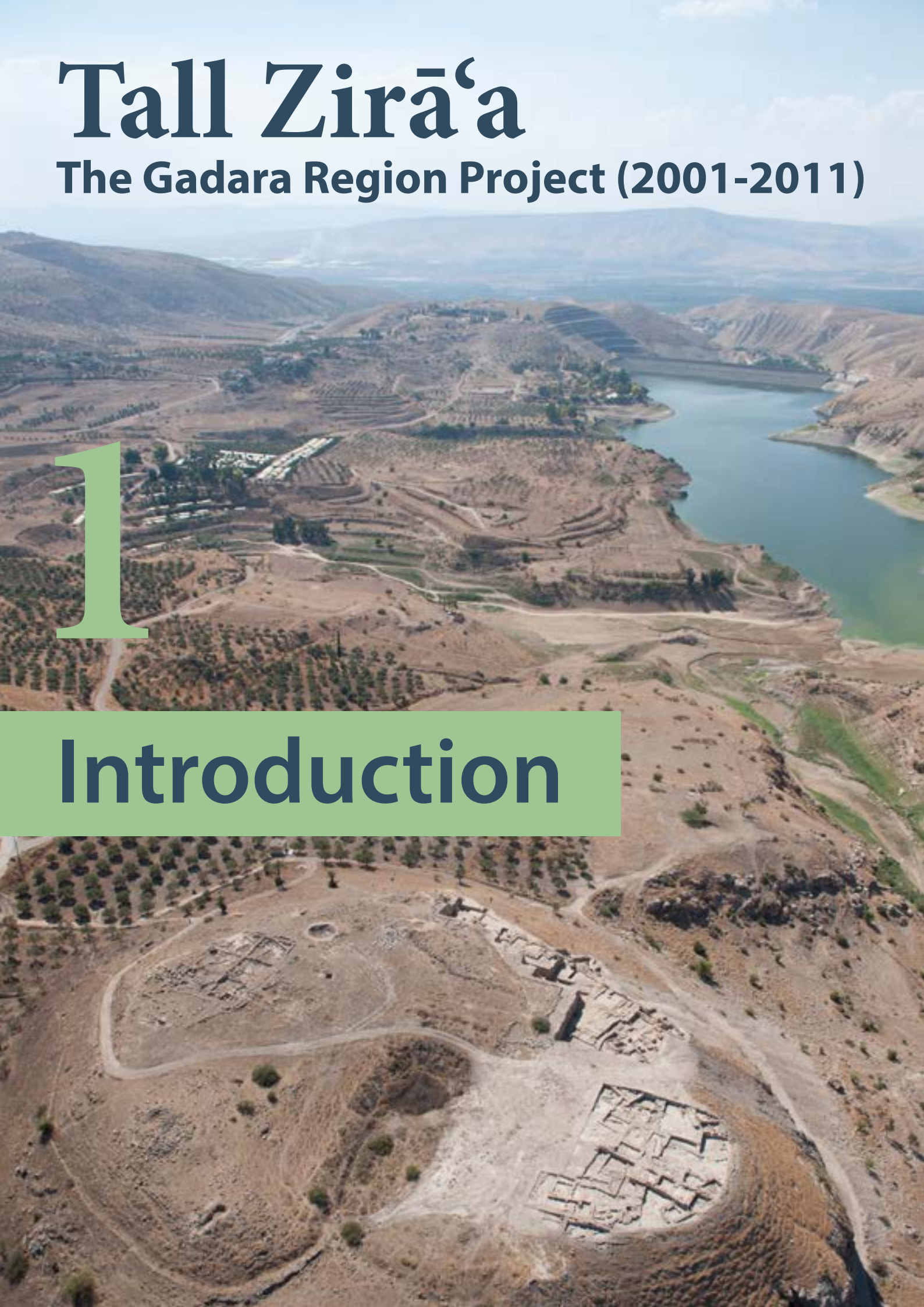
Tall Zirāʿa

The Gadara Region Project (2001-2011)



1

Introduction

German Protestant Institute of Archaeology
(GPIA)

*

Biblical Archaeological Institute Wuppertal
(BAI)

Tall Zirāʿa
Gadara Region Project 2001–2011

Final Report

1
Introduction

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Front and back cover: Tall Zirā'a and Wādī al-'Arab; aerial view, looking from east to west; with courtesey of APAAME, David Kennedy, 2011

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List of Abbreviations

Abbreviated Journals and Series

AA	Archäologischer Anzeiger
AAJ	Annual of the Department of Antiquities of Jordan
AASOR	Annual of the American Society of Oriental Research
ADPV	Abhandlungen des Deutschen Palästina-Vereins
AJA	American Journal of Archaeology
AW	Antike Welt
AnSt	Anatolian Studies
BAH	Bibliothèque archéologique et historique
BaF	Baghdader Forschungen
BarIntSer	British Archaeological Reports. International Series
BASOR	Bulletin of the American Schools of Oriental Research
Berytus	Berytus. Archaeological Studies
BibAr	The Biblical Archaeologist
BSOAS	Bulletin of the School of Oriental and African Studies (London)
DaF	Damaszener Forschungen
DaM	Damaszener Mitteilungen
GrRomByzSt	Greek, Roman and Byzantine Studies
Eretz-Israel	Eretz-Israel. Archaeological, Historical and Geographical Studies
HdArch	Handbuch der Archäologie
IEJ	Israel Exploration Journal
IES	Israel Exploration Society
JASc	Journal of Archaeological Science
JEA	The Journal of Egyptian Archaeology
JFieldA	Journal of Field Archaeology
JMedA	Journal of Mediterranean Archaeology
LA	Liber Annuus
LAA	Late Antiquity Archaeology
MEFRA	Mélanges de l´École francaise de Rome. Antiquité
MKT	Menschen – Kulturen – Traditionen
NEA	Near Eastern Archaeology
NEAEHL	The New Encyclopedia of Archaeological Excavations in the Holy Land
Newsletter PotTech	Newsletter. Departmentof Pottery Technology. University Leiden
OrA	Orient Archäologie
OccOr	Occident und Orient
PEF	Palestine Exploration Fund
PEFA	Palestine Exploration Fund Annual
PEQ	Palestine Exploration Quarterly
QDAP	Quarterly of the Department of Antiquities of Palestine
RB	Revue Biblique
RDAC	Report of the Department of Antiquities, Cyprus
SaalburgJb	Saalburg-Jahrbuch. Bericht des Saalburg-Museums
SHAJ	Studies in the History and Archaeology of Jordan
SyrMesopSt	Syro-Mesopotamian Studies
SIMA	Studies in Mediterranean Archaeology
SMEA	Studi micenei ed egeo-anatolici
StBiFranc	Studium biblicum Franciscanum. Liber Annuus
TAVO	Tübinger Atlas des Vorderen Orients
TelAvivJA	Tel Aviv. Journal of the Institute of Archaeology of Tel Aviv University
ZDPV	Zeitschrift des Deutschen Palästina-Vereins
ZOrA	Zeitschrift für Orientarchäologie

General Abbrevations

Abb.	Abbasid
approx.	approximately
App(s).	Appendix
BAI	Biblical Archaeological Institute Wuppertal
Byz.	Byzantine
c.	circa
CAD	Computer Aided Design
CCA	Canonical Correspondence Analysis
cf.	confer
Chap(s).	Chapter(s)
CIE	Commission Internationale de l´Éclairage/International Lighting Commission
CIELAB	Commission Internationale de L´Éclairage, International Lighting Commission
Diss.	Dissertation
DCA	Detronded Correspondence Analysis
DGPS	Differential Global Positioning System
DoA	Department of Antiquities (Jordan)
EB	Early Bronze Age
ed(s)	editor(s)
e.g.	for example
E Isl	Early Islamic
etc.	et cetera
Fig(s)	figure(s)
GIS	Geographic Information System
GPIA	German Protestant Institute of Archaeology
GPR	Ground Penetrating Radar
GPS	Global Position System
Hell.	Hellenistic
IA	Iron Age
ICP	Inductively Coupled Plasma
i.e.	id est
INAA	Imstrumental Neutron Activation Analysis
Isl.	Islamic
LB	Late Bronze Age
L Isl	Late Islamic
Maml.	Mamluk
max.	maximum
MB	Middle Bronze Age
min.	minimum
n.	note
no(s).	number(s)
Pl(s)	plate(s)
QGIS	Quantum Geographic Information System
RFA	Röntgenfluoreszenzanalyse
Rom.	Roman
TZ	Tall Zirā‘a
Um	Umayyad
undet.	undetermined
VBA	Visual Basic Applications
XRD	X-Ray Diffraction
XRF	X-Ray Fluorescence

Legend for the Abbrevations used in the Catalogues of Chap. II (Pottery, Glass, Stone Material) and in the figure captions

D	Diameter
L	Length
H	Height
W	Width
Th	Thickness
g	Gram

Preface

by Dieter Vieweger/Jutta Häser

Fig. 0.1 Tall Zirā‘a. View from west to east. Photograph taken in 2011 (Source: APAAMEE, David Kennedy).

When the German engineer G. Schumacher explored Transjordan in 1885, Tall Zirā‘a was among his discoveries[1]. He was the first European since the time of the Crusaders to enter the region. However, after thousands of years of prosperity, the valley had changed dramatically during the Ottoman period. The bedouins told Schumacher that the wādī had declined to become a "popular shelter for all sorts of refugees and criminal scum".

Except for a few sugar mills, operated by water power, there were only a few small hamlets. A water flow of about 0.75 m^3 per second flowed through the Wādī al-‘Arab in June 1885, and the Wādī az-Zaḥar added the same amount of spring water. C. Steuernagel wrote:

> "Where the valley widens and the water becomes shallow, there are large numbers of trout that are easy to catch. Once while bathing, Schumacher saw a black water snake, almost a metre long. These are said to be very common here and are highly dreaded"[2].

The archaeologist N. Glueck visited Tall Zirā‘a in 1942. He reported the

> "singularly imposing and completely isolated hill of Tall Zera‘ah (...)"[3]

and mentioned a water source on the plateau of the tall as the

> "result of a natural siphon phenomenon leading the underground flow of the water from the higher level of the hills beyond down to below the bottom and, as through a pipe piercing its center, up to the top of Tall Zera‘ah".

Although the tall[4] had already attracted attention due to its location and imposing appearance, no intensive research was conducted at this time, because of the hill's location close to the border of Israel in the west (c. 7 km) and Syria in the north (c. 14 km). During the foundation

1 Schumacher 1890, 110. 142 f. Schumacher visited Tall Zirā‘a and described remains of rectangular buildings. His obeservations are published by C. Steuernagel (Steuernagel 1926, 81).

2 Steuernagel 1926, 80. Citation is given in English translation; cf. also Schumacher 1890, 142 f. For Schumachers travels see in general: Schumacher 1886.

3 Glueck 1951a, 182 Fig. 71.

4 The Arabic word 'tell' or 'tall' as well as the Hebrew word 'tel' will be written in this publication in the standard literary Arab version 'tall' or 'Tall NN'.

of the State of Israel in 1948 and again during the Six Day War in 1967, the western part of the Wādī al-ʻArab was declared by the Jordanians as a military zone. A passage which had been open in all directions for millennia was thus essentially cut off from sections of its surroundings. The territory around Gadara and the Wādī al- ʻArab, in the triangle where Jordan, Syria and Israel meet, became the north-westernmost corner of the Hashemite Kingdom, and there was not even a paved road to the tall.

Also the construction of the Wādī al-ʻArab Dam in 1978 did not make a significant difference to the *status quo*. The archaeologists who investigated the area within the scope of a rescue survey prior to the dam construction did not appreciate the archaeological potential of the tall, which majestically overlooked the future reservoir.

Another period of time passed until the Oslo Peace Agreement was ratified in 1993, but it was only after the peace treaty between Jordan and Israel, which King Hussein and Prime Minister Yitzhak Rabin signed on October 26, 1994, that the area again became accessible to the public.

D. Vieweger, director of the Biblical Archaeological Institute Wuppertal (BAI) and since 2005 also of the German Protestant Institute of Archaeology (GPIA), travelled many times through the north-western part of Jordan between 1998 and 2000, exploring the area for a suitable tall site, which would serve as an authoritative chronological record for the region's long and important cultural history. He found it in the Wādī al-ʻArab.

Tall Zirāʻa is located in the middle of the Wādī al-ʻArab (*Figs. 0.1* and *0.2*), was continuously occupied for at least 5,000 years, and offers an unique insight into the way of life of the region's people. Its outstanding archaeological significance results from the artesian spring in its centre, which created optimal settlement conditions over thousands of years. For this reason, Tall Zirāʻa offers an unusual opportunity to compile a comparative stratigraphy for northern Jordan from the Early Bronze Age to the Islamic period, while also making it possible to trace cultural developments in urban life, handicrafts and the history of religion over long periods. Moreover, here it is possible to study abundant remains from the Biblical periods in a broad cultural and historical context.

As mentioned above, a major trade route passed through the valley, connecting Egypt in the south with the Syrian-Mesopotamian region in the north (*Fig. 1.22*). The Wādī al-ʻArab also connects the Jordan Valley to the Mediterranean coast via the northern Jordan ford at Ǧisr el-Maǧāmiʻ (Gešer), as well as the plains of Jezreel and Tall al-Ḥiṣn (Beth Shean) to the eastern Jordanian highlands. It was possible to climb from the Jordan Valley, at some 290 m below sea level, to the fertile and very early populated Irbid-Ramtha basin, which lies around 560 m above sea level. Direct routes led from the Irbid-Ramtha basin to Dimašq (Damascus) in the north, Baġdād in the east, and ʻAmmān in the south. Because the Yarmuk Valley to the north and the Wādī Ziqlāb in the south are too steep and narrow to serve as major transport routes, the Wādī al-ʻArab played a prominent geopolitical role. Not surprisingly, economic success and the hard work of residents across the millennia have left a profusion of traces in the valley. More than 200 sites of human habitation, from the very earliest settlements to the Islamic period, provide an eloquent testimony to the history of this region: settlements, channels, water mills, cisterns, oil presses, wine presses, watchtowers and grave sites.

Tall Zirāʻa offered good living conditions for a settlement. The artesian spring offered an unfailing water supply, and the hill provided security. The tall rises impressively (depending on the direction) between 22–45 m above ground. As the only prominent natural elevation in the lower Wādī al-ʻArab, Tall Zirāʻa dominates the valley. From here one cannot only see Gadara, but also easily monitor the narrow entrance of the wādī to the west.

The adjacent fertile wādī ensured adequate nourishment, with potentially arable land in the western and central valley, terraced slopes and spurs suited for rainfed agriculture in the east, as well as the wādī slopes that are suitable for grazing small livestock, forming a broad semicircle from the east and south to the west. As a result of his observations, D. Vieweger decided to implement preliminary investigations here from 1998 to 2000.

The 'Gadara Region Project' was launched in 2001 by the Biblical Archaeological Institute Wuppertal (BAI), Germany. In the first season, the surface of Tall Zirāʻa was explored[5], the tall was accurately surveyed, and

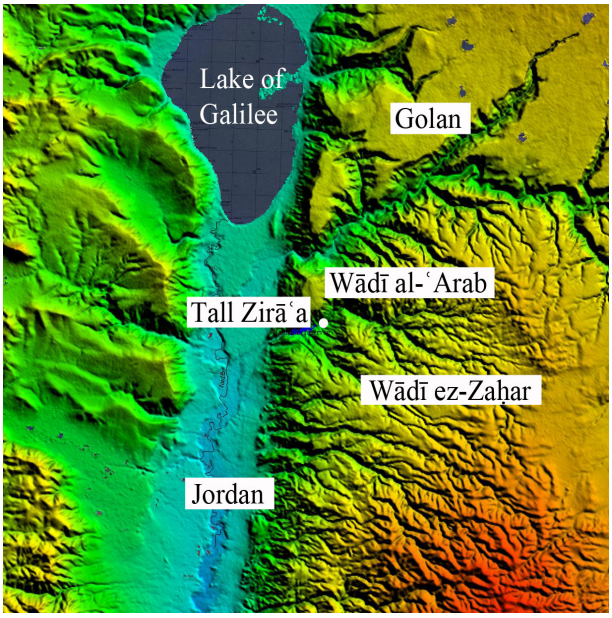

Fig. 0.2 Map showing the area around Tall Zirāʻa (Source: BAI/GPIA).

5 See *Vol. 1., Chap. 2*. For this survey see also Vieweger et al. 2003, 191–216.

more than 22,000 pottery sherds and many other finds were systematically collected and analysed. The survey findings helped to formulate the objectives of the excavation program, and to select suitable areas (residential, religious, administrative and craft production) for investigation.

The first excavation season on the tall was in 2003. The team was financed by the 'Society of Friends of the BAI Wuppertal' and travelled by Volkswagen bus from Wuppertal to Amman via Turkey and Syria, under the direction of D. Vieweger. An Ottoman period house inside the Gadara/Umm Qēs archaeological site was used both as living and working quarters; it was in a state of very poor repair at that time, but has been systematically restored during later seasons, providing modern bathroom and kitchen facilities. The results of the first season on Tall Zirā'a were so promising that the 'Gadara Region Project' was inaugurated, with a planned timeframe of between ten to twenty years.

In 2004, the Biblical Archaeological Institute Wuppertal (BAI) under the directorship of D. Vieweger, and the German Protestant Institute of Archaeology (GPIA) in Amman (which also served as the research unit for the German Archaeological Institute [DAI]), under the directorship of J. Häser, agreed to a close partnership, which ensured ongoing archaeological and interdisciplinary collaboration for the remainder of the archaeological seasons. The German Protestant Institute of Archaeology in Jerusalem (GPIA), run by D. Vieweger since 2005, also joined the work in 2006. The cooperation with the GPIA Amman was confirmed by the new Director of the Institute, F. Kenkel, from 2013 to 2016.

During the course of the subsequent 18 seasons, twenty five strata in three areas have been uncovered, and several scientific processes and archaeological experiments have been carried out; archaeological surface surveys were also completed for the area surrounding Tall Zirā'a, the Wādī al-'Arab, and the Wādī az-Zaḥar.

The slopes of Wādī al-'Arab from Tall Zirā'a upwards to the region of Ṣēdūr and Dōqara, and the region around the Wādī al-'Arab Dam were surveyed in 2009; large parts of this region had not been studied in detail before. In total 78 locations were documented, 30 of which were previously unknown. The survey was continued until 2012. All in all 327 sites were registered which cover an area from Tall Zirā'a to North Šūna.

All finds were stored at the excavation house in Umm Qēs. Some of the more important finds were exported to the Biblical Archaeological Institute Wuppertal (BAI)

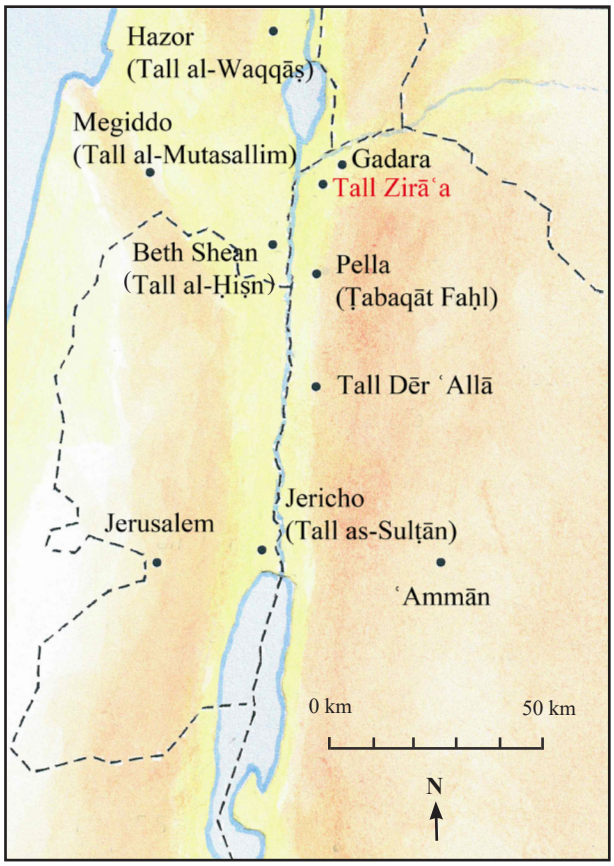

Fig. 0.3 Tall Zirā'a and its geographic location (Source: BAI/GPIA).

and restored by M. Blana; they were returned to the 'Department of Antiquities of Jordan' (DoA) over several stages, with the final delivering to Jordan in the spring of 2015. Furthermore, more than 50 objects discovered during the project are on display in the Jordan Museum in Amman.

Excavation results have been presented as articles in several journals, together with separate publications and dissertations[6]. In addition, the Tall Zirā'a website provides information about current activities on and around the tall in German and English[7].

After 18 intensive seasons of work researching the tall and its environment, it was decided to interrupt excavation and survey activities in order to publish a complete record of the results thus far. To this end, it was decided that from 2012 until 2017 work would be comprised of study seasons in the excavation house at Umm Qēs, to process data and results gathered to date (for the excavations carried out see the film in *App. 0.1*).

6 See e.g. Vieweger et al. 2002a, 12–14; Vieweger et al. 2002b, 157–177; Vieweger et. al. 2003, 191–216; Vieweger et al. 2016, 431–441; Vieweger 2003a, 10; Vieweger 2003b, 459–461; Vieweger 2007, 497–502; Vieweger 2010, 755–768; Vieweger 2013, 231–242; Häser – Vieweger 2005, 135–146; Häser – Vieweger 2007, 526–530; Häser – Vieweger 2012a, 693–696; Häser – Vieweger 2012b, 251–268; Häser – Vieweger 2014, 640; Häser – Vieweger 2015, 20–23; Vieweger – Häser 2005, 1–30; Vieweger – Häser 2007a, 1–27; Vieweger – Häser 2007b, 147–167; Vieweger – Häser 2009, 1–36; Vieweger – Häser 2010, 1–28; Kenkel 2012; Kenkel 2013a, 1–24; Kenkel 2013b, 301–308; Kenkel 2016, 765–781; Kenkel – Vieweger 2014, 12; Schwermer 2014; Gropp 2013; Lehmann – Schulze 2015, 28–30; Schulze et al. 2014, 13; Leiverkus – Soennecken 2016, 509–518; Soennecken – Leiverkus 2014, 14.

7 For an overview of the publications see www.tallziraa.de (9.6.2016).

A total of nine volumes are planned on the following topics:

Volume 1: Introduction.
Aims of the 'Gadara Region Project'; Tall Zirā'a and the Wādī al-'Arab; Research History of Tall Zirā'a; the 2001 Tall Zirā'a Survey; Scientific Methods; Framework of Archaeological Work on Tall Zirā'a.

Volume 2: Early and Middle Bronze Age (Strata 25–17)

Volume 3: Late Bronze Age and Iron Age I (Strata 16–13)

Volume 4: Iron Age IIA/B and IIC (Strata 12–10)

Volume 5: From Persian to Umayyad Period (Strata 10–3). Stratigraphy

Volume 6: From Persian to Umayyad Period (Strata 10–3). Finds

Volume 7: From Abbasid to Ottoman Period (Strata 2–1)

Volume 8: Wādī al-'Arab Survey

Volume 9: Archaeometry

All nine volumes will be published online in English, in order to make the results free of charge and accessible to a wide audience. In addition to this, publishing online enables the 3D-images and reconstructions, together with digital films, to be included with the material, which can thus be integrated and used interactively. Furthermore, an online publication will enable the attachment of original data from the excavations, such as plans and database extracts, which would be otherwise impossible. These additional documents will be published in German and will provide professional researchers with the ability to access the primary data itself, not only as they are interpreted.

General remarks regarding systems and processes used within the publications follow herewith:

- The Israel or Palestine Grid 1923 is the basis for the geographical grid system used for the project. It was first used in autumn 2001 for 5 m x 5 m squares on Tall Zirā'a, and was consequently applied for excavation and survey work alike (see *Vol 1., Chap. 4.1.*).

- Citation styles are based on the directives provided by the German Archaeological Institute (DAI), but have been adapted to the conventions of English language publications.

- In order to minimise misunderstanding, the problem of transliterating Arabic and Hebrew words into English spelling using Latin letters for local sites and family names is dealt with by using the transcription system of the 'Deutsche Morgenländische Gesellschaft', based on the directives of TAVO (see the Tübinger Bibelatlas).

- For detailed explanations of the chronology of the Southern Levant in the scope of the history of Egypt, Syria and Mesopotamia, see Vieweger 2012, 459–507 (*Vol. 1., Chap. 4.3.*).

- In this report the name of the site is called *Tall Zirā'a*. Other transcriptions are e.g.: *Tell Zer'ah* (MEGA Jordan; Jadis; Kerestes et al. 1977/1978; Glueck 1951); *Tell Zer'a* (Reicke – Rost 1979); *Tell Zara'a/ Tell Zara'a* (Schumacher 1890 and Steuernagel 1926); *Tell Zira'a* (Hanbury-Tenison 1984).

- All dimensions in the catalogues as well as in the figure captions are given as cm, if not otherwise stated.

- Besides Figures, Plates and Tables also Appendices are presented in this volume showing films, 3D-models, Panorama and charts. They can be seen on the website www.tallziraa.de (http://www.tallziraa.de/Final-publication/Appendix-Vol-1/1_473.html). See also the 'List of Appendices' this volume on page XXI.

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Johann Wolfgang von Goethe (1749–1832)

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In memoriam

Oberstudiendirektor Dr Heribert Steinmetz †
(23.2.1952–18.10.2015)

Our team member Dr Heribert Steinmetz died suddenly during the publication of this volume.
It is a great loss for all who knew him and worked with him.

Introduction

by Dieter Vieweger/Jutta Häser

Fig. 0.4 The Tall Zirā‘a. View to the east showing the excavation at Area I and II. Photograph taken in spring 2011 (Source: BAI/GPIA).

The present volume is the first in a series of nine planned volumes of the excavations' final report carried out by D. Vieweger and J. Häser. It will provide an introduction to excavation methodology and the objectives of the 'Gadara Region Project'. Apart from that, it will focus on the Tall Survey that took place in 2001 along with the examination of its appendant archaeological finds. In 2003, there already was a preliminary presentation of the Tall Survey. In the present publication, the results of this survey shall be described in detail and made publicly available for future scientific research. Moreover, the main concepts and techniques that form the basis of the excavations, and that the following volumes will build upon—such as chronology, stratigraphy, and the grid system—shall be discussed.

Volume 1 of the 'Gadara Region Project's' excavation report will be divided into the following four thematic blocks: 'Gadara Region Project'/Tall Zirā‘a, the 2001 Survey on Tall Zirā‘a, Scientific Methods and the Framework of Archaeological Work on Tall Zirā‘a.

First Thematic Block: The 'Gadara Region Project'/Tall Zirā‘a

In the volume's first topic block, D. Vieweger and J. Häser will introduce the 'Gadara Region Project' and the Tall Zirā‘a's archaeological and geographical significance. They will discuss the tall's morphology and formation (*Chaps. 1.2.1.* and *1.2.2.*) as well as the natural conditions of the Wādī al-'Arab (*Chap. 1.3.1.*). Following that, a chapter will deal with the wādī's significance as a trade route (*Chap. 1.3.2.*). Then the tall's history of research will be described, outlining the studies by G. Schumacher and N. Glueck as well as the various excavation campaigns and surveys carried out on the tall, and their respective results (*Chap. 1.4.*). The detailed results of these surveys shall be presented chronologically in the following Volumes 2–7.

Second Thematic Block: The 2001 Survey on Tall Zirā'a

The second topic block deals with the survey that was carried out in the months of September and October of 2001 on the tall and in its immediate surroundings. The different types of finds, i.e. pottery, glass, stone finds, and bones, will be described in detail. The focus will rest on the ceramic finds since as many as 22,383 pottery sherds were discovered during the survey. These will be presented by F. Kenkel in *Chap. 2.2.1.* The mere evaluation of the material gathered in the course of the survey already shows that the pottery finds alone reflect a history of settlement covering all periods from the Early Bronze Age to the Ottoman era. Two sherds, each marked with a stamp imprint representing a cross, will be discussed in a separate chapter (*Chap. 2.2.1.2.*). The smaller group of glass finds, altogether consisting of 44 fragments, was examined and evaluated by D. Keller and St. Hoss (*Chap. 2.2.2.*). Most of these glass fragments date from the Byzantine era while some of them date back to Hellenistic – Roman times. The few stone and bone finds collected during the survey will be presented by D. Vieweger (*Chaps. 2.2.3.* and *2.2.4.*).

Two Early Roman limestone vessels that can be regarded as markers for a Jewish settlement will be discussed in detail (*Chap. 2.2.3.3.*) since they bear testimony to Jewish life and the Jewish communities' need for ritual purity around the beginning of the Common Era.

In a closing chapter, the survey's results, with respect to the different survey methods applied, will be evaluated by D. Vieweger (*Chap. 2.3.*).

Third Thematic Block: Scientific Methods

The third topic block will introduce the different scientific methods as well as the technological equipment applied during the excavation campaigns. Their overall objectives, procedures, and results will be presented.

In this block, D. Vieweger will describe—among other subjects—the tall's geophysical prospection by means of geoelectric mapping, twodimensional and threedimensional tomography. The latter allowed the measuring of more than 50 profiles in different configurations (*Chap. 3.5.1.*). Within this chapter D. Biedermann discusses the methodology of crosshole examinations, drilling boreholes at a distance of several metres. Depending on the method applied, either ground radar antennae or geoelectric probe heads are lowered into these boreholes (*Chap. 3.5.2.*). K. Rassmann and S. Reiter undertook a geomagnetical survey on the tall's plateau with a special attention to the area between Area I and II and north-west of it around a supposed tower (*Chap. 3.5.3.*).

Photogrammetry was also applied on the tall (*Chap. 3.2.*; P. Leiverkus and G. Bongartz). Surveying and mapping via photographic images are important fields of application in archaeology, especially when combining modern equipment with digital technologies. Collecting data for representing spatial structures by means of image-based three-dimensional reconstruction can be easily incorporated into the daily excavation routine. With the help of these images, the excavations on Tall Zirā'a took a veritable quantum leap with respect to the daily documentation as well as the architectural stone-by-stone recording of the planum, since three-dimensional images can easily be exported as rectified top views, which in turn serve as the basis of computer-based mapping.

In the framework of an archaeometric program W. Auge performed chemical and mineralogical analyses on pottery, glass, and metal finds; moreover, he examined seals (cylinder seals, scarabs, signet rings), balance weights, gypsum finds, and bitumen. He was able to detect, for instance, a silver amulet as well as a bronze figurine, covered with gold and silver, among the metal finds. It was also discovered that the majority of objects that had primarily been considered to be bronzes were in fact made from pure copper. The examination of raw glass, granulate, and of glass beads suggests that glass was processed, possibly even produced, on the tall. When scrutinizing the pottery finds the main object was to determine their provenance and, in doing so, to establish or at least to complement a 'regional fingerprint' by performing chemical and mineralogical tests and comparing the finds from the tall with the pottery finds from neighbouring settlements. The XRD Method, the ICP Method, and the RFA Method were applied for the analysis of the ceramics. The results of these analyses, however, seem to advise a cautious approach to making overoptimistic statements regarding the provenance of pottery vessels. In this volume the first results are presented by D. Vieweger and J. Häser on basis of W. Auge's researches (*Chap. 3.8.*). W. Auge will prepare Volume 9 with Archaeometry as its topic.

Experimental archaeology (*Chap. 3.4.*; D. Vieweger and J. Häser) was applied on multiple occasions to allow an appropriate interpretation of finds. In 2003, following the excavation campaign, the first project focussing on the history of technology was carried out, examining the traditional building of a tabun (*Chap. 3.4.1.*). In the course of this research, the various work stages—origin, grinding, cleaning, mixing of the clay, origin and processing of the admixture, manual construction of the oven, processing of the oven floor and of the upper rim, preparation of the oven pit, heating of the oven, and the firing procedure—could be documented and analysed. In 2009 and 2012, two differently constructed kilns were built and used for firing pottery vessels with the purpose of better understanding the technical processes and the way the necessary tasks were organised (*Chap. 3.4.2.*). In the spring of 2012, a quadruple-shelled kiln was built that could not only be used for firing ceramics but also for

melting glass. This kiln allowed the researchers to melt raw glass in casting moulds into finished goods (*Chap. 3.4.2.4.*).

The pottery finds of the excavations were identified not only by archaeometric analysis but they also underwent a colorimetric screening process (G. Bülow; J. Große Frericks; W. Auge). For this purpose, the Biblical Archaeological Institute Wuppertal (BAI) and the 'Department of Printing and Media Technology' of the Bergische University of Wuppertal jointly developed a colour-classifying program by optimising a typographical technique for its application in the field of archaeology, and moreover designed a specific computer software. This procedure and its results are described in *Chap. 3.3*.

Chap. 3.1. deals with three-dimensional reconstructions that were produced by the company 'Archimetrix visuelle Kommunikation' and D. Vieweger. Based on the excavations on the Tall Zirā'a, the architects reconstructed a virtual city of the Late Bronze Age. Another project demonstrates the construction and furnishing of an Iron Age I Four Room House. Reconstructions such as these have proven very helpful during the excavations since they encouraged the archaeologists involved to scrutinise single finds in connection with further pieces of information. Discussing the virtual reconstruction works forced them to substantiate the structures depicted in the model. Apart from that, threedimensional reconstructions are very useful when presenting excavation results to the public.

In 2014, L. Olsvig-Whittaker analysed a total of 43 soil samples that had been collected on Tall Zirā'a over the past ten years and that cover a time span from the Late Bronze Age to the Mamluk era (*Chap. 3.7.*). This was a pilot study with the object of finding out whether more material could be obtained using methods designed for archaeobotanical sampling. There are indeed macrofossils at Tall Zirā'a that are characteristic of Near Eastern agriculture. An especially interesting find is that of the bitter vetch, indigenous in Anatolia and northern Iraq, but not in Jordan. The pilot study's results suggest that further and more intensive research on the subject would be very promising

Landscape Archaeology (*Chap. 3.6.*) researches spatial and functional relationships of features such as settlements, roads, installations, fields etc. with their physical, ecological and cultural enviroment. In *Chap. 3.6.2.* L. Olsvig-Whittaker describes the different methods of landscape archaeology, which the 'Gadara Region Project' used in the last years (GIS-based habitat mapping from remote sensing images, multivariate analysis of site characteristics versus landscape characteristics). The aim of this researches is to get a thorough understanding of the environmental setting in which the Tall Zirā'a has been situated during different periods.

Within this chapter K. Soennecken and P. Leiverkus introduce the surface survey, which have been undertaken in the years 2009 to 2011 (*Chap. 3.6.1.*). The examination of all parts of this survey will be published in Volume 9.

Fourth Thematic Block: Framework of Archaeological Work on Tall Zirā'a

The fourth topic block deals with the excavations' general conditions, which serve as the foundation for the research presented in the following volumes. In this respect D. Vieweger and J. Häser discuss the grid system applied (*Chap. 4.1.*), the stratigraphy (*Chap. 4.2.*), the chronological structure (*Chap. 4.3.*), and the samples taken from Area I and Area II for the radiocarbon dating (*Chap. 4.4.*). One sample was analysed from Area II and 47 from Area I.

1. The ‘Gadara Region Project’/Tall Zirā‘a

by Dieter Vieweger/Jutta Häser

Fig. 1.1 Tall Zirā‘a. View to the east showing Area I and II. Photograph taken in summer 2009 (Source: BAI/GPIA).

There are very few places on either side of the Jordan River where it is possible to explore the history of the Southern Levant in such a small area as in the Wādī al-‘Arab. This deeply incised valley with all its diversity is an archaeological stroke of fortune. Numerous springs, fertile soil and a temperate climate afford excellent living conditions.

Tall Zirā‘a (Israel or Palestine Grid Reference: 2119.2252; 32°37’14.19 N; 35°39’ 22.01 Ӧ) is located in the middle of this valley, and the research focuses on exploring this hill. Continuously occupied for at least 5,000 years, it offers unique insights into the way of life of the region’s people. Its outstanding archaeological significance is a result from the artesian spring located in its centre, which created exceptional settlement conditions over thousands of years. For this reason, Tall Zirā‘a offers a unique opportunity to compile an unbroken comparative stratigraphy for northern Jordan from the Early Bronze Age to the Islamic period. It allows to trace cultural developments in urban life, handicrafts and the history of religion over long periods. In addition, it is possible to study the abundant remains from biblical times in the context of other cultural and historical periods.

The ‘Gadara Region Project’ is also examining the surroundings of Tall Zirā‘a: the Wādī al-‘Arab. A major trade route passed through the valley, connecting the Jordan Valley with the Transjordanian highlands, thus forming a link in the route from Egypt to the Syro-Mesopotamian centres (*Figs. 1.21–1.23*). Economic success and the hard work of residents across the millennia have left a plethora of traces in the valley. More than 300 sites provide evidence of human habitation from Palaeolithic to the Islamic period, and are an eloquent testimony of the history of this region; settlements, channels, water mills, cisterns, oil presses, wine presses, watchtowers and grave sites.

Located at the junction between Palestine and the Syro-Mesopotamian cultural zone, the area was politically and culturally influenced by both regions. Cultural developments and political changes in Palestine, which were often initiated from the cultural areas in the north or south, can be understood very well here.

1.1. The ‘Gadara Region Project’

The ‘Gadara Region Project’ was launched in 2001 by the Biblical Archaeological Institute (BAI) in Wuppertal, Germany. During the first two years, the project explored the surface of Tall Zirā‘a, a settlement mound located 4.5 km south-east of the Decapolis city of Gadara (today called Umm Qēs). During this investgation the tall was surveyed intensively; 22,383 pottery sherds and many other finds were systematically collected and analysed (*Chap. 2.*)[1].

Fig. 1.2 The Biblical Archaeological Institute (BAI) in Wuppertal (Source: BAI/GPIA).

Fig. 1.3 The German Protestant Institute of Archaeology (GPIA) in Jerusalem (Source: BAI/GPIA).

The findings helped to formulate the objectives of the excavation and to select suitable areas (residential, religious, adminstrative and craft areas) for further investigation (*Chap. 1.5.*).

The excavation on the tall began in 2003. The first results were so promising that the ‘Gadara Region Project’ was designed and planned for a timeframe of ten to twenty years. In 2004, in order to ensure intensive archaeological work and interdisciplinary collaboration over such a long period, the Biblical Archaeological Institute Wuppertal (BAI; Director D. Vieweger) and the German Protestant Institute of Archaeology in Amman (GPIA; Director J. Häser), which also serves as the research unit of the German Archaeological Institute (DAI), agreed on a close partnership (see *Figs. 1.2–1.4*). The German Protestant Institute of Archaeology in Jerusalem, headed by D. Vieweger since 2005, became associated with the project in 2006.

The ‘Gadara Region Project’, with members from all of the above mentioned institutes, then completed the following tasks: a survey of Tall Zirā‘a (2001), 18 excavation campaigns on the tall (2003 to 2011) and four surveys of the Wādī al-‘Arab environment (2009 to 2012). In order to publish the results, annual study campaigns were undertaken from 2012 to 2016.

Fig. 1.4 The German Protestant Institute of Archaeology (GPIA) in Amman (Source: BAI/GPIA).

1.2. Tall Zirā‘a (*Apps. 1.1–1.3* and *3.1*)

Tall Zirā‘a (translated from Arabic as ‘hill of agriculture’) is circular in cross section; the diametre measures 240 m at the base and 160 m on the plateau (*Fig. 1.1*). The sinter hill covers a total area of more than 5 ha, and its highest point is 17 m below sea level (cf. *Chap. 1.2.2.*).

As the sole prominent natural elevation in the lower Wādī al-‘Arab, Tall Zirā‘a has a dominant position. The wādī connects the Jordan Valley to the Mediterranean coast via the plain of Jezreel and Tall al-Ḥiṣn (Beth Shean) on the west, and with the Jordanian highlands in the east. This gives the tall a prominent geopolitical role (see *Fig. 0.2*; for a view from the tall see *App. 1.1*).

From the tall it is possible to have visual contact with Gadara and its *extra muros* sanctuary, as well as overlook the narrow opening of the wādī to the Jordan Valley in the west[2], the potential arable land in the western and

1 For the 2001 Survey on Tall Zirā‘a see Vieweger 2003 et al., 191–216.

2 Today this view is blocked by the wall of the Wādī al-‘Arab Dam.

Fig. 1.5 The stalactites and stalagmites in a cave on the tall’s eastern slope (Source: BAI/GPIA).

Fig. 1.6 Modern ascent to the tall’s plateau (Source: BAI/GPIA).

Fig. 1.7 Modern water channel within olive groves and vineyards on the tall’s south slope (Source: BAI/GPIA).

central areas of the valley, the terraced hillsides, the spur area in the east that is suitable for rainfed agriculture, and the slopes of the wādī in a wide semicircle from north to south that are suitable for small livestock breeding. The tall rises impressively (depending on the direction) 22–45 m above the landscape and was used as a dwelling place from the Early Bronze Age until well into the Middle Ages. In over 5,000 years of continuous settlement, more than 18 m of cultural debris has accumulated through building, destruction and rebuilding of cities and villages on the hill.

The geological, agricultural and geostrategic advantages of this site are obvious, and naturally encouraged the establishment of settlements; the hill is protected by steep rocky slopes to the north and east, and the east and south sides tower above their surroundings by 22–25 m. An artesian spring rises on the plateau of the tall that produces ample fresh water, even in the dry season (*Fig. 1.12*).

Finally, the living conditions around Tall Zirā‘a were excellent; there were numerous other springs, fertile soil and a temperate climate. The Wādī al-‘Arab and the Wādī az-Zaḥar merge below Tall Zirā‘a, and provide sufficient water for agriculture and animal breeding. The vast scale of arable and pasture land transforms a rather isolated section of the Wādī al-‘Arab (particularly the lower and middle levels), into a formidable self-sufficient settlement area, ideal for mixed agricultural use.

1.2.1. Morphology of Tall Zirā‘a (*Apps. 1.3* and *3.1*)

The appearance of Tall Zirā‘a is not constant; it changes depending on the viewpoint. In the north and east steep hillsides dominate. In the south and west 22–25 m high slopes provide natural protection (*Apps. 1.3* and *3.1*).

The first modern text which mentions Tall Zirā‘a was written by C. Steuernagel, based on observations by G. Schumacher:

> “The tell zara‘a is an almost circular hill, 154 m high, insulated on all sides, vertically sloping to the wād el-ʿarab. The plateau has a diameter of 135 m. In the middle of the plateau rises a spring located in a small well overgrown with reeds whose water flows down the slope in the Wad el-‘Arab. (...) The hill was once fortified by a strong circular wall[3]. There are the remains of a large building at the highest point of the plateau, and also in the vicinity of the spring, and a little south of it are the remains of rectangular buildings whose walls were built of massive hewn limestone and basalt blocks. (...) According to the map, the tell is at least partly inhabited again”[4].

3 G. Schumacher is wrong here. The supposed wall, built with massive stone rows, was actually erected by farmers during the last centuries. It is a secondary structure that should protect the plateau from erosion. The plateau iself was used by the family of Abu Ghassim from Kəfar ’Āsad (Kufr Asad) who ploughed the tall during the 1990’s.

4 Steuernagel 1926, 80 f.

Fig. 1.8 The water channel on the tall's north-east side (Source: BAI/GPIA).

Fig. 1.9 The stretcher-header-wall on the tall's east side (Source: BAI/GPIA).

Fig. 1.10 The Roman/Byzantine bath on the tall's east side (Source: BAI/GPIA).

The modern ascent to the plateau, constructed by a bulldozer, is located on the southern side, and is deeply incised into the tall (*Fig. 1.6*). This path cuts not only a recent plastered water basin near the base and a structure built of spolia on the slope, but also a number of ancient walls on its midway and at the top, which are mostly from the Byzantine and Islamic period (see the excavation of Area III). Therefore, the modern ascent does not fit into the topography of the hill.

The southern edge of Tall Zirā'a offers the easiest way to climb the 25 m to the plateau via a moderate ascent of approx. 150 m. Modern irrigation lines on the terrace-like ledge, which leads from the south-western foot of the tall up to the wide ledge in the north-east, make skillful use of the old causeway. Unfortunately, the old embankment was severely damaged when a new aqueduct was constructed from the spring to nearby olive groves (*Fig. 1.7*). Nevertheless, the carefully constructed former path is still traceable in some places. Additionally, there are substructures which follow the slope downwards.

The prominent ledge in the south-east, where the old ascent reached the plateau, provides plenty of space to easily allow a turn to the west into the former settlement. A high pile of cultural debris has been collected on the side facing the tall on the upper part of the ascent; a 4.5 m deep hole can be seen here, from an illegal excavation. Fragments of the city gate structure are not extant but should be expected to be found in this area. A large number of cacti on the outer ledge may approximate the line of the slope-side fortification of the entrance area, but no physical remains are now present on the surface.

The remarkable descent in the east of the tall overlooks the adjacent deep wādī where several other permanent water springs are still present. The rocks show clear traces of sintering from the outflow of the artesian spring on the tall. In a dripstone cave half way up the slope, rock stalactites and stalagmites can be seen (*Fig. 1.5*). They testify to a considerable flow of water over a long time. A few metres to the north, chalk-sinter sediment has been quarried in a larger cave, possibly to provide more freedom of movement or in order to use the cave as grave. Modern looters have dug a deep pit in the former cave.

The remains of several walls are visible in the upper and middle sections of the eastern slope close to Area II. A north-south oriented, 4.5 m long wall is a prominent feature on the upper part of the slope. It is built of worked stone with *tubuli* on the eastern face. Well burnt ceramic dating to the Classical period was immured into the rough, lower plaster layer (*Fig. 1.10*). Significant traces of sinter on the wall and down the slope as well as deep washed out grooves indicate a strong water flow. Some metres downslope, at the mid-height of the tall, the remains of a stretcher-header-wall were exposed in this way (*Fig. 1.9*). A channel was constructed on the north-east side of the tall; its purpose was to drain surplus water to a nearby wādī in order to control the constant flow of water from the spring and to avoid washouts (*Fig. 1.8*). The time of construction has not been determined[5].

5 Cf. Steuernagel 1926, 81: "One can see a channel on the eastern slope that drains the water to the southern part of the ruin".

To the north, a small wādī on the north-eastern slope of the tall cuts ever more deeply into the ground and joins the Wādī al-‘Arab on the north-east of Tall Zirā‘a. Overgrown with grass, high reeds (some up to 4 m), bushes and trees, it presents an almost idyllic sight and a sense of how fertile and green the entire wādī was in former times.

However, because water pumping stations have now been built to supply the industrial city of Irbid, the ecosystem is being destroyed. Many channels (constructed in different periods) can be seen in the wādī, largely driven into the rock, but partially also concreted over, in order to take advantage of the abundant water resources for agricultural or industrial purposes (particularly mills).

There are also large natural caves at the foot of the steep rock on the northern side of the tall (*Fig. 1.13*), which are still used by bedouins as winter quarters, storage space or stables (including concrete installations and remains from modern tents). Goat paths cover the northern ascent; currently people climb the rock to the summit.

The northern terrace located below the tall may have once served as a lower city, or another type of settlement, which was connected to Tall Zirā‘a (*Fig. 1.15*). A house built from spolia, a destroyed building in the centre of the terrace and the remains of other houses in the south support this assumption. The terrace, however, was leveled by bulldozers in the 1990’s to make way for a new olive grove. The cultural layers have been disturbed and largely destroyed, which can be verified through artificial stone fields and piles of debris where many Roman and Byzantine sherds were found. In 2011, the ‘Wādī al-‘Arab-Dam Authority’ ordered the destruction of the olive grove.

Beyond the north-west edge of the tall the towering rock peters out on the western hillside. The hillslope is only 25 m high on this side, making it vulnerable to potential conquerors; the geographical situation led to greater efforts in fortification, as we can see in Area I.

Olive trees were planted on the gently sloping western plateau in the 1980’s (*Fig. 1.16*) and a bedouin family lived in the adjacent area until 2005. It was presumed at first that the plateau would have been suitable for a lower city as well; however, the surveys from 2009 to 2012 found pottery sherds and worked stones only, but no traces of architecture.

However, a channel cut into the rock and the entrance to a carefully hewn (now robbed) grave can be found directly at the foot of the western slope below the present unpaved roadway. Furthermore, several installations, including a large round millstone, were found on the hillside of the north-west plateau towards the dam.

At the west of the plateau, the Wādī al-‘Arab leads into the modern water reservoir.

The plateau of Tall Zirā‘a is distinctive by a dip in the centre, caused by the permanent pool of water from the spring, and by the already mentioned gently sloping south-eastern entrance area, which once served as a natural outflow for the water from the spring (*Fig. 1.12*). The centre is surrounded for 300 degrees by cultural layers approx. 4 m higher than the centre. Naturally, the cultural

Fig. 1.11 Building substructure; in later times reused as a cistern. Area III, Squares W–X 124–126 (Source: BAI/GPIA).

Fig. 1.12 The artesian spring on Tall Zirā‘a (Source: BAI/GPIA).

Fig. 1.13 One of the caves at the foot of Tall Zirā‘a; north-west side (Source: BAI/GPIA).

Fig. 1.14 Tall Zirā'a. Overview on the plateau. Photograph taken in 2011 (Source: APAMEE, David Kennedy).

Fig. 1.15 The northern terrace below Tall Zirā'a (Source: BAI/GPIA).

Fig. 1.16 The western terrace of Tall Zirā'a (Source: BAI/GPIA).

layer created by human settlement could increase there much faster than in the area of the spring, where the constant water flow removed much of the debris.

The area around the artesian spring was overgrown with reeds, grass and scrub. The drainage channel next to two small trees, running in the direction of the former city entrance, has been dry since 2003. No less than eight flexible rubber pipes were found in the channel that once distributed the water from the spring in different directions. Since 2011, the water flow of the artesian spring has dried up completely. As mentioned previously, the water from the aquifer is now pumped to the modern city of Irbid to the north-east.

About a third of the tall's plateau was used as arable land until the excavation began in 2003. A farmer from the nearby village of Kəfar 'Āsad (Kufr Asad), M. Najib Mehedad, used the plateau for agriculture under the common law until 2001, and piped the water from the spring to the land.

The southern part of the plateau undoubtedly had a special function during the Roman and Byzantine periods. Scattered with worked ashlars as well as Roman and especially Byzantine pottery sherds, it was repeatedly the target of unsuccessful treasure hunters. There is a remarkable *tesserae*-paved courtyard, with an opening which leads into a large vaulted cistern built of ashlars.

Fig. 1.17 Agricultural installation on the tall’s east side. Square AM 145 (Source: BAI/GPIA).

Fig. 1.18 Tall Zirā‘a. Chalk-sinter terrace on the tall’s north-east side (Source: BAI/GPIA).

A Byzantine monastery was discovered here, built over the site of an older Roman building, which had been reused in the Umayyad and Mamluk periods. The 6 m x 10.4 m wide and max. 5.75 m deep cistern was lined with a thick layer of plaster, with two distinct overlays evident, which was about 8 cm thick in total (*Fig. 1.11*). A vaulting technique had been used in the initial construction, to enable further installation elements to be added. The bottom of the cistern was divided by walls, and evidently served as a temporary residential or storage place.

Disused agricultural installations have been found to the south-west of the tall, immediately west of the road leading to it. Depressions for the fixation of vessels and remains of a rock hewn oil or wine press were found here (*Fig. 1.17*). Additionally, a large rock-cut pear-shaped cistern was found in the immediate vicinity.

1.2.2. Emergence of the Natural Hill

The bedrock of Tall Zirā‘a consists of chalk-sinter, mainly calcium carbonate (*Fig. 1.18*). It appears that an aquifer formed a more or less circular sinter terrace in the cross section shaped by the hills 300 m above sea level which surround the tall to the north, east and south, due to the crystallization of minerals from the water over centuries. Carbon dioxide (CO_2) was released from the water due to pressure relief, the natural heating of the water after spillage, and the presence of plants, particularly algae. Consequently, once the carbon dioxide has been released, the natural chalk present in the water, in the form of calcium hydrogen carbonate, was deposited was indissoluble chalk ($CaCO_3$).

It has been adduced that the chemical layers formed on the sinter hill at approx. 0.10 m per year. Due to the fact that the spring water always flows out of the lowest drain, over time a circular hill (in cross section) evolved, with almost equally high sides in every direction. However, the mound did not grow consistently; it is not solid everywhere, and contains numerous caves (*Fig. 1.13*).

The sinter hill has been used as a settlement since the fourth millennium BC. Thus, further increases in the height of the hill were no longer a consequence of the sinter layer of the spring, but rather due to human cultivation on the tall. By the end of occupation, the hill had grown up to 17 m below sea level. G. Schumacher noticed in his records:

> “The Bedouins of the surrounding [area] and the Fellahin claim that the water of the spring was once thermal and that it had a salty, sulfurous taste, which is verified through the large quantity of spring sediment that covers the whole hill; now the water is totally fresh and cool”[6].

6 Steuernagel 1926, 80 f.

1.3. The Wādī al-‘Arab and its Environment (*Apps. 1.1–1.4*)

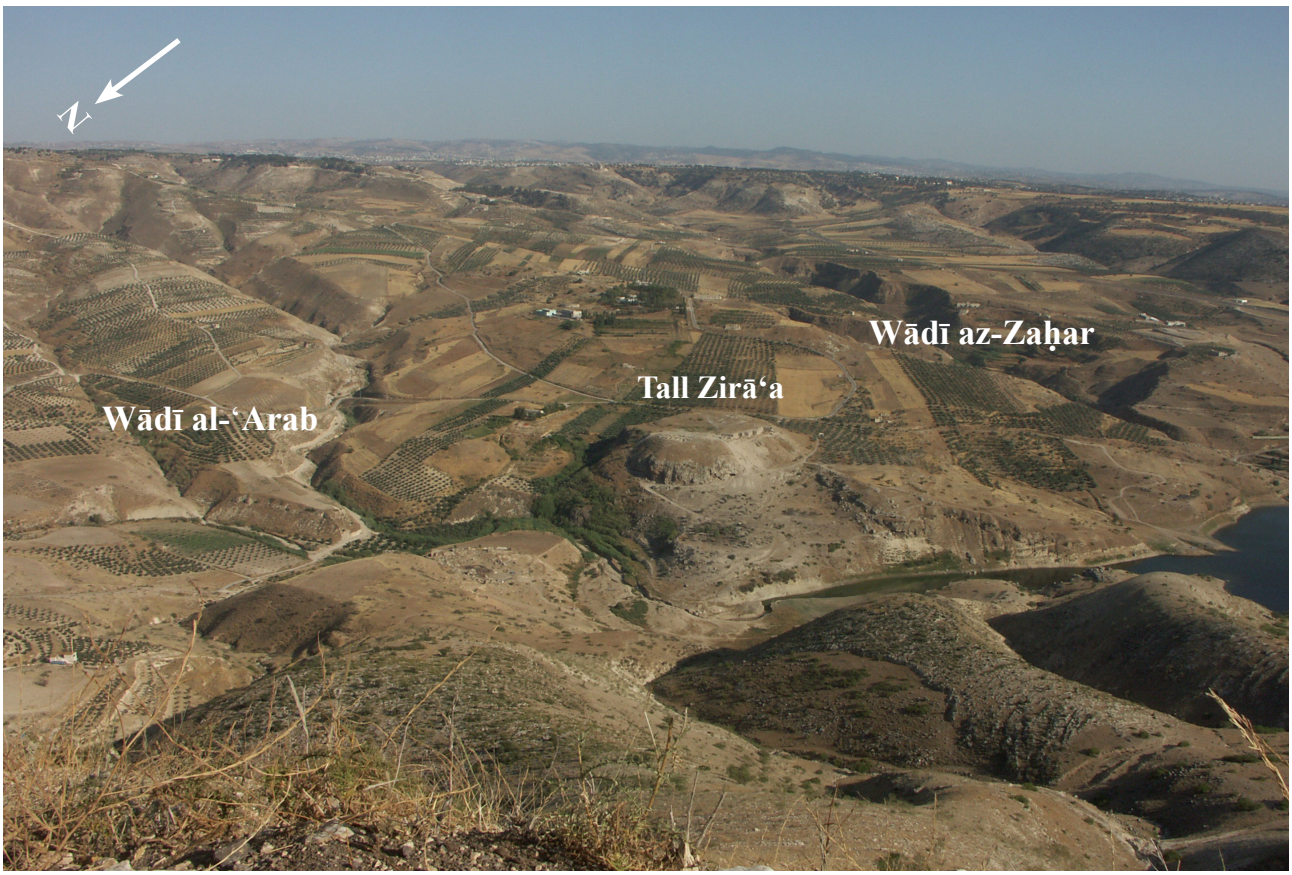

Fig. 1.19 The Wādī al-‘Arab and Tall Zirā‘a. View from the Gadara-plateau. Photograph taken in 2007 (Source: BAI/GPIA).

The highly visible ruins of the famous Decapolis city of Gadara impress not only by their exceptional scenic location, but also by their outstanding archaeological value. High over the Sea of Galilee and close to the Jordan Valley, the site towers at the north-western spur of Transjordan. If one looks from there to the south, an extraordinary fertile valley appears: the Wādī al-‘Arab (*Figs. 1.19–1.21*; see *Apps. 1.2* and *1.3*). Neither its relevance to the ancient cities of Gadara or Bēt Rās nor its own history has been noted in current literature of the region[7].

The Wādī al-‘Arab and its tributary valleys arise in the hill country to the west of Irbid and drains into the River Jordan. There is an abundance of water springs in the wādī, some of which are thermal. Until the 1980’s, approx. 28.8 million m^3 of water passed through the valley annually[8]. The remains of former water mills[9], rock-cut channels and water courses still give the impression of the former abundance of water here. Today, the area is considerably drier because of modern pumping stations. The local peasants are completing the process; they are over pumping the natural water ressource in order to irrigate their fields and olive groves.

The modern dam in the lower wādī was erected in 1987 and can hold a maximum of 17.1 million m^3 of water. The dam provides water for irrigation in the agricultural area in the lower wādī and is stocked with fish. Since its construction, not only rain water but also water from the King Abdullah Channel is stored there.

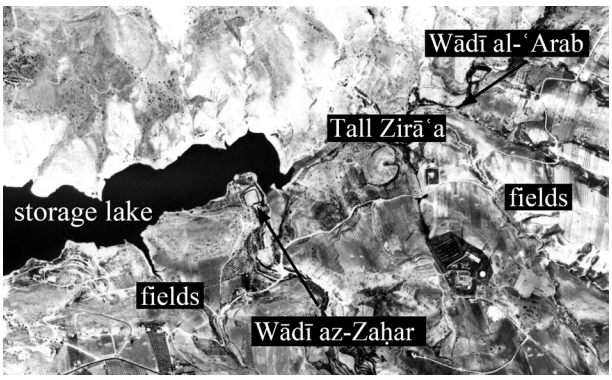

Fig. 1.20 Wādī al-‘Arab with the water reservoir (Source: BAI/GPIA).

7 Cf. Hoffmann 1999, 225–227.

8 Ahmad 1989.

9 Steuernagel 1926, 75. 83. 466 f.; McQuitty – Gardiner 1987.

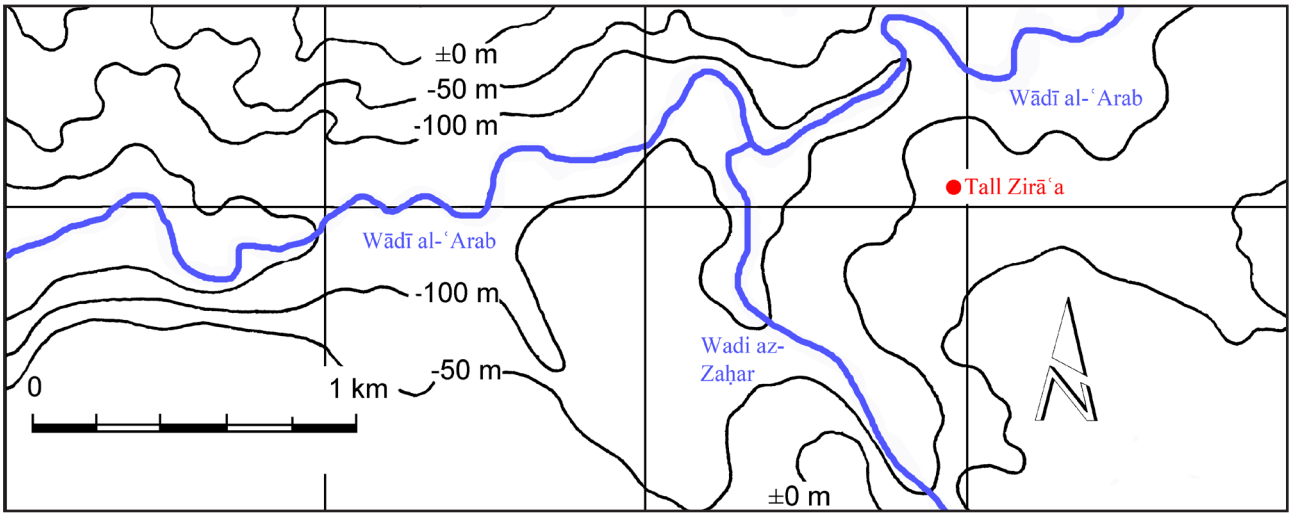

Fig. 1.21 The Wādī al-‘Arab-system (Source: BAI/GPIA).

1.3.1. The Natural Conditions in the Wādī al-‘Arab

The average temperature in the wādī ranges between 15 ºC in winter and 33 ºC in summer, with humidity between 45–75 %[10]. Annual rainfall averages 380 mm, with particularly heavy rainfall expected between December and mid February.

Typical flora of the Wādī al-‘Arab includes the common reed (*Phragmites communis*), oleander (*Nerium oleander*) and tamarisk (*Tamarix aphylla*). Many waterfowl come to this area in autumn and spring; one can find the cattle egret (*Bubulcus ibis*), the little egret (*Egretta garzetta*), the great white egret (*Casmerodius albus*), the grey heron (*Ardea cinerea*), the common teal (*Anas crecca*), and the black coot (*Fulica atra*), the common redshank (*Tringa totanus*), the marsh sandpiper (*Tringa stagnatilis*), the greenshank (*Tringa nebularia*), the pied kingfisher (*Ceryle rudis*), the Smyrna kingfisher (*Halcyon smyrnensis*) and the common kingfisher (*Alcedo atthis*). Additionally, there are common water frogs (*Rana ridibunda*) and several kinds of Talapia (e.g. *Tilapia zilli*/ St. Peter’s fish)[11].

Grain is still cultivated today in the wādī, together with vegetables, which grow even in winter due to the climatic conditions. Tropical fruits thrive in the lower valley; however, the higher reaches are often rocky and suited only for grazing livestock.

1.3.2. The Wādī al-‘Arab as a Trade Route

The Wādī al-‘Arab and its tributary valleys connect the Jordan Valley and the Transjordan high plateau geographically and geopolitically; particularly as the wādī leads into the signifant northern ford of the River Jordan.

Likewise, it connects the Mediterranean Sea via the Jezreel Valley and Tall al-Ḥiṣn (Beth Shean) to the Jordan Valley and from there to the Transjordan high plateau. Thus it was a very important trade route (*Fig. 1.22*). In Pre-Classical periods the 30 km long wādī-system, which provided a more than sufficient amount of water until overpumping and diversion in the twentieth century, was part of an important trade route connecting Egypt with Syria and Mesopotamia. Here (unlike the northern and southern wādīs), the merchants could manage the steep ascent from the Jordan Valley (290 m below sea level) to the East-Jordanian high plateau (550 m above sea level)

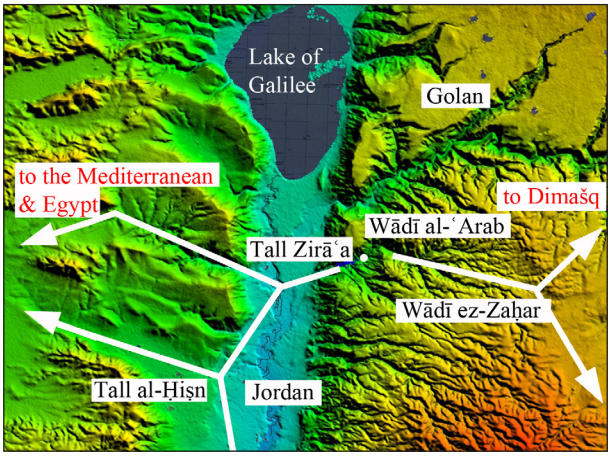

Fig. 1.22 Map showing the trade routes (Source: BAI/GPIA).

10 Hanbury-Tenison et al. 1984, 386.

11 Cf. MMRAE 1991, 226–230; Ahmad 1989, 273–275 and http://www.wetlands.agro.nl/Wetland_Inventory/MiddleEastDir/Doc_chapters/ JORDAN.doc (23.11.2015).

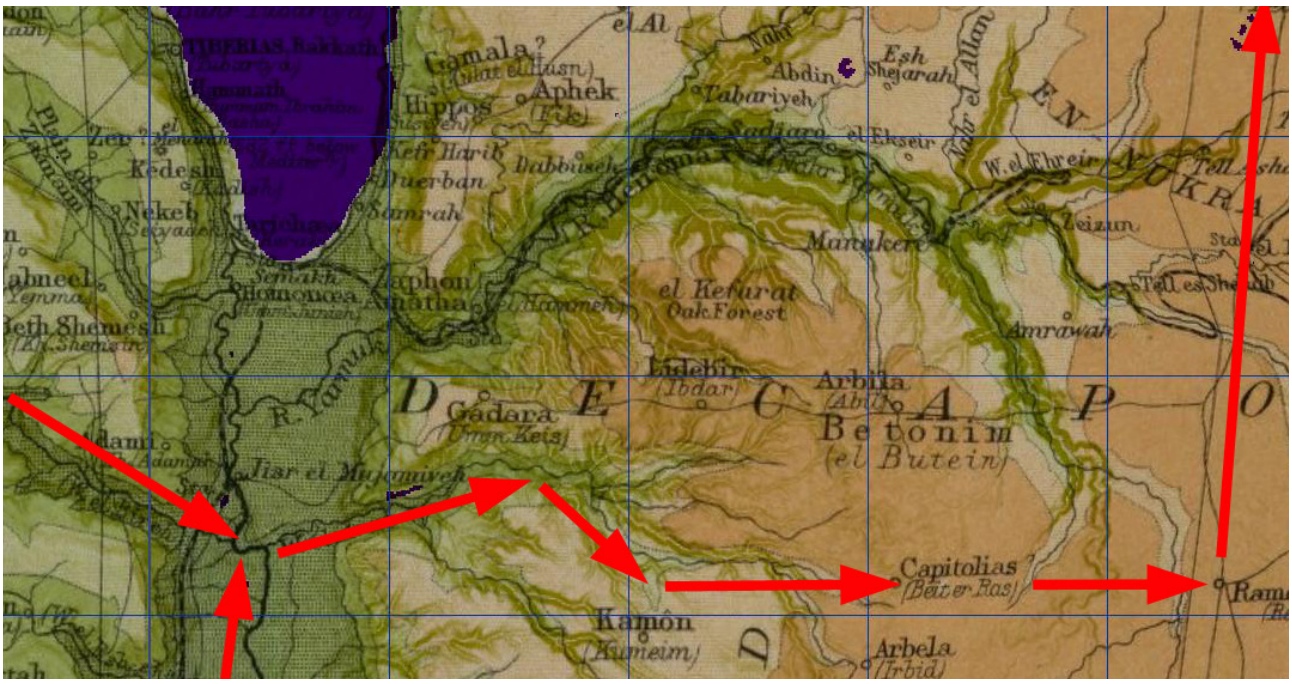

Fig. 1.23 Ascent from the Jordan Valley to the Irbid-Ramtha basin (Source: Section of Bartholomew's quarter inch map of Palestine, 1901, 91.5 cm x 70.5 cm/Edinburgh Geographical Institute).

without the need to overcome steep natural gradients in the terrain or a bottleneck (*Figs. 1.21* and *1.23*). From the fertile Irbid-Ramtha basin in the East-Jordanian high plateau, trade routes led from Dimašq (Damascus) to Mesopotamia or directly through the Ḥaurān mountains and the Arabian Desert to central Mesopotamia[12]. A further trade route led from the Irbid-Ramtha basin to the south (Central Transjordan hill country).

Since the Yarmuk Valley in the north and the Wādī Ziqlāb in the south are too steep and narrow to serve as major transport routes, the great geopolitical importance of the Wādī al-'Arab becomes evident.

Countless finds testify to trading between the inhabitants of Tall Zirā'a with neighboring regions: for example, ceramic vessels from Syria, Greece and Cyprus, bitumen from the Dead Sea, and copper/copper ore from Fēnān (and/or from Timnà) and faience from Egypt; raw glass may come from different regions but potentially a provenance from Egypt can be assumed.

Fig. 1.24 Wādī al-'Arab. View from west. Photograph taken in 2011 (Source: BAI/GPIA).

12 Bartl 2002, 119.

1.4. Research History for Tall Zirā‘a

1.4.1. Records of Gottlieb Schumacher

Fig. 1.25 Gottlieb Schumacher (Source: Eisler 2015/Archive of the Temple Society).

Tall Zirā‘a was among the discoveries of the German engineer G. Schumacher when he explored Transjordan in 1885 (*Fig. 1.25*)[13].

G. Schumacher mentions seeing the visible remains of rectangular buildings on the tall’s plateau:

> “the walls were constructed of massive hewn chalk and basalt ashlars”.

Due to the enormous population decline during the Ottoman period the area around Tall Zirā‘a was assumed to be uninhabited. Surprisingly, G. Schumacher noted that the tall was partly inhabited until the beginning of the nineteenth century[14]; but except for a few sugar mills, operated by water power, there were only a few small hamlets in the vicinity of the tall.

G. Schumacher, who described the water flow through the Wādī al-‘Arab as about 0.75 m^3 per second in June 1885. The flow remained constant until the confluence with the Wādī az-Zaḥar, which supplied the Jordan River with the same amount of water. After this point, the water again remained constant until the confluence into the Ghōr[15].

> “The riverbed consists of soft white chalk, in which the water has scored several parallel channels. The riverside is densely overgrown with oleander, reeds and other bushes, often covering the path through the undergrowth. Where the valley widens and the water becomes calm, there are plenty of trout that are easy to catch. While bathing Dr Schumacher discovered an almost one meter long water snake, which is supposed to be common and feared here”[16].

G. Schumacher’s records are extraordinarily valuable, because they provide an impression of the abundance of water, as well as flora and fauna, from the end of nineteenth century:

> “Right below these rocks is Rās Wād Zaḥar, that is, the beginning of the water-bearing Wād Zaḥar, which owes its name to the ruined Zaḥar el-‘Aḳabi on a hill located to the south-east. There are approximately a dozen water springs on the slopes, overgrown with reed and oleander; they flow down in a small stream that was 4.2 m wide and 25 cm deep in June 1885. The valley drops 95 m over a length of 4 km from here to the outlet of the Wād el-‘Arab. Due to the strong descent, the stream was suitable to power mills. No less than 14 mills are named in northern ‘Ajlūn, (…) all of them located at or next to the river of the Wād Zaḥar. According to modern maps, which show only a few of these names, it seems that most of the mills were in the Wād el-‘Arab. They are primitive constructions and most of them have only one milling gear, but since they are the only mills in that area they are permanently busy; more sophisticated structures would be highly profitable. The riverside is densely overgrown with oleander, raspberries and reed. Small, natural ponds, full of fish, offer the chance to take a refreshing bath”[17].

G. Schumacher states that the Wādī al-‘Arab was rather lively due to the mills, particularly since there are no other industries in the vicinity[18]. By the end of the twentieth century, the valley had changed tremendously compared to Schumacher’s records. The once abundant waters in the wādī were now used to supply the city of Irbid, and the permanently green resting places for migratory birds had dried up. Only the construction of the Wādī al-‘Arab reservoir, which drowned some archaeological sites, restored a fertile ambience to the valley. An agricultural research institute was established on its southern riverside.

Naturally, we cannot draw conclusions about ancient conditions from the present-day situation; however, with the abundant water resources described above and its nu-

13 Steuernagel 1926, 83.
14 Steuernagel 1926, 80 f.
15 Steuernagel 1926, 80.
16 Steuernagel 1926, 80.
17 Steuernagel 1926, 74 f.
18 Steuernagel 1926, 83.

merous settlement remains, the area was beyond doubt used for a wide range of agricultural activities.

G. Schumacher's records about former road links are also of great interest, since they enable conclusions to be drawn regarding the accessibility of this area:

> "The main street coming from the southern Ḥaurān (…), that crosses the Wād Zaḥar near the springs, reaches the eastern end of Wusṭīje 2.5 km north of Wād Bersīnijā (…) The paving suggests Roman origin. (…) We turn back and follow the street east until it reaches the level of the plateau after crossing the Wād Zaḥar. Here, one kilometer north of the street, on an extended plain, one of the main settlements of Wusṭīje is located, Kafr Asad. [It is] 340 m high, almost the same height as Mukēs[19] to the northwest, but about 75 m lower than el-Kabū to the north (…)"[20].

1.4.2. Observations of Nelson Glueck

Fig. 1.26 Tall Zirā'a looking south-south-west. Photograph taken by N. Glueck in 1942 (Source: Glueck 1951a, 183 Fig. 71).

The American Archaeologist N. Glueck visited the area in 1942. In his publication 'Explorations in Eastern Palestine IV' he mentioned the "singularly imposing and completely isolated" Tall Zirā'a, which is rising starkley and massively out of the Wādī al-'Arab. He described the talls topography and reported seeing a spring on the plateau[21].

A photo published by him shows a view from the south-south-western direction, and documents a perspective that is lost today due to the modern dam (*Fig. 1.26*)[22]. N. Glueck also alludes to the archaeological remains:

> "The uneven, terraced top of the hill of Tell Zer'ah was at one time completely enclosed within a strong fortification wall, some parts of which are still visible, particularly on the n. side. This wall probably hails back to the Early Bronze period. Numerous foundation remains are visible on top of the hill, belonging to buildings erected from Roman through medieval Arabic times (...)"[23].

