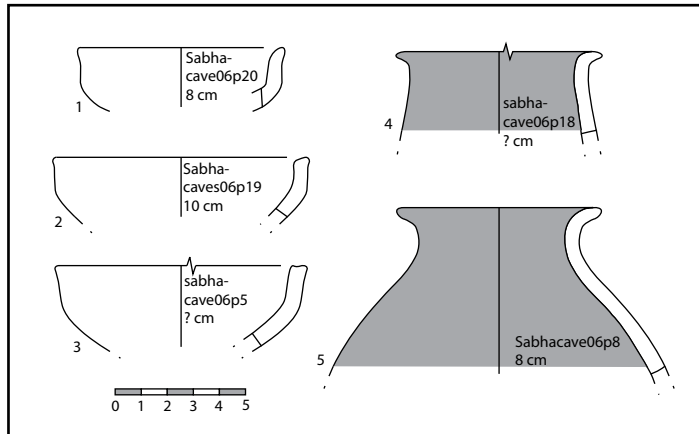


Figure 4.120 Pottery from the Sabha and al-Zīghān caves

No.	Sherd no.	Parallels	Date	Remarks
1	Sabhcave.06p20	Iktanu (Prag 2000: fig.5.3:3) Far'ah N tomb 3 (de Vaux and Steve 1949: fig.3:5) Fara'ah N (de Vaux 1961: fig.3:35, 4:6) Tell 'Umm Hammād (Helms 1992c: fig.227:4)	EB Ia EB Ib	(medium) coarse, iron oxide, chalk, few stone
2	Sabhcave.06p19	Far'ah N tomb 3 (de Vaux and Steve 1949: fig.3:5) Fara'ah N (de Vaux 1961: fig.3:35, 4:6)	EB Ib EB Ib	Medium fine ware, iron oxide, chalk, stone, org.
3	Sabhcave.06p5	c. Far'ah N tomb 3 (de Vaux and Steve 1949: fig.3:5)	EB Ib	Coarse, iron oxide, chalk + organic temper
4	Sabhcave.06p18	East Ghor Canal 1976 Franken (see drawing) Far'ah N tomb 14 (de Vaux 1952: 12:16) Far'ah N tomb 15 (de Vaux 1955: fig.1:9) Tell 'Umm Hammād 2/10 (Helms 1992c: fig.192:6,10) Dāmiyah dolmens (Stekelis 1961: fig.15:125, 19:167, 191; Yassine 1985: fig.6:10)	EB Ib EB Ib EB Ia	Red/orange ware Coarse temper, iron oxide, organic, stone Genre 19
5	Sabhcave.06p8	Far'ah N tomb 8 (de Vaux and Steve 1949: fig.13:20)	EB Ib	Orange ware, iron oxide, chalk, org, medium amount

Table 4.53 Pottery from the Sabha and al-Zīghān caves

In the hope of finding pottery connected to these caves an attempt was made to approach the cliff from the direction of 'Ayn Sabha. The site of 'Ayn Sabha itself was, unfortunately, not re-discovered. It might be located slightly further east or uphill than the imprecise mark on the map suggests. When approaching the cliff from this side several chambers cut into large boulders were discovered on the first promontory in the east overlooking the Jordan Valley (see figure 4.112 and 4.121). A total of 15 chambers and 4 shallow niches were discovered distributed over several boulders. These boulders had broken off from rocks further uphill. This had apparently happened in prehistoric times as the horizontal position of most of the chambers showed that the rocks' positions had not changed since their construction. In a few cases, however, rocks had fissioned even further, dislocating or splitting chambers.

The chambers are in general of rectangular layout with a smaller rectangular entrance, which is often encircled by a frame (see figures 4.124 and 4.126). The chambers are on average *c.* 1.5 m deep, 1.2 m wide and 0.8 m high. Entrances have an average width of 0.5 m, a height of 0.6 m and the walls are usually *c.* 0.3 m thick (see table 4.54). Two caves had a secondary chamber in their back wall (caves 4 and 5). One cave had a small cavity halfway along the wall, possibly for placing a lamp in (Cave 6). The niches have a very similar appearance. Their size is comparable to that of the entrances and they also occasionally have frames.

The inside of the caves was empty apart from some dirt, dry grass and the occasional gecko. The area between the caves was randomly surveyed for diagnostic pottery. Not many datable pieces could be discovered, however. The collected feature sherds are depicted in figure 4.120. Some sherds could be dated to the IA, while others are definitely EBA. Several sherds could not be dated. The best parallels for the EB sherds come from the Tell Far'ah tombs (e.g. de Vaux 1961) (see



Figure 4.122 Caves 10 and 11



Figure 4.123 Niche A



Figure 4.124 Cave 15

table 4.53). The majority of tombs at Tell Far'ah have been dated to the EB Ib period (Charloux 2006: 109). Because of the limited number of sherds and their diverse age, dating is problematic. Based on the pottery it is suggested, likely that activity took place during the EB I(b) period and in a second episode during the Iron Age. This would mean that the chambers were hewn out during the EB I(b) period and reused during the Iron Age.

There are parallels for EB I hewn rock chambers. The tombs near Tell Far'ah N, associated through their pottery, are, however, natural caves worn out in limestone by water (de Vaux and Steve 1949: 102). Rock cut chambers are present in some of the dolmen fields. The closest field containing this kind of rock cut chambers is the Dāmiyah dolmen field located immediately to the south-east of the research area, between c. 8 to 10 km south of the Sabha and al-Zīghān chambers. In this field, where 200 to 300 dolmens and other structures like cist graves have been found, several rock-cut tombs almost identical to the Sabha and al-Zīghān chambers have been found. Stekelis, who surveyed the field in detail and excavated several dolmens, recorded only one rock-cut tomb (no.190) (Stekelis 1961: fig.40). Three further examples should be classified midway between a dolmen and a rock-cut tomb. They are cut into a large boulder, but have an open ceiling, which is topped by a cover stone in similar fashion as a dolmen (no. 152, 161, 146) (Stekelis 1961: fig.38-40, pl.II). This is a type F dolmen in Zohar's classification of Levantine megalithic structures, while the standard dolmen in the Dāmiyah field is referred to as type A (Zohar 1992: 44). Although Stekelis has only investigated and published one of the rock-cut chambers, there are at least two dozen more of these chambers.⁶⁰ Their appearance is very similar to the Sabha and al-Zīghān chambers. They are hewn out of rock boulders, have a rectangular, often framed, entrance and chambers are of similar size. Furthermore, there are also some niches like among the Sabha and al-Zīghān chambers and near the dolmens north of the Zerqa.

None of the rock-cut chambers in the Dāmiyah field yielded any finds. However, given the stone floor and shallow depth of accumulated soil inside the chambers, the chance of finding artefacts is very limited. Nevertheless, two of the type F structures investigated by Stekelis did yield finds. In structure 152 a bronze dagger with a central rib was found and in no. 190 a basalt bowl (Stekelis 1961: 70-71). Both finds can unfortunately not be precisely dated and need not date to the construction of the chamber but may have been left during later (re-)use.

The rock-cut chambers might, however, be connected to the dolmens. They are found at the same location and the entrances of the dolmens are almost identical. The entrances are rectangular and often have a frame surrounding them. On a very general level the chamber created inside the dolmen is similar to that of the rock-cut tomb. Especially when one considers that dolmens were originally surrounded and probably covered by a round plateau of stone blocks. Furthermore, the type F dolmens appear to be an intermediate form between dolmens and rock-cut chambers. The rock-cut chamber excavated by Stekelis is connected to a corridor like the type F dolmen (152) and all excavated dolmens (Stekelis 1961: fig.40). The rock-cut chamber, the type F dolmen and the standard dolmen type are clearly linked and could, therefore, be of the same date.

60 Personal observation + field guide (Scheltema 2008: 76-79).



Figure 4.125 Cave 12



Figure 4.126 Cave 6



Figure 4.127 Cave 6

Stekelis has discovered pottery in the dolmens that he excavated. Based on his drawings and descriptions the pottery should probably be dated to the EB Ib and II periods (Stekelis 1961). The assemblage includes e.g. red burnished plates, plain ledge handles, large necked jars and jugs similar to those discovered in the Tell Far'ah tombs and Tell 'Umm Hammād (de Vaux 1961; Helms 1992c). The few pottery sherds discovered from the Sabha and al-Zīghān caves also fall within this range.

The similarity of the rock-cut chambers to dolmens might suggest an interpretation of the rock-cut chambers as tombs. Their small size makes them unfit for habitation and the entrances seem too small and poorly positioned to allow their use as storage facility. They might therefore very well have been used as burial chambers. Given the lack of finds and later re-use there is no direct evidence either for or against such an interpretation in this specific group of chambers. Similar rock-cut chambers have, however, been discovered elsewhere in the Jordan Valley and support the hypothesized age and function. In the hills directly to the east of Tell Handaqq N. c. 100 tombs have been discovered. These are mainly natural caves that have been enlarged, but in some instances chambers were directly cut into the limestone conglomerate bedrock. According to Mabry, Rawlings and Woodburn many tombs have a square and recessed entrance that was possi-

Sabha & al-Zīghān caves cave no.	Chamber			Entrance			Orientation façade degrees
	depth	width	height	depth	width	height	
1	0.8	0.7	0.65	0.18	0.5	0.65	
2	1.7	1.25	0.9	0.5	0.65	0.6	283
3	1.4	1.10(?)	0.65	0.16	0.5	0.6	300
4	1.57	1.3	0.95	0.12	0.58	0.58	296
chamber in back of cave 4	0.7	0.9	0.75	0.04	0.45	0.75	
5	1.4	1.05	0.8		0.6	0.7	256
chamber in back of cave 5	0.45	0.5	0.75				
6	1.7	1.35	0.9	0.25	0.42	0.64	320
7	1.12 broken	1.1	0.6	0.3	0.45	0.6	fallen
8	1.45	0.8	0.95	0.07	0.85	0.55	46/fallen?
9	1.78	1.67	1.16	frame	0.6	0.58	16
10	2.45	1.45	1.25	0.55	0.55	0.8	310
11	1.45	1.25	0.7	0.25	0.5	0.8	310
12	1.27	1.25	0.87	0.35	0.5	0.6	315
13	broken	1.2	0.85	0.05	0.64	1	fallen
14	broken	c. 1.1	c. 1				fallen
Niche A	0.77	0.75	0.65				110
Niche B	0.3	0.55	0.6				344
Niche C	0.06-0.12	0.6	0.74				114
Niche D	0.27	0.35	0.5				fallen

Table 4.54 Dimensions of chambers in metres

ble originally sealed off by a stone (Mabry 1996: 126). Although none of these tombs is depicted, their description resembles both the Sabha and al-Zighān chambers and the Dāmiyah rock-cut tombs. One recently robbed tomb (NE 1) at Handaquq still contained some pottery and skeleton remains. The pottery consisted of red burnished ware and a line-painted jug dated by the excavators to the EB I period. Although this does not provide a date for the entire area of rock-cut tombs, it does show the area was used for tomb burials during this period. Some years before the excavations at Handaquq N took place Muheisen and his team had already surveyed a part of the tomb area. As they were focused on the palaeolithic periods they only mention that Chalcolithic, EB III, EB IV and some MBA artefacts were found without providing a description or drawings (Muheisen 1988: 520).

Based on the discovered finds, parallels and similar structures it is suggested these chambers should be considered tombs, probably manufactured during the EB I/II periods. The pottery discovered is rather dissimilar to contemporary pottery from settlement sites and the assemblage is admittedly very small. The pottery, further, suggests that the caves saw a second episode of activity during the Iron Age, but the assemblage size is insufficient to provide more detail on sub-period or function. The Dāmiyah dolmen field has also revealed a limited amount of Iron Age activity (Dajani 1967/68). The character of this activity, however, remains to be determined at both sites.

Kirkbride's Tomb Search Party

Area E

It is clear from Kirkbride's notebook that area E was located near sites 6 and 17. The description this time describes the area at the foot of Trought's mountain on the right side of the road. A different hand later added that the right was the west. This is, however, probably wrong as a photograph (figure 4.128) shows that the site was located against the slope to the east of Trought's house and hence also east of his road. The photograph also shows the top of Tell Deir 'Allā on the horizon behind the trees, which together with the relief and badlands of al-Dbāb allow the site to be perfectly situated.

Kirkbride described the area as 'dolmens and stone foundations of large blocks'. What follows is a description of the four or five excavated trenches. Their number is unclear as five entries were made, but they are labelled one to four with number two occurring twice. Two sketches of the loci in the trenches accompany the descriptions.



Figure 4.128 Unidentified trench



Figure 4.129 Unidentified trench

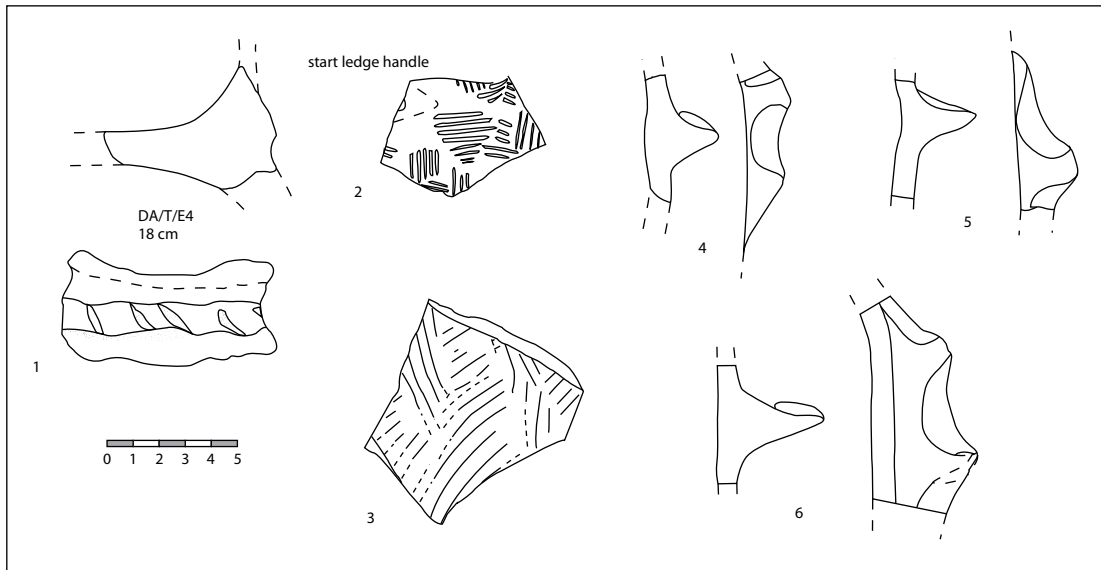


Figure 4.130 Pottery from tomb area E

Trench 1 is referred to as lying inside a small ‘room’. Three loci have been identified; 1-grayish surface sand, 2- stones packed roughly with sand mortar, forming a floor, 3- sand with sherds. A sketch seems to depict trench 1, but the loci described do not completely correspond (see figure 4.132).

Trench 2 is located close to trench 1 and 30 cm beneath the surface the foundations of a wall were found. Here six loci and one feature were discovered; 1- surface (with sherds), 2- packed stones, 3- sandy earth and sherds, 4- below debris from wall, 4a- plaster floor, 5- gravel and yellowish sand below wall, 6- reddish. Feature A is the wall.

Trench 3 has six loci. No note is made of its position in relation to the other trenches. The loci comprise: 1- surface with mixed sherds that originate in the Arabic, Byzantine and Early Bronze Age, 2- sand and stones, 3- wall foundation, 4-area with talus stone (sterile), 5- hole with many Early Bronze Age sherds, 6- below stones (perhaps of no. 3’s wall) there was sand, stones and many Early Bronze Age sherds. The only remark for trench 4 is ‘in talus, in bay of cliff, some sherds’.

The last entry in the notebook is again referred to as trench 2, although it was first labelled three but this was scratched out. Three loci are identified; 1- surface, 2- sandy layer with stones and sherds, 3- a layer of whitish lime with stones and earth (‘top of wall?’ is added here). A note says that the finds in this trench were interpreted as an Early Bronze Age building made of very large blocks of stone. The trench was not finished and was, therefore, backfilled to be reinvestigated the following year. It would appear, however, that this intention was never realised.

The sherds discovered in area E are still present in the Deir ‘Allā Archive at the Faculty of Archaeology at Leiden University. Not all sherds are numbered. The numbered examples are labelled DA/T/E3/5 and once DA/T/E4, which has been interpreted as denoting: Deir ‘Allā, Tomb search party, area E trench 3, locus 5. The paper tags once attached to the bags are, however, also present in the boxes. These are labelled ‘trench 2’ 2 (stoney with sand and sherds), ‘trench 2’ 4, and ‘trench 3’ 1-3 (excavated as one layer). These designations do not appear on the sherds, however, but sherds from these loci are apparently among the unnumbered sherds. A sample of these sherds is depicted in figures 4.130 and 4.131.

The only sherd that was labelled DA/T/E4 is unique within the overall pottery assemblage of numbered and unnumbered sherds. Walls have broken of on three sides and it is, therefore, most likely the central part of a pedestalled bowl. A band with irregular impressions is visible on the exterior. This single sherd seems to predate the rest of the assemblage.

Several sherds exhibit combed decoration on their exterior in a coarsely alternating or herring bone pattern. Two examples have been drawn; one with shallow impressions and the other with broader and deeper impressions. This type of surface decoration is absent in the EB I period, but

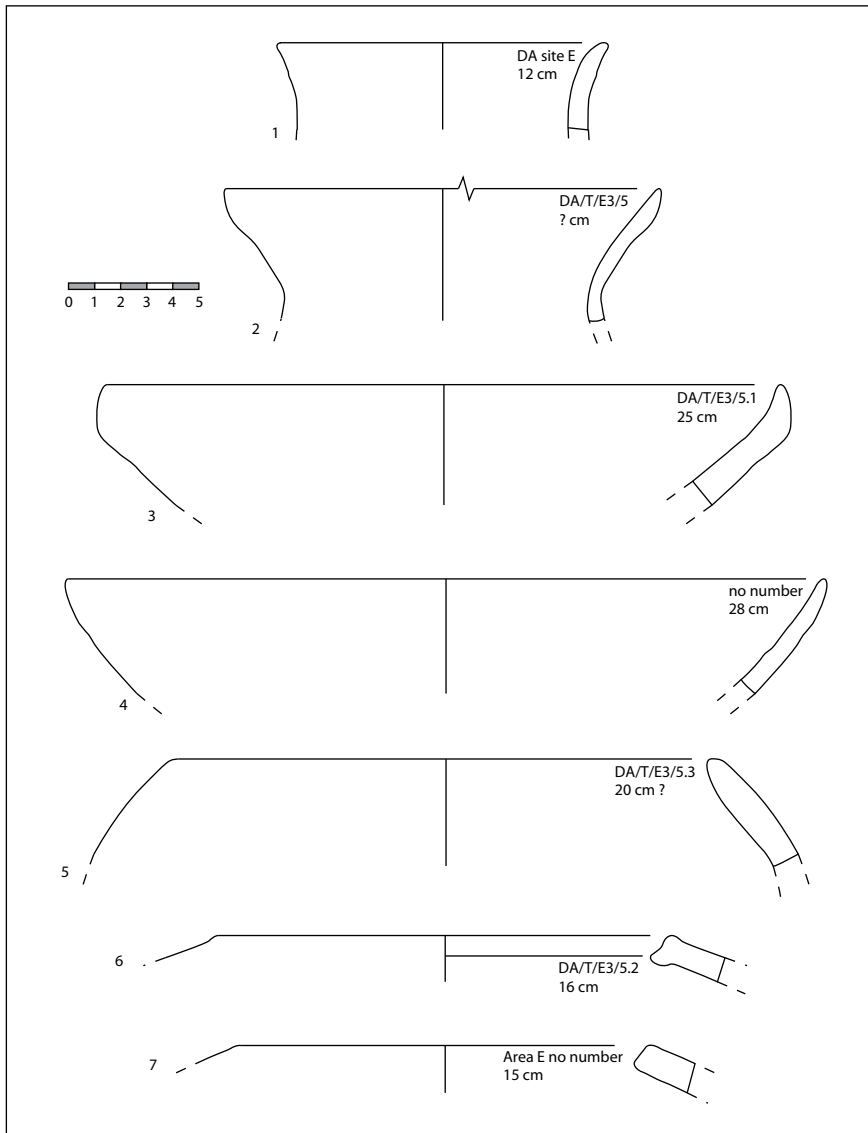


Figure 4.131 Pottery from tomb area E

No.	Sherd no.	Parallels	Date	Remarks
1	DA site E	c. Handaquq S (Chesson 1998: fig.10.3) Baba dh-Dhra' str. III (Rast and Schaub 2003: fig.9.2:6,8) c. Kh. Hamra Ifdan (Adams 2000: fig.21.2:11)	EB II/III EB II EB III	
2	DA/T/E3/5			
3	DA/T/E3/5.1	c. Kh. Hamra Ifdan (Adams 2000: fig.21.8:8)	EB IV	
4	No number	Many examples, but thin walls		
5	DA/T/E3/5.3	c. Handaquq S (Chesson 1998: fig.10.4; Chesson 2000: fig.20.4:4)	EB II/III	
6	DA/T/E3/5.2	Beth Shean (Mazar et al. 2000: fig.14.6:7)	EB III	
7	Area E no number	c. Handaquq S (Chesson 2000: fig.20.3:6) Bab adh-Dhra' str. III (Rast and Schaub 2003: fig.9.1:9) 'Umeiri (Harrison 2000: fig.19.6:1-3) Beth Shean (Mazar et al. 2000: fig.14.5:8)	EB II/III EB II EB III EB III	

Table 4.55 Pottery from tomb area E

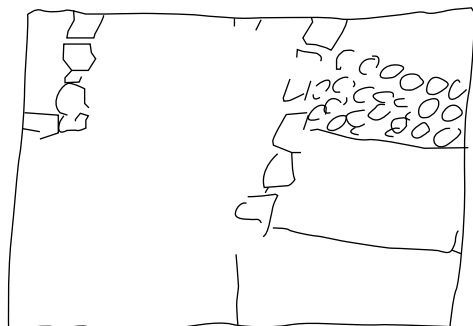


Figure 4.132 Kirkbride's sketch of (probably) trench 1

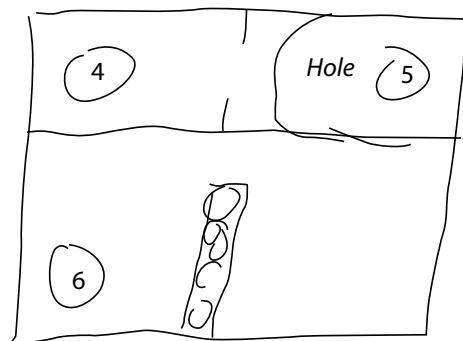


Figure 4.133 Kirkbride's sketch of (probably) trench 3

common in the remainder of the EBA. The several ledge handles that have been discovered are all very similar. They have folded edges that are pushed onto the ledge, while the folds do not adjoin each other but stand slightly apart. Similar combed decoration and ledge handles have been excavated at nearby Tell Handaquq S, dated to the EB II/III period (Chesson 2000: fig.20.4:5). The EB IV envelope ledge handles of nearby Ze'aze'iyah and Nkheil N are flattened even further and the folds adjoin or even overlap each other (Palumbo 1990: fig.47:3, 48:6).

The bowl and jar rims depicted in figure 4.131 can be similarly dated based on parallels with excavated sites. Although several rims are rather plain and simple (Deir 'Allā site E, no number and DA/T/E3/5.3), making parallels in several periods possible, the assemblage as a whole seems to date to the (late) EB II and EB III periods. The assemblage probably post-dates the early part of the EB II period as many typical EB II shapes are absent, while shapes discovered here, like the envelope ledge handle, are missing from clear EB II contexts like Tell 'Umm Hammād. A continuation into the EB IV period cannot be ruled out as bowl DA/T/E3/5.1 has its best parallel in this period and several of the rim shapes also occur in this period.

Summarizing it can be positively stated that the excavated trenches of area E show no connection to EB I al-Rweihah as was initially assumed by Kirkbride. There is no evidence among the available data to substantiate Kirkbride's interpretation that dolmens had been excavated. The stone foundations that she mentions, however, are visible in her sketches. Today nothing of the trenches or of (collapsed) dolmens is visible in this area. Furthermore, the EB (late) II, III and possibly EB IV date of the pottery assemblage does not fit with the period generally assigned to the pottery connected with dolmens in this area, i.e. the EB Ib/II period. Irrespective of the limited and often confusing remarks left to us in Kirkbride's notebook, it is certain that she excavated a site with occupation layers and walls buried in the subsurface that was contemporary with the occupation of Handaquq S and/or Ze'aze'iyeh both located within a 2 km range.

4.2 The Late Bronze and Iron Ages

4.2.1 The Late Bronze and Iron Age distributions pattern

Late Bronze Age and especially Iron Age remains have been discovered at several tell sites in the Zerqa Triangle. Figure 4.134 depicts the tells where Iron Age material was positively identified on the surface. Previous surveys have reported even more locations but this could not be verified as the tell had disappeared or could not be entered, e.g. Tell 'Abū Nijrah or Abu 'Ubaydah. The local LBA and IA pottery typologies are well known and precisely dated by the excavations conducted at several tell sites, especially the long and meticulously excavated stratigraphy of Tell Deir 'Allā. Identification and dating should, therefore, in theory not form a problem concerning the IA pottery of this region. Besides the ease of identifying the pottery, IA pottery is usually also fired at high temperatures and is therefore hard and durable. No episodes of large-scale deposition, that may have buried artefacts, have taken place since the Iron Age (Hourani in prep.). Archaeologically there are, therefore, few factors that should hamper the discovery of IA pottery. Based on the large

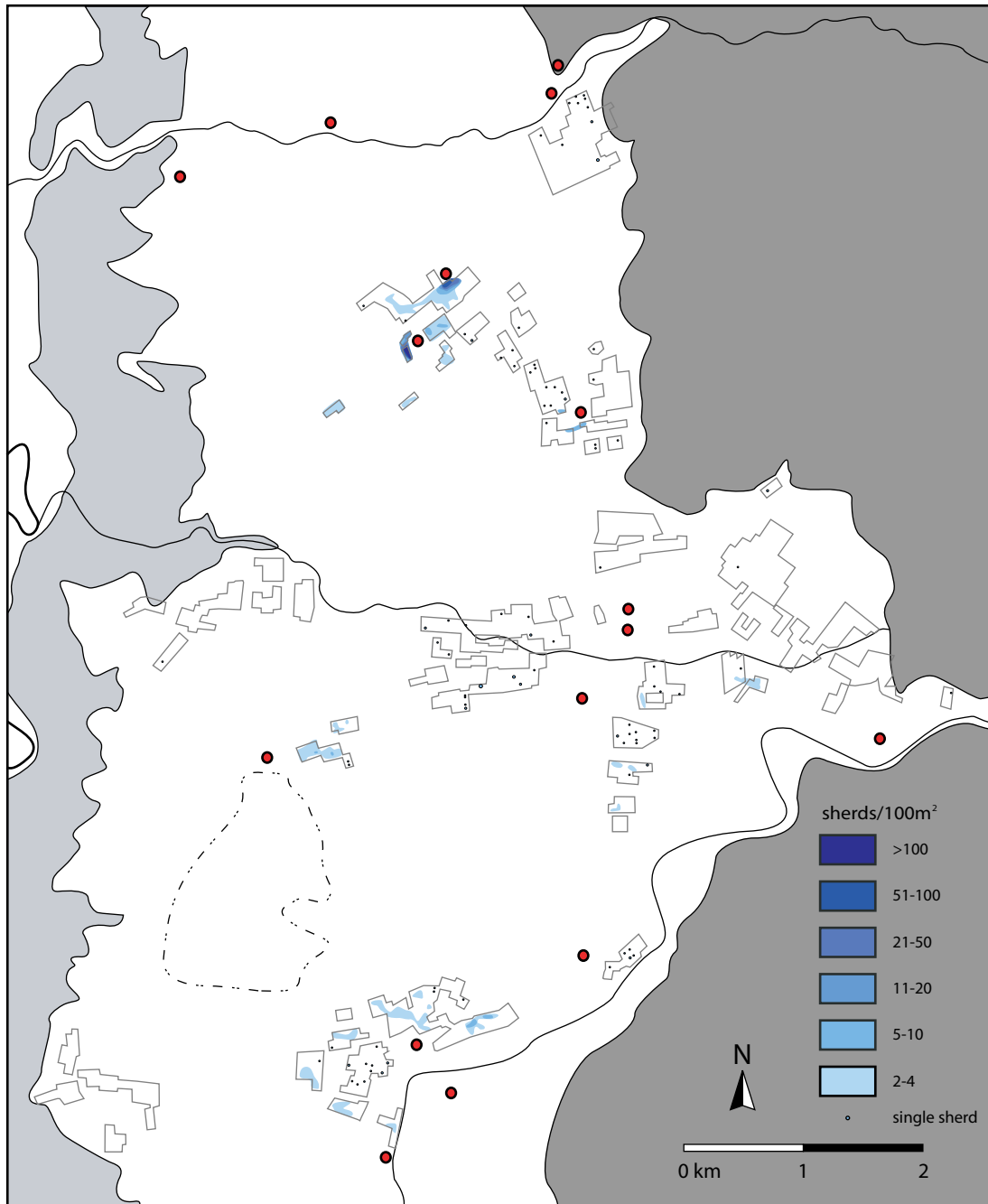


Figure 4.134 Distribution of feature and non-feature sherds dated to the Late Bronze and Iron Ages (red dots represent IA tells and areas encircled by a dotted line are almost devoid of finds)

number of Iron Age tells and good archaeological conditions, it was expected that this would have been reflected in the pottery on the surface. This proved, however, not to be the case. In total only 15 feature sherds could be dated to the LBA proper, while a similar number could date to both the LBA and IA. In 2006 only 27 IA feature sherds were collected. That number was significantly larger in 2005 when the vicinity of Tell al-Mazār and Tell al-Ghazāleh was surveyed ($n = 206$). Nonetheless, away from Tell al-Mazār densities in 2005 were on average as low as during the last season.

In figure 4.134 the combination of feature and non-feature sherds is depicted. From this image it is clear that high densities were only collected in the area between Tell al-Mazār and al-Ghazāleh. These high densities, however, most likely stem from both tells themselves. To the south-west of

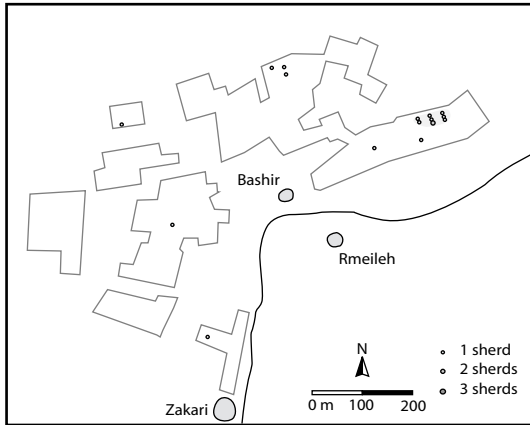


Figure 4.135 Distribution of LBA feature sherds

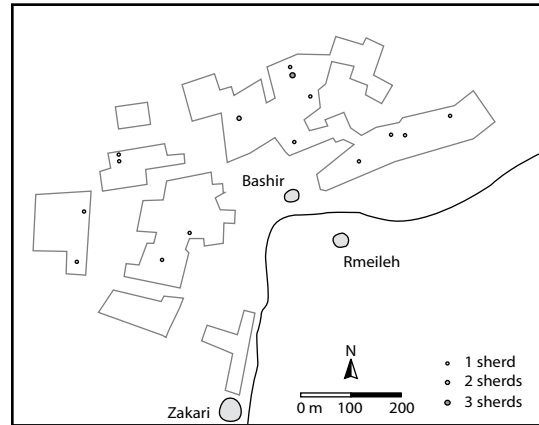


Figure 4.136 Distribution of IA feature sherds

Tell al-Mazār an area with densities of over 100 sherds per 100 m² was discovered. This pottery distribution is, however, slightly different as the ratio between feature and non-feature sherds deviates from that of the rest of the survey. Calculated over the survey as a whole the ratio between LB/IA features and non-features is *c.* 1:4.2. In this area, however, the average ratio is 1:9.9. A possible explanation for this discrepancy might be the influence of the excavation of Tell al-Mazār. In most excavations in this region only the feature sherds are kept and non-feature sherds are discarded somewhere on or near the tell. It is possible that a dump of these non-feature sherds of the excavations of the 1970's was spread out resulting in both higher densities than would 'naturally' be present and a distorted feature to non-feature sherds ratio. Another explanation might be that this high density area represents a mother population buried in the subsoil that primarily consists of large storage jars. However, such a buried feature might have been identified during the construction of the modern house located between this field and the tell. Only excavation can decide which explanation deserves greater credence.

The second area with much higher densities than average is located on the edge of Tell al-Ghazāleh. This tell has been subjected to digging activity at several locations. It might be the case that this soil was spread out over the field causing higher than average pottery density. Secondly, Tell al-Ghazāleh is a low tell with only a slight slope. The agricultural fields start immediately at the foot of the tell. With each ploughing event part of the tell is included causing many sherds to be distributed over the field.

This stands in contrast to, for example, Tell al-ʿAdliyyeh where fields start a few metres away from the tell. Around Tell al-ʿAdliyyeh only a small zone of higher densities was discovered. The western side of Tell al-ʿAdliyyeh has been dug away and immediately in front of the tell the main Jordan Valley road and East Ghor Canal are located. This has undoubtedly affected the halo of sherds that commonly surrounds a tell. Nevertheless, it is clear that the halo around Tell al-ʿAdliyyeh is very small. It is absent to the north and east of the tell and IA sherds have only been discovered in three plots immediately besides the tell. So although slightly higher densities have been discovered in the area directly beside the tell there is no question of a well defined halo.

In all other areas densities are low and distributed more or less homogeneously. Bounded areas with higher than average densities are absent and clear sites stemming from the LBA or IA have, therefore, not been identified. However, when only the Late Bronze Age feature sherds are considered some patterning becomes clear. Only a small number of LBA feature sherds has been identified. These sherds were however restricted to only three locations. Five sherds were discovered within 180 m of Tell al-Ghazāleh, while a sixth was discovered some 460 m to the SSE of the tell. Surveys at Tell al-Ghazāleh itself have documented LBA remains on the surface (Glueck 1951: 307; Ibrahim et al. 1988a: 190). Petit even dated half of the pottery he discovered on the tell to the LBA (Petit in prep.). It is therefore likely that a large share of the non-feature sherds discovered around Tell al-Ghazāleh stems from the LBA.

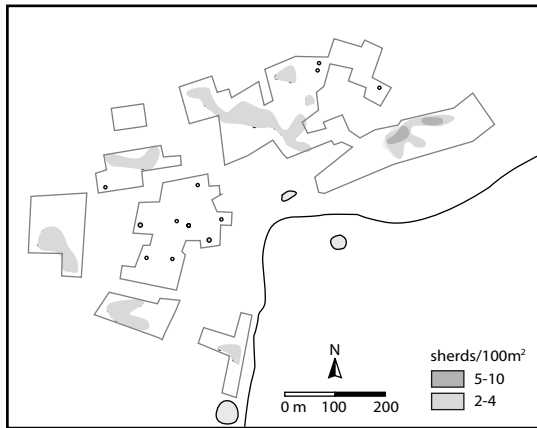


Figure 4.137 LBA/IA feature + non-feature sherds.

The other location where LBA sherds were found was within 100 m of the supposed location of former Tell al-Hammeh West. However, only three sherds were discovered here and these could also date to the IA period. In the same small area seven other sherds were discovered that were dated to the IA.⁶¹ It should be noted that five of these ten sherds belonged to cooking pots. Although the EJVS, that surveyed Tell al-Hammeh West before it was destroyed, does not report having discovered LBA or IA remains, it should be considered that some, probably IA, activity took place at the tell or in its close vicinity.

The third group of LBA feature sherds is clustered most densely. To the north-east of the village of 'Abū al-N'eim a concentration of ten LBA feature sherds was discovered (see figure 4.135). Most of these sherds could be assigned a date in the LBA without any doubt, while just one sherd could also belong to the IA. However, in three cases the LBA date was not unambiguous and sherds could also stem from the Islamic period. The combination of these sherds with a clear LBA date and those with a possible LBA date forms a small cluster with a low density, but one that nevertheless stands out from its surroundings. When the LBA feature sherds are compared to the distribution of IA feature sherds it is clear that the clustering at this location only pertains to the LBA. This makes it likely that a large proportion of the non-feature sherds also stems from the LBA period. This small cluster is, therefore, interpreted as a site representing some sort of human activity carried out at this location in the LBA. Unfortunately the number of sherds is too low to provide any information on the character of this site. Although the number of IA sherds is slightly higher, no clustering comparable to the LBA is visible in this distribution.

Off-site

The off-site areas can be divided into two groups, i.e. areas without any finds and areas with a low off-site density. In figure 4.138 the areas that contain no or only one or two isolated sherds have been encircled with a dotted line. The other areas have low densities of varying intensity, but nowhere do peaks of higher density occur. This entire area is therefore identified as off-site distribution. Within this general area of off-site distribution there are however differences in density. This stands in contrast to the EBA where off-site densities away from the bay of al-Rweihah were more or less the same. This suggests a difference in how these distributions came into being.

The two regions surveyed in the west on the edge of the katār hills are, except for a single sherd, devoid of LB/IA pottery. It seems that this western area was not intensively used during this period or not in a manner that left pottery behind. The other empty zone stretches along the eastern foothills from the village of Dhirār to al-Rweihah. Although the pottery distribution is similar to the western areas, i.e. absent, it is much harder to remain convinced of the interpretation of absence of activity. Tells like Tell al-Qa'dān N and S and Tell al-Hammeh are located on the edge of this zone. The occupation on both Tell al-Qa'dāns has been inferred from survey data, but Tell al-Hammeh has actually been excavated and revealed occupation remains from both the

61 These sherds were dated as follows; 1 x IA, 2 x IA II, 3 x IA? and 1 x L IA/Hell.

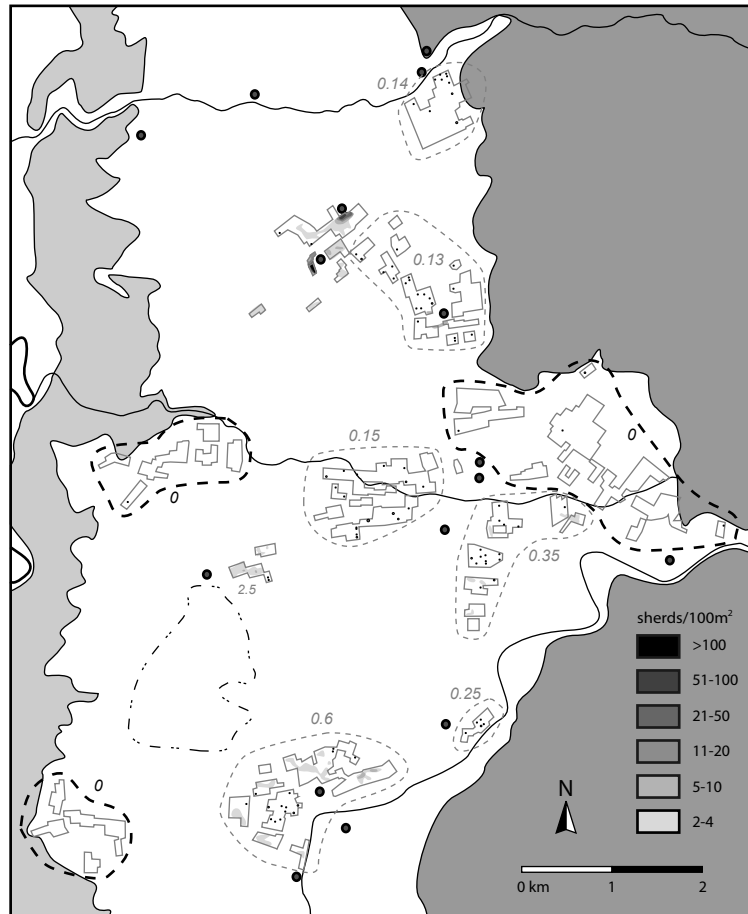


Figure 4.138 Distribution of IA feature and non-feature sherds with low density areas

LBA and IA (Van der Steen 2004: 196). People will have moved outside the confines of their tell, but their activities have either left no remains or these remains have become invisible to us. The high density of EBA artefacts discovered in this area, however, precludes an explanation that argues for deposition of soil coming from the mountains having obscured all artefacts once present on the surface.

The other areas show more or less even distributions of low density off-site material. The differences in these areas range from continuous distributions of densities between 1 and 4 sh/100 m² to very widely scattered remains of less than 0.6 sh/100 m². Examples of continuous 1-4 sh/100 m² distributions can be found in the fields to the east of Tell al-Khsās and those surrounding Tell al-Mazār and Tell al-Ghazāleh (outside the areas with significantly higher densities). This type of distribution seems to be restricted to a small zone around these tells. At Tell al-Khsās it ends *c.* 450 m away from the tell, while densities start becoming less continuous *c.* 300 m to the north and east of Tell al-Mazār.⁶² One could of course suggest that the relatively dense halo around these tells is caused by sherds moving down the tell slope as a result of gravity and then being spread out over a larger area by ploughing. A similar halo would in that case be expected around all tell sites in the region. This is however not the case. The large and at places steep Tell Deir ‘Allā has no halo at all and is surrounded by very low densities. However, Tell Deir ‘Allā is today hemmed in on three sides by modern buildings. The same holds true for Tell al-Khsās, which is at present completely overlain by houses. Nevertheless, other tells that have only slightly been obstructed by later buildings or not at all, like Tell al-Hammeh or Tell Zakarī, also lack any form of halo. It can also be

⁶² In field 192 located *c.* 800 m to the south-west of Tell al-Mazār low densities in continuous fashion have been recorded as well. More surveying is needed to determine whether this distribution stretches as far as Tell al-Mazār or whether it is a localized phenomenon.

considered that the digging at al-Ghazāleh, the excavation of Tell al-Mazār and the levelling and digging in the context of house construction on Tell al-Khsās has resulted in these halos, as was suggested for the high densities immediately beside the tell. However, digging has also occurred at other tells and on a much larger scale, e.g. Tell al-‘Adliyyeh, Tell al-Bashīr, Tell al-Hammeh, and Tell al-Qa‘dān S, but these tells lack large halos.

The remaining areas exhibit a low density of sherds. In figure 4.138 the densities of the specific areas are given for each encircled region. These densities range from low densities of c. 0.14 sh/100 m² in the areas to the south of Tell ‘Ammata, around Tell al-‘Adliyyeh and north-west of Tell Deir ‘Allā to 0.6 sh/100 m² in the areas around Tell al-Bashīr and Tell Zakarī. There is no straightforward explanation for this difference in off-site densities between the various regions. If these densities were related to the tell settlements, for example reflecting erosion of the slope or ploughing out or manuring of gardens surrounding the tells, a different distribution would be expected. The area around Tell Deir ‘Allā would in that case be expected to contain the densest remains as this is by far the largest and longest occupied tell (Van der Kooij 2001; Petit in prep.). Furthermore, although very small the two Tell al-Qa‘dāns are located nearby. Yet the area to the north is devoid of finds, while the areas to the east and west have lower densities than the vicinity of Tell al-Bashīr and Tell Zakarī. Another indication that this off-site distribution is not directly linked to the tells but rather reflects separate human activity of some sort, is the presence of pottery from this period in the area to the south of tell ‘Ammata. Of course this tell saw considerable occupation during the IA as was shown by the excavations of Petit (Petit in prep.). The off-site sherds can not directly stem from the tell, despite seeming to cluster in its vicinity, because the wadi Rajīb is located in between them. This wadi is today a few metres incised, as it most likely also was in the IA (Hourani in prep.). These sherds can, therefore, not have been ploughed away or eroded out of the tell as they would have ended up in the wadi-bed. Post-depositional processes do not explain the difference in off-site density between the regions.

It is, therefore, concluded that these off-site densities must be the result of human activity. It is difficult to establish what sort of activity would leave behind such differential remains. It is absent in an area where IA activity must have been present and that was most likely a very advantageous region in terms of agriculture (see chapter 6.4). This can be taken to suggest that the off-site remains are related to agriculturally less favourable areas. This is not tenable, however, as the difference in soil fertility between the other areas, e.g. west of Tell Deir ‘Allā and around Tell al-Bashīr and Tell Zakarī, is not great.

Another explanation for the difference in density could be that these remains were mainly deposited during a single episode of the IA. One could imagine that in this period both Tell Zakarī and Tell al-Bashīr were fully occupied, while the occupation of DA or Tell al-‘Adliyyeh was much smaller or present only part of the time. The results of Petit’s excavations negate this hypothesis, however. He has found no evidence suggesting a differential occupation. On the contrary, he has concluded that the sites share a similar occupation chronology, possibly related to the climatic opportunities for farming in this region (Petit in prep.). The tell survey was not able to date the remains on the surface of not excavated tells with the chronological precision necessary to answer such questions.

Another hypothesis proposed to explain the existence of off-site remains is that of repeated low-intensity activity throughout the region. One of the likely types of activity is the presence of groups of people herding flocks of sheep and goats. The existence of a pastoral component in these communities has been evidenced by zoological remains discovered in excavations (van Es 2002). To provide these animals with sufficient food they either need to be fed with agricultural surplus during the dry summer time when all pastures in the Jordan Valley disappear or people need to move them up the plateau where pastures are present for much longer. To feed a flock on stored fodder a large quantity needs to be set aside, making the alternative of moving the flock much more advantageous. This herding of flocks away from the village may have been done by a special community of people who were more or less specialized in this type of activity, like the modern Bedouin. Large-scale full nomadism is however unlikely as transport was problematic due to the absence of the dromedary before 700 BC. It could also be that a segment of the sedentary population of the villages herded the flocks, for example young men that acted as professional

herders similar to those involved in the transhumance in medieval communities in the Pyrenees like Montailou (Le Roy Ladurie 1984). Whatever the case may be, the flocks needed to be herded and the people herding them will have left remains in the countryside. However, flocks are likely to have been herded in the Jordan Valley during winter when temperatures are mild especially compared to the plateau where winter temperatures may drop well below zero. Before the first winter rains, so before sowing and after the harvest, flocks may well have been allowed on the fields for a short time to eat the stubble and manure the fields with their droppings. This is widely documented for pre-modern times when farmers paid herdsmen to let the flocks graze on their fields (Dalman 1932: 141). However, when the crops were growing, which in the IA was during the winter season, the flocks needed to be kept away from the fields by their herders. The higher densities, especially around Tell al-Bashīr and Tell Zakarī, do not fit this pattern. Fields will have been located close to the villages and these areas will generally have been out of bounds for herders and their flocks. If these off-site remains were connected to pastoral people living temporarily in the valley one would expect higher densities to exist away from the sites. Other types of temporal habitation must, however, also be considered. One explanation that will be discussed in more detail in chapter 7 is the likelihood that some people continued to inhabit the region after their village on the tell had been destroyed, e.g. by an earthquake as what the case during phase IX of Tell Deir ‘Allā. It is likely that after such a destruction people lived in temporary make-shift structures at the foot of the tells in close proximity to their fields.

Higher densities in the vicinity of tells that border these off-site densities can be explained by manuring and tillage. This pattern of off-site densities, which is visible for other periods, for example in the EBA, cannot explain the difference between the regions in the IA. In some way human activity in the area around Tell al-Bashīr was different from that around Tell Deir ‘Allā, which in turn was different from fields around Tell al-Khsās and Tell al-Mazār. Excavations, however, have shown little differences in the type of settlement present on these tells. All seem to have been small rural villages involved in agriculture with a pastoral component (Van der Kooij 2002; Petit in prep.). Until more data become available the nature of these off-site differences will remain enigmatic.

4.3 The Hellenistic period

4.3.1 *The Hellenistic distributions*

The number of sherds that could be dated positively to the Hellenistic period is very low, namely 62 sherds. This group includes sherds that could not be more precisely dated than Late Iron Age/Hellenistic (6), Hellenistic/Roman (18) or Hellenistic to Late Roman (6). Hellenistic period remains are only rarely identified in surveys (e.g. Barker et al. 2007: CDrom). Excavations of material from this phase have been undertaken, but the pottery chronology and especially its transition from the preceding Late Iron Age or Persian period is poorly understood in this region. Nevertheless, Hellenistic remains have been attested at tell sites in the Zerqa Triangle. Petit has excavated occupation layers containing large stone-lined silos at Tell ‘Ammata (Petit in prep.). At Tell al-‘Adliyyeh he encountered a phase consisting mainly of pits that he dated to the Late Hellenistic/Early Roman period (Petit in prep.). During Petit’s tell site survey he, like the EJVS before him, discovered significant Hellenistic remains on top of Tell al-Kharābeh, especially at the northern summit (9 % of the total assemblage), while he corroborated Kirkbride’s statement that Hellenistic material was present at Tell al-Fukhār (Petit in prep.). Small quantities of Hellenistic pottery were collected on Tell Katāret as-Samra (2 %) and Tell al-Hammeh E (<1 %) (Petit in prep.). The University of Jordan excavations at Tell al-Mazār discovered very early Hellenistic material in the youngest phase of the tell (Yassine 1983: 498). Like at Tell al-‘Adliyyeh this phase consists entirely of storage pits.

Activity during the Hellenistic period is thus attested at five sites in the Zerqa Triangle, yet the number of sherds discovered in the tell site survey was very limited. Even when excavation proved the existence of occupation layers from this period (Tell al-‘Adliyyeh 3 %, Tell al-Mazār 7 %) the

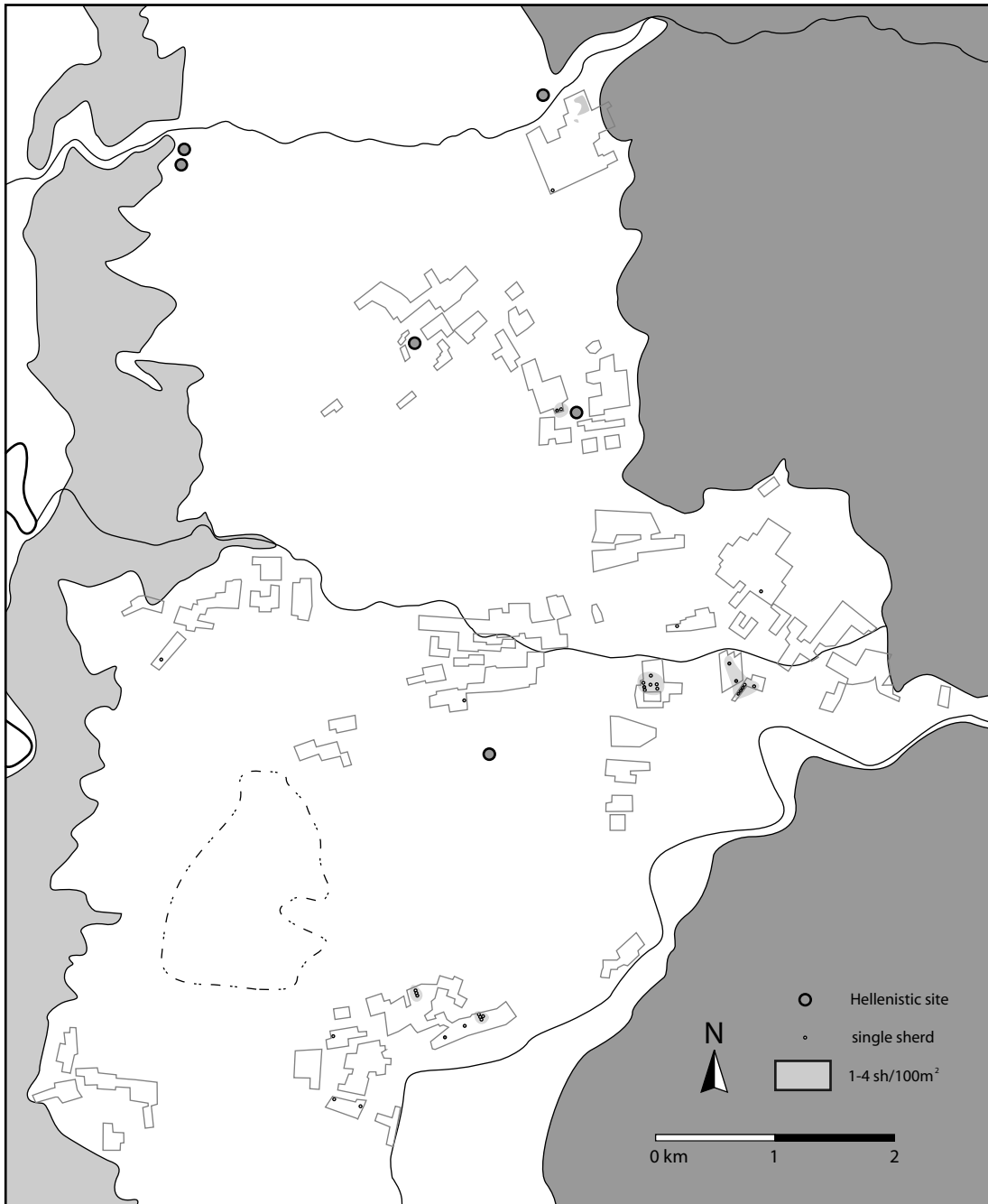


Figure 4.139 feature sherds dated to the Hellenistic period

surveys did not retrieve large numbers of sherds. Nevertheless, the amount of (contemporary) activity may be limited as the excavated sites also showed limited human activity. Tell al-Mazār's Hellenistic remains consisted of storage pits from the early Hellenistic period, while Petit dated the pits at Tell al-ʿAdliyyeh to the Late Hellenistic/Early Roman period. It is likely that during this period permanent human occupation on tells existed only at Tell ʿAmmata.

The lack of large quantities of Hellenistic material may therefore be a combination of both limited human activity and a poor archaeological recognition of the pottery. Nevertheless, low numbers of Hellenistic sherds were recognized in the survey. In a way the Hellenistic landscape can be considered to be a hidden landscape. The occurrence of a few sherds found with some

spatial coherence already stands out from the rest of the region and may be indicative of a site. Although only a few Hellenistic sherds have been found, the majority of these sherds cluster together in small groups, as depicted in figure 4.139.

4.3.2 Hellenistic concentrations

In line with the excavation results the largest number of Hellenistic sherds has been discovered to the south of Tell 'Ammata. A concentration that developed into a large independent site during the later Roman periods has been discovered at this location (see next section). Among the 13,000 sherds that were collected at this site, only 22 could be dated to the Hellenistic. Moreover, of these 22 sherds only nine indubitably stemmed from the Hellenistic period, four were identified as such but a question mark remained, while eight dated to the Hellenistic or Roman period and one sherds could also date to the Iron Age. The spatial distribution of these sherds is, however, rather restricted and forms a clear concentration (see figure 4.140). The location of the Wadi Rajib, the general low sherds densities in this period and the absence of haloes around the other tell sites with Hellenistic remains make is unlikely that this distribution should be related to Tell 'Ammata. The distribution is interpreted as representing remains from the Hellenistic period buried in the subsoil. Although it is only a small fraction of the total pottery collected at this multiperiod flat surface site, compared to the total number of Hellenistic sherds this distribution containing 35 % of all Hellenistic sherds can be regarded as relatively dense. This concentration is therefore interpreted as the start of human activity on the southern bank of the Wadi al-Ghor that was to develop into a dense Roman and Late Roman village. Socially this site was undoubtedly connected to the evidenced habitation on top of Tell 'Ammata. Judging by the few datable feature sherds it is impossible to determine the nature and function of this site, which during the following Roman to Umayyad periods definitely took the form of a settlement.⁶³

The concentration that was discovered to the east of Tell Deir 'Allā is very similar to that of 'Ammata S. In the Roman, Late Roman and Umayyad periods it was a large, dense concentration (see next section), while a much lower number of Hellenistic sherds was also discovered. Only seven sherds could be dated to the Hellenistic period, of which one could also stem from the Early Roman period (see figure 4.141). They cluster at the same location as the later site and based on the same arguments as the 'Ammata S concentration it is suggested that the Hellenistic period is the first period of human activity at this location. It will be clear that seven sherds are too few to provide any conclusions on the function of the site.

Slightly further east, at the location of the destroyed Tell al-Hammeh West another small concentration of Hellenistic sherds was discovered. Contrasting to the previous concentration, these sherds were mostly dated to the Hellenistic/early Roman period ($n = 5$), while one dated to the Hellenistic period proper and another one to the late Iron Age/Hellenistic period. Establishing the

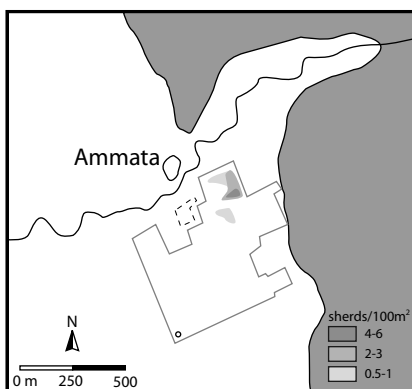


Figure 4.140 Distribution of Hellenistic feature sherds

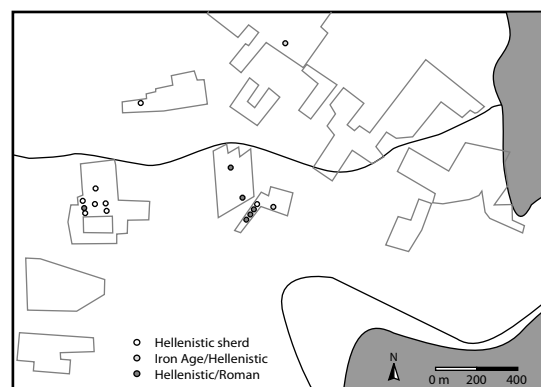


Figure 4.141 Hellenistic feature sherds

63 The 22 feature sherds were identified as bowls ($n = 6$), jars ($n = 7$), jugs ($n = 2$), amphorae ($n = 4$), a cooking pot ($n = 1$) and a fish plate ($n = 1$). These vessels together with the Hellenistic vessels from the field 252 concentration are discussed and depicted with the later pottery from these concentrations in section 4.4.2.

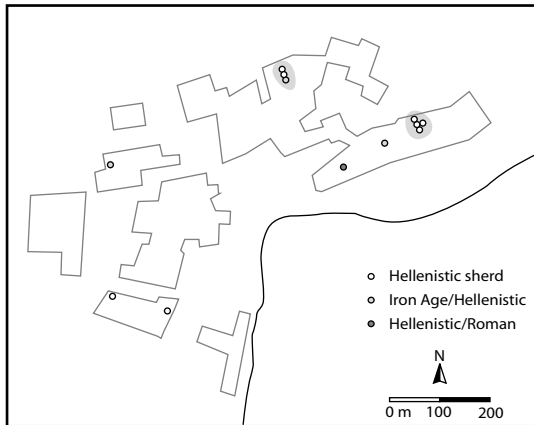


Figure 4.142 Hellenistic feature sherds in the area around 'Abū al-N'eim

nature and date of this tell proved difficult as few artefacts were discovered on the surface. The EJVS still surveyed the intact tell and reported Late Roman, Ayyubid/Mamluk and some possibly EBA remains, but no Hellenistic or Roman remains. Just like with the few Late Bronze and Iron Age remains discovered at this location, the few Hellenistic sherds might point to the presence of remains from this period at or near this tell. The same can be argued for the subsequent Roman period of which a few sherds were discovered. The disturbed nature and low number of artefacts makes identification of all the periods that were present at this tell problematic. The presence of low numbers of sherds from several periods at this location suggests, however, that this area was the focus of human activity in more periods than reported by the EJVS. This clearly shows that the pottery present on top of a tell at a given moment in time might not be indicative of all the periods present within the tell.

The last area where more than a single sherd was found is the area around 'Abū al-N'eim (see figure 4.142). A few relatively isolated sherds were found distributed throughout the fields in this area, while two small clusters are visible. The first cluster is located in the east at the same location where small clusters of LBA and early Islamic sherds were found, including the only Abbasid and Fatimid sherds discovered in the survey. For all these periods the number of sherds is very limited, which results in the near invisibility of these concentrations on the total sherd distribution map. Irrespective of their low number, the clustering of these few sherds might indicate a buried mother population dating to the Hellenistic period.

A second even smaller cluster of only three sherds was discovered slightly further to the north-west (field 305). In this field slightly higher densities are visible on the map of the total sherd distribution (see figure 4.142). A low number of sherds from the LB/IA ($n = 2$), IA II ($n = 2$), Hellenistic ($n = 3$), Roman ($n = 1$) and Roman or later ($n = 10$) periods was identified here, but most sherds were unfortunately undatable non-feature sherds. Except for the Hellenistic period, this area does not stand out in any of the period density maps. Considering the very low densities, this is not surprising, but in a period that has yielded almost no finds, three sherds discovered within 30 m is more than average. Like with the other sites it might be that these three sherds represent some buried Hellenistic feature, but not too much significance should be attached to just three sherds of which one might date to the IA.

Concluding it can be stated that the Hellenistic period has left only sparse remains in the Zerqa Triangle. Nevertheless, the presence of Hellenistic activity in this area is evidenced at some tells and at least the two larger concentrations at 'Ammata S and in field 252. The nature of this activity remains problematic, although the scarce evidence available, e.g. the diversity of the vessel types, suggests these sites might have been habitation in nature. The interpretation of the smaller concentrations is, however, much more problematic. Are they clustered by chance or do they represent past human activity? The presence of Hellenistic remains consisting only of storage pits at two of the three excavated tells suggests the amount of human activity in this region might have been more varied than only sedentary occupation. The construction of storage pits on top of the dry and solid tells is a well known phenomena in this area and was carried out during several

periods including the pre-modern one (Yassine 1983: 498). Yassine states that the pits at Tell al-Mazār were used for a diverse range of functions as the contents ranged from charred grain, chaff and pottery to copper, stone vessels and general rubbish (Yassine 1983: 498). This suggests these pits functioned as general storage facility of communities living elsewhere. These communities may well have been mobile groups returning to the same spot in the Jordan Valley during certain periods of the year. The most likely periods for this habitation of the Jordan Valley is during the winter months. The conditions in the valley are at that time very moderate with temperatures of c. 15° C, especially compared to the much colder plateaus on either side of the valley. The presence of mobile groups camping here for part of the year might explain the small clusters of Hellenistic pottery, e.g. around ‘Abū al-N‘eim. The general low discovery rate of sherds from the Hellenistic period would in that case be even further reduced by the temporary nature of the site leaving only a few sherds to be discovered by the archaeologist. The larger sites of ‘Ammata S and in Field 252 might have started as temporal habitation sites as well and may have become permanent settlements and developed into large sites in subsequent Roman and Late Roman periods as a result of their advantageous location, besides the large settlement on Tell ‘Ammata and possibly along a route from the Jordan Valley along the Zerqa to the settlement of Telul edh-Dhahab and the plateau.⁶⁴

4.4 The Roman, Late Roman and Umayyad periods

4.4.1 Distributions of the Roman, Late Roman and Umayyad periods

Introduction

Without a doubt the largest group of datable sherds discovered in the survey belongs to the Roman and especially the Late Roman periods. The decoration consisting of small ribs and grooves that appear on the body of many vessels is very distinctive and makes these vessels easy to date. The straight and sharp lines, which do not occur regularly in nature, together with the shadow that the protruding ribs often cause, make that these sherds are relatively easily recognized. Apart from the good recognition of the ribbed sherds, the pottery typo-chronology for this period is very good allowing many feature sherds to be rather precisely dated. These good prerequisites make that a relatively large number of sherds from this period could be identified (see figures 4.143 and 4.144). The good archaeological conditions alone can, however, not account for the dense pottery distribution and the Roman period saw probably much human activity in the area. The Umayyad period is included in the depicted distribution patterns as many vessel shapes continue with very few changes from the Late Roman into the Umayyad period, e.g. casseroles or jars. Especially when sherds are small and have few distinguishing features like those uncovered by surveys, these periods could not be distinguished from each other. Roman feature sherds could in many cases be distinguished from Late Roman sherds, but there is a significant amount of overlap and continuation between these periods as well and a large proportion of the sherds could only be labelled Roman/Late Roman. The general distributions of Roman and Late Roman/Umayyad are therefore discussed in this section as a group. In the more detailed discussion of the individual concentrations these periods have been separated. The densities per individual period are, however, much lower than their combined levels, but this is entirely due to the impossibility, in this area at least, of dating survey pottery to a restricted period.

The non-feature sherds that were collected are of limited use for the understanding of the distributions of these periods as they could not be separated into Hellenistic, Roman and Islamic sherds. Combining the distribution of the ribbed sherds and the well dated feature sherds from these periods with the non-feature sherds, it becomes clear in which concentrations the non-features are likely to represent Hellenistic, Roman and Umayyad dates and where they should probably

64 During the Roman period one of the main roads from the Valley up to the plateau probably ran along this site (see section 4.4.3)

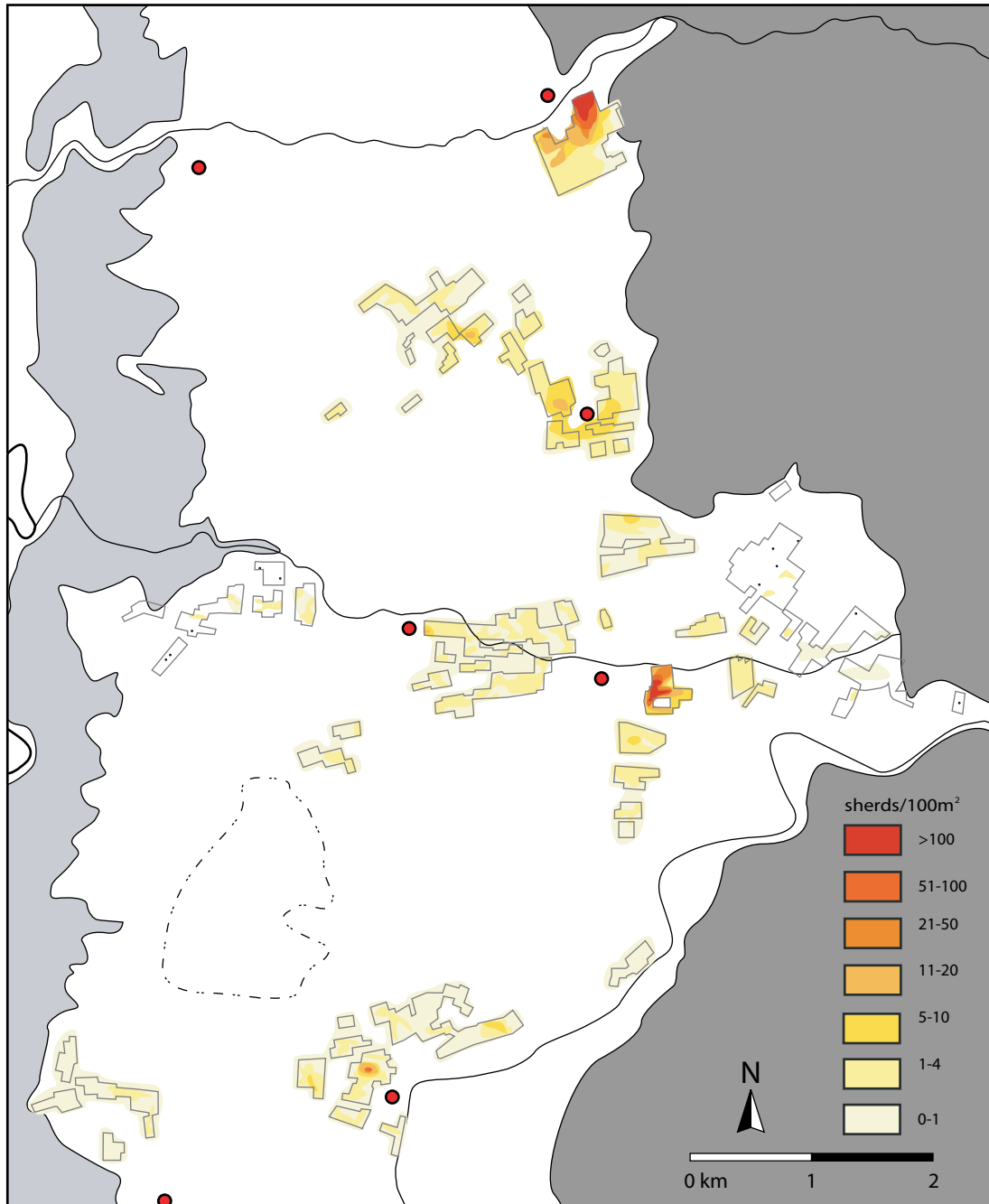


Figure 4.143 Distribution of ribbed sherds

be dated to one of the Islamic periods. If for example a concentration is visible in the non-feature sherds, but ribbed sherds or Roman feature sherds are absent while Islamic feature sherds have been collected it can be safely concluded that the non-feature sherds stem from the Islamic period. This type of dating is of course completely dependent on other data, i.e. the presence of feature sherds and is in itself of little relevance. However, for many of the poorly identifiable Islamic periods only a few sherds could be positively dated. The low number of feature sherds makes the identification of clusters and off-site distributions problematic. The presence of clusters of non-feature sherds that have been proven not to date to the Roman or Late Roman/Umayyad periods can lend additional strength to the presence of a concentration or site in the Islamic periods, which would have remained doubtful otherwise (see section 4.5.1).

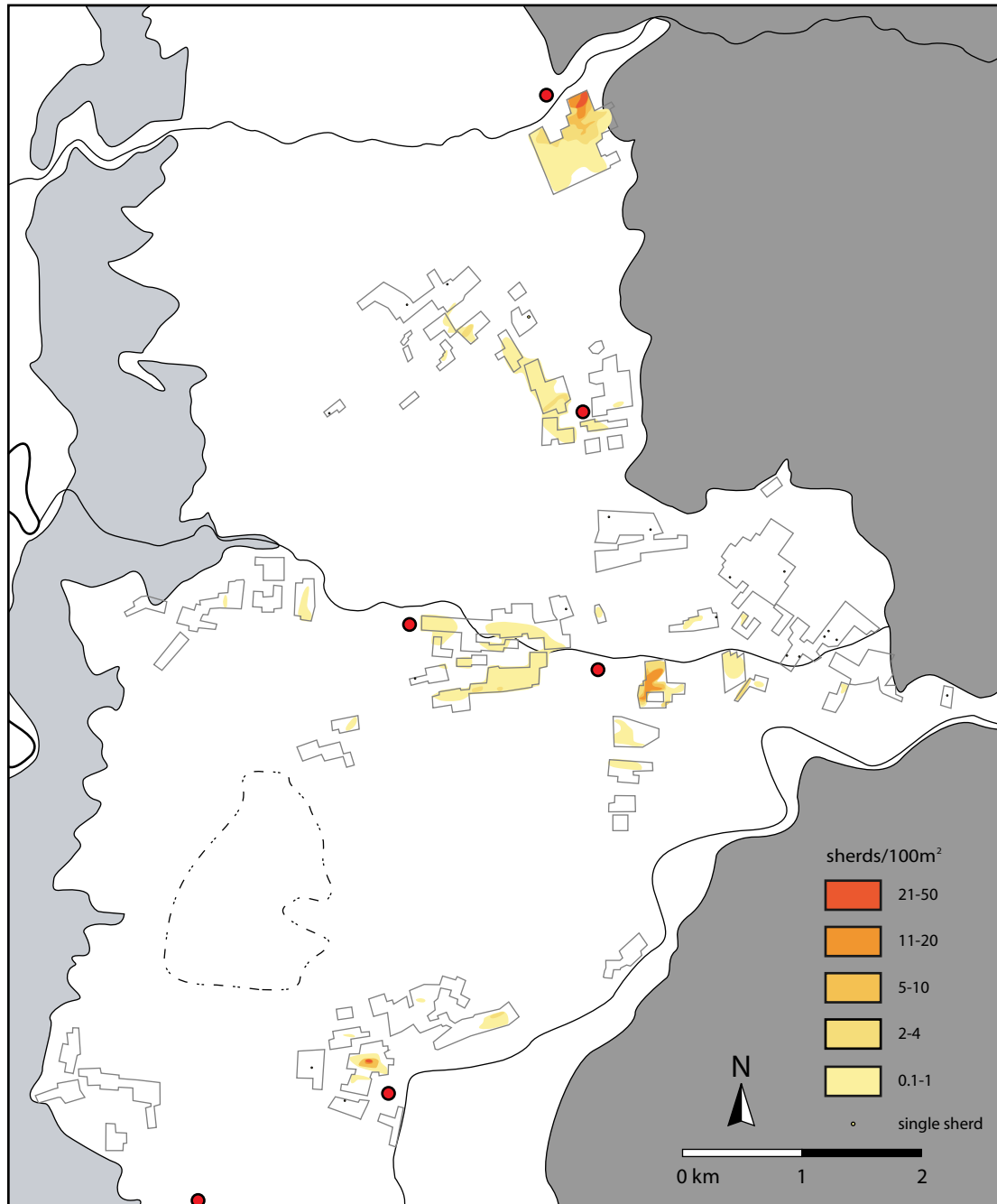


Figure 4.144 Distribution of Roman, Late Roman and Umayyad feature sherds (excluding ribbed sherds)

Sites

In the distributions of both the feature sherds and the ribbed sherds clear bounded areas of much higher than average densities are visible. Especially the ribbed sherd distribution shows very high densities of over 100 sh/100 m². The feature sherd distribution shows lower densities as expected, but the distribution pattern is almost identical. Apart from the haloes around sites that had already been identified as containing remains from at least one of these periods, i.e. Tell al-‘Adliyyeh and Tell ‘Abū Sarbūt, a few areas that can be interpreted as sites have been discovered. The densest, largest and hence most obvious site was discovered south of Tell ‘Ammata. The tell and the site are close neighbours, but the fact that the incised Wadi Rajib separates them refutes the possibility that the site consists simply of run-off material from the tell. The densest pottery distribution of the entire survey was collected in this area with total sherd counts amounting to a maximum

of 906 sherds per plot (50 m²) while sherds predominantly dated to the Hellenistic, Roman, Late Roman and probably Umayyad periods. The high pottery density combined with the large size of the sherds and the comparatively high density of other artefacts related to this period like glass, tesserae and occasional finds of marble make it is very likely that occupational remains are buried in the soil at this location.

A second flat surface site that yielded high pottery densities was discovered on the southern bank of the Wadi al-Ghor a few hundred metres east of Tell Deir 'Allā. The site is very similar to the one south of Tell 'Ammata in terms of date and types of material discovered. Pottery, glass, tesserae, and several polished marble slabs dating from the Hellenistic to the Umayyad periods have been collected. Overall pottery densities are slightly lower, but with total pottery counts of 567 sherds per plot or 1134 sh/100 m², the density is still very high. Houses located at the edges of these fields slightly obscure the total layout of the concentration, but the site seems to have been at least 1.5 to 3 ha and might have been even larger (see below). At Tell Abu Ghourdan, located *c.* 300 m to the west, remains from the Umayyad and possibly also Late Roman periods were excavated (Franken and Kalsbeek 1975: 67ff).

A smaller area where pottery restricted to the later part of the Late Roman period was discovered is located to the north-west of Tell 'Abū al-N'eim. The area of high densities measures only *c.* 50x30 m but densities of over 100 sh/100 m² were recorded. Pottery from the Roman to Umayyad periods has been recorded for Tell 'Abū al-N'eim (Glueck 1951; Melleart 1962; Ibrahim et al. 1988a; and see section 4.4.2). Irrespective of its close proximity to a tell containing material from this period, the much higher densities compared to the rest of the tell's halo and the spatially isolated nature of this small concentration suggests this is most likely a separate site with a mother population buried in the subsoil.

A small concentration containing only a few feature sherds was discovered in field 176. The concentration's clearly higher than average densities and spatially bounded layout visible in both the feature and ribbed sherd distributions suggest the presence of a small site with a buried mother population. The lack of well defined and datable feature sherds makes the interpretation of this site problematic. The quantitative data preclude an interpretation as village or villa and point to a function that left a limited amount of remains, but the qualitative data is insufficient to advance a more detailed interpretation.

Off-site

The overall pottery density away from the sites is very high when compared to all other periods for which areas with no finds at all exist. Except for both the eastern and western areas along the Wadi al-Ghor, the entire ghor is covered in a virtually continuous low density off-site distribution. The feature sherds alone show a less continuous blanket of material, but this is entirely due to the lower number of sherds and the distribution of pottery is still rather widespread when compared to the much more spatially restricted feature sherd distribution from other periods.

The distinction in density becomes especially clear when the average off-site densities between the periods are compared (see table 4.56). The non-feature sherds cannot be used for this comparison as the separation into Roman and Islamic periods was often not possible and these were therefore grouped together. Taking the average site density into account the differences are not very large. The pottery density at Roman to Umayyad sites was only 1.6 times higher than that of e.g. the EB or Mamluk periods. This distinction could simply be the result of better datability or

	Off-site		Sites + halo	
	Feature	Non-feature	Feature	Non-feature
EB	6	36	400	2200
IA	6	16	128	1400
Roman	18	372 158 ribbed	640	9600 5400 ribbed
Mamluk	4	16	388	3400

Table 4.56 Number of sherds found on sites as opposed to the off-site distribution in the countryside

a higher fragmentation and preservation rate of the Roman and Umayyad pottery, and especially a denser occupation and greater use of pottery during these periods. The off-site distribution, however, is circa three times higher than that of the other periods. The different ratios of site and off-site density between the periods show this cannot be attributed to archaeological biases. A different human involvement with the countryside seems to underlie the higher off-site distribution.

In several cases a large part of the off-site distribution seems to be linked to the sites as densities decrease as distance from the site increases. The pattern is most clear when the distribution of well-datable and ubiquitous ribbed sherds is depicted. The off-site tallies around sites like 'Ammata S and Tell al-'Adliyyeh show high densities up to 700 m away from the centre of the concentration or the tell. A similar clear halo is visible surrounding the smaller site in field 176 (NW of Tell al-'Adliyyeh) and besides at 'Abū al-N'eim. Densities do not show an equally clear concentric decrease around the site in field 252 because the neighbouring fields were surveyed in 2004 and the different pottery analysis of this season does not allow the densities to be illustrated in this way. There is, however, no reason to assume that the halo of this site differs from that of the other regions. At Tell 'Abū Sarbūt traces of disturbed occupation from the Roman period have been discovered. According to the excavators only Roman and no Late Roman or Umayyad remains were present. This absence of the ubiquitous Late Roman period seems to be reflected in the small halo surrounding the tell.

The areas of high off-site density are restricted to high density halos around tells and flat surface sites. This link between high density areas and sites negates an interpretation of low intensity shifting activity like the camps of pastoral nomads that has been proposed for other periods (see for example section 4.7.1 on Late Islamic and modern pottery). Such activity is expected to leave behind less homogenous off-site densities and is unlikely to be very closely related to the sites. Densities that increase when the proximity to a site increases are not expected as the flocks need to be kept away from the villages and especially their gardens and fields that are likely to surround the villages. Pastoral nomadic camps are, therefore, usually located at some distance from villages.

Some other common explanations for off-site densities can also be easily refuted. The high densities clearly disprove the possibility that the off-site densities are the representation of a hidden landscape created by erosion, sedimentation and other distorting factors. Distribution of the sherds through ploughing seems to be equally unsatisfactory as an explanation for all sherds distributed throughout the landscape. Although ploughing will undoubtedly have displaced sherds, the large distance over which sherds have been found argues against ploughing as an important factor in the creation of the off-site densities as experiments have shown that tillage only moves artefacts over short distances (see section 3.2). Furthermore, one would expect flat surface sites that now form part of agricultural fields to be much more affected by tillage than tell sites, that are generally not affected by ploughing. Only the edge of a tell is in some cases subjected to ploughing, possibly creating large haloes around the tell. In the case of flat surface sites it is unknown where the sites themselves stop and the haloes begin. This makes direct comparison difficult. However, the distinction in densities further away from the centre of concentrations like 'Ammata S and field 252 and those of Tell al-'Adliyyeh, of which the edges do not seem to have been ploughed, is negligible. This lack of distinction between tells and ploughed sites and the presence of off-site distributions at considerable distances from sites discount tillage as a significant factor in the creation of the off-site distribution.

Settlement size	Radius of scatter (km)
Hamlets and farmsteads < 1.5ha	0.2-0.4
Villages 2-9ha	0.6-1.0
Small town 10-29 ha (only one example)	1.3
Large town/city >40 ha	2.2-6.0

Table 4.57 Approximate radius of significant field scatters surrounding archaeological sites in the Middle East (total sample: 19 settlements) (Wilkinson 1989: table 1).

What remains is the explanation that off-site densities were created by manuring agricultural fields with domestic refuse. Manuring of fields with organic refuse from the village is evidently linked to the village. Each village would probably manure their own fields which were likely located in the immediate vicinity. In this way large haloes of low densities would emerge around each village. The size of the halo and the density of the distribution depend on the duration of manuring, the size of the village and the location of agricultural land. Wilkinson has measured the size of archaeological settlements and related manuring haloes of 19 sites in the Middle East (Wilkinson 1989: 44). The settlements date to different periods and are located throughout the region, yet they share the characteristic that the dimension of the halo increases in tandem with size of the settlement (see table 4.57).

In the Zerqa Triangle it is difficult to determine the size of a halo as settlements are located in close proximity to each other leaving no empty spaces between haloes. It is hypothesized that these smaller and denser haloes immediately next to sites are the result of both lateral movement of remains away from the site through ploughing and erosion and of more intensive manuring of gardens that were probably located closest to the village. The low off-site densities probably also form haloes around the sites, but because these probably overlap with the other haloes, they are not visible. The ubiquitous ribbed sherds exhibit a dense and widespread off-site distribution, while the feature sherds are lower in number and more empty spaces are visible between the sites. Yet, more or less similarly shaped haloes are visible around sites, despite their lower density and more fragmentary coverage. Regarding the ribbed sherds, only in the east does the halo of field 252 seem to peter out into an empty area. If the sherds in this field are taken to be linked to the site in field 252 a halo of *c.* 800 m should exist. The denser halo around Tell al-‘Adliyyeh extends for *c.* 400 to 500 m, but the lower density finds scatter continues for at least a further 400 m before the vicinity of the field 176 site is reached. The end of the ‘Ammata concentration was not reached, but low density off-site scatters exist at least as far as 700 m away from the site. The off-site scatter in the south-westernmost survey area is noteworthy, especially bearing in mind its empty nature in most other periods. The north-western survey area around ‘Abū Nijrah that also borders on the *katār* demonstrates much lower pottery densities. It may be envisioned that the off-site scatter in the south-westernmost area forms the outer part of a halo surrounding Tell al-Muntih located *c.* 1 km to the south. Taken together all haloes around these sites extend at least 700 m up to possibly 1 km from sites. Only the haloes around the small site in field 176 and around Tell ‘Abū Sarbūt, where only a limited number of (early) Roman sherds was found, seem to be smaller. The size of the settlements is not entirely clear as sherd scatters will have emanated from their centres and tells do not show easily which part was occupied during a specific period. Assuming that at least the majority of the surface of Tell ‘Ammata and Tell al-‘Adliyyeh was occupied during this period they had a size of *c.* 0.7 and 0.5 ha respectively. The sizes of the flat surface sites are equally difficult to determine. When the densest part of the concentration whose edges, furthermore, show the sharpest decrease in density are taken to be representative of the location of buried remains in the subsoil, ‘Ammata S would measure *c.* 7 ha, field 252 *c.* 2.7 ha while the ‘Abū al-N‘eim concentration would measure 0.6 ha and the tell 5 ha taken together. Field 176 is much smaller at 0.6 ha. These settlement sizes and the radii of their haloes fall within the hamlet and village levels defined by Wilkinson and thereby fit the more general pattern in the Middle East.

Manuring therefore seems to be a viable explanation for the widespread and relatively dense off-site distribution from this period. A distinction must, however, be drawn between the Roman and Late Roman (/Umayyad) periods. Ribbed decoration was especially common during the Late Roman period and the majority of the ribbed sherds discovered in the survey will stem from this period. Although many sherds could not be dated more precisely than Roman/Late Roman, the proportion of sherds that could be dated to one of these periods is smaller for the Roman period than it is for the Late Roman period. A total of 300 Roman compared to 688 Late Roman/Umayyad feature sherds were identified, while their joint category contained 1329 sherds. Combined with the 8956 ribbed sherds that largely date to the Late Roman/Umayyad period, remains from this period seem to be much more ubiquitous than those from the Roman period. The evidence for ma-

nuring is therefore most convincingly present for the Late Roman period. This fits with the level of agricultural intensification, population density and economic growth that is argued by several scholars to have characterized in this period (e.g. Patrich 1998: 483; Parker 1999: 167, 169).

Tesserae

In total 330 pieces of tessera were collected during the survey. These tesserae are not distributed evenly throughout the region but centres on specific regions. In figure 4.145 the concentrations of tesserae are clearly visible as small high density centres or wider low density distributions. In figure 4.145 four clear concentrations are visible that all fall in with (settlement) sites from the Hellenistic or later period. The northernmost concentration coincides with the flat surface site to the south of Tell 'Ammata. This concentration was dated to the Hellenistic to Umayyad period on the basis

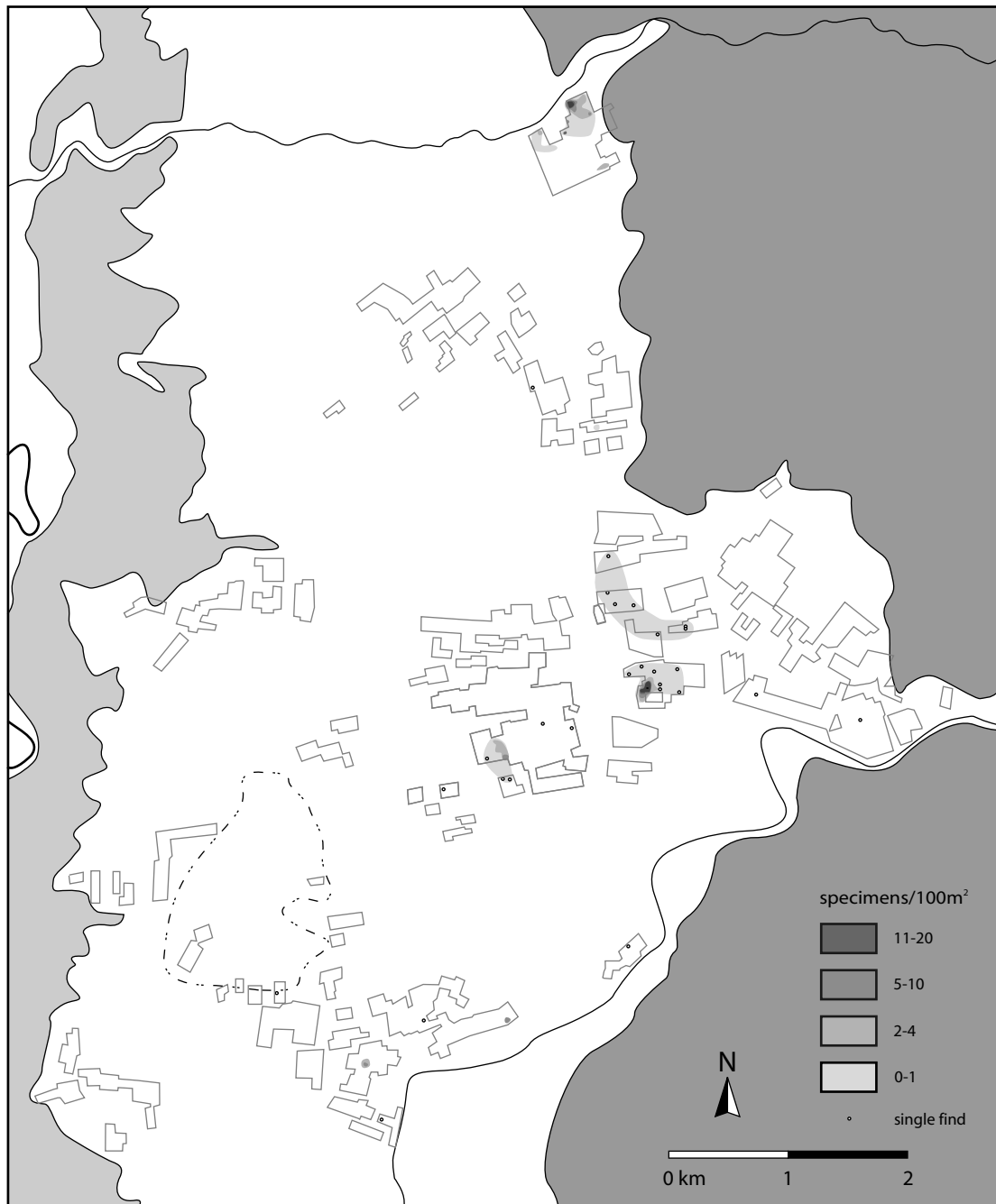


Figure 4.145 Distribution of tesserae

of pottery. The date of this site fits with the general occurrence of mosaics in the Levant. Mosaics first occur in this area in the Hellenistic period. During the Late Roman period mosaic were very popular and intricate multicoloured patterns were manufactured. At the start of the Umayyad period the new Islamic religion prohibited the depiction of living beings and mosaics continued in much simpler geometric and floral patterns. During the following Abbasid and Fatimid periods mosaic floors generally consisted of crude white tesserae (Negev and Gibson 2001: 347-349). The 96 tesserae collected in the 'Ammata concentration are generally of small size and although the majority is white, a few black, red, yellow and orange specimens have been discovered.⁶⁵

The second large concentration located in the centre of the research area around fields 250-260 has been dated to the same period. The 160 mosaic stones discovered showed more or less the same characteristics as those of the 'Ammata concentration, although the spatial distribution is somewhat wider. Given the few distinguishing characteristics of the tesserae it is impossible to say from which period between the Hellenistic and Umayyad period they stem. The third, less dense and slightly smaller concentration surrounds Tell al-Fukhār. **Tell al-Fukhār is a small tell that seems to date to both the Hellenistic and Late Roman period, although some surveys reportedly found pottery from other periods as well.** The tesserae discovered are all whitish or beige, with diameters ranging between 1.3 x 1.7 x 1.9 and 2 x 2.2 x 2.7 cm. These tesserae may therefore stem from both the Hellenistic and the Late Roman period, although the ubiquitous nature of mosaic floors in the Levant as a whole during the Late Roman period makes the latter date more likely. For the very small concentration in the south of the research area, near the village of 'Abū al-N'eim, the correlation with the pottery found at the same restricted location makes a date in the Late Roman period likely. At this location 12 tesserae were collected in a single plot, while the surrounding plots only yielded single stones.

Mosaic stones are clearly associated with architecture and generally with settlements, which is reflected in the almost complete absence of tesserae in the countryside. Although the concentrations of tesserae are in this area clearly connected to settlement sites from the Hellenistic to Late Roman/Umayyad period, the connection is not exclusive. Late Roman remains, the period supposedly marked by the most frequent use of mosaic floors, has been discovered at sites like Tell al-'Adliyyeh, but tesserae are completely lacking. Although mosaics were common and have been evidenced at several locations within the research area, they were not present everywhere and may have expressed a certain degree of exclusivity and wealth.

Glass

Fragments of glass have been discovered in the survey as well in more or less the same areas as the tesserae although in lower quantities (n = 148). More than half of the glass fragments were discovered in the two only proper concentrations visible in their distribution, i.e. the 'Ammata concentration (n = 32) and east of Tell Deir 'Allā around field 252 (n = 60). The remainder of the glass fragments was discovered as very low density distributions over wider areas. However, these wider low density areas also show a focus on certain regions surrounding sites. These have been highlighted in grey in figure 4.146. These low density distributions centre on the area between field 252 and Tell al-Fukhār, the vicinity of 'Abū al-N'eim. A few fragments have been found beside Tell al-'Adliyyeh.

As far as could be determined from the often very small fragments, all glass vessels seem to have been made by the technique of blowing glass instead of being mould made. This technique was first used in this region during the first century BC (Henderson 2000: 64-67). The majority of the glass fragments was turquoise or green/blue in colour. Shapes include simple cups, pointed lamps or amphoriskoi, handles, often folded several times, and a few rounded and square bases. However, the majority of the fragments if formed by thin body sherds. Given the long use and few distinguishing features on most pieces dating is very difficult. Nevertheless, based on the spa-

65 A more detailed description of these concentrations and the tesserae discovered is given in the following section in combination with the pottery description of these concentrations.

tial distribution of most fragments and the dates that can be attached to the few datable pieces it seems likely that most of the glass stems from the Roman, Late Roman and possibly Umayyad periods.



Figure 4.146 Distribution of glass fragments

4.4.2 The Roman, Late Roman and Umayyad concentrations

Fieldno.: 89-93 and 95-96

Toponym: The 'Ammata concentration
 Coordinates: 747,000/3,570,300 (centre)
 Size: 250 x 300
 Days and time surveyed: Sep. 12th-15th, 2005,
 c. 35 man-hours
 Periods discovered: Hellenistic, Roman,
 Late Roman, Umayyad



Figure 4.147 Total sherd distribution (N max. = 910 per plot (=50 m²))

Description

On the first days of the 2005 season a large concentration of pottery was discovered south-east of Tell 'Ammata. The Wadi Rajib runs between this concentration and Tell 'Ammata. The wadi is quite deeply entrenched at this location and has been so at least since the IA (Hourani in prep.). The presence of this deep streambed negates the possibility that the concentration discovered is merely run-off material from the tell. The pottery on the surface, therefore, most likely reflects an archaeological site buried in the subsoil.

As can be seen in figure 4.147 the densest parts of the concentration are located in the north to north-east (fields 90, 91, 92, 95, 96 and the north-western part of field 93). Sherd numbers are extremely high, as many as 910 sherds have been discovered in a single plot (90.4.1). As a plot covered 1x50 m, pottery densities amounted to over 1800 sherds per 100 m². Nowhere in the survey have greater quantities been encountered. Unfortunately the fields further to the north and east were planted and could not be surveyed. In the west houses were built and the area in between had been bulldozed severely, leaving heaps of rubble behind and making surveying impossible (demarcated by the rectangle on figure 4.147). The extent of the concentration in these directions is, therefore, unknown.

The large quantities of sherds that were discovered in this area belonged to several periods. A very small proportion (22 sherds) could be dated to the Hellenistic period, of which only 9 could with certainty be dated to just the Hellenistic period. Irrespective of their low number the clustered nature of the sherds suggests this area can be regarded as representing a buried site. This low number of Hellenistic sherds is typical of the Hellenistic remains in the entire region described in section 4.3. A greater percentage of the discovered pottery could be dated to the Roman period. As can be seen in figure 4.149 the concentration centres on more or less the same location,

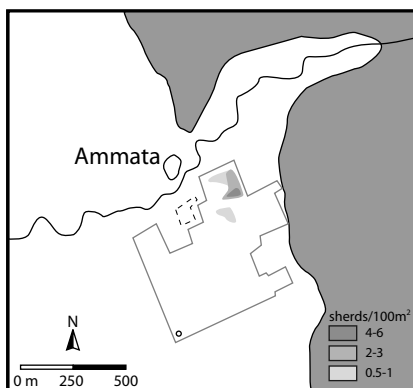


Figure 4.148 Distribution of Hellenistic sherds

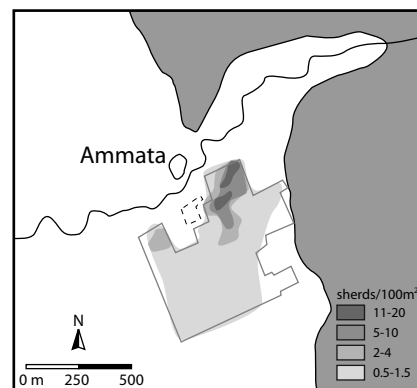


Figure 4.149 Distribution of Roman feature sherds

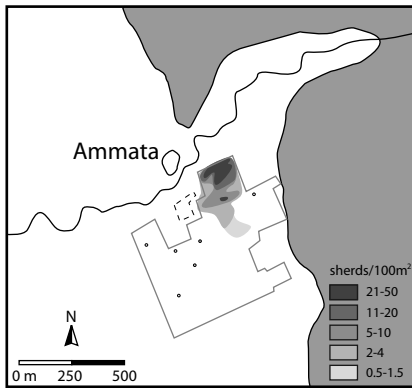


Figure 4.150 Distribution of Late Roman/Umayyad feature sherds

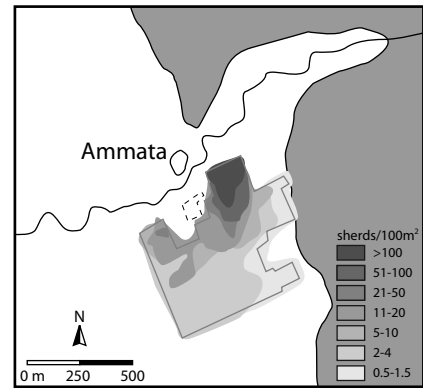


Figure 4.151 Distribution of ribbed sherds

although the densities are higher and the distribution area wider. By far the densest distribution belongs to the Late Roman and Umayyad periods (see figure 4.150). Due to the similarity in several pottery forms these periods are grouped together. Again the centre of the concentration is located to the south-east of Tell 'Ammata and decreases in density towards the south to south-west following the slope of the valley. The Late Roman/Umayyad feature sherds show higher densities than the Roman feature sherds (N max = 20 versus N max = 32 per 100 m²). These distributions, however, only incorporate the precisely dated feature sherds.

When the ribbed body sherds, already described in the previous section, are taken into account the extremely dense nature of this concentration becomes apparent. As discussed before, it is likely that the majority of these ribbed sherds stems from the Late Roman period. The general distribution pattern of the ribbed sherds is similar to that of the other periods. As a result of the much higher sherd numbers, however, the concentration is larger and shows the spatial distribution outside the centre of the concentration. Densities are clearly lowest along the foothills in the east. These areas will have been more heavily affected by sediments coming from the hills. Alternatively, these areas lie slightly higher as the area slopes slowly down towards the south-west. If there is no feature buried beneath the soil, which seems to be the case here, this area is less affected by artefact displacement through e.g. ploughing as a result of gravity. Had the shape of the distribution been entirely dictated by the angle of the slope, the density areas would show an orientation towards the south to south-west. This is, however, not entirely the case. High densities are also present in the west/south-west. The most likely interpretation for this slightly deviating high density area is the continuation of the buried features to the south-west into the bulldozered area.

Although the bulldozered area in the west was not surveyed by the standard method, it was investigated and finds were collected albeit in a random fashion. This area stands out from the other fields of the concentration, as most fields were under cultivation and, therefore, cleared of all large objects. In the bulldozered area, however, many stones lay scattered over the surface, several of which had been hewn. Among them was one clear column drum. Other finds from this area included roof tiles, some small fragments of polished marble, and several tesserae, including a piece of cement with a small mosaic fragment in three different colours still adhering to it (see below). In the section of two shallow holes dug into this area mosaic floors could be seen at *c.* 10 to 40 cm below the present-day surface. In one section a layer of cobblestones was visible underneath a layer of plaster in which the tesserae were fitted.

The inhabitants of the surrounding houses referred to this area as the 'Late Roman church', because structures interpreted as belonging to a church were uncovered during the construction of a house. One man said that when he was a boy some 25 years ago, two 1 m high statues had stood here depicting a lion and gazelle in relief. They had, however, completely weathered away. Although the reliability of these stories is questionable, the finds like the marble and mosaics do point to a slightly more opulent building being located here in the Late Roman period. The local toponym 'Byzantine church' was used to denote this area and its finds, but this does not mean the presence of a church has been proven.

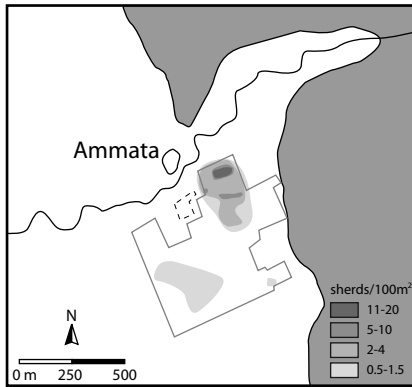


Figure 4.152 Distribution of glass fragments

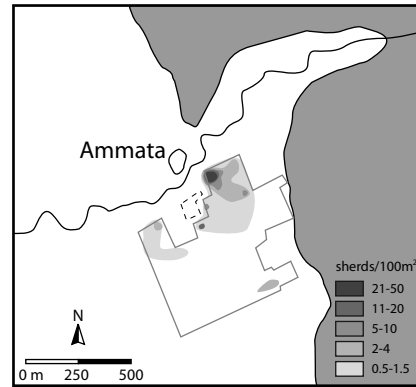


Figure 4.153 Distribution of tesserae

Concluding, a buried site dating to the Hellenistic, Roman, Late Roman and Umayyad periods seems to be present in the north to north-eastern part of this survey area. The Hellenistic concentration is small and probably represents a small site covering at most 60 x 100 m. The Roman period site is slightly larger and if the assumption that the dense centre of concentration reflects the size of the buried site is valid, it may measure *c.* 150 x 250 m. The high number of sherds from the Late Roman period show that at least during this period the buried site probably extended into the area today affected by bulldozers. The presence of large construction remains, pottery and roof tiles corroborated this hypothesis. This would entail a site size of *c.* 250 x 250 m. The presence of a rather homogenous pottery distribution of considerable density several hundreds of meters away from the centre of the concentration may be connected to the practice of manuring the agricultural fields with organic refuse from the settlement as was argued for in the previous section. The pottery discovered and its dating is discussed in detail below.

Other finds

The other finds included fragments of glass and tesserae. As can be seen in figures 4.152 and 4.153, the location of clustering of these two categories differs slightly. Tesserae were attested in larger quantities, but in a more restricted area. Glass fragments cluster east of the tesserae. They are lower in number, but cluster rather tightly in fields 90 and 91. A total of 79 glass fragments were collected of which 27 were rims, bases, handles and fragments with additional features. Most fragments were of a turquoise to (greenish) blue colour and were often vesicular which is consistent with a pre-industrial mode of production. Several of the rims were folded creating an iridized tube of air inside the rim.

The tesserae are of the same type as those discovered in the 'Late Roman church'-area. They are made from yellowish white limestone and range in size between *c.* 1.3 x 1.1 x 1 cm and 3.3 x 3 x 2.4 cm. Their rather irregular shapes, large size and monotonous colours suggest that most mosaics were of a rather crude and plain character. The discovery of the piece of mosaic with different colours, however, points to more elaborate designs also being present.

Other finds of this concentration included several roof tiles. Most of the roof tiles are of the pan tile or tegula type. These are flat slabs with a raised edge. When visible they usually have sand impressions on their base. Their thickness ranges between 1.7 and 3.1 cm. Only a few slabs with raised edges have been collected. These generally have sharp edges and their outer edge protrudes slightly below their base (see figure 4.154). A slightly thicker tile, however, had rounded corners and a completely flat base (see figure 4.154). In one example a corner with two edges was preserved. Here one could see that the edge was not raised over the entire length of the tile but that the first five centimetres of tile were completely flat (see s90.2-3.1m3). In this way the tiles interlocked with each other and were prevented from sliding down. Only one example of a so-called roll tile was found. These tiles are curved and form half or just over half a circle. They are also referred to as imbrices. The example that was discovered spanned 12 cm (see figure 4.154).

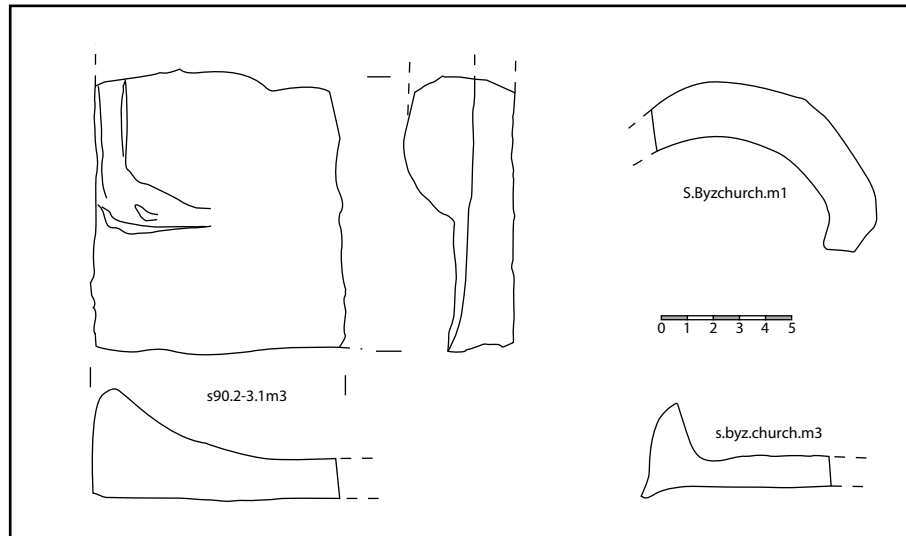


Figure 4.154 Selection of discovered tiles

The number of tiles that have been collected is rather low in the entire concentration. The largest number (6) was found in the bulldozered area. The other fields of the concentration all yielded only one or two specimens. No tiles were found outside the fields forming the densest part of the concentration. Tiles are extremely rare in this area. They have only been discovered in very low numbers in two concentrations both predominantly dating to the Roman and Late Roman period, i.e. this concentration south of Tell ‘Ammata and the concentration centring around fields 251-254 east of Tell Deir ‘Allā. In the larger region tiles are mainly associated with larger public buildings, such as at Pella. This suggests that the standard house in this area probably had a flat roof while larger public buildings had more typical Roman ridged sloping roofs.

Flint

Although several tools and flint debitage have been discovered in the vicinity of the pottery concentration they cannot be positively associated with it. The dating of flint tools is, especially for the later periods like the Roman or Islamic eras, notoriously difficult. The flint distribution shows no clear clustering at the same location as the pottery concentration. Furthermore there is no evidence to chronologically connect the flint to the concentration as the tools discovered here are of an ad hoc nature.

No large flint collection has been discovered in the northern area. In most plots only one or two pieces of flint were collected. At first glance flint artefacts seem to be randomly distributed over the fields in this region; no clear clustering is visible. Furthermore, the distribution of waste and tools also does not demonstrate any spatial patterning (see figure 4.155 and 4.156). However, when the total number of flint artefacts and the ratio between waste and tools of this region is compared to other areas differences become apparent. Fields located just a few kilometres to the south and surveyed by the same team yielded significantly fewer flint artefacts. In the area around Tell al-Mazār and Tell al-‘Adliyyeh only one or two flint artefacts per hectare have been discovered (see figure 4.3 and 4.4). The ratio between waste and tools is very high, even when compared to other concentrations. In this northern area tools constitute 36 % of the total flint assemblage. For the other fields surveyed in the same season only 25 % of the assemblage consists of tools. That is including the EB Ib/II concentration located in fields 126-142 with its larger number of flint tools. If one excludes this EB concentration, the result is a tool versus waste ratio of 1:4 as tools only form 19 % of the total collection.

The apparent lack of a flint concentration around the ‘Ammata concentration is not an actual absence of clustering. The comparison with neighbouring areas to the south, surveyed by the same team and, therefore, not subject to collection biases, shows that the entire northern region should be considered as a dispersed cluster. The wider distribution area of the flint when compared to

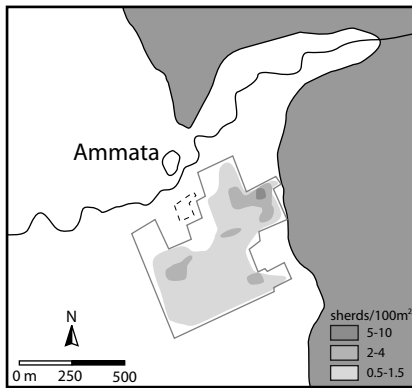


Figure 4.155 Distribution of flint debitage

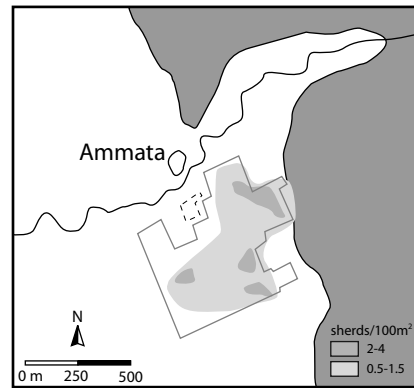


Figure 4.156 Distribution of flint tools

the pottery may be a result of the fact that pottery is mainly related to the specific locations in the landscape like settlements or farmsteads where it was used as e.g. storage containers and serving dishes. Flint artefacts are, however, more used in special activities and less as passive receptacles. Scrapers were, for example, used in the preparation of skins and sickle blades in the harvesting of cereals. Some of these activities, like cereal harvesting, without a doubt took place outside the settlement in the cultivated fields. Other activities, like the slaughtering of animals, may well have taken place outside the confines of the domestic space. This phenomenon would be reflected in a less dense clustering of flint tools. However, it does not explain the waste distribution, for this distribution is related to the manufacturing of a flint tool and not to its use. The characteristics of the tools discovered explain this distribution, however. All tools collected in this area are made with a very simple ad hoc technique using local flint cobbles available everywhere in the fields. These cobbles are relatively small and rounded by water erosion as they were transported by wadis. Many of the artefacts made from them still display this rolled outer surface, which is not cortex as such, but is technologically its equivalent.

The scrapers, notches, and retouched flakes or pieces are all characterized by an ad hoc technology. Due to this technology these artefacts are difficult to place in a chronological context. The retouched flakes, pieces and the notches all grow more abundant in the Late Neolithic period and predominate during Chalcolithic, EB and MB I periods. After that they lose currency and occur only seldom in LBa and IA (Rosen 1997: 92). The scrapers manufactured by an ad hoc technique are equally difficult to date. They occur frequently during the Chalcolithic and EB Age, but decline afterwards (Rosen 1997: 87). Of the retouched blades only one may be considered a backed blade and, therefore, may be dated more specifically to the Chalcolithic period. The others are all simple retouched blades common throughout all periods (Rosen 1997: 65).

There is, therefore, no reason to link the flint assemblage to the pottery concentration along the Wadi Rajib or to Tell 'Ammata. It is more likely that the assemblage is an accumulation of activity in several different periods. The ad hoc nature of the tools in combination with the flint waste and the type of flint makes it likely that these tools were produced locally when needed and were easily discarded when they broke or the need for them ceased. The greater number of flint artefacts and higher frequency of tools compared to other areas suggest that this area either witnessed more activities or saw activity for a longer period of time or a combination of both. The fact that this area, due to its location near the foothills of the eastern plateau, has more flint nodules is not the sole explanation for the greater number of flint artefacts. This would explain a larger amount of flint debitage and waste, but is in disagreement with the higher frequency of tools as these would be transported to and discarded at the place where they were going to be used.

Pottery

The 'Ammata concentration has revealed extremely large quantities of pottery. The largest number of sherds per plot of the entire survey project was collected in this concentration. One plot contained as many as 906 sherds, which is 1812 sherds per 100 m². Compared to pottery densities in

Waste	96
Blade	16
Bladelet	2
Core trimming element	1
Flake	72
Primary element	6
Core	5
Flake core	5
Tools	54
Borer	1
Notch	1
Possible celts	2
Retouched blades	6
Retouched bladelets	4
Retouched flakes	21
Retouched pieces	5
Scraper	14

Table 4.58 Flint artefacts

Greece where such high numbers are more or less the norm, this number is not remarkable. In the Zerqa Triangle and most of the southern Levant as a whole, however, such numbers are not generally encountered in areas away from a tell site. Taking the three survey seasons together, an average of 38 sherds per 100 m² was discovered. In the 2004 and 2006 seasons densities did not reach those of this concentration. The largest numbers discovered were 1322 and 1134 sherds per 100 m² respectively. Both came from concentrations dating to the same periods (see next section).

The majority of the sherds discovered in this concentration were ribbed body sherds. Ribbed decoration is a feature present in the Late Roman and several Islamic periods. Before the Late Roman period this kind of ribbing did not occur. These sherds are, therefore, registered in the database as feature sherds dating to a period called 'Roman or later'. Although ribbed sherds could stem from several Roman and Islamic periods, their most intensive production was during the Late Roman period. Ribbing does occur in the Umayyad and Abbasid periods but on a very small scale, while it is only present on small jugs and the like in the Fatimid period (Sauer 1982: 332, 333, 334). The bulk of the database is, therefore, dated to a broad period but the majority of these sherds stems from the Late Roman period.

Although many other feature sherds could not be dated to a specific period, it was clear that they did not pre-date either the Roman or the Hellenistic periods. These were, therefore, all catalogued as stemming from the 'Roman or later' period. Fortunately, there were also many sherds found that could be dated to a fairly specific time period. A selection of these sherds has been drawn and is depicted in the figures below. This selection is not a proportional reflection of the periods present within the assemblage, but shows examples of the different types present regardless of their frequency within the assemblage. The relative frequencies are based on the database (see appendix 1) and further elaborated upon below.

Red Slip Wares

Several examples of Red Slip Ware (RSW) have been discovered in and immediately around the 'Ammata concentration. Examples of Phocaeen, Cypriot and African RSW have all been found, but their frequencies differ. Especially Phocaeen Red Slip Ware (PRSW) was discovered quite regularly, Cypriot Red Slip Ware (CRSW) was less common and African Red Slip Ware (ARSW) occurred in only seven instances. At Pella a local Transjordanian RSW was identified (Smith and Day 1989: pl.46). In these concentrations some fragments have been identified that most likely constitute local imitations, but these are low in number and clearly identifiable specimens are ab-

No.	Sherd no.	Parallels	Date	Remarks
1	s90.3-4.1p18	(Hayes 1972: p.373-356, fig.80:1-2, 9)	Late Roman	CRSW 1-2: 475-525
2	96.1.1p2	(Hayes 1972: 333, 335, fig.69:17-27)	Late Roman	PRSW 3F-G: 500-550
3	s89.2-3.1p3	(Hayes 1972: 343, fig.71:1-6, 7-10)	Late Roman	PRSW 10A-B: 575-625
4	92.4.1p78	(Hayes 1972: 333,335, fig.69:17-26)	Late Roman	PRSW 3F: 500-550
5	91.1.1p212	(Hayes 1972: 333, fig.68:14-16, fig.69:17-26)	Late Roman	PRSW 3E-F
6	90.1.1p24	(Hayes 1972: 333,335, fig.69:17-26)	Late Roman	PRSW 3F: 500-550
7	96.3.1p9	[Hayes, 1972 #621@149, fig.27:1	Late Roman	ARSW 96?
8	91.7.1p12		Late Roman	? ARSW
9	95.1.2p16	(Hayes 1972: 343, fig.71:7-10)	Late Roman	PRSW 10B: 575-625
10	89.2.1p23	(Hayes 1972: 343, 345, fig.71:11-15)	Late Roman	PRSW 10C: 600-675
11	96.3.1p9		Late Roman	
12	91.3.1p53	(Hayes 1972: 166-169, fig.32:15) (Bonifay 2004: fig. 98)	Late Roman	ARSW 105: 580-660 ST57A: 575-650
13	s90.1-2.1p20	(Hayes 1972: 112-116, fig.19:1, 9) (Bonifay 2004: fig.92:8)	Late Roman	ARSW 67: 360-470 ST41C: 450-500

Table 4.59 Red Slip Wares

sent. RSW is a common tableware occurring throughout the Eastern Mediterranean region in the Late Roman Period (Bes 2007). Although this type of tableware is imported, it occurs even in small inland villages (Wickham 2005: 770). RSW should, therefore, not be regarded as imported luxury items, but as a component of a trading network that stretched into the small agricultural villages of the Near East (Kingsley 2001: 58).

The three types of RSW are differentially represented in this concentration. Especially the distribution of PRSW and CRSW are subject to different geographic foci changing over time. Throughout the Levant PRSW is the commonest type attested (Wickham 2005: 770). PRSW was especially common between 450 and 550 AD, but after that date its occurrence decreases rapidly in the southern Levant (Hayes 2001: 279). With the decrease in PRSW after 550 AD the relative frequency of CRSW rises again complemented by the emergence of more regional fine wares (Hayes 2001: 279). This general trend is however not clearly reflected in the 'Ammata concentration.

The PRSW is primarily constituted by form 3 and form 10 vessels (see figure 4.158). The date of the form 3 vessels fits well with the ubiquitous occurrence of PRSW between 450 and 550 AD. The high number of form 10 vessels clearly post-date this period and fall within the timeframe during which PRSW was greatly on the wane in the south. Hayes states that the Galilee, Hauran and Hama regions formed an intermediate position between the PRSW-scarce south and the north where PRSW remained dominant (Hayes 2001: 279). Although this assemblage is too small to draw any firm conclusions, the presence of a main road through the Jordan Valley may have resulted in a closer connection with the north than its distance would lead one to expect.⁶⁶ A single form 2A bowl dates between *c.* 370 and 425 AD. CRSW mainly takes on form 2 (475-525 AD) and 9 or 10 (550-700 AD). Some could not be specified to a certain form but dated roughly to the fifth century AD (see figure 4.158). The lowest number of bowls is formed by the ARSW. These were manufactured in modern day Tunisia, especially in the region of Carthage. Although the ARSW bowls are smallest group, they span the longest period of time. The earliest type discovered was produced from 325 AD onwards and the latest form until the end of the seventh century. These dates for the production of RSW do of course not necessarily represent the period in which they were used in the 'Ammata concentration. The trading and transportation between, for example, the western part of modern-day Turkey and the Jordan Valley must be allowed for and these vessels may very well have continued to be used after their production had ceased. It has been stated that PRSW is the commonest type in Palestine and Syria, which fits well with the distribution discovered here (Wickham 2005: 770). **The disappearance of this ware was not a uniform phenomenon and the**

⁶⁶ The same phenomenon of close connections to the north and especially the Galilee is visible in other vessel types as well (see below).