Furthermore he mentions ceramic finds from the Early Bronze Age (I–II and III), Iron Age (I–II) and plenty from the Roman, Byzantine and Islamic periods[24].

1.4.3. Modern Surveys Preceding the 'Gadara Region Project'

Although Tall Zirā'a had already attracted attention due to its location and imposing appearance, there had been no intensive research, due to the hill's location close to the border of Israel in the west and Syria in the north; following the foundation of the State of Israel in 1948 and again after the Six Day War in 1967, the western part of the Wādī al-'Arab was declared a military zone.

Two modern archaeological explorations were conducted in the valley before the 'Gadara Region Project'.

19 Today's Umm Qēs.
20 Steuernagel 1926, 75. 77.
21 Glueck 1951a, 182.
22 Glueck 1951a, 183 Fig. 71.
23 Glueck 1951a, 184.
24 Glueck 1951a, 184.

1.4.3.1. The 1978 Survey

The surface inspection, which took place on March 14 and 15, 1978, was an archaeological rescue investigation considering the then planning phase of the Wādī al-‘Arab dam construction. The project was initiated jointly by the ‘Jordan Valley Authority’ and the ‘Department of Antiquities of Jordan’ (DoA). The team consisted of T. M. Kerestes, J. M. Lundquist, (University of Michigan), B. G. Wood (University of Toronto) and K. Yassine (University of Jordan). The results were published as a joint project: ‘An Archaeological Analysis of Three Reservoir Areas in Northern Jordan’[25]. Thereby three locations were discovered (*Tab. 1.1*)[26].

Tall Zirā‘a was rated as the most important archaeological site[27] in the survey area:

> “Site 3 (...) The sherds collected were predominantly from the Late Byzantine period (...), with also a good representation from the Early Bronze period”[28].

Periods	**Areas under study**		**Settlements**		
	A	**B**	**1**	**2**	**3** *Tall Zirā'a*
Paleolithic	2				
Early Bronze Age				2	8?
Early Bronze Age Flint				1?	
Middle Bronze Age II				8	1
Late Bronze Age					
Iron Age	1				1
Persian period					
Hellenistic Age					
Roman period	4	6	20	1	3
Byzantine period	18				14
Early Islamic period					
Late Islamic period	1?				
Ottoman period		1			10
Modern period	1			5	5
Undetermined sherds	1	7	2		
Undetermined flints	3			1	
Total Sherds	**61**	**14**	**40**	**17**	**159**
Total Flints	**5**			**1**	**5**

Tab. 1.1. Survey 2001 on Zirā‘a and in its immediate vicinity.
Site 1: (Israel or Palestine Grid Reference: 2103.2251) is now under water. It was located 119 m below sea level and measured 75 m x 20 m. T. M. Kerestes found it “on a natural tongue projecting into the wadi from the N side. The foundation of a two-room building is clearly visible. The building follows the natural contour of the ridge, and a well-worn path passes in front of the building, continuing along the N edge of the wadi. The small sample of sherds reflects the Early Roman period”[29].
Site 2: (Israel or Palestine Grid Reference: 2113.2253) is located between 100 and 104 m below sea level, and measured 50 m x 20 m. It is situated “on a natural hill on the N side of Wadi Arab. Today there is a small village on the site. Foundations on the S edge of the site ca. 4 m. long appear to be ancient. The artifacts collected were predominantly from the Middle Bronze II period”[30].

25 Kerestes et al. 1977/1978, esp. 129.
26 Table according to Kerestes et al. 1977/1978, 129.
27 The measurements differ in the researchliterature: 40 m (Kerestes et al. 1977/1978, 129), 20 m (Hanbury-Tenison et al. 1984, 389).
28 Kerestes et al. 1977/1978, 129; cf. Hanbury-Tenison et al. 1984, 389 No. 001.
29 Kerestes et al. 1977/1978, 129.
30 Kerestes et al. 1977/1978, 129.

1.4.3.2. The 1983 Survey

In September 1983 the first campaign of the archaeological survey, supervised by J. W. Hanbury-Tenison, was carried out in the Wādī al-'Arab[31]. His team included A. McQuitty, M. Gardiner and N. Khasauneh. In all 25 km^2 were examined and 102 archaeologically relevant sites were documented during the 18 days of fieldwork[32].

> "The areas surveyed were deliberately chosen to represent the total potential of the wadi, whose geophysical and demographic variations are quite considerable. Eleven square kilometers took a section across the whole mouth of the wadi, at the same time covering the area most threatened by the works supplying water to the city of Irbid. Eight square kilometers covered both highland and lowland in the middle wadi, along the Umm Qeis ridge, and six covered the upper wadi around the modern village of Som. (...) Retrieval procedure varied according to the site, but tended to be total pick-up at the poor sites, purposive at the middling, and purposive and total pick-up in random metre-diametre circles at the large. This first season was intended as an overview, (...)"[33].

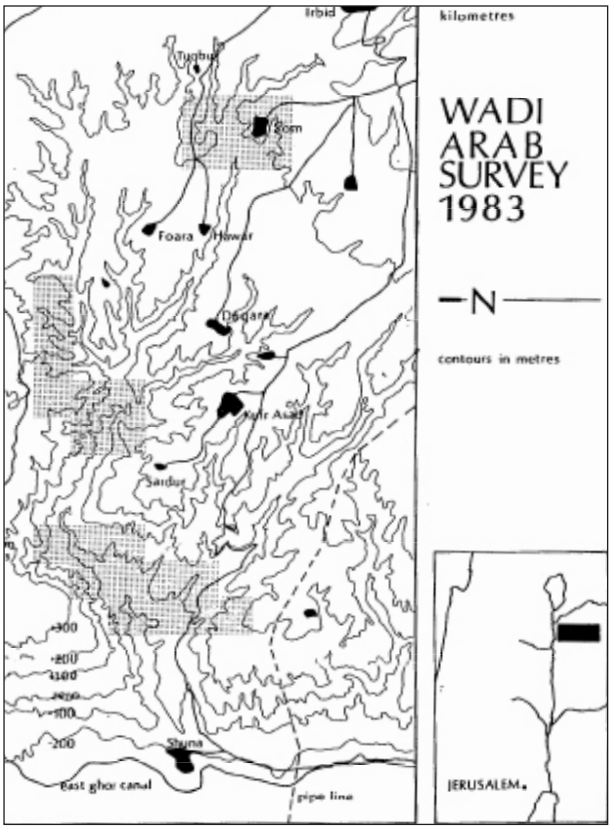

Fig. 1.27 Areas surveyed in 1983 (Source: Hanbury-Tenison et al. 1984, 386).

Since the Early Bronze Age, possibly since the end of the Chalcolithic era, there were three tulūl in the Wādī al-'Arab that were inhabited over several cultural periods: Tall Zirā'a (Israel or Palestine Grid Reference: 2119.2252), Tall Qāq (Ḫirbet Bond; Israel or Palestine Grid Reference: 2128.2233), and Tall Kinīse (Ra'ān; Palestine or Israel Grid Reference: 2191.2271). Regarding the Early Bronze Age, J. W. Hanbury-Tension reported:

> "Settlement was concentrated at the four tells (...), and two field scatters (...), with the Early Bronze II being most in evidence, and the pre-urban material mostly where it remained uncovered by later deposition. There was no evidence of (...) 1. Neolithic or Early Chalcolithic; 2. Golan Chalcolithic; 3. Proto-Urban A or B wares, grey-burnished ware, or Proto-Urban D/Umm Hammad ware (including Jawa ware)"[34].

The few settlements dating to the Middle and Late Bronze Age were localised at Tall Qāq (Ḫirbet Bond), and Tall Kinīse (Ra'ān). The ceramic finds of those ages were, according to J. W. Hanbury-Tension:

> "mainly crude and undoubtedly local (...) There was no evidence of the following: 1. EB/MB (EB4) material. 2. Quality vessels—chocolate on white, white-slip, etc. 3. Cypriot or Mycenean wares, or any other imports"[35].

There were only a few artefacts found that date to the Iron Age[36]. However, material dating to the Hellenistic period and the Middle Ages was detected. J. W. Hanbury-Tenison, for instance, writes:

> "Material from these periods was found at a large number of the sites identified on the survey. The Byzantine and Mamlūk presence was particularly strong. (This) (...) indicates the broad chronological groupings represented at each site from the Hellenistic period onwards"[37].

31 Hanbury-Tenison et al. 1984, 385–424 (text). 494–496 (plates).

32 Hanbury-Tenison et al. 1984, 389. 398. 403.

33 Hanbury-Tenison et al. 1984, 385.

34 Hanbury-Tenison et al. 1984, 392 f.
Ibidem: "Since there are Proto-Urban wares at Shuneh and Arqub edh-Dhar, the absence in the Wadi Arab suggests either a *lacuna* in occupation, or a regional-based typological preference. The preponderance of holemouth jars over V-shaped bowls (...), and the knob handles (...), in conjunction with the thumb-impressed decoration, the triangular section loop handles, and the sparse lithic evidence (...) points to a date at the very end of the Chalcolithic sequence, and is yet only paralleled at the ultimate, and post-Ghassulian, level at Pella Area XIV. If the sites do continue uninterrupted from the Late Chalcolithic to the Early Bronze II (grain wash wares), there may be a division between highland and lowland in the ceramic assemblages, and we might be seeing an example of regional rather than chronological factors in typological variability (...) Of particular interest are the stamp seal impression on the neck of an EB jar (....), and the clay nail or fish hook (?) (...). This latter is a gift for those seeking 'Ubaid parallels for the Palestinian Chalcolithic".

35 Hanbury-Tenison et al. 1984, 393.

36 Hanbury-Tenison et al. 1984, 398.

37 Hanbury-Tenison et al. 1984, 404.

1.4.4. Archaeological Excavations on Tall Zirā‘a, Surveys and Study Campaigns 2001 to 2016 (*App. 0.1*)

Fig. 1.28 Tall Zirā‘a. View from north to south. Overview with the Areas I, II and III. Photograph taken in 2011 (Source: BAI/GPIA).

The ‘Gadara Region Project’ began in 2001 with a survey and geophysical investigations on Tall Zirā‘a (*Chaps. 2.* and *3.5.1.*). Since 2003, excavations of the settlement remains has been the main focus of archaeological research. Furthermore, archaeometric investigations (*Chap. 3.8.*), photogrammetical and aerial surveys (*Chap. 3.2.*), experimental archaeology projects (*Chap. 3.4.*) and archaeobotanical investigations (*Chap. 3.7.*), as well as extensive surveys in the hinterland (*Chap. 3.6.1.*), have been carried out in order to plan future archaeological work, to solve questions of research, to document results, or to widen the archaeological background.

For the last twelve years, excavations have been undertaken in three distinct areas (Areas I–III; see *Figs. 1.28* and *1.32*) in the west, north, and south of the tall. These areas have been correlated chronologically using finds, radiocarbon samples and survey data as the basis of comparison. A total of twenty five strata have been associated with the settlement layers (*Chap. 4.2.*).

The Wādī al-‘Arab Survey was conducted between 2009 to 2012. In total 25 km^2 of both the wādī itself and the tributary system have been examined (*Chap. 3.6.1.*).

1.4.4.1. The Three Excavation Areas on Tall Zirā‘a

Area I (2003 to 2011)

Systematic excavation concentrated on the north-western slope of the tall at first (*Figs. 1.28*, *1.29* and *1.32*). During the Tall Survey in 2001, extremely promising conditions for the investigation of an extensive stratigraphical sequence and excellent prospects for the discovery of significant residential architecture had been determined for this area. Therefore, geophysical surveys were undertaken in 2001 and 2003, with particular intensity on this terrain.

The microclimatic conditions suggest that this part of the hill was particularly favourable for craft purposes. From midday until well into the evening, thermally induced onshore winds from the Mediterranean create a comfortable living environment, which provide ideal working conditions for craftsmen, especially for the operation of furnaces.

Fig. 1.29 Aerial view of Area I. Photograph taken in 2011 (Source: BAI/GPIA).

This location also provided a favourable topography for excavations. The inhabitants were, in terms of natural conditions, less protected on the western slope than on the other slopes to the north and east. The difference in height from the base to the summit of the hill was only 22–25 m, which suggests that the inhabitants of the settlement would have had to create a solid fortification system here. Furthermore, the topographical formation indicates that this area would have included a path to the lower towns situated in the well watered wādī west and north of the tall.

Area II (2006 to 2009 and 2011)

Area II, investigated for the first time in spring 2006, is situated in the northern part of the tall (*Figs. 1.28*, *1.30* and *1.32*). The precipitous slopes, with a maximum of 44 m drop, provided effective protection. In addition, the area offers a useful view to the 'main gate', the natural access to the hill settlement, which was located in the south-eastern part of the tall. Similar to Area III on the south side of the hill, the accumulation of settlement remains was higher here than on the other parts of the tall. Therefore a longlasting sequence of settlement layers could be expected in this place. The topographical position and the state of preservation of this prominent area suggested representive as well as administrative buildings.

Fig. 1.30 Aerial view of Area II. Photograph taken in 2012 (Source: BAI/GPIA).

Area III (2007, 2008, and 2014)

A third area for future excavations was chosen in the spring of 2007 (*Figs. 1.28*, *1.31* and *1.32*). The results of the surveys supported the presumption that a large Byzantine period building, measuring 600 m^2, would be found on the surface of the southern part of the hill. The extent of the building had been indicated by the extensive size of an associated cistern, which was 5.75 m deep, covered an area of approx. 6 m x 10.4 m, and was lined with an 0.08 m thick layer of plaster (*Fig. 1.11*).

Not only the spacious complex, which was easily discernible in the aerial photograph, but also the construction of such a huge cistern only 80 m away from a fresh water well, suggested a large construction with special significance.

Fig. 1.31 Overview of Area III. Photograph taken in 2008 (Source: BAI/GPIA).

Fig. 1.32 General plan of the excavation areas on Tall Zirā'a (Source: BAI/GPIA).

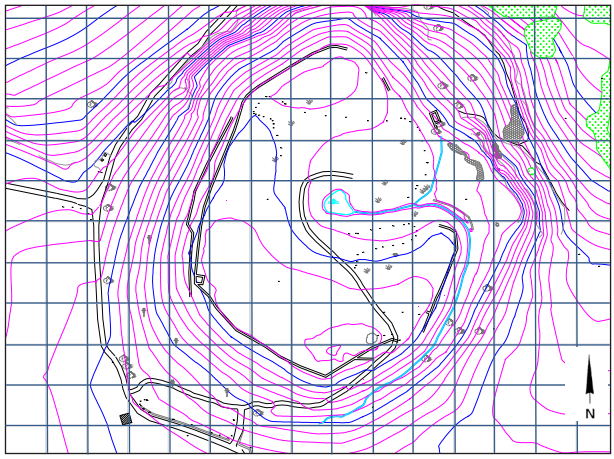

Fig. 1.33 General plan of the excavation grid on Tall Zirā'a. Survey Squares 20 m x 20 m (Source: BAI/GPIA).

1.4.4.2. Archaeological Seasons from 2001 to 2016. An Overview

CAMPAIGNS	EXCAVATIONS						SURVEYS
	Area I		Area II		Area III		
	Surface Area	New Squares	Surface Area	New Squares	Surface Area	New Squares	
2001	<50 m²	AF 115–116	-	-	-	-	Tall Zirā'a
2003 Summer	250 m²	AK 116, AL 116–118, AM 116–119	-	-	-	-	-
2004 Spring	500 m²	AM-AN 115, AN–AO 116–119	-	-	-	-	-
2004 Summer	500 m²	-	-	-	-	-	-
2005 Spring	675 m²	AH 115, AI 115–116, AK 115.117, AP 118–119	-	-	-	-	-
2005 Summer	675 m²	-	-	-	-	-	-
2006 Spring	825 m²	AG 115–116, AH 114.116, AI 117, AP 117	125 m²	AV–AW 128–129, AX 129	204 m²	Test trench in X 124	-
2006 Summer	825 m²	-	-	-	-	-	-
2007 Spring	925 m²	AE 115–116, AQ 118–119	400 m²	AX–AY 128, AV–AY 130–131	-	-	-
2007 Summer	925 m²	-	-	-	600 m²	U–X 123–128	-
2008 Spring	1,025 m²	AQ 120; AR 118–120	825 m²	AT–AU 128–133; AV–AW 132–133; AX 132	-	-	-
2008 Summer	1,025 m²	-	-	-	-	-	-
2009 Spring	1,525 m²	AP 120–123 AQ–AR 121–123 AS–AT 119–123	1,500 m²	AR 132–134; AS 126–134; AT–AU 126–127. 134; AV–AX 126–127; AY 127	-	-	-
2009 Summer	1,525 m²	-	-	-	-	-	Wādī al‘Arab
2010 Spring	1,525 m²	-	1,500 m²	-	-	-	-
2010 Summer	1,525 m²	-	-	-	-	-	Wādī al‘Arab
2011 Spring	1,525 m²	-	-	-	-	-	-
2011 Summer	1,525 m²	-	1,500 m²	-	-	-	Wādī al‘Arab
2012 Summer	study campaign						Wādī al‘Arab
2013 Summer	study campaign						-
2014 Summer	study campaign			645 m²	Y 125, half of AA–Z 125		-
2015 Spring	study campaign						-
2016 Spring	study campaign						-

Tab. 1.2 Overview of the archaeological seasons from 2001 to 2016 (Source: BAI/GPIA).

1.4.4.3. The 2001 Survey on Tall Zirā‘a and in its Hinterland

The first intensive fieldwork season for the ‘Gadara Region Project’ undertaken by the Biblical Archaeological Institute Wuppertal (BAI) began on September 11, 2001 and finished on October 2, 2001.

The survey area covered the whole tall, including the slopes. In all, 127 survey squares with an extent of 20 m x 20 m were examined, that is, 5.08 ha. Altogether 24,124 sherds (plus many remains of Roman – Byzantine roof tiles) were found and catalogued. In total 22,383 of these were detected in the course of the surface inspection of Tall Zirā‘a. Another 1,741 were found during the survey based on the Portugali Method[38] which entailed an examination of fifteen squares 10 m x 10 m of the tall surface to a depth of about one shovel, that is about 0.30 m deep (*Fig. 1.34*). A total number of 2,847 sherds were determined to be diagnostic. All sherds were evaluated both qualitatively and quantitatively.

38 Portugali 1982, 170–190.

Primarily, the chronological classification of the pottery gathered substantiates a long period of settlement activity on Tall Zirā'a, which extends from the Early Bronze Age well into the Ottoman period.

Within the scope of the geophysical exploration of the tall, geoelectrical mapping was undertaken, in order to facilitate planning the archaeological excavations in advance, developing precise excavation strategies, acquiring knowledge for non-excavated areas, and in order to leave large excavation areas undisturbed for coming generations (*Chap. 3.5.1.*). Two-dimensional as well as three-dimensional tomographic techniques were used. More than 50 profiles in various configurations were measured. The surrounding of the tall was also prospected. A digital contour map of the tall and its vicinity was created with these data.

The 2001 Survey Participants:

- BAI Wuppertal: J. Agrawal, A. Baker, K. Bastert-Lamprichs, J. Eichner, Ch. Hartl-Reiter, U. Koprivc, P. Leiverkus, A. Rauen, G. Reimann, D. Vieweger (director of project), and T. Winzer

Fig. 1.34 Survey work in 2001 (Source: BAI/GPIA).

1.4.4.4. The 2001 and 2002 Test Trench Excavation

In 2001, K. J. H. Vriezen, together with a small team from the University of Utrecht, opened a 6 m x 6 m test trench at the western edge of the tall (*Fig. 1.35*)[39]. He continued the work in 2002. Three recent walls were discernible on the surface. Below the surface layer, the team discovered another wall with an adjacent mosaic floor and a tabun. These were dated to the Byzantine period. Beneath this floor, a sequence of four Iron Age houses were uncovered. The lowest stratum showed a settlement layer with collapse debris of a mud brick wall. The excavators initially dated the collapsed wall to the Late Bronze Age, but later corrected the chronological assessment to Iron Age I[40]. Unfortunately, the lower parts of the sounding are severely disturbed by two huge pits dating from the Iron Age II, and are therefore of little use in regard to stratigraphy. As a result of the disturbance, the publication of the test trench was possible only after an objective comparison with the other contexts on Tall Zirā'a until that time[41].

Fig. 1.35 Trench openend by K. Vriezen in 2001. Strata 4 and 3, Area I, Square AF 115–116 (Source: BAI/GPIA).

1.4.4.5. The Summer 2003 Excavation Season with Geophysical Prospection

The 2003 season, conducted by the Biblical Archaeological Institute Wuppertal (BAI), was the first of 18 excavation seasons on Tall Zirā'a. The Tall Zirā'a Survey was also continued.

The excavations on Tall Zirā'a were concentrated on 200 m² of the tall's north-west side (Area I); eight 5 m x 5 m squares were opened, and explored to a depth up to 3 m. The 2001 Survey of the tall had provided a clear concentration of Pre-Classical period sherds (from the Iron Age and Early Bronze Age in particular), within this area, predominantly on the slopes. Four strata have been discerned:

39 Vriezen 2002a, 18 f.; Vriezen 2002b, 9 f.; Vriezen 2003, 13 f.

40 Dijkstra et al. 2005a, 5–26; Dijkstra et al. 2005b, 177–188.

41 Dijkstra et al. 2009.

- In the uppermost stratum (Stratum 4), a large house was found from the Byzantine era. Its rooms were almost exactly aligned to the north.
- The two following strata (Strata 12 and 11) date to the Iron Age. The architectural development of these two layers is quite different. In the upper Iron Age stratum the right-angled corner of a building was excavated; in its western part there was a silo lined with stones. The lower Iron Age layer was almost completely disturbed by later settlement activities.
- The Late Bronze Age settlement layer (Stratum 14) could only be partially excavated, particularly on the western slope (Squares AK/AL 116 and AM 116–118). A casematewall has been found. In the northernmost excavation Square AM 116, a small stonelined opening of a drainage, built into the casemates, was found (*Fig. 1.36*). Towards the south, a stonepaved tower followed.

  Several stone objects, a large number of pottery sherds, some bronze fragments and an alabaster stand were discovered in this area.

Pottery sherds from Tall Zirā‘a have been selected and analysed by the Biblical Archaeological Institute Wuppertal (BAI) together with the ‘German Mining Museum Bochum’. Research focused on a determination of the origin of the pottery: whether locally produced, produced in close proximity (e.g. in Gadara), or in more distant regions (e.g. Southern Levant, Syria, Cyprus) (*Chap. 3.8.1.*). Production technologies were also examined (*Chap. 3.4.*).

Six water mills of the Ottoman period were explored and surveyed in the Wādī al-‘Arab (*Figs. 1.37* and *3.55*).

An archaeological experiment, involving ethnological and technological-historical aspects, was also instigated. A bread oven (tabun) was built, with the individual steps of construction and utilisation documented and analyzed (*Chap. 3.4.1.*; *Pls. 3.3* and *3.4*).

A remote controlled camera fixed to a helium filled balloon was used to photograph the site from a height of 135 m above ground covering an area of approx. 15,000 m^2 (*Fig. 1.38*). The aerial photographs and survey points taken with a Global Positioning System (GPS), were used to identify and map archaeological sites, as well as to produce a contour map and a three-dimensional map of Tall Zirā‘a and its vicinity (*Chap. 3.2.*).

Furthermore, these procedures also provided excellent documentation for the overall situation of the excavation. A montage was created, by overlaying the ground survey control points of individual photographs to create an overview of the whole location (*Fig. 3.9*).

Fig. 1.36. Stone-lined opening of a drainage. Stratum 14, Area I, Square AM 116, Context 4776 (Source: BAI/GPIA).

Fig. 1.37 Penstock mill in the Wādī al-‘Arab (Source: BAI/GPIA).

Fig. 1.38 Aerial photograph of Area I. Photograph taken in 2003 from a helium filled balloon (Source: BAI/GPIA).

More photographic documentation of the excavation squares on Tall Zirā'a was supplied in the autumn of 2003 by perpendicular photographs, taken at an approx. height of 4 m over the excavation areas (*Chap. 3.2.*).

The Season Participants:

- BAI Wuppertal: W. Auge, A. Baker, D. Biedermann (geophysics), W. Bruns, S. Dörfling, A. Gropp, J. Eichner, M. Heyneck, J. Kleb (surveying, photogrammetry), P. Leiverkus (survey), A. Rauen (geophysics), Ch. Schubert, L. Unterbörsch, and D. Vieweger (director of project)
- DAI Berlin: J. Häser (director of project)
- 20 local workers

Fig. 1.39 Excavation at Area I. Summer 2003 (Source: BAI/GPIA).

1.4.4.6. The Spring 2004 Excavation Season

Fig. 1.40 Excavation at Area I. Spring 2004 (Source: BAI/GPIA).

The second excavation season, directed by D. Vieweger and J. Häser, was undertaken on Tall Zirā'a from April 4 to 17, 2004. It was a joint project of the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute of Archaeology Amman (GPIA). The main focus was the excavation of the north-western part of Area I. Ten new excavation squares (AM–AN 115, AN–AO 116–119; that is, 250 m^2) were opened with the active collaboration of 40 volunteers from the Protestant Academy Bad Boll.

In addition to the four strata identified in 2003 from the Roman – Byzantine period, the Iron Age and the Late Bronze Age, and an Early Bronze Age stratum was discovered[42]; a large city wall was excavated in a step trench on the steep slope.

Due to the number of cultural layers present on the tall, it was decided to limit exploration at this stage to the Late Bronze Age strata. Only after these strata had been excavated could a reliable exploration of older strata, in a sufficiently large area, be carried out at an adequate distance to the profile.

In addition to the typological review of the pottery finds, archaeometric investigation, based on representive samples, was continued by W. Auge (BAI Wuppertal) in close cooperation with the 'German Mining Museum Bochum' (A. Hauptmann) (*Chap. 3.8.*).

The Season Participants:

- BAI Wuppertal: W. Bruns (pottery reading), A. Gropp (square leader), M. Heyneck (square leader), J. Kleb (photogrammetry, survey), D. Jagsch (finds registration), H. Jagsch (photography, survey), L. Unterbörsch (square leader), and D. Vieweger (director of project)
- GPIA Amman: J. Häser (director of project)
- Volunteers from the Protestant Academy Bad Boll, April 4 to 16: K. Ammon, S. Bartschat, J. Bieler, H. Bigelmayr, K. Bocklitz, A. Cassel, H. Deininger, S. Deininger, B. Fischer, G. Fitzner, Th. Fitzner (head of volunteers), E. Güntzel, G. Haag, K.-P. Haala, R. Hartmann, H. Herdrich, Ch. Hirth, K. Hungerbühler, D. Komor, H.-J. Kröpsch, K. Kühnel, A. Laderick, K.-U. Leyhausen, S. Lichtenberger, S. Liebegott, W. Luckscheiter, K. Meyer, B. Neusüß, K. Pfeifer, A. Rau, J. Rau, H. Schmidt, R. Schreiber, J. Schulz-Baldes, R. Schweitzer, A. Schwermer, M. Strehl, G. Strobel, A. Wigger-Löffler, H. Wurm, and M. Wurm
- 10 local workers

42 This is Stratum 14 in the final report of the excavation on Tall Zirā'a.

1.4.4.7. The Summer 2004 Excavation Season

The Biblical Archaeological Institute Wuppertal (BAI), in cooperation with the German Protestant Institute of Archaeology Amman (GPIA) conducted a two-week archaeological field school as part of the ‘Teaching Course’ of the GPIA from July 20 to August 6, 2004.

Several stratigraphic questions, particularly the problem of the transition from the Iron Age to the Byzantine period in Squares AN 118–119 and AO 118 have been investigated.

A team of scientists from South Tyrol has documented three excavation squares with a 3D-pixel camera for presenting them as three-dimensional photographes.

The pottery documentation (including databases) was reviewed and optimised by an up-date of the used program.

The Season Participants:

- BAI Wuppertal: P. Leiverkus, F. Rave, A. Schwermer, and D. Vieweger (director of project)
- GPIA Amman: J. Häser (director of project)
- GPIA ‘Teaching Course’: M. Lang, K. Rieger, and Ch. Rösel
- 3D-Pixel (digitalisation and visualisation of objects): P. Daldos and G. Miribung
- 10 local workers

Fig. 1.41 Measurement of a pit in summer 2004. Stratum 6, Area I, Square AN 119 (Source: BAI/GPIA).

1.4.4.8. The Spring 2005 Excavation Season

A further excavation season was conducted by the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute of Archaeology Amman (GPIA) from March 5 to April 5, 2005. The main focus was to extend the excavation area in the north-west of the tall (Area I), in order to clarify the relationship between the building development of the Iron Age II settlement, including the ‘zigzag’ protective wall, with the impressive Iron Age I settlement, which had reused the ruins of the Late Bronze Age city for their habitation.

In all 20 volunteers and 15 local workers reopened 175 m^2 from previous excavations (Squares AH 115, AI 115–116, AK 115, AK 117, AP 118–119), while fieldwork continued over a total area of 675 m^2 of new ground.

During the 2005 excavation, four of the five strata which had already been explored were carefully exposed. In the uppermost stratum, the remains of three large houses dating to the Byzantine period were uncovered. Two houses, one with six rooms, and the other with four, had already been examined in 2003 and 2004. The orientation for both is almost exactly south-east/west. The walls are mostly constructed from undressed stones, with some dressed stones present. The western foundations of both houses are deeper than in the other directions. The buildings are eroded at the western part of the slope, near the edge of the steep incline.

A pebble-paved path or narrow courtyard could be exposed in the baulk of Square AM/AN 119. In Squares AK/AL 117 a courtyard for one of the houses, and in AK 117 and AI 116, a Roman – Byzantine house was uncovered.

Fig. 1.42 Aerial photograph of Area I. Photograph taken in spring 2005 (Source: BAI/GPIA).

Fig. 1.43 Ceramic figurine, TZ 007430-001. Dimensions: L 9.2, W 7.2, H 4.4. 3D-model: *App. 3.4. a* (Source: BAI/GPIA).

Fig. 1.44 Late Bronze Age tower and a sanctuary. Stratum 14, Area I, Squares AI and AK 115–117, AL 115–117 (Source: BAI/GPIA).

Two subsequent strata, dating to Iron Age II, were exposed in 11 squares (AM–AP 118–119, AL 118, AK 117 and AI 116). The 'zigzag wall' of this city had already been discovered in the 2003 and 2004 seasons.

The architectural remains of the Iron Age I stratum have been explored in 14 squares, and a coherent building structure could be established. The remains of the Late Bronze Age city wall had been reused during Iron Age I in almost all of the squares excavated until now.

In the sloped terrain of the excavation area (Squares AI–AO 115–117), it was possible to reach the Late Bronze Age layers; an imposing casemate wall was exposed; features uncovered included a large tower (*Figs. 1.44* and *1.52*). This city wall protected the western slope and included five internal rooms. Three stone slabs were detected inside a structure which was formerly interpreted as a gate. Two rooms were explored in the northern adjoining tower; one of them contained two column bases and a small plastered bench. There were two floor surfaces: a thick chalkplaster surface and below this, a stone pavement.

In the Squares AM–AN 116–117 and AL 117 three channels were exposed, which were covered by large stone slabs. They collected water from the north, east and south, which drained into the casemate at Square AM 116. It can be assumed that the 3 m deep shaft inside the city wall in Square AM 115 (first discovered in 2004) was part of this construction. At the foundation level of the Early Bronze Age glacis, the shaft deviates at an angle of approx. 30 degrees from vertical.

The architecture of the Late Bronze Age is very prestigious, and the finds discovered here reflect also the wealth of the city. A number of bronze objects—like knives and needles—were found, as well as the remains of ceramic figurines, and imported Mycenaean and Cypriote pottery.

The 3 m high city wall running along the western hill was further exposed and dated to the Early Bronze Age.

The Season Participants:

- BAI Wuppertal: A. Baker, S. Bartschat (square leader), W. Bruns (find registration), S. Dörfling (photography), A. Gottschalk, A. Gropp, M. Heyneck (square leader), J. Kleb (photogrammetry, survey), J. Kröpsch (architect), H. Pathe, U. Rothe (square leader), N. Schwarz, A. Schwermer (pottery reading), A. Thobe, L. Unterbörsch (square leader), and D. Vieweger (director of project)
- GPIA Amman: J. Häser (director of project)
- 15 local workers

1.4.4.9 The Summer 2005 Excavation Season

The sixth excavation season on Tall Zirā'a was conducted jointly by the the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute of Archaeology Amman (GPIA) from August 10 to 24, 2005. The focus was to conduct a review and update of the findings so far; this took place in the newly renovated dig house, located in the Ottoman period village, part of the archaeological site of Gadara/Umm Qēs. All finds from the 2001 Survey were reviewed individually, closely evaluated and added to the database, and all known artefacts and contexts were registered according to a uniform standard.

Since that time, all finds have been deposited systematically in the designated Tall Zirā'a storeroom at the dig house in Umm Qēs, where they are always readily accessible. A typological system for the ceramic finds was also developed at this time.

Fig. 1.45 Team member at work. Summer 2005 (Source: BAI/GPIA).

A geophysical survey was conducted in selected areas on Tall Zirā‘a. Furthermore, a regional survey was carried out in the Wādī al-‘Arab for monitoring sites which have already been registered during surface investigations by G. Schumacher[43], T. M. Kerestes[44] and J. W. Hanbury-Tenison[45] since the late nineteenth century.

The Season Participants:

- BAI Wuppertal: A. Cassel, A. Gropp, P. Leiverkus, A. Schwermer, L. Unterbörsch, and D. Vieweger (director of project)
- GPIA Amman: J. Häser (director of project)

1.4.4.10. The Spring 2006 Excavation Season

The sixth excavation season on Tall Zirā‘a was conducted from March 19 to April 22, 2006 by the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute of Archaeology Amman/Jerusalem (GPIA). While fieldwork continued in the already opened Area I, a new section was opened in the north of the tall (Area II).

The excavation site in Area I was extended by six squares (AG 115–116, AH 114, AH 116, AI 117, AP 117) during the spring season.

In Area I, 825 m^2 of previously opened excavation squares were further explored to a depth of 3.9–4 m. A Late Bronze Age layer (fifteenth to thirteenth century BC) was reached in all squares (Stratum 14). This layer is characterised not only by a massive casemate wall with several rooms, but also by a tower, set inwards with two rooms. One of these has served as a sanctuary, the function of the other room is unclear.

At the end of the spring season, remains of residential buildings, dating to the Late Bronze Age, were found for the first time. A large courtyard probably existed in Squares AL–AM 118–119, which was covered by a compacted pisé floor surface, paved with stones in some places. Three channels joined in this courtyard, draining water into the casemate in Square AM 117 (*Fig. 1.46*). Several rooms were arranged around the courtyard; namely in Squares AL 117, AL 118, and AN 118.

An older Late Bronze Age stratum was detected underneath the casemate wall, consisting of a channel and a wall along the slope; however, their structure could not be definitively determined[46]. Finally, the previously excavated prestigious Early Iron Age building (Iron Age I; twelfth and eleventh century BC) could be further explored. It is located to the east of the place where, in the later Late Bronze Age layer, a temple was discovered.

The Iron Age I settlement (twelfth and eleventh century BC; Stratum 13) shows a clear change of culture. Further fortification of the settlement could not be proved. The inhabitants of the Iron Age I settlement did not appear to create their own settlement layout; rather, they reused the walls of their Late Bronze Age predecessors.

The architecture in the older phase of the Iron Age IIA/B stratum (tenth to eighth century BC; Stratum 12) leads to the assumption that the tall’s population increased and that the settlement had an more urban character than the one in the Iron Age I (Stratum 13). Even though the fortifications are not as strong as those of the Late Bronze Age, the Iron Age II settlement was protected by a ‘zigzag’ city wall. Various modifications to the houses were made so that two building phases (older and a younger one) can be distinguished (Strata 12 and 11).

The younger building phase of the Iron Age II stratum (Stratum 11) is marked by an obvious rearrangement of the houses, though not the city wall. In the northern Squares AM–AP 117–119 and the southern Squares AG–AH 115–116, a dense agglomerated architecture could be traced. Three houses were identified in the northern area.

Archaeological finds from the Hellenistic and Early Roman period (fourth century BC to first century AD) were found in 10 of the 31 excavated squares. These indicated that this area was used in that period but not covered with buildings.

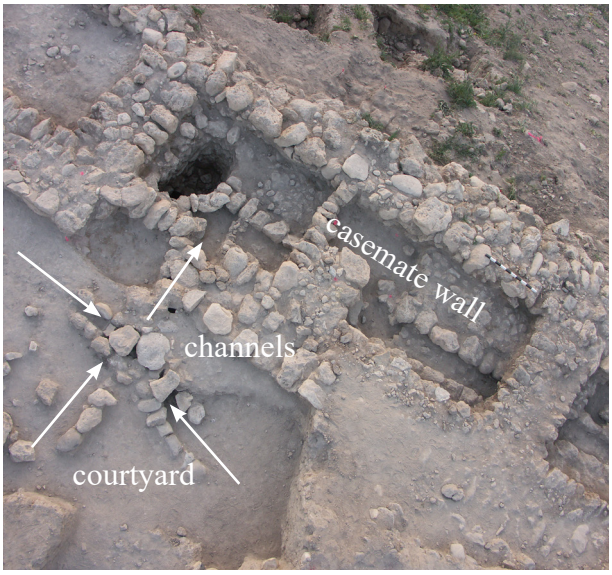

Fig. 1.46 Residential building with casemate wall. Stratum 14, Area I, Square AM 117 (Source: BAI/GPIA).

43 Schumacher 1886; Schumacher 1890.

44 Kerestes et al. 1977/1978, 108–135.

45 Hanbury-Tenison et al. 1984, 385–424 (text). 494–496 (plates); Hanbury-Tenison 1984, 230 f.

46 This is the later Stratum 15, the repair layer of the Middle/Late Bronze Age Stratum 16, which is affected by a landslide at this point.

Archaeological remains from of the Byzantine period were found in 18 of the 31 excavated squares. Five houses, sometimes with elaborated room arrangements, can be distinguished. A stone-paved path or courtyard in the Squares AM–AO 119, following the contour line of the slope, divided the buildings into a western and an eastern section.

A second excavation area was opened in the north of Tall Zirā'a (Area II). The prominently located Area II is one of the highest terrains on the tall's plateau and slopes slightly to the north-east. The physical topography provides the area with excellent protection by a 44 m high rocky precipice; government or administrative buildings were expected because of this. Squares AV–AW 128–129 (*Fig. 1.47*), and AX 129 were opened; all showed signs of recent looting.

A number of building structures were found in this small excavation area, which indicate that a very large building may exist here. Furthermore a paved courtyard, measuring more than 8 m x 4 m with an adjacent room in the south was detected. These could only be partially unearthed during the 14 working days; however, pottery finds indicate a Byzantine period dating.

The Season Participants:

- BAI Wuppertal: W. Auge, S. Burckhardt, M. Culibrk, S. Dörfling (photography), Y. Gönster, A. Gropp, M. Heyneck (square leader), T. Hofmann, J. Kleb (photogrammetry, survey), J. Kröpsch (architect), D. Krückmann, K. Kühne (square leader), A. Laderick, P. Leiverkus (photogrammetry, survey), W. Luckscheiter, S. Matzerath, H. Pathe, Ch. Schubert, A. Schwermer (pottery reading), K. Strauch, L. Unterbörsch (square leader), D. Vieweger (director of project), C. Voigt, and A. Warlies
- GPIA Amman: J. Häser (director of project)
- Volunteers, Thomas Morus Academy, Bensberg: (April 9 to 22): E.-M. Blanke, E. Bremekamp (head of volunteers), M. Bröcker-Garbers, A. Cassel, H. Dinkgraeve, I. Esser, U. Fries, N. Garbers, R. Hartmann, H. Herdrich, H.-M. Jakubik, B. Jantzen, Ch. Jütte, B. Kammann, K.-U. Leyhausen, B. Neusüß, A. Newerla, R. Peters, S. Quinke, K. Schmitz, R. Schreiber, Ch. Schultheis, U. Schwerer, M.-R. Simmon-Kammann, A. Straßburger, M. Strehl, G. Strobel, H.-J. Struck, K. Struck, P. Teichmann, F.-J. Vogel, J. Wendt, and A. Wigger-Loeffler
- 10 local workers

Fig. 1.47 Building structures. Strata 4 and 3, Area II, Squares AV–AW 128–129 (Source: BAI/GPIA).

1.4.4.11. The Summer 2006 Excavation Season

The summer 2006 excavation season on Tall Zirā'a served as a two week study excavation for the 'Teaching Course' held by the German Protestant Institute of Archaeology (GPIA), and at the same time as a short excavation season. Between August 3 and 16, 2006, the archaeological project focused on Area I in the north-west part of the tall, investigating problems with the stratigraphy of this habitation area in particular. The excavation centred around the Late Bronze Age Stratum 14 in Squares AG 115 and AH 115, and on a large Iron Age II (younger phase; Stratum 11) 'house unit' in the Squares AO 118 and AO 119.

During this excavation season another residential building, dated to the older phase of the Iron Age II, was completely investigated (Stratum12; Squares AO 118, and AO 119). This house contained a workshop area comprised of four longitudinal rooms/courtyards. They yielded interesting discoveries: a metal furnace with a crucible still *in situ* in the south-eastern part, together

Fig. 1.48 Jutta Häser (director of project). Summer 2006 (Source: BAI/GPIA)

with a well-constructed fireplace and a working platform in the north-eastern part. A tabun was discovered in the south-western room, and the north-western room contained four of them. It is possible that they were used simultaneously. Close to another room, three freestanding tall column bases made of field stones, a large storage vessel and a cultic stone (*mazzebe*) were found *in situ*, and another tabun with a smooth chalk working area was uncovered (*Fig. 1.49*).

Archaeometric work and experimental archaeology were undertaken near the tall in the Wādī al-‘Arab (*Chaps. 3.4.* and *3.8.*). Fifty vessels were manufactured on a hand-moved potter’s wheel from local clay. They were fired in a kiln which was modelled according to Late Bronze Age examples (*Chap. 3.4.2.3.*). All experiments were supervised by W. Auge (chemist at the BAI Wuppertal) and were documented in detail for archaeometric reasons.

The kiln experiment was continued by extensive follow-up investigations and analyses in Germany. The local clays and pottery sherds found on the tall were analysed for their chemical and mineralogical content, and the temperatures required to produce the pottery finds were calculated using firing experiments (*Fig. 1.50; Pls. 3.5–3.7*; *App. 3.5*).

The Season Participants:

- BAI Wuppertal: A. Abbadi, W. Auge (archaeometry), E. Brückelmann (draftsman), H. Brückelmann (pottery production), A. Cassel, M. Culibrk, A. Gropp, Ch. Heidel, J. Kröpsch (architect), K. Kühne, P. Leiverkus, A. Schwermer (pottery reading), M. Vahrenhorst, and D. Vieweger (director of project)
- GPIA Amman: J. Häser (director of project)
- GPIA ‘Teaching Course’: O. Cremer and St. Ernst

Fig. 1.49 *Mazzebe* (TZ 012653-001) on the left and two of three column bases on the right. Stratum 12, Area I, Squares AO 118–119, Contexts 2180 and 2162 (Source: BAI/GPIA).

Fig. 1.50 Archaeological experiment: firing the kiln in summer 2006. Film: *App. 3.5* (Source: BAI/GPIA).

1.4.4.12. The Spring 2007 Excavation Season

The spring 2007 excavation season of the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute of Archaeology Amman/Jerusalem (GPIA) took place from March 3 to April 10, 2007.

Four new squares (AE 115–116 and AQ 118–119) were opened in Area I. The focus was on the impressive Iron Age I house in the southern part of the area, already discovered in 2006. Therefore, the area around K. Vriezen’s test trench in Squares AF 115–116 was excavated (see *Chap. 1.4.4.4.*). The architectural complex situated there was comprised of two separate sections with separate entrances and a wall dividing the housing complex. This indicates that the building should be interpreted as a ‘double house’.

The Iron Age I layer is characterised by an impressive variety of architectural contexts (Stratum 13). There is hardly a greater contrast to imagine than in the immediate vicinity between the above mentioned double courtyard house in the south, stables and huts, storage pits lined with stones and tent positions in the centre of Area I. In many cases, the remains of the Late Bronze Age structures were reused.

A further focus of the excavation in Area I was the continued exploration of the Late Bronze Age stratum (Stratum 14). In addition to the impressive casemate wall, a tower with a sanctuary in one of the internal rooms, and other settlement structures were discovered and excavated inside the casemate wall. The paved inner courtyard of Courtyard House I and its stonecovered sewers were also unearthed. Courtyard House II consisted of four rooms built around a central courtyard with a covered area in the south which was supported by a column.

An additional building, with excellent stonework, was also uncovered in the northern part of Area I. Over an area of 2.5 m x 2.5 m 24 cylinder seals, an intact metal

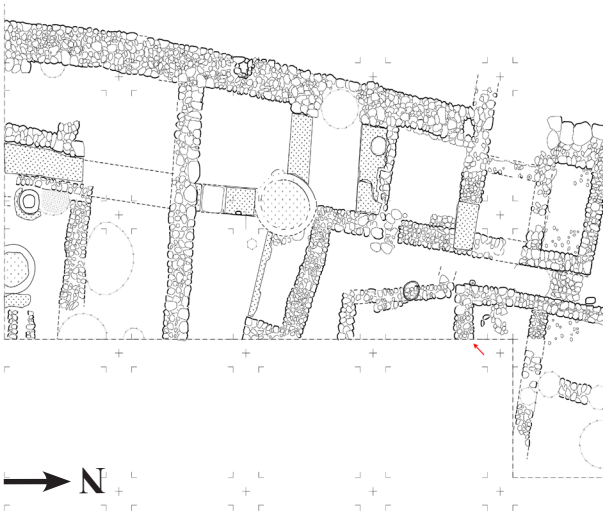

Fig. 1.51 Architectural scetch of the southern part of Area I. Stratum 13. Spring 2007 (Source: BAI/GPIA).

Fig. 1.52 Architectural scetch of the excavation in Area I. Stratum 14. Spring 2007 (Source: BAI/GPIA).

pendant with a figurative image and other valuable finds were found. They point to a special function of this complex, possibly as a temple (see *Fig. 1.52*). The building was protected to the north by the slope of the tall, which at this point is a high stone cliff. The topography explains why this is also the point at which the casemate wall ends.

In Area II large-scale building structures dating to the Roman – Byzantine and Umayyad periods were unearthened. Eleven more squares (AX–AY 128, AV–AY 130–131) were opened to the north and east side of the previous excavation area. The total excavation area now comprises 400 m^2, and reaches the outer limit of the plateau to the north.

A room and a large courtyard, which were constructed in various stages during the Byzantine period, were uncovered in 2006. Further parts of the courtyard were found in the north of the Squares AX–AY 128 and AX–AY 129 as well as in the baulk between Square AX 129 and AX 130.

The extension of the excavation area uncovered another building with the same orientation as the courtyard. The area between the eastern wall of the courtyard and the western wall of the new large building was paved with large stones. It may have been either an alley between two large buildings or another courtyard between two units of one building. The newly excavated area consists of three rooms running almost due south to north in AV–AY 130–131 in its latest stage of construction.

To the south-east, walls and domestic installations were attached to the large building complex in the Umayyad period. There was a small pit in the central room of this building which contained a typical Mamluk pottery vessel which let to the assumption of a—at least partial—reuse of the building.

The lowest level reached to date comprises a large east-west oriented wall, which was first uncovered in Squares AV 128–129 in 2006. During the excavation work, it became clear that it continued to the east in Square AW 130–131. Only the uppermost stones of what is thought to be a foundation wall could be perceived, and it was impossible to date it at this stage of the excavation.

The Season Participants:

- BAI Wuppertal: G. Albers (photography), F. Bachmann (square leader), A. Baker, H. Bremer, M. Bröcker-Garbers, S. Burkhardt, A. Cassel, N. Garbers, Y. Gönster (square leader), A. Gräbner, A. Gropp (square leader), J. Kröpsch (architect), K. Kühne (square leader), A. Laderick, P. Leiverkus (photogrammetry, survey), W. Luckscheiter, C. Mandanici, U. Rothe (square leader), A. Schomberg (square leader), R. Schreiber, A. Schwermer (pottery reading), K. Strauch, M. Strehl, D. Vieweger (director of project), L. Werther (square leader), and A. Wigger-Löffler
- GPIA Amman: J. Häser (director of project)
- Volunteers, Thomas Morus Academy, Bensberg: (March 19 to 30): E.-M. Blanke, Th. Deubel, I. Esser, B. Hellmann, H.-J. Hübner, H.-M. Jakubik, R. Mathias, G. Meuter, S. Meyer-Staufenbiel, K. Moser, E. Mularczyk, A. Newerla, V. Piesche, H. Rasten, G. Schwenkel, J. Soika (head of volunteers), P. Steiner, A. Straßburger, P. Teichmann, H.-U. Uehlecke, R. Weber, J. Wendt, and Th. Wieck
- 10 local workers

1.4.4.13. The Summer 2007 Excavation Season

Fig. 1.53 Aerial photograph of Area I. View from north-west. Photograph taken in summer 2007 (Source: BAI/GPIA).

The excavation team of the Biblical Archaeological Institute Wuppertal (BAI) together with the German Protestant Institute of Archaeology Amman/Jerusalem (GPIA) conducted the summer 2007 excavation season as part of the ‘Teaching Course’ held by the GPIA from August 1 to 16. The main focus of the season was to explore the Iron Age I (Stratum 13, *Fig. 1.54*) and II strata in Area I (Strata 12 and 11).

Work commenced in the southern squares of Area I (Squares AE 114–116 and AF 115–116), where the former test trench excavated by K. J. H. Vriezen of the University of Utrecht in 2001 and 2002 was located (see *Chap. 1.4.4.4.*). The trench was reopened and extended, in order to further define and consolidate his findings, which were unproved until now[47]. The area around the test trench was excavated; two strata of the Umayyad period and a significant stratum of the Byzantine period were uncovered in the Squares AE 114–115. Under these strata an Iron Age II house with an entrance (door hinge stone and threshold) was uncovered. The Iron Age II habitation had been disturbed by two very large pits, which made interpretation of this layer nearly impossible.

In the Squares AF 115–116, below the Byzantine stratum (Stratum 4), two Iron Age II layers were excavated (Strata 12 and 11), which had not been cut by Vriezen’s test trench. Approx. half a metre deeper than the Iron Age II layers, the up to this season unexcavated Iron Age I stratum (Stratum 13) was reached in most of the four squares from the test trench. The previously mentioned large building with carefully constructed walls of two or more rows of undressed stones in the south of Area I was completely uncovered in Squares AE 115–116 and AK 117; the new excavation exposed a very impressive ground plan.

Fig. 1.54 Silo made of clay. Stratum 13, Area I, Squares AG 115–116, Context 1922 (Source: BAI/GPIA).

47 Vriezen 2002a, 18 f.; Vriezen 2003, 13 f.; Dijkstra et al. 2005a, 5–26.

A new excavation area in the south of the tall (Area III) was opened; a Byzantine compound was expected to be found there, associated with a large cistern (10.4 m x 6 m x 5.75 m) which had been uncovered in 2001 (*Fig. 1.11*; see *Chap. 1.2.1.*). In the first instance, the current situation of the surface was documented with the help of aerial photographs. A lot of stones with no discernible context were removed from the area.

A test trench was opened (Square X 124; 10 m x 2 m); a paved floor of the building complex with a door way, a door hinge stone (out of context) and a water collecting basin near the door way (*in situ*) were uncovered.

A review of the material found during former seasons was carried out in the dig house in Umm Qēs/Gadara during the season.

The Season Participants:

- BAI Wuppertal: J. Berggötz, R. Brock (survey), A. Cassel, A. Gropp, Ch. Höher, N. Karagiannidou, K. Kühne, A. Laderick, P. Leiverkus (survey), W. Luckscheiter, U. Rothe, A. Schwermer (pottery reading), and D. Vieweger (director of project)
- GPIA Amman: J. Häser (director of project)
- GPIA 'Teaching Course': W. Auge, A. Basson, M. Heyneck, and M. Rohde
- Scholarship recipients from the Protestant University of Wuppertal: St. Billert, C. Plasche, and B. Stolz

1.4.4.14. The Spring 2008 Excavation Season

The spring 2008 season by the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute of Archaeology Jerusalem/Amman (GPIA) was undertaken from March 7 to April 14 in Areas I and II.

At the end of the season, Area I comprised 1,025 m² of excavated surface. The youngest stratum of Late Bronze Age habitation (fifteenth to thirteenth century BC; Stratum 14) could be reached in the whole area. Squares AQ 120 and AR 118–120 were newly opened. The impressive Late Bronze Age monumental structures in Area I are distinguished by their excellent state of preservation and the architectural precision.

Also remarkable are the number of finds from the Late Bronze Age temple in the north. Cylinder seals (*Fig. 1.55*; 3D-model of such as seal *App. 3.4 c*), scarabs, a miniature silver vessel, several bronze tools (needles, awls, a chisel, daggers) were uncovered, as well as an Egyptian or Egyptianising painted figurine and other figurine fragments. Furthermore, a large number of imported finds from Cyprus, Mycenae and Phoenicia were found.

In one of the courtyard houses in the south, a bottle-shaped and stone-lined pit in the ground was unearthed; the entrance was covered by a meticulously worked, disc-shaped stone with a diametre of approx. 1 m, with a 0.15 m wide hole in its centre; this pit was probably used for storage of grain. It was excavated to a depth of 2.6 m.

Monumental structures were uncovered in the north and south of the excavation area. The northern building had already been excavated in 2007. An impressive staircase, a small part of the courtyard and one more adjacent room to the east were unearthed in the 2008 season.

The house in the south of Area I was excavated further; four well made rooms were totally excplored, and parts of two additional ones were exposed. The solid architecture indicates both an important function of the complex and an important owner of the house.

The large number of glass beads that have been found, together with raw glass lenses and the appropriate industrial pottery vessels, suggest that glass objects were manufactured on Tall Zirā'a in the Late Bronze Age.

As the whole of Area II had been excavated in the 2007 season, the excavation area was extended by Squares AT–AU 128–133, AV–AW 132–133 and AX 132; the

Fig. 1.55 Cylinder seal from the Late Bronze Age temple in Area I, TZ 010105-001. Dimensions: H 3.3, D (max.) 1.4 (Source: BAI/GPIA).

Fig. 1.56 Byzantine/Umayyad building. Stratum 4 and 3, Area II, Square AT 128, Context 10571 (Source: BAI/GPIA).

Area II now covered a total of 825 m^2. As in previous years, the research of the Byzantine and Umayyad periods continued. The aim of this season for Area II was to continue excavating the large Byzantine building which had formed the basis of work here for the last two years (*Fig. 1.57*) .

The southern extension was comprised of three rooms and two courtyards, which were attached to southern walls of the structure. Two occupation levels were identified, both dated to the Byzantine period. Two complete amphorae, with two others which were almost intact, were found in the debris inside the rooms (*Fig. 1.56*). A tabun and two small cooking stoves were uncovered in the upper level in the northernmost room. The well preserved entrances to the rooms also belong to this level; these entrances were blocked at the end of the occupation. A tabun and a storage basin were found in the lower level in the northernmost room. In the room south of it, a floor surface of lime plaster was uncovered. Finally, a large stove was found in the eastern room, and another in one of the courtyards.

The easternmost extension of the large Byzantine building complex could be verified in the Squares AV 132 and AW 132. In these same squares, the eastern extension of a very wide wall of earlier date could be found. However, in Square AV 133 all walls broke off, due to the slope.

The Season Participants:

- BAI Wuppertal: W. Auge (archaeometry), F. Bachmann (square leader), A. Cassel, S. Dillmann (pottery reading), C. Fischer, Y. Gönster (square leader), K. Graffunder, A. Gropp (square leader), F. Kenkel (pottery reading), R. König (square leader), A. Laderick, A. Laube, P. Leiverkus (photogrammetry, survey), C. Mandanici (photography), A. Meyer, B. Neusüß, A. Piller, A. Quentmeier, A. Schomberg (square leader), R. Schreiber, B. Schröder (smallfind documentation), A. Schürmann, U. Schwerer, H. Steinmetz, A. Straßburger, D. Vieweger (director of-project), and A. Wigger-Löffler
- GPIA Amman: J. Häser (director of project)
- Volunteers, Thomas Morus Academy, Bensberg: (March 18 to 30): E. Barkowsky, R. Breitwieser, D. Dahm, H. Franz, B. Grote, R. Grote-Dhom, H. Gerstner, G. Haag, S. Hämke, H. Himmel, H. Hofschulte, G. Hofschulte-Fabian, H.-M. Jakubik, I. Kaul, T. Kuczera-Schwarz, W. Lanquillon, N. Laschinger, J. Luijendijk, G. Lüscher, L. Mathieu, V. Püttbach, Ch. Schultheis, J. Soika (head of volunteers), J. Tinz, H.-U. Uehlecke, E. Unkrig, M. Vogt-Werling, B. Weber, and Th. Weber
- 10–15 local workers

Fig. 1.57 Aerial photograph of Area II. Photograph taken in spring 2008 (Source: BAI/GPIA).

1.4.4.15. The Summer 2008 Excavation Season

Fig. 1.58 Visit of Her Royal Highness Princess Sumaya bint al-Hassan at GPIA Amman in summer 2008 (Source: BAI/GPIA).

The summer 2008 excavation season was conducted from July 19 to August 2 by the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute of Archaeology Amman/Jerusalem (GPIA) within a ‘Teaching Course’ held by the GPIA. Two weeks were reserved for the processing of finds from previous seasons, and two further weeks for the excavation on the tall. On July 16, D. Vieweger and J. Häser presented the ‘Department of Antiquities of Jordan’ (DoA) 250 restored objects found on Tall Zirā‘a. The ceremony was attended by H. R. H. Princess Sumaya bint al-Hassan, H. E. Dr F. al-Khraysheh (Director General of the Department of Antiquities), H. E. Dr F. Nimri (Director of the Jordan National Museum), H. E. Dr J. Heidorn (German ambassador), colleagues from Jordanian and international archaeological institutions along with members of the Jordanian and German press (*Fig. 1.58*).

Fig. 1.59 Excavation in Area III. Summer 2008 (Source: BAI/GPIA).

An Iron Age I silo (Stratum 13) located in Square AE 116 was removed; a 'window-pot' used as a small shrine was discovered inside (*Fig. 1.60*). Another stone silo (*Fig. 1.62*), probably used to store grain, was uncovered in the Late Bronze Age stratum (Stratum 14) when removing the occupation layer from the courtyard (Squares AF–AG 116); a well made mace head and an Egyptian faience figurine were the most remarkable finds (TZ 012657-001). The figurine, which was broken into two parts is shaped as an Uschebti (*Fig. 1.61;* 3D-model: *App. 3.4 b*).

The summer 2008 excavation focused on the new Area III, located in the southern part of the tall plateau. This is the highest point of the plateau, and a large number of stones and wall structures are discernable on the surface. In total 24 squares were opened in Area III: Squares U–X 123–128; a total of 600 m^2 on which a Byzantine complex could be excavated area-wide (except for the Squares U–V 127–128).

A large courtyard (c. 12 m x 12 m) was exposed, with a gateway comprising of finely dressed stones; there was a hole in the threshold stone, for the locking mechanism. Opposite the gate, across an alleyway, a large wall (preserved to c. 1 m height) was revealed, with a long, low bank attached to the southside. A damaged mosaic was uncovered in the middle of the courtyard; a large roundel of coloured stones (red, black and white) was embedded into a thick, white plaster floor surface (*Fig. 1.84*). The opening of a large underground barrel-vaulted cistern was uncovered to the east of the courtyard. A basin and a channel leading into the cistern from the north was placed into the mosaic floor.

The Byzantine wall structures were later reused and new, more irregularly-built walls added, thus creating a number of smaller units. These new structures may belong to either the Umayyad and/or Abbasid periods. The new walls are mainly of fieldstones. In Squares U 123–125 and V 123–125 earlier walls had been leveled and used as flagstones for a large, well-paved courtyard. In Squares W 124–125 and X 124–125 (to the north) a wall dated to either the Umayyad or the Abbasid period was built inside the large Byzantine courtyard.

In Squares W 127–128 and X 127–128 an Umayyad complex was revealed; the walls are preserved to a height of over 1 m, and the remains of finely built doorways with threshold stones came to light. In the interior of the complex, one of the rooms was filled with charcoal and ash, and the remains of nails, hinges and handles from a well-built door were found. The courtyard of the complex was used over a long period of time; various floor surfaces were revealed, each with a tabun oven embedded into the floor. In the north-easternmost room of the excavation area, a well-preserved olive press was uncovered, consisting of a segmented stones, bordered by a thin wall on the outside. There was a square opening in the middle of the stone wheel hub for the structure which had supported the arm of the press. The press at this point is c. 0.40 m high above the floor surface; however, the bottom has not yet been reached. Further study is necessary to reveal the chronological connection between this complex and the courtyard complex further to the west, which is situated higher up the slope and still divided by a large, multi-phased wall.

The excavation of the shallow stone structures, which had been visible on the surface, are dating to the Mamluk period or later.

Fig. 1.60 Small shrine, TZ 005552-010. Dimensions: H 23.5, D (max.) 21.5 (Source: BAI/ GPIA).

Fig. 1.61 Uschebti figurine made of faience, TZ 012657-001. Dimensions: L 8. 3D-model: *App. 3.4 b* (Source: BAI/GPIA).

The Season Participants:

- BAI Wuppertal: A. Cassel, Y. Gönster, F. Kenkel (pottery reading), A. Laderick, P. Leiverkus (survey), A. Quentmeier, Th. Schierl, A. Schwermer (pottery reading), and D. Vieweger (director of project)
- GPIA Amman: J. Häser (director of project)
- GPIA ‘Teaching Course’: K. Gies
- Scholarship recipients from the Protestant University of Wuppertal: L. Grimm and N. Oebbecke
- University Lecturer and Students from the University of Edinburgh: C. Branagan Allen, U. Rothe (head of excavation), and B. Sherry
- M. Werling, together with 10 students from the Fachhochschule Köln, Fachbereich Baugeschichte und Bauen im historischen Kontext
- 15 local workers

Fig. 1.62 Stonelined pit. Stratum 14, Area I, Square AG 116, Context 3701 (Source: BAI/GPIA).

1.4.4.16. The Spring 2009 Excavation Season

The spring 2009 season was conducted by the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute of Achaeology Jerusalem/Amman (GPIA), and took place from March 2 to April 16. Excavations were carried out in Area I and Area II.

The Late Bronze Age city of Stratum 14 had been exposed over approx. 1,000 m² of Area I in 2008. An impressive city groundplan was uncovered 22.9 m below sea level. So far, excavations had revealed several courtyard houses, two particularly large house complexes (not yet excavated in their entirety), a casemate wall and a tower with a sanctuary. In order to clarify the earlier architecture of this area, the focus in 2009 was to remove and excavate the central part, which was protected by the casemate wall, and to uncover the next level.

In doing so, the long process of uncovering the stratigraphy of the tall, which in the coming years will lead to the fourth millennium BC (the Early Bronze Age), was continued. Terraced excavation on the western slope of Area I has enabled the heights of the various levels to be measured (cf. the measuring point of Umayyad level at 17.04 m below sea level): the oldest Late Bronze Age level is c. 24.5 m below sea level, the three Middle Bronze Age levels are c. 25.4 m below sea level, 26.05 m below sea level and 26.35 m below sea level respectively, and a 3 m thick Early Bronze Age fortification was uncovered 31.2 m below sea level.

A water channel and the inner side of slope fortifications were already visible under the more recent Late Bronze Age casemate wall that was removed this spring. These structures were not, as previously assumed, part of a cohesive Late Bronze Age urban building complex, but rather the final phase of an elaborate renovation of the fortification structure in the western part of the city. Initially, only a cobbled area approx. 8 m wide was visible inside the channel that led from one of the two very large house complexes to the downward drain. The cobblestones overlay six consecutive layers of rubble, with a total thickness of 2.5 m, which had been carefully stabilised and compacted, then each of them covered with horizontal paving. On the slope side, the pavings were

Fig. 1.63 The big Nothing—layers of rubble under the casemate wall. Remains of Strata 16, 15 and 14 (Source: BAI/GPIA).

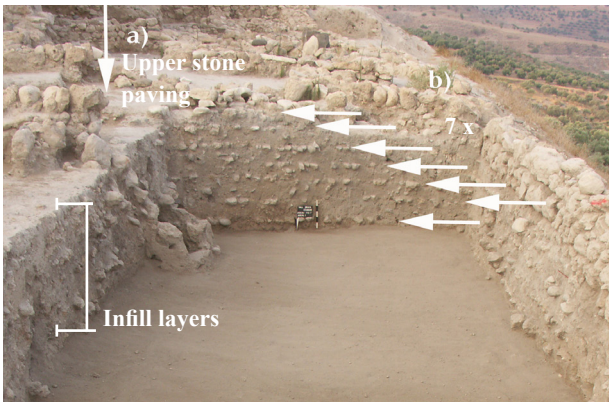

Fig. 1.64 Rubble and paving layers in the profil; on the top centre: remains of Strata 15 and 14 (Source: BAI/GPIA).

Fig. 1.65 Aerial photograph of Area II. Photograph taken in spring 2009 (Source: BAI/GPIA).

bordered by a wall (*Fig. 1.64*). However, because more than 75 % of the finds in these rubble layers consisted of Early Bronze Age pottery sherds, it appears that debris was brought up from the foot of the tall and used in the elaborate foundation work for the Late Bronze Age city.

The high wall at the slope was successively reinforced by layers of rubble from behind. Finds such as a tabun, which was found in one of the paving layers in this structure, indicate that there were probably long time intervals (perhaps the changing of the seasons) between the construction of the various layers, which enabled the top layer to compact and as such be strong enough to support the next layer. Some of the paving layers were linked to minor architectural and functional features which we were unable to interpret.

A major landslide that affected a large area at a distance from the northern edge of Area I during the second construction phase of the Late Bronze Age city was probably caused by an earthquake or flood; there was no indication of manmade destruction, such as a siege. Maybe it was a combination with a collapse of underground caves as they are typical for the natural sinter-hill Tall Zirā'a. The remains of the Late Bronze Age strata were, however, recoverable in the eastern part of Area I, and indicate the severity of the catastrophe; destroyed walls, uprooted paving, and rooms that had fallen down the slope. A similar phenomenon occured on the eastern side of the tall (*Fig. 1.68*).

The enormous reconstruction effort described further above suggests that ownership of the building-ground did not change; the latest stratum excavated up until 2008 was built on two exterior walls that had survived the landslide, and consisted of a courtyard house in the same place with a very similar ground plan to its predecessor, including a tabun in the same room.

A section of an elaborately constructed large house complex (Stratum 14) with well built foundations had been uncovered in the northern part of Area I during the spring 2007 season; this was investigated further in 2009, with the intention of excavating it entirely. To this purpose, Squares AP 120–123, AQ–AR 121–123, AS–AT 119–123 were opened.

In the north-eastern part of Area I, comparable to the nearby part of Area II, several strata with residential debris from the Hellenistic, Roman and Byzantine periods were uncovered. It became clear that this housing development was associated with the remains of the same periods in Area II, and conceivably extended from the hills there to the spring. This residential area reached the outermost north-eastern edge of Area I.

To this date a Umayyad house, together with Byzantine and Roman settlements, all of which contained rich finds, have been uncovered. Also remarkable is the fact that, in the north-eastern area, the Hellenistic stratum has not only pits, which are common for this period in Area I outside the settlement, but also domestic structures.

The 2009 spring season also uncovered four well-built, stone-lined silos from the Iron Age to the Hellenistic period outside the habitation area.

During this year's season, the earliest construction phase of Iron Age II was reached in the northern part of Area I; the remains of the city wall and several well-preserved ovens were found. However, the actual floor level was reached only in some areas, not all. Two almost

Fig. 1.66 Iron Age II kiln. Stratum 10, Area I, Square AT 121, Context 4100 left and Context 4133 right (Source: BAI/ GPIA).

Fig. 1.67 Part of Byzantine building. Strata 4 and 3, Area II, Square AX 127 (Source: BAI/ GPIA).

complete ovens/kilns, constructed with many layers of insulation, were examined in more detail, and material samples were taken for archaeometric analysis (*Fig. 1.66*). Eight ovens (tabun) were found. The ash fill from two of the ovens contained multi-handled pots; this style is also unusual. The fill was also collected for archaeometric analysis.

Particularly noteworthy Area I finds from this season are jewellery items: e.g. beads made of glass and other materials. Several faience and metal finds, another cylinder seal, and a coin were also discovered.

Although the northern and eastern limitations of the building complex in Area II had been defined in 2008, the southern and western limitations were still unknown. Therefore, the excavation area was extended by the Squares AR 132–134, AS 126–134, AT–AU 126–127 and 134, AV–AX 126–127 (*Fig. 1.67*) and AY 127; the excavation area now extended over an area of 1,500 m^2.

It became apparent that the building had a large, irregularly shaped courtyard in the west; another structure was built inside it during the Umayyad period. Umayyad modifications were also uncovered to the east.

As the walls of the Byzantine period building complex were being removed, wall remains from the Roman period were uncovered. Although these were quite damaged, it was clear they belonged to different construction phases. Furthermore, it became apparent that the broad east-west oriented wall which had been uncovered in the previous seasons lay underneath the Roman structures, and must therefore derive from an earlier period; the ceramic finds point to a Hellenistic date. The wall extended to the western edge of the excavation area, but did not terminate. As it does not reappear in Area I, it is presumed that it is either interrupted, or turns to follow another direction.

The Season Participants:

- BAI Wuppertal: W. Auge (archaeometry), F. Bartenstein (square leader), A. Cassel, T. Floerkemeier (smallfind registration), D. Fricke, E. Fricke, E. Gitt, Y. Gönster (square leader), A. Gropp (square leader), H.-M. Jakubik, I. Kaul, F. Kenkel (pottery reading), A. Laderick, P. Leiverkus (photogrammetry, survey), M. Lehmann (square leader), B. Neusüß, S. Olschok (square leader), A. Quentmeier, A. Schomberg (square leader), R. Schreiber, B. Schröder (square leader), Ch. Schultheis, A. Schwermer (pottery reading), C. Siebenhaar, K. Soennecken (square leader), H. Steinmetz, A. Straßburger, M. Strehl, D. Vieweger (director of project), M. Voigt-Werling (architect), and A. Wigger-Löffler
- GPIA Amman: J. Häser (director of project)
- Volunteers, Thomas Morus Academy, Bensberg: (March 29 to April 9): Th. Hettlage, L. Kluß, E. Langendörfer, V. Schipanski, R. Surmann, J. Temsch, H.-U. Uehlecke, J. Uehlecke, E. Unkrig, J. Soika (head of volunteers), J. Voss, T. Wieck, and I. Zürrer
- 20 local workers

Fig. 1.68 Tall Zirā‘a. Landslide on the east side. Photograph taken in 2009 (Source: BAI/ GPIA).

1.4.4.17. The Summer 2009 Excavation and Survey Season

The first survey season in the Wādī al-'Arab was conducted from July 28 to August 15, 2009 (*Fig. 1.69*; *Chap. 3.6.1.*).

With the knowledge of the previous surveys[48] and the target of a hinterland survey in mind, the chosen approach was two-fold: firstly, to revisit the known sites in order to enrich current knowledge, and secondly, to fill gaps in knowledge by surveying areas that had not been surveyed before.

In total 78 sites were recorded in this season; 30 of them have not been published, and may not have been known before. Most of them relate to the Roman and Byzantine periods; the others were used in the Bronze Age, Iron Age or at some point in the Islamic period. No lithic sites were discovered.

The large Tall Qāq (Ḫirbet Bond) and Tall Kinīse (Ra'ān) were revisited. The area around the Wādī al-'Arab Dam was also covered. Additionally, the upward slopes of the Wādī al-'Arab from Tall Zirā'a to the region of Ṣēdūr and Dōqara were surveyed. Higher up in the Wādī al-'Arab from Tall Zirā'a, five penstock mills were recorded, together with two dams (*Figs. 1.37* and *3.55*).

A short excavation season was executed on Tall Zirā'a from July 28 to August 4, 2009 in Squares AN 116–117 and AO 117–118 of Area I. The soil and stone layers were excavated from the compacted rubble stratum found during the excavation in 2008. This stratum was built up after a catastrophic landslide for constructing the new settlement in the late sixteenth/early fifteenth century BC. After 3 m, the end of these layers has not been reached yet.

The Season Participants:

- BAI Wuppertal: K. Adam, W. Auge, E. Brückelmann (draftsman), A. Cassel, A. Gropp, F. Kenkel (pottery reading), A. Laderick, P. Leiverkus (survey), A. Quentmeier, B. Schröder, A. Schürmann, A. Schwermer (pottery reading), K. Soennecken (survey), and D. Vieweger (director of project)
- GPIA Amman: J. Häser (director of project)
- Bergische University of Wuppertal, Department of Printing and Media Technology: G. Bülow and J. Große-Frericks
- GPIA 'Teaching Course': D. Fricke, E. Fricke, and P. Voß
- 5 local workers

Fig. 1.69 Landscape of Wādī al-'Arab. View to the north. Photograph taken in 2003 (Source: BAI/GPIA).

1.4.4.18. The Spring 2010 Excavation Season

The excavation of the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute of Archaeology Jerusalem/Amman (GPIA) from February 22 to April 14, 2010 concentrated on the north-eastern living complexes of Area I.

Significant insights were gained from excavation of the six Classical (Hellenistic, Roman and Byzantine) layers in this section. Large storage silos were uncovered in Area I; these were dated to the Iron Age and the Hellenistic period. The excavation also determined the association with the adjacent buildings of Area II, where these layers had already been comprehensively investigated. The northern part of the tall (Area II) was the nucleus of the Hellenistic and Roman period habitation; the north-eastern part of Area I is thus the south-western section of this nucleus. Only in the very prosperous Byzantine period did the settlement spread out beyond this nucleus to cover the whole tall plateau (including Areas I and III).

Area I also provided particularly suitable conditions for craftsmen. Further structures in the residential areas, which were associated with workshop installations, were

48 The Wādī al-'Arab has been surveyed several times before: cf. Glueck 1951a, 182; Mittmann 1970; Hanbury-Tenison et al. 1984, 385–424 (text). 494–496 (plates).

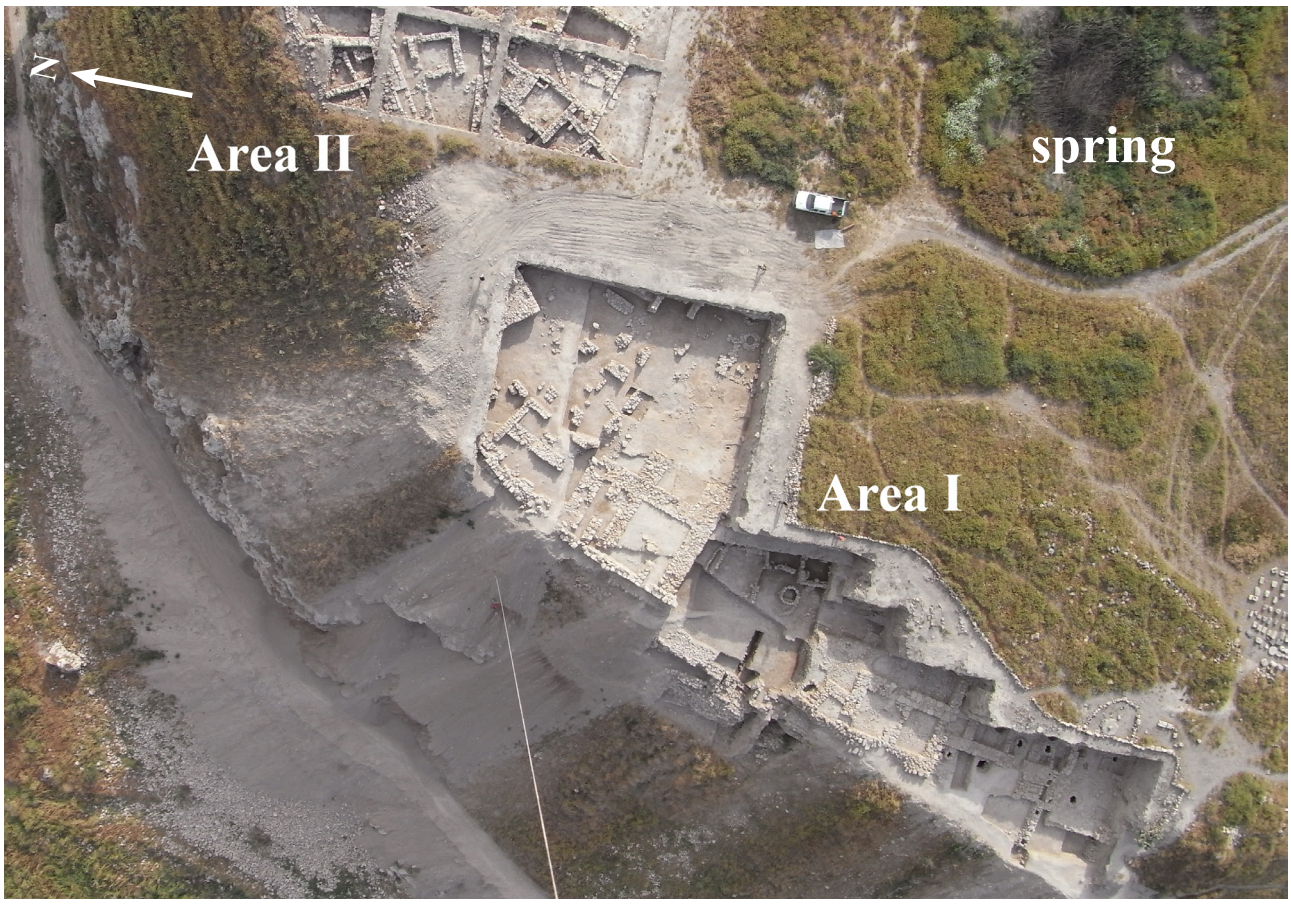

Fig. 1.70 Aerial photograph of Area I and a part of Area II. Photograph taken in spring 2010 (Source: BAI/GPIA).

uncovered. The finds from this area provided spectacular insights into glass, faience, quartz frit, and metal production or processing on the tall.

The Late Iron Age IIA/B strata in the northern part of Area I were partially disturbed by later Hellenistic and Roman activities (wall foundations, grain silos and pits). The underlying Iron Age I structures were far better preserved. Within one of these houses a hearth, associated with a variety of precisely fashioned flint tools, suitable for diverse functions, was uncovered. Altars, cultic stones (*mazzebot*) and a flat divided ceramic basin with a round outlet point to a ritual context (*Figs. 1.72; 3.41* and *3.42*). Several parts of a faience box, a faience knob and a complete cylinder seal of quartz frit, besides raw glass and slag, indicate that this room was a workshop.

The deep trench that had been started the year before in the middle part of Area I was continued; terraced infill layers to stabilise the terrain following a landslide were uncovered. The slope in this area had been repaired in the Late Bronze Age with many layers of stones and soil; more than ten layers were uncovered in 2010. The more central part of Area I which had not been affected by the landslide provided an opportunity to track the continous transition of the settlement sequence until the Middle Bronze Age. Particularly important here was the discovery of a furnace, constructed in the Middle Bronze Age and continued to be used into the Late Bronze Age (*Fig. 1.37*).

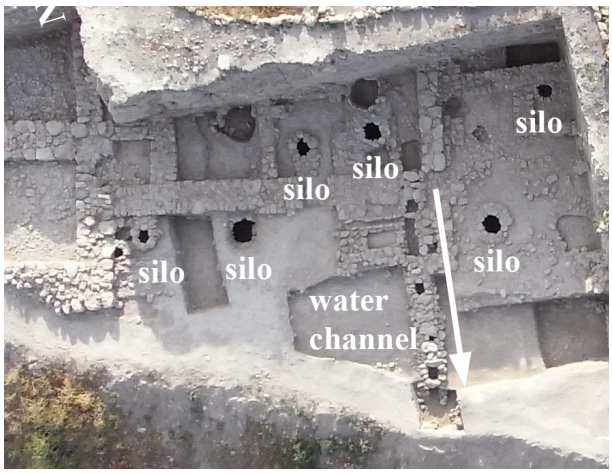

Fig. 1.71 Late Bronze Age water channel and grain silo. Stratum 14, Area I, Squares AG–AH 115–116 (Source: BAI/GPIA).

Fig. 1.72 'Ceramic basket', TZ 006835-016 with a *mazzebe* (a cultic stone, TZ 310339-001). Stratum 13, Area I, Square AP 120, Context 4852 (Source: BAI/ GPIA).

One of the Middle Bronze Age layers also yielded a crucible containing several bronze fragments.

In the southern part of Area I, all habitation phases until the catastrophic landslide around 1500 BC were uncovered. Of particular importance are the various installations built to drain water out of the city. This seems to have been an important consideration on the tall, not only because of the artesian spring in the centre, but also due to heavy rain which typically falls in the winter. Three stonelined vertical channels at the edge of the slope were excavated to a length of 2 m, while a large stormwater shaft with an impressive drainage capacity was excavated to a length of 10 m (*Fig. 1.71*). The latter was particularly well made; stonelined, it was covered at the top and displayed openings (entrances) that had been dug in order to clean and repair it underground.

In the southern part of Area I, the Late Bronze Age city had seven subterranean grain silos lined with stones that were covered with large, round stone lids. They were 2.6–3.3 m deep, with compacted clay floors (*Fig. 1.71*). Their dimensions and elaboration are a good indication of the wealth of the tall's population at this time.

The Season Participants

- BAI Wuppertal: W. Auge (archaeometry), M. Biehl, A. Cassel, H. Diekmann, A. Eigenfeld, S. Fröse, K. Gilles, A. Gropp (square leader), U. Haase (square leader), St. Hoss (smallfind documentation), H.-M. Jakubik, J. Kirschfink, Ch. Köhler, F. Kenkel (pottery reading), E. Kralli, A. Laderick, P. Leiverkus (photogrammetry, survey), J. Molitor (smallfind documentation), B. Neusüß, A. Penninger, St. Raubach (pottery reading), A. Röder (square leader), P. Schaller (photography), R. Schreiber, S. Schütz (square leader), A. Schwermer (pottery reading), K. Soennecken (square leader), H. Steinmetz, A. Straßburger, M. Strehl, D. Vieweger (director of project), M. Voigt-Werling (architect), K. Weber (square leader), and V. Wissner
- GPIA Amman: J. Häser (director of project)
- Volunteers, Thomas Morus Academy, Bensberg: (March 26 to April 5): U. Fahr, H. Koppe, J. Krings, E. Krüger, H.-J. Krüger, J. Listemann, E. Mathias, R. Mathias-Pauer, P. Mundy, J. Nitschke, U. Parnow, H. Raber, B. Ruberg, B. Schneider, A. Schwegler, J. Soika (head of volunteers), St. Steenken, R. Surmann, H. Taflinski, J. Tinz, J. Ucher, H.-U. Uehlecke, Th. Ultsch, F. van Bernem, U. van Bernem, F. Vogel, J. Weisbrich, and H. Wieseler
- 20 local workers

1.4.4.19. The Summer 2010 Excavation and Survey Season

The 2010 season was conducted between July 18 and August 9 in Squares AL–AM 118, AO 118, and AM–AO 119 of Area I. Three strata of the Middle Bronze Age settlement were uncovered. Evidence of copper processing was discovered in some of the squares (*Fig. 1.73*). At the end of the excavation, a stratum with archaeological remains of the transition from Early to Middle Bronze Age was uncovered.

A survey of the Wādī al-'Arab and its vicinity was conducted by the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute for Archaeology Amman/Jerusalem (GPIA) from July 17 to August 9, 2010 (*Chap. 3.6.1.*).

This season in all 57 sites were recorded. The survey covered the area from the village of Dōqara in the west up to the vicinity of Irbid in the east.

Fig. 1.73 Middle Bronze Age furnace. Stratum 15, Area I, Square AM 119 (Source: BAI/ GPIA).

The Season Participants:

- BAI Wuppertal: W. Auge (archaeometry), T. Bühler, A. Cassel, A. Gropp, I. Holzmann, F. Kenkel (pottery reading), S. Kraushaar, A. Laderick, P. Leiverkus (survey), A. Quentmeier, B. Schröder, M. Schulze (archaeometry), A. Schürmann, A. Schwermer (pottery reading), K. Soennecken (survey), and D. Vieweger (director of project)
- GPIA Amman: J. Häser (director of project)

1.4.4.20. The Spring 2011 Excavation Season

The seven-week excavation season of the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute Jerusalem/Amman (GPIA) took place from March 6 to April 25, 2011; the work focused on Area I in the north-west and Area II in the north of the tall.

Three different parts of Area I were excavated in 2011. The first part is in the centre of Area I; it is the part in the east of Area I which was not affected by the landslide around 1500 BC and therefore where architectural features of older structures remained. Two strata of the Early Bronze Age IV/Middle Bronze Age I transitional period were uncovered here; two levels with ephemeral remains of habitation from this period were excavated. The remains consisted of many pits, fireplaces, occupational floors, and some faint indications of stone walls. The finds imply that this area was used for residential activities such as cooking, grinding and storage. Underneath the scattered phases, a new occupational layer with real house structures from the Early Bronze Age III was reached.

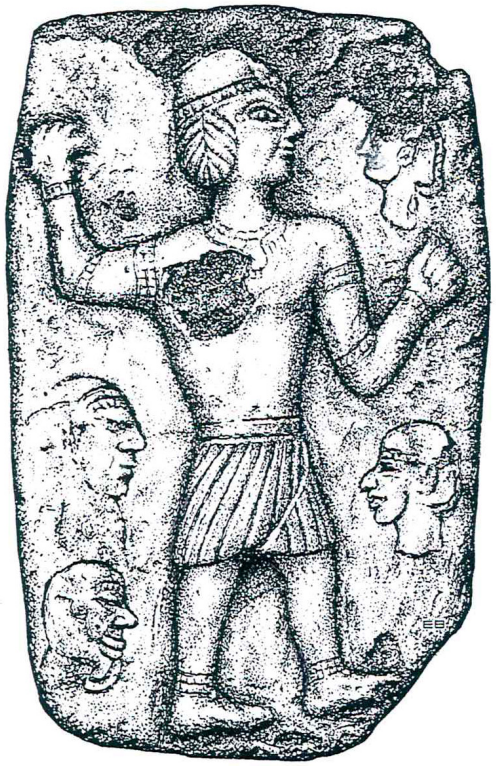

Fig. 1.74 Early Iron Age votive plate with the representation of a king, TZ 018181-001. Dimensions: W 12.5, H 19.1 (Source: BAI/ GPIA).

The second part of the Area I excavation was located on the western slope. During the 2010 season, a straight channel had been found, which ran from the final Late Bronze Age level straight down through the city wall (which cuts the slope here) and a glacis, which were both built in the Early Bronze Age (*Fig. 1.76*). This season, the relationship between the wall, the glacis and the channel was further examined, and the end of the channel was reached; thus the course of the channel from beginning to end could be ascertained and a Late Bronze Age date of the channel could be proved.

The third part of the excavation in Area I explored the extension of the northern area, which was opened in 2007. In the southern part of this area, a large Late Bronze Age building with a pebble paved courtyard had been excavated in 2010. The 2011 excavation revealed that the courtyard was bordered on the east side by a line of four rooms (*Fig. 1.77*). The northern limit was made by a thick wall. However, only the foundation trench of this wall could be determined by the edge of the court-

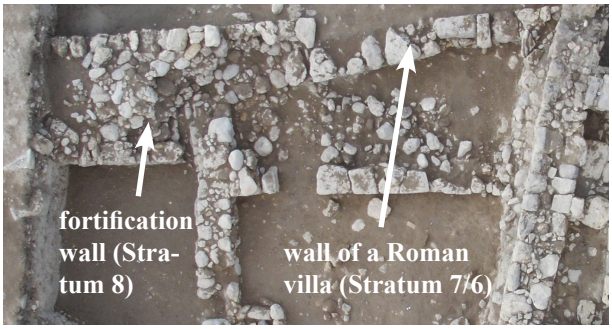

Fig. 1.75 Hellenistic and roman structures. Stratum 8 and 7/6, Area II, Squares AU–AT 126–127 (Source: BAI/ GPIA).

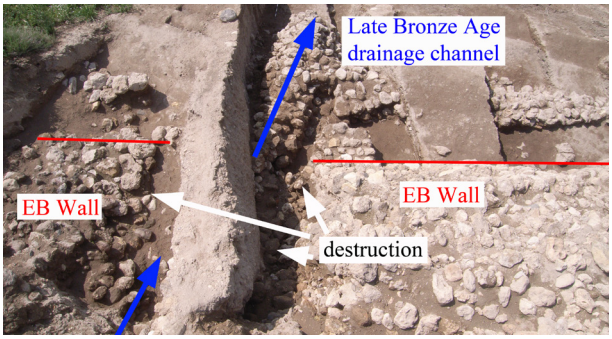

Fig. 1.76 Late Bronze Age channel (Strata 15 and 14) running through the Early Bronze Age city wall (Stratum 25) (Source: BAI/GPIA).

yard pavement on one side, and the edge of the foundation trench on the other; the stones of the original wall had been completely robbed by the inhabitants of the Iron Age I settlement and its associated building activities.

North of the large building with its courtyard and adjoining eastern rooms, walls of different houses of the Iron Age I occupational phase were excavated.

Underneath the Iron Age I stratum, a Late Bronze Age stratum was uncovered; however, for the most part, stone foundations only, from several rooms, were found. The remains of mud brick walls covered with lime plaster were uncovered in only a few places.

An exceptional find from the Iron Age I stratum (Stratum 13) in this area is a ceramic votive plate which depicts a king in a relief (*Fig. 1.74*). He is sourrounded by four heads scratched into the clay (and additionally one head on the back side). Maybe they represent the defeated enemies.

No new squares were opened in Area II during the 2011 season. The focus of the work was to clarify the stratigraphic relationship of the wall structures from the Hellenistic, Roman, Byzantine, Umayyad and Mamluk periods.

During this campaign, the development of the Byzantine building complex could be revealed.

In the following Umayyad period, the Byzantine building structures continued to be used, but modified. Also new houses were built which were placed at those spaces previously unbuilt before, i.e. inside the large western courtyard and at the north-eastern flank of the hill.

While the Byzantine period walls were being dismantled, additional wall remains were uncovered; two strata were identified, both dated to the Roman period (Strata 7 and 6). Since the Roman architecture was almost completely leveled before the construction of the Byzantine building, the traces of the Roman period were very hard to identify.

South of the wide Hellenistic wall, further faint remains of walls belonging to the same period could be identified. They were severely damaged by the levelling of the area before constructing the Roman building (*Fig. 1.75*).

The Season Participants:

- BAI Wuppertal: W. Auge (archaeometry), T. Aukes, G. Bongartz (aerial photogrammetry), A. Cassel, L. Erlacher, Th. Graichen, A. Gropp (square leader), S. Hämke, H.-M. Jakubik (square leader), F. Kenkel (pottery reading), Y. Kunisch (square leader), A. Laderick, P. Leiverkus (photogrammetry, survey), M. Lehmann (square leader), J. Molitor, B. Neusüß, S. Olschok (square leader), A. Penninger, K. Riegel, P. Schaller (photography), R. Schreiber, S. Schütz (square leader), A. Schwermer (pottery reading), D. So, K. Soennecken (square lea-der), H. Steinmetz, A. Straßburger, M. Strehl, C. Thielen, J. Ucher, Th. Ultsch, D. Vieweger (director of project), F.-J. Vogel, M. Voigt-Werling (architect), and Th. Wieck
- GPIA Amman: J. Häser (director of project)
- Volunteers, Thomas Morus Academy, Bensberg: (March 27 to April 13). B. Abitz, E. Bilgram, D. Dreschmeier, U. Fahr, B. Henrich, R. Henrich, M. Kirsch, M. Knaden, M. Krämer, W. Lanquillon, P. Neubert, D. Popp, H. Raber, B. Ruberg, B. Schneider, E. Schneider, G. Schneider, H.-P. Schulz, A. Schwegler, J. Soika (head of volunteers), R. Surmann, J. Tinz, H.-U. Uehlecke, E. Unkrig, J. Weisbrich, J. Wendt, M. Werring, H.-J. Zeuch, and I. Zürrer

1.4.4.21. The Summer 2011 Excavation and Survey Season

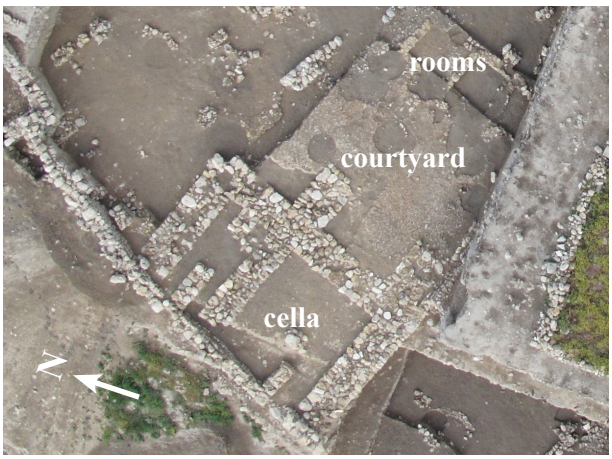

Fig. 1.77 Temple. Stratum 14, Area I, Squares AP 118–122 and AS 119–122. Photograph taken in summer 2011 (Source: BAI/GPIA).

The three-week excavation of the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute of Archaeology Jerusalem/Amman (GPIA) was carried out from July 7 to 27, 2011, and focused on Areas I and II. The third season of the Wādī al-'Arab Survey was conducted parallel with the excavation.

Excavation in the centre of Area I explored a well-constructed domestic building in the habitation areas of the Early Bronze Age II/III and III.

In the northern part of Area I, two separate Middle/Late Bronze Age occupation strata (Strata 14 and 13) close to the previously excavated large Late Bronze Age temple with a pebble paved courtyard were exposed (*Fig. 1.77*); these strata proved the association between the city walls and the Late Bronze Age buildings (Strata 17 and 16).

The previously excavated building structures in Area II were cleared, and some baulks were removed. Additional work attempted to remove as many of the walls from the Byzantine and Roman periods as possible, in order to explore the earlier strata below.

The immediate hinterland of Tall Zirā‘a (Zone A) was completely examined during the third season of the survey and extended to include the wide upper Wādī al-‘Arab region (Zone B) (*Fig. 3.61*). 201 sites and installations are now located on the map, including all sites found in previous surveys (*Chap. 3.6.1.*).

The Season Participants:

- BAI Wuppertal: F. Bartenstein (square leader), A. Cassel, A. Gropp (square leader), F. Kenkel (pottery reading), A. Laderick, M. Lehmann (square leader), P. Leiverkus (survey), C. Pogoda, P. Schaller, M. Schulze (archaeometry), A. Schwermer (pottery reading), K. Soennecken (survey), and D. Vieweger (director of project)
- GPIA Amman: J. Häser (director of project)
- 10 local workers

Fig. 1.78 Excavation in summer 2011. Area I, Square AO 118–119 (Source: BAI/ GPIA).

Fig. 1.79 Excavation team. Summer 2011 (Source: BAI/ GPIA).

1.4.4.22. The Summer 2012 Study Season

The finds and contexts of the exacations on Tall Zirā‘a were analysed during a study season in the dig house at Umm Qēs from May 3 to 27, 2012 in order to prepare them for publication.

The ceramic and small finds (glass, faience, metal and stone) were documented in more detail. They were drawn, photographed and organised typologically by specialists.

At the same time, experimental archaeology was conducted for pottery and glass production (*Chaps. 3.4.* and *3.8.*); a quadruple-shelled kiln modeled in the same way as that found in 2009 (Stratum 10, Area I) was constructed under the supervision of W. Auge (*Pls. 3.8* and *3.9*). It comprised several clay layers rather than only one, in order to achieve improved thermal insulation (*Fig. 1.80*).

C. Vogt und R. Lehmann (University of Hannover) joined the team in Umm Qēs during the study season. They organised a close archaeometric cooperation between the ‘Gadara Region Project’ and the university.

Finally, a 3D-model of Tall Zirā‘a was created, based on the aerial maps (*Fig. 1.81; Chap. 3.2.3.; App. 3.1*).

Some previously located sites in the Wādī al-‘Arab and Wādī az-Zaḥar were revisited this season, in order to take photographs and complete the documentation; their

Fig. 1.80 The modelling of a quadruple-shelled kiln in 2012. See *Pls. 3.8* and *3.9* (Source: BAI/ GPIA).

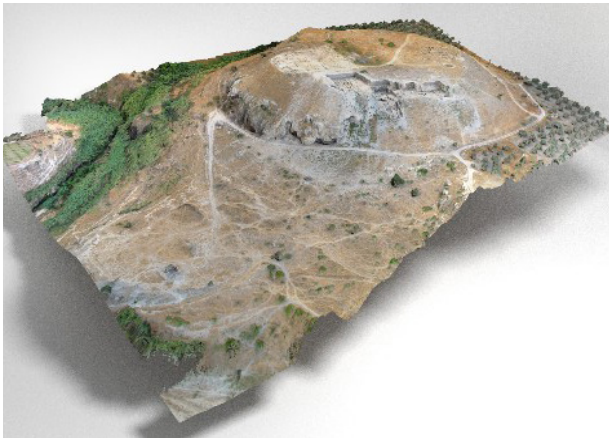

Fig. 1.81 3D-model of Tall Zirā‘a. 3D-model: *App. 3.1* (Source: BAI/ GPIA).

Fig. 1.82 Team of the 2012 study season (Source: BAI/ GPIA).

coordinates were digitally recorded by GPS, and ground measurements determined. Each site was described in detail, and all architectural remains were sketched and photographed.

The Season Participants:

- BAI Wuppertal: W. Auge (archaeometry), G. Bongartz (aerial photography), H. Brückelmann (pottery production), A. Cassel, A. Gropp, St. Hoss (glass and metal documentation), A. Laderick, P. Leiverkus (survey), B. Neusüß, S. Schütz, M. Schulze (archaeometry), A. Schwermer (pottery reading), K. Soennecken (survey), and D. Vieweger (director of project)
- GPIA Jerusalem/Amman: J. Häser (director of project) and J. Oswalt

1.4.4.23. The Summer 2013 Study Season

A second study season was undertaken in the excavation house of the German Protestant Institute of Archaeology (GPIA) in Umm Qēs from April 29 to May 29, 2013.

The main aim of the season was further documentation of the finds which are stored in the dig house in Umm Qēs.

K. Rassmann and S. Reiter from the 'Romano-Germanic Commission of the German Archaeological Institute' in Frankfurt joined the team; they conducted a geomagnetical prospection on Tall Zirā'a as well as other selected sites located during the Wādī al-'Arab surveys (*Chap. 3.5.3.*). Furthermore, they took soil samples from different strata for phosphate analyses.

The Season Participants:

- BAI Wuppertal: T. Aukes (experimental archaeology), G. Bongartz (aerial photogrammetry), A. Cassel, J. Jäger, A. Laderick, D. Prüßner, S. Schütz, K. Soennecken, H. Steinmetz, and D. Vieweger (director of project)
- GPIA Amman/Jerusalem: J. Häser (director of project) and F. Kenkel (pottery reading)
- Romano-Germanic Commission of the German Archaeological Institute Frankfurt: K. Rassmann and S. Reiter (geophysical survey)

Fig. 1.83 Team members of the 2013 study season (Source: BAI/ GPIA).

1.4.4.24. The Summer 2014 Study and Excavation Season

The third study season took place between April 29 and May 29, 2014 in the dig house of the German Protestant Institute of Archaeology (GPIA) at Umm Qēs.

St. Hoss compiled a catalogue of the glass and metal finds from Tall Zirā'a as part of the DFG funded publication project.

The ceramic finds from the Middle and Late Bronze Age, as well as those from the Iron Age (Strata 16–11) were studied; additionally the collections of stone vessels and loom weights were examined. Work also focussed on the stratigraphical interpretation of the excavations in Areas I and II.

Chemists from the University of Hannover in Germany continued to study archaeometric questions. Approx. 175 metal artefacts from Tall Zirā'a were measured using a portable X-ray fluorescence instrument, and the metal quality was determined for the bronze artefacts. Discussion also centred on determining the provenance of the metal sources for these Bronze and Iron Age artefacts. 200 metal and 600 glass samples were collected from Tall Zirā'a for further investigation in Germany, with the aim to determine the provenance of the raw materials for glass and metal production (*Chap. 3.8.*).

In continuation of the work undertaken in 2013, K. Rassmann and S. Reiter from the 'Romano-Germanic Commission of the German Archaeological Institute Frankfurt'. completed the geomagnetic survey on Tall Zirā'a, in order to provide information for the surface layers between Areas I and II, in addition to the area around the artesian spring.

L. Olsvig-Whittaker floated soil samples which were taken from different contexts on Tall Zirā'a for the evaluation of botanical remains (*Chap. 3.7.*).

An excavation focused on the southern part of the tall plateau (Area III), where a significant Byzantine period complex had been explored in 2008, was undertaken from April 29 to May 14. It sought to determine the dimensions of the Byzantine complex, and to investigate any previous structures. Three test trenches were dug in Squares Y 125, Z 125 and AA 125; three occupational strata were determined, dated to the Ottoman, Abbasid/ Mamluk and Umayyad periods.

Despite further investigation, the extent of the Byzantine building remains unclear; additionally, any structures which may have existed in earlier strata have been lost, as a result of the huge cistern constructed beneath this building. However, ceramic finds are evidence of the existence of earlier habitation.

A mosaic in the shape of a rondel had been uncovered at the end of the 2008 excavation in Area III. It contains a Greek inscription with some names and a date. The text indicates that the building complex was a monastery (*Fig. 1.84*).

The mosaic could not be recovered in 2008 so the area had been backfilled. Due to the continuous damaging, it was decided to salvage the mosaic and remove it for safety in accordance with the opinion of the 'Department of Antiquities of Jordan' (DoA), who sent A. Bataineh, the Inspector of Antiquities in Irbid, to assess the situation. The mosaic was expertly lifted by the 'Department of Antiquities staff' on May 18, 2014, and taken to Irbid for restoration.

Fig. 1.84 Salvage of the mosaic in spring 2014. Stratum 3, Area III, Square X 125, Context 30124 (Source: BAI/ GPIA)

The Season Participants:

- BAI Wuppertal: G. Bongartz (aerial photogrammetry), A. Cassel (excavation), J. Häser (director of project), St. Hoss (glass and metal documentation), A. Laderick (excavation), P. Leiverkus (survey analysis), S. Schütz, K. Soennecken, and D. Vieweger (director of project)
- GPIA Amman/Jerusalem: F. Kenkel (pottery reading), and L. Olsvig-Whittacker (archaeobotany)
- Open University of Manchester and Centre of British Research in the Levant: A. Bongartz, R. Hunsdörfer, and U. Rothe (head of excavation)
- Leibniz University of Hannover: R. Lehmann, and M. Schulze (archaeometry)
- Romano-Germanic Commission of the German Archaeological Institute Frankfurt: K. Rassmann, and S. Reiter (geophysical survey)
- 3 local workers

1.4.4.25. The Summer 2015 Study Season

The fourth study season took place from May 16 to June 15, 2015 in the dig house of the German Protestant Institute of Archaeology (GPIA) in Umm Qēs; the work focused on the forthcoming final report of the 'Gadara Region Project'.

Interpretation of the Wādī al-'Arab Survey contexts was continued by K. Soennecken and P. Leiverkus; the pottery from the 2001 Tall Survey were described by F. Kenkel. P. Leiverkus provided geo-referenced maps of all strata excavated on the tall. D. Vieweger worked on catalogues for the stone, metal and glass/faience finds from Strata 25 to 10. J. Häser worked on the stratigraphy of the Byzantine strata in Area I and II. S. zu Löwenstein developed the manuscript layout and the tables to be included. M. Rautenberg digitalised the existing paper drawings for the ceramic finds.

All group members participated in measuring the large cistern in Area III, and contributed to a substantial architectural analysis of this structure.

Season Participants:

- BAI Wuppertal: A. Cassel, J. Häser (director of project), A. Laderick, P. Leiverkus (survey analysis), M. Rautenberg, K. Soennecken, and D. Vieweger (director of project)
- GPIA Amman/Jerusalem: F. Kenkel (pottery reading) and S. zu Löwenstein (editorial work)

1.4.4.26. The Summer 2016 Study Season

The fifth study season took place from May 28 to June 28, 2016 in the dig house of the German Protestant Institute of Archaeology (GPIA) in Umm Qēs; the work focused on the final report of the excavation on Tall Zirā'a in the frame of the 'Gadara Region Project'.

K. Soennecken was working on the stratigraphy and finds of the Late Bronze Age and Iron Age strata. F. Kenkel prepaired the texts and plates about the Hellenistic to Umayyad pottery. D. Vieweger worked on catalogues for the stone, metal and glass/faience finds of the Early to Middle Bronze Age and prepared the texts for Volume 2. J. Häser described the finding contexts of the Byzantine and Umayyad strata. B. Schröder typologised the Bronze and Iron Age silex artefacts. S. Schütz scrutinised the finds of the Hellenstic and Roman strata. L. Olsvig-Whittaker continued her work on the habitation mapping of the tall's sourrounding. A. Schwermer did the pottery reading of the Early and Middle Bronze Age strata. S. zu Löwenstein was in charge of the editorial work.

At May 29, 2016 members of the team visited the tall and recognised immense destructions on the lower part of the tall's southern slope. A bulldozer created two terracements for an olive grove (*Figs. 1.85* and *1.86*). This led to serious damages of archaeological layers on this side. Some structures became visible: *Fig. 1.87* shows the remains a lime-plastered floor and *Fig. 1.88* a wall. The team made photographs, and collected a lot of archaeological finds for preservation of evidence. They date from the Early Bronze Age to the Islamic periods. After the notification to the 'Department of Antiquities of Jordan' (DoA), a meeting was appointed which took place on June, 20. Dr M. Jamhawi, General Director of the DoA, visited the tall together with employees from Irbid and Umm Qēs. The project's directors, D. Vieweger and J. Häser, showed them the destroyed area and pointed out the specific threat to the Early Bronze Age city wall which runs very close below the surface in this archaeological zone. Noting this danger to the archaeological site, the General Director decided immediatly to prevent further bulldozing.

Season Participants:

- BAI Wuppertal: B. Beitz (IT), A. Cassel, J. Häser (director of project), A. Laderick, B. Schröder, S. Schütz, A. Schwermer (pottery reading), K. Soennecken, and D. Vieweger (director of project)
- GPIA Amman/Jerusalem: F. Kenkel (pottery reading), S. zu Löwenstein (editorial work) and L. Olsvig-Whittaker (ground verification for field survey)

Fig. 1.85 Destruction on the tall's south slope in 2016 (source: BAI/GPIA).

Fig. 1.86 Destruction on the tall's south slope in 2016 (source: BAI/GPIA).

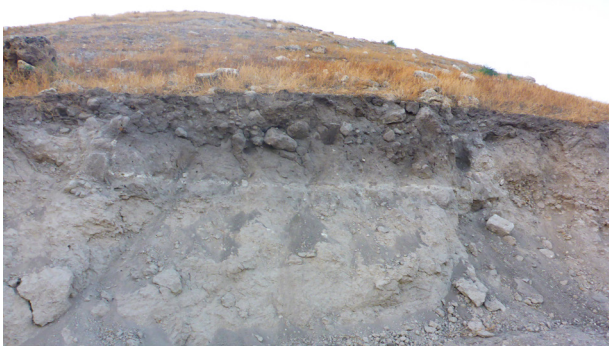

Fig. 1.87 Destruction on the tall's south slope in 2016 with a lime-plastered floor visible (source: BAI/GPIA).

Fig. 1.88 Destruction on the tall's south slope in 2016 with a wall visible (source: BAI/GPIA).

1.5. Aims of the ‘Gadara Region Project’

In general, the ‘Gadara Region Project’ explores the way of life, settlement patterns, and cultural changes in the Wādī al-‘Arab and its tributary, the Wādī az-Zaḥar, from the beginning of human occupation until today. Additional aims are to answer geological, hydrological, agrarian, and trade policy questions. Therefore, the project as a whole aims at exploring the archaeology of the entire landscape.

Mapping of the archaeological sites, archaeological surveying with the collections of finds, photogrammetry, analysis of satellite imagery as well as geophysics (geomagnetics, georadar and geoelectrics) were employed for the investigation (*Chaps. 3.2., 3.5.* and *3.6.1.*). Archaeometric studies on pottery, glass, and metal finds from Tall Zirā‘a as well as experiments for the production of pottery and glass were carried out, allowing deeper insight into the technical skills of the inhabitants of Tall Zirā‘a over time (*Chap. 3.8.*).

The research therefore focused on the following specific questions:

(1) *Archaeology of a Landscape:* This includes the exploration of the landscape of the Wādī al-‘Arab as well as its tributary, the Wādī az-Zaḥar. The relation between the centre, Tall Zirā‘a, and its surroundings are especially interesting. The investigation of agrarian land use, flora and fauna, geology (water, rocks, and soil), trade (roads and infrastructure) and the strategic importance of the valley will result to an better understanding of the historical development of the Tall Zirā‘a and its environment.

(2) *Settlement development:* Tall Zirā‘a and the neighboring settlements Tall Qāq (Ḫirbet Bond) and Tall Kinīse (Ra’ān) served as human settlement sites from the Early Bronze Age until the Ottoman period[49]. Therefore, insights into a settlement process of long duration in a relatively isolated, clearly defined geographical area can be expected.

(3) *Survival strategies*: What survival strategies were developed by the inhabitants over the millennia to adapt to the natural conditions of the valley, and how did they respond to changes in climate and given resources?

(4) *Trade routes*: The trade route through the Wādī al-‘Arab between the Jordan Valley i.e. Tall al-Ḥiṣn (Beth Shean) in the west and the Irbid-Ramtha basin in the east was certainly an important factor for the geopolitical relevance of the valley and the development of the region as a whole (*Fig. 1.22*).

(5) *Stratigraphy*: Tall Zirā‘a is distinguished both by its artesian spring and its privileged location in the fertile and geostrategically important Wādī al-‘Arab. Consequently, the continuous stratigraphy from the excavation of Tall Zirā‘a will be a useful reference instrument for other sites.

(6) *Tall Zirā‘a/Gadara*: The relationship between the urban centre of Gadara and its environment allows new insights into the development of Gadara in the Classical period. The centre was dependent on its environment. Therefore, it is imperative to explore the regional coexistence between the more rural site Tall Zirā‘a and the city Gadara during the Hellenistic, Roman, and Byzantine periods.

The region south of Gadara provides a unique chance to clarify the development of the settlement surroundings in a targeted and extensive way within a naturally confined territory, that is, to explore, especially with regard to Gadara the Pre- and Post-Classical periods in the region of this Decapolis city.

49 Isarel or Palestine Grid Reference of Tall Qāq (Ḫirbet Bond): 2128.2233; Isarel or Palestine Grid Reference of Tall Kinīse (Ra’ān): 2191.2271.

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2. The 2001 Survey on Tall Zirā'a

by Dieter Vieweger/Frauke Kenkel/Daniel Keller/Stefanie Hoss

2.1. Methodology

by Dieter Vieweger

Before commencing the survey in autumn 2001, the Tall Zirā'a was divided into squares oriented to the Israel or Palestine Grid (see *Chap. 4.1.*; *Figs. 1.33* and *4.2*). The survey area covered the whole tall, its slopes and the close vicinity on all sides. In all, 127 survey squares, 20 m x 20 m in size were covered; a total area of 5.08 ha (*Fig. 4.2*).

To obtain consistent survey results, measures were taken to ensure a uniform standard for the gathering of artefacts: all teams (each comprised of two people) were instructed together, thus provided with the same information, and remained in the same personnel composition for the remainder of the survey campaign. A time standard of one hour per square was fixed, to allow sufficient time for each square; teams were directed neither to fall below nor exceed the standard. The geographical requirements profile (that is, the surveying of squares on slopes, hillsides and plain surfaces) was planned so that the amount of work for each day was consistent. Surveying began each day on the slopes and ended on the flat plain surfaces during the hot hours of the day.

The purpose of these methods was to ensure that the same standard of work was possible from the first to the last day of the survey, and not to create a high error rate by subjective 'views' of the survey work, by haste or by the difficult conditions faced on some days due to the terrain.

2.2. Finds

2.2.1. Pottery from the 2001 Survey

by Frauke Kenkel

Fig. 2.1 Iron Age II pottery from the Survey 2001 (from left to right): above TZ 000018-001 and TZ 000045-001; below TZ 000044-007 and TZ 000044-001 (Source: BAI/GPIA).

Fig. 2.2 Islamic pottery from the Survey 2001 (from left to right): TZ 000043-002, TZ 000043-016, TZ 000040-014, and TZ 000040-012 (Source: BAI/GPIA).

All the pottery described here was collected during the 2001 Survey on Tall Zirā'a. It has been screened, described and entered into the project database. Furthermore, it was reexamined during the 2013 study season, and prepared for the forthcoming publication of the 'Gadara Region Project'. After more than ten years of excavation and survey, it was possible to define and date the survey examples more accurately, and to adjust them to typology systems which had been established over the course of the project, such as that for the Bronze and Iron Age cooking vessels (A. Schwermer; PhD-thesis) and that for the material from the Classical periods (F. Kenkel; PhD-thesis)[1]. No complete vessel was found within the survey material. The study is based purely on typo-

1 Kenkel 2012; Schwermer 2014.

logical criteria, comparison with the excavation material from Tall Zirā'a, and other published material from sites in Jordan and Palestine/Israel.

The pottery presented ranges from the Early Bronze Age to the Islamic periods, including one Ottoman pipe fragment. Altogether 22,383 sherds were collected during the survey on the tall. Around 2,847 were designated as diagnostic, and 2,680 could be assigned definitively to particular vessel types[2]. 199 types were then identified as specific for the period they were dated to; these were drawn and recorded in the catalogue to illustrate the entire ceramic typology found during the survey[3]. The plates are organised chronologically in the first instance, open forms are first, followed by closed forms, and finally, from the smallest to the biggest examples. The catalogue also provides a brief description of each illustration. Each sherd in the catalogue is numbered consecutively within the plates (*Pls. 2.1–2.14*). Designations such as jar/jug are used when it is difficult to positively determine vessel type. Detailed fabric descriptions are included in the project database, and will appear in full when the stratified material is published in the forthcoming volumes.

Two stamped Byzantine period base sherds will be presented in a separate chapter because of their iconography (*Figs. 2.4–2.7*; *Chap. 2.2.1.2.*).

2.2.1.1. Typological Studies of the Pottery

The Bronze Age (Pls. 2.1–2.4)

The material from the Bronze Age represents 11 % of the total survey collection. More than 10 % of the total collection are from the Early Bronze Age, mainly holemouth cooking vessels (*Pl. 2.1, nos. 1–10*). Holemouth vessels are the main cooking pot types throughout the Early Bronze Age[4]. However, straight walled cooking pots with 'rope decoration with irregular imprints' are more common during the Middle Bronze Age (*Pl. 2.2, nos. 4–5*)[5], whilst the cooking pots of the Late Bronze Age are characterised by a new development, an everted triangular rim (*Pl. 2.4, no. 4*).

The Bronze Age material includes almost all vessel types. Jars/jugs, bowls and kraters represent the main body of finds; but also plates, lids, chalices, storage vessels and oil lamps are present. According to R. Amiran[6], the bowl depicted on *Pl. 2.2* (*no. 1*) is the most common form of the Middle Bronze Age II period. The jar/jug form on *Pl. 2.2* (*no. 6*) appears more often during the Early Bronze Age; however, jars such as *Pl. 2.2* (*no. 7*) still continue the style from the Chalcolithic period[7]. The combed decoration on *Pl. 2.1* (*nos. 12–13*) is a typical feature on Bronze Age material.

Survey material dated to the Late Bronze Age included two fragments of imported vessels; a 'Cypriot milk bowl' sherd (*Pl. 2.4, no. 1*) and a painted Mycenaean body sherd (*Pl. 2.4, no. 10*). Even though the material derives only from the surface of the tall, the typical Bronze Age types are present; this is confirmed by the presence of the same types within the excavation material.

The Iron Age (Pls. 2.5–2.7)

A considerable number of bowls appear in the survey material which are determined to be a transitional form between the Late Bronze and the Iron Age period; in fact, more than 80 % of the vessel types are bowls. During the Iron Age itself, the situation changes, and 51 % of the vessels from this period are cooking pots, together with jars/jugs, kraters, storage vessels, bowls and some holemouth vessels. While open bowls with gently rounded sloping sides (*Pl. 2.5, nos. 2–3*) are more dominant in the Late Bronze Age, the example in *Pl. 2.5* (*no. 1*) is more likely to date from the Iron Age. The jar/jug on *Pl. 2.5* (*no. 8*) is one example from the six main northern jug types in the Iron Age I period[8]. Thus, the examples in the catalogue are typical cooking pots of the Iron Age for the northern types[9].

The examples on *Pl. 2.6* (*nos. 1–2*) are designated as northern Iron Age I types, and considered direct descendants of the Canaanite prototypes[10]. These are the most common types found in the excavation seasons; however, although they are present in all Iron Age periods, and have a big variety of rim forms, they are present mainly in Iron Age I strata[11]. The last two figures on *Pl. 2.6* (*nos. 14–15*) are particularly thin walled cooking pots. This type was found at only a few sites; it

2 Vieweger et al. 2003, 200.
3 All drawings in the catalogue were produced by the author.
4 Amiran 1969, 55.
5 Amiran 1969, 102.
6 Amiran 1969, 91.
7 Amiran 1969, 55.
8 Amiran 1969, 251.
9 Amiran 1969, 227.
10 Amiran 1969, 227.
11 Schwermer 2014, 192.

does appear in the Late Bronze Age on Tall Zirā'a, but most examples were found in the Iron Age IIA/B strata[12]. A typical example of an Iron Age IIC cooking pot within the tall's ceramic repertoire is that on *Pl. 2.7* (*no. 1*)[13].

One of the predominant jar types from Iron Age IIA/B are ovoid, with ridged necks, as depicted on *Pl. 2.7* (*no. 4*); they were widely distributed, with many variants[14].

The Classical Periods (Pls. 2.8–2.11)

The Classical periods can be divided into three main phases, the Hellenistic, the Roman and the Byzantine periods; however, it is not always easy to designate the ceramic material as belonging to these periods. In fact, it is likely that the following divisions are more accurate; the transition phase from the Persian to the Hellenistic period, the Hellenistic – Early Roman period, the Roman period, the Late Roman – Early Byzantine period, the Byzantine period and the Early Byzantine – Early Islamic period. Compared to the Bronze and Iron Age periods described above, the variety within vessel types, as well as the quantity of sherds, is notably different in the Classical periods.

While in the early transition phase from the Persian to the Hellenistic period, bowls and amphorae are the main types, Hellenistic – Early Roman period sherds exhibit a broader variety of forms, and represent almost 7 % of the total survey collection. In addition to common forms such as jars/jugs, amphorae, bowls and cooking pots, the survey material also provides examples of plates, kraters, basins, flasks, lids, cups and storage vessels. *Pl. 2.8* (*no. 2*) depicts a bowl with an incurved rim, which is typical throughout the Eastern Mediterranean during the Hellenistic period. The date range for these 'Echinus Bowls' is from the second half of the fourth century BC into the first century BC, although they are most common in the third and second centuries BC[15].

A typical fine ware, which was widely distributed in the Late Hellenistic – Early Roman period, is Eastern

Fig. 2.3 Late Hellenistic – Roman pottery from the Survey 2001: TZ 000045-010 (left), TZ 000048-001 (centre above), TZ 000045-002 (centre below), TZ 000044-010 (right) (Source: BAI/GPIA).

The jug on *Pl. 2.7* (*no. 9*) may be an example from the Persian period. All things considered, the survey material which has been designated as either Iron Age, or from the transition phase between the Late Bronze Age and the Iron Age, provides examples from the whole range of Iron Age pottery that was discovered later during the excavation seasons.

Sigillata A (ESA), represented by four examples on *Pl. 2.8* (*nos. 4–7*). The amphora on *Pl. 2.8* (*no. 8*) is a very common form within the excavation material of Tall Zirā'a; however, only one handle, without any trace of a stamp, of the widely distributed Rhodian amphorae was found in the survey material (*Pl. 2.8, no. 12*). The date range for Rhodian amphorae is from late fourth century BC through to the first and perhaps even into the second century AD[16]. The small cup on *Pl. 2.8* (*no. 13*) may be an imitation of a Nabataean form. The bowls on *Pl. 2.9* (*nos. 1–3*) are not a very common form on the tall, from either the survey or the excavation material. No Hellenistic period cooking pot was found in the survey material, although they are very common within the excavation.

Pl. 2.9 (*nos. 8–9*) are typical 'Galilean Bowls' and, together with the casseroles (*nos. 11–12*) and the cooking pots (*nos. 13–16*) on the same plate, are typical representatives of the Roman period. The Late Roman – Byzantine period is mainly represented by examples of imported wares. Examples from all of the three fine wares traded internationally in the Late Roman – Byzantine period are represented in the survey material. One example of African Red Slip Ware (ARS) (*Pl. 2.10, no. 1*) dated approx. to the second half of the sixth and/or the beginning of the seventh century AD appears in the catalogue. The three examples of Cypriot Red Slip Ware (CRS) (*Pl. 2.10, nos. 2–3*) illustrate the most common forms found within the excavation material on Tall Zirā'a, as do the examples of Late Roman C Ware (LRC) (*Pl. 2.10, nos. 5–9*). The final examples are of the most common fine ware in the Eastern Mediterranean, Hayes Form 3 (*Pl. 2.10, nos. 6–8*) which can be found on almost all sites in northern Jordan[17]. It is also the most common Late Roman – Byzantine period imported pottery within the excavation material. The examples on *Pl. 2.11* are bowls, cooking vessels and jars/jugs, mainly from the Late Roman and Byzantine periods, as well as from the Early Islamic period. The oil lamp fragment (*no. 13*) is comparable to other examples dated to the Late Roman – Byzantine period[18]. Three of the four 'peaks' in quantity of survey material are within the Classical periods. The first, which represents almost 7 % of the total survey

12 Schwermer 2014, 193.
13 Schwermer 2014, 173.
14 Amiran 1969, 201. 238.
15 Johnson 2006, 524.
16 Johnson 2006, 534.
17 Kenkel 2012, 90.
18 Kenkel 2012, Pl. 58 La72.

material (as written above), appears in the Hellenistic – Early Roman period, whilst the other two are in the Late Roman – Byzantine (25 % of the total survey material) and Byzantine – Early Islamic period (43 % of the total survey material) respectively.

The Islamic Periods (Pls. 2.12–2.14)

The Islamic material represents only approx. 6 % of the total survey material. It consists mainly of jars/jugs and amphorae, together with some bowls and cooking pots, a few kraters, and finally some plates, storage jars and lids. The material from the Mamluk period is comprised almost exclusively of jars/jugs and bowls; ceramic finds dated to this period from the excavations are chiefly from the fifteenth century AD[19], and it is considered that most of the examples from the survey material are probably from the same century. *Pl. 2.12* (*no. 1*) is a typical example of Byzantine – Early Islamic fine ware, with incised wavy decoration. The basin shown in *no. 2* on the same plate is representative of a whole range of similar vessels; a rather greyish Early Islamic fabric. Most of them are decorated with incised wavy lines, which is a very typical decoration pattern for that period. *Pl. 2.12* (*no. 5*) may be an example of a moulded vessel from the Early Islamic period. The vessels with painted reddish-brown, and sometimes black, geometric patterns (*Pl. 2.12, nos. 6–10*), are from the Mamluk period, most probably from the fifteenth century AD; most of the glazed bowls on *Pl. 2.13* are also dated between the thirteenth to the fifteenth century AD. *Pl. 2.13* (*nos. 9–13*) are typical cooking pots from the Islamic period. Unglazed Islamic pottery, such as the examples on *Pl. 2.14*, appear to be localised forms[20]; therefore, a search in the literature for parallel forms is restricted to a limited area. This difficulty is compounded by the fact that there are few specialists for common Islamic pottery.

The pipe bowl fragment (*Pl. 2.14, no. 16*) is considered to be the most modern pottery sherd within the survey material. Smoking pipes have been discovered throughout the Middle East and attributed to the Ottoman period. Tobacco was introduced to the Ottoman Empire at the beginning of the seventeenth century AD but smoking was not popular before the end of the same century; the earliest considered date for this example is the eighteenth century AD[21]. However comparisons with other fragments suggest a more likely date of either the nineteenth or the early twentieth century AD[22].

Conclusion

The pottery from the survey provides us with a detailed overview of the different types of vessels from the different periods of habitation on Tall Zirāʻa. All examples illustrated in the catalogue were attested in the excavation finds.

Concerning the distribution of the pottery, it is significant that finds from the Classical and Islamic periods are considerably more numerous on the plateaus than on the slopes of the tall. The slopes provided much more Bronze and Iron Age material[23]. The reasons will be shown in following volumes. The most prominent periods in terms of number of sherds are the Late Roman – Byzantine period, with 25 % of the total number of sherds, and the Byzantine – Early Islamic period, with 43 %. The Early Bronze Age represents a little more than 10 %, followed by the Hellenistic – Early Roman period, with almost 7 %. All other periods represent less than 5 % of the total number. It is not only percentages which differ significantly for the different periods, but the concentrations of material also. The highest concentration of Late Roman – Byzantine and Byzantine – Islamic material, as well as sherds from the Mamluk period, were collected in Area III. Sherds from the Hellenistic – Early Roman period, or earlier periods, were detected only on the slopes of that area. The excavations in Area III revealed a large building complex dated to the Late Roman – Byzantine period, with a long settlement history of several building phases and reuse within the Mamluk period (fourteenth/fifteenth century AD). A very similar picture emerges for finds from the excavation in Area II. More Bronze and Iron Age material was collected in the survey squares at the edges of the tall's plateau and on the slopes (Squares AY 125, 129 and 133, AU 113, AQ 133) than those on top of the plateau in that area. Far more examples from the Late Roman – Byzantine and Byzantine – Early Islamic periods were found on the plateau, together with Hellenistic – Early Roman pottery.

The excavations in Area II reached the Hellenistic period strata, and revealed another large building complex from the Hellenistic – Early Roman period, which had been destroyed and backfilled. Area II was still covered with building structures in the Late Roman – Byzantine and Byzantine – Early Islamic periods, proving intensive use of that area during that time.

19 Many thanks to Dr Micaela Sinibaldi, who was the first researcher to examine the medieval material from that area.

20 Tonghini 1998, 63.

21 Tonghini 1998, 68.

22 de Vinzenz 2011, Fig. 1, 1–3; Tonghini 1998, Pl. 83–88 Fig. 150 a–f.

23 Vieweger et al. 2003, 200.

Similarly in excavation Area I, the concentration of Pre-Classsical sherds is much higher in the squares along the edge of the plateau and on the slope, (Squares AD 133, AH 113 and 117, AM 113, AQ 117, AU 117). The pottery distribution is very similar to that in Area II, apart from the fact that the concentration of Hellenistic – Early Roman period material is not as high. Again the survey finds reflect the same distribution pattern as the excavations; pottery of intensive habitation remains dated to the Late Roman – Byzantine and Byzantine – Early Islamic periods were collected, together with material from the Bronze and Iron Ages, but none from the Hellenistic – Early Roman period. The relatively small number of Pre-Classical pottery sherds located on top of the tall plateau can be easily explained by the 5–6 m of cultural debris which overlay the habitation strata where they would have been found[24].

A diverse typology of typical pottery forms is represented within the survey material; however, five major categories can be distinguished. Jars/jugs are the major group, and represent more than 30 % of the material. These are followed by the cooking vessels, with more than 25 %, and then the bowls and amphorae (including some large storage vessels) represent around 20 %. All other types represent such smaller quantities that they are considered for the purposes of this study as one category, including lids, a pipe bowl and forms that could not be assigned.

Distinctive variation occurs in the distribution and variety of vessel types within the different time periods. Jars/jugs and cooking vessels constitute the majority of the finds from the Early Bronze Age, together with some bowls, kraters, plates and few storage jars. In the transition phase from Early to Middle Bronze Age, there is not only less material, but also less variety; cooking vessels are the most prominent group in that period, representing 93 % of the finds, accompanied by some jars/jugs. Although a broad variety of different vessel types exists in the Middle Bronze Age finds, the number are few, similar to those found which date to the transition phase.

The Area I excavations revealed that most of the urban structures on the tall which date from the Early Bronze Age disappeared at the end of the third millennium; this same phenomenon occurs in this period at other sites also. However, habitation continued on the tall, although somewhat reduced[25]. By the Middle Bronze Age, c. 2000 BC, the settlement had grown again, and was comprised of houses and workshops[26]; this is reflected in the broader variety of vessel types from that period. The increased variety of types continues until the Late Bronze Age, although there are shifts in type predominance; during the Middle and Late Bronze Age, jars/jugs are the dominant group, whilst cooking vessels clearly dominate in the Late Bronze Age. At the end of the Late Bronze Age, and within the transition period to the Iron Age, the vessel type distribution again changes completely; 80 % of the finds are bowls, with only 10 % comprised of jars/jugs and a few cooking vessels. At the end of the Late Bronze Age, a massive landslide occurred in Area I, most probably around 1500 BC[27]. Following the catastrophe, the area was backfilled and massive architecture, including a temple, was built on top of it; a lot of imports were identified within the excavated ceramic material from this stratum. The material and architecture together suggest the regional importance of this settlement[28]. The Late Bronze Age settlement was destroyed around 1200 BC; nevertheless, the new Iron Age I structures followed the same orientation as those from the previous period[29].

Within the Iron Age survey material, cooking pots are the largest group, representing 51 % of the finds; nonetheless, jars/jugs and bowls represent most of the remaining 50 %. Altogether, the Iron Age material displays a broader variety of types than the transition period from the Late Bronze Age.

During the Iron Age, the settlement again appeared more urban in character; however, during the eighth century BC the Assyrians occupied the region and the settlement on Tall Zirā'a again lost the former urban character[30]. Only a few remains on the tall can be assigned to the Persian occupation, and again the variety within the survey pottery decreased to mainly bowls and amphorae. Only after the conquest of Alexander the Great in 332 BC was a wider variety, in fact an unprecedented variety, detected. Around the end of the third century BC Gadara was founded on the nearby plateau[31]; it appears that around this time, a large building complex was established in Area II on the Tall Zirā'a plateau. This complex was perhaps destroyed by Alexander Jannaios during the conquest of Gadara. During the Roman period itself, cooking vessels represent 88 % of the pottery material; only at the end of that period are a broader variety of types encountered; this is also when one of the two peaks within the repertoire occurs. This fits very well with the excavations on the plateau, thus attesting that the whole plateau was used during the Byzantine period[32].

Bowls, together with cooking vessels, storage jars and oil lamps represent 80 % of the material from the Byzantine period. Conversely, from the end of the Byzantine period into the Early Islamic period, not only does the second peak within the quantity of pottery appear, but also a broader variety in types occurs, al-

24 Vieweger et al. 2003, 200.
25 Vieweger – Häser 2013, 19.
26 Vieweger – Häser 2013, 20.
27 Vieweger – Häser 2013, 20.
28 Vieweger – Häser 2013, 24.
29 Vieweger – Häser 2013, 26.
30 Vieweger – Häser 2013, 32.
31 Historically Gadara is first mentioned within the framework of the conflicts between the Ptolemies and Seleucids. Gadara was captured in 218 BC (Polyb. 5,71,3). Lichtenberger 2003, 83; Weber 2002, 60. 259 (SQ 2).
32 Vieweger – Häser 2013, 37.

though the main vessel types are concentrated within those required for the storage and preparation of food. The Area III excavations demonstrate that another big complex, associated with the Late Roman – Byzantine and Byzantine – Early Islamic periods, was constructed. It would seem that the Arab conquest of the region in 636 AD had no major impact on the tall settlement pattern[33]. There was no evidence of settlement disruption until the earthquake in 749 AD. The Islamic period survey pottery encompasses a variety of jars/jugs, amphorae, cooking vessels and some bowls. The examples from the Mamluk period are mainly bowls and jars/jugs, which have been attributed to the fourteenth/fifteenth century AD, particularly the examples concentrated in Area III, which are mainly from the fifteenth century AD.

Only one object was found in the survey material from the Ottoman period; a pipe bowl fragment; nevertheless, G. Schumacher saw some houses on Tall Zirā'a in 1885[34]. Therefore, we know there must have been some architectural remains present from that time.

It is possible to infer a great deal of information about the site from the distribution of the survey material on the tall plateau, the variety of vessel types, and the fluctuating concentration of types which exists in the different time periods. Aligning the results of the survey with those of the excavations proves that, whenever a peak of material occurred due to a major building complex in the excavation finds, the survey results reflected a similar increased number of the same type for the same period; that is, the relative distribution of ceramic finds from the settlement remains during all phases are also attested within the surface material finds. Additionally, as it can be stated that a drop of either number of finds or variety of vessel types denotes a major event in the history of the settlements, it can also be stated that, due to the alignment of survey finds to excavation finds, one can use survey material not only to define future excavation areas, but also to deduce tentative observations about the size and history of a site.

2.2.1.2. Two Sherds with a Stamp from Tall Zirā'a

A 'Cross Moline'

The base sherd of a vessel (4.1 cm x 2.9 cm) from Survey Square AH 137 has a stamp (*Figs. 2.4* and *2.5*; TZ 000206–001); throwing marks are visible on the base. The sherd belongs to the type known as Late Roman C Ware (LRC)[35]. The clay is of fine and homogenous manufacture, tempered with chalk particles; the breakage is smooth. The colour of the sherd is 10 R 5/8 red, the core 2.5 YR 5/8 red.

The imprinted seal depicts a cross in a circle. Its form corresponds to the usual depictions from the second half of the fifth century AD[36]. The double drawn cross bars are split at their ends, forming a 'Cross Moline'. The anchor is a typical early Christian symbol; it dates to the time before the Constantinian shift, when usage of the cross was still dangerous and could lead to persecution. In Post-Constantinian periods both symbols, the anchor and the cross, merged to form the 'Cross Moline'.

Fig. 2.4 Base sherd, TZ 000206–001 (Source: BAI/GPIA).

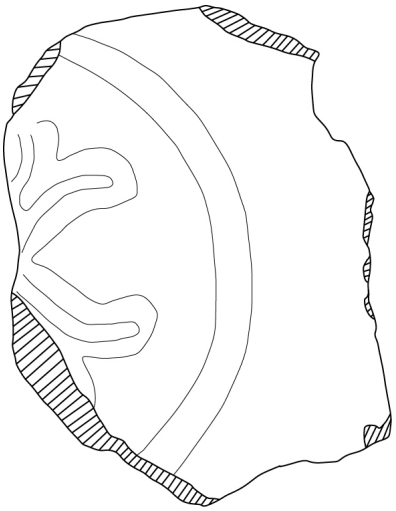


Fig. 2.5 Base sherd, TZ 000206–001 (Source: BAI/GPIA).

33 Vieweger – Häser 2013, 41.

34 Steuernagel 1926, 81.

35 Hayes 1972, 323 f.; Hayes 1980, 525–527; Kerner 1990, 241.

36 Hayes 1972, 364 Fig. j–l.

Another Cross Depiction

Another base sherd from a vessel imprinted with a stamp was found in Square AD 136 (*Figs. 2.6* and *2.7*; TZ 000396–013)[37]. The clay is fine and homogenous, the scarp smooth. This vessel also belongs to Late Roman C Ware (LRC)[38]. The temper consists of very small chalk particles. The unstamped part of the base is slightly rougher. The colour of the sherd is 5 YR 5/6 yellowish red, the core is 5 YR 5/6 yellowish red.

The illustration shows the lower right part of a cross, which is a common symbol from the second half of the fifth century AD[39].

Fig. 2.6 Base sherd, TZ 000396-013 (Source: BAI/GPIA).

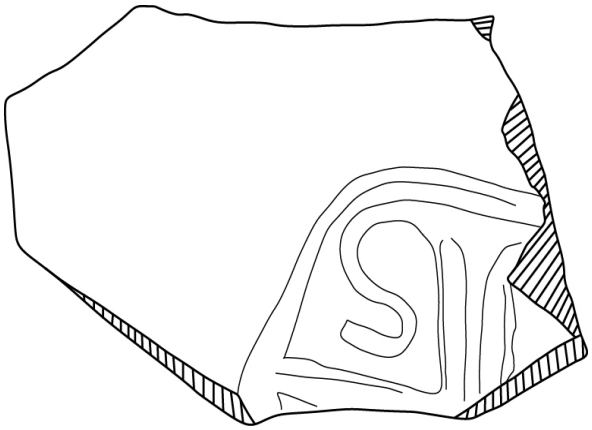


Fig. 2.7 Base sherd, TZ 000396-013 (Source: BAI/GPIA).

2.2.1.3. Early Bronze Age Pottery from Tall Zirā'a (*Pl. 2.1, nos. 1–13*)

Holemouth Cooking Pots

TZ 000369-004
Type: Cooking pot
Rim Form: Holemouth
Figure References: Pl. 2.1, no. 1
Est. D. (inside): 12
Parallel: **EB**: Amiran 1969, Pl. 14, 6–7. 9–10; Banning et al. 2005, Fig. 13, 7–8; Bourke et al. 1994, Fig. 4, 1. 3. 6; Bourke et al. 1998, Fig. 7, 19. 21; Fischer 1993, Fig. 14, 15–16; Harrison et al. 2000, Fig. 8, 1–10; Kamlah 1993, Fig. 3, 10–11; Nigro – Sala 2010, Fig. 5, KB.09.B.818, 19–20. 22 and Fig. 6, KB.09.B.818, 3. 27. 31–32. 34. 36–37. 39. 42–43; Palumbo et al. 1996, Fig. 34, 1–5; Savage – Rollefson 2001, Fig. 5; Schwermer 2014, app. part I, 6, no. 12, KtFB1a.
Note: The cooking pot throughout the Early Bronze Age is mainly a holemouth vessel[40].

TZ 000102-004
Type: Cooking pot
Rim Form: Holemouth
Figure References: Pl. 2.1, no. 2
Est. D. (inside): 17
Parallel: **EB**: Amiran 1969, Pl. 14, 6–7. 9–10; Banning et al. 2005, Fig. 13, 7–8; Bourke et al. 1994, Fig. 4, 1. 3. 6; Bourke et al. 1998, Fig. 7, 19. 21; Fischer 1993, Fig. 14, 15–16; Harrison et al. 2000, Fig. 8, 1–10; Kamlah 1993, Fig. 3, 10–11; Nigro – Sala 2010, Fig. 5, KB.09.B.818, 19–20. 22 and Fig. 6, KB.09.B.818, 3. 27. 31–32. 34. 36–37. 39. 42–43; Palumbo et al. 1996, Fig. 34, 1–5; Savage – Rollefson 2001, Fig. 5; Schwermer 2014, app. part I, 6, no. 10, KtFB1a.
Note: The cooking pot throughout the Early Bronze Age is mainly a holemouth vessel[41].

TZ 000149-002
Type: Cooking pot
Rim Form: Holemouth
Figure References: Pl. 2.1, no. 3
Est. D. (inside): 18
Parallel: **EB**: Amiran 1969, Pl. 14, 6–7. 9–10; Banning et al. 2005, Fig. 13, 7–8; Bourke et al. 1994, Fig. 4, 1. 3. 6; Bourke et al. 1998, Fig. 7, 19. 21; Fischer 1993, Fig. 14,

37 The sherd was found according to the Portugali Method. See *Chap. 2.3.*
38 Hayes 1972, 323–325; Hayes 1980, 525–527; Kerner 1990, 241.
39 Hayes 1972, 364 Fig. j–l.
40 Amiran 1969, 55.
41 Amiran 1969, 55.

15–16; Harrison et al. 2000, Fig. 8, 1–10; Kamlah 1993, Fig. 3, 10–11; Nigro – Sala 2010, Fig. 5, KB.09.B.818, 19–20. 22 and Fig. 6, KB.09.B.818, 3. 27. 31–32. 34. 36–37. 39. 42–43; Palumbo et al. 1996, Fig. 34, 1–5; Savage – Rollefson 2001, Fig. 5; Schwermer 2014, app. part I, 7, no. 8, KtFB1b.
Note: The cooking pot throughout the Early Bronze Age is mainly a holemouth vessel[42].

TZ 000373-004
Type: Cooking pot
Rim Form: Holemouth
Figure References: Pl. 2.1, no. 4; Fig. 2.8
Est. D. (inside): 18
Parallel: **EB**: Amiran 1969, Pl. 14, 6–7. 9–10; Banning et al. 2005, Fig. 13, 7–8; Bourke et al. 1994, Fig. 4, 1. 3. 6; Bourke et al. 1998, Fig. 7, 19. 21; Fischer 1993, Fig. 14, 15–16; Harrison et al. 2000, Fig. 8, 1–10; Kamlah 1993, Fig. 3, 10–11; Nigro – Sala 2010, Fig. 5, KB.09.B.818, 19–20. 22 and Fig. 6, KB.09.B.818, 3. 27. 31–32. 34. 36–37. 39. 42–43; Palumbo et al. 1996, Fig. 34, 1–5; Savage – Rollefson 2001, Fig. 5; Schwermer 2014, app. part I, 6, no. 13, KtFB1b.
Note: The cooking pot throughout the Early Bronze Age is mainly a holemouth vessel[43].

Fig. 2.8 Cooking pot, TZ 000373-004 (Source: BAI/ GPIA).

TZ 000349-001
Type: Cooking pot
Rim Form: Holemouth
Figure References: Pl. 2.1, no. 5; Fig. 2.9
Est. D. (inside): 19
Parallel: **EB**: Amiran 1969, Pl. 14, 6–7. 9–10; Banning et al. 2005, Fig. 13, 7–8; Bourke et al. 1994, Fig. 4, 1. 3. 6; Bourke et al. 1998, Fig. 7, 19. 21; Fischer 1993, Fig. 14, 15–16; Harrison et al. 2000, Fig. 8, 1–10; Kamlah 1993, Fig. 3, 10–11; Nigro – Sala 2010, Fig. 5, KB.09.B.818, 19–20. 22 and Fig. 6, KB.09.B.818, 3. 27. 31–32. 34. 36–37. 39. 42–43; Palumbo et al. 1996, Fig. 34, 1–5; Savage – Rollefson 2001, Fig. 5; Schwermer 2014, app. part I, 7, no. 3, KtFB1b.
Note: The cooking pot throughout the Early Bronze Age is mainly a holemouth vessel[44].

Fig. 2.9 Cooking pot, TZ 000349-001 (Source: BAI/ GPIA).

TZ 000101-001
Type: Cooking pot
Rim Form: Holemouth
Figure References: Pl. 2.1, no. 6
Est. D. (inside): 17
Parallel: **EB**: Amiran 1969, Pl. 14, 6–7. 9–10; Banning et al. 2005, Fig. 13, 7–8; Bourke et al. 1994, Fig. 4, 1. 3. 6; Bourke et al. 1998, Fig. 7, 19. 21; Fischer 1993, Fig. 14, 15–16; Harrison et al. 2000, Fig. 8, 1–10; Kamlah 1993, Fig. 3, 10–11; Nigro – Sala 2010, Fig. 5, KB.09.B.818, 19–20. 22 and Fig. 6, KB.09.B.818, 3. 27. 31–32. 34. 36–37. 39. 42–43; Palumbo et al. 1996, Fig. 34, 1–5; Savage – Rollefson 2001, Fig. 5; Schwermer 2014, app. part I, 9, no. 1, KtFB1c.
Note: The cooking pot throughout the Early Bronze Age is mainly a holemouth vessel[45].

TZ 000452-006
Type: Cooking pot
Rim Form: Holemouth
Figure References: Pl. 2.1, no. 7; Fig. 2.10
Est. D. (inside): 18.5
Parallel: **EB**: Amiran 1969, Pl. 14, 6–7. 9–10; Banning et al. 2005, Fig. 13, 7–8; Bourke et al. 1994, Fig. 4, 1. 3. 6; Bourke et al. 1998, Fig. 7, 19. 21; Fischer 1993, Fig. 14, 15–16; Harrison et al. 2000, Fig. 8, 1–10; Kamlah 1993, Fig. 3, 10–11; Nigro – Sala 2010, Fig. 5, KB.09.B.818, 19–20. 22 and Fig. 6, KB.09.B.818, 3. 27. 31–32. 34. 36–37. 39. 42–43; Palumbo et al. 1996, Fig. 34, 1–5; Savage – Rollefson 2001, Fig. 5; Schwermer 2014, app. part I, 10, no. 1, KtFB1d.
Note: The cooking pot throughout the Early Bronze Age is mainly a holemouth vessel[46].

Fig. 2.10 Cooking pot, TZ 000452-006 (Source: BAI/ GPIA).

42 Amiran 1969, 55.
43 Amiran 1969, 55.
44 Amiran 1969, 55.
45 Amiran 1969, 55.
46 Amiran 1969, 55.

TZ 000125-001
Type: Cooking pot
Rim Form: Holemouth
Figure References: Pl. 2.1, no. 8
Est. D. (inside): 14.5
Parallel: **EB**: Amiran 1969, Pl. 14, 6–7. 9–10; Banning et al. 2005, Fig. 13, 7–8; Bourke et al. 1994, Fig. 4, 1. 3. 6; Bourke et al. 1998, Fig. 7, 19. 21; Fischer 1993, Fig. 14, 15–16; Harrison et al. 2000, Fig. 8, 1–10; Kamlah 1993, Fig. 3, 10–11; Nigro – Sala 2010, Fig. 5, KB.09.B.818, 19–20. 22 and Fig. 6, KB.09.B.818, 3. 27. 31–32. 34. 36–37. 39. 42–43; Palumbo et al. 1996, Fig. 34, 1– 5; Savage – Rollefson 2001, Fig. 5; Schwermer 2014, app. part I, 11, no. 3, KtFB1e.
Note: The cooking pot throughout the Early Bronze Age is mainly a holemouth vessel[47].

TZ 000368-006
Type: Cooking pot
Rim Form: Holemouth
Figure References: Pl. 2.1, no. 9
Est. D. (inside): 27
Parallel: **EB**: Amiran 1969, Pl. 14, 6–7. 9–10; Banning et al. 2005, Fig. 13, 7–8; Bourke et al. 1994, Fig. 4, 1. 3. 6; Bourke et al. 1998, Fig. 7, 19. 21; Fischer 1993, Fig. 14, 15–16; Harrison et al. 2000, Fig. 8, 1–10; Kamlah 1993, Fig. 3, 10–11; Nigro – Sala 2010, Fig. 5, KB.09.B.818, 19–20. 22 and Fig. 6, KB.09.B.818, 3. 27. 31–332. 34. 36–37. 39. 42–43; Palumbo et al. 1996, Fig. 34, 1–5; Savage – Rollefson 2001, Fig. 5; Schwermer 2014, app. part I, 11, no. 2, KtFB1e.
Note: The cooking pot throughout the Early Bronze Age is mainly a holemouth vessel[48].