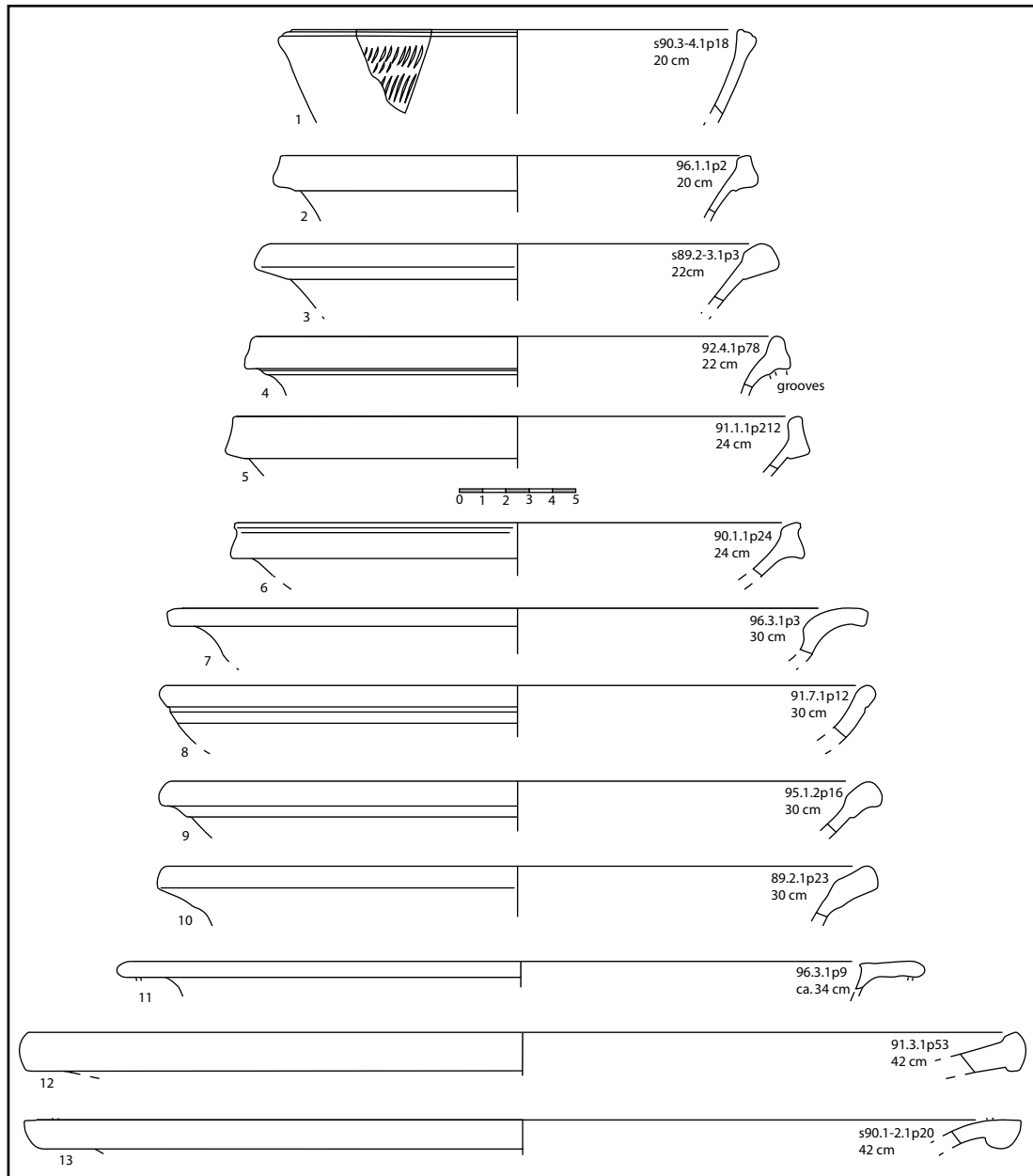


Figure 4.157 Red Slip Wares

reasons behind it are still unclear. The disappearance occurs throughout the eastern Mediterranean (Vroom 2004: 285), but the timing differs per region and vessel type. There are indications that ARSW and CRSW continue in some regions into the late 7th or even early 8th century (Bes 2007: 11, 185). It has long appeared that the end of RSW production coincided with the advent of the Muslim dynasties in this part of the Near East. This change of empire can, however, not be seen as the direct cause, as the Roman Empire continued unaffected in the area where PRSW was produced and, as said, there is now evidence for some local continuation. Other reasons for decline like the difficulty of continuing the long sea travels undertaken or lack of communication have been suggested but no conclusive answer has been reached.

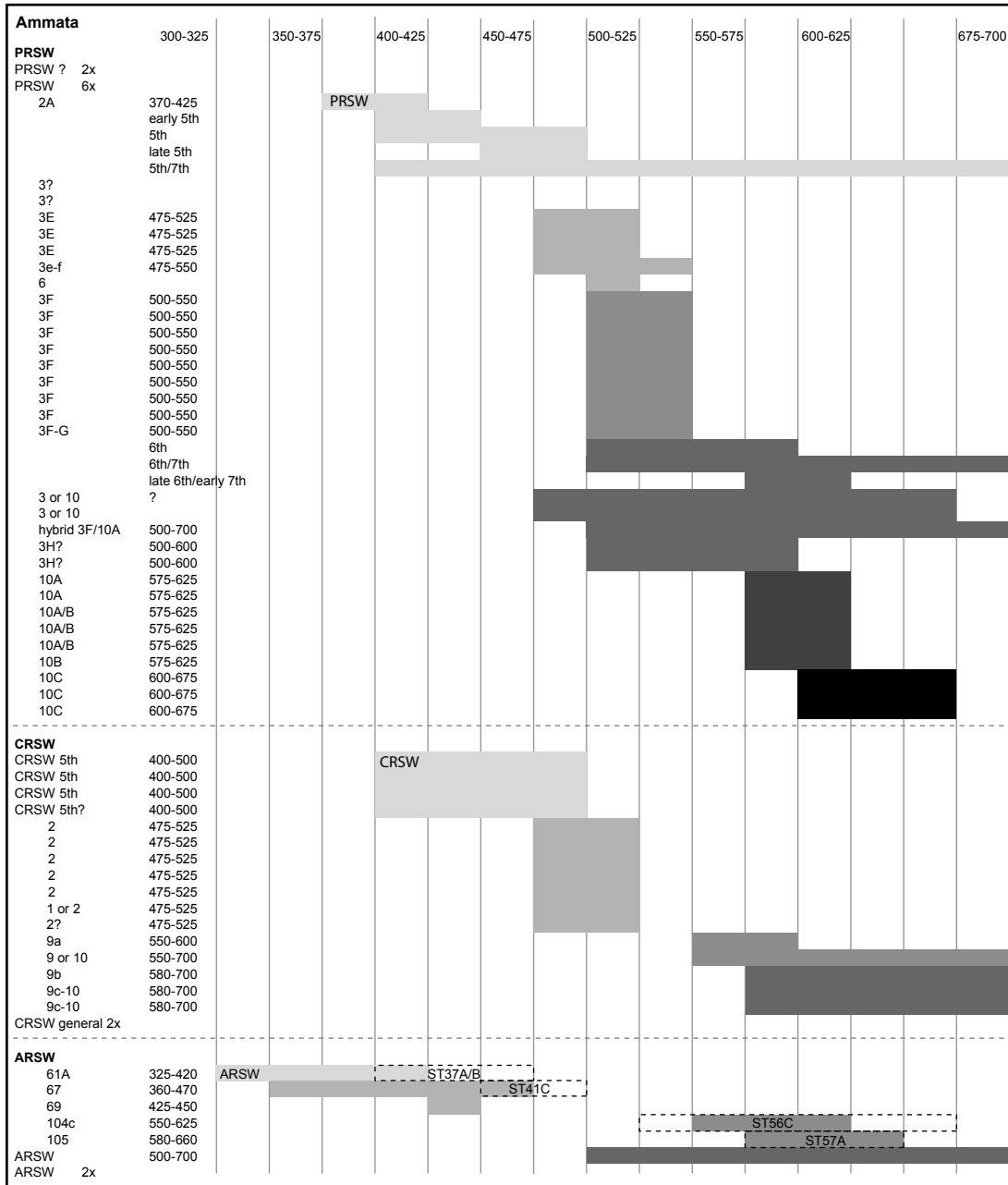


Figure 4.158 Periods of production of different the RSW forms following Hayes (dotted areas are dates and types of Bonifay)

Jars

A large part of the pottery assemblage is formed by jars. The most common type among the jars is the Late Roman bag-shaped storage jar (see figure 4.159 e.g. 90.3.1p7/92.9.1p4). This jar is known as the Late Roman type 5/6 amphora or Palestinian bag shaped jar (Sciallano and Sibella 1994). These jars have a bag-shaped profile, two ring handles attached to the shoulder, and usually a ribbed body. Regularly swirling designs in white paint occur on the body. Examples of this type of decoration have been attested in this concentration, but not in combination with a rim unfortunately. These amphorae are a continuation of the Roman jars and clearly belong to the same production tradition and sometimes even stem from the same workshops (Dark 2001: 37). These bag shaped jars were produced throughout the southern Levant (Kingsley 2001: 50). They were used in the export of wine, but more generally functioned as the typical storage jar used to store

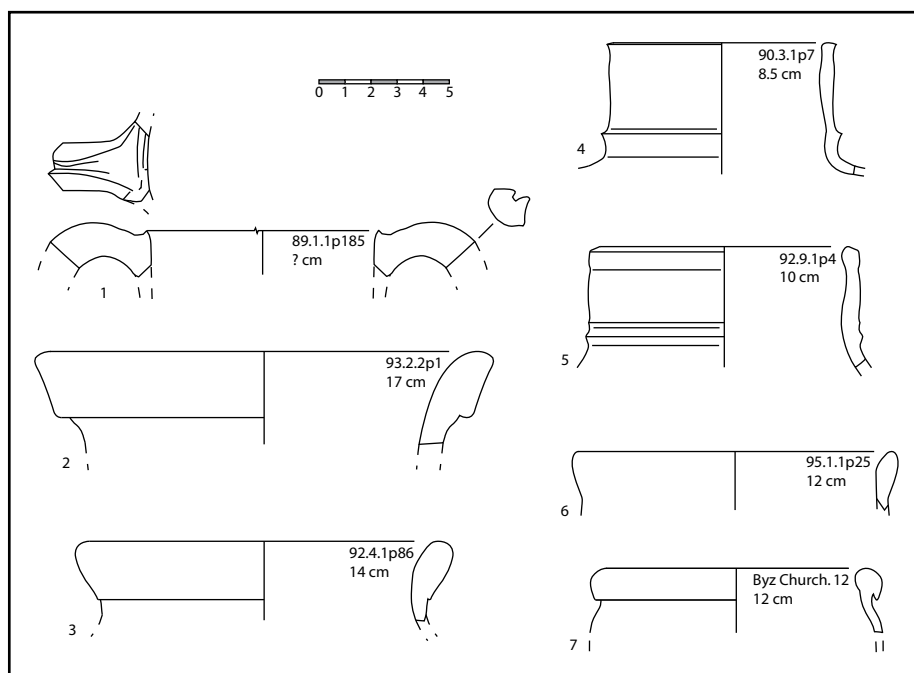


Figure 4.159 Jars

No.	Sherd no.	Parallels	Date	Remarks
1	89.1.1p185	Pinched handle: Amman (Olávarri-Goicoechea 1985: fig.6:1-2)	Roman	
2	93.2.2p1	Pella (McNicoll et al. 1982: pl.127:11)	Hellenistic	
3	92.4.1p86	Pella (McNicoll et al. 1982: pl.127:16)	Hellenistic	
4	90.3.1p7	Pella (Smith and Day 1989: pl.52:12)	Late Roman	7th – early 7th AD
5	92.9.1p4	Pella (Smith and Day 1989: pl.48:9) Caesarea (Bar-Nathan and Adato 1986: fig.2:8)	Late Roman (early) Late Roman	7th – early 7th AD early part 4th AD
6	95.1.1p25	Pella (Smith and Day 1989: pl.54:2) Pella (McNicoll et al. 1982: pl.141:2+4)	Umayyad Umayyad	700 – 725 AD c. 720 AD, Storage jar form 5b, late 6th-early 8th (Magness 1993)
7	Byz church 12	Beth Shean (Johnson 2006: fig.15.9:191)	Late Roman	Fine Late Roman Ware

Table 4.60 Jars

a whole range of products in domestic contexts throughout the region (Kingsley 2001: 50). The presence of this type of jar in the ‘Ammata concentration, therefore, does not necessarily denote grape cultivation in the Zerqa Triangle.

The jars discovered in this concentration generally have a straight or slightly curved neck, a sharp or sometimes rounded rim that is folded to the outside. On the lower part of the neck or on the shoulder a small ridge is visible. As said many ribbed body sherds have been discovered, showing that the utter majority of the jars was ribbed. Good parallels for these jars have been discovered at several excavated sites in the vicinity and the southern Levant as a whole. Similar jars have for example been discovered at Pella, in Beth Shean, Jerash, Amman, Tiberias and Caesarea (see table 4.60 below).

Magness has devised a detailed typology for the jars excavated in Jerusalem (Magness 1993). She subdivided the jars in seven groups ranging in date from the late first/early second century AD to the ninth/tenth century AD. It remarkable that, except for the post-Late Roman forms, there are no good parallels for the jars discovered in the ‘Ammata concentration. Form 4 that occurs during the entire Late Roman Period has for example a thickening or fold on the inside of the rim (Magness 1993: 223). None of the examples discovered in this concentration has a similar thickening of the inside. The jars of Jerusalem, furthermore, exhibit a tendency towards a wider

body and a shorter neck. This trend is, however, visible in the jars from most other sites in the southern Levant. The three variants that Magness distinguishes in the Jerusalem jars, i.e. a slightly everted long neck, a shorter straight neck and a slight inverted short neck, which follow each other chronologically, have no parallels in the 'Ammata concentration. The 'Ammata jars seem much more closely connected to jars from the above mentioned sites to the east and north/north-west. This suggests that the jars from the 'Ammata concentration and those from Jerusalem stem from different workshops and belonged to different local trade networks of wine and olive oil. 'Ammata was apparently more closely connected to a network that incorporated site like Pella, Beth-Shean and Jerash, but excluded Jerusalem. All jars, however, definitely belong to the same general type known as the Palestinian amphora. Only on a more detailed level do variants within this group become visible, possibly reflecting workshops and regional economic ties.

Jars from periods before and after the Late Roman period have, however, also been found. A few rims of Hellenistic jars were found. They have a flaring neck and rim that has been folded to the outside (93.2.2p1/92.4.1p86). Good parallels have, for example, been found at nearby Pella (see table 4.60), but are present at many more sites in the region.

A few jars of post-Late Roman date have also been found. For example 95.1.1p25 (see figure 4.159) is a jar of Umayyad date. It has a rather short straight neck with a rounded, slightly thickened rim. This type is present within the excavated assemblage from Pella dating from the start of the Umayyad period to 746/7 AD when a large earthquake destroyed Pella and many other settlements in the southern Levant. Pella was not reoccupied (Smith and Day 1989: 9). This type of jar is also present at Jerusalem, and termed form 5b by Magness (Magness 1993: 226). At Jerusalem this type could be dated to the late sixth to early eighth century AD, so from the latest part of the Late Roman Period through the Umayyad Period into the start of the Abbasid Period. At Pella this type does not seem to appear before the Umayyad period (McNicoll et al. 1982). The earthquake of 746/7 AD that destroyed Pella must also have affected the Zerqa region. That no jars or any other type of pottery has been found dating after the Umayyad period may indicate that the same kind of severe destruction without rebuilding that occurred at Pella took place at 'Ammata as well.

Bowls

A large number of bowls was present among the pottery assemblage from the 'Ammata concentration. Several could not be dated more precisely than 'Roman or later'. Others fit perfectly within existing typologies. Rim 91.8.1p21, for example, is an example of the arched-rim basins form I as classified by Magness for the pottery of Jerusalem (Magness 1993). This type of bowl has been found at several other sites in the southern Levant, e.g. Amman (Olávarri-Goicoechea 1985: fig.7:18). At Jerusalem it has been dated to the late third/early fourth to sixth centuries (Magness 1993: 204). This date corresponds with the early Late Roman strata in which these bowls have been found in Amman (Olávarri-Goicoechea 1985). Rim s91.7-8.1p1 might be derived from this type of bowl but has less sharp carinations.

Another group of bowls, that have been classified elsewhere as a type that was used in a wider area, are the bowls 91.2.1p254, byz.church 2, and 90.4.1p14. These bowls of dark red or reddish brown ware that are characterized by two grooves on top of the rim are very common in the Galilee. They have been classified by Adan-Bayewitz as Kefar Hananya form IB bowls after their production site (Adan-Bayewitz 1993: 91). In pottery studies they are also referred to as Galilean bowls, due to their abundant occurrence in the Galilee. These bowls have been discovered in excavation layers dating to the second and third century AD and they seem to disappear in the fourth century AD (Adan-Bayewitz 1993: 95). The largest quantities of this bowl type have been found in the vicinity of their production site Kefar Hananya and numbers decrease as distance from the site increases (Adan-Bayewitz 1993: 212). Small numbers of this type of bowl have been found at Pella, Beth-Shean and Jerash (Smith and Day 1989: pl.44; Johnson 2006). These are, however, the most southern occurrences of Kefar Hananya ware discovered so far. South of the line Carmel Mountains – Jezreel Valley – Beth Shean Valley this type of pottery occurs only in rare instances (Adan-Bayewitz 1993: 214). The pottery from this concentration morphologically resembles the Kefar Hananya form Ib bowl very closely. Macroscopically the ware seems to have similar characteristics as the Kefar Hananya ware, but as no petrographic analysis has been undertaken on the

survey assemblage no identification can be made. However, if these bowls do indeed prove to be Galilean bowls this group would constitute the southernmost occurrence of this type of bowl. There are, however, some indications that these bowls might have been locally imitated. In Jerash two bowls morphologically resembling Galilean bowls have been discovered in the waste dump of a pottery kiln (Kehrberg 2007: fig.6:97,99).

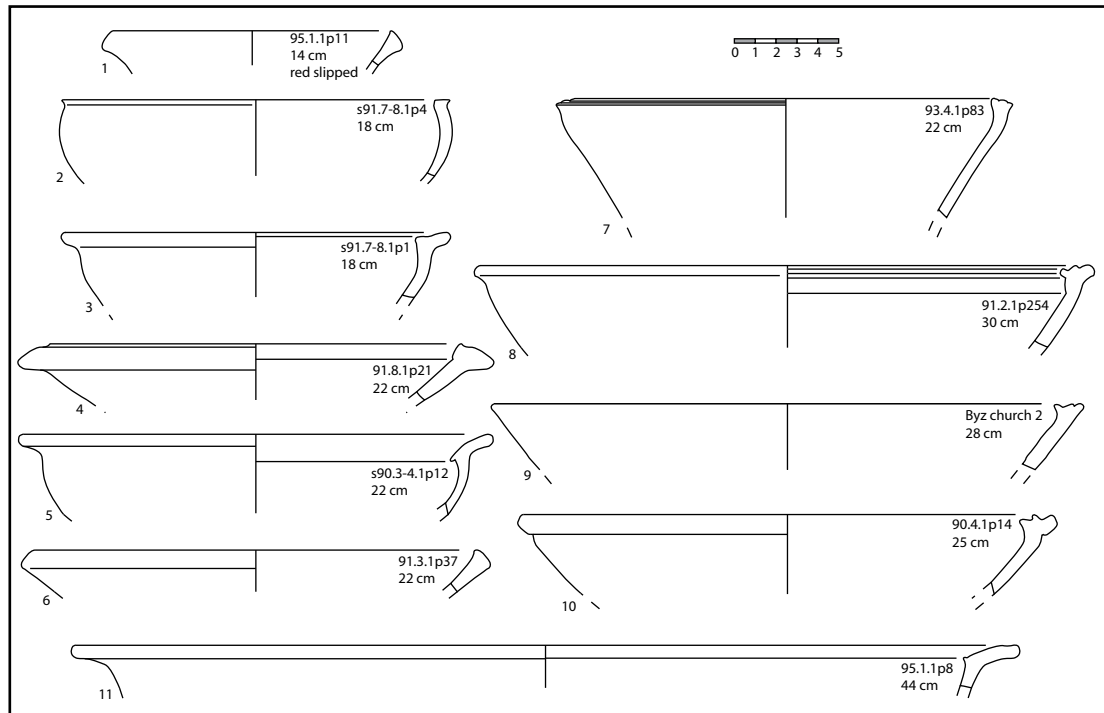


Figure 4.160 Bowls

No.	Sherd no.	Parallels	Date	Remarks
1	95.1.1p11			
2	s91.7-8.1p4			
3	s91.7-8.1p1	c. Caesarea (Magness 1992: fig.60:7)		Derivative of arched-rim basin?
4	91.8.1p21	Jerusalem (Franken 2005: fig.11.6:18) Jerusalem Jewish quarter (Magness 1993: f.3:22))	Late Roman	Arched-rim basin form 1, late3rd/early 4th – 6th AD (Magness 1993: 204)
5	s90.3-4.1p12			
6	91.3.1p37	(Magness 1993: 199:2)	Umayyad?	Fine Late Roman ware bowls 2B, 650-9th/th AD
7	93.4.1p83	Yoqne'am III fig.XII:4 Kefar Hananya (Adan-Bayewitz 1993: 91)	(late) Roman	Galilean bowl, late 1st-late 3th AD/K Hananya IB, 2nd +3rd AD
8	91.2.1p254	Kefar Hananya (Adan-Bayewitz 1993: 91)	(late) Roman	Kefar Hananya IB, 2nd + 3rd until 4th AD
9	Byz church 2	c. Meiron str. IV (Meyers et al. 1981: fig.8.5:33) Kefar Hananya (Adan-Bayewitz 1993: 91)	(late) Roman	Cooking bowl? 250-365 AD Kefar Hananya IB, 2nd +3rd AD
10	90.4.1p14	Yoqne'am (Avissar 2005b: fig. 2.9:1) Kefar Hananya (Adan-Bayewitz 1993: 91)	(late) Roman	Kefar Hananya IB, 2nd +3rd AD
11	95.1.1p8	c. Jerusalem (Magness 1993: 203)	Late Roman	Form of rilled-rim bowl?; late 3th/early 4th – 6th AD

Table 4.61 Bowls

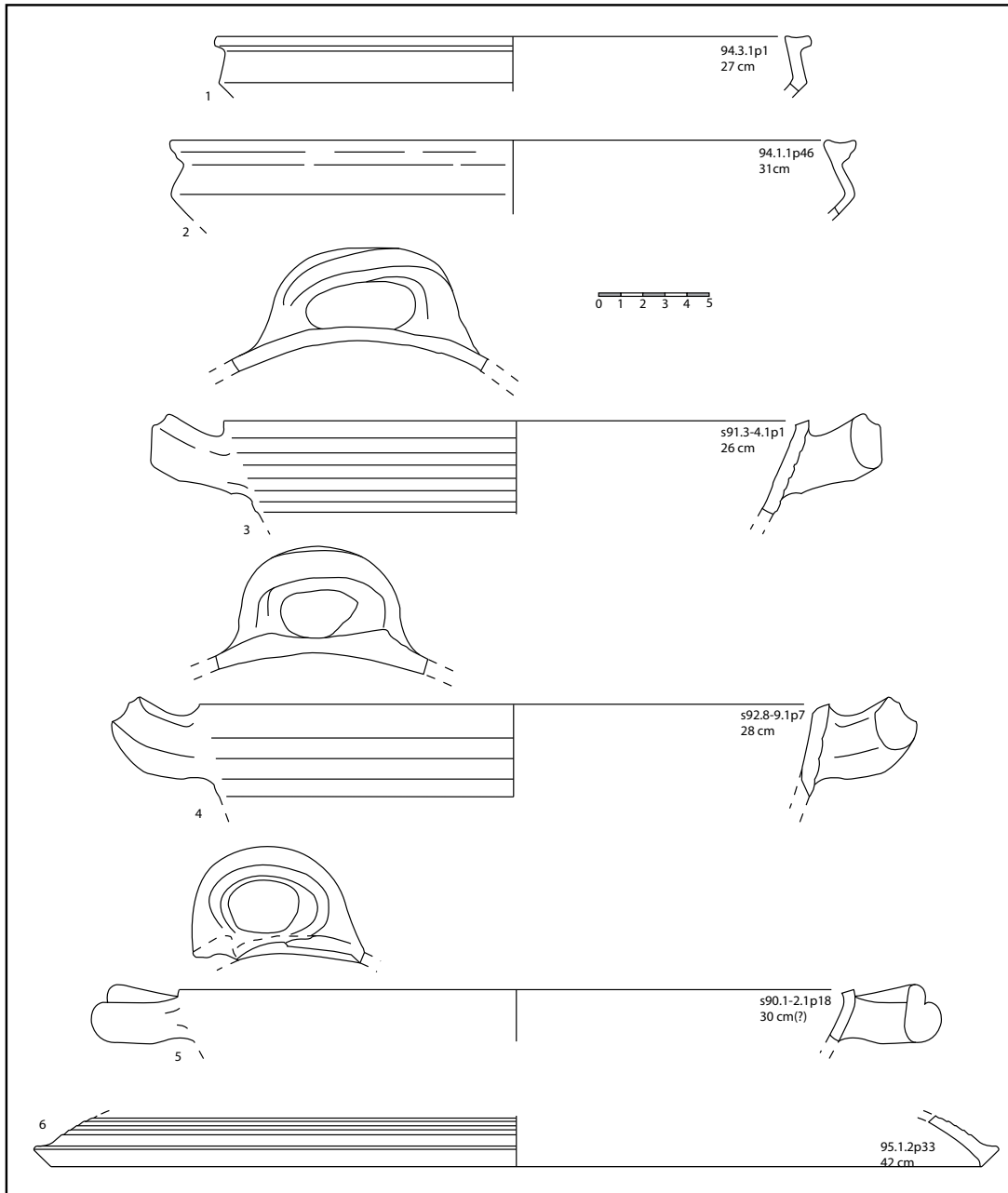


Figure 4.161 Cooking bowls

Cooking vessels

Several types of cooking vessel have been discovered. The most common type was the casserole e.g. s91.3-4.1p1. This is an open bowl with two horizontal handles and wire- or knife-cut rim. These bowls are often ribbed on the outside of their body, but not necessarily, e.g. s90.102.1p18. This type of casserole can be found at most southern Levantine sites of the Late Roman and Umayyad periods. They first appear in the late third/early fourth century AD evolving from a Roman predecessor and continue into the Umayyad period. Magness has categorized the Jerusalem examples as Casserole form 1 and describes a morphological trend through time (Magness 1993: 211). This development is, however, not a strict rule. Early Late Roman casseroles are in general relatively shallow, with rounded walls and thin handles twisted upwards above the rim. Later Late

THE SURVEY RESULTS

No.	Sherd no.	Parallels	Date	Remarks
1	91.4.1p19	Pella (Smith and Day 1989: pl.53:15) Pella (Smith et al. 1992: pl.110:3)	Late Roman Late Roman	Pella: 6th-early 7th Byz phase II: c. 500-525 AD
2	96.2.1p12	Pella (Smith and Day 1989: pl.51:8) Pella (McNicol et al. 1982: pl.138:10) Beth-Shean (Johnson 2006: fig.15.11:222)	Late Roman Late Roman Late Roman	Pella: 6th-early 7th
3	91.4.1p27	Pella (Smith and Day 1989: pl.51:13) Pella (Smith et al. 1992: pl.111:1) Beth-Shean (Johnson 2006: fig.15.11:225)	Late Roman Late Roman Late Roman	Pella: 6th-early 7th Byz phase IIIa: c. 525-550
4	92.3.1p3	Pella (Smith and Day 1989: pl.53:10) Beth-Shean (Johnson 2006: fig.15.11:222)	Late Roman Late Roman	Pella: 6th-early 7th
5	89.1.1p175	Pella (Smith and Day 1989: pl.53:10) Pella (Smith et al. 1992: pl.111:1)	Late Roman Late Roman	Pella: 6th-early 7th Byz phase IIIa: c. 525-550
6	91.9.1p5	Meiron str. IV-V (Meyers et al. 1981: pl.8.9:19) c. Pella (Smith et al. 1992: pl.110:6)	Rom/ L Rom Late Roman	250 – 365/365-650 AD c. 500-525 AD
7	92.2.1p5	Meiron str. IV (Meyers et al. 1981: pl.8.9:25)	(late) Rom	250–365 AD
8	91.9.1p9	Meiron str. IV (Meyers et al. 1981: pl.8.5:37)	(late) Rom	250–365 AD
9	94.3.1p1	Kefar Hananya 3B (Adan-Bayewitz 1993: 121:12) Jerash (Kehrborg 2007: fig.6:102)	(late) Rom (late) Rom	Cooking early 2nd- late 4th Kiln dump until late 2nd/early 3rd
10	94.1.1p46		L.Roman	Casserole
11	s90.1-2.1p18	Jerusalem (Magness 1993) Pella (Smith et al. 1992: pl.98:9)	Late Roman Late Roman	Casserole from 1 6th–early 7th
12	s91.3-4.1p1	Pella (Smith and Day 1989: pl.53:13)	Late Roman	Casserole form 1 6th-early 7th
13	s92.8-9.1p7	Pella (Smith et al. 1992: pl.109:8)	Late Roman	Casserole form 1; l.3rd/early 4th–8th/ 9thAD (Magness 1993: 211)
14	95.1.2p33	Pella (Smith and Day 1989: pl.51:3)	Late Roman	Casserole lid 6th-early 7th

Table 4.62 Cooking vessels belonging to both figures 4.161 and 4.162

Roman examples take on a variety of forms; both shallow and deep bowls occur and walls can be rounded, straight or angular. Final Late Roman and Umayyad bowls are usually deep with often slightly inverted walls and made from a dark brown ware (Magness 1993: 211).

The Roman cooking bowl from which these shapes derive was also discovered in the ‘Ammata concentration but in much lower quantities. Bowls 94.3.1p1 and 94.1.1p46 are good examples of the later Roman carinated casserole. Several specimens have been discovered at Kefar Hananya where they were described as a broad open cooking pot with a carinated shoulder, a round base and a rim diameter that is generally larger than 30 cm (Adan-Bayewitz 1993: 119). They occur throughout the entire region and are generally dated as existing from the early second to the late fourth century AD (Adan-Bayewitz 1993: 124).

Another type of Roman cooking pot is represented by 91.9.1p9 and 92.2.1p5. Both have parallels in the pottery from stratum IV at Meiron (Meyers et al. 1981: pl.8.5:37/8.9:25). This stratum has been dated to a late phase of the Roman period (250-365 AD) (Meyers et al. 1981: XVIII). Another parallel with Meiron is cooking jar 91.9.1p5. At Meiron this jar is referred to as stemming from stratum IV/V (Meyers et al. 1981: 8.9:19). Stratum V largely covers the Late Roman and Umayyad periods (365-750 AD), giving this jar a very broad date range of *c.* 500 years. A similar shape has been discovered at Pella in the second Late Roman phase (Smith et al. 1992: pl.110:6). This phase has been dated to the first quarter of the sixth century AD (Smith et al. 1992: 174).

The other cooking jars (96.2.1p12, 91.4.1p27, 92.3.1p3, 89.1.1p175, and 91.4.1p19) discovered in this concentration can be regarded as the jar-shaped equivalent of the casserole. They are almost as numerous and equally date to the Late Roman period with some examples continuing into the Umayyad era (Smith and Day 1989: 223, pl.51,58:12). In the Pella publication they are referred to as neckless cooking jars and regarded as a development from the Roman cooking jar. This Roman jar has a neck, which is folded outward in the Late Roman period and becomes more and more compressed at the top and outside of the rim as time passes (Smith et al. 1992: 223). In area II/IV at Pella the neckless cooking jar with a folded rim but without a compressed top appears in the second Late Roman phase dating to the first quarter of the sixth century AD (Smith et al. 1992: 174).

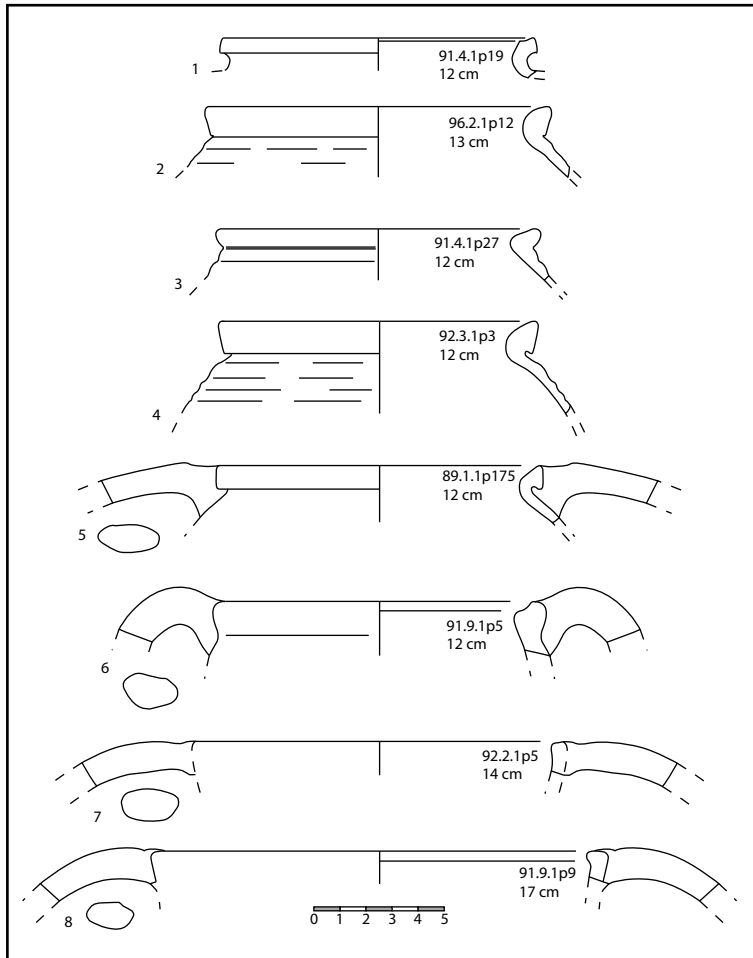


Figure 4.162 Cooking jars

Only in phase IIa (second quarter sixth century AD) does the rim become compressed (Smith et al. 1992: 175). Seen from this perspective jars 91.4.1p27 and 89.1.1p175 might be later than the more rounded rimmed jars 96.2.1p12 and 92.3.1p3, but both types continue until the end of the Late Roman period and possibly even into the Umayyad period. Other excavations date these vessels to the Late Roman period as a whole without making chronological distinctions (e.g. Johnson 2006).

Miscellaneous

A few sherds deriving from so-called Syrian mortaria have been discovered. These are generally regarded as imports from Syria and occur at several Late Roman sites in the southern Levant, e.g. Pella, Beth-Shean, Capernaum, Caesarea (see table) (Loffreda 1974; Johnson 2006: fig.15.10:215). Hayes first identified the place of production of this type of mortarium as Ras el-Bassit and dated it to the third and early fourth century AD (Hayes 1967: 342). Discoveries of mortaria since then have extended the date into the first half of the eighth century AD (Johnson 2006: 547). None of the sherds discovered have stamps showing the potter's name in Greek writing common on the larger bowls of this group.

Another special type of vessel is the base of an unguentarium (91.3.1p66). It is made from a buff/light brown micaceous ware. A morphologically very similar base also made from a micaceous ware has been uncovered within the late Late Roman layers at Pella (Smith and Day 1989: pl. 50:5). This base was most likely imported from Egypt judging by its ware (Smith and Day 1989: 106). It differs from 91.3.1p66 in that it is dark red instead of light brown. Four micaceous sherds

from Late Roman Caesarea, however, are of an orange to brown colour (Magness 1992: 132). It is possible that this unguentarium base is related to these specimens, but no further identification seems possible.

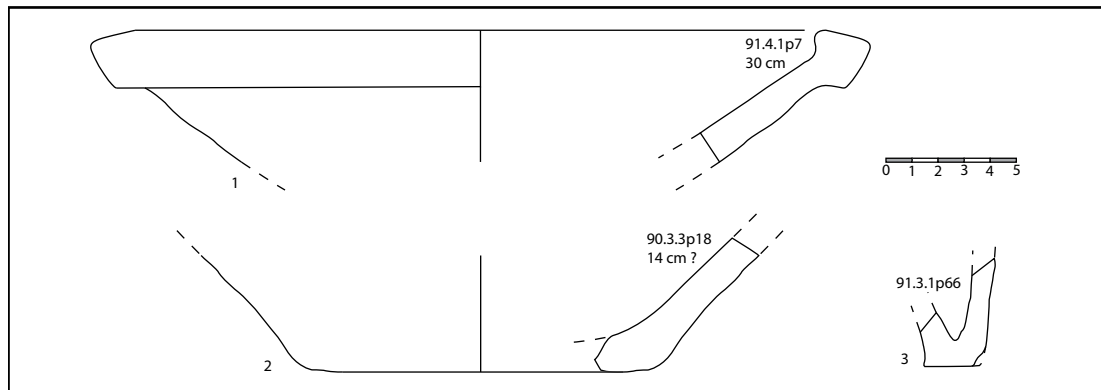


Figure 4.163 Miscellaneous

No.	Sherd no.	Parallels	Date	Remarks
1	91.4.1p7	Pella (Smith and Day 1989: pl.49:10) Beth Shean (Johnson 2006: fig.15.10:215)	Late Roman Late Roman	6th-early 7th Syrian Mortarium 3rd – mid-8th AD
2	90.3.3p18	Pella (Smith and Day 1989: pl.49:12)	Late Roman	6th-early 7th Syrian Mortarium
3	91.3.1p66	Caesarea (Magness 1992: 132) Pella (Smith and Day 1989: pl. 50:5)	Late Roman Late Roman	Base unguentarium

Table 4.63 Miscellaneous

Basins

A often occurring and conspicuous sherd type that was discovered derives from a large basin. Large fragments of a simple hand-made, straight walled basin were discovered throughout the concentration.⁶⁷ The basin has a simple, rounded rim, often slightly flattened on the top. Rim diameters are large, with an average of \approx 45 cm, but diameters of more than 60 cm also occur. All basins are made from the same light coloured buff, brown, orange or pinkish coarse terracotta ware, often having a (dark) grey core. The many flat bases in the same ware and exhibit the same production technique in all likelihood form the lower part of these basins. All bases have sand impressions on their bottom. No handles have been found in this ware. Both rims and bases have walls of uneven thickness and clear traces of differentially pressurized areas. These basins were evidently made quickly with little care for external finishing.

In the ‘Ammata concentration 48 feature sherds of these great basins have been collected, but many more body sherds have been discovered. Compared to the number of other identifiable vessel categories this is a considerable group. A few parallels for this vessel have been found at Pella and Capernaum. At Pella very similar basins have been discovered in both the Late Roman and Umayyad phases (see table below) (McNicoll et al. 1982). They first appear in phase IIIa of the Late Roman period (Smith et al. 1992: 176). These vessels are morphologically sound parallels and the ware is described as a coarse terracotta ware, which is similar to the ‘Ammata basins. Smith says that their ware is so similar to that of tiles that these basins were initially mistaken for them (Smith 1973: 225). This resemblance to tiles is also recognized in the ‘Ammata concentration. At Pella another, related type of large basin is present in this period. These basins are equally large, have the same general shape, but the rim seems to have been compressed at its top forming a rounded

⁶⁷ These basins have been referred to in the database as LSB, which stands for Large Straight Basin.

groove. These basins are made from a coarse chaff-tempered ware. This type of basin is absent in the 'Ammata concentration. A morphologically similar basin has been excavated from early Late Roman layers at Capernaum (type D45) (Loffreda 1974: fig.14:12-14).

Although very similar basins have been found at these excavated sites, their publications do not point to equally large numbers being uncovered. Their simple unremarkable shape may have caused them to be underrepresented in publications, but their total absence at most sites must be taken as representing reality.

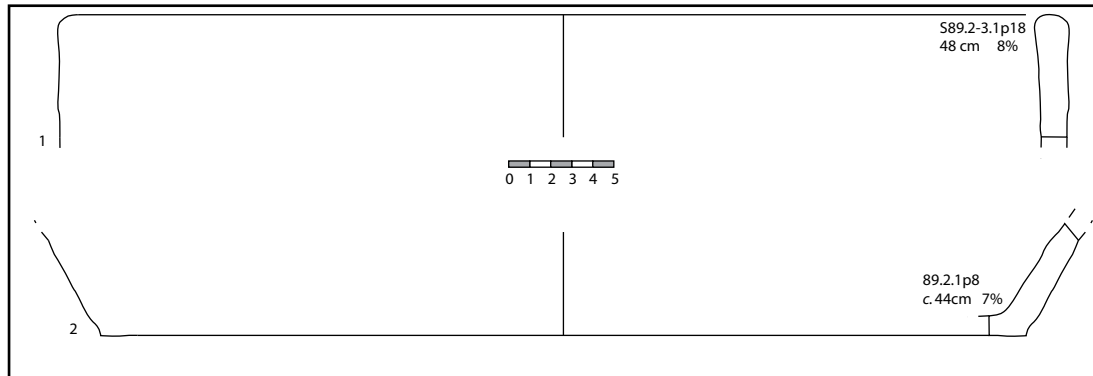


Figure 4.164 Basins

No.	Sherd no.	Parallels	Date	Remarks
1	91.4.1p7	Pella (Smith and Day 1989: pl.49:10) Beth Shean (Johnson 2006: fig.15.10:215)	Late Roman Late Roman	6th-early 7th Syrian Mortarium 3rd – mid-8th AD
2	90.3.3p18	Pella (Smith and Day 1989: pl.49:12)	Late Roman	6th-early 7th Syrian Mortarium
3	91.3.1p66	Caesarea (Magness 1992: 132) Pella (Smith and Day 1989: pl. 50:5)	Late Roman Late Roman	Base unguentarium

Table 4.64 Basins

Pottery chronology and function

If the total assemblage as recorded in the database is considered the relative frequencies of datable sherds per period can be calculated. In the fields that form the centre of the concentration, i.e. fields 89-93 and 95-96, a total of 2716 feature sherds were discovered. A large share of these feature sherds was made up of ribbed body sherds that probably mainly date to the Late Roman period. Essentially these sherds are body sherds and should, therefore, not be included as body sherds from other periods like e.g. the Hellenistic period are not diagnostic and, therefore, not regarded as feature sherds. When these ribbed sherds are left out of the equation a total of 1267 feature sherds remains. Table 4.65 gives the relative frequencies of the sherds identified to periods.

Relative frequencies periods (N = 1267)	
Undated	18 %
Roman or later	40 %
Iron Age	<1 %
Hellenistic	2 %
Roman	9 %
Roman/Late Roman	9 %
Late Roman	12 %
Late Roman/Umayyad	8 %
Islamic	1 %

Table 4.65 Periodization of feature sherds discovered in the 'Ammata concentration

A number of comments should be made about this table. It is certain that this table does not represent the relative intensity of occupation per period at the site. Older layers have been subject to more biases than those of younger date. Older layers are, for example, buried deeper and artefacts have a smaller chance of ending up at the surface. Artefacts from older layers, furthermore, have a longer period of existence and have been subject to more deteriorative factors. The numbers of Iron Age and Hellenistic sherds might, therefore, once have been greater than appear in this table. Nevertheless, their numbers are so small, especially when the ribbed body sherds are taken into consideration as well, that these sherds most likely do not represent occupational activities at this location. Their numbers fall within the normal range of pottery spread around tells by post-depositional factors. It is more likely that they represent the remains of activities carried out in the fields by people living on Tell 'Ammata. The 'Settling the Steppe' excavations at this tell have shown that it was extensively occupied during these periods (Petit in prep.). The same hypothesis applies to the small Islamic presence, mainly represented by a few glazed sherds. Both excavations and historical sources have shown that Tell 'Ammata was occupied during the Ayyubid/Mamluk periods (Petit in prep.; Le Strange 1965: 393).

The larger proportions of sherds dating to the Roman, Late Roman and Umayyad periods correspond to the well datable drawn sherds. Inferring from these securely dated sherds it seems warranted to state that the majority of the Roman sherds dates to the later part of that period (see above). The Late Roman period is clearly the most ubiquitous period present in the pottery assemblage of this concentration. A large part of the pottery provisionally dated to the Roman/Late Roman period will probably date to the Late Roman period. Similarly a high percentage of the Late Roman/Umayyad group likely belongs to the Late Roman period. This group mainly consists of casseroles and the large straight basins that occur in both periods. As many of the Late Roman vessels continue into the Umayyad period and only a few shapes occur that date restrictedly to the Umayyad period, it was often difficult to separate the two periods in this concentration, e.g. regarding the cooking pots. Although typical Umayyad vessels and features have been identified it is difficult to determine the proportion the Umayyad remains represent in the entire assemblage. The short duration and limited change within the Umayyad periods makes it impossible to securely establish the end date of this concentration, but it was clearly somewhere within or at the end of the Umayyad period.

Although the original type of vessels to which sherds belonged could often not be ascertained, it is possible to advance a hypothesis about the character of the concentration. Unfortunately, it is impossible to give percentages of the vessel types discovered. Many of the rims could only be identified on a very general level; i.e. open (bowl) or closed (jar). Furthermore, some vessels are better recognisable than other; casseroles, for example, are identifiable by their rim, their ware and their horizontal handles. Given these biases and the small number of securely identified vessel types no percentages are given, but one is referred to the database for more detailed information. Nevertheless, some conclusions can be drawn about the activities carried out at this location. For the Roman, Late Roman and Umayyad periods cooking pots have been discovered in considerable quantities. For example, as many as 50 identifiable casserole rims and handles and a slightly lower amount of cooking jars ($n = 15$) were discovered, showing cooking took place at this location. Together the cooking vessels made up 19 % of the identifiable assemblage. The 79 fragments of RSW show that during the Late Roman period food was served here as well. Serving vessels amounted to 23 %. The typical Late Roman/Umayyad jar was discovered in large quantities (153 from all periods) pointing to a considerable storage and possibly trade function as these vessels were used in both activities. Furthermore, there are indications that the 48 large straight-sided basins discovered might have been connected to short-term domestic storage (see section below on Tell 'Abū al-N'eim). The storage jars and large basins together make up 58 % of the assemblage. Together these sherds show that domestic activities like cooking, eating and storage undoubtedly took place at this location. The percentages given to the separate activities like cooking, serving and storing should, however, not be relied upon too heavily as they derive from a proportional comparison within this group. Vessels that could not be identified with some precision are not incorporated in this group but together these 'undiagnostic' vessels form a very sizable group.

Indications for other (industrial or craft) activities have not been discovered on a large scale. Some craft production might of course have occurred, but it was not so abundant as to be visible in the survey assemblage. Based on the pottery assemblage this concentration can, therefore, be interpreted as representing village occupation during the later part of the Roman, Late Roman and Umayyad period.

Conclusion

The pottery leads to the conclusion that the surveyed concentration represents village occupation layers from the (Late) Roman, Late Roman and probably Umayyad periods buried in the subsurface. The tesserae in different colours show mosaic floors of a certain level of sophistication were present. Furthermore the roof tiles, glass fragments and polished marble slabs point to some level of luxury not typical of small agricultural villages. A part of the settlement may, therefore, have seen a slightly higher level of luxury perhaps in the form of a wealthy person's villa. Whether this more opulent portion of the settlement took the form of a church, which the modern inhabitants claim to have found, or of a villa remains unknown and can only be ascertained by future excavations.

The discovery of pottery dating to the later part of the Roman period is quite remarkable as this period has not been encountered in the excavations of the tell nor in any of the recent surveys (Mittmann 1987: 51; Ibrahim et al. 1988b: 169-170; Petit in prep.). Early Roman period finds have been discovered but only in small quantities (Ibrahim et al. 1988b: 169-170; Petit in prep.). This might mean that Tell 'Ammata was not inhabited during the later part of the Roman period or that the extent of the occupation was very limited. This absence of later Roman period remains on the tell stands in contrast to occupation development of the flat surface site to the south where undisputed Roman period pottery has been found deriving from the earlier but especially from the later part of that period.

The Late Roman period, however, has been amply attested on the surface of Tell 'Ammata. As much as 76 % of the sherds collected in the survey of Tell 'Ammata could be dated to the Late Roman period (Petit in prep.). The pottery from the Iron Age II period only amounted to 3 % and the Hellenistic pottery formed 12 % of the assemblage. The excavations have shown, however, that both the Iron II and the Hellenistic occupation of the tell was quite intensive. The Late Roman layers covering it clearly masked the importance of the earlier periods at the tell. The same problem of course occurs in survey concentrations. This makes it difficult to determine whether the low frequencies of Hellenistic and Iron Age pottery represent buried occupation layers or are part of the normal 'spill' around a tell in this region. Although no conclusive answer can be given without excavation, the very low absolute numbers of sherds from these periods do not allow the interpretation of buried remains. The pottery of the latest phase dating to Ayyubid/Mamluk period formed only 8 % on the surface, showing this occupation was clearly smaller than that of the lower Late Roman period. This period is completely absent from the concentration.

Judging by the pottery the concentration forms some sort of border zone between the northern and the southern regions. As described above this region represents the southernmost extension of the Galilean bowl or Kfar Hananya ware. After the occurrence of this bowl the arched-rim bowl is found here. This is a typical southern pottery type first identified in Jerusalem. It is, for example, absent at Pella. Jericho in the south, however, does have the arched-rim bowl, but here the Galilean bowl is lacking (Magness 1993: fig. 7). In the Late Roman network of contacts that influenced the Palestinian amphora the 'Ammata concentration seems to have been part of the northern network. Apparently the Zerqa Triangle lay at the junction of both spheres of influence during these periods. The relatively distant north- and southward movements of pottery may have been induced by the Roman (and later) road that passed through the Jordan Valley. Several milestones have been discovered in this part of the Jordan Valley. Two are located in the research area and could be dated to 181/182 AD by their inscriptions (Mittmann 1970; O'Hea 2002). They were probably erected when the road was restored. This was one of the larger well-paved roads in the country, as shown by a stretch of the original pavement discovered at 'Abū al-Zīghān (Mallon et al.

1934; Mittmann 1965: 86). These roads greatly improved the possibilities of transport and regions became more tightly interconnected. The fact that 'Ammata lay along this road might explain why pottery from both the north and the south met at this site.

A topic that cannot be ignored when discussing Tell 'Ammata is its identification with the historical city of Amathous. A town called Amathous, 'Ammata or 'Amta appears in historical sources in three periods. Flavius Josephus makes mention of a Hellenistic town called Amathous, which 'was the strongest of all the fortresses above Jordan' (Josephus 1981: 39). It will be clear from the size and excavated building remains at Tell 'Ammata and its location, that this site is very unlikely to be the Hellenistic Amathous.⁶⁸ A second source mentioning a town called Amathous is Eusebius (c. 349-420 AD). In his *Onomasticon* he describes Ammathous as a village 21 miles south of Pella (Eusebius et al. 2005: 24). This site is likewise often considered to be Tell 'Ammata. Mittmann argues that it can, therefore, not be identified by Tell 'Ammata as this is located only 17 miles south of Pella. He positions Eusebius' Ammathous to the east of Tell Deir 'Allā in the area of Tell al-Hammeh East and West, but by the lack of large-scale Late Roman remains at these sites argues it must have been Tell 'Abū al-Zīghān where he claims to have discovered Late Roman remains (Mittmann 1987: 54). Excavations and survey of 'Abū al-Zīghān have, however, not revealed extensive Late Roman remains. Thus Mittmann's identification seems untenable, but he convincingly demonstrated the serious doubts that should be attached to the identification of Tell 'Ammata as Ammathous. The third period in which historical sources mention a city called 'Ammata or Amta is the Islamic period. In 1154 AD the Arab geographer Idrisi described 'Amta together with Ariha (Jericho) and Beisan as one of the finest cities in the Ghor (Le Strange 1965: 31). Yakut wrote in 1225 that 'Amta is a town in the middle of the Ghor where the tomb of 'Abū 'Ubaydah is located. It is supposed to be 12 leagues from Tabariyyah.⁶⁹ As a further characteristic he added that excellent arrows were manufactured here (Le Strange 1965: 393). These descriptions might denote Tell 'Ammata, which was occupied during this period and lies close to 'Abū 'Ubaydah.

Historical sources from three different periods have pointed towards the Zerqa Triangle for the location of a city called Ammathous or 'Amta. It is possible that in these periods not only a town but the whole region was referred to by this name. Josephus says, for example, that Gabinius divided the whole region in five districts, one of which was called Ammathous. In the late sixth century AD Ap(m)athous is referred to as one of four districts and its description seems to position it in this area (Mittmann 1987: 52). In the Islamic period Yakut mentions that the district 'Ammata is located in the Ghor north of the Dāmiyah district (which is the southern part of the research area) (Mittmann 1987: 52). This it seems that during the last millennium the Zerqa Triangle was known as the 'Ammata region and the location of the city 'Ammata may have differed per period.

The reason for the end of the occupation of Tell 'Ammata and the site south of the Wadi Rajib is unknown. Neither the survey nor the excavation provided information on this topic. Occupation continued into the Umayyad period, but the precise moment that these sites were abandoned is not clear. If the occupation continued until the end of the Umayyad period any buildings existing will probably have been damaged in the earthquake of 749 AD. This well-recorded earthquake damaged large parts of the southern Levant (Amiran et al. 1994: 266,267). The excavations at Pella have identified severe destruction that could be related to this earthquake (Smith and Day 1989). Pella was not immediately rebuilt. The same course of events might have taken place at this concentration, but this type of reasoning is of course pure conjecture.

Preservation and threat

The limited level of abrasion and the often still large size of the sherds (pieces of more than 10 cm were by no means an exception) suggests that the pottery had not been on the surface long. The quite nucleated nature of the concentration showing the highest artefact densities in areas bordering on the Wadi Rajib and a fast decrease in densities when moving farther south show that little

68 Tell Mughanni located up the hill north of Tell Hammeh East has often been regarded as a likely candidate (Mittmann 1987: 56).

69 Tabariyyah = modern Tiberias, 1 league or farsah is the equivalent of c. 6 km, which makes 72 km. Tell Ammata is located c. 76 km from modern Tiberias as the crow flies.

horizontal movement has occurred. These factors suggest that occupation layers might still be present within the subsoil. Most likely they are within reach of today's motorized ploughs making ploughing a serious threat for the existence and preservation of the site. The increased construction of houses on this side of the wadi also poses a risk to the site. At the time of surveying a new house was being built immediately west of the so-called 'Byzantine church' area. The nature of this area today, with bulldozer dumps and holes, makes it a likely candidate for future construction activities, especially because all surrounding areas are used for agriculture. The only comfort in this regard is the clear interest and awareness of their archaeological heritage the local inhabitants displayed. Aided by the right stimulation by institutions like the Department of Antiquities, this might strengthen the chances of preservation of this archaeological site.

Field no.: 250-254 and 258-260

Toponym: East of Deir 'Allā
 Coordinates: 747,550/3,565,400
 Size: c. 150 x 150 m
 Days and time surveyed: Sep. 28th,
 Oct. 1st-2nd, 2006,
 c. 35 man-hours
 Periods discovered: Hellenistic, Roman,
 Late Roman, Umayyad

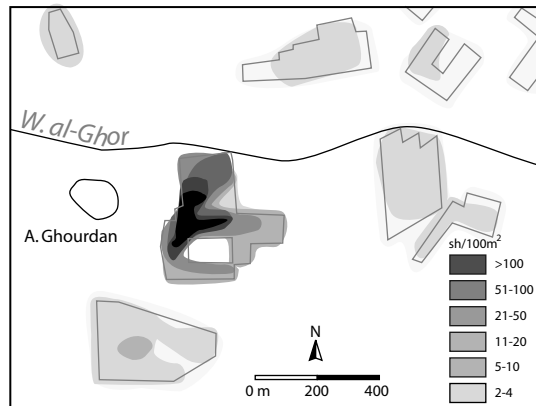


Figure 4.165 Distribution of ribbed sherds

Description

About 300 m east of Tell Deir 'Allā a dense pottery concentration was discovered. Densities of c. 700 sherds per 100 m² were discovered in the densest area of the concentration. Already in the field it was realized that the concentration was actually two partially overlapping concentrations of different dates. The southern concentrations turned out to be primarily Roman and Late Roman in date, while the northern concentration mainly consisted of Mamluk sugar pottery sherds. The Mamluk concentration is described separately in a later section.

This site was not reported by Glueck or the EJVS and does not appear in JADIS. Franken, however, mentioned that a large Late Roman settlement is located east of Tall Abu Ghourdan, but gave no further details (Franken 1960: 392). It seems likely that Franken was referring to this very concentration.

A modern farm villa is located on top of a little rise just next to the concentration.⁷⁰ The men working the land surrounding it had discovered several column bases, drums, and capitals together with grinding stones and other hewn stones and had used them as terrace decoration. None of the capitals were the same. One was of the Corinthian order and had stylized acanthus leaves, while two others belonged to the Doric order. Two further capitals were without decoration. One large column base was found. Together with the drums these capitals make clear that at least five columns once stood at this location. There is some evidence that a number of these columns might have survived in an upright position for several centuries. In a travel description written in 1901, frère Abel mentioned passing some columns just before reaching Deir 'Allā (Abel 1910: 555). On a British military map from 1918 the presence of pillars is marked to the east of Tell Deir 'Allā.

Other rather exceptional finds were the pieces of polished marble slab discovered in some of the plots. The presence of marble in this area and the care that had been taken in polishing it shows this concentration must represent something more significant than a simple farmer's shed.

⁷⁰ Most likely it has been built on the centre of the concentration, but as it was impossible to survey this area or the road immediately to its south we were unable to determine this.

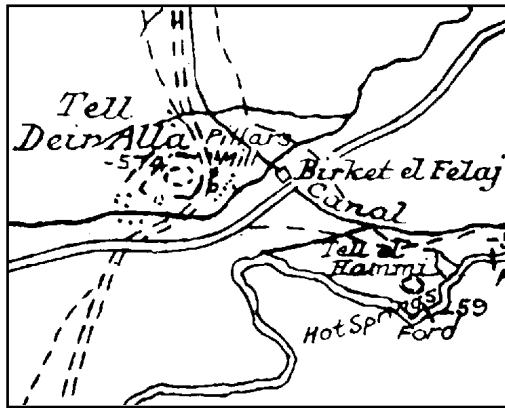


Figure 4.166 British map of 1918 marking the presence of pillars east of Tell Deir 'Allā

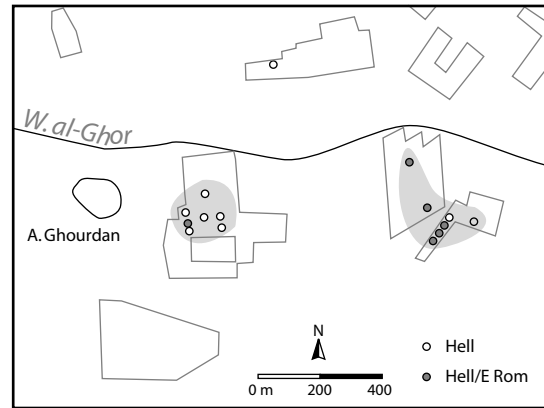


Figure 4.167 Distribution of Hellenistic feature sherds

The pottery discovered at this concentration stems from several periods. The oldest clustering remains discovered at this location date to the Hellenistic period. As was already discussed in a previous chapter the number of Hellenistic sherds discovered was very low. This is typical for the period. The fact, however, that the Hellenistic sherds discovered in these fields cluster together quite tightly has led to the belief that this area harbours a site from this period (see previous section). Some of the few identifiable sherds from this period have been drawn and these are discussed below. A cluster from the Roman period with higher densities was discovered (see figure 4.168). Although many more sherds were discovered than in the Hellenistic cluster, densities are still not very high. The highest number of identifiable feature sherds in one plot was only five, which gives a density of 10 sh/100 m². It should, however, be kept in mind that these are only the well identifiable sherds and that many more sherds were found that could only be dated Roman/Late Roman or 'Roman or later'. Actual densities are, therefore, probably significantly higher and more detailed study including ware analysis will probably identify more sherds from this period. The centre of the Roman concentration is, however, very similar to the area in which the Hellenistic sherds were found. This is also the area in which the densest part of the Late Roman concentration was found. Densities are higher in this period with up to 22 sherds per plot and average top densities of 20 to 25 sh/100 m². Similar to the Roman period concentration different hotspots of higher densities are visible. These, however, probably result from biases like the different collection rate of surveyors, modern agricultural and building activities and the disturbance as a result of the later site at this location. The surroundings of the site are seemingly empty in the Late Roman period. This is, however, not the case. The ubiquitous ribbed body sherds depicted in figure 4.165 mostly stem from this period. Rather than empty, the landscape is in fact replete with remains from the Late Roman period.

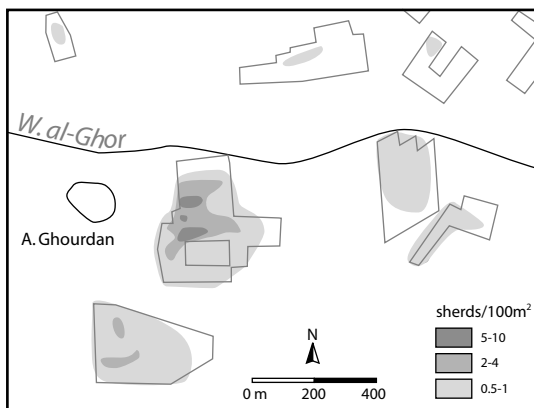


Figure 4.168 Distribution of Roman feature sherds

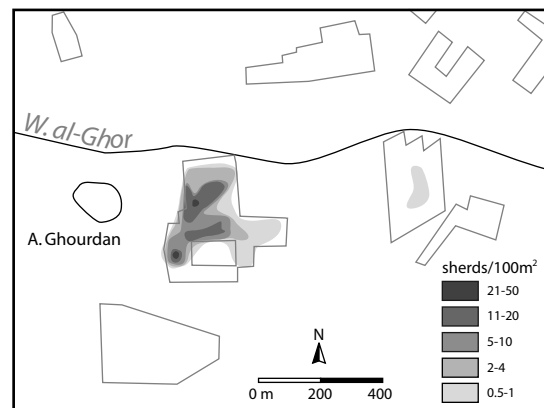


Figure 4.169 Distribution of Late Roman feature sherds

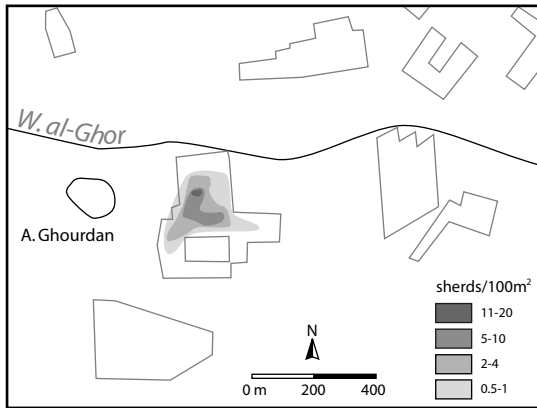


Figure 4.170 Distribution of glass fragments

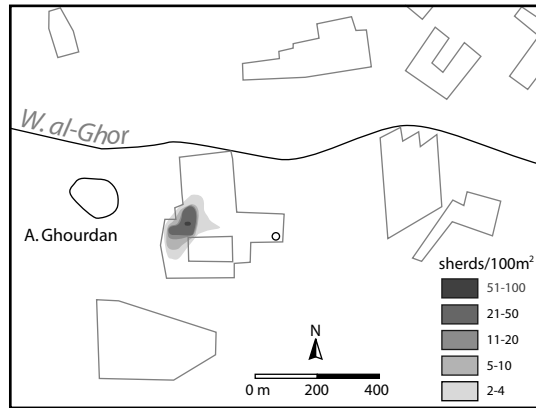


Figure 4.171 Distribution of tesserae

Other finds

The distributions of both the mosaic stones and glass fragments show an equally clear concentration as the pottery. In figures 4.170 and 4.171 the density distribution of tesserae and glass fragments are depicted. The distribution of tesserae is centred on the same plots as the pottery. Most tesserae are rectangular in shape averaging around 1.3 x 1.3 x 1cm and made from cream coloured limestone. Only a small percentage had a darker grey or brownish colour. Irregular or larger examples (e.g. 2 x 1.8 x 1.2 cm) do, however, also occur occasionally. The total number of 188 pieces of tesserae, recovered from a limited area, suggests that a significant piece of floor was paved with mosaic stones at this location. Three pieces were still connected to each other by the mortar in which they were once fitted (252.1.1m13t). The absence of different coloured stones and the relatively large size of the tesserae show that these pieces formed a simple floor with very limited designs.

The fragments of glass that have been discovered are very similar to the fragments discovered in the ‘Ammata concentration. These fragments are all of turquoise to greenish blue colour and contain air holes. The fragments include rims and folded rims like in the ‘Ammata concentration, bases, among which a typical square base of a Roman flask, and elaborate handles containing many folds. A total of 60 glass fragments was found among including 3 bases, 4 handles and 17 rims predominantly of bowls but also of flasks and juglets. One bracelet was found but this probably belongs to the overlapping Mamluk concentration. The overlap between these two sites makes it problematic to determine the period to which these finds belong. The majority of the finds seems to date to the Roman and Late Roman period, but only more detailed analysis can confirm this hypothesis.

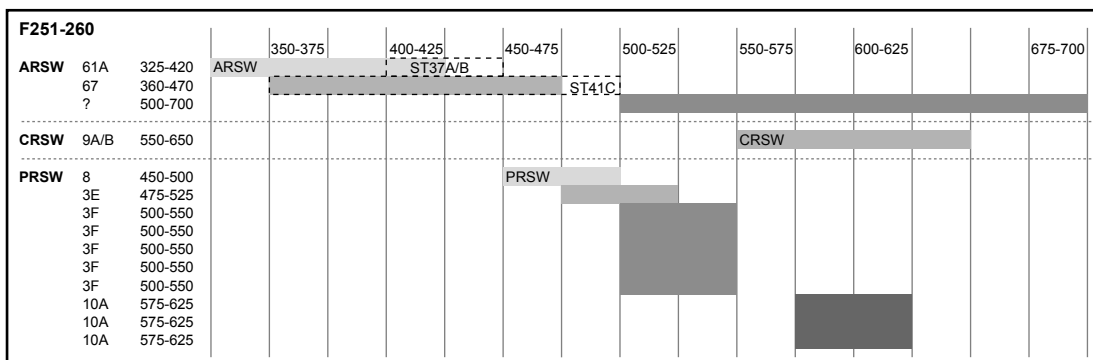


Figure 4.172 RSW (dotted areas are dates and types given by Bonifay)

Pottery

Red Slip Ware⁷¹

A total of 19 sherds of imported red slipped tableware have been discovered. Three pieces of PRSW and two fragments ARSW could not be retraced to their specific form type as classified by Hayes (Hayes 1972; Hayes 1980). The other forms have been arranged according to production centre and date (figure 4.172).

The tableware discovered here was produced in a period starting around the second quarter of the fourth century AD and ending somewhere in the mid-seventh century. These production dates do of course not mean this pottery could not have been used in the concentration after this date. As in the ‘Ammata concentration, the PRSW predominates (12 PRSW versus 1 CRSW and 5 ARSW). The low number of CRSW, the type that outnumbered the ARSW in the ‘Ammata concentration, might be attributable to the high level of bias present when dealing with such low numbers.

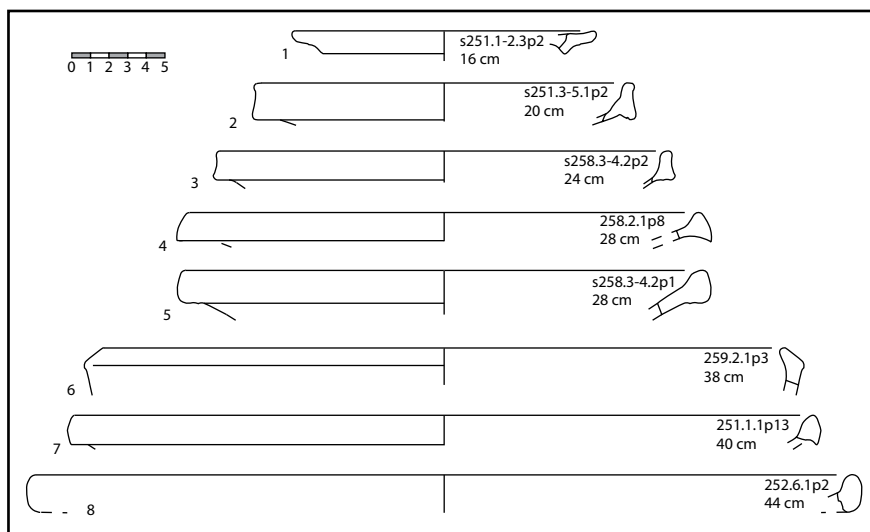


Figure 4.173 RSW

No.	Sherd no.	Parallels	Date	Remarks
1	s251.1-2.3p2	(Hayes 1972: 342, fig.70:1-2)	Late Roman	PRSW 8
2	s251.3-5.1p2	(Hayes 1972: 333, fig.68:14-16)	Late Roman	PRSW 3E
3	s258.3-4.2p2	(Hayes 1972: 333, fig.69:17-26)	Late Roman	PRSW 3F
4	258.2.1p8	(Hayes 1972: 343-345, fig.71)	Late Roman	PRSW 10A
5	s258.3-4.2p1	idem	Late Roman	PRSW 10A
6	259.2.1p3	(Hayes 1972: 100, fig.17, 18) (Bonifay 2004: fig.90)	Late Roman	ARSW 61A ST37A/B
7	251.1.1p13	(Hayes 1972: 379-382, fig.81,82)	Late Roman	CRSW 9A/(B)
8	250.2.1p14			
9	252.6.1p2	(Hayes 1972: 160-166, fig.30) (Bonifay 2004: fig.fig.108)	Late Roman	ARSW 104 a/b ST56A

Table 4.66 RSW

71 For more detailed information on Red Slip Wares one is referred to the section on the Ammata concentration above.

Bowls

The bowls are a diverse group generally dating to both the (late) Roman and Late Roman periods. Two larger groups can be distinguished. First are the Galilean bowls. This group of dark red, hard fired ware with considerable quantities of small temper is morphologically characterized by a widening rim with two grooves on top. A similar type of bowl, referred to as form IB, was manufactured at Kefar Hananya and from there distributed over most of the Galilee (Adan-Bayewitz 1993: 91). In the Galilee area it is commonly found in second and third century contexts and its latest occurrence is dated to the fourth century (Adan-Bayewitz 1993: 95). Given the lack of petrographic analysis, a positive identification is not possible. If these bowls indeed belong to the Kefar Hananya ware they would, together with the examples discovered in the 'Ammata concentration, represent the southernmost occurrence of this vessel type.

The second group of bowls are the so-called 'arched-rim bowls'. Magness has classified this group within the Jerusalem assemblage as 'arched-rim bowls form 1' (Magness 1993: 204). At Jerusalem they occur from the late third/early fourth to the sixth century AD. This type of bowl is common in the area around Jerusalem, but also occurs further north at sites like Jericho and Amman (Olávarri-Goicoechea 1985; Magness 1993: map 7). In the northern areas of the southern Levant this type of bowl is absent, e.g. at Pella or Beth-Shean (Smith and Day 1989; Johnson 2006).

The other bowls discovered in this concentration form a less homogeneous group. Bowls 251.4.1p3 and 252.2.2p1 can both be considered local imitations of originally imported Roman sigillata cups and bowls, although they are made from a light coloured buff/beige ware. These local imitations differ both in ware and in morphology, but their general shape with the sharp, almost protruding carination on which they were inspired is easily recognizable. These bowls are common

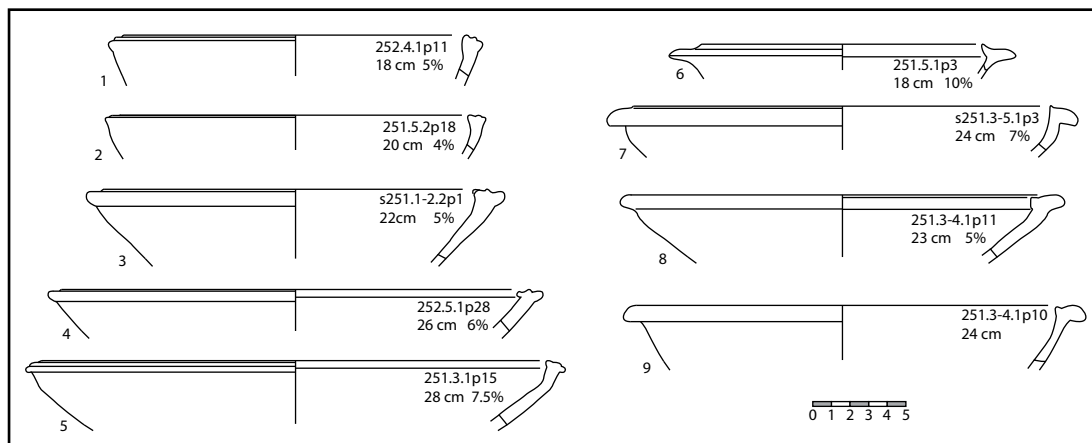


Figure 4.174 Galilean and arched-rim bowls

No.	Sherd no.	Parallels	Date	Remarks
1	252.4.1p11	Kefar Hananya (Adan-Bayewitz 1993: 91) Capernaum (Loffreda 1974)	(late) Roman (late) Roman	Form 1B, common Galilee 2nd+3th, latest 4th AD Type A12: 123 – 300 AD
2	251.5.2p18	Idem	(late) Roman	
3	s251.1-2.2p1	Kefar Hananya (Adan-Bayewitz 1993: 91) c. Yoqneam (Avisar 2005b: fig.2.9:1,2) Jerash (Kehrberg 2007: fig.6:97,99)	(late) Roman Roman/L Rom (late) Roman	Form 1B, common Galilee 2nd+3th, latest 4th AD Dump until late 2nd/early 3rd
4	252.5.1p28	Kefar Hananya (Adan-Bayewitz 1993: 91) Capernaum (Loffreda 1974)	(late) Roman (late) Roman	Form 1B, common Galilee 2nd+3th, latest 4th AD Type A12: 123 – 300 AD
5	251.3.1p15	Kefar Hananya (Adan-Bayewitz 1993: 91)	(late) Roman	Form 1B, common Galilee 2nd+3th, latest 4th AD

Table 4.67 Galilean bowls

THE SURVEY RESULTS

No.	Sherd no.	Parallels	Date	Remarks
6	251.5.1p3	e.g. Jerusalem (Magness 1993: 204)	Late Roman	Arched-rimmed basins form 1 Late 3rd/early 4th – 6th
7	s251.3-5.1p3	idem	Late Roman	
8	s251.3-4.1p11	Idem Amman (Olávarri-Goicoechea 1985: fig.7:18)	Late Roman (early) L Rom	
9	s251.3-4.1p10	Idem	Late Roman	

Table 4.68 Arched-rim basins

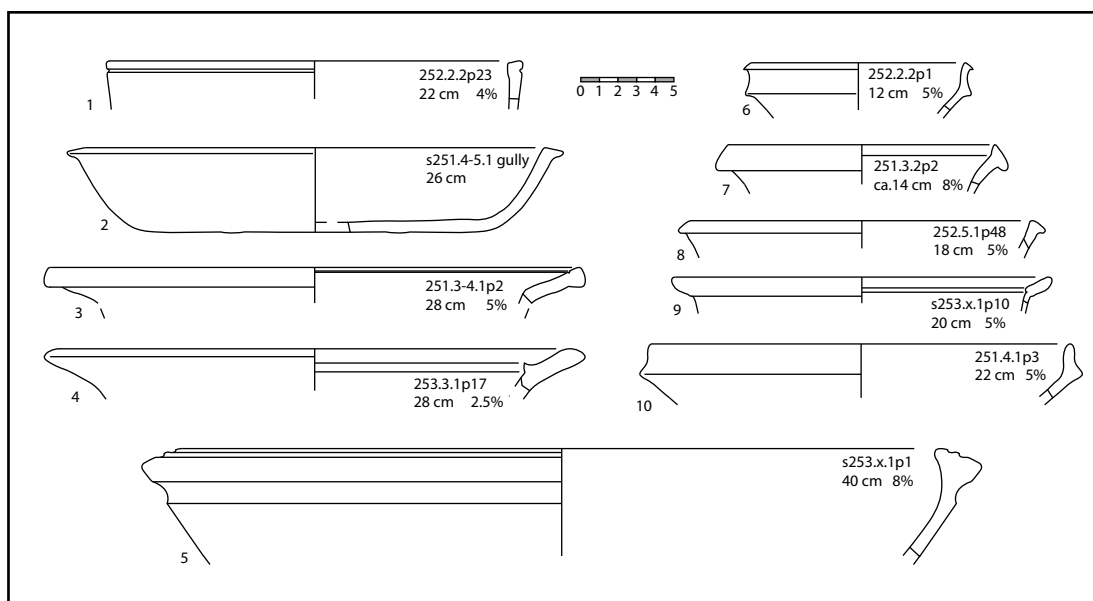


Figure 4.175 Bowls

No.	Sherd no.	Parallels	Date	Remarks
1	252.2.2p23	Jerash (Kehrborg 2007: fig.2:14, 4:60)	(late) Roman	
2	s251.4-5.1 gully	Jerash (Kehrborg 2007: fig.10:60,61)	(late) Roman	
3	s251.3-4.1p2	c. Jewish Quarter (Magness 1993: fig.1:16) c. Jerusalem (Magness 2005: fig.3-9)	Late Roman Roman	Variant of rilled rim?: late 3rd/ early 4th-6th, but unslipped
4	253.3.1p17			Poss. arched-rimmed basin
5	s253.x.1p1	Capernaum (Loffreda 1974: fig.12:16)	Late Roman	Type C12b
6	252.2.2p1	Quseir al-Qadim (Whitcomb and Johnson 1982: pl.11:p) Jerash (Kehrborg 2007: fig.2:3,4)	Roman L Roman	Local imitation imported sigillata
7	251.3.2p2			
8	252.5.1p48			
9	s253.x.1p10			
10	251.4.1p3	Quseir al-Qadim (Whitcomb and Johnson 1982: pl.11:p) Jerash (Kehrborg 2007: 7:34) (Hayes 1972: 373ff)	Roman (late) Roman Late Roman	Local imitation imported sigillata Poss. CRSW form 7

Table 4.69 Bowls

throughout the southern Levant, e.g. at Jerash and Quseir al-Qadim (Whitcomb and Johnson 1982: pl.11:p; Kehrberg 2007: fig.2:3,4). At Jerash the imitated cups like 252.2.2p1 are very numerous in the kiln dump deposits of the Zeus temple that ante-dates the later second/early third century AD, but they are practically absent from the hippodrome deposits that have a *terminus ante quem* of the later third/early fourth century (Kehrberg 2007: 34).

Other Roman bowls are 252.2.2p23 and s251.4-5.1 'gully'. Both have parallels in the later Roman period kiln dumps discovered in the Hippodrome and Zeus temple of Jerash (Kehrberg 2007: 31). Of bowl s251.4-5.1 several sherds that could be refitted were discovered in a small gully on the edge of the concentration. Combined, the refitted sherds formed c. 40 % of the base and a small segment of the rim. This archaeologically complete vessel exhibited a careful finishing of the body and red slipping of both the inside and outside of the vessel. In the survey several very similar rims have been discovered. The other bowls are more enigmatic and lack good parallels.

Jars

A similar range of jars to those present in the 'Ammata concentration has been found. The most common jar type discovered in the concentration is the Late Roman ridge-necked jar, e.g. s253.x.1p2 or s251.3-4.1p12. It is made from hard fired dark brown/grey clay and is very typical for Late Roman assemblages in this area. It was present in all the Late Roman concentrations discovered in the survey.

Jars dating to the Hellenistic period have also been found but in much lower numbers. Two examples have been depicted here (252.2.2p26 and 252.5.1p20). A jar rim that might date to the Hellenistic period is 252.3.1p20. Its quite straight walls and slightly inverted position is, though atypical, present in the Hellenistic as well as the Late Roman and Umayyad periods (see table 4.70). Another problematic jar is 252.2.2p12. This very typical rim shape has an almost exact parallel at Late Roman Beth Shean, but this sherd has a diameter of 40 cm instead of 15 cm (Johnson 2006: fig.15.13:265). Similar, but not identical jars have been found in Jerusalem. As these have an everted rim, but little or no neck Magness has termed this type holemouth jar 1A (Magness 1993: 232). Jar or more likely amphora 252.3.1p14 has no clear parallels, but is most probably of a non-local ware. Its shape and ware place this vessel within the (Hellenistic) Roman/ Late Roman period, but exact parallels could not be found.

No.	Sherd no.	Parallels	Date	Remarks
1	252.6.1p15	c. Kefar Hananya 5B1 (Adan-Bayewitz 1993: 140:2) Capernaum (Loffreda 1974: fig.3:14)	(early) Late Rom (I)Rom/Late Rom	Early 4th-earlier 5th Type A8; 300-450 AD
2	252.3.1p20	Pella (McNicoll et al. 1982: pl.127:12) Caesarea (Adan-Bayewitz 1986: fig.3:4,5) Pella (Smith and Day 1989: pl.58:10)	Hell (I) Late Roman Umayyad	
3	252.3.1p14			
4	252.2.2p26	Pella (McNicoll et al. 1982: pl.127:7) Amman (Olávarri-Goicoechea 1985: fig.8:17)	Hellenistic IA II	
5	252.5.1p20	Pella (McNicoll et al. 1982: pl.127:11)	Hellenistic	
6	s253.x.1p2	Pella (McNicoll et al. 1982: pl.139:6) Tiberias (Amir 2004: fig.3.8:1)	Late Roman Late Roman	
7	251.3.1p8	c. Tiberias (Amir 2004: fig.3.8:6) c. Pella (Smith et al. 1992: pl.110:10)	(late) Late Rom Late Roman	Northern bag shaped jar; 5th-7th AD (Galil./JV/Transj) Byz II: 500-525 AD
8	252.2.2p12	c. Beth-Shean (Johnson 2006: fig.15.13:265) c. Jerusalem (Magness 1993: 232:6) c. Oboda (Negev 1986: fig.965/970)	Late Roman Late Roman Hell/Rom	Same shape rim but 40 cm diam. Poss. hlm jar 1A 5th-6th
9	s251.3-4.1p12	Amman (Olávarri-Goicoechea 1985: fig.6:7)	(early) Late Roman	
10	252.5.1p34	Pella (McNicoll et al. 1982: pl. 139:9) Caesarea str.5 (Bar-Nathan and Adato 1986: fig.1:11)	Late Roman	Late 6th-early 7th AD Str. 5; late 5th + 6th, some 7th

Table 4.70 Jars

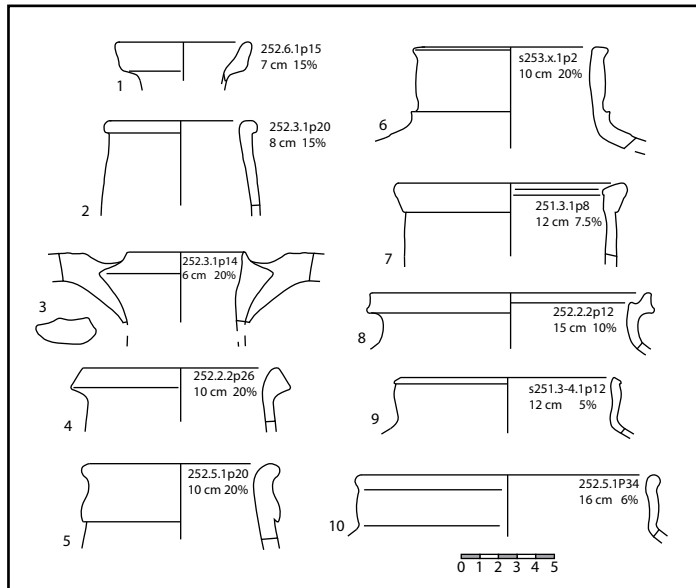


Figure 4.176 Jars

In general the majority of the jars stems from the Late Roman period, possibly with some continuation into the Umayyad period. A smaller number of jars could be dated to the Hellenistic and Roman periods. The types of vessels discovered are very similar to those of the 'Ammata concentration and very good parallels have been excavated at Pella.

Cooking vessels

A large assemblage of cooking vessels has been collected in this concentration. Like in all Late Roman concentrations discovered in the survey, several Late Roman/ Umayyad casseroles were discovered (251.5.2p17, 251.4.1p20, 251.4.1p36 and 253.2.1p5). Casserole 253.2.1p5 is an example of the deep bowls with an inverted rim. There is a trend to generally date these to the Late Roman and Umayyad periods, but this is not a rule (Magness 1993: 211). Equally well known are the Late Roman/ Umayyad cooking jars with a folded rim and no neck (s251.3-4.1p6 and s253.2.1p6). Both types have been described for the 'Ammata concentration. A slightly different but clearly related jar type is illustrated by 252.6.1p43. When this type is understood according to the proposed cooking jar development of increasing folding and compressing of the rim, this shape can be regarded as a further developed specimen where the top was compressed so heavily that an additional ridge was created on the side (Smith 1973: 223). A similar jar has been excavated from Late Roman Beth-Shean (Johnson 2006: fig.15.11:227). A jar from the same period, but less commonly found is s251.3-4.1p17. Almost the same shape has been found in the 'Ammata concentration (91.4.1p19) and parallels can be found at Pella and Jerusalem, where Magness has categorized this shape as cooking pot 4A, dating to the fifth/sixth to late seventh/early eighth century AD (Magness 1993: 219). Rim s251.3-4.1p14 probably also dates to the Late Roman period, although no exact parallels could be discovered. A very similar cooking jar has, however, been found at Jerusalem (type 3B) dating to the sixth and seventh century AD (Magness 1993: 218).

Cooking pots dating to the Roman period have also been found, although not in such large quantities. The thin-walled cooking jars with a small groove on top of the rim (252.5.1p43 and 252.6.1p12) are a very common type during the Roman period. They have been found at Kefar Hananya (type 4C dating from the early second to the mid fourth century AD), Masada (from c. 75-135 AD), Amman and Pella, but many more examples could be given (McNicoll et al. 1982: pl.132:10; Olávarri-Goicoechea 1985: fig.6:6; Adan-Bayewitz 1993; Bar-Nathan 2006: pl.28:14,23,26). A less common Roman type is 252.2.1p21, a cooking bowl with T-shaped rim. The

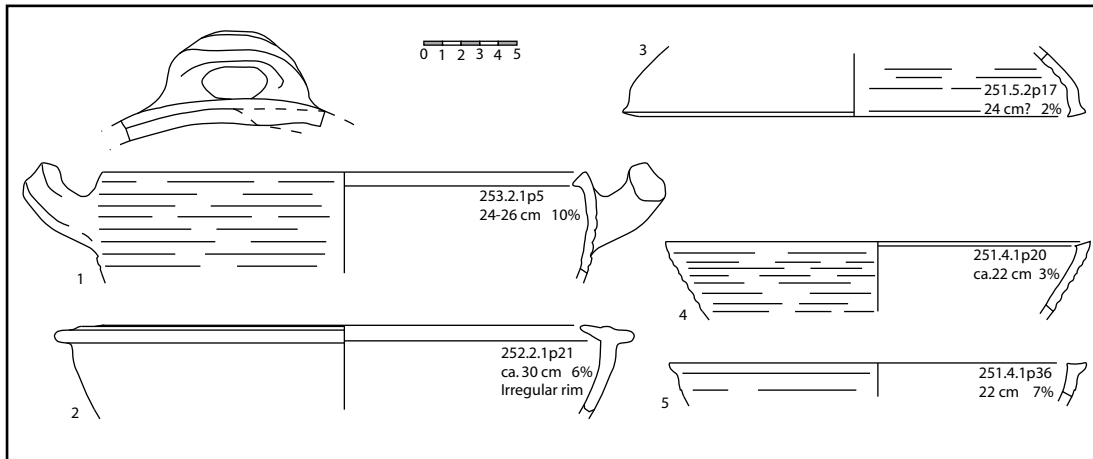


Figure 4.177 Casseroles

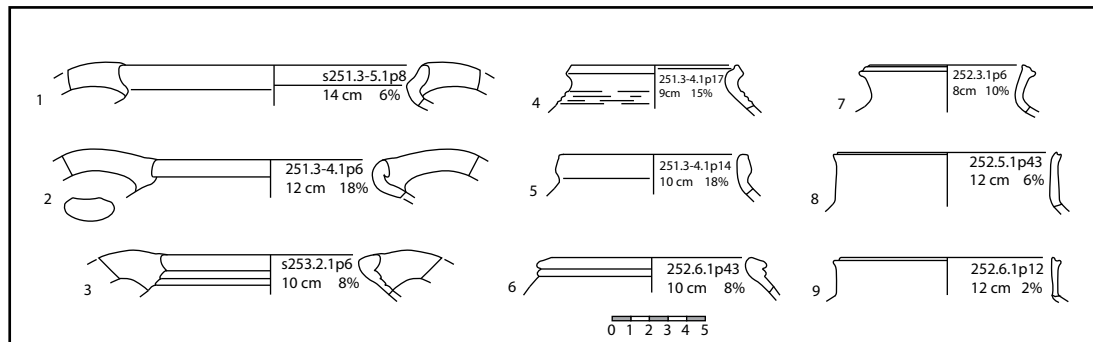


Figure 4.178 Cooking jars

No.	Sherd no.	Parallels	Date	Remarks
1	253.2.1p5	Pella (McNicol et al. 1982: pl.143:2)	Late Rom/Um	Casserole form 1: Umayyad until 746/7 AD
2	252.2.1p21	c. Anafa (Berlin 1997: pl.34: PW309,310)	Roman	Galilean ledge rim cooking bowl, starts in 40/50 AD
3	251.5.2p17	Pella (Smith and Day 1989: pl.51:4)	Late Rom/Um	Casserole form 1; 6th- early 7th
4	251.4.1p20	Pella (Smith and Day 1989: pl.51:6)	Late Rom/Um	Casserole form 1; 6th- early 7th
5	251.4.1p36		Late Rom/Um	Casserole form 1
1	s251.3-5.1p8	Cooking pot 4C (Magness 1993: 219,220:4) Jerusalem (Magness 2005: fig.43:5, 21:3,4)	Roman Roman	Kiln: c.50 – 250 AD
2	s251.3-4.1p6	Pella (McNicol et al. 1982: pl.138:9)	Late Roman	Late 6th/early 7th AD
3	s253.2.1p6	Pella (McNicol et al. 1982: pl.138:10) Beth-Shean (Johnson 2006: fig.15.11:225)	Late Roman Late Roman	Late 6th/early 7th AD
4	s251.3-4.1p17	Cooking pot 4A (Magness 1993: 219)	(l) Late Rom/Um	5th/6th- late 7th/early 8th AD
5	s251.3-4.1p14	Cooking pot 3B (Magness 1993: 218)	(l) Late Rom/Um	6th-7th AD
6	252.6.1p43	Pella (McNicol et al. 1982: pl.138:6) Beth-Shean (Johnson 2006: fig.15.11:227)	Late Roman Late Roman	Late 6th/early 7th AD
7	252.3.1p6	Kefar Hananya 4C (Adan-Bayewitz 1993: 130:17)	Roman	Not typical form for 4C c. 125-350 AD
8	252.5.1p43	Yoqueam (Avisar 2005b: fig.2.9:6) Amman (Olávarri-Goicoechea 1985: fig.6:6) Masada (Bar-Nathan 2006: pl.28:14,23,26) Pella (McNicol et al. 1982: pl.132:10)	(late) Roman Roman Roman	Kefar Hananya 4C; 125-350 AD (Adan-Bayewitz 1993) 75-135 AD tomb 12
9	252.6.1p12	idem	Roman	idem

Table 4.71 Cooking vessels belonging to both figures 4.177 and 4.178

best parallel is found at Tel ‘Anafa, where it is first encountered around 40/50 AD (Berlin 1997: 92). Cooking jar s251.3-5.1p8 should also be dated to the Roman period as parallels at among others Jerusalem show (see table below).

Basins

Like in the ‘Ammata concentrations several large straight walled basins have been discovered.⁷² A very similar bowl, but with a vertical position, had a remarkable feature in that a metal clip used for repairing a break still adhered to the sherd. A few other clips have been discovered during the survey but never on an identifiable rim sherd. The best parallel stems from the Umayyad occupation of Pella (McNicoll et al. 1982: pl.147:12,17). A late Late Roman basin from Caesarea is, however, also a good parallel (Adan-Bayewitz 1986: fig.4:11).

Basin 252.3.1p27 is the only clear Umayyad rim discovered in this concentration. Several other sherds could belong to both the Late Roman and Umayyad period, but this basin sherd can be exclusively dated to the Umayyad period. Its dark grey ware with lots of small gritty temper and pie-crust decoration along the outside of the rim make it an distinctive bowl that occurs quite commonly in occupation levels of this period, e.g. at Jerash and Pella (see table).

No.	Sherd no.	Parallels	Date	Remarks
1	252.3.1p27	Pella (McNicoll et al. 1982: pl.149:7) Jerash (Schaeffer and Falkner 1986: fig.10:7)	Umayyad Umayyad	
2	251.4.1p2	Pella (McNicoll et al. 1982: pl.147:12/17) Caesarea (Adan-Bayewitz 1986: fig.4:11)	Umayyad (l) Late Rom	
3	252.2.1p45			Large basin, same ware, vertical walls
4	253.x.1p6			
5	252.2.1p40	(Magness 1993: 246)	Late Roman/Um	Jug/juglet 6A late 3rd – early 8th
6	252.3.1p11	c. Pella (Smith et al. 1992: pl.113:9)	Late Roman	Byz IIIb; 550-575 AD

Table 4.72 Basins and miscellaneous vessels

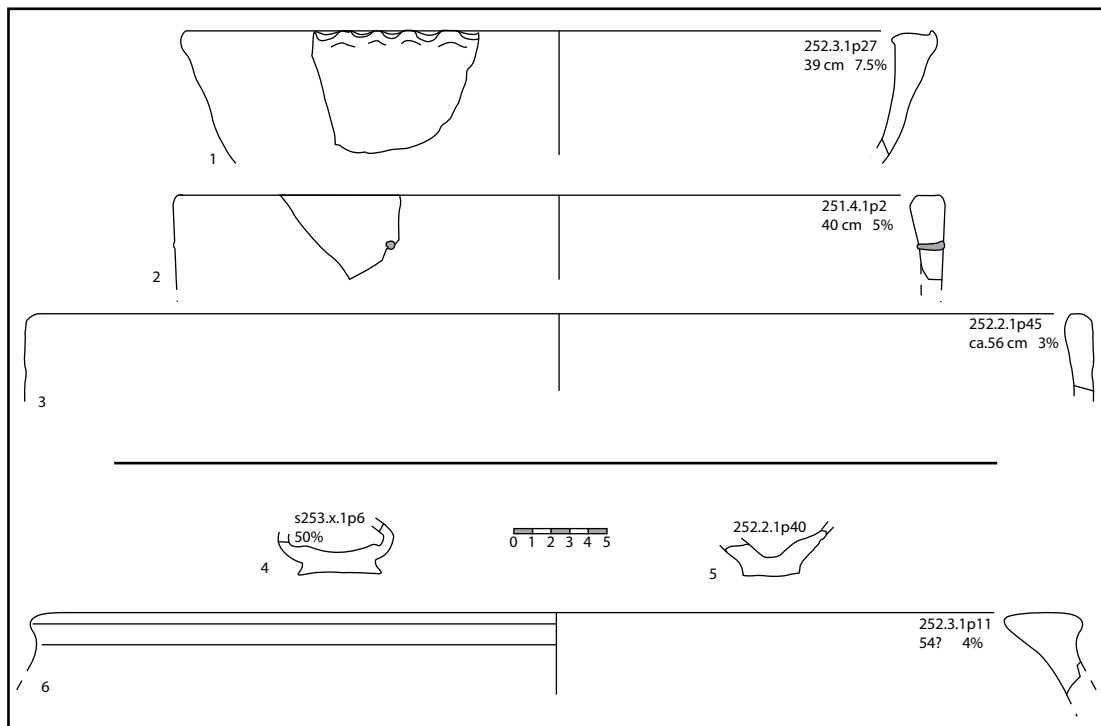


Figure 4.179 Basins and miscellaneous vessels

⁷² These basins have been referred to in the database as LSB (Large Straight Basin).

Bases and miscellaneous vessels

The small base (252.2.1p40) of a juglet or small jar is quite a common form among pottery assemblages from this period. It occurs in several wares and often has a string-cut base, like this specimen. Magness has classified this pottery type as jug/juglet 6A for Jerusalem and dated it to the late third to early eighth century AD (Magness 1993: 246). The second small base (s253.x.1p6) is evidently thrown and made from a gritty cooking pot ware. No good parallels could be found, but the ware and production technique would not stand out in the Late Roman period. Rim 252.3.1p11 has very few parallels. This type of rim, but with a much smaller diameter, has been found in Roman layers at Jerusalem (Magness 2005: fig.31:2). The best parallel seems to stem from Late Roman phase IIIb Pella, but this is not an exact likeness either (Smith et al. 1992: pl.113:9).

Pottery chronology and function

When the feature sherds counts are calculated into relative frequencies the following table can be drawn up (see table 4.73).⁷³ Like in the 'Ammata collection, the ribbed body sherds have not been taken into account. Furthermore, a later Mamluk concentration partly overlaps (see section 4.6). All Mamluk or general Islamic sherds are also ignored. Sherds dating to the Umayyad period, however, are taken into account. The table below shows that most sherds could not be closely dated. The other periods and their relative frequencies compare very well to the chronology of the 'Ammata concentration. There is a small Hellenistic assemblage (1 % of the total pottery assemblage), a large percentage is made up of Roman pottery, but the dominant period is again the Late Roman era. Given the difficulty in distinguishing certain Umayyad vessels types from Late Roman ones, these periods are again largely treated as one period. Some clearly Umayyad vessels have, however, been discovered in this concentration. These finds demonstrate that at least a portion of the occupation did continue into the Umayyad period.

Relative frequencies feature sherds per period (N = 574)	%
Undated	3
Hellenistic or later	3
Roman or later	50
Late Roman or later	9
Hellenistic	1
Roman	3
Roman ?	2
Roman/Late Roman	5
Late Roman	9
Late Roman/Umayyad	13
Late Roman ?	3

Table 4.73 Periodization of feature sherds discovered in this concentration

The number of positively identified vessel forms is again too small to provide percentages. Similar to the 'Ammata concentration the mix of casseroles ($n = 73$), cooking jars ($n = 19$), RSW ($n = 19$) and basins ($n = 12$) points to a domestic function. These vessels were complemented by as many as 213 bowls and 200 jars. These vessels could unfortunately only seldom be more specifically classified, just like the drawn and discussed sherds above.

Based on the pottery it can, therefore, be concluded that the earliest, although very limited, activity occurred in the Hellenistic period. The number of Hellenistic sherds is, however, too small to say anything about the type of activity at this location. These sherds might represent activities carried out in the landscape by the Hellenistic people living elsewhere, but given the low number of sherds in the entire research area and the degree of clustering, these sherds might also represent habitation. During the Roman period more evidence of activities at this location has been discov-

⁷³ See the section on the Ammata concentration for all the biases and constraints concerning this subject.

ered. Judging by the Roman pottery described above, these remains predominantly date to the later part of the Roman period. As cooking vessels, storage jars, cups and bowls have been discovered these vessels most likely represent village occupation during this period. The same type of context can be argued for concerning the Late Roman period. It seems likely that some occupation continued into the Umayyad period, although the type of site is impossible to establish on the basis of this much smaller assemblage.

Conclusion

Given the dense and clustered nature of this concentration in the Hellenistic, Roman, Late Roman and Umayyad periods it is very likely that the artefacts discovered on the surface represent a buried feature in the subsoil. The characteristics of the finds, including glass and tesserae, as well as cooking, storage and serving vessels, lead to an interpretation of this site as a settlement or at least a place of habitation where domestic tasks were carried out. The glass fragments, tesserae, tiles, the polished marble slabs and the columns point to a more luxurious component existing at this location as well. The characteristics of this concentration are very similar to the 'Ammata concentration. The concentration contains pottery dating to the same periods as the 'Ammata concentration. Besides from the periods present, the pottery is also very similar in terms of morphological types and fabrics used. Again both the Galilean bowl and the arched-rim bowl, originating in the North and South respectively, have been found at this concentration. Like in the 'Ammata concentration the pottery reflects domestic activities. Based on these many similarities it can be concluded this concentration and the 'Ammata concentration should on a general level be regarded as contemporaneous and most likely represent similar types of sites.

Located *c.* 100-200 m to the east is the Late Roman graveyard discovered and excavated by Kirkbride during the first excavation campaigns at Tell Deir 'Allā in the early 1960's (see next section). As no pottery was ever published or relocated in the Deir 'Allā Archive at Leiden University it is impossible to check this date. If a Late Roman date is accepted, it seems logical to assume a connection with the concentration under discussion.

It is likely that an important road ran past the site during at least part of its history. A milestone was discovered *c.* 2 km north of Tell Deir 'Allā. Its inscription states that Gadora, identified with Salt, is 20 miles from there (O'Hea 2002: 235). To reach Salt it is likely that the road turned east near Tell Deir 'Allā and scaled the slopes of the eastern plateau south of Tell al-Hammeh. This route is evidenced by both Mallon's and Mittmann's observations. In the 1930's and 1960's respectively they report a probably Roman road on the northern slope of 'Abū al-Zīghān (Mallon 1934: 60; Mittmann 1965: 86). On top of the hill in the direction of Salt other remains of milestones have been found (Huppenbauer 1962: 175). Together these milestones show that a road ran from the area of Deir 'Allā to Salt. It is likely that the road passed along the concentration. Its age is, however, more difficult to establish. Two milestones north of Deir 'Allā were erected in 181/182 AD on the occasion of the restoration of the road (Mittmann 1970: 146). An inscription on one of the milestones on the slope dates these to 251-253 AD (Huppenbauer 1962: 179). These inscriptions often only date some restoration work undertaken at the road. It is likely that this road existed long before these dates and continued long after as well. It was, therefore, at least for some period of time contemporaneous with the concentration under discussion.

In the discussion on the identification of Ammathous described above, Mittmann convincingly argued that Tell 'Ammata could not be the Roman/ Late Roman Ammathous described by Eusebius as the distance from Pella is too short (Mittmann 1987: 53). If one accepts the distance given by Eusebius, Ammathous should be located somewhere east of Deir 'Allā, argues Mittmann. He identifies 'Abū al-Zīghān where he has found some Late Roman pottery as the Late Roman Ammathous (Mittmann 1987: 54). Today no Late Roman remains are to be found at 'Abū al-Zīghān, which leads to the conclusion that the site discovered by Mittmann was probably not very large. It can only be speculated, but it is likely that had Mittmann known about the concentration discussed here he would have regarded it as a candidate for identification as Ammathous as location, age and possibly also size or significance fit. Whether this or any other site in the area should be identified with ancient Ammathous can probably never be established. It seems very likely,

however, that different towns/villages known by that name in different periods were located in the Zerqa Triangle. The wandering of place names in a certain area is an interesting and probably regularly occurring phenomenon.

The reason for the cessation of occupation at this location is unknown. Occupation certainly continued into the Umayyad period. If there was some habitation at the end of the Umayyad period it will certainly have suffered from the heavy earthquake in 748/9 AD. This earthquake affected large parts of the southern Levant and destroyed Pella, which was not rebuilt until centuries later. However, it is likely that people only left the region entirely when their subsistence had already become precarious. If habitation is very successful people are more likely to rebuild their houses and their life and continue as before. Irrespective of its destructive potential, an earthquake must destroy more than only structures to be the cause of total abandonment. In the following chapters it will be argued that this region is highly dependent on the irrigation system. As will be discussed in detail later on, it is likely that if an earthquake destroyed the irrigation system at the wrong moment in time subsistence may have become much more difficult in this region and large parts of the population may have seen no other solution but to move away. This sequence of events might have occurred at this concentration in 748/9, but only through excavation can this ever be ascertained.

Preservation and threat

Today the fields of this concentration are used as agricultural land. Although deep ploughing will definitely affect any occupation layers present in the subsoil, severe distorting processes have already taken place at this location. To the north and slightly overlapping the artefact distribution, the remains of a Mamluk sugar production site have been discovered (see section 4.6). This industry will undoubtedly have affected the Late Roman remains. If, for example, stone blocks had been used in Late Roman buildings, as the presence of the columns leads one to suspect, it is likely some of the blocks were reused in the sugar mill. Among the sugar pottery a few hewn sandstone blocks have been found, which might well have been reused.

Another distorting effect that has acted upon the concentration is the modern farmhouse immediately south and east of the concentration. It is very likely that the surface concentration once stretched to this location. As this is an old house already visible on a 1940's RAF aerial photograph and it is built on quite solid ground it is likely that the foundation trenches are not very deep and archaeological remains might not have been completely destroyed.

Notwithstanding these past distortions the site might still be relatively well preserved. The amount of movement down the slope towards the Wadi el-Ghor is rather limited as can be seen in figures 4.168 and 4.169. The size and level of abrasion of the sherds show that these have not been on the surface for a very lengthy period of time. It is likely that the recent mechanized deep ploughing has brought sherds to the surface, that had remained untouched during centuries of simple arid ploughing.

Field no.: 80 (plots 5 and 6) and 232 (line 1 to 4)

Toponym: 'Abū al-N'eim

Coordinates: 745,350/3,562,100 (tell)
745,170/3,562,330 (concentration)

Size: c. 40 x 50 m (concentration)

Days and time: Nov. 20th, 2004 and Oct. 19th, 2006,
c. 4 man-hours

Larger area: idem +

Oct. 18th-20th 2006

Periods: Late Roman/Umayyad
(c. 500-750 AD)

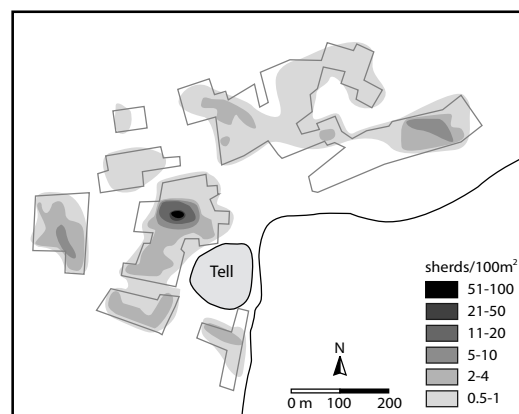


Figure 4.180 Distribution of ribbed sherds

Description

During the 2004 and 2006 seasons fields around the present-day village of ‘Abū al-N‘eim were surveyed. Given the many occupation remains of different ages in the area around the bend in the Zerqa river it was decided to survey this region rather extensively. This resulted in the discovery of non-tell concentrations in the area around Tell ‘Abū al-N‘eim. This tell, also known by the name Tell Sahwan, was surveyed by Glueck, Mellaart and the EJVS. Glueck and Mellaart described it as a rather large, but low mound with a small modern village on its top. This description still fits the present-day situation perfectly. Mellaart dated it rather broadly from the Roman to what he called the Arabic period (Mellaart 1962). The artefacts Glueck discovered fall within the same periods including Roman, Late Roman, Medieval and modern Islamic remains (Glueck 1951: 316). The EJVS is more precise in dating and reports that a few remains from the Roman, Late Roman and Umayyad periods were found, but that most artefacts dated to the Ayyubid/Mamluk periods (Ibrahim et al. 1988a: 191). Both the earliest and the latest periods reported by these surveys have been corroborated (see below).

In 2006 a *c.* 2 m wide hole was cut into the southern side of the tell. While examining the section Hourani was able to recover a few sherds from the first occupation layer deposited above virgin soil and from the last layer visible in the section. Both are depicted in figure 4.181. The sherd from the oldest layer (A.Nu‘eim06p3) is a clear example of a Roman cooking jar. This is a very common vessel in the Roman period of this region and has been excavated at many sites, like e.g. Masada, Yoqneam, Amman (Olávarri-Goicoechea 1985; Avissar 2005b; Bar-Nathan 2006). Similar examples have been excavated at Pella in early Roman contexts of sounding 8 (Smith and Day 1989: pl.44:12). The sherd from the uppermost layer (A.Nu‘eim06p2) is a typical example of the HMGPW from the Mamluk period. It is a bowl with designs painted on the inside, outside and the top of the rim, supplemented by a band of impressions on the outer wall. An almost identical bowl has been excavated at Tell ‘Abū Sarbūt (LaGro 2002: fig.3.28). LaGro mentions that this type of decoration is rather exceptional, but perhaps the present find negates the validity of this statement for the Zerqa Triangle region. These finds securely date the earliest and latest periods of occupation of the tell.

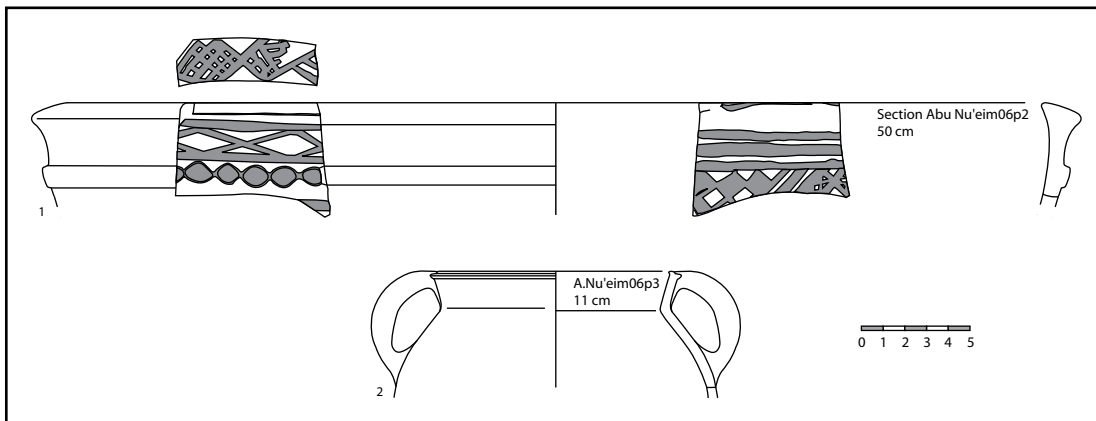


Figure 4.181 Finds from the section at Tell ‘Abū al-N‘eim

No.	Sherd no.	Parallels	Date	Remarks
1	A.Nu‘eim06p2	‘Abū Sarbūt (LaGro 2002: fig.3.28)	Mamluk	Upper layer
2	A.Nu‘eim06p3	Yoqneam (Avissar 2005b: fig.2.9:6) Amman (Olávarri-Goicoechea 1985: fig.6:6) Masada (Bar-Nathan 2006: pl.28:14,23,26) Pella (McNicoll et al. 1982: pl.132:10)	Roman	Bottom layer

Table 4.74 Finds from the section at Tell ‘Abū al-N‘eim

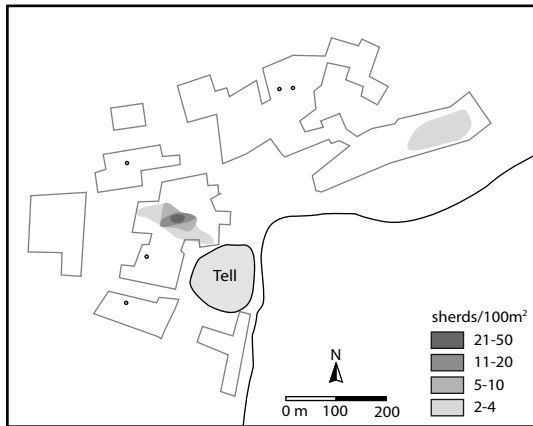


Figure 4.182 Distribution of Late Roman/Umayyad feature sherds

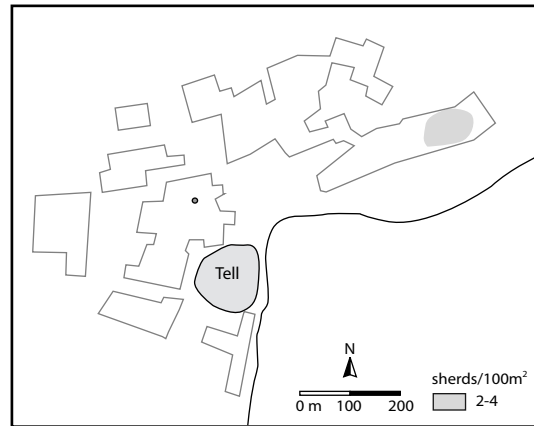


Figure 4.183 Distribution of Roman feature sherds

Similar periods have been discovered in the fields around the tell. The finds from the Islamic periods will be discussed in the following sections. When the ubiquitous ribbed sherds discovered around this tell are depicted, it becomes clear that the pottery around Tell 'Abū al-N'eim is not distributed in haloes of decreasing density as would be expected. A clear bounded area of higher densities exists to the north-west of the tell. When the better datable feature sherds are plotted, an even more distinct distribution emerges (see figures 4.182 and 4.183). The north-western concentration is constituted almost exclusively by Late Roman and Umayyad pottery.⁷⁴ Feature sherds from the Roman period are absent from this area but form a very low density cluster in the north-east of this sub-region. This is an enigmatic cluster that will be further discussed in the next section as Early Islamic pottery was found here as well.

Pottery

The pottery discovered in this north-western area forms a homogeneous group. Virtually all feature sherds date to the Late Roman and Umayyad periods and the majority of the closely datable sherds belongs to the later part of that period, between *c.* 500 and 750 AD. Differentiation between Late Roman and Umayyad pottery is difficult as many vessel forms change very little in the transition from the Late Roman to the Umayyad period (Hendrix et al. 1997: 252). The casseroles, for example, continue into the Umayyad period with only minor alterations. Clear morphological changes are difficult to detect, but early examples tend to be shallow with thin horizontal handles twisted upwards, while later vessels are generally deeper and have less twisted and more vertical handles (e.g. Magness 1993: 211). The small fragments discovered in the survey did, however, not allow a more precise dating than Late Roman/Umayyad. The cooking jars all have the folded rim, no neck and sometimes the compression of top of the rim that Smith regarded as a more advanced stage in the development of the cooking jars from Pella (Smith 1973: 223). These jars are very common in the Late Roman period and are occasionally encountered with heavy compression on the top and side of the rim in Umayyad layers, e.g. at Pella (Smith and Day 1989: pl.58:12). If the rim chronology proposed for Pella is accepted, then judging by the limited compression of their rims, the cooking jars discovered here would not date to the Umayyad period.

The same dating to the Late Roman and Umayyad periods pertains to the so-called large straight basins (LSB) that have parallels in both Late Roman and Umayyad contexts (McNicoll et al. 1982: pl.147:12/17; Adan-Bayewitz 1986: fig.4:11). Several of these basins have been discovered in the other concentrations of this period described above (see figure 4.186).

⁷⁴ These periods are referred to as Late Roman and Late Roman/early Islamic in the database.

THE SURVEY RESULTS

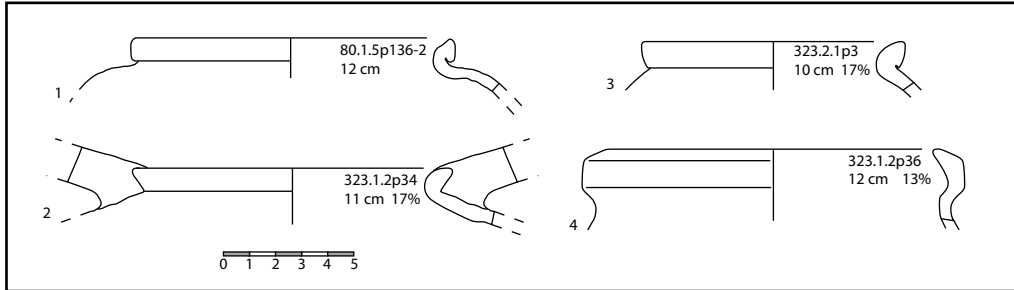


Figure 4.184 Cooking jars

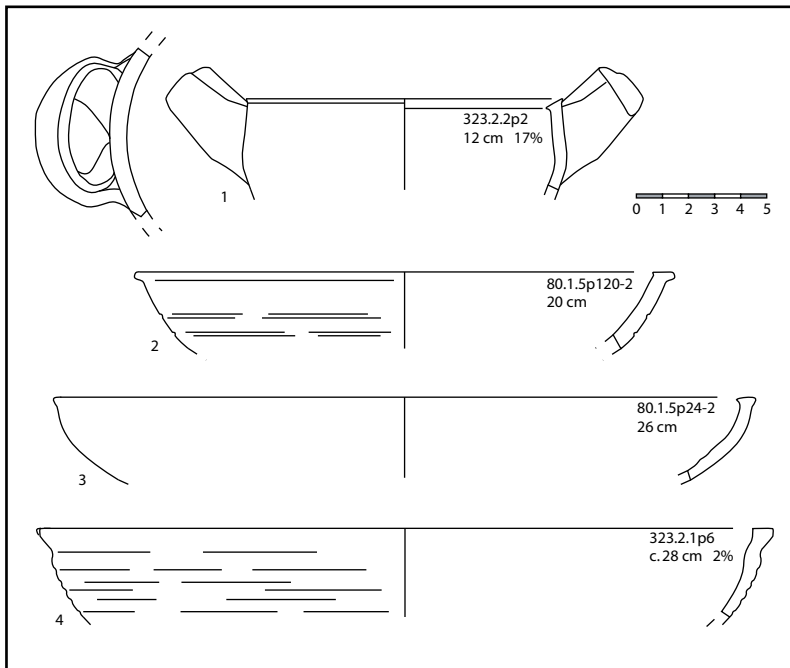


Figure 4.185 Casseroles

No.	Sherd no.	Parallels	Date	Remarks
1	80.1.5p136-2	Pella (McNicoll et al. 1982: pl.138:9)	Late Roman	
2	323.1.2p34	Pella (McNicoll et al. 1982: pl.138:5)	Late Roman	
3	323.2.1p3	Pella (Smith and Day 1989: pl.51:16)	Late Roman	
4	323.1.2p36	c. Yoqne'am (Avisar 2005b: fig.2.5:8) c. Caesarea (Adan-Bayewitz 1986: fig.4:3,4)	Early Roman (I) Late Roman	Type 3 cooking pot
1	323.2.2p2	Pella (Smith and Day 1989: pl.51:12)	Late Rom/Um	Casserole form 1
2	80.1.5p120-2	Pella (Smith and Day 1989: pl.51:1)	Late Rom/Um	Casserole form 1
3	80.1.5p24-2	Pella (Smith and Day 1989: pl.53:6)	Late Rom/Um	Casserole form 1
4	323.2.1p6	Pella (Smith and Day 1989: pl.51:1)	Late Rom/Um	Casserole form 1; lid

Table 4.75 Cooking vessels belonging to both figures 4.184 and 4.185

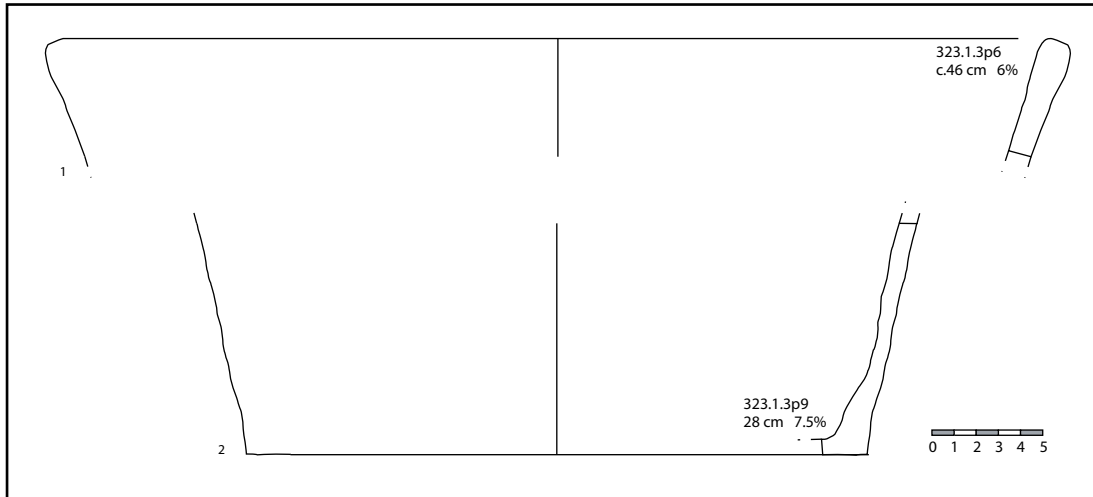


Figure 4.186 Basins

No.	Sherd no.	Parallels	Date	Remarks
1	323.1.3p6	Pella (McNicoll et al. 1982: pl.147:12/17) Caesarea (Adan-Bayewitz 1986: fig.4:11)	Umayyad Late Late Roman	LSB
2	323.1.3p9	idem	L Late Roman/Umayyad	LSB

Table 4.76 Basins

Several vessel types, like the cooking pots, basins and two unguentaria, can, therefore, only be dated to a fairly broad period covering the Late Roman and Umayyad periods. Storage jar rims, however, change more rapidly during these periods. The jars discovered are typical of the Late Roman period and judging by the short, swollen necks more likely belong to the later part of that period. The Red Slip Ware (RSW) bowls can be even more precisely dated. Ten RSW sherds were collected in this area and were all of the Phocaean type. As many as eight could be identified as form 3F as described by Hayes (Hayes 1972: 333). This type was produced between 500 and 550 AD.

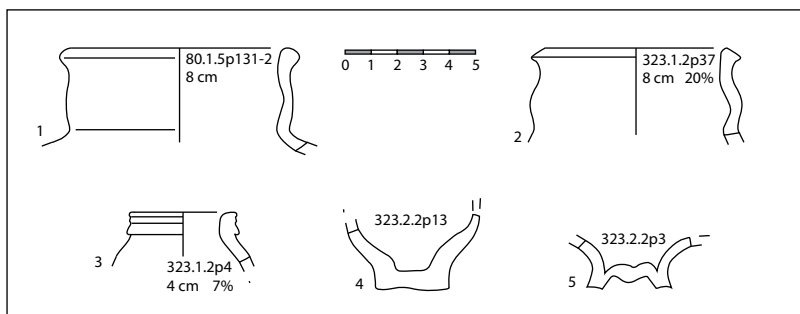


Figure 4.187 Jars and jug(lets)

No.	Sherd no.	Parallels	Date	Remarks
1	80.1.5p131-2	Caesarea str.5 (Bar-Nathan and Adato 1986: fig.1:11)	(I) Late Roman	Str. 5 late 5th + 6th, some 7th
2	323.1.2p37			
3	323.1.2p4	Amman (Olávarri-Goicoechea 1985: fig.6:7) Pella (Smith and Day 1989: pl.48:5)	(e) Late Roman (I) Late Roman	6th-early 7th
4	323.2.2p13	Jerusalem (Magness 1993: 246)	Late Rom/Um	Jug/juglet 6A late 3rd-early 8th
5	323.2.2p3	c. Caesarea (Adan-Bayewitz 1986: fig.4:21)	(I) Late Roman	jug

Table 4.77 Jars and jug(lets)

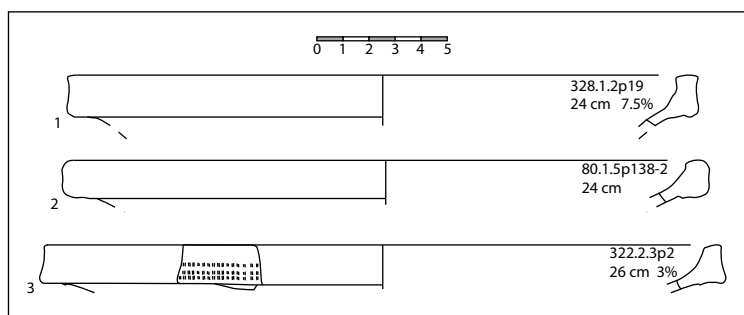


Figure 4.188 RSW

No.	Sherd no.	Parallels	Date	Remarks
1	328.1.2p19	(Hayes 1972: 333, fig.69:17-26)	500-550 AD	PRSW 3F
2	80.1.5p138-2	idem	500-550 AD	PRSW 3F
3	322.2.3p2	idem	500-550 AD	PRSW 3F

Table 4.78 RSW

The majority of the storage jars, most cooking jars and all of the RSW vessels could, therefore, be firmly dated within the Late Roman/early Islamic period. Typical Umayyad vessels or features, like piccrust decoration on rims, are absent. Furthermore, the shapes within the vessel categories resemble each other very closely; cooking jars are of the sharply folded rim type, storage jars have a small diameter and swollen necks and almost all RSW bowls are of the PRSW 3F type. The other Late Roman concentrations had more differentiation within their assemblages. The small amount of pottery dating to other periods discovered among this assemblage (see table 4.79) is either of miscellaneous date, e.g. undatable or possibly belonging to LBA or Roman jars, or can be connected to the other main occupational period present at Tell 'Abū al-N'eim, namely the Mamluk period (see below). This uniformity suggests a shorter period of occupation than the other concentration. It can, therefore, be concluded that a date in the later part of the Late Roman period is most likely, although some continuation into the early Islamic period cannot be ruled out.

The identifiable feature sherds of the four northern lines of field 323, which constitute the centre of the concentration, are grouped according to vessel type in table 4.79. Immediately noticeable is the large number of cooking vessels, constituting about half of the Late Roman assemblage. This stands in contrast to both the 'Ammata and field 251 east Deir 'Allā concentrations, where much lower percentages cooking pots have been found, 13 % and 29 % respectively.⁷⁵ The

Period	Vessel type	No.
Late Roman (Umayyad)	Casserole	17
	Cooking jar	14
	Storage jar	10
	PRSW 3F bowl	4
	Basin (LSB)	16
	Base unguentarium	2
Other period	Bowl Mamluk	6
	Jar (LB/Rom/?)	5

Table 4.79 Distribution of vessel forms from field 323, lines 1-4

⁷⁵ I.e. in the concentration east of Deir 'Allā, 26 of the 89 determinable vessels were cooking pots, while at Ammata only 47 of the 357 Late Roman and early Islamic sherds are casseroles.

basins form an equally large category compared to the other concentrations from this period. At the concentration east of Deir 'Allā, for example, only 12 large basins were found while the total collection is much larger.⁷⁶ In the 'Abū al-N'eim concentration the basins form as much as 25 % of the total Late Roman/Umayyad assemblage, while in the two other concentrations from this period only *c.* 13 % were basins.

Unfortunately the function of these large basins remains enigmatic. Their large open shape suggests they were used for short-term storage of bulk items. It is likely they were used to store commodities that were needed regularly, for example (staple) food supplies in a kitchen context. At Pella one basin showed traces of a thick layer of plaster on the inside of the vessel suggesting it was made waterproof to hold liquids (Smith 1973: 225). Plastering these vessels to waterproof them would seem unnecessary if they were simply used to hold water, as the low organic temper content makes them relatively watertight. Some permeability will, nevertheless, always exist when dealing with unglazed vessels. This slight water loss is, however, not necessarily regarded as negative. Quite the contrary, modern-day villagers of Sardinia, for example, preferred unglazed water jars to glazed ones stating that the water from the unglazed jars tasted better. Trying to understand this preference Annis examined the jars petrographically and chemically. She discovered that the permeable character of the vessel had a purifying effect on the water, making them more valued than watertight glazed jars (Annis 1985).

Vessels without plaster, slip or glaze might, therefore, have been used and possibly even preferred for water storage. However, the large diameters of these basins, which make closing them difficult, would render them very susceptible to contamination by e.g. dust, leaves, and feathers blown around by the wind.

Considering the pottery assemblage with its large component of cooking pottery, together with the large basins that might have had a domestic function of short-term storage of food supplies, an interpretation of this concentration as related to kitchen activities and stemming from the (late) Late Roman/Umayyad period seems likely. The other finds discovered in this concentration further corroborate this conclusion.

Other finds

In plots (80.1.5 and 6) several human teeth were found together with unidentifiable bone remains. The teeth represented two molars, one premolar, one inciser and a very small incisor. The molars are quite heavily worn. The presence of several teeth in combination with fragments of glass suggests these finds may represent the remains of a cemetery (see below). Glass objects are common grave goods in the Byzantine period (see section 4.4.3). Several other bones were discovered in plot 323.1.2, located immediately to the south. One of the long bones discovered lacks both epiphyses, which makes determination hazardous. However, the length, width and straightness of the bone suggest it is a human femur.

Among the other identifiable bones of plot 323.1.2 two fragments of long metatarsal bovine bones were present. These bones showed clear cut marks resulting from heavy butchering. Another small fragment may be identified as the tibia of a sheep or goat, but the small size of the bone makes proper identification impossible. Bone decays very quickly when exposed to the elements on the surface. As garbage is today not often dumped on the fields, the survey as a whole discovered very little bone. The sudden appearance of several pieces of bone including some with cut marks is, therefore, remarkable. It is of course not possible to date bone without absolute dating techniques, but the very fact that it was present on the surface and located at the centre of a Late Roman/Umayyad concentration suggests it might have been ploughed up recently. The large proportion of cooking vessels from the Late Roman/Umayyad periods that was discovered in this area suggests this area might have been a food preparation area.

Very few artefacts other than pottery have been collected. Just three fragments of glass were found in 2006 with only one of them displaying distinctive features. This was a body fragment, most likely of a bowl of pink to purplish glass with two greenish bands across its body (329.2.1m1g). In 2004 fifteen fragments of glass were collected in field 80; eight of them in a single plot (80.1.5),

⁷⁶ At Ammata, 48 LSB were discovered among the total of 357 Late Roman and early Islamic feature sherds.

five others in the next plot (80.1.6) and a rim in plot six between lines one and two. One of these fragments was a small globular base of turquoise colour. This fragment could either be the base of a single bodied unguentarium or the base of a glass lamp from the Late Roman period (Hadad 2003: 193). The rim (s80.1-2.6m1) is of greenish glass and the edge is folded outwards forming a tubular rim. The diameter seems to be large.

Mediterranean seashell of the Columbelloidae family was discovered in the same plot (80.1.5m3).⁷⁷ A hole, worn around the edges, was discovered in one of the sides. The gloss around the hole showed it had clearly been used for a prolonged period of time and was possibly worn as a pendant. The same type of shell was excavated from a tomb at Pella (Smith 1973: pl.80).

Other finds included two fragments of tobacco pipes (80.3.1m1 and 325.2.1m1).⁷⁸ The first fragment is too small to establish a date. The second, however, has a very clear parallel to a specimen (no.79) discovered at Yoqne'am, which has been dated to the 19th century (Avisar 2005a: 89-90). This find is probably related to the more recent or pre-modern use of the village on top of Tell 'Abū al-N'cim.

Tesserae have also been discovered. A total of 17 were found in the fields surrounding the tell. In field 80 and 329 solitary specimens have been discovered. The other 15 tesserae all stem from the eastern plots of field 323 and 12 of these derive from a single plot (323.3.2). This area of tesserae lies immediately south of the concentration Late Roman/Late Roman pottery and might be related to it. Morphologically the tesserae are similar to those discovered in the 'Ammata concentration and fields 251-253.

Flint

The number of flint artefacts is very low. The flint debitage consists mainly of flakes and blades. North of the tell in fields 79 and 80 two sickle blades and a microlithic drill were discovered. South of the tell a possible scraper and two retouched blades were collected. Given the difficulty in dating these tools and the long period of occupation of this area it is impossible to correlate these tools to either a period or a tell.

Conclusion

Given the sharply bounded nature of this concentration and large size of the pottery fragments it is concluded that a mother population is likely buried in the subsoil. The spatial restriction and good preservation of the finds suggests that the site has not been seriously affected by ploughing. Based on the pottery discovered, these deposits most likely date to the Late Roman period, probably its later part with some continuation into the Umayyad period. The large percentage of cooking vessels combined with red slip tableware and the basins which might also be connected to food storage suggest this concentration should be interpreted as a food preparation area. The relatively large number of glass finds discovered in a restricted area located slightly to the north around plots 80.1.5 and 80.1.6 seem to belong to the same period. It is uncertain what this area's exact relationship was to the pottery concentration or the tell was. Tell 'Abū al-N'cim reportedly also dates to the Late Roman and Umayyad periods. Unfortunately this could not be corroborated as the entire tell is today covered by a modern village and Glueck, Mellaart and the EJVS did not depict the artefacts collected. It is, therefore, unknown whether this concentration away from the tell should be regarded as a separate feature related to the occupation on the tell, as an isolated occupation in a period without occupation on the tell or even as a dump of soil from the tell at this location. This last possibility is, however, unlikely as mixing at least with later Mamluk layers on the tell would be expected. Furthermore, no differences in soil were attested, which one would expect if village occupation layers consisting mainly of (organic) refuse and mud-brick rubble had been dumped on agricultural fields. Summarizing, it is highly likely that a recently ploughed up later Late Roman/Umayyad site concerned with food processing was discovered.

⁷⁷ Thanks must be expressed to Wim Kuijper, Faculty of Archaeology, Leiden University, for the identification of taxonomic order of this shell.

⁷⁸ See also section 4.7.2 on tobacco pipe distribution.

4.4.3 Other Roman, Late Roman and Umayyad period discoveries in the Zerqa Triangle

Although there is evidence that there was significant occupation in this area during the Roman and Late Roman periods, very few remains have been excavated. At large excavated tells, like Tell Deir ‘Allā, Tell al-Mazār and Tell Dāmiyah, no remains from this period have been found. In his tell survey Petit discovered remains from the Roman/Late Roman period in quite large quantities at several sites (see table 4.80). These results are unfortunately slightly biased as not only rims but all diagnostic sherds were collected. This means that all ribbed body sherds are included in these percentages. The estimated number of Roman/Late Roman vessels at sites with less than 30 % sherds from this period was very low (Petit pers. comm.). Petit even regarded the 29 % collected at Tell al-Hammeh East as representing only a very limited number of vessels, rendering it doubtful whether any significant occupation was present at this location. The only significant amounts of Roman/Late Roman sherds discovered in Petit’s tell survey were present at Tell al-‘Adliyyeh and Tell Dāmiyah, that were both excavated (see below). Another bias is that the sherds were not separated into their individual periods, but with only two exceptions, i.e. Tell ‘Ammata and Tell Zakarī, the Roman and Late Roman periods were taken to form one category. The low number of early Roman period finds detected in the field survey cannot be compared with these data. Glueck divides the pottery in Roman and Late Roman, while the EJVS even distinguishes between early and late within these periods. The problem with the latter survey, however, is that its conclusions cannot be checked. In general, however, the three surveys agree with each other regarding the periods present. Small amounts of Roman and or Late Roman pottery have been found at several other tells (see table 4.81). These quantities, however, are very low and it is not likely that these sherds represent occupation layers inside these tells.

Significant Roman/Late Roman presence has, however, been attested on the surface of Tell ‘Ammata and Tell al-‘Adliyyeh. Petit has undertaken small-scale excavations at both tells (Petit in prep.). Tell al-‘Adliyyeh yielded 79 % Roman/Late Roman pottery on the surface. In the excava-

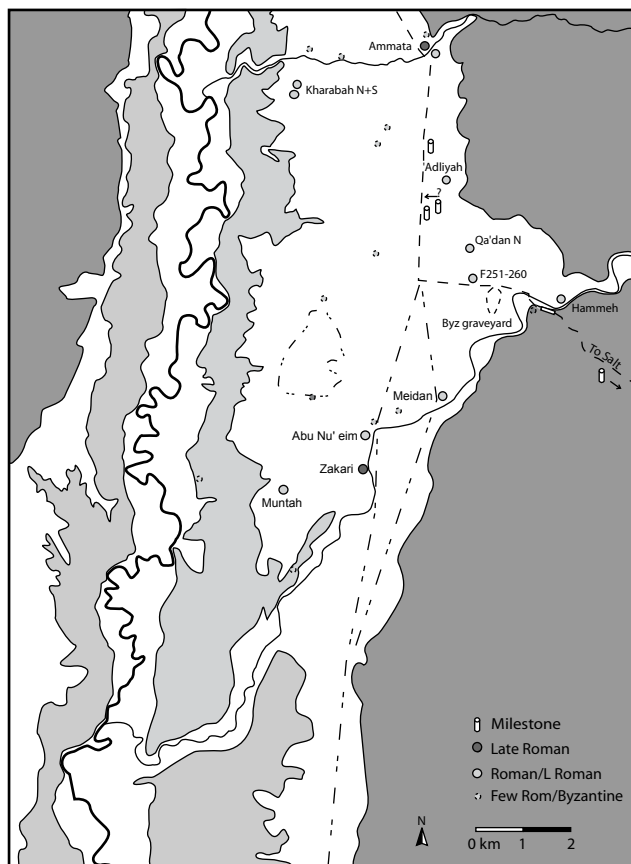


Figure 4.189 Location of Roman/Late Roman sites, milestones and likely trajectory main road

tion, phase 16 was dated to the Late Hellenistic/Early Roman periods. In the area excavated this phase only contained pits and no architecture. On the surface 3 % of the pottery discovered dated to the Hellenistic period. After a pause renewed activity took place at Tell al-‘Adliyyeh during the Late Roman period (phase 17). This occupation was of a different character than during the previous phase and consisted of thick stone walls of buildings. The pottery assemblage comprised both household utensils and storage facilities (jars). Petit interpreted this architecture as representing either a fort or a large farmhouse (Petit in prep.). The increase in occupation from the Roman to Late Roman period witnessed in the survey concentrations is also visible at Tell al-‘Adliyyeh, that was only occupied during the Late Roman period.

A similar picture emerges from the excavations at Tell ‘Ammata. Here Hellenistic occupation has been attested followed by a period of abandonment and resettlement during the Late Roman period (Petit in prep.). The absence of occupation during the Roman period at the tell stands in contrast to the Roman occupation discovered in the concentration to the south of the tell.

It seems likely from the concentrations discovered in the survey and the few tells that could be more precisely dated that most occupation took place during the Late Roman period, perhaps with a continuation into the Umayyad period. Although it cannot be proved, it is likely that most sherds found on the surface of tells and dated to the Roman-Late Roman period as a whole predominantly stem from the Late Roman period.

Site	Percentage of total sherds discovered
al-‘Adliyyeh	79 % Roman + Late Roman (+ 11 % Umayyad)
‘Ammata	76 % Late Roman
al-Kharabeh S	51 % Roman + Late Roman
al-Kharabeh N	26 % Roman + Late Roman
al-Hammeh E	29 % Roman + Late Roman
al-Qa’dān N	26 % Roman + Late Roman
Maydān	27 % Roman + Late Roman
Zakarī	15 % Late Roman
al-Muntih	Glueck: Roman significant number, Late Rom dominant

Table 4.80 Tell sites where large proportions of Roman and/or Late Roman sherds have been discovered by previous surveys (Glueck 1951; Ibrahim et al. 1988b, a) (Petit in prep.)

Site	Percentage of total sherds discovered
Qōs W	3 % Roman + Late Roman
Al-Mazār	5 % Roman + Late Roman
Ghazāleh	2 % Roman + Late Roman
al-Rabī/ al-Khsas	4 % Roman + Late Roman
Umm Hammād	5 % Roman + Late Roman (EJVS only Late Roman)
Kat. al-Samrā’	2 % Roman + Late Roman
Kh. al-Buweib	few Roman + Late Roman (LP)
Tell al-Buweib	significant presence (EJVS) Byz, less E Roman
al-Nkheil N	few L Byz/Um (EJVS), Glueck few Rom + Byz
‘Abū al-Zighān	few Late Roman (EJVS + Mittmann)
Arqadat	few Late Roman
Bashir	few Roman + Late Roman (Glueck)
al-Rkābī	significant Roman + Late Roman (Glueck)
‘Abū Sarbūt	Levelled but Roman/Late Roman presence
al-Fukhār	Late Roman presence

Table 4.81 Tell sites where low proportions of Roman and/or Late Roman sherds have been discovered by previous surveys (Glueck 1951; Ibrahim et al. 1988b, a) (Petit in prep.)

Apart from the excavated tells there is, however, some other excavated material that stems from this period. During Kirkbride's search for an Iron Age cemetery at Tell Deir 'Allā in 1960 and 1961, she discovered a Late Roman burial ground immediately west of and underneath the village of al-Dbāb in the badlands (site 5 in her notes). Small trenches in four areas were excavated in 1960. Unfortunately their results were never published and no pottery from this cemetery could be discovered in the Deir 'Allā Archive at Leiden University. The only published reference to this cemetery can be found in Franken's preliminary article on the Tell Deir 'Allā excavation of 1960 and one sentence in an exhibition catalogue from 1986 (Franken 1960; Homes-Fredericq and Franken 1986). Franken does, however, not give any interpretation other than the statement that they discovered a Late Roman settlement to the East of Tell Deir 'Allā and that they found a large cemetery of possibly early Christian burials even further east. In mentioning a Late Roman settlement east of Tell Deir 'Allā he could be referring to Tell Abu Ghourdan that had been discovered by then and Late Roman material was identified on it, but also to the concentration discovered around fields 252 and 253, although no mention is made of this site has been made elsewhere.

In the exhibition catalogue Franken writes that a buried square building located in the middle of the cemetery is clearly visible on aerial photographs (Homes-Fredericq and Franken 1984: 229). Nothing can be seen on aerial photographs from 1940, 1953, 1978 or 2000 that resembles a buried square feature. On the 1:10,000 map that is based on 1952 aerial photographs a strange square feature, which is not a contour line, but does not represent a modern house either is depicted. If this is the same structure that Franken refers to it would be located under the northern part of the present-day village of al-Dbāb and measure *c.* 60 x 60 m. The only more detailed information on these excavated trenches is found in Kirkbride's unpublished notebook. In the following description an account of her notes is given.

The first trench, referred to as area A, is located within the badlands of the present-day al-Dbāb village. Kirkbride describes the exact location of this trench as just west of the refugee village, in the waste ground and on Trought's road. The trench is stated to be 2 m wide, but nothing is said of its length. From a sketch it seems that the trench measured 2 x *c.* 5 m. No official drawings on lined paper exist, only a sketch in the notebook and three photographs remain. Fortunately, the description is fairly accurate.



Figure 4.190 Area A under excavation in 1960 (Deir 'Allā Archive, University of Leiden)

When digging Kirkbride seems to have encountered three main layers; layer A, a brown clayey soil that was fairly soft; layer B, a sticky brown clay with numerous white specks; and finally a yellow clay banded with grey clay which was very hard. Kirkbride suspected this last layer was part of the natural soil.

This, however, also yielded archaeological remains. A total of five burials was discovered in this trench. All burials were single graves in which the skeleton lay extended on its back with arms straight along the body. They were orientated with the head towards the north-east and the feet towards the south-west. Kirkbride proposed they may have been orientated towards Jerusalem that lies to the southwest of Deir 'Allā. Only a few of the graves contained grave gifts.

Kirkbride gives a separate description of each excavated burial. Burial one, see figure 4.191, contained an adolescent of *c.* 14 years old. It had been buried in the yellow clay of layer three. Its head was underneath the stones of a later grave (grave number five) and had been crushed by it. Burial two was only touched upon in the south section of the trench, therefore, only the skull was discovered. Heavy slabs had been placed over the grave. The third burial discovered was that of an infant. The infant was treated in the same manner as the adults; it lay on its back, extended and in alignment with Jerusalem. The only difference was that the left arm was flexed up at the elbow. The burial was placed in a trough of burned clay. This was interpreted as an old irrigation canal that had been cut or reused by the grave. This had happened in two other places as well, but here no mention is made of the location. The grave was covered with 4 slabs and an upright stone stood at the feet. Burial four was found just underneath the topsoil and remained unexcavated. This is the grave visible in the lower left corner of the photograph in figure 4.191. The grave was ringed by small round stones and had two upright stones. The orientation was again north-east to south-west. If the position of the body was the same as in the other graves the feet were covered with the largest upright stone. The level at which grave four was discovered was, however, much higher and suggests a younger age. Furthermore, the type of grave with a row of stones encircling it and two larger stones at the head and feet seems to indicate this was an Islamic burial. Islamic burials were also orientated north-east to south-west but with the head to the south-west and facing north-east. If this was indeed the case the largest stone would be located over the head, which is the normal practice (see also section 4.6.3). Kirkbride, however, makes no mention of this possibility and assumes this burial to date to the Late Roman period as well.

The last grave, number five, must be considered as the most extraordinary. This time the body was laid in a sort of built up sarcophagus. First the grave was outlined by a line of small round boulders. On top of them neat building blocks were placed. Six large flat slabs covered the grave and small stones were placed between all slabs to close the cist as completely as possible. When dismantling the grave it was discovered that on the reverse of the third slab from the foot end a

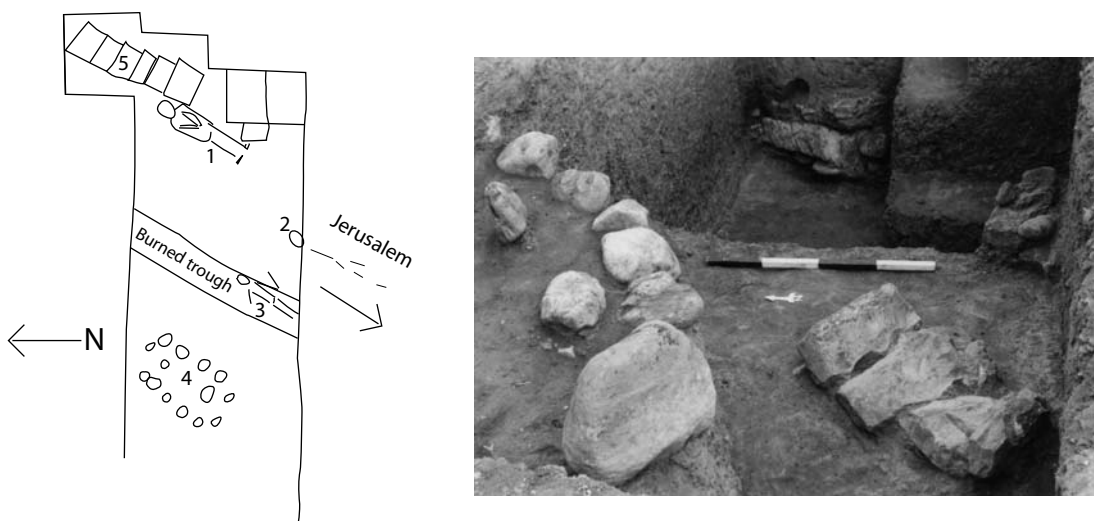


Figure 4.191 Area A, showing graves 2-5 (photograph + sketch by Kirkbride)

figure had been carved out by the pecking technique. The figure shows a sort of pillar with two horn-like attributes on top and two lines protruding from its middle part on either side. The lower part of the figure remained rough. It was suggested that the figure stemmed from an older period, originally stood upright and was reused as a covering slab of this grave. Its exact age was not clear to the excavators, but it was suggested that it could be of Iron Age origin and that it was definitely pre-Roman. Franken included a photograph of this stele in his article on the first season of excavation at Tell Deir 'Allā (Franken 1960: pl.16a).

Area B

Little information can be gained from the description of area B. It was located to the east of the refugee camp within the badlands. Again the trench was 2 m wide. Kirkbride defined 6 different soil layers. As there is no drawing or sketch it is uncertain what the relation between these layers was. The upper layer consisted of dark clay. This is followed by a layer referred to as a line of large boulders forming the foundation of possibly a house. Mud plaster had been smeared between the stones and it seemed that there were originally at least two courses. Underneath the stones is a black occupation layer, which is followed by a light clay layer and again a layer of dark occupation debris. The deepest layer is described as a mixture of clay and *khunma*.⁷⁹ Franken later added that the pottery discovered largely dated to the Early Iron Age, combined with a few Late Bronze sherds and a few Arabic to modern sherds, the last mainly located in the top levels. Franken states that the pottery is very similar to the main tell, by which he probably meant Tell Deir 'Allā, but that they were not incorporated in the main type series.

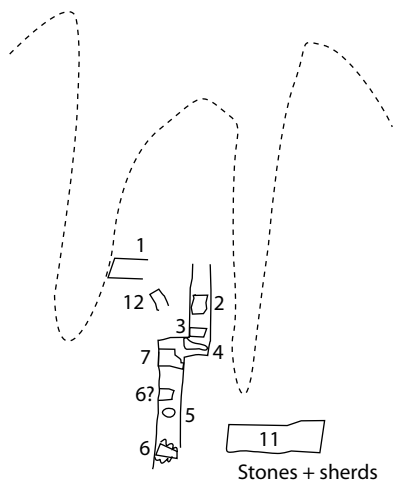


Figure 4.192 Sketch from Kirkbride of Area C

Area C

This area is located on the eastern side of the badlands, both up the side and along the top of a spur near what Kirkbride refers to as Ahmad's house, the location of which is unknown today. This time nothing is said about the size of the trench but the small sketch shows more than one trench. In contrast to her description of area A she only makes some general remarks concerning these graves. Like in the other areas the graves are all aligned northeast-southwest. Some are lined with stones while others are covered with slabs. Again an ancient canal was discovered that must have been older than the burial, because several graves cut into it.

⁷⁹ It is unclear what *khunma* denotes.

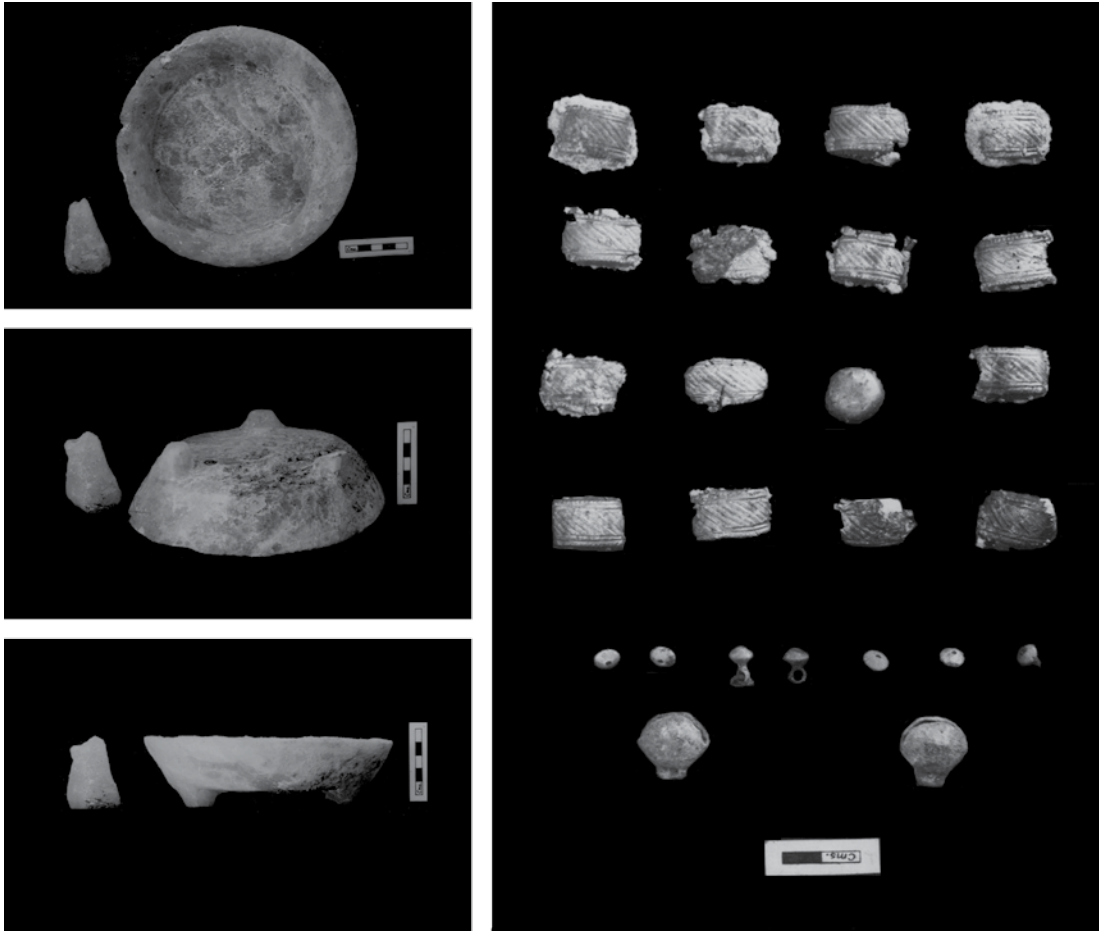


Figure 4.193 Finds discovered in area C (photograph Deir 'Allā Archive Leiden University)

From the notes it seems that seven burials were found in the first trench. The fairly indiscriminate sketch provides little clarity (see figure 4.192). In burial number five bronze bells were discovered (see figure 4.193). Kirkbride suggests these were most likely attached to a bracelet or ankle ring. Grave number six was again lined with stones and had a large slab across the feet.

At least two more graves were found, numbers eleven and twelve. Both were hit by the pick during excavation. The sketch shows that they were located in separated trenches. Near the head of skeleton eleven rings of gold leaf with a decorated middle band with raised diagonal stripes were found. They were strung on a tiny copper chain. Kirkbride notes that they are rather large, squarish and chunky and that they were more likely used as earrings rather than as a necklace. A photograph with 'Area C' written on the back discovered in the Deir 'Allā Archive shows several small beads and rings besides the bells of grave five (see figure 4.193). Grave eleven has not been marked on the sketch, only its trench.

Kirkbride notes that in grave twelve an alabaster tripod bowl with a tiny, rather rough pestle was found. Three photographs of a bowl and pestle that perfectly fit this description were found in the archive, but these were labelled as stemming from Tell al-Mazār (however, one photograph also carried a question mark). This must have been a mistake and it is fairly certain that the bowl depicted here is the same as the one described by Kirkbride. The bowl itself is still present in the Deir 'Allā Archive. Grave number twelve further revealed *c.* 12 glass tear bottles that were lying under the skull and were broken in antiquity. All of these bottles had long necks, small bodies and recessed bases, wrote Kirkbride. Except for a small sketch no photographs, drawings or fragments of the bottles themselves remain.

In the notebook there are also the entries ‘13 small juglet –broken’ and ‘14 broken cooking pot’. It is uncertain whether these numbers refer to graves, trenches or to find numbers. In the exhibition created by Homes-Frederique and Franken in 1985 in Brussels three items from this cemetery were shown. These were the alabaster bowl, a glass bottle (inv. no. J.13139 Amman), and a bronze spoon (inv. no. J.13138 Amman). The catalogue description states that these three objects were found in a grave at the Late Roman cemetery two kilometres east of Tell Deir ‘Allā (Homes-Fredericq and Franken 1984: 229, 230). The inventory numbers of the last two items show that these must have been brought to the depot of the Department of Antiquities in Amman.

Area D

The notes on area D are short and puzzling. The trench was located on the school plateau just above area B. As the school is still in the same location the identification of this location does not form a problem (748,000/3,565,000). Unfortunately, the notes say nothing more but ‘many single graves aligned on Jerusalem. From Abu Aqab’s tell?’.

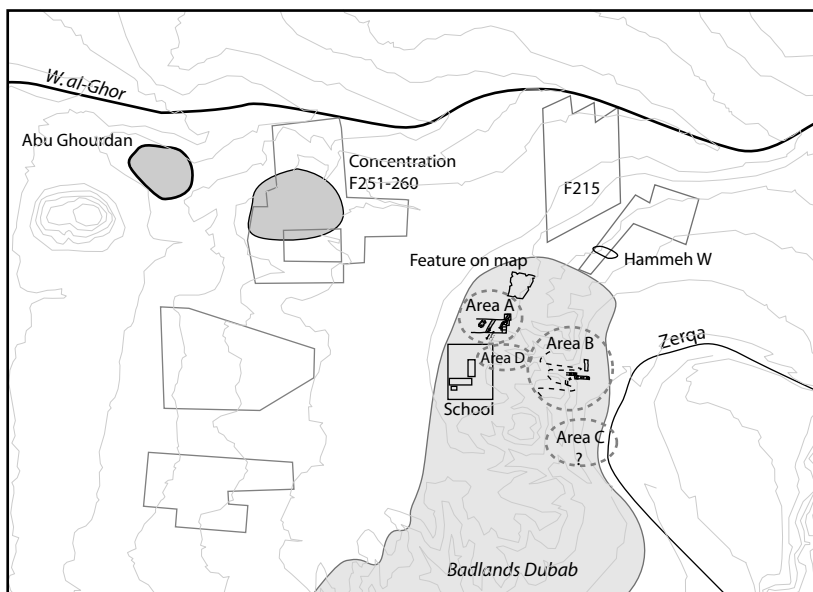


Figure 1.194 Deduced location of the cemetery trenches made by Kirkbride and related features

In a field north of the village of al-Dbāb surveyed in 2006 a number of large more or less flat stones was discovered in plot 215.7.2. The field was recently ploughed and surrounding the stone an east-west running band of *c.* 5 m wide extending over some 75 m of more clayey banded soil was visible. The larger stones were in general elongated and more or less angular (55 x 30 x 15 cm and 75 x 30 x 15 cm), but a rounded example (55 x 60 x 15 cm) was also present. A broken lower grinding stone (40 x 25 x 15 cm) was also found. Unfortunately pottery was rare and no precise date can, therefore, be given to this discovery. It seems likely, however, that a Late Roman grave similar to the ones excavated by Kirkbride less than a hundred metres to the south was encountered. The stones are similar both in appearance and size and the broken grinding stone may well have been reused to cover a grave like the stele in Kirkbride’s excavation area A.

If graves were indeed touched upon in field 215 the cemetery would measure *c.* 45 m from north to south taking the mentioned school of al-Dbāb as the southernmost edge. From east to west the badlands measure *c.* 350 m from halfway up the hills in the East where area C must have been located to the other side of the road running west of the village of al-Dbāb. This amounts to *c.* 15 ha, making it a very large cemetery should this total area have been used. In the excavated trenches the graves were certainly densely packed as fourteen graves plus the ‘many single graves’ of area D were unearthed in the small area excavated thus far.



Figure 4.195 Stones in plot 215.7.2 (towards the WSW with Tell Deir 'Allā on the horizon)

The Roman road

Several milestones discovered in the Jordan Valley show that one of the main roads through the Roman Empire passed through the rift valley. In the eastern Jordan Valley at least eleven milestones have been discovered north of the Zerqa (e.g. Mittmann 1970). A few hundred metres SSW of 'Abū 'Ubaydah, *c.* 150 m to the west of the modern Jordan Valley road, four parts of a milestone were discovered during construction work (Mittmann 1970: 143). Their find locations show that the original findspot had been disturbed. Part of the column containing an inscription was found at the foot of the East Ghor Canal dike, 50 m to the west two other parts were found and the fourth piece was located in a side irrigation canal further to the west (Mittmann 1970: 143). The inscription is exactly the same as that of a milestone located a mile to the south, except that a location and mileage are absent (see below). The inscription can be dated to the seventh period of yearly *tribunicia potestas*, which should have fallen between 10 December 181 and 9 December 182 AD (Mittmann 1970: 146). The top part of a second milestone and the foot of a column were discovered somewhere in an agricultural field *c.* 1.6 km north of Tell Deir 'Allā and *c.* 350 west of the Jordan Valley road (Mittmann 1970: 143).

Mittmann concludes that a Roman road crossed the Jordan Valley from north to south on the eastern side of the Jordan. He supposed the road went along Tell 'Ammata, passed 'Abū 'Ubaydah to the west and ran *c.* 500 m to the west of Tell Deir 'Allā. Here there might have been another road connecting Amman and Salt to the valley (see below) (Mittmann 1970: 143,144). Although no milestones have been found further south, Mittmann supposed that the road continued south towards Livias (Tell al-Rama). It is, however, certain that there was a crossing over the Jordan to the west and Mittmann suggested this might very well have been at Dāmiyah where the Wadi Far'ah offers an easy route to Neapolis (Nablus) on the Cisjordanian plateau (Mittmann 1970: 144)

At more or less the same location north-west of Tell Deir 'Allā as Mittmann described the lower half of a milestone was discovered which probably fits the upper part discovered by Mittmann (O'Hea 2002: 235). Today this stone stands in front of a house on the western side of the Jordan Valley road just south of the village of Dhirār, but its original findspot was further to the east (O'Hea 2002: 235; pers. comm. farm owner). This part contained an inscription with traces of



Figure 4.196 Selection of stone artefacts in front of the house in 2006

red

paint, which are invisible today (O’Hea 2002: 235). In 2006 the landowner was visited. This man is evidently interested in antiquities as he and his farm hands had gathered a collection of columns, bases, hewn stones and many grinding stones in front of his house. These were all found on his property, located to the west of the present day Jordan Valley road and extending from north to south for a few kilometres.

The inscription on the milestone is identical to the inscription on the one from ‘Abū ‘Ubaydah except for the mileage, which is lacking at ‘Abū ‘Ubaydah, and was, therefore, also dated to 181/182 AD (see figure 4.197) (O’Hea 2002: 236). These milestones were most likely erected during the restoration of the road carried out on the occasion of the visit of the Roman emperor to this part of his empire in 183 AD. The lowest part of the inscription reads: ‘from Gadoron: 20 miles’. Gadoron can be identified with Godora or modern Salt, which is indeed *c.* 20 Roman miles away (O’Hea 2002: 237). Fortunately the inscription is very clear at this part so the place cannot be confused with Gadara, which is modern Umm Qays.⁸⁰

The direction to Salt makes it likely that a side road joined up with the north-south road. Some other finds provide further indications of the trajectory of this road. In 1934 Mallon describes a paved road at the foot of the northern slope of Tell ‘Abū al-Zīghān, which he concluded must date to the Roman period. He describes this road as well preserved and six meters wide. A row of regular hewn stone divides the road in two halves that both slope down slightly towards the edges. The road ran towards the west and this track could be made out for *c.* 1 km until it reached the bed of the Zerqa (Mallon 1934: 60). In the 1960’s Mittmann probably detected the same stretch of road. He described it as a five meter wide paved road with rows of longer stones in the middle and at the edges, which extended for *c.* 100 m. As the road was partly cut into the slope of the hill he was able to make it out almost completely up the plateau (Mittmann 1965: 86). Today nothing of this road could be discovered. Further up the slope, however, more milestones have been discovered. Near the village of Hawai, 1.5 km south of Nedi Oscha` at foot of the Jebel Mesera, four to five milestones have been discovered that can be dated by their inscription to the reign of emperor Trebonian and his son which lasted from 251 to 253 AD (Huppenbauer 1962: 175,179). Slightly to the south of this stone with inscription a small piece of paved road was discovered and at Nedi Oscha` anepigraphic milestones have been found. It seems very likely that the road to Salt



EMPEROR CAESAR LUCIUS AURELIUS
COMMODUS ANTONINUS, AUGUSTUS
GERMANICUS SARMATICUS, YEAR 7
OF TRIBUNICIAN POWERS, YEAR 3 OF
CONSULSHIP, SON OF THE DIVINE
ANTONINUS (M. AURELIUS), NEPH-
EW OF THE DIVINE PIUS (ANTININUS
PIUS), GREAT-NEPHEW OF THE DI-
VINE HADRIAN, FATHER OF THE FA-
THERLANDS, FROM GADORON, 20
MILES.

Figure 4.197 Milestone along Jordan Valley road, south of Dhirār. Translation (O’Hea 2002: 235).

80 A similar milestone near the village of Kufrinji located to the north of Deir ‘Allā was reported already in 1960. In the garden of the miller George Hamid Murad several fragments of a milestone were found that contained an inscription, divided over two fragments, also dating to the reign of Commodus (180-192). No mileage was indicated (unpublished notes H. Brunsting, Deir ‘Allā Archive).

branched off from the north-south road just north of Tell Deir 'Allā, passing along the concentration in fields 251-254 and crossing the Zerqa at 'Abū al-Zīghān. Here the 100 m stretch that was preserved shows that the road was fully paved. From here it continued up the slopes in a southeasterly direction towards Salt. The discovery of the epigraphic milestones at Hawai shows that the roads in the Zerqa Triangle were not only restored in 181/182 AD but still used in 251/253 AD. The latest date of a milestone in the Jordan Valley is 305/306 AD (Mittmann 1970: 148,149). Although no inscriptions are available to prove it, it is likely the Roman roads continued to be used during the Late Roman period.

Conclusion

The number of tells that had a Roman or Late Roman occupation phase is rather limited. Only Tell al-'Adliyyeh and Tell 'Ammata yielded remains from the Late Roman period both on their surface and in their excavated layers (Petit in prep.). The other tells contained lower amounts of Roman/Late Roman pottery. Given the number of sherds and their bias it seems that occupation at these tells cannot have been more than a simple shed or some storage facility. More extensive occupation in the form of villages or hamlets does not seem to have taken place at these tells. The other tells where remains of these periods have been found represent even smaller scale activities perhaps mere visits. Apart from Tell al-'Adliyyeh and Tell 'Ammata more intensive village occupation in this period seems to have been founded on previously unoccupied areas, e.g. the 'Ammata concentration and the concentration in fields 252-254. Tell al-Muntih, Tell 'Abū Sarbūt and Tell 'Abū al-N'eim are tell sites today, but their earliest periods seem to be Roman and/or Late Roman and initial settlement, therefore, took place on virgin soil. All these newly founded settlements seem to have started on a small scale in the Hellenistic and/or early part of the Roman period, increased in significance in the later part of the Roman period and reached their climax in the later part of the Late Roman period, only to end somewhere in the Umayyad period. The two excavated tell sites however, lack early Roman remains and only demonstrate occupation of some size during the Late Roman period, while Abu Ghourdan was probably first occupied in the Late Roman period and remained occupied into the Umayyad period (Franken and Kalsbeek 1975). The flourishing Late Roman society that has been attested elsewhere in Transjordan, which had its climax in the sixth century AD, is thus also visible in the Zerqa Triangle (Oettel 2004: 233).

The presence of a major road and crossroad, probably built at some point during the Roman period and restored in 181/182 AD, may have stimulated settlement in the area. The concentrations discovered are essentially village settlements that had a level of luxury beyond the simple farms/hamlets that were characteristic for so many other periods in this region. The fragments of different glass bowls, bottles, flasks, the multi-coloured mosaics, marble slabs and the columns of which some had acanthus leaf decorations demonstrate this higher level of opulence. The cemetery discovered by Kirkbride also shows that a certain amount of luxury was available to the people buried. This is especially clear from the gold plated rings, beads and bells, the 12 glass bottles and alabaster bowl with pestle found in individual graves. Although only a small part has been excavated and the locations of excavated areas are not determined with certainty, it is nevertheless clear that the graveyard covers a large area and contains many graves. The collected and excavated finds as a whole point to a subsistence relying for a large part on farming. Compared to cities both to the east and west, like Jerash, Umm Qays, Madaba or Jerusalem, these villages were mere rural villages or possibly villas, which made up the rural countryside outside the urban centres.

4.5 The Islamic period

4.5.1 *The Islamic distributions (excluding the Ayyubid/Mamluk period)*

The distributions dated to the Islamic Period in general are problematic as this is more or less a remainder category. The pottery of these periods has only recently received a significant amount of scholarly attention (e.g. Stacey 2004; Avissar and Stern 2005). However, identification of pot-

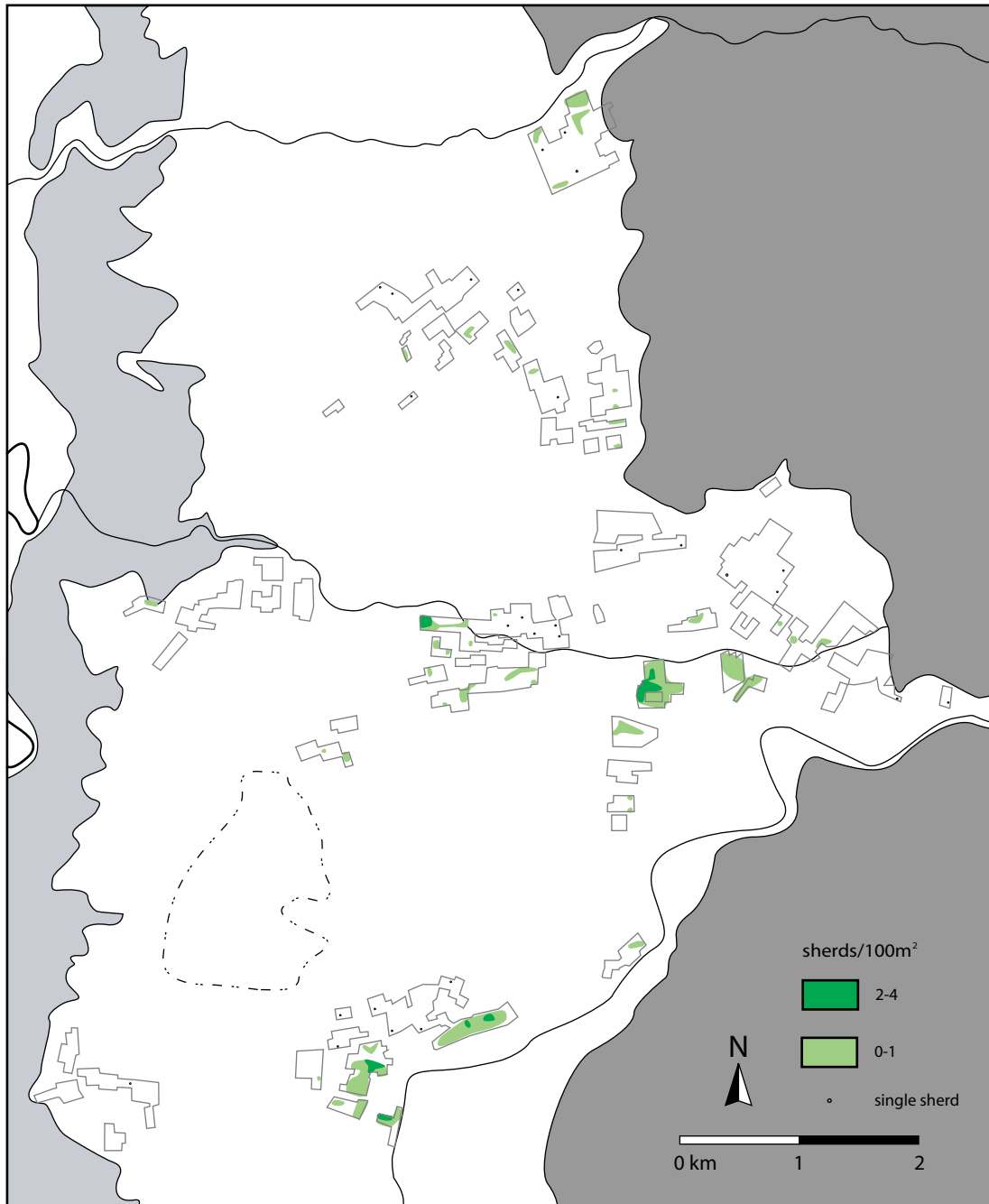


Figure 4.198 Distribution of feature sherds dated to the Islamic Period.

tery from this period proved difficult in the survey and only in a few cases could a precise date be given. The only clearly datable period that was discovered in this survey was the Ayyubid/Mamluk period. This pottery distribution is treated separately as a distinct pattern is visible. Furthermore the last phase of the Ottoman and the (pre-) modern periods, termed Late Islamic/modern, could be distinguished. The remainder of the pottery of the Islamic period was difficult to date. Only a few feature sherds were discovered and of these only two could be positively identified as stemming from one of the subperiods, i.e. the Abbasid and Fatimid periods.⁸¹ Given the broad cultural

81 Both sherds came from the same plot, i.e. 300.2.5.

and chronological range of the Islamic period all sherds can be regarded as being of questionable date. They post-date the Late Roman/Umayyad periods and do not belong to Mamluk or recent times, but dating cannot be more precise than somewhere in the period from 750 to 1250 AD and the presence of pottery dating between *c.* 1600 and 1850 cannot be ruled out as this is a poorly understood period. It is impossible to give a detailed interpretation of the pottery distribution from this period, but a few insights can be gained from it.

It is clear that general densities are very low. In a few areas densities are more clustered and slightly higher than the standard 0 or <1 sh/100 m². This is, for example, the case to the south of Tell 'Ammata. Historical sources report that 'Ammata or 'Amta as it was then called was occupied during the Late Fatimid and Ayyubid periods, as both Idrisi writing in 1154 AD and Yakut (1225 AD) mention it as being a settlement (Le Strange 1965: 31, 393). Other historical sources and architectural remains show that 'Ammata and its vicinity were occupied during the Mamluk period as well (see section 4.6). The pottery discovered might well be connected to the occupation of this site during these periods.

Another slightly denser area has been discovered east of Tell 'Abū Sarbūt. Excavations have revealed the presence of a succession of villages during the Ayyubid, Mamluk and possibly early Ottoman periods (De Haas et al. 1989, 1992). It is likely that the pottery discovered besides this tell is linked to these excavated remains. Non-standard pottery from these periods was likely not recognized and hence has been grouped under the general Islamic pottery category.

The cluster centring in field 252 might show the same phenomenon as the halo around Tell 'Abū Sarbūt. At this location both a Mamluk concentration (see section 4.6.2) and a Hellenistic to Umayyad concentration (see section 4.4.2) were discovered. Pottery from these sites may have been dated to the general Islamic group. Another factor that may have played a role is the presence of habitation from the Abbasid, Fatimid and Ayyubid/Mamluk periods at Tell Abu Ghourdan located somewhat to the west. The slightly higher densities may be part of the halo of this site, which was interpreted as a small village (Franken and Kalsbeek 1975).

The higher densities in the fields surrounding Tell 'Abū al-N'eim are most likely connected to the presence of the tell that has attested remains from all periods since the Roman period (Glueck 1951: 316; Ibrahim et al. 1988a: 191). The densities are too low and spatially too connected to the tell to suggest that these sherds represent separate sites. They may of course be related to the manuring of gardens surrounding the tell, but a link to the tell seems clear.

The already discussed enigmatic concentration to the north-east of 'Abū al-N'eim may, however, represent a separate site with features buried beneath the surface. As discussed before, apart from these sherds this area contains faint clusters of a few poorly visible periods, i.e. the LBA and Hellenistic Period. Regarding the Islamic periods, this is the location where the only precisely datable sherds were discovered. The wide distribution of very low densities extending to the west may be related to the Mamluk sugar pottery concentration located here. Nevertheless, the small cluster of slightly higher density in the east may represent a buried feature. The low number of sherds and the poor datability prohibit any firm conclusions, however.

Concluding, the pottery from the Islamic period discovered in the survey is subject to severe dating problems, which hampers firm conclusions being drawn on the basis of the spatial pottery distribution. When a more detailed pottery typo-chronology applicable to the Jordan Valley becomes available it might very well be that more concentrations can be identified from the pottery assemblage collected in the survey. Additional information will probably make it possible to date sherds more precisely that are now classed as 'general Islamic' or have not been dated at all. Although, the understanding of these periods is rapidly expanding, the published material, especially regarding wares, was at the time of pottery analysis insufficient to date this relatively low number of fragmented surface pottery more precisely.

4.6 The Ayyubid and Mamluk periods

4.6.1 The Ayyubid / Mamluk period distributions

Introduction

The pottery dating to the Mamluk period was collected and analyzed slightly differently from the standard method. The sugar industry sites described below yielded a great many large and heavy sherds. Given their large mass and the uniformity of the pottery total collection was impractical and unnecessary. It was therefore decided to count the so-called sugar pottery and only collect a representative sample from the sites encountered. Off-site sugar pottery, however, was collected like all other sherds. The sugar pottery from sites can, therefore, not be broken down into feature and non-feature sherds, but as they have a very typical shape and ware non-feature body sherds could usually be identified as sugar industry pottery without any difficulty. The off-site sugar pottery body sherds are included in the non-feature sherds. However, they were often recognized as sugar pots and by the entry of a remark they can be separated from the other non-feature sherds from this period. The very typical form and to a lesser extent ware of these vessels, which is a direct result of their special function, made these vessels highly recognizable. Furthermore, their thickness has ensured that many large fragments have survived to this day meaning that few sherds will have been missed. This has resulted in a high identification rate of this type of vessel present on the surface.

The non-sugar industry pottery from the Mamluk Period on the other hand was collected and analyzed in the standard way. Given the inclusion of this period in the relatively homogeneous non-feature sherd group incorporating all sherds from the Hellenistic period onwards, the non-feature sherds from this period cannot be identified separately. However, the character of the pottery from this period means that probably only a small proportion of the total pottery assemblage will have generated non-feature sherds. The most common type of pottery in this period is the so-called Hand-Made Geometrically Painted Ware (HMGPW) (see next section). This is a pottery type bearing intricate geometric decoration painted in dark purple or reddish slip sometimes on a white slipped surface. By virtue of their decoration all sherds from this type of vessel will be feature sherds. The second, but much less common group of vessels is that of the glazed wares. Like the HMGPW, body sherds from these vessels fall within the feature sherd category. The plain ware vessels and hence the indeterminable non-feature sherds form only a small proportion of the total Mamluk pottery assemblage (see next section). Like the sugar pottery, the domestic Mamluk pottery is well recognizable and well datable. It is, therefore, believed that of the Mamluk pottery present on the surface only a relatively small portion was not collected from the surface or could not be identified.

The sugar pottery sites

The sugar pottery distribution map depicted in figure 4.199 shows four areas with clearly higher than average densities. In the northern and north-eastern concentrations densities do not exceed 20 to 50 sherds per 100 m², while the other two areas have much denser centres yielding to more than 100 sh/100m². There seems to be a difference between these high density areas. The southern and to a lesser extent also the south-eastern concentration show a typical site layout with a high density centre surrounded by concentric circles of decreasing densities. In the southern concentration the entire concentration seems to have been surveyed, while the south-eastern one may extend slightly further to the west. Given their layout with high densities spread out over a small bounded area these two sites are interpreted as a site with remains below the surface. The other two higher density areas are truncated on at least one site. This edge together with the lower densities suggests these areas might merely be part of the dense halo surrounding the site instead of the centre of the site located above the buried mother population itself. Information on the vicinity seems to corroborate this hypothesis. Immediately to the south of the northern concentration the remnants of a watermill surrounded by many sugar pot sherds was discovered inside the village

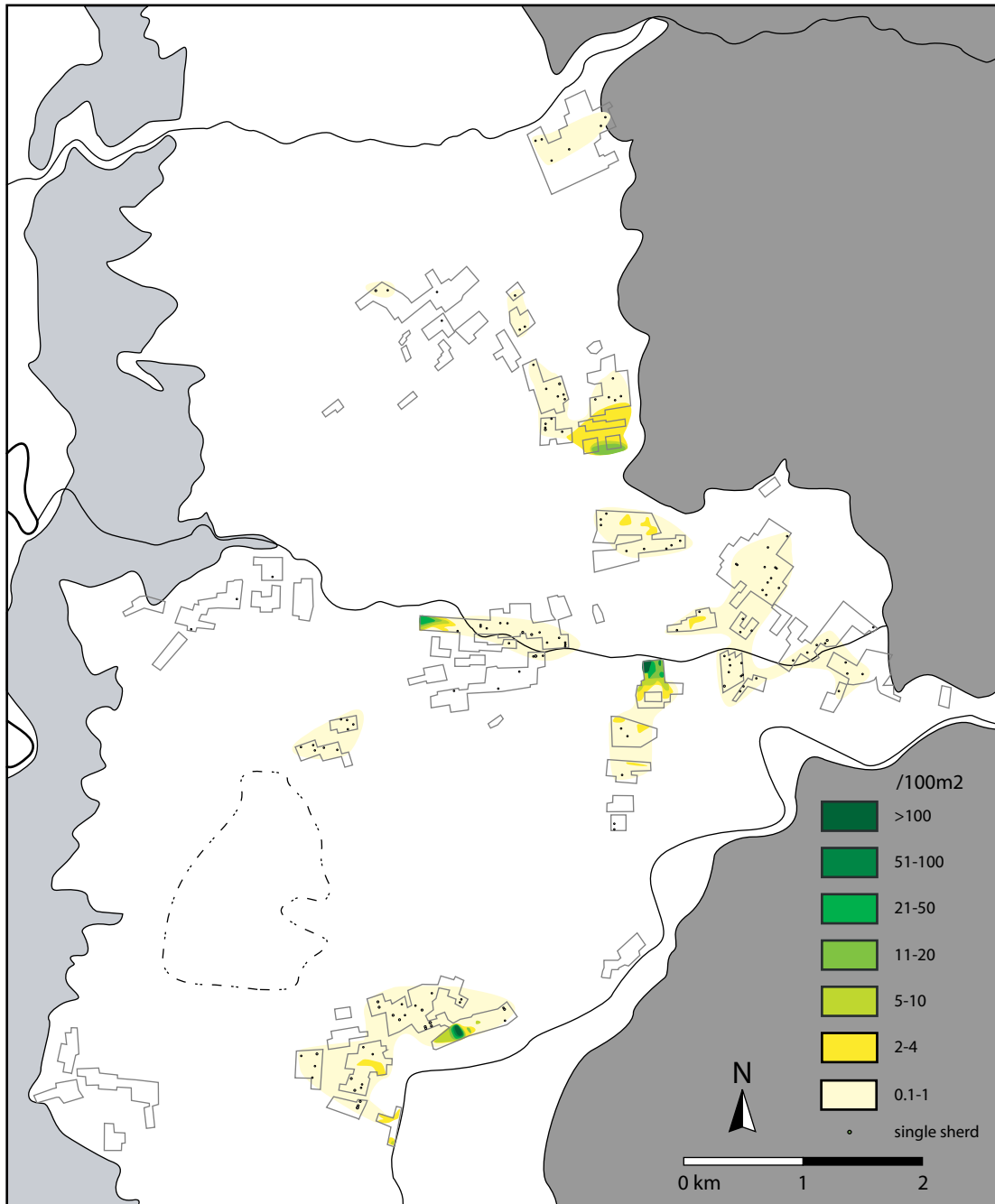


Figure 4.199 Distribution of Mamluk sugar industry pottery

of Dhirār (see next section). Villagers informed us that a tell had once been present at this location, but nowadays a road runs over it. The area around the mill and beside the road was surveyed, yielding many sherds from the Mamluk period. Unfortunately the village did not allow the utilisation of the standard survey method making statistical comparison and depiction of this site on the distribution map impossible. Nevertheless, the presence of a site from this period suggests the interpretation of the higher density area to the north as part of the halo is correct.

A similar situation pertains to the north-western concentration. Immediately to the west of this concentration lies the excavated Tell ‘Abū Sarbūt. Excavations have demonstrated the existence of a series of Mamluk villages and structures related to the sugar industry at this site (De Haas et al. 1989, 1992). The density to the east of the site that is lower than the densities at the centres of the

other two sites can therefore be regarded as a halo surrounding the actual Mamluk site. The closer proximity together with the modified nature of the tell explains the higher densities compared to the northern concentration.

Sugar pottery off-site distribution

Apart from these sites, low densities of sugar pottery were discovered across large parts of the region. Densities are not high, but their wide distribution makes that ploughing or the manuring of gardens are not likely explanations. Furthermore, the industrial nature of the pottery rules out temporary encampments of nomadic groups as a reason for this distribution. The very dense concentrations and wide distribution of the off-site materials similarly discount the explanation of a 'hidden' landscape of which only a few sherds survive. The only explanation that cannot be directly refuted is that of manuring. In this case manuring would not or not only be done with domestic but also with industrial refuse. This is not only a fitting explanation for this pottery distribution, it is also evidenced in historical sources (Galloway 1989: 36). Given the location of at least four sugar industry sites in this region, it is likely that large parts of the region were used for the cultivation of sugar cane (see section 6.3). Sugar cane depletes the soil very rapidly. People have tried to counteract this by crop rotation, cultivation of green manure and manuring itself (Galloway 1989: 36). Both animal dung and ash may have been used. Cattle was kept for transport and traction. Archaeozoological analysis has confirmed the presence of a considerable amount of cattle (Van Es 1995). These animals will have visited the mill regularly while transporting cane and will probably have had a fixed resting place where sherds may have become mixed in with the dung which was later distributed over the fields. The other way in which manuring may have distributed sherds over the fields is the use of ash as fertilizer. The production of sugar involved the repeated heating of the sugar cane by which large quantities of ash were produced. There are no texts that record the use of ash from the mill to enrich the fields, but the practice of burning down the stubble on the fields to aid ploughing, weeding and to fertilize the soil has been reported, e.g. in texts by Nuwayri (Tsugitaka 1997: 216). Given the demonstrated benefit of ash for soil fertility, the large quantities of ash that were a by-product of sugar production may have been spread out over the fields as well. It seems warranted therefore to conclude that the wide off-site distribution that is similar to the Roman to Umayyad distribution, although much less dense, was the result of manuring.

The non-sugar industry pottery

The distribution of Mamluk pottery that was not related to the sugar industry is very different, although finds were discovered in the same areas. What immediately stands out are the much lower densities and the smaller area over which finds were discovered. This difference in off-site distribution suggests these assemblages from the same period are subjected to dissimilar processes. Archaeologically there is little difference in the visibility and identification of these assemblages. Furthermore, post-depositional and geomorphological processes will have been similar. The difference must, therefore, be attributed to variable human activity. As discussed above, the sugar pottery off-site distribution was interpreted as representing the manuring of the fields. This was evidently not carried out with domestic refuse as the distribution depicted in figure 4.200 shows large areas that are completely empty. The cattle that were the likely producers of manure were, therefore, kept at the mill and not in the village.

Furthermore, the densities in the fields where considerable quantities of pottery were found are not as high as those of the sugar industry sites. Densities and especially the shape of the distributions are very similar to distribution patterns that have been interpreted as haloes. Especially the distribution to the east of Tell 'Abū Sarbūt is very similar to the sugar pottery distribution located on the same spot. Given the similarity, the same interpretation of a halo around the village on the tell is attached to this concentration.

The higher densities around Tell 'Abū al-N'eim are given the same interpretation of a halo based on the spatial relationship with the tell. The higher density area encircles the tell and drops to zero a few metres away from the tell. Only the field to the south of the tell had higher than

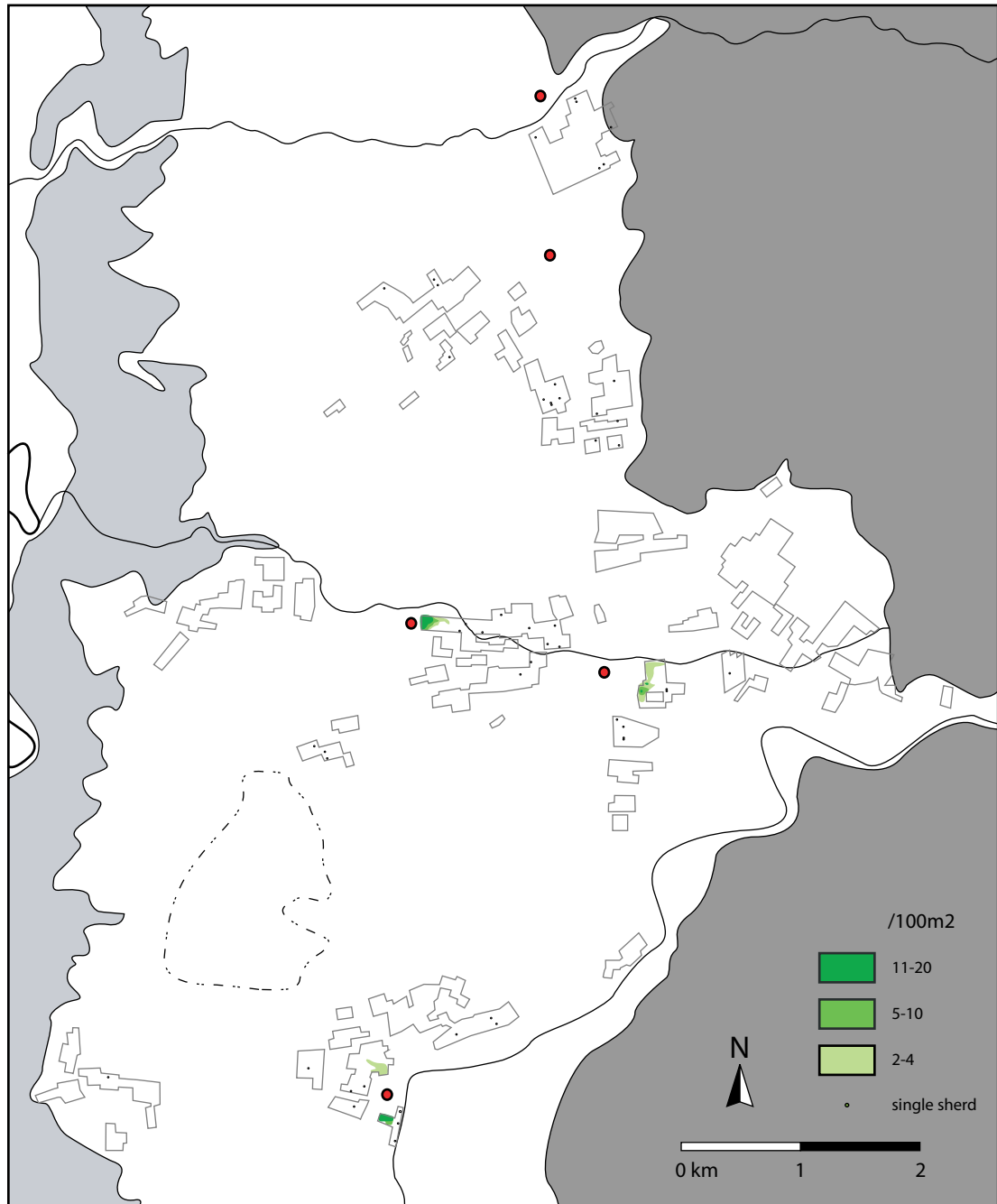


Figure 4.200 Distribution of non-sugar industry feature sherds from the Mamluk Period

average densities; together with the low level of abrasion of the sherds and its spatial restriction this area might be taken as the extension of the site at this location (see following section for more detail).

The small amount of domestic pottery discovered at the same location as the sugar industry site to the east of Abu Ghourdan is difficult to interpret. On the one hand it can be considered as belonging to a halo of pottery surrounding Tell Abu Ghourdan. Franken's excavations have proved the existence of village occupation from the Mamluk period at this location. The presence of the mill precludes the possibility that the halo was partly created by the manuring of gardens in the immediate vicinity of the tell. On the other hand, this concentration does show a small area with higher than average densities that might be regarded as a centre and shows decreasing densities towards the north, east and south. This small concentration may, therefore, also be interpreted

as a small habitational area connected to the industrial site, for example in the form of a guard house commonly referred to in texts or an area where people who worked in the mill took their meals.⁸²

The low off-site densities visible between Tell 'Abū Sarbūt and Tell Abu Ghourdan, to the north of Dhirār and to a lesser extent also to the south of Tell 'Ammata may be linked to work in the fields surrounding these villages and even to very low intensity manuring, possibly once sugar cultivation had ceased. The excavations at Tell 'Abū Sarbūt have shown that village occupation continued after sugar industry at this site had ceased to exist.

In conclusion, it can be stated that the industrial and domestic segments of Mamluk society have left very distinct distributions that were clearly generated by different activities. Although the difference in type of pottery assemblage should be taken into account, the archaeological differences of recognition and datability are very small between sugar industry and domestic Mamluk pottery. Post-depositional processes will undoubtedly have acted differently on varying types of remains, e.g. a stone mill and boiler room compared to a small mud-brick farm. Yet, the difference are so great and especially the industrial off-site pottery is so widely distributed that different human actions must lie at the basis of this distinction.

4.6.2 The Ayyubid/ Mamluk concentrations

Fieldno.: 31, 250-251

Coordinates: 747,550/3,565,550 (centre)

Size: c. 100 x 100m (centre)

Date and time surveyed: Oct. 24th, 2004 and Sep. 28th, 2006, c. 18 man hours

Periods discovered: Mamluk

Description

During the 2004 season the survey came across a dense concentration of sugar pots located c. 500 m east of Deir 'Allā.⁸³ Large numbers of sugar moulds and syrup jars were discovered (see figure 4.201). The surveying of this concentration was not carried out in a complete fashion because of the large quantity of sherds. Only a limited amount of domestic, non-industrial Mamluk pottery was found. To check whether this limited amount of domestic pottery was representative of the entire site, the supposed centre of the concentration, which had been planted in 2004, was surveyed in 2006. Again large quantities of sugar pottery were discovered, while only a limited number domestic pottery sherds were collected, mainly of the so-called hand-made geometrically painted ware (HMGPW) (Johns 1998). In contrast to the 2004 season sugar pottery was only counted in 2006. These counted sugar pots were registered among the non-feature sherds.

In figure 4.201 the counted number of sugar pots are depicted. It is clear that the highest densities are present in the northern part of field 251. While the densest plot (251.5.3) contained as many as 324 pieces of sugar pottery giving an average of almost 750 sherds /100m². The number of feature sherds stemming from non-sugar related pottery was much lower. In field 251 where the highest densities of sugar pots were found as few as four Hand-Made Geometrically Painted Ware (HMGPW) sherds, three glazed sherds and six possible plain domestic vessels from the Mamluk period were collected (see database). These types of vessels are generally regarded as having a domestic function. In figure 4.202 the domestic Mamluk feature sherds are depicted. Numbers are low, especially compared to the dense sugar pot concentration from the same period. The highest density reached in this area is 19 sherds /100m². Notwithstanding the small numbers there is a clear difference in the location of sugar pottery and of domestic pottery. While the highest den-

82 A more detailed account of this distribution will be given in the next section.

83 In publications several names are used to denote sugar pottery. Here sugar bowls or sugar moulds are used to refer to the upper funnel part, while syrup jar is the term used for the lower receptacle part. Another common name is molasses jar. The term sugar pot is used for both the sugar bowl and syrup jar in contrast to e.g. Stern who uses this term to denote the sugar bowl (Stern 2001).

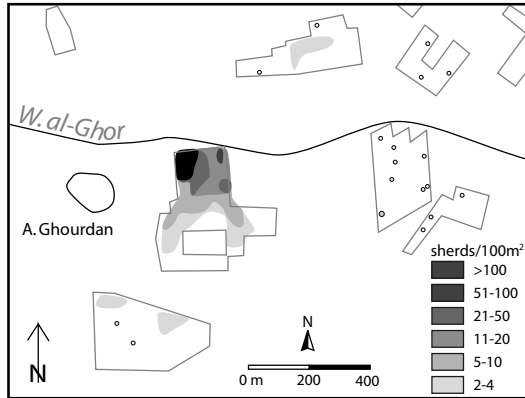


Figure 4.201 Distribution of sugar pottery

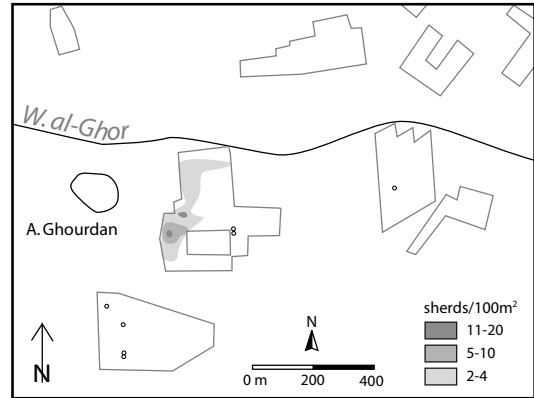


Figure 4.202 Distribution of domestic Mamluk feature sherds

sities of sugar pottery are located on the slope towards the Wadi el-Ghor, the domestic pottery centres in fields 252 and 253, more or less at the location of the Late Roman/Byzantine concentration described above.

Pottery

The sugar pots form the largest share by far of the pottery discovered in this concentration. In the entire area around this concentration (fields 250-254, 258-260) a total of 1811 sugar pot sherds were counted in 2006.⁸⁴ The total number of non-sugar pottery feature sherds amounted to only 88 sherds, which is less than 5%. Of these 88 overall domestic sherds 60, i.e. 68%, belonged to the so-called Hand-Made Geometrically Painted Ware (HMGPW).⁸⁵ This HMGPW is a very typical pottery type that appears around the second half of the 12th century (Johns 1998: 65). This ware is made from a coarse, poorly levigated fabric often with grog and chaff temper (Johns 1998: 87; LaGro 2002: 61). The bowls and medium sized jars or jugs made from this ware are handmade, often with the aid of a shaping dish, and only occasionally using a slow turning wheel (Franken and Kalsbeek 1975: 168; Johns 1998: 87). The surface was either slipped white or creamish or left unslipped giving a brownish to creamish colour. Most vessels are wet-smoothed and typically circa 50% of the vessels is burnished (LaGro 2002: 62). As the name already suggests, the most conspicuous feature of this type of pottery are the geometric designs painted in purple or dark reddish colours on rims, bodies and handles. Spirals, zig-zag motifs, meanders and rectangles are combined into intricate patterns. Both Franken and LaGro have drawn up long lists of motifs used (Franken and Kalsbeek 1975: fig.51,52; LaGro 2002: fig.3.0.1-21). However, the number of motifs and their integration into patterns seems almost endless, ensuring that no two pots are identical. The firing temperature of this ware is low and clouding through uneven firing occurs regularly (Johns 1998: 87). Firing most likely occurred in open fires (LaGro 2002: 62).

Total (non-sugar) Mamluk feature sherds	88
HMGPW	60
Monochrome glazed ware	7
Thin sgraffito ware	1
Glazed lamp	1
Green/brown glaze	1
Polychrome splashed glazed ware	1
Other domestic vessels	7

Table 4.82 Absolute numbers of Mamluk domestic feature sherds from fields 250-254, 258-260

⁸⁴ Both feature and non-feature sherds taken together.

⁸⁵ Other names given to this ware are 'pseudo-prehistoric ware', 'Ayyubid/Mamluk ware', 'Arab Geometric ware' (e.g. LaGro 2002: 55).

Whereas the introduction of this pottery type is relatively well fixed chronologically, its end date poses problems. It certainly extends into the 15th century AD as well dated stratigraphic contexts show (Johns 1998: 66). In later Ottoman times a pottery very similar to the HMGPW is present. Most likely the HMGPW of the Mamluk period did not disappear entirely at the end of that period, but developed into a very similar handmade painted Ottoman ware that has lasted until the present, when the modern handmade painted pottery of certain regions is reminiscent of the HMGPW of the Mamluk period (Johns 1998: 67). This Mamluk ware is the common pottery type in the entire Levant and, like in this concentration, it usually constitutes the majority of a pottery assemblage, e.g. Tell 'Abū Sarbūt and Tell Abu Ghourdan (Franken and Kalsbeek 1975; LaGro 2002). It is still uncertain by whom and where this pottery was produced. Its considerable weight and fragility due to the low firing temperature make it unlikely these vessels were traded over long distances (Johns 1998: 72). Petrographic research is, however, needed to ascertain whether these vessels were produced locally, perhaps by itinerant potters or in domestic production, or whether small production centres existed from where vessels were traded over small distances. During Late Ottoman and early modern times hand-made pottery was made by women for personal use in the household, because they could not afford finer wheel-thrown pottery (Ziadeh-Seely 2000: 83).

Although the number of non-glazed and non-HMGPW domestic pottery sherds will be under-represented in this concentration the high numbers of HMGPW are not exceptional. Excavations have shown that during the Mamluk period this was the common type of pottery, e.g. at Abu Ghourdan (Franken and Kalsbeek 1975). Northedge has, for example, stated that in Amman the HMGPW becomes the only tradition available at a certain moment (Johns 1998: 68). Other Mamluk concentrations discovered in the survey have revealed a similar distribution of HMGPW, glazed ware and other domestic Mamluk pottery (see e.g. Mamluk Tell 'Abū al-N'eim in section 4.4 and below). The HMGPW appears in the second half of the twelfth century, is very abundant in the Mamluk period, and continues in a derived form into the Ottoman period (Johns 1998: 66,67).⁸⁶ A few specimens of this type of ware discovered in this concentration are depicted in figure 4.203.

Eleven glazed sherds were discovered in this concentration. In this area glazing starts in the Umayyad period, but the use of this technique remained marginal during this early on (Hendrix et al. 1997: 266). In the following Abbasid period glazing is still only found on a small proportion of vessels. Abbasid glaze is characterized by a new technique called polychrome glaze present on the interior of plates and often in green, yellow or purple (Sauer 1986: 326). Underglaze decoration of green and brown painted lines on a yellow-green background also appear in this period, like Coptic glaze, green glaze, splash glaze and turquoise or blue glaze (Hendrix et al. 1997: 266). Glazing in the Fatimid period is characterized by presence on only a small proportion of vessels (Hendrix et al. 1997: 279). In this period a clear glaze is often applied to dark red cooking pots and polychrome splash glaze often occurs on plates (Sauer 1982: 334). Other styles include monochrome glaze, Fayyumi and sgraffito ware (Hendrix et al. 1997: 279). Glazing only becomes more common in the Ayyubid/Mamluk period. Glazed pottery was once regarded a hallmark of this period, but recent excavations have negated this (Hendrix et al. 1997: 291). Ayyubid/Mamluk glazed ware consists of green, yellow and brown monochrome glazed bowls often with moulded designs, underglaze painting, slip trailing and sgraffito (Sauer 1982: 335; Hendrix et al. 1997: 291).

The glazed sherds of this concentration can predominantly be dated to the Mamluk period. The seven small pieces with green and yellow glaze probably belong to the monochrome glazed ware. This type of glaze started in the later twelfth century, was abundant in the 13th and 14th centuries and continued in a derived form into the Ottoman period (Avisar and Stern 2005: 10-15). Only the wall profile and rim form can be used to date these bowls more precisely, but none of the discovered sherds is sufficiently preserved for this. The thin line sgraffito ware (252.1.1p9) occurs throughout most of the southern Levant and is generally dated to the 13th century (Avisar and Stern 2005: 16). Another green glazed sherd had a pinched rim with traces of soot on it (251.3.3p2). This sherd belongs to a lamp similar to the example depicted by Avisar and Stern and has been

86 For more information on the HMGPW one is referred to the Mamluk Abu N'eim concentration treated in section 4.4.2.

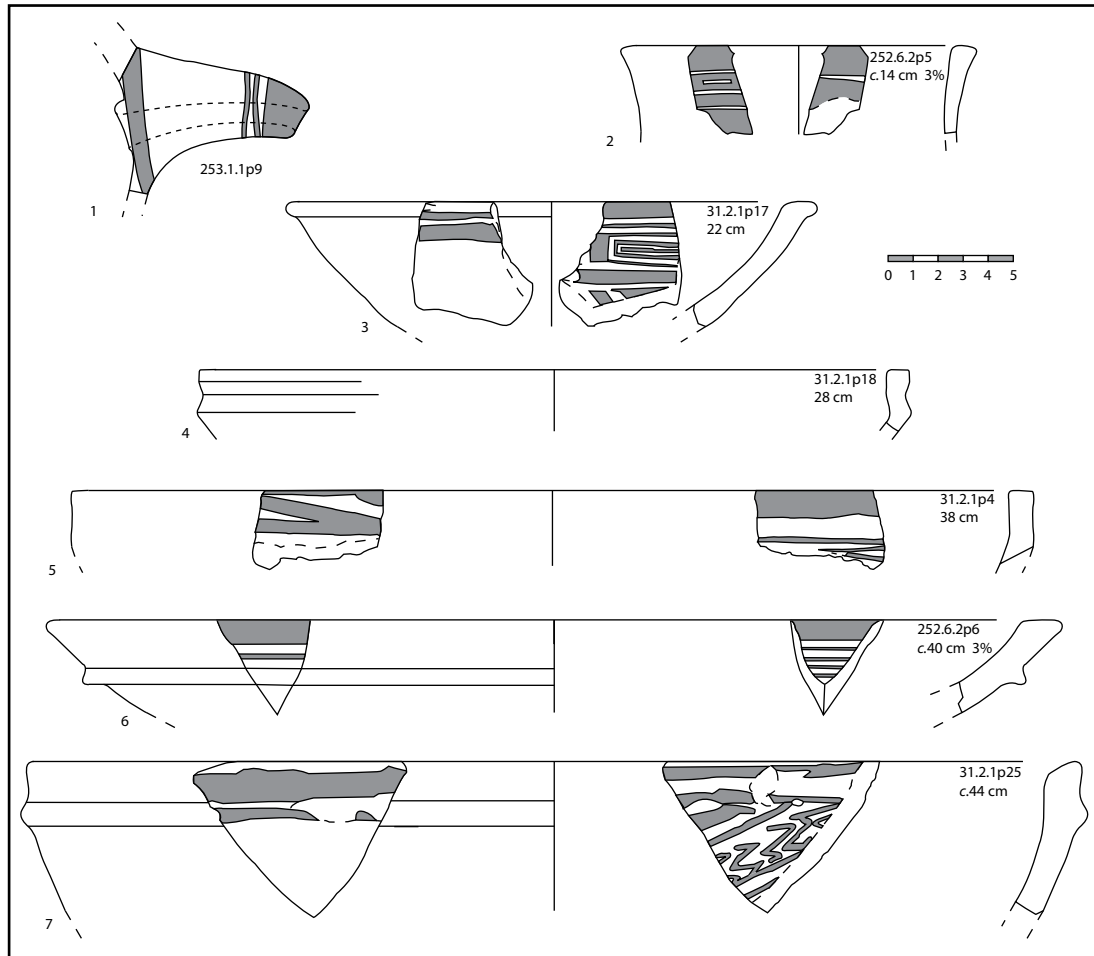


Figure 4.203 Selected HMGPW

No.	Sherd no.	Parallels	Date	Remarks
1	253.1.1p9	'Abū Sarbūt (LaGro 2002: fig.3:62)	Mamluk	HMGPW
2	252.6.2p5	'Abū Sarbūt (LaGro 2002: fig.3:48) 'Abu Ghourdan (Franken and Kalsbeek 1975: fig.66:4)	Mamluk	HMGPW, phase P
3	31.2.1p17	'Abu Ghourdan (Franken and Kalsbeek 1975: fig.62:4)	Mamluk	HMGPW; phase M
4	31.2.1p18		Mamluk	Same fabric
5	31.2.1p4	'Abū Sarbūt (LaGro 2002: fig.3:91)	Mamluk	HMGPW
6	252.6.2p6	'Abū Sarbūt (LaGro 2002: fig.3:90)	Mamluk	HMGPW
7	31.2.1p25	'Abu Ghourdan (Franken and Kalsbeek 1975: fig.63:32)	Mamluk	HMGPW, phase N

Table 4.83 HMGPW

dated to the Mamluk period or later (Avisar and Stern 2005: 128, fig.53:5, pl.XXXIV:4). Sherd 252.2.1p48 might belong to the so-called polychrome splash ware first appearing in the Fatimid period, but the identification of this sherd is not incontrovertible (Stacey 2004: 117, fig.5.25:1).

Apart from the HMGPW and the glazed pottery seven plain ware domestic vessels were identified. These numbers are without a doubt biased as plain ware feature sherds with a simple and hence common shape often cannot be pinpointed to a specific period. In this concentration these will often not have been distinguishable from the Late Roman/Byzantine concentration discovered in the same field. Non-descript Mamluk sherds will, therefore, be present in the database under the heading 'Roman or later'. These non-descript sherds are of course present in all concentrations. However, if a concentration is a single period site or the other periods are ceramically

very distinct, e.g. the Late Roman and EBA, a general idea regarding the date of these sherds can often be formed through ware comparison. In this concentration, however, the large number of Late Roman/Byzantine sherds masks the quite similar looking Mamluk sherds.

The sugar pottery

Sugar pottery is the most ubiquitous pottery found in the Mamluk period and is clearly associated with sugar production sites.⁸⁷ Sugar pottery consists of sugar bowls or funnel and syrup jars. During the production of sugar a syrup was procured that was poured into the sugar bowl to solidify. The remaining liquid dripped through the funnel into the syrup jar. To retrieve the sugar from the bowls many of them had to be broken resulting in high numbers of sugar bowls present at Mamluk sugar production sites. The 1811 sugar pot sherds counted on the surface of this concentration are few when compared to the quantities unearthed in excavations of sugar production sites. At neighbouring tell 'Abū Sarbūt as many as 94236 of the 157616 sherds excavated belong to sugar pots, even though the sugar industry ceased to exist halfway through the stratigraphic sequence of the site (LaGro 2002: table 1.1). The number of sherds discovered at the tell are of course related to the character of the loci excavated but the great quantity at Tell 'Abū Sarbūt, nevertheless, shows that the concentration discovered is no exception in this regard. LaGro examined the pottery from the Tell 'Abū Sarbūt excavation according to production techniques (LaGro and De Haas 1989/1990, 1991/1992; LaGro 2002). This is one of the few detailed analyses of excavated sugar pottery to date. An earlier pottery study of Mamluk pottery that included sugar pots was conducted by Franken and Kalsbeek on the material from Tell Abu Ghourdan located only 300 m west of this concentration (Franken and Kalsbeek 1975). Although only courtyard layers were excavated and no structural traces of sugar production were attested, considerable quantities of sugar pottery were excavated. Franken identified two types of sugar pots; type 1 and 2, now known as syrup jars and sugar bowls, and he described their general production method (Franken and Kalsbeek 1975: 143). In the sugar production process the sugar bowl was placed on top of the syrup jar and the boiled sugar juice was poured into the sugar bowl to crystallize, while the remaining liquid dripped into the syrup jar. Elaborating on original work of Franken and Kalsbeek LaGro identified several sub-techniques. These mainly differed from each other in the way the rim was formed, i.e. folded inwards or outwards, the addition of an extra coil or putting pressure on the rim (LaGro 2002: 43-46). In this way 23 subtypes of bowls and 13 subtypes of syrup jars were defined, of which examples have been found throughout all phases of Tell 'Abū Sarbūt. Such a detailed analysis is far beyond the scope of this research, but some general similarities and differences were noted.

The sugar pots discovered in this concentration resemble those from Tell 'Abū Sarbūt and Tell Abu Ghourdan on a general level. Exact parallels are, however, difficult to find. The thickened rim, the shape of the entire bowl and size of the diameter are, for example, very similar, but the folded and flattened rim of 31.6.3p27 or the slightly flaring profile of 30.10.1p1 are absent from the 'Abū Sarbūt or Abu Ghourdan collections (Franken and Kalsbeek 1975; LaGro 2002). The bases or funnels of the sugar moulds differ even more. The types represented by 251.5.3p14 and 251.5.3p12 are completely absent from both 'Abū Sarbūt and Abu Ghourdan. Specimen 251.5.3p1 has parallels at Abu Ghourdan though (see below). At Ghourdan only four bases have been drawn, hardly a representative assemblage. For 'Abū Sarbūt this type of base is depicted in the article of 1989/1990 but is for some reason not included in LaGro's 2002 dissertation (LaGro and De Haas 1989/1990: fig.29). The syrup jars show the same general similarity, while lacking perfect parallels. Rim s251.1-2.3p1 is different from the other syrup jars, both in this concentration and in the Tell 'Abū Sarbūt assemblage. **A similar rim has been discovered at Beth Shean where it was dated to the Crusader period (Avissar and Stern 2005: fig.43:3).** The amount of published sugar pottery and especially the number of syrup jars is, however, so small that it might very well be possible that this

87 The process of producing sugar and the function of pottery in this process will be described in chapter 6.

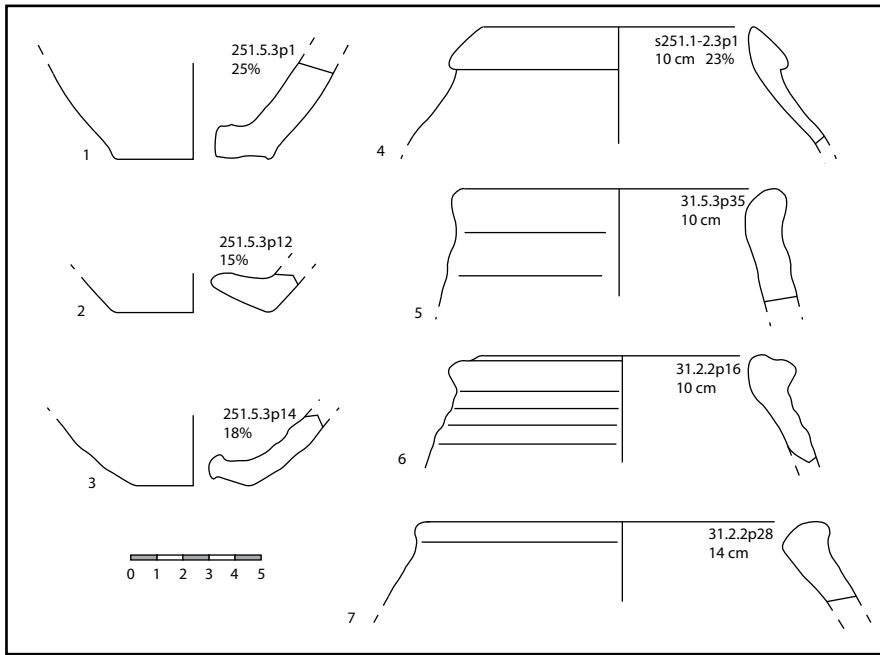


Figure 4.204 Sugar bowls

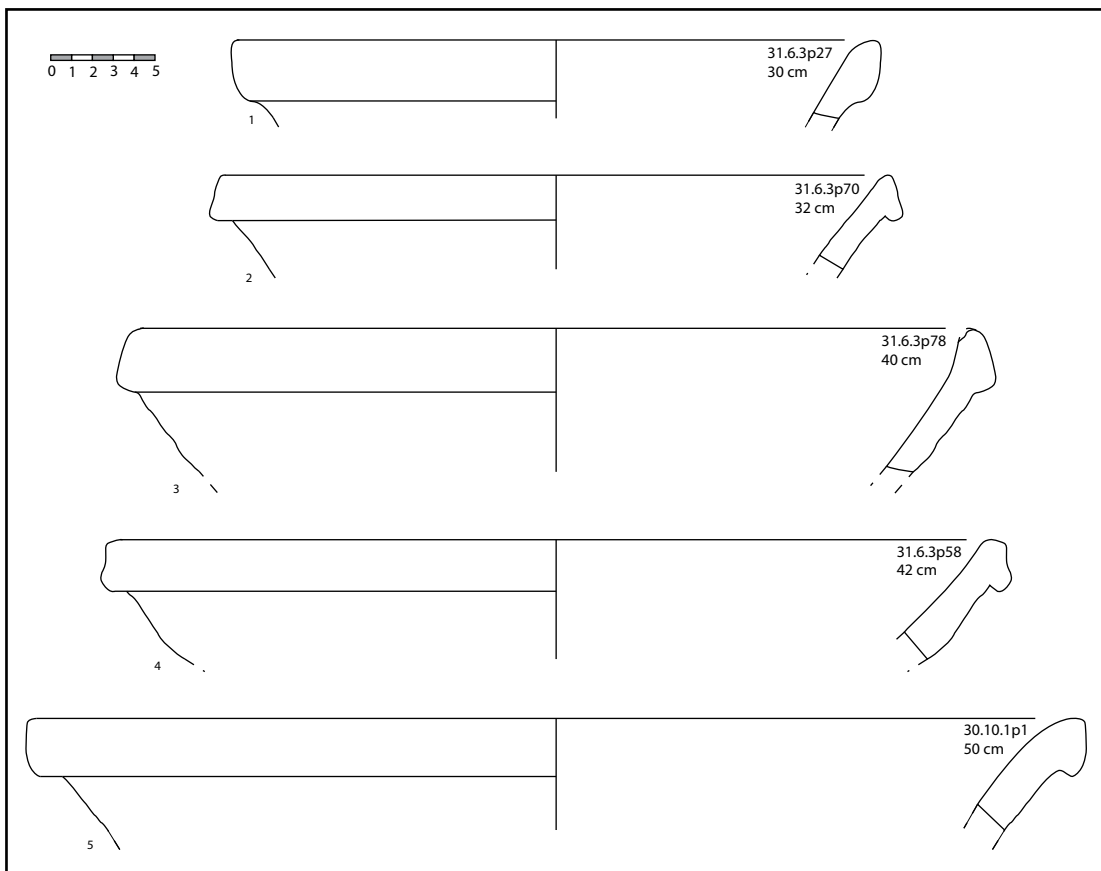


Figure 4.205 Sugar bowl bases and syrup jars

No.	Sherd no.	Parallels	Date	Remarks
1	251.5.3p1	Ghourdan (Franken and Kalsbeek 1975: fig.44:27)	Mamluk	Sugar bowl: funnel
2	251.5.3p12		Mamluk	Sugar bowl: funnel
3	251.5.3p14		Mamluk	Sugar bowl: funnel
4	s251.1-2.3p1	Beth Shean (Avisar and Stern 2005: fig.43:3)	Mamluk	Syrup jar: Crusader
5	31.6.3p35	c. 'Abū Sarbūt (LaGro 2002: fig.2.46)	Mamluk	Syrup jar
6	31.2.2p16	'Abū Sarbūt (LaGro 2002: fig.2.44)	Mamluk	Syrup jar
7	31.2.2p28		Mamluk	Syrup jar
1	31.6.3p27	Ghourdan (Franken and Kalsbeek 1975: fig.45:10)	Mamluk	Sugar bowl
2	31.6.3p70		Mamluk	Sugar bowl
3	31.6.3p78		Mamluk	Sugar bowl
4	31.6.3p58		Mamluk	Sugar bowl
5	30.10.1p1		Mamluk	Sugar bowl

Table 4.84 Sugar pottery belonging to both figures 4.204 and 4.205

type of jar continued into the Mamluk period. Other survey finds of this area were several pottery wasters. These sometimes took the form of overfired sugar bowls, whereas other specimens were nothing but vitrified lumps of clay.

On the whole, the sugar pot assemblage of Tell Abu Ghourdan seems to share more similarities with the discovered concentration than with the assemblage excavated at Tell 'Abū Sarbūt. This homogeneity between the two collections is not surprising. The close proximity of the survey concentration to the tell suggests both assemblages should be regarded as part of a single activity. The people operating the sugar mill probably lived in the village of Abu Ghourdan. The remains of Abu Ghourdan in general were of a domestic nature and the site was interpreted as a village (Franken and Kalsbeek 1975). The presence of sugar pottery in village contexts that are not directly related to the actual production of sugar at that location is well evidenced (LaGro 2002: 37). The relative amount of sugar pottery at Abu Ghourdan, although quite significant, is in comparison to the pottery from sugar mills too low to represent actual sugar production at that location (see also section 2.2 and below). The inhabitants of Abu Ghourdan were without a doubt actively involved in the production of sugar, but the actual crushing, boiling and drying of the sugar took place at the mill located at the concentration under discussion.

It can be concluded that the general manner in which sugar pottery was produced is the same as described by Franken and agreed upon by LaGro (Franken and Kalsbeek 1975: 143). The general shape is the same for all sugar pot sites in the area. This suggests that the method for producing sugar was also the same and no evidence is visible in the pottery collected in the survey to contradict this. On a more detailed level, i.e. LaGro's sub-types of production, differences between the assemblages are clear. To be able to positively determine the differences between the collections a detailed pottery analysis into the production techniques of the survey collection should be undertaken. Unfortunately, this is impossible within the parameters of present study. LaGro's own comparison of the 'Abū Sarbūt pottery to that of Abu Ghourdan gives, however, an indication on this subject. He had to conclude that because of the wide variety of rims it was impossible to compare the sites (LaGro 2002: 41). It seems that more diversity is present within the sugar pot assemblage than their similarity in shape suggests at first sight. Several different methods in the production of sugar pottery existed. What is remarkable, however, is that these many rim shaping techniques co-existed and only show very slight diachronic trends (LaGro 2002: 42). Both Franken and LaGro had to conclude that the rim types could not be used as dating tool as all variations occurred in all phases (Franken and Kalsbeek 1975: 147; LaGro 2002: 42).

The characteristics of the sugar pottery allow some other conclusions to be drawn about their production process. The fact that these vessels were needed in such large quantities and in an industry context with high disposal rates suggests that they were probably manufactured as fast as possible. A balance must have been found between necessary characteristics of the vessel and production time. Especially the bowls had a short lifespan on average, as many were broken when the

solidified sugar would not come out of the bowl. Large-scale production usually results in a higher degree of standardisation, at least per potter or workshop (Van der Kooij and Wendrich 2002: 150). A further conclusion to be drawn from the sugar bowls and jars is that their large weight and relative fragility makes transport over large distances improbable. The pottery was most likely produced at the site of the sugar industry. The misfired sugar pots and vitrified waste material, present at virtually all sugar industry sites and indeed in all discovered sugar pot concentrations of the survey, corroborate this (see also next sections on field 81 and the Zakarī kiln) (Strange Burke 2004: 114). This on-site production of pottery might explain the limited amount of resemblance between the concentration under discussion and connected Tell Abu Ghourdan on the one hand and Tell 'Abū Sarbūt on the other. The vessels did not come from the same workshop but were produced on site by, at least partly, different groups of people. A historiographer from the Mamluk period wrote that in Egypt sugar pottery was produced as a seasonal activity each November (LaGro 2002: 37). Given the seasonal character of the sugar production the production of sugar pottery might very well have been a seasonal enterprise in this region as well.

Interpretation

Based on the pottery assemblage containing so many sugar pots and so many large fragments it has been suggested that this concentration must have been connected to sugar production. This conclusion is strengthened by the morphology of the site. To the north the site borders on the Wadi al-Ghor. In the slope towards this wadi a thick ashy deposit is visible. On the surface this area is more or less the centre of the concentration. Besides the ubiquitous sugar mould, ash is one of the main waste products of sugar production. It is likely that these thick ashy deposits are the result of the heating of sugar pulp to evaporate the moisture over a prolonged period of time and are perhaps mixed with ash from kiln firings.

Within the banks of the Wadi el-Ghor a layer consisting solely of sugar pottery was visible. Later deposits covered it. This layer suggests that either broken sugar vessels were dumped here purposefully or many vessels were eroded down the slope over a short period of time, causing the absence of sand between the sherds. Within the wadi section a large lump of completely vitrified clay was also found (s900.3.3p2). A second large brick had clearly retained its original mud-brick shape, but was fired throughout. Both finds are not the remains of pottery firing gone wrong, but more likely derive from either the kiln or the structure used for heating the sugar-cane pulp. Further mud-brick construction material has not been found. Several hewn stones have, however, been discovered on the surface. It is not certain whether these derive from the Mamluk sugar installation or from the Late Roman site located on more or less the same spot or perhaps through reuse of both (see paragraph 4.4).

If this site was indeed the location of a sugar mill, running water must have been brought to the site in some way. The concentration is located alongside the Wadi al-Ghor, but this wadi can only have served as drainage because it flows at a lower level than the site. This is the only natural watercourse in the vicinity. Water must, therefore, have been brought to the site by means of a manmade canal. As a significant amount of momentum and thus altitude difference is needed the canal must have run along the top of the ridge on which the site is located. In the 1950's a canal of the ethnohistorically recorded irrigation system existed on this location. On the 1:10.000 map one can see that it makes a sharp turn to the north exactly at the location of the sugar mill site and joins the Wadi al-Ghor at this point. A similar situation has been reported for the late Ottoman period by Abel. He mentioned that the mill of Deir 'Allā was fed by a canal that brought water from the Wadi Zerqa (Abel 1910: 555). The presence of a canal powering a mill at the same location as a Mamluk sugar mill suggests a certain level of continuity existed in the infrastructural organization of the landscape from the Mamluk period to the sub-modern period.⁸⁸

Further evidence can be gained from other historical sources and eyewitness accounts. In his discussion of the likelihood that some sugar industry took place at Tell Abu Ghourdan, Franken mentions that traces of 'sugar mills' were still visible some years before the excavation took place

88 For more detailed information on the connection between the ethnohistorically reported and Mamluk irrigation systems see the next chapter.

in 1967 several hundred meters to the east of Tell Abu Ghourdan (Franken and Kalsbeek 1975: 219). Franken was most likely referring to the site described here. Unfortunately he did not describe what the remains were that caused him to identify the area as a sugar mill. On aerial photographs taken in the 1940's only a vague north-south running line is visible. On a British map of September 1918 the presence of a mill is documented immediately east of Deir 'Allā (see figure 4.166 in the section 4.4).

An older historical source that mentions the presence of a watermill at Deir 'Allā stems from the early Ottoman period. Tax records dating between 1525 and 1597 AD show that the village of Dayr 'Allā was taxed for *c.* 1.5 millstone (Hütteroth and Abdulfattah 1977: 168).⁸⁹ Many of the Mamluk sugar mills were reused in Ottoman and early modern times as bread mills, e.g. the mill in the village of Dhirār (see below). It seems likely that the Mamluk sugar mill at Deir 'Allā evidenced by the pottery was probably reused as a bread mill during Ottoman times.

Conclusion

The enormous quantities of sugar pot sherds, the location of the concentration and the mention of a mill in eyewitness accounts and historical sources all point to the conclusion that this concentration was once the site of a Mamluk sugar mill. The fact that the low amounts of domestic pottery were discovered south of the sugar pottery concentration points to a different function of each area. The numbers of domestic Mamluk pottery are too low to suggest village occupation next to the mill, but the presence of a single domestic house, perhaps a guard of the mill which historical sources suggest was usually present, seems possible. Another interpretation might be that this was some sort of small 'lunch' area of the workers of the sugar mill. In this way several equally unverifiable hypotheses can be thought up. Nevertheless, it seems clear that there were spatially separated areas of sugar industry and small-scale but chronologically related domestic activity. The contemporary Tell Abu Ghourdan, located only *c.* 200 m to the west, was undoubtedly connected to this sugar mill. Although a significant number of sugar pots was excavated, the tell should be interpreted as village judging by the other vessels in the assemblage. In this small area of *c.* 500 x 300 m a sugar mill with some sort of domestic context, a village and a graveyard (at Tell Deir 'Allā, see next section) all dating to the Mamluk period have all been attested.

Field no.: 329

Toponym: 'Abū al-N'eim
 Coordinates: 745,370/3,561,810
 Size: *c.* 60 x 100 m
 Days and time surveyed: Oct. 22th, 2006,
c. 1.5 man-hours
 Periods discovered: Mamluk

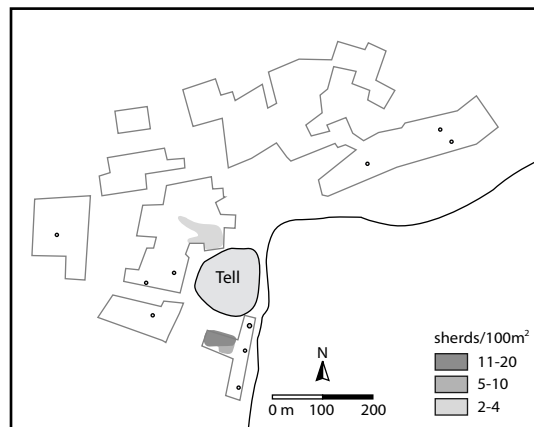


Figure 4.206 Distribution of domestic Mamluk feature sherds

Description

A general description of the area has been given in the section on the Byzantine/Umayyad remains of Tell 'Abū al-N'eim. In this section only the Mamluk pottery concentration of field 329 is discussed. For more information on the other find categories collected in the larger area one is referred to the Byzantine concentration. As most of these artefacts could not be precisely dated

⁸⁹ The village is taxed 80 akça; a fulltime millstone is taxed for 60 akça, a seasonal one for 30 akça (Hütteroth and Abdulfattah 1977).

they are described as a group without discrimination as to period. As can be seen in figure 4.206 Mamluk pottery was found in all fields encircling Tell 'Abū al-N'ēim. In field 329 to the south of the tell a clear concentration of Mamluk sherds has been discovered. The pottery densities discovered here were high as was the preservation of the sherds. North and south of this area the fields were covered by greenhouses and thus could not be traversed. To the west it had been possible in 2004 to survey one field while greenhouses were being constructed. Possibly these preparations hampered the visibility, but it is a given that almost no sherds were collected in this area. Nevertheless, even if this field is regarded as having yielded a biased result the higher pottery density in field 329 is clear.

Although this concentration is clearly connected to Tell 'Abū al-N'ēim it is impossible to say whether this is a Mamluk extension of the village to the south or whether part of the tell was dug away and dumped here. Given that the field was surrounded by greenhouses it was impossible to determine whether a different type of soil was present in the surroundings. It can, therefore, not be ruled out that this concentration was a dump of soil from the tell.

Artefacts other than pottery were extremely rare. Only three fragments have been discovered. One piece of pink to purplish coloured glass with two greenish coils was discovered (329.2.1m1g). Another find was a broken jar stopper (329.2-3.2m1), made from glazed ware of dark red fabric, probably dating to the Mamluk period. The third find consisted of a simple tessera with adhering remains of mortar (329.3.2m1t). Apart from the jar stopper these finds cannot be positively connected to the Mamluk period and may just as well stem from any of the other periods present at Tell 'Abū al-N'ēim.

Pottery

The pottery discovered in this small concentration is remarkably uniform. From the feature sherd assemblage collected in this field as many as 88 of the 130 sherds (68 %) could be positively dated to the Mamluk period. Amongst the remaining assemblage several sherds are present that might date to the Mamluk period, but could equally well stem from any period since the Roman era. Only four sherds could be positively dated to the Umayyad period and one cooking bowl most likely stems from the Late Bronze IIA period (329.3.2p17). By far the majority of the feature sherds could thus be dated to the Mamluk period. Within this category there is another unequal distribution. Of these 88 Mamluk sherds as many as 72 sherds belonged to the so-called Hand-Made Geometrically Painted Ware (HMGPW) so common during the Mamluk period. The pottery depicted in figure 4.207 is a selection of the best preserved HMGPW sherds discovered in the 'Abū al-N'ēim concentration. Compared to published Mamluk period excavations this is a very standard collection both in shapes and decoration motifs (Franken and Kalsbeek 1975; LaGro 2002). Bowls occur in several types, for example with a distinct carination (e.g. 323.1.2p14) categorized by LaGro as group 6 at Tell 'Abū Sarbūt (LaGro 2002: 79). Other bowls (e.g. 329.1.1p7) have a flaring rim comparable to specimens excavated at Abu Ghourdan (Franken and Kalsbeek 1975: 190). Furthermore, the neck of a small jar or jug (329.1.1p6) and a plate-like lid (329.1.1p1) have been depicted. Both shapes are less common in the small assemblage from this concentration, but form part of the standard HMGPW corpus (see table 4.85).

Within the small body of other securely dated non-HMGPW feature sherds, the glazed wares predominate (see table 4.86). A total of nine glazed sherds was found, while six sherds belonged to sugar pots, jars and a cooking pot. Of the glazed sherds, the largest segment is made up by the so-called sgraffito ware. In this ware a layer of usually light coloured slip is applied to the surface of bowls. Designs are incised in this slip exposing the darker coloured orange-brown to reddish-brown fabric of the clay. Subsequently a green or yellow glaze is applied. Although sgraffito ware already appears in the Fatimid period this specific type should most likely be dated to the 13th century and occurs throughout most of the southern Levant (Avisar and Stern 2005: 16). Both thin and broad lined sgraffito occurs at Tell 'Abū Sarbūt. In this concentration, however, only thin lined sgraffito has been found.

Monochrome green or yellow glazes over a whitish slip also occur. Although Hendrix reports monochrome glazed bowls as occurring in the Fatimid period already LaGro states that these bowls first appear in the second half of the twelfth century AD and were widely used during the

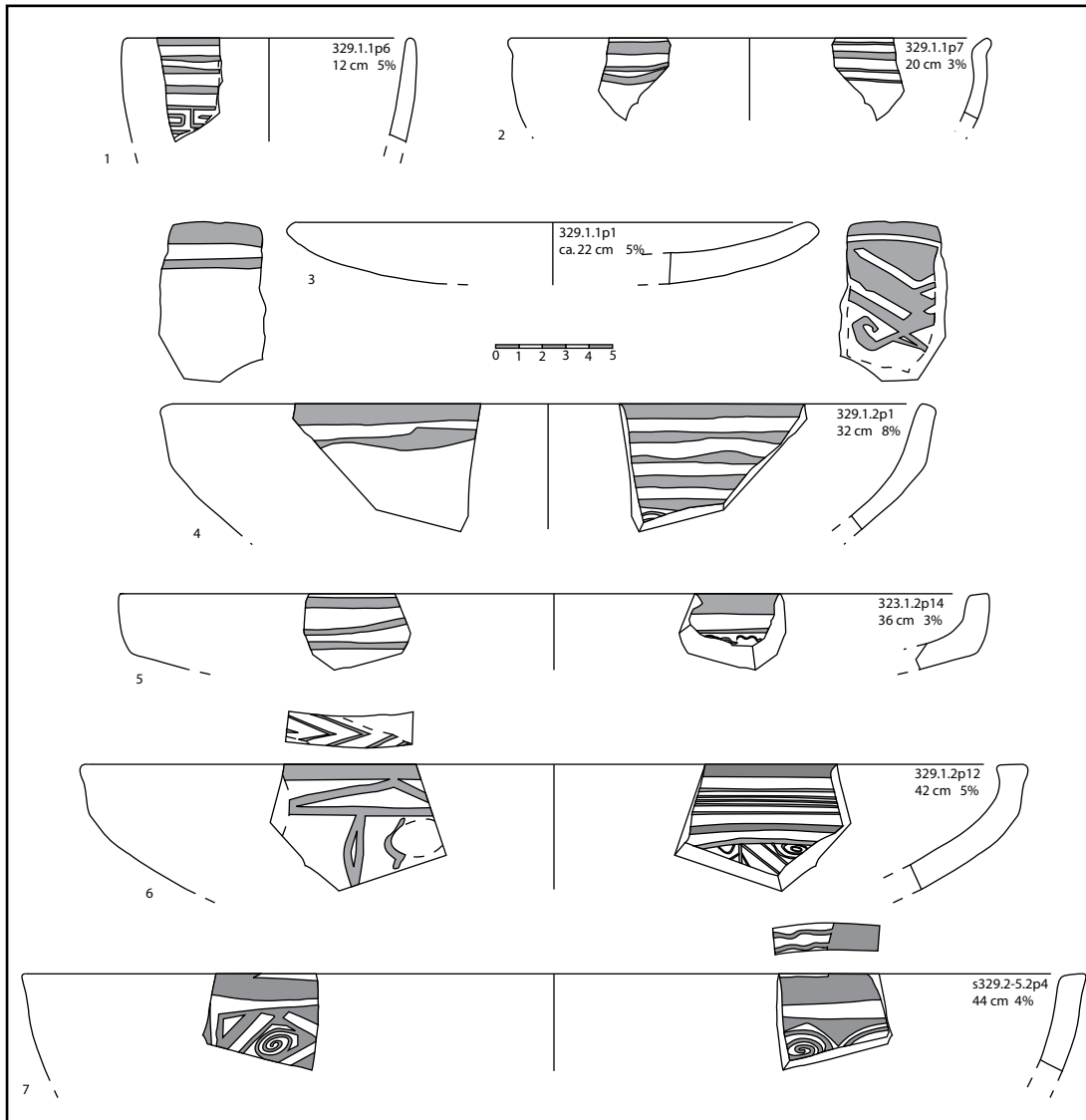


Figure 4.207 Selected HMGPW

thirteenth century (LaGro 2002: 87). This way of glazing continued into the Ottoman period. Only the rim forms can provide a more precise date (Avisar and Stern 2005: 10-15). As no rims were discovered in this concentration the monochrome glazed pottery cannot be assigned a precise date. The predominance of Ayyubid/Mamluk pottery, however, makes a date somewhere in this period more likely than a date in the Fatimid period which was hardly attested during this survey. As the sherds collected were small it is of course also possible that they are nondiagnostic fragments of sgraffito ware.

One slip painted glazed sherd was found. Here a motif was painted on the body in a whitish slip after which a green or yellow glaze was applied. These vessels usually occur from the 12th to 14th century AD at several sites in the southern Levant (LaGro 2002: 103). Slip painted or trailed vessels continue for a longer period of time and are usually decorated with spirals (Avisar and Stern 2005: 19). In the field immediately to the east a faience sherd was found whose glassy outside was bright blue/turquoise (330.2.1p2). Faience also occurs in the Mamluk period. In all it seems that the majority of the glazed sherds stems from the Ayyubid/Mamluk periods although some types do occur over a longer period.

Glazed pottery	
Monochrome green	2
Monochrome sgraffito ware green	1
Monochrome sgraffito ware yellow	3
Bichrome sgraffito ware green/brown	1
Slip painted with yellow glaze	1
Slip painted with green glaze	1

Table 4.86 Glazed pottery from field 329

The small group of non-HMGPW and non-glazed ware contains a rather typical pointed ear handle or Islamic ledge handle belonging to a handmade globular cooking pot (329.2.2p17). These pots occur from the middle of the thirteenth to the end of the fifteenth century AD (Avisar and Stern 2005: 94). Furthermore, 2 definite and 3 possible sugar pots have been discovered. Among the non-feature sherds an additional 14 sugar pots could be identified. This low number of sugar pots is rather inconsistent with the other Mamluk concentrations discovered. These sites yielded enormous quantities of sugar pottery complemented by a low number of domestic HMGPW and glazed pottery.

Interpretation

The low number of sugar pots suggests this concentration reflects the only uniquely domestic context discovered in the survey contrasting to the more commonly discovered sugar mills that yielded a low amount of domestic pottery. Important in this context is the discovery of a kiln, described below, most likely used for the production of sugar pots about 250 m further to the south. A large sugar pot concentration to the northeast of Tell 'Abū al-N'eim represents the location of a sugar mill. The area of Tell 'Abū al-N'eim showcases all aspects characteristic of Mamluk rural occupation in the Jordan Valley, namely the production of sugar in a mill/refinery to the north-east, the production of sugar pottery in the kiln to the south, the village itself that supplied the labour force and the agricultural fields surrounding it where the cane and other crops were grown.