TZ 000375-002
Type: Cooking pot
Rim Form: Holemouth
Figure References: Pl. 2.1, no. 10; Fig. 2.11
Est. D. (inside): 30
Parallel: **EB**: Amiran 1969, Pl. 14, 6–7. 9–10; Banning et al. 2005, Fig. 13, 7–8; Bourke et al. 1994, Fig. 4, 1. 3. 6; Bourke et al. 1998, Fig. 7, 19. 21; Fischer 1993, Fig. 14, 15–16; Harrison et al. 2000, Fig. 8, 1–10; Kamlah 1993, Fig. 3, 10–11; Nigro – Sala 2010, Fig. 5, KB.09.B.818, 19–20. 22 and Fig. 6, KB.09.B.818, 3. 27. 31–32. 34. 36–37. 39. 42–43; Palumbo et al. 1996, Fig. 34, 1–5; Savage – Rollefson 2001, Fig. 5; Schwermer 2014, app. part I, 11, no. 6, KtFB1e.
Note: The cooking pot throughout the Early Bronze Age is mainly holemouth vessel[49].

Fig. 2.11 Cooking pot, TZ 000375-002 (Source: BAI/GPIA).

Jars/Jugs

TZ 000285-002
Type: Jar/Jug
Form: Ledge handle
Figure References: Pl. 2.1, no. 11; Fig. 2.12; Vieweger et al. 2002, Fig. 15.
Wall thickness: 0.7
Parallel: **EB**: Amiran 1969, Pl. 9, 18; Hendrix et al. 1997, no. 55, 101 and no. 90, 113.
Note: Irregularly painted decoration and three notches on the bottom side of the handle.

Fig. 2.12 Jug, TZ 000285-002 (Source: BAI/GPIA).

TZ 000290-003
Type: Jar/Jug
Form: Decorated body sherd
Figure References: Pl. 2.1, no. 12; Fig. 2.13
Wall thickness: 1
Parallel: **EB**: Amiran 1969, Pl. 17, 15; Banning et al. 2005, Fig. 9, 1; Hendrix et al. 1997, no. 103, 117.
Note: Combed decoration on the outside of the sherd.

Fig. 2.13 Jug, TZ 000290-003 (Source: BAI/GPIA).

47 Amiran 1969, 55.
48 Amiran 1969, 55.
49 Amiran 1969, 55.

TZ 000263-008
Type: Jar/Jug
Form: Decorated body sherd
Figure References: Pl. 2.1, no. 13; Fig. 2.14
Wall thickness: 1
Parallel: **EB**: Amiran 1969, Pl. 17, 15; Banning et al. 2005, Fig. 9, 1; Hendrix et al. 1997, no. 103, 117.
Note: Combed decoration on the outside of the sherd.

Fig. 2.14 Jar/Jug, TZ 000263-008 (Source: BAI/GPIA).

2.2.1.4. Early and Middle Bronze Age Pottery from Tall Zirā'a (*Pl. 2.2, nos. 1–7*)

Bowls

TZ 000375-001
Type: Bowl
Rim Form: Thickened inverted rim, triangular in section
Figure References: Pl. 2.2, no. 1; Fig. 2.15
Est. D. (max.): 28
Parallel: **MB I/MB II**: Amiran 1969, Pl. 26, 3 and Pl. 25, 4; **MB I**: Bourke et al. 1998, Fig. 17, 6; Houston Smith 1973, Pl. 27, 496.
Note: According to Amiran this is the commonest bowl of the MB IIB–C period[50].

Fig. 2.15 Bowl, TZ 000375-001 (Source: BAI/GPIA).

TZ 000102-006
Type: Bowl
Rim Form: Outward sloping thickened and slightly grooved rim
Figure References: Pl. 2.2, no. 2
Est. D. (inside): 33
Parallel: No parallel found.
Note: –

TZ 000333-005
Type: Bowl
Rim Form: Thickened inverted rim, horizontal upper side
Figure References: Pl. 2.2, no. 3; Fig. 2.16
Est. D. (max.): 40
Parallel: **EB I/EB II**: Amiran 1969, Pl. 9, 10 and Pl. 18, 6; **MB I**: Houston Smith 1973, Pl. 27, 926.
Note: Deep hemispherical bowl.

Fig. 2.16 Bowl, TZ 000333-005 (Source: BAI/GPIA).

Cooking Pots

TZ 000045-004
Type: Cooking pot
Rim Form: Slightly inverted rim, in the upper part grooved inside
Figure References: Pl. 2.2, no. 4; Vieweger et al. 2002, Fig. 21.
Est. D. (max.): 27
Parallel: **MB**: Amiran 1969, Pl. 30, 3
Note: 'Rope decoration' at the outside of the rim with irregular imprints. The straight-walled cooking pot is one of the most common forms[51]. It appears predominantly in the Middle Bronze Age strata within the Tall Zirā'a excavations (Strata 19–16)[52].

TZ 000307-001
Type: Cooking pot
Form: Decorated body sherd
Figure References: Pl. 2.2, no. 5; Vieweger et al. 2002, Fig. 21.
Wall thickness: 1.2

50 Amiran 1969, 91.
51 Amiran 1969, 102.
52 Schwermer 2014, 115.

Parallel: **MB**: Amiran 1969, Pl. 30, 1; Bourke et al. 1998, Fig. 17, 12; Hendrix et al. 1997, no. 139; Houston Smith 1973, Pl. 34, 717. 730. 1282; Schwermer 2014, app. part I, 18, no. 7, KtMB1b.
Note: 'Rope decoration' at the outside of the rim with irregular imprints.

Jars/Jugs

TZ 000325-003
Type: Jar/Jug
Rim Form: Thickened outward everted rim and almost straight neck
Figure References: Pl. 2.2, no. 6; Vieweger et al. 2002, Fig. 15
Est. D. (max.): 24
Parallel: **EB/MB**: Amiran 1969, Pl. 17, 6; Fischer 1993, Fig. 14, 13; Fischer 1994, Fig. 12; Hendrix et al. 1997, no. 108, 121; Houston Smith 1973, Pl. 27, 919.
Note: This form appears more often during the Early Bronze Age period.

TZ 000367-001
Type: Jar/Jug
Rim Form: Inward bending neck and outward everted rim (rail-rim)
Figure References: Pl. 2.2, no. 7; Fig. 2.17
Est. D. (max.): 27
Parallel: **EB**: Amiran 1969, Pl. 14. 3.
Note: The jars of this kind still continue the tradition of the Chalcolithic period, in form as well as in the decoration[53].

Fig. 2.17 Jar/Jug, TZ 000367-001 (Source: BAI/GPIA).

2.2.1.5. Middle and Late Bronze Age Pottery from Tall Zirā'a (*Pl. 2.3, nos. 1–9*)

Bowls

TZ 000187-004
Type: Bowl
Rim Form: Rounded slightly inturned rim
Figure References: Pl. 2.3, no. 1; Fig. 2.18
Est. D. (inside): 12
Parallel: **MB**: Amiran 1969, Pl. 25, 8; Houston Smith 1973, Pl. 35, 576.
Note: Small hemispherical bowl.

Fig. 2.18 Bowl, TZ 000187-004 (Source: BAI/GPIA).

TZ 000126-002
Type: Bowl
Rim Form: Open bowl with rounded sides and inturned rim
Figure References: Pl. 2.3, no. 2; Fig. 2.19
Est. D. (max.): 24
Parallel: **MB**: Amiran 1969, Pl. 25, 3; Houston Smith 1973, Pl. 35, 770.
Note: —

Fig. 2.19 Bowl, TZ 000126-002 (Source: BAI/GPIA).

TZ 000111-003
Type: Bowl
Rim Form: Wide open bowl with slightly rounded sides and inturned rim
Figure References: Pl. 2.3, no. 3
Est. D. (inside): 30
Parallel: **EB/MB**: Amiran 1969, Pl. 11, 4; Houston Smith 1973, Pl. 35, 770.
Note: The vessel can be also considered a small platter, due to its size.

53 Amiran 1969, 55.

Krater

TZ 000045-003
Type: Krater
Rim Form: Inward bending neck with a flat horizontal rim, rounded at the outside
Figure References: Pl. 2.3, no. 5; Fig. 2.20
Est. D. (max.): 24
Parallel: **MB II**: Yadin et al. 1958, Pl. 112, 12.
Note: —

Fig. 2.20 Krater, TZ 000045-003 (Source: BAI/GPIA).

Cooking Pots

TZ 000229-001
Type: Cooking pot
Rim Form: Inward bending neck and outward flaring rim, pointed at the upper part of the lip
Figure References: Pl. 2.3, no. 7
Est. D. (max.): 28
Parallel: **MB II/LB I**: Hendrix et al. 1997, 139, no. 135; Schwermer 2014, app. part I, 25, no. 4 and 26, no. 12, KtMB/SB1a; Yadin et al. 1958, Pl. 138, 2.
Note: This type appears with more than 500 examples predominantly in the late phase of the Early Bronze Age III and the transitional period between the Early and Middle Bronze Age on Tall Zirā'a (Strata 21 and 20)[54].

TZ 000357-005
Type: Cooking pot
Rim Form: Inward bending neck and outward flaring slightly thickened and rounded rim
Figure References: Pl. 2.3, no. 6; Fig. 2.21
Est. D. (max.): 25
Parallel: **MB II**: Amiran 1969, Pl. 9, 31 and Pl. 28, 2; Schwermer 2014, app. part I, 26, no. 12, KtMB/SB1a; Yadin et al. 1958, Pl. 116, 2.
Note: This type appears with more than 500 examples predominantly in the late phase of the Early Bronze Age III and the transition period between the Early and Middle Bronze Age on Tall Zirā'a (Strata 21 and 20)[55].

Fig. 2.21 Cooking pot, TZ 000357-005 (Source: BAI/GPIA).

Bowls/Kraters

TZ 000403-005
Type: Bowl/Krater
Base Form: Outward flaring rounded base ring
Figure References: Pl. 2.3, no. 8; Fig. 2.22
Est. D. (max.): 8.5
Parallel: **MB**: Hendrix et al. 1997, no. 143, 141; Houston Smith 1973, Pl. 35, 738.
Note: —

Fig. 2.22 Bowl/Krater, TZ 000403-005 (Source: BAI/GPIA).

TZ 000336-005
Type: Bowl/Krater
Base Form: Flat base, rounded at the outside
Figure References: Pl. 2.3, no. 9; Fig. 2.23
Est. D. (max.): 10.8
Parallel: **MB**: Houston Smith 1973, Pl. 38, 831.
Note: —

Fig. 2.23 Bowl/Krater, TZ 000336-005 (Source: BAI/GPIA).

54 Schwermer 2014, 95. 128.

55 Schwermer 2014, 95. 128.

TZ 000403-001
Type: Bowl/Krater
Rim Form: Vertical thickened rim, slightly outward bending, broadened to the upper part of the lip with a groove on the outer upper part
Figure References: Pl. 2.3, no. 4; Fig. 2.24
Est. D. (inside): 20
Parallel: **MB**: Bourke et al. 1998, Fig. 20, 12; Yadin et al. 1958, Pl. 112, 13.
Note: This type is very similar to the examples from the excavation strata 19 to 17 that are mainly from the Early Bronze Age period.

Fig. 2.24 Bowl/Krater, TZ 000403-001 (Source: BAI/GPIA).

2.2.1.6. Late Bronze Age Pottery from Tall Zirā'a (*Pl. 2.4, nos. 1–10*)

Bowls

TZ 000163-008
Type: Milk bowl
Rim Form: Hemispherical bowl with a thinned rounded lip
Figure References: Pl. 2.4, no. 1; Fig. 2.25; Vieweger et al. 2002, Fig. 18
Est. D. (max.): 16
Parallel: **LB I/II**: Amiran 1969, Pl. 53, 2–6. 8; Yadin et al. 1960, Pl. 123, 5–6.
Note: Painted brown decoration on a white to beige slip. Import from Cyprus.

Fig. 2.25 Milk bowl, TZ 000163-008 (Source: BAI/GPIA).

TZ 000111-002
Type: Bowl
Rim Form: Rounded bowl with rounded lip and a carination right under the straight-sided rim
Figure References: Pl. 2.4, no. 2
Est. D. (max.): —
Parallel: **LB IA/II**: Amiran 1969, Pl. 61, 13 and Pl. 62, 6; Mazar 2006, Fig. 12.1.
Note: This type of bowl is more common in the Iron Age period.

TZ 000434-001
Type: Bowl/Krater
Rim Form: Inward bending neck and thickened slightly outward bending flat lip
Figure References: Pl. 2.4, no. 3; Fig. 2.26
Est. D. (max.): 40
Parallel: **LB**: Amiran 1969, Pl. 41, 10.
Note: —

Fig. 2.26 Bowl/Krater, TZ 000434-001 (Source: BAI/GPIA).

Cooking Pots

TZ 000413-002
Type: Cooking pot
Rim Form: Everted triangular rim
Figure References: Pl. 2.4, no. 4
Est. D. (max.): 24
Parallel: **LB**: Amiran 1969, Pl. 42, 8; Bourke et al. 1998, Fig. 11, 2; Herr – Clark 2008, Fig. 18, 8; Schwermer 2014, app. part I, 32, no. 1, KtSB1a.2.
Note: The everted triangular rim is a new development of the Late Bronze Age period and also one of the main features of the examples of that period on Tall Zirā'a (Strata 15 and 14)[56].

56 Amiran 1969, 135; Schwermer 2014, 145.

TZ 000011-003
Type: Cooking pot
Rim Form: Triangular rim
Figure References: Pl. 2.4, no. 5
Est. D. (max.): 29
Parallel: **LB**: Amiran 1969, Pl. 42, 10; Bourke et al. 1994, Fig. 20, 3; Schwermer 2014, app. part I, p. 40, no. 1, KtSB1e; Yadin et al. 1958, Pl. 145, 5.
Note: The everted triangular rim is a new development of the Late Bronze Age and also one of the main features of the examples of that period on Tall Zirā'a (Strata 15 and 14)[57].

TZ 000014-015
Type: Cooking pot
Rim Form: Triangular rim
Figure References: Pl. 2.4, no. 6
Est. D. (max.): 34
Parallel: **LB**: Amiran 1969, Pl. 42, 10; Bourke et al. 1994, Fig. 20, 3; Schwermer 2014, app. part I, 40, no. 1, KtSB1e; Yadin et al. 1958, Pl. 145, 5.
Note: The everted triangular rim is a new development of the Late Bronze Age and also one of the main features of the examples of that period on Tall Zirā'a (Strata 15 and 14[58].

TZ 000114-003
Type: Cooking pot
Rim Form: Like a squat but longer and with a more edged triangle lip
Figure References: Pl. 2.4, no. 7
Est. D. (max.): 34
Parallel: **LB IIB**: Amiran 1969, Pl. 42, 14; Houston Smith 1973, Pl. 48, 698.
Note: According to Amiran this is the most typical shape of the last phase of the Late Bronze Age cooking pots (Strata 15 and 14)[59].

Storage Jars

TZ 000334-002
Type: Storage jar
Rim Form: Slightly outward bending neck with thickened and everted rounded rim
Figure References: Pl. 2.4, no. 8; Fig. 2.27
Est. D. (max.): 22
Parallel: **MB/LB**: Amiran 1969, Pl. 44, 4; Bourke et al. 1998, Fig. 20, 8; Yadin et al. 1958, Pl. 130, 1–2.
Note: Stated as a 'domestic jar'[60].

Fig. 2.27 Storage jar, TZ 000334-002 (Source: BAI/GPIA).

Pithoi

TZ 000127-003
Type: Pithos
Rim Form: Slightly inturned thickened overhanging and rounded rim
Figure References: Pl. 2.4, no. 9; Fig. 2.28
Est. D. (max.): 20
Parallel: **LB**: Amiran 1969, Pl. 44, 1–6; Papadopoulos – Kontorli-Papadopoulos 2010, Fig. 10c, 126.
Note: —

Fig. 2.28 Pithos, TZ 000127-003 (Source: BAI/GPIA).

Jugs

TZ 000014-008
Type: Jug
Form: Decorated body sherd
Figure References: Pl. 2.4, no. 10; Fig. 2.29
Wall thickness: 0.74
Parallel: **LB**: Amiran 1969, 179–181, Pl. 57.
Note: Mycenaean import.

Fig. 2.29 Jug, TZ 000014-008 (Source: BAI/GPIA).

57 Amiran 1969, 135; Schwermer 2014, 145.
58 Amiran 1969, 135; Schwermer 2014, 145.
59 Amiran 1969, 140.
60 Amiran 1969, 142.

2.2.1.7. Late Bronze/Iron Age and Iron Age Pottery from Tall Zirā'a (*Pl. 2.5, nos. 1–9*)

Bowls

TZ 000397-002
Type: Bowl
Rim Form: Bowl with a vestigial carination and flat horizontal rim
Figure References: Pl. 2.5, no. 1; Fig. 2.30
Est. D. (max.): 20
Parallel: **IA**: Yadin et al. 1958, Pl. 45, 15.
Note: This bowl is more likely an Iron Age example, since there has been no parallel found within the Bronze Age material so far.

Fig. 2.30 Bowl, TZ 000397-002 (Source: BAI/GPIA).

TZ 000021-028
Type: Bowl
Rim Form: Rounded bowl with rounded rim, pointed at the inside
Figure References: Pl. 2.5, no. 2
Est. D. (max.): 30
Parallel: **LB**: Amiran 1969, Pl. 38, 22; Houston Smith 1973, Pl. 48, 39.
Note: The open bowls with gently rounded sloping sides are dominant in the Late Bronze Age[62].

Bowls/Kraters

TZ 000340-001
Type: Bowl/Krater
Rim Form: Inverted with round thickening exterior rim
Figure References: Pl. 2.5, no. 5; Fig. 2.32
Est. D. (max.): 21.6
Parallel: **LB/IA**: Amiran 1969, Pl. 41, 1. 10, Pl. 69, 2, Pl. 74, 1; Fischer 1997, Fig. 7, 3; Fischer – Feldbacher 2011, Fig. 8, 2; Houston Smith 1973, Pl. 48, 548; Sauer – Herr 2012, Fig. 2.7.4 and 2.14.1.
Note: This type of kraters shows mainly two types of handles: perpendicular loop-handles or horizontal loop-handles. However, this example does not provide us with such information.

TZ 000337-001
Type: Bowl
Rim Form: Almost straight sloping sides, rounded rim, pointed at the inside
Figure References: Pl. 2.5, no. 3
Est. D. (max.): 31
Parallel: **LB**: Amiran 1969, Pl. 38, 14; Fischer 1997, Fig. 5, 1; Houston Smith 1973, Pl. 41, 898 and Pl. 47, 44.
Note: The open bowls with gently rounded sloping sides are dominant in the Late Bronze Age[61].

TZ 000268-001
Type: Bowl
Rim Form: Rounded rim, interior thickened
Figure References: Pl. 2.5, no. 4; Fig. 2.31
Est. D. (max.): 32
Parallel: **IA**: Amiran 1969, Pl. 60, 10; Hendrix et al. 1997, no. 225, 177; Sauer – Herr 2012, Fig. 2.8, 11.
Note: —

Fig. 2.31 Bowl, TZ 000268-001 (Source: BAI/GPIA).

Fig. 2.32 Bowl/Krater, TZ 000340-001 (Source: BAI/GPIA).

61 Amiran 1969, 124.

62 Amiran 1969, 124.

Jars/Jugs

TZ 000333-001
Type: Jar/Jug
Rim Form: Outward flaring thickened rim, slightly triangular in section
Figure References: Pl. 2.5, no. 6; Fig. 2.33
Est. D. (max.): 11
Parallel: **LB/IA**: Amiran 1969, Pl. 43, 8, 10, Pl. 44, 1, 5; Fischer – Walmsley 1995, Fig. 10, 9; Hendrix et al. 1997, no. 210, 169.
Note: According to Amiran this vessel is more likely one of the 'domestic jars'[63].

Fig. 2.33 Jar/Jug, TZ 000333-001 (Source: BAI/GPIA).

TZ 000330-004
Type: Jar/Jug
Rim Form: Thickened collar like rim, slightly grooved on the outside
Figure References: Pl. 2.5, no. 7; Fig. 2.34
Est. D. (max.): 12
Parallel: **LB/IA**: Herr – Clark 2008, Fig. 16, 11; Sauer – Herr 2012, Fig. 2.3.1; Yadin et al. 1958, Pl. 141, 8.
Note: —

Fig. 2.34 Jar/Jug, TZ 000330-004 (Source: BAI/GPIA).

Jars/Jugs

TZ 000340-002
Type: Jar/Jug
Rim Form: High cylindrical neck, thickened rim and rounded lip
Figure References: Pl. 2.5, no. 8; Fig. 2.35
Est. D. (max.): 11
Parallel: **IA**: Amiran 1969, Pl. 84, 3; Yadin et al. 1960, Pl. 58, 17–18.
Note: Example of one of the six main northern types of jugs in the Iron Age I period[64].

Fig. 2.35 Jar/Jug, TZ 000340-002 (Source: BAI/GPIA).

Jugs/Kraters

TZ 000471-008
Type: Jug/Krater
Rim Form: One-ridged neck, bulbous body
Figure References: Pl. 2.5, no. 9; Fig. 2.36
Est. D. (max.): 26
Parallel: **IA**: Amiran 1969, Pl. 71, 9; Fischer – Feldbacher 2011, Fig. 8, 4; Mazar 2006, Fig. 12.2, KR51–52; Sauer – Herr 2012, Fig. 2.28. 3. 5–6.
Note: This type of krater is often standing on three loop-handles[65].

Fig. 2.36 Jug/Krater, TZ 000471-008 (Source: BAI/GPIA).

63 Amiran 1969, 142.
64 Amiran 1969, 251.
65 Amiran 1969, 217.

2.2.1.8. Iron Age Cooking Pots from Tall Zirā'a (*Pl. 2.6, nos. 1–15*)

Cooking Pots

TZ 000397-003
Type: Cooking pot
Rim Form: Elongated rim, triangular in section
Figure References: Pl. 2.6, no. 1; Fig. 2.37
Est. D. (max.): 27
Parallel: **IA I**: Amiran 1969, Pl. 75, 3; Dijkstra et al. 2009, Fig. 4.7. 4–5; Fischer – Feldbacher 2011, Fig. 2, 5–6; Mazar 2006, Fig. 12.3; Schwermer 2014, app. part I, 52, no. 1, KtEZ2a.2.
Note: Considered to be an example of the Iron Age I period in the north and a direct descendent from its Canaanite prototypes[66]. Within the excavations of Tall Zirā'a this type is the dominating type throughout the Iron Age period, but can be found mainly in Iron Age I stratum (Stratum 13). It has the most variations of rim types[67].

Fig. 2.37 Cooking pot, TZ 000397-003 (Source: BAI/GPIA).

TZ 000054-022
Type: Cooking pot
Rim Form: Elongated rim, triangular in section
Figure References: Pl. 2.6, no. 2
Est. D. (max.): 33
Parallel: **IA I**: Amiran 1969, Pl. 75, 11; Schwermer 2014, app. part I, 52, no. 1, KtEZ2a.2; Yadin et al. 1958, Pl. 48,1.
Note: Considered to be an example of the Iron Age I period in the north and as a direct descendent from its Canaanite prototypes[68]. Within the excavations of Tall Zirā'a this type is the dominating type throughout the Iron Age period, but can be found mainly in Iron Age I Stratum 13. It has the most variations of rim types[69].

TZ 000020-004
Type: Cooking pot
Rim Form: Elongated thickened inward bending rim, slightly concave, rounded lip and pronounced ridge at the outside
Figure References: Pl. 2.6, no. 3; Fig. 2.38
Est. D. (inside): 25
Parallel: **IA II**: Amiran 1969, Pl. 75, 11; Daviau 1994, Fig. 20, 5; Mazar 2006, Fig. 12.3 CP54; Schwermer 2014, app. part I, 54, no. 2, KtEZ2b.1.
Note: —

Fig. 2.38 Cooking pot, TZ 000020-004 (Source: BAI/GPIA).

TZ 000081-002
Type: Cooking pot
Rim Form: Elongated rim, slightly concave, rounded lip and pronounced ridge at the outside
Figure References: Pl. 2.6, no. 4
Est. D. (max.): 30
Parallel: **IA II**: Schwermer 2014, app. part I, 54, no. 2, KtEZ2b.1.
Note: —

TZ 000190-001
Type: Cooking pot
Rim Form: Slightly inturned thickened rim, rounded lip with a small ridge at the outside
Figure References: Pl. 2.6, no. 5
Est. D. (max.): 30
Parallel: **IA**: Amiran 1969, Pl. 75, 14; Schwermer 2014, app. part I, 57, no. 8, KtEZ2b.2.
Note: Example from the northern types of cooking pots[70].

TZ 000048-002
Type: Cooking pot
Rim Form: Elongated rim, triangular in section.
Figure References: Pl. 2.6, no. 6
Est. D. (max.): 30
Parallel: **IA**: Amiran 1969, Pl. 75, 10; Schwermer 2014, app. part I, 56, no. 3, KtEZ2b.2.
Note: Example from the northern types of cooking pots[71].

66 Amiran 1969, 227.
67 Schwermer 2014, 192.
68 Amiran 1969, 227.
69 Schwermer 2014, 192.
70 Amiran 1969, 227.
71 Amiran 1969, 227.

TZ 000476-007
Type: Cooking pot
Rim Form: Ridged concave neck, thickened and rounded lip
Figure Reference: Pl. 2.6, no. 7; Fig. 2.39
Est. D. (max.): 26
Parallel: **IA II**: Mazar 2006, Pl. 18.1 BL54; Palumbo et al. 1996, Fig. 36, 8; Sauer – Herr 2012, Fig. 2.24, 10; Schwermer 2014; app. part I, 59. No. 3, KtEZ2b.4.
Note: —

Fig. 2.39 Cooking pot, TZ 000476-007 (Source: BAI/GPIA).

TZ 000120-005
Type: Cooking pot
Rim Form: Elongated thickened rim, slightly concave, rounded lip and pronounced ridge at the outside
Figure Reference: Pl. 2.6, no. 8
Est. D. (max.): 30
Parallel: **IA II**: Schwermer 2014, app. part I, 61, no. 1, KtEZ2b.5.
Note: —

TZ 000238-007
Type: Cooking pot
Rim Form: Elongated thickened rim, slightly concave, rounded lip and pronounced ridge at the outside
Figure Reference: Pl. 2.6, no. 9; Fig. 2.40
Est. D. (inside): 23
Parallel: **IA II**: Lamprichs – al-Sa'ad 2003, Fig. 25, 3; Schwermer 2014, app. part I, 63, no. 1, KtEZ2b.6.
Note: —

Fig. 2.40 Cooking pot, TZ 000238-007 (Source: BAI/GPIA).

TZ 000044-001
Type: Cooking pot
Rim Form: Elongated thickened rim, slightly concave, rounded lip and pronounced ridge at the outside
Figure Reference: Pl. 2.6, no. 10
Est. D. (max.): 30
Parallel: **IA II**: Schwermer 2014, app. part I, 63, no. 1, KtEZ2b.6.
Note: —

TZ 000248-002
Type: Cooking pot
Rim Form: Elongated thickened rim, rounded lip and sharp ridge at the outside
Figure References: Pl. 2.6, no. 11; Vieweger et al. 2002, Fig. 16
Est. D. (max.): 30
Parallel: **IA**: Amiran 1969, Pl. 75, 12; Schwermer 2014, app. part I, 65, no. 3, KtEZ2c.1.
Note: Example from the northern types of cooking pots. Handles appear to be more frequent than in the period before[72].

TZ 000018-002
Type: Cooking pot
Rim Form: Elongated rim, triangular in section
Figure References: Pl. 2.6, no. 12; Fig. 2.41; Vieweger et al. 2002, Fig. 16.
Est. D. (max.): 33
Parallel: **IA**: Amiran 1969, Pl. 75, 1; Hendrix et al. 1997, no. 196, 163; Schwermer 2014, app. part I, 67, no. 3, KtEZ2d.1.
Note: Example from the northern types of cooking pots[73].

Fig. 2.41 Cooking pot, TZ 000018-002 (Source: BAI/GPIA).

TZ 000126-004
Type: Cooking pot
Rim Form: Elongated inward bending rim, slightly concave, rounded lip and pronounced ridge at the outside
Figure References: Pl. 2.6, no. 13
Est. D. (inside): 31
Parallel: **IA II**: Schwermer 2014, app. part I, 68, no. 11, KtEZ2d.1.
Note: —

72 Amiran 1969, 227.

73 Amiran 1969, 227.

TZ 000044-009
Type: Cooking pot
Rim Form: Elongated inward bending rim, slightly concave, rounded lip and pronounced ridge at the outside
Figure References: Pl. 2.6, no. 14
Est. D. (max.): 30
Parallel: **IA II**: Fischer – Walmsley 1995, Fig. 7, 1; Schwermer 2014, app. part I, 75, no. 5, KtEZ3b.
Note: This type has a specific thin body wall and can be found only on few sites so far. On Tall Zirā'a it appears in the Late Bronze Age but has its main focus in the Iron Age IIA/B strata (Strata 15, 14, 12 and 11)[74].

TZ 000298-012
Type: Cooking pot
Rim Form: Elongated inward bending rim, slightly concave, rounded lip and pronounced ridge at the outside
Figure References: Pl. 2.6, no. 15; Fig. 2.42
Est. D. (max.): 37
Parallel: **IA II**: Schwermer 2014, app. part I, 75, no. 9, KtEZ3b.
Note: This type has a specific thin body wall and can be found only on few sites so far. On Tall Zirā'a it appears in the Late Bronze Age but has its main focus in the Iron Age IIA/B strata (Strata 15, 14, 12 and 11)[75].

Fig. 2.42 Cooking pot, TZ 000298-012 (Source: BAI/GPIA).

2.2.1.9. Iron Age IIA/B and Iron Age IIC Pottery from Tall Zirā'a (*Pl. 2.7, nos. 1–11*)

Cooking Pots and Jars

TZ 000044-008
Type: Cooking pot
Rim Form: Short thickened rim
Figure References: Pl. 2.7, no. 1
Est. D. (max.): 14
Parallel: **IA II**: Schwermer 2014, app. part I, 80, no. 1, KtEZ4b.
Note: Within the excavations of Tall Zirā'a this type appears predominantly in Iron Age IIC stratum (Stratum 10) but it is rather scarce[76].

TZ 000075-006
Type: Cooking Jar
Rim Form: Relatively short neck, thickened outward bending rim, rounded lip with a deep groove at the outside
Figure References: Pl. 2.7, no. 2; Fig. 2.43; Vieweger et al. 2002, Fig. 16
Est. D. (max.): 20
Parallel: **IA II**: similar to Lamprichs – al-Sa'ad 2003, Fig. 26.3.
Note: It seems that this type is rather late.

Fig. 2.43 Cooking jar, TZ 000075-006 (Source: BAI/GPIA).

Holemouth

TZ 000391-001
Type: Holemouth
Rim Form: Holemouth jar with an elongated inturned rim
Figure References: Pl. 2.7, no. 3; Fig. 2.44
Est. D. (inside): 20
Parallel: **IA II**: Amiran 1969, Pl. 69, 6; Mazar 2006, Fig. 12.4 SJ59 or Pl. 30, KR55.
Note: —

Fig. 2.44 Holemouth jar, TZ 000391-001 (Source: BAI/GPIA).

74 Schwermer 2014, 193.
75 Schwermer 2014, 193.
76 Schwermer 2014, 173. 194.

Storage Jars

TZ 000045-001
Type: Storage Jar
Rim Form: Thickened ridged neck, lip triangular in section
Figure References: Pl. 2.7, no. 4
Est. D. (max.): 30
Parallel: **IA II**: Amiran 1969, Pl.79, 1; Hendrix et al. 1997, no. 261, 191; Lamprichs – al-Saʿad 2003, Fig. 21,2; Mazar 2006, Fig. 12.4. SJ52b; Palumbo et al. 1996, Fig. 36, 10.
Note: The ovoid jars with ridged necks become one of the predominant types during the Iron Age IIA/B period. The main innovation of this type of vessel is the pronounced shoulder, which is lost in the shown example[77].

Pithoi

TZ 000242-003
Type: Pithos
Rim Form: Straight thickened rim, rounded lip, and shallow groove at the outside
Figure References: Pl. 2.7, no. 5; Vieweger et al. 2002, Fig. 21
Est. D. (max.): 24
Parallel: **IA II**: Palumbo et al. 1996, Fig. 36, 16; Sauer – Herr 2012, Fig. 2.26, 1. 6.
Note: —

Jars/Jugs

TZ 000387-005
Type: Jar/Jug
Rim Form: Slightly concave neck, outward everted rim
Figure References: Pl. 2.7, no. 6
Est. D. (max.): 14
Parallel: **IA II**: Amiran 1969, Pl. 83, 17.
Note: Since this example is lacking the handles and any decoration, it can be assigned only with the rim fragment to Amiran's parallel. Whether it should be considered as 'Ammonite pottery' has to remain unclear.

TZ 000356-004
Type: Jar/Jug
Rim Form: Ridged thickened neck, lip triangular in section
Figure References: Pl. 2.7, no. 7; Fig. 2.45
Est. D. (max.): 10
Parallel: **IA II**: Amiran 1969, Pl. 81,1; Lamprichs – al-Saʿad 2003, Fig. 26,1; Mazar 2006, Fig. 12.4. SJ52b; Yadin et al. 1960, Pl. 60, 8.
Note: According to Amiran, this group of ovoid jars with ridged necks has a widespread distribution and appears in many variants[78].

Fig. 2.45 Jar/Jug, TZ 000356-004 (Source: BAI/GPIA).

TZ 000248-003
Type: Jar/Jug
Rim Form: Ridged neck, overhanging lip
Figure References: Pl. 2.7, no. 8
Est. D. (max.): 9
Parallel: **IA II**: Yadin et al. 1958, Pl. 48, 12 and Pl. 57, 3.
Note: —

Jugs

TZ 000388-004
Type: Jug
Rim Form: Thickened concave rim and flat lip with grooves at the outside
Figure References: Pl. 2.7, no. 9; Fig. 2.46
Est. D. (max.): 27
Parallel: **IA II (Persian?)**: Kamlah 1993, Fig. 5, 1; Mazar 2006, Fig. 12, 6 AM52.
Note: Possibly Persian period.

Fig. 2.46 Jug, TZ 000388-004 (Source: BAI/GPIA).

77 Amiran 1969, 238.

78 Amiran 1969, 241.

Bowls

TZ 000392-022
Type: Bowl
Base Form: Thickened outer base ring and a second smaller inside one
Figure References: Pl. 2.7, no. 10
Est. D. (max.): 7
Parallel: **IA IIC**: Amiran 1969, 201, photo 217.
Note: Could be the base of a 'bar-handled' bowl[79].

TZ 000356-002
Type: Bowl
Rim Form: Slightly inturned rim with rounded lip and horizontal 'bar-handle' right at the outside of the lip
Figure References: Pl. 2.7, no. 11; Fig. 2.47
Est. D. (max.): 32
Parallel: **IA IIC**: Amiran 1969, Pl. 63, 8–10, Pl. 64, 28; Hendrix et al. 1997, no. 192, 161; Mazar 2006, Fig. 12.1 BL53.
Note: Usually two such handles are attached.

Fig. 2.47 Bowl, TZ 000356-002 (Source: BAI/GPIA).

2.2.1.10. Hellenistic and Early Roman Pottery from Tall Zirā'a (*Pl. 2.8, nos. 1–13*)

Plates/Bowls

TZ 000045-007
Type: Bowl
Rim Form: Everted slightly bellied wall with horizontally everted and rounded rim
Figure References: Pl. 2.8, no. 1, Fig. 2.48; Vieweger et al. 2002, Fig. 18
Est. D. (max.): 15
Parallel: **3rd–1st century BC**: Kenkel 2012, Pl. 15, Form Sa4.1.
Note: –

Fig. 2.48 Bowl, TZ 000045-007 (Source: BAI/GPIA).

TZ 000196-001
Type: Bowl ('Echinus-bowl')
Rim Form: Rather short and only slightly inverted rim with rounded lip
Figure References: Pl. 2.8, no. 2; Fig. 2.49
Est. D. (inside): 17
Parallel: **1st century BC**: Sauer – Herr 2012, Fig. 3.8, 12; Kenkel 2012, Pl. 14, Form Sa1.16.
Note: This type of bowl is characteristic throughout the entire Hellenistic period.

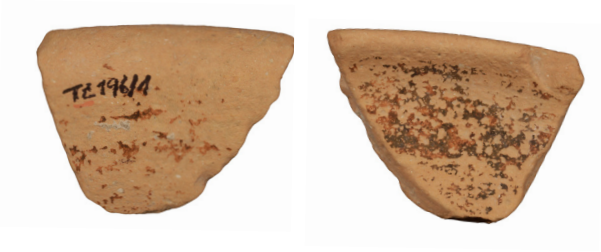


Fig. 2.49 Bowl, TZ 000196-001 (Source: BAI/GPIA).

TZ 000111-004
Type: Bowl
Rim Form: Triangular and inverted rim, almost in a right angle
Figure References: Pl. 2.8, no. 3; Fig. 2.50; Vieweger et al. 2002, Fig. 20
Est. D. (max.): 40
Parallel: **IA II/Persian?**: Sauer – Herr 2012, Fig. 2.35, 16.
Note: The fabric of this bowl is more likely a Hellenistic one, but the shape has closer parallels to the earlier periods.

Fig. 2.50 Bowl, TZ 000111-004 (Source: BAI/GPIA).

79 Amiran 1969, 201.

Bases

TZ 000119-009
Type: Bowl
Base Form: Moderately high, splaying ring base with small ring just inside the ring
Figure References: Pl. 2.8, no. 4; Fig. 2.51
Est. D. (max.): 6
Parallel: **1st century AD**: Sauer – Herr 2012, Fig. 3.12, 17 (Hayes Form 39).
Note: —

Fig. 2.51 Base, TZ 000119-009 (Source: BAI/GPIA).

TZ 000075-011
Type: Bowl
Base Form: Thick ring foot
Figure References: Pl. 2.8, no. 5; Fig. 2.52
Est. D. (max.): 10
Parallel: **Late 1st century AD**: Hayes 2008, Fig. 6, 141 (P32033).
Note: This kind of ring foot probably belongs to a plate and can also be found in the Çandarli Ware of the late first century AD[80].

Fig. 2.52 Bowl, TZ 000075-011 (Source: BAI/GPIA).

TZ 000168-007
Type: Bowl
Base Form: Rather flat and broad ring base
Figure References: Pl. 2.8, no. 6; Fig. 2.53
Est. D. (max.): 14
Parallel: **1st century AD**: Kenkel 2012, Pl. 10, Form ETS.8.6; Sauer – Herr 2012, Fig. 3.12, 13 (Hayes Form 28).
Note: —

Fig. 2.53 Bowl, TZ 000168-007 (Source: BAI/GPIA).

TZ 000021-026
Type: Bowl/Plate
Base Form: Flat ring base with a small ring just inside the ring
Figure References: Pl. 2.8, no. 7; Fig. 2.54
Est. D. (max.): 11
Parallel: **30 BC–20/25 AD**: Sauer – Herr 2012, Fig. 3.12, 14 (Hayes Form 29).
Note: —

Fig. 2.54 Bowl/Plate, TZ 000021-026 (Source: BAI/GPIA).

Amphorae

TZ 000219-015
Type: Amphora
Rim Form: Thickened, on the outside concave rim, round out-flaring lip
Figure References: Pl. 2.8, no. 8 Vieweger et al. 2002, Fig. 17
Est. D. (max.): 11
Parallel: **Hellenistic – Early Roman**: Kenkel 2012, Pl. 37, Form Am3.2.
Note: Very common form within the excavation material of Tall Zirā'a from this period (Strata 9–6).

80 Hayes 2008, Fig. 24. Nr. 788 (P9868).

TZ 000348-004
Type: Amphora
Rim Form: Thickened, everted convex rim, marked with an edge at the transition to the body, rounded lip
Figure References: Pl. 2.8, no. 9; Fig. 2.55
Est. D. (max.): 11
Parallel: **Hellenistic – Early Roman**: close to Kenkel 2012, Pl. 37, Form Am4.8.
Note: —

Fig. 2.55 Amphora, TZ 000348-004 (Source: BAI/GPIA).

Fig. 2.56 Amphora, TZ 000003-003 (Source: BAI/GPIA).

TZ 000003-003
Type: Amphora
Rim Form: Short, slightly everted, thickened rim with round lip
Figure References: Pl. 2.8, no. 10; Fig. 2.56
Est. D. (max.): 11
Parallel: **Early Roman**: Kenkel 2012, Pl. 37, Form Am6.4f; Sauer – Herr 2012, Fig. 3.20, 1.
Note: This form is also a very common type in the Late Hellenistic – Early Roman period of Tall Zirā'a (Strata 8–6) .

TZ 000281-002
Type: Amphora
Rim Form: Vertical, convex neck with thickened rim and triangular lip
Figure References: Pl. 2.8, no. 11; Fig. 2.57; Vieweger et al. 2002, Fig. 17.
Est. D. (max.): 10
Parallel: **Early Roman**: close to Kenkel 2012, Pl. 42, Form Am23.4b; Sauer – Herr 2012, Fig. 3.20, 6. 10.
Note: —

Fig. 2.57 Amphora, TZ 000281-002 (Source: BAI/GPIA).

TZ 000110-014
Type: Amphora (Rhodian)
Form: Handle
Figure References: Pl. 2.8, no. 12
Est. D. (handle): 3
Parallel: **Hellenistic**.
Note: Since there were no traces of a stamp on that handle fragment and also the part where the handle is bending over is missing it is not possible to date this fragment any closer.

Cups

TZ 000011-005
Type: Cup
Rim Form: Thickened everted, slightly triangular rim
Figure References: Pl. 2.8, no. 13; Fig. 2.58; Vieweger et al. 2002, Fig. 19
Est. D. (max.): 7
Parallel: **Early Roman**: Kenkel 2012, Pl. 18, Form Tg2.
Note: It might be an imitation of a Nabataean form.

Fig. 2.58 Cup, TZ 000011-005 (Source: BAI/GPIA).

2.2.1.11. Hellenistic – Roman and Roman Pottery from Tall Zirā'a (*Pl. 2.9, nos. 1–16*)

Bowls

TZ 000204-002
Type: Bowl
Rim Form: Almost vertical, irregular thickened everted rim and flat lip on the top. The rim has a clear slightly overhanging edge at the transition to the body
Figure References: Pl. 2.9, no. 1; Fig. 2.59; Vieweger et al. 2002, Fig. 19.
Est. D. (max.): 24

Parallel: **Late Hellenistic – Early Roman**: Kenkel 2012, Pl. 30, Form Sü12.2.
Note: Only 29 examples of this bowl type could be excavated so far. With the three samples of the survey they are altogether 32 rims. It cannot be stated that this is a very common form on the tall.

Fig. 2.59 Bowl, TZ 000204-002 (Source: BAI/GPIA).

TZ 000370-002
Type: Bowl
Rim Form: Almost vertical, irregular thickened everted rim and flat lip. The rim has a clear slightly overhanging edge at the transition to the body
Figure References: Pl. 2.9, no. 2; Fig. 2.60; Vieweger et al. 2002, Fig. 19
Est. D. (max.): 38
Parallel: **Late Hellenistic – Early Roman**: Kenkel 2012, Pl. 30, Form Sü12.2.
Note: Only 29 examples of this bowl type could be excavated so far. With the three samples of the survey they are altogether 32 rims. It cannot be stated, that this is a very common form on the tall.

Fig. 2.60 Bowl, TZ 000370-002 (Source: BAI/GPIA).

TZ 000202-001
Type: Bowl
Rim Form: Similar to bowls 1 and 2 but the rim is slightly inturned
Figure References: Pl. 2.9, no. 3; Vieweger et al. 2002, Fig. 20
Est. D. (max.): 40
Parallel: **Late Hellenistic – Early Roman**: Kenkel 2012, Pl. 30, Form Sü12.2..
Note: Only 29 examples of this bowl type have been excavated so far. With the three samples of the survey they are altogether 32 rims. It cannot be stated that this is a very common form on the tall.

Amphorae

TZ 000153-003
Type: Amphora
Rim Form: Vertical slightly everted neck with outward-slanting rim and flat lip
Figure References: Pl. 2.9, no. 4
Est. D. (max.): 11
Parallel: **Early Roman**: Kenkel 2012, Pl. 42, Form Am23.3g; Sauer – Herr 2012, Fig. 3.21, 4–5.
Note: —

TZ 000333-002
Type: Amphora
Rim Form: Rather thick vertical slightly everted neck and a flat out-slanting lip. Small groove at the transition from neck to body
Figure References: Pl. 2.9, no. 5; Fig. 2.61; Vieweger et al. 2002, Fig. 20
Est. D. (max.): 11
Parallel: **Late Hellenistic – Early Roman**: Kenkel 2012, Pl. 41, Form Am23.1b.
Note: —

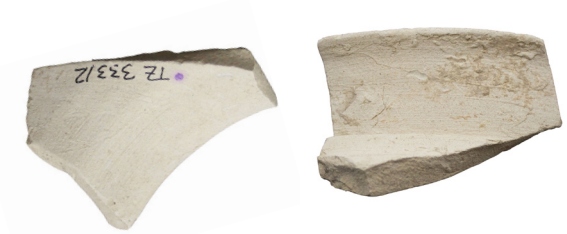


Fig. 2.61 Amphora, TZ 000333-002 (Source: BAI/GPIA).

Jars/Jugs

TZ 000034-001
Type: Jar/Jug
Rim Form: Slightly out-curved neck with almost horizontally everted, thickened rim and a flat lip, forming an angular rim
Figure References: Pl. 2.9, no. 6
Est. D. (max.): 13.5
Parallel: **Late Hellenistic – Early Roman**: Kenkel 2012, Pl. 33, Form Kru10.2.
Note: —

TZ 000348-005
Type: Jar/Jug
Rim Form: Outcurved rim with rounded lip
Figure References: Pl. 2.9, no. 7
Est. D. (max.): 13
Parallel: **Late Hellenistic**: Sauer – Herr 2012, Fig. 3.1, 10.
Note: —

Cooking Bowls

TZ 000004-001
Type: Cooking bowl
Rim Form: Slightly outflaring body wall with grooved rim
Figure References: Pl. 2.9, no. 8
Est. D. (max.): 20
Parallel: **1st–3rd century AD**: Kenkel 2012, Pl. 23, Form Gb2.
Note: This form can have two small handles on either side. They are called 'Galilean bowls' because the production centre of Kafr 'Inān (Kafar Hănanyà) was the main supplier of kitchenware during the Roman and Early Byzantine period. Whether the examples of Tall Zirā'a are products of Kafr 'Inān (Kafar Hănanyà) or not still needs to be answered.

TZ 000394-001
Type: Cooking bowl
Rim Form: Slightly outflaring body wall with thickened and grooved rim
Figure References: Pl. 2.9, no. 9
Est. D. (max.): 27
Parallel: **Last quarter of the 1st–second half of the 3rd century AD**: Kenkel 2012, Pl. 23, Form Gb1.2; Dijkstra et al. 2009, Fig. 4.1.12.
Note: This form can have two small handles on either side. They are called 'Galilean bowls' because the production centre of Kafr 'Inān (Kafar Hănanyà) was the main supplier of kitchenware during the Roman and Early Byzantine period. Whether the examples of Tall Zirā'a are products of Kafr 'Inān (Kafar Hănanyà) or not still needs to be answered.

TZ 000267-004
Type: Cooking bowl
Rim Form: Slightly outflaring body wall with thickened and grooved rim, which has a clear edge on the inside at the transition to the body wall
Figure References: Pl. 2.9, no. 10; Vieweger et al. 2002, Fig. 17
Est. D. (max.): 28
Parallel: **2nd–4th century AD**: Kenkel 2012, Pl. 23, Form Gb3.1.
Note: This form can have two small handles on either side. They are called 'Galilean bowls' because the production centre of Kafr 'Inān (Kafar Hănanyà) was the main supplier of kitchenware during the Roman and Early Byzantine period. Whether the examples of Tall Zirā'a are products of Kafr 'Inān (Kafar Hănanyà) or not still needs to be answered.

Casseroles

TZ 000481-001
Type: Casserole
Rim Form: Carinated body with a slightly incurved neck and a flat horizontal lip
Figure References: Pl. 2.9, no. 11; Vieweger et al. 2002, Fig. 17
Est. D. (max.): 20
Parallel: **1st–4th century AD**: Kenkel 2012, Pl. 21, Form Kas4; Dijkstra et al. 2009, Fig. 4.1.12.
Note: This form can have two small handles on either side.

TZ 000014-001
Type: Casserole
Rim Form: Carinated body with a slightly incurved neck and a flat horizontal lip.
Figure References: Pl. 2.9, no. 12; Fig. 2.62
Est. D. (max.): 20
Parallel: **1st–4th century AD**: Kenkel 2012, Pl. 21, Form Kas4.
Note: This form can have two small handles on either side.

Fig. 2.62 Casserole, TZ 000014-001 (Source: BAI/GPIA).

Cooking Pots

TZ 000212-001
Type: Cooking pot
Rim Form: Upright or slightly everted neck with a horizontal and grooved rim
Figure References: Pl. 2.9, no. 13; Vieweger et al. 2002, Fig. 17
Est. D. (max.): 16
Parallel: **1st–4th century AD**: Kenkel 2012, Pl. 25, Form Kt18.5.
Note: Two handles on each side of the vessel can be expected.

TZ 000255-007
Type: Cooking pot
Rim Form: Upright or slightly everted neck with a horizontal rim
Figure References: Pl. 2.9, no. 14; Fig. 2.63
Est. D. (max.): 10
Parallel: **Early Roman**: Kenkel 2012, Pl. 25, Form Kt18.1.
Note: Two handles on each side of the vessel can be expected.

Fig. 2.63 Cooking pot, TZ 000255-007 (Source: BAI/GPIA).

TZ 000334-001
Type: Cooking pot
Rim Form: Upright or slightly concave neck with a thinned everted rim
Figure References: Pl. 2.9, no. 15; Vieweger et al. 2002, Fig. 17.
Est. D. (max.): 11
Parallel: **Roman**: Kenkel 2012, Pl. 17, Form Kt16.5.
Note: Two handles on each side of the vessel can be expected.

TZ 000291-008
Type: Cooking pot
Rim Form: Short out-curved neck with thickened almost square rim, grooved on top
Figure References: Pl. 2.9, no. 16
Est. D. (max.): 12 (inside)
Parallel: **Late Roman**: Kenkel 2012, Pl. 26, Form Kt30.2.
Note: Two handles on each side of the vessel can be expected.

2.2.1.12. Late Roman and Byzantine Pottery Imports from Tall Zirāʿa (*Pl. 2.10, nos. 1–9*)

Plates/Bowls

TZ 000135-003
Type: Bowl
Rim Form: Shallow bowl with rounded knobbed rim and grooves on inside below rim; the body recurves slightly below the rim
Figure References: Pl. 2.10, no. 1
Est. D. (max.): 33
Parallel: **550–625 AD**: Hayes 1972, 162, Fig. 30:23 (ARS Hayes Form 104 C).
Note: –

TZ 000061-002
Type: Bowl
Rim Form: Bowl with a flaring wall and a ungrooved thickened vertical rim, convex on outer face
Figure References: Pl. 2.10, no. 2; Fig. 2.64
Est. D. (max.): 22
Parallel: **580/600–end of 7th century AD**: Hayes 1972, 380, Fig. 82:12 (CRS, Hayes Form 9 B).
Note: —

Fig. 2.64 Bowl, TZ 000061-002 (Source: BAI/GPIA).

TZ 000049-001
Type: Bowl
Rim Form: Bowl with a rather steep wall, bearing rouletting and a knobbed rim with two grooves
Figure References: Pl. 2.10, no. 3; Fig. 2.65; Vieweger et al. 2002, Fig. 18
Est. D. (max.): 25
Parallel: **c. 460–475 AD**: Hayes 1972, 374, Fig. 80:2 (CRS, Hayes Form 2).
Note: This type has sometimes stamped decoration on the bottom, surrounded by grooves. Maybe this is a transition form from Hayes Form 2 to Hayes Form 9.

Fig. 2.65 Bowl, TZ 000049-001 (Source: BAI/GPIA).

TZ 000043-003
Type: Bowl
Rim Form: Shallow bowl with knobbed rim and two grooves
Figure References: Pl. 2.10, no. 4
Est. D. (max.): 36
Parallel: **around 450 AD**: Hayes 1972, 374, Fig. 80:1 (CRS, Hayes Form 2).
Note: Common form and clearly a copy of African Red Slip Ware Hayes Form 84 (ARS) with its rouletting; often stamped decoration on the bottom. This example is rather large and shallower than the average.

TZ 000091-002
Type: Bowl
Rim Form: Bowl with sloping wall, slightly curved and heavy rim of squarish profile, rounded on the outside and slightly concave underneath with a small offset at junction with the wall

Figure References: Pl. 2.10, no. 5; Vieweger et al. 2002, Fig. 18
Est. D. (max.): 24
Parallel: **Late 6th–early 7th century AD**: Hayes 1972, 344, Fig. 71:2 (LRC, Hayes Form 10 A).
Note: —

TZ 000269-001
Type: Bowl
Rim Form: Bowl with a vertical rim incorporating a flange and flaring curved wall. The rim is vertical thickened, generally concave on outer face with a less pronounced overhang at the bottom; three lines of rouletting on outer face
Figure References: Pl. 2.10, no. 6; Fig. 2.66; Vieweger et al. 2002, Fig. 18
Est. D. (max.): 28
Parallel: **6th century AD**: Hayes 1972, 332, Fig. 68:16 (LRC, Hayes Form 3 E).
Note: Typical for this form is the frequently discoloured (black, brown) rim as a result of firing conditions. Also very often stamped decoration appears on the bottom, combined with grooves and rouletting.

Fig. 2.66 Bowl, TZ 000269-001 (Source: BAI/GPIA).

Bases

TZ 000262-005
Type: Bowl
Base Form: Shallow ring base
Figure References: Pl. 2.10, no. 9; Fig. 2.67
Est. D. (max.): 11
Parallel: **Late 5th–6th century AD**: This form is comparable to bowl bases as published in Hayes 1972, 332, Fig. 68 and 334, Fig. 69 (LRC Form 3).
Note: —

TZ 000267-006
Type: Bowl
Rim Form: Bowl with a vertical rim incorporating a flange and flaring curved wall. The rim is vertical, generally concave on outer face with a less pronounced overhang at the bottom and a slight offset at junction with the wall; two lines of rouletting on outer face
Figure References: Pl. 2.10, no. 7; Vieweger et al. 2002, Fig. 18
Est. D. (max.): 29
Parallel: **6th century AD**: Hayes 1972, 332, Fig. 68:16 (LRC, Hayes Form 3 E).
Note: Typical for this form is the frequently discoloured (black, brown) rim as a result of firing conditions. Also very often stamped decoration appears on the bottom, combined with grooves and rouletting.

TZ 000395-003
Type: Bowl
Rim Form: Bowl with a vertical rim incorporating a flange and flaring curved wall. The rim is vertical, generally concave on the outer face with a less pronounced overhang at the bottom and a slight offset at junction with the wall; three lines of rouletting on outer face
Figure References: Pl. 2.10, no. 8; Vieweger et al. 2002, Fig. 18
Est. D. (max.): 35
Parallel: **6th century AD**: Hayes 1972, 332, Fig. 68:16 (LRC, Hayes Form 3 E).
Note: Typical for this form is the frequently discoloured (black, brown) rim as a result of firing conditions. Also very often stamped decoration appears on the bottom, combined with grooves and rouletting.

Fig. 2.67 Bowl, TZ 000262-005 (Source: BAI/GPIA).

2.2.1.13. Roman – Byzantine, Byzantine and Byzantine – Early Islamic Pottery from Tall Zirāʿa (*Pl. 2.11, nos. 1–13*)

Mortaria

TZ 000420-001
Type: Mortarium
Rim Form: Flaring body wall with everted thickened horizontal rim, flat at the surface; rounded slightly overhanging rounded lip
Figure References: Pl. 2.11, no. 1
Est. D. (max.): 32
Parallel: **2nd–4th century AD**: Kenkel 2012, Pl. 31, Form Mo4.3.
Note: More than 80 examples of this vessel type have

been found during the excavations on Tall Zirā'a. The fabric is similar to mortaria from the north-eastern coast of the Mediterranean.

TZ 000280-005
Type: Mortarium
Rim Form: Flaring body wall with everted thickened folded rim creating a hole in the section; rounded triangular lip
Figure References: Pl. 2.11, no. 2; Fig. 2.68; Vieweger et al. 2002, Fig. 20.
Est. D. (max.): 40
Parallel: **2nd–4th century AD**: Kenkel 2012, Pl. 31, Form Mo4.4.
Note: See Pl. 2.11, no. 1.

Fig. 2.68 Mortarium, TZ 000280-005 (Source: BAI/GPIA).

Cooking bowls

TZ 000146-002
Type: Cooking bowl
Rim Form: Out-flaring body wall with very short, more or less upright rim and thinned lip; the rim has two grooves on the exterior; ribbed body wall
Figure References: Pl. 2.11, no. 4; Vieweger et al. 2002, Fig. 17.
Est. D. (max.): 26
Parallel: **5th–7th century AD**: Kenkel 2012, Pl. 22, Form Kas11.1.
Note: This type of cooking bowl can be found within the excavated ceramic material of Tall Zirā'a with 103 examples. Close parallels are coming from Umm Qēs (Gadara) and Ṭabaqāt Faḥl (Pella) (Houston Smith 1989, Pl. 28, 1208; Kerner 1990, Fig. 37, 115; Kerner 1997, Fig. 14,5; McNicoll et al. 1992; Pl. 109, 10; Nielsen et al. 1993, Pl. 29, 171–174).

TZ 000013-011
Type: Cooking bowl
Rim Form: Out-flaring body wall with very short, more or less upright rim and thinned lip; the rim has two irregular grooves on the exterior
Figure References: Pl. 2.11, no. 3; Fig. 2.69
Est. D. (max.): 30
Parallel: **5th–7th century AD**: Kenkel 2012, Pl. 22, Form Kas11.3.
Note: This type of cooking bowl can be found within the excavated ceramic material of Tall Zirā'a with 103 examples. Close parallels are coming from Umm Qēs (Gadara) and Ṭabaqāt Faḥl (Pella) (Houston Smith 1989, Pl. 28, 1208; Kerner 1990, Fig. 37, 115; Kerner 1997, Fig. 14, 5; McNicoll et al. 1992; Pl. 109, 10; Nielsen et al. 1993, Pl. 29, 171–174).

Fig. 2.69 Cooking bowl, TZ 000013-011 (Source: BAI/GPIA).

Casseroles

TZ 000153-004
Type: Casserole
Rim Form: Convex wall with short, everted rim, internal groove on squarish lip; small ledge at the lower end of the rim's interior
Figure References: Pl. 2.11, no. 5; Fig. 2.70; Vieweger et al. 2002, Fig. 17.
Est. D. (max.): 27
Parallel: **2nd–4th century AD**: Dijkstra et al. 2009, Fig. 4.2.2; Kenkel 2012, Pl. 21, Form Kas3.
Note: Might be a product of the Galilee.

Fig. 2.70 Casserole, TZ 000153-004 (Source: BAI/GPIA).

Cooking Pots

TZ 000345-001
Type: Cooking pot
Rim Form: Convex neck with outward-slanting rim and thinned lip; with ledge between neck and shoulder
Figure References: Pl. 2.11, no. 6
Est. D. (max.): 10

Parallel: **Late Roman – Early Byzantine**: Kenkel 2012, Pl. 24, Form Kt12.
Note: —

TZ 000101-003
Type: Cooking pot
Rim Form: Upright or slightly out-curved and short neck with grooved rim and everted lip; the outer lip higher than the inner
Figure References: Pl. 2.11, no. 7; Fig. 2.71
Est. D. (max.): 14 (inside)
Parallel: **Roman – Byzantine**: Kenkel 2012, Pl. 26, Form Kt25.
Note: —

Fig. 2.71 Cooking pot, TZ 000101-003 (Source: BAI/GPIA).

TZ 000325-001
Type: Cooking pot
Rim Form: Flaring rim with out-curved, thickened rim, rounded lip with an edge on the lower outside; strong ribbing on exterior neck
Figure References: Pl. 2.11, no. 8; Fig. 2.72
Est. D. (max.): 12
Parallel: **5th–7th century AD**: Kenkel 2012, Pl. 26, Form Kt30.3.
Note: —

Fig. 2.72 Cooking pot, TZ 000325-001 (Source: BAI/GPIA).

Amphorae

TZ 000325-002
Type: Amphora
Rim Form: Short convex neck with folded rim, creating a hole in the section and flat rounded lip
Figure References: Pl. 2.11, no. 9; Fig. 2.73
Est. D. (max.): 9
Parallel: **Byzantine – Umayyad**: Kenkel 2012, Pl. 43, Form Am23.6c.
Note: —

Fig. 2.73 Amphora, TZ 000325-002 (Source: BAI/GPIA).

Jars/Jugs

TZ 000011-014
Type: Jar/Jug
Rim Form: Flaring, slightly convex neck with rather large everted rim and thinned lip
Figure References: Pl. 2.11, no. 10
Est. D. (max.): 8
Parallel: **Late 3rd – Early 4th century AD**: Kenkel 2012, Pl. 34, Form Kru12.2
Note: —

TZ 000262-001
Type: Jar/Jug
Rim Form: Flaring neck with short, slightly thickened and everted rim and rounded lip
Figure References: Pl. 2.11, no. 11.
Est. D. (max.): 8
Parallel: **Late Roman – Late Byzantine**: Kenkel 2012, Pl. 41, Form Am22.2.
Note: —

TZ 000261-004
Type: Jar/Jug
Rim Form: Almost vertical, irregularly formed neck with short, slightly thickened and everted rim and rounded lip
Figure References: Pl. 2.11, no. 12; Fig. 2.74
Est. D. (max.): 9
Parallel: **Late Roman – Late Byzantine**: Kenkel 2012, Pl. 41, Form Am22.1d.
Note: —

Fig. 2.74 Jar/Jug, TZ 00261-004 (Source: BAI/GPIA).

Oil lamps

TZ 000367-028
Type: Oil lamp
Form: Small fragment of the upper part of an oil lamp with relief decoration. Irregular lines and dots probably all around the *infundibulum* and a row of short lines along the side
Figure References: Pl. 2.11, no. 13
Wall thickness: 0.3
Parallel: **Late Roman – Byzantine**: Kenkel 2012, Pl. 58, Form La72.
Note: Mould made lamp with typical Late Roman – Byzantine decoration.

2.2.1.14. Late Byzantine – Early Islamic, Umayyad and Mamluk Pottery from Tall Zirāʿa (*Pl. 2.12, nos. 1–10*)

Bowls (Early Islamic/Umayyad)

TZ 000455-001
Type: Bowl
Rim Form: Rounded wall with rounded rim, slightly grooved below the rim on the outside
Figure References: Pl. 2.12, no. 1; Fig. 2.75; Vieweger et al. 2002, Fig. 19
Est. D. (max.): 12
Parallel: **525–550 AD (Byzantine)**: Hendrix et al. 1997, 241, no. 364; McNicoll et al. 1992, Pl. 111, 7; Uscatescu 2001, Fig. 19, 1; **1st Half of the 8th–Early 9th century AD**: Sauer – Herr 2012, Fig. 4.1, 15.
Note: Incised wavy decoration on the body wall, fine ware. This is a very common bowl type in the Byzantine period.

Fig. 2.75 Bowl, TZ 000455-001 (Source: BAI/GPIA).

Kraters (Early Islamic/Umayyad)

TZ 000324-005
Type: Krater
Rim Form: Flaring, carinated-like body wall with everted rim and an internal ledge, rounded thinned lip; the carination is more an overhanging section
Figure References: Pl. 2.12, no. 2; Fig. 2.76
Est. D. (max.): 60
Parallel: **Early Islamic**: Sauer – Herr 2012, Fig. 3.78, 1; Tonghini 1998, Fig. 115, f.
Note: The examples from Tall Zirāʿa are all from a greyish fabric and therefore rather Early Islamic, than Byzantine products. Most are decorated with incised wavy lines on top of the lip and the body wall. This is a very typical decoration pattern for that period.

Fig. 2.76 Krater, TZ 000324-005 (Source: BAI/GPIA).

Amphorae (Early Islamic/Umayyad)

TZ 000398-001
Type: Amphora
Rim Form: Externally thickened and incurving rim
Figure References: Pl. 2.12, no. 3; Fig. 2.77
Est. D. (max.): 11
Parallel: **Byzantine – Umayyad**: Fuller 1987, Fig. 51, B; Kenkel 2012, Pl. 43, Form Am23.7c; Konrad 2001, Fig. 14, 3.
Note: —

Fig. 2.77 Amphora, TZ 000398-001 (Source: BAI/GPIA).

Cooking Pots (Early Islamic/Umayyad)

TZ 000110-003
Type: Cooking pot
Form: Ledge handle
Figure References: Pl. 2.12, no. 4; Fig. 2.78
Wall thickness: 1
Parallel: **Islamic**: Franken – Kalsbeek 1975, Fig. 49, 7.
Note: With incised decoration.

Fig. 2.78 Cooking pot, TZ 000110-003 (Source: BAI/GPIA).

Jars/Jugs (Early Islamic/Umayyad)

TZ 000467-001
Type: Jar/Jug
Form: Body sherd
Figure References: Pl. 2.12, no. 5; Fig. 2.79; Vieweger et al. 2002, Fig. 21
Wall thickness: 0.8
Parallel: **Early Islamic (8th–9th century AD)**: Bloch et al. 2006, p. 38–43; Rousset 2001, 224. 230; Tonghini 1998, Pl. 77–82;
Note: Cream ware? Decorated with a relief. It seems that it consisted of small arrow-like decoration. Probably mouldmade.

Fig. 2.79 Jar/Jug, TZ 000467-001 (Source: BAI/GPIA).

Bowls (Mamluk)

TZ 000040-003
Type: Bowl
Rim Form: Rounded wall and vertical rim with angular lip
Figure References: Pl. 2.12, no. 6; Fig. 2.80; Vieweger et al. 2002, Fig. 19
Est. D. (max.): 30
Parallel: **Mamluk**: Walker et al. 2011, Fig. 29, 1.
Note: Painted brown geometric decoration on a light beige slip. Handmade.

Fig. 2.80 Bowl, TZ 000040-003 (Source: BAI/GPIA).

Jars/Jugs (Mamluk)

Fig. 2.81 Jar/Jug, TZ 000021-016 (Source: BAI/GPIA).

TZ 000021-016
Type: Jar/Jug
Rim Form: Slightly everted rim with thinned rounded lip
Figure References: Pl. 2.12, no. 7; Fig. 2.81; Vieweger et al. 2002, Fig. 19
Est. D. (max.): 10
Parallel: **12th–15th century AD**: Bloch et al. 2006, Pl. 17, Ta.2537, p. 101; Dijkstra et al. 2009, Fig. 4.1.1; Sauer – Herr 2012, Fig. 4.15, 15.
Note: Painted brown geometric decoration on a light beige slip. Handmade.

TZ 000129-002
Type: Jar/Jug
Rim Form: Everted rim with rounded lip
Figure References: Pl. 2.12, no. 8; Vieweger et al. 2002, Fig. 19
Est. D. (max.): 17
Parallel: **12th–15th century AD**: Dijkstra et al. 2009, Fig. 4.1.1; Sauer – Herr 2012, Fig. 4.15, 14.
Note: Painted brown geometric decoration on a light beige slip. Handmade.

TZ 000042-011
Type: Jar/Jug
Form: Handle
Figure References: Pl. 2.12, no. 9; Fig. 2.82
Handle width: 3.4
Parallel: **Ayyubid – Mamluk:** Fuller 1987, Fig. 17–20; Kareem 2000, Fig. 47.1–2; Sauer – Herr 2012, Fig. 4.16, 2–13.
Note: Vertical flat handle.

Fig. 2.82 Jar/Jug, TZ 000042-011 (Source: BAI/GPIA).

TZ 000138-014
Type: Jar/Jug
Form: Body sherd
Figure References: Pl. 2.12, no. 10; Fig. 2.83
Wall thickness: 0.7
Parallel: **Ayyubid – Mamluk**: Fuller 1987, Fig. 17–20; Kareem 2000, Fig. 49.1–8; Sauer – Herr 2012, Fig. 4.16, 2–13.
Note: Painted brown geometric decoration on a light beige slip. Handmade.

Fig. 2.83 Jar/Jug, TZ 000138-014 (Source: BAI/GPIA).

2.2.1.15. Islamic Pottery from Tall Zirāʿa (*Pl. 2.13, nos. 1–13*)

Bowls

TZ 000165-003
Type: Bowl
Rim Form: Slightly thickened rim, rounded lip and carination under the rim on the outside
Figure References: Pl. 2.13, no. 1; Fig. 2.84
Est. D. (max.): 8
Parallel: **Islamic**: Franken – Kalsbeek 1975, Fig. 37, 21–22.
Note: —

Fig. 2.84 Bowl, TZ 000165-003 (Source: BAI/GPIA).

TZ 000054-006
Type: Bowl
Rim Form: Outward bending, slightly thickened rim, rounded lip
Figure References: Pl. 2.13, no. 2
Est. D. (max.): 8
Parallel: **Islamic**: Franken – Kalsbeek 1975, Fig. 37, 7.
Note: —

TZ 000372-007
Type: Bowl
Rim Form: Thickened and slightly outward bending rim, rounded lip
Figure References: Pl. 2.13, no. 3
Est. D. (max.): 21 (inside)
Parallel: **13th–15th century AD**: Kareem 2000, Fig. 6.4.
Note: Brown and green glaze inside.

TZ 000416-003
Type: Bowl
Rim Form: Thickened everted rim, slightly convex at the inside, rounded inward slanting lip
Figure References: Pl. 2.13, no. 4
Est. D. (max.): 26
Parallel: **Mamluk**: Franken – Kalsbeek 1975, Fig. 47, 4.
Note: Brown glaze inside.

TZ 000179-002
Type: Bowl
Rim Form: Rim profiled outward and thickened on the inside; carinated
Figure References: Pl. 2.13, no. 5; Vieweger et al. 2002, Fig. 19
Est. D. (max.): 8
Parallel: **Ayyubid – Mamluk (mainly 13th–14th century AD)**: Franken – Kalsbeek 1975, Fig. 37, 32; Hendrix et al. 1997, 293, 455; Kareem 2000, Fig. 4.9 and 69.5; Walker 2005, Fig. 9, 3.
Note: Green and yellow glaze inside and outside. The most common shape within the glazed ware is the

hemispherical bowl, occasionally carinated, with a slightly upturned rim. It seems to have had utilitarian functions including that of tableware[81].

TZ 000067-007
Type: Bowl
Rim Form: Straight out flaring rim, rounded lip
Figure References: Pl. 2.13, no. 6; Fig. 2.85; Vieweger et al. 2002, Fig. 19
Est. D. (max.): 32
Parallel: **Ayyubid – Mamluk**: Franken – Kalsbeek 1975, Fig. 35, 16.
Note: Brown glaze with yellow stripes, inside and outside.

Fig. 2.85 Bowl, TZ 000067-007 (Source: BAI/GPIA).

Bowls/Plates

TZ 000146-005
Type: Bowl/Plate
Base Form: Flat ring base
Figure References: Pl. 2.13, no. 7
Est. D. (max.): 9
Parallel: **Mamluk**: Franken – Kalsbeek 1975, Fig. 37, 78.
Note: Yellow glaze with brown lines inside.

TZ 000389-002
Type: Bowl/Plate
Base Form: Medium ring foot, slightly splayed
Figure References: Pl. 2.13, no. 8; Fig. 2.86
Est. D. (max.): 10
Parallel: **Mamluk**: Abila 2000, Area J, Tomb 21, Locus 04, Reg. no. 1148.
Note: Greenish-yellow glaze, inside and outside.

Fig. 2.86 Bowl/Plate, TZ 000389-002 (Source: BAI/GPIA).

Cooking Pots

TZ 000311-003
Type: Cooking pot
Rim Form: Globular cooking pot with inverted slightly thickened rim and rounded lip
Figure References: Pl. 2.13, no. 9; Fig. 2.87
Est. D. (max.): 12
Parallel: **12th–13th century AD**: Kareem 2000, Fig. 41.19.
Note: Part of a deep incised line on the outside.

Fig. 2.87 Cooking pot, TZ 000311-003 (Source: BAI/GPIA).

TZ 000216-006
Type: Cooking pot
Rim Form: Thickened inverted rim, angular lip, flat on the top
Figure References: Pl. 2.13, no. 10; Fig. 2.88
Est. D. (max.): 16
Parallel: **Islamic**: Bloch et al. 2006, Resafa Pl. 9, 8. 10, 1–2; Tonghini 1998, Fig. 41 f.
Note: —

Fig. 2.88 Cooking pot, TZ 000216-006 (Source: BAI/GPIA).

81 Tonghini 1998, 62.

TZ 000338-001
Type: Cooking pot
Rim Form: Thickened vertical rim, rounded lip
Figure References: Pl. 2.13, no. 11
Est. D. (max.): 25 (inside)
Parallel: **Islamic**: Bloch et al. 2006, Resafa Pl. 9, 3. 10, 11.
Note: —

TZ 000348-001
Type: Cooking pot
Rim Form: Outcurved neck with everted horizontally rim, rounded lip; slight carination under the neck at the outside body wall
Figure References: Pl. 2.13, no. 12; Fig. 2.89
Est. D. (max.): 28
Parallel: **Islamic**: Bloch et al. 2006, Resafa Pl. 8, 12; 9, 15; Kareem 2000, Fig. 44.5.
Note: —

Fig. 2.89 Cooking pot, TZ 000348-001 (Source: BAI/GPIA).

TZ 000036-007
Type: Cooking pot
Handle Form: Vertical loop handle of a glazed globular cooking pot
Figure References: Pl. 2.13, no. 13
Wall thickness: 0.6
Parallel: **Crusader period**: Houston Smith 1973, Pl. 77, 483; Sauer – Herr 2012, Fig. 4.18, 3–4.
Note: Dark brown glaze.