Fieldno.: 81 (north-east of 'Abū al-N'eim)
 Coordinates: 745,960/3,562,560
 Size: c. 60 x 40 m
 Date and time surveyed: Nov. 20th, 2004,
 c. 10 man-hours
 Periods discovered: Mamluk

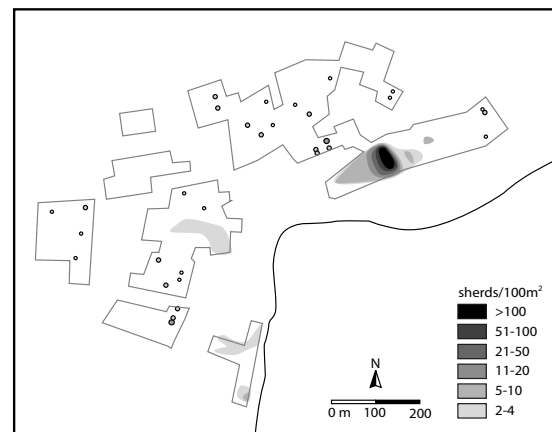


Figure 4.208 Distribution of sugar pottery

Description

In 2004 a Mamluk sugar pottery concentration was discovered in field 81. The centre of the concentration was located at almost the same spot as the EB I concentration described before (section 4.1.2). However, whereas the EB I concentration centred in the north-east of this field, the Mamluk concentration centres more in south-east (see figure 4.208). The high densities, large fragment sizes and the spatially bounded character of the concentration suggest a buried feature stemming from the Mamluk period is present at this location. The sugar pot sherds were so abundant that the collecting of sherds was stopped. While the EB I concentration extended into the

surrounding fields 300, 307 and 308, the distribution of Mamluk sugar pottery is more restricted. A few sugar moulds were discovered in the western plots of field 300, but never more than two or three per plot. The buried Mamluk mother population is, therefore, either smaller in size or has been less affected by horizontal movement as a result of post-depositional processes than the EB I concentration.

Similar to all the other discovered sugar production sites sugar pottery is mixed with low quantities of domestic HMGPW. Other, similarly typical finds are pieces of vitrified clay or mud-brick and pottery. Some of these pieces are clearly overfired sugar pots, while others have become amorphous lumps. A few pieces were completely vitrified on one side, and clearly showed mud-brick material on the other. These fragments in all likelihood either stem from a kiln lining or from the boiling room of the sugar factory where sugar-cane pulp was heated. A *c.* 20 cm large piece of basalt grinding stone has been found here as well (81.11.m1). It has a central circular hole with a raised edge and on the other side a grinding surface with one, *c.* 2 cm high, protruding block. It is severely damaged so its original shape or even the way in which it was used for grinding cannot be determined. The raised block makes a rotational movement impossible. It might be part of one of the small secondary presses known from historical sources (see chapter 7). However, its exact age and whether this grinding stone fragment is connected to the sugar production centre remain unknown, although it should not be considered as pre-Roman.

Given the distribution pattern and the type of finds collected it is concluded that this concentration probably represents the remains of a sugar production site once present at this location. The large amount of sugar pottery and wasters combined with the absence of domestic pottery clearly indicates the industrial nature of the site. The fact that sugar was produced at this location suggests a mill was also present here. However, no structural remains of a mill have been found. Nevertheless, the topographic circumstances make this a likely location for a mill. The altitude difference required to gain sufficient water power in order to turn the wheels is present as the site is located on the bank of the Zerqa that is quite deeply incised at this location. Furthermore, an irrigation canal bringing water to power the mill was present here in the pre-modern irrigation system that probably dates back to at least the Mamluk period, but this will be discussed in much greater detail in chapter 6. Furthermore, the remains of a (pre-modern) watermill were present in the direct vicinity until at least 1988 (pers. observation Van der Kooij). It was not located on the same spot as the Mamluk concentration but it was fed by the same irrigation channel.

Kiln Tell Zakarī

Coordinates: *c.* 745,425/3,561,620
 Size: diameter *c.* 2.3 m, depth *c.* 1m
 Date and time surveyed: Nov. 25th, 2004
 Periods discovered: Mamluk

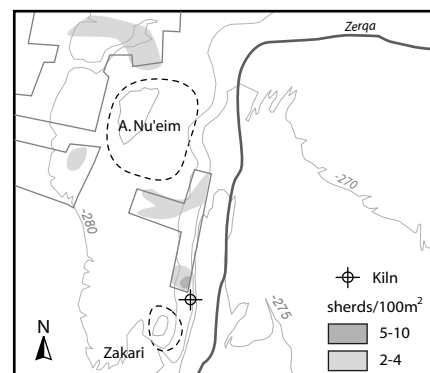


Figure 4.209 Location of kiln and Mamluk feature sherds

Description

On the very last day of the 2004 survey season a recently dug hole was discovered on the northern edge of Tell Zakarī. The partial remains of a round mud-brick structure with vitrified walls had been uncovered by the digging activity. Several sugar moulds were discovered in the spoil pile (see figure 4.210). It is likely that the remains of a pottery kiln dating to the Mamluk period and used for the manufacture of sugar pottery and possibly other pottery types has been uncovered.

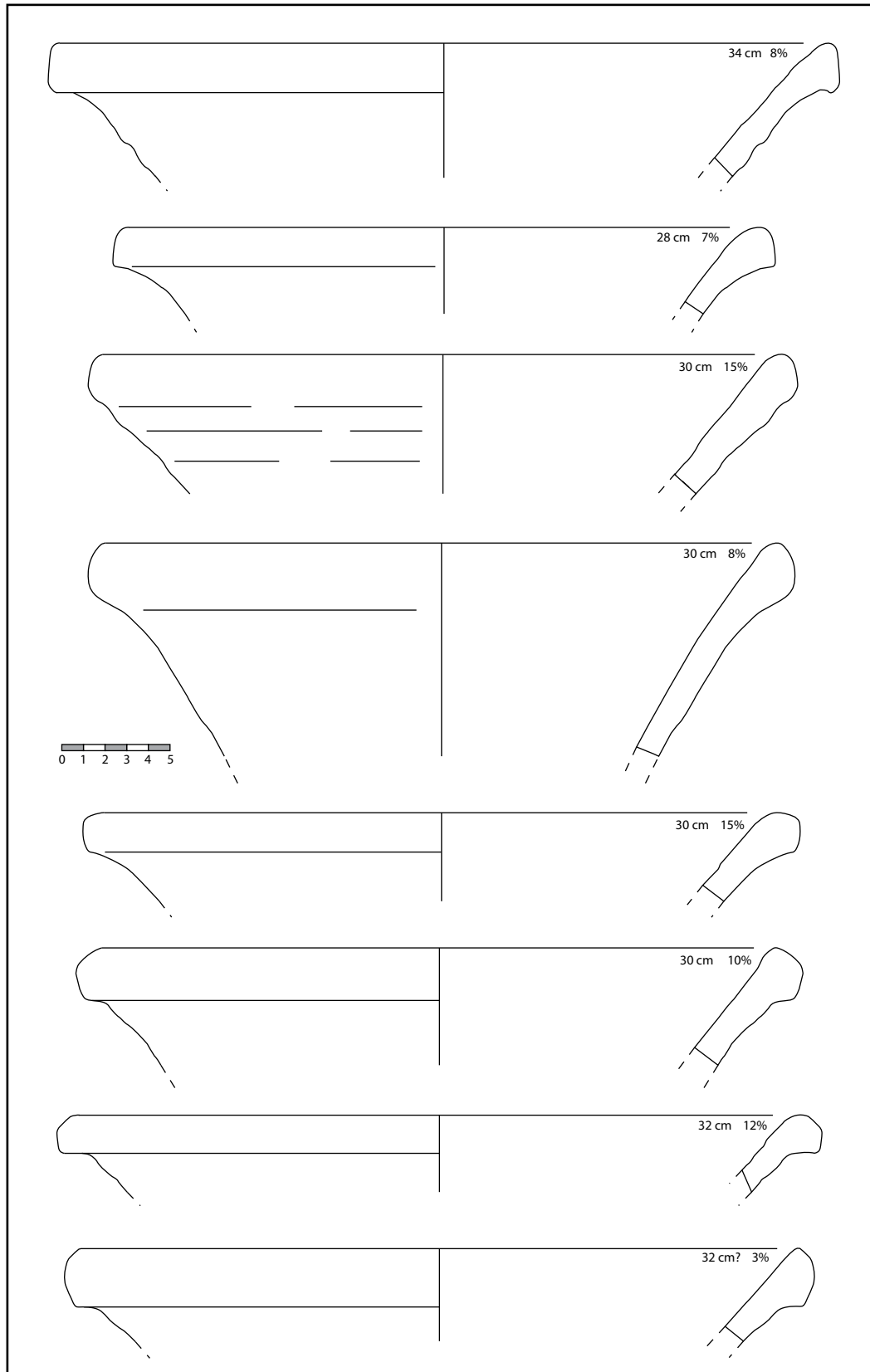


Figure 4.210 Kiln Zakarī sugar moulds

No.	Sherd no.	Parallels	Date	Remarks
1	329.1.1p7	Abu Ghourdan phase P (Franken and Kalsbeek 1975: fig.66:3)	Mamluk	HMGPW: white slip
2	329.1.1p6	'Abū Sarbūt (LaGro 2002: fig.3:43, 45) Yoqueam I (Avisar and Stern 2005: fig.47:2)	Mamluk	HMGPW: white slipped:jar
3	329.1.1p1	'Abū Sarbūt (LaGro 2002: fig.3:110,111,113) Pella (Walmsley 1997: fig.9:7)	Mamluk	HMGPW: no slip: lid
4	329.1.2p1	'Abū Sarbūt (LaGro 2002: 3:93) Pella (Walmsley 1997: fig.9:5)	Mamluk	HMGPW: no slip: group 6
5	329.1.2p14	'Abū Sarbūt (LaGro 2002: 3:93) Abu Ghourdan phase H (Franken and Kalsbeek 1975: fig.54:13)	Mamluk	HMGPW: no slip: group 6
6	329.1.2p12	Abu Ghourdan phase N (Franken and Kalsbeek 1975: fig.64:3)	Mamluk	HMGPW: white slip
7	s329.2-5.2p4	Abu Ghourdan phase J (Franken and Kalsbeek 1975: fig.56:8)	Mamluk	HMGPW: no slip

Table 4.85 HMGPW

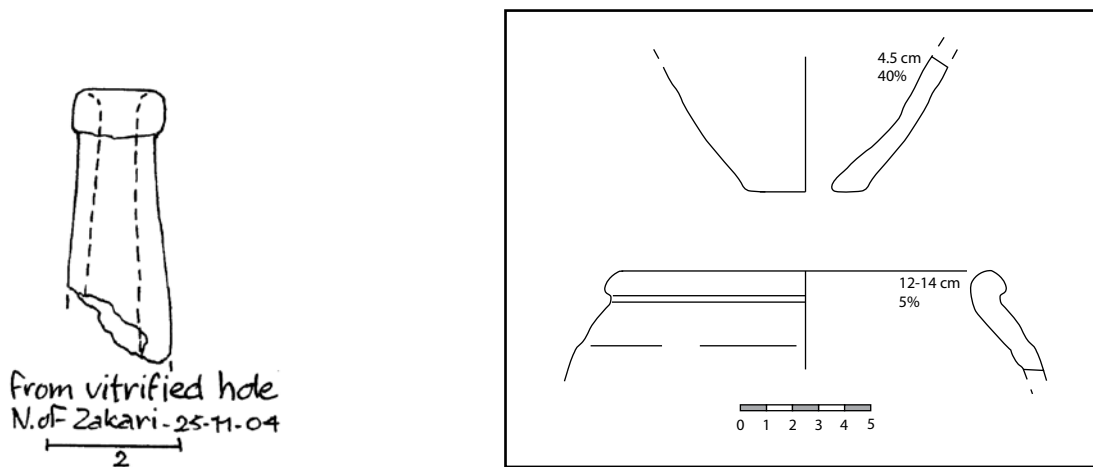


Figure 4.211 Small spout (drawn by H. de Reede)

Figure 4.212 Funnel and syrup jar

The newly dug pit had a diameter of *c.* 2.4 m, and had original kiln wall for about a third of its circumference. On all other sides the wall had completely disappeared but the curve of the extant wall made it clear that the original kiln circumference had been comparable to the recently dug pit. In some parts where the wall could be seen in section, it was visible that the kiln wall consisted of an outer layer of mud-bricks (see figure 4.213). Towards the inside of the kiln these mud-bricks had become completely burned. The bricks themselves had coloured orange to red and layers of cement-like clay of lighter yellowish grey colour were clearly visible between them. Towards the inside of the kiln the clay turned creamish grey in colour. Strangely the clay in between the mud-bricks was now of orange colour and seemed to be very similar to the clay from which the pottery was made. This layer was only 2 to 4 cm thick and ended in a completely molten glazy green 0.5-1 cm thick layer on the inside of the kiln. Clear stream and drip patterns were visible in this molten layer. Given the extent of melting the walls have been subject to, it seems likely that the discovered remains formed part of the firing chamber.

The modern pit was probably dug slightly below the bottom of the kiln as one part of the wall showed an inward curve of the molten clay (see figure 4.213). This was most likely caused by the running of the molten clay over the floor of the kiln. The different heights at which this spreading occurred might indicate either different firing episodes or one episode during which temperatures fluctuated and the point of vitrification was exceeded more than once.

The pottery discovered in and around the kiln remains consisted almost entirely of sugar pots. These vessels were, however, not overfired. They might have been accidentally broken or left behind for some other reason. Their original context is also unclear. They were found inside the pit or in the dump from the recently dug pit, but all were clearly out of situ. Most vessels were sugar bowls and only a few syrup jars were discovered. This reflects the bowl : jar ratio normally dis-

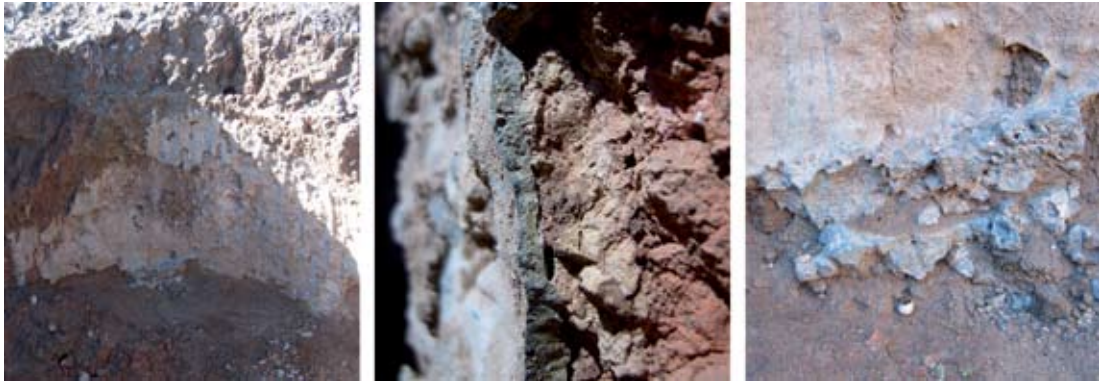


Figure 4.213 Molten kiln lining

covered at sugar pottery sites. The moulds discovered seem to represent one or perhaps two types of production technique. Their rim shape, diameter and profile are very similar although minor differences are clear.

In the last field of the 2006 season this location was approached again. In the last plot of field 330 (330.2.6) several sugar moulds were discovered (see figure 4.210). Although this is not the exact location of the kiln, which is 30 to 40 m toward the south-west, these sherds are undoubtedly connected to the kiln. Among the pottery collected in this plot one clearly domestic Mamluk bowl was discovered. The pottery collected around the kiln in 2004 also contained a single find of non-sugar pottery dating to the Mamluk period. This was a small spout, very similar to specimens discovered at Tell 'Abū Sarbūt and Tell Abu Ghourdan (phases H-M) (Franken and Kalsbeek 1975: 11-13; LaGro 2002: fig.9:32). This sherd, although it is only a single find, suggests that not only sugar pottery was fired in the kiln but also domestic Mamluk pottery. The firing and hence possibly also the production of Mamluk sugar pottery and domestic pottery seems to have been combined occasionally and was not entirely separated from each other.

Franken and Kalsbeek have made some interesting conjectures about the kilns used to make sugar pottery based on the vessels discovered at Tell Abu Ghourdan (Franken and Kalsbeek 1975: 164). In thin-sections they observed that a small percentage of the sugar vessels was overfired or even vitrified, another proportion was well-fired and the largest group was less-well fired and softer. These groups have a rough ratio of 1:3:6.⁹⁰ They subsequently compared these data to an ethnographic parallel. In the refugee village of Karameh further south in the Jordan Valley potters fired their pots in wide-based dome-shaped kilns with a fire chamber below it. The vessels from the lowest part of the kiln, so closest to the fire chamber, were inevitably completely or partially vitrified and could not be sold. The layers of vessels above had a white surface, referred to as bloom or scum, and a red core. These were the best fired vessels as they were hardest. At the top of the kiln temperatures were lower, vessels were red and remained rather soft. These were less valued and sold for less (Franken and Kalsbeek 1975: 164). Compared to the sugar pottery ratio the number of soft-fired vessels was lower in the Karameh kilns. If the ratio of Abu Ghourdan is representative of an average kiln load, it can be concluded that the kiln in which the sugar pottery was fired was less broad at the base and higher than the modern Karameh kilns (Franken and Kalsbeek 1975: 146). Franken continues by arguing that the sugar moulds were most likely not placed inside each other as this would hamper the firing. Probably based on the ethnographic analogy, they assume that the pots were stacked at least three meters high. The fire chamber would then be at least one meter high, while the entire kiln would measure about five meters in height and have a diameter of two meters (Franken and Kalsbeek 1975: 147). The inferred diameter of the discovered kiln and the height to which the walls of the surmised fire chamber reached perfectly fit the assumptions made by Franken and Kalsbeek. Unfortunately the sugar pottery discovered in the courtyard layers of Abu Ghourdan was probably not representative of an average kiln load. It is most likely that

⁹⁰ Vitrified 9 %, well fired 27 % and less well fired 65 % (Franken and Kalsbeek 1975: 146).

the actual sugar factory of Abu Ghourdan was located circa 300 m to the east around field 151 (see above). It would be interesting to examine the sugar pot assemblages discovered in the survey with regard to this hypothesis, but this lies outside the scope of this study.

Toponym: Dhirār⁹¹

Coordinates: 747,275/3,567,325

Size: ??, *c.* 40 x 50 m,
but destroyed

Date and time surveyed: Oct. 6th, 2005,
c. 2 man-hours

Periods discovered: Mamluk

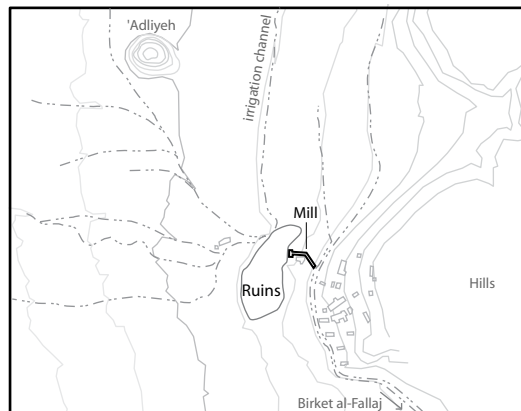


Figure 4.214 Location of mill Dhirār and irrigation channels

Description

During the surveying of field 161 just north of the modern village of Dhirār a large stone wall was noticed between the village houses. This wall proved to be part of a former watermill. It was made from hewn stones that were still covered with plaster in some places. The wall runs east-west and for about 20 m before making a *c.* 110 degree turn to the south-east (see figure 4.214). On the south-eastern side the wall runs into the slope of the abutting foothills and the modern road that is running here. On the western side the wall runs towards a buttressed endpoint. On this side there is a difference in height of about 5 m. In the corner of both walls the north-west to south-east running wall seems to have continued to the north-west. From the corner a small part of this wall continues but has collapsed after 1 to 2 m. One can see, however, that a vault started in the wall immediately after the corner. The rest of the walls or building have completely disappeared or been built over by the neighbouring house. On the top of the wall two plastered ridges of *c.* 30 cm high had been constructed. Together they form a 1 to 1.2 m wide plastered canal. It runs from where the wall has been built against the slope towards the buttressed end in the west. What form this canal takes on top of the western end of the wall is unfortunately unknown due to a rather ferocious dog positioned on top of the wall that proved impossible to appease, even by its owner.

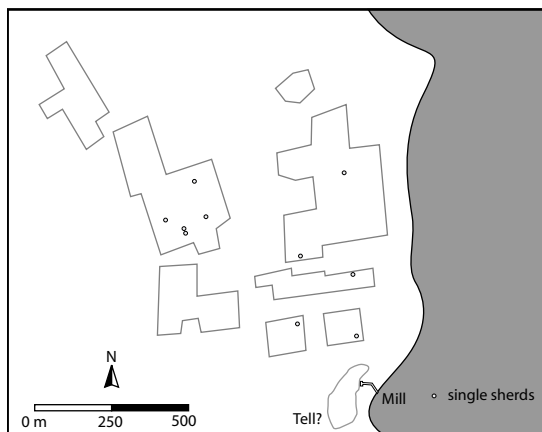


Figure 4.215 Distribution of domestic Mamluk feature sherds near Dhirār

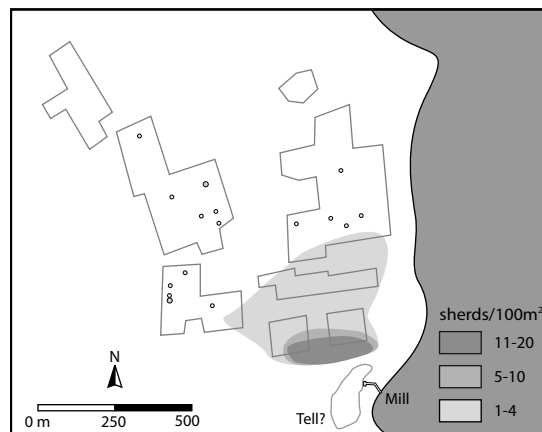


Figure 4.216 Distribution of sugar pottery near Dhirār

91 Dhirār is also spelled as Dherar or Zerar.

Villagers recounted that this structure was part of an old watermill that had been in use until 1970 to grind cereals. On the western edge of the wall a chute had been present through which the water fell, turning a wheel that activated the grinding stones. Judging by the chute it is likely that this mill was of the horizontal wheel type. Vertical wheels are practically absent in Jordan considering functioning mills and ruins (McQuitty 1995: 748). This system of the mill and its canal was referred to as *fallağ* by the villagers. The Arabic word *fallağ* literally means crack, break or fold but together with the term *qanat* it refers to an underground canal bringing groundwater to lower lying fields (Wilkinson 2003: 47). In this area all open canals tapping the Zerqa are called *qanat* (see section 5.2). The oral history of the village ran that the wheel had been powered by water from a canal that tapped the Zerqa and ran along a basin called *birket al-fallağ*. This *birket al-fallağ* (meaning pond or reservoir of the irrigation canal) is today no longer visible in the landscape, but on British and German maps from the beginning of the Mandate period it has been depicted and named. It was located to the ENE of Deir ‘Allā on the northernmost main irrigation channel, locally known as the Dhirār canal (see section 5.2). Therefore, it seems certain that this old watermill was connected to the ethnohistorically recorded irrigation system, which apparently functioned, at least in part, until 1970. From this mill the canal continued to the west according to the villagers.

Most remarkable, however, was that this sub-modern bread mill was surrounded by Mamluk sugar pot sherds. It is widely agreed upon that sugar pot sherds are the most indicative feature of sugar manufacturing (Strange Burke 2004: 112). It is, therefore, concluded that this location has been in use during the Mamluk period as a place of sugar production. The same villagers recounted that there used to be a tell immediately west of the mill that was locally known as Tell Tahuneh (tell of grinding). The tell had, however, been partly bulldozed away to make room for the Dhirār medical centre and partly paved over as part of the present-day main village road. The part that had been removed now hosted the ‘garden’ of the village’s clinic and was completely barren. This surface of *c.* 25 x 40 m was, therefore, randomly surveyed in an attempt to collect pottery that could date the occupation period of this tell. Again predominantly sugar pottery was discovered mixed with some Mamluk pottery of a non-industrial nature, e.g. monochrome green glazed pottery. These domestic sherds were, similar to the other sugar pot concentrations, rather scarce and formed only a limited part of the entire pottery assemblage (<5 %). Only 10 of the total collection of 192 rim sherds belonged to non-sugar pot sherds. Among this group of ten sherds there was one monochrome green glazed sherd and one slip painted glazed sherd, the rest belonged to undecorated plain wares. This small group can hardly be securely dated, but all sherds could belong to the Mamluk period (Avisar and Stern 2005). The absence of HMGPW is, however, remarkable. Within the sugar pottery assemblage there is another strong dichotomy visible; as many as 175 sugar moulds were collected, whereas only 17 syrup jars were encountered. The syrup jars form less than 9 % of the sugar pottery assemblage, which is slightly low but not extraordinary for a sugar pot collection. At Tell ‘Abū Sarbūt the percentage of sugar bowls in the sugar industry phases varied between 17 % and 32 %. To come to definite conclusions on the sugar bowl : syrup jar ratio, pottery from stratigraphic layers clearly connected to the sugar industry should be compared but this is unfortunately not possible for Tell ‘Abū Sarbūt, Tell Abu Ghourdan or the survey concen-



Figure 4.217 Mill construction Dhirār Figure



4.218 Canal on top of mill

trations.⁹² The excavated sugar production site of Lower Horbat Manot located farther away in the western Galilee does provide some ratios. This refinery starts in the Crusader period when it has a ratio of 98 % sugar bowls to 2 % syrup jars. In three secure loci from the Mamluk period the sugar bowls amount to 64 %, 69 % and 80 % of all sugar pots (Stern 2001: table 3). The Mamluk sugar bowls, therefore, form a clearly lower percentage than those of the Crusader period. The percentage from the Dhirār mill lies more or less between both periods. In order to come to clear conclusions on the average ratio between syrup jars and sugar bowls more sites need to be excavated and published. Nevertheless, this relatively low syrup jar percentage clearly demonstrates the much higher breakage rate of sugar moulds.

Thus, it can be concluded that during the Mamluk period a sugar production site, which included a watermill, was located at the same location as the bread mill 500 to 800 years later. Given the lack of running water at the site, water to power the sugar mill must have been brought to the site by canals just like in the ethnohistorical period.

The exact plan of a standard Mamluk sugar mill is relatively unknown. Although ruins and large quantities of sugar pots have revealed many sugar production sites, only a few have been excavated. At nearby Tell 'Abū Sarbūt no mill but a building that was used in the production of sugar was discovered (Steiner 1997: 148). In one of the Mamluk phases a large building consisting of several rooms built around a large (18x10m) courtyard was excavated. As much as 90 % of the pottery consisted of sugar pots. In contrast to previous and later layers no ash was discovered. Amongst the debris on the floor of one of the rooms several ostraca were found. None mentioned sugar as such but they were contracts or notes on quantities of some unnamed commodity (Steiner 1997: 148). Further information is found in the faunal assemblage. A relatively high percentage (7.5 %) of the identified bones belonged to dromedaries. These were most likely used as pack animals for the transportation of the sugar (van Es 1995: 89). It seems that Tell 'Abū Sarbūt functioned as some sort of administrative trade centre of the sugar industry during the Mamluk period. Traces of a mill where sugar-cane was pressed have not been found. However, given the enormous quantity of sugar pots and the fact that these large heavy funnels were in all likelihood removed before transport it is highly likely that an actual sugar production centre was located in the vicinity.

Remains of an actual mill have been excavated at Tawahin es-Sukkar in the Ghor as-Safi on the south-eastern side of the Dead Sea (Jones et al. 2000; Photos-Jones et al. 2002). Here a canal brought water from the nearby wadi over the top of a broad wall very much like the construction at Dhirār. At the end the water fell 3 m down a water chute powering the millstone (Jones et al. 2000: 527). The excavations revealed a large lower millstone in which a smaller vertical upper millstone moved around in circles (Photos-Jones et al. 2002: 604). This is a so-called edge-runner mill. Behind the area of the canals and millstones several rooms appeared in the geomagnetic survey (Jones et al. 2000: fig.4). Beside the building remains a large dump consisting of ashes, sugar pot sherds and pottery wasters has been discovered (Photos-Jones et al. 2002: 606).

A similar site, known under the same name, has been partly excavated near Jericho (Taha 2004). Here the canal, chute and millstone are still clearly visible on the surface. It is remarkable that beside the large amount of sugar pottery of which two bowls contained the Arabic inscription 'the good honey', remains of a kiln with both copper scrap metal and sugar pots inside have been found (Taha 2004: 75). That honey was the common term for sugar in this period is demonstrated by the Crusader Jacobus de Vitriaco, who wrote in the 11th century that sugar-cane grew in the valley and that its 'honey' was eaten with bread by the local people (LaGro 2002: 26). Honey was of course the most common sweetener until the advent of sugar. Based on the pottery, the installations near Jericho were dated to the Crusader and Mamluk periods (Taha 2004: 76) Taha mentions that besides sugar pottery a relatively large number of lamps has been found (Taha 2004: 75). Similar observations have been made by Stern regarding the excavation of a Crusader, Mamluk and early Ottoman mill at Lower Horbat Manot in western Galilee. She too mentions relatively large

92 The stratigraphic phasing of Tell 'Abū Sarbūt as implemented by LaGro does not correspond to the detailed stratigraphic analysis proposed by Steiner (LaGro 2002: 7-9; Steiner 2008). Unfortunately LaGro has not connected the pottery to their stratigraphic loci making comparison between both phasings impossible. At Tell Abu Ghourdan only courtyard layers were discovered. Hopefully the prospective final publication of the Tawahin es-Sukkar excavations in the Ghor es-Safi can shed more light on this question (Photos-Jones et al. 2002).

quantities of lamps having been found, which she relates to round-the-clock activities during the harvesting season (Stern 2001: 300). Given the fast decline of sucrose in harvested sugar cane this seems a logical conclusion (see section 7.3). She furthermore discovered metal slag and fragments that might be connected to the production or repair of metal cauldrons in which the sugar cane pulp was boiled (Stern 2001: 300). Although the buildings were constructed by the Hospitallers in a typical Crusader fashion the general layout is very comparable to the later Mamluk remains in the Jordan Valley. Water was brought from a wadi via canals and an aqueduct to a chute powering the millstones (Stern 2001: 303). Although no fireplaces were discovered, plenty of ash, burned bricks and charcoal was found (Stern 2001: 299). There was a large courtyard where the boiled sugar pulp dried. Based on the many sugar bowl sherds she concludes that this was most likely also the place where the sugar was removed from the bowls (Stern 2001: 303). Given the many similarities and the fact that this site continued to be used without interruption in the Mamluk period it is likely that the later Mamluk sugar production sites in the Jordan Valley stand in the same tradition. Combined with 15th to 17th century drawings of sugar production sites these excavations provide a more or less accurate impression of the layout of a sugar mill with boiling rooms and drying areas all of which must have been present at Dhirār (Galloway 1989: pl.3).

4.6.3 Other Ayyubid/ Mamluk period discoveries in the Zerqa Triangle

A few Mamluk remains that have not yet been described in the off-site distributions or in the discussion of the concentrations were discovered during the survey. In 2006 the survey covered the northern part of the bay of al-Rweihah. In the foothills to the north two small caves were visible. The inside of these caves had until very recently been used to shelter sheep and goats and was covered in recent deposits that yielded no archaeological finds. The area in front of the caves was, however, also surveyed and sherds were discovered here.

These caves may be the same as site number 19 surveyed by Muheisen and his team while searching for Palaeolithic sites on the eastern side of the Jordan Valley. They are not described and they fall just outside the map. They were dated to the Ayyubid/Mamluk and modern periods (Muheisen 1988: 519). There are, however, many caves in the foothills and Muheisen calls them the al-Rweihah caves, whereas these are closer to Dhirār than to al-Rweihah.

The finds discovered in front of both caves can mostly be dated to the Mamluk period. In front of the western cave thirteen syrup jars, three sugar moulds and two sugar mould funnel pieces were found. The large number of syrup jars in relation to the sugar moulds is remarkable as the moulds always form the overwhelming majority at sugar production sites. Furthermore, two omphalos bases have been found that might well stem from syrup jars. A base made of a fine ware, two coarse disk-bases, and a coarse trumpet base were found. The latter three probably belong to the HMGPW. Three other rim sherds also exhibit no slip or paint but may, judging by their production technique and ware, belong to the HMGPW. Five truly HMGPW sherds have been found. Five cooking pot sherds tempered with coarse calcite were collected: two body parts and three ledge handles typical of the Mamluk period (Franken and Kalsbeek 1975: fig.49:5-7). A small part of a spout made from a fine ware and body sherds with broad black painted lines were found. Similar examples are present at Tell Abu Ghourdan in the Umayyad and the Mamluk phases



Figure 4.219 Caves north of field 237

(Franken and Kalsbeek 1975: fig.18, 33). Remarkable is a jar rim, similar in shape to that of a syrup jar, that bears incised horizontal lines alternating with zigzag lines below the rim. The sugar pottery, HMGPW and the cooking pots provide clear dates in the Ayyubid/Mamluk period. The other sherds discovered are less clearly of a Mamluk age but do fit within the period.

The eastern cave did harbour a single sherd. This was the rim of a calcite tempered hand made cooking pot present at Ayyubid/Mamluk Tell Abu Ghourdan and Pella (Franken and Kalsbeek 1975: fig.49:4,13; Walmsley 1997: fig.9:8,9). The ledge handles that were found belong to this type of cooking pot. Outside the eastern cave two further cooking pot ledge handles were found. A small Mamluk rim sherd with yellow slip painted glaze on the interior was found. Four HMGPW sherds were collected: a disk base, the rim of a large bowl, a jar fragment and a small bowl covered in dark red/purple and black paint. Sugar pottery sherds were also collected, i.e. two moulds, one funnel and four syrup jars. All these sherds can unhesitatingly be dated to the Mamluk period. Five finely tempered sherds, of which four probably stem from the same jar, have bands of black paint as decoration. Comparable types of decoration occur in both the Umayyad and the Mamluk periods, e.g. at Tell Abu Ghourdan (Franken and Kalsbeek 1975: fig.18, 33).

Concluding, both caves seem to have been used at least during the Mamluk period, but possibly earlier and later as well. Although sugar pottery has been found, there was little of it and there was obviously no sugar production site at this location. The HMGPW and the cooking pots argue for a domestic function. The size of the eastern cave makes habitation impossible. It may have been used as such in combination with a tent, as is known from 19th century itineraries when caves were used for storage, animal shelter or some domestic functions like cooking (Stuernagel 1925: 353). It has also been suggested that caves were used for burials during the Islamic period. The number of cooking pots and HMGPW vessels contrasts with the proper burial ground found on top of Tell Deir 'Allā where mainly sugar pots and jewellery were found. It is, therefore, suggested that the pottery in and predominantly around the caves represents some kind of domestic activity connected to habitation nearby, irrespective of whether it was permanent or temporary, during the Mamluk period.

About 500 m due east of Tell al-Mazār and 450 m to the SSW of Tell al-Ghazāleh a waste area with many large boulders was discovered on the edge of field 177 (coordinate *c.* 746,160/3,568,395). As stones, especially large stones of over 50x50 cm, are not locally available in the Jordan Valley the presence of this rubble area was remarkable. Upon closer inspection traces of recent digging in this rubble uncovering a wall and a vaulted construction were revealed. This wall consisted of large boulders with smaller stones in between them. Although severely collapsed and covered with debris, a vaulted ceiling seems to have created a cavity that was touched upon by the recent digging. Vaulted constructions were a feature introduced to this region in the Roman period. However, in this specific region it is a type of construction that is specifically related to the Late Roman, Crusader and Mamluk periods. Given the size of the stones and the general type of construction it is most likely that this structure dates to the Mamluk period (pers. comm. Van der Kooij). Unfortunately, no pottery that would allow a more precise date was found in association with this structure. Nevertheless, it seems clear that a building of quite massive construction was present at this location that dates to somewhere after the Roman period but probably lay in ruins in the 19th century as no reports of a structure at this location have been found.

The Settling the Steppe survey did not discover further Mamluk remains, but previous surveys and excavations disclosed more information on Mamluk activity in the Zerqa Triangle. The most famous remnant of the Mamluk period is the tomb of 'Abū 'Ubaydah . 'Abū 'Ubaydah , or Amir ibn 'Abdullah al-Jarrah, was one of the companions of Mohammed and a general in the Muslim army that fought against the Byzantine troops, who died in the ghor in 639 AD. He was an important leader in the early days of Islam and his grave became an important site over the course of time. Today his tomb is the site of a large mosque, a cemetery, and religious education centre and could not be surveyed. The EJVS, however, reports that they discovered EB, IA II, Byzantine, Ayyubid/Mamluk and Ottoman period finds at 'Abū 'Ubaydah (Ibrahim et al. 1988a: 190). Due to the modern buildings and inaccessibility the archaeological information is rather limited, but is fortunately supplemented by several written records. The earliest record that could be found is from Yakut, who writes in 1225 AD that the tomb of 'Abū 'Ubaydah al-Jarrah is located at 'Amta,

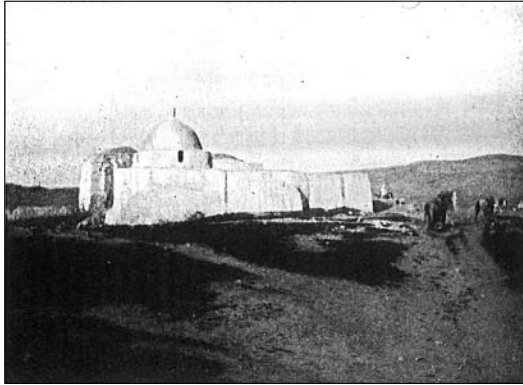


Figure 4.220 'Abū 'Ubaydah around 1900. Photo Dr. Ehrlich (Abel 1911: pl.1-1)

a town in the ghor (Le Strange 1965: 393). A few decades later, Sultan Baybars ordered a tomb to be erected over the grave. This order was executed in 1267 AD under supervision of the governor of the Mamluk province of 'Ajlun to which the ghor belonged (Fischbach 2001: 526). An inscription, still visible today, above the northern entrance to the domed structure over the grave of 'Abū 'Ubaydah states that it was erected in May 1267 AD (al-Hijja 675 H) (Van Berchem 1903: 34).⁹³ It reads that the construction of a domed structure was ordered over the grave monument of 'Abū 'Ubaydah by sultan Baybars (Van Berchem 1903: 46). This substantiates the statement of Yakut as the inscription shows the grave was already marked before the erection of a structure over it. The inscription goes on to state that certain estates were appointed as waqf for the upkeep of the tomb complex (Van Berchem 1903: 34). This waqf constituted half of the proceeds of Dayr Tubin (Tunin?) that was part of the lands of Homs in the district of *'das Kurdenschlosses'*. The castle of the Kurds is today more commonly known as the *'Krak de Chevalier'*, which Baybars had conquered only six years before in 1271 AD. The fact that the land appointed as waqf was located so far away shows the high level of integration and administrative control of the Mamluk empire. The inscription further states that the construction works were supervised by emir Nasir al-din Mankli, the governor of the 'Ajlun province and surprisingly also the personal taster of sultans Baybars and Sa'id (Van Berchem 1903: 48). A second inscription commemorates a further extension executed in April 1288 AD (Abel 1911: 410). In this inscription the emir Husam al-din Turuntaj, governor of Egypt under sultan Kalawun, states to have ordered the restoration of the mosque executed in rabi'i 687 (April 1288) under supervision of emir Akkuj al-Sharifi, who was in that very same year appointed governor of Salt and Balqa (Van Berchem 1903: 51). Van Berchem argues that both emir Husam al-din Turuntaj and Sultan Baybars likely passed 'Abū 'Ubaydah a couple of years before their inscriptions were erected (Van Berchem 1903: 50,51).

In an account a few decades later the tomb and adjoining buildings are described. In the summer of 1326 Ibn Battuta passed through the ghor and visited the tomb of 'Abū 'Ubaydah. He states that there stood a house at which food was supplied to all travellers. He spent the night there (Gibb 1958: 82,83). Ottoman records show that the tomb was repaired several times during the late 19th and early 20th centuries (Fischbach 2001: 541). Descriptions and photographs of 19th/20th century travellers show that the domed white structure over the tomb is essentially the same as in the early Mamluk period and equally make mention of a guard's house providing some services to travellers (Buckingham 1825: 12; Abel 1911: pl.II:1). Buckingham is the only person who entered the mosque and described the inside, but writes disappointedly that the walls are plain and the tomb is an 'elevated mass, rising from the floor, spread with a covering cloth' [...] 'from the ceiling hung numerous paltry lamps, ostrich eggs, shells, etc.' (Buckingham 1825: 13). These objects were probably offered at the tomb as votive gifts over the centuries. As Buckingham visited in 1816 when the Jordan Valley was slowly starting to become inhabited again after a time in which it was the sole territory of the Bedouin, it seems that the mosque and tomb of 'Abū 'Ubaydah with adjoining guard house were one of the few permanent

93 The inscription was copied by Schumacher in 1898. Due to a writing error in the original publication by Schumacher the date was given as 657 H instead of 675 H (Schumacher 1899: 17).

structures in the Zerqa Triangle that possibly continued uninterrupted since the early Mamluk period (see also the next chapter). Unfortunately, today nothing survives of the houses adjoining the mosque or the Mamluk mosque as the entire area is now covered by the large religious complex and cemetery of 'Abū 'Ubaydah .

The official recognition of the cemetery of 'Abū 'Ubaydah as the only approved cemetery of the region in the 1970's ended a practice that can also be traced back to at least the Mamluk era, although without evidence for an unbroken continuity. This is the custom of burying the dead on top of Tell Deir 'Allā and many of the other tells in the area. During the excavations at Tell Deir 'Allā a large number of graves was discovered in the upper layers of the tell.⁹⁴ Virtually all dead were positioned with the head to the west and facing Mekka indicating these are Muslim burials. In the northern excavation areas, which cover 50 x 75 m, as many as 574 burials were found. Different types of graves were found, e.g. a simple pit grave, a grave covered with mud bricks or a grave covered with sugar pot sherds (Borsboom 2001: 17,18). The graves covered with sugar pots undoubtedly stem from the Mamluk period, but the remainder of the graves is difficult to date. Grave goods have been recorded for a third of the graves, but as the majority is formed by jewellery that is clearly worn and may have been very old at the time of burial the grave goods provide generally no means of dating (Franken-Burggraaff 2008). Exceptions are the few graves where grave goods take the form of a sugar mould placed beside the head of the deceased (Borsboom 2001: appendix).

It is, therefore, certain that the cemetery was used in the Mamluk period when occupation in the Zerqa Triangle was relatively dense and the village of Abu Ghourdan at the foot of the tell was occupied. When the cemetery came into use or in which other periods it was used is, however, impossible to determine by only relative dating methods. Borsboom suggests, however, that the distribution of graves over the tell might give some chronological indication. In the southern squares of the northern half of the tell fewer burials and no sugar pots were found. Furthermore only two of the five recognized grave types are present. Borsboom argues that these graves were perhaps made by the Bedouin who seasonally camped here during the Ottoman period. As they were only at Deir 'Allā temporarily there will have been fewer deaths and hence fewer burials (Borsboom 2001: 61). In the more recently excavated squares on the southern half of the tell the trend of fewer burials continues (pers. comm. Van der Kooij). The distinction between a dense northern and a less dense southern part of the tell, therefore, seems to hold true. Modern villagers of Deir 'Allā related that they used this cemetery as well before 'Abū 'Ubaydah was declared to be the only official cemetery. Today only small children are buried on the tell. The presence of Muslim burials on tells is very common in this area, e.g. at Tell Zakarī, al-Rweihah, Tell 'Umm Hammād and Tell al-'Adliyyeh.

As little chronological distinction can be made within the cemetery and because no physical anthropologist was present at these early excavations of Tell Deir 'Allā, little is known about the people who were buried. The grave goods buried with the deceased mainly take the form of jewellery and sometimes consist of pottery or small objects like spindle whorls (Borsboom 2001: 39). The jewellery is generally not expensive and abraded showing it might have been worn. The inexpensive nature of the grave goods and burials does not necessarily imply a poor community, as the Qur'an prescribes all people should be buried equal (Borsboom 2001: 39). Jewellery is also buried with children, and children are buried among adults. Jewellery given to children is often too big for them to have worn. Likewise, men are accompanied by female jewellery. This suggests that jewellery may have been given to the deceased as tokens of remembrance or as amulets (Borsboom 2001: 60). Both the burial gifts and grave types do not show social stratification, but as said this may be down to the religious prescriptions.

94 These graves have not been fully published, but a table of the objects discovered in the 1960 to 1964 and 1967 excavation seasons have been published by Franken-Burggraaf and an extensive MA-thesis has been written by Marloes Borsboom analysing the cemetery and comparing it to religious rules and ethnographic practice (Borsboom 2001; Franken-Burggraaff 2008).

A similar cemetery, dated solely to the Mamluk period, has been excavated at Pella (Mamluk Fahl/Fihl). Here the graves of 110 adults and 142 children were discovered and analysed by physical anthropologists (McPhillips and Walmsley 2007: 127). The Deir 'Allā graves that contained information on the age of the deceased showed a similar division where the categories of adults and children/juveniles were of the same size (Borsboom 2001: 25).⁹⁵ All graves were simple ovoid pits measuring on average 1.5 x 1.75 m in length and were 0.5 m wide. This is comparable to grave type one of which 80 % of the Deir 'Allā cemetery consisted (Borsboom 2001: 25). At Pella, however, a row of stones was sometimes laid along the pit flanking the body (McPhillips and Walmsley 2007: 128). This practice is absent at Deir 'Allā, but stones are rare in the ghor in contrast to the foothills of Pella. Mud bricks and sugar pots might, however, have taken the place of stones. Grave goods were scarce at Pella and like Deir 'Allā they mainly consisted of personal jewellery (McPhillips and Walmsley 2007: 128). Analysis of the skeletons by Bourke revealed that the average life span was c. 30-35 year. This, together with the high infant mortality, is typical of most pre-industrial societies. The absence of visible trauma suggested that infections were the main cause of death. Pathology revealed cases of degenerative spinal disease and osteoarthritis indicative of hard work (McPhillips and Walmsley 2007: 128). Based on the similarity in graves and buried population the results might very well have applied to the Deir 'Allā cemetery as well.

Given the large occupation present in the valley during the Mamluk and early Ottoman periods and the scarcity of remains from Islamic periods before and after that period it is likely that the majority the graves was dug during this era. Furthermore, it can probably safely be assumed that the inhabitants of the Mamluk and Early Ottoman villages of Abu Ghourdan and Deir 'Allā, which were probably one and the same, were responsible for a large share of the graves on the tell, although not necessarily exclusively. Given the archaeological and historical data on occupation of the region it is suggested that most graves date to the Mamluk/early Ottoman period, perhaps together with burials from the early ethnohistorical period. The other Islamic periods will definitely account for some of the graves but these will not form a large percentage.

Another structure that can be securely dated to the Mamluk period is the bridge over the Jordan at Dāmiyah. The same obituary of sultan Baybars, which stated that he commissioned the construction of the mosque at 'Abū 'Ubaydah in 1267, noted that he built this bridge in 1266 (LaGro 2002: 16). Ruins of this large stone bridge still exist today. It consisted of five arches and crossed both the Jordan and by means of a curve also the Zerqa. Schumacher described in 1898 that it was 93 m long and 4 m wide. This length was necessary as the Jordan was 40 m wide even in the days of Schumacher and regularly overflowed (Schumacher 1899: 35,37). The size and workmanship of the bridge suggest Dāmiyah was also an important crossing point in the Mamluk period allowing one of the major routes connecting east and west to pass the Jordan.

Small numbers of Mamluk sherds have been found by Petit's tell survey of the Settling the Steppe-project and by the EJVS and Glueck's survey at Tell al-'Adliyyeh, Tell al-Hammeh East and West, Tell al-Qa'dān North, Tell al-Qōs West, Tell al-Mazār, Khirbet al-Buweib (Petit in prep.)



Figure 4.221 Mamluk bridge at Dāmiyah around 1898 (Schumacher 1899: 34)

⁹⁵ Age was determined on the basis of the length of the skeleton or grave resulting in rather imprecise data.

(Glueck 1951; Ibrahim et al. 1988a). In Petit's survey the number of Mamluk sherds at Tell al-Hammeh East, Tell al-Qōs West, Tell al-Mazār, and Khirbet al-Buweib constitute less than 1 % of the total number of sherds. Given the number of sherds collected this means that no more than two Mamluk sherds were collected in an one area (Petit in prep.). The amount of Mamluk activity at these locations seems negligible and did not take the form of permanent occupation. As the Mamluk period is generally the last phase of occupation at these tells, later occupation layers generally do not obscure the Mamluk remains. They have, however, been subject to erosion during the last five centuries. However, as most tells are not continuously occupied the other layers of a tell have been subjected to similar episodes of erosion when these were the final occupation layer.

At Tell al-'Adliyyeh the amount of Mamluk pottery discovered in Petit's survey of the surface comprised 3 % of all sherds. In the excavation the only Islamic remains discovered were seven burials. These burials were located NE-SW with the head facing south. One or two rows of stones were placed over each grave along the length of the grave. It seems that like Tell Deir 'Allā and Tell Zakarī, Tell al-'Adliyyeh was also used as a cemetery during the Islamic period. As no grave goods were discovered, these graves could not be more accurately dated than the Islamic period, but a link with the Mamluk pottery on the surface seems likely. At Tell al-Qa'dān North the Mamluk sherds made up 3 % of the total assemblage. These sherds were only concentrated on the southern flank of the tell (Petit in prep.). The limited number of sherds and distribution over the surface shows that any occupation present will have been very small scale.

There were furthermore a few tells for which Mamluk or 'Medieval' remains were reported by the other surveys, but that could not be confirmed by Petit's or this survey. These tells included Nkheil North, Tell al-Khsās/al-Rabi', Tell 'Abū al-Zighān, Tell Maydān, and al-Muntih (Glueck 1951; Melleart 1962; Ibrahim et al. 1988a). These tells were resurveyed, but no Mamluk remains were discovered. A few other tells could not be resurveyed as they were bulldozed away or built over, i.e. Tell al-Bashīr, Tell al-Qa'dān South, and Tell al-Hammeh West. At Tell al-Hammeh West a few Mamluk sherds were discovered at the location where the tell used to be (fields 216, 217), but the importance and character of the Mamluk remains are unknown. A few Mamluk sherds ($n = 8$) were also discovered on the surface of Tell Dāmiyah. The majority of these sherds consisted of the HMGPW ($n = 7$) (Petit in prep.). Larger numbers of Mamluk sherds were discovered at Tell Katāret as-Samra and Tell Dāmiyah. (Petit in prep.). At Katāret as-Samra 8 % of the sherds collected were of an Ayyubid/Mamluk age ($n = 17$) (Petit in prep. chapter 14). Like at most other Mamluk sites, the majority of these sherds (11) belonged to the HMGPW, while two sherds were glazed (Petit in prep.).

The number of Mamluk remains in the research area not touched upon in the survey is thus limited. There are, however, some noteworthy remains located just outside the research area. Itineraries of 19th and early 20th century travellers show that a sugar mill was located just south of the Zerqa. Abel wrote in 1901 that while inspecting the dolmen field at Dāmiyah his party discovered a millstone that was still attached to the rock of the hill. Its diameter was 2.7 m and it was 0.7 m thick (Abel 1910: 552). It seems that they had discovered a millstone in the process of being made. The travertine of which the dolmens are made is a coarse type of stone that would withstand the demands on a millstone quite well. It is of course unknown to which period this millstone belongs and whether it was used to grind sugar cane. Close by the dolmen field though lay a sugar mill and in Abel's days the dolmen field was referred to as Tawahin es-Sukkar, or sugar mill. This mill is also described by Abel when he writes that 25 min further to the WNW in the ghor there was another millstone called Hadjar Maflouq. This stone had a diameter of 2.18 m and was 0.8 m thick. It was of the same stone type as the first one. Nearby were the remains of a sugar mill that had two big grinding stones (Abel 1910: 552). These statements seem to connect the millstones to the sugar mill. The EJVS probably visited the same location at the mouth of the Wadi Fannush. They surveyed two sites here that contained Ayyubid/Mamluk remains, i.e. Tell al-Maflūq West and slightly further to the east Tawahin es-Sukkar (Ibrahim et al. 1988a: 191). It seems that this is the sugar mill Abel referred to. Further to the north lies Tell al-Dōlānī. This tell was also visited during the survey and many HMGPW and glazed sherds were found. A few sugar pots

were present but not in large quantities. The EJVS also reports Mamluk remains at the modern village of al-Ma‘addī, but this is at present completely built over. It can, therefore, be concluded that Mamluk occupation and sugar cultivation took place to the south of the Wadi Zerqa as well.

Conclusions

During the Mamluk period at least three larger villages -Abu Ghourdan, ‘Ammata, ‘Abū al-N‘eim- were present in the Zerqa Triangle and just south of the Zerqa there was village occupation on Tell al-Dōlānī. These three villages in the research area all had sugar mills located nearby. No evidence for a village was discovered in the vicinity of Dhirār, while at Tell ‘Abū Sarbūt a village was present during some phases of the Mamluk period whereas the site seems to have been an administrative centre connected to the sugar industry. It should be noted that all Mamluk villages or mills were located at sites that had been occupied during the Late Roman/Umayyad periods (see also section 4.4). Only the mill of Dhirār seems to have been located in a previously unoccupied location, although Tell al-‘Adliyyeh with its Late Roman stone building is located only *c.* 300 m to the north-west. Except for Tell ‘Ammata, the large tells with extensive Bronze or Iron Age occupation, like Tell Deir ‘Allā, Tell al-Mazār or Tell Dāmiyah, were not inhabited during the Mamluk period. These tells were, however, used for interment of the dead. At Tell Deir ‘Allā a large Islamic cemetery existed of which some of the burials have been proven to date to the Mamluk period. Similar to Tell Deir ‘Allā some of the graves present at other tells which have not been investigated may well stem from the Mamluk period. Unfortunately, excavation is morally problematic and even if excavation has been carried out relative dating is often impossible due to the lack of artefacts.

The Mamluk domestic remains discovered in the caves between Dhirār and al-Rweihah may indicate a more mobile segment of Mamluk society. The size of the caves prohibits permanent occupation, but the pottery discovered points to domestic activities. The presence of this pottery makes the possibility that these caves were used as graves unlikely as grave gifts had been uncommon since the advent of Islam. However, no indications of permanent architecture have been discovered. With a view to the topography permanent architecture seems unlikely at this location. Although it cannot be corroborated, it might be suggested that the remains discovered here represent temporary occupation of more mobile groups (partly) living in tents, like the Bedouin who frequented this location during the late 19th/early 20th century.

The construction works undertaken by the Mamluk sultans on the bridge at Dāmiyah and on ‘Abū ‘Ubaydah’s tomb show the involvement of the central government in this area. Communication and transport were evidently so important as to induce government involvement. The Mamluk period was essentially the only period when a permanent bridge was available that probably allowed unrestricted communication between the eastern and western side of the Jordan. The waqf set aside for ‘Abū ‘Ubaydah’s tomb at the Krak de Chevalier shows the high level of integration of the Mamluk Empire and the incorporation of the Zerqa Triangle within it. In conclusion, it can be stated that the Zerqa Triangle was relatively densely occupied during the Mamluk period and through its profitable sugar cane cultivation the region was incorporated into the larger Mamluk Empire.

4.7 The Late Islamic period

4.7.1 *The Late Islamic or (early) modern distributions*

The pottery making up the distribution depicted in figure 4.222 stems from the very last period collected in the survey, i.e. the Late Islamic or pre-modern period. The few sherds of obviously modern pottery like porcelain coffee cups and oil painted jars are, however, excluded. The pottery consists of a very typical ware containing many small mineral inclusions, e.g. sand.⁹⁶ This group of vessels consists for a large part, but not restrictedly, of large jars. By virtue of its very remarkable ware this type of vessels could be identified among the non-feature sherds as well. The density dis-

⁹⁶ The ware was termed ‘gritty ware’ and was entered as such in the database.

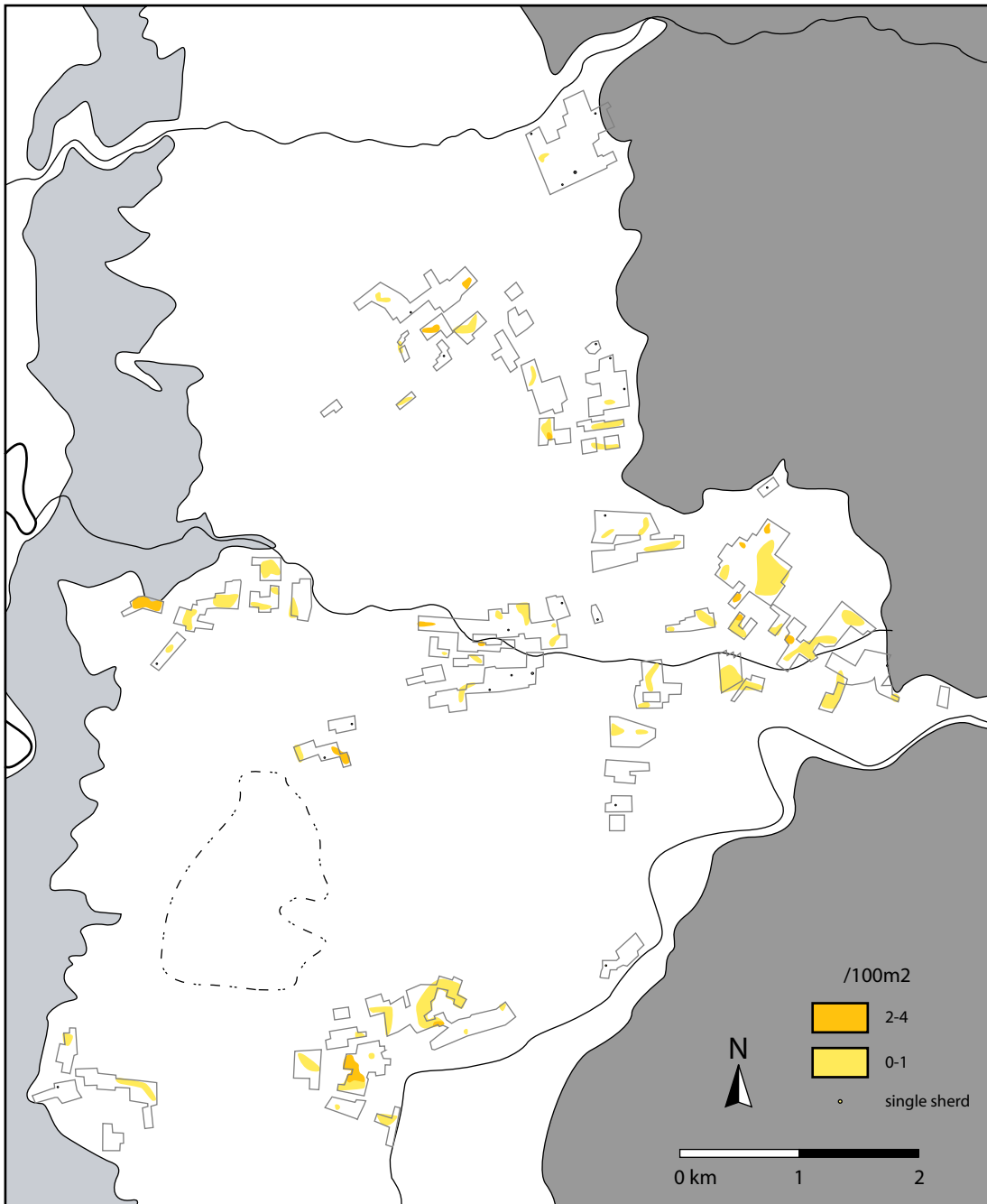


Figure 4.222 Distribution of Late Islamic or (early) Modern pottery

tribution depicted in figure 4.222, therefore, includes both feature and non-feature sherds of this pottery group. Although no firm absolute date can be assigned to this pottery, it probably stems from *c.* 1850 or even later until the 1970's and to a lesser extent even up to today. Today a similar type of jar made of a similar ware is sold at roadside stalls as a water jar or flower pot. It is very likely that this slightly older, but definitely related jar had the same function.

Remarkable in the spatial distribution of this pottery group is the low density, but very wide-spread occurrence throughout the region. Clear concentrations as were present in most other periods are absent from this distribution. However, where most other periods had a clear focus on a certain area within the research area while other areas had much lower densities, this area shows little differentiation between the various parts of the region. Even the westernmost areas that were devoid of pottery in most periods show densities similar to the rest of the region.

Apart from the widespread existence of low densities of pottery, a second noteworthy departure from most other periods is the clustered nature of the finds. Where the distribution patterns of e.g. the EBA, the Late Roman or Mamluk periods show a relatively homogeneous low density spread of isolated sherds throughout the region, isolated sherds are virtually absent in the distribution pattern of this late period. In this period sherds cluster in small groups of a few sherds that are separated from other small clusters by empty space. A logical explanation for this clustering would be the fact that these sherds stem from a single jar that retained some spatial coherence due to the recent data and subsequently few post-depositional processes that acted on it. This was, however, not the case, at least not in all examples. This phenomenon gives the pottery density map in figure 4.222 a somewhat spotty appearance.

The absence of sites is not very remarkable. From old itineraries, aerial photographs and maps it is known which villages existed during this period. As will be described in more detail in chapter 5 the last century and a half saw the development of the Jordan Valley from an area devoid of sedentary population that was entirely the domain of the Bedouin into the modern densely populated settlement system consisting of several rapidly growing villages. The rapid population growth has meant that no villages in this area have been abandoned during this period. Together with the fact that the survey was unable to investigate modern villages, an absence of village remains from this period is to be expected.

Noteworthy, however, is the absence of haloes of higher density areas around modern villages. Hypotheses for the creation of such haloes of higher densities around areas that were interpreted as sites, i.e. a buried feature in the subsoil, included post-depositional processes like ploughing that moved artefacts over the surface and rubbish disposal outside the village boundaries, especially in the form of the manuring of gardens. Both activities are evidenced to be absent in this period. The absence of ploughing in inhabited villages requires little explanation. The villages are, furthermore, all of a nucleated type, that prohibits the presence of gardens or other types of fields that need ploughing. The second explanation that relied on the presence of gardens close by the village and other fields further away as has been documented for many agricultural communities in the Near East can also be discounted. The *musha'* system practised in this area since the reinstatement of agriculture, that involved the rotation of agricultural land among clan members, resulted in the absence of gardens surrounding the village (see section 7.2). Each farmer was allotted a different piece of land every few years. Vegetable gardens were, therefore, distributed throughout the region instead of being clustered around the village. The absence of haloes around modern villages that are evidenced to have existed for some time also shows that other forms of sherd movement, like trampling, movement by animals or e.g. playing kids, are of little effect on the general density distribution. Next to modern villages, however, an increased number of plastic and metal jars and especially plastic bags was found. These were not collected or counted but a small halo would probably appear had they been plotted.

What hypotheses remain to explain this density distribution? Ploughing, erosion and other post-depositional processes moving sherds away from their original location are not tenable. The distribution is different from the expected results of restricted garden manuring. Furthermore, the clustering in small groups divided by empty space differs widely from the expected pattern created by large scale manuring with domestic refuse that is expected to leave a rather homogeneous spread of sherds across the landscape. The pottery can also be discounted as representing the last vestiges of a much denser, past landscape that is now hidden but for these few sherds. From several different sources the activity and infrastructure of the Zerqa Triangle during this period is known and this rules out a disappeared hidden landscape.

The explanation of low intensity shifting activity cannot be repudiated as easily. The distribution pattern that was expected from this type of activity involved small numbers of artefacts distributed over a wide region. Depending on the type of activity, for example temporary camps of mobile groups or living sherds and temporary guard houses within the fields, the remains may be clustered. Given the predominant function of this type of pottery, namely as water jar, an interpretation of some sort of habitation seems very likely. This does not directly denote activities like working, sleeping, or eating at this location, but simply suggests people being at that location for such a time to make the transportation of a water jar worthwhile. Such a location could for

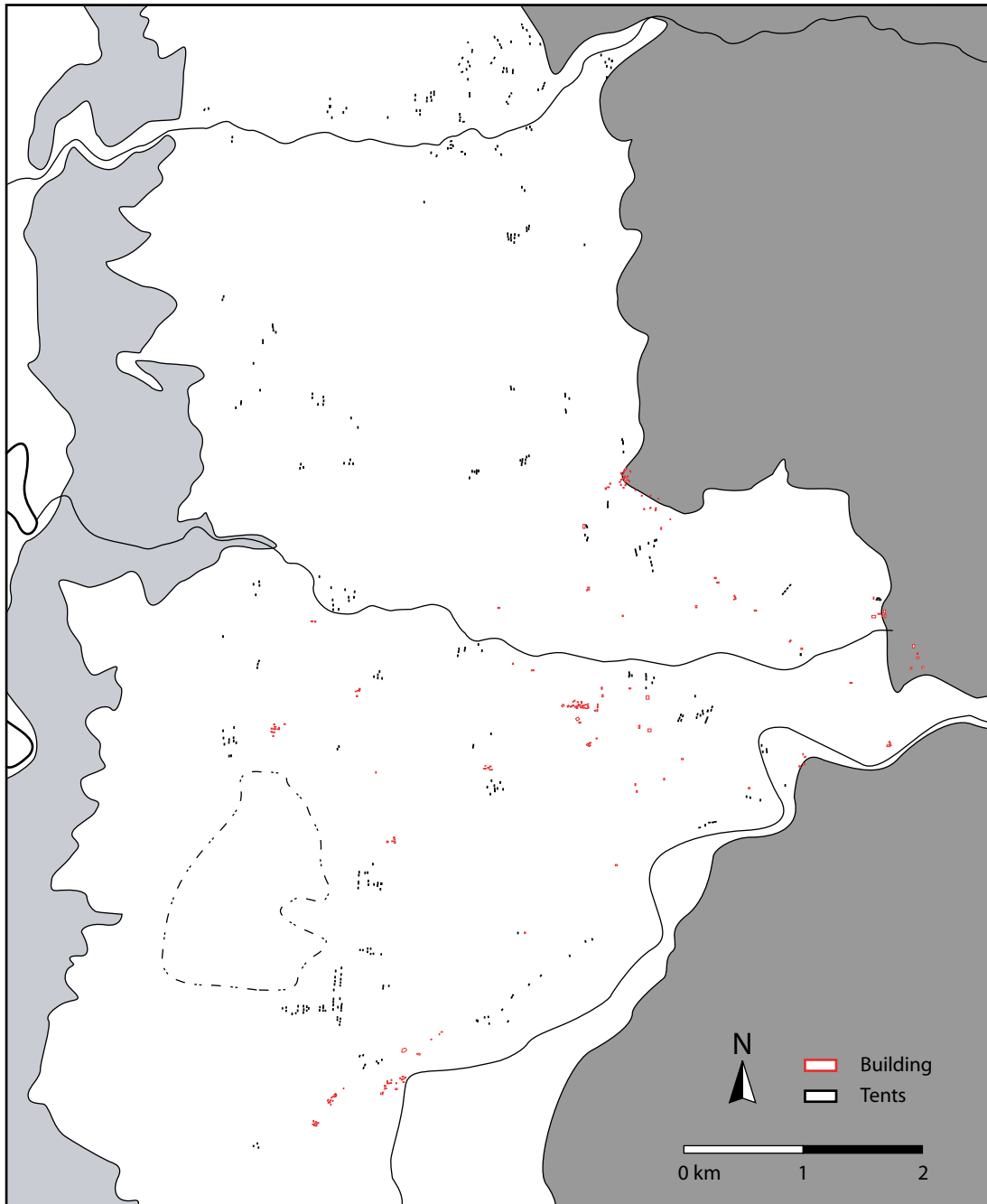


Figure 4.223 Tents (black) and houses (red) redrawn from an aerial photograph from July 1953 (Royal Geographic Society)

example also be the corner of a field where people worked for several hours on a row. Although several jars were identified and the best (modern) parallel is that of the water jar, the small number of clearly identifiable vessels makes it impossible to exclude the possibility that other vessel types were made from this ware as well.

Two types of low intensity shifting habitation, contrasting to only working during the day, were present in this region during the past 150 years. The least shifting, but very low intensity form is that of small structures where farmers spend the night during busy periods of the agricultural cycle to minimize travel time or to guard the crops before harvest (Dalman 1932: fig. 12-15). Similar structures still exist today and consist of little more than a very flimsy structure of wood or plastic to provide some shade and shelter. Other items are today often a bed, consisting of only a frame, only a mattress or sometimes both, some water containers and a transistor radio. Sometimes, but

not always, a small gas cooker and some pans are present.⁹⁷ Even today, when material items are very ubiquitous and disposable, the materiality of such a structure is very limited. Thirty to a hundred years ago when the Jordan Valley was still very small and fully 'pre-modern' the number of possible remains will have been even lower. Concluding, it is known that this type of structure existed and may very well be represented in the distribution pattern. An unambiguous identification of such a site is, however, problematic.

The second type of activity that fits the distribution pattern is that of groups of Bedouin camping in the Jordan Valley for a certain period of time. This is a well evidenced phenomenon that gradually decreases in importance through time. In the early 19th century this was the only form of habitation in this region and remained important until at least the 1950's (see chapter 5). Large scale agricultural development, increased population pressure and the creation of the modern irrigation system from the 1960's onward have greatly reduced the temporary presence of mobile groups in the valley resulting in only a handful of groups camping in the Zerqa Triangle today.

On aerial photographs taken in July 1953 a large number of black, goat's hair tents is visible. This is slightly remarkable as this already deep into the summer months when the weather in the Jordan Valley is far from ideal. Bedouin depending on a pastoral livelihood were reliant on the presence of pastures for their flocks and had moved up the plateau at the end of spring. The increase in population, aggravated by the influx of Palestinian refugees, resulting in an infilling of the landscape by agriculturalists and the increase of personal property may have made this mobile lifestyle problematic as early as the 1950's. The Bedouin camping in the valley in July may have been involved in agriculture and have extended their stay until the harvest and its processing was completely finished. The presence of many circular white areas that may be identified as threshing floors strengthens this hypothesis. It is likely that shortly after harvest the tent dwellers moved up the hills to return in October for the next agricultural cycle. Irrespective of the reason for their prolonged stay the number of tents compared to the number of houses and villages present at that time is very informative (see figure 4.223). In total 393 tents could be detected on the aerial photograph in comparison to 174 permanent buildings. These numbers are based on the visible structures on the aerial photographs. In this way it was impossible to determine the function of a building and it is known that permanent structures used only for storage by sedentary and pastoral people alike were present as well. The buildings are, therefore, not all houses, whereas the tents probably are. From a census it is known that 118 houses were present in the Deir 'Allā district in 1951. Compared to the 393 tents it is clear that the mobile component in the valley was still very significant as recently as the 1950's. When the average household size in this region of 6 persons from 1994 is taken as calculation index for the situation 40 years earlier a mobile population of 2334 versus 708 sedentary people is gained.⁹⁸ Even though mobile groups typically leave few durable remains that a survey in this type of landscape can pick up on, the large extent of this phenomenon will have generated an identifiable pottery distribution pattern.

More telling for the interpretation of the pottery densities under discussion is the distribution pattern of these tents (see figure 4.223). The tents are grouped into small clusters of only two or three tents up to clusters of 20 tents as is visible in the south. These groups are widely dispersed throughout the region, although their probable involvement in agriculture has led to a slight focus on irrigation channels and wadis (see chapter 5). These clusters of tents camping at the same location for several weeks or months will have left low density clustered remains similar to the pottery density pattern depicted in figure 4.222. It is, therefore, concluded that the distribution pattern of (early) modern period pottery to a large extent represents the temporary habitation of groups of Bedouin in the Zerqa Triangle.

⁹⁷ Based on personal observations in the field.

⁹⁸ Based on the General Census of Population and Housing of Jordan 1994 (<http://www.dos.gov.jo>)

4.7.2 Late Islamic tobacco pipes

Soon after the discovery of tobacco in the new world smoking became a popular pastime in several parts of the old world. During the early 17th century smoking and hence tobacco pipes became widely known in the Near East (Avisar 2005a: 83). Throughout the Ottoman Empire tobacco pipes have been found, often in very large quantities, in surveys and excavations (Baram 1999: 137-138). Within the Ottoman Empire there existed several regional centres that produced some distinctive local traditions (Simpson 2002). Some of the pipes discovered in the survey belong to such local traditions only occurring in Cis- and Transjordan, whereas others have a wider distribution. The first tobacco pipes discovered in the region are made of pale white to greyish clay (Simpson 2000). In the survey 4 clear examples of shank ends from this earliest period have been discovered (see figure 4.224). They are of pale clay and have stepped-ring shank ends with simple decoration very similar to examples found at Tell Jezreel, Belmont Castle and Tell Yoqne'am (see table 4.87). Two pipe fragments are made of the same pale clay and show diagonal punctate line decoration on the head (208.4.4m1, see figure 4.224). No parallels for this type of head have been found, but given the similarity in ware it is suggested that these pipes may belong to the same type as the shank ends discussed above and hence have a similar early date. This type, labelled type I in the assemblage from Belmont Castle studied by Simpson, which is used as guideline here, probably continues into the early 18th century (Simpson 2000: 147).

During the 18th century the pale ware type is superseded by a burnished red to brown ware (type II) (Avisar 2005a: 83). These pipes have a short stem and round bowl and date to the 18th century (Simpson 2000: 149). Two pipes discovered in the survey may stem from this period but can also belong to another type. Only one pipe clearly belongs to this type. This head fragment contains cypress-tree stamps in alternating rows. Examples of this type have been discovered at Belmont Castle where Simpson suggests they may represent a local Palestinian tradition as this specific decoration is absent in other parts of the Ottoman Empire (Simpson 2000: 149). In Jerusalem several examples of this type with alternating cypress-tree impressions have been found (Simpson 2008: fig. 268:7-15). The presence of this type in the Jordan Valley strengthens this assumption.

Simpson type III or splashed glazed pipes have not been discovered in the survey (Simpson 2000: 152). Type IV might be represented by a small fragment with sharp incision but the fragment is so small that it is also possible that it belongs to type II. A red slipped and burnished bowl rim might belong to type V, which has been dated to the 18th and 19th centuries (Simpson 2000: 153). A type that has not been identified at Belmont Castle but that has parallels at Yoqne'am where it is referred to as type IV dates to the second half of the 18th century (Avisar 2005a: 89).

The most common category besides the early pipes, however, is Belmont Castle's type VI. This group incorporates red-slipped and burnished pipes where the bowl is lily-shaped or flaring and the end of the shank is decorated with roulette impressions (Simpson 2000: 157). This type is usually dated between 1850 and 1930 AD (Simpson 2000: 157; Avisar 2005a: 89). The specimens collected in the survey have almost identical parallels in the excavated assemblages (see table 4.87). Two fragments belong to the very distinct type disc-based type VII. Again surfaces are red slipped and burnished. The specimens discovered here probably belong to a local Palestinian type that has been dated between 1850 and 1900 AD (Simpson 2000: 165). The disc-based pipes in general,

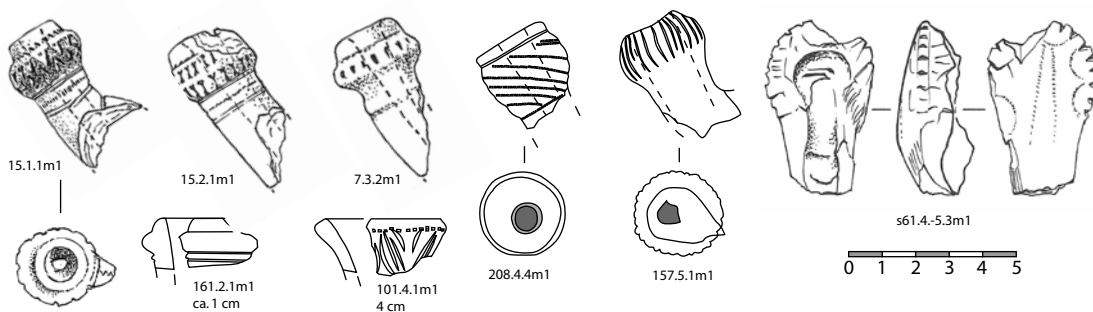


Figure 4.224 Tobacco pipes (pen drawings H. de Reede).

however, are one of the shapes that occurred throughout the region as is evidenced for example by slightly different but generally disc-based pipes found in Corinth and the Athenian Agora (Robinson 1985: 188, pl.57). One example collected in the survey possibly belongs to Belmont Castle's type VIII. This is a red slipped and burnished pipe with a rouletted and fairly open vertical bowl (Simpson 2000: 167). However, only a small fragment possibly containing rouletted decoration has been found, which is too small for proper identification. If the identification with type VIII is correct, this fragment would date to the 19th century. Another fragment also shows parallels to specimens dated to the late 19th century, i.e. Yoqne'am type VI (Avisar 2005a: 91).

It is noticeable that the pipe fragments that could be dated stemmed predominantly from either the 17th century or the period between 1850 and 1930 AD. Pipes dating to the intermediate period are present, but they are less common and mostly with an uncertain identification. Figure 4.225 shows the location of pipes grouped according to the date given to their best parallels (see table 4.87). The focus on the 17th and the late 19th/early 20th century is clear. The predominance of these two periods is telling and can be connected to historical sources discussing the habitation in the Jordan Valley in this period. Ottoman administrative records describe the Jordan Valley as a region devoid of sedentary population during the late 17th, 18th and early 19th century ruled by lawless Bedouin (see chapter 5 for a more detailed description). Although these historical sources must be treated with care, the statement that the Jordan Valley was devoid of sedentary population seems to hold true as no structural remains from this period have been found in excavations or attested by other types of written sources. The survey did not discover pottery from this period, but pottery from this period has only been succinctly studied and is hence difficult to identify. Furthermore, the absence of sedentary population does not mean the valley was depopulated. The region was inhabited, albeit in a temporary fashion by people with a mobile lifestyle.

From Ottoman tax records it is known that during the 16th century villages in the Zerqa Triangle were still inhabited (Hütteroth and Abdulfattah 1977). Although not very dense, there was still a considerable population present in this area. Based on the earliest tobacco pipes it can be suggested that this population level may have continued into the 17th century. The distribution of the pipes does not provide a clear indication of whether these people were sedentary village dwellers or nomadic Bedouin (see figure 4.225). Furthermore, pipes are small, easily transported items that people probably carried with them and hence probably have a wider distribution pattern than strictly domestic pottery. Similar to other areas like Europe, pipes are often found in fields away from villages. This makes an interpretation of distribution patterns even more problematic.

There were only two tobacco pipes that stemmed from the period between 1700 and 1800 AD, i.e. one near Dhirār and one near 'Abū al-N'eim (see figure 4.225). Two other specimens, discovered near Deir 'Allā could only be imprecisely dated between 1700 and 1900 AD (see figure 4.225). The number of pipes from this longer period is clearly lower than that of the early and later period and might reflect the population density in the area. The later period between *c.* 1850 and 1925 AD has revealed most tobacco pipe remains. This increase in pipes coincides with the rise in sedentary population in the Zerqa Triangle documented by early itineraries and the first detailed maps and aerial photographs. The low numbers of discovered pipes make it almost impossible to draw conclusions on the distribution pattern of the different periods. Ten pipe fragments were too fragmented to be dated which leaves only 21 dated tobacco pipes to be evaluated. This small group of finds seems to demonstrate a prevalence for the central area around the Wadi al-Ghor and Dhirār in the earliest period leaving the area around 'Abū al-N'eim devoid of finds. However, during the late period the area around 'Abū al-N'eim is the densest area, although densities of only five pipes are not very convincing. If these low densities are taken to reflect some distribution that can be relied upon, it can be concluded that during the 17th century habitation focussed on the area around Deir 'Allā. This habitation may have taken the form of the last sedentary occupation in the region with 'Abū al-N'eim and 'Ammata having been abandoned already. The 18th and early 19th century saw less habitation and probably not in the form of sedentary occupation in villages. The increase in pipes and their distribution over the entire area in the late 19th and 20th century probably reflects the resedentarization of the region and increase in population during this period. However, the number of artefacts discovered is too low to draw any firm conclusions; only tentative suggestion can be made on the basis of these finds.

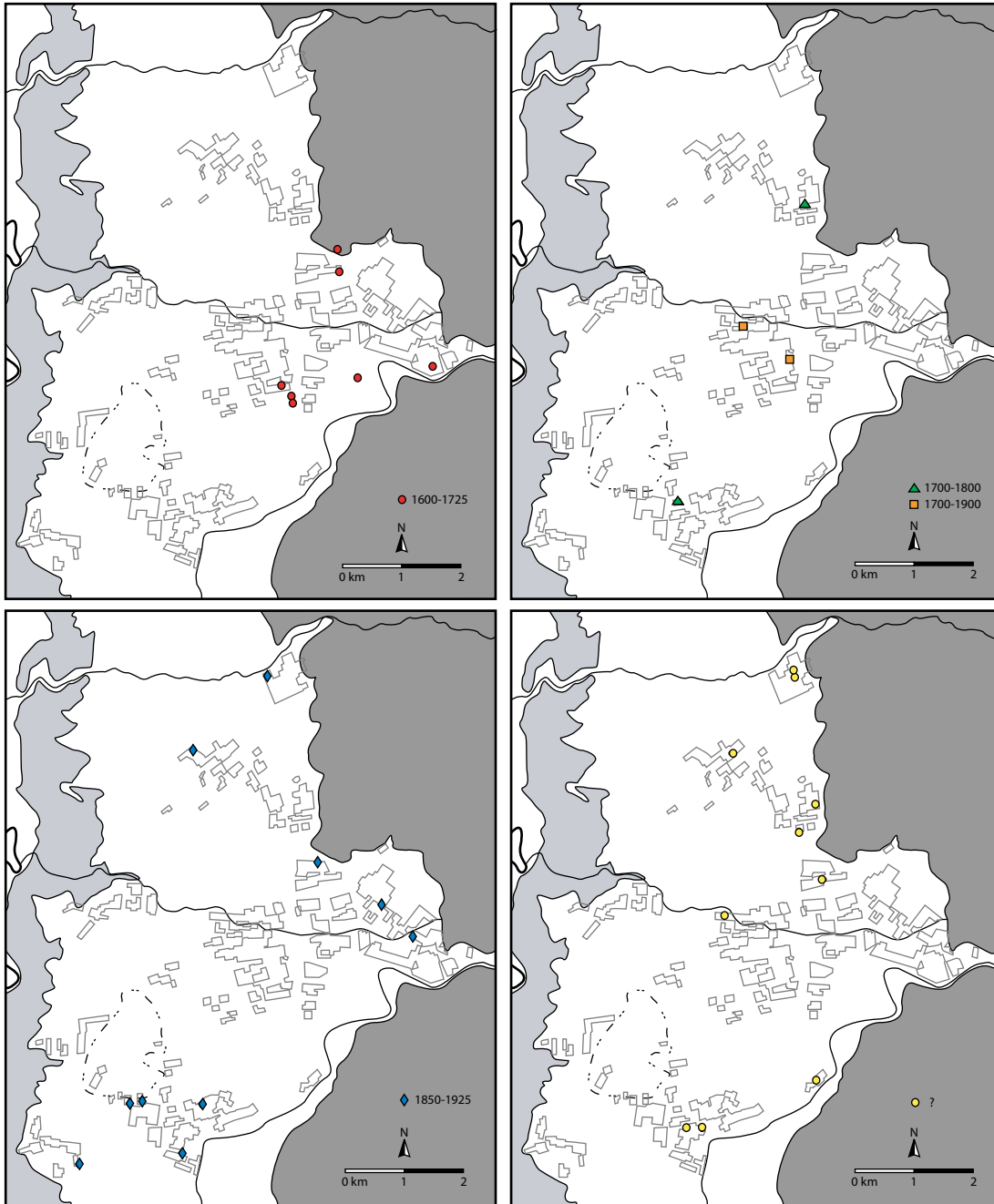


Figure 4.225 Distribution of tobacco pipes

No.	Ware colour	Type ¹	Date	Description	Reference
7.3.2m1	white	I	17th/early 18th		Yoqne'am (Avisar 2005: 83)
15.1.1m1		I	17th/early 18th		Jezreel (Simpson 2002: fig.1:1)
15.2.1m1	pale	I	17th/early 18th		Jezreel (Simpson 2002: fig.1:4)
s17.1.1-2m1	red slip + burnish	V?	18th/19th?		Jerusalem (Simpson 2008: fig.268:2)
s61.4-5.1m1	red slip	VII	1850-1900	disc-shaped, incisions on edge	Belmont Castle (Simpson 2000: fig.13.8:172)
62.4.2m1	red	?	ca. 19th	lily shaped with incisions and punctated line, decoration like 227.2.3m1	
80.3.1m1	brownish grey	?		too small	
94.1.1m1	red				
94.2.1m1	red			fragment of bowl, punctate roulette lines; rather coarse ware	
101.4.1m1	red slip	VI	1850-1930	Lily bowl, decoration no good parallel	
135.4.2m1	light red/grey ware	II/IV	18th/19th?	sharply defined grooves	Jezreel (Simpson 2002: fig.3:19)
143.7.5m1	red ware, no slip	VI?	1850-1930	no rim/decoration	Bal'ama (Taha and Kooij 2007: fig.61:8)
151.6.4m1	black			small fragment, diamond shaped checkerboard impressions	
151.11.2m1	pale	I	17th/early 18th	shank with stepped ring, coarse ware, no decoration	Belmont Castle (Simpson 2000: fig.13.1:4)
157.5.1m1	red slip, light orange clay		1750-1800	Yoqne'am type IV	Yoqne'am (Avisar 2005: 89)
161.2.1m1	black	I/II	17th/18th	simple stepped ring on shank end	Belmont Castle (Simpson 2000: fig.13.1:4 or 9)
162.7.2m1		?		too small	
180.5.1m1	pale			fragment	
184.8.1p1					
197.8.3m1	red slip	VI	1850-1930	Lily bowl, simple long rouletted incisions below rim, No perfect parallel	Belmont Castle (Simpson 2000: fig.13.7)
208.4.4m1	pale	I?	17th/early 18th?	round bowl with diagonal punctate lines, Type I?	no parallel
208.6.4m1	red	VI	1850-1930	small, rouletted	Belmont Castle (Simpson 2000: fig.13.5)
227.2.3m1	red		late 19th	Yoqne'am type VI;convex bowl	Yoqne'am (Avisar 2005: 91)
243.10.3m1	red	VII	1850-1900	disc-shaped, incisions on edge	Belmont Castle (Simpson 2000: fig.13.8)
248.7.3m1	grey			incised lines, no rim	
258.5.2m1	pale	I?	17th/early 18th?	round bowl with diagonal punctate lines. Type I?	no parallel
296.1.3m1	red slip	VI	1850-1930	long pointed shank	Belmont Castle (Simpson 2000: fig.13.6)
311.4.4m1	red, grey fired	VIII?	19th???	punctated line, no rim	Belmont Castle (Simpson 2000: fig.13.8)?
315.5.1m1	white to grey	II	18th	sharp lines, high fired, cypresse-tree stamps in alternating row, prob. Bowl part.	Belmont Castle (Simpson 2000: fig.13.2)
316.3.4m1		?		Palestinian tradition	Jerusalem (Simpson 2008: fig. 269:7-15)
				too small	
325.4.1m1	red	VI	1850-1930	rouletted	Belmont Castle (Simpson 2000: fig.13.5)
					Jezreel (Simpson 2002: fig.1:7,8)

Table 4.86 Tobacco pipes discovered in the survey. Typology used by Simpson on the Belmont Castle assemblage is adhered to in this study (Simpson 2000).

5 Settlements in the steppe: surviving the summer

5.1 Introduction

In chapter 4, the vestiges of human occupation discovered in this region over time were discussed and an attempt was made to provide an interpretation of the actions or phenomena that caused them. These results, however, only provide an answer to one of three research questions, i.e. what remains of human activity are visible in the Zerqa Triangle and what caused them? The other two research questions put forward in chapter 1 involved the way in which people were able to create a livelihood in this arid steppe zone and the level of intensity with which the region was inhabited. The following three chapters will attempt to answer two questions. The evidence for large-scale and intensive occupation that was discovered in the survey suggests this region was occupied by a considerable sedentary population in several different periods. Excavations have corroborated this and have shown that in many periods agriculture formed a major part of the subsistence economy in this region, although a pastoral component was clearly also present (see following chapters). In order to cultivate the steppe zone actions need to be taken to overcome the dry period, in this case the summer season. In the present chapter the severity of the steppe climate will be evaluated focussing on the possibilities of dry farming. Subsequently, the evidence for actions taken by the inhabitants to overcome the drought will be discussed, i.e. evidence for irrigation. Attention will be paid to structural, or archaeological, remains of such a system which leads to the reappearance of several features discussed in the previous chapter. However, archaeological remains are scarce, especially of the earlier periods, which necessitates the use of historical and ethnohistorical sources. Having discussed how people in different periods were able to overcome the aridity in the present chapter, the subsequent chapter 6 will focus on the possibilities of the entire community to inhabit this region. By studying the agricultural systems of three different societies in a detailed fashion, the water demands and carrying capacity can be calculated along broad lines. These data will give information on the intensity of habitation. In chapter 7 the social aspects of communities inhabiting this region will be discussed. In this way, hopefully, providing a detailed and encompassing view on why people lived in this steppe zone and how they managed in certain periods. Unfortunately, there is not sufficient information for every period to carry out this type of analysis. For certain periods the survey has collected a lot of information, but specific data that only excavations can provide, like botanical remains, are absent. In other periods a minimum of information was discovered in the survey, thereby allowing a few assumptions to be made on the basis of the absence of evidence. However, the biases of a survey and difference in the character of the material culture unearthed make such conclusions very hazardous. Consequently, the following chapters are chronologically more restricted than the results of the survey described in chapter 4. Although this is of course unfortunate, future research specifically aimed at these questions can easily fill in these lacunae.

The Jordan Valley is a low lying area with high average temperatures and little precipitation (see section 2.1). As was already described in chapter 2 the Jordan Valley is characterized by a semi-arid climate with dry summers and wet winters. As a result of the high temperatures the potential evapotranspiration is high. The high potential evapotranspiration combined with the limited amount of rainfall imposes serious restraints on the crops grown in this area. The minimum amount of rainfall needed for dry farming is considered to be *c.* 250 mm per year (Wirth 1971: 92). The

Deir ‘Allā region falls just within this zone with an average precipitation of 290 mm a year.⁹⁹ This boundary of 250 mm rainfall is by no means a magic number that always holds true. The actual potential for dry farming depends as much on the manner in which the rain falls as it does on the actual quantity.

As described in section 2.1 the interannual variability of rainfall in the Zerqa Triangle is very high and years where rainfall remains below 250 mm occur very frequently. Furthermore, in Deir ‘Allā rain falls only between October and April, while the summer remains completely devoid of rainfall and has very little dew (see table 5.1). This precipitation distribution poses severe restraints on the cultivation of summer crops, but also on many winter crops that have not fully matured by the time the rains end and that still need a small amount of water. Furthermore, the actual amount of available water also depends on the relief as subsurface groundwater flows may substantially augment the available water. However, in the Zerqa Triangle this is only a factor in the few wadi beds near the foothills and in the streambed of the Zerqa river. In the ghor itself the groundwater table is extremely low (Anonymous 1969a). Additionally, the water available depends heavily on the potential evapotranspiration. In short, a more precise way of determining the possibilities of dry farming in a certain region is needed as local factors like timing of precipitation, amount of potential evapotranspiration and the characteristics of crops need to be taken into account.

A method that is used by, for example, hydrologists is to compare the water that is needed per month or per day and the amount of evapotranspiration in that region with the water that is available for each day or month (e.g. Allen et al. 1998). In this manner the water deficit or surplus can be calculated per plant per month. To determine whether irrigation is necessary in this region this method will be used to calculate the water demand for several different crops known to have been cultivated during the ethnohistorical period (*c.* between 1900 and 1940) in this part of the Jordan Valley.

The Deir ‘Allā region is fortunately well monitored regarding meteorological data. The Deir ‘Allā Agricultural Research Centre is located within the modern village of Deir ‘Allā, immediately south of Tell Deir ‘Allā. This experimental farm was founded in 1951 and includes a meteorological station that provides us with detailed, local data covering the greater part of the past 50 years. Based on the data from this station the following table could be created giving the potential evapotranspiration (ET_o) and rainfall in mm per day averaged per month.

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Av. rainfall mm/month ¹	11.0	41.0	59.0	67.0	56.0	44.0	10.0	3.0	0.1	0.0	0.0	0.2
Av. rainfall mm/day	0.4	1.4	1.9	2.2	2.0	1.4	0.3	0.1	0.0	0.0	0.0	0.0
ET _o mm/day ²	4.4	3.8	2.8	2.3	2.7	3.5	5.5	6.5	6.9	6.5	6	5.2

Table 5.1 Average rainfall and potential evapotranspiration as measured at Deir ‘Allā between 1976 and 2005

The amount of water a plant needs over a certain period of time depends on the characteristics of the plant multiplied by the potential evapotranspiration of the region. The amount of water that a plant needs irrespective of the environment in which it grows is referred to as the crop coefficient (K_c). By multiplying the crop coefficient with the local potential evapotranspiration level, the water demand in a specific region can be determined. There are of course many additional factors that influence the water demand of a plant, e.g. soil and groundwater. Within the present study, where only the general possibilities of dry farming and irrigation farming and the stress on the agricultural system are investigated, a very broad and simple calculation suffices and the water demand per crop (ET_c) is calculated as follows:

$$ET_c = ET_o * K_c$$

⁹⁹ Rainfall and temperature data were acquired from the Jordanian Meteorological Department (<http://met.jometeo.gov.jo>) and calculated over the 30 year period from 1976 to 2005.

This calculation is based on full evapotranspiration and full water requirements. Although a complete fulfilment of the water requirements will give the best harvest, crops can grow with less than their total water requirement and still provide a satisfactory crop. Furthermore, the crop coefficient depends on the growth stage of the plant. When a plant is, for example, in its initial stage of germination it needs significantly less water than in its middle stage when grains are formed. The FAO¹⁰⁰ has developed a list of crop coefficients and lengths of development stages of the most common crops (Allen et al. 1998: table 11 + 12). Crop growth has been divided into four general stages. Each of these stages has an individual crop coefficient. The duration of the four development stages differs per crop and per region, i.e. crops mature faster in warm climates than in temperate ones when sufficient rainfall is available. Furthermore, ancient crops differ from modern crops that have been subjected to intensive selection and breeding. However, the difference lies not in the amount of water crops need, but in the duration of their growth period. Modern crops mature faster than old crops and hence need less water (e.g. Karimi and Siddique 1991). The data given by Allen *et al* can, therefore, not be taken to represent crops in the Jordan Valley without any modification (Allen et al. 1998). Today, the high temperatures in the Jordan Valley combined with drip irrigation and heavy fertilization ensure that multiple crops per year can be grown. These data are, however, not representative for crops grown during the pre-modern period and earlier when crops were grown without modern modifications and chemical fertilizers. The general FAO data have, therefore, been modified using agricultural calendars from the early 20th century. Dalman, for example, details the tasks of a farmer in the northern Jordan Valley near Lake Tiberias for each month (see table 6.1 in section 6.2) (Dalman 1932: 216, 217, 1933: 4-6). These data combined with a report published in 1939 that gives some information on crop duration and sowing/harvesting periods for the Deir ‘Allā region specifically (Ionides 1939). These have been compared to data from the same period but from a wider region (e.g. Dalman 1932, 1933; Abujaber 1989). It should be noted that the pre-modern crops in the Jordan Valley had a shorter growing season than modern crops in Mediterranean or semi-arid regions as registered in the FAO database. This suggests that in the absence ethnohistoric sowing and harvesting information the FAO periods should generally be regarded as too long instead of too short. Based on the combination of these data the duration and timing per crop were determined. These estimates are admittedly approximations and generalization as planting and harvest dates differed per region and per year depending on the environmental circumstances. Furthermore, crops were often planted at several different moments to spread the risk of rains coming late or early and the entire crop failing. The sowing of wheat, for example, commenced with the first rains in November, but continued into February (Dalman 1932: 216, 217). In this way both risk and the labour expenditure was spread over the year.

	Oct		Nov		Dec		Jan		Feb		Mrt		Apr		May		Jun		Jul		Aug		Sep	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Wheat					0.1	0.1	-0.1	-0.1	0.4	0.4	1.7	1.8	4.6	6.0	7.4	2.5								
Barley					-1.1	-0.6	-0.6	-0.1	1.1	2.6	2.6	6.0	1.1	1.5										
lentil					-0.8	-0.4	-0.5	1.0	1.0	2.4	-0.4	1.3												
broad bean					-0.5	-0.5	-0.3	-0.4	1.1	1.1	2.6	1.1												
flax			0.0	-0.1	0.2	0.2	-0.4	0.3	1.0	1.0	2.4	2.5	5.7	1.1	1.5	1.5								
sugar cane	5.1	5.1	3.4	1.5	0.2	0.2	-0.4	-0.5	0.0	0.0	0.0	0.0	4.1	4.1	5.1	5.1	8.6	8.6	8.1	8.1	7.5	7.5	6.5	6.5
sesame															2.2	2.2	4.8	4.8	7.2	7.2	6.6	1.5		
grape	1.6	1.6	0.3										1.3	1.4	3.8	3.8	4.1	4.1	5.5	5.5	5.1	2.7	2.3	2.3
date	3.6	3.6	2.1	2.0	0.6	0.6	-0.1	-0.1	0.4	0.4	1.7	1.8	4.6	4.7	5.8	5.8	6.2	6.2	5.9	5.9	5.4	5.4	4.7	4.7
millet													1.3	3.3	6.4	6.4	2.1							
sorghum														1.4	4.5	4.5	6.9	6.9	6.5	2.3	2.1			
chick pea												0.0	1.9	3.6	4.5	6.4	6.9	6.9	2.3					
pea											0.0	1.4	4.1	6.0	7.4	1.9								
olive	2.7	2.7	1.3	1.3							0.9	0.9	3.5	3.6	4.5	4.5	4.8	4.8	4.6	4.6	4.2	4.2	3.6	3.6
pistachio									-0.9	-0.9	1.2	1.2	3.8	3.8	7.1	7.1	3.1	3.1	2.9					
veget early					0.1	0.1	-0.1	-0.1	0.4	0.8	2.3	2.3	4.9	4.9										
veget spring											1.0	1.1	4.6	4.7	6.7	6.7	6.6							
fruit general	2.7	2.7	1.3	1.3	0.1	0.1	-0.6	-0.6	-0.1	-0.1	1.0	1.1	3.5	3.6	4.5	4.5	4.8	4.8	4.6	4.6	4.2	4.2	3.6	3.6

Table 5.2 Water demand per month for crops regularly cultivated in the Jordan Valley

In table 5.2 the water demand per month has been calculated for some crops frequently occurring in the Jordan Valley, both today and preciously as evidenced in excavations. To allow more variation and to be slightly more precise each month has been divided into two fortnights. The crop coefficients of the different growth stages of the crops have been placed in the specific

100 Food and Agriculture Organisation of the United Nations (FAO)

months according to the local agricultural information. These numbers have then been multiplied by the potential evapotranspiration factor for the specific fortnight. This gives the total water demand per crop per month measured in mm per day. This number has subsequently been reduced by the precipitation of that month which gives the amount of water that is still needed or indicates whether a crop can survive by rainfall alone. The months in which a crop can survive on rainfall alone have been left colourless, the months in which there is a water deficit have been coloured light to dark grey depending on the degree of water deficiency. To elucidate this calculation wheat is taken as an example for which all steps taken in order to come to the water demand depicted in table 5.3 are described.

An example;

In the early 20th century wheat was sown in November or December and harvested in May or June. This gives an average duration of 180 days which is markedly shorter than the 240 days given by the FAO for wheat planted in November in the Mediterranean region.

Growth stage	Initial	Development	Mid	Late	total
Duration FAO (days)	30	140	40	30	240
Early 20th C. dates JV	22.5	105	30	22.5	180
Crop coefficient (Kc)	0.7	0.9	1.15	0.4	

Table 5.3 Crop coefficient and duration of growing stages of wheat

Considering that the planting of wheat started in December, wheat needs 0.7 times 2.8 mm/day which is the potential evapotranspiration rate of December. This calculation shows that wheat needs 1.96 mm water per day in December. The average rainfall in November is 1.9 mm/day. This is more or less the same as the water demand of wheat in that month, which suggests that with some water stress wheat can be grown using dry farming in December. During the first fortnight of May, however, the situation is different. By May, five months had passed since the planting of the wheat. The wheat had by then passed through the initial and developmental growth stages and was at the end of the middle growth stage during which it had a crop coefficient of 1.15 mm/day. The potential evapotranspiration had in May risen to 6.5 mm/day, while rainfall only amounted to only 0.1 mm/day. Together these numbers give a water deficit for wheat of 7.4 mm/day in May. In the second half of May, however, wheat enters the last developmental stage in which the crop coefficient drops to 0.4 mm/day. With the same potential evapotranspiration and precipitation that gives a water deficit of 2.5 mm/day, which is significantly less but still too much for dry farming.

From the overview of the water demand of some of the most common crops in the Deir 'Allā region included in table 5.2 it is clear that dry farming is only possible during some months. Each crop needs additional water during at least some months of its growth cycle. Even crops with a relatively short growing season or with a low water demand, like barley or lentils, cannot survive without additional water in this region. The increasing water demand during the spring and summer months is not so much the result of the water need of the crops during this stage in their lifecycle. In most cases the plants even need less water in this period as they are in their last growth stage, which generally requires much less water. The most influential factor during these months is the dramatic increase in potential evaporation and the absence of precipitation. April and May see only a very low amount of rainfall and June, July, August and September are completely dry.

The absence of rainfall and high potential evapotranspiration, therefore, form a restriction on farming in the spring and summer months. In autumn or winter the start of the winter rains is the restricting factor. For winter crops to be sown farmers have to wait until the start of the winter rains. Apart from the occasional few and irregular drops during October the rains proper generally only start in November and often only in the latter part. In archaeological terms these November rains form a terminus post quem of the winter crops. This makes it impossible to push the entire crop cycle further back into autumn to avoid the spring/ summer months.

Concluding it seems certain that dry farming is impossible under the present environmental conditions in this region. To reduce water stress during the spring and summer months some sort of irrigation must have been practised. Although climatic changes have undoubtedly taken place, climatic proxy data show it is unlikely that major changes have occurred at least since the Late Bronze and Iron Ages (see chapter 2). However, if we assume climatic changes occurred that altered the possibilities of dry farming, the change must have been very great. It is unlikely that the entire Mediterranean climate system changed without leaving traces identifiable by modern climatologists. It can, therefore, be assumed that summers were always dry and hot and the level of potential evapotranspiration will have been more or less the same. Smaller changes that were able to occur without leaving major traces involve differences in rainfall quantities and slight temperature variations. However, for more rainfall to have any impact on the possibilities of dry farming the change must be very substantial. In February, for example, most crops have an average water deficit of 1 mm/day; this means an increase of 30 mm during the whole of February. In March the deficit has risen to 2 mm/day meaning that an increase of 60 mm a month is needed. The deficit in April is regularly as much as 3.5 mm/day calling for an increase of 105 mm in that month, while the modern rainfall in April is only 10 mm for the whole month. This would necessitate a tenfold increase which is very unlikely. The few climatic development models available for this region do not predict such major changes. Based on the data from the Soreq cave, variations in rainfall have been calculated for the past 8000 years. The conclusion was that after 2000 BC precipitation, although variable, was in general lower with a maximum of slightly over 40% of the modern amount, while temperatures were at most a few degrees higher (Bar-Matthews et al. 2003: fig. 13A). These data are not local and they often only poorly correlate to other climatic proxy data making it problematic to use such models in calculations. Nevertheless they, like many other climatic proxy data, show that major differences in rainfall and temperature only occurred before 2000 BC (Rosen 2007: 70ff). It is, therefore, unlikely, even though changes in rainfall and temperature undoubtedly took place, that changes occurred on such a scale as to affect the possibility of dry farming in the Zerqa Triangle.

It should be stressed that all calculations are general and low on detail. The water demands per crop and deficits per month should not be taken as absolute truths. Many parameters could not be taken into account. Amounts will differ per year, per crop variety, per specific stretch of land and possibly also per farmer depending on the techniques used. The water demands given represent the most ideal situation but plants can be grown with less than the full water requirements during part or even most of the growing season. The harvest will still have been rather satisfactory without fulfilling the complete water requirements. It is not likely that farmers strived to fulfil the full water demands in an environment where water was a restricting factor. Irrespective of these drawbacks, the broad and general picture of dry farming possibilities and water deficits does show that irrigation is necessary for all crops for which information is available. It can, therefore, safely be stated that irrigation is essential for crop cultivation in the Zerqa Triangle today and will have been so during at least the past four millennia. In the following paragraphs the irrigation systems of four different periods for which sufficient information is available, i.e. the pre-modern period, the Mamluk period, the IA and the EBA, will be discussed. Although the survey has revealed many artefacts from the Roman period and based on the artefact scatters it seems certain that agriculture was practised on a large scale, there is unfortunately insufficient local information to incorporate this period as well. The very small excavation trenches at Tell al-‘Adliyyeh revealed only very scant remains from this period and did not provide archaeobotanical data. The scale on and intensity with which agriculture was practised in this period shows that irrigation must have been present on a considerable scale. However, although the location of the settlements may provide some insights in the type of irrigation, more information is needed from this region to come to any tenable conclusions. For the other periods that are not considered both survey and excavation data are insufficient to evaluate the irrigation system.

5.2 The ethnohistorical irrigation system

Today the Deir 'Allā region is irrigated by drip irrigation powered by motorized pumps taking water from the east Ghor Canal.¹⁰¹ However, before the East Ghor Canal was completed in 1966 a different system was used.¹⁰² This system has been described by Tarawneh in his study on the rural transformation of the Jordan Valley (Tarawneh 1989, in prep.).¹⁰³ Through interviews conducted in 1986 with people from Deir 'Allā who could remember the situation in the 1920's and 1930's Tarawneh was able to give a description of what the irrigation system looked like at that time and how it functioned. His interview-based information has been checked and augmented through occasional conversations with people in the field during survey work and an interview with two old men from Abu Ghourdan who could remember the pre-1950 situation. This interview was conducted on the evening of 14th of October 2006 in the presence of Fuad Hourani, Ahmed Jūdeh, a son of one of the men and I. It must be stressed that none of the participants is trained as an anthropologist and that the interview should, therefore, not be regarded as an ethnographic study. A valuable description of the ethnohistorical irrigation system of Deir 'Allā supplemented by a model on its technical and social aspects and its applicability to the past has been published by Van der Kooij (2007).

All informants, both of 1986 and 2006, described that the system consisted of small canals that made use of the slowly dipping valley plain to transport water over a large part of the plain. The system tapped water from the Zerqa at a relatively high point before it enters the valley. Three main channels carried the water to smaller secondary and tertiary canals that distributed it over the fields in an even manner. In this way a large area of the Zerqa Triangle could be irrigated. The canals themselves were simple constructions of mud mixed with straw, only the main canals consisted of stones in combination with mud and straw. A similar construction of mud and straw was used to block the canals to distribute the water equally over all fields (Tarawneh in prep.: 25).

The distribution of water over the fields was decided daily by a board of sheikhs. They determined which fields were to be watered and how much. The amount of water that was to be let into a canal was measured in mawsim¹⁰⁴. One mawsim represented twelve hours of irrigation. A mawsim was measured by means of a stick with markings on it.¹⁰⁵ If an area was to be irrigated the blockade in its channel was opened and water was allowed to pour into it until the mark on the mawsim stick was reached and the canal would be closed off again. In the same way the water was divided among the smaller channels (Tarawneh in prep.: 24). Tarawneh's informants claim that this system was accurate and precise (Tarawneh in prep.: 24). In conversations on the old irrigation system that I myself have conducted with people in the Deir 'Allā area, several people stressed that the system supplied enough water for everyone.

The location of these canals remains somewhat problematic in Tarawneh's study. Tarawneh is under the impression that there are no maps available of the old irrigation system. To fill this lacuna he has drawn a map of his own based on descriptions of his informants (Tarawneh in prep.: 15). This map is inherently very basic. It shows the position of the three main channels with some secondary channels branching off from them. If this sketch is superimposed on the present-day topographical map of the region the general location of the main channels is clear. The three main channels originate somewhere in the tell al-Hammeh region where the Zerqa enters the valley plain. The northernmost principal channel runs more or less along the foothills of the plateau to-

101 The development towards the irrigation and agricultural system of today has been described in detail by R. Khouri. For more information on the economical and political decisions that led to the construction of the new system and its implications one is referred to this book (Khouri 1981).

102 The East Ghor Canal, also known as the King Abdallah Canal, was constructed in separate episodes. Construction started in 1959, but the third section that runs through the research area was only completed in 1966.

103 Tarawneh describes this system in his unpublished MA-thesis from Yarmouk University, which was later slightly modified and expanded to be published as a monograph. As these manuscripts differ slightly they are used changeably.

104 Tarawneh transcribed the word as Maosim. The o does not exist in Arabic, but probably refers to the arab letter usually transcribed as either a w or an ū depending on its position within the word. The word maosim is therefore written here as mawsim despite the lack of a written Arabic original.

105 Mawsim means season in Arabic and is the origin of the word monsoon (because of its seasonal occurrence). It is more likely, however, that mawsim should here be understood in connection to the verb mawasa that translates as 'to mark'.

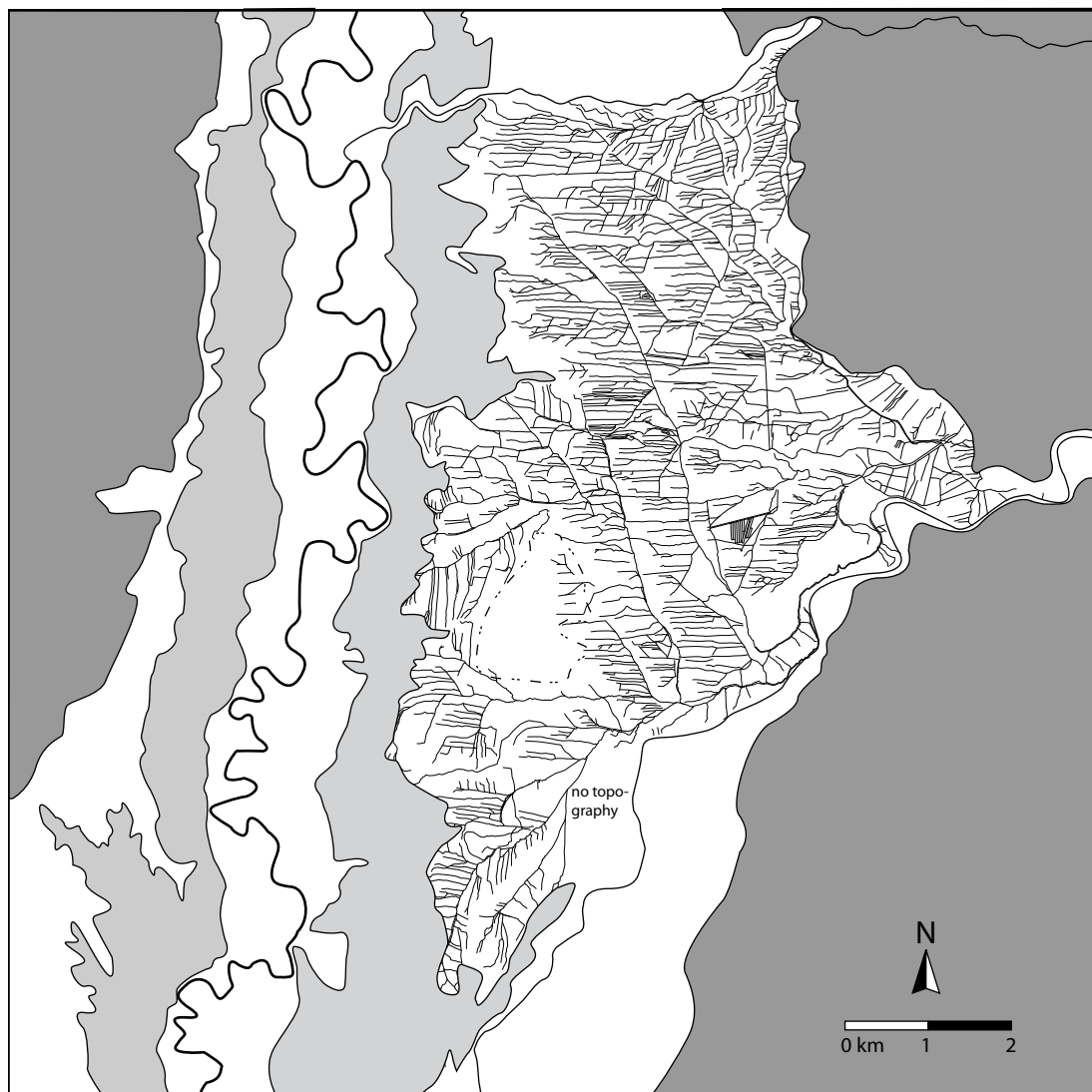


Figure 5.1 Irrigation canals in the ghor of the Zerqa Triangle around 1952

wards the north-west. Tarawneh calls this the Shqaq channel.¹⁰⁶ The second main channel, referred to as Mu'taredah, runs from the Tell al-Hammeh area first to the south-west and then also turns towards the north-west.¹⁰⁷ The third channel, known as Maydan, runs south-west first and turns in the vicinity of the present-day village of 'Abū al-N'cim to proceed in a westerly direction.¹⁰⁸

On the 1959 1:50,000 map of the region there are parts of canals depicted in the vicinity where Tarawneh located the main irrigation channels (Anonymous 1959). These canals are most probably the remains of the canals described by Tarawneh, but different names are given to them. The northern canal referred to as Shqaq by Tarawneh bears the name Mazāriyeh (after Mazār 'Abū 'Ubaydah), while the Mu'taredah canal is called Yahudiyeh (see also Van der Kooij 2007: 137). These names on the map were, however, unknown by the local farmers today. The interviewed men from Abu Ghourdan agreed with Tarawneh's description concerning the Maydan and

106 Shqaq probably derives from the Arabic *šaqq*, pl. *šūquq* literally meaning a narrow opening or crack. It is also a common term in agriculture, where a *shqaq* operation means the opening of new land to cultivation (Abujaber 1989: 49). This meaning fits perfectly with the irrigation canal that made more land open to cultivation. Another origin of the term could, however, be *šiqqa*, pl. *šiqāq* meaning half, moiety, piece of land or limited area.

107 Mu'taredah could derive from *mu'tarid* meaning running or lying across or transversal, which seems to concur with its location.

108 Maydān in Arabic denotes an open place, open tract, field, line, domain, square, or battleground. Tell Maydān is located alongside this canal. It is uncertain whether the name of the tell derived from the canal or the other way round.

Mu'taredah channels but were adamant that the northern channel was called Dhirār after the village located along it. According to them the Shqaq canal was located to the south of the Zerqa and ran in the direction of Tell Dāmiyah. The map supports their claim as the southern part of area east of the Zerqa is referred to as 'Ghor Tell Dāmiyah wa esh-Shqaq' (plain of Tell Dāmiyah and el-Shqaq). However, names can easily change or shift location. Tarawneh was, however, mistaken in his statement that no maps of the old irrigation system remain. It is true that none of the officially published maps depict the system when it was still functioning. There are, however, unpublished scale 1:10,000 maps that were specifically designed for the development of the present-day irrigation system and detailedly depict the irrigation system present at that time (Anonymous 1965). These maps are compiled on the basis of very detailed 1:2,500 aerial photographs taken in 1952. At that time the old irrigation system was still fully operational and is therefore visible on the maps in extreme detail. Figure 5.1 depicts the irrigation channels in the ghor of the Zerqa Triangle as show on the 1:10,000 map.¹⁰⁹

It is clear that the complete irrigation system is much more complex than the few main and side channels Tarawneh depicted. What is clear from this figure is that most channels that run from east to west, perpendicular to the relief. The channels that continue over a long distance mostly run diagonally through the landscape and diagonally with regard to the relief. The shorter canals that end after a few hundred metres tap these longer canals. The difference between primary and lower order canals is therefore also morphologically clear. The difference in orientation is easily explained; the main channels need to carry the water as far as possible, which means descending through the relief slowly. In figure 5.2 the areas irrigated by the different main channels are coloured in alternating shades of grey. The Dhirār and Maydan channels irrigate large tracts of land and are tapped by many secondary, tertiary and even lower order canals. The Mu'taredah channel mainly has canals that do not bifurcate further and irrigates a smaller area, but the canal traverses the longest distance. The canal traverses as much as eleven kilometres from its point of tapping to its final drainage point.

In figure 5.2 the course of the Wadi al-Ghor has been highlighted. Although this wadi contains very little water in dry periods, during the wet winter season it may have supplied the channels crossing it with an additional volume of water. The water it supplied needed to be regulated to prevent occasional floods destroying the canals. It is likely that the basin (Birket al-Fallaḡ) located in this vicinity played a role in this attempt. The channels also benefited from each other as canals often flowed into each other. This phenomenon is especially clear for the border region between the area of the Dhirār channel and the Ammata canal.¹¹⁰ In figure 5.2 the channels watered by both systems are rendered in a third shade of grey. This area, which was irrigated from two sides, will have benefited from the difference in discharge between the Wadi Rajib and Wadi Zerqa as these rivers have different drainage areas that are governed by slightly different rainfall regimes (see section 7.4).

It is not become clear from Tarawneh's description where the main irrigation channels tapped water from the Zerqa. The 1:10,000 maps do not provide much information either. As these maps only depict the plain that could be irrigated the higher parts of the Zerqa to the east of Tell al-Hammeh fall outside the scope of these maps. The Dhirār canal, especially, is located at a relatively high altitude and would therefore necessarily be tapped quite far east towards the upper course of the Zerqa. The point of tapping probably falls just off the eastern edge of the map, but the canal has approached the Zerqa so closely the point of tapping is probably close by.¹¹¹ The Mu'taredah canals taps just west of Tell al-Hammeh and bends south around the modern villages of Al-Dbāb

109 Canals are present both to the north of the Wadi Rajib and to the south of the Zerqa (the Shqaq channel), but for the sake of clarity they are not depicted.

110 This last canal is called Qanat al-'Irna on the English 1959 map. It was also referred to as the Balawneh canal after the tribe occupying this area.

111 Abu Shihab, an old inhabitant of the region described in an interview with Mohammed Jamrah, who was a member of the Tell Deir 'Allā excavation team, that in the early part of the 20th century a canal running NNW towards 'Abū 'Ubaydah tapped the Zerqa some 3 km east of Tell Deir 'Allā. Although this estimate is probably slightly too low, it shows that the tapping point cannot have been located very far away (Kooij and Ibrahim 1989: 13). The 1:50,000 map (2nd ed.) also suggests the point of tapping is located in this vicinity.

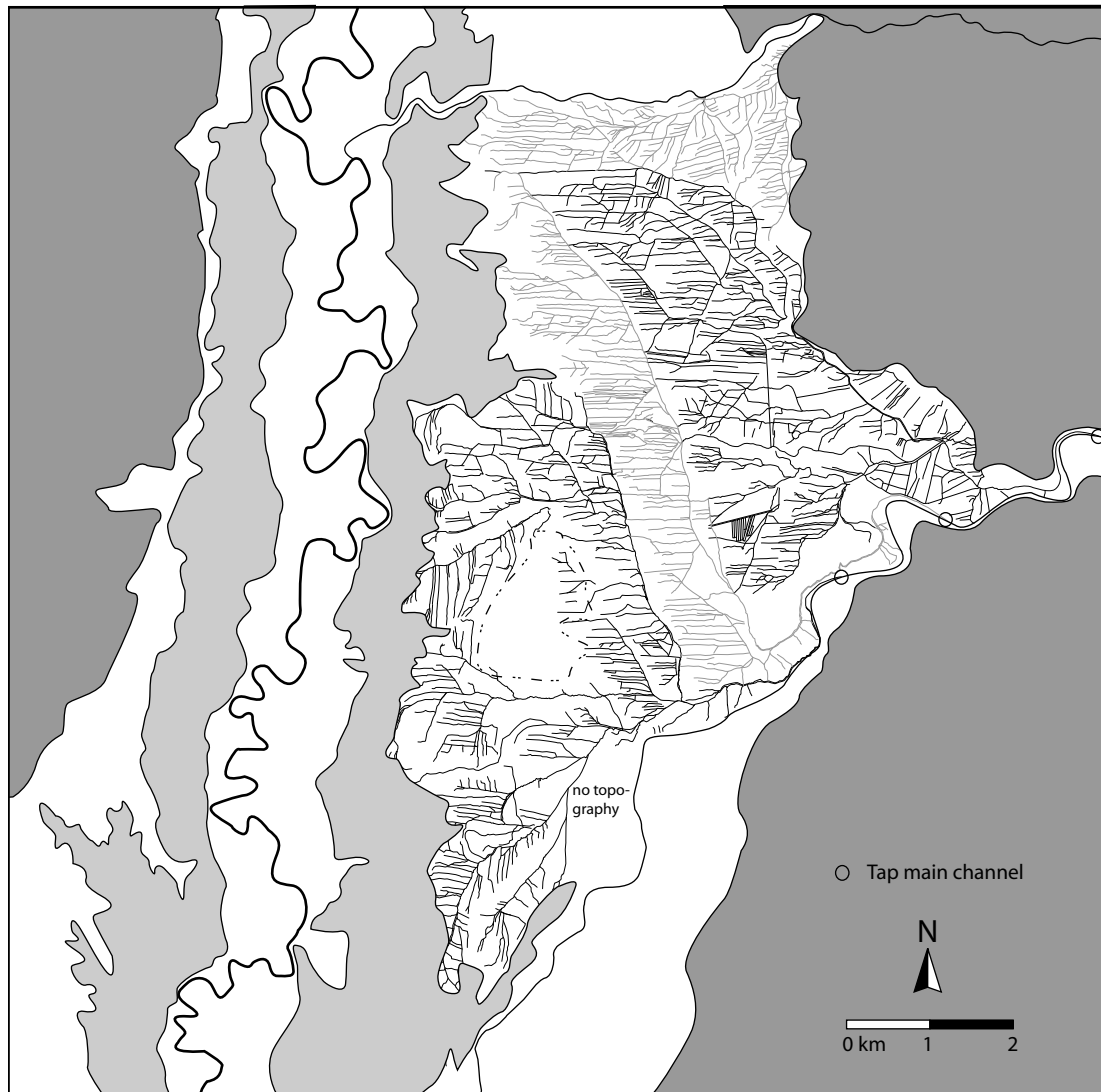


Figure 5.2 Irrigation system around 1952 showing point of tapping and areas irrigated by the main canals

and Sawalha before it turns to the north-west irrigating the lands to the west. This detour is caused by the area of badlands below Al-Dbāb running towards Sawalha. This area is higher than the surroundings and thus prohibits irrigation canals crossing it. The Maydan channel moves away from the Zerqa near Tell Maydan where the Zerqa starts to be entrenched culminating in a height difference of *c.* 10 m at 'Abū al-N'cim.

During his geomorphological fieldwork for the Settling the Steppe-project Hourani discovered part of the ethnohistorical irrigation channel and what is most probably its inlet at the foot of Tulul el-Dhahab. Tulul el-Dhahab represents two tells on two separate natural hills located about 6 km east of Deir 'Allā within the Zerqa valley. The river Zerqa makes a S-like turn around both hills. At the western foot of Tulul el-Dhahab West there is a natural basin-like area within the Zerqa valley. Within this rather flat and wide area a ridge of large boulders and sand divided the Zerqa in two courses. The boulders in this ridge and within both courses of the Zerqa were eroded considerably showing that the ridge was not recently pushed into place by bulldozers to facilitate the dirt track that now runs across it.

It seems that the eastern branch, which had a slower water flow, could have been closed off by a dam that would raise the water level within the basin. Along the edge of this eastern basin a rectangular canal was carved out into a large rock. From this rock the canal continued along the edge of the slope and could be traced in an interrupted fashion for several kilometres along the Zerqa

towards the west. The canal, following the contour lines of the slope and sloping down slowly, was either cut out into the slope or built alongside it from stones, clay or sometimes cement. This basin and canal seem to have been the inlet of the canal that runs just east of the Dhirār channel a little higher up the slope. The course of the canal can be followed until the last turn in the Zerqa before it reaches the plain. There the position of this canal is too high for it to connect to the Dhirār channel. When the Dhirār canal is traced on the 1:10,000 map it seems to tap the Zerqa in or just east of this Zerqa curve (see figure 5.1)¹¹². The old men from Abu Ghourdan affirmed that a dam of the irrigation system was located somewhere near Tulul al-Dhahab. This basin and its channel seem to have irrigated the flat areas along the Zerqa slopes that are suitable for agriculture between Tulul edh-Dhahab and the Jordan Valley plain. From there the channel ran parallel to the Dhirār channel but higher up the slope as can be seen on the 1:10,000 map.

The old men from Abu Ghourdan were also able to recollect the locations of the inlets of the other main channels. One canal tapped the Zerqa just upstream from the bridge over the Zerqa leading to 'Abū al-Zīghān village (see figure 5.1). The old men said this was the Maydan canal, but according to the 1:10,000 map it was the Mu'taredah canal. From here it runs east and south of Al-Dbāb and Sawalha and then veers northwest. The map also shows the Maydan channel starting directly east of Sawalha. The Shqaq channel on the southern bank of the Zerqa starts just south of Al-Dbāb according to the map. The old men gave the same location as inlet point.

The old men also related that near the inlet of the Shqaq channel a rather important wadi ran down from the mountains. To protect the canal from the erosional forces of the wadi a dam, made of bags of straw and animal dung, was built in the wadi. This dam could, however, often not withstand the heavy wadi flow caused by winter rains and was regularly washed away.

Time depth

The combined information of Tarawneh's analysis, the 1:10,000 map and the additional data of the Ghourdan men seems to accurately portray the irrigation system as it was during the early 1950's. How far might it be possible to trace the system described above back into history though? On an aerial photograph from the 1940's the irrigation system is clearly visible (see figure 5.3 after (Glueck 1951)). What is remarkable, however, is that only parts of the area are under cultivation whereas the irrigation channels continue over a larger region. From other aerial photographs, maps and censuses it is known that less than 200 people permanently inhabited this region at that time and that these were concentrated in the eastern part of the region (see section 4.7.1 and 6.1). This suggests that the irrigation system once supplied water to an agricultural system that was larger than the photographed community. Another aerial photograph dating to 1917 also shows the irrigation system (see figure 5.4).¹¹³ Again only part of the irrigation system was in use at that time.

Reports from 19th century Western travellers that traversed the region also give information on the irrigation system at that time. The earliest person to leave a description of the research area is Burckhardt. Burckhardt describes that on the third of July 1812 his group departed from 'Abū 'Ubaydah and passed 'the northern branch' of the Zerqa near a mill (Burckhardt 1822: 347). This northern branch of the Zerqa is most likely the northern main irrigation channel in the present day village of Dhirār. Dhirār is located one kilometre to the south of Abu Obeidah, which accords well with Burckhardt's description that they had been travelling for 15 minutes when they passed the mill. At Dhirār a mill, connected to the northern irrigation channel, was in operation until the 1970's and during the survey indications have been found that it was probably much older (see below). Burckhardt's interpretation of the watercourse as being a branch of the Zerqa and not a man-made channel might be echoed by the 1851 map of Van de Velde (see figure 5.5). On this

112 The 1:10,000 map ends just after this curve and it is uncertain whether the Dhirār is connected to the Zerqa or runs immediately parallel to it.

113 Two photographs exist from the Deir 'Alla region apparently taken during the same period, possibly even during the same flight, but from a slightly different position. These have been published separately. One derives from the collection of Hauptmann Steiner (Kedar 1999: 164). The other photograph is reproduced by Dalman and was taken by German Fliegerabteilung 302 in 1917 or 1918 and can be found in the Reichsarchiv under number 1174 (Dalman 1925: pl.84). The date of the other photograph is not clear. The original present in the Munchen archive is not dated (pers. comm. G. van der Kooij).

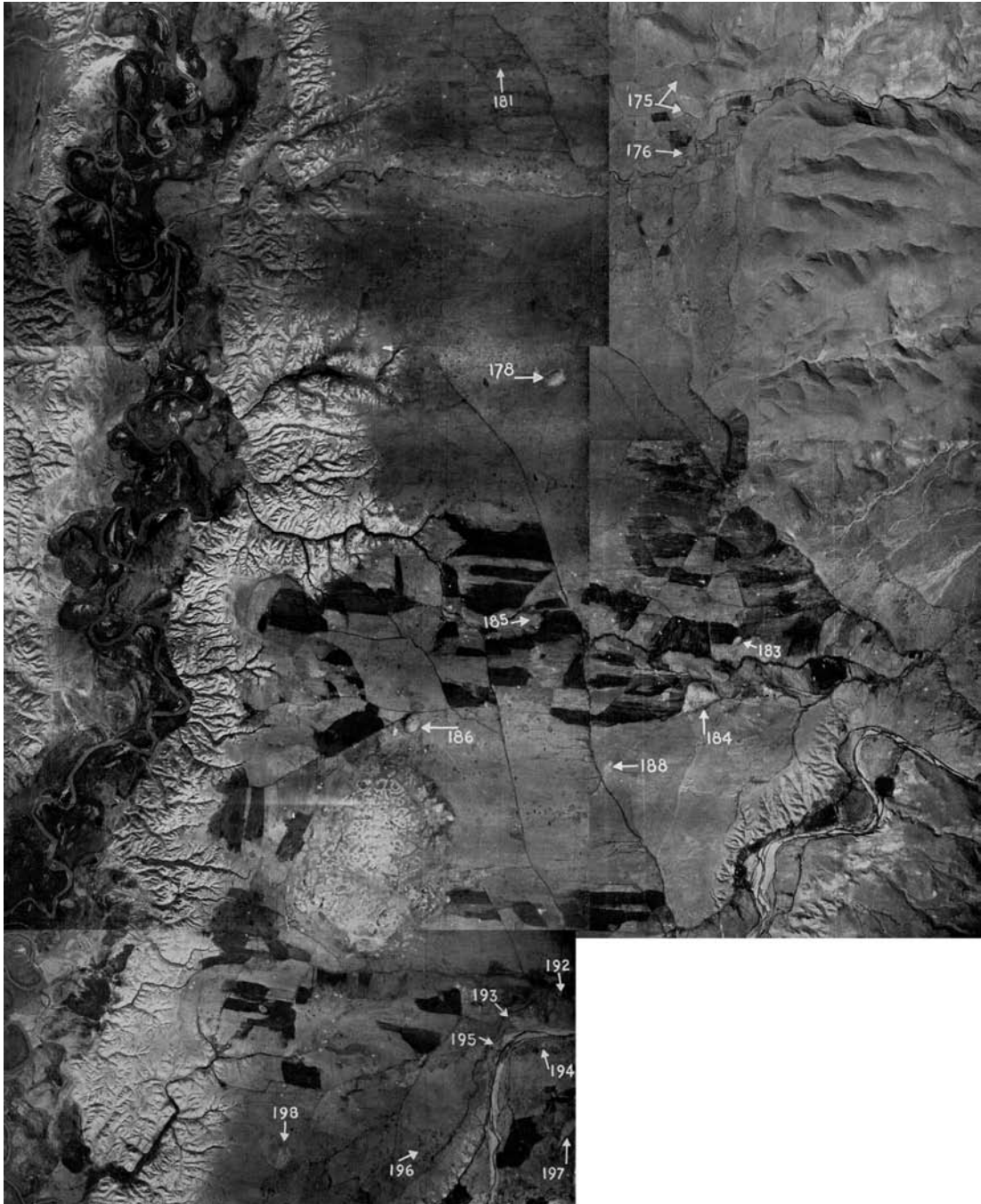


Figure 5.3 RAF aerial photograph of the 1940's showing irrigation canals (after Glueck 1951)

map a stream branches off from the Zerqa to the Northwest. From the description of his travels it is clear that Van de Velde did not enter the ghor around Deir 'Allā himself but took his compass bearings from a hilltop overlooking it. For more detailed surface information he might have consulted the itinerary of Burckhardt, which was available at that time. Van de Velde might have been able to discern a watercourse from the top of the hill, but he might not have been able to distinguish between a manmade channel and natural river branch.

A second traveller in this region that left a report provides us with a description that clearly implies the practice of some sort of irrigation. On the 30th of August 1847 Lt. Molyneux passed along the research area on an expedition along the Jordan to the Dead Sea. When standing on the hills west of the Jordan Molyneux describes the area between 'Abū 'Ubaydah and the Katar hills as 'a considerable plain with many trees, and apparently well cultivated'. South of the Zerqa every-



Figure 5.4 German aerial photograph from 1917 looking east (After Kedar 1999: 164)

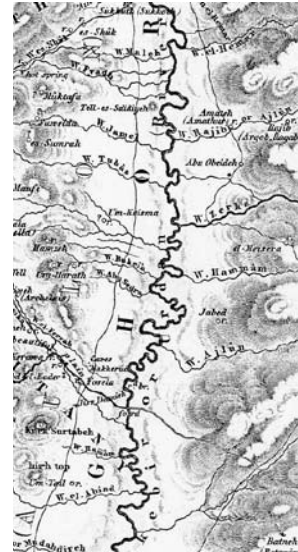


Figure 5.5 Map of the Jordan Valley drawn by Van de Velde around 1851

thing except for the actual bed of the Jordan seems barren and desolate (Molyneux 1848: 119). As Molyneux travelled at the height of summer when the last rains had fallen months ago any cultivated fields must have been irrigated.

The first person to actually use the word canal and provides us with the evidence that the irrigation system at that time was very similar to the one of the 1950's described by Tarawneh is the Duc de Luynes in 1864. He describes that the water from the Zerqa is guided into a canal of *c.* 2 m deep when it enters the valley. This canal runs along the foothills and distributes the water over the plain by way of many smaller channels. He notes that the farmers safeguard the preservation of the dikes, fords and canal inlets. The further his group travelled away from the canal the more dry and barren the land became (Luynes sd: 133-135).

A reference to the age of one of these canals is given by Merrill, who travelled through these parts between 1874 and 1877. He describes that there used to be a hot spring at the mouth of the Zerqa near Tell al-Hammeh but that it had disappeared by the time he visited. An old man he met could remember bathing in it as a boy. This man attributed the drying up of the spring to a canal that was dug in Ibrahim Pasha's time (1832-1840) near and above the spring. Merrill describes that the canal was still in use in his time (Merrill 1881: 193).

The digging of the canal in Ibrahim Pasha's time does not fit with the likely presence of a channel at this location when Burckhardt passed in 1812. This discrepancy might, however, be attributed to a false conclusion drawn by the old man that informed Merrill. Another reason for the hot spring drying up derives from the work of Steuernagel who based himself largely on the notes made by Schumacher during his travels in 1898 (Steuernagel 1925). Schumacher describes that a big channel ran to the east of Tell Deir 'Allā and tapped water from the Zerqa. This alone does not identify it as the Dhirār channel. Schumacher mentions, however, that the channel was connected to a basin, called birket el-fellaj, containing old brickwork (Steuernagel 1925: 353).¹¹⁴ This basin is depicted under the same name on one German and two British maps from 1917 and 1918. On the map the basin is connected to the Dhirār canal. Therefore the Dhirār canal did exist in Schumacher's time, but the hot spring was also present as he took detailed temperature measurements. Even today, when the Zerqa flow is only a fraction of what it used to be, the hot spring still exists.

Merrill further writes that in the Zerqa region any area can be reached by irrigation canals, that it is extensively cultivated and contains 'many fine farms' (Merrill 1881: 382). Merrill was apparently quite interested in this system of irrigation and has traced some, at that time unused, channels

114 Birket el-Fallaj can best be translated as 'basin of the canal'.

into the foothills, being able to track them for 5 to 8 miles. From this he concluded that the original system cultivated tracts of land not only on the valley plain but also into the foothills (Merrill 1881: 382). He concludes that it originally must have been a sizable undertaking as the channels continue over large distances and through terrain that is difficult to reach and modify. The channels follow the face of the mountains, sometimes leading across steep rock cliffs or underneath ledges. Only skilled workmen could have carried this out (Merrill 1881: 383). Being intrigued by the construction of the canals he questioned the local people specifically on this topic. He notes that 'those who cultivate the land say that they dig no new ones, and the Arabs assert that they have always existed here' (Merrill 1881: 382). The farmers assured him repeatedly that neither they, nor their fathers had anything to do with the construction of these canals. They further asserted that when they want to bring a new piece of land under cultivation all they have to do is clean out and repair the old channels (Merrill 1881: 383). Merrill notes that there are also irrigation channels tapping water from the Zerqa and leading it towards the south for several miles and resulting in 'beautiful fields of wheat'. Further south the area is dry and barren until the Wadi Nimrin (Merrill 1881: 420).

An itinerary from 1914 describes how the canals were organised. Seeger, describing an excursion of the German Evangelist Institute in Jerusalem, writes that at the point where the Zerqa enters the valley, canals immediately tap it. Canals lead the water both to the north and the south of the river in a fan-shaped way as each canal bifurcates over and over. From above it looks like green fans grown from the Zerqa gorge into the valley. In this manner the inhabitants are able to cultivate fields and gardens at great distances from the river. However, well tended fields lie beside abandoned, dry, half destroyed canals leading to lands that are dry wasteland covered in small cobble stones and thorny bushes (Seeger 1915: 157). This description shows that the way in which canals branched off from each other is very similar to the 1950's situation. At this time the Shqaq channel to the south of the Zerqa also already existed. It is uncertain whether the unused channels Seeger describes were recently abandoned or whether they stem from a previous period of large-scale cultivation of the valley. The low intensity of habitation and agriculture in the valley during the early 20th century suggests the latter option. The slow accumulation rate of stones in the valley also suggests that stony fields were left uncultivated for a long period of time.

The land of the Bedouin

Concluding from these itineraries it can be stated that at least by 1864, but most probably as early as 1812, an irrigation system was in use that functioned in the same way as the 1950's system did. Merrill's account is the most interesting in this respect as he actively questioned the inhabitants. Their statement that neither they nor their direct predecessors constructed the canals but that it had always been there is very interesting. From historical sources it is known that the Jordan Valley was almost completely devoid of sedentary farming communities in the period that predates these travel accounts. It was the territory of mobile Bedouin tribes who spent the winter in the warm Jordan Valley (Abujaber 1989: 85). In this period the region was part of the Ottoman Empire. The Ottomans had inherited a region that was increasingly subjected to Bedouin incursions from the Arabian Peninsula. During the previous Mamluk period villages had clustered into defensible areas even if these were located away from the agriculturally rich areas (Walker 1999: 214). When the Ottomans came to power in this region at the start of the sixteenth century they reinstated a strict government and with the aid of several garrisons the Bedouin threat was subdued and sedentary farm life was again able to thrive (Walker 1999: 214). This was, however, short-lived and before the end of the sixteenth century Ottoman military investments in the region were so low, because of their military campaigns in Europe, that remaining garrisons were not able to withstand the Bedouin tribes pushing northwest from the Arabian Desert. Several Arabian tribes, like the 'Adwan and the Beni Sakhr, migrated into Transjordan and occupied a territory as far north as the Madaba plain. Again sedentary farmers abandoned the fertile plains and moved to more defensible settlements in the highlands and on the edge of the plateau (Walker 1999: 215).

It is uncertain when the Jordan Valley became part of the territory of the Bedouin tribes. Initially the agricultural villages that existed in the Zerqa Triangle will probably have continued on a small-scale. Once the tribes had spread from their territory in the south and occupied the entire

Transjordanian plateau, the Jordan Valley will also have become part of their realm, if only in winter. From historical sources it is known that some of the Bedouin that lived on the western edge of the Transjordanian plateau used to move to the Jordan Valley in winter to profit from the milder winter climate (Burckhardt 1822: 345). As the climatic circumstances have changed little since, this movement will most likely have occurred at that time as well.

Historical evidence for the presence of Bedouin tribes threatening the sedentary population in the Jordan Valley around 1600 comes from two different sources. On the one hand there are Ottoman documents, on the other hand stand itineraries of early foreign travellers. The Ottoman documents represent people complaining to the provincial government in Damascus or orders given by the provincial government to the authorities in towns like Jeruzalem or 'Ajlun. Several of these documents show that raids conducted by invading Bedouins were increasingly threatening the settled population in most of the districts, even those of Nablus or Jeruzalem located within the hill country of Cisjordan. One document dated to December 1st, 1581 is an order to the authorities of several districts. It is reported that the landlords of the district of Safad, located west of Lake Tiberias, had complained about the absence of troops in the area.¹¹⁵ Taking advantage of this absence the Bedouins and Druzes had risen in a general rebellion and 'indulge in raiding villages, attacking travellers, and killing people'. It had been impossible to collect taxes during the past three years and 'business and agriculture in the *sanjak*¹¹⁶ are at a complete standstill' (Heyd 1960: 88). The local authorities were ordered to capture the rebel leaders, confiscate all muskets and send them to Istanbul (Heyd 1960: 88). From the course history took in the next few centuries, it may be concluded that this order proved difficult to realise.

A different document dated two years later concerns the district of 'Ajlun of which the Jordan Valley is part. However, as this district covers the majority of Transjordan, excluding the north, it is uncertain whether this document pertains to the entire region or just part of it.

28 ramadan 991 (15 oct 1583)

This one too [was given to the kethuda of the Beg of 'Ajlun].

'Order to the cadi of Damascus and to its (the) cadis who belong to the province of Damascus:

It has now been learnt that many villages and inhabited and cultivated places belonging to the province of Damsacus are on the verge of falling into ruin and that native deputy-judges (nünvab), in contravention of custom and regulations (kanun), take money beyond all reason when (for) issuing legal certificated and copies of [entries in] the records [of a law-court]. There is no end to oppression and injustice of this sort.

Therefore the cha'ush Ferhad, one of the cha'ushes of the sublime court, has been dispatched in order that the truth may become known as to what had caused and brought about that the province of Damascus, while from olden times inhabited and cultivated, has at present day become so desolate and ruined, and whether the native deputy-judges have in fact committed acts of oppression and injustice...' (Heyd 1960: 54/55).

Again villages and cultivated areas are in danger of being abandoned. This time no mention is made of direct Bedouin raids but their power may be inferred because when a few months later these local deputy-judges were fired they were referred to by a term that means either Bedouin or Arab (Heyd 1960: 54).

The early itineraries from European travellers stem from the same period. In 1601 John Sanderson, British merchant, while travelling through the hill country of Cisjordan to Jerusalem notes that they passed 'old great stony ruines of a citie. No inhabitants here. And many other ruined places wee travelled over where had beene townes, but now were cragged stones ...' (Foster 1931: 100 n1). On his journey back to Damascus he wrote near Tiberias; 'thence we passed, for feare of Arabian theeves, which are in tropps about those contryes, pitching their tents at divers tims in divers plaines and frutefull places, liveinge a little commomwelth emongest themselves,

115 Most troops in the southern Levant had been sent to participate in the war against the Persians that started in 1578 (Heyd 1960: 88).

116 Sanjak = district

subject to no lawe, begitting children and breeding up all sorts of cattell for their use. They are of divers trades, as smithes, shoemakers, weavers, and sutch like; and amongst them have exelent running horses, wherewith they often ride a theevinge.’ (Foster 1931: 114).¹¹⁷ A similar account of hazardous areas can be read in William Lithgow’s ‘Rare adventures and painful peregrinations’ (Phelps 1974). In the days before Easter 1612, the author joins a small pilgrimage organized by the Christian Guardian of Jerusalem to the Dead Sea and Jordan river in order to visit the place where Jesus retreated for 40 days. This was a dangerous trip undertaken only once a year and well escorted by 60 cavalrymen and 40 foot soldiers (Phelps 1974: 241). Lithgow wrote when they were two hours east of Jerusalem ‘we entered into a dangerous way and a most desolate and fabulous soil’ [...] ‘in all this deformed country we saw neither house nor village for it is altogether desertous and inhabited only by wild beasts and naked Arabians’ (Phelps 1974: 143). A few hours further in their journey they are attacked by the naked Arabians he had described; ‘the unwelcomed arabs environed and invaded us with a storm of arrows, which they sent from the tops of little hard hills whereupon they stood...’ (Phelps 1974: 144). A few soldiers were wounded but they were able to withstand the attack. The next day they were attacked a second time before reaching the village of Jericho. Jericho, normally quite a large village because of the agricultural potential provided by its spring, was a poor village counting only 9 houses at that time. Lithgow mentions that he ‘saw many ruinous lumps of the walls and demolishings of the old town, which is a little distant, about a short quarter of a mile’ (Phelps 1974: 146). He was probably referring to Biblical Jericho when he mentioned the old town, but it is unlikely that Tell el-Sultan had another appearance than it has today and showed remains of walls.¹¹⁸ It is more likely that the walls Lithgow described belong to an abandoned Mamluk or Early Ottoman village.

From these different types of documents a similar image comes to the fore. This is the image of a country in which the sedentary farming population is under increasing pressure from Bedouin tribes. These tribes take advantage of a weakened local government, weakened as a result of the war with the Persians and military undertakings in Europe (Walker 1999: 214). Travelling became dangerous as lonely voyagers were attacked and robbed by wandering groups. Villages were raided and livestock, grain and sometimes even children were stolen (Buckingham 1825: 15). Because of the continuing raids and the heavy tribute farmers sometimes had to pay to be left alone many were forced to migrate to regions where the central Ottoman government was able to enforce their laws and guarantee safety. In this way the Transjordanian plateau and Jordan Valley became completely devoid of permanent population in the 17th century apart from a few market towns like ‘Ajlun and Salt.

Direct evidence from the region itself for this lack of sedentary population is scarce. Most information stems from historical sources from neighbouring regions e.g (Heyd 1960). The first source to report on the middle Jordan Valley is dated to the end of the 17th century and is mainly based on the oral tradition of the Bedouin themselves. The ‘Adwan tribe who occupied the western part of the Belqa rose in power and forced the Mihdawi tribe into the Jordan Valley (Abujaber 1989: 68). Initially the Mihdawi moved to the region around Nimrin, Kafrayn and Rama, but in a second campaign the ‘Adwan also claimed the southern Jordan Valley and pushed the Mihdawi further north into the area of the Balawneh tribe around Abu Obeidah. The Mihdawi based themselves at Tell el-Saidi¹¹⁹ under the protection of Ibn Asra, the sheikh of the Balawneh (Peake 1958: 169). At some later moment a disagreement arose about the distribution of land amongst the sons of a powerful ‘Adwan sheikh and the ‘Adwan moved even further north in the Jordan Valley until, after a battle on the banks of the Zerqa river, supposedly in 1750, they occupied the entire area up to the Zerqa river and the Mihdawi fled further north (Peake 1958: 170).

117 Sandersons original field notes were rewritten by a servant, who made many spelling errors.

118 Tells were at that time not recognized as remains of the past. Only in the 19th century did people realize that tells were the accumulated occupation debris of past people. Merrill e.g. writes about Tell Deir ‘Allā: ‘The large mound is covered with broken pottery of many colors and qualities. There is every evidence that the mound is artificial; indeed, so far as it has been examined beneath the surface, it is a mass of debris.’ (Merrill 1881: 388).

119 Tell es-Sa’idiyah.

The state of the Jordan Valley changed around the start of the 19th century from a region utilized by pastoral Bedouin to an area where agriculture was of growing importance. Most of the Jordan Valley was now the territory of the 'Adwan. Although the 'Adwan themselves were completely pastoral and nomadic in nature they were involved in some agriculture by means of slaves that were positioned as farmers in the Jordan Valley (Abujaber 1989: 69). The Bedouin tribes that originally occupied the Jordan Valley but that were severely weakened by the conquests of the 'Adwan also resorted to agriculture (Abujaber 1989: 69). In the course of the first half of the 19th century the Jordan Valley was resettled by sedentary farmers on a small scale. Larger farms started to develop and eventually the Ottoman government realized the agricultural potential of this neglected region. Transjordan as a whole was incorporated into the world capitalist economy and became a centre for the production of export goods for Europe (Fischbach 2001: 529). Especially areas in the Jordan Valley near wadis coming from the plateau, assured of a permanent supply of water for irrigation, were highly profitable and these were procured by rich merchants from the cities and even by the Sultan (Fischbach 2001: 529). The Zerqa Triangle would definitely qualify as such an area. The renewed Ottoman interest in the region and its efforts to stimulate agriculture resulted in the Tanzimat reforms and the Land Code of 1858 (Fischbach 2001: 530). In this code the land was registered according to four categories: private land (*mulk*), state land (*miri*), public land (*waqf*) and unclaimed or dead land (*mawat*).¹²⁰ In 1876 land in the 'Ajlun district, of which the Jordan Valley was part, was registered in this way (Fischbach 2001: 530). The area under study was registered as state land and the Bedouin tribes who lived and worked on the land were granted usufructuary rights. Several land reforms followed the Ottoman Land Code but essentially this was the predecessor of the system used in the 1940's and described by Tarawneh.

For this period starting that witnessed a return to agriculture there are again reports from European travellers. This time the research area itself is described. Taken together, these give an account of the changing situation from a pastoral Bedouin society to one in which agriculture is of growing importance.¹²¹ The first travellers to pass the region were Burckhardt and Buckingham in 1812 and 1816 respectively. Burckhardt wrote: 'the valley of the Jordan affords pasturage to numerous tribes of Bedouins. Some of them remain here the whole year, considering it as their patrimony; others visit it only in winter.' [...] 'We met with several encampments of stationary Bedouins, who cultivate a few fields of wheat, barley, and Dhourra' (Burckhardt 1822: 346). Buckingham sketched a similar picture in 1816. He makes no mention of any form of cultivation in the ghor and the only sedentary occupation reported by him were the house of the caretaker of 'Abū 'Ubaydah's tomb and a few huts (Buckingham 1825: 12).¹²² South of 'Abū 'Ubaydah they encountered 'a party of robbers driving home the cattle and the camels that they had stolen during the night.' A second group followed them at some distance. To avoid being attacked Buckingham and his companion returned to 'Abū 'Ubaydah. From a third group of Arabs they learned that the first two had been outcasts of the Beni Sakhr tribe, who occupy the desert to the east of the Dead Sea.¹²³ The third group was itself composed of the Beni Abbad tribe members and had also been on 'plundering excursion, and had carried off some goats and kids from the camps through which they had passed [...]' (Buckingham 1825: 15). They hired two men of this tribe to guide them through this area but before they had travelled 5 km their guides abandoned them as they saw the tribe they had robbed in pursuit of their own group. While hurrying away they tried to rob Buckingham and his companion of their firearms (Buckingham 1825: 16). Although Buckingham and his companion were not hurt themselves, mainly because of the intimidating aspect of their weapons, their many encounters with raiding tribes in the course of just one morning shows how

120 A more detailed description of land categorisation and its social implications is given in chapter 5.1.

121 Pastoralism and agriculture are however not mutually exclusive. One community usually practised a combination of both, whereby one practice often outweighed the other.

122 Recorded by an inscription on the wall of the mosque, the tomb was renovated and a mosque was built in 1259 AD (657 H) by the Mamluk sultan Baybars. The presence of the tomb and a mosque is recorded by the Arab geographer Ibn Battuta who passed Abu Obeidah in July, 1326 and wrote; 'We visited the tomb; besides it there is a religious house at which food is supplied to all wayfarers, and we spent the night there.' (Gibb 1958: 83). Its existence in the early 16th century is attested in the first Ottoman tax records after their conquest of the area when a share of the tax of the Ammata plantation is set aside for 'Abū 'Ubaydah (Fischbach 2001: 526).

123 Buckingham refers to them as Beni-Szakker (Buckingham 1825: 14).

hostile the Jordan Valley was at that time. Molyneux reports that the area around 'Abū 'Ubaydah was the territory of the 'Ameers in 1848. It extended about 2 days travelling to the north after which the territory of the Beni Sakhr started. An 'Ameer sheikh informed him that the 'Ameer consisted of 800 men, while the Beni Sakhr counted 600-700 men. The most powerful tribe that was involved in the ghor at that time was that of the Anizees. They were 15,000 to 16,000 men strong (Molyneux 1848: 116/7). Peake mentions that the Anaizah, probably the same tribe, grew strong around 1700. They move from the eastern desert into the territory of the Beni Sakhr on the Jordanian plateau. The Beni Sakhr, up to then a powerful tribe were weakened and forced to move into the Jordan Valley and Cisjordan (Peake 1958: 217). Apparently this division of power still obtained in the mid 19th century.

As demonstrated above in the paragraph on irrigation, later travellers encountered sedentary farming communities. Many of them, however, also described pastoral tribes living in the area. Lynch, for example, wrote in 1849 when passing just north of 'Abū 'Ubaydah that they crossed a village just raided by two hundred Bedouin who killed several men and took almost all their horses, cattle and sheep (Lynch 1849: 228/9). Within the research area they passed a large Bedouin camp of black tents and near Dāmiyah they encountered Bedouin of the Bely or al- Mikhail Meshakah. (Lynch 1849: 248/9).¹²⁴ Although there evidently is some sedentary occupation in the Jordan Valley, the raid described shows that little had changed since Buckingham and Burckhardt crossed the region. A similar situation is described by Tristram who visited the region in 1858. He wrote that the whole eastern ghor was abandoned at that time and no villages remained; only their ruins and traces of derelict irrigation channels were visible (Tristram 1866: 575). However, elsewhere in his book he wrote that the Beni Hassan had lost most of their power and territory in the Jordan Valley and were plundering the few fellahin villages north of the Zerqa (Tristram 1866: 492). This contradicts his previous statement that the entire ghor was abandoned. Tristram is possibly somewhat biased and gives little importance to the few small villages that existed to strengthen his description of the in his view negative actions of the Bedouin. For example, throughout his book he refers to the Bedouin as 'wild savages'. He further writes 'Now the whole [ghor] is in the hands of the Bedouin, who eschew all agriculture, excepting a few spots here and there cultivated by their slaves; and with the bedouin come lawlessness and the uprooting of all Turkish authority. No government is acknowledged on the east side.' (Tristram 1866: 494).

About 20 years later the situation had changed, however. Between 1874 and 1877 Merrill passed through the research area and described the agriculture and its irrigation system in detail (see above). At this moment then some sedentary agriculturists were present, although agriculture was still limited in extent. The same tribes described by earlier travellers were, however, still camping in the region. Merrill, for example, writes that at the Zerqa the Beni Sakhr camped with many black tents and that the fields were 'covered with camels' (Merrill 1881: 192). When he later returned to the Zerqa region he mentioned that now the Beni Abbad camped along the Zerqa, especially near Tell al-Hammeh, while the Mashalkha tribe was camping near 'Abū 'Ubaydah (Merrill 1881: 374). Another 20 years later Schumacher travelled through the area, mentioning some permanent structures. At 'Abū 'Ubaydah there were a few 'miserable straw huts' and a few shops where Christians from Nablus und Kafrinji in the harvest period and summer exchanged products like rice and sugar for flour. Near the village of Dhirār he encountered a few caves used as animal pens together with about 20 huts. These huts belonged to the 'Arab al-Maschalcha, who live in the southern part of the Zerqa Triangle. The tribe owned about 300 tents. The northern part, also called ghor Bueib, was the territory of the Balawneh tribe that consisted of about 400 tents (Steuernagel 1925: 352/3). In the first registration attempt in the ghor after the Ottoman Land Code of 1858 that took place in the same year as Schumacher passed the region, the lands around 'Abū 'Ubaydah were

124 These Bely or al- Mikhail Meshakah are probably a tribe of the al-Mashalkha confederation that reside in the 'Ghor Dāmiyah' (Peake 1958: 177). Lynch was a lieutenant of US Navy and probably did not speak Arabic; this explains the often deviating Arabic names. It might be that Bely should be understood as Beni (litt. 'sons of' or 'men of the tribe of').

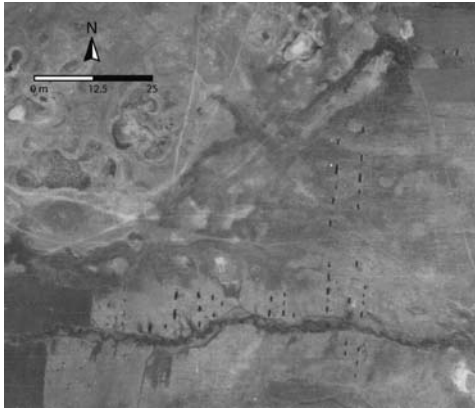


Figure 5.6 Rows of Bedouin tents west of 'Abū al-N'ēim (Aerial photograph 1953, courtesy of the Royal Jordanian Geographic Centre)



Figure 5.7 Empty countryside in 1960 (taken from Tell Deir 'Allā to the north-west)

registered as state land or miri land with usufructuary rights to the tribes who lived on the land and cultivated it (Fischbach 2001: 531). These tribes were recorded some years later as the Balawna, Wahadina, 'Abbad, and the Mashalkha (Fischbach 2001: 526).¹²⁵

In this period up to 1900 the development towards a more sedentary agricultural population had evidently started but was still fairly limited. Albright, for example, wrote as late as 1926 that during his time as director of the American School for Oriental Research in Jerusalem he visited the entire Jordan Valley in search of archaeological remains except for the area between the Wadi Yabis and Zerqa because this is '[...] hard to study under the present circumstances, owing to the hostility of the local tribesmen, especially the Suhūr' (Albright 1926: 14). On a photograph of Tell Deir 'Allā taken somewhere in the 1930's by Horsfield, the director of the department of antiquities at that time, a few structures are visible on the southeastern side of the tell but the remainder of the countryside is empty and uncultivated. On the aerial photographs of the 1940's very few permanent structures can be seen. Near the Wadi Rajib the black woollen tents of the Bedouin can be seen. One of the most common ways to set up a camp is to connect several tents on their short side so that a straight line of tents is produced. These long lines are visible on the aerial photograph (see figure 5.6).

The 1:10,000 map of the 1950's and the photographs taken during the first excavations at Tell Deir 'Allā in 1960 (see figure 5.7) show that the landscape of the Zerqa Triangle was cultivated, but that habitation was still quite sparse at that time. Only the last few decades have seen a mass of building activity. Today the construction of houses and shops is a continuous process and villages are slowly conglomerating. Notwithstanding the high degree of permanent habitation, small groups of Bedouin still camp in the Jordan Valley, especially during winter. The symbiosis between sedentary agriculturalists and nomadic pastoralists, that must always have been present in an environment like the Jordan Valley, will recur in chapter 7.

The period before the Bedouin dominance

Merril's record of the statement made by villagers in the late 1870's that neither they nor their fathers or grandfathers dug the canals, but that they only cleaned existing ones is very telling given the largely pastoral history of the Jordan Valley in the previous centuries. The last evidence of sedentary agriculturists in the Zerqa Triangle before the period of Bedouin hegemony stems from the Early Ottoman period. Textual records from this period have survived listing the amount of tax villages had to pay. Archaeological remains from the Ottoman period are very scarce. This will partly be due to actual absence or very limited occupation of the region, but will also be attributable to the poor archaeological knowledge of Ottoman pottery in this area. Studies dealing

¹²⁵ The Balawneh tribe is also recorded by Peake as the tribe inhabiting the area immediately north of the Zerqa (Peake 1958: map 1). Today the area around the Wadi Rajib is still referred to as Ghor Balawnah and al-Balawnah is a very common surname in the region.

with Middle and Late Islamic pottery are fortunately on the rise in recent times (for an overview of published studies see (Walker 2004: 122)). Although the bias against the Late Ottoman periods undoubtedly exists, the limited presence of Ottoman and modern pottery in the survey seems to be real, albeit exaggerated by biases caused by archaeology.

The early Ottoman tax records date between 1525/6 and 1596/7 AD and comprise the data of seven different censuses (*daftari*) (Hütteroth and Abdulfattah 1977: 3). Hütteroth and Abdulfattah have grouped all these data according to district and province and tried to identify the villages paying taxes with modern or archaeologically/historically attested villages. The Zerqa Triangle, which was part of the province of 'Ajlun and the ghor district, had three or four villages paying tax in the 16th century, i.e. Deir 'Allā, Suwayr, Mahdata and Abisa (Hütteroth and Abdulfattah 1977: map 1). The types of products that were taxed in these villages suggest irrigation must have been practised at this time.¹²⁶ At Deir 'Allā crops like indigo and cotton were taxed. Both indigo and cotton are tropical plants that were introduced in the southern Levant with the advent of Islam around 700 AD (Watson 1981: 30). Given their tropical nature these plants need warm temperatures and a lot of water. If irrigation is present both resources are available in the Jordan Valley, but without irrigation the ecology of the Jordan Valley is not suitable for their cultivation. In the early Ottoman period indigo cultivation was restricted to the Jordan Valley (Hütteroth and Abdulfattah 1977: 83). Historical reports of indigo cultivation occur, however, already in the Middle Islamic period, for example by Idrisi in 1154 AD, suggesting irrigation dates back much further (see below) (Le Strange 1965: 31). In the village of Suwayr summer crops were taxed (Hütteroth and Abdulfattah 1977: 167). Without irrigation, is impossible to grow any form of summer crop in the valley. Animals were also taxed and the records show that water buffaloes were kept in the villages Deir 'Allā, Abisa and Mahdata (Hütteroth and Abdulfattah 1977: 167-169). The tax records show water buffaloes were only kept in plains that were naturally more humid or could theoretically be well irrigated, like the Jordan Valley, the Beth Shean Valley and the northern Coastal Plain (Hütteroth and Abdulfattah 1977: 85). Another indication for irrigation in the tax records was the recording of mills at Deir 'Allā and Suwayr and of syrup or oil presses at Mahdata (Hütteroth and Abdulfattah 1977: 167-169). Although both mills and presses can of course have been powered by animal force, it is very likely given the watermills of both the Mamluk and Ottoman periods that these were watermills and water powered presses as well. Deir 'Allā was charged 80 akçe for mills. The amount of tax depended on the number of millstones and whether they functioned the whole year round (60 akçe) or only part of the year (Hütteroth and Abdulfattah 1977: 72). The village of Suwayr was, for example, taxed 180 akçe, which implies that there may have been three permanently operational stones. Year-round activity precludes wadis powering the mill and three stones would have necessitated a large canal.

Unfortunately only the village of Deir 'Allā could be positively identified, while for the three other villages only a general location could be given. Nevertheless, it has been deduced that Suwayr was probably located in the bend of the Zerqa close to modern 'Abū al-N'ēim. A second village, called Abisa, was located in the vicinity of Tell Dāmiyah in the zor. The village of Mahdata was most likely located somewhere between modern Deir 'Allā and Karaymeh and therefore might have been located near Tell 'Ammata (Hütteroth and Abdulfattah 1977: map 1). Unfortunately, the information on which Hütteroth and Abdulfattah based the locations they propose has not been provided and their conclusions can, therefore, not be checked. If the locations proposed by the authors are accepted, however, it is remarkable that the villages are located at the same locations as the ethnohistorically known villages of Deir 'Allā, 'Abū al-N'ēim, 'Ammata and Dāmiyah, and except for Dāmiyah all lie along the main irrigation channel. The same villages were, however, already present in the Mamluk period (see chapter 4.6). The same locations, therefore, seem to be suitable places for occupation in all these periods. This might be because the same principles governed the choice of village location, i.e. the manner in which irrigation was organized, or because habitation continued in some form throughout this period. This habitation can, for example, simply take the form of a storage facility that caused pastoral nomads to return to this location again and again.

126 A detailed description of the taxed products and agriculture of this period is given in the next chapter.

Either way, the continuity in settlement locations suggests that the manner of irrigation might be similar to the ethnohistorical system as that would be the easiest and most profitable means of irrigation at these locations.

5.3 Mamluk irrigation

The cultivation of sugar cane that was ubiquitous during the Mamluk period could not have been carried out in the Jordan Valley without the use of irrigation. Sugar cane is a tropical crop and precipitation in the Jordan Valley does not supply enough water for a successful full growth cycle. Furthermore, sugar cane requires such high temperatures that it can only successfully mature during the warm summer season when precipitation is completely absent in this region. Irrigation is therefore essential for sugar cane cultivation in the Jordan Valley, especially considering the industrial scale on which sugar was produced (see also the following chapter). During the spring and summer the sugar cane will have needed watering every few days depending on the growing stage of the cane.

Another indication for irrigation during the Mamluk period is the presence of mills to crush the sugar cane. The sugar production centres were located beside the mills keeping the transport as fast and easy as possible. In the research area five such sugar production sites have been attested. Historical sources, for example Nuwayri (1380-1432 AD), describing the production process of sugar state that watermills were used in the southern Levant (Deerr 1949/50: 92). Excavations at Jericho, Ghor es-Safi and Horvat Manot and several surveys have demonstrated the use of watermills in sugar production (Stern 2001; Photos-Jones et al. 2002; Taha 2004). The discovery of a watermill at Dhirār in combination with a sugar pottery concentration strongly suggests that a watermill was in operation at this location in the Mamluk period (see previous chapter). The mill had, until it ceased to be used in the 1970's, been fed by the ethnohistorically known Dhirār channel. The presence of a mill in the Mamluk period suggests that a canal similar to the Dhirār channel was located here as well. As the Dhirār channel was the most northerly main channel irrigating a large area by the use of secondary channels branching off, it is likely that a similar system existed in the Mamluk period irrigating sugar cane planted in fields downstream.

It is very likely that a Mamluk watermill was present at the sugar pottery concentration east of Tell Deir 'Allā. No intact structure was found, but an itinerary and map from the start of the 20th century show the presence of a mill at that location at that time (Abel 1910: 555). Franken mentions that in the early 1960's remains of a mill were still present at this location (Franken and Kalsbeek 1975: 219). If this mill was a watermill, it can only have been powered by an irrigation canal, because it is located above the level of the only natural water source in the area, the Wadi al-Ghor. The Wadi al-Ghor did, therefore, not power it, but more likely acted as drainage. The 1:10,000 map shows the presence of a canal at this location (see figure 5.1). A similar situation is found near Tell 'Ammata, where no mills are visible today, but several itineraries and maps show that there were mills in the late 19th century along canals of the pre-modern irrigation system.

The other sugar production centres also attest to a system very similar to the pre-modern irrigation system, not directly through the presence of watermills in the recent past, but by their location and layout. The sugar production centre near 'Abū al-N'eim is located on a higher level than the Zerqa. The Zerqa could therefore not have powered a mill at this location, but only have supplied drainage. The fields located around 'Abū al-N'eim could also not have been watered by the river passing the site as the Zerqa is too incised here. To irrigate the fields the Zerqa must be tapped further upstream and redirected to this area by canals. During the sub-modern period this was indeed the way in which this part of the ghor was irrigated. The ethnohistorical Maydan channel ran directly along the sugar production centre. It therefore seems logical that a mill present at this location was fed by an irrigation channel tapping the Zerqa further upstream.

At the fifth sugar related site known in the research area, Tell 'Abū Sarbūt, the excavations did not reveal the presence of a watermill (Steiner 2008). LaGro concluded from this absence that it was more likely that cattle powered the mill (LaGro 2002: 32). However, as no archaeological remains of a mill have been found, there is no evidence for a bovine powered mill either. The only

conclusion that can be drawn is that if there was a mill, it was located on an unexcavated part of the tell. The ethnohistorical Mu'tarredah channel runs just east of the tell. If there was a water-mill, this canal may have powered it and the canal could definitely have irrigated the surrounding fields.

All sugar production centres are thus located along channels that were in the pre-modern period primary canals. This seems logical as the mills will have needed a significant amount of water power. The amount of water carried by secondary or tertiary channels could not have been sufficient. Furthermore, the mills needed a constant supply of water. This permanent supply would only have been available in the main channels as all the other canals were opened or closed depending on which fields were to be irrigated that day. Given the assumed location of the main irrigation channels in the Mamluk period at more or less the same locations as the pre-modern channels, it can be concluded that the entire irrigation system was essentially similar. This irrigation system and village locations were inherited by the people of the Early Ottoman period from the Mamluk inhabitants of the region.

Just outside the research area to the south of the Wadi Zerqa another sugar mill was reported, i.e. Tawahin es-Sukkar. This mill is located both on the Wadi Fannush and along the shqaq irrigation canal that taps water from the Zerqa and transports it to the south. Again there is a clear link between the presence of a main irrigation channel and sugar mills. This is of course not surprising as the area south of the Zerqa is part of the same irrigation system.

Unfortunately too little is known about the earlier Islamic periods. The survey recovered only a few sherds dating to this period. Although these scarce remains suggest that some occupation was present in the valley at this time, it is not clear where settlements were located, during which periods these were occupied and what mode of subsistence was practiced. This makes it impossible to determine whether an irrigation system was used and if so what form it took.

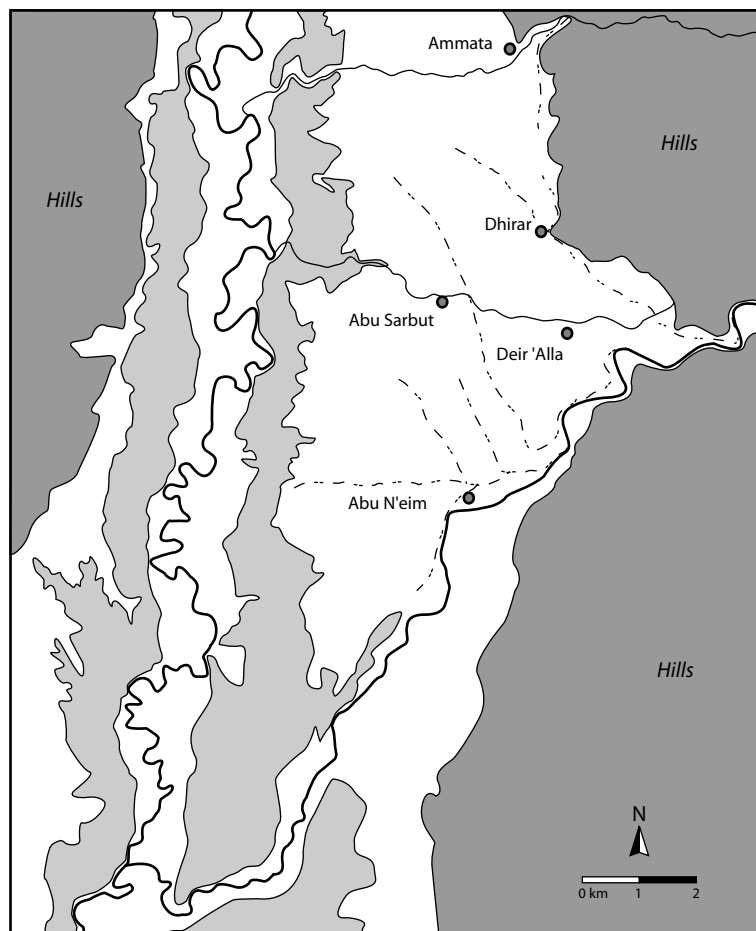


Figure 5.8 Mamluk sugar mills with the pre-modern main irrigation channels overlaid

5.4 Roman and Late Roman irrigation

No structural features like the watermill remains have been discovered for the Roman and Late Roman periods. From the survey and some excavations it is clear that Tell 'Ammata, Tell al-'Adliyyeh, the concentration east of Tell Deir 'Allā and near Tell 'Abū al-N'eim were large sites with occupation. These sites were most likely involved in agriculture, although its character is difficult to establish without botanical remains. Excavation has proved that remains from this period were once present at Tell 'Abū Sarbūt but were levelled and removed by later Mamluk activity (Steiner 2008: 162, 164). This co-occurrence of Roman and Late Roman remains with later Mamluk remains is not an exception but occurs at all the aforementioned sites. At Tell 'Abū Sarbūt and the concentration east of Tell Deir 'Allā the Mamluk remains are located directly on top of the Late Roman remains, while at the other sites the location has shifted slightly.

Additional sites from the Late Roman period have of course been discovered, though these do not seem to have been of the same size as the sites described above. The total number of people living in the Zerqa Triangle appears to have been significantly higher than during the Mamluk period, but major sites were apparently located at the same locations as the Mamluk sugar mills. The previous paragraph has demonstrated that these locations were important areas in the irrigation system where the main canals passed. Although there are no actual remains of irrigation canals that point to the existence of a system of water management in the Late Roman period, there are several indirect arguments in favour of such a system having been present.

As already pointed out the location of sites is such that the largest sites are located at advantageous points in the later irrigation system. Furthermore, several sites like Tell al-Muntih, Tell al-Fukhār and Tell al-Qa'dān lie in the middle of the plain at great distances from natural water sources. If the inhabitants cultivated the land beside their villages water must have been brought to these areas in some way. The irrigation system using canals seems very well suited for this aim (see also following paragraph on the IA irrigation).

The quite high number of sites combined with the high cultivation intensity, as suggested by the dense blanket of sherds probably resulting from manuring, imply that a great volume of water will have been needed. Precipitation alone will not have been able to fulfil the water demand of both people and animals as agriculture. The investment in agriculture as is evidenced by the large scale manuring and the likely focus on certain crops for export as indicated by the number of Late Roman 5/6 amphorae discovered in the survey suggest that the significant demand for water would have been a problem necessary to overcome. In other regions of the Levant several complex water management systems have been evidenced. The safeguarding of a reliable water supply was therefore clearly a vital concern during the Late Roman period. Unfortunately the character of the Jordan Valley as a whole and the nature of the suspected system of canal irrigation are not very suited to preservation which means that no structural remains have survived in the present landscape.

There is, however, one discovery that might represent the remains of an irrigation channel that has a terminus ante quem in the Late Roman period. In the excavations conducted by Kirkbride at the Late Roman cemetery under the modern village of al-Dbāb described in section 4.4.2 she mentions that one of the burials (nr. 3) was placed in a trough of burned clay. Kirkbride concluded that this trough might well have been an irrigation channel that had gone out of use. Similar troughs were discovered at two other locations in the excavation, but these were unfortunately not drawn. If these are indeed irrigations canals they prove that canals redirecting water from natural water-courses were used as early as the Late Roman period, but possible even before.

5.5 Iron Age irrigation

There is no doubt that IA communities in the Zerqa Triangle practised some form of irrigation. The question remains, however, what form this irrigation took. Unfortunately, no direct evidence for the IA irrigation system has been discovered. The only indications available to us that can shed some light on the system are the topography of the Zerqa Triangle and the location of IA settlements.

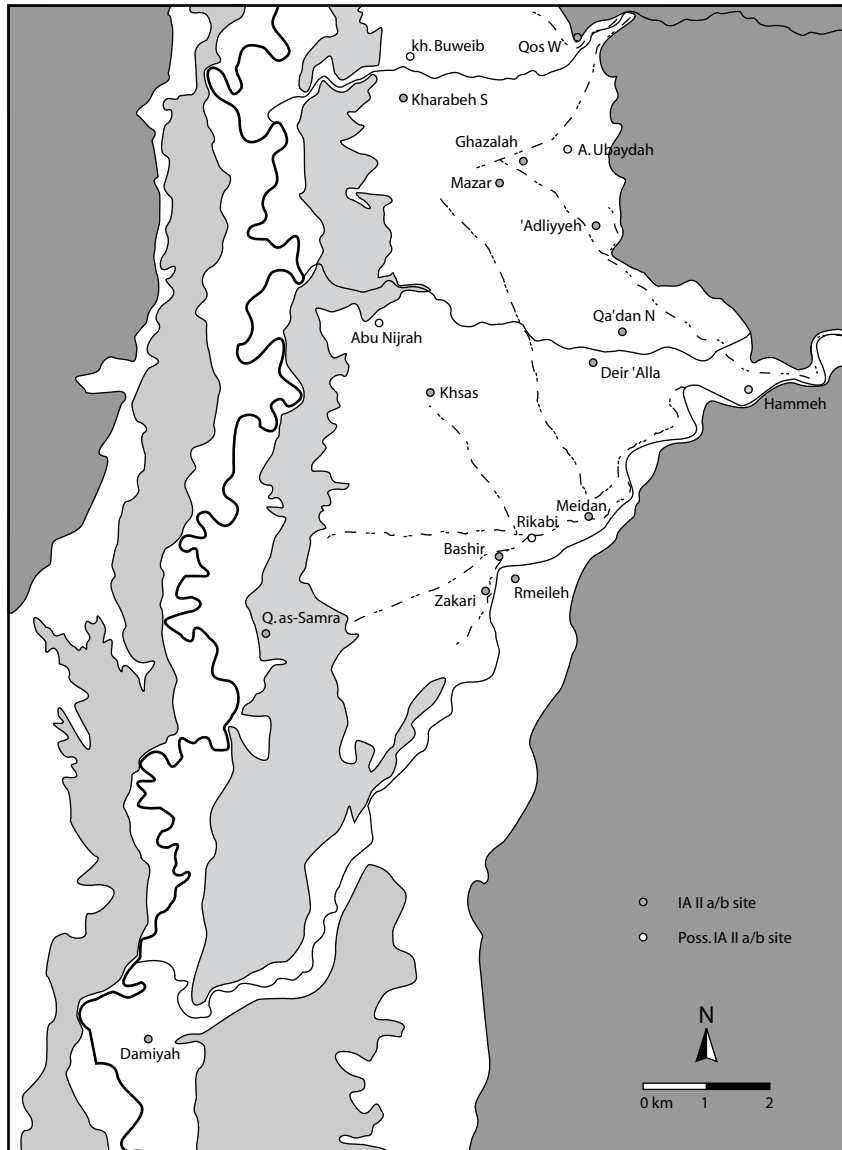


Figure 5.9 Sites in the research area dating to the IA IIa/b with modern irrigation canals

The location of the IA settlements provides an indication of the type of irrigation that was practised. IA remains have been discovered at 19 tells. Several of these tells have been excavated, revealing settlement remains. Although there is some difference between these villages, all can be considered as villages involved in subsistence agriculture (see next chapters). As can be seen in figure 5.9 several IA tells, like Tell al-Mazār, Tell al-Khsās, Tell al-Ghazāleh and Tell al-'Adliyyeh are located in the middle of the ghor away from water courses. It is assumed that the inhabitants of a village cultivated the land in the vicinity and not at several kilometres distance. The location of several IA tells in the middle of the valley therefore suggests that water was brought to their surroundings. The presence of run-off irrigation using dams located near the foothills was not an option as this could not supply the centre of the plain with water. The most logical option is that of canals supplying inland villages with water for their fields and for drinking. Remarkably, one of these inland tells, Tell al-Khsās, was among the first of areas to be (re-) settled upon the return of sedentary occupation to the valley at the start of the 20th century. The maps of the ethnohistorical irrigation system clearly show a canal passing along the foot of the tell. It is very likely that similar canals feeding settlements in the middle of the valley plain existed in the IA. In contrast to the Mamluk situation, where a link between the pre-modern canals and those of Mamluk age could be

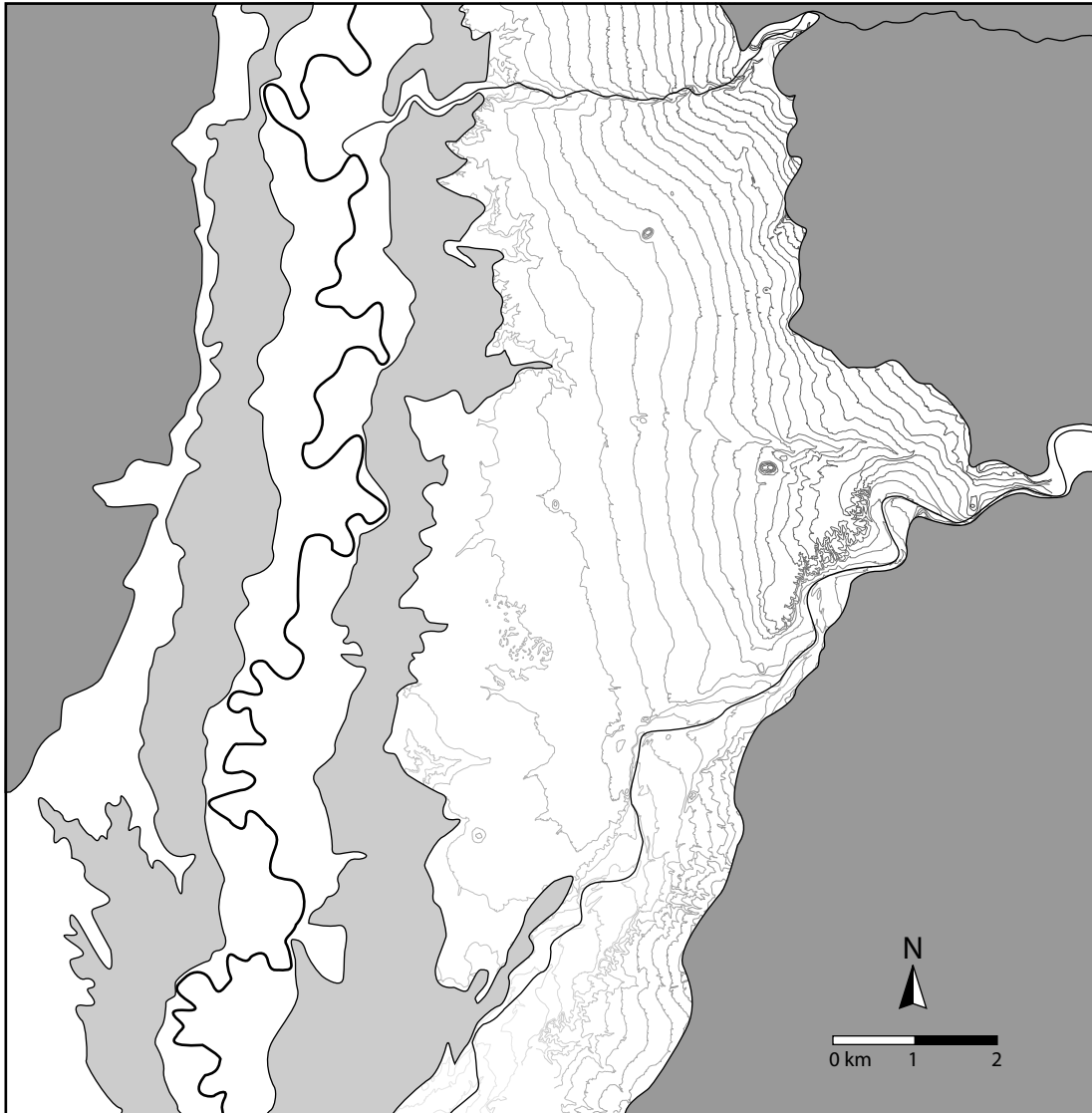


Figure 5.10 Elevation of the Zerqa Triangle shown by contour lines

established, no such continuity can be argued for the IA. There is therefore no evidence for the location of these canals, except for the indirect deductions that can be made on the basis of the location of the tells and the general layout of the valley.

The topography of the Jordan Valley, with its relatively flat plain sloping gradually down towards the Jordan, is highly conducive to a form of canal irrigation like the ethnohistorical system, which uses the gravity created by the slope of the surface. As discussed before this form of irrigation involves relatively little engineering, although it does require a substantial labour investment if a large region is to be irrigated. Topographic features like the relatively steep and rocky outcrops of the hill at al-Rweihah and Dhirār and the elevated area south of the modern village of Al-Dbāb would restrict the possibilities of canal location and to some extent dictate the tapping points and course of the main channels. In each canal system a way around the 'hill' of Al-Dbāb had to be sought. A way to pass it along the north is less likely than the pre-modern solution along the south as the contour lines dictate that tapping the northern route would have to occur very high upstream, even to the east of Tell al-Hammeh. The location of the canal between al-Rweihah and Dhirār also seems dictated by the topography. If the northern area of the Zerqa Triangle was to be irrigated, the north-eastern main channel would have to stay on high terrain as close to the eastern edge of the valley for as long as possible. The steep rock outcrops at al-Rweihah and Dhirār

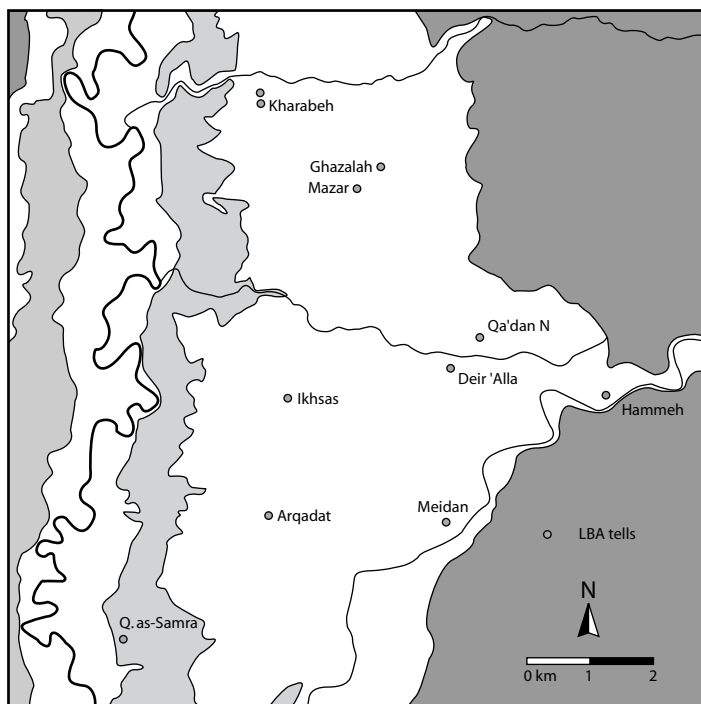


Figure 5.11 Sites in the research area yielding LBA remains

mean that a channel would have to circumvent them at the base. There is only one path from one outcrop to the other which is more or less a straight line. The almost certain presence of this canal and hence of agriculture and activity in this eastern area makes the absence of survey finds from the IA in this area even more difficult to explain (see section 4.2).

The steep Zerqa section that starts at Meidan and rises very rapidly to amount to a vertical section of circa 10 m at the village of 'Abū al-N'eim forms another boundary. If the area to the west of Meidan is to be irrigated a canal has to tap somewhere northeast of Meidan where the Zerqa is not so deeply incised and still at a relatively high elevation. These topographical features form a restriction to the possible locations of especially the main channels. This gives a very general indication of what a canal irrigation system in the IA may have looked like. The location of secondary and tertiary canals within the ghor itself, however, is much less restricted and may have varied considerably. However, the location of IA tells along pre-modern and Mamluk irrigation channels like for example Tell al-Khsās, Tell al-Ghazāleh, Tell al-'Adliyyeh, all located in areas where there are no restrictions on the course of channels, suggests that the pre-modern irrigation system may in essence date back to the IA.

5.6 Late Bronze Age irrigation

The same arguments that have been put forward for the IA also apply, albeit to a lesser extent, to the LBA. LBA remains have been discovered at 11 of the tells (see figure 5.11). These are mostly the same sites that also yielded IA remains and like the IA tells several of these settlements were located in the middle of the plain, e.g. Tell al-Mazār, Tell al-Ghazāleh, Tell al-'Arqadat and Tell al-Khsās. Not as many sites were occupied during the LBA, but location choice and general settlement pattern are similar to the IA. It seems that the settlement pattern, irrigation system and general infrastructure of the Zerqa Triangle that is clearly visible in the IA started in the LBA. Only Tell Deir 'Allā, Tell al-Mazār and Hammeh have been subjected to excavations of some considerable extent which means that little is known about the LBA occupation in the Zerqa Triangle. Due to this lack of information the LBA is not discussed in the following chapters.

5.7 Middle Bronze Age irrigation

Little is known about the Zerqa Triangle during the MBA. The survey yielded only a few sherds that could possibly date to the MBA. Petit's site survey together with the previous site surveys recorded only a few sites with some MBA remains (see appendix II). At Tell Umm Hammad a few sherds dating to the MBA were found. The excavators do not interpret these sherds as representing some form of occupation, but suggest that this area was perhaps used as agricultural land (Helms 1992: 11). A similar interpretation seems applicable to Tell al-Qōs, al-Kharābeh N, and Tell Dāmiyah where less than 2 % of the pottery collected by Petit dated to the MBA. At Kātaret al-Samrā' 4 % of the sherds stemmed from the MBA, but this is still a small proportion (Petit in prep.).

At Tell al-Hammeh 6 % of the sherds stemmed from the MBA. This is still a small proportion, but Tell al-Hammeh was meticulously surveyed by Petit and a large sample was collected. The excavations by Van der Steen furthermore revealed some LBA/MBA remains (Van der Steen 2004: 196). It, therefore, seems that Tell al-Hammeh was indeed occupied during some period within the MBA. The extent and type of presence remains elusive, however.

At Meidan 19 % of the pottery studied by Petit could be dated to the MBA/LBA. Like at Tell al-Hammeh these sherds probably only represent the later part of the MBA. The proportion of the total assemblage is, however, such that these are not chance finds and actual presence of some sort seems to have occurred.

The only site at which clear and unambiguous occupational remains have been attested is Tell Deir 'Allā. **In several excavation areas of the tell MBA remains have been attested. The MBA II village of Deir 'Allā was established on a low natural hill. The settlement consisted of rather thick walled rooms (1-1,5 m) and several courtyards. The buildings were well constructed and well planned. The site might at some point have been surrounded by a rampart. Based on the architecture and artefacts found, the excavators suggest that the site might have fulfilled a central role in the region (Van der Kooij 2006).**

The three sites that might have yielded occupation remains of some sort, with at least Deir 'Allā being a settlement, are all located along water courses. It is uncertain to what level the rivers had become incised during the MBA. It is, therefore, not clear whether people needed to purposefully redirect water to their fields. The low number of sites suggests that population was not large and people may simply have farmed on naturally moist fields. The location of all sites along the river Zerqa or wadi Rajib seems to suggest this. On the whole there is insufficient evidence to prove irrigation was either needed or practised.

5.8 Early Bronze Age irrigation

It is a much debated topic whether irrigation was practised during the EBA (e.g. Rosen 1995; Philip 2001: 184, 185; Rosen 2007: 128ff). Although most researchers agree to some sort of irrigation having been practised during this period, unambiguous evidence is scarce and hypotheses on the manner and level of human involvement in this irrigation remain rather vague. In the following pages the available evidence for the presence and manner of irrigation in the Jordan Valley and the Zerqa Triangle in particular will be discussed.

Although there is ample evidence that climatic conditions during the Late Chalcolithic and EBA were different from those of today, this does not mean that the present-day arid areas of the southern Levant were ideally suited to dry-farming. Several types of climatic proxy data, like speleothems, lake sediments and pollen cores suggest that the EBA was characterized by slightly moister conditions (Robinson et al. 2006: 1537; Rosen 2007). Temperature, season of precipitation and air circulation were, however, comparable to today (Robinson et al. 2006: 1519, 1529, 1530). This means that the summer was also dry and marked in the Jordan Valley by a large water deficit as potential evaporation exceeded precipitation by far. At Bab adh-Dhra' archaeobotanical research has, for example, shown that the EBA natural vegetation in the environment of Bab adh-Dhra' was very similar to the present vegetation. In both periods the southern ghor belonged to the Sudano-Deccanian enclave (McCreery 2003: 461). This shows that although conditions were somewhat moister the similarities in substrate, temperature and season of precipitation resulted

in more or less similar vegetation zones. This implies that semi-arid conditions prevailed in this region, which most likely made dry farming a hazardous enterprise. Irrespective of the moister conditions, potential evaporation in this area will have been high and rainfall restricted to one period in the year. Today, the rainfall deficit at Deir 'Allā ranges from an average of 94 mm during the wettest month of February to 347 mm in July, when rainfall is absent and temperatures are high.¹²⁷ The higher precipitation is unlikely to have turned this deficit into a water surplus. This winter deficit is, however, slightly misleading. Precipitation in this region falls mostly as short intense showers. Meteorological data from the 1930's and 1940's taken at Dāmiyah Bridge have recorded the number of rain days in each month (Ashbel 1945). These data show that there was an average of 27 rain days each year. During these days there is a water surplus that seeps into the soil and is more or less protected there and can be utilized by vegetation for a longer period than only the day that rain fell. Dry-farming is very difficult under modern conditions and only possible for crops with a very short growing season, but the possibilities might have been slightly better during the EBA. It remains unlikely, however, that drought susceptible crops could have been successfully grown over a longer period of time in the EBA without any form of irrigation taking place.

The archaeological research has provided several indications for the practice of irrigation during the EBA in the Jordan Valley. One of these was the identification of botanical remains of crops that were unlikely to have been grown under dry-farming. These include grape (*Vitis vinifera*), flax (*Linum ussitatissimum*), Einkorn (*Triticum monococcum*) and the garden pea (*Pisum sativum*). Archaeobotanical remains of charred grape pips, fruits and wood have been discovered at the EBA Jordan Valley sites of Shuneh N, Abu Kharaz, Pella, Tell as-Sa'idiyeh (Cartwright 2002: 103; Bourke et al. 2003: 376; Riehl and Kümmel 2005; Fischer 2006: table 61). Further south to the east of the Dead Sea and in the Wadi 'Arabah the sites of Bab adh-Dhra' and Wadi Fidan site 4 have also yielded remains of grape (McCreery 1980: 201, 202; Riehl and Kümmel 2005). The EBA site of Jawa located in the basalt desert in north-east Jordan also yielded grape remains, as well as peas and possibly also Einkorn (Willcox 1981). Peas were only found at Shuneh N and Bab adh-Dhra', but this is probably in part due to small chances of loss of peas due to their larger size.¹²⁸ Einkorn, however, was encountered at a much wider range of sites, i.e. Shuneh N, Bab adh-Dhra', Jericho, Abu Kharaz and possibly Tell as-Sa'idiyeh (Tubb 1988: 82; Bourke et al. 2003: 373; Riehl and Kümmel 2005; Fischer 2006: table 61). Another type of cereal that has been suggested to represent irrigation is naked, hexaploid bread wheat (*Triticum aestivum*), which has been discovered in great quantities (11,000 grains) in a storage silo at EBA Jericho (Hopf 1983: 595). Hopf concludes that the presence of free-threshing bread wheat in combination with grapes implies proper artificial irrigation (Hopf 1983: 579). A crop that needs a lot of water is flax, especially when it is used to produce fibres for cloth. Flax is the crop that is the least likely to have been grown in the arid Jordan Valley under dry-farming conditions. EBA finds of flax are often located at very arid locations, like Pella, Abu Kharaz and especially Bab adh-Dhra' and Wadi Fidan site 4 (Bourke et al. 2003: 376; Riehl and Kümmel 2005; Fischer 2006: table 61). To some extent these arguments also apply to the Late Chalcolithic period as grapes have been found in layers from this period at Tell Shuneh N and flax remains were excavated at Tell Abu Hamid in the middle Jordan Valley (Neef 1988: 29). The number of sites that yielded this type of botanical remains is lower, but this is partly due to the smaller number of excavated and well published Late Chalcolithic sites in the Jordan Valley. The large, finely woven, linen cloth discovered in a Chalcolithic burial in the Nahal Hemar, north-west of Jerusalem in the so-called cave of the warrior shows that flax must have been cultivated in large quantities (Schick 1998).

Flax was also discovered at Khirbet az-Zeraqun, located a few kilometres north of Irbid, although it was not very ubiquitous (Riehl 2004: 116). Khirbet ez-Zeraqun is located on the eastern plateau and receives more rainfall than Deir 'Allā, i.e. today 469 mm average annual precipitation,

127 Calculated on the basis of data from 1950-2005 and based on evaporation rates used by the Jordan Valley Report (Anonymous 1969a)

128 During sieving before consumptions peas, due to their larger size, only rarely slip through the mesh of the sieve, whereas the smaller lentils fall through more easily. This explains the greater abundance of lentils in archaeobotanical samples.

while temperatures are on average 7 degrees lower.¹²⁹ The modern water deficit is, therefore, lower than in the Jordan Valley, although water remains a critical factor especially during the dry summer months. Riehl has tried to calculate the EBA water availability at Khirbet ez-Zeraqun using climate models (Riehl et al. 2008: 1015). She concluded that water resources will have been critical at Zeraqun especially during late spring or early summer when crops are in their final stage of ripening (Riehl et al. 2008: 1015). She has argued that cereals were probably grown by dry-farming, but other crops like flax and pulses will probably have been more problematic (Riehl 2004: 115). Using carbon isotope levels in crop remains Riehl has tried to identify differences in water availability. She concluded that the high variability in carbon 13 fixation at Khirbet ez-Zeraqun is most likely the result of irrigation as soil moisture content changed considerably between periods of irrigation and the episodes when the soil lay fallow (Riehl et al. 2008: 1020). This evidence for irrigation at more humid Khirbet ez-Zeraqun suggests that the cultivation of similar crops in the considerably more arid Jordan Valley almost certainly required some form of irrigation.

Some authors argue that the size of seeds is also indicative of the amount of available water. If water is scarce seeds tend to remain smaller than when water is abundantly available (Van Zeist and Heeres 1973). Donaldson and Mabry argue, for example, that the relatively large size of bread wheat discovered in two samples at Tell Handaqq N indicates irrigation was practised (Mabry 1996: 143). However, only three grains of this type of wheat were discovered in the very small samples and only two could be measured (Mabry 1996: table 5). Furthermore, it is argued for Jericho that flax may have been cultivated under irrigation as linseeds were discovered that are so large that, when shrinkage resulting from carbonization is corrected for, they fall within the size category supposed to result from irrigation in this area (Van Zeist and Heeres 1973: 27; Hopf 1983). There are, however, further factors that can cause a distinction in seed size. As seed size is a domestication characteristic, the entire population may have been of a relatively small size. Additionally, the small seeds may normally be overrepresented as these were the ones to slip through the sieve. Flax poses another problem. Different characteristics are valued depending on whether flax is grown for fibre or for oil. When oil is the aim the linseeds should be as big as possible, while flax used for fibre should be as long as possible. Cultivation is aimed to promote these characteristics. These and other considerations make for many reasons for differences in seed size. Seed size is, therefore, not a reliable indicator for irrigation.

Phytolith research is another line of investigation that can shed light on the moisture conditions under which cereals grew. Phytoliths are mineralized bodies of amorphous silica that form in the epidermal cells of certain plants, including grasses (Rosen and Weiner 1994: 125). When plants grow under arid conditions phytoliths consisting of individual cells are formed. When conditions are moist, the plant takes up more silica and cells are silicified together into long strains of joined cells (Rosen 1995: 35). Rosen argues that she has identified hundreds of silicified plant cells per phytolith in the cereals of Tel Yarmouth (Rosen 2007: 139). In a semi-arid area like the vicinity of Tel Yarmouth this indicates that irrigation agriculture was practised. Analysis of samples from Late Chalcolithic sites in the northern Negev, i.e. Shiqmim and Gilat, revealed that these sites also likely practised some sort of irrigation (Rosen and Weiner 1994: 131). A sample from Tell as-Sa'idiyeh was also analyzed by Rosen, leading her to conclude that wheat and barley were irrigated in this area (Cartwright 2002: 110).

McCreery's study of the archaeobotanical remains of Bab adh-Dhra' and Numeira also involved spectrographic analyses of soil samples and ancient plant specimens. Levels of Barium in cultivated plants from Bab adh-Dhra' and Numeira were often significantly higher than normal. The levels of non-cultivated plants were much lower. McCreery states that the high levels of Barium may have been caused by irrigation with spring water rather than rain or wadi water (McCreery 1980: 188). The recorded high levels of Strontium and Boron in ancient plants suggest saline conditions (McCreery 1980: 187, 195). McCreery sees the envisioned increasing salinity of the soils reflected in the trend from wheat and flax to a dominance of barley and fruit (McCreery 1980: 259). The increased salinity is regarded to have been a result of a prolonged period of intensive irrigation (McCreery 2003: 463).

129 Based on data from the Jordan Meteorological Department in Amman.

The oldest argument in favour of some sort of irrigation is the presence of a considerable number of sites in the arid Jordan Valley. For the EB II and III site size and the size of the constructed features is also an argument in favour of some sort of irrigation. Considering only the Zerqa Triangle, a single quite large Late Chalcolithic site was discovered in field 27, while there is evidence for Late Chalcolithic presence between 'Abū al-N'eim and Tell Zakarī and possibly at Qataret as-Samra. In the subsequent EB I period as many as seven sites of some magnitude were discovered in this small area, i.e. Tell 'Umm Hammād, Kateret as-Samra, Tell al-Maflūq, field 81, al-Rweihah, field 128 and field 163. These are supplemented by the small concentrations discovered in fields 210/229 and 238 that probably do not represent villages but at most isolated farmsteads or sheds. Nevertheless, they are evidence of additional human activity in this area. Most of these settlements are of limited extent, however, with the exception of Tell 'Umm Hammād that was estimated by the excavators to measure 16 ha (Helms 1992: 10). Seven sites, including a very large one, might be considered a lot for a region in which dry-farming is a hazardous undertaking even in somewhat moister conditions. To support such a number of different communities environmental conditions must be stable, which they probably were not considering the location in the rain shadow about 1000 m below the hills neighbouring on two sides and the variable conditions hypothesized for the 4th millennium (Cordova 2007: fig.6.4). The following EB II and III periods have revealed fewer sites, but the sites that have been discovered are large and fortified showing that a lot of labour force was present and invested in these construction works. Tell Handaqq S covers an area of 15 ha and was enclosed by a 3 to 4 m wide city wall of at least 4 m high entirely constructed from large boulders. On the other side of the Jordan an even larger fortified settlement was located at the mouth of the Wadi Far'ah, i.e. Tel Makhrūq measuring *c.* 6 ha in extent. At Tell al-Qōs, located on the spot where the Wadi Rajib enters the valley, additional EB II/III remains were discovered. Although no excavations were undertaken, the detailed survey carried out by Petit yielded EBA pottery over an area of 5.7 ha (Petit in prep.: table 10.1). Even without attempting to calculate the number of inhabitants, it is clear that three sites of such size needed a considerably large and stable subsistence base to survive over a prolonged period of time. It is highly unlikely that dry-farming was able to provide such conditions in an area with such high level of evaporation, limited rainfall and at least five completely dry summer month. Similar sites have been discovered elsewhere in the Jordan Valley, i.e. Beth Shean, Pella, Abu Kharaz, Handaqq N, Tell es-Sa'idiyeh, Jericho, and slightly further south, Bab adh-Dhra'. This makes it clear that similar agricultural practices must have been carried out throughout the Jordan Valley during the fifth and fourth millennium.

It is thus highly likely some sort of water supply other than rainfall was utilized at least in the Jordan Valley. So what was the most likely way that irrigation was carried out? The EBA climate was probably somewhat moister than that of today. As stated above, the amount of additional rainfall in the Jordan Valley itself will probably have been rather limited as a result of its location in the rain shadow of the Central Hill Country. However, the rain that falls in the hills both to the east and the west of the valley will, after subtraction of water used by plants, eventually end up in the Jordan Valley. The hills on both sides of the valley are the drainage area of the wadis and rivers that flow into the Jordan River. The higher levels of precipitation will, therefore, result in a higher discharge of the wadis and rivers.

Today, heavy winter rains often result in flood flows. There is a large difference between base flow and flood flow in some of the wadis. Especially the Zerqa and Wadi Kufrinji, both important in the research area and its immediate vicinity, are greatly influenced by flood flow. Flood flow is the result of rainfall that is not absorbed by the soil, but runs off over the surface and flows directly into the wadis. In the wadis this water can create fast-running torrential flows consisting of large volumes of water. Because of their high velocity and mass these flood flows often have a destructive effect and pre-modern farmers seldom utilized these floods to irrigate their fields (pers. comm. men Abu Ghourdan; Anonymous 1969b: 3).

Irrespective of the possible higher precipitation in the Late Chalcolithic and EBA periods it is likely that the flood flow was at that time smaller than today or at least less torrential. Pollen cores have shown that the hills were covered by denser forests than today. In pollen cores from Huleh, Ghab, and the Tiberias the amount of arboreal pollen is much higher than today's vegeta-

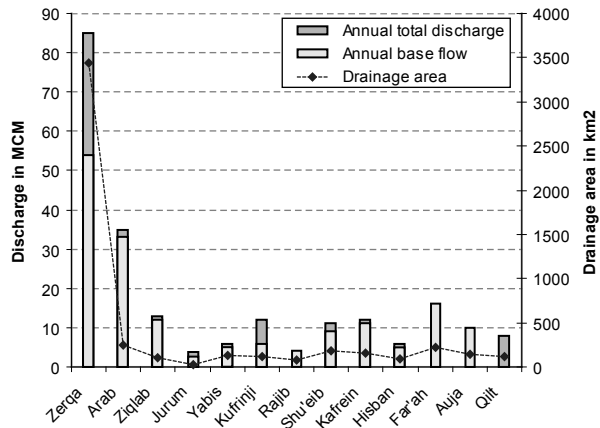


Figure 5.12 Annual discharge of wadis based on data from 1928-1965. Discharge is measured in million cubic metres (MCM) and divided in base flow and flood flow, together amounting to total discharge (Anonymous 1969a)¹³⁰

tion would generate (Rosen 2007: 84, 85). In the Lake Tiberias core the arboreal pollen represents up to 45-60% of the total during the fourth millennium, which has led to the interpretation that the natural forest was much denser than it is today (Baruch 1986: 44). During the third millennium the amount of *olea* pollen increases suggesting olive cultivation was practised on a considerable scale, but the overall level of arboreal pollen remains 45-60% (Baruch 1986: fig. 4). In the northern Golan cores from the crater at Birkat Ram demonstrate high levels of *c.* 80% arboreal pollen until the Persian period (Neumann et al. 2007: fig. 3).

The surface of the hills above the Jordan Valley was, therefore, in all likelihood covered by a forest in contrast to the typical almost bare hills of today. Today the bedrock surfaces regularly, but investigation of soil trapped underneath tells has shown that EBA sites are in general founded on a layer of *terra rossa*, whereas IA sites often stand directly on top of the bedrock (Cordova 2007: 194). At some point before the IA the soil that covered the hills had eroded away, but during the EBA both soil and forest cover were still present. Their presence meant a lower direct run off of precipitation over the surface. The amount of flood flow in the wadis will therefore have been more limited as rainfall entered the wadis only slowly through the groundwater and subsurface run off. Flood flows with a high current velocity and hence a high great erosive potential were not common. Wadis and streams were characterized by a stable flow with a low current velocity that caused sedimentation instead of erosion especially in the lower reaches of the drainage system.

Geomorphological investigations on the Nahal Beersheva by Goldberg and on the 'Erani Terrace and in the vicinity of Megiddo by Rosen have revealed alluvial deposits of silt and fine sand layers during the Chalcolithic and EBA (Rosen 2006: table 21.1, 2007: 87). These sediments were identified as overbank deposits of low energy streams that probably overflowed each wet winter season (Rosen 2007: 88). This suggests that the wadis and streams were not as deeply incised at that time as they are today. In the Wadi al-Wala on the Transjordanian plateau remnants of the Chalcolithic/EBA floodplain have been investigated in combination with archaeological data, i.e. Khirbet Iskander (Cordova 2007: 189; Cordova 2008: fig.6). Pollen embedded in these deposits show that the floodplain had a high moisture content in this period. Only at the end of the EBA did erosion start to play a greater role, resulting in the wadi becoming incised, probably due to a lower groundwater table (Cordova 2007: 190; Cordova 2008: 456). A similar date for the end or reduction of overbank deposits and the inception of less variable stream beds and incision of streams caused by the onset of drier conditions has been hypothesized for other locations as well (e.g. Donahue 2003: 55; Rosen 2006: 469, 2007: 88). During the Late Chalcolithic and early part of the EBA, however, streams were most likely barely incised, had a low current velocity and a greater

¹³⁰ These data predate the construction of dams in several of the rivers and wadis, which affected their discharge. For the Yarmouk river only the total annual discharge is available, which is 438 while it has a drainage system of 6805 km².

discharge as a result of the higher precipitation. Instead of a single incised meandering stream like the Zerqa, valleys in this period were probably characterized by a system of several, possibly braided, channels that overflowed in a non-invasive manner. The overflow probably seeped slowly into the soil instead of largely running off like flash floods do today. Several authors have suggested that these valleys that received additional water annually besides precipitation were ideal for agriculture (Issar and Zohar 2004: 81-82, 103; Rosen 2006: 469; Cordova 2007: 189; Rosen 2007: 138). These floodplains not only received more water as a result of the overflowing of rivers than areas that were dependent on precipitation alone, but the presence of the river and overflowing also resulted in a higher groundwater table and the preservation of water in the soil after the rains had stopped. The effects of the dry season were delayed in the floodplains making them ideal areas for cultivation.

Given the environmental conditions prevailing in the southern Levant it is likely that a form of floodplain farming was practised on valley floors. The Jordan Valley and specifically the Zerqa Triangle would rank among the most perfectly suited areas of the region for this type of farm-



Figure 5.13 Main EBA II/III sites in the Jordan Valley with important side wadis

ing. Is there, however, archaeological evidence that can determine whether this type of farming was indeed practised? The argument most often put forward is the association of sites and wadi floodplains. Levy has advanced this argument with respect to Late Chalcolithic sites in the northern Negev, whereas Bourke has argued along similar lines for Late Chalcolithic sites in the Jordan Valley (Levy and Alon 1987: 81; Bourke 2002: 12). EBA sites in the Jordan Valley show the same locational preference (Ibrahim et al. 1988: 171) generating the same argument concerning their mode of subsistence (e.g. Philip 2001: 190). In figure 5.13 the most important wadis ending in the Jordan Valley are depicted together with important archaeological sites from the EB I - III periods.¹³¹ It indeed holds true that all major sites, especially the large fortified EB II/III sites, are located in the floodplains of the most important wadis.

The sites of Pella, Jericho and Bab adh-Dhra' were moreover located beside a spring. The negative association between wadis and sites is perhaps even more telling; where there are no wadis there are no sites. This is especially the case in the southern part of the Jordan Valley and besides the Dead Sea. In this area sites are more scarce and only located near the largest wadis that have a clear floodplain. The Wadi Mujib, for example, is of course a large wadi that has a large drainage area and a considerable discharge. However, no site has been discovered at its mouth as there is no floodplain present. The wadi emerges from a steep rock face bordering closely on the shore of the Dead Sea.

The number of large EBA sites is lower on the western side of the Jordan Valley than on the eastern side. The sites of Beth-Shean, Makhruq and Jericho are located on the three most important wadis. This is probably due to the fact that the eastern side of the central hill country like the Jordan Valley lies in the rain shadow. Moist winds from the Mediterranean are forced to rise along the western side of the hills, but when the clouds are over the top of the hill they can descend again and temperature increases making precipitation less likely. Only the large wadis like the Wadi Far'ah, whose drainage system stretches far into the hill country, benefit from the rainfall of the hills. The short wadis carry less water than their neighbours on the eastern side of the valley.

On a smaller scale the location of the sites in the Zerqa Triangle exhibits the same pattern (see figure 5.14). Late Chalcolithic and EB I sites are all located in the valley plain. They are either positioned along the Zerqa like al-Rweihah, field 81, Tell 'Umm Hammād and field 500, or located along Wadi al-Ghor or one of the several other small wadis coming from the hills north of the Zerqa (i.e. the concentrations in field 27 and around field 128). The small concentration of field 163 was located between two small wadis, while Khirbet al-Maflūq may have profited from overflow of the Zerqa as well as from the Wadi Fannush located to its north.

At the end of the EB I or the start of the EB II period a general trend commences in the southern Levant in which the many small sites of the plain disappear and are replaced by a few very large walled sites located on small hills above the valley plain, e.g. Pella, Abu Kharaz, and Handaquq S. Although these do not border directly on the wadi anymore, they are located in close proximity and usually overlook the floodplain of the wadi. In the Zerqa Triangle and directly to the west of the Jordan, three such large sites have been discovered. These are Tell Handaquq S measuring 15 ha and overlooking the Zerqa, Tell al-Qōs on the Wadi Rajib which has an estimated size of 5.7 ha and Tell Makhruq at the mouth of the Wadi Far'ah, extending over *c.* 6 ha (see figure 5.14). Their location overlooking these major wadis and their floodplains suggests these areas were still important during this period.

Another argument in favour of floodplain farming comes from the Settling the Steppe-project's geomorphologic research. Layers of silt and fine sand overbank sediments very similar to the deposits discussed above have been identified by Hourani at several locations along the Zerqa and Wadi al-Ghor (Hourani in prep.). Alternating with in situ EBA occupational deposits at Tell 'Umm Hammād he discovered layers of alluvial red loam. Similar alluvial deposits were discovered in connection to Late Chalcolithic deposits discovered in the Zerqa section between Tell Zakarī and Qatar Zakarī/'Abū al-N'eim. Alluvial low current velocity deposits were also discovered in between Late Chalcolithic in situ habitation deposits in Hourani's sounding of the Late Chalcolithic concentration of field 27 (Hourani in prep.). Along the Wadi al-Ghor similar deposits were discov-

131 The modern discharge data of most of these wadis have been given in figure 5.12.

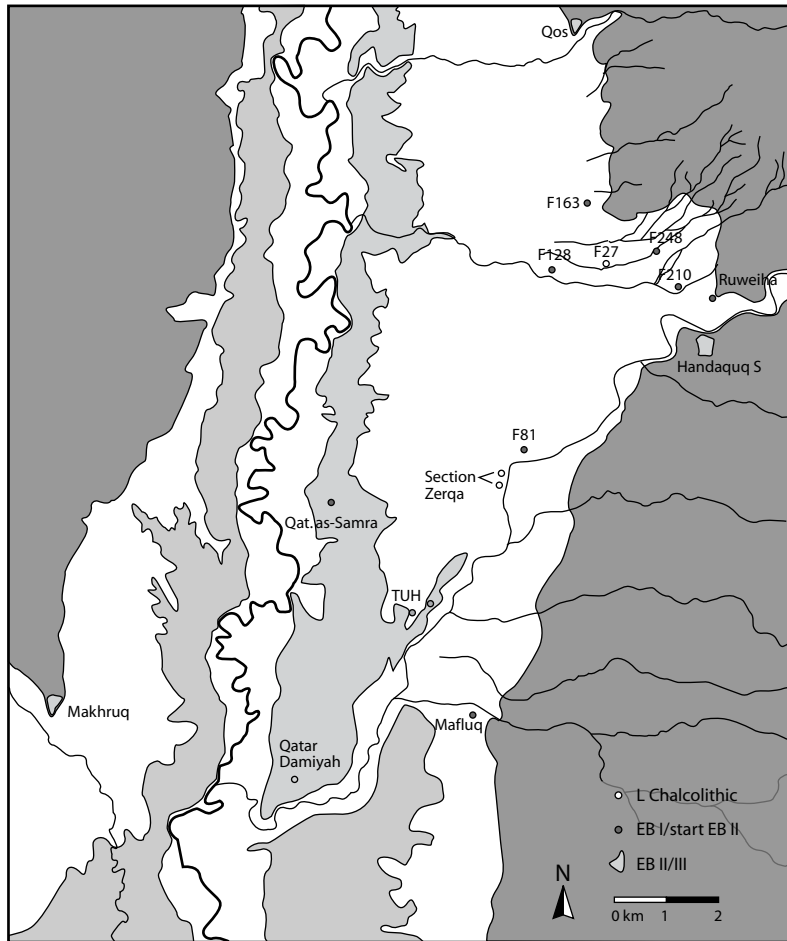


Figure 5.14 EBA sites in the Zerqa Triangle

ered in several soundings. In all it can be concluded that the Zerqa, the Wadi al-Ghor and probably several currently defunct wadis regularly overflowed during the Late Chalcolithic and EBA. The regular low intensity overflowing brought much more moisture to these areas and added to the already much higher groundwater table (Hourani in prep.). Additionally these overbank deposits brought new fertile soil with good agricultural properties. Together with the moister conditions of soil and climate the fertile soil created good conditions for successful agriculture.

The evidence for floodwater farming cited above does not give information on the manner in which the actual farming or irrigation was carried out. Scholars differ in opinion as to how floodwater irrigation was practised. Some argue that check dams or basins trapped or collected water (Helms 1981: 157ff; Levy and Alon 1987: 81; Mabry 1996: 124), while others maintain that the annual overflow presented a natural form of irrigation that required little human involvement (Rosen 2006: 469). When the wadis overflowed in winter, perhaps more than once, and the water seeped into the soil slowly thereby raising the already high groundwater table even further, the water trapped in the soil might very well have been sufficient to provide the crops with water during the final and crucial stage of their growing cycle. All crops grown during the EBA were winter crops. Cereals usually have a maximum growing cycle of as long as eight months, but that probably averaged around five months, especially considering the relatively high temperatures in the valley. Riehl has tried to estimate the most likely period of barley cultivation during the EBA. Based on modern cereals, the environment, and ancient texts, she assumes that the growing cycle of barley stretched from November to March (Riehl et al. 2008: 1013). A sowing in November would fit well with the probable start of winter rains in this month. The winter rains are, even with the drip irrigation of today, generally considered the start of the period of crop cultivation (see chapter 6.2). After the barley is full-grown the crucial period of grain filling starts. For modern cereals this takes *c.* 40-50

days. Riehl assumes that grain-filling in EBA barley most likely took place during the second half of April and throughout May (Riehl et al. 2008: 1013). The duration and period of grain filling will have depended on the local environment. The warm climate in the Jordan Valley will undoubtedly have shortened the growing period. Ethnohistorical data on the timing of farming show that cereals could be harvested in the Jordan Valley up to six weeks before the cereals in the hill country were ripe, i.e. in the first half of April as opposed to the end of May (see chapter 6.2). Today, the bulk of the precipitation at Deir 'Allā falls between November and March. Combined with the floods and higher groundwater table precipitation may have sufficed for the cultivation of barley and some other crops like millet or lentil. However, for wheat and some other crops with a long growing season or a late harvest time, the water availability will have been problematic during the period of grain filling. The wheat cycle, for example, continues into May or June when temperatures were undoubtedly high as was the potential evapotranspiration (see next chapter). The high groundwater table and large stream flow of the wadis will, however, not have ended the moment the rains ceased. The slow seepage into the alluvial soils of the plain will have held the water for some time as this type of soil has good moisture retention capacities. Furthermore, the vegetation cover on the hills and hence the subsurface runoff into the wadis will have meant a delayed discharge of rainwater by the wadis. Wadi flow will therefore have remained high and even have caused overflowing for some time after the cessation of the winter rains. Admittedly, factors like timing of rainfall and high stream flow are unknown for the EBA, but as no major changes in weather systems have been hypothesized, it is likely that EBA seasonality was more or less comparable to that of modern times. The cultivation of crops in the floodplains under natural flood irrigation or with only minor modifications like the construction of small ridges around the edges of a flooded cultivated field to trap the water, therefore, seems possible.

There are a few indications that human intervention of some scale was carried out. The nearest site that allegedly yielded structural evidence of EBA irrigation is Tell Handaqq N (Mabry 1996). At this site a walled settlement of (late) EB I and EB II date has been discovered on a small hilltop (Mabry 1996: table 3). The site borders on the Wadi al-Sarar and surface explorations have revealed several other archaeological features in the neighbourhood. On the foothills *c.* 200 m further to the east wall remains have been found along with three separate tomb areas (Mabry 1996: fig. 2).¹³² In the Wadi al-Sarar, located between two tomb areas, the excavators have identified two dams constructed of boulders that originally spanned the width of the Wadi al-Sarar, but were breached when the wadi became more deeply incised. A radiocarbon date of charcoal trapped behind the dam suggested the dam was constructed before the end of the Late Chalcolithic period (mid-fourth millennium BC). Stratigraphically it was clear that the dam was built after the lower structures on the eastern hill had been abandoned.¹³³ Mabry concludes that the dams were used to slow down the winter floods and trap water and silt on the agricultural fields behind the dam (Mabry 1996: 124). A second feature in the vicinity of Handaqq N indicate irrigation is a *c.* 100 m wide basin, today three metres deep, located immediately to the north-east of the walled western settlement (Mabry 1996: fig.2). It is uncertain whether this is an artificial or a natural reservoir (Mabry 1996: 125). The basin was used to water livestock and irrigate fields downstream until recently. Each year it was partially filled by winter runoff without human involvement (Mabry 1996: 124). Mabry hypothesized that in protohistoric times a gully might have diverted water from the Wadi al-Sarar to fill the basin completely. They undertook some coring inside the basin which revealed that silty clay sediments continued uninterrupted until at least 4.5 m below the surface, while no bottom was found (Mabry 1996: 124). As no excavation has been carried out and no datable finds have been discovered in connection with the basin the interpretation of the basin as an EBA construction is problematic and only based on the circumstantial evidence of its close proximity to

132 In the excavation report the entire area spanning the western hill and the wall remains on the eastern hill has been taken as the settlement area thereby spanning as much as 25-30 ha. The walled western site, however, only encompasses 6 ha. No soundings were undertaken on the eastern hill, which makes it difficult to establish whether these sites were fully contemporaneous (the precise location of the survey finds is not clearly specified). Thus the site size is here taken to be the size of the walled western hill with the possibility of additional structures located on the eastern hill.

133 The pre-EB I construction date of the wall makes contemporaneity of at least the low lying wall feature of the eastern hill with the EBA walled settlement on the western hill problematic.

the EBA settlement. The basin might well be a natural depression that fills up with runoff water during winter. This water may have been used by EBA people as it was by the modern inhabitants. There was probably no need to store water for use during the dry summer during the EBA in the valley as hypothesized by Mabry. The wadis entering the valley are indeed largely dry during the summer nowadays, but this is mainly the result of the overexploitation of the water resources and the construction of dams upstream. In the pre-1965 situation none of the larger wadis entering the valley fell dry during the summer (Anonymous 1969a). Considering the moister climatic conditions and environmental situation during the Late Chalcolithic and EBA this was almost certainly the case at that period of time too. Summarizing, the features present in the vicinity of Tell Handaqui N indeed hint at the possibility that remains of human modification of the landscape with regard to irrigation are present, but their dating and exact nature and function remain problematic. More research is needed to positively identify these features as Late Chalcolithic or EBA irrigation features.

Similar types of features have been discovered outside the Jordan Valley as well. Levy identified diversion walls along the banks of main wadi channels in the northern Negev as Chalcolithic in date (Levy 1986: 103). Doubt has, however, been cast on the age of these constructions and a date in the Byzantine instead of the Chalcolithic period has been suggested (Gilead 1988: 421). Recent excavation in the wadi Arabah near 'Aqaba have revealed similar walls together with channels, basins and enclosure walls of a so-called *bafayir* (a hole dug in the ground to obtain and retain water) (Khalil and Eichmann 2006: 145). Its close proximity and apparent link to the intermediate Late Chalcolithic/Early Bronze Age site of Hujayrat al-Ghuzlan provide only circumstantial evidence of its date. Study of the date and character of this system are on-going, but the shape and manner of construction of the walls have led the researchers to conclude that these structures belonged to a developed system of irrigation (Khalil and Eichmann 2006: 145). Geophysical research has furthermore established that groundwater in this presently arid area may well have reached the surface during the fourth millennium. Many of the stones used are coated in a residue stemming from spring or flowing water, clearly linking the walls to some sort of water management (Khalil and Eichmann 2006: 145).

Another reservoir has been discovered in the 9 ha walled EB II city of Arad located in the hill country west of the Dead Sea. At the lowest point of the city, adjacent to the city wall, a large depression that apparently functioned as water reservoir was discovered. The roads of the city radiate out from this basin and probably acted as channels leading the runoff water towards the reservoir (Amiran et al. 1978: 13). The reservoir had a capacity of 950 m³ (Amiran et al. 1996: 106). At Arad a reservoir to store water for the dry summer months may have been a necessity as no spring is present and winter runoff in the wadis ceases during the warmest summer months (Amiran et al. 1978: 13; Amiran et al. 1996: 106). Another large, 500 m³, reservoir has been discovered in the EB III city of 'Ai. Here the reservoir was, however, paved with stone slabs and enclosed by the city wall on one side and by a dam of stones and clay on the others (Amiran et al. 1996: 106). This reservoir seems to show a higher level of human modification. A large tunnel system aimed at water procurement has been found at EB II-III Khribet Zeraqun in northern Jordan (Bienert 2004: 43). Its date is, however, much debated as three similar systems located on the other side of the wadi within one kilometre were located nearby a Neolithic and an Iron Age site. Proposed dates for these systems range between EBA and Roman times (Bienert 2004: 45).

The best evidence of EBA water management is, however, found at Jawa on the Wadi Rajil in the eastern desert. The city walls surrounded an area of 5.5 ha, while building remains discovered outside the wall encompassed a total area of c. 12 ha (Helms 1981: fig.13, 30). Stratigraphy is largely lacking as a result of the stone constructions. Based on the pottery a date of the site in the EB I period seems warranted, but it is uncertain whether the entire city was occupied simultaneously (Betts 1991). Furthermore, it has been suggested that the pottery can also be regarded to have parallels in EB II assemblages from Syria and that it allows an alternative interpretation in which the site was occupied during short distinct periods within the EB (I) period (e.g. Philip 1995; Braemer and Echallier 2000). Irrespective of these drawbacks the discovery of a large fortified site shows that this arid region was rather densely populated during at least some periods of the EBA. Today Jawa receives less than 100 mm of rain per year and no springs are present. The

modern mean annual rainfall of the Rajil catchment area is estimated at 233 mm (Whitehead et al. 2008: 523). A recent hydrological study of Jawa has modelled the mean annual precipitation of the Wadi Rajil catchment area for the EBA. They suggest it may have ranged between 123 and 329 mm per year (Whitehead et al. 2008: 525). Obviously a subsistence economy based on dry farming is impossible in this region.

However, a series of deflection dams and walls channeling water from the wadi Rajil into ten reservoirs have been discovered (Helms 1981: 157ff). Helms identified three separate systems with their own separate tapping point, dams, channels, pools and irrigatable fields (Helms 1981: fig.69). Helms assumes all three systems were in use at the same time and calculates that the capacity of the reservoirs would have amounted to as much 52,100 m³ (Helms 1981: table 4). Whitehead et al. have recalculated the storage capacity using, for example, different EBA rainfall estimates and number of reservoirs in use. Like Helms they calculate how many people could theoretically be sustained by the available water. They conclude that especially the use of water for irrigation of the fields put a heavy strain on the water availability. Instead of increasing the agricultural productivity and thereby the potential population, they show that failure rates rapidly rise with an increase in irrigated area. They conclude that an increase in the irrigated area causes a rapid reduction in sustainable population (Whitehead et al. 2008: 527).

A problem in their otherwise well-considered argument is their failure to include season of irrigation and the water received by local runoff and wadi overflow. They recon that all water needed for the irrigated agriculture stems from the reservoirs. This is, however, unlikely to have been the case as EBA crops were winter crops benefiting from the annual rainfall and from the likely overflow or deflection of water from the Wadi Rajil that brings water from areas of higher annual precipitation. The bulk of the water needed for cultivation will have stemmed from these sources. Only during the later part of the growing cycle of crops may additional water from the reservoirs have been needed. When the plan view of the dams, canals, reservoirs and fields is considered, the likelihood that reservoirs were used to water the fields diminishes. Most of the fields identified by Helms as irrigated areas are located upstream from the reservoirs and could therefore only have been irrigated by manually bringing the water to the fields which is unnecessary and labour intensive (Helms 1981: fig. 69). Helms realized this and suggested that these fields located along the canals leading to the reservoirs were irrigated by opening a sluice when the reservoirs had been filled (Helms 1981: 185). Helms, moreover, clearly states that, although he suspects human involvement in watering these fields located along the canals, unambiguous evidence for irrigation was only discovered in field 3 in the form of terrace walls connected to the ancient water system (Helms 1981: 185). The presence of channels and sluices leading only to these fields strongly suggests some sort of irrigation (Helms 1981: fig. 69). The top plan, furthermore, suggests that field 6 was restrictedly watered by runoff from the local hills to the west of the site (Helms 1981: fig.69). This suggests winter runoff was large enough to warrant the construction of canals and attempt to farm with the available runoff water.

Irrespective of the actual manner in which fields were irrigated and water deflection was carried out, the number and scale of constructions that were probably related to water is sufficient to conclude that the EBA community was actively practising water management on a significant scale. Without considering the possible involvement in canal irrigation, it is clear that water management in the form of water storage was necessary to survive the dry summer in the desert area around Jawa. However, the storage of water cannot directly be taken as evidence for irrigation. The reservoirs at for example Handaquq, 'Arad, 'Ai and Jalul are proof of water management and show that EBA communities had the knowledge to redirect water, but they cannot be considered as direct evidence for irrigated agriculture. If dates of the dam at Handaquq N and the system of deflection walls near Hujayrat al-Ghuzlan are correct, these dams together with the fields and canals at Jawa are the only constructional evidence of field irrigation during the Late Chalcolithic and EBA.

Concluding, all available evidence suggests that EBA, and possibly also Late Chalcolithic, communities were engaging in a certain level of water management. The large central reservoirs discovered at several sites along with the more commonly encountered cisterns, demonstrate that water storage was a well known phenomenon. Sparse remains in areas on the fringes of the desert have shown that EBA people were also capable of redirecting watercourses, probably partly in

order to irrigate fields. Although such evidence is largely lacking from the Jordan Valley, except for the possible dam at Handaquq N, it is likely that communities located here were equally able to modify the landscape in this way if necessary. The recovered crop remains indicate that more water was available in the fields than could result from rainfall alone. It is, however, uncertain what level of human engagement was involved. The geomorphological evidence suggests that a large part of the additional water may have been supplied in a natural form of irrigation, i.e. low velocity overflowing. Some construction of walls to direct or retain the overflow water longer may have taken place. It is, however, unlikely that remains of such construction are still to be found given the common use of mud bricks in the valley and the intensive agricultural use of the valley over several millennia. Nonetheless, a manner of agriculture that used floodwater farming involving a low level of human water management was undoubtedly practised.

6 Carrying capacity and habitation intensity

6.1 Introduction

Taking the water demands as calculated in section 5.1 as starting point an attempt will be made in this chapter to demonstrate the differences in carrying capacity and habitation intensity between various agricultural systems. To effect this comparison numerous calculation to have be performed that each rely upon a set of variables. Especially for the older periods not all these variables are available. Assumptions and estimates will by necessity be made in the following paragraphs, but these undermine the reliability of the numerical outcome.

Figure 6.1 provides an overview of the steps undertaken to reach a comparison of the carrying capacity and habitation intensity together with the various problems and uncertainties of using such a model for archaeological cases when not all necessary variables are available. These calculations will be attempted for periods for which most information is available, i.e. the pre-modern period, the Mamluk period and the IA. As was demonstrated in the previous chapter these societies were in all probability characterized by very similar systems of canal irrigation. Furthermore, information on the amount of habitation in the region is available in the shape of the survey and excavation data. The amount of remains from these periods that was discovered suggests that the Iron Age probably saw the densest occupation, that during the Mamluk period only a few small villages existed in the Zerqa Triangle and that in the pre-modern period the region was scarcely occupied judging from the handful of scattered sherds that were discovered. On a basic level one could argue on the basis of these data and the fact that similar irrigation and agricultural systems were used that the region came closest to its carrying capacity during the Iron Age and that hence the habitation intensity was highest in this period. In the present chapter it will be investigated whether this conclusion is warranted. It will be clear that more variables are at play than the simple reasoning that more remains means more people entailing higher habitation intensity.

In the following paragraphs an attempt will be made to determine the irrigation demand of a specific cropping system throughout the year. This will be compared to the available water resulting in an approximation of the amount of land that can be successfully cultivated and the maximum crop yield that can be gained. This yield can subsequently be translated into number of people that can potentially be fed which will be compared to estimates of the number of people actually present in the region at one moment in time (see figure 6.1). It will be clear from this series of steps that need to be taken and the amount of information required that several assumptions and estimates need to be made to carry out this reasoning for the periods in question. In order to make the reliability of the ultimate outcome extremely clear, emphasis will be placed here on the most important assumptions and estimates. This also allows the repetition of these calculations with other presuppositions and in different situations.

One of the prerequisites of this method is the availability of data like rainfall, amount of discharge and potential evapotranspiration. These data are clearly not readily available for ancient periods. The first assumption, therefore, concerns the general similarity of the climate and estimates on the possible variation compared to the present climate. It is, however, possible to use long-year averages in the equation. As the climate is supposed to have changed only minimally between the present-day, the Mamluk period and the IA period the modern data are taken as average for all three periods (see also chapter 2). For each period the long year average is used in the calculation as well as the data from the driest year in the past century. Other more specific estimates for the Mamluk and IA climate could have been calculated as well, but as the range between the average and the driest year is already quite large each estimate for the ancient period would fall in this range. A more specific estimate per period would only create a false sense of accuracy. This line of reasoning is made possible by the general consensus among climatologists that although there

were undoubtedly small climatic variations, no major climatic changes have occurred over the last three to four thousand years (Rosen 2007: 101). This is generally speaking, however, not the case regarding the EBA. As discussed in the previous chapter the EBA climate was probably quite different from that of today. For this reason none of these calculations can be carried out for EBA agriculture.

The second assumption concerns the similarity of the characteristics of (pre-)modern crops with those of crops cultivated during antiquity. The water demand per crop determined in section 5.1 is based on the characteristics of modern crops made applicable to cultivation in the Jordan Valley during the first half of the 20th century. Little is known about the growing season of the ancient crops. Was wheat, for example, also planted in November/December during the IA and did it similarly take 5 months to mature? The only information on this topic available in the southern Levant is found in an inscription excavated at Tell al-Jazari identified with ancient Gezer in 1908 by Macalister (Macalister 1912: pl.cxxvii). This inscription, dating around 950-900 BC, has become known as the Gezer calendar as it reads 'two months of it (i.e.) harvest time, two months of it (i.e.) grain planting, two months of it (i.e.) late planting, one month of it (i.e.) hoeing, one month of it (i.e.) barley-harvest, one month of it (i.e.) harvest and feasting, two months of it (i.e.) vine tending (grape harvest), one month of it (i.e.) summer fruit' (Sivan 1998: 105). Although this calendar gives some insight into differences of timing of some crops, translation remains problematic and no correlation to our modern calendar is readily available. However, crop growth and planting habits are heavily influenced by temperature and rainfall. As the IA climate was most likely quite comparable to the modern climate it is likely that the agricultural cycle was also comparable. The start of the winter rains will have been equally determining for the start of planting. Furthermore, a similar temperature and soil will have resulting in similar harvest timing and crop yield. Pictographs from Uruk IV (fourth millennium BC) and Old Babylonian seal impressions show that these types of ploughs were very similar to the wooden ard ploughs used in the first half of the 20th century (Borowski 1978: 48). In the southern Levant the metal end points of ploughs have been excavated at several sites dating to the IA, e.g. Beth Shean, Tell Beth Mirsim, Tell el-Full, Beth Shemesh, Tell ed-Duweir, Tell en-Nasb and Jezer (Borowski 1978: 49; Hopkins 1985: 222). These plough points indicate that the essential shape of the IA plough is more or less preserved in today's ploughs. Other agricultural tools like metal and flint sickles, threshing sledges and hoes have also been attested to have changed remarkably little over the centuries (e.g. Van der Kooij and Ibrahim 1989: 99, cat no 136-137). Furthermore, chemical fertilizer, controlled crop selection and mechanized farm equipment were all absent before 1950 AD in the Jordan Valley. This similarity in climate, soil, and agricultural techniques makes a comparison, albeit along very general lines, between pre-modern and IA agriculture possible.

Another assumption concerns the agricultural economy and especially the crop division. For the late pre-modern period data regarding which crops were cultivated and in what proportions are quite good. Data on crop frequency in the early pre-modern period is, however, already much more limited. For the Mamluk period and IA there are, furthermore, only archaeobotanical data, which cannot be translated directly into crop proportions. Excavated archaeobotanical remains provide information on the type of crops that were cultivated, but establishing the relative frequency of these crops is more difficult. This is a major problem for which there is no easy solution at the moment. Simply based on the available archaeobotanical data, especially the combination of number of samples in which a type of crop is present and the number of seeds discovered, together with ethnohistorical data and information from historical texts, a crop division is estimated for archaeological periods. This is clearly and admittedly a weak point in the line of reasoning, but at the moment no better option is available. Specific detailed archaeobotanical research should be carried out to better deal with this problem. Unfortunately this line of investigation goes beyond the scope of this research. Although the crop proportions are clearly of influence and an attempt is made to be as accurate as possible, the type of crops cultivated and their timing are especially important in the periods concerned as will become clear later on in this chapter. The distinction in types of crops cultivated allows a comparison between the periods even assuming that the crop proportions are only an approximation of the actual system.