2.2.1.16. Islamic and Ottoman Pottery from Tall Zirā'a (*Pl. 2.14, nos. 1–16*)

Storage jars

TZ 000032-002
Type: Storage jar
Rim Form: Thickened rim, profiled outward
Figure References: Pl. 2.14, no. 1; Fig. 2.90; Vieweger et al. 2002, Fig. 21
Est. D. (max.): 21
Parallel: **Islamic**: Kareem 2000, Fig. 45.11.
Note: Unglazed Islamic pottery is characterised by strong local connotations; the search for parallels in the literature should thus be restricted to a limited area[82]. Could be an early example.

TZ 000195-004
Type: Storage jar
Rim Form: Collared-in-turned-rim, grooved at the outside
Figure References: Pl. 2.14, no. 2
Est. D. (max.): 20
Parallel: **12th–13th century AD**: Kareem 2000, Fig. 42.2 and 43.13.
Note: Could be an early example.

Fig. 2.90 Storage jar, TZ 000195-004 (Source: BAI/GPIA).

TZ 000348-002
Type: Storage jar
Rim Form: Convex neck and folded rim with rounded lip, ridge at the transition from neck to body wall
Figure References: Pl. 2.14, no. 3
Est. D. (max.): 14.5 (inside)
Parallel: —
Note: —

TZ 000304-003
Type: Storage jar
Rim Form: Thickened and folded horizontal and inward bending rim, rounded lip
Figure References: Pl. 2.14, no. 4
Est. D. (max.): 17 (inside)
Parallel: **Early Islamic**: Bloch 2011, Pl. 22, 466; Franken – Kalsbeek 1975, Fig. 48.
Note: The parallel to the example in Bloch 2011 is only by shape not by fabric.

TZ 000018-001
Type: Storage jar
Rim Form: Thickened, folded band rim, inward bending sides
Figure References: Pl. 2.14, no. 5
Est. D. (max.): 34
Parallel: **Ayyubid – Mamluk (11th–14th century AD)**: Tonghini 1998, Fig. 145 f.
Note: —

82 Tonghini 1998, 63.

Jars/Jugs

TZ 000077-001
Type: Jar/Jug
Rim Form: Thickened everted rim, flat on the top with rounded lip
Figure References: Pl. 2.14, no. 6
Est. D. (max.): 5 (inside)
Parallel: **Early Islamic**: Houston Smith – Day 1989, Pl. 58, 22.
Note: —

TZ 000019-009
Type: Jar/Jug
Rim Form: Thickened everted rim, flat on the top with squared lip
Figure References: Pl. 2.14, no. 7
Est. D. (max.): 11
Parallel: **Umayyad**: Konrad 2001, Fig. 7, 3; **Ayyubid –Mamluk (11th–14th century AD)**: Tonghini 1998, Fig. 148,b.
Note: —

TZ 000075-001
Type: Jar/Amphora
Rim Form: Long straight neck with rolled squared rim profile
Figure References: Pl. 2.14, no. 8; Fig. 2.91
Est. D. (max.): 15
Parallel: **Late Byzantine – Early Umayyad**: Bavant – Orssaud 2001, Fig. 9, 39; Daviau – Beckmann 2001, Fig. 4, 16; **Ayyubid – Mamluk (11th–14th century AD)**: Tonghini 1998, Fig. 122, d.
Note: Probably with two handles.

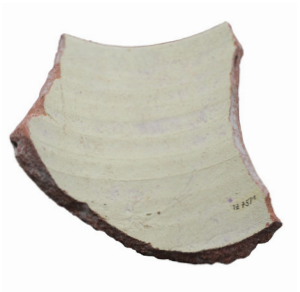


Fig. 2.91 Jar/Amphora, TZ 000075-001 (Source: BAI/GPIA).

TZ 000418-001
Type: Jar/Jug
Rim Form: Outward bending thickened neck with everted squared rim
Figure References: Pl. 2.14, no. 9
Est. D. (max.): 10
Parallel: **Early Islamic (Umayyad?)**: Bloch 2011, Pl. 15, 248 b.
Note: —

TZ 000036-002
Type: Jar/Jug
Rim Form: Everted rim with rounded lip
Figure References: Pl. 2.14, no. 10
Est. D. (max.): 14
Parallel: **Fatimid**: Whitcomb 1988, Fig. 4, a; **Ayyubid – Mamluk (11th–14th century AD)**: Tonghini 1998, Fig. 121, d.
Note: —

TZ 000138-012
Type: Jar/Jug
Form: 'turban-handle'?
Figure References: Pl. 2.14, no. 11
Wall thickness: 0.3
Parallel: **8th–11th century AD**: Tonghini 1998, Fig. 31, u.
Note: It seems that the 'turban shaped' knop of that handle is broken and only the negative round impression is left.

TZ 000430-009
Type: Jar/Jug (Chalice?)
Base Form: Pedestalfragment
Figure References: Pl. 2.14, no. 12; Fig. 2.92
Wall thickness: 1.2
Parallel: **13th–15th century AD**: Sauer – Herr 2012, Fig. 4.20, 20.
Note: Body sherd from the bottom of the vessel with attached remains of a stand.

Fig. 2.92 Jar/Jug, TZ 000430-009 (Source: BAI/GPIA).

TZ 000389-007
Type: Jar/Krater
Form: Body sherd
Figure References: Pl. 2.14, no. 13; Fig. 2.93
Wall thickness: 1
Parallel: **Early/Middle Islamic**: Fuller 1987, Fig. 31, C–D; Fig. 36, A–B; Tonghini 1998, Pl. 54; Walker 2012, Fig. 4.11, 25.
Note: Combed body sherd. Incised wavy lines.

Fig. 2.93 Jar/Jug, TZ 000304-012 (Source: BAI/GPIA).

TZ 000304-012
Type: Jar/Jug
Form: Body sherd
Figure References: Pl. 2.14, no. 14
Wall thickness: 0.6
Parallel: **Early/Middle Islamic**: Bloch 2011, Pl. 19, 209. 435; Fuller 1987, Fig. 31, C–D; Fig. 36, A–B; Tonghini 1998, Fig. 29c.
Note: Combed body sherd, incised wavy lines.

TZ 000430-001
Type: Jar/Jug
Form: Body sherd
Figure References: Pl. 2.14, no. 15
Wall thickness: 0.8
Parallel: **19th century AD**: Simpson 2002, Fig. 2, 11; **Modern**: Fuller 1987, Fig. 16, B.
Note: Decorated body sherd; small squared impressions. It is possible that this is a part of a pipe bowl[83].

Pipes

TZ 000098-001
Type: Pipe bowl
Form: Shank end with parallel dotted lines running around the bowl
Figure References: Pl. 2.14, no. 16; Fig. 2.94
Est. D. (max.): 1.86 and 0.77 inside
Parallel: **Ottoman (19th – Early 20th century AD)**: de Vinzenz 2011, Fig. 1, 1. 3; Tonghini 1998, Pl. 83–88 and Fig. 150 a–f.
Note: Smoker's pipes were discovered throughout the Middle East. They can be attributed to the Ottoman period. Tobacco was only introduced into the Ottoman Empire at the beginning of the seventeenth century AD, but smoking was not popular until the late seventeenth century AD[84].

Fig. 2.94 Pipe bowl, TZ 000098-001 (Source: BAI/GPIA).

83 See Simpson 2002, Fig. 2, 11.

84 Tonghini 1998, 68.

Plate 2.1: EB pottery from Tall Zirāʿa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	cooking pot	TZ 000369-004	V 109	west slope	HM Buff	EB
2	cooking pot	TZ 000102-004	AQ 141	east slope	HM Coarse	EB
3	cooking pot	TZ 000149-002	Z 113	west slope	HM R2B	EB
4	cooking pot	TZ 000373-004	AD 109	west slope	HM Buff	EB
5	cooking pot	TZ 000349-001	N 133	south slope	HM R2B	EB
6	cooking pot	TZ 000101-001	AM 149	east slope	CP 6	EB
7	cooking pot	TZ 000452-006	R 109	south slope	HM Buff	EB
8	cooking pot	TZ 000125-001	AQ 145	east slope	HM Buff	EB
9	cooking pot	TZ 000368-006	Z 109	west slope	HM Buff	EB
10	cooking pot	TZ 000375-002	AH 113	west slope	HM R2B	EB
11	handle	TZ 000285-002	AU 109	west slope	HM R2B	EB
12	body sherd	TZ 000290-003	AQ 109	west slope	HM Combed	EB
13	body sherd	TZ 000263-008	AY 121	north slope	HM Combed	EB

Plate 2.1: EB pottery from Tall Zirā'a—Survey 2001

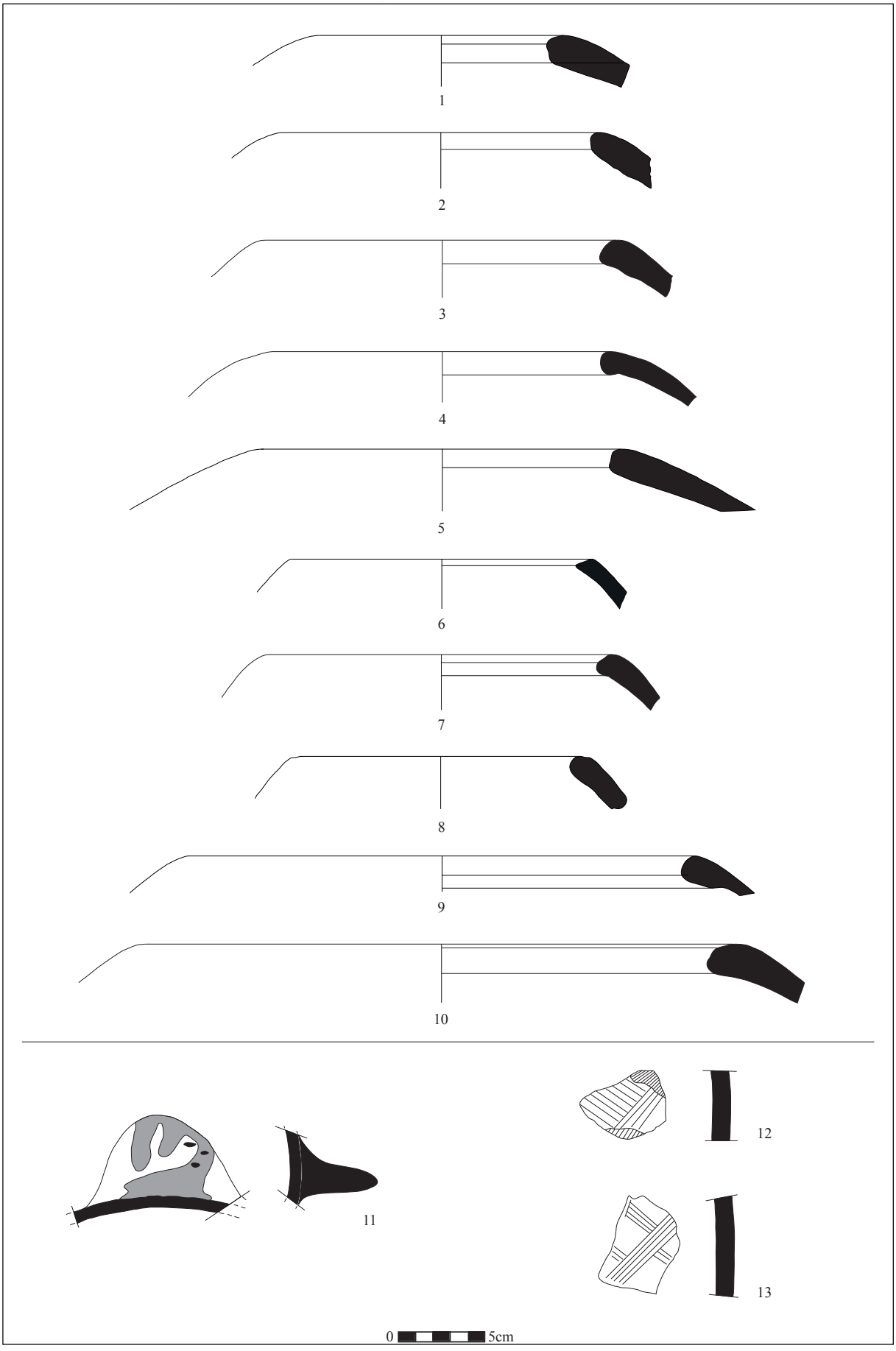


Plate 2.2: EB, EB I/EB II, EB IV/MB I pottery from Tall Zirāʿa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	bowl	TZ 000375-001	AH 113	west slope	HM Buff	MB I/MB II
2	bowl	TZ 000102-006	AQ 141	east slope	HM R2B	EB
3	bowl	TZ 000333-005	AQ 113	west slope	HM GW	EB/MB I
4	cooking pot	TZ 000045-004	AY 125	nord slope	CP 5	EB IV/MB I
5	cooking pot	TZ 000307-001	AM 109	west slope	CP 5	EB IV/MB I
6	jar/jug	TZ 000325-003	AH 113	west slope	HM Coarse	EB II/MB
7	jar/jug	TZ 000367-001	V113	west slope	HM GW	EB

Plate 2.2: EB, EB I/EB II, EB IV/MB I pottery from Tall Zirā‘a—Survey 2001

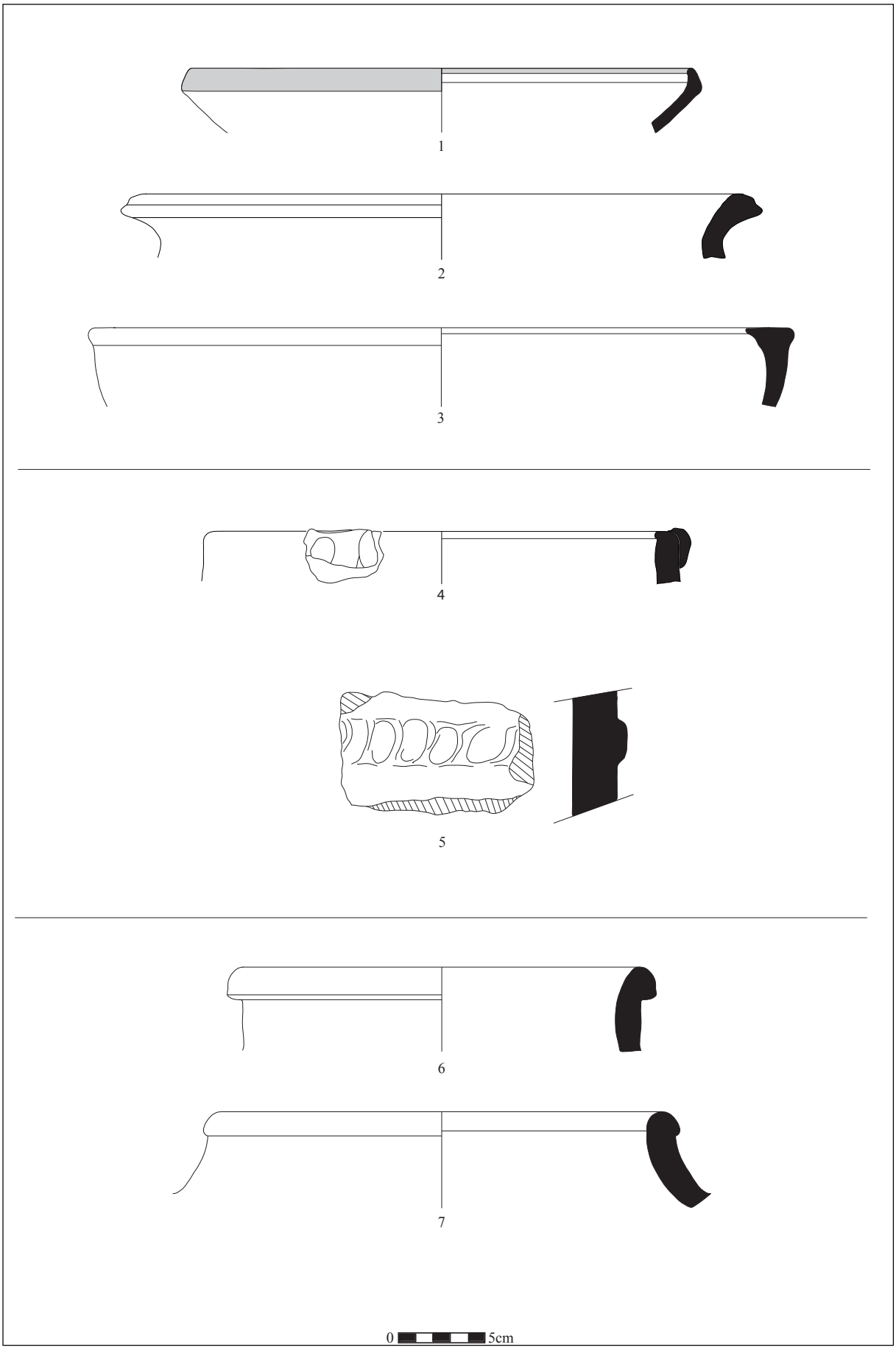


Plate 2.3: MB, MB II/LB I, MB/LB pottery from Tall Zirāʿa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	bowl	TZ 000187-004	AD 137	plateau	HM P-f	MB
2	bowl	TZ 000126-002	AQ 149	east slope	WM C Buff	MB/LB
3	bowl	TZ 000111-003	AQ 141	east slope	WM C SR2B-f	EB/MB
4	bowl/krater	TZ 000403-001	AT 119	–	WM C Buff	MB
5	krater	TZ 000045-003	AY 125	north slope	WM R2B P	MB/LB
6	cooking pot	TZ 000357-005	AH 109	west slope	CP 3-c	MB II/LB I
7	cooking pot	TZ 000229-001	AM 141	east slope	CP 3	MB II/LB I
8	bowl/krater	TZ 000403-005	AT 119	–	WM C Buff	MB
9	bowl/krater	TZ 000336-005	AQ 109	west slope	WM C Buff	MB

Plate 2.3: MB, MB II/LB I, MB/LB pottery from Tall Zirāʿa—Survey 2001

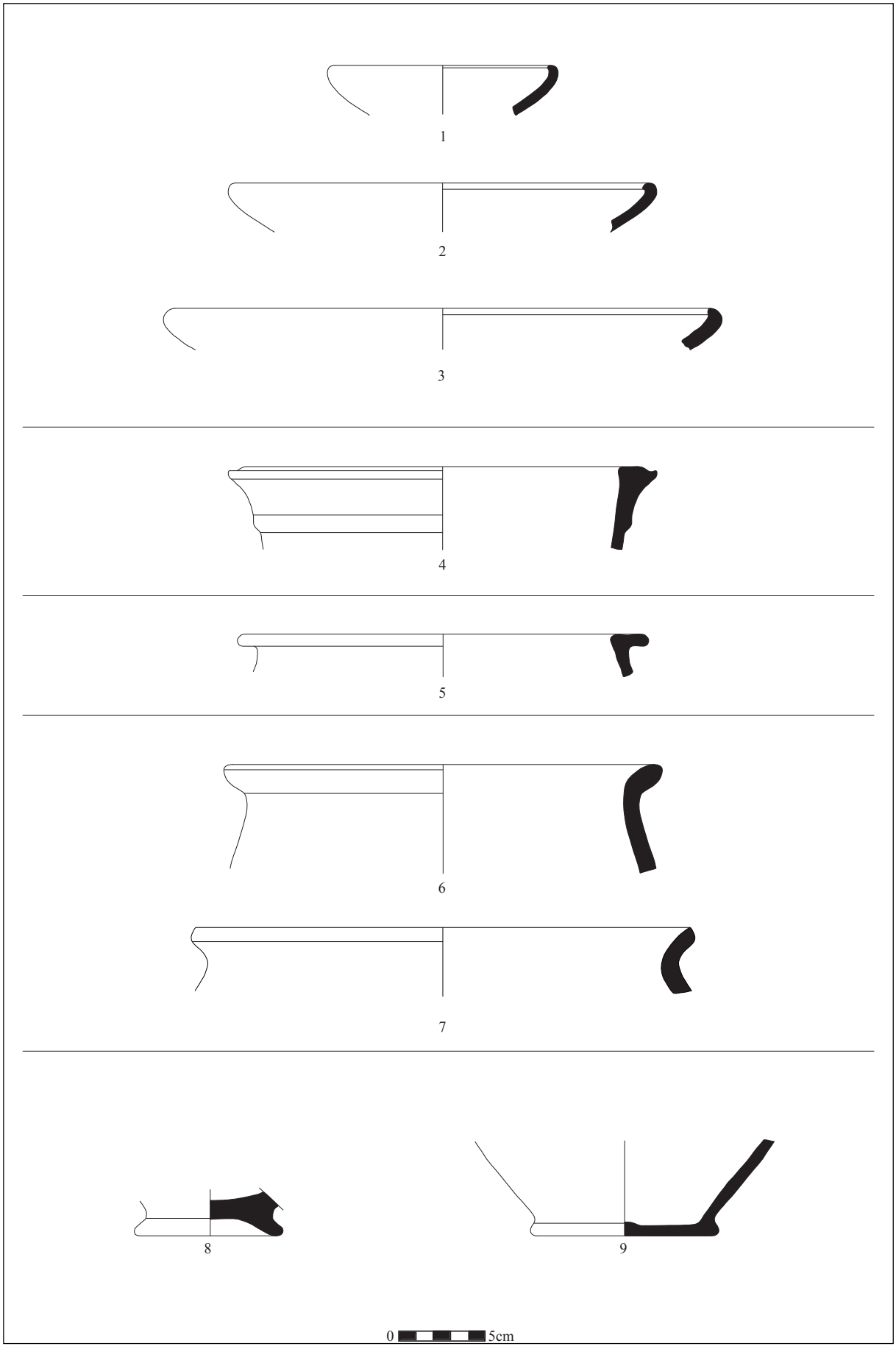


Plate 2.4: LB and LB IIB pottery from Tall Zirāʿa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	milk bowl	TZ 000163-008	BC 125	north slope	Wh Sl (Zyp)	LB
2	bowl	TZ 000111-002	AQ 141	east slope	WM C SBuff-f	LB
3	bowl/krater	TZ 000434-001	Z 145	east slope	WM C R2B	LB
4	cooking pot	TZ 000413-002	AT 119	plateau	CP 3	LB
5	cooking pot	TZ 000011-003	AD 117	plateau	CP 3	LB
6	cooking pot	TZ 000014-015	AD 113	west slope	CP 3	LB
7	cooking pot	TZ 000114-003	AQ 137	east slope	CP 3-c	LB IIB
8	storage jar	TZ 000334-002	AU 109	west slope	WM C R2B	LB
9	pithos	TZ 000127-003	AQ 145	east slope	WM C Buff	LB
10	jug	TZ 000014-008	AD 113	west slope	WM Myk	LB

Plate 2.4: LB and LB IIB pottery from Tall Zirā‘a—Survey 2001

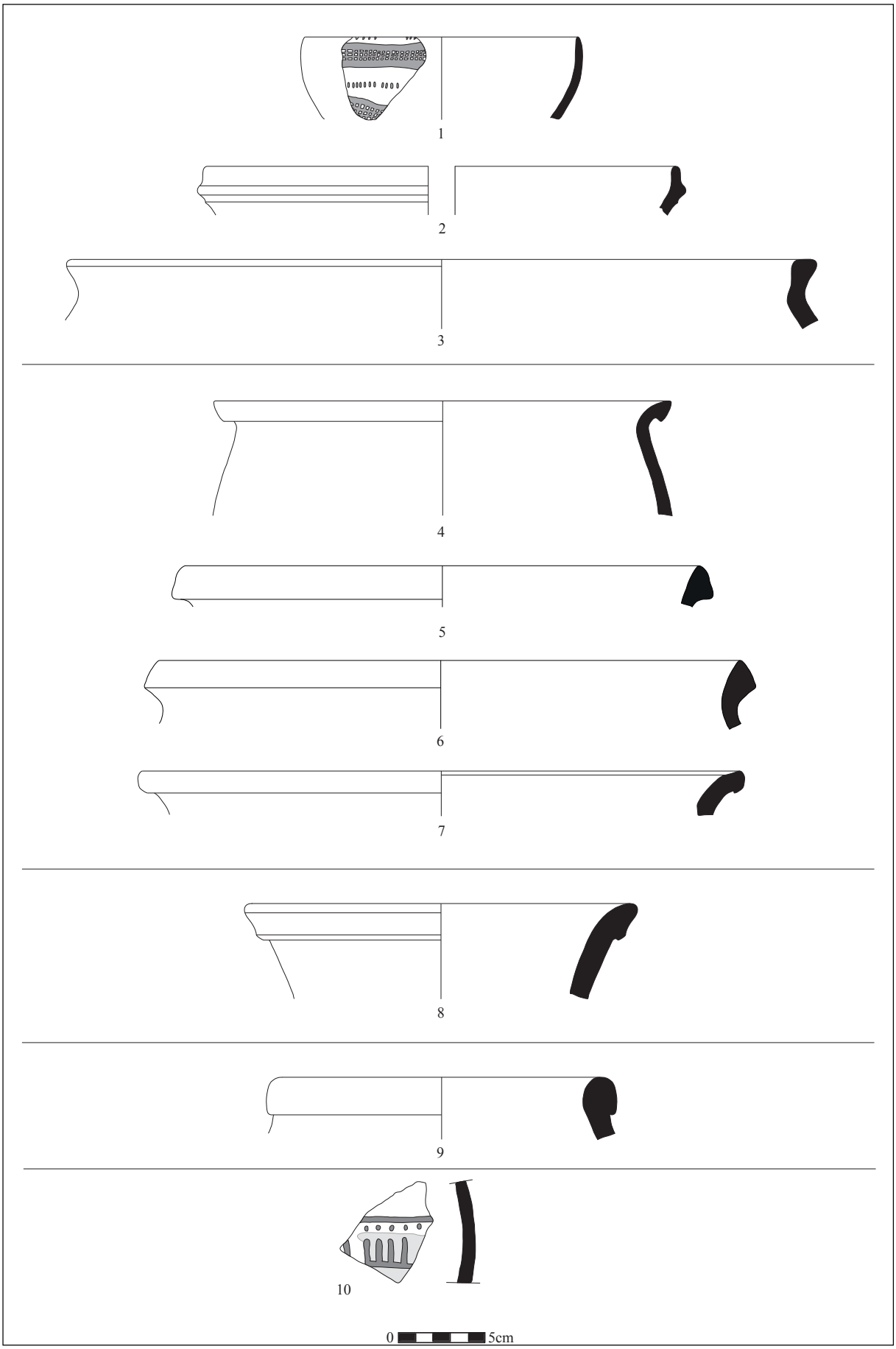


Plate 2.5: LB, LB/IA and IA pottery from Tall Zirāʿa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	bowl	TZ 000397-002	AT 119	west slope	WM C R2B-f	IA
2	bowl	TZ 000021-028	AD 113	west slope	WM C R2B	LB
3	bowl	TZ 000337-001	AY 109	north slope	WM C Buff	LB
4	bowl	TZ 000268-001	AQ 117	west slope	WM C R2B	IA
5	bowl/krater	TZ 000340-001	AU 113	north slope	WM C Buff	LB/IA
6	jar/jug	TZ 000333-001	AQ 113	west slope	WM C R2B	LB/IA
7	jar/jug	TZ 000330-004	AM 113	west slope	WM C R2B-f	LB/IA
8	jar/jug	TZ 000340-002	AU 113	north slope	WM C R2B-f	IA
9	jug/krater	TZ 000471-008	AM 145	east slope	WM C R2B	IA

Plate 2.5: LB, LB/IA and IA pottery from Tall Zirāʿa—Survey 2001

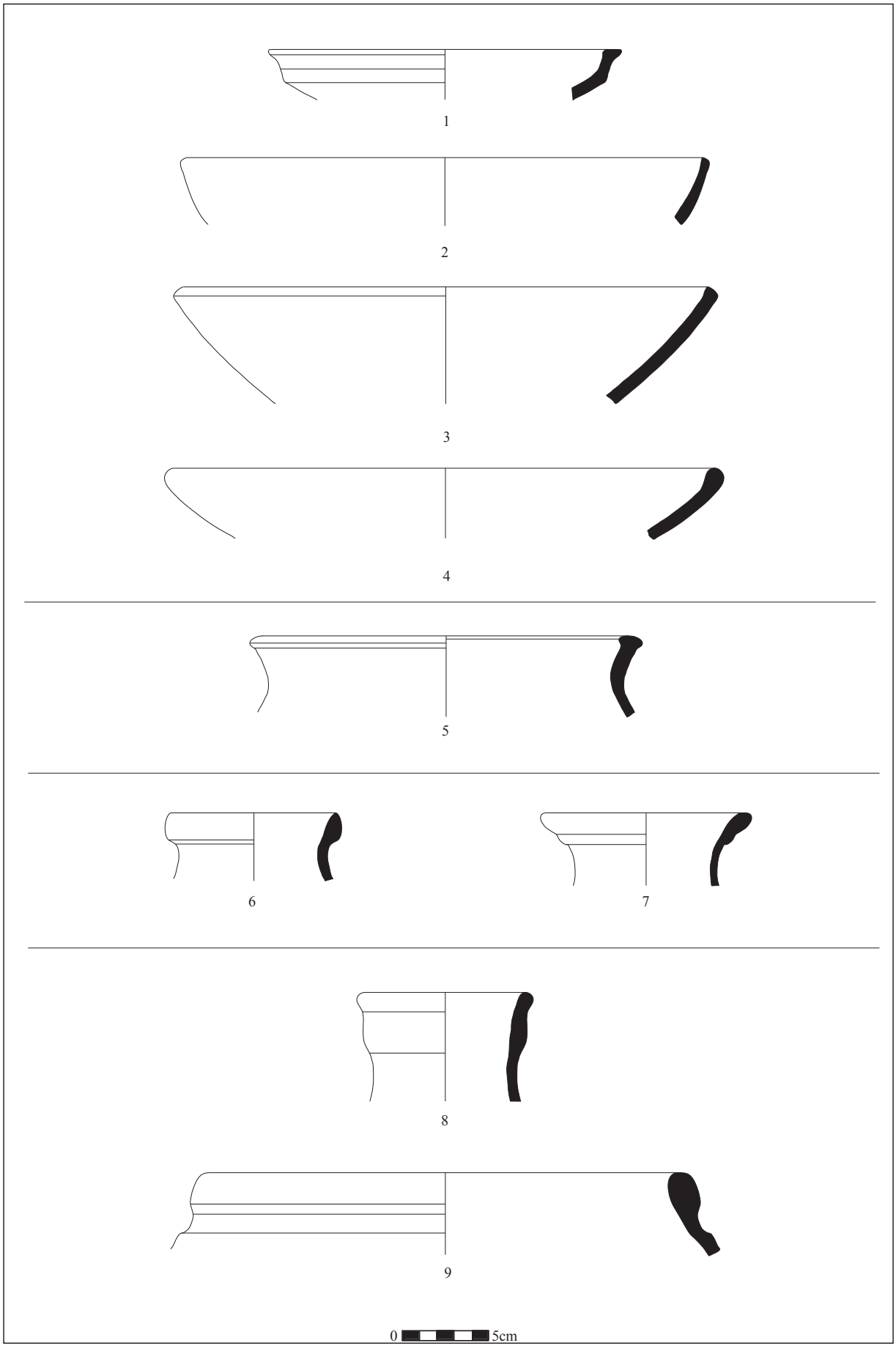


Plate 2.6: IA Cooking pots from Tall Zirāʻa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	cooking pot	TZ 000397-003	AT 119	plateau	CP 1	IA I
2	cooking pot	TZ 000054-022	AQ 121	plateau	CP 1	IA I
3	cooking pot	TZ 000020-004	AM 117	west slope	CP 1	IA II
4	cooking pot	TZ 000081-002	Z 121	plateau	CP 2 TZ	IA II
5	cooking pot	TZ 000190-001	AY 145	north slope	CP 2 TZ	IA
6	cooking pot	TZ 000048-002	AU 129	plateau	CP 1	IA
7	cooking pot	TZ 000476-007	AM 145	east slope	CP 3	IA II
8	cooking pot	TZ 000120-005	AQ 137	east slope	CP 2 TZ	IA II
9	cooking pot	TZ 000238-007	AM 145	east slope	CP 1	IA II
10	cooking pot	TZ 000044-001	AY 125	north slope	CP 1	IA II
11	cooking pot	TZ 000248-002	AD 141	east slope	CP 1	IA
12	cooking pot	TZ 000018-002	AH 121	plateau	CP 1	IA
13	cooking pot	TZ 000126-004	AQ 149	east slope	CP 2 TZ	IA II
14	cooking pot	TZ 000044-009	AY 125	north slope	CP 2 TZ	IA II
15	cooking pot	TZ 000298-012	R 125	plateau	CP 1-f	IA II

Plate 2.6: IA Cooking pots from Tall Zirā‘a—Survey 2001

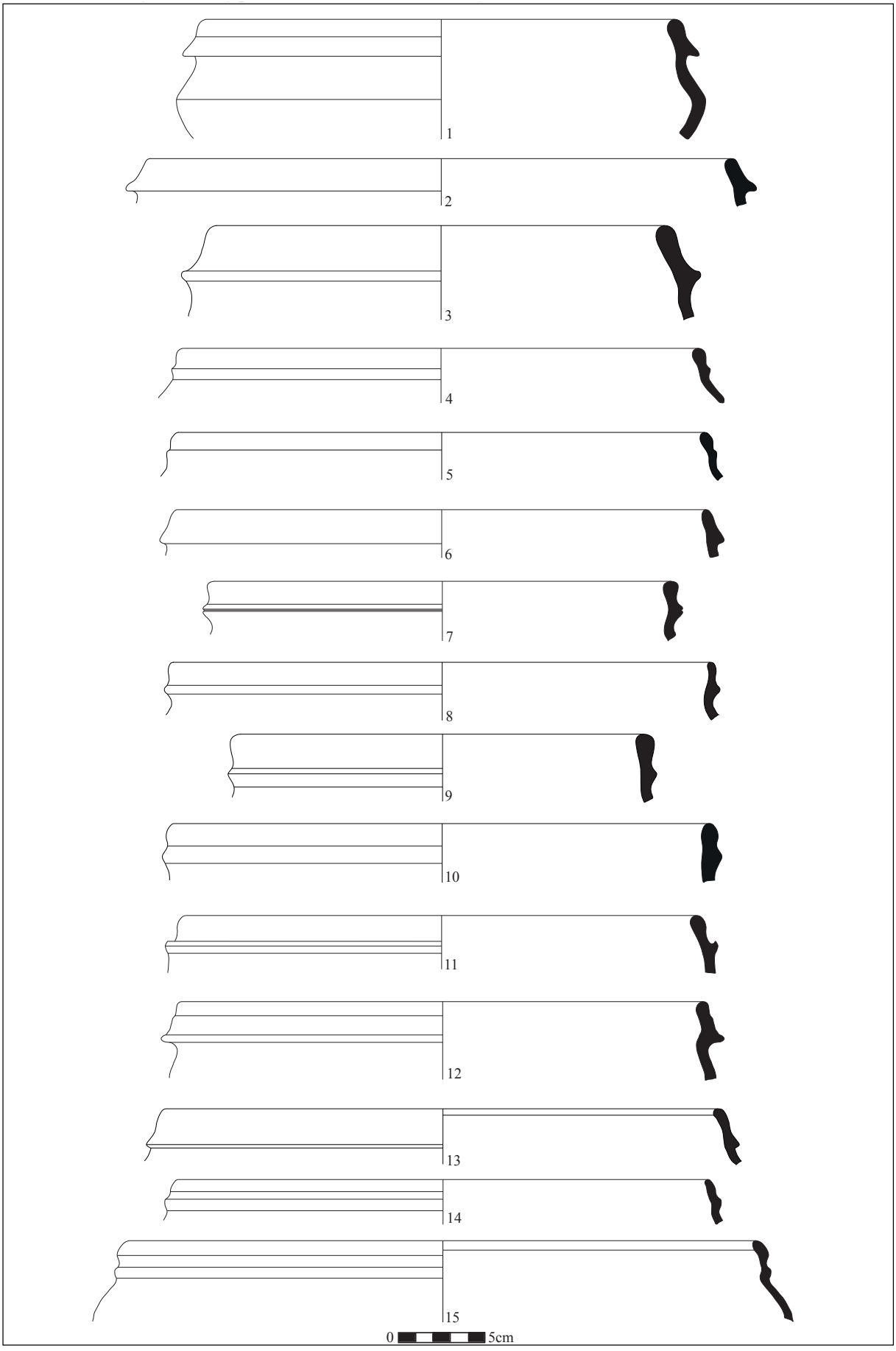


Plate 2.7: IA II, IA IIC pottery from Tall Zirāʿa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	cooking pot	TZ 000044-008	AY 125	north slope	CP 1	IA II
2	cooking jar	TZ 000075-006	AM 137	plateau	CP 3	IA II
3	holemouth	TZ 000391-001	I 133	south slope	WM C R2B	IA II
4	storage jar	TZ 000045-001	AY 125	north slope	WM C Buff	IA II
5	pithos	TZ 000242-003	AD 141	east slope	WM C R2B	IA II
6	jar/jug	TZ 000387-005	I 133	south slope	WM C R2B	IA II
7	jar/jug	TZ 000356-004	AH 105	west slope	WM C Buff	IA II
8	jar/jug	TZ 000248-003	AD 141	east slope	WM C Buff	IA II
9	jug	TZ 000388-004	I 133	south slope	WM C R2B	IA II (Persian?)
10	bowl	TZ 000392-022	I 133	south slope	WM C R2B	IA IIC
11	bowl	TZ 000356-002	AH 105	west slope	WM C R2B	IA IIC

Plate 2.7: IA II, IA IIC pottery from Tall Zirāʿa—Survey 2001

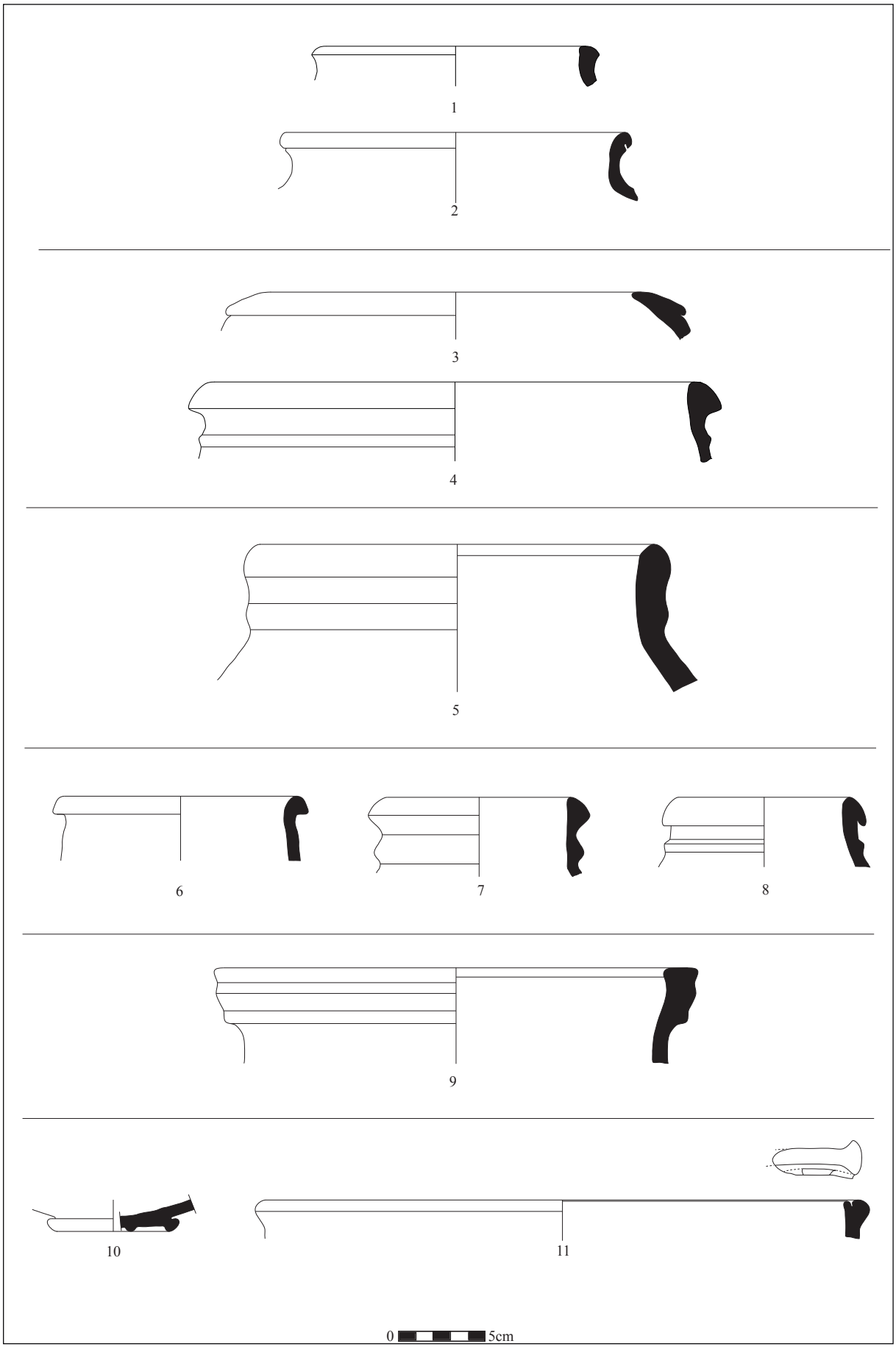


Plate 2.8: Hellenistic and Early Roman pottery from Tall Zirāʿa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	bowl	TZ 000045-007	AY 125	north slope	Cl Grey	Hellenistic
2	bowl	TZ 000196-001	AH 149	east slope	Cl Bu2Br-f-sl	Late Hellenistic
3	bowl	TZ 000111-004	AQ 141	east slope	Cl Coarse Bu2Br	IA II/Early Hellenistic?
4	bowl	TZ 000119-009	AM 137	plateau	ESA	Early Roman
5	bowl	TZ 000075-011	AM 137	plateau	ESA	Late Hellenistic – Early Roman
6	bowl	TZ 000168-007	Z 133	plateau	ESA	Early Roman
7	bowl/plate	TZ 000021-026	AD 113	west slope	ESA	Early Roman
8	amphora	TZ 000219-015	AQ 133	plateau	Cl Chal Red	Hellenistic – Early Roman
9	amphora	TZ 000348-004	N 129	south slope	Cl Chal Bu2Br	Late Hellenistic – Early Roman
10	amphora	TZ 000003-003	AM 121	plateau	Cl Buff	Hellenistic – Early Roman
11	amphora	TZ 000281-002	AU 117	north slope	Cl Chal Red-sl	Hellenistic – Early Roman
12	amphora	TZ 000110-014	AQ 145	east slope	Cl Amph-rhod	Hellenistic
13	cup	TZ 000011-005	AD 117	plateau	Cl Chal Red	Early Roman

Plate 2.8: Hellenistic and Early Roman pottery from Tall Zirā'a—Survey 2001

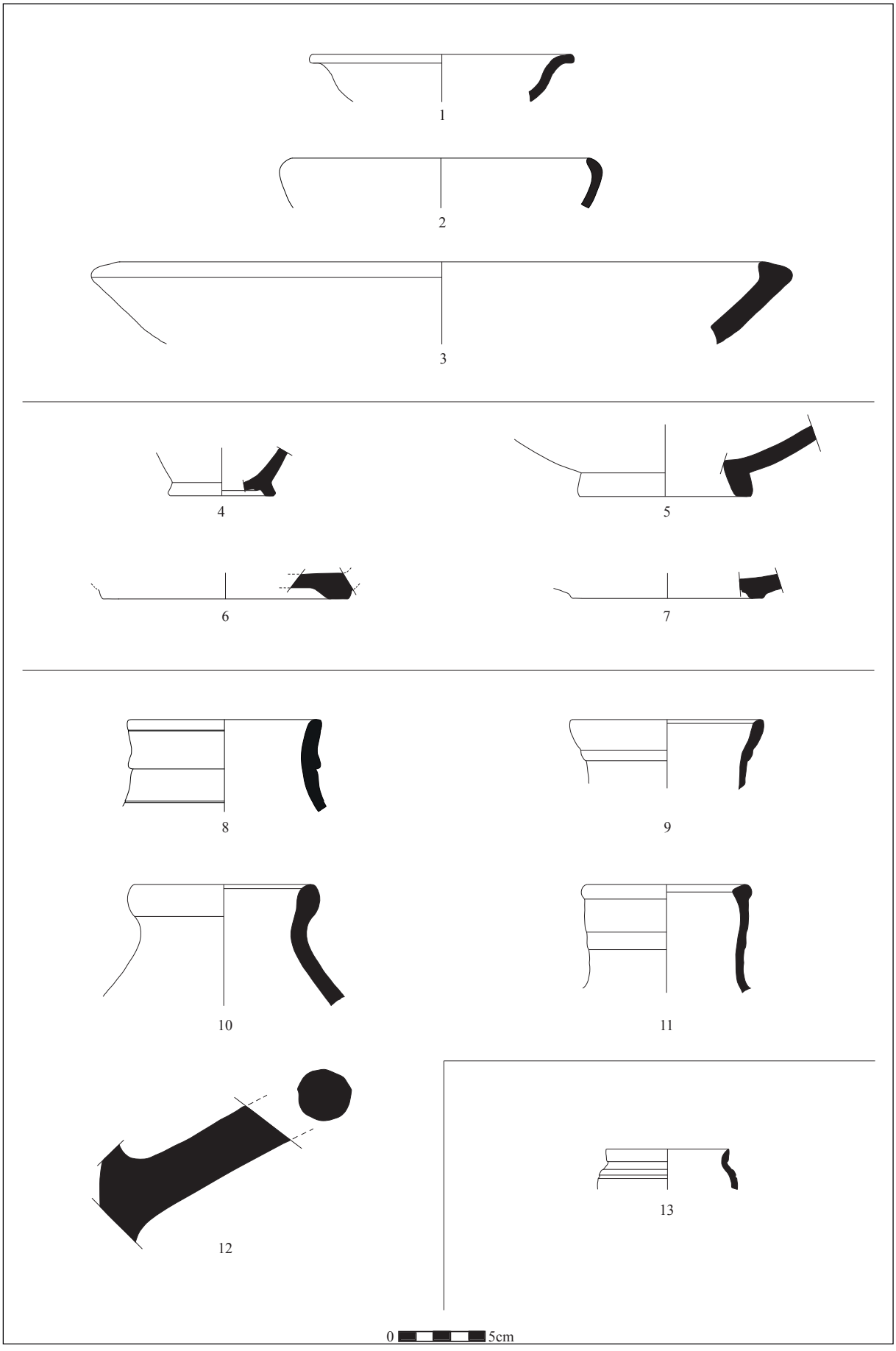


Plate 2.9: Hellenistic/Roman and Roman pottery from Tall Zirāʿa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	bowl	TZ 000204-002	AH 137	plateau	Cl Bu2Br-amph	Late Hellenistic – Early Roman
2	bowl	TZ 000370-002	V 105	west slope	Cl Bu2Br-f-sl	Late Hellenistic – Early Roman
3	bowl	TZ 000202-001	AM 133	plateau	Cl H Buff	Late Hellenistic – Early Roman
4	amphora	TZ 000153-003	AY 129	north slope	Cl Buff-hard	Hellenistic – Roman
5	amphora	TZ 000333-002	AQ 113	west slope	Cl H Buff	Late Hellenistic – Early Roman
6	jar/jug	TZ 000034-001	Z 133	plateau	Cl Bu2Br-amph	Late Hellenistic – Early Roman
7	jar/jug	TZ 000348-005	N 129	south slope	Cl Bu2Br-f	Late Hellenistic (Roman)
8	cooking bowl	TZ 000004-001	AD 117	plateau	Cl Red CP 2	Roman
9	cooking bowl	TZ 000394-001	AT 119	plateau	Cl Red CP 2	Roman
10	cooking bowl	TZ 000267-004	AY 117	north slope	Cl Red CP 2	Roman
11	casserole	TZ 000481-001	R 141	south slope	Cl Red CP 3	Roman
12	casserole	TZ 000014-001	AD 113	west slope	Cl Red CP 2	Roman
13	cooking pot	TZ 000212-001	AH 145	east slope	Cl Red CP 2	Roman
14	cooking pot	TZ 000255-007	BC 121	north slope	Cl Red CP 2	Early Roman
15	cooking pot	TZ 000334-001	AU 109	west slope	Cl Red CP 2	Roman
16	cooking pot	TZ 000291-008	AQ 113	west slope	Cl Red CP 5	Late Roman

Plate 2.9: Hellenistic/Roman and Roman pottery from Tall Zirā‘a—Survey 2001

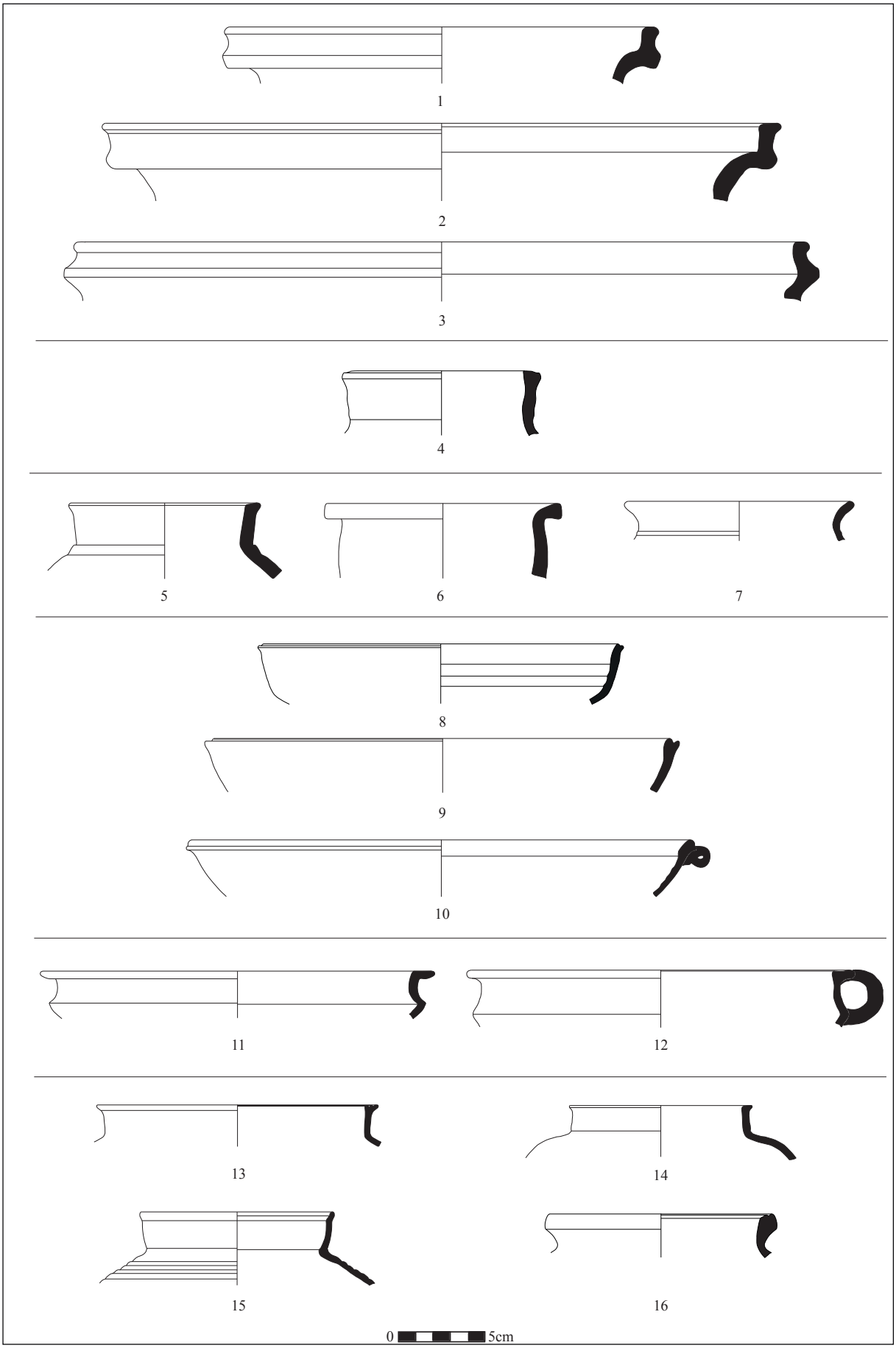


Plate 2.10: Late Roman and Byzantine imports from Tall Zirāʻa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	bowl	TZ 000135-003	Z 121	plateau	ARS	Late Roman – Byzantine
2	bowl	TZ 000061-002	AQ 129	plateau	CRS	Late Roman – Byzantine
3	bowl	TZ 000049-001	AU 129	plateau	CRS	Late Roman – Byzantine
4	bowl	TZ 000043-003	AD 129	plateau	CRS	Late Roman – Byzantine
5	bowl	TZ 000091-002	V 125	plateau	LRC	Byzantine
6	bowl	TZ 000269-001	AQ 117	west slope	LRC	Late Roman – Byzantine
7	bowl	TZ 000267-006	AY 117	north slope	LRC	Late Roman – Byzantine
8	bowl	TZ 000395-003	AQ 121	plateau	LRC	Late Roman – Byzantine
9	bowl	TZ 000262-005	AY 117	north slope	LRC	Late Roman – Byzantine

Plate 2.10: Late Roman and Byzantine imports from Tall Zirā‘a—Survey 2001

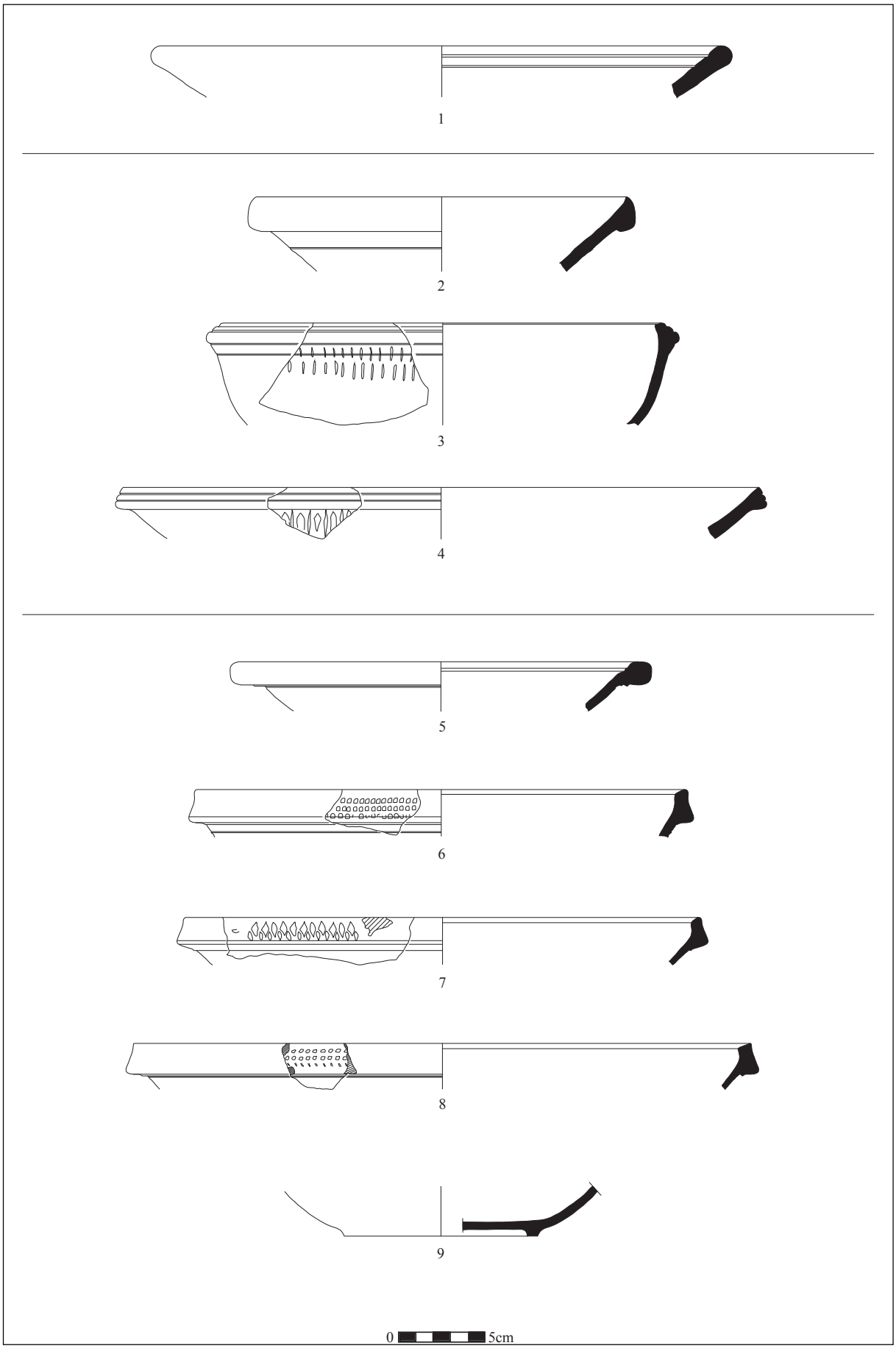


Plate 2.11: Roman – Byzantine, Byzantine and Byzantine – Early Islamic pottery from Tall Zirāʿa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	mortarium	TZ 000420-001	AQ 129	plateau	Cl Bu2Red-grog	Roman – Early Byzantine
2	mortarium	TZ 000280-005	AU 117	north slope	Cl Bu2Red-grog	Roman – Early Byzantine
3	cooking bowl	TZ 000013-011	AM 121	plateau	Cl Red CP 4	Byzantine – Early Umayyad
4	cooking bowl	TZ 000146-002	V 133	south slope	Cl Red CP 4	Byzantine – Early Umayyad
5	casserole	TZ 000153-004	AY 129	north slope	Cl Red CP 3	Roman – Early Byzantine
6	cooking pot	TZ 000345-001	N 137	south slope	Cl Red CP 1	Late Roman – Early Byzantine
7	cooking pot	TZ 000101-003	AM 149	east slope	Cl Red CP 4	Roman – Byzantine
8	cooking pot	TZ 000325-001	R 121	south slope	Cl Red CP 5	Byzantine – Early Umayyad
9	amphora	TZ 000325-002	R 121	south slope	Cl BS WP	Byzantine – Umayyad
10	jar/jug	TZ 000011-014	AD 117	plateau	Cl BP	Late Roman – Early Byzantine
11	jar/jug	TZ 000262-001	AY 121	north slope	Jerash Ware	Late Roman – Late Byzantine
12	jar/jug	TZ 000261-004	AY 121	north slope	Jerash Ware	Late Roman – Late Byzantine
13	oil lamp	TZ 000367-028	V 113	west slope	Cl C Bu2Br-f	Late Roman – Byzantine

Plate 2.11: Roman – Byzantine, Byzantine and Byzantine – Early Islamic pottery from Tall Zirā'a—Survey 2001

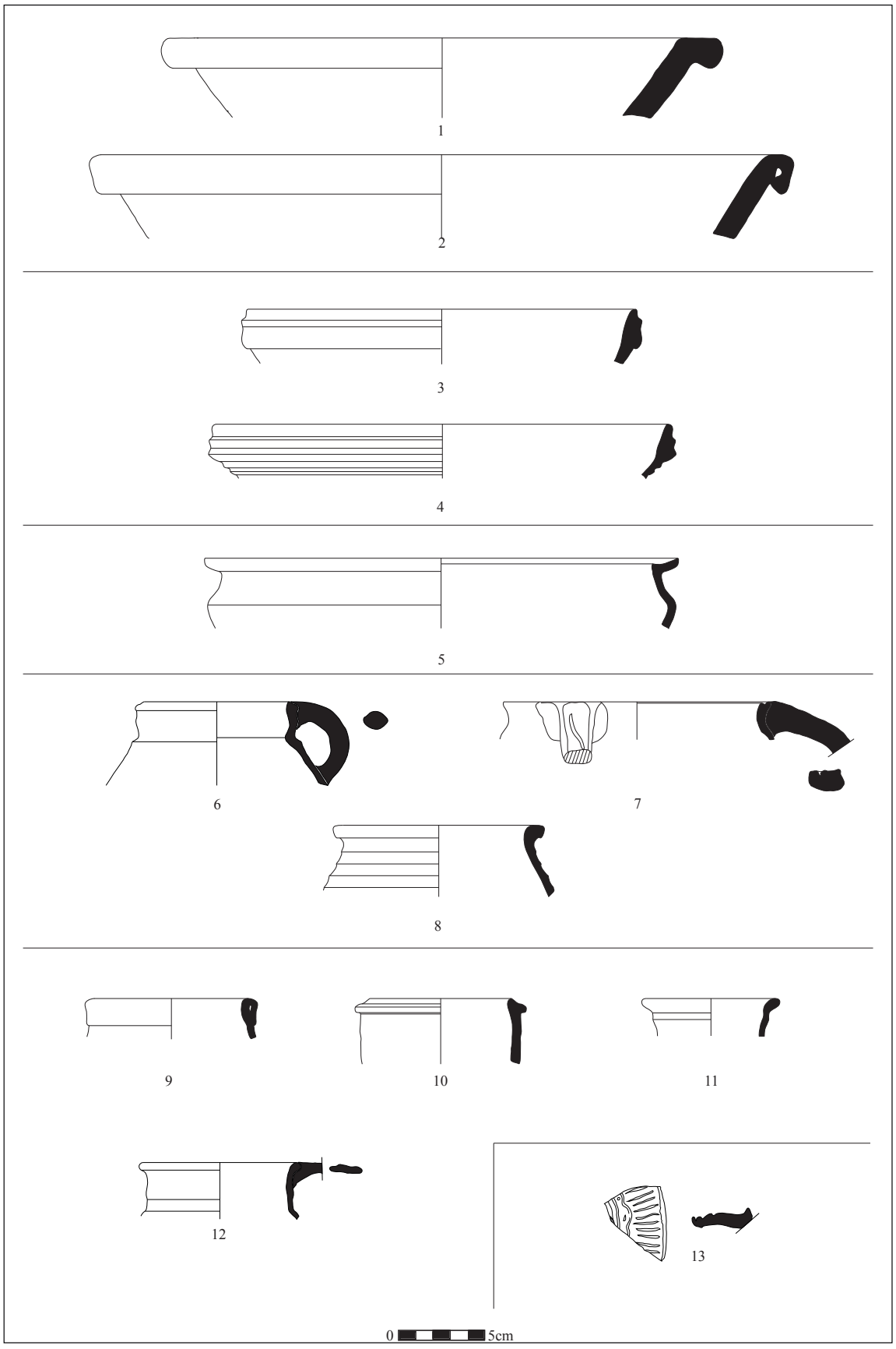


Plate 2.12: Late Byzantine – Early Islamic, Umayyad and Mamluk pottery from Tall Zirāʻa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	bowl	TZ 000455-001	R 109	south slope	PK	Late Byzantine – Umayyad
2	krater	TZ 000324-005	R 117	south slope	Is Grey WS	Umayyad
3	amphora	TZ 000398-001	Z 129	plateau	Is Grey WS	Byzantine – Umayyad
4	cooking pot	TZ 000110-003	AQ 145	east slope	Is HM	Umayyad
5	jar/jug	TZ 000467-001	N 117	south slope	Is Grn	Early Islamic
6	bowl	TZ 000040-003	AD 129	plateau	Is HM Ptd	Ayyubid – Mamluk
7	jar/jug	TZ 000021-016	AD 113	west slope	Is HM Ptd	Ayyubid – Mamluk
8	jar/jug	TZ 000129-002	V 125	plateau	Is HM Ptd	Ayyubid – Mamluk
9	jar/jug	TZ 000042-011	AD 129	plateau	Is HM Ptd	Ayyubid – Mamluk
10	jar/jug	TZ 000138-014	AD 121	plateau	Is HM Ptd	Ayyubid – Mamluk

Plate 2.12: Late Byzantine – Early Islamic, Umayyad and Mamluk pottery from Tall Zirā'a—Survey 2001

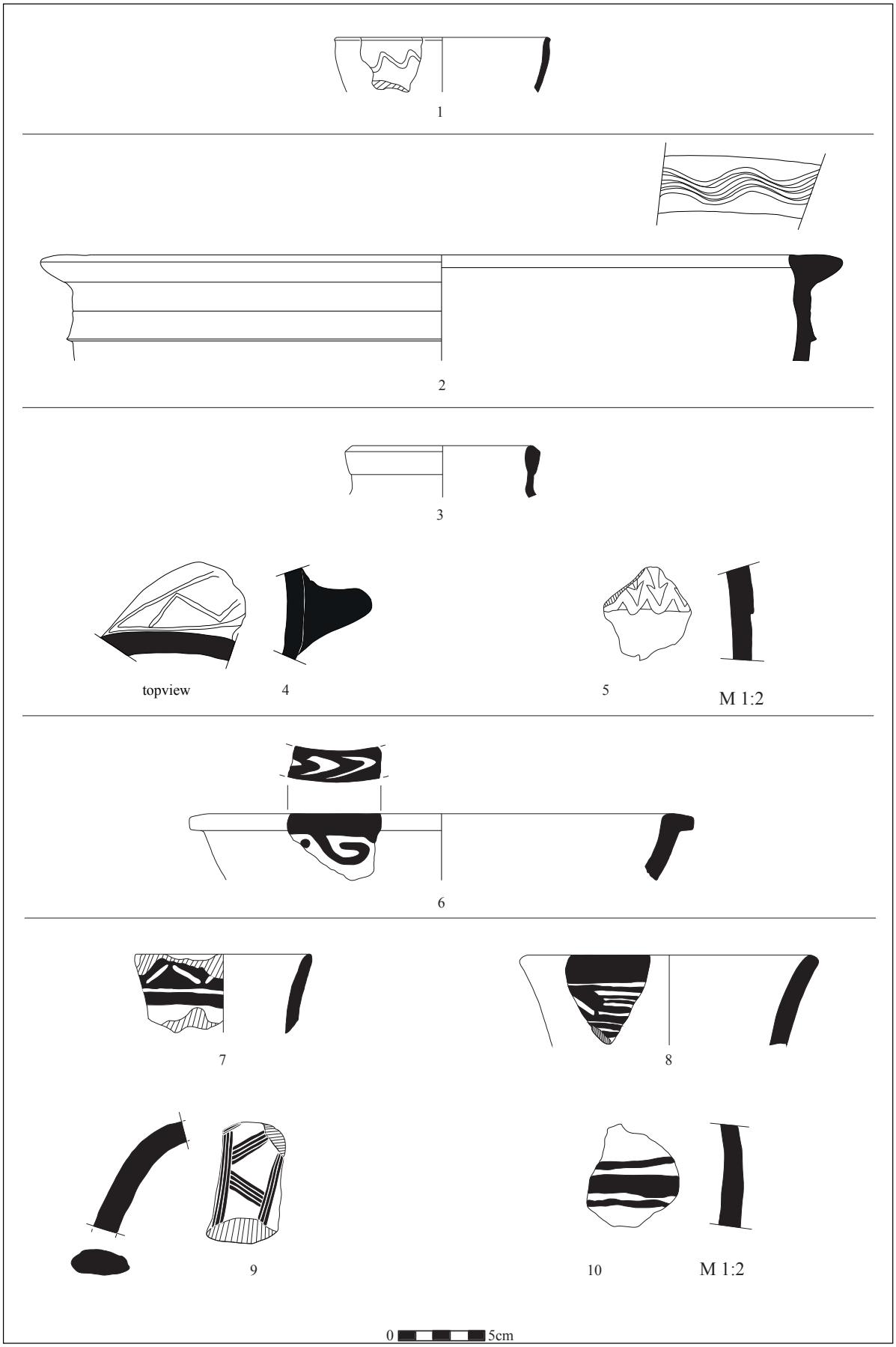


Plate 2.13: Islamic pottery from Tall Zirāʿa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	bowl	TZ 000165-003	V 125	plateau	Is Red-Buff sl	Islamic
2	bowl	TZ 000054-006	AQ 121	plateau	Is Bu2Br	Islamic
3	bowl	TZ 000372-007	AH 113	west slope	Is Glz	Islamic
4	bowl	TZ 000416-003	U 132	–	Is Glz Bu2Br	Mamluk
5	bowl	TZ 000179-002	Z 129	plateau	Is Glz Red	Ayyubid – Mamluk
6	bowl	TZ 000067-007	AD 125	plateau	Is Glz	Ayyubid – Mamluk
7	bowl/plate	TZ 000146-005	V 133	south slope	Is Glz Bu2Br	Mamluk
8	bowl/plate	TZ 000389-002	I 133	south slope	Is Glz Red	Mamluk
9	cooking pot	TZ 000311-003	N 125	south slope	Is Red	Islamic
10	cooking pot	TZ 000216-006	AM 129	plateau	Is Red	Islamic
11	cooking pot	TZ 000338-001	AU 113	north slope	Is Red	Islamic
12	cooking pot	TZ 000348-001	N 129	south slope	Is Red2Br	Islamic
13	cooking pot	TZ 000036-007	AD 125	plateau	Is Glz Red	Crusade

Plate 2.13: Islamic pottery from Tall Zirā'a—Survey 2001

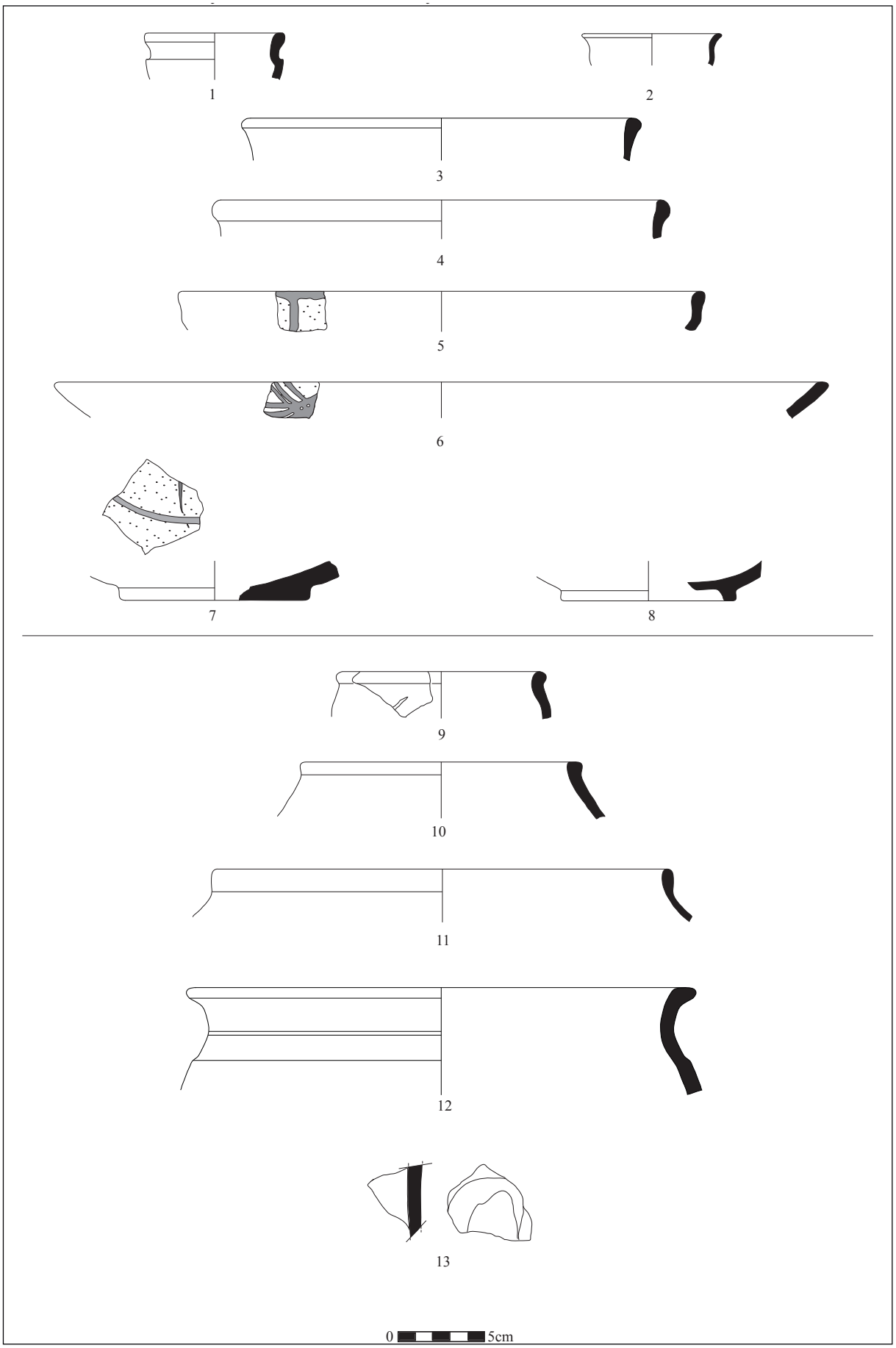
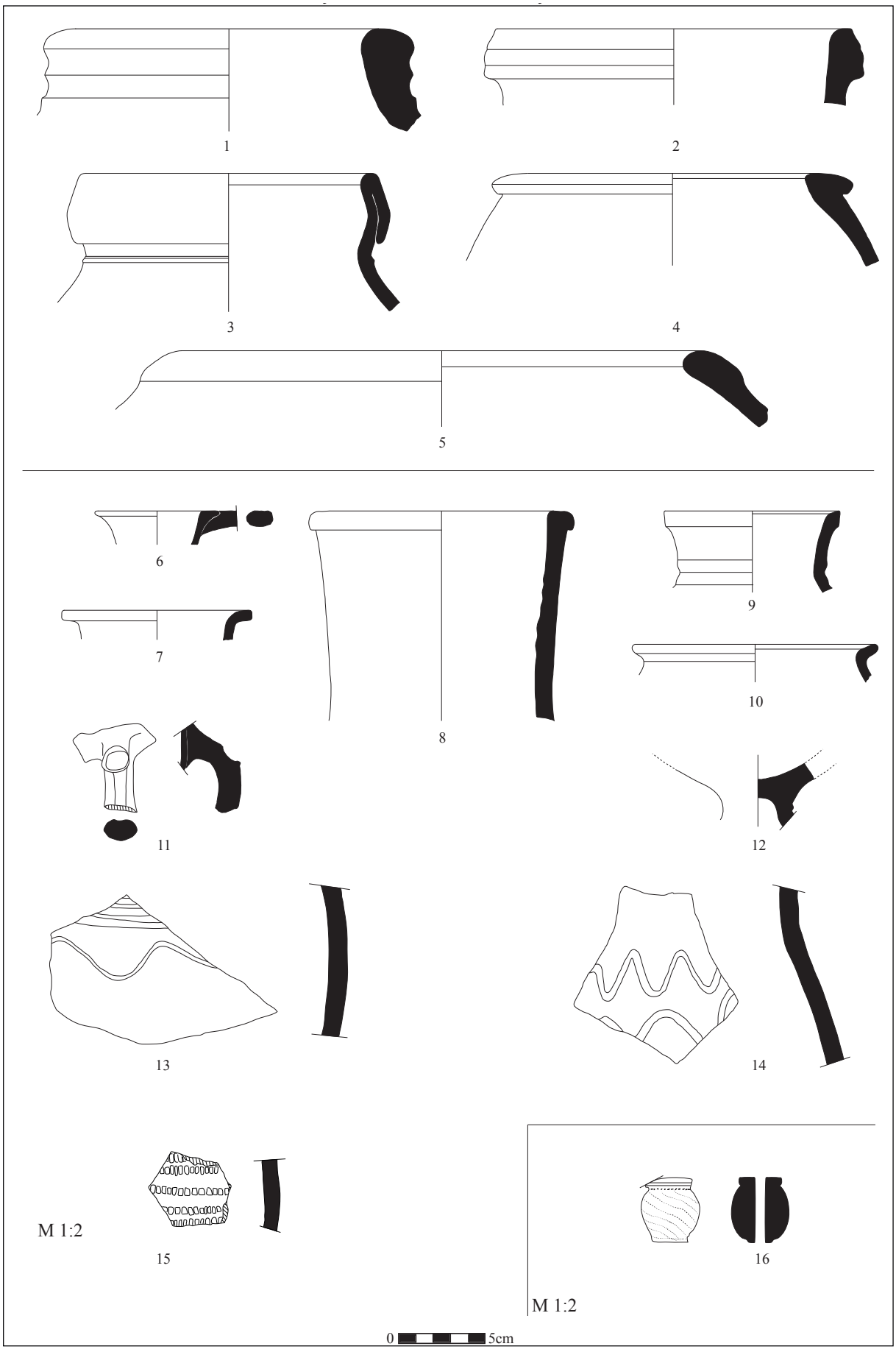


Plate 2.14: Islamic and Ottoman pottery from Tall Zirāʿa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric group	Date
1	storage jar	TZ 000032-002	AH 125	plateau	Is Coarse	Islamic
2	storage jar	TZ 000195-004	AM 145	plateau	Is Coarse	Islamic
3	storage jar	TZ 000348-002	N 129	south slope	Is Red2Br	Islamic
4	storage jar	TZ 000304-003	AM 109	west slope	Is Coarse	Islamic
5	storage jar	TZ 000018-001	AH 121	plateau	Is Coarse	Islamic
6	jar/jug	TZ 000077-001	Z 117	plateau	Is Red	Islamic
7	jar/jug	TZ 000019-009	AM 117	west slope	Is Red2Br	Islamic
8	jar/amphora	TZ 000075-001	AM 137	south slope	Is Red-Buff sl	Islamic
9	jug/jug	TZ 000418-001	AQ 129	plateau	Is Bu2Br-sl	Islamic
10	jar/jug	TZ 000036-002	AD 125	plateau	Is Red2Br	Islamic
11	jar/jug	TZ 000138-012	AD 121	plateau	Is Red	Islamic
12	jar/jug	TZ 000430-009	I 121	south slope	Is Red2Br	Islamic
13	jar/krater	TZ 000389-007	I 133	south slope	Is Red2Br	Islamic
14	jar/jug	TZ 000304-012	AM 109	west slope	Is Buff	Islamic
15	jar/jug	TZ 000430-001	I 121	south slope	Is Grn	19th century AD - Modern
16	pipe bowl	TZ 000098-001	V 117	south slope	–	Ottoman

Plate 2.14: Islamic and Ottoman pottery from Tall Zirāʿa—Survey 2001



2.2.2. Glass Finds from the 2001 Survey

by Stefanie Hoss/Daniel Keller

The glass finds from the 2001 Survey on Tall Zirā'a were first studied by D. Keller, who wrote a report on the finds. The 2003 to 2014 excavation glass finds were studied between 2010 to 2014 by St. Hoss, and will be published in a later volume of the final report of the excavation on Tall Zirā'a. In order to maintain a single glass typology throughout the Tall Zirā'a publications, the typology of the 2001 report was amended by St. Hoss (with D. Keller's consent) in 2015; references to the academic literature were updated at the same time.