One of the final assumptions involves estimates of crop yields and human diet. There are obviously no data on ancient yields from the Zerqa Triangle. However, the soil and fertility of the Zerqa Triangle have remained relatively unchanged. As stated before and will become clear from the following paragraphs, agricultural techniques have probably changed little over the periods concerned. Given the similarity in agriculture and the location in the same region it is assumed

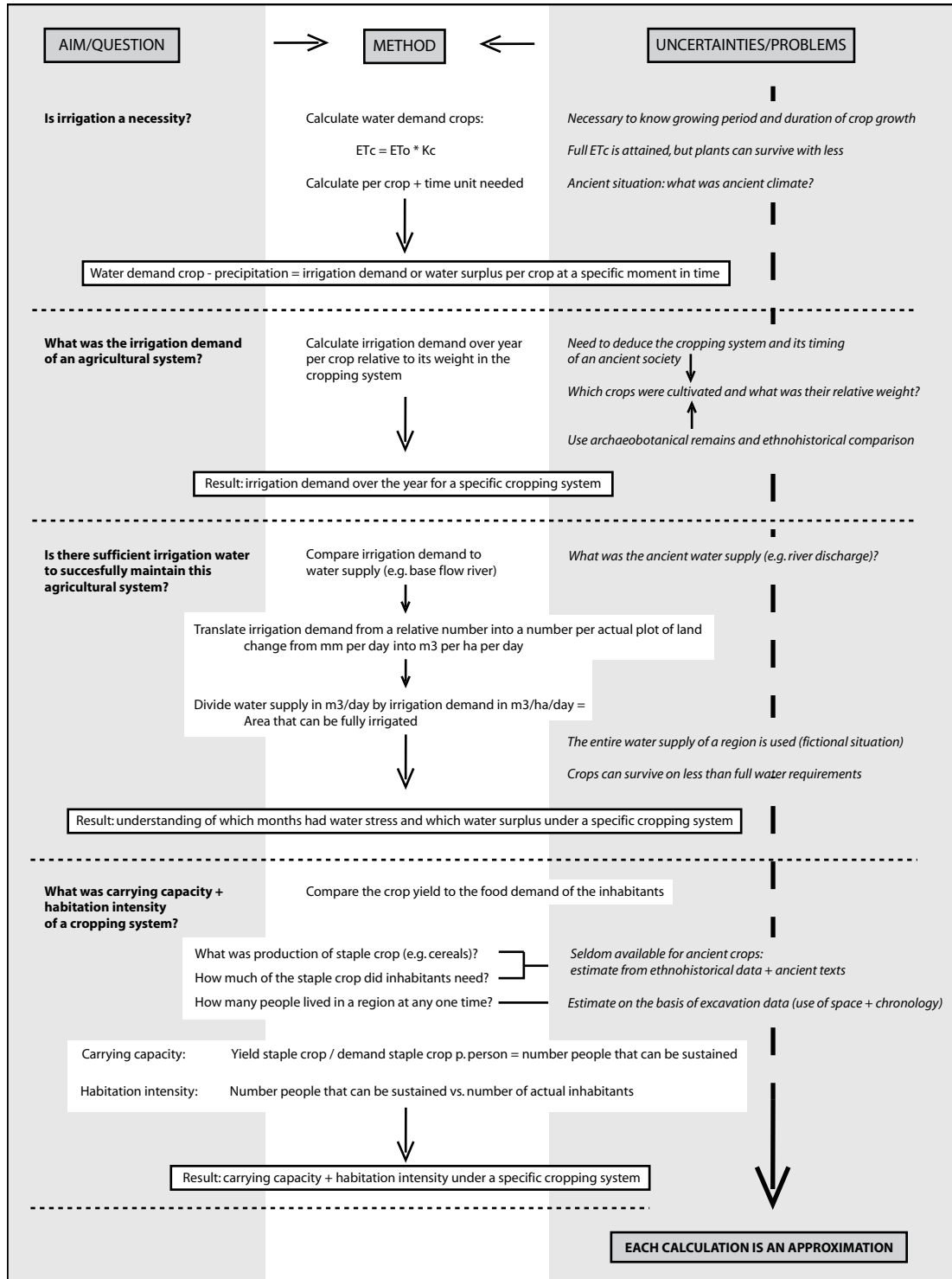


Figure 6.1 Model of irrigation calculations used in this chapter

that agricultural produce will have been comparable between periods. These ethnohistorical data will therefore be used in conjunction with the available historical data. Although differences are certainly present, they are not so great as to invalidate all comparisons.

These known yields are furthermore real measured yields depending on the specifics of a certain year and not yields from crops that received full water requirements. As described in the previous chapter the calculation is based on full water demands, but plants can survive with less than the complete amount of water they need, although this may result in smaller plants and lower yields. The calculations presuppose that crops that grew under the ideal circumstances will probably provide higher yields. The periods of water stress that will emerge from the calculations are therefore no immediate threat to the crops, especially not if they are of short duration. Crops have some resilience and can survive on less than their ideal amount of water. On the other hand, the calculations suppose the entire base flow of the river is used for irrigation. This is a fictitious situation that will never occur. People need water for drinking as well and in each irrigation system water is lost through seepage and other problems. These considerations make that the outcome of all these calculations are on the one hand too high and on the other too low. Detailed hydrological modeling that takes into account aspects like the soil type, the structure of the canals and the minimal growth possibilities of crops may come to more accurate numbers. Like many other aspects of this model such an analysis goes beyond the scope of this research and the many other estimates and assumptions upon which the calculations rest ensure that the outcomes as such cannot be fully relied upon anyway. They serve more or less as relative numbers that enable the comparison between different agricultural systems in the same region. A comparison of this system to other regions on the basis of absolute numbers derived from this model lies beyond the possibilities.

6.2 Ethnohistorical agriculture

As most data needed in the calculations are available for the pre-modern period the description of the agricultural system and carrying capacity calculations will be taken as starting point. In the pre-modern era a limited number of people inhabited the Zerqa Triangle, all predominantly engaged in subsistence agriculture. Unfortunately botanical samples like those from archaeological excavations are absent. This is, however, compensated by numerous oral accounts and written sources, like tax records, reports of early ethnographers like Dalman and some special agricultural studies undertaken in the context of the new irrigation system that was being developed. First a short description of the data available on the agricultural practices and techniques used at the start of the 20th century will be given. This will be followed by a calculation of the potential carrying capacity and population pressure in the Zerqa Triangle during the pre-modern period.

6.2.1 Pre-modern agricultural techniques and calendar

Unfortunately detailed records on how agriculture was carried out, e.g. when were crops sown or when were they watered, are not available for the Zerqa Triangle itself. There are descriptions from other parts of Cis- and Transjordan, however. Dalman has described all aspects concerning agriculture in the whole of the region in minute detail (Dalman 1932). His observations were made between 1900 and 1925 and although describing agriculture in general he makes mention of specific details of the different parts of the region. The records of the Abujaber family farm at Yaduda provide a valuable account of the daily practice of cultivating fields in the Belqa' (Abujaber 1989: 45ff). The following account is largely based on these sources and although they do not directly describe the Zerqa Triangle the very similar practices in most parts of the country indicate that agricultural techniques and habits were rather uniform during this time period. The occasional different agricultural practices in the Jordan Valley compared to the rest of the country that are described by Dalman are taken to be applicable to the Zerqa Triangle as well. The following account is therefore an approximation of agricultural practices in the research area.

The fields were normally organized in such a way that the vegetable plots were located close to the villages and the field crops like cereals or sesame were planted further away (Dalman 1932: 187). Agriculture in the Zerqa Triangle, however, was characterized by a redistribution of plots



Figure 6.2 Plough used near Sawalha in 2005 (Photographs taken in field 145)

amongst farmers every few years (see next chapter). This frequent change in ownership will have dictated a different organisation of the fields. It is likely that a farmer located his vegetables closest to the irrigation channel as these were generally summer crops and most heavily depended on irrigation water. The location of fields and vegetable plots changed every few years, as dictated by the irrigation and tenure systems, but had the additional benefit of countering exhaustion of the soil brought on by prolonged cereal cultivation. Refertilizing exhausted soils by applying manure was a largely unknown phenomenon in the wider region (Dalman 1932: 139). Fields were generally left fallow or planted with plants that acted as green manure. Dung was rather scarce as animals were mostly herded away from the village and only stood in their stables for a limited part of the year (Dalman 1932: 139). The dung that was collected was mainly used as fuel in the form of dung cakes and occasionally vegetable plots were manured with it (Dalman 1932: 140). A certain form of manuring was, however, practised by herds led onto the fields after harvest to feed on the stubbles. All dropping were left on the soil and this practice was valued so much that herders were sometimes paid to bring their flocks to graze on certain fields (Dalman 1932: 141). Another manner of revitalizing the soil was burning the stubbles and weeds after harvest. The ash was later ploughed into the soil (Dalman 1932: 141). Dalman saw this practice being carried out in the ghor immediately west of Dāmiyah, where thorn bushes were burned at the end of April to prepare the soil for summer crops (Dalman 1932: 142).

The first step in the agricultural process was ploughing. Ploughing was performed several times depending on whether a winter or summer crop was to be grown. Ploughing was done with a simple wooden ard type of plough drawn by bulls, donkeys, horses or even camels. This type of plough is still used today and was encountered several times during the survey (see figure 6.1). This type of plough breaks the soil without turning it and usually only reaches 10 to 15 cm deep. The depth of the plough can be adjusted by changing the place at which the animals are tied up to the plough up to a maximum depth of 20 cm (Dalman 1932: 186). This seems rather superficial, but Dalman describes that it was very effective as this depth was the upper soil zone that benefited from moisture from lower, more humid, layers. It was also the level until which the roots of leguminosae or green manure reached and where bacteria acted upon the soil, both making it more nutritious (Dalman 1932: 186). Dalman describes that German colonists using European ploughs had been ploughing below this level, opening up what he calls dead soil, which had a marked negative effect on their yields (Dalman 1932: 186).

Before the actual ploughing for the winter crops started, the soil was subjected to a kind of preliminary ploughing called *kerab* (Dalman 1932: 180). This first ploughing was done before the onset of winter rains, uprooting the weeds present in the subsoil and leaving them on the surface where they were scorched by the sun (Dalman 1932: 180). Furthermore, it opened up the soil so the rains would enter it more easily instead of flowing away in canals and wadis.

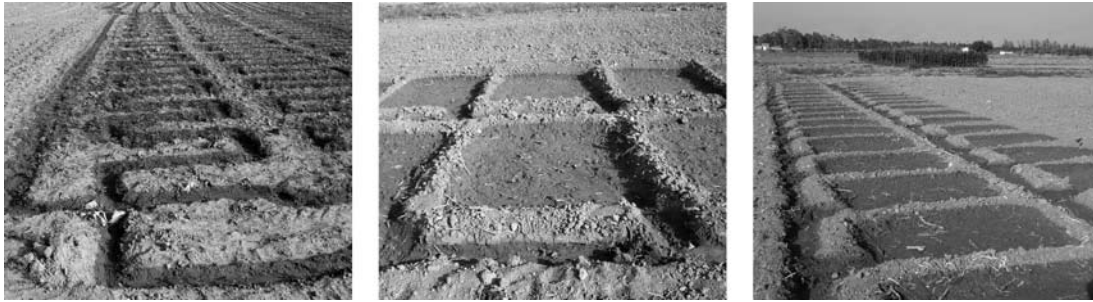


Figure 6.3 Modern nursery beds in the Zerqa Triangle

If summer crops were to be planted ploughing was often done as often as four times. A farmer of al-Salt related that he ploughed four times; first in February, then at the start of March, then at the end of March and finally in mid April (Dalman 1932: 207). The number of ploughings depended on the crop that was to be grown. Ploughing was essential for summer crops as the humidity of the soil was of the utmost importance during the arid hot summer. Furthermore, the last winter rains had to enter the soil as deeply as possible. Lastly, a warm humid layer between upper and lower soil was created in which micro-organisms that bind nitrogen flourish. The ploughed in weeds enhanced this phenomenon (Dalman 1932: 206). Dalman writes that the farmers were unaware of the chemical reasons behind this phenomenon, but experience had taught them that this kind of treatment gave the best results (Dalman 1932: 206). In most parts of the country the first sowing of summer crops started in the second half of March, but the warm Jordan Valley was always a few weeks ahead. The actual date sowing started, however, depended on the weather. For example, if sowing had been too early and heavy rains occurred when the fields were already sown this could ruin crops like sesame as the water formed a crust that was too hard for the small plants to break through (Dalman 1932: 208). Some vegetables were first sown in a kind of nursery bed that was a small basin surrounded by earthen dikes (Dalman 1932: 187). This kind of bed is still used today for the initial sowing of some vegetables (see figure 6.2). When the plants were large enough they were replanted in larger beds. Summer vegetables that were planted in beds included cauliflower, cabbage, European bean, Arab bean, okra, aubergine, tomato, and several types of cucumbers (Dalman 1932: 209). There were, however, also summer field crops. These were chickpea, sesame, sorghum, maize, occasionally lupine, and at Jericho and probably also elsewhere in the valley cotton (Dalman 1932: 206). These crops were planted by dropping one seed at a time in the furrow after the plough had passed.

Winter crops were sown differently. Firstly, the soil was not ploughed as often. The repeated ploughing for the summer crops still sufficed for the winter crops. The soil was generally only ploughed once to desiccate the weeds before the rains started. When the winter rains had come, which usually occurred somewhere between the end of October and the start of December, a second ploughing was carried out. During this ploughing, that occurred between mid-November and mid-December, the fields were sown immediately by casting the seed in front of the plough. The plough then went over the seed covering it with soil (Dalman 1932: 175,180). Sowing was often done at several moments to spread the risk of failure by early rains that could destroy the young crops (Dalman 1932: 176). The Yaduda records of 1908/09 show, for example, that wheat was sown in different episodes from mid-November until the start of February, while barley was sown both in the first half of December and around mid-January (Abujaber 1989: table 3.1). Winter crops were generally field crops and included wheat, barley, lentils, European beans, peas, joint vetch, and in many regions fenugreek, fodder vetch, and lupine (Dalman 1932: 179). Lentils, peas, beans and vetch were not sown like the cereals but by letting individual seeds fall in the furrow behind the plough and were covered by the plough making the next furrow besides it (Dalman 1932: 183). Several variations on this method existed in the different regions.

Once the crops had been sown and successfully come up, the continuous task of weeding started. This was mostly done by women as it was light and rather flexible work (Abujaber 1989: 53). Weeding is important as weeds are competitors for water and minerals. Furthermore, har-

vesting was much more difficult if thorny weeds were among the crop. Furthermore, sorting of impure cereals cost a lot of extra time and the crop could never be sold as dearly as pure yields. Furthermore, at the start of the 20th century fields, especially on the Transjordanian plateau, had been under cultivation for only a relatively short time after centuries of being pasture land. Weeds were therefore very resilient and if a field was not tended properly, it would quickly return to its former uncultivated condition (Abujaber 1989: 52).

To a large extent the climatic situation of the region determined when the fields were ready to be harvested. Barley could, for example, typically be harvested in the Jordan Valley in the first half of April, whereas it was not ready until the end of May in the hill country (Dalman 1932: 6). At Yaduda wheat and barley could generally not be harvested until mid-June (Abujaber 1989: 55). Harvesting was done in two ways: firstly by uprooting the plant, and secondly by cutting it with a sickle. The first method was used for crops like lentils, vetches, chickpeas, sesame and wheat and barley if these had remained small. The second was predominantly used for cereals like wheat and barley (Abujaber 1989: 55). Harvest was always a stressful time as several things, like locusts, fire, theft and herds crossing through the fields, could ruin the crops at the last moment (Abujaber 1989: 55). When the different crops could be harvested and how much time this would take mainly depended on the regions and the relative amounts sown. At Yaduda for example cereal harvest took two months while vegetables were finished in a fortnight (Abujaber 1989: 55,58). The timing of harvests will have been different in the Jordan Valley where the growing season was much shorter and sometimes both a winter and a summer crop could be had from the same field. Fields were, of course, sometimes left fallow to revitalize them, but an important part of the nourishing process was carried out by crops like beans, vetches, lupine, that have the capacity for nitrogen fixation. The yearly agricultural cycle of the Jordan Valley was through its climate markedly different from both the eastern and western hills adjoining it. Although no data from this early period are available for the Zerqa Triangle, Dalman recorded the year cycle for another village in this warm low lying zone, i.e. al-Ruwer near Tiberias (see table 6.1). Although not identical, the agricultural calendar of Deir 'Allā will have been very similar.

	Field crops	Vegetables
September	Guarding summer crops (maize) until harvest from mid-September onwards	Harvest eggplant; Sowing in nursery beds: tomato, cauliflower, lattichsalat (c. rucola)
October	Training young plough oxen First ploughing fallow land	Replant tomatoes. Sowing onion, lettuce, radish, white beetroot, parsley, pepper
November	If sufficient rainfall sowing broad bean, wheat	Cont. Oct. Sowing pumpkin, garlic, white beans
December	Sowing winter crops: wheat, barley, lentils, fenugreek	Cont. November
January	Like Dec. Late sowing barley and joint vetch	Cont. Dec. maintaining vegetable plots
February	Late sowing wheat, joint vetch. Weeding winter crops. First ploughing summer crops and early sowing chickpea	Sowing tomatoes, cucumber, pumpkin, European beans, okra. Maintaining and weeding vegetable plots
March	Weeding winter crops Sowing summer crops: chickpea	Sowing like February + eggplant
April	Sowing summer crop; sorghum From mid April; harvest broad bean, lentil, joint vetch, barley	Sowing different types melons e.g. water melons. Maintaining vegetable plots. Harvest zucchini, tomato, beans, cucumber, onion, garlic, lettuce, beet, pepper, radish, bean
May	Cont. harvest winter crops; also wheat End May: sowing summer crops: maize	Maintaining vegetable plots. Harvest zucchini, tomato, beans, cucumber
June	Cont. harvest wheat and barley Sowing summer crop; maize	Harvest zucchini, tomato, cucumber, eggplant, okra
July	Harvest wheat	Harvest tomato, eggplant, okra, cumin
August	Harvest wheat + guarding sorghum fields From mid-August harvest sorghum	

Table 6.1 Agricultural calendar of al-Ruwer in the Jordan Valley near Lake Tiberias c. 1902-1917 based on information of father Sonnen (after Dalman 1932: 216,217, 1933: 3-6)

Unfortunately very little is known about the animals present in of the villages. Tarawneh mentions that in the Zerqa Triangle animal raising was a secondary source of subsistence for the early 20th century villagers (Tarawneh in prep.: 25). Sheep and goats were kept together with smaller numbers of cattle (Tarawneh in prep.: table 3). The powerful clans, the so-called Hurr clans, kept herds of sheep and goats that were looked after by their employees. Most agricultural labourers also actively raised livestock, which was an essential part of their diet. Their agricultural produce was generally insufficient to survive on (Tarawneh in prep.: 30). The household staff of the sheikh (the 'Abid), finally, were also involved in animal husbandry and were usually given a number of animals as private property by the sheikh (Tarawneh in prep.: 29). Based on the scarce data it is likely that most families kept a few animals to supplement their diet but that large flocks were not reared by the inhabitants of the valley during this period.

6.2.2 Crop division

Today, agriculture in the Jordan Valley is completely focussed on the production of export crops, like tomatoes, cucumbers and lettuce. The development towards the cultivation of cash crops was already underway in the mid 20th century. This is clearly visible when the crop types cultivated in 1953 and 1966 in the area between the Wadi Yabis and the Zerqa are compared (see table 6.2). The rise in vegetables at the cost of cereals and to a lesser extent fruit as well is very clear. The proportion of cereals in the crop assemblage was large in a non-export based system. However, the 1953 agricultural system was already influenced by the demands of the outside world. The vegetables grown include relatively large quantities of tomato, squash, and half of the vegetable assemblage is made up of watermelon. A share of these vegetables will have been sold, especially the large proportion of watermelons.

	1953	1966	1986
Cereals	84	28.2	12.4
Vegetables	13	71.6	64.3
Fruit	3	0.2	23.4

Table 6.2 Crops cultivated in the southern part of the north-eastern Ghor represented in percentages of land taken up by them in 1953, 1966 (after Anonymous 1969b: table E-13) and 1986 (Elmusa 1994: table 3.2)

Unfortunately the detailed data of 1953 and 1966 are not available for this part of the ghor for the earlier decades of the pre-modern period. The predominance of cereals at the turn of the 20th century is, however, attested by several accounts from other areas. For example, the tax collected from Cisjordan in the years between 1920 and 1928 was collected in kind and totals per crop are given in tons. Tax amounted to 1/8 of the total crop yield after deduction of sowing-seed and rent (Dalman 1933: 158). On average 51% of the tax consisted of wheat, 26% of barley, 15% of sorghum, 4% of vetches and lentils and sesame accounted for 2% each (Dalman 1933: 159). Apart from sorghum which was only introduced after the IA, the similarity with the dominant crops of the IA is striking. Another report documents the crop yields per year of one farmer cultivating 200 dunum with his wife, two grown daughters, four children and two donkeys in the Jezreel Valley. This area of land yielded a total of 9278 kg comprising 35% wheat, 20% barley, 21% broad bean, 13% sesame and 10% sorghum (Dalman 1933: 158).¹³⁴ Dalman further notes that in Hebron 27 ha were for 95% covered with cereals while the remaining 5% were taken up by fruit trees. Abujaber also provides data on his family's farm at al-Yaduda from the first years of the 20th century (Abujaber 1989). Data of sowing activity of one rabta or work gang are available for seven years. In the following table the amount of seed sown is shown in kilograms and calculated for one feddan, which measured between 8 and 15 hectares in Transjordan during this period (Abujaber 1989: 262). Although these are sowing data in weight measurements per feddan and not area measurements, they do provide a good insight into the division of crops.¹³⁵ Clear from this table is the

¹³⁴ Dalman relies on Elazari-Volcani (*The fellah's farm 1930*) for these data.

¹³⁵ Crop yield is estimated at 10 times the sown amount in this area and period (Abujaber 1989: 160).

predominance of cereals. At Yaduda barley was restrictedly cultivated for fodder and surplus were sold. Cereal consumption was restricted to wheat (Abujaber 1989: table 8.2). The predominance of wheat in the human vegetable diet is also clearly shown by the rations or *muna* labourers at Yaduda were supplied with. For a whole year a labourer received 480 kg of wheat, 264 kg of millet, 18 kg of raisins, 8 kg of olive oil, 8 kg of molasses, 9 kg of onions and 9 kg of salt (Abujaber 1989: 92). Millet was cultivated because it is a very fast growing and drought resistant crop with little risk of failing (Zohary and Hopf 2000: 83). In the early 20th century it was only eaten by the poor or in times of crop failure (Abujaber 1989: 189). In 1914 rations were reduced as a result of the First World War and a labourer only got 42 kg of wheat per month during 7 months, 6 kg of lentils per year and 3 kg of salt per year to sustain his family (Abujaber 1989: 92). If this ration was indeed the entire food supply of a family, in other words if they had no small gardens where they grew some vegetables themselves, the diet these people and potential animals was for 95% cereal. In the hilly area of the Belqa' region the principle crops in this period were wheat, barley, millet, lentils, and chick pea listed in order of abundance (Abujaber 1989: 189). Like elsewhere, wheat was by far the most important crop and Abujaber estimates that it might have accounted for two-thirds of cultivated Belqa' land (Abujaber 1989: 189).

	wheat	barley	beans	nī'manih (vetch)	lentils	kirsanih (vetch)	sorghum/ chick pea	sesame
1908/9 (rabta of 18 feddan)	846	297	80	80	36	138		
1908/9 (rabta of 18 feddan)	1148	290	80	80	36	136		
1909/10 (rabta of 19 feddan)	936	379	98.5	106	56.8	155	30	45
19010/11(rabta of 25 feddan)	1172	296	1.3	1.5	1.2	1.8		
19011/12 (rabta of 29 feddan)	767	245	60	70	119	189		
19012/13 (2 rabtas each 15 f.)	828	277	79	113	127	163		14
19012/13 (rabta of 24 feddan)	881	410	96	143	178	141		
Seed per feddan in %	58	19	4	5	5	8	0.2	0.5

Table 6.3 Seed sown at Yaduda calculated per feddan (8-15 ha) (after Abujaber 1989: table 3.2)

Although it is difficult to compare these dissimilar data, it is noteworthy that vegetables are absent from these early reports. Fruit occurs only in restricted instances, while pulses are consistently present, yet only in relatively small quantities. Sesame, a crop for which the first evidence was found at IA Tell Deir 'Allā, is more or less consistently present in limited quantities (Neef 1989: table 2). Cereals, consisting mainly of wheat and to a lesser extent of barley, form the bulk of the cultivated crops in all examples.

These data are, however, very specific of the pre-modern age and cannot be unproblematically transplanted onto Mamluk and IA agriculture. However, Dalman specifically notes that the agriculture he described was not yet influenced by the modern agricultural techniques that were emerging in the region at that time. Crops were grown without artificial fertilizer, but soil was safeguarded against exhaustion by allowing land to lie fallow for some time and by rotating of summer and winter crops that had variable exhaustive characteristics or could even refertilize the soil as leguminosa like peas and beans do (Dalman 1933: 160). Furthermore, import and export of crops was still very limited in this period. Rice was imported and Cisjordan bought a small portion of its wheat requirement from Transjordan (Dalman 1933: 159; Abujaber 1989: 104). Al-Yaduda, however, was in the process of becoming a large farm with many labourers and was starting to orient itself on the export of wheat to Cisjordan. On the whole, though, farmers were small more or less self-sufficient subsistence cultivators.

	Yaduda Av. 1908-1913	Cisjordan Av. tax 1920's	Jezreel 1930	Hebron (pre 1935)	NE Ghor 1953
Cereals	77.3	92	65	95	79
Pulses	9	2	21		0.3
Vetches	13.2	4			
Sesame	0.5	2	13		4
Fruit				5	3

Table 6.4 Cultivated crops in percentages

A very detailed account of the crops cultivated in the Jordan Valley stems from 1953 and is part of an unpublished study of the Jordan and Yarmouk Valleys undertaken by engineers in the context of the development of the modern irrigation system and East Ghor Canal in 1969 (Anonymous 1969b). In table 6.5 the amount of dunum taken up by the various crops in 1953 in the north-eastern ghor, stretching from Lake Tiberias to the Zerqa, is given. It is fortunate that measurements are in square measurements. It is clear that wheat and barley are still the most commonly cultivated crops (66%). Crops like sorghum (13%) and sesame (4%) are typical for the Jordan Valley as both need large amounts of water and relatively high temperatures. The amounts of vegetables (13%) and fruit (3%) are rather low. This situation, however, rapidly changed and only 10 years later the percentages had shifted to 44% cereals (75,500 du), and 45% of more profitable vegetables (76,500du) and 11% fruit (18,000 du) (Anonymous 1969b: table E-67) (see table 6.2).

Some of the products listed in 1953 seem to represent the first experiments of the crops that would become important during the 1960's and after. Today, a limited range of crops is cultivated in the valley. The most dominant crops in the Zerqa Triangle today are cucumbers and tomatoes, followed by lettuce, potatoes, onions, malukhiya, cauliflower and some watermelons.¹³⁶ Citrus and date palm plantations also occur regularly. Bananas do not occur in the Zerqa Triangle, but are common in the northern and southern part of the Jordan Valley. These modern crops are predominantly cash crops cultivated for export. Wheat and barley are not cultivated in the Zerqa Triangle today. The presence of the same types of crops, albeit in very limited quantities, may indicate that some initial steps towards this trend had already been taken in 1953.

6.2.3 Agricultural possibilities and irrigation reality

The data provided by the agro- and socio-economic study (table 6.5) apply to the entire area between the Zerqa and Yarmouk River, i.e. the north-east Ghor. The cropping pattern may, therefore, have deviated slightly in the Zerqa Triangle itself. Based on other historical records and eye-witness reports it is unlikely that bananas were grown in the Zerqa Triangle (Tarawneh in prep.). Another reason to calculate the agricultural possibilities of the Zerqa Triangle for 1953 is the presence of several other types of data for this time period. Firstly, a population census from 1951 gives data on how many people permanently inhabited the Deir 'Allā district.¹³⁷ Furthermore, a 1:10.000 map showing features like roads, irrigation channels, buildings was published in 1953 (Anonymous 1965). This map is, however, partly based on slightly earlier data. Most importantly, aerial photographs of the majority of the Zerqa Triangle are available from 1953 (Royal Geographic Society 1953). Apart from features also visible on the map, the photographs show a large number of black goat hear Bedouin tents scattered throughout the region, it shows which canals were in use at that time and it shows harvested fields, fields that still had crops on them and areas that had not been brought under cultivation. Like all photographs the aerial photographs show only a single moment in time, which is in this respect very valuable.

136 These are personal observations during three survey seasons. For details on crops encountered in the surveyed and neighbouring fields see the field form database.

137 The official census data were unfortunately not available at the time of writing. The data of the Deir 'Alla district from this census were, however, presented in a paper by L. Layne entitled *The use of space amongst the 'Abbad Bedouin of the Jordan Valley* at the 'Symposium on Anthropology in Jordan: State of the Art, Amman February 25-28 1984. A transcript of this paper which was present in the Jordan Valley Archive at the Yarmouk University in Irbid.

By 1953 some initial modernization in agricultural technology had, however, already begun. The first orientation towards exportable crop type was made. Fertilizer was probably used, but in low quantities as this is one of the costs that have increased most between 1953 and 1965 (Anonymous 1969b: 136). This makes it impossible to compare these data directly to the early pre-modern period discussed above. It does, however, provide a point of reference especially regarding the limits of this type of cultivation.

The crop distribution pattern as shown in table 6.5 has been slightly modified. Firstly, the bananas have been removed as these were probably never grown in the Zerqa Triangle. Secondly, farming in 1953 still involved crop rotation and periods in which the land lay fallow. There are unfortunately no data on exactly how much terrain lay fallow. The aerial photographs provide no detailed information as the already harvested fields cannot be separated from fallow fields. The percentage of land that lay fallow has, therefore, been simply estimated at 30%.

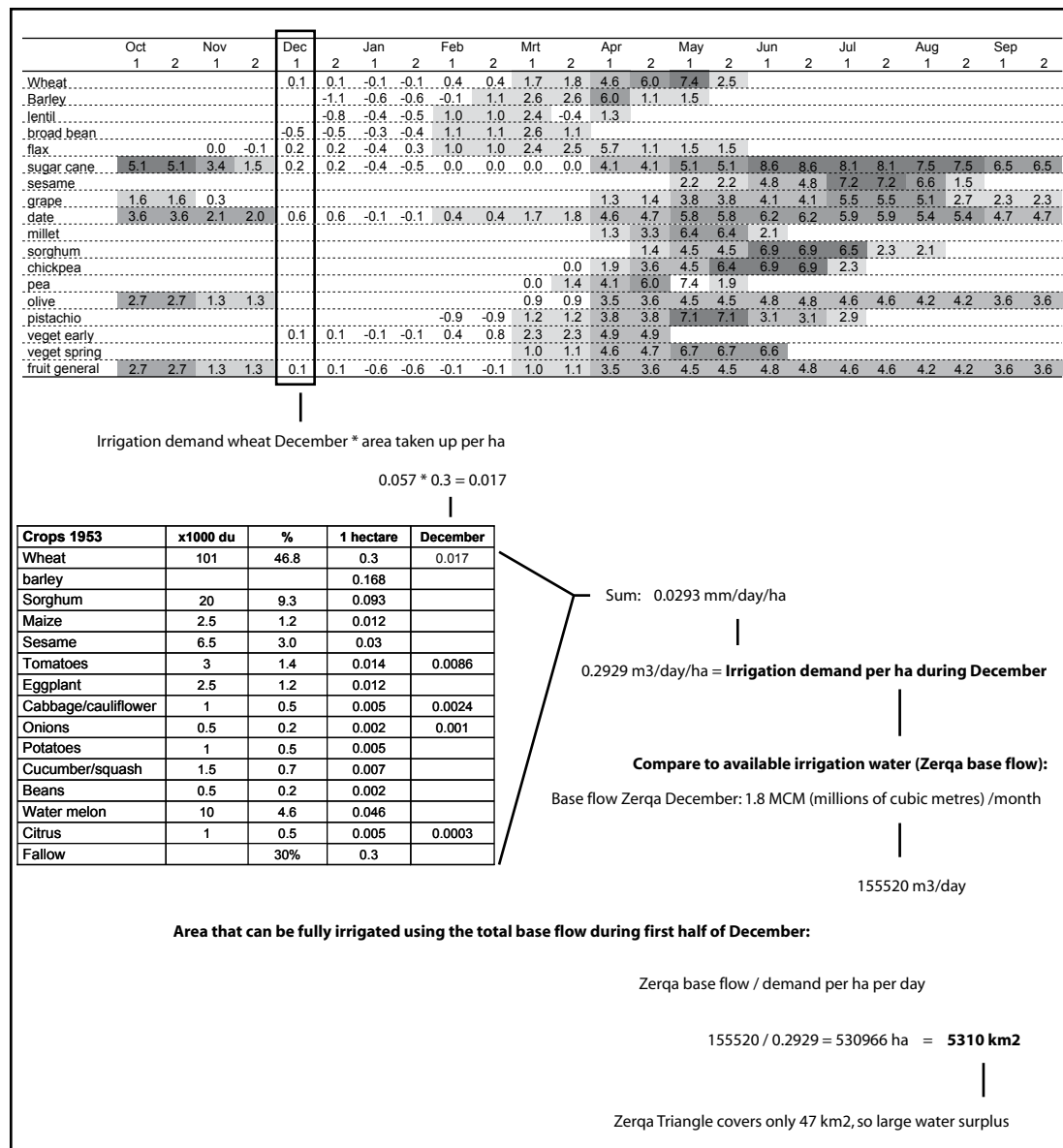


Figure 6.4 Calculation model to convert water demand of crops into area that can be fully irrigated using the total available water. Data from December 1953 were taken as example.

Crops in NE Ghor 1953	1000 du	% (estimated)
Wheat and barley	101	46.8
Sorghum	20	9.3
Maize + other	2.5	1.2
Total cereals	130	57.3
Oil crop: Sesame	6.5	3
Pulses: Beans	0.5	0.2
Tomatoes	3	1.4
Eggplant	2.5	1.2
Cabbage + cauliflower	1	0.5
Onions	0.5	0.2
Potatoes	1	0.5
Cucumber + squash	1.5	0.7
Water melon	10	4.6
Total vegetables	20	9.1
Bananas	3	-
Citrus + other	1	0.5
Total fruit	4	0.5
Fallow	-	30

Table 6.5 Amount of dunum in the north-eastern Jordan Valley taken up by different crops in 1953 (Anonymous 1969b: table E66)

Having established the crops that were cultivated and their relative importance, the water demand can be calculated using the data discussed in section 5.1. By dividing the water demand per crop by their relative proportion the water demand under the specific cropping pattern is obtained. If that amount is in turn translated from mm per day, which is an abstract number, into cubic metres a day, a measurement of the volume of water needed is gained. In other words, in each hectare 40% is left fallow, while 30% is taken up by wheat. When the water demand of wheat in the first half of March, i.e. 1.7 mm/day, is multiplied by its relative weight, i.e. 0.3, and then translated from mm into m³ the water needed each day to cultivate one hectare of wheat is obtained, i.e. 5.192 m³/day.¹³⁸ If the same calculation is repeated for all crops present in the agricultural system, the total water demand per hectare is acquired.

Having calculated the daily water demand of one hectare needs per day under this cropping pattern the demands per fortnight can be compared to the discharge of the Zerqa. Like most rivers, the Zerqa discharge consists of base and flood flow. It has been ascertained from the local inhabitants that the pre-modern irrigation system did not utilize the flood flow as people had no means of storing the water. The following calculations, therefore, use only the base flow. The monthly base flow as provided for the years from 1928 to 1966 is given in millions of cubic metres per month (Anonymous 1969a: table B-25/A). These have to be translated into m³ per day to be comparable with the crop water demands. Normally, river discharge is given in mm per second. These numbers are better comparable than the large quantities when the discharge is expressed in cubic metres per day. For the sake of clarity the Zerqa discharge is here given as mm/sec, although the calculation required m³/day. If the total Zerqa base flow in m³/day is divided by the amount of cubic metres of water the crops need per day per hectare, the maximum number of hectares is obtained that can be cultivated if all the water in the Zerqa were to be used for irrigation. In figure 6.6 these calculations are carried out for the average base flow and for the year that had the lowest yearly base flow in the 38 years over which records are available.

¹³⁸ 1 mm of rain that falls on 1 m² makes 1 litre. One litre converts into 0.001 m³. This means that the 0.5192 mm of rain needed on 1 ha is 5192 litre which is equivalent to 5.192 m³.

IA Ila/b	ha	Oct		Nov		Dec		Jan		Feb		Mit		Apr		May		Jun		Jul		Aug		Sep	
		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Wheat	0.3			0.017	0.018	-0.027	-0.039	0.129	0.129	0.5192	0.525	1.385	1.8075	2.2135											
barley	0.168			-0.178	-0.093	-0.099	-0.018	0.1856	0.4377	0.441	1.0066	0.1806	0.2567												
Sorghum	0.093																								
Maize	0.012																								
Sesame	0.03																								
Tomatoes	0.014			0.0314	0.0128	0.0283	0.0086	0.0185	0.0068	-0.005	-0.005	0.0095	0.0245	0.06463	0.0844	0.1033	0.0714								
Eggplant	0.012																								
Cab/caulif	0.005			0.0134	0.0065	0.0092	0.0024	0.0024	-0.001	0.0011	0.0042	0.0042	0.0095												
Onions	0.002																								
Potatoes	0.005																								
Cucum/squ	0.007																								
Beans	0.002																								
Wat. melon	0.046																								
Citrus	0.005			0.0136	0.0134	0.0065	0.0063	0.0003	0.0003	-0.003	-0.003	-0.0006	-0.0006	0.0052	0.0053	0.01758	0.0178	0.0223	0.0223	0.0241	0.0242	0.0228	0.0228	0.021	0.021
Demand mm/day	0.0136	0.0582	0.0283	0.0463	0.0293	0.0401	0.0068	0.0011	0.1354	0.321	1.0116	1.0225	2.66597	2.4862	3.4451	1.7427	1.1985	1.1937	0.9705	0.5424	0.5007	0.1236	0.0555	0.0182	0.0182
Demand m3/day	0.1363	0.5816	0.2831	0.4625	0.2929	0.4014	0.0677	0.0108	1.3538	3.2102	10.116	10.225	26.6597	24.862	34.451	17.427	11.985	11.937	9.7045	5.4243	5.007	1.236	0.5553	0.182	0.182
Zerqa base flow	1.4	1.4	1.6	1.6	1.8	1.8	2.0	2.0	2.0	2.0	2.0	2.2	2.2	2.0	2.0	1.8	1.8	1.6	1.6	1.4	1.4	1.3	1.3	1.3	1.3
Irrigatable km2	8877	2080	4884	2989	5310	3874	25517	160744	1276	538	188	186	65	70	45	89	115	116	125	223	224	909	2023	6171	6171
Base flow dry year	0.9	0.9	1.2	1.2	1.2	1.2	1	1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	0.7	0.7	0.4	0.4	0.4	0.7	0.7	0.7	0.7	0.7
Irrigable km2	5073	1188	3663	2242	3540	2583	12759	80372	702	296	102	101	39	42	18	35	29	29	62	111	121	489	1089	3323	3323
Zerqa flow 1952/3	1.5	1.5	1.8	1.8	0.9	0.9	1.8	1.8	2.3	2.3	2.7	2.7	2.6	2.6	2.2	2.2	2.2	2.2	2.2	1.7	1.7	1.7	1.7	1.7	1.7
Irrigatable km2	8660	1974	2699	2038	131	109	2677	3111	0	12489	1290	1298	81	87	55	108	156	156	153	274	296	1201	2636	8059	8059

Table 6.6 Irrigation potential for pre-modern agriculture (Zerqa base flow is given in millions of cubic metres per month)

The maximum amount of land that can be irrigated with water from the Zerqa is 47 km² and lies on either side of the river when the Zerqa discharge is used to the full. In table 6.6 the irrigable area for the 1953 crop distribution pattern has been calculated. It is clear from these data that for this agricultural system water is not a restricting factor under normal weather conditions. Even in May when the water supply is most restricted, as much as 45 ha - almost the entire agricultural area - can be irrigated. During the driest year the first half of May was also the period with the lowest available water. This time, however, only 18 ha could be irrigated. This water stress lasted only a fortnight, however. In the previous fortnight as much as 42 ha could be irrigated while the fortnight following this stressed period received sufficient water to irrigate 35 ha. During June, however, there was a longer period of water shortage in which the amount of water available sufficed to irrigate 29 ha. It is likely that plants were able to cope with little water during a short period of water shortage like in the first half of May. Some crops, e.g. barley, are well suited to overcome periods of insufficient water. Farmers may even have decided to distribute the water unevenly over the crops, limiting the amount of water given to the more drought resistant crops in order to provide drought intolerant crops with more water. In this way people may have slightly increased the amount of land that could be irrigated slightly. Furthermore, the zor with its higher groundwater table requiring less irrigation may also have been cultivated, although this is only a small area.

6.2.4 Population density

Calculations on how many people can be fed usually focus on the amount of cereals that are cultivated. Cereals and especially wheat have been a major staple food for millennia and in many regions. Both ethnographic and historical data are available on how much wheat a person needs per year to survive on. Several authors have published data on how much grain was consumed per person in one year. Kramer, for example, provides data based on a literature study on wheat consumption for a range of pre-modern villages in Iran and Turkey (Kramer 1982: table 2.3). In the village she studied herself people consumed between 120-200 kg of wheat per person. In two villages in Turkey people consumed between 192 and 200 kg and 320 kg respectively. Villagers in Iran consumed circa 250, 183-438 and 120-225 kg per person in one year (Kramer 1982: 181, table 2.3). Schwartz also provides an overview of grain consumption per year of both ancient and ethnographic records (Schwartz 1994: table 2). Referring to other studies he states that Egyptian ration records list amounts between 219 and 365 kg, while Mesopotamian ration records report a wide range from 279 to 558 kg. Roman military records show that 365 kg was provided per person. Schwartz gives additional averages of 190-235, 200 and 278 kg per person per year (Schwartz 1994: table 2). Based on Middle Assyrian ration lists Wiggermann gives the most detailed data. He has calculated that an adult male received 234 kg, an adult female 149 kg and a child just 74 kg of grain per year (Wiggermann 2000: 186). Local southern Levantine data are provided by Broshi. He states that grain consumption in classical Athens, Rome and a small Egyptian village was very similar and averaged 200 kg per person per year. He states that modern Arab villagers in the hill country of Cisjordan have a very similar consumption of 183 kg per year and the same applies to villages in Egypte (206) and former Yugoslavia (181) (Broshi 1993a: 421). He rightly states that the actual production must have been higher as sowing seed, loss and some animal fodder need to be accounted for. He estimates these to amount to 50% of the total yearly consumption and concludes that 300 kg grain is required per person per year (Broshi 1993a: 421). Other modern local data stem from Dalman who relates that it has been calculated that early 20th century people in Cisjordan consumed 157 kg wheat per year while 15 kg was put to the side as sowing seed for the next year (Dalman 1933: 159). The aforementioned farmer in the Jezreel Valley who cultivated 200 du with his wife, two adult daughters and four children used 1110 kg of wheat for personal consumption. Taking four children to be the equivalent of 2 adults this family consumed 185 kg wheat per person per year (Dalman 1933: 158).

The amount of wheat needed to sustain a person furthermore depends on the amount of other food resources, especially meat, that is consumed. Pastoralists are known to be able to survive on a minimum of agricultural products, simply by relying on meat, milk and blood supplied by their flocks (Lewis 1987; Ginguld et al. 1997). The economy of the people in the Jordan Valley

undoubtedly included a pastoral component. However, it is unlikely that the animal products made up a large proportion of the diet in the pre-modern period as none of the early ethnographers have documented this. Furthermore, the maintenance of large flocks would have placed certain demands on society that have not been documented. These demands would include for example the presence of a large part of the community to herd the flocks elsewhere during summer when most natural pastures in the ghor have dried up. Smaller flocks can be fed on the plants that grow in the riverbed of the Zerqa and the zor where the groundwater table is higher, but these lands cannot sustain large flocks. Certain factions of society, like families that had many sheep and goats or wealthier families that could afford to buy more meat¹³⁹, may have consumed less wheat. However, these are in all likelihood exceptions and the normal family diet of the pre-modern period relied quite heavily on cereals.

From the data accumulated above it is apparent that the historical data are on average higher than the more reliable ethnographic observations. The ethnographic data average 218 kg per person per year, although, given the amount of sowing seed needed and standard amount of waste a total of 300 kg per person per year seems to be a workable average. This is also more or less in line with ancient historical sources. If 300 kg of wheat a year is taken as the yearly requirement per person one can calculate how many people can be fed with the spoils of the cultivated area. When the total area that can be cultivated with water from the Zerqa, i.e. 47 km², is considered; the area taken up by wheat is 32% of 47 km², i.e. 1504 ha. Ionides states that the Zerqa Triangle provides average wheat yields of 100 kg per du which is 1000 kg per ha (Ionides 1939: xxiii). This number agrees with data provided by Dalman who states that the Jezreel valley gives wheat yields of between 60 and 78 kg per du, while in the Jordan Valley very high yields can be gained amounting to as much as 100 times the sown quantity (Dalman 1933: 153, 155). In 1965 yields of irrigated cereals of 100 - 120 kg per du were achieved in the Jordan Valley as a whole, while non-irrigated wheat was only grown in the northernmost part of the Jordan Valley and yielded only 35 kg per du (Anonymous 1969b: 34, 35).

Assuming that each dunum can produce 100 kg of wheat and that one person needs 300 kg of wheat a year, it can be calculated that a maximum of *c.* 5000 people could live in the Zerqa Triangle if the total agricultural area could be supplied with sufficient irrigation water. Under the 1953 crop division an average year allowed only 45 ha to be fully irrigated, resulting in a maximum population of *c.* 4500 people. In a dry year the possibilities are much more restricted, however. Again, May is the most problematic month regarding the water supply. In a dry year there is only sufficient water to irrigate 18 km², which means only 1756 people can comfortably live in the area (see table 6.7). These conditions, however, only pertain for a fortnight and might only slightly reduce yields. To illustrate this, the second most critical month for wheat in a dry year still allowed a population of 3471 people to sustain itself. It is, furthermore, likely that farmers reacted to dry circumstances by abstaining from the planting of certain crops. The onset of a dry year will undoubtedly have been noticed already during late winter or spring, which afforded the possibility to decide against cultivating crops that grow in spring and/or summer. Watermelon would be a sensible crop to abandon as these were most likely not cultivated for personal use and they take up a large share of the water in the most critical month of May. The same applies to the second round of tomatoes to be cultivated in one year and the cultivation of sorghum. If these crops are not cultivated or the timing of several crops is shifted a much larger area can be cultivated.

Given the detailed data for 1953 options can be calculated very precisely. As the agricultural year is determined by the rainy season the year is split during the summer instead of in winter. Data from the winter of 1952 until September 1953 are used. The crop pattern is calculated using the monthly rainfall and Zerqa base flow data from 1952/3. In 1952 the winter rains arrived exceptionally late. Only in January 1953 did significant precipitation start. The months January, February and March received as much as 249 mm of the total 270 mm that fell that year, resulting in a very unbalanced rainfall distribution. The absence of precipitation in early winter, which apparently occurred in the Zerqa basin as a whole, had a clear effect on the Zerqa base flow that was

139 This phenomenon was documented by G. van der Kooij in 1972 and 1974 in the Syrian village of Hadidi (Van der Kooij 1976a: 91, 104; pers. comm. Van der Kooij).

much lower than normal in December 1952 (2.4 versus an average of 4.7 MCM) and January 1953 (4.7 versus 5.3 MCM). The high amount of precipitation between January and March, however, meant that the total precipitation was still slightly above average. The high mid to late winter precipitation is reflected in higher than average base flow in March (7.2 versus 5.9 MCM) and April (6.7 vs. 4.9 MCM). A heightened base flow of 1 MCM continued throughout the rainless summer, showing the delay in base flow very clearly. These monthly fluctuations will have been present throughout history, but cannot be accounted for. Under normal precipitation, like 1953, they are not very significant as water was not a critical factor. In 1952/3 water was not a critical factor and under the estimated cropping pattern the entire Zerqa Triangle could be cultivated. Yields for the entire ghor were documented to be 85 kg per dunum, which is lower than more specific data for the Zerqa Triangle albeit from the 1930's, i.e. 100 kg/du (Ionides 1939: xxiii; Anonymous 1969b: table E-66). This lower yield is probably the result of the incorporation of less fertile areas and the occasional cultivation of wheat under dry farming conditions elsewhere in the Jordan Valley (Anonymous 1969b: 35). Based on a wheat yield of 85 kg/du (which is probably too low) almost 4000 people could be sustained in the Zerqa Triangle.

From the population census it is known that 118 households existed in the Deir 'Allā district in 1951 (Layne 1984). On the 1953 aerial photograph 158 buildings were counted. Taking additional sheds and storage buildings of the Bedouin into account this fits quite well with the 118 households. The aerial photographs furthermore showed 393 black goat hair Bedouin tents. Adopting the modern household size of 6 people, which fits well with ethnographic data from other regions during that age, it can be calculated that in July 1953, 3066 people were living in the Zerqa Triangle (e.g. Kramer 1982: 5.3). This number lies well below the maximum carrying capacity in an average year as well as that of 1952/3. It is significantly higher than the carrying capacity of the most stressed fortnight of a dry year, but if this short episode is overcome by the abandoning or temporal shift of a summer crop the carrying capacity rises to above the number of people evidenced in 1952/3. It can, therefore, be concluded there was no significant stress in the Zerqa Triangle during the pre-modern period. Furthermore, average and wet years may well have allowed surplus production, especially if the focus lay more on cereal cultivation than on (summer) vegetables, which is likely for the earlier years of the 20th century. Tax requirements and interest rates of loans may however have greatly lowered the carrying capacity as part of the produce went elsewhere and the local inhabitants did not benefit from it.¹⁴⁰ Although a small proportion for tax or loan repayments is included in the general quantity of surplus needed, it is known that in this period interest rates were often very high and large fortunes were made by money lenders. This will not have affected everyone, however, and the exact quantities are unknown and therefore not incorporated in the calculation.

	irrigable km ²	No. persons
Average year	45	4514
Dry year	18	1756
1952/3	47 (total)	3995
Census/aerial photographs		3066

Table 6.7 Estimated irrigable area and potential maximum population for the early modern period supplemented with census data

¹⁴⁰ It has been estimated that a farmer in the first half of the 20th century spent 60% of his produce on land lease, tax, ploughing and animal fodder (Elmusa 1994: 34). Unfortunately, the relative weights of these aspects are not specified.

6.3 Mamluk agriculture and habitation stress

6.3.1 *Cane cultivation and sugar production*

Central to the agricultural system of the Mamluk period is the cultivation of sugar cane. Sugar cane (*saccharum*) is a tropical crop that was probably first cultivated for the production of sugar in India in the first century BC. From there the plant and the attached knowledge came to the Levant with the advent of Islam, along with other new crops and techniques (Watson 1981: 30). During these first centuries the techniques of cultivation and sugar production were known but only practised on a small-scale. The prerequisites of large-scale irrigation, a large labour force and a market willing to procure the sugar needed for the industry to develop were not met during the first few centuries. Around 1100, however, the European Crusaders encountered this plant and its sweet product and sugar cane cultivation took off (Peled 1999: 252). The demand for this sweet new product was large and the Crusaders played an active role in the founding and operation of new mills and refineries, for example at the excavated site of Horvat Manot in western Galilee (Stern 2001). In a short period of time the sugar industry greatly expanded, aided by Crusader laws that protected water rights (Peled 1999: 251). As the tropical sugar cane needs abundant water and high temperatures, sugar industry was mainly centred in the coastal plain and both the northern and southern Jordan Valley, e.g. at Jericho (Taha 2004). The middle part of the Jordan Valley was not part of the Crusader realm and these centuries were troubled times (Boas 1998: 140; LaGro 2002: 13). Sugar production may have been present but was not flourishing as in the rest of the country. In the Zerqa Triangle no evidence for sugar production of this age has been found. Here the first mills and refineries appear in the Ayyubid/ Mamluk period (see section 4.6). From this period onwards sugar production also took off in this region as is shown by the many sugar mills and sugar pot concentrations encountered in the survey. At the end of the Mamluk period the sugar production had ceased; 16th century Ottoman tax records lack any reference to sugar (Hütteroth and Abdulfattah 1977). In this section the characteristics of the cultivation of sugar cane and the production of sugar in the Zerqa Triangle will be investigated. Starting point is the archaeological remains discovered in the research area, aided by historical sources and evidence from the larger area where sugar was produced. The aim of this section is to elucidate the agricultural particularities and the societal implications that such an industrial cultivation of a tropical crop will have had on this region.

The Mamluk period is one of the periods in Levantine history from which a wealth of historical sources have survived. Any study of such a period should combine written records and archaeology. Walker argues persuasively that the study of Mamluk Jordan would benefit from this line of study, but warns that use of the abundant written sources from Egypt has biased the understanding of the situation in modern-day Jordan (Walker 2004: 120). Unfortunately, written records dealing with areas outside Egypt are rare, seldom published and hardly ever translated. The present section on such a well-documented historical period, therefore, by necessity relies mainly on the references and quotations of these primary sources by modern authors. Future opening up of more historical accounts and especially administrative and tax records will greatly aid the understanding of the archaeological remains of the sugar industry and the society in which it functioned.

6.3.2 *Ecological characteristics of sugar cane cultivation*

The tropical nature of sugar cane makes the southern Levant a marginal area for its cultivation resulting in a lower sugar content. Water and temperature are essential for a successful crop. Temperatures between 27°C and 38°C are ideal; below 21°C growth is greatly reduced, while sugar cane does not grow at all below 11 to 13°C (Galloway 1989: 14). Today, Deir 'Allā has a year round temperature of 23.6°C, which makes cane cultivation possible though conditions are not ideal. The modern mean monthly temperature of Deir 'Allā, depicted in figure 6.3, shows that growth will predominantly take place during the summer months from June to September. During the winter

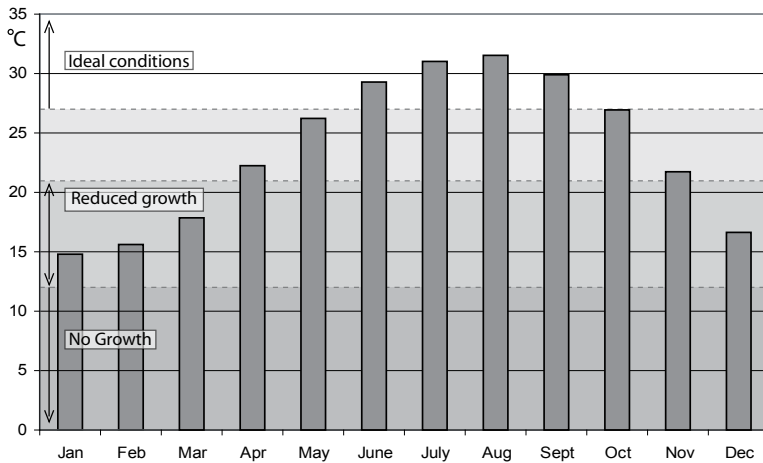


Figure 6.5 Modern mean monthly temperatures at Deir 'Allā with characteristics of sugar cane growth

months of December, January and February growth will be very limited. These monthly temperatures make sugar cane production in this area an undertaking characterized by seasonal peaks of activity.

Another vital precondition for the cultivation of sugar cane is water. In order to grow the cane needs a permanent abundance of water, especially during the normally hot and dry summer months. It is clear that in the Levant the necessary water had to be provided by means of irrigation. Cultivation could therefore only take place in irrigable areas. The Jordan Valley and especially areas neighbouring perennial wadis or rivers coming down from the plateau, like the Zerqa, were ideally situated. The irrigation system of the Zerqa Triangle as described in the previous chapter perfectly suited the needs of the sugar industry. The year-round water availability combined with some of the highest (winter) temperatures in the region allowed the Jordan Valley to become an area of large-scale industrial sugar production.

The demand on soils needed for sugar cane cultivation are less stringent. Arab writers speak of good soils or best quality land, e.g. al-Makhzumi (Tsugitaka 1997: 216). Modern studies, however, show that soils are not very determinative and that sugar cane can be grown on a wide range of soil types. The growing of sugar cane, however, heavily deteriorates the fertility of the soil making the application of fertilizer necessary (Galloway 1989: 15). Several Mamluk reports state that after sugar cane the land either had to be planted with different crops or left fallow, for as many as four years according to al-Makhzumi (Tsugitaka 1997: 216). Additional manuring was also practised, either by direct application onto the land or through dissolving the manure in irrigation water (Galloway 1989: 36).

If the prerequisites of temperature and water are met with, sugar cane can be grown by inserting a part of the stem of a mature cane in the ground. Sugar cane consists of several nodes or joints divided by parts of stem or so-called internodes (Galloway 1989: 13). When covered with soil each node will produce a new stem. Planting these stem parts is labour intensive, but does not need to be carried out each year. If the stems containing one or more nodes that remain after a crop is harvested are covered again with soil a new crop can be grown from them. This second crop is called a ratoon crop (Galloway 1989: 13). With every successive ratoon crop, however, the sugar content of the cane decreases. When the profit on the sugar is lower than the cost of replanting, a field is ploughed and another so-called plant crop is grown again. The maturing of plant cane takes 12 to 18 months, considerably longer than that of ratoon cane (Galloway 1989: 13). Historical sources report a growing period of ten months depending on the local circumstances (Tsugitaka 1997: 217).

In a detailed description on sugar cultivation in his hometown of Qus (Egypt), al-Nuwayri describes the steps taken from the first ploughing until the harvesting of the crop. Although this description is based on Egypt it can be applied along general lines to the Jordan Valley as Nuwayri himself already states: ‘this explanation is about cultivation in the province of Qus, but it is not much different from that of other provinces’ (Tsugitaka 1997: 216).

In Barmahat (25 February – 26 March), after the weeded fields are cultivated six times by large-sized ploughs (Muqalqila), and smoothed by harrows after six more ploughings, sugar cane with two joints is planted by throwing it into ridged fields. The second year sugar cane is irrigated after burning the old stubble. When seed leaves grow, soil loosening is done to weed the fields, which continues until the end of Bashnas (26 April – 25 May). During this period the plants are to be irrigated at intervals of fixed days, 28 times in total, every time for 2-3 hours. The second year harvest in Kibak (27 November – 26 December) and the first year harvest in Tuba (27 December – 25 January) are reaped and carried on horses and donkeys to a pressing factory, where the points and roots are cut off by a large sword (Tsugitaka 1997: 216).

The main difference between Jordan Valley and Egyptian agriculture is the type of irrigation. Egypt relied on the yearly flooding of the Nile. An amount of water was trapped in basins to irrigate the fields during the year, but in contrast to the Zerqa irrigation system water was not permanently available. Notwithstanding the less continuous water supply in Egypt it is clear that the Mamluks were aware of the importance of regularly watering the sugar cane during the early part of the growing season as Nuwayri states that irrigation was carried out 28 times until the end of May. The possibility of irrigation during the summer months will undoubtedly have been exploited in the Jordan Valley. This will probably have increased sugar yields.

The extensive tillage the fields needed before sugar cane could be planted is one of the aspects that makes cane cultivation very labour intensive. Nuwayri writes that a field has to be twice ploughed six times. The word he uses for large-scale plough, *muqalqila*, refers to a new kind of plough especially developed for cane agriculture. It was wider and could plough deeper than the old ploughs. It probably appeared in the mid 13th century AD. The furrows in which the cane was planted were probably also made by this plough (Tsugitaka 1997: 207). Makrizi, however, also describing cane cultivation at Qus, writes that ‘holes are made with the spade and in each is placed two pieces of cane’ (Deerr 1949/50: 89).¹⁴¹ Each piece of cane has four joints and Deerr mentions that this is in line with modern practice (Deerr 1949/50: 89). Makrizi also states that the land is divided into small squares with canals leading the water to each square (Deerr 1949/50: 89). Today this type of irrigation is commonly practised for crops like *malukhiyah*, a sort of spinach, and these squares are used as nursery beds.

Makrizi writes that with the first leaves of the sugar cane the weeds also appear and ‘weeding is continued without stopping until the cane is vigorous, resistant and thick’ (Deerr 1949/50: 89). This weeding is done by loosening the soil and is a very essential and time-consuming task. One of the main problems of sugar cane is its susceptibility to pests, rodents and insects (Galloway 1989: 15). The main solution to this problem open to the Mamluk cultivators will have been the permanent cleaning of the fields. Two ways of preventing rodents and insects are mentioned. To counteract the feared borers that bore themselves into the canes, both Makrizi and Nuwayri describe that tar was added to the irrigation water by installing wooden boxes containing a mix of water and tar in the canals, which slowly dripped through holes in the bottom into the irrigation channel (Deerr 1949/50: 89,90). Another option was the building of small overhanging walls around the fields that caused a mouse climbing up to bump his head and fall down (Deerr 1949/50: 90). Nuwayri describes the damage mice had done previously by referring to a plaque that occurred in 1174 when the mice caused 100 feddan of sugar cane only to yield 80 moulds of sugar (Deerr 1949/50: 90).

The harvesting of the cane occurred in different months depending on whether it was a plant or ratoon crop. Up to this day harvesting is usually done by hand and therefore labour intensive. In this respect sugar cultivation has changed little from Mamluk times onwards. When the crop

141 The accounts of Makrizi (1364-1442) and Nuwayri (1380-1432) are very similar and they are probably based on the same source (Deerr 1949/50: 88).

harvested is a plant crop, the stem remains in the soil. Everything on the surface is burnt, according to Makrizi, and then the ratoon crop is watered, hoed and weeded in the same way as plant cane (Deerr 1949/50: 89). The first crop is called chiefs and the second khalifs (Deerr 1949/50: 89). Given the consistent lack of a name for a third crop among all writers it can be assumed only one ratoon crop was grown after a plant crop. Makrizi also describes the activities that had to be performed in November before the harvesting and pressing of the cane started. This included the selling of old and sick animals and the purchase of new ones, the buying of reeds and straw for the boiling house and the production of the sugar pottery (Deerr 1949/50: 90). In December the crushing and boiling of cane truly started and the harvested lands were planted anew with cane and colocasia according to Makrizi (Deerr 1949/50: 90).¹⁴²

6.3.3 Archaeobotanical evidence

In the Zerqa Triangle several pottery concentrations pointing to sugar production have been found. Excavations at Tell 'Abū Sarbūt have revealed a few phases during which a large building existed that harboured many sugar pottery sherds. These phases were followed by phases in which a village was present (De Haas et al. 1989, 1992; Steiner 2008). Botanical samples have been collected in these excavations and analyzed (Grootveld 2000). One of the aims of this research was to detect remains of sugar cane. This was unfortunately unsuccessful as sugar cane rarely leaves any botanical macro remains like burned seeds. Nor can phytolith research provide any certainty because sugar cane cannot be identified more accurately than to its general family of *Panicoideae*. Sugar cane can therefore not be evidenced archaeobotanically. However, other botanical macro-remains were present, mainly in the form of charred seeds. Unfortunately the number of samples from the strata of the sugar building is rather limited; only four samples stemmed from this phase D (Grootveld 2008: table 1). Two samples were collected from a floor, one stemmed from mudbrick debris and the fourth from collapsed remains of an oven (Grootveld 2008: table 1). It is therefore impossible to interpret the relative number of species discovered in the samples. It is assumed that the crops discovered were cultivated in the vicinity of the tell irrespective of whether they stemmed from the sugar related building or from the village. Although the sugar related building may not have had an agricultural character it is unlikely that crops were imported from far away. It is therefore assumed that presence in the tell reflects cultivation in the surrounding fields, which does of course not apply to absence of a crop.

Apart from several types of weeds, which might well have been eaten or used otherwise, cultivars were present. These include several types of cereals, i.e. bread or hard wheat (*Triticum aestivum/durum*), emmer wheat (*Triticum turgidum* ssp. *dicoccon*), einkorn (*Triticum monococcum*), barley (*Hordeum vulgare*), rye (*Secale cereale*), sorghum (*Sorghum bicolor*) and millet (*Panicum*) (see table 6.8) (Grootveld 2000: table 2). *Triticum turgidum* ssp. *durum* or hard wheat and *Triticum aestivum* or bread wheat were among the earliest cultivars in the region (Zohary and Hopf 2000: 50, 57). Both types of wheat were the preferred cereal for bread making. Both einkorn and emmer wheat were found in only one sample and were mainly used for porridge and flat bread as their rising capacity is much lower than that of *Triticum aestivum/durum*. Since the Roman period both had also been widely used as animal fodder (Zohary and Hopf 2000: 35). Sorghum was introduced in the Levant at a late stage, i.e. in the Roman period or even later (Zohary and Hopf 2000: 89, 90). Sorghum thrives under warm conditions and was cultivated as a summer crop in the Levant. Barley has been common in the Near East since the Neolithic. It is more resistant to salty conditions and drought than bread wheat and serves both as animal fodder and for human consumption (Zohary and Hopf 2000: 59). Rye is also part of the diet of both man and animals. It has a good drought resistance and can be grown on poor acidic and sandy soils (Zohary and Hopf 2000: 69). Millet is a very resistant crop. It can be grown under difficult circumstances, like 'intense heat, poor soils and severe droughts' (Zohary and Hopf 2000: 83). It has a very short lifecycle of only 60 to 90 days, which makes is

142 The term colocasia is most likely an interpretation by the translator of *Colocassia esculenta*, the latin taxonomic name for an edible tropical plant native to Polynesia and SE Asia.

possible to grow this crop without irrigation in areas with a short wet season like the Jordan Valley (Zohary and Hopf 2000: 83). The grains are rich in protein and are either boiled like rice or ground to make porridge (Zohary and Hopf 2000: 83).

Few vegetables have been found, which is mainly a result of the poor conservation characteristics of vegetables and their limited chances of becoming charred. Three seeds of beet (*Beta vulgaris*) have been found (Grootveld 2000: 15, 2008: table 1). Although beet has been cultivated as a vegetable since Roman times, it is more likely that these three seeds originate from wild plants that occur regularly in fields of this region (Zohary and Hopf 2000: 201; Cappers 2005/2006: 433).¹⁴³ Bitter vetch (*Vicia ervilia*) is a grain legume that, like barley, can grow on poor and slightly saline soils. It has been grown since the Neolithic in the Near East, but its bitter taste and the fact that it is poisonous to humans if consumed untreated has meant that since the Roman period it was primarily used as animal fodder. Only in times of famine is bitter vetch eaten by humans (Zohary and Hopf 2000: 116). As fodder bitter vetch can only be fed to ruminants, because it is poisonous to other species. In sheep and cattle it should, however, not make up more than 25% of the diet. The pea (*Pisum sativum*) is one of the most commonly found pulses in excavations.¹⁴⁴ It was domesticated as early as the Neolithic and occurs regularly in for example EBA contexts (see section 7.6). It is well adapted to the warm Mediterranean climate and its seeds have a protein value of 22% (Zohary and Hopf 2000: 101). The only fruit that was found is the fig (*Ficus carica*). The fig is a typical Mediterranean plant and was among the earliest cultivars in the Near East, possibly even pre-dating the domestication of cereals as was attested at several early Neolithic sites including some in the Jordan Valley (Kislev et al. 2006: 1372).

Crops like bread and hard wheat, barley, pea, bitter vetch and fig are very common in excavations in this area. In the IA II excavations of both Tell Deir 'Allā and the 'Settling the Steppe' excavations of Tell 'Ammata, Tell al-'Adliyyeh and Tell Dāmiyah these are the crops that are most often present (see following section) (Grootveld in prep.). These crops can all be regarded as typical of the Mediterranean diet since at least the Neolithic period. More exceptional finds are millet and rye. Millet has not been found in samples of the Settling the Steppe excavations analyzed by Grootveld, but Neef states that it is present in the botanical remains of Tell Deir 'Allā phase VI, 7th century, onwards (Neef 1989: table 2). Millet is one of crops that can endure heat, drought and salinity extremely well. The short growing cycle of millet might very well have allowed it to be grown as a dry-farming crop during the wet winter season. Millet was, however, only found in a single sample, but in a relatively large quantity of 95 grains. Rye was also only present in one sample and this sample contained just the one grain, which might actually have been wild.

Part of the annual agricultural crops comprises to the so-called Fabaceae or Leguminosae, e.g. pea and bitter vetch. This group of plants is today often cultivated as a rotation crop with wheat, for example, as they are natural fertilizers. Cultivating members of the Fabaceae heightens the level of nitrogen in the soil thereby counteracting soil exhaustion. Other members of this family of Fabaceae are found among the weeds, i.e. *Astragalus*, *Medicago*, *Astroides*, *Lotus*, and *Hippocrepis*. These weeds are, however, only found in small quantities and there are no indications that they were purposely grown as green manure (Grootveld 2000: table 1).

To place these four samples found in the actual sugar related building in a broader context the other Mamluk samples from Tell 'Abū Sarbūt are included here as well. Grootveld analyzed eleven samples in her thesis and included a table containing twelve samples analyzed by Neef (Grootveld 2000: table 1). No numbers of seeds counted have been given for Neef's samples, only a presence or absence of a crop is recorded. Although the number of seeds discovered in these samples is still very limited, the increase of the number of samples provides a better insight into Mamluk agriculture. It is clear from these combined results that bread wheat and barley are by far the most common crops grown in the Zerqa triangle during the Mamluk period. Fig is also present in a large share of the samples. One fig, however, contains hundreds of seeds. A large number of seeds

143 In modern Egypt beet is one of the species that frequently occurs in both grain samples and threshing remains (Cappers 2005/2006: 433).

144 This may in some cases be a result of too large a mesh size that did not retain smaller pulses like lentils.

Annual agricultural crops	Phase D		Grootveld		Neef	total samples (n = 23)
	no. samples	no. seeds	no. samples	no seeds	no. samples	
<i>Triticum aestivum/durum</i> (Bread/hard wheat)	2	14	4	46	8	12
<i>Triticum aestivum/durum internodium</i>	-	-	3	180	9	12
<i>Triticum monococcum</i> (Einkorn)	1	5	1	5	-	1
<i>Triticum cf dicoccon</i> (cf Emmer)	1	15	1	15	-	1
<i>Triticum</i> (Wheat)	2	15	5	65	-	5
<i>Hordeum vulgare</i> (Barley)	1	600	3	715	8	11
<i>Hordeum internodium</i>	2	37	7	88	7	14
<i>Secale cereale</i> (Rye)	1	1	1	1	-	1
<i>Panicum</i> (Millet)	1	95	1	95	2	3
<i>Sorghum bicolor</i> (Sorghum)	-	-	1	5	-	1
<i>Beta vulgaris</i> (Beet)	1	3	2	6	-	2
<i>Pisum sativum</i> (Pea)	1	1	1	1	-	1
<i>Lens culinaris</i> (Lentil)	-	-	-	-	1	1
<i>Vicia ervillia</i> (Bitter vetch)	1	4	1	4	-	1
<i>Coriandrum sativum</i> (Coriander)	-	-	-	-	1	1

Perennial agricultural crops						

<i>Vitis vinifera</i> (Grape)	-	-	1	2	-	1
<i>Ficus carica</i> (Fig)	2	2	7	13	5	12
<i>Prunus insititia</i> (Damson)	-	-	-	-	1	1
<i>Punica granatum</i> (Pomegranate)	-	-	2	28	1	3

Wild crops						

<i>Zizyphus spina-christi</i> (Christ's thorn)	-	-	2	6	6	8

Table 6.8 The number of samples containing a specific crop and the total number of seeds counted by Grootveld and Neef for all Mamluk of Tell 'Abū Sarbūt (based on tables in Grootveld (2000)). NB: phase D samples are also incorporated in columns three and four.

may, therefore, only represent one fig. In these samples the number of seeds is remarkably low, but seeds are very consistently present in half of the samples. This does point to a more or less continuous consumption of figs during the Mamluk period.

What becomes clear when the samples of the later phases are compared to the samples from the sugar industry phases is that the range of cultivated crops other than sugar cane did not in essence change. These crops were probably typical for the local subsistence of the villagers. Most crops, like the cereals, pulses and fruits, were also common during the pre-modern periods and in the Iron Age samples (see previous and next sections). These crops are typical for Mediterranean subsistence agriculture and are seldom exported. Cereals are too bulky and relatively cheap to make overland transport cost effective. There are no indications that other crops like the pulses and legumes were traded in this period. It can therefore be concluded that crops represent the standard subsistence crops cultivated by the Mamluk farmers at Tell 'Abū Sarbūt.

The early Ottoman period, culturally a direct continuation from the Mamluk period, provides additional data on agriculture that is not biased towards the better resistant crops. Tax records have survived from the decades immediately following the Mamluk period. These records, dating between 1525/6 and 1596/7 AD, show which crops of four villages in the Zerqa Triangle were taxed (Hütteroth and Abdulfattah 1977).

Table 6.9 shows the amount of akçe paid by the villages as tax. In the 'Ajlun province, to which the Zerqa Triangle belongs, tax constituted 25% of most agricultural crops (Hütteroth and Abdulfattah 1977: 77). It is therefore known that the total amount of wheat harvested in Deir 'Allā had a value of 11200 akçe. In the case of wheat it is known that this was measured in gararas or sacks and that one sack cost 140 akçe in 'Ajlun (Hütteroth and Abdulfattah 1977: 68). From this it follows that the village of Deir 'Allā produced 80 sacks of wheat. Unfortunately, this kind of data is not available for the other crops and the actual size of a sack is also unknown.

CARRYING CAPACITY AND HABITATION INTENSITY

	Deir 'Allā	Suwayr	Abisa	Mahdata
Family heads	46	17	12	32
Bachelors	4	-	-	-
Moslem	All	All	All	All
Wheat	2800	1400	2100	1400
Barley	2400	800	800	1600
Summer crops	-	1200	-	-
Olive	-	120	-	-
Sesame	360	1800	720	340
Vineyard	-	-	-	-
Fruit trees	-	-	-	-
Other trees	-	-	-	-
Cotton	180	-	-	-
Almond	-	-	-	-
Vegetable/fruit garden	-	-	-	-
Grape syrup	-	-	-	-
Indigo	9000	-	-	-
? Unreadable	3000	-	-	360
Rice	-	-	-	-
Occasional revenues	200	-	280	440
Goats/beehives	260	-	100	-
Water buffaloes	400	-	500	200
Oil/syrup presses	-	-	-	80
Pasture, winter grass lands	-	-	-	-
Market toll, administration	-	-	-	-
Water mill	80	180	-	-
Total	10500	5500	4500	5120

Table 6.9 Tax paid in akçe by villages in the research area (after Hütteroth and Abdulfattah 1977: 167-169) Also note that certain taxable crops are absent.

From the taxed crops it is clear that cereals were as important in the villages as the botanical remains suggest. The tax records further show the presence of sesame. Sesame is a crop with good preservation characteristics that will probably turn up in the archaeological record if it has been present. Sesame seeds were present in several samples from Iron Age Tell Deir 'Allā (Neef 1989: 36). Taxed crops that have poor preservation qualities and that will not have survived are cotton, indigo and probably a large share of the summer crops as these are often mainly vegetables. Indigo is a cash crop used for the manufacturing of dyes that has similar characteristics to sugar cane. It is a tropical crop introduced during the 8th century AD, which requires a lot of water and sun (Watson 1981: 30). Historical references for indigo cultivation in the Jordan Valley date back to 10th century AD and continue throughout the 12th, 13th and 14th centuries AD (Balfour-Paul 1997: 19). It may even have been grown in alternation with sugar cane as indigo is a green manure that improves nitrogen levels in the soil. Apart from a few sherds with holes that LaGro suggests might be linked to indigo processing, there are no indications for indigo cultivation in the Zerqa Triangle in the Mamluk period (LaGro 2002: 52).

Crops that were only cultivated in small quantities will not have been taxed. The fig tree that was present in the vicinity of Mamluk Tell 'Abū Sarbūt may well have survived into the Early Ottoman period, but if it was a single tree it will not appear in the tax records. The same applies to small vegetable gardens. The similarities between both data and chronological proximity demonstrate that tax records and archaeobotanical remains are complementary and should be used in combination.

6.3.4 Water demands and population density

Using the information described in the previous sections a cropping pattern can be deduced that might approach that of the Zerqa Triangle during the Mamluk period. Given the absence of reliable numerical data any deduced cropping pattern will be highly tentative. On the basis of the available evidence an estimation of the crop proportions was reached. Alternative estimates can be argued for and will give slightly different results (see below).

Sugar cane was probably the major crop or it was at least cultivated to the greatest capacity of the valley. Based on the historical records it has been assumed that sugar cane was grown for two years after which the land lay fallow or was cultivated with other crops for four years. Assuming that sugar cane was planted to the maximum extent this pattern leads to in the conclusion that a system was used in which 30% of the land was planted with sugar cane, 30% lay fallow and the remaining 40% was used for the cultivation of the food supplies of the inhabitants. The number of samples in which wheat and barley were present together with ethnohistorical and period specific evidence suggests that these cereals may have been cultivated in equal amounts. Both cereal crops have been estimated to form 16% of the total agricultural produce. Other cereals have been found in smaller quantities of which the summer crop sorghum was one example. The land occupied by this cereal has been established at 3%. The remaining 5% of the land is divided over pulses (2%), vegetables (2%) and fruit (1%). The pulses consist of lentil and broad bean, estimated to be present in equal quantities. The vegetables possibly included beets, but other types are likely to have been cultivated of which no traces have survived. The archaeobotanical records show that grape, fig and pomegranate were present. However, crop coefficients are only available for grape.

In table 6.10 the calculated water demands per fortnight for this cropping system are shown. The modern climatic data are taken as basis. Several climatic proxy data argue for a wetter period around 1100 or 1200 AD, so at the advent of intensive sugar production and just before the Mamluk period (Enzel et al. 2003: fig. 2a; Rosen 2007: 90). However, after this moister period it became drier again. It is assumed that the climate of the Mamluk period was slightly wetter or similar to that of today. For this reason the modern data on rainfall, Zerqa discharge and potential evapotranspiration are used, although the possibilities for Mamluk agriculture may have been slightly greater as a result of the additional rainfall. It is clear that in terms of average water availability pretty much the entire agricultural area of the Zerqa Triangle can be irrigated, i.e. 45 km². The area that can be irrigated in a dry year is, however, much smaller. Compared to the pre-modern system the most problematic period falls somewhat later, i.e. in June. This is due to the sugar cane that needs year-round watering. Thus the restrictive month for wheat differs from that of sugar cane. In normal years there is always more water than needed during the period of wheat growth. Given that 16% of the total 47 km² has been estimated to have been used for wheat and assuming that average wheat yields of the 1930's are also applicable for the Mamluk period, a total yield of 725,000 kg of wheat could be attained in the Zerqa Triangle per year. Taking a wheat supply of 300 kg as the basic yearly requirement per person, a maximum of *c.* 2500 people could have been fed under the proposed Mamluk cropping system which focussed heavily on sugar cane.¹⁴⁵ This is, however, the maximum carrying capacity of the region. The agricultural potential will have been much lower during dry years. Taking the driest year of the almost 40 year time period for which there are detailed data as a basis for calculation the potential yield is much lower. During the period in which wheat grew the driest month allowed the cultivation of 21 km². Only 1100 people could be fed with the wheat that could be grown in this smaller area. Admittedly, these dry conditions only prevailed for a fortnight during the last development phase of the crop. It is likely that the crops could cope with a less than optimal amount of water for a short period. Furthermore, if the crop yield was indeed reduced during one year as a result of extremely dry conditions people were probably able to overcome drastic food shortages by reducing rations, using stored cereal supplies or shifting consumption to cereal types normally only fed to animals, like vetches or barley. Mud brick lined storage silos, especially when they are located on tell sites where compacted and dry soils prevail, can store cereals for a few years when they remain sealed. The practice of large-

145 Although undoubtedly present, the proportion of animal products in the diet was probably relatively small based on the archaeozoological remains that will be discussed in section 7.3.

IA IIa/b	Oct		Nov		Dec		Jan		Feb		Mrt		Apr		May		Jun		Jul		Aug		Sep		
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
ha	0.3	1.544	1.530	1.015	0.435	0.059	0.060	-0.131	-0.143	0.008	0.008	-0.006	0.000	1.220	1.230	1.531	1.530	2.587	2.588	2.438	2.438	2.250	2.250	1.948	1.950
sugar cane	0.3	1.544	1.530	1.015	0.435	0.059	0.060	-0.131	-0.143	0.008	0.008	-0.006	0.000	1.220	1.230	1.531	1.530	2.587	2.588	2.438	2.438	2.250	2.250	1.948	1.950
wheat	0.16					0.009	0.010	-0.015	-0.021	0.069	0.069	0.277	0.280	0.739	0.964	1.181	0.400								
barley	0.16							-0.025	-0.013	-0.014	-0.003	0.027	0.063	0.144	0.026	0.037									
sorghum	0.03														0.041	0.134	0.134	0.207	0.207	0.195	0.068	0.063			
lentil	0.01							-0.008	-0.004	-0.005	0.010	0.010	0.024	-0.004	0.013										
bean	0.01							-0.005	-0.005	-0.003	-0.004	0.011	0.026	0.011											
vegetables	0.02							0.001	0.001	-0.002	-0.003	0.009	0.017	0.045	0.046	0.098	0.099								
fruit (grape)	0.01	0.016	0.016	0.003										0.013	0.014	0.038	0.038	0.041	0.041	0.055	0.055	0.051	0.027	0.023	0.023
total mm/day	1.560	1.546	1.018	0.435	0.069	0.071	0.000	0.000	0.106	0.140	0.435	0.399	2.227	2.372	2.920	2.102	2.835	2.836	2.688	2.561	2.364	2.277	1.971	1.973	
Demand m3/day	15.598	15.458	10.184	4.350	0.693	0.708	0.000	0.000	1.067	1.403	4.349	3.990	22.266	23.723	29.198	21.015	28.348	28.359	26.878	25.610	23.640	22.770	19.713	19.734	
Base flow (mm/s)	1.4	1.4	1.6	1.6	1.8	1.8	2.0	2.0	2.0	2.0	2.2	2.2	2.2	2.0	2.0	1.8	1.8	1.6	1.6	1.4	1.4	1.3	1.3	1.3	
Irrigatable km2	78	78	136	318	2246	2197	infinite	infinite	1636	1232	437	476	476	78	73	53	74	49	49	45	47	48	49	57	
Base flow bad year	0.8	0.8	1.2	1.2	1.2	1.2	1	1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	0.7	0.7	0.4	0.4	0.4	0.7	0.7	0.7	0.7	
Irrigatable km2	44	45	102	238	1497	1464	infinite	infinite	900	678	238	260	47	44	44	21	29	12	12	23	24	26	27	31	

Table 6.10 Irrigation potential for the deduced Mamluk cropping system

scale grain storage in silos on tells is attested for several periods at different tells in the region (e.g. Yassine 1983: 498; Van der Kooij 2001: table 1). The ability to withstand water shortages also depends on the choices made by the farmers in times of drought. When there was a water shortage, was the available water used to irrigate the food crops and hence guarantee a comfortable subsistence or did they choose, or more likely were they compelled, to use the water to secure the yield of the case crop, i.e. sugar cane?

It is extremely difficult to come to a population estimate of the Zerqa Triangle in the Mamluk period. In the irrigation zone of the Zerqa four sites have been identified as containing Mamluk period remains, i.e. Tell 'Abū Sarbūt, Tell Abu Ghourdan, 'Abū al-N'eim and Tell Al-Dōlānī to the south of the Zerqa. Tell Ammata was also occupied during the Mamluk period but this tell is located on the Wādī Rajīb instead of the Wādī Zerqa. Tell 'Abū Sarbūt and Tell Abu Ghourdan have both been excavated, but Tell Abu Ghourdan yielded only courtyard layers (Franken and Kalsbeek 1975). The later phases of Tell 'Abū Sarbūt revealed village occupation, but as this was a relatively small-scale excavation project only a small part of the settlement is known (De Haas et al. 1989, 1992; Steiner 1997, 2008). It is uncertain whether the entire tell was occupied and whether the village was densely settled or not. The fact that the admittedly small excavations at Tell Abu Ghourdan only produced occupation layers might suggest that village occupation was not very dense.

The only way to attain some indication of the general size of the population is to measure the sizes of the sites and provide a very general estimate of how many people could inhabit that area. This, however, also poses problems. Tell 'Abū al-N'eim is a very flat tell which is now completely overbuilt. The size is therefore simply assumed from a rise visible on the 1:10.000 contour map. This is obviously not very precise. Tell Al-Dōlānī seems to be located on a natural hill, which makes the demarcation of its boundaries equally problematic. However, from these very imprecise measurements it follows that Tell 'Abū Sarbūt and 'Abū al-N'eim occupy *c.* 1.2 ha, while Tell al-Dōlānī covers 0.6 ha and Abu Ghourdan only 0.2 ha. The calculated maximum population that could live in this area under normal rainfall was 2500 decreasing to only 1100 as a minimum in a dry year. Divided over the total occupied area this gives an average of *c.* 780 to 345 people per hectare. A total of 780 people living on one hectare is very high and not likely during the Mamluk period in this area. Given the evidence of quite a large courtyard at Tell Abu Ghourdan 345 people per hectare seems still quite high, though possible (see next section). It is, however, more likely that the average number of people per hectare in Mamluk settlements was lower than that number. This means that it is unlikely, even in a dry year, that the carrying capacity was ever exceeded and that people had to cope with a food crisis. However, the exhaustive nature of the sugar cane may have resulted in lower grain yields. This may have meant that during dry years the carrying capacity was reached sooner and Mamluk inhabitants of the Zerqa Triangle were familiar with food shortages. These lower yields are, however, speculative and their impact cannot be measured in this study.

6.4 Iron Age agriculture and habitation stress

Using motorized pump and drip irrigation, today multiple harvests can be gained each year in the Zerqa Triangle. These modern techniques were of course not at the disposal of Iron Age people. The farming techniques used at the start of this century were, however, more akin to those of the Iron Age. Ploughs consisted of simple animal drawn wooden implements, which are still used quite regularly today. No chemical fertilizers existed, nor any motorized equipment. Given this similarity in agricultural techniques and considering that farmers from both periods were cultivating the same regions it will be attempted to calculate a possible carrying capacity of the Zerqa Triangle under the IA agricultural system. This potential population density will then be compared to the possible number of people that inhabited the Zerqa Triangle during the IA IIa/b period. The IA IIa/b and in specifically the 9th century BC was chosen as the basis of these calculations for several reasons. First of all, this is one of the periods during the IA for which most information is available. Especially Tell Deir 'Allā phase IX that had been destroyed by an earthquake and subsequent fire and was extensively excavated has revealed a large amount of information (e.g.

Van der Kooij and Ibrahim 1989; Van der Kooij 2002). Furthermore, most sites excavated within the scope of the Settling the Steppe-project by Petit yielded remains from this timeframe (Petit in prep.). Apart from the large amount of information the IA IIa/b was chosen because it was, together with the 7th century, one of the most intensively occupied periods (Petit in prep.). During this time the majority of all IA sites was occupied. Petit discovered IA IIa/b remains at as many as 19 tell sites in the research area. Furthermore, the excavated tells revealed quite densely built villages in contrast to several other phases for which only very scant architectural remains were discovered (Van der Kooij 2001).

6.4.1 Iron Age IIa/b irrigation agriculture

The excavated IA IIa/b tells have all yielded remains that indicate that these tells were mainly small rural villages. As will be discussed below, none of the sites is of a large size. Furthermore, stored agricultural products have been discovered at tells with sufficiently large excavation areas (Yassine 1983; Neef 1989; Van der Kooij 2002). Although a few features point to a more central function of the larger tells like Tell Deir 'Allā and Tell al-Mazār, these tells do not the village level (see next chapter). Although some storage occurred, it was not on such a scale as to go beyond simple food storage, some surplus to overcome lean years and sowing seeds for the next year. There is no evidence of large-scale trade in surplus products, although this may have occurred on such a small scale as to leave few traces. In all it can be concluded that the IA IIa/b villages in the Zerqa Triangle were principally engaged in small-scale subsistence farming.

In table 6.11 the crops that have been discovered in IA IIa/b layers excavated at Tell Deir 'Allā, Ammata, Tell al-'Adliyyeh and Tell Dāmiyah have been grouped together to gain a sample of some size. It is immediately noticeable that large quantities of wheat, barley, flax, fenugreek and cumin have been found. These high seed numbers are, however, mainly attributable to a few stores of these products discovered in phase IX of Tell Deir 'Allā (Neef 1989: table 2). These stores, which contain up to 20,000 wheat grains or 25,000 flax seeds, together with the differential seed production of crops distort the frequency. However, the high number of samples in which remains of the same crops have been found and the presence on all tells show that their high number is not entirely a result of these biases. Wheat was present in the largest number of samples, while barley was found in only half that number. Both crops were discovered on all excavated tells. Emmer wheat was found in a much lower number of samples and only at two of the four tells, which suggests that it formed a less important component of the IA IIa/b diet. Regarding the pulses, bitter vetch formed the largest category. It was discovered at all sites except Tell Dāmiyah. Bitter vetch is poisonous, but by soaking it in water it can be made suitable for human consumption although its bitter taste has meant that it is primarily eaten in times of great stress (Zohary and Hopf 2000: 116). In small quantities it can be used as animal fodder. A common pulse present in the Levantine diet since the Neolithic is the lentil. In the IA IIa/b it most likely formed an important part of the human diet given its occurrence in 15 samples from all four settlements irrespective of its poorer preservation qualities compared to many other crops presented in table 6.11. Other types of pulses probably played a less significant role in human consumption and were not found on all sites. Flax was already noted for its high number of seeds. This is mainly due to two stores in phase IX of Tell Deir 'Allā where 25,000 and 19,900 seeds respectively were discovered. Furthermore, one plant produces many seeds greatly increasing the number of seeds discovered per sample. Nevertheless, flax is present in 36 samples distributed over all tells except Tell Dāmiyah and together with the special stores this suggests it was cultivated in significant quantities for either fibre or oil production. Another crop that can be used for oil is sesame. The earliest occurrence of proper sesame in the southern Levant stems from Tell Deir 'Allā phase IX (Neef 1989: table 2). At Tell Deir 'Allā 191 seeds have been discovered distributed over 9 samples, while the other sites have yielded no remains of this plant (Neef 1989: table 2). Several herbs, like coriander, cumin and fenugreek, have been found in sometimes large quantities in Tell Deir 'Allā phase IX. At the other sites only small quantities of coriander were found. This difference is probably due to the good preservation and sudden destruction of Tell Deir 'Allā phase IX. It provides an intriguing insight into cooking and especially flavouring of dishes during the IA in the Zerqa Triangle.

Furthermore, the products of several different types of fruit trees have also been attested. By far the largest group of remains was formed by grape pips. Grape pips are quite hardy and several pips occur in one grape, yet they occur in a wide range of samples distributed over all excavated tells. Given their ubiquitous presence it is likely that grape vines were local to the Zerqa Triangle. Another fruit that was present at all sampled tells is the fig. Given their high seed production it is not likely that large orchards were present, but a few trees will have existed near each tell. It is, however, known that figs and grapes have been preserved by drying in the Jordan Valley at least since the EBA (Cartwright 2002). In this way they could be exchanged more easily, making it impossible to conclude the presence of such trees on the basis of the presence of their fruits. Nevertheless, both trees grow very well in the Jordan Valley and their presence at all sites in significant quantities makes a local cultivation likely. The same holds true for dates that were present, albeit in low numbers, at all sites except Tell Deir 'Allā. Dates require warm conditions and the Jordan Valley is, therefore, particularly well suited to their cultivation (Zohary and Hopf 2000: 165). Today a lot of land in the Zerqa Triangle is being converted into date plantations. Date trees need a steady supply of water, though, making irrigation essential in this part of the valley (Zohary and Hopf 2000: 166). Pomegranate was found at Tell Deir 'Allā and one seed was discovered at Ammata. This fruit can, however, not be dried and was grown locally. Based on the discovery of both fruits and wood in phase IX contexts of Tell Deir 'Allā Neef also concludes that fig, vine, pomegranate and date trees were grown locally in the Zerqa Triangle (Neef 1989: 36). Olive trees, however, were most likely not local. Although olive cultivation is possible and olive stones have been attested at all sites except Tell Dāmiyah, it is likely that during the IA the cultivation of olive trees was restricted to the hill countries on either side of the valley (Neef 1989: 36). Olives were, therefore, probably imported into the Jordan Valley. This conclusion is strengthened by the absence of olive wood at Tell Deir 'Allā (Neef 1989: table 1).¹⁴⁶

Based on the combination of number of seeds, the number of samples in which a crop was discovered and the number of settlements at which it was discovered it can be concluded that wheat, barley, lentil, flax, bitter vetch, grape, fig and coriander were commonly cultivated crops in the IA IIa/b period. Other cereals, pulses, herbs and fruits were known and cultivated but in lower quantities. Vegetables are notably absent from table 6.11. Their perishable nature makes their preservation unlikely. It is, however, likely that some vegetables were grown during the IA period. From the dried botanical remains discovered in the Nahal Mishmar cave it is known that onions and garlic were part of the diet in this region as early as the Chalcolithic period (Bar-Adon 1980: 200). It is highly likely that other vegetables were cultivated as well, but simply have not survived.

Based on the archaeobotanical data it can be concluded that the IA diet probably consisted of a large proportion of cereals supplemented by pulses, flax, some fruits, herbs and possibly vegetables. Nevertheless, with the present amount of knowledge and without the possibility to conduct specific archaeobotanical investigations it is difficult to establish the relative frequencies of the crops that were cultivated. For lack of a better option the ethnohistorical record is used to get a better understanding of the different amounts of various crop species a small subsistence farmer is likely to grow in this region. On the whole the 20th century farmers can be regarded as quite similar to IA IIa/b farmers. They were small-scale subsistence farmers. They cultivated the same types of crops on the same soils as the IA people. Furthermore, they largely used the same agricultural techniques and implements as IA farmers. And lastly, they were subject to more or less the same climatic conditions as IA agriculturalists. The ethnohistorical data is therefore used to establish an estimated crop division. It is acknowledged that this is not an ideal solution. Unfortunately, archaeobotanical research that is specifically aimed at solving the question of the relative frequency of crops cultivated lies beyond the scope of this research. The estimated cropping system is, therefore, undoubtedly flawed and the absolute numbers should not be relied upon too heavily. However, as the calculations are only to be used on a very general level and to compare between the different cropping systems the IA cropping system is estimated, fully acknowledging all the flaws.

146 The absence of olive wood stands in contrast to the EBA when olive wood was amply used in building construction and as fire wood at Tell as-Sa'diyeh (Cartwright 2002: 109).

CARRYING CAPACITY AND HABITATION INTENSITY

Annual agricultural crops	Seeds whole	fragment	Samples whole	fragment	No. of tells
Cereals					
Triticum aestivum/durum (bread/hard wheat)	25642		56		4
threshing remains	325		24		-
internodium	42		7		-
Triticum cf. dicoccon (cf. emmer)	94		15		2
threshing remains	90		14		-
Triticum (wheat)	1		1		-
Hordeum vulgare ssp distichum (2-row barley)	10443		27		1
threshing remains	912		11		-
Hordeum vulgare ssp. vulgare (6-row barley)	187		6		1
threshing remains	24		2		1
Hordeum vulgare (barley)	171		10		3
chaff/internodium	9		3		-
Cf. Hordeum (cf. barley)	3		1		-
Pulses					
Cicer arietinum (chick pea)	4		2		2
Lens culinaris (lentil)	116		15		4
Lathyrus sativus (grass pea)	3		2		2
Pisum sativum (pea)	29		6		2
Vicia faba (horse bean)	1		1		2
Vicia ervilia (bitter vetch)	573		21		3
Vicia sativa ssp. sativa (common vetch)	4		2		1
Oil crops					
Linum usitatissimum (flax)	46497		36		4
Sesamen orientale (sesame)	191		9		1
Herbs					
Trigonella foenum-graecum (fenugreek)	3389		9		1
Cuminum cyminum (cumin)	25084		12		1
Nigella sativa (black cumin)	9		6		1
Coriandrum sativum (coriander)	220		21		3
Lepidum sativum (garden cress)	10		4		1
Perennial agricultural crops					
Vitis sylvestris (grape)	487	934	36	6	4
Ficus (fig)	472		34		4
Olea europea (olive)	35	9	11	2	3
Punica granatum (pomegranate)	139		13		2
Phoenix dactylifera (date)	-	22	-	4	3
Prunus dulcis (almond)	2		1		1

Table 6.11 Botanical remains from Tell Deir 'Allā, Tell al-'Adliyyeh, Tell 'Ammata and Tell Dāmiyah from the IA IIa/b (after Grootveld in prep.; Neef 1989: table 2; Van Zeist and Heeres 1973: table 1). Neef reports 10 seeds of garden cress to have been discovered in 40 samples but this is evidently a typing error (Neef 1989: table 2). It was assumed that instead of 40 samples only 4 were present

In the early pre-modern diet discussed in section 6.2 cereals were the most dominant crop supplemented by a smaller amount of pulses and probably some fruits and vegetables. Considering the archaeobotanical remains presented in table 6.11 it is likely that cereals, divided in wheat and a lower amount of barley, also formed a major part of the cultivated crops of the IA IIa/b period. It is estimated that cereals comprised 80% of the IA agricultural produce with wheat and barley present in a 2:1 ratio. The large stores of flax, combined with the high number of samples in which flax remains were present and the fact that flax was present at most tell sites leads to the conclu-

sion that a considerable proportion of the land was devoted to crop production. The high number of looms excavated at Tell Deir 'Allā that were at least partly used for linen cloth production strengthens this conclusion (Van der Kooij 2002). It is estimated that 6% of the total cultivated area was taken up by flax. In the archaeobotanical record pulses were identified relatively frequently and ethnographically they formed a substantial part of the production. The pulses as a whole were estimated to form 6% of the total assemblage. Sesame formed only a small part of both the ethnohistorical and archaeobotanical remains and was, therefore, estimated at 2%. Although vegetables were absent in both data types some vegetables are likely to have been cultivated albeit on a very small scale. Together with the herbs they are estimated to form circa 3% of the total. Fruit likely constituted a similarly low percentage. Given the absence of chemical fertilizers and the practice of crop rotation in which land is left unused, fallow land should also be accounted for. Ethnography has shown that this could involve large parts of the countryside. As a result the amount of fallow land is set at as much as 40% of the total cultivated area. Table 6.12 gives the total estimated crop division for the IA IIa/b period.

Crops	Division crops in %	Division incl. fallow
Wheat	55	33
Barley	25	15
Pulses	6	3.6
Flax	6	3.6
Sesame	2	1.2
Vegetables/herbs	3	1.8
Fruit	3	1.8
Fallow	-	40

Table 6.12 Estimated IA IIa/b crop division

Having estimated the crops that were most likely cultivated in significant amounts and their relative importance, the water demand can be calculated in the same way as has been done for the other periods. The subdivision into individual types of pulses and fruit was problematic, however. From the archaeobotanical remains it is clear that the largest proportions were formed by bitter vetch and lentils supplemented by smaller quantities of peas and chick pea. Vetches as a fodder crop are not very important today; they are seldom grown under irrigation and hence no crop coefficients are available. Furthermore, peas are today cultivated as a summer crop. However, they can also be grown during winter, which was most likely the case during the IA. Modern crop coefficients of summer peas are not applicable to the IA. The fruits have a similar problem. Crop coefficients are available for grape and date, but are missing for fig and pomegranate. In the absence of specific data the missing crops are simply substituted with the most dominant crop for which data are available. The pulses, therefore, consist almost entirely of lentils, while grape dominates the fruits. Although water demands do of course vary according to crop type, the difference will not be enormous as growth development and water demands are to some extent comparable within the general crop class (Allen et al. 1998: table 11, 12.). The same general crop coefficient is taken for the vegetable as a class. As no vegetable remains have been excavated the general crop coefficient of the entire category was used. In figure 6.13 the water demand per hectare for the assumed IA IIa/b cropping pattern is given.

It is difficult to reconstruct the IA II climate. From the combination of climatic proxy data it seems clear that circumstances were broadly comparable to those of today although they were characterized by frequent low intensity changes (see chapter 2). However, it cannot be established whether conditions were slightly warmer and drier or cooler and wetter. The reconstructed rainfall and temperatures from the Soreq cave suggest that during the IA II period rainfall may have been slightly less than today, while temperatures were similar (Bar-Matthews et al. 2003: fig.13). The fol-

IA IIa/b	Oct		Nov		Dec		Jan		Feb		Mrt		Apr		May		Jun		Jul		Aug		Sep		
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
ha	0.32	0.15	0.03	0.006	0.012	0.036	0.018	0.029	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
Wheat	0.018	0.019	-0.029	-0.042	0.138	0.138	0.554	0.560	1.477	1.928	2.361	0.800													
Barley	-0.159	-0.083	-0.089	-0.017	0.166	0.391	0.394	0.899	0.161	0.229															
Lentil	-0.023	-0.013	-0.014	0.029	0.029	0.073	-0.011	0.040																	
Chickpea	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Sesame	-0.001	-0.003	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Flax	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Vegetables	0.018	0.029	0.028	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Grape	0.029	0.028	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Date	0.004	0.004	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Demand mm/day	0.033	0.032	0.008	0.002	0.027	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
Demand m3/day	0.3286	0.32	0.0823	0.02	0.2689	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281	0.281
Base flow Zerqa mm/sec	1.4	1.4	1.6	1.6	1.8	1.8	1.8	1.8	2.0	2.0	2.0	2.2	2.2	2.2	2.0	2.0	2.0	1.8	1.8	1.6	1.4	1.4	1.3	1.3	1.3
Irrigatable km2	3790	3891	16478	67834	5650	5407	5407	5407	14441	836	458	166	175	62	75	57	158	758	757	573	614	625	1532	2378	2372
Base flow had year	0.8	0.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.7	0.7	0.4	0.4	0.7	0.7	0.7	0.7	0.7
Irrigatable km2	2062	2117	12146	50000	3959	3788	3788	3788	7138	445	244	87	92	36	44	22	62	182	181	284	304	347	851	1286	1282

Table 6.13 Irrigation potential for the deduced IA cropping system

lowing calculations are based on the modern climatic data, but it may be the case that conditions were slightly drier. The small-scale variability that seems to have existed cannot be sufficiently precisely dated to be incorporated in these calculations.

From the results depicted in table 6.13, it is clear that under average conditions the amount of water available in the river even in the most water consuming months surpasses that needed for cultivation. The potentially irrigable terrain in a bad year, however, drops below the total amount of land available. During April and especially in the first half of May IA people were not able to cultivate all agricultural land in the area for lack of water. In the first half of May there was only sufficient water to irrigate 22 km². This was, however, only the case for two weeks and both before and after that specific fortnight double or triple amounts of water were available. It is not certain, though likely that the crops were able to withstand two weeks of receiving only half the water they actually needed. Especially drought resistant crops like barley, lentil, chick pea and date were undoubtedly able to survive such an episode without too many problems. The crop yield of more delicate crops like flax might have been reduced. However, with the risk of failure of the entire crop in mind crops were often planted at several moments within the suitable period. Variability in rainfall and the occurrence of bad months were reckoned with. A disappointing rainfall was, therefore, probably not a major problem, but it will have put stress on the society and possibly given rise to some sort of longer term storage system. The high variability in precipitation and discharge meant that bad years occurred regularly. The average of these bad years probably formed the upper limit of agriculture that was possible and hence the maximum number of people that were able to live in this area.

Assuming IA farmers were also able to harvest 100 kg per dunum of irrigated wheat, the total amount of wheat that could be produced in a normal year is 1,504,000 kg wheat. Divided by the amount needed per person per year, i.e. 300 kg, potentially *c.* 5000 people were able to live in the Zerqa Triangle under average rainfall and discharge volumes.¹⁴⁷ In a bad year the possibilities were more restricted. Taking as a basis the 22 km² land that could be supplied with sufficient water during the most stressed month of a bad year only about 2325 people could be sustained without stress.

6.4.2 Iron Age IIa/b population density¹⁴⁸

To determine how closely the IA IIa/b population approached the potential population density of the Zerqa Triangle under this type of agricultural regime an estimate must be made of how many people were living in the region at that time. A total of 19 tells with Iron Age IIa/b occupation have been identified within the region. By combining these excavation and survey data an insight can be gained into how many people lived in the region during the Iron Age II period. By applying ethnographic models of population density in villages to the excavated data an attempt can be made to translate the built up surface of IA II tells into the number of people residing in them. This number can then be offset against the agricultural potential of the region expressed in maximum population size.

Establishing population estimates for archaeological periods is subject to many determining factors that are not always known. The results should, therefore, be treated with the utmost caution. The following exercise should, therefore, not be taken as an exact representation of the population density during the IA II, but is only aimed determining the intensity of occupation during this period. In other words a general estimate of the likely number of people present in the Zerqa Triangle during the IA IIa/b will be compared to the maximum number of people that could live here when the full irrigation potential was realized.

¹⁴⁷ The consumption of animal products might have lessened the amount of wheat consumed, while the imposition of tax or interest will have increased the amount of wheat needed per person. There are no indications that either aspect was very influential however (see section 7.4).

¹⁴⁸ The following section has been published in a modified form as part of a larger article within the proceedings of the fifth International Conference on the Archaeology of the Ancient Near East held in Madrid in 2006 (Kaptijn 2008).

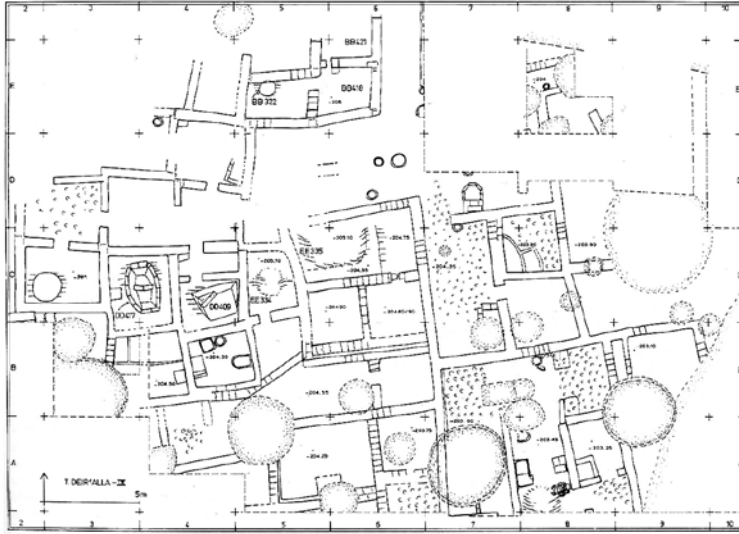


Figure 6.6 Plan Tell Deir 'Allā phase IX (Van der Kooij 2002: fig. 5-1)

Many attempts have been made to estimate the population size in archaeological periods and many methods have been criticized e.g. Broshi (1992; 1993b), Naroll (1962), Shiloh (1980) and Sumner (1979). Data from pre-industrial Palestinian villages from the Mandate Period, where 160-250 people per hectare (p/ha) were recorded for the central hill country and 250-400 p/ha for the coastal plain, have, for example, been used to population estimates for Iron Age villages in the hill country (Lehmann 2004). However, to use ethnographic data one must be certain that the determining factors that underlie the ethnographic phenomenon are similar to those of the archaeological case. In the case of the Zerqa Triangle the environmental and socio-economical circumstances of the Mandate period may to some extent be compared to those of the Iron Age II period. The settlements themselves, however, differ. Almost all Iron Age villages take the form of tell settlements, where building space is scarce. The ethnographic villages, however, are all flat surface settlements that have no strict spatial limitations. Population growth can be easily accommodated in such a village by extending the village's outer limits. In a tell settlement, however, the built up space will become more compacted as open spaces and courtyards are filled in with buildings. Ethnographic examples from tell villages do exist but they are relatively rare. One interesting example is Tell Marib in Yemen, where 286-302 p/ha were recorded, but this is unfortunately not applicable to the Zerqa Triangle as the two-story buildings and the relatively open settlement plan do not correspond to the excavated settlement remains in the Zerqa Triangle (Van Beek 1982).

Another way to determine how many people lived in the Zerqa Triangle during the Iron Age II period is to take the excavations as a starting point. This has been attempted at several other Iron Age site in the region, for example 'Ai and Tell Beit Mirsim (Shiloh 1980). The Iron Age II remains of Tell Deir 'Allā form an excellent starting point as they have been intensively excavated, especially the village plan of phase IX which was destroyed by an earthquake around 800 BC (Van der Kooij and Ibrahim 1989; Ibrahim and Van der Kooij 1991, 1997). As is shown in figure 6.6 a considerable part of the phase IX settlement has been excavated. Excavations on other parts of the tell have shown that the Iron Age occupation was restricted to the eastern top, which covers approximately 0.7 ha. This would therefore mean that 11.4 % of the village was excavated. The plan shows a tightly packed village with few streets or passages, with hatching denoting where traces of roofing were found. With the exception of the small room in which the plaster text describing the prophecy of Bileam was found and whose function remains enigmatic, there are no indications that large areas of public space existed in the village. Following the formula proposed

Tell	Status	Total ha tell	IA remains ha	Population
Deir 'Allā	excavated	2.9	0.7	245-385
Al-Mazār	excavated	1.8	1.5	525-825
Tell Dāmiyah	excavated	0.7	0.7	245-385
al-Hammeh	excavated	0.57	0.5	175-275
al-Bashir		0.64	0.4	140-220
al-Ghazāleh		0.2	0.2	70-110
al-Khsās/Rabī'		0.99	0.5	175-275
Katāret al-Samrā'		large	0.1	35-55
al-Kharābeh N		0.5 (LP)	0.1	35-55
al-Kharābeh S		0.9 (LP)	0.2	70-110
Qa'dān N		0.2	0.1	35-55
al-Qōs W		5.7	0.5	175-275
Zakarī		0.59	0.4	140-220
al-Rmeileh	Destroyed	0.47	0.4	140-220
Maydān	Built over	0.29	0.1	35-55
Kh. al-Buweib	Built over			
'Abū Nijrah	Not located			
al-Rkābī	Not located			
'Abū 'Ubaydah	Built over			
Total			6.5	2275-3575

Table 6.14 Iron Age II tells in Zerqa Triangle

by Naroll, that uses roofed space as the determinant, *c.* 350 people would have lived in the village (Naroll 1962). However, the problem is once again that none of the case studies on which Naroll based his model concurred tell settlements. Van der Kooij (2002) has attempted to establish the use of space during this phase. By looking at features such as hearths, looms and storage space, it is possible to define to some degree of certainty the units that might have belonged to a nuclear family. Keeping in mind the Bileam text that was discovered in this phase (square C5 in figure 6.4) and which points to the likelihood of relatively small-scale public space it is possible to designate *c.* seven units that may have housed a nuclear family. By using ethnographic data on nuclear family size from small, largely pre-industrial agricultural villages in the region, a mean of five to seven people per nuclear family was established (Sumner 1979: 169-170; Kramer 1982: 159-160; Qutaifan 1990: 70; Lehmann 2004: 152).¹⁴⁹ From these data it can be inferred that *c.* 35 to 50 people lived in the excavated part of the village. As this is only 11.4 % of the village a total population of *c.* 300 to 330 people can be calculated, giving a density of *c.* 440 to 600 people p/ha. As the small excavations executed by Lucas Petit within the scope of the 'Settling the Steppe'-project show that the settlement occupation of some of the other sites in the region is less dense than Tell Deir 'Allā phase IX, a density of 350 to 550 people p/ha will be used (Petit in prep.).

To get a population estimate of the Zerqa Triangle as a whole this density will be applied to the total built up surface of the tells in the area. The overview of the artefact distribution pattern dated to the IA which was discussed in section 4.2 has shown that settlement remains dating to the IA were encountered. This implies that occupation was restricted to tell sites during the Iron Age. It is of course difficult to establish whether the whole tell or just a part was inhabited during this period. For the excavated tells a fairly educated guess can be made, while the survey conducted by Petit has divided the tells into smaller areas making it possible to differentiate between them. Although all these tells have generated Iron Age IIa/b pottery, it remains impossible to determine

¹⁴⁹ Qutaifan reports an average of 7.2 for the village of al-'Aluk in Jordan and a national average of 7.1 for Jordan. Kramer's average is based on 40 Iranian villages in the 1966 census where sizes ranged from 4.2 to 7.6 with a modal size of 5.3. Kramer also grouped data from 25 villages or areas in the entire eastern Mediterranean which gives a modal household size of 5.5. Lehmann mentions an average household size of 4.8 for Palestinian villages from 1931.

whether all tells were fully contemporaneous and inhabited during the entire period of the IA IIa/b. Petit has concluded that it is highly likely that these tells were all in use during the 9th century, so contemporaneous with Tell Deir 'Allā phase IX. For this period the excavated tells yielded quite dense occupation remains, while the pottery was very similar to that discovered on the tells that were only surveyed (Petit in prep.). It is likely that the Zerqa Triangle was densely occupied during (part of) the 9th century and that a similar episode occurred in the 7th century (Petit in prep: chapter 15). Tells reported by older surveys to contain Iron Age II pottery, but that could not be surveyed because they had either disappeared or been completely built over are left out of the calculation. The population estimate for the region will, therefore, be rather low. Table 6.14 shows that the total surface of all tells amounts to 6.5 ha giving a total of between *c.* 2275 and 3575 people in the Zerqa Triangle during the Iron Age. Tell al-Qōs and possibly al-Kharābeh N and S should, however, be excluded from this calculation as these areas are fed by channels from the Wadi Rajib and not the Zerqa.¹⁵⁰ This gives a total population of *c.* 1995-3135 people living in the area fed by water from the Zerqa.

6.4.3 Iron Age II a/b occupation intensity

The calculated 2325 people that could be sustained during a bad year is by no means an absolute number. Many assumptions and estimates underlie these calculations. Furthermore, a crop does not fail when water availability lags behind the desired amount for a few days. Moreover, people are able to survive with less than the standard requirements for a year or so. Notwithstanding all these drawbacks, the calculations give some indication as to when the boundaries of agricultural possibilities are approached and when human habitation starts to become stressed. Above all, the calculations show that in normal years water is not the restricting factor that determines the carrying capacity of this area. In average years and even during most months of a dry year there is more water than is needed for irrigation. Land is the limiting factor or, put differently, the agricultural techniques are the restriction. The absence of chemical fertilizer and the apparent absence or low level of manuring with domestic refuse in the IA, which is observable in the sherd distribution, meant that large tracts of land had to lie fallow. Could this land have been cultivated as well as is the case today through the use of artificial fertilizer the carrying capacity would have been much greater. In that case the amount of irrigation water would become the restricting factor once more. In the Late Roman period, when manuring of the fields with domestic rubbish likely took place given the pottery distribution pattern, the carrying capacity was probably higher than that of the IA.

The estimated population density for the IA IIa/b in the Zerqa Triangle can now be compared to the calculated carrying capacity. Excluding the sites that lay outside the stream area of the Zerqa the maximum number of inhabitants ranged between *c.* 1995 and 3135 persons. In normal years it will have been no problem to feed all these people. Given the absence of indications that surplus was traded or specifically produced for certain products (pers. comm. Van der Kooij), it can be assumed that surplus that was produced in very wet years, which occur as often as dry years, stored for use in bad years. Most periods of the IA have yielded ample evidence for significant cereal storage (Van der Kooij 2001). The large storage silos on top of the tells were ideally suited to cereal storage for several years. As there is always a chance of a wet year people may as a rule cultivate too large an area, or in this case the entire agricultural area, in the hope that should the year turn out average to good a high yield will be gained. However, there is an equal chance that the wet season will turn out to be dry and they will have wasted energy in cultivating areas that will fail as there is not sufficient water to irrigate the entire region. There is, however, a well known practice among the Bedouin living in desert areas, who simply plough and sow some cereals in the hope that by chance the year is moist and they will have some profit. Hence, this practice is often referred to

150 In the ethnohistorical system the area of al-Kharābeh N and S is reached by canals stemming from both the Rajib and the Zerqa.

as opportunistic or chance agriculture and is carried out by several groups living in marginal areas (Wendrich 2008: 514). This practice may in an alternate form also have been carried out in the IA Zerqa Triangle.

Thanks to drought resistance of crops and storage of surplus, the number of persons living in the valley may have been higher than the calculated amount for the most stressful month of a dry year. However, if the medium of the calculated number of people living on tells, i.e. *c.* 2500, is taken as average it is clear that the IA IIa/b society was probably familiar with periods of some stress, given the carrying capacity of 2327 people in a dry year. Years in which people had to content themselves with less than their expected amount of food or had to rely on stored surplus of previous years will have occurred. This situation, however, will only have obtained for a relatively limited period within the IA. Petit's study has shown that the IA IIa/b period was probably the most densely occupied of all IA phases and even within the IA IIa/b it is likely that only during the 9th century were all known sites occupied contemporaneously (Petit in prep.) The intensity of habitation was, therefore, high during this part of the IA and stress may have occurred in years with disappointing harvests. However, in normal years and during other, less densely settled periods of the IA, it is unlikely that water stress occurred in the Zerqa Triangle.

6.5 Conclusion

It will be clear from the sections above that the type of agricultural system adopted is highly determinative of the amount of land that can be irrigated. A system focussing on summer crops and fruit trees requires a different amount of water and water stress occurs in different periods than a system based on the cultivation of winter cereals. In figure 6.5 the irrigation water demands in mm per day averaged over a two week period are depicted for the different agricultural systems. The shape of the graphs is determined not only by the crops and their water demand, but also by the potential evapotranspiration and the precipitation. The irrigation demand is, therefore, generally very low in the winter months notwithstanding the many crops that are cultivated in that period. The biggest difference exists between the Mamluk period and both other periods. The cultivation of sugar cane, which also demands water during the dry summer where potential evapotranspiration levels are high, results in a different type of curve. Only during a short period in winter is the demand for irrigation low or nonexistent. The dip in need for irrigation visible in May is mainly due to the shift from winter to summer crops. Around the time that winter crops are being harvested, the planting of summer crops like sorghum starts. The continued water need of the sugar cane ensures the high overall demands. In the pre-modern period there were no major crops that needed a lot of water year-round. Summer crops were cultivated but these generally had a short cycle. Sorghum and sesame could for example be harvested in August while eggplant was already full grown in the first half of July. Only maize continued until the end of September, but was only cultivated in small quantities. These water demands of the short-cycle summer crops are the reason for the slowly decreasing demand from June to September. The IA IIa/b agricultural system shows that additional water is only needed when the rains cease and temperatures rise. During April and May water demands are as high as during the Mamluk period. The dip visible during the second half of April is the result of the different timing and growing cycles of certain crops. Lentils can,

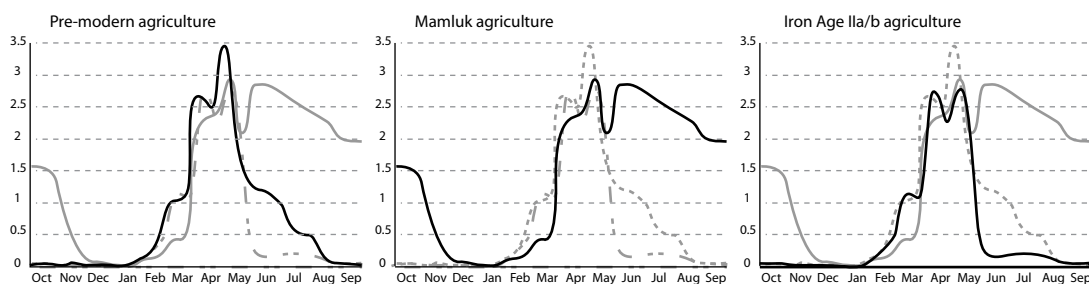


Figure 6.7 Water demand trend lines per period in mm per day (averaged over a fortnight)

for example, be harvested in April, while wheat continues to grow. The advanced development stage of wheat means that a higher amount of water is needed than during the initial stages of its growing cycle. In April both barley and flax are at the development stage in which they need most water, accounting mainly for the first peak. A fortnight later these crops are almost ready to be harvested and need only a small amount of water. Wheat, however, peaks during the first half of May, when the cultivation of sesame begins and grape starts to need more water. These three form the second peak. The practice of spreading the sowing and hence harvesting times of crops which IA farmers most likely employed like their modern counterparts will have evened out these dips and peaks by spreading water demands more evenly. However, only the general trends were calculated in this chapter. Although it would be possible to account for this distribution of sowing periods of the different crops, such a calculation would only provide a more gradual trend line and give a false sense of accuracy.