All glass fragments included in this report will be classified according to St. Hoss's typology (TZ-Group). The original report did not include sherd measurements, so all measurements included in the plates are approximate.

2.2.2.1. Typology of the Glass Finds (*Pl. 2.15, nos. 1–7*)

Only 44 glass fragments were found during the survey; two are from the twentieth century (TZ 000462-001 and TZ 000462-002), with the other 42 fragments dated from the Early Roman to the Early Byzantine periods.

Sherd TZ 000486-001 is a fairly large piece of molten greenish glass of unidentifiable shape; most likely as a consequence of having been in a fire. It is therefore impossible to determine if it was originally part of a glass vessel (either a large bowl or bottle) or a windowpane. The remaining 41 glass fragments can be divided into two groups: four are from windowpanes, and the remaining 37 are attributed to glass vessels.

Windowpanes

All four window fragments are made of greenish blue glass and belong to rectangular panes (TZ-Group 74). Such rectangular panes were set into wooden frames, secured by lead and perhaps also by putty[85]. Two of them were free-blown (TZ 000095-001 and TZ 000128-001), while the other two (TZ 000485-001 and TZ 000312-001) were cast, and most likely belonged to the same pane. Both free-blown and cast windowpanes were common in Byzantine Jordan, as respective finds from Umm Qēs (Gadara)[86], Ǧaraš (Jerash)[87] and Wādī Mūsā (Petra)[88] show. In Palestine and the wider Levant, glass windowpanes are frequently found in Byzantine churches, although they also occurred in other buildings. Rectangular as well as round windowpanes became more common in Near Eastern houses during Late Antiquity, as examples from Ṭabaqāt Faḥl (Pella) and Sabasṭiya (Samaria) demonstrate[89].

Glass Vessels

Among the 37 glass vessel fragments, two belong to the group of Early Roman cast glass (TZ-Group 5); a greenish blue rim from an early ribbed bowl (TZ 000227-001; *Pl. 2.15, no. 1*) and a flat pale green base (TZ 000241-002), which belongs either to another early ribbed bowl or to a linear cut bowl (TZ-Group 6).

Ribbed bowls are so widely distributed through the whole Mediterranean that D. Grose assumes a widespread manufacture[90]. In the Near East, they are known from Heliopolis (Baalbek)[91] and Bairūt (Beirut)[92] in Lebanon as well as Ǧabȧ (Sha'ar-Ha-'Amakim)[93], Rāmat Ha-Nadīv[94], Tulūl Abū l-'Alā'īq/Tall as-Samrāt (Jericho)[95], 'Ain Ǧidi (En Gedi)[96], Tall Sandaḥanna (Maresha)[97], 'Ain Boqeq[98] in Palestine and Israel as well as Sī' (Seeia) in southern Syria, and Ǧaraš (Jerash)[99] and Wādī Mūsā (Petra)[100] in Jordan. While the start date for the production of this type is difficult to determine, it appears certain that they were in use by the last quarter of the first

85 Keller – Lindblom 2008, 335; Komb 2009, 18 f.; Hoss forthcoming.
86 Unpublished finds studied by D. Keller.
87 Meyer 1988, 194 f.
88 O'Hea 2001, 371 f.
89 O'Hea 2007, 236 f.
90 Grose 2012, 60.
91 Hamel – Greiff 2014, 147.
92 Jennings 2004/2005, 37–42.
93 Burdajewicz 2009, 177 f., Fig. 2, 22–35.
94 Cohen 2000, Pl. 1, 1–3.
95 Jackson-Tal 2013, Pl. 3.4, 25–30. 12.
96 Jackson-Tal 2007, 477, Pl. 2, 1–3.
97 Jackson-Tal 2005, Fig. 2, 1.
98 Jackson-Tal 2000, 73 f., Pl. 1, 2–5.
99 Dussart 1998, 56 type AIII 3, Pl. 2, 23–24.
100 Keller 2006, 188 f.

century BC, with a probable end date of the production by the first half of the first century AD. Linear bowls date from the mid-first century BC until the mid-first century AD[101]; this form was also widespread in the Western and Eastern Mediterranean[102].

The other 35 glass fragments belong to free-blown glass vessels, 17 of which are unidentifiable body sherds. Ten fragments are greenish blue, three each are bluish green and pale green respectively, while one is yellowish green. This is a typical range of colours for Late Roman and Byzantine glass in Jordan and Israel. The absence of colourless glass, which was mainly produced in the second and third centuries AD, demonstrates an absence of glass from the Mid-Roman period, and points towards a Late Roman or Byzantine date for these glass fragments.

The nine bases can be divided by the following groupings: two fairly high base rings and two concave bases, all of a greenish blue colour, two folded bases, one of which is made of pale green glass, while the other is colourless. The remaining three are solid bases from beakers, of pale green or bluish green glass (TZ 000492-006, *Pl. 2.15, no. 2*; TZ 000313-001; TZ 000388-015). They belong to a well-known type of Late Roman beaker dated to the fourth century AD (TZ-Group 33). Beakers with similar bases were found in Sabasṭiya (Samaria)[103], Nahăriyya[104], Məṣad Tāmār[105], ‘Ain Ğidi (En Gedi)[106], Umm Qēs (Gadara)[107], Ğaraš (Jerash)[108], Sī‘ (Seeia),‘Ammān and ‘Ain az-Zāra[109] as well as in Wādī Mūsā (Petra)[110]. However, in fourth century AD contexts, they appear to be more abundant in the north of Jordan than in the south.

Regarding the nine rims; three are from bluish green, greenish blue or pale green large plates or shallow bowls with a folded rim (TZ-Group 17: TZ 000488-001; TZ 00493-001, *Pl. 2.15, no. 3*; TZ 000253-001). Finds from Ğalāme (Jalame) suggest a fourth century AD date[111]. A typical feature of these vessels is an out-folded collar, which is folded upwards at its lower end. Plates with the same style of rim have also been found in Jordan in Ğaraš (Jerash)[112], ‘Ammān and ‘Ain az-Zāra[113] They were also a well-known glass vessel shape during the fourth century AD in the Lebanon (Bairūt [Beirut])[114], Jordan valley (Scythopolis [Beth Shean]), Galilee (Tall al-Ḫirba [Meiron]) and Yarmuk valley (al-Ḥamma [Hammat Gader])[115]. Similar plates from southern Jordan and the Negev, such as finds from Wādī Mūsā (Petra)[116] and Məṣad Tāmār do not have the upwards-folded end of the collar[117].

The six remaining rims represent five different types; a bluish green plate or dish with a double-folded rim (this type does not have a TZ-Group: TZ 000241-001; *Pl. 2.15, no. 4*) is quite a common type in northern Jordan and northern Israel, as finds from Umm Qēs (Gadara)[118], Ğaraš (Jerash) and ‘Ammān[119] as well as from Bēsara (Beth She‘arim)[120] and Ğalāme (Jalame)[121] indicate. But they do also occur in southern Jordan, as demonstrated by finds from Wādī Mūsā (Petra)[122].

A greenish blue bowl with a fire-rounded rim had a double hollow fold in the wall (TZ-Group 12: TZ 000184-001; *Pl. 2.15, no. 5*). Bowls with this decoration are quite widespread in the Near East, although in lesser quantities than other forms. Parallels occur in Bairūt (Beirut)[123], Ğalāme (Jalame)[124], Rāmat Ha-Nadīv[125], al-Ḥamma (Hammat Gader)[126], ‘Ain Ğidi (En Gedi)[127] and Tulūl Abū l-ʿAlāʾīq/Tall as-Samrāt (Jericho)[128]. They also occur occasionally in northern Jordan at Umm Qēs (Gadara)[129], Ğaraš (Jerash)[130] and ‘Ammān[131], and are well represented among the Late Roman glass finds from Wādī Mūsā (Petra)[132]. According to R. E. Jackson-Tal, these vessels date from the Late Roman to the Byzantine period[133].

A bluish green bowl with a fire-rounded thickened rim (TZ-Group 7: TZ 000489-001, *Pl. 2.15, no. 6*) belongs to

101 Jennings 2000, 53; Keller 2006, 187 f.
102 Grose 2012, 54.
103 Crowfoot 1957, 404 f. 410. 413 Fig. 94, 14. 95, 20.
104 Barag 1965, 29 Pl. 3.
105 Erdmann 1977, 100. 114 cat. no. 13–25 Pl. 1, 13–16.
106 Jackson-Tal 2007, 484. Pl. 7, 5–6.
107 Andersen 1993, 198 cat. no. 418 Pl. 42.418.
108 Meyer 1988, 193, Fig. 6, Z–dd.7, A–B.
109 Dussart 1998, 96–99 type BVIII. 121 Pl. 21, 18.23–24. 30–36. 38–40.
110 Keller 2006, 220 Pl. 16r.
111 Davidson Weinberg – Goldstein 1988, 47–49 cat. no. 71–76 Fig. 4–7.
112 Meyer 1988, 191 Fig. 6, L–M.
113 Dussart 1998, 75 type BII.311 Pl. 11, 2–10.
114 Jennings 2004/2005, 171–174, Fig. 7.21.
115 Tall al-Ḥiṣn (Beth Shean): Hadad 2005, 21 Pl. 3, 56–59, 67–70. Tall al-Ḫirba (Meiron): Meyers et al. 1981, 70 f. Pl. 9.10, 15–16. 9.11, 1–4. al-Ḥamma (Hammat Gader): Cohen 1997, 400 Pl. I, 10–12.
116 Keller 2006, 201 type VII.2 Pl. 7a.
117 Erdmann 1977, 105. 123 cat. no. 274–275 Pl. 4, 274–275.
118 Andersen 1993, 198 cat. no. 417 Pl. 42, 417.
119 Dussart 1998, 75 f. type BII.312. 321. 322 Pl. 11, 1–16.
120 Avigad 1976, 207. 209–213 cat. no. 49 Fig. 100 Pl. 69.
121 Davidson Weinberg – Goldstein 1988, 49 f. cat. no. 80–81 Fig. 4–8, 80–81.
122 Keller 2006, 210 type VII.20 Pl. 11g.
123 Jennings 2004/2005, 106 Fig. 5.19, 4.
124 Davidson Weinberg – Goldstein 1988, 53 f. cat. no. 109–117 Fig. 4–15.
125 Cohen 2000, 481 Pl. 4, 2.
126 Cohen 1997, 401 Pl. II, 3.
127 Jackson-Tal 2007, 475 Pl. 1, 7.
128 Jackson-Tal 2013, 107 Pl. 3.5, 37.
129 Andersen 1993, 198 cat. no. 412 Pl. 42, 412.
130 Meyer 1988, 191 Fig. 6, Q.
131 Dussart 1998, 78 type BV.12 Pl. 12, 11–13.
132 Keller 2006, 206 f. type VII 10c, 11d and 13d Pl. 9d, 9h, 10a–b.
133 Jackson-Tal 2007, 475; Jackson-Tal 2012, 183.

a type which is also common in Bairūt (Beirut)[134] and Heliopolis (Baalbek)[135], as well as in Ǧalāme (Jalame)[136], Rāmat Ha-Nadīv[137], Scythopolis (Beth Shean)[138], Ḥănitā[139], Tall al-Ḫirba (Meiron)[140] , Tulūl Abū l-'Alā'īq/Tall as-Samrāt (Jericho)[141] and Məṣad Tāmār[142], and also in both northern Jordan[143] and Wādī Mūsā (Petra)[144]. This type of bowl is not only found in contexts from the first century AD (at 'Ain az-Zāra) but also from Levantine contexts dated from the third to the seventh century[145]. The finds from Heliopolis (Baalbek) come from closed contexts of the third/fourth centuries AD[146].

A bluish green bowl or beaker with a fire-rounded straight rim (TZ 000247-001) may have belonged to either TZ-Group 8, a type of small hemispherical bowl, or to TZ-Group 28, which are smallish beakers. As beakers represent a much higher proportion of the glass finds from the excavation than the bowls, it seems likely that this sherd also belonged to TZ-Group 28. Beakers of this type had a very long period of use, from the late first to the eighth century, and are widespread in the Near East, occurring in Lebanon (Bairūt [Beirut])[147], Israel (al-Ḥamma [Hammat Gader])[148] and Ḥorvat Meṣad[149]) southern Syria and northern Jordan (Buṣērā [Bosra], 'Ain az-Zāra, Umm Qēs [Gadara][150], Ǧaraš [Jerash][151] and 'Ammān[152]) as well as southern Jordan (Wādī Mūsā [Petra][153] and Dēr 'Ēn 'Abātā[154]).

Two bluish green bottles with fire-rounded rims and conical necks (TZ-Group 44: TZ 000257-001, *Pl. 2.15, no. 7*; TZ 000461-001) represent a type which has been found in Bairūt (Beirut)[155], Jalame[156], Scythopolis (Beth Shean)[157], Rāmat Ha-Nadīv[158], Ṭabarīya (Tiberias)[159], al-Ḥamma (Hammat Gader)[160], Ḥorvat Meṣad[161], Tulūl Abū l-'Alā'īq/Tall as-Samrāt (Jericho)[162], 'Ain Ǧidi (En Gedi)[163], Umm Qēs (Gadara)[164], Buṣērā (Bosra), Ǧaraš (Jerash), 'Ammān and 'Ain az-Zāra[165] as well as in Wādī Mūsā (Petra)[166] and Dēr 'Ēn 'Abātā[167].

2.2.2.2. Analysis of the Glass Finds

The parallels for all these glass vessel types among the fourth century AD glass finds from Jalame suggest a similar date for the identifiable fragments of blown glass vessels, (although an extension into the early fifth century AD cannot be excluded), and some of the types continue into the sixth or seventh century AD (particularly the bottle and the bowl or beaker with the fire-rounded straight rim). However, it is remarkable that there is not a single typical glass fragment of the later fifth, sixth or early seventh centuries AD, such as stemmed glass lamps, bottles with blue trails, stemmed goblets or bull's eye window panes. It can therefore be concluded that the glass finds from this survey represent only two phases of the settlement of Tall Zirā'a, namely the Early Roman period (the two cast glass vessels), and the fourth/early fifth centuries AD (the blown glass vessels). However, this does not necessarily mean that these two periods were the main occupational phases on Tall Zirā'a, because the finds record of only nine rather small glass fragments is not sufficient evidence to support this hypothesis. Furthermore, one has to be aware of the circumstances influencing the way in which glass enters the archaeological record. First of all, glass was always recycled, which means that broken glass pieces were collected for remelting, and are thus underrepresented in the archaeological record[168]. The two small peaks in the chronological distribution of the

134 Jennings 2004/2005, 105 f., Fig. 5.18, 1–2.
135 Hamel – Greiff 2014, 150 Fig. 16.3–8.
136 Davidson Weinberg – Goldstein 1988, 40 f. cat. no. 6–11. Fig. 4–2.
137 Cohen 2000, 168 Pl. 1, 13.
138 Hadad 2005, 21, Pl. 2, 34–36, 38–39; Hadad 2006, 626 Fig. 19.1, 5–6, 9–10.
139 Barag 1978, 13.21 cat. no. 10.38.
140 Meyers 1981, Pl. 9.10, 1.6.
141 Jackson-Tal 2013, 106 f. Pl. 3.5, 36.
142 Erdmann 1977, 107. 132. 137 cat. no. 565. 730 Pl. 6, 565. 730.
143 Dussart 1998, 60 type BI 211 (Pl. 4, 1–16). 65 f. type BI 4211 (Pl. 6, 1–9). 77 type BIII 1, (Pl. 12, 1–3).
144 Keller 2006, 206 type VII, 11a, Pl. 9e.
145 Keller 2006, 206.
146 Hamel – Greiff 2014, 150, Fig. 16.3–8.
147 Jennings 2004/2005, 71 f., Fig. 4.1, 6–8, 91 f., Fig, 5.7.
148 Cohen 1997, 410, Pl. III,20.
149 Jackson-Tal 2012, 184 Fig. 8.2, 6–7.66
150 Andersen 1993, 198 cat. no. 412 Pl. 42, 412.
151 Meyer 1988, 191 Fig. 6, Q.
152 Dussart 1998, 95 f. type BVIII 111/112. BVIII 15. BVIII 2111. 104–106, Pl. 21, 1V17. Pl. 23, 8–35.
153 Keller 2006, type VII 28a. VII 29 a/b. VII, 31a. VII 32a. 215–218, Pl. 15d. 15k–l. 16c. 16 f.
154 O'Hea, 2012, 305 cat. no. 49–51. Fig. 633–636.
155 Jennings 2006, 77 f. Fig. 4.10, 12. 177 f. Fig. 7.26, 15–20, 22.
156 Davidson Weinberg – Goldstein 1988, 73 cat. no. 293–295. 298. 300 Fig. 4–35.
157 Hadad 2005, 24–27 Pl. 12, 235–237. 244. 246. Pl. 18, 352–354; Hadad 2006, 626 f. Fig. 19.2, 19–21.
158 Cohen 2000, 170, Pl. III, 28–29. 34–36.
159 Hadad 2008, 170 f. Pl. 5.4, 57.
160 Cohen 1997, 419–427 Pl. VI, 6, 13, Pl. VII, 4–5, Pl. VIII, 11–16.
161 Jackson-Tal 2012, 186 Fig. 8.3, 1, 6.
162 Jackson-Tal 2013, 114 Pl. 3.10, 3–5.
163 Jackson-Tal 2007, 487 Pl. 8, 5.
164 Andersen 1993, 197 cat. no. 382 Pl. 41, 382.
165 Dussart 1998, 132–135 type BX.1125a1 Pl. 34, 4–37.35, 1–13.
166 Keller 2006, type VII 54a, 226. Pl. 19h. type VII 79a, 234. Pl. 220.
167 O'Hea 2012, 307 f. cat. no. 65. 68. 70–71. 77. Fig. 649. 652. 654–655. 661.
168 Cool – Price 1995, 6 f.

glass finds from this survey (the first being in the late first century BC/early first century AD, the second in the fourth/early fifth century AD) may indeed reflect two major occupational phases, but there are also other possible explanations for this distribution of glass finds, such as a major destruction of the settlement of Tall Zirā'a during these two periods and a continuous occupation in the intermediate time, in which glass was recycled and did not enter the archaeological record. Neither idea can be verified by analysing survey finds only; without well-documented, well-excavated archaeological contexts, the interpretation of these finds remains uncertain. Based only on the glass finds, it can be stated that they are typical for an overall picture of the glass in use in northern Jordan during the Early Roman period and the Late Roman/ Early Byzantine period; however, they cannot be used to conclude either continuity or discontinuity of occupation on the site.

2.2.2.3. Catalogue of the Glass Finds (*Pl. 2.15, nos. 1–7*)

Rectangular Flat Window Panes/TZ-Group 74

TZ 000485-001
Square AD 117; plateau
Colour: Greenish blue
Description: Rim fragment of a rectangular windowpane; cast
Figure References: —
Dimension: L 1.5; D not measurable; Th 0.9
Parallel: **Byzantine**: Meyer 1988, 194 f.; O'Hea 2001, 371 f.; Komb 2009, 87–94; Jackson-Tal 2012b, 69 Fig. 4, 60–01; O'Hea 2012, 311 Fig. 688; Hoss forthcoming, Group 74. cat. no. W.1–W.6.
Note: This rim fragment probably belongs to the same pane as TZ 000312-001.

TZ 000486-001
Square AD 117; plateau
Colour: Pale green
Description: Melted piece of glass; free-blown
Figure References: —
Dimension: L 11.8; W 4.7
Parallel: **Byzantine**: Meyer 1988, 194 f.; O'Hea 2001, 371 f.; Komb 2009, 87–94; Jackson-Tal 2012b, 69 Fig. 4, 60–01; O'Hea 2012, 311 Fig. 688; Hoss forthcoming, Group 74. cat. no. W.1–W.6.
Note: —

TZ 000095-001
Square Z 121; plateau
Colour: Greenish blue
Description: Rim fragment of a rectangular windowpane with rounded rim; free-blown
Figure References: —
Dimension: L 3; W 2.2; D not measurable; Th 0.25
Parallel: **Byzantine**: Meyer 1988, 194 f.; O'Hea 2001, 371 f.; Komb 2009, 87–94; Jackson-Tal 2012b, 69 Fig. 4, 60–01; O'Hea 2012, 311 Fig. 688; Hoss forthcoming, Group 74. cat. no. W.1–W.6.
Note: —

TZ 000128-001
Square V 117; south slope
Colour: Greenish blue
Description: Rim fragment of a rectangular windowpane with rounded rim; free-blown
Figure References: —
Dimension: L 2; W 2; D not measurable; Th 0.2–0.3
Parallel: **Byzantine**: Meyer 1988, 194 f.; O'Hea 2001, 371 f.; Komb 2009, 87–94; Jackson-Tal 2012b, 69 Fig. 4, 60–01; O'Hea 2012, 311 Fig. 688; Hoss forthcoming, Group 74. cat. no. W.1–W.6.
Note: —

TZ 000312-001
Square R 117; south slope
Colour: Greenish blue
Description: Rim fragment of a rectangular windowpane; cast
Figure References: —
Dimension: L 5.3; W 2.5; Th 0.5
Parallel: **Byzantine**: Meyer 1988, 194 f.; O'Hea 2001, 371 f.; Komb 2009, 87–94; Jackson-Tal 2012b, 69 Fig. 4, 60–01; O'Hea 2012, 311 Fig. 688; Hoss forthcoming, Group 74. cat. no. W.1–W.6.
Note: This rim fragment probably belongs to the same pane as TZ 000485-001.

Ribbed Bowl/TZ-Group 5

TZ 000227-001
Square AM 133; plateau
Colour: Greenish blue
Description: Rim sherd of an early ribbed bowl, cast
Figure References: Pl. 2.15, no. 1
Dimension: L 2.5; D not measurable; Th 0.4
Parallel: **Hellenistic – Roman**: Dussart 1998, 56 type AIII 3 Pl. 2, 23 f.; Cohen 2000, Pl. 1, 1–3; Jackson-Tal 2003, Fig. 2, 1; Jennings 2004/2005, 37–42 Fig. 2, 8–14; Jackson-Tal 2007, 477 Pl. 2,1–3; Burdajewicz 2009, 177 f. Fig. 2,22–35; Jackson-Tal 2013, Pl. 3.4, 25–30; Hoss forthcoming, Group 5. cat. no. A.25–A.29. Pl. 4.
Note: —

Linear-cut Bowl/TZ-Group 6

TZ 000241-002
Square V 137; east slope
Colour: Pale green
Description: Flat base sherd of a linear-cut or early ribbed bowl; cast
Figure References: —
Dimension: —
Parallel: **Early Roman**: Jennings 2000, 50–53 Fig. 6; Keller 2006, 187 f. type II, 3 Pl.1e; Grose 2012, 54 f.; Hoss forthcoming, Group 6. cat. no. A.30–A.31. Pl. 4.
Note: —

Beaker/TZ-Group 33

TZ 000492-006
Square AQ 129; plateau
Colour: Bluish green
Description: Solid base sherd of a beaker; free-blown
Figure References: Pl. 2.15, no. 2
Dimension: L 1.7; D (base) 4.8; Th 0.3
Parallel: **Early Byzantine (4th century AD)**: Davidson Weinberg – Goldstein 1988, 60–62 Fig. 4–23; Cohen 1997, 410 Pl. III, 14–15; Dussart 1998, 96–98 type BVIII 121. Pl. 221,25–41; Keller 2006, 221 type VII38. Pl. 17–18; Hadad 2005, Pl. 21, 400; Gorin-Rosen 2010, 221, Fig./Pl. 10.2, 5; Hoss forthcoming, Group 33. cat. no. E.1–E.8. Pl. 16.
Note: —

TZ 000313-001
Square R 125; plateau
Colour: Pale green
Description: Solid base sherd of a beaker; free-blown
Figure References: —
Dimension: L 1.8; D (base) 5.0; Th 0.3–0.4
Parallel: **Early Byzantine (4th century AD)**: Davidson Weinberg – Goldstein 1988, 60–62 Fig. 4–23; Cohen 1997, 410 Pl. III, 14–15; Dussart 1998, 96–98 type BVIII 121. Pl. 221, 25–41; Keller 2006, 221 type VII38. Pl. 17–18; Hadad 2005, Pl. 21, 400; Gorin-Rosen 2010, 221 Fig./Pl. 10.2, 5; Hoss forthcoming, group 33. cat. no. E.1–E.8. Pl. 16.
Note: —

TZ 000388-015
Square I 133; south slope
Colour: Pale green
Description: Solid base sherd of a beaker; free-blown
Figure References: —
Dimension: Th 0.8
Parallel: **Early Byzantine (4th century AD)**: Davidson Weinberg – Goldstein 1988, 60–62 Fig. 4–23; Cohen 1997, 410 Pl. III, 14–15; Dussart 1998, 96–98 type BVIII 121. Pl. 221, 25–41; Keller 2006, 221 type VII38. Pl. 17–18; Hadad 2005, Pl. 21, 400; Gorin-Rosen 2010, 221, Fig./Pl. 10.2,5; Hoss forthcoming, group 33 cat. no. E.1–E.8, Pl. 16.
Note: —

Plate or Shallow Bowl/TZ-Group 17

TZ 000488-001
Square AD 117; plateau
Colour: Greenish blue
Description: Rim sherd of a plate with folded collar rim; free-blown
Figure References: —
Dimension: L 1.2; Th 0.3; D not measurable
Parallel: **Early Byzantine (4th century AD)**: Isings 1957, 148 form 118; Davidson Weinberg – Goldstein 1988, 47 f. Fig. 4–7; Cohen 1997, 400 Pl. I, 10–12; Dussart 1998, 75 type BII 311. Pl. 11, 2–10; Keller 2006, 201 type VII 2. Pl. 7a; Hadad 2006, 626 Fig. 19, 2. 17; Jennings 2004/2005, 75 f. Fig. 4, 7; Hoss forthcoming, cat. no. B.38–B.40. Pl. 9.
Note: —

TZ 000493-001
Square AY 125; north slope
Colour: Bluish green
Description: Rim sherd of a plate with folded collar rim; free-blown
Figure References: Pl. 2.15, no. 3
Dimension: L 2.8; Th 0.23; D (opening) 34
Parallel: **Early Byzantine (4th century AD)**: Isings 1957, 148 form 118; Davidson Weinberg – Goldstein 1988, 47 f. Fig. 4–7; Cohen 1997, 400 Pl. I,10–12; Dussart 1998, 75 type BII 311. Pl. 11, 2–10; Keller 2006, 201 type VII 2. Pl. 7a, Hadad 2006, 626 Fig. 19, 2, 17; Jennings 2004/2005, 75 f. Fig. 4, 7; Hoss forthcoming, cat. no. B.38–B.40. Pl. 9.
Note: —

TZ 000253-001
Square BC 121; north slope
Colour: Pale green
Description: Rim sherd of a plate with folded collar rim; free-blown
Figure References: —
Dimension: L 1.5; D (opening) 40; Th 0.3
Parallel: **Early Byzantine (4th century AD)**: Isings 1957, 148 form 118; Davidson Weinberg – Goldstein

1988, 47 f. Fig. 4–7; Cohen 1997, 400 Pl. I, 10–12; Dussart 1998, 75 type BII 311. Pl. 11,2–10; Keller 2006, 201 type VII 2. Pl. 7a; Hadad 2006, 626 Fig. 19, 2. 17; Jennings 2004/2005, 75 f. Fig. 4, 7; Hoss forthcoming, cat. no. B.38–B.40. Pl. 9.
Note: —

Plate or Dish/Singular Find at Tall Zirā'a/No TZ-Group

TZ 000241-001
Square V 137; east slope
Colour: Bluish green
Description: Rim sherd of a plate with double-folded rim; free-blown
Figure References: Pl. 2.15, no. 4
Dimension: L 1.3; D (opening) 30; Th 0.15
Parallel: **Late Roman – Early Byzantine**: Avigad 1976, 207. 209–213 no. 49 Fig. 100 pl. 69; Davidson Weinberg – Goldstein 1988, 49 f. cat. no. 80–81 Fig. 4–8. 80–81; Andersen 1993, 198 cat. no. 417 Pl. 42, 417; Dussart 1998, 75 f. type BII.312.321.322 Pl. 11, 11–16; Keller 2006, 210 type VII.20, Pl. 11g.
Note: —

Bowl/TZ-Group 12

TZ 000184-001
Square Z 113; west slope
Colour: Greenish blue
Description: Rim sherd of a bowl with fire-rounded rim and double fold in the wall; free-blown
Figure References: Pl. 2.15, no. 5
Dimension: L 1.6; D not measurable; Th 0.2
Parallel: **Late Roman – Early Byzantine**: Davidson Weinberg – Goldstein 1988, 53 f. Fig. 4–15; Cohen 1997, 401 Pl. II, 3; Dussart 1998, 78 type BV.12 Pl. 12, 11–13; Cohen 2000, 481 Pl. 4, 2; Keller 2006, 206 f. type VII 10c. 11d and 13d. Pl. 9d. 9h. 10a–b; Jennings 2004/2005, 106 Fig. 5, 19. 4; Jackson-Tal 2007, 475 Pl. 1, 7; Jackson-Tal 2013, 107 Pl. 3.5, 37; Hoss forthcoming, cat. no. B.26–B.29. Pl. 8.
Note: —

Bowl/TZ-Group 7

TZ 000489-001
Square AD 133; west slope
Colour: Bluish green
Description: Rim sherd of a bowl with fire-rounded thickened rim; free-blown
Figure References: Pl. 2.15, no. 6
Dimension: L 2; Th 0.2; D (opening) 16
Parallel: **Late Roman – Umayyad**: Davidson Weinberg – Goldstein 1988, 40 f. Fig. 4–2; Dussart 1998, 60 type BI 211 Pl. 4, 1–16. 65 f. type BI 4211 Pl. 6, 1–9 and 77 type BIII 1 Pl. 12, 1–3; Cohen 2000, 168 Pl. 1, 13; Israeli 2003, 157 cat. no. 157; Keller 2006, 206 type VII, 11a Pl. 9e; Hadad 2005, 21 Pl. 2, 34–36. 38 f.; Hadad 2006, 626 Fig. 19.1, 5–6. 9–10; Jennings 2004/2005, 105 f. Fig. 5.18, 1–2; Jackson-Tal 2013, 106 f. Pl. 3.5, 36; Hamel – Greiff 2014, 150 Fig. 16.3–7; Hoss forthcoming, cat. no. B.1–B.7 Pl. 5.
Note: —

Bottles/TZ-Group 44

TZ 000257-001
Square AY 121; north slope
Colour: Bluish green
Description: Rim sherd of a bottle with fire-rounded rim and conical neck; free-blown
Figure References: Pl. 2.15, no. 7
Dimension: L 1.8; D (opening) 6; Th 0.2
Parallel: **Late Roman – Umayyad**: Cohen 1997, 419–427 Pl. VI, 6. 13. Pl. VII, 4–5. Pl. VIII, 11–16; Dussart 1998, type BX 1111b2–BX1121b. 128–132 Pl. 32–33. type BX 1125a1–BX1125a2 132–136 Pl. 34,4–35, 25. type BX 1143138f Pl. 37, 11–22. type BX 131–132. 140 Pl. 38,1–4. type BX 3111–3141. 142 Pl. 1–6. type BXIV 8, 279. Pl. 63, 1; Cohen 2000, 170 Pl. III, 28–29. 34–36; Broshi 2003, 334. 346. 350 cat. no. 431. 455. 462; Israeli 2003, 168 f. 242 cat. no. 179. 181–182. 184–313. 262 cat. no. 343; Keller 2006, type VII 54a. 226 Pl. 19h.type VII 79a. 234. Pl. 220; Hadad 2005, 24–27 Pl. 12, 235–237. 244. 246 Pl. 18, 352–354; Hadad 2006, 626 f. Fig. 19.2, 19–21; Jennings 2004/2005, 77 f. Fig. 4.10, 12, 177 f. Fig. 7.26, 15–20. 22; Jackson-Tal 2007, 487 pl. 8, 5; Hadad 2008, 170 f. Pl. 5.4, 57; Jackson-Tal 2012a, 186 Fig. 8.3, 1, 6; O'Hea 2012, cat. no. 65. 68. 70–71. 77. 307 f. Fig. 649. 652, 654 f.. 661; Jackson-Tal 2013, 114, 3.10, 3–5; Hoss forthcoming, cat. no. K.4–K.9 Pl. 19.
Note: —

TZ 000461-001
Square I 109; south slope
Colour: Bluish green
Description: Rim sherd of a bottle with fire-rounded rim and conical neck; free-blown
Figure References: —
Dimension: L 1.3; D (opening) 5; Th 0.5
Parallel: **Late Roman – Umayyad**: Cohen 1997, 419–427 Pl. VI, 6, 13. Pl. VII, 4–5. Pl. VIII, 11–16; Dussart 1998, type BX 1111b2–BX1121b. 128–132 Pl. 32–33. type BX 1125a1–BX1125a2. 132–136 Pl. 34, 4–35, 25. type BX 1143138f Pl. 37, 11–22. type BX 131–132. 140 Pl. 38, 1–4. type BX 3111–3141. 142 Pl. 1–6. type BXIV8. 279 Pl. 63, 1; Cohen 2000, 170 Pl. III, 28–29. 34–36; Broshi 2003, 334. 346. 350 cat. no. 431. 455. 462; Israeli 2003, 168 f. 242 cat. no. 179. 181–182. 184. 313. 262 cat. no. 343; Keller 2006, type VII 54a. 226 Pl. 19h. type VII 79a, 234 Pl. 220; Hadad 2005, 24–27 Pl. 12, 235–237. 244. 246 Pl. 18, 352–354; Hadad 2006, 626 f. Fig. 19.2, 19–21; Jennings 2004/2005, 77 f. Fig. 4.10, 12. 177 f. Fig. 7.26. 15–20. 22; Jackson-Tal 2007, 487 Pl. 8, 5; Hadad 2008, 170 f. Pl. 5.4, 57; Jackson-Tal 2012a, 186 Fig. 8.3, 1, 6; O'Hea 2012, cat. no. 65. 68. 70–71. 77. 307 f., Fig. 649, 652, 654 f., 661; Jackson-Tal 2013, 114, 3.10, 3–5; Hoss forthcoming, cat. no. K.4–K.9, pl. 19.
Note: —

Bowl/Beaker with Fire-rounded Straight Rim/TZ-Group 8 (Bowl) or 28 (Beaker)

TZ 000247-001
Square R 129; plateau
Colour: Greenish blue
Description: Rim sherd of a bowl or a beaker with fire-rounded straight rim; free-blown
Figure References: —
Dimension: L 1.3; D (opening) 8; Th 0.2
Parallel: **4th century (bowl)/Roman – Umayyad period (beaker)**: References for the Bowl: Jennings 2004/2005, 95 f. Fig. 5.10–11; Keller 2006, Type VII5d. 202 f. Pl. 7h. References for the Beaker: Cohen 1997, 410 Pl. III, 20; Dussart 1998, 104–106 type BVIII 15. type BVIII 2111 Pl. 23, 8–35; Keller 2006, 215–218 type VII 28a. type VII 29 a/b. type VII 31a. type VII 32a Pl. 15d, 15k–l. 16c. 16 f.; Jennings 2004/2005, 71 f. Fig. 4.1, 6–8. 91 f. Fig, 5.7; Jackson-Tal 2012a, 184 Fig. 8.2, 6–7; O'Hea, 2012, 305 cat. no. 49–51. Fig. 633–636; Hamel – Greiff 2014, 157 Fig. 16.5.25–26; Hoss forthcoming, cat. no. D.12–D.19 Pl. 14.
Note: —

Folded Bases/TZ-Group 25

TZ 000487-001
Square AH 121; plateau
Colour: Colourless
Description: Folded base sherd; free-blown
Figure References: —
Dimension: L 2.1; Th 0.4
Parallel: **Late Roman – Byzantine (probably longer popular)**: Davidson Weinberg – Goldstein 1988, 44 Fig. 4-4; Rütti 1991, cat. no. 4821. 4826. Pl. 178; Cohen 1997, 402 Pl. II, 7–8; Dussart 1998, 77 type BIII 1 Pl. 12,1; Cohen 2000, Pl. I, 10; Hadad 2005, 21 Pl. 74–75; Jennings 2004/2005, 189 Fig. 8.3; O'Hea 2012, 304 cat. no. 43 Fig. 628; Jackson-Tal 2013, 110 Pl. 3.4, 46; Hoss forthcoming, cat. no. C.18–C.27 Pl. 13.
Note: —

TZ 000015-001
Square AM 121; plateau
Colour: Pale green
Description: Folded base sherd; free-blown
Figure References: —
Dimension: L 2.5; W 1.7; D not measurable; Th 0.4
Parallel: **Late Roman – Byzantine (probably longer popular)**: Davidson Weinberg – Goldstein 1988, 44, Fig. 4-4; Rütti 1991, cat. no. 4821. 4826. Pl. 178; Cohen 1997, 402 Pl. II, 7–8; Dussart 1998, 77 type BIII 1 Pl. 12,1; Cohen 2000, Pl. I, 10; Hadad 2005, 21 Pl. 74–75; Jennings 2004/2005, 189 Fig. 8.3; O'Hea 2012, 304 cat. no. 43. Fig. 628; Jackson-Tal 2013, 110 Pl. 3.4, 46; Hoss forthcoming, cat. no. C.18–C.27 Pl. 13.
Note: —

High Base Ring/TZ-Group 24

TZ 000024-001
Square AM 124; plateau
Colour: Greenish blue
Description: Base sherd with high base ring; free-blown
Figure References: —
Dimension: L 2.3; D (base) 8; Th 0.6
Parallel: **Roman – Umayyad**: Davidson Weinberg – Goldstein 1988, 58 Fig. 4–20; Rütti 1991, cat. no. 5057–5080 Pl. 180–181; Cohen 1997, 401 f. Pl. II, 9–11; Dussart 1998, 66 type BI 4212a Pl. 6, 10. 68 type BI 4222a2/b1 Pl. 7, 11–18. 74 type BII 12 Pl. 10, 13–15; Hadad 2005, 21 Pl. 3, 72–72; Jennings 2004/2005, 191–193 Fig. 8.5; O'Hea 2012, 304 cat. no. 44–45 Fig. 629–630; Jackson-Tal 2013, Pl. 6.2, 15; Hoss forthcoming, C.1–C.17 Pl. 12.
Note: —

TZ 000096-001
Square Z 125; plateau
Colour: Greenish blue
Description: Base sherd with high base ring; free-blown
Figure References: —
Dimension: L 2.1; D not measurable; Th 0.2–0.3
Parallel: **Roman – Umayyad**: Davidson Weinberg – Goldstein 1988, 58 Fig. 4–20; Rütti 1991, cat. no. 5057–5080 Pl. 180–181; Cohen 1997, 401 f. Pl. II, 9–11; Dussart 1998, 66 type BI 4212a Pl. 6, 10. 68 type BI 4222a2/b1 Pl. 7, 11–18. 74 type BII 12 Pl. 10, 13–15; Hadad 2005, 21 Pl. 3, 72–72; Jennings 2004/2005, 191–193 Fig. 8.5; O'Hea 2012, 304 cat. no. 44–45 Fig. 629–630; Jackson-Tal 2013, Pl. 6.2,15; Hoss forthcoming, cat. no. C.1–C.17, Pl. 12.
Note: —

Concave Base Ring/TZ-Group 26

TZ 000485-002
Square AD 117; plateau
Colour: Greenish blue
Description: Concave base sherd; free-blown
Figure References: —
Dimension: L 3.2; W 3.1; Th 0.2
Parallel: **Late Roman – Byzantine**: Cohen 1997, 402 Pl. II, 5–6; Dussart 1998, 57 type BI 1211 Pl. 3, 12–15; Cohen 2000, Pl. I, 8–9; Hadad 2005, 21 Pl. 3, 76; Jennings 2004/2005, 80 f. Fig. 4.14, 3–4; Jackson-Tal 2007, Pl. 1, 9; Burdajewicz 2009, Fig. 4, 58. 60–61; Jackson-Tal 2012a, 180 Fig. 8.1, 13; Jackson-Tal 2013, Pl. 3.6, 47–48. 50; Jackson-Tal 2013, 6.2, 17; Hoss forthcoming, cat. no. C.28–C.30 Pl. 13.
Note: —

TZ 000314-001
Square R 121; south slope
Colour: Greenish blue
Description: Concave base sherd; free-blown
Figure References: —
Dimension: L 0.6; D not measurable; Th 0.6
Parallel: **Late Roman – Byzantine**: Cohen 1997, 402 Pl. II, 5–6; Dussart 1998, 57 type BI 1211 Pl. 3, 12–15; Cohen 2000, Pl. I, 8–9; Hadad 2005, 21 Pl. 3, 76; Jennings 2004/2005, 80 f. Fig. 4.14, 3–4; Jackson-Tal 2007, Pl. 1, 9; Burdajewicz 2009, Fig. 4, 58. 60–61; Jackson-Tal 2012a, 180 Fig. 8.1, 13; Jackson-Tal 2013, Pl. 3.6, 47–48, 50; Jackson-Tal 2013, 6.2,17; Hoss forthcoming, cat. no. C.28–C.30 Pl. 13.
Note: —

Unidentifiable Glass Fragments

Pale green

TZ 000488-002; body sherd; free-blown; Square AD 117; plateau

TZ 000276-001; body sherd; free-blown; Square AY 121; north slope

TZ 000464-002; body sherd; free-blown; Square N 117; south slope

Bluish green

TZ 000490-001; body sherd; free-blown; Square AM 117; west slope

TZ 000276-002; body sherd; free-blown; Square AY 121; north slope

TZ 000493-002; body sherd; free-blown; Square AY 125/locus L 2; north slope

Greenish blue

TZ 000494-001; body sherd; free-blown; Square V 121/locus L 2; plateau

TZ 000134-001; body sherd; free-blown; Square Z 117/locus L 1; plateau

TZ 000137-001; body sherd; free-blown; Square AD 121/locus L 1; plateau

TZ 000247-002; body sherd; free-blown; Square R 129; plateau

TZ 000312-002; body sherd; free-blown; Square R 117/locus L 1; south slope

TZ 000314-002; body sherd; free-blown; Square R 121/locus L 2; south slope

TZ 000316-001; body sherd; free-blown; Square N 125; south slope

TZ 000353-001; body sherd; free-blown; Square N 133; south slope

TZ 000353-002; body sherd; free-blown; Square N 133; south slope

TZ 000464-001; body sherd; free-blown; Square N 117; south slope

Yellowish green

TZ 000188-001; body sherd; free-blown; Square AD 137/locus L 1; plateau

Colourless

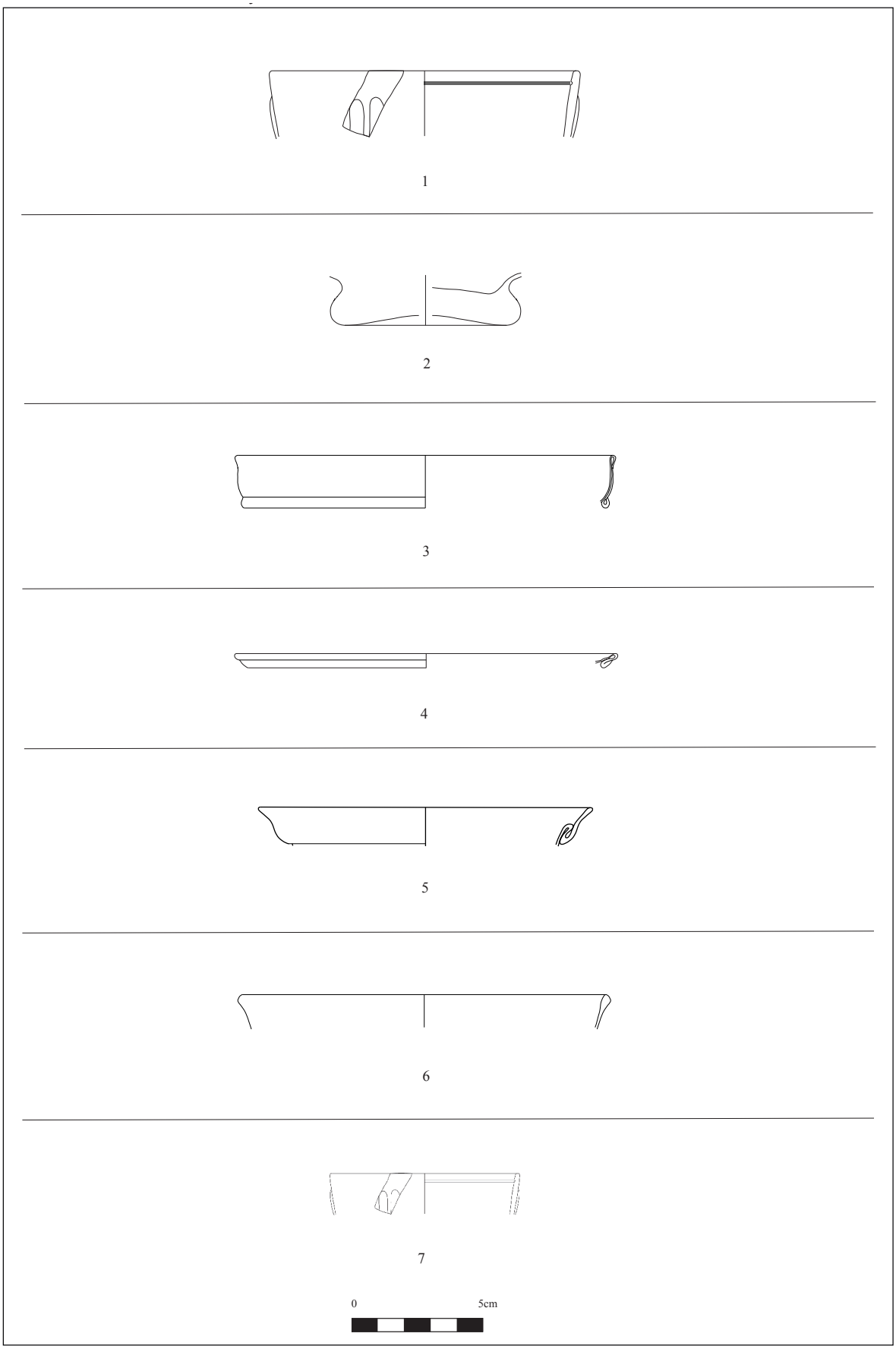
TZ 000462-001; sherd of a modern glass vessel; free-blown; Square I 125; south slope

TZ 000462-002; sherd of a modern glass vessel; free-blown; Square I 125; south slope

Plate 2.15: Glass from Tall Zirāʿa—Survey 2001

No.	Type	Inv.No.	Square	Context	Fabric colour	Date
1	bowl	TZ 000227-001	AM 133	plateau	greenish blue	Hellenistic – Roman
2	beaker	TZ 000492-006	AQ 129	plateau	bluish green	Early Byzantine
3	plate	TZ 000493-001	AY 125	north slope	bluish green	Early Byzantine
4	plate	TZ 000241-001	V 137	east slope	bluish green	Late Roman – Early Byzantine
5	bowl	TZ 000184-001	AD 137	west slope	greenish blue	Late Roman – Early Byzantine
6	bowl	TZ 000489-001	AD 133	west slope	bluish green	Late Roman – Umayyad
7	bottle	TZ 000257-001	AY 125	north slope	bluish green	Late Roman – Umayyad

Plate 2.15: Glass from Tall Zirāʿa—Survey 2001



2.2.3. Stone/Mineral Finds from the 2001 Survey

by Dieter Vieweger

2.2.3.1. Stone/Mineral Finds of Different Types

In all 153 stone/mineral objects were found during the 2001 Survey: five chalk sinter ecofacts, two river pebbles and 146 further artefacts of different types of stones.

The ecofacts consist of chalk sinter. Some of them have a shape of a tube (TZ 000003-013; TZ 000415-001; TZ 000172-001; *Figs. 2.103–2.105*). Of course the naturally perforated chalk sinter tubes emerging from the sinter accumulations could be used both in their complete and their broken state (water pipe, filling aids). But that is not provable for the individual object and probably not likely, since hundreds of such finds were found on Tall Zirā'a, which itselfs arose due to sinter accumulations.

The two pebbles (TZ 000164-002; TZ 000006-002; *Fig. 2.97*) were probably used as rubbing stones.

The other 146 stone artefacts are made of marble (seven finds), limestone (107 finds), basalt (30 finds), silicate stone (one find) and silex (one find). The latter object is a silex pecked hammer stone (TZ 000383-001; *Fig. 2.102*). Like the two pebbles the silicate stone (TZ 000115-001; *Fig. 2.100*) could be used as a grinding stone. However, it has retouchings at one of its narrow sides, which qualifies it also for use as a scraper.

Among the marble finds are plates being smoothed on both sides (e.g. TZ 000124-002; TZ 000131-001) as well as wall/floor tiles (TZ 000359-001; TZ 000359-002; TZ 000065-002). The limestone objects include 102 *tesserae* of different colour (reddish, grey, white, brown; TZ 000446-002), the foot of a large object (TZ 000406-001; *Fig. 2.106*), a ring stone (TZ 000115-002; *Fig. 2.95*), a grinding stone (TZ 000053-001; *Fig. 2.99*) and two Early Roman limestone vessels (TZ 000497-001; TZ 000495-001; *Figs. 2.107–2.110*). Because the latter are considered as a marker for a Jewish population, these two vessels are discussed in a special chapter (*Chaps. 2.2.3.3.* and *2.2.3.4.*). The foot (TZ 000406-001; *Fig. 2.106*) could originally have been part of a vessel or of a table; it is not possible to make a more precise classification of this object.

The described stone finds refer to different areas of everyday life. The ring stones are household items of various functions. Especially the basalt objects show the production and preparation of food: 13 bowls, nine or ten grinding stones and three saddle qerns. The *tesserae*, wall or floor tiles and the marble slabs belong to interior decorations of buildings.

The accumulation of *tesserae* in Square I 117 and the marble plates, widely distributed on the tall's surface refer to a wealthy Roman – Byzantine (Umayyad) settlement on Tall Zirā'a. On this special place a monastery dated to the Byzantine to Umayyad period has been excavated.

2.2.3.2. Catalogue of the Stone/Mineral Finds

Architecture/Interior Decoration

TZ 000059-001
Square AQ 125; plateau
Description: Two flat marble slabs; fragments
Figure References: —
Dimensions: L 9.5/10.4; Th 1.9/2.2
Date: —
Material: Marble

TZ 000124-002
Square AM 137; plateau
Description: Marble slab; fragment; carefully smoothed on both sides
Figure References: —
Dimensions: L 7.7; W 6.8; Th 1.88
Date: —
Material: Marble

TZ 000131-001
Square V 125; plateau
Description: Marble slab; fragment; carefully smoothed on both sides
Figure References: —
Dimensions: L 9.1; W 5.4; Th 4.01
Date: —
Material: Marble

TZ 000328-001
Square R 121; south slope
Description: Marble slab; fragment; smoothed on both sides
Figure References: —
Dimensions: L 17.7; W 11.1; H 2.65
Date: —
Material: Marble

TZ 000359-001
Square AD 105; west slope
Description: Marble slab; wall or floor tiles?; fragments; smoothed only on one visible side
Figure References: —
Dimensions: L 9.1; W 4.1; H 2.7
Date: —
Material: Marble

TZ 000359-002
Square AD 105; west slope
Description: Marble slab; wall or floor tile?; fragment; smoothed only on one visible side
Figure References: —
Dimensions: L 10; W 8; H 3.2
Date: —
Material: Marble

TZ 000065-002
Square AQ 129; plateau
Description: Tessera; completely preserved
Figure References: —
Dimensions: L 2.3; W 2.1; H 2.6
Date: —
Material: Limestone

TZ 000446-002
Square I 117; south slope
Description: 102 *tesserae*; completely preserved; different sizes and colours (reddish, brown, gray, white)
Figure References: —
Dimensions: —
Date: —
Material: Limestone

Household

TZ 000115-002
Square AQ 137; east slope
Description: Stone ring; half preserved; circular; in the middle conically drilled from two sides
Figure References: Fig. 2.95
Dimensions: H 3.8; D (max.) 13; D (opening inside) 2.6
Date: —
Material: limestone

Fig. 2.95 Stone ring, TZ 000115-002 (Source: BAI/GPIA).

TZ 000458-001
Square R 109; south slope
Description: Stone ring; fragment; double conic in cross section; also conically drilled from two sides
Figure References: —
Dimensions: L 5; D (opening inside) 1.6
Date: —
Material: Basalt

TZ 000460-001
Square I 121; south slope
Description: Stone ring; half preserved; round in cross section; conically drilled from two sides
Figure References: —
Dimensions: H 5.6; D (max.) 9.4; D (opening inside) 2.8
Date: —
Material: Basalt

TZ 000117-001
Square AQ 145; east slope
Description: Stone ring; half preserved; circular; conically drilled from two sides
Figure References: —
Dimensions: H 5.9; D (max.) 14.7; D (opening inside) 4.5
Date: —
Material: Basalt

Production of Food

TZ 000164-002
Square V 133; south slope
Description: Grinding stone; half preserved; wear polish; oval in cross section
Figure References: —
Dimensions: L 5.1; W 5.3; H 4
Date: —
Material: Pebble

TZ 000449-001
Square I 109; south slope
Description: Grinding stone?; wear polish
Figure References: —
Dimensions: L 10.4; W 5.9; H 3.9
Date: —
Material: Basalt

TZ 000164-001
Square V 133; south slope
Description: Foot of a bowl; half preserved
Figure References: Fig. 2.96
Dimensions: L 7.6; D (max.) 5.8
Date: —
Material: Basalt

Fig. 2.96 Foot of a stone bowl, TZ 000164-001 (Source: BAI/GPIA).

TZ 000010-001
Square AH 121; plateau
Description: Bowl; fragment
Figure References: —
Dimensions: L 10; W 9; H 7
Date: —
Material: Basalt

TZ 000026-001
Square AD 117; plateau
Description: Bowl; fragment
Figure References: —
Dimensions: L 11; W 6; H 5.9
Date: —
Material: Basalt

TZ 000050-001
Square AU 129; plateau
Description: Bowl; fragment; c. one fifth preserved
Figure References: —
Dimensions: L 16; W 24.5; H 10.7
Date: —
Material: Basalt

TZ 000051-001
Square AY 125; north slope
Description: Bowl with one remaining foot; fragment
Figure References: —
Dimensions: original H 6.1
Date: —
Material: Basalt

TZ 000052-001
Square AU 129; plateau
Description: Bowl; rectangular and flat; half preserved
Figure References: —
Dimensions: L 15.2; W 16; H 6
Date: —
Material: Basalt

TZ 000065-003
Square AQ 129; plateau
Description: Bowl; fragment; with one remaining foot
Figure References: —
Dimensions: L 7; H 5
Date: —
Material: Basalt

TZ 000100-001
Square AM 145; east slope
Description: Bowl; fragment
Figure References: —
Dimensions: H 12; L 18; W 27; Th 3.5
Date: —
Material: Basalt

TZ 000118-001
Square AQ 141; east slope
Description: Bowl; almost completely preserved; irregularly shaped; slightly dented
Figure References: —
Dimensions: L 24.5; W 18; H 7.5
Date: —
Material: Basalt

TZ 000148-001
Square V 129; plateau
Description: Bowl; small rim fragment
Figure References: —
Dimensions: H 6.8; Th 2.06
Date: —
Material: Basalt

TZ 000217-001
Square AQ 133; plateau
Description: Bowl; fragment; without a foot base
Figure References: —
Dimensions: H 10
Date: —
Material: Basalt

TZ 000428-001
Square N 113; south slope
Description: Bowl; fragment.
Figure References: —
Dimensions: H 6.2; Th 1.5
Date: —
Material: Basalt

TZ 000393-001
Square I 133; south slope
Description: Bowl; outside unfinished; completely preserved
Figure References: —
Dimensions: L 11.2; W 9.5; H 6.9; D (opening inside) 5.5
Date: —
Material: Basalt

TZ 000458-002
Square R 109; south slope
Description: Bowl; fragment; contact area carefully smoothed at the bottom
Figure References: —
Dimensions: H 3.6; Th 2.1
Date: —
Material: Basalt

TZ 000006-002
Square AM 117; plateau
Description: Grinding stone?; half preseved; oval in cross section
Figure References: Fig. 2.97
Dimensions: L 8; W 5.5; H 5.2
Date: —
Material: Pebble

Fig. 2.97 Grinding stone?, TZ 000006-002 (Source: BAI/GPIA).

TZ 000010-002
Square AH 121; plateau
Description: Grinding stone; fragment; preserved to one quarter; round or oval in cross section
Figure References: —
Dimensions: D (max.) 5.9
Date: —
Material: Basalt

TZ 000006-001
Square AM 117; plateau
Description: Grinding stone; completely preserved; oval in cross section; wear polish
Figure References: Fig. 2.98
Dimensions: L 9.6; W 8.6; H 5.2
Date: —
Material: Basalt

Fig. 2.98 Grinding stone, TZ 000006-001 (Source: BAI/GPIA).

TZ 000063-001
Square AQ 129; plateau
Description: Grinding stone; half preserved; round in cross section
Figure References: —
Dimensions: L 19; W 13; H 7
Date: —
Material: Basalt

TZ 000124-003
Square AM 137; plateau
Description: Grinding stone; completely preserved; oval in cross section; flat bottom
Figure References: —
Dimensions: L 11.5; W 6.3; H 4.6
Date: —
Material: Basalt

TZ 000124-004
Square AM 137; plateau
Description: Grinding stone; completely preserved; flat bottom
Figure References: —
Dimensions: H 4.3; L 5.6; W 5.2
Date: —
Material: Basalt

TZ 000203-001
Square AM 133; plateau
Description: Grinding stone; fragment; less than a half preserved; flat bottom; round upper side
Figure References: —
Dimensions: H 2; D 8.7
Date: —
Material: Basalt

TZ 000203-002
Square AM 133; plateau
Description: Grinding stone; completely preserved; oval in cross section; rough at both sides, but flat; wear polish
Figure References: —
Dimensions: L 10.6; W 8.2; H 5.4
Date: —
Material: Basalt

TZ 000231-001
Square AM 141; east slope
Description: Grinding stone; fragment; round and flattened at the bottom; wear polish
Figure References: —
Dimensions: H 5.5; D 8.8
Date: —
Material: Basalt

TZ 000383-002
Square I 145; south slope
Description: Grinding stone; completely preserved; ovoid
Figure References: —
Dimensions: L 16; D (max.) 8
Date: —
Material: Basalt

TZ 000053-001
Square AU 125; plateau
Description: Grinding stone/mortar; completely preserved; round in cross section; the outer side is untreated
Figure References: Fig. 2.99
Dimensions: H 3.7; D (max.) 8.8; hollow D (max.) 3.9
Date: —
Material: Limestone

Fig. 2.99 Grinding stone/mortar, TZ 000053-001 (Source: BAI/GPIA).

TZ 000055-001
Square AH 121; plateau
Description: Saddle quern; outside unfinished; completely preserved
Figure References: —
Dimensions: L 27.5; W 14.5; H 7.9
Date: —
Material: Basalt

TZ 000296-001
Square AM 133; plateau
Description: Saddle quern; half preserved
Figure References: —
Dimensions: L 22; W 15.3; H 7.4
Date: —
Material: Basalt

Pecked Hammer Stone

TZ 000383-001
Square I 145; south slope
Description: Pecked hammer stone; completely preserved
Figure References: Fig. 2.102
Dimensions: L 5.4; W 4.3; H 4.9
Date: —
Material: Silex

Ecofacts

TZ 000003-013
Square AM 121; plateau
Description: Ecofact; fusion in the shape of a tube
Figure References: Fig. 2.103
Dimensions: L 5.1; D (max.) 3.3; D (opening inside) 1.2
Date: —
Material: Chalk sinter

TZ 000364-001
Square Z 105; west slope
Description: Saddle quern; fragment
Figure References: —
Dimensions: L 7.2; W 8.7; H 3.9
Date: —
Material: Basalt

TZ 000115-001
Square AQ 137; east slope
Description: Hammer stone; wear polish and retouching at thicker end
Figure References: Fig. 2.100
Dimensions: L 10.8; W (max.) 5.1; H 3
Parallels: Yahalom-Mack 2007, 643 Reg. No. 189255 Fig. 11.3:8; Photo 11.6.
Date: —
Material: Silicate stone

Fig. 2.100–2.101 Left: Hammer stone, TZ 000115-001; right: Hammer stone; Tall al-Ḥiṣn (Beth Schean) (Source: BAI/GPIA/Yahalom-Mack [2007] 645 Photo 11.6).

Fig. 2.102 Pecked hammer stone, TZ 000383-001 (Source: BAI/GPIA).

Fig. 2.103 Ecofact, TZ 000003-013 (Source: BAI/GPIA).

TZ 000415-001
Square AQ 129; plateau
Description: Ecofact; half preserved; object has the shape of a tube; lengthwise broken
Figure References: Fig. 2.104
Dimensions: L 5.7; W 4.8; H 2.4
Date: —
Material: Chalk sinter

Fig. 2.104 Ecofact, TZ 000415-001 (Source: BAI/GPIA).

TZ 000113-001
Square AQ 137; east slope
Description: Ecofact; object has the shape of a small bowl
Figure References: —
Dimensions: H 4.3; D (max.) 8.1
Date: —
Material: Chalk sinter

Uncertain Function

TZ 000406-001
Square Z 129; plateau
Description: Foot of a vessel or the foot of a table; carefully smoothed; flat downwards
Figure References: 2.106
Dimensions: H 4.36; D (foot) 2.6; D (max.) 4.3
Date: —
Material: Limestone.

TZ 000172-001
Square Z 129; plateau
Description: Ecofact; object has the shape of a tube; lenghtwise broken
Figure References: Fig. 2.105
Dimensions: L 11.7; D (max.) 7
Date: —
Material: Chalk sinter

Fig. 2.105 Ecofact, TZ 000172-001 (Source: BAI/GPIA).

TZ 000204-004
Square AH 137; plateau
Description: Ecofact; groove at the flat side. Natural perforation; lengthwise broken
Figure References: —
Dimensions: L 6.7; W 3.6; H 2.9
Date: —
Material: Chalk sinter

Fig. 2.106 Foot of a vessel or table, TZ 000406-001 (Source: BAI/GPIA).

2.2.3.3. Two Early Roman Limestone Vessels

Early Roman limestone vessels from the Southern Levant had their golden age from the end of the first century BC until the beginning of the second century AD. They were particularly popular in Jerusalem, Judea, and Galilee. On Tall Zirā'a, altogether 102 limestone fragments of presumably 81 vessels were found; two of them, TZ 000497-001 and TZ 000495-001 (*Figs. 2.107–2.110*), during the tall's survey in 2001. Particularly in the strata 7 (Early Roman) and 6 (Roman), many objects of this kind were uncovered[169]. These will be published in a later volume of the final report of the excavation.

Archaeological findings of Early Roman limestone vessels took place in Jerusalem as early as the second half of the nineteenth century. The wheelthrown vessels were easy to recognise as bowls and pitchers. However, the fragments of handmade pitchers, cups, or beakers were erroneously termed 'measuring cups'[170].

An initial methodological classification of the limestone vessels found on the Ophel of Jerusalem by R. A. S. Macalister and J. G. Duncan[171] was soon followed by multiple other findings of limestone vessels also beyond the city boundaries of Jerusalem. However, the

169 Vieweger – Häser 2014, 137–156.

170 There is no standard pertaining to the holding capacity of these vessels; thus, their function as measuring cups can definitely be excluded. See Gibson 1983, 184; Gibson 2003, 292 f.; Cahill 1992, 210; Magen 2002, 97.

171 Macalister – Duncan 1926, 158 Fig. 152. Pl. 16, 1–32.

major breakthrough in assessing and appreciating these vessels was only achieved by the following important excavations in Jerusalem by:

- K. Kenyon in Silwān/the City of David[172]
- B. Mazar south of the Temple Mount (today an archaeological park)[173]
- N. Avigad in the Jewish Quarter[174]
- M. Broshi, and Y. Magen on Mount Zion[175]
- Y. Shilo in Silwān/the City of David[176]

The stone vessels were made from soft limestone (Arab. Ka'akule)[177] that could be recovered in quarries but also from the spoil of rock tombs. In most of the quarries whitish, predominantly soft limestone was gouged that had only few impurities and was easy to hew.

The production sites were located outside the settlements close to or even inside the limestone quarries, such as in Hizmā, in Ǧebel al-Mukābir, in Tall al-Fūl (Gibea), and at the eastern foot of Mount Scopus (all close to Jerusalem), and also in Rēnā in Galilee. There, the blocks of stone could be processed directly on site, using the cisterns for imbuing the stone with water, which was necessary for shaping the vessels.

As a consequence, several workshops were located near Jerusalem, such as in Rȧmat Rȧḥel, in Bethany, in Tall al-Fūl (Gibea), in Ḥorvat Zimrī (Pisgat Ze'ev), or in Jerusalem proper. Further workshops are known in:

- Galilee: Ṣaffūrīya (Sepphoris), Talḥūm (Kafernaum/Kapharnaoum), Nabūriya (Nabratein), Bēt Laḥm (Bethlehem)
- Shefela: Ḫirbet Ḥazzāna (Ḥorbat Ḥazzān)
- Golan: as-Salām (Gamla)

Tools, turntables, cores that were separated from the vessels in the turning process, as well as semi-finished goods indicate production sites since it can be assumed that waste—such as the discarded cores from the turning process—would not have been traded along with the finished products[178].

The Early Roman limestone vessels were no luxury goods. This is evidenced by the fact that they were uncovered all across Jerusalem. They were found both in large cities and small villages (such as the Tall Zirā'a) or hamlets. Their wide geographical distribution over a long period of time—from the end of the first century BC right through to the beginning of the second century AD[179]—proves that they must have been affordable.

The emergence of limestone vessels is possibly closely related to the advent of ossuaries only a few years previously. The latter were partly discovered close to the (little older) ritual baths (*Mikwaot*) and to autonomous synagogue buildings. In these cases, they can be viewed as markers of a Jewish community[180]. Accordingly, as mentioned above, the limestone vessels could be found especially in those regions where a predominantly Jewish presence can be assumed (Jerusalem, Judea, Galilee, but also in the coastal settlements with a mixed population—less in Samaria very seldom in Transjordan).

At the end of the first Pre-Christian century, there appear to have been serious changes in the religious rites of Jewish communities.

In 1992, J. M. Cahill presented a fundamental typology of Persian, Hellenistic, and Early Roman limestone vessels in her publication on the stone artefacts from the excavations of Y. Shiloh in Silwān/the City of David[181]. This typology has been applied for the vessels of Tall Zirā'a. A decade later, Y. Magen added a similar system based on his excavation finds on the production site of Ḥizmā[182]. Finally, it should be noted that there are also two more recent typological publications by S. Gibson[183] and again by Y. Magen[184].

The models for the vessel forms at hand were vessels made of wood, metal, glass, or ceramics. The two following types of limestone vessels, as defined by Cahill 1992, could be established during the survey on the Tall Zirā'a:

Type 2.a.i. handmade with traces of chiselling, barrel-shaped vessels or 'measuring cups' (TZ 000495-001; *Figs. 2.107* and *2.108*).

Type 2.a.i.A.1. handmade with traces of chiselling, barrel-shaped vessels or 'measuring cups', cups with a handle (TZ 000497-001; *Figs. 2.109* and *2.110*).

The two stone vessels found during the Survey 2001 on Tall Zirā'a were discovered at a presumed Early Roman settlement (Survey Square AD 133) and at the southern slope (Survey Square I 133) that often served as a waste disposal site in those times.

172 Kenyon 1974, 230. Cf. Tushingham 1985, Fig. 74–76.

173 Mazar 1971, 20 f. Fig. 12; Ben-Dov 1982, 157–160; Mazar – Mazar 1989, 87 Pl. 13,28. 36–37. 99 Pl. 19,12–16. 107 Pl. 24,21.

174 Avigad 1983, 174–183.

175 Broshi 1976, 81–88.

176 Shilo 1984, 30b.

177 Gibson 2003, 289 n. 24 f.

178 Gibson 2003, 291. Cahill holds a different opinion (Cahill 1992, 219).

179 Geva 2006, 218–238.

180 Cf. Gibson 1993, 302.

181 Cahill 1992, 190–274.

182 Magen 2002.

183 Gibson forthcoming. He focusses on the types excavated in Gamlȧ, though, and deals less with the total stock of Early Roman objects.

184 Magen 2002, 63–115.

2.2.3.4. Catalogue of the Early Roman Limestone Vessels

TZ 000497-001
Square AD 133; plateau
Description: Limestone vessel; flat bottom of a beaker with a piece of the wall; vertical chisel marks at its outer side
Type: 2.a.i.A.1. (Cahill 1992)
Figure References: Figs. 2.107 and 2.108
Dimensions: H 3.1; D (foot) 8.25; Th 0.96
Date: **Early Roman**
Material: Limestone

TZ 000495-001
Square I 133; south slope
Description: Limestone vessel; rectangular handle of a bowl with a thumbs' hole
Type: 2.a.i. (Cahill 1992)
Figure References: Figs. 2.109 and 2.110
Dimensions: D (handel height) 5; Th 1.1
Date: **Early Roman**
Material: Limestone

Fig. 2.107 Limestone vessel, TZ 000497-001 (Source: BAI/GPIA).

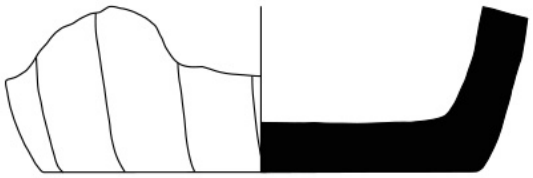


Fig. 2.108 Limestone vessel, TZ 000497-001 (Source: BAI/GPIA).

Fig. 2.109 Limestone vessel, TZ 000495-001 (Source: BAI/GPIA).

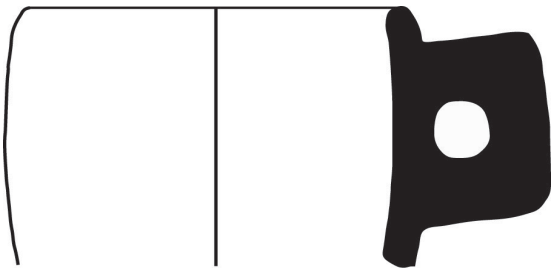


Fig. 2.110 Limestone vessel, TZ 000495-001 (Source: BAI/GPIA).

2.2.4. Bone Finds from the 2001 Survey

by Dieter Vieweger

The catalogue comprises only a small quantity of bone finds. Due to their limited specific significance they do not have any special importance.

TZ 000234-001
Square AM 145; east slope
Description: Indeterminable bone
Dimensions: —

TZ 000463-001
Square I 125; south slope
Description: Sheep; *astragalus*; right talus
Dimensions: L 2.74; W 1.63; H 1.32

TZ 000496-001
Square AM 145; east slope
Description: Indeterminable bone
Dimensions: —

TZ 000482-001
Square AM 145; east slope
Description: Indeterminable bone
Dimensions: —

TZ 000483-001
Square AM 145; east slope
Description: Indeterminable bone
Dimensions: —

TZ 000051-004
Square AY 125; north slope
Description: Sheep/goat; right femoral head
Dimensions: —

TZ 000472-010
Square AM 145; east slope
Description: Cattle; right *calcaneus*
Dimensions: L 7; W 3.1; H 2.6

2.3. The 2001 Survey Results

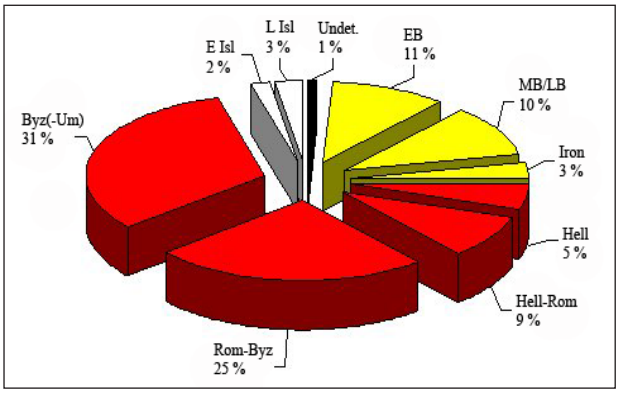
by Dieter Vieweger

2.3.1. Results of Find Distribution

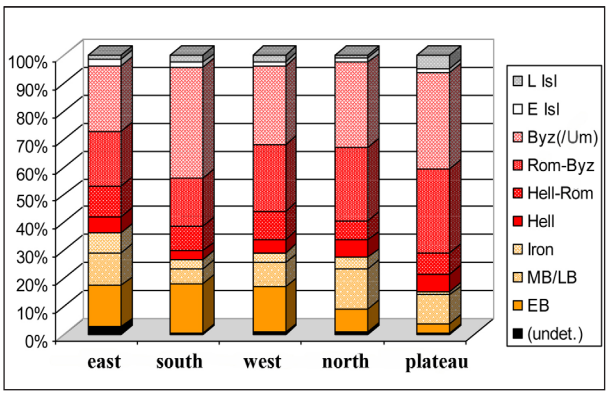
During the 2001 season on Tall Zirā'a the survey covered the whole tall, also including the slopes (in total 5.08 ha, 127 squares, each 20 m x 20 m). Within this survey 22,383 pottery sherds were collected. During a special survey based on the Portugali Method[185] 1,741 sherds were sampled. Altogether this makes 24,124 sherds[186]. All finds were catalogued and analysed according to qualitative and quantitative criteria, with 2,847 sherds registered as diagnostics.

Firstly, the chronological classification of the pottery gathered substantiates a long period of settlement activity on Tall Zirā'a; the earliest period recorded is the Early Bronze Age, the youngest is the Ottoman period (*Graph 2.1*). However, distribution of the sherds was not even over the tall (*Tab. 2.1*). Differences in the numbers and types of sherds found in diverse areas on the tall (from the beginning of the survey, a distinction has been made between the plateau and the slopes) demand a thorough evaluation.

A comparison of the quantity of sherds found for each zone is illustrated in *Graph 2.2*, which describes the proportional distribution of chronologically classified pottery sherds in every zone. The obvious difference between the finds from the plateau and those from the slopes is conspicuous. On the plateau, finds from the later periods are much more numerous, particularly from the Hellenistic to the Byzantine period (78.5 %). Although the number of finds is substantially less for the Islamic periods (6.23 %), ceramics from these periods were nevertheless found here in considerable numbers. However, within the latter group of types, only Early and Late Islamic pottery differentiate significantly between the two different areas of plateau and slopes, with 6.2 % on the plateau compared to 2.4 % (north) – 4.1 % (south) on the slopes. Finds on the plateau from the Pre-Classical periods (from Early Bronze Age to the Iron Age) comprise only 14.6 % and are thus clearly underrepresented. This is quite understandable considering the huge amount of cultural debris of the later periods. It must also be noted that these quantitative differences do not necessarily reflect the intensity of settlement activities during the periods they represent; illicit excavations that can be also traced all over the plateau have probably disturbed the original stratification, and may be responsible for some of the 14.6 % of sherds dating to the Pre-Classical periods which were found.



Graph 2.1 Chronological classification of all ceramics found on Tall Zirā'a (excluding the Portugali Method survey) (Source: BAI/GPIA).



Graph 2.2 Proportional distribution of chronologically classified pottery on Tall Zirā'a (excluding the Portugali Method survey) (Source: BAI/GPIA).

185 Portugali 1982, 170–190.

186 Plus many vestiges of Roman – Byzantine roof tiles.

	East	South	West	North	Plateau	Σ
Undetermined	78	32	36	58	52	256
Early Bronze Age	394	671	675	405	214	2359
Middle/Late Bronze Age	308	197	355	717	695	2272
Iron Age	198	124	152	210	74	758
Hellenistic period	147	124	191	311	419	1192
Hellenistic – Roman period	298	342	429	351	508	1928
Roman – Byzantine period	524	656	990	1327	2044	5541
Byzantine (-Umayyad) period	621	1507	1167	1529	2301	7125
Early Islamic period	59	64	61	83	107	374
Late Islamic period	38	94	94	41	311	578
Total result	2665	3811	4150	5132	6715	**22.383**

Tab. 2.1 Chronological classification of all pottery sherds found on Tall Zirā'a according to survey area (excluding the Portugali Method survey) (Source: BAI/GPIA).

The vast majority of the Pre-Classical sherds (Early Bronze Age to Iron Age) were found on the slopes of the tall (with 25.9 % on the north and 33.7 % on the east side)[187] where, along the extensive edges, the Pre-Classical layers were not covered by later strata as much as on the plateau.

The average number of sherds per square in the total survey area is 176.2 sherds (22.383 in total within 127 squares). On the plateau the average number of sherds is with c. 176.7 sherds similar to the mean value of the total area. A higher number was found on the rocky northern slope which descends steeply to the Wādī al-'Arab, i.e. 233.3 sherds per square. Artefacts were also found in large numbers along the edges and at the bottom of the slopes. The number of pottery sherds was quite good on the west slope (153.7 sherds per square); the many terrace-like edges of this slope, with a height of 25 m and abundant cultural remains covering it, practically guaranteed a lot of finds. By contrast, the south slope and the east slope both produced a lower average number of finds, the former, being well protected by antique walls, and the latter, because it is dominated by scattered ashlars.

The *Graphs 2.3 a–e* provide even more detail for the quantitative data. The x-value for each diagram represents the average number of finds per square (20 m x 20 m). A comparison of the diagrams illustrates that the frequency of Roman – Byzantine sherds (on average 53.78 sherds per survey square) and Byzantine (– Umayyad) finds (60.55 sherds per square) on the plateau is noticeable.

Regarding the finds on the east, south and west slopes, the distribution graphs for chronological classification are quite similar, whereas the flat plateau and the steeply descending slope to the north show similarities in distribution, despite their dissimilarity in appearance. This may be related to the fact that 'slope wash' from the tall during rain periods is less significant on the northern slope because of the stony ground there. Therefore, prehistoric layers are less likely to reach the surface.

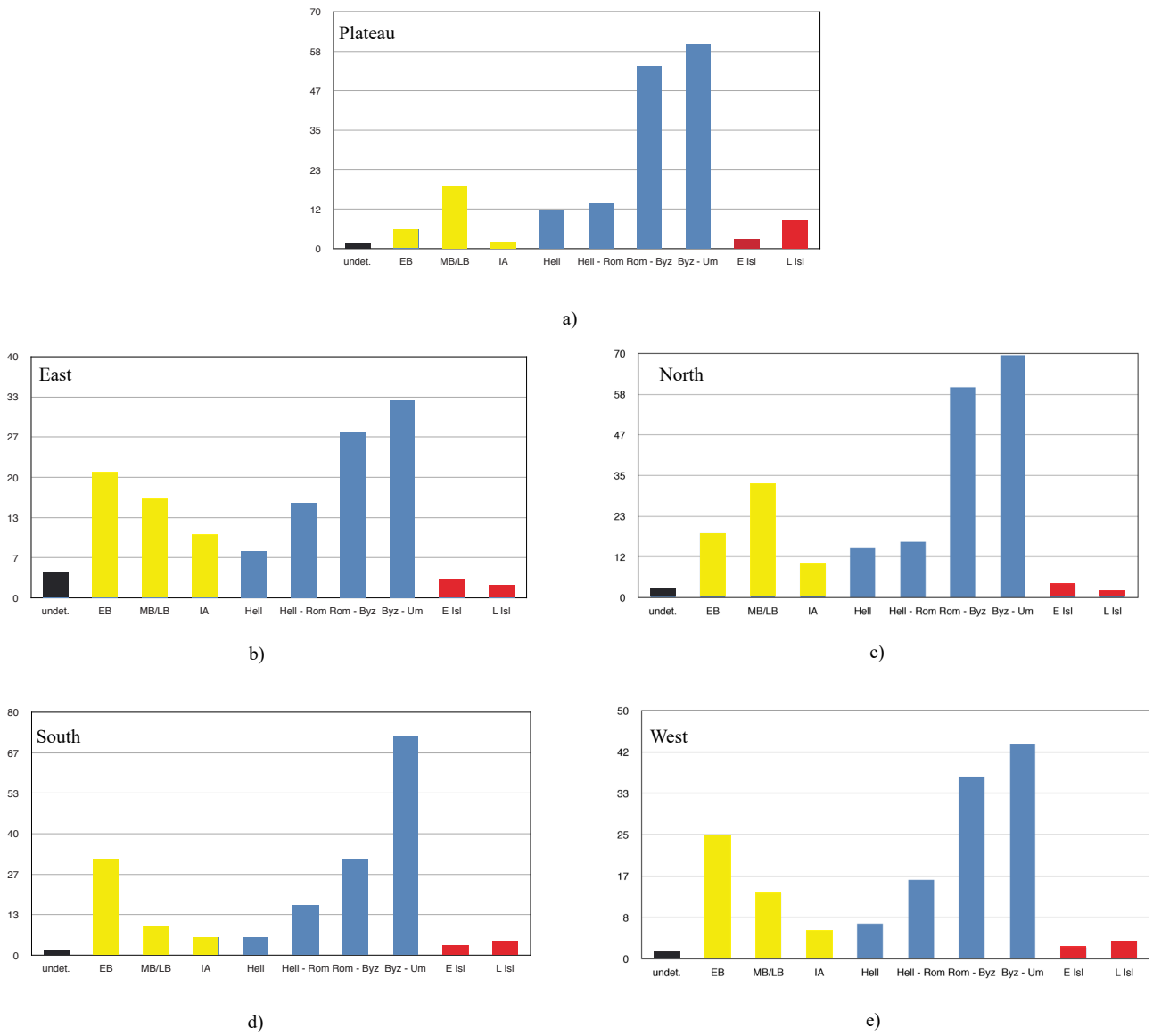
Pre-Classical artefacts were particularly numerous on the slopes, due in part to topographical reasons, but primarily due to intensive settlement activity in the Early Bronze Age. The even distribution of Early Bronze Age pottery sherds over the whole west half and the north-eastern slope of the tall is remarkable. Compared to an average of 18.57 sherds per square over the tall as a whole, up to 94 sherds per square were found in the western area. The two Survey Squares Z 113 and R 109 yielded 80 sherds, while Survey Square AM 109 yielded 94 Early Bronze Age ceramic finds.

The excavations in the western part of the tall evidenced signs of a landslide that had seriously affected the settlement; refilling conducted immediately afterwards yielded ceramic finds dating to the Early Bronze Age (see Stratum 15 which will be published in Volume 3).

However, only a few but very distinctive ceramic concentrations were discovered at the north-eastern transition from the plateau to the upper slopes (*Fig. 2.112*); 38 sherds in Survey Square AQ 133, 68 in Survey Square AU 137 and 158 in Survey Square AM 141.

The Iron Age ceramic finds, which were less well attested in terms of quantity (on average 5.96 sherds per square), were concentrated for the most part on the north-

187 Sherds dating to the Early Bronze Age were found 10 times more often on the slopes of the tall than on the plateau; sherds from the Iron Age nine times more often. On average, the comparison of the number of sherds from other periods is 2 : 1 (finds from the slopes/ the plateau).



Graphs 2.3 a-e Overview of the distribution of sherds for the main areas on Tall Zirā'a

west slopes (15–29 sherds per square) (*Fig. 2.113*) and, to a lesser extent, in the north-east (up to 25 sherds per square) and south-east (up to 19 sherds per square). With 59 sherds, the robbed grave in Survey Square AM 145 obviously yielded the highest density of Iron Age pottery.

In contrast to the expected results, Hellenistic, Hellenistic – Roman, Roman – Byzantine, and Byzantine (– Umayyad) sherds, which were found in great numbers over the tall as a whole (114.95 sherds per square), were not quantitatively numerous in the south-east and eastern areas of the plateau. Two survey squares contained large numbers of finds from this period (*Fig. 2.115*); both Z 121 and R 125, yielded 210 sherds. An examination of the ashlars from the building remains, including column drums and bases, cisterns etc., lead to the assumption that a large building of the Roman – Byzantine period would be found in that area. Roman – Byzantine period pottery sherds were concentrated in the central west (more than 200 in almost every survey square, with 550 sherds per square in some cases; e.g. Square AD 117), north-west (up to 460 sherds per square) and north-east (up to 320 sherds per square) areas of the plateau and the upper slopes of the tall adjoining these areas.

Islamic period sherds were concentrated on the plateau (11.0 sherds per square), particularly in the vicinity of the artesian spring (69 sherds per square); although the quantities of finds from the different Islamic periods were not consistent. However, in spite of the fact that the majority of the sherds were painted or glazed, the actual quantity of the sherds found was quite limited. The Middle and Late Islamic ceramic finds covered the area extending from the artesian spring and its immediate surroundings to the south (*Fig. 2.116*), whereas the Early Islamic finds occurred primarily close to the artesian spring, especially in the north-east corner of the plateau. Hence, one can infer that only certain parts of the plateau were used for settlement purposes during the Islamic periods. However, the validity of such conclusions can only

be proven by excavation. Nonetheless, G. Schumacher reported at the end of the nineteenth century that the hill was at least partially inhabited again[188].

Finally, it must be stated that the quantitative differences between prehistoric finds (from the Early Bronze Age until the Iron Age) and sherds dating to Classical periods does not necessarily reflect the intensity of settlement activity in that period. Rather, such differences might be better explained by the deep cultural deposits from younger strata which overly older strata over the whole tall.

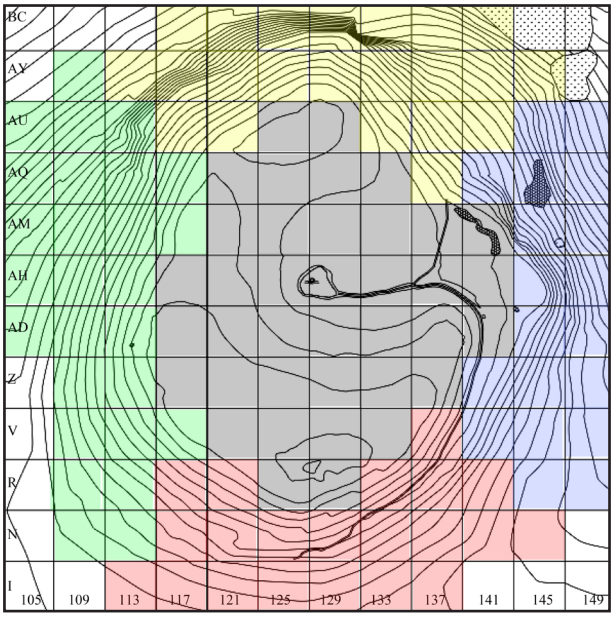


Fig. 2.111 Tall Zirā'a. Survey squares and areas of search: north (yellow), south (red), east (blue), west (green) and plateau (grey) (Source: BAI/GPIA).

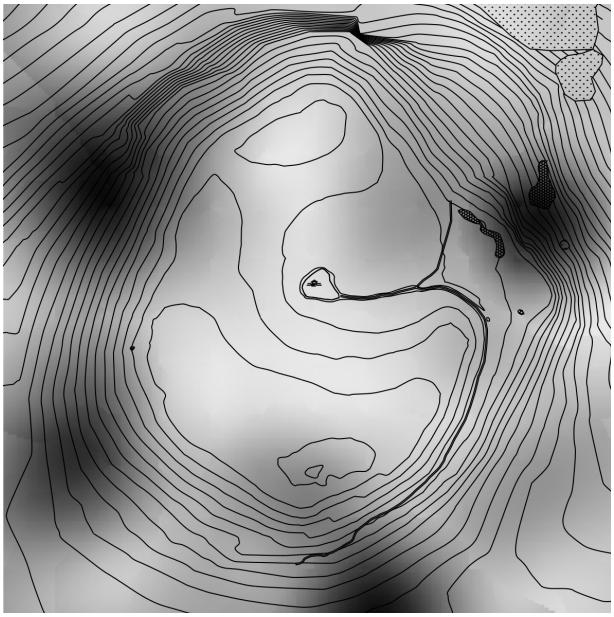


Fig. 2.112 Pottery sherd distribution. Early Bronze Age. Distribution between 0 (white) and 15 (black) sherds per 400 m² (Source: BAI/GPIA).

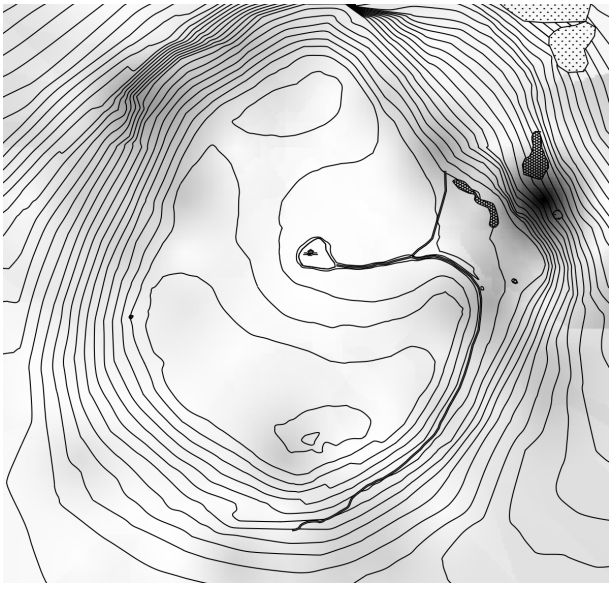


Fig. 2.113 Pottery sherd distribution. Iron Age. Distribution between 0 (white) and 15 (black) sherds per 400 m² (Source: BAI/GPIA).

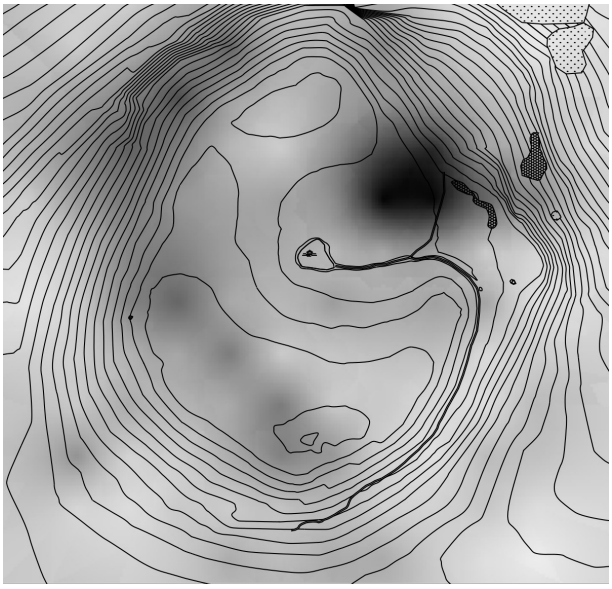


Fig. 2.114 Pottery sherd distribution. Hellenistic – Roman. Distribution between 0 (white) and 15 (black) sherds per 400 m² (Source: BAI/GPIA).

188 Steuernagel 1926, 81.

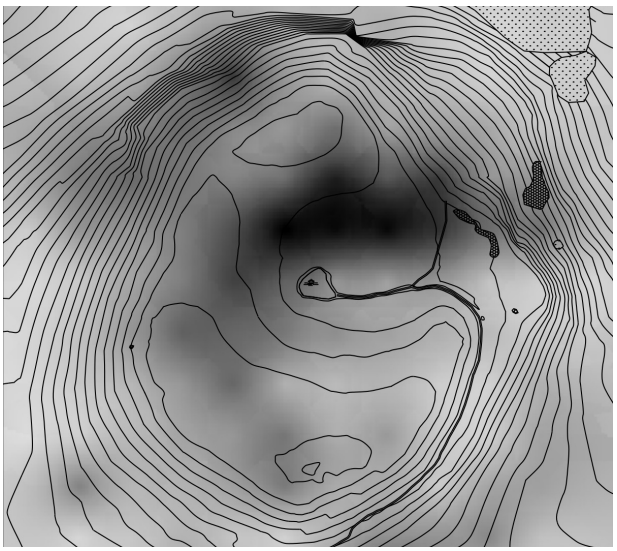


Fig. 2.115 Pottery sherd distribution. Roman – Byzantine. Distribution between 0 (white) and 15 (black) sherds per 400 m² (Source: BAI/GPIA).

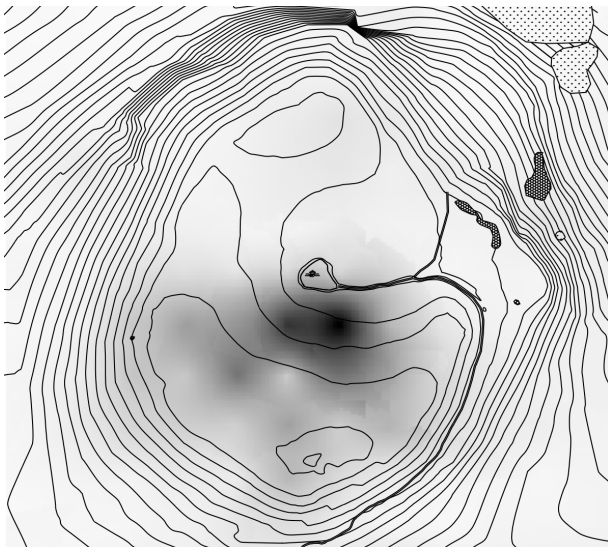


Fig. 2.116 Pottery sherd distribution. Late Islamic. Distribution between 0 (white) and 15 (black) sherds per 400 m² (Source: BAI/GPIA).

2.3.2. Comparison of Different Survey Methods

Several alternative survey methods were discussed during the planning stage of the Tall Zirā'a Survey. Additionally, because none of the team members from the Biblical Archaeological Institute Wuppertal (BAI) was experienced in surveying a tall site such as Tall Zirā'a, which had been settled over an extensive timespan, with massive cultural deposits, the autumn 2001 Season served not only as the initial archaeological investigation of the tall itself, but also as a study in alternative survey methods.

Various survey methods were tested; in addition to a complete collection of every visible artefact on the surface, the survey applied the directives presented by Y. Portugali[189], thus examining the surface up to the depth of a shovel, was applied. The focus was to determine whether the Portugali Method would, in addition to a quantitative increase in the number of artefacts, also lead to better qualitative results for a tall which had been occupied over a long period of time.

It was tested whether random selection or directed selection of squares better reflect the overall distribution of finds on the tall. This has been carried out in order to be able to test the results statistically and to be more efficient. That is, not only the reliability of the different methods was measured, but also the amount of work which had to be invested to gain the result.

In order to ensure comparable survey results, specific directives were given to guarantee a consistent standard; teams were instructed jointly, the composition of the teams remained unchanged, and teams were given a specific time frame for sampling, of one survey square per hour. The geographic achievement profile (that is, the proportion of steep slopes compared to more gently inclined and level surfaces) was planned in advance to ensure that physical work required on any given day was comparable to any other day. Requiring additional work on any given day, completing a survey square in less than one hour, or any other change to the designated work schedule, such as delays, were considered undesirable. These measures were intended to maintain the same standard of collection from the first to the last square, and to prevent an increase in the error rate as a result of individual, subjective decisions regarding collection method, speed, topographically caused problems or other nonstandard ideas.

Processing included:

a) The completed Tall Survey:

- Area: 127 squares, each 20 m x 20 m
- Expenditure of work: 18 work days for two teams of two people

b 1–4) Four surveys using alternative random samples for survey squares (with each using a separate set of standards). A random sample of the tall as a whole was chosen on three separate occasions. On one occasion, a random sample of three squares from each of the five main areas of the tall (the plateau and the four hill slopes) was chosen:

- Area: 15 squares, each 20 m x 20 m
- Expenditure of work: two work days for two teams of two people

189 Portugali 1982, 177–188.

Fig. 2.117 Survey participants applying the Portugali Method (Source: BAI/GPIA).

Fig. 2.118 Survey participants sampling in one square (Source: BAI/GPIA).

c 1) One survey based on a directed sample of survey squares (standard: three squares per slope and three squares on top of the plateau). After a thorough inspection of the tall, before commencing the survey, fifteen representative squares were selected.

- Area: 15 squares, each 20 m x 20 m, per person
- Expenditure of work: two work days for two teams of two people

c 2) One survey based on a directed sample of survey squares (without any preconditions concerning the location on the tall):

- Area: 15 squares, each 20 m x 20 m per person
- Expenditure of work: two work days for two teams of two people

d) One survey was conducted based on the methodological directives of Y. Portugali[190]. As a complete exploration of all 127 squares of the tall according to these directives appeared to be impracticable, the method described above in c 1) was chosen as a basis for the selection of the 'Portugali Squares'; that is, a survey based on a directed sample, without any preconditions concerning location on the tall):

- Area: 15 squares, each 5 m x 5 m
- Expenditure of work: four work days for two teams of two people
  Estimated work expenditure for the completed survey: 135.5 work days for two teams of two people

A complete survey which would have required 18 work days for each two person team was not considered to be cost effective. Conventional survey require two work days, whereas surveys (conducted over 15 squares) according to the Portugali Method require four work days. The expenditure of work required to conduct a complete survey according to the Portugali Method is enormous; 135.5 work days for each team of two people. It would have been impossible to conduct the survey with the same number of team members. Although the investigated area and the number of finds collected as a result would have been increased, the inevitable subjective decisions regarding site selection would have caused issues for the survey analysis. Consequently, it was decided that, given the usual length of excavation seasons in foreign countries, conducting a traditional Portugali Survey Method was not feasible.

Comparison of the five methods described above produced the following results:

a) A survey which requires a total pick up of all sherds (*Graph 2.1*) guarantees the most representative view of the facts regarding the chronology of a tall. It allows not only for an overall evaluation of the complete tall, but also of single (even small) areas in a representative way. An effective excavation strategy can be created only after the collection of reliable data regarding which areas would be most suitable for further investigation after the ground survey; for example, areas with either a higher or lower concentration of sherds of a specific ware or period must be investigated, to discover the reasons for this. Therefore, a survey which covered all areas seemed to be an unalterable precondition for the excavation of a multiphased tall with abundant cultural deposits.

b 1–4) Random selection (*Graph 2.4*) of about 10 % from the possible total survey area has produced a surprisingly rich database, which does provide enough information for a reliable estimation of chronology to be formulated. In all tests that were based on random selection, the value of data collected was greater compared to that collected from purposive sampling. If talls are to be included within the scope of extensive geographic explorations, this method appears to be recommendable.

However, single areas of the tall cannot be surveyed comprehensively using this method, as

190 See Portugali 1982, 170–188.

corresponding analyses produced partly significant dissonant values.

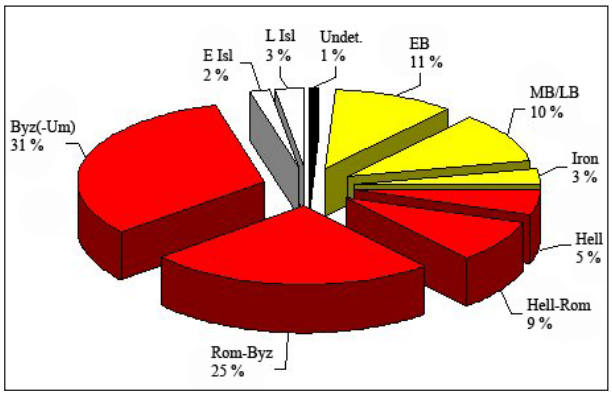
c 1) Selection 1 (*Graph 2.6*), which was specifically selected, achieved a satisfying result of finds collection, although they were less than the results from other areas which were selected randomly. Nonetheless, because of the selection criteria, it was possible to get approximate data about chronological distribution on the main areas of the tall.

However, despite the fact that the amount of work to conduct such a survey in preparation for an excavation is not onerous, this method is not recommended.

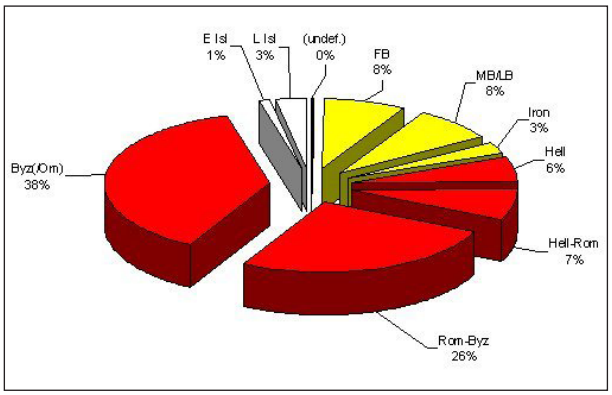
c 2) Although the results from Selection 2 (*Graph 2.5*) produced useful interpretations, the same reservations regarding excavation preparation which apply to Selection 1 are also valid, particularly as it is not possible to produce any reliable statements about individual areas of the tall due to the design of the sample method.

d) The expenditure of work required to conduct a survey properly according to the Portugali Method (*Graph 2.7*) is enormous; furthermore, because of the size of Tall Zirā'a, only a sample of squares from the survey will be able to act as the basis of future explorations. Considering the limited prospects for gathering information in light of the plethora of periods and the enduring settlement of the tall, conducting a survey based on this method has been discounted at the present time.

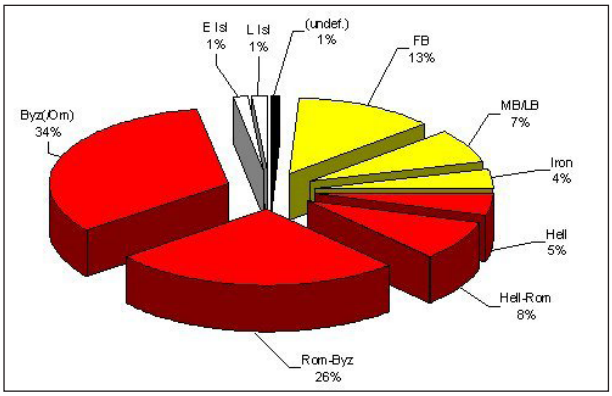
In addition to the significant amount of work required, and the rather mediocre results for calculations of the total numbers, it is not possible to gain insights for every individual area of the tall; however, this is exactly what is required for an excavation strategy. It must also be remembered that, in contrast to a one- or two-phase excavation site, which is excavated to a depth of approx. 10–15 cm, with surface finds thus reflecting to a great extent what should be found below the surface, Tall Zirā'a has cultural debris deposits from c. 16 m, with the survey therefore providing little indication for much of the underlying deposits.



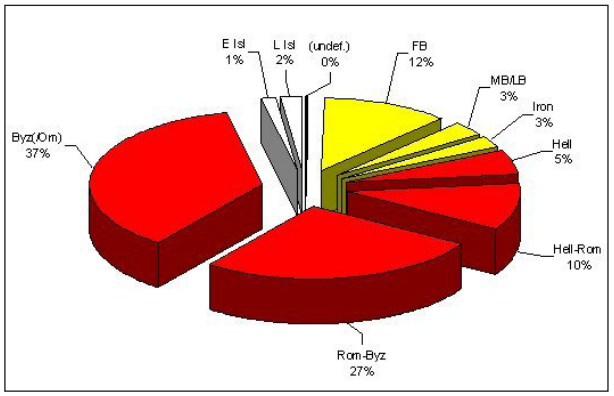
Graph 2.4 Survey results from randomly selected surface areas; Selection b 1 (Baseline: 15 squares; 2,266 sherds) (Source: BAI/GPIA).



Graph 2.5 Survey results from systematically selected surface areas; Selection 2 (Baseline: 15 squares; 2,998 sherds) (Source: BAI/GPIA).



Graph 2.6 Survey results from systematically selected surface areas; Selection 1 (Baseline: 15 squares; 2,941 sherds) (Source: BAI/GPIA).



Graph 2.7 Survey results from the Portugali Method area (Baseline: 15 squares; 2,490 sherds) (Source: BAI/GPIA).

Percent (%)	Tall survey a	Random selection				Directed selection		Portugali Method
		b_1	b_2	b_3	b_4	c_1	c_2	d
Undetermined	1	1	0	2	1	1	0	0
Early Bronze Age	11	13	9	12	11	13	8	12
Middle Bronze Age/Late Bronze Age	10	10	12	8	9	7	8	3
Iron Age	3	4	4	4	4	4	3	3
Hellenistic period	5	4	6	6	5	5	6	5
Hellenistic − Roman period	9	10	8	8	9	8	7	10
Roman − Byzantine period	25	22	26	26	28	26	26	27
Byzantine (Ummayad) period	31	32	32	31	29	34	38	37
Early Islamic period	2	2	1	2	1	1	1	1
Late Islamic period	3	2	2	2	3	1	3	2
Deviation	0	4.24	4.0	3.16	4.0	5.48	8.37	9.70

Tab. 2.2 Sequence of deviations (all values are percentages and rounded off to the closest whole integer)
Random Selection: The average deviation with 99 % confidence is 2.8 %, the maximal deviation is 10 %; the average deviation with 95 % confidence is 2.4 %, the maximal deviation is 8.5 %.
Directed selection: The average deviation with 99 % confidence is 3 %, the maximal deviation is 11 %; the average deviation with 95 % is 3 %, the maximal deviation is 10 %.

The Portugali Method, therefore, is principally useful when the natural conditions present a strong possibility that a representative collection of sherds will be found on the surface itself or close to the surface, or if the investigated area has to be thoroughly surveyed because of a threat to survival (for example, due to modern construction) in order to arrive at a useful survey result.

If one relates the individual survey types to a complete survey of the tall, which includes the largest quantity of sherds and a complete account of all tall areas, the following calculation of deviation is attained:

$$\|x - y\|^2 = \sum_{i=1}^{n} (x_i - y_i)^2$$

The deviations in the bottom line and a clear sequence of deviation from the defined standard highlights the squares that were selected by the random generator during the four surveys. Considering the comparatively small effort required for surveying randomly generated squares (including less intensive work with the finds material after the survey) this is the most suitable method for investigating talls in the context of extensive area surveys.

However, when taking preparation of the excavation into account, one arrives at a different conclusion. Admittedly, a complete survey of a tall is a lot of work, but it not only enables more reliable findings, but also provides the possibility to determine fundamental facts about individual areas of the tall, both large and small, based on analysis of all sherds.

As the development of an excavation strategy should be focused on obtaining reliable results for particular areas of a tall (e.g. areas with unusually high or low concentrations of sherds of a certain type or time) a complete Tall Survey emerges as the method of choice before excavation when the tall is multiphased with correspondingly deep deposits of cultural debris, thus assembling a sufficiently cohesive reference material, which accurately reflects topographical as well as chronological data. This is of fundamental importance if accurate statistical data is to be achieved as an end result of the project. It should be stated here that the Portugali Method does provide both large numbers of finds (approx. four times the number of sherds per square as other survey methods), and accurate statistically quantifiable data; its advantages for a one- or two-phase tall are undisputed. However, it did not produce finds which were qualitatively superior.

The excavation required full recording and mapping of all recognizable structures on the surface, e.g. walls, channels, cisterns, walkways, graves, caves and many others; therefore, a full survey could be carried out on Tall Zirā'a with little additional effort. Before the autumn 2001 season, the team would have preferred to identify and select appropriate squares to be investigated, restricting the survey to one-tenth of the total surface area of the site, compared to the investigation produced by random selection; an assessment of the results of such a survey cannot now be ascertained.

The final results from the various survey methods will be compared to the excavation results in the following volumes of the final report of the excavation.

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3. Scientific Methods

by Dieter Vieweger/Jutta Häser/ Patrick Leiverkus/Götz Bongartz/Gilles Bülow/Johannes Große Frericks/Dietmar Biedermann/Armin Rauen/Knut Rassmann/Samantha Reiter/Katja Soennecken/Linda Olsvig-Whittaker/David Adan-Bajewitz

3.1. Animated 3D-Models of Archaeological Excavation Contexts from Tall Zirā'a (*Pls. 3.1* and *3.2*; *Apps. 3.5–3.11*)

by Dieter Vieweger/Jutta Häser

Fig. 3.1 3D-reconstruction of the Late Bronze Age city on Tall Zirā'a. Film: *App. 3.9* (Source: archimetrix.de/BAI/GPIA).

Within the scope of the 'Gadara Region Project', the Biblical Archaeological Institut Wuppertal (BAI) engaged C. Panneck and H. Siegel from the company 'Archimetrix visuelle Kommunikation' to work on a reconstruction project. Two archaeological contexts from the Late Bronze Age and the Iron Age were selected, and 3D-models were created. The primary object was to provide accessibility for a wide range of people.

In the first instance, an impression of a idealised Four Room House from the Iron Age I/II was created, which could be entered interactively, and explored by a virtual visitor (*Figs. 3.2* and *3.3*; *Apps. 3.6–3.9*). The second project produced an animated film, presenting the Late Bronze Age city on Tall Zirā'a. As if viewed from above the city, the animation presents an aerial view of the city and leads the observer through the streets and into the interior of a sanctuary (*Figs. 3.1* and *3.9* and *3.10; Apps. 3.6* and *3.7*). The reconstructions are based not only on results from the current excavations at Tall Zirā'a, but also on comparative contexts at other archaeological sites, such as the excavations at Tall al-Fāri'a (Tirza) and Tall Qasīla (Yarkon), as well as on architectural information from the written sources[1].

3D-reconstructions provide a dual function; on the one hand, they force the archaeologist to reproduce all aspects of archaeological contexts faithfully, through all periods of their use or occupation, and therefore to reconstruct them completely in architecture or shape. On the other hand, they also help to understand the function(s) of the various installations; such as those for cooking and baking, or those for ceramic productions. Finally, they provide better understanding of the physical reality for constructions such as walls and roofs; thus, virtual reality plays an important role in answering questions concerning materials and construction methods (*Chap. 3.4.*).

The 3D-reconstructions were also very useful for the excavation process, as they cause the archaeologist to scrutinise contexts more precisely in order to discern further information; for example, about the masonry, the production method(s) for handicrafts, or even about the construction methods themselves. Such critical analyses which took place during the creation of the 3D-models

1 See e.g.: Chambon 1984, 24 Fig. 3.31–3.47 (Tall al- Fāri'a [Tirza]);http://sara.theellisschool.org/ironage/places/tellqasile.html (12.7.2016) (Tall Qasīla [Yarkon]); Mazar 1999, 103–108 (Tall Qasīla [Yarkon]); Mazar 2008, 319–336 (Tall Qasīla [Yarkon]).

led to complex debates about the limits and opportunities of interpretation possibilities, and the methodological verifiability of general assumptions. In order to provide a correct illustration of the building structures, an 'articulation' of opinions was required during ongoing critical discussions regarding the virtual reconstructions.

3D-reconstructions should lead to increased archaeological discourse among archaeologists and other experts working in the field. Furthermore, 3D-animations should be used in the presentation of archaeological contexts on sites and in museums, in order to provide the general public with a visual impression of the historic appearance and the former functions of the reconstructed contexts, thus imparting a better understanding of ancient life.

The special benefits of virtual 3D-reconstructions become evident when compared to physical building replicas; for example, the houses of Tall Qasīla (Yarkon) in the Eretz Israel Museum in Tel Aviv. Such reconstructions not only replicate a fixed stage of research and state of preservation, which does not always reflect current theory or condition, but also require ongoing repairs and maintenance. The Tall Qasīla houses were strongly in need of repair and were given up due to their high maintenance costs.

In contrast, virtual 3D-reconstructions can be changed easily, and adapted to ongoing excavation and interpretation. Moreover, it is always possible to add more information and comparative examples, thus ensuring that reconstructions of the contexts are up-to-date with current research. Finally, 3D-reconstructions bridge the gap between the experience of living in the modern world and imagining the way of life in earlier historical periods. Within the scope of a museum presentation, they enable the results of the Tall Zirā'a excavations to be accessible to, and understood by, a wider audience.

3.1.1. Reconstruction of an Iron Age I Four Room House (*Pl. 3.1; Apps. 3.6–3.8*)

The Four Room House was chosen for virtual 3D-reconstruction for two reasons.

Firstly, the settlement on Tall Zirā'a was rebuilt immediately after its destruction around 1200 BC, either by an earthquake or by an incident. The new settlement was superimposed over the existing walls from the Late Bronze Age city, but without a city wall. Although the Iron Age I settlement continued the tradition of the Late Bronze Age courtyard-houses (especially in the southern part of Area I) Four Room Houses, which are a typical variant of residential architecture for the Iron Ages I and II (1200–520 BC; Strata 13–10), were built in the northern part of Area I. Such houses, with rooms entered from an exterior courtyard, were perfectly adapted to the dry climate of Palestine during the Iron Age. Such houses were first found in Israel. However, they had a wider distribution both east and west of the Jordan River, and are closely connected to the Late Bronze Age period.

Secondly, the Palestinian mountain environment was marginal in terms of agriculture at that time; rainfall was insufficient for many crops, compelling the inhabitants to follow mixed agriculture (tillage, olive trees, vineyards, horticulture) combined with hunting and (if possible) fishing, as well as livestock breeding, principally sheep and goats. The Four Room House was an optimal adaption for these requirements, as it provided lodging for humans as well as animals as well as space for storage, drying and preparation of a variety of food.

The Four Room House in the 3D-model was constructed as closely as possible with the same procedures as those used in the Iron Age. At first a low wall base of fieldstones was built, in order to create a foundation and ensure stability (*Fig. 3.2; Pl. 3.1*); it also acted as a barrier to keep the house dry from underneath, to enable moisture sensitive goods such as cereals to be stored. The base was then coated with straw and local clay. The straw prevents the clay from crumbling, and provides thermal

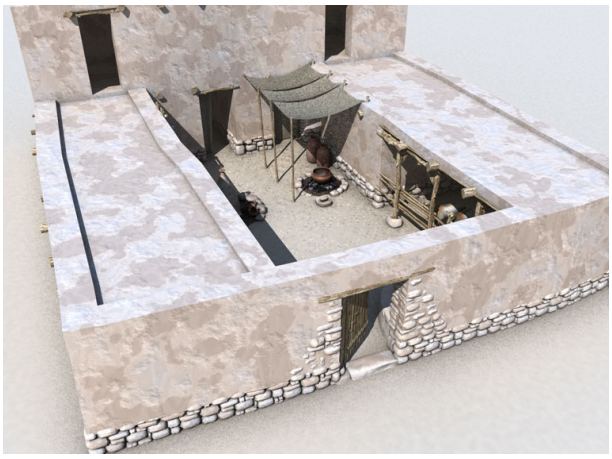


Fig. 3.2 3D-reconstruction of an Iron Age I Four Room House. Film: *App. 3.7* (Souce: archimetrix.de/BAI/GPIA).

Fig. 3.3 3D-reconstruction of the courtyard of an Iron Age I Four Room House. Film: *App. 3.6* and *3.7* (Souce: archimetrix.de/BAI/GPIA).

insulation. In most cases, the clay walls were plastered with a calcareous clay layer, which kept away moisture and vermin (for the construction see *App. 3.6*).

The roofs were supported by short timbers sourced from the local area; long beams were probably too valuable for house construction, and reserved for prestigious buildings. The width of the room therefore was limited by the length of the root beams. Several layers of thin branches, brushwood, straw and reeds were applied over the beams. Then, in order to make the roof impermeable, they were covered with clay, which had to be maintained regularly. Depending on the space available, and the financial status of the owner, a second floor could be built to provide more living space. The flat roof was used to dry the harvest and as a living area in the summer months.

The 3D-reconstruction also reveals what the internal areas may have looked like when in use, for such activities as milling, baking and food storage. A ceramic kiln was included, to represent the highly developed craftmanship which enriched everyday life (*Fig. 3.3*).

A virtual, independent, self-determined tour is possible through all the rooms, using Microsoft software; additionally animated scenes of the house construction, as well as daily activities, are available for Microsoft and MAC OS X software systems (*Apps. 3.7* and *3.8*).

3.1.2. Reconstruction of the Late Bronze Age City (*Pl. 3.2; Apps. 3.9–3.11*)

A second project between the Biblical Archaeological Institute Wuppertal (BAI) and the company 'Archimetrix visuelle Kommunikation' attempted to reconstruct the Late Bronze Age city on Tall Zirā'a (*Fig. 3.1*). Not only the massive architecture, but also the valuable findings and high percentage of imported ceramics from Cyprus, Syria and the rest of the Eastern Mediterranean prefigure the importance of the city as a trade and craft centre. Here ceramics, metal, glass, faience and quartz frits were produced or processed. It is therefore quite conceivable that the Late Bronze Age city on Tall Zirā'a was the centre of a citystate located at the important trade route leading from the Mediterranean to Dimašq (Damascus).

The 3D-reconstruction of this city is based on excavation results from 2003 until spring 2008. The most recent Bronze Age stratum in Area I was completely excavated over a surface area of 1,750 m^2 (Stratum 14); the most prominent structure was a massive casemate wall, which protected the settlements north-western flank. In the southern part of Area I, the wall ended in a large tower protruding inwards towards the city (*Fig. 3.6; Figs. 1.52* and *1.53*); it included a partitioned long-room temple, possibly a small sanctuary (*Fig. 3.4; App. 3.10*). Originally the researchers interpreted the architectual remains south of the tower as a gate. But now, it is certain that the city had only one gate, located in the east.

Also in the southern part of Area I, a large courtyard house with several rooms was detected. Noteworthy are the carefully designed fire pit, storage facilities in the form of several stonelined, pear-shaped silos, and a double mud brick wall, preserved to a hight of approx. 1 m and 1.2 m thick. The interior wall was plastered with a 5 cm thick lime layer on both sides, while the western, 2 m thick outer wall of the building was also the southern extension of the city wall.

Next to the tower on the city side were three houses, each with a central courtyard (*Figs. 1.52* and *1.53*). North of these was a prominent building with a large room, whose roof was supported by a pillar; another room adjoins it further to the north. Because of its two long, narrow spaces, this may have been a staircase. To the east of the room was a very carefully paved courtyard, with several rooms on its eastern side. This building complex was a *temple in antis*; i.e. a rectangular *cella* with a porch formed by the protruding side walls (*antae*).

A city plan detailing what the city probably looked like was produced; based on the contexts discovered during the excavations as well as photogrammetric and

Fig. 3.4 3D-reconstruction of the sanctuary in the tower. Film: *App. 3.10* (Source: archimetrix.de/BAI).

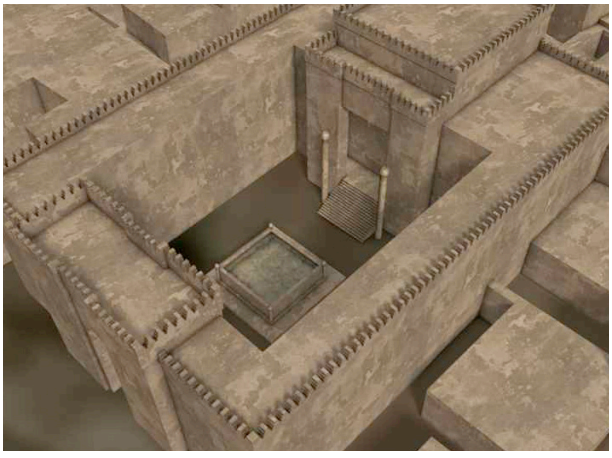
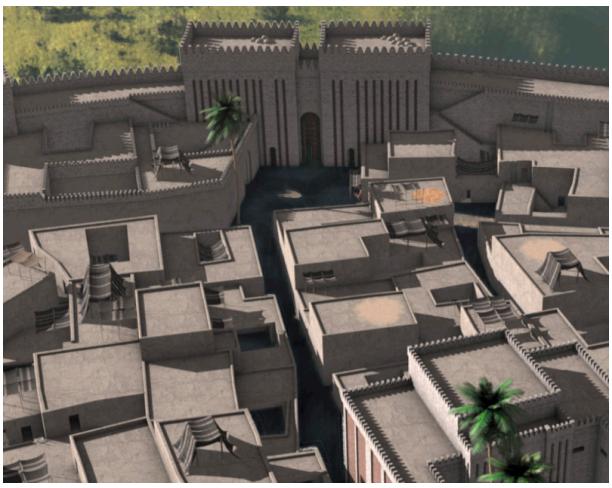


Fig. 3.5 3D-reconstruction of a temple type used in the Southern Levant. Film: *App. 3.9* (Source: archimetrix.de/BAI).



Figs. 3.6–3.7 3D-reconstruction of the Late Bronze Age city on Tall Zirā'a. Left: The western side of the city (Area I); right: the south side (with Area III). Film: *App. 3.9* (Source: archimetrix.de/GPIA/BAI).

geophysical surveys of the total area. It permits an idea of the settlement on Tall Zirā'a. The designs of the city wall, residential buildings and monumental structures, such as temples and a palace for example, are based on typological conclusions from verified references for the Southern Levant during the Late Bronze Age. Due to the massive extant remains in the excavated section of the casemate wall and the adjacent tower, the vertical dimensions of these building structures can be estimated realistically. The form of the battlements, ornamentation and other formal aspects were modeled by the company 'Archimetrix visuelle Kommunikation' based on comparable buildings in the Levant.

An important factor which had to be taken into account when dealing with the challenges posed by the reconstruction was to consider the constrution conditions and building restraints, as well as the economic and cultural aspects, of urban development of that period.

As explained above, the appearance of the Late Bronze Age city on Tall Zirā'a (*Apps. 3.9* and *3.10*; *Fig. 3.1*; *Pl. 3.2*) can be established according to archaeological research and the reconstruction of the city plan. The settlement was surrounded by a massive city wall with several towers, which followed the crest of the hill. Originally the researchers thought that there were two gates, as shown in the 3D-model. But the close examination of the excavation contexts proved that this assumption was wrong. There was only one gate on the east side of the hill. Its location is corroborated topographically by a pronounced access path to the settlement. Typologically, it could have been a Zigzag-Gate ('Knickachs-Tor') as they were typically used in Late Bronze Age cities in that region. However, its design and dimensions shown in the 3D-reconstruction are fictious.

The eastern gate was used mainly for transport and trade. It is logical to place the storage facilities near the gates (*Fig. 3.8*).

Because water was vital and perhaps scarce during the summer, the abundant water flow from the artesian spring in the centre of the tall within the settlement must have been considered a wonderful, divine phenomenon, and a temple was almost certainly located near it (*Fig. 3.5*). The size and orientation of the temple in the reconstruction, however, is based on academic assumptions rather than archaeological evidence. The urban area was developed by analogy with the excavated houses from other parts of the tall. The streetscapes are designed in the same way; for example, there is no archaeological proof for the location of a palace at the highest point in the north of the tall, but there is a strong probability that such a building could have been constructed there.

The animation of the Late Bronze Age city ends with the windowless small sanctuary in Area I. Its interior and exterior appearance can be accurately reconstructed due to the archaeological contexts found until spring campaign 2008 (*Fig. 3.4; App. 3.10*). Later excavations revealed a forecourt with a *temenos* wall lying to the east of the temple. Inside the forecourt was an unusual altar; the top layer was made from ceramic sherds, which had been accurately placed to create a pattern. These architecture features are not integrated in the 3D-reconstructions due its later discovery.

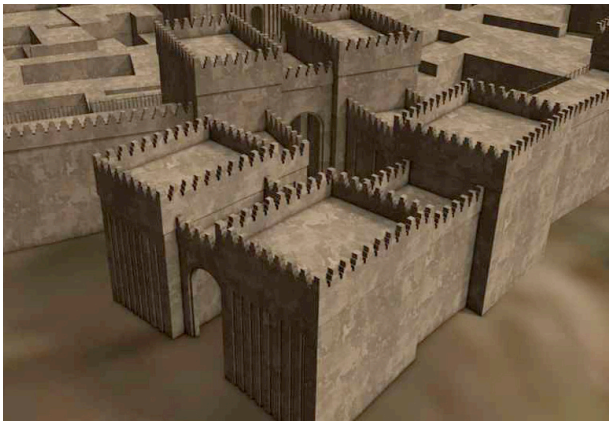


Fig. 3.8 3D-reconstruction of the main gate. Film: *App. 3.9* (Source: archimetrix.de/BAI).

Plate 3.1: Reconstruction stages of an Iron Age I Four Room House (Film: *App. 3.6*)

1. Construction of the foundation wall

2. Construction of the rising mud brick walls

3. Construction of the roof step 1

4. Construction of the roof step 2

5. Construction of a second storey step 1

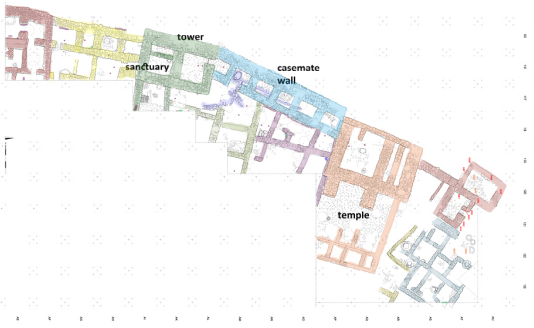
6. Construction of a second storey step 2

7. Overview of the Four Room House

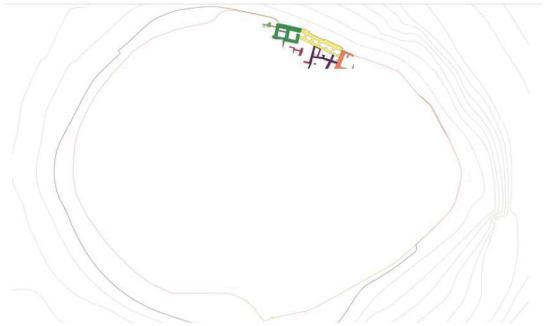
8. Reconstruction of the courtyard

Plate 3.2: Reconstruction stages of the Late Bronze Age city on Tall Zirā'a (Film: *App. 3.11*)

1. View on the excavation area (Area I)

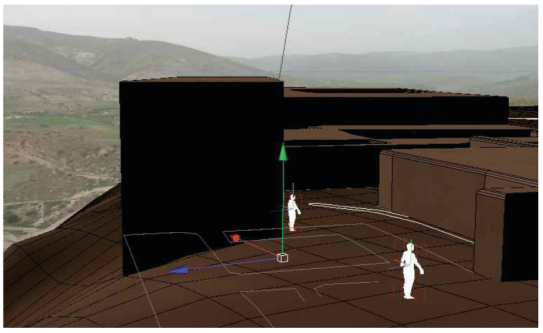


2. Architectural scetch of the foundations walls in Area I

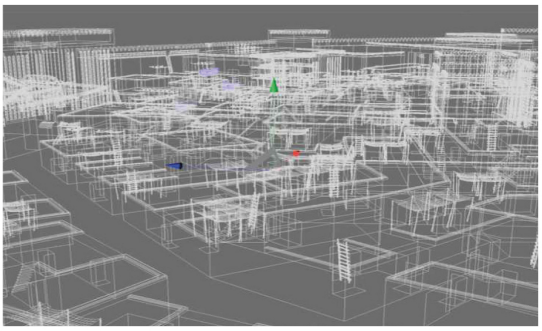


3. and 4. Graphical supplement to the excavated structures in Area I: houses, temples, streets, gate, city wall etc.

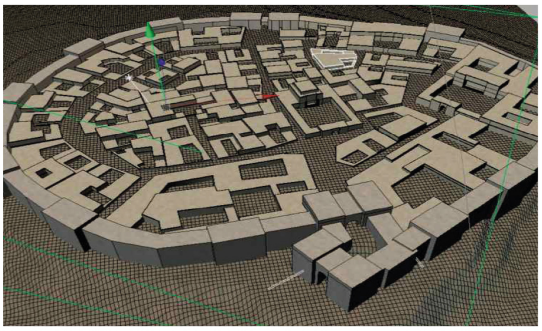
5. Area I. Insertion of people in order to get an impression of size ratio



6. Area I. Drawing up of quadratic building structures



7. The computer calculates the height and extent of the buildings



8. 3D-reconstruction of the Late Bronze Age city

3.2. Aerial Survey and Photogrammetry (*Apps. 3.1–3.4*)

by Patrick Leiverkus/Götz Bongartz

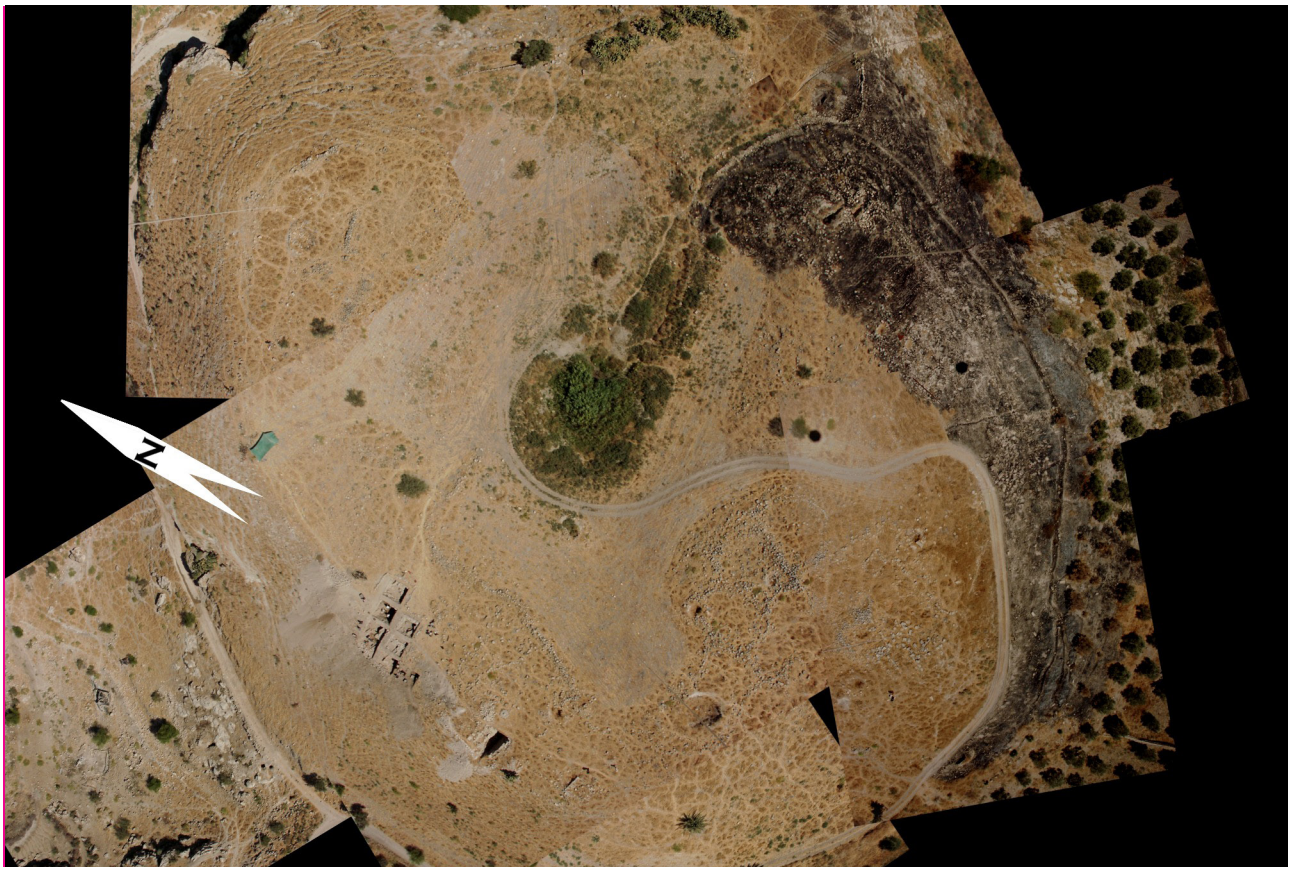


Fig. 3.9 Aerial view of Tall Zirā'a. Mosaic of rectified photographs taken from a helium filled balloon in 2003 (Source: J. Kleb).

Excavations destroy—this fact is common knowledge and often deplored. Still, nothing can be done about it. Destruction is an integral part of excavating. If all goes well, what remains after the campaign has been completed, is a detailed excavation report for the world's archaeological libraries, a comprehensive work documentation, and an accessible, well-ordered store containing the artefacts. On the site, however, the actual evidences of the past—especially those from Pre-Classical periods—can only seldom be preserved and thus, after a few years, are hardly presentable.

Therefore every modern excavation campaign should strive for exhaustive documentation of the daily progress to ensure that as little information as possible gets lost between the actual event of excavating and its final report of the excavation. This should ideally also allow researchers to reconstruct correlations that may have been overlooked at the time of the excavation at a later date and thus arrive at new conclusions. Following this concept, experiments were undertaken that went as far as installing video cameras at the excavation squares, conducting daily interviews with the excavators, and also recording group discussions nonstop. But even this unreserved conservation of each and every piece of information provides no satisfactory solution to the problem of sensible documentation. Given the flood of material, nobody will ever be able to correctly assess the objective excavation progress and reconstruct it for publication without sorting the vital data from the less important ones. The concept of comprehensive data recording only postpones the necessary, inevitable task of selection, analysis, and interpretation. Apart from this, vast quantities of data would accumulate over time that could currently be neither processed nor safely stored.

For this reason, a methodically sound documentation of the excavation works as well as the careful storage of the finds are the real 'treasure' to be retrieved and preserved. This includes diaries, drawings, photographs, and databases—but also the stone-by-stone architectural plans of the excavated relics. Traditionally, they are drawn to scale on graph paper during the excavation campaigns by means of metre sticks and coloured pencils. These efforts are supported by modern surveying instruments, usually a tachymeter that measures single points with centimetre precision. These calibrated control points make it possible to connect any newly drawn plan with the master plan. Plans like these that contain control points can be digitalised in CAD systems.

However, drawing in the field poses several problems. First, every drawing or sketch lacking photographic documentation raises the suspicion of subjectivity. After all, people only draw what they (recognise and) see, and in their drawings they emphasise objects according to their own interpretation of the excavation while it is taking place. In all likelihood they will miss some elements or cannot consider certain connections in their interpretations because the future excavation progress is yet unknown. In addition, manual documentation is very timeconsuming and requires a lot of precious manpower. Both time and manpower are very valuable resources, especially during excavation campaigns abroad that usually have to be confined to only a few weeks per year.

This is why the necessity arose on Tall Zirā'a during the past eleven years to objectify the documentation of the excavated, i.e. later destroyed, strata and to optimise it temporally. The aim was to reduce the necessary manpower while significantly improving, i.e. objectifying, the quality of documentation. This was realised by the implementation of innovative methods that were tested during excavation campaigns and proved themselves in practice. They will be described below.

3.2.1. Photogrammetry and Documentation of Archaeological Features

by Patrick Leiverkus

3.2.1.1. Digital Photogrammetry

In the campaign of 2003, digital photogrammetry of excavation squares was introduced on Tall Zirā'a. It has proven to be both easy to perform with little technological effort and precision, and efficient and fast, compared to conventional drawings.

In order to document the excavation progress, the worked squares that are 5 m x 5 m in size, are photographed daily from a vertical perspective with the aid of a portable rod, at an altitude of at least 4 m (*Fig. 3.10*). Afterwards the distortion by the camera's perspective is rectified. Finally the digital images are adjusted to each other by way of ground control points (i.e. the corner points of the squares) (*Figs. 3.11* and *3.12*).

At the beginning, the daily photographs complemented the excavators' hand drawings but they eventually often replaced them completely. It was easy for the documenting square leader to mark the finds on the photo prints and add them to the documentation. Moreover, this procedure compels the excavator to adjust the sketches he or she made during the dig to the aerial view photograph that is less prone to manipulation, to check the finds' correct locations, and to review his or her personal interpretation from a different perspective. Since the photographs are taken at regular daily intervals, it is possible at a later time to reconstruct the excavation progress to the day. Furthermore, the photographs are very accurate in every detail; in that respect they are vastly superior even to very good drawings. It is important, however, that the rectified photos are taken by a surveyor in cooperation with an archaeologist who has constantly been supervising the excavation at the respective square. This ensures that the recordings of the excavation progress take place regularly at convenient moments.

For many years these images have also been used for making architectural plans of the excavated relicts that are fully correct in terms of position and masonry detail. Rectified images are a reliable foundation for digitization in a CAD system. The advantages are obvious: the production of these square images is much faster and easier than that of hand-drawn plans. However, there are also disadvantages: the twodimensional rectification only encompasses the level on which the ground control points are located. If walls jut out from this level, they remain distorted due to the perspective. The more the walls protrudes upwards and the farther it is located at the image's margins, the stronger the distortion becomes. This is particularly obvious when the overlapping fringe zones of two pictures have to be connected.

Additional photographs and ground control points as well as working with several rectification planes can help avoid these problems. This, however, will significantly increase the necessary labour input. And still, more often than not the final result will remain unsatisfactory because, in spite of manual finishing, an exact correspondence of the overlapping zones can only be approximated.

Fig. 3.10 Photographing with a telescope pole (Source: GPIA/BAI).

Fig. 3.11 Unrectified image of Square AL 117 (Source: GPIA/BAI).

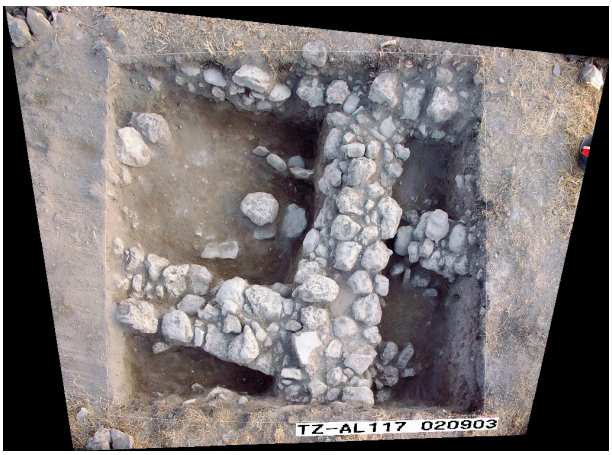


Fig. 3.12 Rectified image of Square AL 117 (Source: GPIA/BAI).

3.2.1.2. Representation of a Spatial Structure by Means of Image-Based 3D-Reconstruction (*Apps. 3.1–3.3*)

In the spring and summer of 2011, a technology was implemented in the excavation routine on Tall Zirā'a that incorporates an innovation from computer sciences, 'structure from motion'. This technology was developed in the 1980s in the field of computer vision with the purpose of reconstructing three-dimensional structures from (camera-recorded) motion sequences; more specifically, from a set of static images[2]. It always aims at evaluating the camera's positions from the set of images in order to grasp the geometries depicted. For this purpose, conspicuous spots or characteristics are identified in the individual images (usually automatically) that can easily be relocated in the entire set. Since every picture has been taken from a slightly different perspective, the exact position of these spots varies from one image to the next. With the aid of these shifts the camera's individual positions and thus ultimately a 3D-model can be reconstructed. The 3D-reconstruction by means of close-range photogrammetry constitutes a very robust method of producing exact models of a static scene that is only inferior to laser scanning with respect to accuracy. Although, due to the camera's limited resolution, the quality of the images diminishes with increasing distance, this technique can still deliver satisfactory reconstructions even at longer ranges.

The great advantage of the 'structure from motion' technique is its simplicity. While laser scanners are very expensive devices, photogrammetrical surveying can be performed with ordinary photo cameras. This is particularly advantageous during an excavation in the field where it is nearly impossible to get spare parts or new equipment should any damage occur. Another advantage is the speed of shooting. Our test scene was documented in less than a minute while a laser scanner would have needed significantly more time. Only photographing reflective surfaces is still tricky and thus in need of improvement: these objects cannot be detected unless they are sprayed with talcum powder.

The technique of 'structure from motion' allows archaeologists to digitally reconstruct the three-dimensional structure of a specific object or excavation area from a set of photographs taken from different perspectives. During an excavation, walls, installations, or entire areas are photographed in this manner from different perspectives. These images are fed into 3D-modelling software which uses the data to generate 3D- models that allow the visualization of the individual finds and their correlating positions from random points of view. The models' accuracy makes it possible to present an exact, undistorted perspective of the excavation area that can easily serve as the foundation of a digital (architectural) drawing. Therefore, the results of this method constitute a quantum leap with regard to stone-by-stone representations of the planum.

However, it should be noted in this context that skilful and comprehensive photograph is only one aspect of the evaluation process. Calculating and generating the models by means of a high-capacity computer is a very tedious task and should not be underestimated even though it is largely automated.

The technique is useful in even more respects: it allows the researcher to 'peep behind walls' even in retrospect. Other than two-dimensional images, the 3D-models enable him to change his point of view and investigate random details in various contexts that have not been considered before. Accordingly, the interpretation of excavation finds can be reevaluated with hindsight and thus also be improved. Examples of digital images such as described are appended (*Apps. 3.1–3.3*).

2 For the technology of 'structure from motion', see Bongartz 2011.

3.2.2. Aerial Photogrammetry for the Creation of Maps (*App. 1.3*)

by Patrick Leiverkus

In order to get image data suitable for 3D-reconstruction it is necessary to take aerial photographs. There are basically two options: land-based pictures, taken for instance by means of a telescopic pole, or airborne images, photographed from a helicopter or a similar aircraft.

At first the shots of the excavation squares were taken with the aid of a pole of 5 m in height on which a digital single lens reflex camera linked to a remote release was mounted (*Fig. 3.10*). Via video glasses the photographer could take more or less precise pictures of the squares. However, handling the pole was very tedious and exhausting. So, in 2003, the idea was born to mount the camera on a weather balloon filled with helium and to draw this device across Tall Zirā'a with a line. The camera position was controlled by means of either a TFT monitor or a head display, the latter of which proved especially efficient in bright sunlight. A relatively small carrier balloon turned out to be the best choice (*Figs. 3.13* and *3.14*).

The images procured by a remote-controllable camera platform mounted to a helium balloon, taken from a maximum altitude of 135 m and covering an area of up to 15,000 m² per image were very satisfactory (*Figs. 3.15* and *3.14*). They are intended to serve as survey photographs for site plan data on the one hand and as informative documentation on the excavation site and its surroundings on the other. The single rectified images are connected to form a map via ground control points.

Despite the method's overall success, however, the balloon proved to be very wind-sensitive, even implicating the risk of total loss since it was only attached to a slim line. Moreover, the necessary helium was often difficult to procure and, besides, the balloon itself was very fragile.

For these reasons, it was resolved in the campaign of 2011 to introduce an independent aircraft as a novel, airborne photogrammetrical device. The possible options were those of a helicopter or of suspended platforms. Since helicopters are difficult to handle and also susceptible to faults, due to their complicated mechanical system, a suspended platform was decided on. Because of its higher level of flight safety and also for financial reasons an octocopter assembly kit has been chosen. The octocopter can fly up to an altitude of 250 m and has a range of 2 km. It is remote-controlled and transmits the potential photographic shooting area to the pilot via video glasses (*Figs. 3.15* and *3.16; App. 1.3*).

A series of images taken from elevated altitudes—i.e. from an aircraft such as a balloon, an octocopter, a helicopter, or a small airplane—can serve to generate 3D-models that document entire excavation sites or survey areas precisely to centimetres and thus make them accessible for future examination and processing.

A final remark: A three-dimensional documentation such as described above only requires the tools that are necessary in any case during an excavation campaign: camera, tachymeter or differential GPS, CAD system, mobile telescopic pole, and aircraft. The high-capacity computers only have to be equipped with a 3D-modelling software that, after an initial instruction has taken place, can essentially be operated without in-depth technical knowledge.