The water demands compared to the available Zerqa base flow provide an insight into the water stress and agricultural possibilities of this region. From the calculations above it has become clear that under normal conditions water was not a constraining factor during any of the periods. When precipitation and base flow lay around the long year average, there was sufficient water to irrigate the entire area suitable for agriculture under any of these agricultural systems. In a dry year, however, when both precipitation and Zerqa base flow lagged behind the long-year average, water availability was more problematic. During short periods of time only half of the agricultural lands could be irrigated. Crops will have been able to cope with less water over such a short period of time. Only if water shortage continued over a longer period of several weeks will the agricultural possibilities of the region have become more restricted. During the IA IIa/b period some degree of water shortage only occurred for a single fortnight. Food production will not have been severely hampered by this short episode. Furthermore, the estimated total population of the area is more or less the same as the number of people that can be sustained if the water stress that was calculated to have existed for a fortnight determined the crop yields that could be reached. Only in the unlikely event that crops could not withstand two weeks of little water might a slight food shortage have occurred. In all other years and during less densely settled periods of the IA the carrying capacity of the Zerqa Triangle was not approached. The frequent short-term climatic changes that have been suggested by some climatic proxy data might have caused more frequent or somewhat drier years. These will, however, only have become problematic during periods of high settlement densities that existed in the Zerqa Triangle during 9th and 7th century BC (contemporaneous with Tell Deir 'Allā phases IX and VII) according to the research by Petit. However, in general there is no reason to assume water stress and failing harvests during the IA in the Zerqa Triangle.

The water demand was higher during the Mamluk period as a result of the focus on sugar cane. The high water demand of sugar cane meant that in a dry year only 12 km² of the region could be cultivated during summer. As hardly anything else other than sugar cane was cultivated during that part of summer, this water shortage only restricted the amount of sugar cane that could be cultivated. Barley and wheat had already been harvested by that time. Nevertheless the sugar cane also limited the amount of wheat that could be cultivated resulting in a total of 1100 people that could maximally subsist here. Although it is difficult to arrive at population estimates for this period, it is clear that the Zerqa Triangle was not very densely settled in this period. Only four villages existed and their build up may not have been very dense. The climate may have been slightly wetter at least at the start of the Mamluk period (Rosen 2007: 101). This may have enhanced the agricultural possibilities somewhat. Given the small area that could be successfully cultivated with sugar cane during summer, the proportion of wheat may have been larger than was estimated beforehand. In all, the carrying capacity of the region was most closely approximated during the Mamluk period, although severe food shortages and failed harvests are not likely as the total population was low and the flexibility to distribute water over the crops existed, provided this decision was up to the farmers.

The carrying capacity of the pre-modern agricultural system is comparable to that of the IA although the water stress was greater during the summer months because of the greater focus on summer crops. In a dry year there was much less water available and hence the number of people that could be sustained in this area was also lower. The minimum amount of *c.* 18 ha or 1750 people is probably too low as crops could endure a short period of little water. Immediately after this short dry fortnight 35 km² could once more be irrigated, allowing *c.* 3470 people to live comfortably. This carrying capacity will not have been met during the early part of the 20th century when only a few people inhabited this area, whether permanently or seasonally. The gradual population increase that took place during the mid 20th century would have put irrigation and the agricultural system under stress had technology in the form of the new irrigation system, chemical fertilizers and motorized farm equipment not increased agricultural potential and yields. The enormous increase from almost 4000 people inhabiting the region in 1953 to the 26,000 that were listed in 1994 was only possible due to these technological changes.¹⁵¹

151 Jordanian Department of Statistics, general census of population and housing 1994.

7 Irrigating communities

7.1 Introduction

Having discussed the irrigation and agricultural systems in the previous chapters the following pages will focus on the link between the irrigation system and society. In each period the way in which irrigation was practised was influenced by the community and the larger cultural framework that had created it. Similarly the irrigation system itself imposed certain conditions upon the communities. The irrigation system and the society are, therefore, mutually constitutive and interdependent.

During three periods discussed in the previous chapter the irrigation system was probably very similar, i.e. the pre-modern periods, the Ayyubid/ Mamluk period and the IA. During all three periods a system of small open canals consisting of a few main channels and a large number of lower order canals irrigated the Zerqa Triangle. Given the topographic layout of the Zerqa Triangle it is furthermore likely that the main channels were located at similar locations, resulting in a similar infrastructural organization. The system of canals is, moreover, inherently hierarchical in nature as gravity dictated that people upstream had control over the water supply leaving people downstream in a dependent position. Under different socio-political circumstances this hierarchy may develop, but it can also remain hidden or subjected to other concerns.

Notwithstanding the similarities, the social aspects of the irrigation system differed per period. In each society the irrigation system functioned differently and water rights were organized in distinctive ways. These differences and other aspects of the social organization of agriculture and the irrigation system will be discussed in this chapter.

7.2 The ethnohistorical agro-social structure

7.2.1 Overview of ethnohistorical land tenure

In this section the situation in the Zerqa Triangle during the early 20th century will be described, but in order to do so a short overview of the developments leading up to that period needs to be given. During the early 19th century, which was the transition point between the dominance of the Bedouin tribes and the resettlement of the valley by agriculturalists, the sheikhs played an important role. The Bedouin raids of the 17th and 18th centuries described in chapter 5 had left the Jordan Valley almost completely devoid of sedentary occupation. Land to settle on and cultivate was abundant in the early 19th century. Powerful sheikhs from villages in neighbouring regions and Bedouin tribes who were able to claim land and defend it came to the ghor and founded new villages or incorporated the few existing hamlets (Fischbach 2000: 11). The sheikh as undisputed leader usually had the authority to distribute the land over the envisioned cultivators. Sometimes sheikhs were only interested in the control of agricultural surplus and refrained from actually claiming the land as their private property. After some time, however, most sheikhs took the land as their property and allowed the villagers to cultivate it as sharecroppers (Fischbach 2000: 12). Most sheikhs strived to control the best, usually irrigable, lands available (Fischbach 2000: 14). This practise is clearly visible in the Zerqa Triangle (see below). Several Bedouin sheikhs came to own large tracts of land in this way. The 'Adwan sheikhs, for example, owned large pieces of land in the Ghor Kafrayn and the Ghor Nimrin south of the Zerqa Triangle (Abujaber 1989: table 4.1).

During this initial period most cultivation took place under the Musha' system. Musha' literally means joint or collective ownership and it denotes that agricultural land surrounding the villages is property of the community rather than individual farmers. The land is divided into plots allotted by the sheikh to the family heads in the village, while the plots are redistributed among the villagers every two to nine years (Wahlin 1988: 375). Plots could be distributed among all males in the village, to each pair of oxen, or shares were allotted to families (Fischbach 2000: 40). The redistribution of the plots could be determined by lot or as a decision by the village elders or representatives (Fischbach 2000: 40). The manner described by Tarawneh suggests that the latter version was practised in Deir 'Allā (see below). Often collective decisions were made about agricultural concerns and sometimes punishments could be imposed on misbehavers (Fischbach 2000: 39).

Abujaber argues that the tribal customs of the farmers combined with the small number of people living as farmers did not allow a mode of production in which the sheikh or landowner treated the cultivators as serfs, but instead this form of joint ownership headed by the sheikh emerged (Abujaber 1989: 85). Within the musha' system, however, help was sometimes hired during busy times, sometimes for a day or a week, sometimes for the whole season. These people were paid in kind, which was often the most common cultivar, i.e. wheat. Some of the Bedouin tribes also employed forced labour. The 'Adwan forced their slaves to cultivate the fields in the Jordan Valley. These slaves were usually black and their forefathers had often been bought from slave traders from Africa (Abujaber 1989: 85). It might be that these slaves later developed into the Ghawarna that were organised along tribal lines like the Bedouin, but from whom it was known their origin was different (see below).

Fischbach states that there is a relationship between the type of agriculture and the presence or absence of the musha' system. In Transjordan the musha' system was most commonly practised in the province 'Ajlun of which the ghor formed a part. In this district irrigated lands and orchards were usually privately owned, as a large and long-term investment is needed to make these lands profitable. Rain fed cereal cultivation, however, was often done under the musha' system (Fischbach 2000: 41,42). The ethnohistorical situation of Deir 'Allā described by Tarawneh dates from a later period and it is uncertain which type of musha' system was practised here if indeed it was practised at all. On the one hand the lands needed irrigation involving a large investment which was according to Fischbach usually carried out under private ownership, on the other hand the plots were redistributed each year like in the musha' system (see below for more detail). It can, however, be suggested that a variant of the musha' system existed in which the irrigation stimulated collective ownership and cultivation instead of inducing creation of privately owned land. The system of irrigation used was impossible to establish and maintain individually, but necessitated a communal effort.

During the 19th century the Ottomans tried to stimulate export-oriented cultivation through the implementation of a new land regime. Several new laws on land tenure and cultivation were proclaimed during the Tanzimat Reforms (1839-1876) (Fischbach 2001: 530). The most important law in this respect was the Land Code of 1858. Land became divided into *milk* (privately owned), *miri* (state owned), *waqf* (trust), *matruka* (non-arable public land), and *mawat* (dead or unused land) (Fischbach 2000: 25-27). Registration of the 'Ajlun province according to this new land code started in 1876 and registrars arrived in the ghor in the mid 1880's (Fischbach 2001: 530, 531). The Ottoman government tried to claim as much land as state owned miri land as possible. The Ghor 'Abū 'Ubaydah, i.e. the area between the Rajib and 'Abū 'Ubaydah, was, for example, registered as miri land instead of as waqf for the tomb of 'Abū 'Ubaydah, which was essentially privately owned land, as the family guarding the tomb claimed (Fischbach 2001: 532). This controversy over the Ghor 'Abū 'Ubaydah has to this day not been settled.

Although Tarawneh has no direct information on the changes that occurred in the Zerqa Triangle connected to the 1858 Land Code, he does mention something that might be closely connected to it. He claims that in the 19th century the villagers of Deir 'Allā bestowed their land on the sultan in return for protection against the Bedouin by the Ottoman army (Tarawneh in prep.: 16). During the 19th century Bedouin tribes from the eastern hills raided the villages of the ghor to supplement their own diet that lacked cultivated products with cereals present in the agricultural villages. This practice of raiding is vividly described by early 19th century European travellers like

Buckingham (Buckingham 1825). In order to avoid being raided the villages paid *khawa*, a kind of protection fee, to the Bedouin. By this transaction the land became *miri-mudawara* land or state land that was part of the property of the sultan. Tarawneh states that the farmers now had to pay a tithe and a rental tithe to the state, which amounted to *c.* 22.5% of the total yield besides the fee they had to pay to the sheikh (Tarawneh in prep.: 16). Nims, describing the same phenomenon for the northern Jordan Valley, states that here the land was transformed to *miri-mudawara* land to avoid taxation (Nims 2005: 7). The sheikh of the ruling clan, the *Ghazawiye*, only paid a small sum in rent to the sultan and further made a good income by collecting his share from the share-croppers who cultivated the land. Late 19th century Ottoman registrar books corroborate this tax exemption (Nims 2005: 7). Although it cannot be substantiated this more economic reason may well have been equally or more important than the envisioned protection by the Ottoman army from the Bedouin.¹⁵² It is, moreover, doubtful whether the influence of the army was so powerful as to cause the Bedouin to abstain from raiding certain villages. It is unlikely that the government felt compelled to station a garrison of soldiers in the small villages of the Zerqa Triangle, which was probably the only way to keep the Bedouin in check.

After the implementation of the Ottoman Land Code the general structure of agriculture in the ghor probably did not change much. Land was still cultivated in the same way by crop sharing and redistribution of the plots between the farmers every few years. An important organizational change was that the sheikh who formerly had often held the authority to redistribute the lands was now vested with the formal power to collect the taxes owed to the Ottoman state (Tarawneh in prep.: 16). During later years the tax collectors or *multazim* became very powerful and often acted of their own accord. Together with moneylenders they amassed large tracts of land as private property when landowning farmers were unable to repay their debts. Moneylenders were often Christian merchants residing in the larger cities in the area like Salt, 'Ajlun or Nablus. One of the merchants that acquired large tracts of land was Iskander Ilyas Salim Kassab, a Greek Orthodox Christian from Damascus who lived in Salt and became a moneylender in the Belqa in 1886. He acquired thousands of dunum of land in the Ghor al-Farah, Ghor Wahadina and the Ghor Tell Dāmiyah and Shqāq in the south of the research area in 1910-1911 (Fischbach 2000: 55). Tarawneh describes that in the 1930's the Elias family, moneylenders from Salt, obtained much land in the Zerqa Triangle, for example to the north and west of Deir 'Allā and west of Tell Maydan (Tarawneh in prep.: 17, map 3). This Elias family and Iskander Ilyas are undoubtedly related. The well dated acquisition by Iskander Ilyas suggests that the influence of the Elias family may have started before the 1930's and their possible presence should be kept in mind when considering the ethnohistorical situation (see below).

A further development in land tenure was brought about by the Land Settlement act of 1933. This law was issued by the Mandate government, which regarded the *musha'* system as the cause of all agricultural backwardness and tried to stimulate private land ownership (Wahlin 1988: 375).¹⁵³ However, this law initially had no large-scale effects either. The communally held land usually became registered as the property of the sheikh who had already possessed the authority over the land as he allotted the lands to the various clan members (Nims 2005: 7). The overall structure of cultivation had changed little by this reform and only in the 1950's did technological changes, development of the irrigation system, the large influx of Palestinian refugees and new land reforms alter the land tenure and agricultural system dramatically.

The pre-1950's situation described by Tarawneh has undergone these Ottoman and Mandate land reforms, but the remnants of the *musha'* land tenure system are nonetheless still recognizable. As is the case with each moment in time, the pre-1950's socio-agricultural system of the Zerqa Triangle was the result of a history of internal and external influences that acted with different effects on the people living there and their mode of subsistence. Contrary to what is usually the case in archaeology, some of the influences on the system, such as the reforms described above, can be

152 In the Ottoman defter (tax record) of this period from the 'Ajlun district the places 'Amta and Dāmiyah appear as the only villages in the Zerqa Triangle. It can, therefore, be suggested that the remainder of the Zerqa Triangle was land belonging to the sultan and not taxed, but it may also have been uninhabited (Bakhit and Hamud 1989: map).

153 Walpole, the director of Land and Surveys in Transjordan, wrote "It is doubtful whether a tenure more inimical to good farming and development could have been devised by any community" (Wahlin 1988: 375).

detected in ethnohistorical accounts. The following description of the early 20th century situation as recounted by Tarawneh is probably an amalgamation of memories from different episodes in the late 19th/early 20th century.

7.2.2 The Zerqa Triangle in the early 20th century

Tarawneh gives a description for the area around Deir ‘Allā, that encompasses the ghor from as far south as Umm Hammad and stretches north to somewhere around the village of Dhirār judging from his maps (Tarawneh in prep.: map 2). The ghor of the Zerqa Triangle was the territory of several clans. Land was divided among them according to their power (see figure 7.1). In each clan the landlord or sheikh controlled the available land and water and decided how the land was to be distributed among the individual clan members.¹⁵⁴ Each married male was appointed a plot or *faddan* of land to cultivate. During Mamluk times a faddan was simply a unit of measurement, but in this period the term denotes the plot allotted to one cultivator. The size of this plot depended on the other essential commodity besides land, water. A faddan located next to an important irrigation canal contained maximally 40 dunums, whereas a faddan at greater distance from channel could amount up to 60 dunums. A faddan was also said to be the area of land that could be ploughed by a pair of oxen in one day or the equivalent of six sacks of produce (Tarawneh in prep.: 30).¹⁵⁵ Every few years the faddans were redistributed among the cultivators and people who had cultivated a faddan far away from channels were now allocated a better location (Tarawneh in prep.: 30).

The land controlled by the sheikh was cultivated by two types of farmers. On the one hand there was the *fellah* (pl. *fellahīn*) who rented the land and water from the sheikh in return for a third of the harvest, but other than that was independent from the sheikh. The fellah was strictly speaking a sharecropper but his relation to the sheikh was generally regarded as one of partnership. The fellahīn usually had close kinship ties with the sheikh (Tarawneh in prep.: 31). The system of sharecropping through partnership by which the fellahīn worked is often referred to as *muzara’a* in Transjordan (Abujaber 1989: 86; Nims 2005: 7).

On the other hand there was the *harrath* (pl. *harrathīn*), literally meaning ploughman. The form of socio-economic relationships described here is referred to as harrath economy by Tarawneh, but is also known as *muraba’a* (Abujaber 1989: 86). The harrath had a far less equal relationship with the sheikh than did the fellah. His position was closer to that of a hired farmhand than that of a sharecropper. The harrath agreed to work on the land of the sheikh in return for a quarter of the surplus. The sheikh decided what was to be cultivated and supplied land, water, seed and draught animals (Tarawneh in prep.: 31). The sheikh provided the harrath with an amount of cereal and some other food supplies (*muna*) to live on during the year (Tarawneh in prep.: 30). The harrath brought in the implements like a plough and the labour force and he took care of the sheikh’s animals (Tarawneh in prep.: 30). Most harrath also reared animals of their own to supply meat, milk, and wool. Tarawneh states that once the harrath had ploughed the land the ‘contract’ was signed and he was forbidden to work outside the sheikh’s territory until the period of agreement had ended with the measuring of the grain in the second year (or later) (Tarawneh in prep.: 30).

The harrath was essentially contracted and completely bound to the sheikh. An example of this is that the sheikh could order his harrath to work the land of a befriended sheikh for only the payment of their daily meals (Tarawneh in prep.: 31). The females of a harrath household worked in the house of the sheikh if he required it (Tarawneh in prep.: 30). The harrath was furthermore referred to as the harrath of a certain sheikh (not of the clan). The villagers of Deir ‘Allā remembered that the sheikhs of the most powerful clan always had dozens of harrath households working for them (Tarawneh in prep.: 31). In spite of their bound status, farmers in the Jordan Valley often preferred to work as harrath instead of as fellah because the risks attached to farming like failed harvests and resulting debts were lower (Nims 2005: 7).

154 A sheikh is the leader of a tribe of (settled) Bedouin. In settled non-Bedouin communities the leader is called a mu’allim (litt. teacher or master) (Abujaber 1989: 86). The fact that the inhabitants of the Deir ‘Alla region still speak of sheikhs attests to their Bedouin past.

155 Tarawneh does not mention the contents of the sacks and writes that his informants could not agree on whether the weight of a sack was 50 or 100 kg.

Tarawneh gives an account of how the harvest was divided.¹⁵⁶ First the tax due to the state (*'ushr*) was deducted. Then the amount needed as muna in the coming year was taken off and a similar portion was set aside to feed the sheikh's household staff (the 'Abid; see below). The remainder was divided between the harrath and the sheikh who sold or exchanged his share at the regional markets in towns like Salt, 'Ajlun and Nablus (Tarawneh in prep.: 31). Muraba'a literally means divided into four because the harrath would get a quarter of the harvest after tax was subtracted (*raba'* means quarter in Arabic) (Abujaber 1989: 86). Nothing is said about the seed needed for sowing the fields again, but this was undoubtedly subtracted beforehand. Both Tarawneh and Nims state that the part the harrath received amounted to slightly less than a fifth of the total harvest (Nims 2005: 7; Tarawneh in prep.: 31). Abujaber is able to corroborate this statement with the record books of his family farm at al-Yaduda (Abujaber 1989: 87). In the years between 1900 and 1911 the state tax was 12.5% of the total harvest. The wheat withheld as muna was 8 sa's, which is almost 48 kg per harrath each month.¹⁵⁷ On average the total muna was *c.* 4% of the total harvest. When these were subtracted from the total harvest of 100% the net harvest to be divided was 83.5%. Of this the harrath got a quarter and the landowner three quarters, so 20.9% and 62.6% of the total harvest. The data from 1911 show that the share of the harrath had dropped to a fifth, leaving him with only 16.7% of the total harvest plus the also decreased muna (Abujaber 1989: table 5.1).

Although the actual practice of cultivation will have differed little between fellah \bar{n} and harrath \bar{n} , their social status was rather dissimilar. The fellah was held in considerably higher regard than the harrath was. Whereas the harrath was predominantly a labourer, the fellah stood on more or less equal terms with the sheikh although he was considerably poorer and less powerful. The fellah was so to speak the poor relation of the sheikh; he was often needy and in terms of power and influence definitely inferior to the sheikh but he was still family. The higher social status of the fellah and his partnership relation with the sheikh may well be one of the remnants of the Musha' system, in which the sheikh was the *primus inter pares* of the community. Through the land laws and predominantly as a result of the growing number of people depending on agricultural land for a living, land had become a valuable commodity and thus prone to unequal labour relations and abuse. The large influx of Palestinians seeking a livelihood after 1948 and the growing importance of mechanization, government intervention and international trade made this system obsolete.

7.2.3 The social system

Next to the system of land tenure and labour relations the community in the Zerqa Triangle was structured according to a social system of clans and families. In this area three separate groups existed: the Hurr clans, the 'Abid families and the Ghawarneh clans (Tarawneh in prep.: 26). These three groups had a different history and social status. The Hurr and Ghawarneh clans were organized along tribal lines; they consisted of several clans that each had a leader, the sheikh, and each clan had its own territory (Tarawneh in prep.: 27). The 'Abid were different, however. They did not have their own territory, they had no leader and did not consist of different clans. The 'Abid consisted of individual families that worked as servants in the households of the Hurr sheikhs (Tarawneh in prep.: 27). 'Abid were always black and a non-black could never become an 'Abid (Tarawneh in prep.: 28). 'Abd (pl. 'Abid) literally means slave in Arabic. The 'Abid were, however, servants and not slaves, although like slaves they became part of the household of the master and derived their identity from it. Nevertheless, their origins do probably stem from slavery. Until slavery was abolished by the Ottoman government around 1900 Arabs purchased slaves from Africa,

156 Tarawneh uses the word surplus but this should probably be understood as harvest, although sowing seed may have been subtracted already (see below).

157 The accounts of the al-Yaduda farm of the Abujaber family of south Amman show that in difficult years like during the First World War the harrath got significantly less muna than during normal year. In 1914 muna consisted of 42 kg wheat monthly and 6 kg lentils and 3 kg salt a year. In 1910 a harrath received 480 kg wheat, 264 kg millet, 18 kg raisins, 7.5 l olive oil, 7.5 kg molasses, 9 kg onions, and 9 kg salt a year. After the war such large amounts of millet were never distributed again, however (Abujaber 1989: 92).

mainly from Sudan (Raz and Atar 2004: 302). The 'Abid are essentially servants, but Tarawneh mentions that in the Deir 'Allā area they could also work as harrath. 'Abid were never fellahīn, however (Tarawneh in prep.: 28).

The 'Abid were not a clan and did not have land. Nevertheless, their social position was regarded as above that of the Ghawarna, although the Ghawarna were often economically better off than the 'Abid (Tarawneh in prep.: 28,29). The 'Abid derived status from their connection to the Hurr sheikh. The Ghawarna sheikhs were not allowed to have 'Abid as servants. An 'Abid could, however, become a harrath of a Ghawarna sheikh. The 'Abid harrath, however, would have a higher status than a Ghawarna harrath, because his family worked for a Hurr sheikh (Tarawneh in prep.: 29). The 'Abid were appointed as guards to keep the large numbers of harrath working for the sheikh under control (Tarawneh in prep.: 29). The three social groups did not intermarry. The different clans within one social group did, however, exchange marriage partners. If someone wanted to marry an 'Abid girl the sheikh, not the father, had to be asked permission (Tarawneh in prep.: 29).

The Ghawarna probably share a similar history to that of the 'Abid. Ghawrani (pl. Ghawarneh) literally means valley or ghor dweller, but it is a term commonly used to denote the black Afro-Arab people of the valley (Shryock 1995: 331). They must originally stem from Africa (Egypt/Nubia), but have been living in the Jordan Valley and surrounding areas for a long time. Over the course of time they have become embedded in Bedouin tribal organisation with a leading sheikh and several separate clans. They are often classified as a separate clan within the Bedouin tribes by local Bedouin or as true Bedouin by outside observers (Falah 1990: 408; Shryock 1995: 331). Van Aken states that the Ghawarna of the Deir 'Allā region were part of the Mashalkha tribe that is also mentioned as living in this area in itineraries (Merrill 1881: 374; Peake 1958: 177; Van Aken 2003: 49). In the Deir 'Allā area there were four Ghawarna clans; the Salim, Zayat, Jaber and Naser (Tarawneh in prep.: 29). Each of these clans had a sheikh and the members either worked as fellahīn or as harrathīn.

The two Hurr clans, the Mamduh and the Shararah, also had a tribal organisation with a sheikh and a separate territory (Tarawneh in prep.: 17). Hurr means free in Arabic and these clans probably stem directly from Bedouin tribes, or at least they regard themselves as such. The Sharara may stem from the Bedouin tribe called the Shararat, the largest buyers of wheat at the Abujaber farm at Yaduda during some period before 1885 (Abujaber 1989: 277).¹⁵⁸ The term Hurr suggests they considered themselves to be the rightful autonomous people of the area. In the social hierarchy the Hurr clans were also considered to have the highest status. Within the clan the sheikh occupied the undisputed highest position followed by the fellahīn of his clan that were in turn followed by the clan's harrathīn.

This status is reflected in their territory. Figure 7.1 is a map of the clan territories drawn by Tarawneh on the basis of oral information but modified on the basis of detailed maps from this period or slightly after (Anonymous 1965; Tarawneh in prep.: map 2). Although the Hurr clans numbered the fewest people, they occupied the largest territories (Tarawneh in prep.: 27). Apart from the fact that the Mamduh had the largest and most profitable territory they also occupied the most important parts of the irrigation system and the most fertile lands. Their territory covers the entire area watered by both the Dhirār main channel and the Mu'tarredah main channel. These canals tapped the Zerqa highest upstream leaving less water to be tapped further downstream by the Maydan channel. This may have been critical during dry years. All the other clans were dependent on the Maydan main channel and were, therefore, in a much less fortunate situation as they had to share the water and were dependent upon each other. The territory of the other Hurr clan the Sharara is not large in comparison to the other territories, but it had a marked superior position compared to the other clans on the Maydan channels as it was the first to tap the canal.¹⁵⁹ All the other territories were located downstream and, therefore, dependent on the Sharara.

158 Shararah probably ends in a ta-marbuta, which means that when it is followed by another word a 't' is pronounced, otherwise it is soundless. This explains the variation in the end 't'.

159 The Naser were probably a small and dependent clan unable to assert rights over the Mutarredah canal along which their small territory was located. The Maydan canal is located on a lower elevation making tapping impossible.

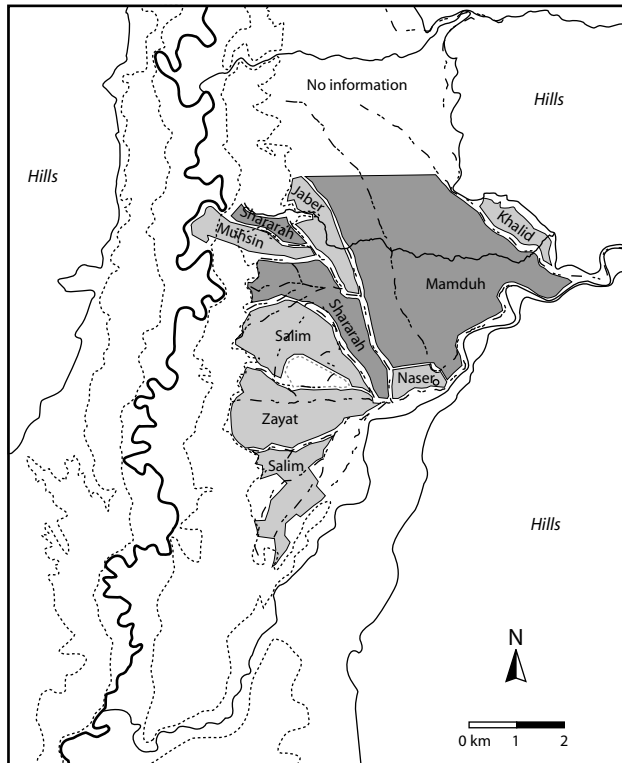


Figure 7.1 Pre 1940's clan territories. Adapted from Tarawneh (in prep.: map 2) incorporating the irrigation canal as depicted on the 1:10.000 maps.¹⁶⁰

The relations between most other clans will have been more equal, because most canals were shared. The Salem, for example, tapped the canal with which the Zayat tapped the Maydan main channel. The Salem, therefore, derived their water from a tertiary canal, whereas the territory of the Zayat was irrigated by a secondary channel. The Zayat were, however, as dependent on the water of the secondary channel after it was tapped as the Salim were on their tertiary canal. A dominant position can only be gained when one is independent from a canal further downstream. The Sharara could, for example, tap as much from the Maydan channel as they wanted and leave as little water in the remainder of the channel as they chose to, because they did not need the Maydan channel after their secondary channel had tapped from it. Based on the irrigation system it is, therefore, clear that although the territory of the Sharara clan as one of the Hurr clans did not distinguish itself from the Ghawarneh clan territories in size, its location within the irrigation system lends it a hierarchically higher position.

In the map of the clan territories another territory appears, the Khalid, that, according to Tarawneh's text, is neither a Hurr nor a Ghawarna clan. An explanation for this can perhaps be found in a similar study by Nims on the northern ghor (Nims 2005). In this area one of the Hurr clans outside the Zerqa Triangle, that was also referred to by Tarawneh, the Ghzawi, held the dominant socio-economic position (Nims 2005: 6; Tarawneh in prep.: 27). Nims describes that Palestinian refugees who arrived in the ghor in 1948 did not acknowledge the authority of the Hurr sheikhs of the Ghzawi beyond that of the owners of land and water (Nims 2005: 8). The social superiority of these sheikhs was not taken as a given just because they were Hurr clans. Peasant who wanted to be independent from these landowners decided to open up fields in areas outside the irrigation system (Nims 2005: 8). The territory of the Khalid may well have been a similar attempt to subsist outside the reach of the powerful clans of the area. Recent newcomers like Palestinians would not be incorporated into the existing system of Hurr and Ghawarna clans. The land is lo-

¹⁶⁰ The location of the Naser clan territory is not entirely clear from the available maps and should, therefore, be treated with circumspection.

cated in the bay of al-Rweihah almost in the foothills. Several small wadis run down from the hills. These are, however, only water bearing during the wet winter season and even then their volume is not great. If dry farming is to be practised in the ghor of the Zerqa Triangle this would be the best location for it (see the section on EB agriculture).

The harrath system of labour relations was thus overlain with a social system of historically separate clans of Hurr and Ghawarna and a special group of 'Abid servants. Both systems were, however, intertwined as the clan with the highest status also had the highest position in the agricultural labour system. The location of the territories shows that not only the control over land, but also over water made clans and their leaders powerful.

7.2.4 Conclusions

Agriculturally the pre-modern period can be characterized as a period of simple technology and self-sufficient farming based on cereals. Cereals formed the bulk of the crops cultivated complemented by some vegetables for personal use. Only a small share of the crops was for trade purposes. Trade was restricted to cereals and these were exchanged with fully nomadic Bedouin groups for animal products. Money played no part in these transactions. Exchange took place in a few larger towns in the region, but transport was difficult and dangerous, which hampered the development of an integrating trade system. Only upon the development of real urban centres in Cisjordan that were unable to maintain themselves agriculturally, did the areas suitable for cereal cultivation like the Jordan Valley and Belqa' region in Transjordan become more focussed on producing crops for export. This development meant a return to the monetary system and incorporated local economies into that of the larger region. Over the course of time regions started to produce the crops that were best suited or unique to their climatic circumstances, which had to an extreme degree been the case in the Middle Islamic and Mamluk periods with sugar cane and indigo cultivation in the Jordan Valley. Mechanization, government intervention and the new irrigation system eventually made the Jordan Valley part of the world economy it operates within today.

The early ethnohistorical situation shows that when there is no stress on land because the number of people is limited, the Zerqa Triangle can be cultivated on an egalitarian basis. This is shown by the Musha' system that started with the first resettling of the ghor after the Bedouin dominance. The land could only be successfully cultivated when an irrigation system was present. Although people in the 1870's said they only reopened already existing canals, the reinstatement of the irrigation system cannot have been carried out by each individual farmer (Merrill 1881: 382). The reinstatement of the irrigation system must have been a communal task. Furthermore, the distribution of water over the system needs to be organized communally, because a decision made by one farmer had immediate consequences for his neighbours. The tribal background of most farmers resulted in a situation in which the elders or sheikhs of the community had authority in communal matters including the irrigation system.

A system in which a 'first come, first served'-mentality regulated land tenure would have been equally possible in this situation. People who settled first would have been able to claim the best land located at prime locations along the irrigation system. It seems, however, that the tribal organisation in which all clan members were considered equal prevented such a system from developing. A system arose in which good and bad plots rotated between farmers overseen by the elders or sheikh. Farmers communally maintained the irrigation system and the sheikh mainly acted as representative and leader of all the farmers or clan members. On the level of the different clans the system was less egalitarian. Inherent in the tribal system was the division in clans and tribes that fought each other, often literally, to achieve a higher hierarchical position. The most powerful clans successfully claimed the most profitable areas within the irrigation system. It remains uncertain whether these powerful Hurr clans settled in this region before the other Ghawarna clans. In other words, it is not clear whether on this level the right of the first settlers was enforced or whether the social status of the Hurr clans was respected to such a degree that they were able to claim the best lands on the basis of their position in the social hierarchy. When the first Palestinian refugees

came to the Jordan Valley in 1948 land had become private property. Palestinian farmers had to either work as a harrath for a big landowner or bring a piece of poor quality soil that had not yet been incorporated in the irrigation system under cultivation.

The initial land tenure system thus seems to have been regulated within the clans and based, at least in spirit, on equality, although it remains debatable whether this equality was a reality in practice as well. With the creation of private land and the greater stress on land and water as a result of the growing population the egalitarian system disappeared and was replaced by the harrath and fellah systems. The fellah system is reminiscent of the *musha'* system and a certain level of, at least theoretical, equality stemming from the former system is visible. In the harrath system the hierarchy is entirely based on the labour-capital distinction. These asymmetrical labour relations result from the Ottoman and Mandate attempts to introduce private property and the increased stress on land and not so much from the character of the irrigation system. The egalitarian nature or basic idea behind the agricultural system present during the early years of resettlement of the Zerqa Triangle shows that the irrigation system can under specific social circumstances function in a unifying way irrespective of its inherently hierarchical nature. The later enforcement of private property and increasing population pressure resulted in property differentiation and unequal labour relations.

7.3 Mamluk society

7.3.1 Chronology

It is unknown when the cultivation of sugar started the Jordan Valley as a whole and in the Zerqa Triangle in particular nor when it developed into a large industry. Only a couple excavations have been carried out which have produced only a few absolute dates. LaGro, an Arabic linguist by training, has given an informative overview of the historical sources that shed some light on the presence or absence of sugar cane in the Jordan Valley (LaGro 2002: 25-27).

The first reference to sugar cane in the Jordan Valley is from Muqadassi at the end of the tenth century AD. In his enumeration of the most important characteristics of the Jordan Valley, i.e. heat, indigo, bananas and palm trees, sugar is missing. It does, however, feature in his broader list of 36 products typical for the Jordan Valley. The export of sugar only took place at Tyre he writes. It can, therefore, be concluded that sugar cane was grown in the valley, but it was not important. This situation seems to have persisted for at least 150 years because at the end of the 11th century the Crusader Jacobus de Vitriaco mentioned sugar cane being cultivated in the valley, while Idrisi wrote in the mid-twelfth century that indigo was at that time still the principle crop. At the start of the 13th century agriculture in the Jordan Valley had apparently changed as Yaqut wrote rather extensively about sugar cane, which was now the principle crop. At the start of the 14th century Abu al-Fida mentioned only indigo and not sugar cane as a crop of Jericho. A few years later, however, in 1335 Jacopo de Verona specifically mentioned sugar cane as a crop of the area around Jericho and the eastern ghor. In reports from the end of the 14th and start of the 15th century sugar cane was mentioned for the ghor, although it was reportedly less abundant than in Egypt. In an itinerary from the mid 15th century no sugar cane is mentioned any more for Jericho, while in a treaty from the end of the 15th century it was stipulated that Florentine merchants supplied the Mamluk Sultan with molasses for his court. The local Mamluk production of sugar seems to have died out completely at that time (LaGro 2002: 25-27). Based on the historical sources sugar production in Jericho and probably in the ghor at large seems to have been present on a small scale at least from the end of the tenth century. In the early 13th century there is the clear statement that sugar cane was the prime agricultural product of the ghor. By the middle of the 15th century there are some indications that the importance of sugar cane was waning and at the end of 15th it had disappeared altogether.

The few archaeological excavations that have been carried out support this historically based picture. At Jericho the excavations undertaken in 2000 by the Palestinian Department of Antiquities and Cultural Heritage revealed remains from both the Crusader and Mamluk periods (Taha 2004).

The excavation, however, awaits final publication leaving the details unknown. The same applies to the excavation of Tawahin es-Sukkar in the Ghor es-Safi. Only upon the detailed publication of the stratigraphy will information on the continuity of the site become available (Photos-Jones et al. 2002).

At Tell 'Abū Sarbūt several phases dating to the Ayyubid/Mamluk period have been excavated. The earliest phase at Tell 'Abū Sarbūt predates this period, however, and stems from the Roman period (third-fourth centuries AD). Based on the pottery the following five phases were all dated to the Ayyubid/Mamluk period (Steiner 2008: 161-162). All phases were subdivided into several subphases. Throughout all the phases large quantities of sugar pottery were found. During the first Ayyubid/Mamluk phase C a building was present that seems to have had a domestic function (Steiner 2008: 193). Thick ash-layers dumped against a small building were found together with many sugar pottery sherds (Steiner 1997: 147). Sugar production may have been present at the site, but no structural remains were found. This building was superseded for some reason by a much larger building with thick walls in phase D (Steiner 1997: 148). This is the phase for which sugar production was positively identified. The building consisted of a series of rooms around a courtyard entered into over a large four metre wide stone threshold (Steiner 2008: 193). In one of the rooms a bench with five sugar moulds set into a bench was discovered. In the courtyard eleven ostraca were found, that unfortunately do not mention sugar but demonstrate the administration of goods at this place (Steiner 2008: 179). At a certain moment in time this building was also levelled to make room for a new plastered floor and a large building with a probably domestic function (phase F). This building fell out of use twice and was covered with alternating layers of yellow and black deposits before being rebuilt (Steiner 2008: 179). These deposits suggest some industrial activity was carried out elsewhere on the tell (Steiner 2008: 182). After a period of abandonment several buildings were erected again, destroyed and rebuilt (phases H and J) (Steiner 2008: 185, 192). Sugar pottery is still present during these phases, but the industrial activity seems to have ceased (Steiner 2008: 194).

Two radiocarbon dates from Tell 'Abū Sarbūt **have been published, but these have not been** linked to the stratigraphy as published by Steiner. LaGro mentions that the oldest sample stems from the phase when the sugar industry had definitely ended and dates to the wide range of 1292 to 1448 cal. AD. The second dates the last phase of occupation of the tell and ranges between 1434 and 1510 or 1598 and 1610 cal. AD (LaGro 2002: 10). The lack of a link between the stratigraphy and radiocarbon dates makes the absolute dating of Tell 'Abū Sarbūt problematic but it seems that the sugar industry ended before the end of the 15th century, which is in line with the historical data.

An important conclusion from the Tell 'Abū Sarbūt excavations is that the sugar industry was not a continuous phenomenon throughout the Mamluk period. The structures at Tell 'Abū Sarbūt were rebuilt several times. LaGro argued that the site remained unoccupied for a considerable time before it was rebuilt and tried to find a reason for this abandonment. He proposed the Mongol raids of 1299 or the prolonged drought of 1304 as principle reasons, but realized many other factors might be involved as well (LaGro 2002: 35). An important point he makes is that the sugar industry required stable economic and political conditions, as large investments were needed (LaGro 2002: 35). For example, irrigation, transport and trade systems were essential, and mills and refineries had to be constructed. Furthermore, cultivation of sugar cane is a time consuming process. It takes more than a year for the first crop to ripen and sugar cultivation is usually only economically profitable if subsequent ratoon crops are grown as well. The rebuilding and changing layout of the phases might also be related to the frequent earthquakes in this region. These earthquakes might have damaged the structures making rebuilding and sometimes even levelling necessary. However, the continuation of the sugar industry suggests that earthquakes were not so severe as to destroy the irrigation system and infrastructure beyond all repair.¹⁶¹

161 Four severe earthquakes have been recorded from this period, i.e. in or around 1303, 1456, 1481 and 1546 (Amiran et al. 1994: 270-271).

7.3.2 Sugar cane processing and sugar production

After the harvesting of the sugar cane it had to be processed as quickly possible, at the latest within 24 hours, as the sucrose level starts to decrease immediately after cutting (Galloway 1989: 16). The layout of a sugar mill and refinery has been elaborated on in chapter 4 in the section on Dhirār. The focus here will, therefore, lie on the production process of sugar manufacturing. The most elaborate historical account is written by al-Nuwayri on the production of the Egyptian city of Qus.¹⁶² The archaeological remains in the Jordan Valley and the more fragmentary historical accounts on the sugar production in this part of Bilad ash-Shams agree with the description of Al-Nuwayri and show the process of sugar production was very similar if not the same. Numayri states that the production process started in December when the cane was harvested and brought to the *ma'sarab* (LaGro 2002: 30) (see chapter 6). *Ma'sarab* is the Arabic word used to describe a sugar production centre located within the cane fields where the cane was transformed into raw sugar. Another name for this type of sugar production centre is *tabun*, meaning mill or grinder, e.g. Tell Tahunah or Tawahin es-Sukkar. It is different from a *matbakh*, which only denotes sugar refineries in a city. In the Matbakh the raw sugar produced in the *ma'sarab* was purified through additional boiling into the finished product, i.e. pure sugar (LaGro 2002: 28,29).

After harvesting the cane was brought to the refinery where the roots and top were cut off. Nuwayri writes that this was done on wooden tables with grooves by great knives 2/3 ell long and 1/3 ell wide (Deerr 1949/50: 90,91). There is no archaeological evidence for this activity. The tops were kept separate and later manufactured like the sugar cane into syrup of poorer quality referred to as *khabiyah* (LaGro 2002: 30). The defoliating and cutting off of the roots is today often already done in the field. The waste is then left and burnt together with the stubble. Nuwayri does not mention where and when defoliation occurred, but it likely happened at the same time as the roots and top were removed. If defoliating indeed occurred at the refinery the waste may well have been dried and used as fuel in the refinery. No archaeological evidence for this practice has been found, although charred remains of the grass family that might belong to sugar cane have been reported for Horbat Manot (Stern 2001: 299). A lot of fuel will, however, have been needed for the boiling of the sugar and the firing of sugar pottery and this will likely have been a scarce commodity in naturally dry and heavily cultivated areas like the Jordan Valley. Animal dung is a common and well-attested source of fuel, e.g. at Iron Age Deir 'Allā (Neef 1989: 30). Given the great need for fertilizer in sugar cane cultivation it seems very probable that most, if not all of the dung, was spread over the fields as manure. It is, therefore, likely that all suitable waste products from the sugar cane were utilized as fuel.

When the tops and roots were removed and the cane was cleaned, it was carried to another area where it was chopped up and brought to the mill to be crushed (LaGro 2002: 31). Nuwayri writes that the mills of Qus were driven by bovines, whereas archaeology shows that most Levantine mills were powered by water (see section on the mill at Dhirār). The millstones discovered in excavations are all of the so-called edge-runner type consisting of a large lower millstone on which a smaller wheel-shaped stone ran vertically in circles. For example, at Tawahin es-Sukkar in the Ghor es-Safi both stones have been found in situ (Photos-Jones et al. 2002: 602). The crushed cane was put in baskets and put under a press to remove the remaining juice (Deerr 1949/50: 90). No traces of presses have been found in the Jordan Valley. This lack of presses might be explained by the presence of water-powered mills. This made longer and harder pressing of the cane easy and less labour intensive than the additional use of smaller man or animal powered presses. The juice from both pressings was mixed, sieved and brought to the boiling area of the refinery (LaGro 2002: 30). Nuwayri states that for one millstone eight small boilers and one large boiler were needed (Deerr 1949/50: 91). The fibrous waste product of the crushing is today called bagasse.¹⁶³ In modern

162 As Numayri's account of sugar production present in his book 'Nihāyat al-arab fi funūn al-adab' is not available in translation this section is mainly based on a summary given by LaGro and a translated section by Deerr (Deerr 1949/50; LaGro 2002).

163 This is, however, a term that arose in the 19th century and stems from the Spanish bagazo and the French bagasse which means the husks of olives, grapes and other fruits after pressing (Oxford English Dictionary - Online). In the Americas it became the common term for pressed sugar cane waste.

sugar cane production it is often used as fuel in a dried form. Apart from a single charred fragment discovered in the ash of the refinery at Horbat Manot that resembles a piece of cane but could only be identified as a member of the gramineae family, there are no indications for such a use of bagasse in the Mamluk period (Baruch 2001: 310). It might also have been used as animal fodder.

The strained juice was boiled until it had reduced to a thick syrup. The thickened syrup was then poured through a woollen cloth and boiled a second time. The thick juice is now called *mablāb*, which translates as honey. This syrup was brought to the 'house of the pouring' where it was poured into the sugar moulds discovered so abundantly in the survey (Deerr 1949/50: 91). The moulds were brought to a separate drying area in the 'house of the pouring' and placed in or on top of long benches. Underneath each mould a jar was placed, in which the remaining liquid dripped (LaGro 2002: 30). This jar was called *qadus* by Nuwayri and is what archaeologists call the syrup jar. The sugar mould is said to have three holes in its base that were plugged by pieces of cane (LaGro 2002: 30). The southern Levantine moulds have only one central hole in their base. In one of the excavated rooms at Tell 'Abū Sarbūt a bench with five sugar pots inserted in it has been found (Steiner 2008: 171, fig.15, 16). LaGro thinks these moulds served as a support for moulds containing the boiled syrup (LaGro 2002: 8). It does not become clear, however, if and where the syrup jars were placed in this construction. In these moulds the syrup started to crystallize. During this time the moulds were occasionally refilled until they remained completely full. At this stage the sugar moulds were moved, as Nuwayri puts it, 'from the house of the pouring to the covered house' (Deerr 1949/50: 91). It probably took some time before the sugar had completely crystallized. Once this had taken place, the sugar was referred to as *qand* (LaGro 2002: 30). The *qand* was removed from the moulds, a process during which many moulds broke as is evidenced in archaeology. The sugar cones were brought back to the boiling room dissolved in a blend of water and milk and were boiled again producing a white sugar and syrup (LaGro 2002: 31). There is no evidence of syrup being traded; it was probably consumed locally. Another product that was only locally used was the so-called *khabiyah* syrup. This was the product of the crushing and boiling of the tops of the cane. The sucrose quantity was much lower and the resulting syrup was of poor quality (LaGro 2002: 30).

There are no precise statements as to how long this process of sugar production lasted. Makrisi describes that the sugar from Qus was shipped to the matbakh of Fustat at the end of May and in June (Deerr 1949/50: 90). At this time the entire refining process had, therefore, finished. The decreasing sugar content necessitated the starting of the production process immediately after the harvest. Once the cane had been crushed and boiled the sucrose degradation was stopped and the manufacturing process slowed down. The crystallization and drying of the sugar probably took a considerable amount of time as is indicated in historical sources. It is furthermore likely that the harvest was episodic and lasted for some time. After flowering the sucrose level in the sugar cane does not increase any more, nor does it decrease unless frost occurs, a very rare phenomenon in the Jordan Valley (Galloway 1989: 14). As degradation starts after cutting, it will have been vital to cut no more than the sugar mill and refinery could process. There are some archaeological indications, i.e. the many lamps discovered at both Tawahin es-Sukkar near Jericho and Horvat Manot, that sugar refineries worked round the clock (Stern 2001; Taha 2004). The remark by Nuwayri that a supervisor had to keep records day and night to prevent theft, leads one to suppose that refineries worked day and night (LaGro 2002: 34).

7.3.3 The production of the Zerqa Triangle

In the Zerqa Triangle several sites show indications that sugar production took place there (see section 4.6). The rapidly decreasing levels of sucrose after harvest meant that processing sites were located in close proximity to the fields, while the difficulty of transport meant that the crushed cane was processed and the sugar dried where it was milled. The sugar pottery simply seems to have been too heavy for transport and the large amount of pottery found around mills like Dhirār suggest this was indeed the case. At Dhirār, Deir 'Allā and Ammata both mills and sugar pottery

have been clearly evidenced.¹⁶⁴ A mill was very likely present Near 'Abū al-N'eim in field 81 although no tangible traces remain. At Tell 'Abū Sarbūt, however, the situation is more problematic. The large quantity of sugar pottery, consisting of both moulds and jars would suggest the presence of a refinery. The excavations, however, did not reveal traces of a mill or a boiling area. A building with courtyard containing large numbers of sugar pottery and ostraca referring to trade was discovered (Steiner 1997). The excavators interpret this building as an administrative centre relating to sugar (Steiner 1997). However, had this site only been an administrative centre from which the sugar was transported to the city it is unlikely that so many sugar pot sherds would have been found. Once the sugar had dried it could be transported without a container as a solid cone of sugar. Taking the heavy mould of *c.* 6 kg as well would be impractical and unnecessary.¹⁶⁵ And even if the mould was transported as well occasional breakage at the administrative centre would not result in over 94,000 sugar pottery sherds (LaGro 2002: table 1.1). The building can furthermore be considered as a final drying area before transport, but it would be illogical for it to be located far away from the mills. It is, therefore, suggested in contrast to the excavators, that the complex at Tell 'Abū Sarbūt likely functioned as a sugar refinery with a mill and boiling area located besides the tell or on a part not touched by the excavation. The large number of sugar pots are impossible to explain in any other way. The fact that the actual mill and boiling room were absent in the excavation is no evidence that they were not present close by.

It, thus, seems that four refineries were present in the area irrigated by the Zerqa as well as one irrigated by the Rajib. As the area to the south of the Zerqa that was also irrigated with its water was not surveyed it is possible that additional refineries existed in this region during the Mamluk era. Within the research area itself it is unlikely that refineries were missed. The large quantities of sugar pots combined with the robust construction of the water mill and refinery make it unlikely that all traces of this large-scale activity would have been obliterated. The amount of terrain covered, not only as part of the intensive survey but also through more ad hoc examination of the countryside in combination with previous surveys and itineraries of early travellers that usually report very well recognizable mills, make it very likely that all Mamluk mills have been discovered.

It is, therefore, assumed that five mills were present in the Zerqa Triangle during the fourteenth century. The fourteenth century AD is the period for which historical sources amply demonstrate sugar cultivation in the Jordan Valley and which can be regarded as the height of the Levantine sugar production (e.g. Ashtor 1981: 92). It is furthermore assumed that the mills processed the sugar cane cultivated in the fields surrounding it. Sugar cane is a bulky crop. It can grow three to six meters high and has a diameter of 2 to 4.5 cm (Clayton et al. 2006 onwards). The amount of transporting will, therefore, have been kept to a minimum.

At three of the five sugar refineries villages have been attested. Franken's excavations at Abu Ghourdan have attested village occupation in close proximity to the mill in field 250 (Franken and Kalsbeek 1975). The concentration discovered in field 329 and the pottery collected by previous surveys on Tell 'Abū al-N'eim itself show that a contemporaneous village was present near the refinery of field 81 (e.g. Ibrahim et al. 1988: 191). On top of tell Ammata surveys and the excavations by Petit have attested domestic remains from the Mamluk period (Petit in prep.). Furthermore, in the 13th century Yaqut refers to Ammata as a town and Idrisi calls it a city in the twelfth century (Le Strange 1965: 393, 31). However, the excavations of Tell 'Abū Sarbūt have not attested village occupation related to the sugar industry (Steiner 2008). As only part of the tell was excavated, it is possible that there was village occupation elsewhere on the tell. It is likely that there was a guard present at the site. This type of habitation is, however, very limited and may have been discovered at the southern part of the field 250 concentration where small quantities of domestic Mamluk pottery were found (see section 4.6). A similar situation exists at Dhirār, where a low tell was present next to the mill. As no excavations have taken place and the tell has largely disappeared it is uncertain whether the tell represents village occupation or only the refinery followed by later

164 At Ammata mills have been evidenced in early itineraries and by other surveys, but as they are located to the north of the Zerqa they were not incorporated in the survey.

165 A Mamluk sugar mould excavated in the cemetery of Deir 'Alla was weighed. This example that was broken almost perfectly in half weighed slightly under 3 kg.

occupation. The presence of some sort of habitation next to or within walking distance of the refineries seems necessary at least during the harvesting and sugar processing season as considerable numbers of labourers would be needed.

Five mills in an area of which over 40 km² could be irrigated under normal conditions seems a lot (see section 5.3 and 6.3). Considering the locations of the refineries it is clear that these tend to be located very close together. The distance between the mill of Dhirār and that of Deir 'Allā is, for example, as little as 1.7 km and 'Abū Sarbūt is only about two kilometres away from either locations. These small distances suggest that the agricultural land belonging to each mill was rather limited. If the area of the Zerqa Triangle is divided by the conventional Thiessen-polygon analysis into territories, large parts of the Zerqa Triangle appear to have been located on the fringes. Through these border regions some territories, for example 'Abū al-N'eim and 'Abū Sarbūt, become very large making it unlikely that the farmers in these villages were able to cultivate their entire territory. Considering the importance of the irrigation system described in the previous chapter Thiessen polygon analysis does not seem applicable in this region. The landscape of the Zerqa Triangle is not a blank area of equal accessibility and opportunity. It is so to say pre-programmed by the irrigation system, which is in turn governed by the local topography. When the supposed Mamluk irrigation system as described in the previous chapter is superimposed on the Mamluk map of the region, the sugar production centres can be seen in this context. What is immediately apparent is that all sugar mills are located along one of the main irrigation channels. Ammata is located along the Wadi Rajib, from which canals branched off to both the North and the South. Dhirār is located along the Dhirār or Mazāriyah canal. Deir 'Allā lies along the Wadi el-Ghor, but water to power the mill is supplied by secondary irrigation canals from the Dhirār channel. 'Abū Sarbūt is located along both the Wadi el-Ghor and the Mu'taredah canal, whereas 'Abū al-N'eim is located on the Maydan canal.

Given the clear link between the mills and the main irrigation channels it is assumed that the fields watered by the same channel produced the sugar cane processed in the mill located along it. If the area irrigated by each of the main channels is grouped together the agricultural territories around 'Ammata, 'Abū al-N'eim and Tell 'Abū Sarbūt are clear because these can be regarded as similar to the area irrigated by these canals (see figure 7.3). The areas of Dhirār and Deir 'Allā form a problem, however. The land surrounding these production centres is irrigated by the same channel, i.e. the Dhirār channel. If these lands were indeed worked by two different communities they must have cooperated in the use of the irrigation water, whereas the other territories were essen-

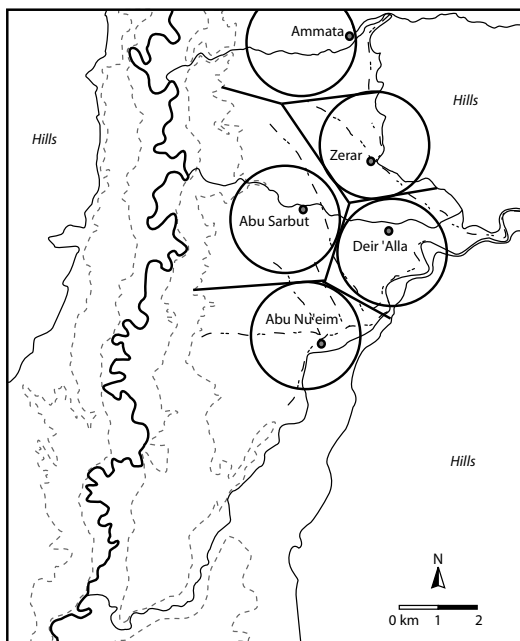


Figure 7.2 Thiessen polygons drawn around the sugar mills

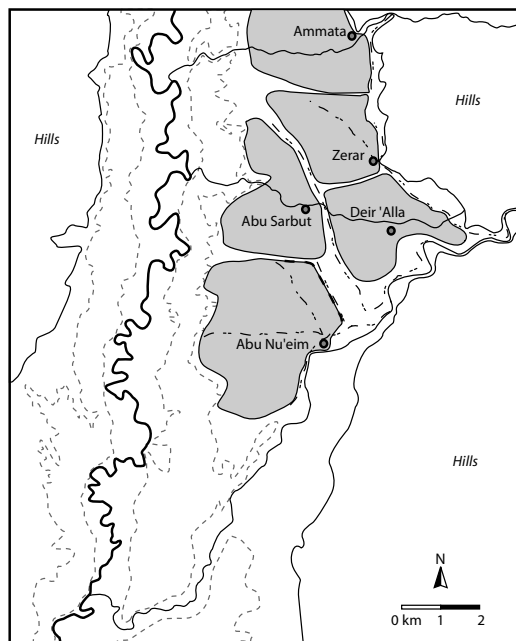


Figure 7.3 Reconstructed territories based on the irrigation system

tially self-sufficient thanks to their individual inlet. The mills of Deir ‘Allā and Dhirār are also the most closely spaced and it is unclear whether there was a village present at Dhirār. This suggests that the Dhirār mill may have been a dependency of Deir ‘Allā. A contra-argument would, however, be that the northernmost area of the Dhirār channel is rather far away from Deir ‘Allā, which would have been the village in which the farmers lived. This is, however, still within the five kilometre activity radius envisioned for farmers. Tell ‘Abū Sarbūt is located downstream of Deir ‘Allā on the Wadi el-Ghor. This communal use is, however, not sharing of a water source on the same level as Dhirār and Deir ‘Allā, because the Wadi el-Ghor will not have been as important for irrigation. Seeing that the water supply is mainly dependent on rainwater from the hills, its water flow will probably have been very slight during summer.¹⁶⁶ It is, furthermore, too much embedded to power a watermill or to be used for irrigation. There is no evidence for this use in the ethnohistorical record. The wadi was most likely mainly used for drainage and the mill was located on its bank because of the height difference needed. No village remains were excavated at Tell ‘Abū Sarbūt. If no village was present at the mill the people working in the refinery and in the fields might have travelled to and fro each day from one of the other villages, most likely Deir ‘Allā as the entire agricultural domain of Tell ‘Abū Sarbūt lies within one hour’s walking of Deir ‘Allā. If this was the case, Tell ‘Abū Sarbūt, like Dhirār, can in a sense be regarded as a dependency of Deir ‘Allā.

7.3.4 Produce calculations; an exercise

Based on the previous chapter the sugar cane yield and the amount of sugar that could be produced from it can be calculated for the estimated cropping pattern. The sugar yield can be calculated in two separate ways. First, the cultivated area can be compared to ethnohistoric sugar cane yields and the amount of sugar that could be obtained from it. Second, Mamluk writers provide information on sugar yields per area of cultivated land. Admittedly, both methods are imprecise and only give a very broad indication of how much sugar might have been produced in the Zerqa Triangle.

The first method uses sugar cane yields gained in Egypt in the 1870’s. Today no sugar cane is grown in the Jordan Valley, which means there is no detailed information on actual yields under the same pedological and climatic circumstances. Today and in the last few centuries, sugar cane production has focussed on areas with better suited climatic condition like south-east Asia and the Americas. Furthermore, modern chemical fertilizers have largely countered the problem of soil exhaustion. These crop yields are, therefore, not applicable to the Zerqa Triangle in the Mamluk period. Available data that approach the Mamluk situation most closely, both in technological development and climatic circumstances, stem from 1870’s Egypt (Rabino 1884). All that time sugar cane cultivation in Egypt relied on pre-modern agricultural methods without artificial fertilizer. The report makes no mention of it, but it is unlikely that steam engines had already by that time found their way into the sugar production process. Temperatures are slightly higher in the south of

	cane	sugar	molasses
1875	24351	1815	
1876	22935	1736	
1877	26587	2217	
1878	25425	2159	
1879	24303	2021	522
1880	25694	2159	478
1881	14730	1546	397
1882	34504	2895	721
Average	24816	2068	529

Table 7.1 Egyptian sugar yields translated into kg/ha (after Rabino 1884: 429)

¹⁶⁶ Today the Wadi al-Ghor is almost completely dry during summer.

Egypt than in the middle Jordan Valley, but the climate is roughly similar. The available data cover the years between 1875 and 1882 and give information on area cultivated, total cane yield and total sugar yield, in the later years supplemented by molasses and alcohol yields (Rabino 1884: 429).

When an average production of 24816 kg cane and 2068 kg sugar per ha are taken as guideline the production of the Zerqa Triangle can be calculated. For sugar cane June is the month with the highest water restriction. In a dry year only 12 km² can be cultivated, which gives an area of 366 ha when 30% of the agricultural potential is used for cane cultivation. This gives a total of 9,076,313 kg cane which can be converted into 756,359 kg sugar and 193,479 molasses. These quantities seem vast. They are, however, quite modest compared to modern Egyptian yields; in 1982 average yields of 85,700 kg/ha were reached and in 2001 as much as 121,000 kg/ha was obtained (FAO 2005). If Mamluk writers can be trusted in their statement that sugar cane fields could be cultivated for two years and had to lie fallow for four years, based on the water availability it seems possible that as much as 750 tonnes of sugar was produced per year in the Zerqa Triangle. Even if a lower yield and higher sugar loss as a result of less sophisticated production techniques are accounted for, the sugar yield still amounts to many tons. This seems incredibly high, but historical records show that the Mamluk Empire was exporting and consuming unbelievable quantities of sugar (see below).

The second line of investigation is based on the historical records. The writings of both Maqrizi and Nuwayri give some indications on how much sugar could be gained from a field. Their unit of measurement is the feddan, which was 6368 m² in the fourteenth century (LaGro 2002: 31). Maqrizi writes that the yield of a feddan ranged between 40 and 80 moulds depending on the quality of the sugar cane (LaGro 2002: 31). According to Tsugitaka, Ibn Mammati gives the same number of 40-80 moulds per feddan, which he says was the equivalent of 400-800kg and had a value between 20 and 100 dinars (Tsugitaka 1997: 219). This implies that one mould had a value of 0.5-1.25 dinar depending on the sugar price. Nuwayri states that one feddan produced 37.5 - 62.5 qintar qand (raw sugar), 20-30 qintar syrup and 12 qintar khabiyah (LaGro 2002: 31). In his description of Qus, Nuwayri states that one feddan could maximally produce 3 dariba of which 5/6 was qand and 1/6 was syrup. A dariba was the measurement for a certain quantity of crushed cane that came off the press and contained 24 Egyptian qintar (Deerr 1949/50: 91). In Qus a feddan could, therefore, maximally produce 60 qintar of qand and 12 qintar of syrup, which falls well within the range described above. The size of one qintar is problematic. The fact that Nuwayri specifies that a dariba contains a certain amount of Egyptian qintar suggests that in other regions a qintar may have had different sizes. In fact most provinces in the Mamluk Empire had their own weight systems. Maqrizi mentions in his description of Qus that a mould held approximately one qintar (LaGro 2002: 30). The description of the moulds from Qus deviates from the moulds discovered in the Zerqa Triangle in that they have 3 holes in the side instead of 1 central hole. The moulds are used in the same way, however, as they are placed over syrup jars and are carried around when filled with sugar (see above). It is assumed that both the moulds from the Jordan Valley and from Egypt were similar in size, but given the unfortunate fact that no sugar industry sites have been excavated in Egypt this cannot be corroborated. The treatment of the moulds argues against the modern weight of 50 kg for a qintar. Some historians even use 90 kg as the weight of a qintar, but the production of vessels of such a size and the subsequent transport seem impossible (e.g. Ashtor 1981: 107). At Tell 'Abū Sarbūt the contents of the moulds centred around two peaks, the first between 8 and 12 litres the second around 16 litres (LaGro 2002: 42). The actual size of a qintar is, therefore, not clear, but it will likely be somewhere between 8 and 16 litres. For this reason the qintar is regarded in the following calculation as approximately one mould.

Under the proposed cropping pattern 366 ha or 574 feddan could be cultivated with sugar cane in a dry year. Taking Maqrizi's production data of 40-80 moulds per feddan, this gives a total between 22974 and 45948 moulds of sugar per year. Nuwayri's figures suggest that 21,538-35,897 qintar qand, 11,487-17,230 qintar syrup and 6892 qintar khabiyah syrup were produced each year in the Zerqa Triangle. The amounts obtained from the two writers fall more or less within the same range. It is unfortunate that there is no detailed information on the size of a qintar. However, if a qintar is taken to be the equivalent of a mould as Maqrizi stated and the sizes of the moulds for Tell 'Abū Sarbūt are taken as standard, a qintar may either weigh c. 10 or 16 kg. With qintars of

10kg the amounts of the Mamluk writers lag behind the ethnographic calculations, while 16 kg qintars give only a slightly lower average of c. 735 ton sugar when one takes Maqrizi's 80 moulds per feddan into account. However, the total sugar yield will have amounted to something between 220 ton plus 115 ton syrup and an absolute maximum of 750 ton sugar.

Divided over five mills this means each mill processed between 4595 and 9190 moulds according to Maqrizi and between 7983 and 10625 mould in total in Nuwayri's calculation.¹⁶⁷ Nuwayri mentions that the large boiler (*khabia*) in which the juice was boiled for the first time could hold 25 qintar (Deerr 1949/50: 91).¹⁶⁸ This means that, if Nuwayri's statements are accepted, the large boiler had to heat a load of cane juice at least 184-425 times.

The conducted calculation is of course fraught with uncertainties, unknown prerequisites and misguided assumptions. It should, therefore, not be regarded as a definitive calculation the actual amount of raw sugar produced in this area. It is, however, a good exercise to better understand the quantities dealt with in the sugar industry. Most of the uncertainties or unknown factors can be estimated with a certain degree of reliability, e.g. the cultivated territories. This makes that the numbers are not exact but fall within a restricted probability range and can be used to place the sugar cultivation of the Zerqa Triangle in a better contextualized perspective. The quantities of sugar the Mamluk sultans in Cairo consumed and gave away can now be better understood. In 1344 AD, for example, 18000 qintar of sugar were used during the wedding festivities of the son of the sultan. In the early part of the 14th century the sultan's court in Cairo consumed 1000 qintar of sugar during Ramadan. In the 1340's this had risen to 3000 qintar. The sugar used and collected reached such enormous numbers and represented such great wealth that when the goods of the treasurer of the personal possessions of the sultan were confiscated there was an amount of sugar and candy among it with a value of 80,000 dinars (Ashtor 1981: 95). Nevertheless, the Mamluks were able, despite the great consumption by the court, to export to Europe and other Arabic countries. It is estimated that the total yearly export to Europe from Bilad al-Shams and Egypt amounted to 30,000 to 50,000 dinar at the end of the fourteenth century (Ashtor 1981: 98). It should be kept in mind that the sugar of the Zerqa Triangle was raw sugar that had to undergo further refining in the *matbakh* of the city where the volume of *qand* sugar was reduced each time it was dissolved and boiled again.

7.3.5 Archaeozoology

The sugar production is not only visible in the botanical remains of the region, its repercussion are also visible in the excavated faunal assemblages. Two sets of data are available. The assemblage of Tell 'Abū Sarbūt has been analysed and published by Van Es. He also examined the faunal remains from the Tell Abu Ghourdan but the results have not been published (Van Es 1995).¹⁶⁹ Unfortunately all phases of the tells are grouped together, making it impossible to separate the sugar production assemblages from those of village occupation. The collection of faunal remains of Tell Abu Ghourdan is, furthermore, rather small with 196 fragments from identifiable domesticated species. This makes comparison between the two all the more difficult, but nevertheless the same general characteristics show up. Both assemblages harbour large numbers (41.3-41.5%) of cattle remains (*Bos taurus*). The Iron Age levels of Tell Deir 'Allā showed much lower percentages on average of 25% cattle (Van Es 2002: 263). Consequently the total percentage of sheep (*Ovis aries*) and goat (*Capra hircus*) bones is much lower in the Mamluk layers than in the Iron Age phases; 39.8 % and 35.2 % for the Mamluk tells versus an average of 73% for Iron Age Tell Deir 'Allā

167 The slightly different sizes and productivity of the territories are not taken into consideration.

168 He states that the boiler held 50 matr and that one matr is half a latin qintar which can again be divided into 200 dirhams (Deerr 1949/50: 91). As a Mamluk dirham is the equivalent of c. 3 grams, it is clear that a latin qintar is not of equal size to the qintar that is the equivalent of a mould.

169 As part of his studies on the faunal remains from Tell Deir 'Allā, Van Es has studied the material from Tell Abu Ghourdan as well. The data referred to here stem from an unpublished report Van Es submitted to the project director, G. van der Kooij.

(Van Es 1995, 2002, n.d.). For Tell 'Abū Sarbūt Van Es has published the age distribution of the domesticated cattle. As much as 80% of the cattle lived for over three years, which suggests that they were primarily reared for milk and traction and not for their meat (Van Es 1995: 93).

The second difference with the Iron Age faunal assemblage concerns the high numbers of horses, donkeys and dromedaries. At Tell Abu Ghourdan 13.3 % of the identifiable bones belonged to donkeys (*Equus asinus*). At Tell 'Abū Sarbūt 5.2% were identified as belonging to the equus species, while 0.4% and 0.3% could be positively identified as donkey and horse (*Equus caballus*) respectively (Van Es 1995: table1a). The average number of horses/donkeys in the Iron Age layers of Tell Deir 'Allā was only 0.9%. The large percentage of dromedaries (*Camelus dromedarius*) (8.5 % and 5.6 %) cannot be compared to the Iron Age as the dromedary was introduced around 700 BC and occurs only in the IA IIc phase of Tell Deir 'Allā where it constituted 0.5% of the domesticated animal assemblage. In the article on the Iron Age faunal assemblage of Tell Deir 'Allā Van Es mentions that the number of dromedary bones differed per phase within the Mamluk period (Van Es 2002: 265).

At Tell 'Abū Sarbūt the age distribution of the dromedary is quite similar to that of cattle. Only a small percentage (7.1%) consisted of juvenile or young animals while 92.8 % were adult animals (Van Es 1995: 94). Dromedary was most likely not eaten, but served primarily as pack animal. Sheep and goats were the animals that were kept for meat. A total of 32% were killed between 0.5 and 1.5 years old. Another 30% lived between 1.5 and 3 years. These animals probably lambed once and provided milk and offspring. The remaining 34% lived for over three years (Van Es 1995: 94,95).

It can, therefore, be concluded that the sheep and goat supplied most of the meat in the Mamluk villages of the Zerqa triangle. Their decrease in importance within the assemblage did not necessarily represent an absolute decline, but can also reflect an increase in cattle, equids and dromedary. Milk was obtained from sheep and goats, but also from cattle and possible dromedary. Today, dromedaries are occasionally herded in this part of the Jordan Valley for both their milk and meat. The age distribution at Tell 'Abū Sarbūt suggests dromedaries were primarily used as pack animals there. It is likely that they were used for traction and transport of the cane and possibly also of sugar to the refineries in the city. Cattle bones were discovered in large quantities, especially when compared to zoological remains from the IA (Van Es 2002). The large number of bovines might very well explain the high proportion of barley compared to wheat that was reported for Tell 'Abū Sarbūt (Grootveld 2008). In this part of the world cattle is seldom kept in flocks that move from pasture to pasture to graze. They are generally kept close to the settlement and their diet is at least supplemented with fodder like barley. In the Mamluk period they were

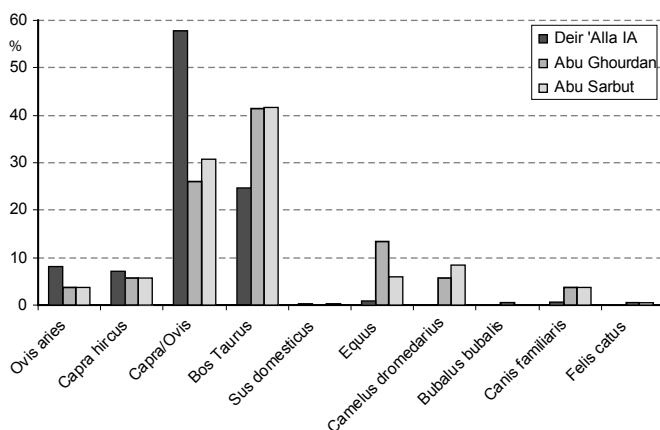


Figure 7.4 Relative numbers of identified domestic species from Tell Abu Ghourdan (n = 196) and Tell Abu Sartbut (all phases, n = 3194) compared to the average of IA Tell Deir 'Allā (based on Van Es 1995, 2002, n.d.)

undoubtedly kept for milk and traction. They will have ploughed the fields and possibly turned the millstone when there was no watermill at Tell 'Abū Sarbūt. Their dung, together with that of

all other animals, will have been used as manure and as fuel. They may have been used for transport as well. A text from 1419 AD shows that sultan Qaytbay used cattle for the transportation of goods (LaGro 2002: 32). Concluding, the presence of equids, dromedaries and larger numbers of cattle seems to be directly related to the industrial production of sugar in the Zerqa Triangle. The increased importance of these animals will have altered the manner of animal rearing. Sheep and goats were often herded away from the tell as they followed the disappearing pastures during the hot summer (see next section). Cattle were less suited to herding over large distances and cattle, equids and dromedaries were needed on the sugar fields for large parts of the year. This may have changed the way sheep and goats were herded as well, but there is no archaeological evidence for this. It is, however, highly likely that a smaller part of the community was involved in sheep and goat herding away from the village. Sheep and goat had become less important for milk as this could also be gained from the other animals and during the harvest all hands were needed in the sugar industry.

7.3.6 The social structure of the sugar industry

The organisation of the sugar cultivation and production differs from the small-scale cultivation by independent farmers that was most likely the norm before and possibly after the Mamluk era. During the first small-scale phase of sugar production, small independent landholdings existed on which people both cultivated the cane and processed it into sugar. Historical sources show that when the large profits that could be achieved through sugar production became common knowledge people from outside the region gained control of the sugar production. Both wealthy entrepreneurs and members of the royal family acquired sugar estates in agricultural areas (Ashtor 1981: 99). For Egypt there are, for example, records that show that the Banu Fudayl family planted as much as 1500 feddan, which is over 955 ha, of sugar cane per year in the first half of the fourteenth century (Ashtor 1981: 99). The largest sugar producers were, however, the families of the sultan and high-ranking emirs. In Damascus there was, for example, a special administration exclusively concerned with the sugar industry of the sultan. This department registered the deliveries of raw sugar from the sultan's estates in the Jordan Valley among other things. The raw sugar was then brought to the royal refineries (*matbakh*) in Damascus for further refining until pure white sugar was gained (Ashtor 1981: 99).

There are indications that the Sultan of Damascus owned at least part of the Zerqa Triangle. In 1398 the sultan visited the Jordan Valley. This visit was recorded, because he arrested two of his emirs. One of them, emir Djulban, was at the time of his arrest on the lands the emir had allotted to him. These lands were located at 'Ammata and al-'Adliyyeh (LaGro 2002: 18). Unfortunately there is no direct link to the sugar industry, but the sultan himself had connections to sugar production in the Jordan Valley. Six months after his trip to the Valley he appointed an emir as director of financial affairs in Syria. In this capacity the emir forced others to buy a certain amount of sugar from the Jordan Valley to ensure the turnover of the Sultan's business (LaGro 2002: 19).

The forced purchase of sugar from the sultan was not a unique occurrence. Towards the end of the fourteenth century the Mamluk dynasties had gained the monopoly over the sugar production (Ashtor 1981: 101). The sultans had achieved this through the simple appropriation of sugar and funds from important sugar producers. Sugar industrials were also simply outcompeted through abuse of authority and unfair decrees. The sultan and his employees were, furthermore, not subject to the normal tax levied on sugar. This gave them an economic advantage. They also forced individual sugar entrepreneurs to buy the royal sugar or dictated that sugar could only be sold through royal sugar agents (Ashtor 1981: 102). The historical sources show that through all these measures they had managed or were actively trying to gain a monopoly position (Ashtor 1981: 103).

For the people in the Jordan Valley it would probably have been of little significance whether the estate they worked on was owned by the sultan or by a private entrepreneur. Both will have tried to make as much profit as possible. From historical sources on agricultural practices it seems that the estates on which people worked and the capacity in which they performed their work can be divided into two groups. On the one hand there are the estates on which people cultivated the land as sharecroppers. On the other hand there are the demesne lands where the work is done by

serfs in the form of a sort of *corvée* duty (Galloway 1989: 41). The former type of agriculture seems to have been the norm for most agricultural lands, whereas the latter was restricted to sugar cane cultivation and even in that realm only a small percentage of the land was worked in this fashion (Galloway 1989: 41). In the Jordan Valley almost all the well irrigable land, including the highly profitable Zerqa Triangle, will have been used for cane cultivation during the height of the sugar industry.

The sharecroppers that worked the large estates had to hand over part of their harvest to the landowners, the amount depending on the quality of their land and whether or not they had used the landowners' seed and equipment. Thanks to historical sources, the amount of tax levied on sugar cane farmers whom the government had supplied with tools and oxen is known. This tax amounted to 5 dinars per *feddan* for plant crop (*kharaj al-ra's*) and $2+5/24$ dinars on ratoon crop (*kharaj al-khilfa*). Farmers who used their own implements only paid 2 or $3/4$ dinar per *feddan* for a plant or ratoon crop respectively (Tsugitaka 1997: 220). A tax for making use of the presses was also levied, but no records of the amount have survived (Tsugitaka 1997: 220). These tax data stem from Egypt though and in contrast to the southern Levant the system of land tenure in Egypt has been well attested in historical sources. In Mamluk times Egypt was subject to the *iqta* system (see e.g. Tsugitaka 1997). Land was controlled by the sultan who granted estates or *iqta's* to military fiefs. The land on these estates was farmed by sharecroppers who paid tax or a proportion of their crop to the owner of the estate. The *iqta* land was not hereditary and returned to the sultan after the holder had died (Galloway 1989: 41).

It is probable that the plantations in the Jordan Valley functioned according to this system or a similar one, but little evidence is available. The reference of the emir who was arrested at the plantations of Ammata and Adliyyeh allotted to him by the sultan corroborates the suggestion that certain people owned large plots that were by necessity cultivated by others who stood in a dependent relationship to the owner. Given the rarity of *corvée* labour, it is likely that the land in the Zerqa Triangle was worked by sharecroppers who paid tax or relinquished part of their crop to the owner of the estate. This was either a military official appointed by the sultan or a private entrepreneur. During the fourteenth century, however, the sultan tightened his grip on the sugar production and private entrepreneurs became less common. How the sultan increased his influence on the fiefs to whom he had allotted land has not been recorded exactly, but the many decrees concerning sugar issued by sultans like Barsbay shows they actively tried to become monopolists (Ashtor 1981: 103). The sultan, however, also acquired land as part of his personal estate (*khass*). Large tracts of this land were located in the Jordan Valley (Walker 2004: 120).

Walker states that the Ottomans inherited the Mamluk's tax apparatus, which they adopted after only limited modifications (Walker 2004: 122). Early Ottoman tax records can, therefore, often be used as indicators of the status of the land in the Mamluk tenure system. Tax records from the first century of Ottoman rule over this area list four villages paying tax in the research area (Hütteroth and Abdulfattah 1977: 167-169). Deir 'Allā is the only village located with certainty, of the others only a general location is indicated. The village of Deir 'Allā paid tax to the governor of the district (Hütteroth and Abdulfattah 1977: 168). The villages of Suwayr, possibly located near 'Abū al-N'eim, and Abisa, in the Dāmiyah area, paid tax directly to the Sultan (Hütteroth and Abdulfattah 1977: 167). The fourth village placed by Hütteroth and Abdulfattah in the vicinity of Ammata, made payments to a military fief (Hütteroth and Abdulfattah 1977: 169). This fits with the statement of 1398 when 'Ammata and al-'Adliyyeh were the allotted property of an emir. For 'Ammata it is, furthermore, known that in the early sixteenth century the Ottomans decreed that a portion of the taxes from the Ammata plantation was to be set aside as *waqf* to provide for the maintenance of the tomb of 'Abū 'Ubaydah (Fischbach 2001: 526). The use of *waqf*, the setting aside of the spoils of an area to provide for a religious institution, was already common practice among the Mamluks. It is known that when Sultan Baybars built a mosque and a superstructure over the tomb of 'Abū 'Ubaydah in 1276 AD, he ordered a piece of land as *waqf* for its maintenance. The inscription on the tomb states that this land was not located in the Jordan Valley, but at the village of Dayr Tubin in the Homs province of modern Syria (Van Berchem 1903: 48). This shows the integrated nature of the Ottoman Empire and the efficiency of its administration that enabled such widely dispersed areas to be linked. If the early Ottoman tax records indeed re-

flect the Mamluk situation, two of the areas in the Zerqa Triangle were the direct property of the Sultan, one was controlled by a military officer and Deir 'Allā paid to the governorate in 'Ajlun. These local data fit in with the general picture of land tenure in the Mamluk Empire very well. How all these developments and changing property rights affected the sharecroppers in the Zerqa Triangle remains unknown, however.

7.3.7 Conclusions

It seems clear that the sugar cane plantations in the Zerqa Triangle were under firm control of outsiders. 'Ammata and Dhirār/ al-'Adliyyeh were controlled by a military fief and were indirectly property of the Sultan, while 'Abū al-N'eim might have been the personal property of the Sultan. The farmers cultivating the fields will have stood in a dependent relationship to these owners. It is unknown how the labour relations were organized exactly, but it seems to have been some sort of sharecropping arrangement. Data on taxes levied on land but also on the rented equipment are available from historical sources. It seems that, similar to the pre-modern period, sharecropping was the norm. The labour relations may have changed over time. It seems that at the height of the sugar industry, especially when the sultans were actively striving to gain a monopoly, the desire to gain as much profit as possible was so great that the labour relations will have become highly unbalanced. The Jordan Valley farmers will have been used to produce as much sugar at the lowest cost as possible. The Mamluk rulers were in general not soft on conquered territories outside the urban heartland. Mamluk agriculture in the Jordan valley can be considered as the profit based cultivation of cash crops by absentee landlords. Although the farmers in the valley will have been on the lowest rang in the ladder of power and profit, it might have been possible that at least groups within the farming community reaped the fruits of their profitable agriculture. Unfortunately, no data are available on the general health of the Mamluk people buried at Tell Deir 'Allā. The exact socio-economic position of the Zerqa Triangle farmer cannot be ascertained, but the enormous wealth acquired by the ruling class in the cities suggests little profit remained for the farmers themselves.

Areas like the Jordan Valley, and especially the Zerqa Triangle which could be well irrigated, were vital to the economy of the Mamluk era. The Mamluk rulers, therefore, took care that communication and transport were safeguarded as is evidenced by the bridges and roads constructed during this period. Apparently, the power and organisation of the Mamluk Empire were such that it was capable of reconstructing damage caused by the frequent earthquakes in this area speedily enough for the sugar industry not to suffer long-lasting effects. The power of the Mamluk rulers must have extended into Transjordan, which can be regarded as part of the periphery during Mamluk times. The firm control by the government during this period provided stable conditions that were essential for sugar cultivation. The waqf of 'Abū 'Ubaydah shows that distant parts of the empire were integrated into Bilad al-Shams as a whole and were controlled from Damascus. The people of the Zerqa Triangle will have known where their sugar went and that they were part of the Mamluk Empire. The cultivation of a cash crop for the international market controlled by the rulers in the urban centre far away will have essentially integrated the farmers into the wider economy instead of isolating them like the pre-modern situation.

7.4 The Iron Age tell site society

7.4.1 Introduction

From the previous chapters it has become clear that the Zerqa Triangle mostly saw occupation in the form of small villages during the IA IIa/b periods (see section 5.5). Most settlements did not occupy more than 0.5 ha and can without a doubt be referred to as small villages or hamlets. As discussed in the previous chapter these villages were most likely involved in subsistence agriculture based on the cultivation of cereals. Irrigation was essential to successful agriculture and the system probably consisted of a network of small open canals stretching over large parts of the

ghor of the Zerqa Triangle. The following section will focus on the IA community that inhabited the Zerqa Triangle. What effect did the irrigation system have on the IA society? Furthermore, the fast oscillation between habitation and abandonment visible at most settlements in the region will be discussed and related to the irrigation system. Eventually the question that needs answering is why people settled the region so densely during some sub-phases of the IA and why they seem to have almost completely abandoned it during others. What was the reason for this highly changeable society and are we correct in supposing that the region was abandoned or might habitation have shifted to a type less easily recognized in archaeology?

In contrast to the archaeobotanical assemblages that are quite well studied and understood, the archaeozoological character of these sites is less well known. Archaeozoological remains have been uncovered at most excavated sites, but only those of Tell Deir 'Allā allow intensive study (Van Es 2002).¹⁷⁰ From Tell Deir 'Allā it is clear that during the entire IA domestic animals far outweighed the wild animals. The highest proportion of wild species was discovered in the IA IIc period and amounted to 6.9% of the total. During the LB and IA I periods this was as low as 1% and during the other IA sub-phases it was generally less than 5% (Van Es 2002: 263). Wild animals that were hunted included Mesopotamian fallow deer (*Dama mesopotamica*), and to a lesser extent gazelle (*Gazella subgutturosa*) and wild boar (*Sus scrofa*). Furthermore, a small number of bones stemmed from several species of rodents, fish, and birds (Van Es 2002: 265, n.d.). The domestic animals form the majority of the faunal assemblage. Sheep (*Ovis aries*) and goat (*Capra bircus*) bones dominate the domestic assemblage. In all IA phases sheep and goat amounted to over 70% of the number of identified specimen (NISP). Concerning weight they are, however, less important than cattle (*Bos taurus*) and only constituted a little under 40% (Van Es 2002: 263). Cattle, as the second important group, had a slightly higher proportion in weight than sheep and goat, but did not exceed 30% in NISP (Van Es 2002: fig. 2). Only in the IA II period did cattle outweigh sheep and goat (Van Es 2002: fig. 3). Small proportions are formed by equids (*Equus asinus* and *Equus caballus*, NISP <1.6%), pigs (*Sus domesticus*, NISP <0.5%), and after 700 BC also dromedary (*Camelus dromedaries*, NISP 0.5%) (Van Es 2002: table 2a, n.d.). Although there are small percentual differences among domestic animals between the sub-phases of the IA, the difference in number of bones discovered prohibits the drawing of firm conclusions.¹⁷¹ In short, it seems clear that the IA faunal assemblage was dominated by domestic animals, supplemented by a small proportion of hunted wild animals. Cattle formed the most important supply of meat. Their milk, skin, and traction power were, however, probably also used. However, only a small percentage of the bones showed deformations as a result of heavy labour (Van Es 2002: 265). Equids were probably also used as draught or pack animals, although their number is relatively restricted. Sheep and goat were undoubtedly kept for their wool, milk and meat (Van Es 2002: 265). Unfortunately, no age distributions are given for the different species making it difficult to distinguish whether animals were primarily kept for their meat or for secondary products.

7.4.2 Social implications of the irrigation system

IA villages in the Zerqa Triangle seem to have consisted of a few households grouped together, whose inhabitants occupied themselves with crop cultivation on the surrounding fields that were supplied with water from a canal irrigation system. They, furthermore, kept flocks of sheep and goats and a lower number of cattle. The flock supplied meat, wool and milk, while the cattle were also used as plough animals apart from providing meat and milk. A few horses and donkeys or mules were probably also used as draught and pack animal. In all, these villages were small self-sufficient entities involved in cultivating crops and rearing a few animals. Apart from small differences in size the excavated sites are characterized by equality (Petit in prep.). Unfortunately a large number of the sites has not been excavated. This is problematic as differences may exist that do not show up in mere size and artefacts scatters. Both the tell site and landscape surveys have, how-

170 Archaeozoological remains have been discovered, collected and identified in the soundings conducted by Petit at Ammata, Tell al-'Adliyyeh and Dāmiyah, but these samples were too small and too fragmented to permit any clear conclusions.

171 IA IIb only yielded 201 bone fragments, while 1967 were collected from the IA Ib period.

ever, not discovered any indications that some IA sites were of a different nature than others. In all, except for a few sub-phases on the larger tells that will be discussed below, the villages in the Zerqa Triangle seem to have been characterized by equality.

With regard to the irrigation system equality is on the one hand to be expected and on the other hand quite remarkable. The irrigation system as a whole has contrasting social implications. On the one hand, the system harbours an inherent hierarchy. Areas downstream are at the mercy of areas upstream as water passes these upstream sites first. These areas are, therefore, able to block the canal, leaving areas downstream without water. Downstream areas are, therefore, always in a dependent position with regard to areas upstream. The archaeological remains in the Zerqa Triangle do not indicate such a hierarchy, however. There are a few larger tells, but the differences are small and their sizes still fall within the village level. Some of these larger tells are, furthermore, located downstream while small tells like *Maydān* and *Qa'dān N+S* are located upstream. The different occupation phases of the sites make it difficult to determine which tell phases were contemporaneous and stood in a hierarchical relationship to each other. The dense occupation and likely contemporaneity during parts of the 8th and 9th century AD shows that hierarchical relationships had the potential to exist in this period. The fact that the archaeological remains show mainly egalitarian relationships may be taken as evidence against a clearly hierarchical system. The pre-modern clan system, however, shows that a hierarchical system can exist without leaving archaeologically visible traces. The hierarchy in the clan based system was mainly visible in the size and location of the territories and less in the material culture of the different villages. These social relationships and their non-material expression will be difficult or even impossible to detect in the archaeological record, especially as only a few sites have been intensively excavated.

On the other hand, the entire region is dependent on the same primary canals and as such all villages should be involved in the communal maintenance of the system. Similarly, a system for distributing the water over the region was needed. It is likely that all villages had a communally agreed upon set of rules regarding how the water was to be divided between them. The presence of sites of considerable size located far downstream, like *Tell al-Mazār* and *Tell al-Khsās*, shows that there was no policy of first come, first served during times of dense occupation in the Zerqa Triangle. If such a policy had been in place these sites would have had great difficulties to survive as they would receive no water whatsoever in times of water stress. The presence and apparent success of such inland sites leads to the conclusion that communal decisions were made over the distribution of the water, at least during periods of relatively dense occupation in the region.

There are, however, a few indications that argue against complete equality between the sites and their inhabitants. The differences are, however, only slight and often only present during a short period. A few settlements were larger in size and/or show a differentiation in function. The settlements of *Tell Deir 'Allā*, *Ammata*, *Tell Dāmiyah* and *Tell al-Mazār* are slightly larger in size during one or several of the IA sub-phases. Their sizes do, however, not outsize exceed the village level, i.e. the largest site still only amounts to *c.* 1.5 ha. There is by no means a clear division between small and large sites. Site sizes resemble a gradual scale of increasing dimensions. Yet, it is clear that the above-mentioned sites are larger than average and at some of these settlements more activities took place than only subsistence farming, at least during part of their existence.

In *Tell Deir 'Allā* phase IX, for example, which is best documented as a result of the sudden fire that destroyed it, there is evidence that a lot of weaving took place. In the excavated area depicted in figure 6.4 as many as 15 groups of over 15 individual loom weights were discovered. Each group probably represents one vertical loom (Ibrahim and Van der Kooij 1991: 18). Given the assumption that about seven households inhabited this area, it follows that each household owned two looms. The large stores of flax discovered in this phase might have been connected to this weaving activity as they may have contained flax fibres for the production of linen. However, it can not be ruled out that the flax discovered was used purely for the production of linseed oil. Based on these finds it has been suggested that, in addition to an agricultural function, *Tell Deir 'Allā* operated as a centre for cloth production (Boertien 2008).

Another discovery from phase IX shows that *Tell Deir 'Allā* may have been a centre in other respects as well. In 1967 the now famous and much discussed Balaam text was discovered here (Hoftijzer and Van der Kooij 1976, 1991). In a small room remains of text written in ink on plaster

applied to the western wall were discovered. The text relates a prophecy of Balaam, son of Beor, also known from the Old Testament (Van der Kooij and Ibrahim 1989: 67; Hoftijzer and Van der Kooij 1991). The function of the room is not entirely clear. Two old wall stumps of a previous phase located immediately in front of the new walls may have acted as benches. A small depression was present in the heavily trodden floor of the room, while the room was only partly roofed by reed matting (Ibrahim and Van der Kooij 1991: 20, 21). No other discoveries in this room or in its vicinity point to a religious function, but the careful execution of the text and the obvious experience of the scribe together with the contents make this text a standout feature that undoubtedly had a special significance to the villagers and may well have had a wider religious impact in the region.

Tell Deir 'Allā was thus different from the other IA IIa/b settlements in that it was slightly larger, it was possibly the focus of religious attention and its inhabitants probably produced more cloth than was strictly necessary for their own use. This slightly different function of the settlement might first of all be connected to its location along the Wadi al-Ghor, which provided it with fresh water at a short distance. The site was, furthermore, of considerable antiquity already in the IA. The first occupation of Tell Deir 'Allā started in the MBA, followed by very significant LBA and IA I occupation (Franken 1969; Van der Kooij and Ibrahim 1989; Franken 1992). By the time IA II people settled on Tell Deir 'Allā it was already an impressive tell site of *c.* 20 m high. These factors might have contributed to the slightly different functions and larger size of the settlement in phase IX. However, these were only minor variations, while the site remained predominantly occupied with subsistence farming and some herding.

One of the other larger settlements, Tell 'Ammata, was only first settled in the IA period. Yet, during certain periods of its existence it covered a large area (Petit in prep.). The excavated areas were too small to determine whether it had more functions than only subsistence agriculture. Its larger than average size may, however, be connected to its location at the spot where the Wadi Rajib enters from the foothills. An irrigation canal that was to supply the ghor with water from the Rajib needed to tap somewhere around here and pass along the tell. Located upstream along a main irrigation channel, the tell is obviously in the dominant position. Tell al-Hammeh is located at more or less the same location along the Zerqa, but this may primarily be connected to the good conditions at this location for the iron production that took place here during the IA IIa period (Veldhuijzen and Van der Steen 1999: 191). The presence and success of villages downstream shows that these tells did not usually act upon their ability to cut the other settlements off from their water supply, but they may have threatened to do so. The fact, however, that both sites remained unoccupied during many phases of the IA shows safeguarding the main irrigation channels was not a major issue in IA society (see below).

Tell Dāmiyah forms an exception to the other tells by its location in the Zor. This location may well be the reason for its slightly larger size, longer existence and different function. Although the zor is subject to the same climate as the rest of the Zerqa Triangle, its agricultural potential is much greater. By its location within the actual streambed of the Jordan it benefits greatly from groundwater. The location of Tell Dāmiyah at the confluence of the Zerqa and Jordan, furthermore, makes it subject to the seasonal overflowing of both the Jordan and Zerqa rivers. In his geomorphological soundings next to Tell Dāmiyah, Hourani discovered many layers of overflow deposits also dating to the IA (Hourani in prep.). Regarding its location and hence agricultural possibilities Tell Dāmiyah, therefore, deviates from the other IA sites located in the Ghor. This is visible in the archaeobotanical record, especially in the weeds. Several species have been discovered that grow in wet and marshy environments (Grootveld in prep.). Furthermore, the Zerqa is at this point only slightly incised which allows for easy construction of a short independent irrigation canal. The significant water benefit from groundwater and overflowing meant that Tell Dāmiyah would have been able to cultivate land under drier conditions than sites in the ghor. The fact that its inhabitants could dig a separate irrigation channel meant that it was independent of the general irrigation system in the ghor and of the other villages. This might explain the continued occupation of Tell Dāmiyah around 900 when other sites are abandoned in Petit's interpretation of the regional settlement pattern (Petit in prep. and below). The tell is furthermore located at one of the few fords in the Jordan. This ford might well have existed in the IA as well given the mention in the bible of a

ford near the city of Adama, a site that has been identified with Tell Dāmiyah (Josh 3:16). This ford may well have contributed to the special function Tell Dāmiyah had during phase 9 dated around 700 BC (Petit in prep.: fig. 15.1). The layout of the site, the discovery of a bulla with cuneiform writing, the presence of Assyrian palace ware and an exceptional anthropomorphic statue led Petit to conclude that Tell Dāmiyah served a public function and possibly was an administrative centre (Petit et al. 2006, in prep.).

Tell al- Mazār is the last tell that is significantly larger than the other IA villages. Like Tell Deir ‘Allā it already had significant deposits from previous periods and for both the IA I and IIa/b (phase VII) the excavator has argued for a, at least partly, non-domestic function (Yassine 1983: 510, 1984). Its size, the excavated architectural layout and artefacts indicate that Tell al- Mazār was an important site at least during part of the IA. With regard to the irrigation system this is remarkable. The site is located deep inland at considerable distances from year-round water sources. In any form of canal irrigation system it would be located far downstream along a canal and hence be in a dependent position. In the pre-modern irrigation system, however, this area is the point where canals from the Zerqa and the Wadi Rajib meet each other (see figure 5.2). The fact that this area can be supplied with water from two different sources might well have been advantageous. This results from the fact that the Rajib and Zerqa are fed by different drainage systems. The water from the Zerqa mainly stems from the hill country around Amman, while the Rajib is fed with water that falls in the hills around Jerash (Hourani 2002: fig. 3.4). These areas have slightly different rainfall patterns and geological formations resulting in different timing and volume of discharge (Anonymous 1969a: table B-25, 31). Combined, these differential water supplies may have provided greater security and agricultural potential to the area around Tell al- Mazār. However, the differences are not very large and an exceptionally dry year will have been felt in both discharge systems. On a social level, however, the two supply systems would definitely have made Tell al- Mazār less dependent. In case of a feud with villages closer to the Zerqa, that were able to close the canal tapping the Zerqa, Tell al- Mazār could always rely on the water from the Rajib. Even though there are no indications for such feuds, the threat alone could simply have sufficed. The inability to use such a threat on Tell al- Mazār might well have lent it more independence and power. Apart from shielding it from social threats, the double water supply of Tell al- Mazār might also have made it less vulnerable to environmental threats. The absence or small size of upstream villages together with the large downstream villages suggests hierarchy and social threat were not primary concerns in IA society. It is, therefore, more likely that the presence of two water supplies made Tell al- Mazār better equipped to cope with environmental stress.

The same might to a lesser extent also be applicable to Tell Deir ‘Allā, as this site, although fully incorporated in the Zerqa irrigation system, was also located along the Wadi al-Ghor. The wadi al-ghor was necessarily incorporated in the irrigation system as the system had to be protected from the flood flow that would otherwise damage the canals. This was most likely resolved by a reservoir that received the floods and regulated the flow further downstream as was the case in the pre-modern system. The Wadi al-Ghor was, therefore, incorporated in the system, but it was still an independent water source, albeit a small one. As discussed before, Tell Dāmiyah was also not dependent on the irrigation system alone. By the potential to create its own separate irrigation system it was socially independent and through the benefits of additional water from groundwater and overflowing it was also considerably less dependent on irrigation than many other sites.

It can, therefore, be concluded that some of the larger sites fulfilled more functions than strictly subsistence agriculture during at least part of their existence. These sites were often of some antiquity and were already clearly visible and probably impressive tell sites. Most importantly, however, these settlements seem to have been connected to less dependent locations in the irrigation system where more than one water source was available. These locations seem to have been more important or advantageous than a dominant position upstream along a canal. However, the presence and importance of habitations differs between the sub-phases of the IA showing that these principles of dependency were not present in all periods, but they might have played a role during some periods. The differences are furthermore small and remain in the realm of village occupation.

7.4.3 Regional occupation history

The detailed and large-scale excavations at Tell Deir 'Allā, the small soundings at Tell 'Ammata, Tell al-'Adliyyeh and Tell Dāmiyah and to a lesser extent also the preliminary excavation reports from Tell al- Mazār and Tell al-Hammeh all provide a history of occupation and abandonment of these sites. Petit has attempted to give an overview of the synchronicity of habitation and abandonment phases of the various sites (Petit in prep.: chapter 15). He has based himself foremost on their stratigraphy, supplemented by pottery comparisons and some radiocarbon data. The determination of synchronicity is, however, difficult and often hazardous as stratigraphy, pottery analysis and the usually limited number of radiocarbon dates fail to approach the timescale on which people and human society as a whole functioned. Unless a very detailed sequence of radiocarbon samples is available in which each layer to be dated is represented by several samples in order to reduce the margin of error, positing synchronicity between sites is very difficult. Lacking detailed radiocarbon sequences Petit has attempted to come to a hypothesis of settlement synchronicity based on pottery comparisons and the regular occurrence of earthquakes, which he assumes would cause destruction throughout the region.

The following overview of occupation, abandonment and site synchronicity during the IA IIa/b is, unless additional references are given, based on Petit's work and for a more detailed view one is referred to his monograph (Petit in prep.). At the start of the IA II period Tell Deir 'Allā (phase L), Ammata (phase 15) and Tell al-'Adliyyeh (phase 9) were all occupied and represented quite dense, well-constructed villages. Tell Dāmiyah may have been occupied as well but excavations did not reach this level. Compared to the other tells Tell al-'Adliyyeh is significantly smaller, but in the small excavated area at least two multi-roomed buildings were discovered separated by a large courtyard. Similar well-built villages were present at Tell al- Mazār and Sa'idiyeh. All sites end in destruction and a period of abandonment follows. Petit hypothesizes that these destructions may be synchronous and attributable to an earthquake. New settlements start at Tell Deir 'Allā (phases XI and X), Tell 'Ammata (phases 14 and 13), Tell al-'Adliyyeh (phase 10), Tell al- Mazār (phase VII) and Tell Dāmiyah (phase 21) somewhere between 975 and 950 BC. Again these are relatively densely settled with quite heavy wall constructions sometimes accompanied by massive surrounding walls, e.g. Tell 'Ammata phase 14. Around 950 BC there is another destruction that seems to occur on a wide scale as destructions dated to more or less the same period have been identified outside the Zerqa Triangle as well, e.g. at Megiddo and Rehov. Based on the wide extent of this destruction Petit argues that this may have been another earthquake. After this destruction only minor indications for habitation in the region have been identified. Tell 'Ammata was completely abandoned, Tell al-'Adliyyeh only shows limited seasonal activity and the only evidence from this period discovered at Tell Deir 'Allā is an enormous mud-brick lined pit. This pit has a diameter of 12 m and is *c.* 5 m deep (Van der Kooij 2001: 295). Although there is no evidence of architecture some activity evidently took place at Tell Deir 'Allā and judging by the size of the pit several people must have been involved. The other significant activity present has been discovered at Tell al-Hammeh. High resolution radiocarbon dates have dated excavated remains of iron production to 930/910 cal BC (Veldhuijzen and Rehren 2007: 191).¹⁷² This makes it the oldest known iron production site in the world. No habitation remains were discovered connected to the furnaces, but may have been present on the other, unexcavated part of the tell. This will, however, have been uncomfortable during smelting activity. The only site where habitation remains, although very scant, have been found dating to this timeframe is Tell Dāmiyah. After a short interval following the supposed earthquake, small-scale 'squatter' occupation took place at Tell Dāmiyah. Only a few traces of architecture were found surrounded by an enclosure wall. Three phases (18, 17 and 16) were identified, each of them destroyed by fire and rebuilt after a short time.

More widespread and intensive occupation only appeared around 850 BC when both Tell Deir 'Allā and Tell Dāmiyah were levelled on a large scale and settled in dense fashion within a very short period of time. These were Tell Deir 'Allā phase IX and Tell Dāmiyah phase 15, which was

¹⁷² Radiocarbon analysis (accelerated mass spectrometry (AMS) analysis with ¹³C–¹²C correction) was carried out on two short-lived olive wood charcoal samples (*Olea europaea*) from the production phase of the furnaces giving a date of 930/910 cal BC (\pm 40 years; 1σ ranges of 1000–900 and 940–850 cal BC) (Veldhuijzen and Rehren 2007: 191).

destroyed and immediately rebuilt in phase 14, again followed by phase 13. Phase 13 of Tell al-‘Adliyyeh cannot be clearly dated, but might very well have started around the same period. In his survey Petit collected pottery from the 9th century on the majority of the tells in the region. It is likely that the period from 850 until *c.* 700 BC saw several episodes of dense habitation in the Zerqa Triangle (see below).

Around 800 BC Tell Deir ‘Allā and Tell Dāmiyah were destroyed again. For Tell Deir ‘Allā phase IX there is very good evidence that this destruction was the result of an earthquake this time. A sudden fire resulted in perfect archaeological conditions with all artefacts and feature left in their original context including the plaster text (Van der Kooij 2001: 297). Indications of water staining visible on the plaster text suggest this earthquake took place in the rainy season (Van der Kooij 1976a: 99). An alternative interpretation might suggest a lot of water was used to put out the fire, but given the sudden character of the fire and the height of the tell this is less likely. Immediately after the destruction both tells seem to have been rebuilt again following or less the same layout, possibly by the same people (Tell Deir ‘Allā phase VIII and Tell Dāmiyah phase 12). Phase VIII was only of short duration and rebuilding had not been completed before Tell Deir ‘Allā was rather abruptly abandoned and left unoccupied for some time (Van der Kooij 2001: 297). Tell Dāmiyah phase 12 consisted of much open space and was abandoned around *c.* 775-750 BC. Petit states that around this time Tell al-Bashīr and Tell al-Ghazāleh were also abandoned and Tell al-Mazār and Qa’dān **were greatly reduced in size. It seems that until *c.* 750/730 the Zerqa Triangle was only scarcely populated.** Around this period Tell Deir ‘Allā (phase VII), Ammata (phases 12 and 11), Tell al-Hammeh and Tell Dāmiyah (phase 10) were all reoccupied. It is likely that many sites were inhabited during this period as Petit as discovered 8th century remains in significant quantities at almost all sites. Similar to the 9th century this was probably a period of dense habitation of the Zerqa Triangle. Tell Deir ‘Allā phase VII again saw a dense village with well constructed, deeply founded walls (Van der Kooij 2001: 297). At Tell Ammata, however, only courtyard layers were discovered, but this may well be the result of the small scale of the soundings. Tell Dāmiyah was probably settled at more or less the same time as Tell Deir ‘Allā and was also a relatively dense village with considerable accumulation, a well constructed surrounding wall and paved alleyways. Tell Dāmiyah phase 10 ends in a sudden fire after which the settlement was quickly rebuilt. The subsequent phase 9 comprised a multi-roomed building with niches, a cobble stone floor and walls still two courses high. In this phase a bulla with cuneiform writing and an enigmatic anthropomorphic statue were discovered. Petit has interpreted Tell Dāmiyah as being a public centre possibly related to trade or administration. Both Tell Deir ‘Allā VII and Tell Dāmiyah 9 were destroyed by fire. Petit suggests that this might have occurred around 700 to 675 BC and possibly have been political in nature, e.g. a revolt against the Neo-Assyrian presence at Tell Dāmiyah. The excavators of Tell Deir ‘Allā see indications for another earthquake, however (Van der Kooij 2001: 297).

As stated the perfect synchronization of the different settlement cycles is problematic as chronological detail is absent. In a few cases archaeologically evidenced earthquakes suggest a possibility for synchronizing. A large earthquake will have affected all settlements occupied at that moment. The geologically dynamic nature of the rift valley causes earthquakes to occur regularly. Several attempts have been made to reconstruct ancient earthquakes and their scale on the basis of historical sources and archaeological remains (e.g. Russell 1985; Amiran et al. 1994). Given the frequency of earthquakes in the past few centuries it is likely that several earthquakes took place during the IA. The fact, however, that large earthquakes are usually preceded and followed by a range of smaller earthquakes compromises the synchronizing effect of earthquakes. It is, furthermore, difficult to distinguish cracks in the build-up of the tell caused by an earthquake from those caused by differential compression of older layers. At Tell Deir ‘Allā the distinction between these two types of cracks could in a few cases be made, allowing a proper identification of an earthquake, e.g. in phase IX (Van der Kooij and Ibrahim 1989: 82). Most destructions, including those caused by earthquakes, are generated or accompanied by fire (see Petit in prep.). Fire destruction was always a serious threat given the abundance of flammable materials and the open nature of cooking fires, oil lamps and tabuns. A small earthquake that preceded a large one could, if a village was unfortunate, cause a devastating fire, while the earthquake itself did not damage the architecture. The destructive effects of smaller pre- and aftershocks, therefore, hamper the possibilities to synchro-

nize destruction layers on the basis of single earthquakes. Only when clear evidence of earthquake cracks, not to be confused with differential compression cracks, are identified in an excavation can a large earthquake be assumed to have affected that specific site.

Pottery itself is not a very good instrument for synchronisation. Although pottery can of course be used to date stratigraphic layers, it is not a very detailed dating device. Certain vessel types can have remained in production and use for a long time. Furthermore, certain traditions change only marginally over time. Change, moreover, occurs differentially throughout and between regions. A certain form can continue to be used for much longer at a specific site or in a certain region than elsewhere. Pottery can, therefore, not be regarded as a very precise dating instrument. Based on the pottery and using the correlation to occupation phases of Tell Deir 'Allā that are also dated by absolute dating techniques Groot has, for example, proposed a slightly deviating synchronisation of Tell Deir 'Allā, Tell Dāmiyah, Ammata and Tell al-'Adliyyeh (Groot in prep.). The synchronisation of Petit as excavator is adhered to here, but it should be kept in mind that pottery can never be taken as an absolute dating method and variability will always remain possible.

The posited synchronisation of settlement and abandonment in the Zerqa Triangle as described above is, therefore, not as straightforward and unambiguous as hoped for. However, irrespective of the correlations between the different settlement cycles, the fast oscillation between habitation and abandonment is visible at almost all excavated sites in the region. Within the c. 300 years of the IA IIa/b period Tell Deir 'Allā saw 5 to 6 phases of occupation, at Tell al-'Adliyyeh 4 to 5 phases were identified, while Tell 'Ammata only went through three to four phases separated by a long period of abandonment. Tell Dāmiyah, however, shows the largest number of phases, i.e. 11 to 12, that are inherently of short duration and cannot have been separated by long periods of abandonment (see Petit fig. 15.1). Some occupation phases were immediately rebuilt after destruction, e.g. Tell Deir 'Allā phase IX and Tell Dāmiyah phase 13, while in other cases the site was abandoned after destruction. It is remarkable that most phases end in destruction accompanied by fire, which was often sudden judging by the in situ location of artefacts. There is no reason to suspect the destructions were a result of violence as no weapons or pre-fire destructions have been documented (Van der Kooij 2001; Petit in prep.). Focus is here placed on the IA IIa/b period but the same oscillation between occupation and abandonment continues throughout the remaining IA, and the argument applies equally to that period.

Based on the fast oscillation it can be concluded that IA society in the Zerqa Triangle was rather unstable, although certain periods saw dense habitation. Sometimes a settlement was rebuilt immediately after its destruction and it is likely that this was done by the same people, given the similarity layout of the architecture and artefacts that usually occurred in these cases. At other times the site was abandoned. This differential behaviour should be explained. Why did people sometimes rebuild their village immediately and abandon it at other times. And why did people (re-) settle the Zerqa Triangle at all?

To understand why a phase ended one should evaluate how it ended, i.e. was it destroyed and in what manner or did people simply abandon it? Only in the case of Tell Deir 'Allā phase IX is there good evidence that it was destroyed by an earthquake. There are several other phases that are destroyed in a sudden fire based on the fact that all artefacts were left in situ because people did not have time to remove them. Such a destruction may have been caused by an earthquake, but not necessarily. Other natural disasters like lightning can also have caused such a fire. Given the scarcity of large trees and the fact that most villages were located on high tells in an otherwise flat plain, lightning strikes are not unlikely. The fire can also have been caused by accident, e.g. through a fallen oil lamp, or by outside interference. Although there are no indications of proper battle with weapons, a local feud may have driven people to 'secretly' set their enemies' village on fire. There are no indications that such acts occurred, but little evidence is to be expected to remain from such an act. Another possibility that has been documented in ethnography and ends in destruction by fire is the act in which inhabitants abandon their villages of their own accord and upon leaving set it on fire themselves, like among (pueblo) Indians in the USA (Montgomery 1993). This scenario distinguishes itself from the other possibilities in the fact that artefacts that remain useful to the villagers are taken with them. Villages treated in such a way are generally largely devoid of finds. There are archaeological cases in which intentional burning down of the settlement in a ritual act

is a likely option to have taken place, e.g. the Neolithic 'burnt' level 6 village at Tell Sabi Abyad (Verhoeven 1999: 62). There are, however, no indications that this scenario occurred in any of the destruction phases identified in the Zerqa Triangle (Van der Kooij 2001; Petit in prep.).

According to the excavators the following phases were all destroyed by fire in an abrupt way leaving most artefacts in situ; Tell Deir 'Allā L, X, IX, and VII, Ammata 15[?] and 13, Tell al-'Adliyyeh 9, 10, Tell Dāmiyah 21, 13 and 9. There is very strong evidence to conclude that Tell Deir 'Allā phase IX was indeed destroyed by an earthquake. Notwithstanding the synchronization problems, it is very likely that the destruction of Tell Dāmiyah 13 was the result of the same earthquake. Both sites are dated to the same period, they exhibit a very similar sort of occupation and both sites were immediately rebuilt after the destruction. Habitation phases 18, 17, 15 and 14 of Tell Dāmiyah were burned but the excavation area was too small or too few remains were present to determine whether it was a sudden fire which surprised people. Tell Dāmiyah 16 might have been destroyed by fire and have a hiatus, but this is not entirely certain and phase 11 was destroyed without fire while phase 17 only experienced a limited amount of fire. Although there are many possible explanations for a fire starting, for example a fallen oil lamp or a spark from a hearth, experiments on North American mud-brick pueblos have shown that mud-brick structures are rather fire resistant (Wilshusen 1986: 247). Although fire resistance will of course depend on the local construction method and use of the rooms, the experiments show fires were usually caused by more destructive events than a simple fallen oil lamp. In this region earthquakes and possibly lightning seem likely candidates to cause fires.

Contrasting to sudden destruction by fire, there is only limited evidence of simple abandonment of a village. Tell Deir 'Allā phase VIII was abandoned without evidence of fire or destruction (Van der Kooij 2001: 297). It seems that the inhabitants simply moved away quite suddenly and after a very short period as construction of the destroyed architecture did not reach completion. The only other period in which simple moving away without destruction has been detected is Tell Dāmiyah phase 12. This phase was probably contemporaneous with Tell Deir 'Allā phase VIII as both villages went through fast rebuilding phases after the only well evidenced earthquake, i.e. that of 800 BC. Other phases that were abandoned without destruction having occurred are Tell al-'Adliyyeh phase 12 and Tell Dāmiyah phase 19, but these contained only few remains.

A few occupation phases contained so few architectural remains or were exposed over such a small area that it was not possible to establish the nature of the abandonment with certainty. These phases are Tell Dāmiyah 11, and 10, Ammata 14 and 12, and Tell al-'Adliyyeh 13.

Given the high number of sudden destructions by fire, it can be concluded that this was a serious threat to which all villages were susceptible. As discussed before, several causes can underlie destruction by fire. Yet, most destructions seem to have been sudden unforeseen occurrences contrasting to planned abandonment of a site without destruction. It is, furthermore, important what happens to the site after destruction. People either abandoned it or they started rebuilding it. In most cases destruction of a site resulted in abandonment. However, there are a few cases of immediate rebuilding, like Tell Deir 'Allā phase VIII and Tell Dāmiyah phase 12. This rebuilding suggests that conditions for habitation in the Zerqa Triangle were, notwithstanding the destruction of the village, of such potential that people opted to stay in the area. Apparently, there was no social or political threat that forced people to leave the area. Similarly, if the destruction was caused by a natural disaster, the amount of damage and the environmental circumstances allowed people to rebuild their livelihood. There the irrigation system comes into play.

7.4.4 The fast oscillation between settlement and abandonment: damage to the irrigation system

The potential to sustain a living in the Zerqa Triangle greatly depends on the irrigation system. If the area was hit by a severe earthquake, the irrigation canals undoubtedly also suffered damage. Dams and simple sluices will have broken, and soil shifts will have affected the course of canals and broken its lining. In several, modern, examples considerable damage to irrigation systems has

been documented after severe earthquakes.¹⁷³ Studies in Japan have demonstrated that irrigation canals, especially ones made of wattle and daub instead of concrete are relatively resilient to earthquakes compared to houses and other structures (Isamu et al. 2006). Nevertheless, a large earthquake undoubtedly resulted in major repairs throughout the system. There are also other agents capable of destroying the irrigation system, e.g. large flash floods, whereas people trying to cause damage could have destroyed both canals and villages. Irrespective of the nature of the destruction it will undoubtedly have taken some time to repair the entire irrigation system. It is unlikely that a relatively small group of people was able to reconstruct a badly damaged system in only a few days. This duration of repairs is crucial to the possibility to rebuild a livelihood after a major earthquake or other large-scale disaster. Well-organized societies that could possibly even rely on help from outside like the Mamluk and possibly the Late Roman communities would have had a much greater capacity for coping with such damage. The IA communities consisted primarily of small villages and hamlets that cooperated in the functioning and maintenance of the irrigation system, but seem to have had little further organisation. This is in contrast to even the LBA when smaller villages were organized around larger centres like Tell Deir 'Allā that may have taken a leading role in organising repairs. In periods when the Zerqa Triangle was only marginally occupied or when only small, loosely organized communities were present like the IA or several of the early Islamic periods, the organisation of quick repairs might have posed great difficulties.

If the irrigation system was destroyed during the summer months when all crops had been harvested and the system only supplied water to a few fruit trees, the absence of irrigation water will not have had too much of an impact and people will have had some time to repair the system before the next crops were to be planted. The chances of survival in this area will have depended on the amount of stored food stuffs that survived the likely destruction of the village. People will have needed their stored crops to plant and eat until the next harvest was ready. It will have been difficult to survive on wild food supplies and flocks alone, especially during summer. If people had been able to rescue their valuable items they may have traded these for food in areas that had not suffered destruction. It might well have been possible to rescue some valuables as the absence of casualties in any of the destroyed villages shows that although the destructions were sudden, people did have time to evacuate in an orderly fashion.

Nevertheless, if stored harvests were destroyed a summer earthquake or any other disaster will have been difficult to overcome and people might have been forced to move away to areas where food was available. A destruction during the rainy season, for example in January, might have been easier to cope with. Most crops are able to survive without irrigation during these months. People will have had a few weeks to repair the system before the crops depended on irrigation water again. Although the crops themselves might have suffered some destruction, the destructive effect of an earthquake on an agricultural field will probably have been limited. If stored crops were largely destroyed, people would only need to survive for a few weeks or months before the first crops of that year would be ready. The possibility to gather wild plants is, furthermore, much greater during these months than in the dry season. If the irrigation system was destroyed during a time when crops fully depended on irrigation water, e.g. April, May, October or November, the crops would inevitably be lost. Especially during the warm and dry months of April and May crops will only have been able to survive a few days without irrigation water. During the spring months the stored supply would, furthermore, be largely depleted and independent survival in this area will have been almost impossible. If some stored supplies survived an autumn destruction, people might be able to replant some late crops using rainfall, restore the irrigation system in time before early spring and complete a successful harvest at the start of summer.

However, destruction of both the settlement and the irrigation system will always have had a devastating result. If part of the stored food supply survived, continued habitation of the Zerqa Triangle may have been a possibility if the stores could be stretched until the next harvest. If both the irrigation system and the stored supplies were destroyed, survival in the area would only seem possible if the destruction occurred somewhere in winter. If both the village and the irrigation

173 For example in Peru in 2007 an earthquake of 8.0 on the Richter scale destroyed several kilometres of an irrigation canal.

system were destroyed, out of the two, the irrigation system was the more essential for survival and will have been the first priority for reconstruction. While repairing the irrigation system and attempting to secure a successful crop people will probably not have had time to reconstruct their houses and presumably lived in simple temporary structures that left very few remains. These temporary structures may have been located on the tell, possibly in the form of the occasional 'squatter' occupation identified by Petit (Petit in prep.). Given the chaos of the ruined buildings, the possible threat of collapse or the bad memories people may have associated with that location it is equally likely that they chose to stay in the fields. This type of habitation will have left few permanent remains. It is, therefore, possible that this type of occupation is reflected in the bounded areas of relatively low pottery densities discovered in certain regions of the survey. It will have taken time to repair the irrigation system especially as at the same time all normal agricultural tasks needed to be performed to procure a harvest as optimal as possible under these undoubtedly more trying circumstances. It may, therefore, have taken a long time before people had enough time of their hands to start rebuilding a proper village. This period after the destruction of a village and before a new village was constructed may very well be reflected in the hiatus visible at many tell sites after a destruction phase. Although a hiatus appears, this does not necessarily mean that the region itself was abandoned.

7.4.5 The interplay between sedentary agriculture and pastoral nomadism

Van der Kooij has put forward the possibility that people turned to the alternative subsistence economy which was always present besides agriculture, i.e. pastoralism (Van der Kooij 2001). This model explains the fast oscillation between occupation and abandonment and the apparent cultural link between different occupation phases. When habitation of the region became problematic for some reason, e.g. as a result of an earthquake, or agricultural or social stress, people could easily shift to the pastoral aspect of their economy and become more mobile. Pastoralism that involved herding flocks outside the direct vicinity was a likely feature of IA society. If flocks were of a considerable size it will have been necessary to guide them up the hills in search of pasture. During the rainless summer all wild grasses and shrubs become desiccated leaving no pastures on which to feed the flocks. When flocks are small, there is the possibility to keep them in the region, herd them in the riverbeds where some vegetation remains and supplement their diet with purposely grown fodder or cereal surplus. It can be proposed that the bare summer fields were occasionally irrigated to artificially create pastures, but this is not very likely. First of all, it is quite labour intensive, but it also depletes the soil unnecessarily. A third argument is the high risk of salinization of the already naturally relatively saline soil resulting from the high level of evaporation.¹⁷⁴ It is, therefore, more likely that large flocks were escorted up the hills where temperatures were lower and precipitation more abundant causing pastures to desiccate later. This move probably occurred after the winter crops had been harvested as the flocks could then be fed on the remaining stubble making ploughing easier, while at the same time refertilizing the fields with their droppings. By the time all fields had been harvested the lambs that had been born in spring would be sufficiently mature to make the journey. With the advent of the winter rains flocks would return to the valley. A major drawback of the absence of flocks would be the inability to gain milk from them. The people moving away with the flocks would probably continue milking and might process the surplus into cheese or dried yoghurt like the modern Bedouin. This might not have been a very large problem in the end as especially sheep but to a lesser extent also goats have a clear seasonality in lambing and hence in lactation period, which means that most of the animals would have stopped weaning by the time they travelled into the hills.

Among modern pastoral nomads living in several regions lambs are mostly conceived during the wet period and given the gestation period of about 5 months they would be born around April in the Jordan Valley (Dahl and Hjort 1976: 90, 213). Lactation continues for circa three to four months (Dahl and Hjort 1976: 212). This means that most of the sheep stop producing milk at the

¹⁷⁴ The Zerqa Triangle has a relatively high risk of salinization due to the saline Lisan deposits in the subsurface and the high salt content of the Zerqa water as a result of the salty deposits it cross-cuts before it reaches the ghor (Anonymous 1969b: 43, 1969a: 67).

end of June or July. This does not mean that all lambs are born between March and May, but there is a clear peak in sheep births in this period (Dahl and Hjort 1976: fig. 9.1). More or less the same applies to goats, although the degree of seasonality is lower and goat births are distributed somewhat more evenly throughout the year (Dahl and Hjort 1976: 92, 213). It is likely that during this period sheep and goats remain near the village. The lactation period of sheep and goats follows the period of lactation of cattle. Cows provide most milk during the wet season. There is a clear peak in calving just before the start of the wet period (Dahl and Hjort 1976: 150). Lactation may last for seven to eight months although it is clearly linked to breed and environment and only really effective during four months (Dahl and Hjort 1976: 143). Cows lactating during the dry part of the year yield much less milk than in a wet period, i.e. on average 2.5 litres per day versus 4.5 litres per day in the wet season (Dahl and Hjort 1976: 144). In some areas, like northern Arabia, cows only give milk during the five month wet period (Dahl and Hjort 1976: 142). It is, therefore, likely that in the Jordan Valley cows were mainly milk producers during winter. The amount of milk available for human consumption is much higher with cattle than with sheep and goats. Modern data for cattle show that humans can obtain *c.* 1 to 1.5 litres of milk a day from one cow during the wet season and a maximum of 0.5 litres in the dry season (Dahl and Hjort 1976: 146). Sheep provide humans with *c.* 40-60 litres per lactation period which is the equivalent of *c.* 0.4 litres per day and goats give 60-80 litres in total or 0.6 litres a day (Dahl and Hjort 1976: 212). This makes sheep less productive than goats and much less than cows in the wet period. Sheep's milk with its *c.* 1100 kcal is, however, more nutritious than either cows' or goats' milk which contains *c.* 700 kcal (Dahl and Hjort 1976: 154, 216). Sheep furthermore provide high quality wool which was apart from their meat probably an important reason to keep sheep as well as goats and cattle. Cows were, therefore, the most effective milk producers, but there were fewer of them in IA Tell Deir 'Allā than sheep and goats (Van Es 2002). For human food consumption it was and still is ideal that the peaks in milk production of both animal groups are complementary and hardly overlap.

If herds of sheep and goats were large or resources low in a certain year it is likely that flocks were herded outside the valley in summer saving fodder and surplus otherwise needed to feed the animals. Although cattle is herded in a fully nomadic way in some regions, e.g. among the Masāi in Africa (Ryan et al. 2000), it is unlikely this was practised in the Jordan Valley with its steep adjoining hills. Archaeozoological analysis mainly provides relative frequencies between the different species. It is, however, much more difficult to provide absolute numbers of animals that were kept at one moment. It is, therefore, impossible to determine for the IA IIa/b period whether sheep and goat herds were of a size that made herding away from the valley during summer necessary. If IA herds were indeed large, IA communities probably incorporated a subgroup involved in mobile pastoralism. There are of course many possibilities for the composition of these more mobile pastoralist groups. They can for example consist of young men that looked after the animals belonging to their family or be a group of specialized herders who herded the animals of others, such as transhumance herders in the Alps or Pyrenees, or involve entire families or communities that specialized in pastoralism, e.g. pre-modern Bedouin. A host of possibilities is documented in ethnographic and ethnohistorical research (e.g. Le Roy Ladurie 1984; Lewis 1987; Cribb 1991; Barnard and Wendrich 2008). A restriction that might have affected the manner in which mobile pastoralism took place is the absence of the camel during the IA IIa/b. At Tell Deir 'Allā the first camel bones appear around 700 BC (Van Es 2002: 265). Camels can carry much heavier loads than equids. Their absence will have posed considerable limitations to the luggage mobile people could carry with them and have affected the temporary housing of these groups. For example, the goat hair tents used by the modern Bedouin would be impossible to transport without camels. A less mobile type of pastoralism or a manner in which only specialized young shepherds lived under quite simple conditions during part of the year seems, therefore, the most likely for the IA period.

If IA communities moved their flocks out of the valley during summer their group incorporated people who were familiar with living outside the village, away from agricultural products and took care of herds during at least part of the year. They undoubtedly established contacts with the

regions they moved into. The experience with this mobile lifestyle and their contacts with other regions may have made it easier to shift the balance from sedentary farming to mobile pastoralism in times of agricultural, social or political stress in the valley.

It is unlikely that IA people ever became complete nomadic pastoralists. Pastoralism and agriculture like nomadism and sedentism are both part of a continuum of which the extremes at either end occur only seldom (Cribb 1991: fig. 2.1). Full nomadic pastoralists living completely without agricultural products are very rare. Within the southern Levant there is no evidence for fully nomadic or even semi-nomadic pastoralism in the IA or any earlier period (Grigson 1998: 259). In the Jordan Valley the high numbers of cattle and pig compared to sheep and goat in combination with the diverse range of crops cultivated suggest mixed farming was practised with possibly some small-scale vertical movement along the slopes of the plateau (Grigson 1998: 259). It is, therefore, likely that IA pastoral people always relied on some agricultural products and IA society incorporated both an agricultural and pastoral component.

7.4.6 Total abandonment or small-scale occupation?

Given the commonalities between different occupation phases on either side of a supposedly more pastoral period, the question whether some people might have remained in the Zerqa Triangle and continued to practise agriculture should be asked. There are a few arguments in favour of the assumption that agriculture continued to be practised in the area albeit in a very restricted fashion and possibly only seasonally. First of all, there is the already mentioned degree of continuity in the site layout between several phases separated by hiatuses. Some continuity can of course be the result of wall remains that were still standing at the time of reoccupation. However, if there is also continuity in the use of the various rooms and the location of doors or hearths, continuity of the people who reoccupied the site can be supposed. Secondly, the pottery assemblages of different occupation phases at Tell Deir 'Allā show a degree of continuity (Groot in prep.). For example, the so-called mansef plate, which is unique to Tell Deir 'Allā, has been discovered in different occupation phases from the early IA to the late IA III periods *c.* 500 BC (Tell Deir 'Allā phases F to V) (Groot 2007: 92, pers. comm.). This type of vessel has only been found within the Zerqa Triangle and petrographic and chemical analyses have shown that it was made out of clay from the local Tell Dāmiyah Formation (Groot 2007: 106) It is unlikely that people making these vessels at Tell Deir 'Allā stopped making them when they moved away only to resume production in an unchanged form again when they came back a few decades later. If a certain vessel is not manufactured for a few decades changes in production technique, clay and temper use will undoubtedly occur. This type of vessel has, however, occasionally been found at other sites in the Zerqa Triangle and at a few locations in the countryside during survey. It is more likely that a few people remained in the region, but lived in a manner that left very few archaeologically visible remains. This would explain the continued presence and limited change between the different periods of habitation on the tells.

Another important argument in favour of small-scale continuity of occupation in the region is the irrigation system. As described above successful irrigation agriculture requires both knowledge and social rules and practices on how to distribute the water and maintain the system. It would be very difficult and time consuming to 'invent' these requirements at the advent of each new occupation period. Both requirements, therefore, argue for some continuity. Similarly, the complete reconstruction of the irrigation system would require a lot of effort, whereas an expansion of a system where inlet, main channel and basic technology are available would be much easier. The central message of the Bileam text discovered in phase IX Tell Deir 'Allā, in which Bileam warns what will happen if people do not heed the gods, with land turning from fertile cultivated land into 'desolation and wilderness where hares roam' might refer to the difficulty of bringing land under cultivation (Van der Kooij and Ibrahim 1989: 68). Cultivation in this area is much more complex than simply ploughing, planting seeds and letting them grow while rain provides sufficient water. Furthermore, the relatively sudden widespread habitation of the region in certain phases forms not so much an argument but more an indication that the area was never completely depopulated. The steep rise in settlements over a short period of time cannot be the result of natural popula-

tion growth. The rapid increase in house construction shows that a large population was present either in the region itself or in neighbouring regions. Summing up, it seems likely that at least some people were always present in the region and continued more or less the same manner of subsistence. Due to problems of synchronisation discussed above and the fact that several sites have only been surveyed rather than excavated it is impossible to say whether population shifted through the region from one tell to the other or, alternatively, whether occupation took place as low intensity habitation leaving few remains at more dispersed locations throughout the landscape. This might, however, have been only temporary occupation like the tent dwellers of the 1950's that were involved in agriculture during most of the year and only moved away during the hot summer months after the crops had been harvested. It can, however, also take the shape of small dispersed farms that were occupied year-round but only by small groups of people. The small but bounded areas of low density pottery distribution identified in the survey could very well be explained by such a phenomenon of small-scale low intensity agriculturalists living in the valley between the periods of large-scale dense occupation of tell sites. The evidence that such low intensity habitation indeed took place during this period comes, counter-intuitively, from the excavated tell sites. A several tell sites traces of what Petit refers to as squatter occupation have been excavated (Petit in prep.). This squatter occupation comprises very scant remains of people living on the tells but without the use of permanent architecture or many artefacts. People lived in a manner that left very few remains in between the ruins of destroyed villages on tells. Similar groups living in the same fashion will have lived on the plain amongst the agricultural fields, thereby generating the distribution patterns detected in the survey.

When agriculture was successful the number of inhabitants might have increased and the habitation structures might have become increasingly permanent. This trend might have resulted in year-round sedentary occupation in fixed mud-brick houses as have been excavated in the occupation phases of the tell sites. Similar sedentarization processes have been documented in ethnography, for example during the mid 20th century in the Zerqa Triangle. However, the early 1950's habitation of the Zerqa Triangle shows that full blown agriculture can be practised very well by groups that remain partly mobile and continue living in temporary dwellings leaving few archaeological remains. In the 1950's situation, however, always a part of the community was always present in the valley.

During the IA the Zerqa Triangle seems to have been occupied by a very flexible society, that was able to shift between densely settled villages practising intensive agriculture and both low intensity occupation that was probably more restricted in size and a pastoral way of life. It is unlikely that the Zerqa Triangle was ever completely abandoned or that subsistence shifted completely to either end of the spectrum. Even in the most intensive agricultural phases villagers always kept some animals. Similarly it can be assumed that pastoral nomadic people relied on agricultural products and that some agriculture was always present in the valley. The very fact that rapid oscillation between habitation and abandonment could take place on the tells shows that some habitation probably always existed. Complete development of an agricultural system, an irrigation system and all inherent social characteristics is simply too complex to attempt every new occupation episode. This is, however, not to exclude the possibility that influxes of people from elsewhere occurred. As long as there was a tradition of irrigation agriculture and all the accompanying rules and knowledge were present in the valley newcomers, albeit in small numbers, might very well have become incorporated in Jordan Valley society thereby increasing the population rapidly. Habitation may have shifted between tells, but the lack of chronological detail makes this hypothesis impossible to prove or falsify. The type of habitation practised during the tell site 'abandonment' phases is simply much less visible in archaeology. Remains of this type of habitation are likely among the low density off-site distributions identified in the survey. However, the problem of isolating groups of remains left by one or related activities within this landscape which is one large palimpsest together with the lack of sufficient chronological detail makes detailed identification of this habitation impossible at the moment.

7.5 Early Bronze Age society

7.5.1 Introduction: Early Bronze Age agricultural villages

In contrast to an irrigation system using canals the Late Chalcolithic and EBA overflow agriculture was not hierarchical in nature. With minor differences, all areas located along the overflowing river or wadi had the same chances. If the river overflowed all these areas were supplied with water. People were not able to influence the water supply of their neighbours like the inhabitants of other periods could. Late Chalcolithic and EBA people were, however, highly dependent on whether the river would overflow or not and what the volume of overflow would be. Regarding the water supply people were, therefore, dependent on environmental factors and had little influence over their neighbours.

It is clear that the climatic circumstances during the third and fourth millennia BC were dissimilar to the modern climatic circumstances. Little can, therefore, be said about the need for irrigation to secure a successful harvest. The calculations carried out to determine the water stress the agricultural system was under can, therefore, not be replicated for the Late Chalcolithic/EBA I. Besides climatic data other essential parameters are also absent. There are, for example, no archaeobotanical data available from the Zerqa Triangle for this period. It will, furthermore, be more hazardous to estimate how many people lived in the Zerqa Triangle at any one time given the difficulties of precise dating. The absence of absolute radiocarbon dates together with the much less detailed pottery chronology and long duration of the period make it impossible to determine which sites were contemporaneous. Additionally, there are few data on the settlement layout during this period in the direct region. Only Tell 'Umm Hammād has been substantially excavated but the many small excavation areas did not reveal a large topplan of the available architectures (Betts 1992: fig. 25-34). The only houseplans of some size stem from Tell Handaquq S, but date to the later EB III period when settlements were markedly different from the earlier period (Chesson 2000). It is, therefore, impossible to estimate how many structures were on average present within a certain area. Calculations are, therefore, absent and some other information necessarily stems from related areas.

Although there is no information on the crops that were cultivated from the Zerqa Triangle itself, there is good information available from sites located in similar environmental circumstances elsewhere in the Jordan Valley. The closest and perhaps also one of the best preserved contexts was excavated at Tell as-Sa'idiyeh only four km north of the research area along the Wadi Kufrinjeh. On the lower tell in layers dated to the EB II period an assemblage of finds was discovered that led the excavators to refer to this area as the scullery (Tubb et al. 1997). In this room pottery vessels combined with several different types of food remains were discovered (Cartwright 2002). These remains included barley, both emmer and einkorn wheat, and several pulses like chick pea, broad bean, lentil, and bitter vetch (Cartwright 2002: 102). Furthermore, a whole range of fruits could be identified of which some were so well preserved that it could be attested that they had been dried in the sun, probably to preserve them longer, e.g. grapes (Cartwright 2002: 104). Other fruits included fig, pomegranate, olive and wild plants like the hawthorn, Christ's thorn, pistachios, acorns and capers (Cartwright 2002: 103-110). Cartwright was able to determine that the caper buds were probably pickled in grape vinegar (Cartwright 2002: 109). Discoveries of wood from grape, fig, olive, pomegranate and Christ's thorn show that these plants probably grew locally. These species all grow in the same Mediterranean and steppe environments probably present in the Jordan Valley during this period. The hawthorn, pistachio and acorn, however, grow in deciduous oak forest, carob-lentisk forest and maquis and were, therefore, probably imported to the Jordan Valley (Cartwright 2002: 107, 108). Capers are generally found on higher altitude pastures, but during the survey they were also found in the foothills bordering the ghor. Capers may, therefore, also have been pretty much local. It is remarkable how similar this early third millennium plant assemblage is to those of later periods like the IA, Mamluk and even pre-modern periods.

From the overview of cultivated crops from sites in the Jordan Valley depicted in table 7.2 it is clear that like in most other periods cereals dominate the archaeobotanical assemblage. The internal division of the cereals differs, however. At Bab adh-Dhra' barley systematically outweighs wheat, whereas wheat is found in higher proportions at more northerly situated sites like Pella and Abu Kharaz. At all sites the dominant wheat category is formed by emmer wheat, followed by einkorn and very small percentages of free-threshing macaroni or bread wheat (e.g. McCreery 2002: 256). At Pella, however, bread wheat dominated over emmer wheat (Bourke et al. 2003: 377). Barley consisted of both the 2-rowed and 6-rowed type, but often preservation was insufficient to determine the types. At Bab adh-Dhra' 6-rowed barley was predominant, while 2-rowed was most common at Wadi Fidan site 4. However, all examples were hulled and fully domesticated (McCreery 2003: 451). Like at Sa'idiyeh different fruit types were present at most other sites and it is very likely that trees grew locally, although some import of dried fruit cannot be ruled out. Similar to other periods, pulses and especially the lentil are regularly recovered. Just as in many of the other periods flax was also cultivated in the vicinity of several sites.

7.5.2 Changing settlement pattern

The newly discovered settlements have greatly enhanced the understanding of the settlement distribution in the Zerqa Triangle. In the Jordan Valley as a whole the change in the type and location of settlements between the EB I and EB II and III periods is visible. This changing settlement

	Tuleilat Ghassul	Abu Hamid	Shuneh Chalch.	W. Fidan 4	Handaqq N EB Ia	Shuneh Ia	Shuneh Ib	Abu Kharaz Ib	Bab EB Ib n = 882	Jericho PU	Jericho EB II	Pella IB/II n = 483	Abu Kharaz 2b	Abu Kharaz 2c	Bab EB II n = 458	Sa'idiyeh II	Bab EB III n = 1404	Numeira EB III	Kharaz EB total	
Hordeum (vulg)	x	x	x	x	x	x	x	x	50	xx		33	x	x	63	x	18	x	33	
Triticum																				33
Triticum dicoccum		x	x	x	x	x	x	x	33	x	x	52	x	x	20	x	8	x		17
Triticum monococcum			x			x	x	x	<1		x	?	x		<1	x	<1	x		12
Triticum dur./aestiv.		x	x		x				<1		x	<1			<1		<1	x		0.2
Linum usitatissimum		x	x	x	?				2			1			1		9	x		0.2
Cicer arietinum	x	x													1	x				
Pisum sativum	x					x											1			
Lathyrus sativum		x	x																	x
Lens culinaris	x	x	x	x	x	x	x	x	1			6	x	x	1	x	<1	x		1.2
Vicia ervilia	x		x			x			1				x		<1	x	<1			
Vicia faba	x		x			x		x					x			x				0.2
Olea europaea	x	x	x				x	x				1			1	x	<1	x		0.1
Vitis vinifera				x		x	x	x	2			0.5		x	9	x	5	x		1.4
Pistachia				x				x	<1							x				
Punica granatum																x				
Ficus carica	x	x		x	x				12	x		4			4	x	55	x		0.3
Ficus sycomorus																x				
Phoenix dactylifera				x					<1											
Zizyphus sp ch. (w)																x	3			
Avena sativum				x															x	0.1
Capparis spinosa (w)																x				
Celtis tournefortii (w)												2.5								

Table 7.2 Archaeobotanical remains from EB I and II contexts mainly in the Jordan Valley (x denotes presence while numbers represent percentages, w = wild) based on (Neef 1988; Philip and Baird 1993: 35; Mabry 1996; Fischer 1997: 161, 162; Bourke 2002; Cartwright 2002; McCreery 2002: 256; Bourke et al. 2003: 373-378; McCreery 2003; Riehl and Kümmel 2005; Fischer 2006: table 61).

pattern involves a move from several small open sites on the valley plain to only a few large walled settlements at high points in the foothills. This change has been demonstrated for other parts of the Jordan Valley and is very clearly exemplified by the newly discovered sites in the Zerqa Triangle (e.g. Philip 2003). The results of the survey discussed in section 4.1 will be summarized for the sake of clarity. During the Late Chalcolithic period occupation consisted of at least the large settlement discovered in field 27.¹⁷⁵ Given the artefacts discovered this site undoubtedly represents a settlement of considerable size, c. 1.5 ha but possibly even larger. Within the Zerqa section beneath both 'Abū al-N'eim and Tell Zakarī, Hourani identified *in situ* remains, i.e. stone lined pits that contained (Late) Chalcolithic pottery (Hourani *in prep.*). Through survey some Chalcolithic pottery was also discovered on the surface above the cliff. These finds seem to represent one or more sites at this location that were partly destroyed by the later incision of the Zerqa. The remains clearly date to the Chalcolithic period and may date to the Late Chalcolithic period, but the scarcity of finds makes it impossible to provide a precise date. Nevertheless, it is clear that the Zerqa Triangle saw Late Chalcolithic habitation on a considerable scale just within the al-Rweihah fan, possibly supplemented by a second site, or two small sites, along the Zerqa although this site might predate the Late Chalcolithic period.

The site in the south at Qatar Tell Dāmiyah was provisionally dated to the transitional period between the Late Chalcolithic and EBA. Future research is, however, indispensable to provide a better fixed date of this quite unique assemblage. Notwithstanding the large-scale erosion, this site can still be interpreted as a settlement given the diverse nature of both the pottery and flint assemblages. Chronologically this transitional site is followed by three temporally closely related settlements, i.e. field 81, al-Rweihah and Qataret es-Samra. These sites probably all commence at the start of the EB Ia period. None of the sites is very large and none measures over 2 ha. Based on the pottery assemblage Tell 'Umm Hammād seems to start slightly later but still in the EB Ia period. While the other sites cease to exist at the end of the EB I period, Tell 'Umm Hammād continues into the EB II period. Tell 'Umm Hammād differ in other respects too. The many parallels between Tell 'Umm Hammād and Jawa in the Eastern Desert have not been observed in the other sites in the region (Helms 1987). Although the holemouth jars with impressions below the rim common at Jawa are also frequently found in the Zerqa Triangle and a few other vessel shapes show parallels the pushed up lug handle is missing from the holemouth jars and the other parallels are only sporadic. The frequent parallels discovered at Tell 'Umm Hammād are not replicated at the sites discovered in the survey. Furthermore, contrasting to the other settlements that remain small and do not exceed 2 ha, Tell 'Umm Hammād covered an area of 16 ha in the EB Ia and Ib periods (Helms 1992: 10). Its size, however, greatly diminished during the EB II period when it only covered 2 ha and somewhere at the end of that period the site was abandoned. The enigmatic Tell 'Umm Hammād ware that was found at Tell 'Umm Hammād among other sites has also been found at the site in field 128. At Tell 'Umm Hammād the Tell 'Umm Hammād ware is present in the EB Ib and II period. Subsequently, field 128 was accorded a similar date although the non-Tell 'Umm Hammād ware pottery does not show many EB II characteristics making it likely that the site ended relatively soon after the advent of the EB II period. A similar date was given to the small EBA settlement in field 163 located 1.5 km to the NNE. Another site containing Tell 'Umm Hammād ware was excavated by Mellaart, i.e. Tell al-Maflūq (Mellaart 1962; Leonard 1992). Two smaller and less precisely datable concentrations have been found in the al-Rweihah fan in fields 210/229 and 248. In both cases the limited amount of pottery seemed to indicate that the sites were used in two distinct episodes, i.e. in the EB I and EB II/III periods.

Summarizing, whereas the Late Chalcolithic period was represented by two sites of which only one was definitely a settlement, the EB I period saw the existence of at least seven settlements and two smaller sites that may have had other functions. There are chronological differences between the sites, some started or ended earlier, but except for Tell 'Umm Hammād which was greatly reduced in size but continued to exist, it seems that these sites were all abandoned before or slightly after the start of the EB II period. Except for Tell 'Umm Hammād, all sites were, furthermore,

175 References to a few sherds of Late Chalcolithic or EBA date are omitted from this short overview, only clear sites are incorporated in the discussion.

of a relatively small size that did not exceed 2 ha. Additionally, all sites were located on the Jordan Valley plain or ghor at locations close to watercourses like the Zerqa or Wadi al-Ghor as was discussed in the previous chapter.

This settlement pattern contrasts to that of the EB II and III periods when all habitation was clustered in large walled settlements on hilltops overlooking the plain instead being located on it. These large walled settlements show urban characteristics like planning, public spaces and the presence of some central authority that regulated at least the communal constructions like the town wall. This phenomenon has, therefore, sometimes been referred to as early or proto urbanization and occurs throughout the southern Levant (e.g. Mazar 1990; Levy et al. 2007: vii). At some locations in the southern Levant and the Jordan Valley in particular the emergence of cities and this alternative settlement pattern started already in the EB Ib period, e.g. at Pella, Abu Kharaz, Handaquq N, Bab adh-Dhra' (Mabry 1996; Bourke 1997; Fischer 2000; Rast and Schaub 2003). In the Zerqa Triangle, however, the change from several small villages on the plain to a single walled large-scale settlement in the foothills only seems to have taken place in the EB II period with the emergence of Handaquq S.¹⁷⁶

Handaquq S is a large site enclosed by a wall. In 2005 part of the edge of the site was destroyed exposing a section through the surrounding wall. It became clear that in the west the wall consisted entirely of stone boulders forming a c. 4 m wide wall of at least 4 to 5 m high. The outer shells of the wall were made from larger boulders while the inside was filled with smaller, although descent sized stones. In 1934 Mallon reports Handaquq S as a large 400 x 500 m settlement surrounded by a large stone wall preserved up to a height of 1.4 m at certain locations. The stones were not worked and did not contain mortar, but the faces of the walls are straight and steep. If protruding rocks stood in the way of the wall they had simply been cut through. In the west a large tower protruded from the wall on the outside, while the remains of two others were visible on the inside of the wall (Mallon 1934: 59). Today, nothing remains of the towers, nor are parts of the wall still standing. In 1993, 1994 and 1996 Chesson conducted excavations at this site. Although the pottery on the surface suggests large-scale presence of both EB II and III remains, the excavations only revealed EB III remains (Chesson 1998; Chesson 2000). However, the excavations did not reach virgin soil. In the four phases that were excavated several rectangular rooms separated by courtyards were identified (Chesson 1998: fig. 2-5). Chesson states that the site covers 15 ha which corresponds to the area enclosed by the wall. The slightly greater surface reported by Mallon probably relates to his statement that there are also construction remains visible outside the main wall (Mallon 1934: 60). The site is located on the top of a small foothill which rises steeply from the Zerqa on its northern side and is bordered in the south by a wadi. The hill extends c. 100 m above the valley and via a small saddle continues to rise up the plateau in the east. The site offers a commanding view over the valley plain and especially over the al-Rweihah fan.

A similar site is located on a foothill immediately north of the Wadi Rajib, i.e. Tell al-Qōs. This site has not been excavated but survey showed that over at least 5.7 ha large numbers of sherds from the EB II and III period were encountered (Petit in prep.). A third site of this date and character has been found on the other side of the Jordan at Khirbet Makhruq. Like the other sites it is located on top of a hill overlooking the valley at the mouth of the Wadi Far'ah. It was excavated in the 1970's and proved to be surrounded by a large wall of mud-bricks on a stone foundation that was 2 m wide and had been preserved up to a height of 5 m. Pottery was dated to the EB II period (Yeivin 1974: 259, 260).

The large walled sites form a clearly distinct settlement pattern from the many small EB I settlements on the plain. The EB I inhabitants of the Zerqa Triangle decided at a certain moment to move out of their multiple villages in the valley plain into a single large site on a hilltop. What was the reason for this decision?

176 The large quantities of pottery from the EB II and III suggest a settlement of considerable size only emerged in the EB II period. EB I pottery has, however, been found at the site and the area may, therefore, have been occupied on a small scale already in the EB I (Chesson 1998: 20). Hopefully future excavation will be able to reach the bedrock and determine the start of the settlement.

7.5.3 Social reasons for settlement change

From a subsistence and environmental point of view there is predominantly continuity. Although there are no local archaeobotanical remains, the data from other parts of the Jordan Valley show that the same crops were cultivated in more or less the same proportions. There was, however, probably a development towards intensification. It has been argued that there is increasing emphasis on horticulture. Crops like olive and grape became increasingly important (Neef 1990; Grigson 1998: 250, 259; Genz 2003). There might furthermore have been an increase in the focus on surplus production or at least on the storage of it. Settlements in all periods had storage facilities of course but in the EB II walled settlements a concern for both household storage and storage on a larger scale is visible (Chesson 2003; Philip 2003: 112). However, essentially the agricultural system of the EB II and III period seems to have developed during the (Late) Chalcolithic period. Horticulture and floodwater farming have both been evidenced in the Chalcolithic period, although on a much smaller scale than in the later EBA. The same areas were cultivated, i.e. at the mouth of large wadis coming from the plateau, probably using more or less the same techniques and crops.

Despite the similarities in agricultural system there are definite changes on a social level between the Late Chalcolithic, EB I and EB II periods. During the Late Chalcolithic period the settlement system was characterized by a few large villages of up to 10 ha in size, like Tuleilat Ghassul, Gilat, Shiqmim or Abu Hamid, and a large group of small villages of ca 1 ha (Levy 1998: 227). The EB I period, however, seems to be characterized by small villages although occasional exceptions like Tell 'Umm Hammād and Jawa are present. In the Late Chalcolithic period religion or cult seems to have been central to society as is evidenced by the fact that all artefact types that can be

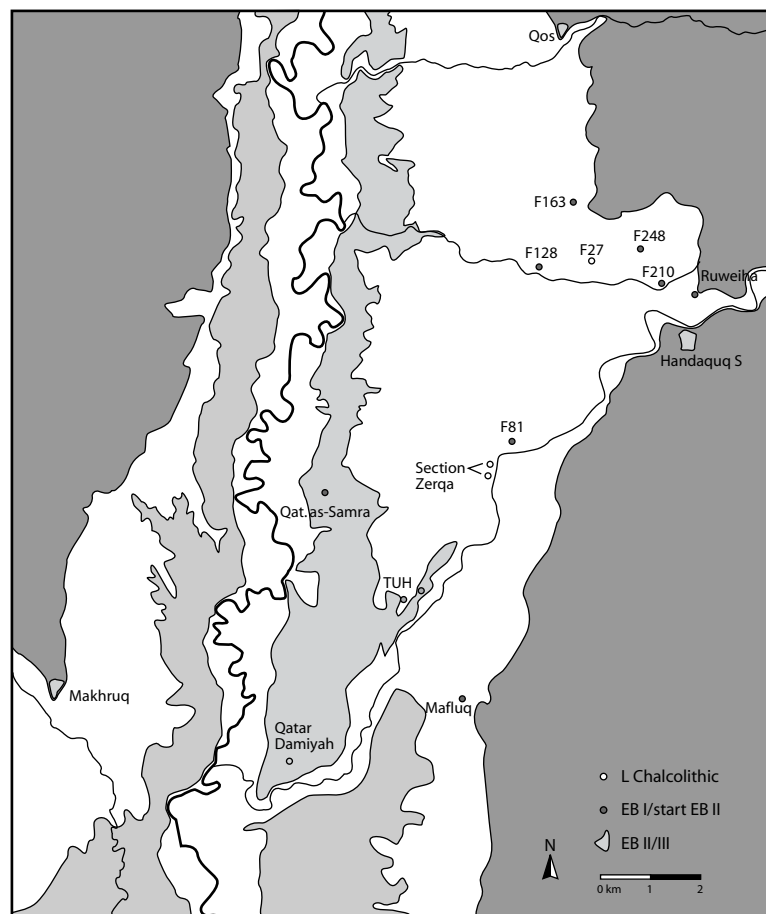


Figure 7.5 Late Chalcolithic and EBA sites in the Zerqa Triangle

regarded as status objects, e.g. arsenic copper artefacts, carefully worked mace heads of (exotic) stone, ivory figurines, objects and pillar figures, are all related to ritual or cult (Kaptijn 2003, 2005). These objects are completely absent in the EBA and in the structures that have been identified as cultic like those at Megiddo, mainly sheep and goat bones were discovered (Wapnish and Hesse 2000). The ritual expression is much less visible in EBA society and, notwithstanding the many problems and drawbacks attached to this topic, there seems to be less concern with religion in the EBA. Such a comparison lies beyond the scope of the present topic, however, and can only be discussed with the attention it deserves in a separate study. It is important to note though that the Late Chalcolithic and EBA societies are, despite the clear similarities in subsistence, differ in several aspects of the social realm.

The differences between EB I and II communities, however, also seem to be predominant on a social level. Using a landscape approach Philip has argued that the shift in settlement location towards hilltops above the plain and the construction of large surrounding walls is related to territoriality and group identity (Philip 2003: 113). The walls present at all large sites seem to be disproportionately large with regard to any possible outside threat (Philip 2003: 113). No indications of warfare have been discovered at any of these settlements. From a defensive viewpoint these walls are, furthermore, not very effective. Taking Handaquq S as an example, it is clear that the location on the lowest top of the foothills with the plateau rising up immediately beside it is not a very strategic location. Aggressors coming from above can approach the site very closely and attack the settlement by simply aiming all kinds of projectiles at the settlement from the higher slope. A walled village in the plain would be better defensible. Secondly, if Handaquq S was under siege the water supply would immediately have become compromised. The nearest water is found in the Zerqa. Yet, the river was not incorporated in the walled area. Had water supply been a concern, it would have been very easy to simply alter the course of the wall slightly and make a safe passage towards the river. A similar lack of secure water supplies is visible in many of the other walled settlements (Philip 2003: 111). The only exception is formed by Khirbet az-Zeraqun where a tunnel system has been found that runs towards groundwater. However, dating the tunnels proved difficult and the assumed link of the tunnels with the EBA settlement on top has come to be questioned by the discovery of other tunnels ending in or near sites from different periods on neighbouring hills (Bienert 2004). It, therefore, seems that the walls are not strictly defensive in nature.

The move from the valley plain towards hilltops overlooking the valley may have more to do with achieving greater visibility than with defence (Philip 2003: 115). The walled sites are located on clearly visible hilltops overlooking the valley. From Handaquq S one has a magnificent view over the valley and especially over the al-Rweihah fan. All EB I villages are clearly visible from Handaquq, except for Tell 'Umm Hammād which disappears in the haze on a hot summer's day. The agricultural lands, that supposedly had not changed since the EB I period, are similarly visible. The most dominating view is, however, over the al-Rweihah fan. The al-Rweihah fan was to all probability the most heavily cultivated area as it holds the most fertile soils and receives most water not only by the overflow of the Zerqa but also from wadis like the Wadi al Ghor (see section 5.5 and Hourani in prep.). The importance of the al-Rweihah fan as an agricultural area in the Late Chalcolithic and EB I periods has been demonstrated by the presence of several settlements (see figure 7.5). The higher than average pottery densities throughout the entire fan can be connected to this intensive and prolonged agricultural activity.¹⁷⁷ Looking out over their agricultural lands the inhabitants of Handaquq may have felt a sense of ownership or territoriality. More importantly, however, when seen from outside the settlement, from the hills but especially from the valley, the settlement on the hilltop with its high stone walls will have optically seemed to dominate the region. The cultivated valley before it will have stood out from surrounding uncultivated areas watched by the settlement with its impressive walls. Although the setting and walls were in a practical sense not defensive, this does not mean that they may not have acted as such. People

¹⁷⁷ Pottery within agricultural fields can, for example, be related to water storage or food consumption of people working in the fields. As in the pre-modern era it may have been necessary to protect crops from wild animal or possibly other communities.

might have perceived a threat and the walls, hilltop location and congregated community might have instilled sufficient awe as to be an effective defensive system. In this way conflict may have been avoided, so that the flaws in the defence might never have become known.

It has been argued that the intensification of agriculture, possibly in part resulting from an increasing population, and especially of horticulture resulted in an increased sense of territoriality (e.g. Philip 2003: 106). Horticulture meant that there was a delayed return as planted trees had to be nurtured for a few years before the first fruits could be harvested. Olive trees, for example, only give fruits after five to six years and can continue to produce fruits for hundreds of years (Zohary and Hopf 2000: 145). Claims on prolonged use of an area became imperative when horticulture became more important compared to perennial crops. An intensification of agriculture might have resulted in a greater stress on the land that was well suited to agriculture. It is, however, likely that a true stress on land emerged only slightly later in the EBA. Towards the end of the third millennium drier climatic circumstances and greater incision of rivers and wadis came about (Cordova 2007; Rosen 2007: 80ff; Wossink 2009). These less advantageous climatic conditions, however, post-date the shift in settlement and cannot be connected to this change. The salinization problems evidenced at Bab adh-Dhra' which probably resulted from prolonged intensive irrigation agriculture are equally unlikely to have emerged already at the end of the EB I period in the Zerqa Triangle (McCreery 1980: 188, 195, 2003: 463). These processes of desertification, salinization and exhaustion of the soil may well have become problematic in the Zerqa Triangle at a later stage during the EBA, however, possibly at some point during the EB III period. Especially the al-Rweihah fan had by that time been cultivated and irrigated for a long time and the supposed decrease in water will probably have been felt by the quite numerous inhabitants of Handaquq S. The higher off-site densities in the al-Rweihah fan may very well reflect an attempt to maintain the highest yields possible by applying manure and organic domestic rubbish collected in the village to the fields. The focus of Handaquq S will have been foremost on the al-Rweihah fan, hence the higher densities in this area.

These problems, however, only started after the EB I period. During the EB I period people may have become aware that fertile land that could be watered easily was limited. The EB I villages show that the al-Rweihah fan was probably mainly taken up by agricultural fields. This focus on certain areas might well have necessitated the cooperation of several communities. If flood irrigation indeed employed the use of dams to trap the water, neighbouring communities may well have depended on the same water and same dams. Seeing how it is impossible to establish the contemporaneity of the EB I settlements on the basis of survey data it is not certain whether this was the case in the Zerqa Triangle. It may have encouraged the forming of closer ties between villages and eventually given rise to a sense of shared identity. The shift from several small villages to a single large village suggests that the region as a whole, represented by the large walled village, became more important than the smaller individual communities. The construction of the wall of Handaquq S will have been a massive communal undertaking. It can be suggested that the very act of communally carrying out such a task strengthened shared identity and a sense of community. However, such suggestions will always remain hazardous and difficult to verify. It can, however, be safely stated that the construction of these large encircling walls was a very labour intensive undertaking that required the cooperation of the entire community and showed a sort of presence and permanence in the area.

Another labour intensive act that will have bolstered the territorial claims of the groups to a certain area was the construction of the megalithic grave structures discovered at several locations within the foothills. At several places along the edges of the al-Rweihah fan groups of dolmens or rock-cut chambers have been discovered (see section 4.1).¹⁷⁸ These megalithic structures are locat-

178 Apart from the small groups of dolmens discussed in section 4.1 and the large dolmen field at Dāmiyah (see section 2.2) Mallon mentions the presence of now disappeared dolmens. He states that south-west of Handaquq S, between the 'gorge' of the Zerqa and the village of al-Ma'addī, a group of collapsed dolmens, tumuli and a large circle with a diameter of 40 m were present. Further south, but still north of the Dāmiyah field, he discovered double dolmen and tomb structures that resembled those of Tuleilat Ghassul (Mallon et al. 1934: 156). This and other reports show that dolmen were in the recent past even more common than they are today. Although dolmens are disappearing rapidly, their number is even today still too large to assume that only a small elite group was buried in this way.

ed at more or less the same elevation and location as the walled settlements. In the Zerqa Triangle this location may, however, be as much connected to the presence of suitable stone as to anything else. Especially the location of the large Dāmiyah dolmen fields seems to be predominantly determined by the presence of travertine outcrops. As transport over large distances is impractical dolmens were constructed at the location where suitable stones were available. Like the walled settlements the construction of a dolmen or rock-cut chamber would have been labour intensive and impossible to carry out by a single person. Both are, furthermore, highly visible structures. By their presence these structures may have incorporated these areas within the cultural realm like the agricultural fields in the valley. The construction of these monuments and the interment of the deceased members of the group in them generate a permanent link between these communities and the region. Like the walled settlements the dolmens suggest a concern with territoriality and permanence.

Although dating remains problematic given the few well identifiable feature sherds collected by the survey in connection to the megalithic structures described in section 4.1, the excavated remains of the Dāmiyah dolmen field suggest that the earliest finds in the dolmen stem from the EB Ib period (Stekelis 1961; Yassine 1985). Their construction, therefore, probably predates the shift in settlement from the plain to the foothills with regard to Handaquq S, but is of the same date as the emergence of Pella, Handaquq N and Abu Kharaz to name a few. The erection of dolmen, however, undoubtedly continued in the EB II period and was, therefore, at least partly contemporaneous with Handaquq S. Besides megalithic structures people were also buried in shaft tombs and charnel houses during the EBA, e.g. Bab adh-Dhra' (Schaub and Rast 1989). This type of burial is largely absent in the Zerqa Triangle. Only one shaft tomb has been discovered in the region. This tomb, NE22, was found within the EB IV shaft tomb cemetery of Tiwal esh-Sharqi, located immediately south of Tell 'Umm Hammād and contained an adult male between 25 and 30 years old with a height of *c.* 1.72 m in flexed position, an adult female and a juvenile aged 10-15 (Tubb 1990: 47-50). There may, however, have been more of these EB I shaft tombs in the area, but the intensive agricultural activity in the valley likely disturbed those located within cultivatable areas. It has been suggested that shaft tombs that are generally found in close proximity to villages are connected to sedentary agriculturalists, while dolmens which show a less clear connection to settlements were the burial grounds of pastoral nomadic groups (e.g. Zohar 1992). This dichotomy is less clear today and as elaborated on in the previous section it is unlikely that fully nomadic or even semi-nomadic pastoralists existed before the Hellenistic period. Although there are no local archaeozoological data from the Zerqa Triangle, in other areas of the Jordan Valley cattle, that are less mobile, formed the largest meat supply during both Late Chalcolithic and EBA. Cattle formed 68-74% of meat supply in the Late Chalcolithic and EBA, while sheep and goats only constituted 18-19%. Pig, however, constituted as much as 9-14% (Grigson 1998: fig.6c). The high proportion of pigs, which are not suited to a mobile existence, demonstrate that at least part of the communities were completely sedentary. The wide range of cultivated plants and the presence of pig and cattle show that EBA communities survived bases on mixed farming possibly with some small-scale vertical seasonal movement along the slopes of the plateau. Both types of burial in the Zerqa Triangle are, therefore, regarded as being related to largely sedentary mixed farming communities. The dolmen, rock-cut chamber tombs and several intermediate forms are, therefore, suggested to be the expression of a similar social concern as the walled sites, only in a different medium. They are highly visible, lay a claim to territory and require a shared labour investment.

In the absence of climatic, agricultural or topographical changes it has been argued that the shift from several small EB I villages in the plain to a single large walled settlement on a hilltop in the foothills is likely the expression of social change. The high visibility, communal construction and social aggregation of such a village show a greater concern with territory and a widening sense of identity among the regional group probably as a result of agricultural intensification. A precursor of these processes expressed in the walled settlements is visible in the construction of the megalithic tombs in the foothills where the same principles of linking the group to the land, communal construction and continuity come to the fore. The reason for this change is difficult to specify, but the intensification of agriculture and especially the growing focus on horticulture that presupposes territoriality and permanent claims seem to have played an important role.

8 Conclusions

Having discussed the results of the survey, the manner of irrigation and the character of agriculture and habitation it is time to return to the aims and questions outlined in the first chapter. In the following sections an attempt will be made to answer the three research questions set for this study. In the last section the general question and aim of the Settling the Steppe-project at large, i.e. why did people come to live in the Zerqa Triangle and why did they abandon it, will be discussed with respect to the focus of this study, i.e. occupation history, environment, agriculture and irrigation. Although the Zerqa Triangle is spoken of as a uniform entity, the conclusions only pertain to those areas actually surveyed. The largest part of the Zerqa Triangle remains uninvestigated. Additional future survey work to check and refine the following conclusions would of course be extremely valuable. However, the sampling level of slightly over 10 % supplemented by the fact that the investigated fields were not centred on a single location but distributed over several parts of the research area, ensures that the following conclusions can be regarded as applicable to the Zerqa Triangle as a whole with a fair degree of confidence.

8.1 What remains of human activity are visible and what caused them?

The results of the survey have shown that the artefacts on the surface can attain very high densities. Densities of over 1000 sherds per 100 m² were of course not the norm, but they were by no means exceptional either. The total sherd numbers depicted in figure 4.1 in chapter 4 show that specific areas yielded very high pottery densities. Especially around Tell Deir 'Allā densities of over 200 sherds per 100 m² were encountered over large areas. In this area it is very clear that the Jordan Valley is a large palimpsest as tells and surface concentrations from different periods abut one another and sometimes even overlap. To attain meaningful distribution patterns the various periods had to be considered separately. The distribution patterns of pottery remains discussed in chapter 4 show that similar distinct types of patterning are visible for most periods. The distribution patterns of virtually every period show bounded areas of relatively high densities that contrast to the lower density surroundings. These lower density areas are not uniform, now consisting of smaller low density islands separated by empty space, e.g. during the IA, then consisting of a more or less continuous blanket of artefacts, possibly with slight variations in density, e.g. in the Late Roman period. The distribution pattern of several periods also revealed regions that were completely devoid of finds. The fact that the same areas did reveal artefacts from other, often older, periods indicates that no distorting factors are at play, but that these areas actually lacked artefacts of that period.

The interpretation of these various elements within the distribution patterns was sometimes rather straightforward, while at other times it proved very difficult. The ability to successfully interpret a certain distribution pattern also depended on the available information and character of the period concerned. The interpretation of a distribution pattern of a period for which high artefact densities had been recorded tended to be easier than the interpretation of an artefact-scarce period. Certain periods or activities simply left few remains, were of short duration, were difficult to date or the remains were more heavily affected by post-depositional factors. Densities per period can, therefore, not be easily compared to each other and the density is not simply a reflection of the intensity of habitation of that period. It is, for example, known that at a certain moment in 1953 about 3000 people were living in the Zerqa Triangle. However, only 65 sherds could be dated to the Late Islamic/Modern period as a whole. The EBA on the other hand left 947 datable feature sherds, but the question remains whether there were ever 3000 people living in the Zerqa Triangle

at any one time during this period.¹⁷⁹ For this reason high and low density areas are discussed in relative terms. A number of sherds that represent a high density area in one period may only constitute a low density in the another. The spatial variation and relative distinctions in density are what matters in the interpretation, not the absolute number of artefacts collected.

Given the generally large number of artefacts they yielded, the bounded high density areas were often relatively easy to interpret. Based on characteristics discussed in chapter 3 most of these areas were interpreted as settlements. Settlements taking the form of higher than average bounded density areas occurred in most periods. In several periods it is very likely these settlements had permanent architecture, but this cannot be securely determined through survey. Another activity that left many remains in a small area surrounded by much lower densities was the Mamluk sugar industry.

The bounded low density areas are more difficult to interpret as the data on which an interpretation can be based are much more restricted. Bounded areas consisting of only a few sherds that are located in an otherwise 'empty' landscape, like the small Hellenistic concentrations, can, as discussed, still reflect settlements. However, a similar distribution from the Late Roman period will not be recognized, as the entire countryside is covered in a low density artefact scatter. In the EBA such a bounded low density concentration would be recognized but can only represent a very short-lived or a very small habitation site as the larger and denser concentrations that have also been found show that biases were not so severe as to obscure the majority of the remains from this period. During periods in which these low density areas likely represent some low intensity activity these areas might reflect short-term habitation like temporary encampments of mobile people. Although there are few characteristics that can positively identify such habitation, ethnographic sources have made it possible to identify such remains in the pre-modern situation. The few remains left by such activity from this recent period shows the artefacts left by similar activity of more ancient date will be very difficult to detect as remains were already scarce after only a few decades. Nevertheless, it is likely that the low density and spatially restricted concentrations of the IA represent similar low intensity habitation.¹⁸⁰ Alternatively low density bounded areas may represent agricultural structures in the fields, like guard posts, sheds and standard resting places. All these activities have been attested in ethnographic descriptions from the early 20th century and it is likely that these structures were present in earlier periods as well.

Although cemeteries have been identified in other surveys and have the potential to be relatively well recognisable in the archaeological record, this survey only identified one example of cemetery remains, i.e. north of the village of Al-Dbāb where a Late Roman cemetery had already been identified. This location was identified not on the basis of pottery, but by the presence of large stone slabs. Based on pottery alone, this area would, however, not have been identified as a cemetery.

Low density remains were also discovered in another form, i.e. spread out in more or less continuous fashion over large parts of the countryside. Analogous to survey results from other parts of the Mediterranean this type of remains has been identified as the practice of manuring the agricultural fields with organic waste materials from the settlements (e.g. Bintliff et al. 2007). This practice is most clearly visible in the Late Roman period as sherds from this period were discovered almost everywhere in the landscape. This evidently quite intensive agricultural use of the countryside corresponds to the large and probably densely inhabited settlements discovered from this period. Throughout the southern Levant the Late Roman period is characterized by intensive agriculture and a high population density (Patrich 1998: 483; Parker 1999: 169). Unfortunately there are no excavated remains dating to this period from the Zerqa Triangle or its close vicinity making it impossible to determine the type of agriculture and population density of this area. However, based on research from other regions it is likely that the agricultural practice

179 The 65 sherds from the Late Islamic/Modern period stem from a period of maximally 450 years, i.e. from the start of the Ottoman period to 1950, but judging by the pottery more likely from the last 200 years. The EBA pottery predominantly dates to the EBA I, which covers *c.* 600 years. The pottery therefore more likely has a ratio of 65 Late Islamic/Modern sherds compared to 300 EBA sherds.

180 Nevertheless, this activity was most likely of a more permanent nature and left more remains resulting in the fact that these distributions are still visible today.

that resulted in this continuous artefact scatter was estate-based and export oriented (Parker 1999). This is a completely different system than the one that generated a similar, albeit slightly more restricted, distribution in the EBA. It has been hypothesized that intensive agriculture and manuring agriculture were also the reason behind the more or less continuous artefact distribution that was discovered in the Rweihah fan especially. However, this agriculture was village oriented and to a large degree aimed at local subsistence. Although this type of distribution pattern was the result of intensive agriculture in both cases, the type of agriculture and the society underlying it clearly differed from the EBA to the Late Roman period.

The difficulties that arise from low artefact densities are to a certain extent the result of the intensity of the survey. Had the survey investigated plots spaced 2 metres apart instead of 15 metres a higher level of detail would have been reached and some low density areas might possibly have become better defined and interpretable. However, the amount of terrain that can be covered with the same resources is much smaller and it was decided that a better spatial distinction does not justify such a regional restriction of an already small area. Furthermore, the interpretation of these low density concentrations will remain difficult when instead of two sherds the total may now be ten sherds of which still only one or two are datable.

A different line of investigation that might enhance our understanding of certain distributions and is possible with regard to the present assemblage is detailed period specific analysis. The aim of this study was to assemble a diachronic overview of a little known area, i.e. the countryside between tells. An attempt was made to study all discovered periods as detailed as possible within the present time constraints, but given the wealth of information it is impossible for a single person to retrieve all information that is potentially available. Nevertheless, the present study provides a framework and the collected material can now be used for detailed analysis of specific elements present within the assemblage.

A derived aim of this research concerned the testing of survey methodology and design in this region that was not studied in such a way before. It can be safely concluded that the conditions for survey work in the ghor of the Zerqa Triangle are in many respects ideal. Although this is an area of soil accumulation, which of course obscures remains on the surface, the very same phenomenon acts to preserve the remains. Soil deposition is especially severe in the areas neighbouring the foothills in the east. In these areas deposition was sometimes so great as to hamper the identification of buried remains. The same is true regarding the periods before the late EBA. During this period the different discharge regime of the rivers and wadis resulted in overbank deposits that buried artefacts in the vicinity of water courses. Especially the older Neolithic remains are obscured by this deposition. Late Neolithic pottery has been found but only by Hourani in sections along wadis.

Erosion is a minor problem in the ghor. Only within the streambed of the Zerqa and to a much lesser extent the bed of the Wadi al-Ghor and Wadi Rajib does erosion take place. In the Qatar area, however, erosion is a very significant factor and one of the reasons this area was not considered in the survey. The almost level plain of the Jordan Valley means that lateral displacement of artefacts as a result of slope angle was not a factor that acted on the remains in the Zerqa Triangle.

Crucially, surface visibility was perfect throughout the region as a result of agricultural activity. The Zerqa Triangle is more or less dominated by the cultivation of vegetables and fruit trees, which in contrast to cereals and many other field crops entails bare tracts of land between the sown furrows. The percentage of the surface that was visible generally lay between 80% and 100%. The agricultural use of the fields also meant that the field walking itself was easy as the ploughing furrows and the vegetable beds guided the fieldwalkers and there was hardly a winding route. The large scale farming of today is revealing sites for the first time. This results in rather fresh remains on the surface today. This is, however, also the biggest threat to buried archaeological features. The ard plough that is nowadays becoming rare has hardly disturbed the buried artefacts throughout the period during which it was used as it only disturbs the upper 15 to 20 cm of the soil. Many mother populations buried in the soil have, therefore, been left largely untouched. The modern ploughs, however, reach much deeper. Although many sites are buried at depths not reachable by

modern ploughs, the ones located within the modern ploughzone and that at this moment still retain a good level of conservation will become increasingly ploughed out and depleted in the near future.

8.2 With what intensity was the Zerqa Triangle inhabited in the different periods?

The answer to the second research question that concerns the level of habitation intensity cannot be answered by simply referring to the number of remains discovered in the survey. Even without considering the many biases and distortions that ensure that remains from different periods cannot be directly compared to each other, the absolute number of remains from a period does not necessarily reflect the intensity of occupation. The intensity of habitation can be seen as a dependent on the carrying capacity of the region and the population density. Although there are many problems with regard to estimating ancient population densities, the meaning of the term is straightforward, i.e. how many people lived in a region at one moment in time. The carrying capacity is, however, subject to additional variables. Given that the region and its soils and fertility have remained more or less the same over time and the agricultural techniques used in the different periods are very similar, the carrying capacity of this region is largely determined by the crop pattern used and the water that is available in a specific period. Due to the low groundwater table the available water in the Zerqa Triangle is determined by rainfall and river discharge. In chapter 6 an indication has been given of the water demand under specific cropping patterns that were reconstructed for three periods. It has been shown that different regimes of cultivation can result in very different water demands. Especially the timing of planting has great implications for the water demand and hence the carrying capacity of the region. A choice for crops whose growing cycles have slightly different timings and therefore mature more evenly over the year considerably increases the carrying capacity and labour intensiveness of agriculture. By the evaluation of crop regimes that cultivate both winter and summer crops it has become clear that the most critical time regarding water availability is not so much the hot and dry summer months, but late spring (April/May), when most winter crops are still maturing in the fields but summer crops have already been planted.

By determining the carrying capacity under the different crop systems it has been calculated in chapter 6 that the agricultural system of the IA which relied only on winter crops could sustain the largest population, i.e. \approx 5000 people under average precipitation, decreasing to \approx 2300 people in a dry year. The estimated population density of \approx 2000 to 3100 people meant that water and hence food stress was a reality during dry years if the population approximated the higher estimates (see section 6.4). According to Petit's synchronisation exercise these high estimates will, however, only have been reached during one or perhaps two short phases within this period (Petit in prep.). During the Mamluk period the year-round cultivation of sugar cane placed a high demand on the available water. Especially the high water demand of the crop during June resulted in a low carrying capacity, i.e. 1100 people in a dry year and 2500 people in an average year (see section 6.3). Although too few Mamluk settlements have been excavated in this area to provide a good population estimate, it is unlikely that this low carrying capacity was exceeded. Irrespective of the intensive sugar cane cultivation that was undertaken and that used the region to its full potential, the necessary crop rotation left sufficient land and water available to grow the winter crops that the local population needed as food supply. The carrying capacity of the pre-modern agricultural system is slightly lower than that of the IA. This is predominantly due to the high water demand in May resulting from the overlap of winter and summer crops (see section 6.2). The recorded population density of \approx 3000 people, however, far exceeds the carrying capacity of \approx 1750 people during a dry year. The number of people that can be fed in a normal year, \approx 4500 people, far higher, however. The fact that dry years undoubtedly occurred regularly means that people probably practised food storage and made the choice to irrigate staple crops over export and crops not vital to survival to overcome these poor years. It is likely that the people in other periods had similar mechanisms to cope with dry years. It should, however, be mentioned that a large proportion of the pre-modern inhabitants of the Zerqa Triangle was not permanent but semi-nomadic. Nevertheless, it is unlikely that the more mobile proportion of the population simply moved away in a dry year because that

would deprive them of vital agricultural produce. Furthermore, a dry year would only reveal itself when winter rains had still not fallen in December or January, but by that time a lot of labour had already been invested in ploughing and planting fields. As a dry year could not be predicted beforehand, farmers could not anticipate a dry year but had to prepare themselves for it each year. Food storage, the cultivation of crops that could be stored for a long time and the dispersal of planting over a considerable period of time was, therefore, essential for long-term occupation in this region. Concluding, it can be stated that the carrying capacity of the Mamluk period was by far the lowest, but it seems that the habitation intensity was also the lowest. The carrying capacity of the IA agricultural regime was the highest. However, the cultivation of summer crops will have made the pre-modern farmers less dependent on the success of the winter cultivation, which could of course fail for many other reasons than drought alone, e.g. fire, animals, raiders, or general hostility. The intensity of habitation was highest during the pre-modern period, although a few periods during the IA II period approached this intensity very closely. Although it should always be remembered that these calculations are only indications of the likely situation based on interpretations and assumptions, irrespective of all their drawbacks these indications provide a better founded evaluation of intensity between the periods than the archaeological remains alone can provide.

Unfortunately, the data required to reconstruct cropping patterns and population densities were not available for other periods. However, further research, especially in the form of excavations, will be able to generate these data and provide valuable new insights in the socio-economic and agricultural characteristics of these periods. Especially the EBA, Roman and Late Roman periods are very promising and future excavations with a special focus on botanical remains of some of the sites discovered in the survey would be very enlightening.

8.3 How did people create a living in this arid steppe zone in different periods?

When the water demands of individual crops that are known to have been cultivated in the Zerqa Triangle are compared to modern and estimated ancient precipitation data it is clear that irrigation is and was a necessity for almost all crops in this region. The manner in which irrigation took place is more difficult to determine as there are no extant remains of the ancient irrigation system in this heavily cultivated region. However, ethnohistorical reports and old maps show the pre-modern canal irrigation system in detail. In chapter 5 the manner in which irrigation took place using these canals was described. This chapter discussed that based on the location of settlements, sugar mills and the topography of the Zerqa Triangle, the canal irrigation as it was known until the 1960's is much older and dates back at least to the Mamluk period. During the IA and probably the LBA as well a very similar irrigation system using primary canals located in more or less the same locations was in use. Little is known about the MBA, but it is clear that the irrigation system and the climatic conditions during the EBA and preceding periods were very different. During at least the early part of the EBA regular low energy overflowings in addition to a moister overall climate provided sufficient water to cultivate the areas besides watercourses. EBA communities may have used dams to retain the water longer, but due to the lack of structural evidence this is difficult to ascertain.

This EBA system which made use of the natural overflowing of rivers and wadis is very different from the system of canal irrigation used in most other periods. The system using canals is hierarchical in nature because only a few main channels tap the river and all areas located downstream are dependent on the people upstream as they can block the canal and leave the downstream area without water. In the EBA agricultural system the overflowings were a natural phenomenon that occurred over large areas along rivers and wadis. The small villages that were predominantly located along the river and wadis were all independent and equal in terms of water availability. During the EB II period almost all villages on the plain were abandoned and the large walled settlement of Handaqq S emerged. A similar change in settlement pattern is visible in other areas as well. The reason for the shift in preferential settlement location is not entirely clear but the dominant location of Tell Handaqq S overlooking the most profitable agricultural areas of the plain and the increasing importance of horticulture suggest that a rise in territoriality may well have played an important role.

During the other three periods for which sufficient information is available, i.e. the IA, Mamluk and pre-modern period, a system of small open canals was used. Although the same essentially hierarchical system of canal irrigation was used in three different periods, the socio-economical and socio-cultural characteristics of these periods meant that irrigation was organized in quite distinct ways. Irrespective of the essential hierarchical nature of the irrigation system, societies were not necessarily hierarchically organized in the three different periods. During the IA, settlements were generally characterized by equality. All settlements took the form of small villages. Nevertheless, some sites were slightly bigger and exhibited more functions than strictly domestic habitation. These sites like Tell Deir 'Allā, Tell al- Mazār, and Tell Dāmiyah were, however, not located upstream, but often quite the opposite. Especially Tell al- Mazār is located far downstream near the end of a canal. These sites have in common that they are located at places that do not rely on one water source alone and this ability to spread risks might, together with other factors, have caused or at least enabled these sites to outgrow others in both dimensions and functions. Nevertheless, irrespective of the differences between sites, all IA settlements are small and do not transcend the level of village communities.

In the Mamluk period a similar system of canal irrigation was dominated by the sugar industry. The Zerqa Triangle was home to four or five sugar production sites that were mostly located along a separate primary channel. The sugar mills and hence the villages that were mostly found in association with these centres, therefore, functioned independently from each other. Although all sugar production centres and villages were independent with respect to water, the villagers themselves were in many respects not independent. The sugar industry was dominated by the Mamluk government headed by the sultan and considering the dominant position of the sugar industry and the labour intensive nature of sugar cane cultivation and sugar production, most inhabitants will have been employed in the sugar industry. Only on fields of secondary quality and on fields that lay fallow will villagers have been able to grow subsistence crops for themselves. However, these villagers, who were the actual producers of the sugar, did not benefit from the money made in the sugar trade, which was amassed by the sultan and wealthy traders in the capital Damascus. So although communities were independent with respect to water and irrigation, in economical terms they relied on the heads of the sugar industry and many people will have served as dependent labourers in the sugar industry.

During the pre-modern period there is, similar to the other periods, both equality and hierarchy are visible. During the pre-modern periods the society of the Zerqa Triangle was clan-based. People and territory were divided into clans that were both hierarchical and egalitarian. Within a clan itself the social system was headed by the sheikh who was considered the *primus inter pares* of the clan members. Land was divided equally among the clan members and rotated every few years to distribute the profitable lands close to irrigation channels equally amongst the farmers. Amongst clan members, therefore, generally equality prevailed. However, for people outside the clans society was not so egalitarian as they were regarded as people of lower standing and could only farm land as a sharecropper or farmhand employed by the sheikh. Additionally, the household staff of the sheikh stood outside the entire clan system. There was also a hierarchy amongst the clans. On the one hand there were the powerful Hurr clans that had the largest territories and/or the land located farthest upstream. On the other hand there were the secondary Ghawarneh clans that occupied smaller areas downstream and making them dependent on the Hurr clans. Although clan-based society is often regarded as egalitarian especially as a result of laws advocating land property claims and the settling of newcomers, the system developed into a very hierarchical system that enable certain sheikhs and moneylenders to become very powerful.

It can be concluded that at least since the IA the climate in the Zerqa Triangle was of such a nature that irrigation was a necessity. The way in which people managed this irrigation had implications for their society. Certain characteristics are enclosed within the system of canal irrigation, but their outcome is dependent on the socio-economic and socio-cultural system of the different periods. Nevertheless, all societies necessarily had to devise a way to deal with these issues and organize irrigation.

8.4 Why did people settle in the Zerqa Triangle and why did they leave it?

Provided certain requirements like artificial water supply can be safeguarded, the Zerqa Triangle is a very profitable region to inhabit. The alluvial deposits ensure soil fertility, while the high temperatures make for significantly shorter growing seasons of crops than in the neighbouring hill countries. Today three crops can be cultivated per year and in the past a successive summer and winter crop will have been feasible. If a society is able to irrigate the fields this region is a very advantageous region to inhabit. Given the layout and topography of the valley there is only one effective means of irrigation which is relatively easy, i.e. a system of interdependent small open canals. These canals are relatively easy to construct and involve little technical skill. However, their creation is labour intensive, especially if large parts of the valley need to be irrigated. Furthermore, the canals are interrelated and water use and canal maintenance require communal organisation. Apart from the creation and maintenance of the canals, society needs to have commonly accepted regulations on water distribution and use. Both the social and the structural preconditions of a successful irrigation system take time to develop. A successful irrigation system, therefore, requires a stable society, but as long as such preconditions are present the Zerqa Triangle is a very profitable region to inhabit.

The fact that agriculture and hence sedentary occupation depended on the irrigation system made communities vulnerable. If for some reason the irrigation system was damaged on a large scale, survival of sedentary communities was critically threatened. Although communities will probably always have incorporated a pastoral component in their subsistence economy, they will have been unable to sustain permanent occupation of the Zerqa Triangle on pastoralism alone. During the hot and completely dry summer animals had to move out of the valley in search of fresh pastures. Furthermore, both pure pastoralism and pure agriculture are rare and are unlikely to have existed in the distant past. People in the Zerqa Triangle will, therefore, necessarily have partially depended on agriculture and damage to the irrigation system could, therefore, have had disastrous consequences if it occurred during the wrong season. There are several phenomena that could damage the irrigation system on a large scale. A regularly occurring phenomenon in this area that is capable of such destruction is an earthquake. The occurrence of a heavy earthquake destroying both settlements and their basis of subsistence will have severely jeopardised permanent occupation in the Zerqa Triangle. However, there are many other destructive phenomena, e.g. intentional human destructions like warfare or local feuds, natural disasters like landslides or social factors like neglect or mismanagement. When permanent occupation reappeared after a relatively short period of time like during the IA II, it is clear that the region was not abandoned by the entire population as the creation of the physical and social organisation of the irrigation system is too time-consuming. Furthermore, there are several material traditions like pottery and architecture that show continuity between the different periods of occupation. Contrary to the settlement cycle suggested by the excavation of tell sites, it is unlikely that the Zerqa Triangle was ever completely abandoned during the IA II period. It is more likely that people focussed on the reconstruction of their subsistence basis and changed to a less intensive way of habitation that left only few remains. The low density bounded areas of IA pottery discovered in the vicinity of tell sites likely represent this type of habitation.

During the IA II period there were evidently reasons to remain in the Zerqa Triangle, but during other periods these reasons may have been absent. Reasons for staying will have included population pressure as people will not have been able to move into other areas without causing distress, the profitable agricultural circumstances of the Zerqa Triangle, political circumstances forcing people to remain in this area and its setting along trade routes including one of the few fords in the Jordan. The reasons for leaving are also manifold. Reasons for leaving that may have played a role in the different periods include the size of society, small communities will have found it difficult to reconstruct their livelihood and easier to move to other regions, general economic decline, political stress, hostilities, and probably most importantly the inability to survive when destruction of stored food supplies and their subsistence base occurred during the most difficult period of the year.

It is impossible to provide detailed reasons for settlement and abandonment in all periods as the data are simply insufficient. The excavated sites in the region have shown that in most periods there was very rapid oscillation between settlement and abandonment. A survey is incapable of reaching this level of chronological detail. The relatively large number of intensively excavated sites from the IA in the Zerqa Triangle has proven that the combination of survey and excavation results can uncover some of these reasons. For several other periods, e.g. the EBA, the Late Roman period and the Mamluk era, the level of research is also quite good and only little additional information is needed to get a better insight into the reasons for settlement and abandonment.¹⁸¹ If future research were to focus on these phenomena, the returns in the form of a better understanding of the reasons for settlement and abandonment would be significant. Nevertheless, it can be safely stated that the high agricultural potential this steppe region can reach under the right circumstances will have been a major reason for settlement in the past and still is for the 26,000 people that inhabit this arid region today.

181 I.e. the acquisition of more botanical data and radiocarbon dates for the EBA, the excavation of one of the flat surface sites of the Late Roman period and the re-evaluation of the Tell Abu Ghourdan excavations regarding the Mamluk period

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Appendix I Dated pottery

2005	No.
Unspecified 'Early'	33
Neolithic	1
Late Chalcolithic/EB	14
EB	307
MB?	1
LB	4
LB/IA	3
IA	206
Hellenistic	16
Hellenistic/Roman	9
Hellenistic or later	4
Roman	221
Roman/Late Roman	283
Roman or later	1419
Late Roman	175
Late Roman/Umayyad	130
Late Roman or later	4
Umayyad	2
Mamluk	259
Islamic	159
Late Islamic/modern	15
	3265
Ribbed (Late Roman)	3893
Total 2005	7158

2006	No.
Late Neolithic/Chalcolithic	3
Late Chalcolithic	57
Late Chalcolithic/EB	41
EB	559
LB	11
LB/IA	12
LB/Islamic?	3
IA	27
Late IA/Hellenistic	6
Hellenistic	16
Hellenistic/Roman	9
Hellenistic-Late Roman	2
Hellenistic or later	78
Roman	92
Early Roman	5
Roman/Late Roman	73
Roman or later	1048
Late Roman	127
Late Roman/Umayyad	205
Late Roman or later	235
Late Roman or Islamic	2
Umayyad	4
Early Islamic	3
Abbasid	1
Fatimid	1
Crusader	2
Ayyubid/Mamluk	6
Mamluk	379
Islamic	187
Late Islamic	5
Late Islamic/Modern	29
Modern	21
	3229
Ribbed (Late Roman)	3819
Total 2006	7048

Appendix II

Periods discovered at tells by previous surveys

	Neo	Neo/Ch	M Chal	L Chal	EB I	EB II	EB III	EB IV	MB I	MB II	LB I	LB II	IA I	IA II	Pers	E Hell	L Hell	E Rom	L Rom	E Byz	L Byz	Umay	Abbas	Ay/Mam	Ott			
Qos																												
EJVS																												
Glueck N part																												
Glueck S part																												
Petit west				6%		56%				2%			5%	12%	2%				3%						<1%			
Ammata																												
EJVS																												
Glueck																												
Excavation																												
Petit																												
Survey Ammata																												
Petit																												
Kh Buweib																												
EJVS																												
Glueck																												
Petit																												
Tell Buweib																												
EJVS																												
Kharabeh																												
EJVS																												
Petit N				2%		10%			2%		39%	<1%	5%	2%	1%	9%			26%									
Petit S						11%					30%	1%	2%	1%	3%				51%									
Nkheil																												
EJVS N																												
EJVS S								1?																				
Glueck																												
Mazar																												
EJVS																												
Glueck																												
Opgraving																												
excav sub-tell																												
Petit																												
Ghazaleh																												
EJVS																												
Glueck																												
De Contenson																												
Kirkbride																												
Petit																												
Abu Obeidah																												
EJVS																												
Adliyah																												
Petit survey																												
Petit excav																												
Dirar																												
EJVS																												
survey																												
Abu Sarbut																												
EJVS																												
Glueck																												
Kirkbride																												
Opgraving																												
Abu Nijrah																												
EJVS																												
Glueck																												
Ruweiha																												
Kirkbride																												
Site 17+area E																												
EJVS																												
Helms																												
Hammeh E																												
EJVS																												
Glueck																												
Mellaart																												
Kirkbride																												
Excavation																												
Petit																												

LIFE ON THE WATERSHED

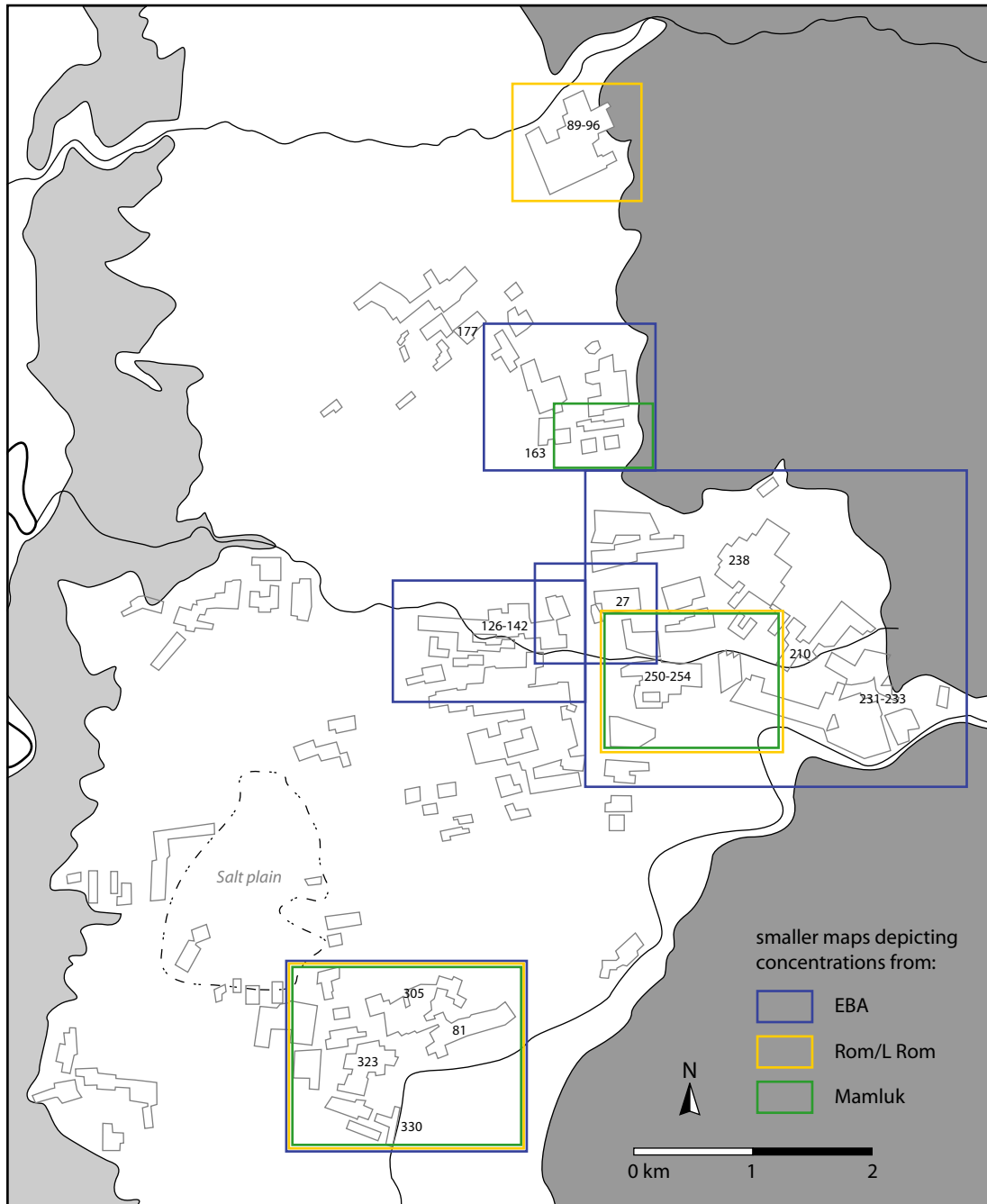
	Neo	Neo/Ch	M Chal	L Chal	EB I	EB II	EB III	EB IV	MB I	MB II	LB I	LB II	IA I	IA II	Pers	E Hell	L Hell	E Rom	L Rom	E Byz	L Byz	Umay	Abbas	Ay/Mam	Ott
Zighan																									
EJVS 159																									1
EJVS Alla 164										?															
Gordon/Villiers (All)																									
Excavation																									
HammeH west																									
EJVS						1 (n=1)		1?																	
Qad N																									
EJVS																									
Glueck																									
Petit				11%		15%					19%	15%	7-4%						26%					3%	
Qa'd S																									
EJVS																	1?				1?				
Glueck																									
Abu Ghourdan																									
EJVS																								1?	
Glueck																									
Mellaart																									
Kirkbride																									
Opraving																									
DA																									
EJVS																									
Glueck																									
De Contenson																									
Mellaart																									
Excavation																									
Fukhar																									
EJVS																	n=1								
Glueck																									
Kirkbride																									
Fukhar East																									
Petit																									
Rabi'lkhzas																									
EJVS								n=1																	
Glueck																									
De contenson																									
Kirkbride																									
Petit												5%	9%	41%						4%					
Arqadat																									
EJVS								n=1																	
Petit																									
Meidan																									
Glueck				?																					
EJVS (Shubah)																									
Mellaart																									
De Contenson																									
Petit						4%				19%	4%	12%	35%							27%					
Rikabi																									
Glueck																									
EJVS									1?																
Mellaart																									
Bashir/Asiyeh																									
EJVS																									
Glueck																									
Mellaart																									
Remeileh																									
EJVS																									
Glueck																									
Petit																									
Abu Nu'eim																									
Glueck																									
Mellaart																									
EJVS																									

Appendix III Arabic names of tells

Tell al-Qōs	تل القوس
Tell al-Buweib	تل البويب
Tell al-Kharābeh	تل الخرابة
Tell ‘Ammata	تل عمته
al-Nkheil	النخيل
’Abū ‘Ubaydah	ابو عبيدة
Tell Ghazāleh	تل غزالة
Tell al- Mazār	تل المزار
Tell al-‘Adliyyeh	تل العدلية
Tell Dhirār	تل ضرار
’Abū Nijrah	ابو نجر
Tell ‘Abū Sarbūt	تل ابو صربوط
Tell Deir ‘Allā	تل دير علا
Tell Abu Ghourdān	تل ابو غوردات
Tell al-Qa’dān	تل القعدان
al-Rweihah	الرويحة
Tell al-Hammeh	تل الحمع
’Abū al-Zīghān	ابو الزيهان
Ze’aze’iyyeh	زعزعية
al-Dbāb	الدبب
Tell al-Fukhār	تل الفخار
Tell al-Khsās	تل الخصاص
Tell al-Rabī‘	تل الربيع
Tell al-‘Arqadat	تل العرعدت
Tell Mīdan / Shu‘ba	تل الميدان / تل شعبه
Tell al-Rkābī	تل الركابي
Tell al-Bashīr	تل البشير
’Abū al-N‘eim	النهم
Tell al-Rmeileh	تل الرميعة
Tell Zakarī	تل زكري
Tell al-Muntih	تل المنطح
Katāret al-Samrā’	كتار السمراع
Tell ‘Umm Hammād	تل ام حماد
Tell Dāmiyah	تل داميه
al-Ma‘addī	المعدي
Tell al-Dōlānī	تل الدولاني
Tell al-Maflūq	تل المفلوق
al-Zerqa	الزرقة
katār	كتار
zor	زور
ghor	خور
wadi	وادي

Appendix IV

Location of smaller maps depicted in chapter 4



Acknowledgements

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Dutch Summary

Leven op de waterscheiding. De reconstructie van bestaanswijzen in een steppe zone door middel van archeologische veldverkenning: een diachroon perspectief op bewoning in de Jordaanvallei

Hoofdstuk 1 Theoretische inkadering en onderzoeksvragen

Dit onderzoek is onderdeel van het door NWO (Nederlandse Organisatie voor Wetenschappelijk Onderzoek) gesubsidieerde project '*Settling the Steppe. The archaeology of changing societies in Syro-Palestinian drylands during the Bronze and Iron Ages*'. Het doel van dit project is te verklaren waarom mensen er door de tijd heen telkens weer voor hebben gekozen de droge steppe-regio's van het Nabije Oosten te bewonen. Om deze doelstelling te realiseren zijn de volgende onderzoeksvragen geformuleerd:

- Wat waren de redenen voor bewoning van de steppe en waarom werd deze telkens weer verlaten?
- Hoe waren mensen in staat om stabiele samenlevingen in deze gebieden te onderhouden?
- Wat was de relatie tussen de gemeenschappen in de steppe en hun buuren in de klimatologisch gunstigere Mediterrane zone?

Het project bestaat uit twee onderzoeksgebieden, namelijk de Syrische Jezirah en de Jordaanvallei rond Tell Deir 'Allā. Het hier gerapporteerde onderzoek maakt deel uit van het Jordaanse onderzoeksgebied. Andere onderzoeken in deze onderzoeksregio omvatten het *tell-site* onderzoek uitgevoerd door Petit, geomorfologisch onderzoek door Hourani en archeobotanisch onderzoek door Grootveld. Als vanzelfsprekend bestond er een nauwe samenwerking met deze onderzoekers.

Het hier gerapporteerde onderzoek heeft een landschappelijk karakter en is gericht op het identificeren en verklaren van menselijke resten uit het verleden die op de oppervlakte zijn aangetroffen tijdens de veldverkenning. De onderzoeksvragen, die op basis van de algemene vraagstellingen van het project geformuleerd zijn, luiden:

- Welke archeologische resten zijn vertegenwoordigd in het onderzoeksgebied en met welke menselijke activiteiten kunnen deze in verband worden gebracht?
- Hoe intensief was de regio bewoond in de verschillende perioden?
- Hoe hebben mensen door de tijd heen voorzien in hun levensonderhoud?

Om deze vraagstellingen te beantwoorden is een intensieve veldverkenning uitgevoerd die in de volgende hoofdstukken zal worden besproken. Om de derde vraag te beantwoorden is een reconstructie van de akkerbouw in drie periodes waarover voldoende informatie aanwezig is, gemaakt. Deze zijn vervolgens vergeleken met de mogelijkheden voor akkerbouw in de Jordaanvallei. In deze droge zone is irrigatie heel belangrijk en bij de reconstructie van de akkerbouw is dan ook specifiek gelet op de aanwijzingen voor het gebruik van irrigatie.

Hoofdstuk 2 De Zerqa Driehoek

Het onderzoeksgebied omvat het deel van de vallei tussen de Wadi Rajib in het noorden, de rivier de Zerqa in het zuiden en de Jordaan in het westen. Vanwege de loop van de Zerqa, die de regio een driehoekig uiterlijk geeft, wordt dit gebied ook wel Zerqa Driehoek genoemd. De regio bestaat uit drie landschappelijke eenheden: de vlakte van de vallei, de *ghor* geheten, het lager gelegen stroombed van de Jordaan, de *zor*, en de erosieve zone tussen beide vlaktes, de *katār*. De survey heeft zich met name geconcentreerd in de *ghor* en omvat 42 km² (het totale onderzoeksgebied heeft een omvang van 72 km²).

Het huidige klimaat in de Zerqa Driehoek wordt gekenmerkt door hete droge zomers en milde natte winters. De gemiddelde juli-temperatuur in Deir 'Allā is 39° C, terwijl de gemiddelde temperatuur in de koudste maand, januari, nog altijd 18,7° C bedraagt. Neerslag valt alleen tussen oktober en mei. De gemiddelde jaarlijkse neerslag is 291 mm. In het verleden was het klimaat weliswaar anders dan vandaag de dag, maar het is onwaarschijnlijk dat het in grote mate afweek. Er zijn aanwijzingen dat het Late Chalcolithicum en de Vroege Bronstijd gekenmerkt werden door een gematigder en vochtiger klimaat, terwijl de omstandigheden na 2000 v. Chr. in toenemende mate droger werden. In de IJzertijd was het klimaat waarschijnlijk vergelijkbaar met dat van vandaag maar met kleine fluctuaties binnen deze periode. Nattere omstandigheden waren naar alle waarschijnlijkheid kenmerkend voor de eerste eeuw voor Christus en rond 1100-1200 na Chr. Deze fysisch geografische en klimatologische eigenschappen van de Zerqa Driehoek hebben een grote rol gespeeld in de mogelijkheden en het karakter van bewoning van deze regio door de tijd heen.

Hoofdstuk 3 Methode van veldverkenning

Om in staat te zijn om niet alleen grote concentraties artefacten op het oppervlak, die vaak het gevolg zijn van relatief langdurige bewoning, maar ook minder omvangrijke resten van landbouw of nomadische groepen te kunnen herkennen is gekozen voor een intensieve veldverkenningstechniek. Hierbij staan de lopers 15 m uit elkaar en lopen een traject van 50 m waarbij al het aardewerk dat wordt aangetroffen binnen een zone van één meter breed wordt verzameld. Vervolgens draait de loper om en loopt over dezelfde lijn terug terwijl hij of zij alle andere materiaalcategorieën verzamelt. De verzamelde artefacten worden vervolgens gedetermineerd en in databases ingevoerd. Door deze databases via GIS aan ruimtelijke informatie te koppelen is het mogelijk de artefacten per periode of type weer te geven op de kaart van het onderzoeksgebied. Op deze manier kan de aard en vorm van de verspreidingen per periode ruimtelijk zichtbaar worden gemaakt. Door deze verspreidingen vervolgens te vergelijken met de verwachte resten van bepaalde activiteiten, zoals bemesting, bewoning in een nederzetting of tijdelijke bewoning in tenten, is het mogelijk om tot een interpretatie van de aangetroffen resten uit het verleden te komen. Op deze manier zijn de artefacten, die besproken zullen worden in hoofdstuk 4, verzameld, geanalyseerd en geïnterpreteerd.

Hoofdstuk 4 De resultaten van de veldverkenning

In totaal zijn tijdens de veldverkenning 109.673 scherven verzameld. Een groot gedeelte van de scherven en andere aangetroffen artefactcategorieën kan gedateerd worden in het Late Chalcolithicum en de Vroege Bronstijd. Resten uit eerdere perioden beperken zich tot enkele vuurstenen artefacten uit het Neolithicum. De vondsten uit het Late Chalcolithicum en de Vroege Bronstijd vertonen een verspreidingspatroon dat gekenmerkt wordt door kleine clusters met een hoge vondstdichtheid van zeer uiteenlopende aard, zoals vuurstenen sikkels, maalstenen, aardewerken voorraadvaten en kookpotten. Deze concentraties zijn geïnterpreteerd als nederzettingsresten. Er zijn zulke nederzettingsresten aangetroffen uit het Late Chalcolithicum, de overgangsfase tussen het Late Chalcolithicum en de Vroege Bronstijd en de Vroege Bronstijd I. Resten uit de Vroege Bronstijd II, III en IV zijn schaars. Nederzettingen waren in het Late Chalcolithicum en de Vroege Bronstijd vooral gelegen langs de Zerqa en langs wadi's. Uit geomorfologisch onderzoek is bekend dat rivieren in deze periode meer water voerden dan vandaag de dag en, belangrijker, dat de afvoer gelijkmatiger was. Rivieren waren niet zo diep ingesneden als tegenwoordig en traden jaarlijks op een rustige wijze buiten hun oevers. Geomorfologisch onderzoek van Hourani heeft fluviaat afzettingen aangetoond in dit gebied die alterneerden met bewoningsresten uit het Late Chalcolithicum en de Vroege Bronstijd en daardoor in dezelfde periode te dateren zijn. Daarnaast zijn tijdens de veldverkenning in voor akkerbouw gunstige gebieden diffuse strooiingen van vondstmateriaal gekarteerd die wijzen op bemesting.

Uit de hierop volgende Midden-Bronstijd zijn geen resten aangetroffen. Dit is opmerkelijk, daar de opgravingen op Tell Deir 'Allā wel resten uit deze periode hebben opgeleverd en het aardewerk uit deze periode ook goed herkenbaar is. Uit de Late Bronstijd en de IJzertijd zijn wel

vondsten gedaan, maar duidelijke concentraties met grote hoeveelheden artefacten ontbreken. Wel herkenbaar zijn ruimtelijk beperkte concentraties bestaande uit een klein aantal scherven. Er is geopperd dat deze concentraties de resten zijn van kleine tijdelijke nederzettingen van nomadische groepen of tijdelijke niet-intensieve bewoning door de voormalige bewoners van de *tell*-nederzettingen die in deze periode meerdere malen verwoest en verlaten zijn.

De Hellenistische periode is slecht herkenbaar in deze regio. Er is slechts een zeer klein aantal scherven uit de Hellenistische periode gevonden tijdens de veldverkenning. Deze scherven zijn echter geclusterd in enkele groepen wat erop duidt dat hun locatie niet toevallig is, maar dat zij waarschijnlijk een in de ondergrond aanwezige site weerspiegelen.

De Romeinse en met name de Laat-Romeinse periode is zeer goed vertegenwoordigd in het verzamelde aardewerk. Met name de goed herkenbare geribbelde scherven van Laat-Romeinse Palestijnse amforen en kookpotten zijn in grote aantallen over vrijwel het gehele onderzoeksgebied aangetroffen. Deze wijde verspreiding van Romeïns en Laat-Romeïns aardewerk is waarschijnlijk een gevolg van grootschalige bemesting van akkerbouwgrond met afval uit nederzettingen. Binnen deze diffuse verspreiding van Romeïns en Laat-Romeïns aardewerk zijn drie duidelijke concentraties aan te wijzen. Daarbinnen zijn grote aantallen scherven gevonden samen met dakpanfragmenten, stukken mozaïek en brokken marmer. In één van deze concentraties, ten oosten van Tell Deir 'Allā, zijn verschillende zuilfragmenten aangetroffen. Vanwege de variatie aan artefacten en de verscheidenheid aan vertegenwoordigde aardewerktypen zijn deze concentraties geïnterpreteerd als de materiele neerslag van kleine nederzettingen of villa's met een zekere mate van status blijkens de aanwezigheid van niet-lokaal marmer en mozaïeken. Binnen deze concentraties zijn ook resten uit de Umayyaden-periode aangetroffen. De aardewerktypen uit deze periode zijn morfologisch echter sterk verwant aan de Laat-Romeinse en zijn daarom vaak moeilijk van elkaar te onderscheiden. De concentraties tonen echter duidelijk dat deze gebieden ook in de Umayyaden-periode nog bewoning kenden. Jongere resten zijn op deze locaties niet aangetroffen.

Uit de eeuwen na de Umayyaden-periode is slechts een handvol scherven aangetroffen. Hoewel deze scherven veelal in één gebied geconcentreerd zijn en tonen dat de regio niet geheel onbewoond was, is het aantal aangetroffen vondsten zo laag dat de aard en precieze datering van activiteiten uit deze perioden onduidelijk blijven.

De Ayyubidisch/Mamlukse periode wordt wederom weerspiegeld door grote hoeveelheden scherven. De overgrote meerderheid van het aardewerk bestaat uit zogenaamde suikerpotten. Dit is aardewerk dat werd gebruikt bij de productie van suiker uit suikerriet. Omdat bij het verwijderen van de suiker uit de aardewerken container de laatste vaak brak, worden op suikerproductiesites vaak enorme hoeveelheden suikerpotten aangetroffen. Binnen het onderzoeksgebied zijn vier concentraties met grote hoeveelheden suikerpotten gevonden. Binnen deze gebieden zijn ook aanwijzingen gevonden voor watermolens. Het suikerriet werd in deze molens geplet waarna de suikerpulp werd gezuiverd en ingekookt tot suiker. In alle vier de gevallen zijn in de directe nabijheid van de suikerpotconcentraties en molens ook concentraties huishoudelijk aardewerk aangetroffen die duiden op de aanwezigheid van nederzettingen. Ook buiten de terreinen waar het suikerriet werd verwerkt, zijn verspreid over de regio resten van suikerpotten aangetroffen. Deze verspreiding is waarschijnlijk het gevolg van het bemesten van akkers met mest en as dat in grote hoeveelheden ontstond bij de suikerproductie. Het verspreidingspatroon van dateerbare artefacten uit de Ayyubidisch/Mamlukse periode toont dat de regio intensief werd gebruikt voor de verbouw en productie van suikerriet en suiker, maar dat het aantal nederzettingen beperkt was.

Uit de Ottomaanse en vroeg moderne periode is wederom slechts een kleine hoeveelheid vondsten aangetroffen. De aangetroffen artefacten vertonen een verspreidingspatroon dat wordt gekenmerkt door een groot aantal kleine concentraties met een lage vondstdichtheid. Uit historische bronnen is bekend dat de Jordaanvallei in de Ottomaanse periode amper permanente bewoning kende. Alleen in de winter kwamen grote groepen Bedoeïenen met hun kuddes naar de vallei om daar te overwinteren. Op luchtfoto's uit de eerste helft van de 20^{ste} eeuw is duidelijk te zien dat de Bedouïnen verbleven in verschillende kleine kampen verspreid over de gehele *ghor*. De gekarteerde verspreidingspatronen van het aardewerk komen hier goed mee overeen en weerspiegelen waarschijnlijk de herhaaldelijke aanwezigheid van groepen voor een korte periode.

In zijn geheel heeft de veldverkenning een breed en divers diachroon beeld opgeleverd dat loopt vanaf enkele schaarse artefacten uit het Neolithicum tot aan materiaal achtergelaten door pastoraal nomadische groepen uit de jaren '50 van de vorige eeuw. Het is duidelijk geworden dat de verspreidingspatronen divers van aard zijn en verschillende activiteiten weerspiegelen variërend van bewoning in nederzettingen of tijdelijke kampen tot industriële suikerproductiecentra en bemesting. Deze reconstructie van activiteiten maakt nog niet duidelijk hoe mensen in de verschillende perioden in staat waren om te overleven in deze droge regio. Deze vraag is behandeld in hoofdstuk 5.

Hoofdstuk 5 Wonen in de steppe: het irrigatiesysteem

In het voorgaande hoofdstuk is aangetoond dat de Zerqa Driehoek in verscheidene perioden bewoond is geweest. Gezien het droge klimaat is het de vraag hoe mensen in verschillende perioden in staat waren deze regio bewoonbaar te maken. Door middel van een simpel model uit de hydrologie is geprobeerd te berekenen hoeveel water een gewas nodig heeft om tot volle wasdom te komen. Dit model is gebaseerd op het zogenaamde *crop coefficient*, dit zijn gewas-specifieke evapotranspiratie waarden, vermenigvuldigd met de potentiële evapotranspiratie in de regio. Wanneer dit voor een aantal gewassen die nu en in het verleden in deze regio werden verbouwd wordt berekend en deze uitkomsten worden vergeleken met de hoeveelheid neerslag, dan blijkt dat al deze gewassen tijdens een aantal maanden niet de volledige hoeveelheid water krijgen die ze nodig hebben. Gewassen kunnen weliswaar tijdelijk met minder dan de ideale hoeveelheid water overleven, maar in dit geval is het tekort vaak zo groot dat extra water in de vorm van irrigatie noodzakelijk is. Ondanks klimaatsfluctuaties is duidelijk dat ook in eerdere periodes de hoeveelheid neerslag niet voldoende kan zijn geweest om succesvol akkerbouw te bedrijven zonder irrigatie.

Irrigatie is dus noodzakelijk om deze regio te bewonen. De vraag is hoe mensen in de verschillende perioden irrigatie hebben bewerkstelligd. De meest logische wijze om het gebied te irrigeren is een systeem dat gebruikt maakt van het reliëf van de vallei en de aanwezigheid van de permanent watervoerende Zerqa rivier. Wanneer deze in haar bovenloop wordt afgetapt door middel van een kanaal, dan kan dit kanaal door de contourlijnen van de vallei te volgen een groot gebied overbruggen. Door telkens vertakkende kanalen kan op deze wijze een groot gebied geïrrigeerd worden. In de vroeg moderne periode bestond in dit gebied inderdaad een dergelijk systeem dat door middel van drie hoofdkanalen een gebied van meerdere kilometers ten noorden en zuiden van de Zerqa van irrigatiewater kon voorzien. Dit systeem is te herleiden tot het begin van de 20^{ste} eeuw toen er slechts enkele boeren permanent in de vallei verbleven. Het is onwaarschijnlijk dat deze kleine gemeenschap in staat was dit grote systeem aan te leggen. Rond 1910 hebben westerse onderzoekers uit de mond van enkele van deze boeren opgetekend dat niet zij, noch hun vaders of grootvaders deze irrigatiekanalen hebben gegraven, maar dat deze al aanwezig waren en dat zij deze slechts hersteld hebben. Gezien de afwezigheid van landbouwers in de vallei tijdens de Ottomaanse periode is de enige periode waarin een dergelijk irrigatiesysteem aangelegd kan zijn de Mamlukse periode.

In de Mamlukse periode werd de Jordaanvallei gekarakteriseerd door de productie van suiker uit suikerriet. Voor de verbouw van suikerriet, een tropisch gewas, is veel water nodig. In de Jordaanvallei impliceert dit de noodzakelijkheid van irrigatie. Daarnaast dient het suikerriet tot pulp vermalen te worden. Dit gebeurde in watermolens. In de Zerqa Driehoek zijn resten van zulke watermolens aangetroffen. Eén van deze molens was tot enkele decennia geleden in gebruik als een korenmolen en was gekoppeld aan het hoofdirrigatiekanaal zoals dat in gebruik was in de vroeg moderne tijd. Omdat deze watermolen op basis van haar bouw en de vele suikerpotscherven die er omheen zijn gevonden zonder twijfel in de Mamlukse periode is te dateren, moet dit irrigatiekanaal toen ook al aanwezig zijn geweest. Ook de andere concentraties suikerpotscherven zijn langs hoofdkanalen van het vroeg moderne irrigatiesysteem gevonden en het vroeg moderne irrigatiesysteem is daarmee in grote lijnen hetzelfde als dat in de Mamlukse periode. Nederzettingen uit de (Laat) Romeinse periode zijn op dezelfde locaties gevonden als de Mamlukse watermolens,

wat doet vermoeden dat ook in deze periode, waarin grootschalige akkerbouw werd bedreven, een irrigatiesysteem in gebruik was waarvan de hoofdkanalen nog in de vroeg moderne periode in gebruik waren.

Uit de IJzertijd of de Late Bronstijd zijn geen concrete resten aangetroffen die te verbinden zijn met irrigatie, zoals watermolens. Wanneer echter naar de ligging van nederzettingen uit deze periode wordt gekeken, dan valt op dat verschillende nederzettingen midden in de vallei liggen op plaatsen waar geen natuurlijke watertoevoer is. Deze nederzettingen zullen voor hun drinkwater, maar met name voor de bevloeiing van de bijbehorende akkers meer water dan regen alleen nodig hebben gehad. In het moderne irrigatiesysteem lopen belangrijke kanalen direct langs deze nederzettingen. Ondanks de afwezigheid van nog herkenbare resten van irrigatiekanalen lijkt in de Late Bronstijd en de IJzertijd een met het vroeg moderne systeem vergelijkbaar irrigatiesysteem te hebben gefunctioneerd.

Uit de Midden Bronstijd is slechts een gering aantal nederzettingen bekend zonder aanwijzingen voor irrigatie. Voor deze periode is simpelweg te weinig informatie aanwezig om een uitspraak over de aan- of afwezigheid en de methode van irrigatie te doen. In de Vroege Bronstijd lijkt een geheel ander systeem om extra water te verkrijgen in gebruik te zijn geweest. In deze periode was het klimaat waarschijnlijk iets vochtiger en minder warm. Daarnaast was de afvoer van water door rivieren en wadi's minder kortstondig en krachtig dan de *flash floods* van vandaag. De rivieren waren veel minder ingesneden en traden waarschijnlijk jaarlijks gedurende enige tijd buiten hun oevers. De tijdens het veldwerk aangetroffen nederzettingen uit het Laat Chalcolithicum en de Vroege Bronstijd lagen alle op de oever en op de door Hourani aangetroffen overstromingsafzettingen van de Zerqa en van verscheidene wadi's. De gewassen die verbouwd werden, de locatie van de nederzettingen en de aangetoonde overstromingen maken het waarschijnlijk dat de bewoners van de Zerqa Driehoek in deze periode gebruik maakten van de natuurlijke toevoer van water tijdens overstromingen door dit water langer vast te houden op de akkers door simpele dammen. Deze vorm van irrigatie wordt 'floodwater' irrigatie genoemd.

Samenvattend kan gesteld worden dat het onderzoek naar de wijze van irrigatie heeft uitgewezen dat de hoofdlijnen van het irrigatiesysteem in het onderzoeksgebied, hoewel niet continu gebruikt, wortels hebben die vele millennia teruggaan in de tijd.

Hoofdstuk 6 Irrigatiebehoefte en bewoningsintensiteit

In dit hoofdstuk is getracht om de verschillen in waterbehoefte en de daaraan gerelateerde potentiële bevolkingsdichtheid tussen de akkerbouwsystemen uit de vroeg moderne tijd, de Mamlukse periode en de IJzertijd te reconstrueren en te vergelijken. Voor de overige perioden zijn op dit moment helaas onvoldoende archeologische data beschikbaar. Door gebruik van een model dat de waterbehoefte van cultuurgewassen kan omzetten naar de hoeveelheid water nodig per oppervlakte eenheid is geprobeerd om te berekenen welk oppervlak geïrrigeerd kan worden met het water dat de Zerqa aanvoert. Hierbij is het van groot belang om te weten welke gewassen werden verbouwd en welk areaal zij innamen. Voor de vroeg moderne periode is dit vrij nauwkeurig vast te stellen door middel van landbouwrapporten. Voor de Mamlukse periode en de IJzertijd ontbreken zulke gegevens echter. Om de vergelijking toch uit te kunnen voeren is een schatting van de gewasverhoudingen in beide akkerbouwsystemen gemaakt. Hiervoor is gebruik gemaakt van archeobotanische gegevens, ethnohistorische parallellen en historische bronnen. Deze gereconstrueerde gegevens zijn ongetwijfeld geen exacte weergave van de werkelijkheid. Zij geven echter wel een globaal inzicht in de verbouwde gewassen en hun verhoudingen. Omdat de uitgevoerde berekening slechts een grove vergelijking van de drie systemen beoogt en geen absolute cijfers of exacte gegevens pretendeert te genereren, wordt het toelaatbaar geacht om de berekening ondanks alle kanttekeningen toch uit te voeren.

Wanneer de waterbehoefte over het gehele jaar wordt bekeken, wordt duidelijk dat met name de groeiperioden van de verschillende gewassen van grote invloed zijn op de waterbehoefte. In de vroeg moderne periode geeft de overlap tussen de laatste rijpingsfase van de wintergewassen en de eerste groeifase van de zomergewassen een hoge behoefte aan irrigatiewater. Dit betekent dat er

minder grond bebouwd kan worden, waardoor de hoeveelheid mensen die van de opbrengst kan leven ook kleiner is. In de IJzertijd daarentegen werden alleen wintergewassen verbouwd waardoor minder irrigatiewater nodig was, omdat er dan meer regen valt, en er dus meer grond gecultiveerd kon worden. De suikerrietverbouw in de Mamlukse periode had tot gevolg dat er gedurende grote delen van het jaar een grote hoeveelheid irrigatiewater nodig was. Er waren echter geen korte maar hevige pieken in waterbehoefte zoals in de vroeg moderne periode.

Ondanks de hoge waterbehoefte in het voorjaar binnen het vroeg moderne systeem betekent dit niet dat de Zerqa Driehoek in deze periode het minst kon produceren of het kwetsbaarst was. De berekeningen gaan uit van de maximale waterbehoefte van gewassen. Planten kunnen echter zonder problemen korte tijd overleven op minder dan hun ideale waterhoeveelheid. Daarnaast is de verbouw van zowel winter- als zomergewassen minder gevoelig voor misoogsten of andere onvoorziene omstandigheden.

Door een schatting te maken van het aantal mensen dat op een moment in de Zerqa Driehoek woonde kan de intensiteit van bewoning in deze drie perioden vergeleken worden. Deze schatting is gebaseerd op opgegraven resten aangevuld met gegevens uit de veldverkenning en het nederzettingsonderzoek van Petit. Hieruit is gebleken dat de Mamlukse bewoning relatief beperkt was in omvang terwijl in de IJzertijd juist een relatief grote groep mensen de regio bewoonde. Het aantal inwoners in de vroeg moderne periode is bekend en groeide in de eerste helft van de 20^{ste} eeuw van enkele tientallen naar *ca.* 4000 inwoners. De vrij constante grote behoefte aan irrigatiewater zorgde er echter voor dat de grenzen van leefmogelijkheden in de relatief spaarzaam bewoonde Mamlukse periode het dichtst werden benaderd. Uit de in dit hoofdstuk uitgevoerde berekeningen wordt duidelijk dat bevolkingsaantallen alleen niet voldoende zijn om uitspraken te doen over bewoningsintensiteit. De draagkracht van de natuurlijke omgeving is even belangrijk en wordt in grote mate bepaald door het gebruikte akkerbouwsysteem. Om een goede inschatting te kunnen maken van de bewoningsintensiteit in het verleden is het daarom essentieel de levenswijze van de bevolking in ogenschouw te nemen

Hoofdstuk 7 Irrigatiegemeenschappen

In dit hoofdstuk wordt de link tussen het irrigatiesysteem en de irrigerende samenleving onderzocht. De in de vorige hoofdstukken besproken gemeenschappen, de vroeg moderne, de Mamlukse en die in de IJzertijd, werden allemaal gekenmerkt door een vergelijkbaar irrigatiesysteem dat uit kanaaltjes bestond. Dit systeem is in essentie hiërarchisch omdat benedenstroomse gebieden afhankelijk zijn van de mensen die de bovenloop van de kanalen beheersen. Desondanks worden de gemeenschappen gekenmerkt door zeer verschillende sociale structuren.

In de vroeg moderne periode, bijvoorbeeld, werd de Zerqa Driehoek gekenmerkt door een samenleving die aan de ene kant egalitair was, terwijl deze aan de andere kant juist extreem hiërarchisch was. In deze periode was de bevolking verdeeld over verschillende clans. Binnen deze clans heerste een egalitair systeem waarbij het land, dat gemeenschappelijk eigendom was, elke paar jaar over de verschillende clanleden werd verdeeld. Wie in de ene periode een stuk land ver weg van een irrigatiekanaal had bewerkt, kreeg in de volgende periode een voordeliger stuk dichtbij een hoofdirrigatiekanaal. Op een vergelijkbaar egalitaire wijze werd het water dat door de irrigatiekanalen stroomde dagelijks over de percelen verdeeld. Deze egalitaire verdeling van land en water gold echter alleen voor officiële clanleden en binnen het grondgebied van één clan. Groepen mensen die buiten de clanstructuur stonden werden niet in dit systeem toegelaten en konden niet profiteren van de irrigatiekanalen. Daarnaast bestonden er grote verschillen tussen clans. De acht clans in de Zerqa Driehoek waren verdeeld over twee zogenaamde *Hurr* clans, wat 'vrij' betekent in het Arabisch, en zes *Ghawarna* clans, wat verwijst naar de inwoners van de *ghor* en vandaag de dag een negatieve betekenis heeft. De *Hurr* clans beschouwden zichzelf als de rechtmatige eigenaars van de Zerqa Driehoek, terwijl de *Ghawarna* als inferieure, latere binnenkomers werden gezien. Dit is ook te zien aan de ruimtelijke organisatie van de clanterritoria. Van de twee *Hurr* clans heeft de één duidelijk het grootste territorium dat twee hoofdirrigatiekanalen omvat. Het territorium van de tweede *Hurr* clan verschilt in grootte niet van dat van de *Ghawarna* clans. Wanneer echter

naar de irrigatiekanalen wordt gekeken is duidelijk dat het kanaal dat het gebied van de Hurr clan bevoeit net iets eerder van het hoofdkanaal aftakt dan de kanalen van de Ghawarna territoria, die daardoor dus in een afhankelijke positie stonden.

In de Mamlukse periode bestond er een geheel andere sociale situatie in de Zerqa Driehoek. In deze periode werd de Jordaanvallei gedomineerd door de productie van suiker uit suikerriet. Op basis van schriftelijke bronnen is bekend dat deze productie in handen was van grootgrondbezitters en de sultan. Deze machthebbers wisten grote winsten te behalen, waarschijnlijk ten koste van de lokale bevolking die het werk uitvoerde. De suikerproductiecentra in de Zerqa Driehoek lagen waarschijnlijk in het centrum van territoria die werden bepaald door de ligging van de hoofd-irrigatiekanalen en van vergelijkbare omvang waren. Op deze landerijen werd het suikerriet verbouwd dat in de productiecentra verwerkt werd tot suiker. Tussen de verschillende suikerproductiecentra en hun omringende gronden zijn weinig verschillen in omvang of materiële cultuur zichtbaar, terwijl deze van verschillende typen eigenaren waren waaronder de sultan. Verder dan dit gaat de gelijkwaardigheid niet in de Mamlukse periode. De inwoners van de Zerqa Driehoek waren in deze periode waarschijnlijk arbeiders die afhankelijk waren van de grote spelers in de suikerindustrie.

De IJzertijdresten in de Zerqa Driehoek worden gekenmerkt door een groot aantal kleine *tell*-nederzettingen en een aantal kleine concentraties artefacten op de omringende velden. Opgravingen hebben aangetoond dat deze nederzettingen hoofdzakelijk kleine landbouwende dorpsgemeenschappen omvatten, die weinig onderlinge verschillen laten zien. Er is echter een aantal nederzettingen dat een iets grotere omvang heeft en (zeer geringe) aanwijzingen vertoont voor een meer gediversifieerde levenswijze, bijvoorbeeld de textielproductie van Tell Deir 'Allā. Opvallend is dat de betreffende nederzettingen allemaal gelegen zijn op plekken waar meerdere waterbronnen aanwezig waren. Waarschijnlijk hadden deze nederzettingen een voordelige positie omdat zij niet afhankelijk waren van één irrigatiekanaal of wadi. Daarnaast worden de opgegraven nederzettingen gekenmerkt door een snelle opeenvolging van bewoning, verlaten -vaak in de vorm van een verwoesting- en wederopbouw. Deze snelle opeenvolging van bewoning, verlaten en herbouw toont dat de Zerqa Driehoek bewoond werd door een flexibele samenleving die bij tegenslag, van welke aard dan ook, snel wisselde tussen de verschillende componenten van hun levenswijze; namelijk akkerbouw en nomadische veeteelt. Dit model van het verleggen van nadruk tussen de twee componenten binnen de levenswijze is voorgesteld door Van der Kooij (2001). De in de veldverkenning aangetroffen artefactconcentraties in de omgeving van *tells*, de continuïteit in aardewerkvormen en huisconstructie en het continue onderhoud aan het irrigatiesysteem maken het waarschijnlijk dat een (klein) deel van de bevolking permanent in de Zerqa Driehoek aanwezig was, zij het op een archeologisch slecht 'zichtbare' wijze.

De reeds beschreven verandering in het nederzettingssysteem van veel kleine nederzettingen in de vallei in de Vroege Bronstijd I naar grote ommuurde centrale nederzettingen in de heuvels in de Vroege Bronstijd II is slecht te verklaren door klimatologische, topografische of landbouwtechnische veranderingen alleen. Er is dus waarschijnlijk ook sprake van een verandering van sociale aspecten. De goede 'archeologische zichtbaarheid', gemeenschappelijke bouwwerkzaamheden, en toegenomen groeps-grootte tonen dat er mogelijk sprake is van een toegenomen territorialiteit en identiteit. De reden hiervoor is moeilijk in detail vast te stellen, maar intensivering van de landbouw en de opkomst van (olijf)boomgaarden -die een investering over lange tijd vragen speelden- waarschijnlijk een grote rol.

Hoofdstuk 8 Conclusie

In dit hoofdstuk worden de vragen zoals die gesteld zijn in het eerste hoofdstuk en die zijn onderzocht in de voorgaande hoofdstukken kort samengevat en beantwoord. In hoofdstuk 4 is onderzocht welke resten van menselijke activiteit er in de Zerqa Driehoek zichtbaar zijn en waardoor zij tot stand zijn gekomen. In dit hoofdstuk is duidelijk geworden dat deze regio vanaf het Neolithicum bewoond is geweest en enkele fasen van intensieve bewoning heeft gekend hetgeen is weerspiegeld in verspreidingspatronen van artefacten met verschillende vorm en intensiteit. Door vergelijking

met de materiële neerslag van bekende activiteiten zoals is beschreven in hoofdstuk 3 konden deze verspreidingspatronen geïnterpreteerd worden als het resultaat van uiteenlopend menselijk handelen in het verleden.

De in de veldverkenning geïdentificeerde bewoningsresten uit verschillende perioden werpen de vraag op hoe de bewoners door de tijd heen in deze droge regio voorzien hebben in hun levensonderhoud. In de beantwoording van deze vraag staan het irrigatiesysteem (hoofdstuk 5) en de sociale aspecten ervan (hoofdstuk 7) centraal. Het is duidelijk geworden dat irrigatie noodzakelijk is om in deze regio te overleven en dat een vergelijkbaar systeem van kanaalirrigatie vanaf de Late Bronstijd tot enkele decennia geleden gebruikt werd om grote delen van de Zerqa Driehoek te bevoeien. Irrigatiewater was essentieel om akkerbouw te bedrijven en het onderhoud van het irrigatiesysteem en de verdeling van water zullen in alle perioden dan ook een centrale rol in de samenleving hebben ingenomen. Bestudering van de sociale aspecten van het irrigatiesysteem in verschillende perioden toont dat de samenleving en het irrigatiesysteem elkaar wederzijds hebben beïnvloed en dat een morfologisch vergelijkbaar irrigatiesysteem heel diverse sociale gevolgen kan hebben in verschillende samenlevingen.

De intensiteit van bewoning in de verschillende perioden was het centrale thema in hoofdstuk 6. In dit hoofdstuk is gebleken dat de bewoningsintensiteit sterk afhangt van het landbouwsysteem. De drie perioden waarvoor deze analyse is uitgevoerd tonen dat de maximale draagkracht van de regio het dichtst benaderd werd in de periode met de meest intensieve akkerbouw en niet in die met de meeste inwoners. De voornaamste conclusie van dit hoofdstuk is dan ook dat de bewoningsintensiteit nooit los gezien kan worden van de bestaanswijze van de samenleving. Dit lijkt voor de hand liggend, maar het geringe aantal gedetailleerde studies naar landbouwsystemen in het verleden toont dat de implicaties van deze conclusie niet altijd volledig worden gerealiseerd.

Tot slot is in de conclusie teruggekeerd naar de algemene vraag van het 'Settling the Steppe'-project, namelijk waarom komen mensen telkens weer in deze regio wonen en waarom is zij zo vaak verlaten? Het antwoord op het eerste deel van de vraag is simpel; de Zerqa Driehoek is door haar alluviale afzettingen en het klimaat een uitermate geschikt landbouwgebied. Echter, er moet wel een manier worden gevonden om voldoende extra water te verkrijgen. Hiervoor is een georganiseerde samenleving nodig die in staat is een irrigatiesysteem aan te leggen, te onderhouden en zo nodig te repareren. De relatief frequente aardbevingen, plotselinge overstromingen en de locatie van de regio als doorgangsgebied maken dat de bewoners van de Zerqa Driehoek het hoofd moeten kunnen bieden aan onverwachte tegenslagen. Is de gemeenschap hiertoe in staat dan is de Zerqa Driehoek een zeer vruchtbare regio voor landbouwende samenlevingen.

CV

Eva Kaptijn was born in Tilburg in September 15th, 1978. After finishing her secondary education in 1996 (St. Odulphus Lyceum, Tilburg) she went to Leiden University to study archaeology. In January 2003 she received her MA in Theoretical Archaeology and in Archaeology of the Levant with a thesis entitled '*Cognition in archaeology. Religion and ideology in southern Levantine Chalcolithic society*'. During and after her studies she participated in several excavations in The Netherlands, Italy, Jordan, Palestine and Turkey. After her graduation she spent some time at Yarmouk University in Irbid (Jordan) to look into the environmental and cultural characteristics of the Jordan Valley and the possibilities of survey. This research was made possible by a grant from the Prins Bernhard Cultuurfonds and the exchange program between Leiden University and Yarmouk University. After working in Dutch commercial archaeology for a period of time she received a PhD position at Leiden University within the NWO-funded research project *Settling the Steppe. The Archaeology of changing societies in Syro-Palestinian drylands during the Bronze and Iron Ages*. This book is the result of this research.

LIFE ON THE WATERSHED

The scarcity of water is a major problem in many parts of the Near East today and has been so in the past. To survive in such a region people should be able to structurally attain more water than rainfall alone can supply. The archaeology of this area should not only identify when people inhabited such a region and what the character of this habitation was, but also how people were able to survive in such a region and why they chose to live there in the first place.

In this book these questions have been studied for the Zerqa Triangle; a region in the middle Jordan Valley around Tell Deir 'Allā (Jordan). By means of a detailed pedestrian archaeological survey the intensity of habitation of the region from the Neolithic to early modern periods is investigated. Efforts have been undertaken to reconstruct the agricultural practices in the various periods and simultaneously the means by which the different communities were able to practice agriculture; in other words, how did they irrigate the land? By focussing on the different social responses of communities conclusions have been drawn on how and why people managed to create a living in this arid, but potentially very fertile region.

This book not only contributes to the ongoing discussion of the archaeology of marginal areas, but also provides a huge amount of new data on the archaeology of the Jordan Valley, both in the form of newly discovered settlement sites from several different periods as well as remains from several more inconspicuous types of human activity present in the countryside.

LIFE ON THE WATERSHED

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