Fig. 3.13 Application of a helium filled balloon (Source: GPIA/BAI).

Fig. 3.14 Aerial photograph of Area I, taken from a helium filled balloon. Photograph taken in 2005 (Source: GPIA/BAI).

Fig. 3.15 Airborne octocopter. Film: *App. 3.1* (Source: GPIA/BAI).

Fig. 3.16 Aerial photograph of Area II. Photograph taken from the octocopter in 2011 (Source: GPIA/BAI).

3.2.3. Three Application Examples (*Apps. 1.3* and *3.1–3.4*)

by Götz Bongartz

3.2.3.1. Large Scale: The Tall Zirā'a (*Apps. 1.3* and *3.1*)

The technology described above was applied in order to generate a digital image of Tall Zirā'a as a whole. To this end an octocopter equipped with a high-resolution camera flew over and circled the excavation site multiple times at an selected altitude (*App. 1.3*). In the process, pictures were taken at altitudes from 20 m to 80 m, which served to reconstruct the entire region as a 3D-model (*Fig. 3.17*). This digital model can now be observed from any angle on the computer screen. Since it can be randomly turned and zoomed it offers interesting views of the excavation site as a whole and, if desired, even detailed insights into selected sectors (*App. 3.1*). Apart from that, the model has been printed out by a 3D-printer and thus be used as tangible illustrative material.

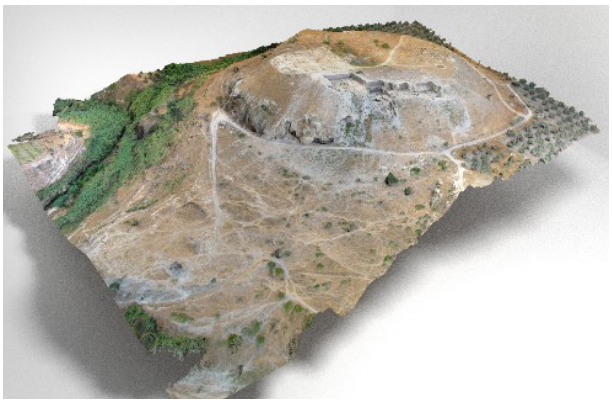


Fig. 3.17 3D-model of Tall Zirā'a: *App. 3.1* (Source: BAI/GPIA).

3.2.3.2. Medium Scale: Areas and Squares (*Apps. 3.2* and *3.3*)

The daily archaeological documentation was aided by 3D-reconstructions of complete excavation squares (or even entire areas) that could be used to create exact rectified images (e.g. Square AL 117, *Fig. 3.12*). Since the three-dimensional perspective can be adjusted with regard to the viewing angle it is also useful for a retrospective inspection of findings that may not have been properly appreciated at the time of the excavation. Since the octopoter was already deployed on the tall, it was available and expedited the process. However, pictures taken manually on the ground would also have been adequate (*Fig. 3.18; Apps. 3.2* and *3.3*).

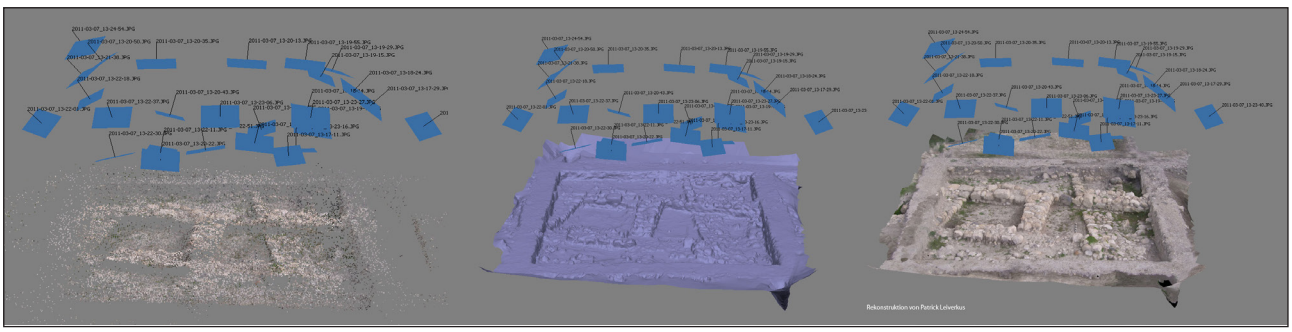


Fig. 3.18 Workflow for image-based 3D-reconstruction in an archaeological context (Source: BAI/GPIA).

3.2.3.3. Small Scale: Objects (*App. 3.4 a–c*)

3D-documentation of single finds has been especially valuable for the Biblical Archaeological Institute Wuppertal (BAI). In the course of the excavations, hundreds of objects were transported from Tall Zirā'a to Wuppertal where they were cleaned and restored in a time-consuming process. In order to a) sufficiently document these objects—that meanwhile have all been shipped back to Jordan—and b) also have them 'available' for future screening for conspicuous features/characteristics that have as yet been undetected or disregarded, three-dimensional scans of each and every object of pottery or metal were made (*Fig. 3.19*; see examples of movable 3D-images in *App. 3.4 a–c*). Moreover, these data enable us to fabricate exact replicas.

3D-technology has been successfully applied for many years in the field of construction research, among others.

In order to guarantee a high level of quality down to the minutest detail as well as colour fastness, the Biblical Archaeological Institute Wuppertal (BAI) has developed an individual scanning system that employs a 3D-scanner exclusively constructed for this purpose and a special software by means of which BAI staff members can edit the pictures and data in a few steps and reconstruct a 3D-image of the find.

In contrast to the laborious and time-consuming method of documenting archaeological finds by means of manual drawings three-dimenional scans provide a less arduous way of documentation. They eliminate the element of interpretive subjectivity while at the same time permitting the capture of an object's surface (including processing traces and stress marks etc.) with millimetre precision. In addition to printed publications, 3D-models are also fit for beamer-based presentations and publications on the Internet. A 3D-model is much more detailed than any drawing and thus a reliable copy of the artefact.

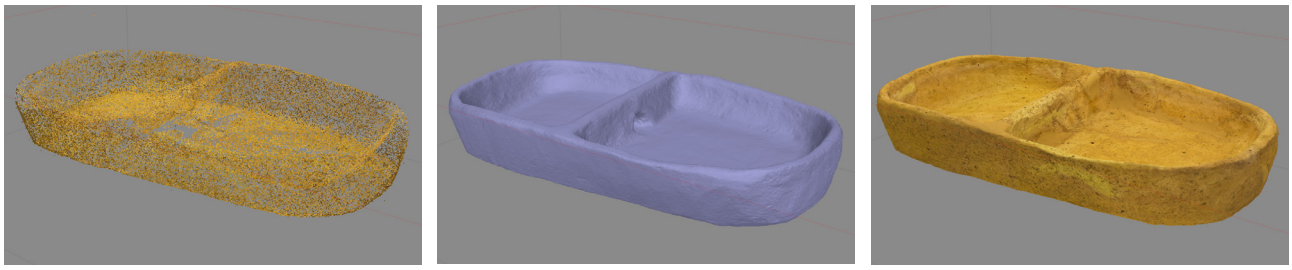


Fig. 3.19 Workflow for 3D-image of an object, TZ 006835-016: 1. Point cloud 2. Model without texture 3. Model with texture (Source: BAI/GPIA).

3.3. Colorimetric Examination of Ceramic

by Gilles Bülow/Johannes Große Frericks

Most ceramics are classified into ware groups primarily based on their colour, firing quality, tempering, sherd quality, and surface treatment[3]. The colour's key figure is usually determined by matching it visually with a colour table such as the Munsell table (Munsell Soil Color Charts, Baltimore 1954). However, this method involves several disadvantages: First, visual perception is very subjective and dependent on the prevailing lighting conditions (that often vary to a large extent); moreover, the colours listed in the colour tables often do not really match those of the pottery fragments. For this reason, the Biblical Archaeological Institute Wuppertal (BAI), respectively W. Auge, and the 'Department of Printing and Media Technology' of the Bergische University of Wuppertal have jointly introduced an objective physical method of measurement.

For the purposes of this project, a CIELAB-based colour-classifying program for archaeological finds (ceramics) was developed by optimising a typographical technique for its application in the field of archaeology[4]. It eliminates the element of uncertainty (caused by the subjective visual colour matching by a human being) by turning it into an objective procedure that can be carried out at the excavation site with only little technical equipment. The colorimetry is performed by means of a spectrophotometer and a specially developed computer program ('BAI Computer') that determines the ware groups as well as the closest chromaticity on the Munsell soil color chart. Colorimetric metering works with an internal source of light, based on the CIE-L*a*b* colour system. Thus, the ceramics can be classified unambiguously via objective measurements, clearly defined measurement conditions, and a likewise defined colour space to determine ware groups.

3 Kerner – Maxwell 1990, 240.

4 On the development of a CIELAB-based color classifying program for archaeological finds (pottery) see project work by G. Bülow and J. Große Frericks: Bülow – Große Frericks 2009.

3.3.1. The L*a*b* Colour System (*Fig. 3.20*)

Spectrophotogrammetrical classification of pottery takes place within the CIE colour space (*Fig. 3.20*). The CIE-L*a*b colour system is based on the theory of complimentary colours and was developed in 1976 by the CIE (Commission Internationale de l'Éclairage, International Lighting Commission).

In a three-dimensional space, all colours visible to the human eye can be illustrated and described by the three coordinates L*, a*, and b*. The L* axis serves as lightness coordinate while a* and b* describe the colour shade. Spectral distributions, such as the remissions of finds, can be converted into L*a*b* coordinates with the help of a reference illuminant.

The CIE-L*a*b* colour space was applied for the colour classification of the pottery for the following reasons:

- The CIE-L*a*b* colour system allows characterizing each specific colour (on a measured piece of pottery) by a triplet of numbers (L*, a*, b*).
- The characterisation of colours by triplets of numbers facilitates data processing with Excel (more specifically: with VBA). Thus, colour values can be archived or used for further calculations.
- The CIE-L*a*b* colour system allows calculating the (colour) difference of two colour points by application of the Delta-E or the CIEDE2000 formula. The high quality of such colour difference calculations has been established, e.g. by test series conducted by the Fogra Research Association Print'[5].
- The rendition of the colours by means of L*-, a*-, and b*-axes is comparatively easy to conceive and comprehend even for nonspecialists.

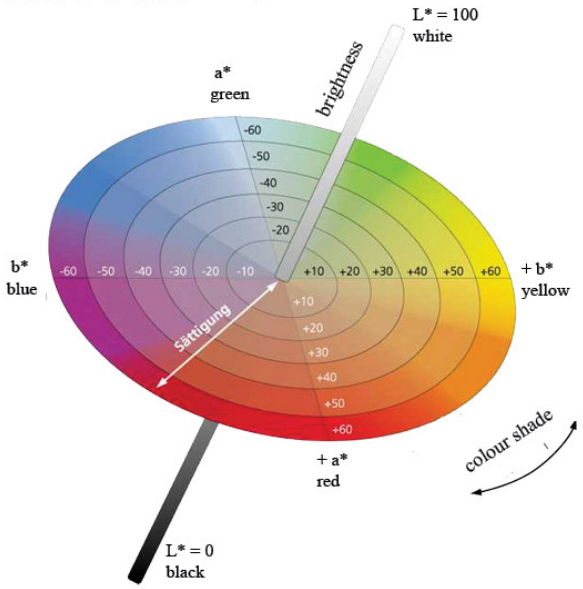


Fig. 3.20 The CIE-L*a*b* colour system (Source: G. Bülow/J. Große Frericks).

3.3.2. The Program ('BAI Computer')

The program collecting the L*a*b* values (obtained by converting the spectral distribution with the aid of the standard illuminant D65, that is equivalent to natural daylight and thus more or less reflects the visual colour matching conditions on the excavation site), classing them with ware groups, and defining the nearest 'Munsell soil colour' sample was developed on the bases of Microsoft Excel and its integrated scripting language Visual Basic Applications (VBA). It was called 'BAI computer' in reference to the Biblical Archaeological Institute Wuppertal (BAI).

3.3.2.1. Method of Classification of Pottery Ware Groups by Means of the 'BAI Computer' *(Fig. 3.21)*

The 'BAI computer' collects the L*a*b* data, processes them, and, among other things, finally establishes the pottery sherd's ware group.

The measured find's identification number and its subgroup are recorded in the 'BAI computer's' entry mask. As soon as the data are complete, the calculations are carried out. The results appear in a pop-up window and are moreover added to a spreadsheet.

Once the data pool of measured ceramics is large enough to safely assume that it reflects the characteristic chromaticity of a particular ware group, tolerances and target values are defined by means of the L*a*b* values.

From now on, when a piece of pottery is measured, it can be classed with a certain ware group as long as the values are located within previously defined tolerances. If not, the distance from the closest target value is used for classification.

5 Kraushaar et al. 2008, 42.

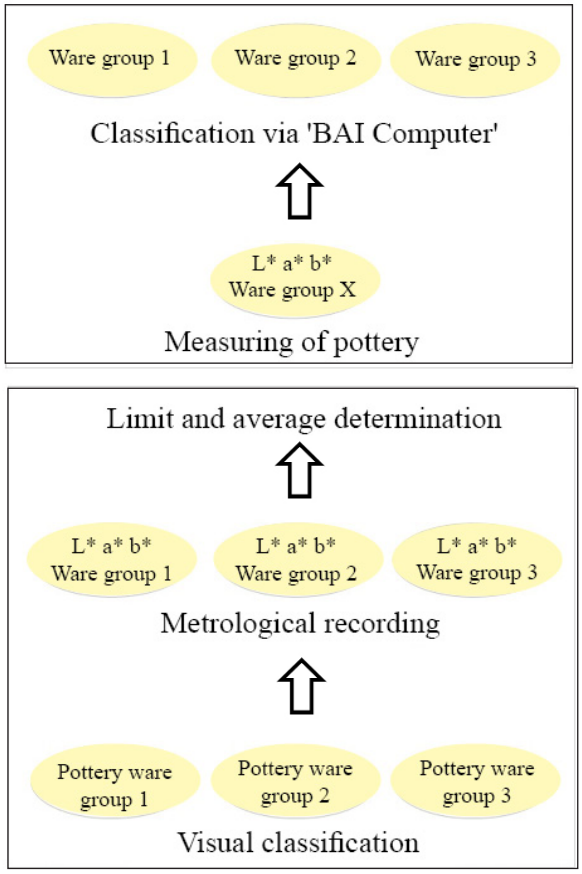


Fig. 3.21 Method of classification of pottery ware groups by means of the 'BAI Computer' (Source: G. Bülow/J. Große Frericks).

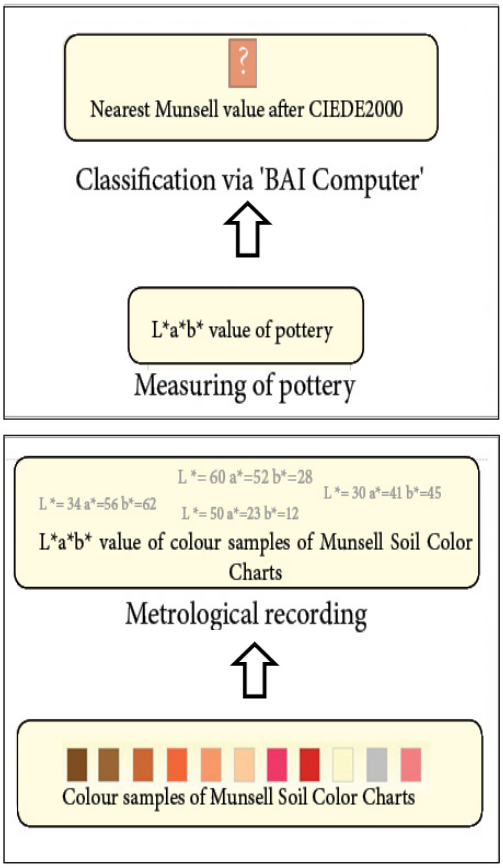


Fig. 3.22 Method of allocation of Munsell value by means of the 'BAI Computer' (Source: G. Bülow/J. Große Frericks).

3.3.2.2. Method of Allocation of Munsell Value by Means of the 'BAI Computer' *(Fig. 3.22)*

At first all colour samples of the 'Munsell soil colour charts' were recorded by spectrophotometry. The measured L*a*b* values along with their respective Munsell colour codes were then entered on an Excel spread sheet.

Now, when a sherd's L*a*b* data are registered, the nearest L*a*b* value will be matched to a colour sample from the 'Munsell Book of Soil Color' by means of colour difference calculation. CIEDE2000 is applied for calculating the colour difference because it takes into account the sensitivity of the human eye to colour differences[6].

3.3.3. Methods of Measurements and Definition of L*a*b* Tolerances

Whether the 'BAI Computer' is fit for practical application largely depends on its ability to evaluate the measurement data. To find out, about 8000 measurements of ceramics were carried out.

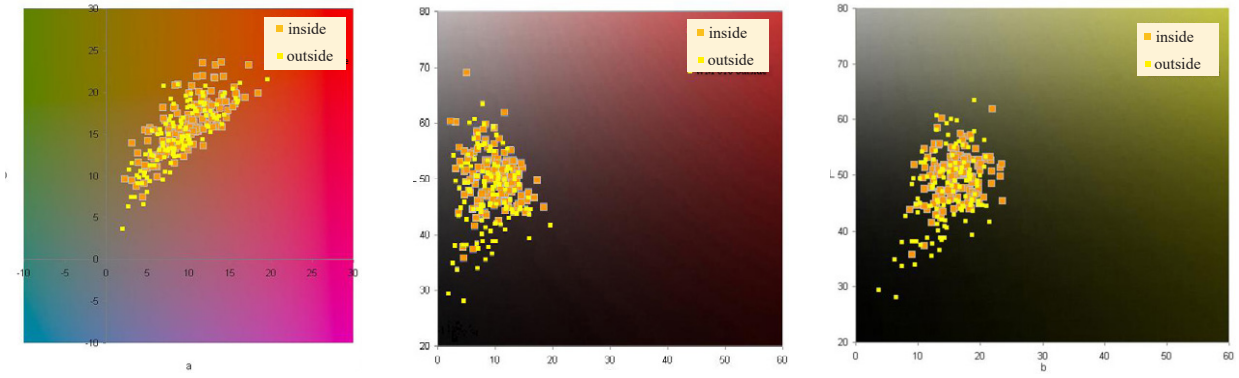
At first, pottery specialists of the Biblical Archaeological Institute (BAI) classed the finds visually with particular ware groups according to the 'Munsell soil color charts'. Afterwards, the finds were recorded by a spectrophotometer (X-Rite Eye-One Pro Spectrophotometer and its appendant software X-Rite Key Wizard Software Win by the company X-Rite Europe, Ltd.). In the process, four measurements were carried out at different points—both on the interior and on the exterior—of the pottery sherd. The average value of these four measurements marks the sherd's L*a*b* value. The reliability of the measuring method is guaranteed by observing standard deviations. Thus, it is ensured that the four individual measurements do not differ too widely, and falsification of the results by outliers is prevented.

A ceramic find's L*a*b* values are entered on an Excel spreadsheet along with its Tall Zirā'a inventory number, the ware group it was originally classed with,

6 Cf. Schläpfer 2002, 76.

and its Munsell value. Thus, it can be assigned the correct L*a*b* value of a specific 'Munsell soil color' sample by means of colour difference calculation.

The measured data were then used to create diagrams that represent the coordinates on the a*/b*-, L*/a*-, and L*/b*-planes as a point within the L*a*b* colour space (*Graph 3.1*). The aim of visually depicting the L*a*b* triplet of numbers is to show the approximate colour spaces of the individual ware groups.



Graph. 3.1 Depiction of measured data as scatterplots on three layers, exemplified by ware group WM 610 (Source: G. Bülow/J. Große Frericks).

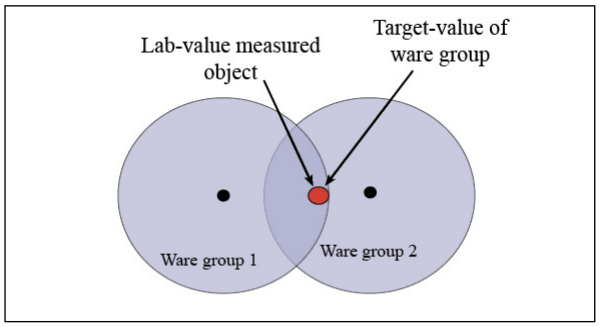
3.3.3.1. Determination of L*a*b* Tolerances

The scattering range of the results is wide and cannot be confined arbitrarily. Moreover, depicting the results as scatterplots may be visually appealing and allow colour interpretation; however, it does not reflect the frequency of occurrences of measured data within a certain domain. Thus, further diagrams were created that also represent the frequency distribution of the L*-, a*-, and b*-values (*Graph 3.3*).

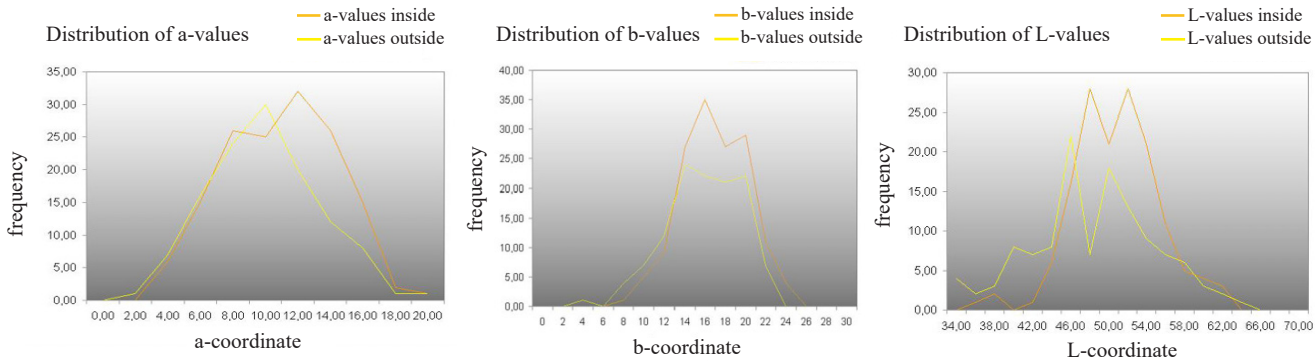
These diagrams illustrate the frequency in which certain L*-, a*-, and b*-values occur among the ceramics of a particular ware group.

After analysing the frequency distributions of individual ware groups, experienced archaeologists and experts in the field of ceramics established the ware groups' respective L*-, a*-, and b*-tolerances.

The L*a*b* tolerances define a minimum and a maximum value for each of the three coordinates. Any piece of pottery belongs to a certain ware group if its L*a*b* values lie within this range. Should the L*a*b* values of a ceramic find lie outside the range of one ware group or be in a range where the L*a*b* tolerances of two ware groups overlap, the spatial distance (delta E value) to the closest L*a*b* target value is the decisive factor (*Graph 3.2*).



Graph 3.2 Example of a measuring object in an overlapping zone (Source: G. Bülow/J. Große Frericks).



Graph 3.3 Frequency distribution of the L*-, a*-, and b*-values, exemplified by ware group WM 610 (Source: G. Bülow/J. Große Frericks).

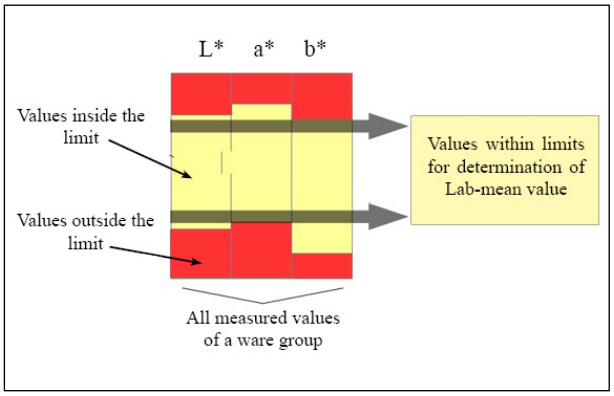
3.3.3.2. Calculation of Target Value

Finally, all measured values of a ware group that lie within the established tolerances are registered on a new spreadsheet, and a new mean value is calculated. These mean values form the L*a*b* value that is characteristic of a specific ware group.

3.3.3.3. Comparison of Pottery Ware Groups

When categorising the pieces of pottery visually, the different ware groups overlap to a certain extent. The degree of overlapping allows an assessment of the 'BAI Computer's' classification quality:

- If it is low, there is a distinct colour distinction between two ware groups; classification is mostly unambiguous and recognizable to the human eye.
- If it is high, many ceramic finds may lie in a threshold range where only the spatial distance to the nearest target value can class them with one ware group or another. A visual classification is difficult. This is where the 'BAI Computer' is helpful: it classes the pieces of pottery unambiguously with a specific ware group.



Graph. 3.4 Measured values lying within the defined tolerances (Source: G. Bülow/J. Große Frericks).

3.3.4. Conclusion

3.3.4.1. Measuring Methodology

Colorimetric examination by means of a spectrophotometer and the program/'BAI computer' allows an objective classification of ware groups. However, the process of measuring is sensitive and requires a certain qualification. For instance, it is of the utmost importance that the measuring device rests solidly on the measured object. Even the slightest shaft of light intruding from the side can influence the result and thus render the measurement useless.

Unfortunately, even strict adherence to the measuring guidelines cannot completely eliminate the element of subjectivity—for instance when choosing the measuring points deemed representative of the find's characteristic colour value. Eventually it is always the measuring archaeologist who decides which of the often multiple colour shades on a piece of ceramic reflects its original colour. This example also shows that comprehensive knowledge of the chromophoric components on ceramics as well as good communication among the archaeologists are indispensable.

3.3.4.2. Classification into Pottery Ware Groups

After a few initial trials in the field, the BAI's pottery specialists perceived the 'BAI computer's' classifications of ware groups as comprehensible and correct. To assess the program's reliability, they were given finds with L*a*b* values that were located in the overlapping ranges of two ware groups and had been assigned to either of them by the 'BAI computer'. Here, too, the computer's classifications were approved by the archaeologists.

Due to every individual observer's subjective perception, it is not possible to judge a ware group classification as downright correct or incorrect. On the whole, however, we can summarise that by implementing objective measurements and clear definition of the ranges of ware groups decision-making has been made easier and more reliable.

3.3.4.3. Statistical Evaluation

One of the advantages of applying statistical evaluation is its flexibility. No matter what the colour ranges of the individual ware groups are and how much they overlap—their ranges and mean values can always be calculated. This means that even at other excavation sites with completely different subgroups and ware groups these could be classed by entering and evaluating data by means of this method.

Visualising the results with the aid of diagrams has proved to be a very helpful method because it facilitates understanding the results for the observer. This is an advantage since staff members who are not familiar with the L*a*b* colour space may be involved in defining the ranges.

However, there is also a disadvantage to the method of statistical evaluation: in order to achieve a representative result and allow recognizing outliers for what they are, a relatively large number of measuring objects (finds) is necessary. And even if the 'BAI computer' can classify ware groups based on statistically evaluated data, independent of human interference—these data are still acquired on the basis of a set of finds that had primarily been divided into ware groups by visual classification.

This demonstrates once again that absolute objectivity is not possible. The visual classification of finds by qualified staff is indispensable and forms the basis for the spectrophotometrical definition of ware groups by means of the 'BAI computer'.

3.3.4.4. Classification of Munsell Values

The Programm/'BAI computer' classes each find with the closest Munsell chromaticity.

It is a positive aspect that the calculation of the nearest Munsell value is based on the CIEDE2000 colour difference formula and thus takes into consideration the colour difference perception of the human eye.

The method of classifying an object's Munsell value by measuring the distance of its chromaticity from the nearest chromaticity of a Munsell colour sample is without doubt pragmatic and self-evident. Still it is difficult to appreciate the value of classification by means of the Munsell value. In the course of the huge number of measurements that were performed, the Munsell value classifications were visually compared to the colour samples of the Munsell book of soil color on a regular basis. Some of the results were comprehensible or even identical, sometimes completely different colour samples had been chosen. However, this is not simply a phenomenon of the 'BAI computer': when discussing the matter with archaeologists from the BAI, there were also widely differing views on the colour shades of some pieces. What can be done to preclude these discrepancies?

To begin with, it has to be stated that a Munsell value classification that satisfies each and every onlooker does not exist. However, the problem might be solved by optimizing the function that calculates the Munsell value by factoring in the results of visual classifications. To this end, a set of characteristic pieces of pottery covering all ware groups could first be assessed by spectrophotometry and then be assigned a Munsell value by a group of archaeologists after visual screening under standard lighting. The results could be added to the database and compared to the BAI computer's classifications. If a trend could be detected, such as "The BAI computer tends to match saturated red finds with unsaturated Munsell colour samples", corrective parametres could be drawn up to counteract this discrepancy. However, it is dubious whether the possible benefit would be worth the time and effort necessary for writing such a complex operation and for the additional visual classifying procedures.

Still, this example, as well as the research in other task fields, shows that working on the subject matter from a technical point of view has added several novel ideas to the previous approach.

3.4. Experimental Archaeology (*Pls. 3.3–3.9*; *App. 3.5*)

edited by Dieter Vieweger/Jutta Häser[7]

In addition to the excavations and surveys carried out in the context of the 'Gadara Region Project', experimental studies on the technological advancement of skilled crafts and trades in ancient times were performed in cooperation with the Biblical Archaeological Institute Wuppertal (BAI; resp. W. Auge), the 'German Mining Museum Bochum', and the University of Hannover's archaeometric research group. These studies focussed on both the material clay and the production of ceramics and glass (W. Auge, partly in cooperation with M. Schulze and H. Brückelmann). Special attention was given to the production of ceramics in the Bronze and Iron Ages. Moreover, a tabun was reconstructed, and in the process the technique of baking bread was analyzed (*Chap. 3.4.1.*).

7 This article is written by D. Vieweger and J. Häser; it is based on the research results of W. Auge (BAI Wuppertal); detailed informations will be published in Volume 9 (W. Auge, Archaeometry, in: D. Vieweger – J. Häser (eds.), Tall Zirā'a 9, forthcoming).

In their provenience analyses, archaeometric examinations provided information on the local pottery production and on imports from different regions of the Levant or the Eastern Mediterranean area (*Chap. 3.8.1.*). The archaeological experiments were conducted to make these theoretical conclusions about the different classes of ceramics and their different modes of production practically comprehensible and thus test their logical rigour. In doing this, the technological skills and knowledge of potters as well as the technology of kiln construction in their respective historical eras could be assessed and appreciated.

Based on the results of chemical and mineralogical analyses and on the state of knowledge of traditional pottery in northern Jordan or other regions of the Southern Levant and the Eastern Mediterranean area[8], the production of a few selected pottery classes and their forms was re-enacted. In the process, attention was paid to all production steps, from the clay mining in the surroundings of Gadara to the fabrication of the respective final product. The following issues were paramount:

- Search for places of clay mining
- Mining and methods of processing the clay (including tempering/alloys)
- Technical and artistic forming of the pottery according to the respective era, with or without a potter's wheel
- Surface processing (including slip or engobe)
- Painting and ornament
- Firing and different baking procedures
- Kiln construction

In the years from 2001 to 2012, several kilns were reconstructed in Germany and in the Gadara region. They were used for experiments on the production of ceramics (*Chap. 3.4.2.*) as well as for producing raw glass experimentally and for melting glass (*Chap. 3.4.3.*).

Apart from the excavation finds, ethnological studies among the descendants of traditional potters and kiln builders as well as written sources served as models in these endeavours (see e.g. *Chap. 3.4.2.2.*).

3.4.1. Reconstruction of a Tabun (*Pls. 3.3–3.4*)

Quite a few tabuns for baking bread (*Fig. 3.24*) as well as kilns which might have been used for the processing of glass objects were found on the Tall Zirā'a. Tabuns were used in almost every epoch.

Samples of several tabun walls were taken for chemical and mineralogical analyses. The results of these analyses served as references for identifying locally produced ceramics and for localising clay deposits in the Tall Zirā'a's surroundings.

In order to allow the researchers to study the construction method of tabuns along with their manner of functioning, M. Saleh—a farmer living on the grounds of Gadara who had learned the tradition of kiln building from his mother, an experienced tabuniye, who still assisted him in his works—was ordered to build a tabun in the year of 2003 (*Fig. 3.23; Pls. 3.3* and *3.4*). In the process, only traditional building techniques were applied.

The tabun built by M. Saleh was fully functional and was used for baking pita bread and meat alike during many excavation campaigns.

One focus of the experiment was the tempering and the grogs employed. The clay came from a deposit near Umm Qēs that W. Auge and D. Vieweger had explored during the summer campaign of 2003. The most important temper added were organic matter such as reed shreds, rush, and goat hair, and also calcite. Their function was to guarantee the kiln's heat resilience (expansion during firing and contraction during cooling-off) without being damaged (cracks etc.).

The reconstruction of a tabun moreover allowed the researchers to understand in detail the construction and building process of the kilns found on the Tall Zirā'a. The kiln wall was constructed according to the tongue and groove principle (*Pls. 3.3* and *3.4*).

Other interesting insights were gained about the manufacturing and firing of the kiln itself, the details of the tabun's manner of functioning (how to handle the embers and the ashes; how to fan the fire; how to prepare the food) and especially about the way the operator was able in ancient times to manage and recognise the different degrees of heat without being equipped with the technical tools available today. The people in antiquity will have achieved the latter by observing both the flames/embers and the warming of the kiln's surface.

Figs. 3.23–3.24 Left: Reconstructed tabun; right: Iron Age I tabun. Stratum 13, Area I, Square AE 115, Context 3258 (Source: GPIA/BAI).

8 Cf. e.g. London 1990 and Ohnefalsch-Richter 1913.

3.4.2. Construction of Pottery Kilns (*Pls. 3.5–3.9; App. 3.5*)

Although there is sufficient analytical and archaeological evidence pointing to the fact that the vast majority of Pre-Classical ceramics—especially the large ware groups WM C Buff, WM C R2B as well as all cooking pot (CP) groups—were produced locally there is still no positive archaeological proof of the presence of a pottery workshop on the Tall Zirā'a. It can be assumed that these would have been located on the edge of the permanently water-bearing stream in the Wādī al-'Arab or on the wide slopes of the lower cities. Unfortunately, though, all archaeological relics on these sites were destroyed by bulldozers in the course of the construction works for the dam project and when planting olive groves. Still, various potter's wheels made of basalt were found during the excavations on the tall.

In order to clarify the possibility of an earlier local pottery production, three differently constructed kilns were built during the campaigns of 2001, 2006, and 2012, and subsequently used for firing ceramics (*Chaps. 3.4.2.1., 3.4.2.4.* and *3.4.3.3.*).

3.4.2.1. Construction of an Updraft Kiln in 2001

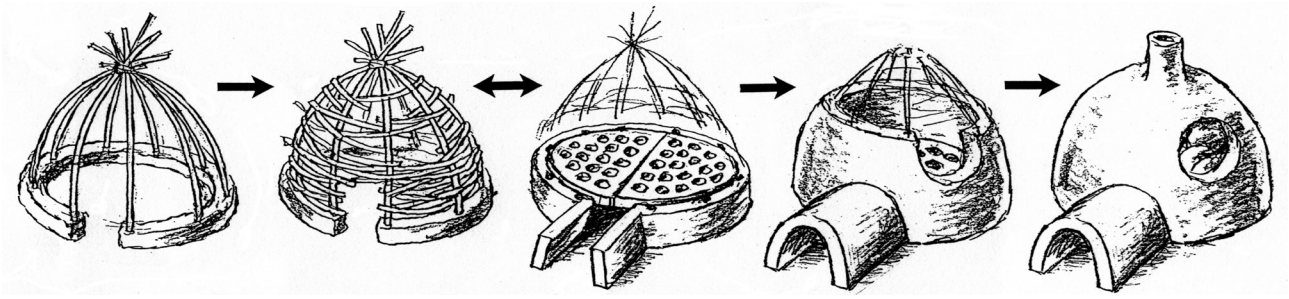


Fig. 3.25 Construction of an updraft kiln (Source: BAI/GPIA; drawings made by E. Brückelmann).

Fig. 3.26 The replica of an updraft kiln (Source: BAI/GPIA).

In 2001, an updraft kiln was recreated which had been in use in the Near East in Pre-Classical times, such as found in Iran (e.g. in Tepe Sialk; for the construction of such a kiln see *Fig. 3.25*)[9].

The kiln was formed from a clay-straw composite covering a framework of twigs. In front of the stoking hole, a poking channel was built; at the top, a hole was left as a smoke funnel to which an extension could be affixed. There was also a side hole for inserting the vessels (*Fig. 3.26*).

During the kiln's construction and while firing the ceramics first insights were gained which in turn were helpful during the later experiments.

3.4.2.2. Ethno-Archaeology as an Approach to Better Understanding Technical Procedures

When preparing for building another kiln in the summer of 2006, the researchers not only drew on the models but also on the methods of ethno-archaeology, a cultural anthropological discipline. This branch of research observes and examines traditional ways of living and working of present-day tribes or inhabitants of certain regions and, by way of analogy, tries to infer the corresponding circumstances in earlier, primarily nonliterate, eras[10].

The following fields of application are especially auspicious[11]:

- Comparison of forms
- Functional identification of objects and finds
- Comparison of technological procedures
- Comparison of social, political, and economic structures

9 Cf. Majidzadeh 1975/1976, 207–221.

10 Basics on the matter and on application of the method cf. London 1990. For an outline of the systematics of ethno-archaeological analogies, see Näser 2005.

11 On this, see Näser 2005; Watson 1999, 49 f.

An approach like this can disclose new possible ways of interpreting specific archaeological issues and, if applicable, widen their range. Thus it may be possible to find explanations that support the assumptions arrived at by investigating the finds.

In the summer of 2006, the excavation team from the Tall Zirā'a visited a pottery workshop near Zarqa, an industrial centre of Jordan. They studied traditional technological procedures that have survived into the present, such as: origin of the different sorts of clay, their conditioning, the manufacturing process, the forms of the various vessels as well as construction, capacity, and operating mode of the kilns. The insights gained during this excursion were very helpful for the reconstruction and utilisation of the new kiln on the Tall Zirā'a. However, while the present-day search for clay and its preparation can definitely be compared to the same activities in Pre-Classical times, kiln construction, firing, the amount of material needed, and the necessary degrees of heat are only comparable with classical (Hellenistic/Roman/Byzantine) kilns.

3.4.2.3. Construction of an Updraft Kiln in 2006 *(Pls. 3.5* and *3.6; App. 3.5)*

After successfully building a tabun in the summer of 2003, the preparations for constructing a pottery kiln modelled after the Late Bronze Age kiln of the Tell Brak (Syria) were taken up[12].

In order to find out the operating requirements it was necessary to analyse the (original) firing temperatures of the pieces of pottery found on the Tall Zirā'a. To do so, cut ends of ceramic sherds underwent laboratory tests to find out their chemical and mineralogical compositions. The temperatures at which the ceramics had been formerly fired or, alternatively, temperatures necessary for firing the local clays could be found out by means of firing experiments. The chemical analyses revealed that the local clays contain large amounts of CaO and their compositions strongly resemble those of the ceramics of the ware groups WM C R2B, WM C Buff or Cl Bu2Br found on the Tall Zirā'a. As the firing experiments with ceramic samples of these ware groups showed, the temperatures were between 550–600 °C and 750–800 °C.

In a pottery workshop in Brüggen-Born (Germany), the potter H. Brückelmann tested the clays available in the surroundings of Gadara for their suitability to be fired into ceramics (plasticability and firing experiments in an electric kiln). At the end of these preliminary tests in June 2006 a prototype of the envisaged kiln was built and loaded with 30 vessels formed from clays from the Tall Zirā'a and from the surroundings of Umm Qēs. They emulated the Bronze Age and Iron Age ceramic vessels found on the Tall Zirā'a. The kiln was heated to 700 °C and 750 °C, respectively. The ceramic firings themselves could be carried out appropriately and the yield was satisfying with only 10 % breakage. However, the vessels' quality did not reach the models' functional characteristics. Moreover, the kiln was not very heat-resistant and broke down after the second operating test. This was due to the major temperature fluctuations between day and night in Brüggen-Born and also to the fact that the time allotted for the construction of the kiln had been much too short to allow it to dry out sufficiently before being taken into operation.

Fig. 3.27 Reconstruction of a pottery kiln on the Tall Zirā'a in 2006. Film: *App. 3.5* (Source: BAI/GPIA).

The insights gained from this experiment were incorporated into the construction and into the drying and heating process of the pottery kiln later built near the Tall Zirā'a. This kiln was built in Umm Qēs by M. Saleh, using the clays from Gadara/Umm Qēs that had evolved from the weathering of basalt. The clay was tempered with goat hair and straw chaff (*Pls. 3.5* and *3.6; App. 3.5*).

The kiln was constructed layer upon layer over the course of several days and then dried in the open air for a long time. Following that, when it had reached a 'leather-hard' condition, it was 'baked out', i.e. completely dried, for three days at a constant heat level.

The reconstructed kiln was 0.75 m in height with a wall thickness of 0.05 m and a diametre of 0.50 m; the firing chamber's capacity was approx. 100 litre. The wall was erected over a bottom plate and a second, vent-holed floor and connected to them by means of tongue and groove joints. The upper part of the kiln had a smoke outlet and could be removed for filling the chamber. Finally, there was also an opening for adding fuel (*Fig. 3.27*).

12 For the kiln in Tall Brak, see Eiland 1998/1999, 69–84.

H. Brückelmann formed about 50 vessels from local clay (*Fig. 3.28*). They conformed to the ware groups WM C R2B and WM C Buff and were copies of vessels from the Middle Bronze/Late Bronze/Iron Ages. They were fired in the reconstructed kiln, using first wood (during the heating-up phase) and then dung as fuel. Temperatures of 700–750 °C were easy to attain and also to maintain over longer stretches of time. The firing yield of undamaged ware was 90 %. However, some vessels that had been located on the vent-holed floor and had been exposed to the fire more or less directly developed blistering/bursting after a little while (overheating!). It turned out, though, that this type of kiln cannot permanently maintain temperatures above 700 °C that are required for fring highly SiO_2-containing ceramics (i.a. Cl Red, Roman – Byzantine period). For attaining these firing temperatures, the necessary energy consumption renders any kind of economical working impossible. However, even after the efforts to reach temperatures of over 700 °C the kiln was still in a good condition. This will be ultimately due to the addition of special tempering materials during its construction as well as the specific method of drying and heating the kiln before putting it to use.

Fig. 3.28 Hanna Brückelmann forming ceramic vessels (Source: BAI/GPIA).

For comparison, after two firing procedures in the kiln, a batch of ceramics was fired in an open fire. However, the yield of undamaged, well-fired vessels was lower (50 % breakage) in the open fire and significantly more fuel was needed than in the closed kiln. The non-efficiency of this procedure was thus evident.

The experiments could demonstrate the following:

(1) A single-duct pottery kiln made from clay is absolutely capable of firing ceramics from local (calcite-rich) clays with a satisfying yield of undamaged ware.

(2) Temperatures of 700–750 °C are easy to attain and maintain over a longer stretch of time in an oriental environment. Baking temperatures of over 900 °C, however, that were customary in Roman times, e.g. for the ware groups Cl Red and Cl Red BS, could not be reached with this type of kiln.

(3) The calcite-rich clays used for manufacturing the ceramics are not suited for firing temperatures more than 750 °C.

(4) Firing pottery in an open fire can also achieve respectable results. However, the disadvantages are obvious: non-uniform and uncontrollable temperature distribution and energy loss because of strong radiation of heat.

(5) The following work stages could be analysed and documented (*Pls. 3.5* and *3.6*):

- Search for clay, and clay mining
- Composition of the ingredients for tempering
- Grinding, sifting, and compounding of clays
- Production of tempering (blending, pounding, and churning)
- Production of the bottom plate (pounding, measuring and excision)
- Production of the vent-holed floor
- Connecting the vent-holed floor and the bottom plate
- Building the kiln wall (tongue and groove system)
- Manufacturing a kiln lid with a controllable smoke outlet
- Firing the kiln: filling the kiln with dung, firing the dung thoroughly from the inside and from the outside
- Firing the ceramics: filling of the kiln, raising the temperature by means of a temperature ramp, opening of the kiln and removal of the ceramics

A short film documenting the different work stages of material procurement and the building and operation of the pottery kiln can be found in the appendix to this volume (*App. 3.5*).

3.4.2.4. Construction of a Quadruple-Shelled Kiln in 2012 *(Pls. 3.8* and *3.9)*

In Area I two multilayered, carefully insulated kilns dating from the Iron Age II were found standing side by side in 2009 (Stratum 10, Area I, Square AT 121, Context 4100; *Fig. 3.29*). Their outstanding features are their characteristic shape (oval), their good isulation and a quadruple-shelled wall: two layers of clay, one filling layer (soil or air) and one layer of ceramic sherds. The latter also served as additional heat reservoirs and insulators (on the construction of kilns of this type, see also *Pl. 3.8*). The advantage of this

type of construction is its extraordinary energy efficiency: even at an inside temperature of significantly more than 900 °C the outer shell was surprisingly cool.

Since comparable specimens could also be verified in the Late Bronze Age (Stratum 14) the question arises whether they were used for firing ceramics and/or processing glass (for melting and cooling-off) and which temperatures could be attained and maintained in the process. The kiln modelled after these exemplars was therefore tested with respect both to firing ceramics and to melting glass (*Chap. 3.4.3.*).

When the experiment was conducted it became obvious that kilns of this type were very well suited for firing ceramics (*Chap. 3.4.2.3.*). Contrary to the Late Bronze Age, cylindrical and only single-leaf kiln reconstructed in 2006, this one could easily reach and maintain a firing temperature of more than 900 °C.

The cooking pots fabricated in this process were subsequently tested for their serviceability (leak tightness, abrasion resistance, thermal and mechanical stability, etc.). Finally they were used for preparing soup and millet gruel over an open flame[13].

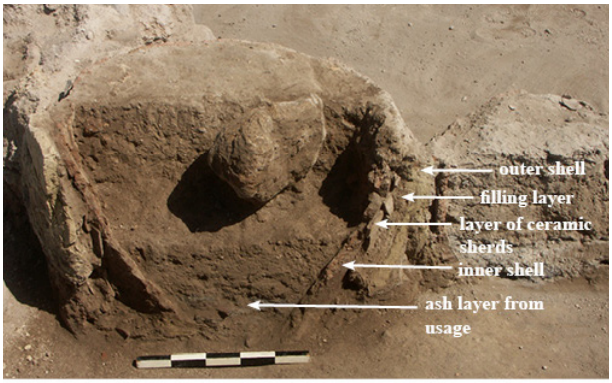


Fig. 3.29 Quadruple-shelled kiln. Stratum 10, Area I, Square AT 121, Context 4100 (Source: GPIA/BAI).

3.4.3. Experiments on Melting Glass and the Processing of Raw Materials

In the course of the summer campaign of 2010, experiments were started on melting glass and on fabricating raw glass out of the raw materials naturally occurring on the Tall Zirā'a and in its surroundings. A possible melting and cooling procedure had been previously tested in the laboratory of the company Schott GmbH (Schott, Ltd.) in Mainz, Germany, and was applied for the on-site experiments.

3.4.3.1. Production of Raw Glass

Several test arrangements, some of them inside at the kitchen stove and some of them outside in a hollow in the earth, were reconstructed. The raw materials used were silex and quartz gravel, and different reaction mixtures were applied (*Fig. 3.30*). Some of these were heated in a tin box, the others in a porcelain crucible. For kindling the coal, additional air was supplied by means of a blow-dryer instead of a pair of bellows.

The successes in producing glass were only rudimentary: during the experiments, the reaction mixtures melted only partially or only to a little extent on the surface; some tests even yielded no results at all, neither a chemical reaction nor melt flow. However, one experiment was conducted successfully with a reaction mixture consisting of 13 g SiO_2 (silex) und 1.7 g Na_2CO_3 (sodium carbonate) that was kept in a plastic bag. To begin with, the silex powder was treated with hydrochloric acid in order to eliminate any possible trace of carbonates before adding the sodium carbonate. This was done to guarantee the development of CO_2. Afterwards the mixture was decanted and washed with water several times. First the mixture of SiO_2 and hydrochloric acid was decanted and then, during the cleaning process, that of SiO_2 and water. In both instances decanting meant that the solid matter was given time to precipitate on the crucible floor and

Fig. 3.30 Above: Quartz gravel as raw material; below: silex as raw material (Source: BAI/GPIA).

13 Schwermer 2014, 61.

then the superfluous dissolution (hydrochloric acid/water) was poured off so that the silex was left. The matter was weighed while it was still slightly humid and then ground in a mortar with sodium carbonate. The reaction mixture was heated in a tin can standing in an earth hollow. The coal in this hollow had been heated in advance. The test duration was 60 minutes. It resulted in a strong melt flow; moreover, small glass pellets and a glint could be discerned (*Fig. 3.31*).

An experiment for the production of glass using quartz gravel can also be considered partially successful. The reaction mixture consisted of 1.5 g SiO_2 (silex) and 0.3 g Na_2CO_3 (sodium carbonate) along with 10 % Na_2O (sodium oxide) and was suspended with water. It was heated in a porcelain crucible that was placed in the earth for better insulation. The porcelain crucible was coated with a humid mass of $CaCO_3$ (calcium carbonate) on the inside bottom. The coals were additionally fanned by means of a blow-dryer. The test duration was 30 minutes (*Fig. 3.32*). As a result, the mixture was semi-vitrified and there was a slight melt flow; moreover, a few small glass pellets could be discerned.

The fact that the efforts at fabricating glass were only partially successful can be mainly ascribed to the kiln's failure to produce the necessary temperatures. Quartz sand/gravel requires very high temperatures since its melting point is relatively high (more than 1500 °C).

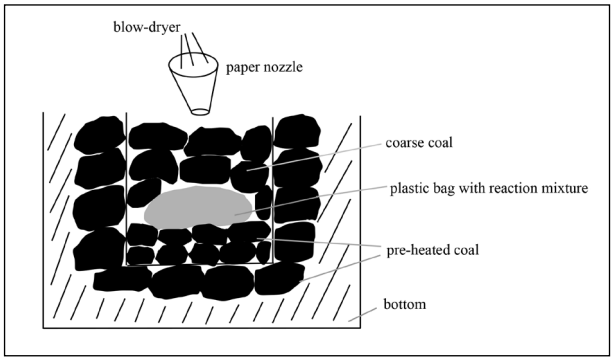


Fig. 3.31 Raw glass made from mixture of 13 g SiO_2 (silex) and 1.7 g Na_2CO_3 (Na_2O 10 %) (Source: BAI/GPIA).

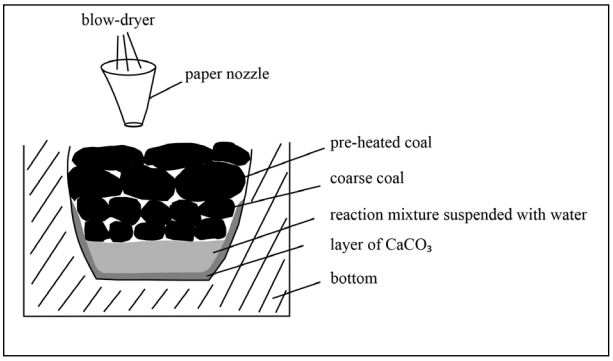


Fig. 3.32 Raw glass made from mixture of 1.5 g SiO_2 (silex) and 0.3 g Na_2CO_3 suspended with water (Source: BAI/GPIA).

3.4.3.2. Melting Raw Glass

Experiments to melt glass were carried out both in open air and inside on a stove with different reaction mixtures and vessels. These experiments were only rudimentally successful since some of the reaction mixtures did not melt at all, others melted only partially and were sometimes sintered together.

An experiment with a reaction mixture consisting of 10 g glass, 1.7 g Na_2CO_3 (sodium carbonate), and 10 % Na_2O (sodium oxide), which was kept in a plastic bag, was more successful. The mixture was heated in a tin can standing in an earth depression. Prior to that, the coal had been preheated. The coal was fanned with a blow-dryer for approx. 45 minutes; then the tin can was left sitting in its cavity with a closed lid for another approx. 30 minutes (*Fig. 3.33*). There was a strong melt flow, especially where the coal had direct contact with the can. A few small glass pellets were also discernible.

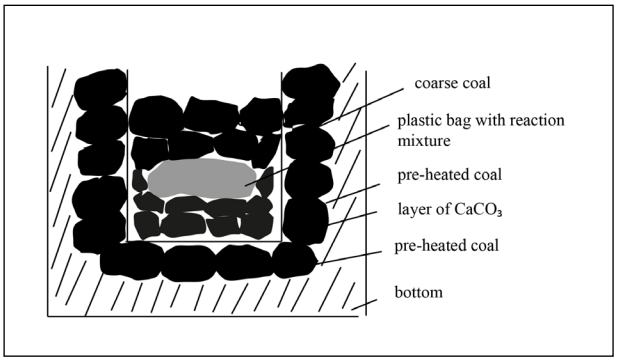


Fig. 3.33 Glass made from the reaction mixture of 10 g glass and 1.7 g Na_2CO_3 and 10 % Na_2O in a plastic bag (Source: BAI/GPIA).

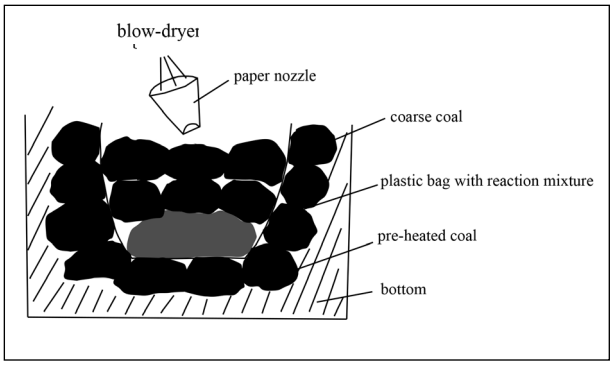


Fig. 3.34 Glass made from 4.2 g glass, 0.3 g Na_2Co_3 and 5 % Na_2O in a plastic bag (Source: BAI/GPIA).

Another experiment was conducted with a reaction mixture consisting of 4.2 g glass, 0.3 g Na_2CO_3 (sodium carbonate) and 5 % Na_2O (in a plastic bag) in a porcelain crucible. The test duration was 20 minutes. The porcelain crucible containing the reaction mixture was placed in an earth depression which had been preheated with coal. The coal was additionally fanned with a blow-dryer. To begin with, the glass obtained during a previous experiment described above was pestled and subsequently ground together with the soda in a mortar (*Fig. 3.34*). The mixture melted together, and a gas evolution took place.

The glass melting experiments were only partially successful because the necessary high temperatures of more than 900 °C could either not be reached or not be maintained long enough.

3.4.3.3. Glass Production in the Quadruple-Shelled Kiln

Apart from the glass melting experiments described above one more was conducted in the quadruple-shelled kiln in 2012 (*Figs. 3.35* and *3.36*). There, different sorts of glass were fused at more than 1000 °C in ceramic or plaster moulds formed like a spacer bead (e.g. TZ 010337-001; *Fig. 3.45*) or like the female figurine (TZ 015318-001; *Fig. 3.88*). The quadruple-shelled kiln could easily reach temperatures of more than 1000 °C (*Chap. 3.4.2.4.*).

Fig. 3.35 Filling the kiln with glass samples (Source: BAI/GPIA).

Fig. 3.36 Glass production in the kiln (Source: BAI/GPIA).

3.4.3.4. The Glass Production on Tall Zirā'a

The results of the glass melting experiments demonstrate that fusing glass on the Tall Zirā'a was possible. There are other finds which let assume that glass production and/or processing was not only possible but really executed. These finds are raw glass (TZ 012474-001; *Fig. 3.37*), amorphous and spherical glass granulate (TZ 016622-001; *Fig. 3.38*), a spherical bead without piercing (TZ 007546-001; *Fig. 3.40*) and a wound bead with its clay core of still intact (TZ 016663-001; *Fig. 3.39*).

In the northern part of Area I (Stratum 13, Square AP 119, Context 1317) a working area was found with a *mazzebe*, a working stone and hammer stones (e.g. TZ 015991-001, TZ 015994-001; *Fig. 3.41*) and several 'industrial vessels' were found (*Fig. 3.44*). It has been suggested that this kind of vessels were used in a production process without defining the kind of material processed. Maybe it was used in the processing of glass but this has still

Figs. 3.37–3.38 Left: Raw glass found on Tall Zirā'a, TZ 012474-001. Area I, AQ 120, Context 3421; right: glass granulate, TZ 016622-001 (Source: GPIA/BAI).

Figs. 3.39– 3.40 Semi-finished products. Left: bead with its clay core still intact, TZ 016663-001. Dimensions: H 0.8, D (max.) 1.4; right: bead, TZ 007546-001. Dimensions: H 1, D (max.) 3 (Source: GPIA/BAI).

Fig. 3.41 Working area with *mazzebe* and basket-shaped vessel. Stratum 13, Area I, Square AP 120, Context 4852 (Source: BAI/GPIA).

Fig. 3.42 Basket-shaped ceramic vessel, TZ 006835-016. Dimensions: L 51, W 30, H 6.3 (Source: BAI/GPIA).

to be proven. In the same context, there was also a remarkable two-chambered, basket-shaped ceramic vessel (TZ 006835-016; *Fig. 3.42*) discovered. Its specific function is as yet uncertain; maybe it was made for coating objects with suspensions for faience fabrication or it had a cultic function like a similar two-chambered, basket-shaped basalt trough found in Tall Ḥālaf.

Large numbers of glass objects from the Classical era were habitually found on the tall. The large number of glass finds from Pre-Classical times, however, are uncommon in the context of further finds in the Southern Levant since glass was usually recycled. This is an additional argument for the processing or even production of glass on the tall.

Among the valuable Pre-Classical finds are many, mostly spherical beads, a female figurine (TZ 015318-001; *Fig. 3.82*), a zoomorphic pendant (TZ 015314-001; *Fig. 3.88*), beads (e.g. TZ 014558-001; *Fig. 3.44*), two pendants (e.g. TZ 010337-001), and several rod-shaped beads (e.g. TZ 013881-001; *Fig. 3.45*).

Fig. 3.43 Left: industrial vessel, TZ 004291-001. Dimensions: D (max.) c. 9, D (opening) 3.6; right: industrial vessel, TZ 002843-001. Dimensions: H c. 19; D (foot) 12 (Source: GPIA/BAI).

Figs. 3.44–3.45 Left: spacer bead, TZ 014558-001. Dimensions: L 3.3, W 3.5, H 1.5; right: rod-shaped bead, TZ 013881-001. Dimensions: H 2.2, D (max.) 0.6 (Source: BAI/GPIA).

Plate 3.3: Stages of a tabun's construction, Part I (campaign 2003)



1.–3. Search of the clay and its dismantling



4.–6. Compilation of the ingredients for the tempering: rushes, straw, and goat hair



7.–9. Grinding, sieving and mixing of clays



10.–12. Producing of the temper



13.–15. Construction of the bottom

Plate 3.4: Stages of a tabun's construction, Part II (campaign 2003)



16.–18. Construction of the vent-holed bottom






19.–24. Construction of the kilnwall with the cleanout



25.–27. Firing the tabun



28.–30. Preparing the food and baking of the bread

Plate 3.5: Stages of a kiln's construction, Part I (campaign 2006) (Film: *App. 3.5*)


1.–2. Exploiting the clay



3.–5. Compilation of the ingredients for the temper: rushes, straw and goat hair



6–8. Grinding and sieving



9.–11. Producing the temper: mixing, pitching, milling



12.–14. Construction of the bottom: pitching, measuring and cutting.

Plate 3.6: Stages of a kiln's construction, Part II (campaign 2006) (Film: *App. 3.5*)



15.–17. Construction of the vent-holed bottom



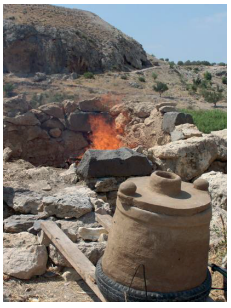
18.–20. Construction of the kilnwall



21.–23. Construction of the lid



24.–26. Producing of vessels and engobe



27.–29. Firing of the kiln: lower part is placed on the glow

Plate 3.7: Stages of a kiln's construction, Part III (campaign 2006) (Film: *App. 3.5*)



30.–32. Firing of the kiln: joining the different parts of the kiln and its firing



33.–35. Burn out of the dung from outside and inside


36.–37. Firing of the ceramic: filling of the kiln

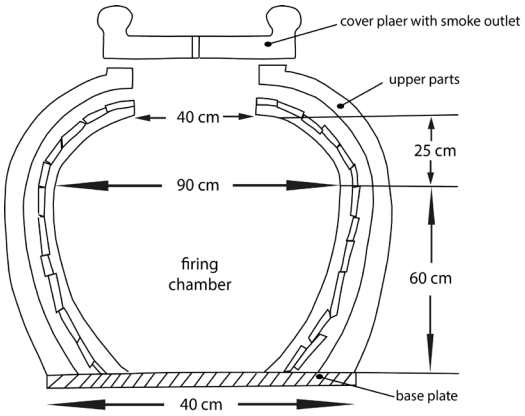


38.–40. Firing of the ceramic: inreasing the heat and measuring the temperature



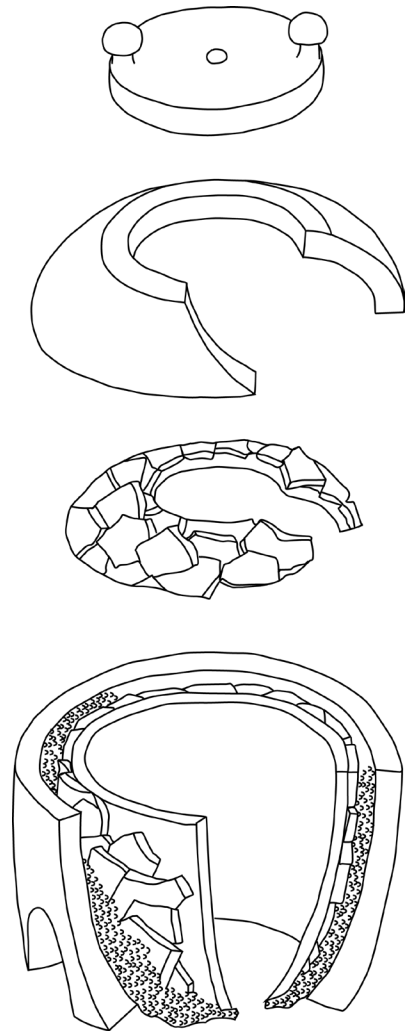
41.–43. Firing of the ceramic: opening of the kiln and taking off the ceramic

Plate 3.8: Construction of a quadruple-shelled kiln

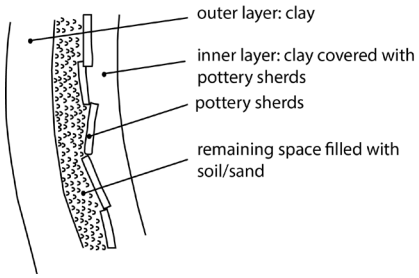


Sketch of the quadruple-shelled kiln

Construction of the quadruple-shelled kiln



Different parts of the quadruple-shelled kiln



Cross section of the kiln wall

Construction of the quadruple-shelled kiln

Plate 3.9: Firing of ceramics in the quadruple-shelled kiln

1. Producing the ceramics

2. and 3. Filling the kiln with ceramics

4.–6. Closing the kiln, sealing the lid, and firing the kiln

7.–9. Measuring the heat

10.–12. The product

3.5. Geophysics

by Patrick Leiverkus/Armin Rauen/Dieter Vieweger/Dietmar Biedermann/Knut Rassmann/Samantha Reiter

Fig. 3.46 Tomography (Source: BAI/GPIA).

Fig. 3.47 Geoelectrics (Source: BAI/GPIA).

In the campaigns of 2001, 2007, and 2014 geophysical explorations were undertaken on the Tall Zirā'a, employing different measuring methods (*Chaps. 3.5.1.* and *3.5.3.*). Besides the classic archaeological survey methods deep drillings were also carried out in 2007 (*Chap. 3.5.2.*).

3.5.1. Geophysical Survey in 2001

by Patrick Leiverkus/Armin Rauen/Dieter Vieweger

Within the scope of the geophysical exploration on Tall Zirā'a, geoelectric mapping and twodimensional as well as three-dimensional tomographic techniques were brought into action in September/October, 2001 (*Figs. 3.46* and *3.47*). The measurements took place on the plateau and on the western slope.

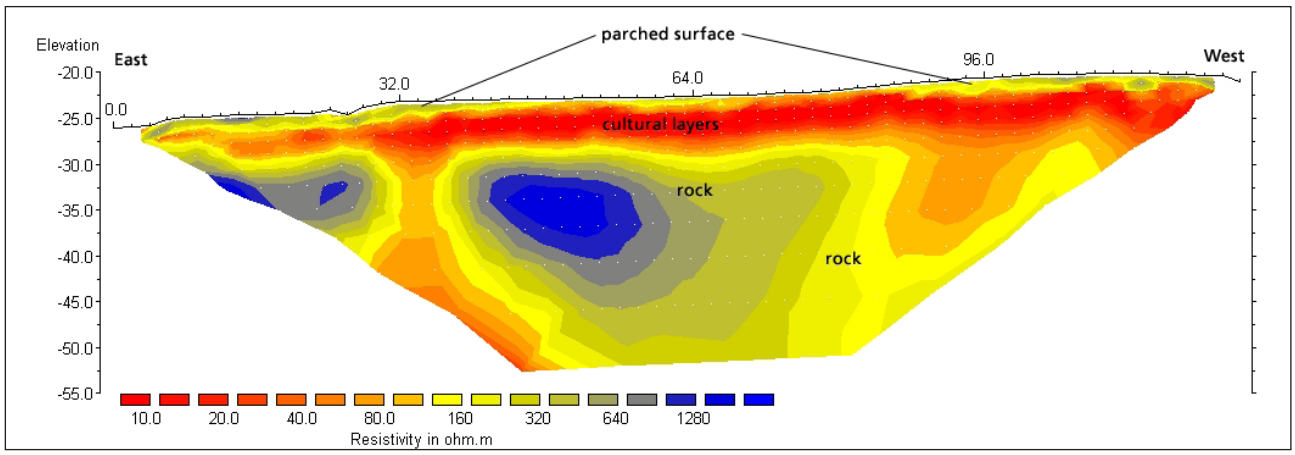
The aim of the geophysical survey was:

- To be able to plan archaeological excavations in advance and to develop exact strategies for the planned excavations
- To acquire knowledge of non-excavated areas
- To leave undisturbed larger excavation areas for coming generations

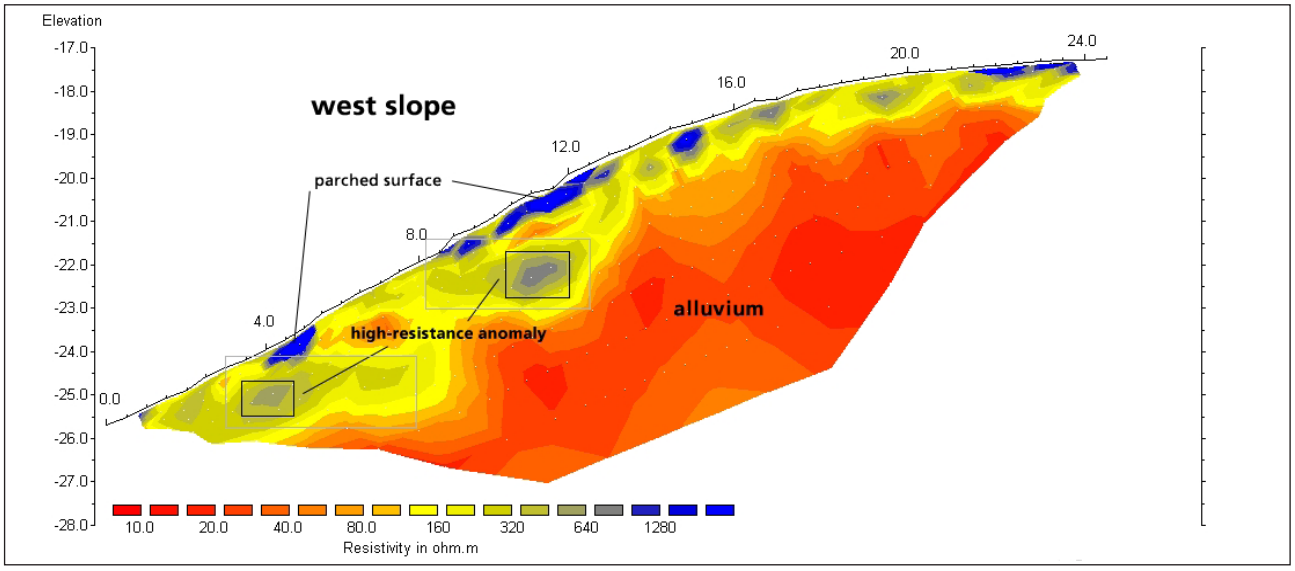
For the purpose of the geophysical exploration a LGM 4-Point Light µC and a Geolog 2000 GeoTom were used[14]. On Tall Zirā'a more than 50 profiles in various configurations could be measured. Two important results can be presented:

(1) The first profile shows a measurement (in dipol-dipol configuration) which runs across the tall in an east-west direction and yields essential geological insights (*Graph 3.5*). For this, 63 electrodes were positioned at a distance of 2 m from each other. In the profile shown below a cultural layer of 5–6 m thickness can be recognised, showing a low-ohmic value (up to 100 Wm to the max.) below the dried-up surface which, as expected, appears as a high-ohmic anomaly (more than 160 Wm).

14 For the geophysical surveys undertaken see e.g.: Vieweger – Häser 2005, 8–10; Vieweger et al. 2003, 205 f.



Graph 3.5 East-west profile of the tall plateau (measurement: dipol-dipol configuration, 2 m electrode gap, 63 electrodes; Iteration 4, RMS-fault = 24.5) (Source: BAI/GPIA).



Graph 3.6 West slope profile (measurement: dipol-dipol configuration, 0.5 m electrode gap, 50 electrodes; Iteration 4, RMS-fault 12.9) (Source: BAI/GPIA).

An important observation of the measurements confirms the enormous thickness of the cultural layer of the Tall Zirā'a.

In the east of the tall, the bedrock almost reaches up to the surface. Since the whole tall slopes slightly towards the east, the water from the artesian spring drained off in that direction. Probably the striking down-going double-conic (low-ohmic) area at 32.0 m is to be seen in connection with the artesian spring.

The deep 'basin' in the area of 94.0 m could be one of the many sinter caves in the tall.

(2) On the west slope about 20 parallel placed profiles were plotted and measured with 50 electrodes at 0.5 m distance (*Graph 3.6*). Here the dipol-dipol configuration was also used in order to ensure a better resolution of the screen process prints. This way, a location of the walls on the tall's slopes was hoped for, which was not possible on the surface. In the illustrated model, two high-ohmic anomalies can be traced at 4.0 m and 11.0 m, lying up to 2 m below the surface. Since these anomalies occur in all 20 parallel profiles, it can be assumed that they are related to the remains of city wall structures.

3.5.2. Crosshole Investigations in 2007

by Dietmar Biedermann

Fig. 3.48 Geological depth profile (Source: BAI/GPIA).

Fig. 3.49 Insertion of the borehole equipment (Source: BAI/GPIA).

The informative capacity of geophysical examinations is usually limited to a few metres below the surface of the terrain to be explored. The resolution accuracy declines with increasing depth, independent of the method used. This applies to both wave-based methods such as ground radar and seismology and potential drop methods such as geoelectricity (*Fig. 3.52*) and geomagnetism. This circumstance is particularly disadvantageous when it comes to very large excavation sites like the Tall Zirā'a. Where excavation depths of 18 m and more are necessary these methods cannot provide any information on structures buried in the deeper layers, especially if there are several archaeological strata.

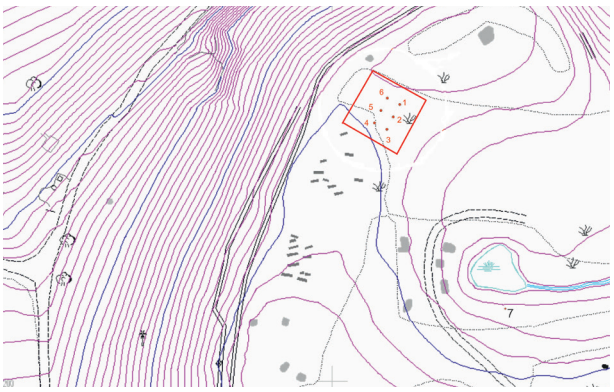
This problem can be solved by the method of crosshole examinations. For this, two boreholes are drilled at a distance of several metres (*Fig. 3.48*). Depending on the method applied, either ground radar antennae or geoelectric probe heads are lowered into these boreholes (*Fig. 3.49*). Afterwards the terrain between them is explored geophysically, thus achieving a much better resolution in the deeper strata than would have been possible with measurements from the surface. In order to find out whether crosshole examinations can be conducted on the Tall Zirā'a with its partially very complex layering, the engineering office 'Hani Karasneh' from Irbid was consigned in 2007 to drill six boreholes 7 m deep and then conduct geoelectric measurements. The holes were drilled by means of the dry drilling method with air flushing. They were driven in the north-western area of the tall. The location and orientation of the drillings is represented in *Figs. 3.50* and *3.51*.

In order to meet archaeological requirements in terms of precision the electrodes were placed at a distance of 0.3 m from each other, allowing an object resolution of approx. 0.5 m. The measurements were conducted by means of a combination of surface and depth soundings.

The boreholes were regularly spaced in a grid of two parallel rows, each with three drillings set at a distance of 2.5 m from each other. The measurements were carried out by means of multielectrode equipment developed by the company 'Erich Lippmann Geophysical Instruments' that allows simultaneous activation of 50 electrodes.

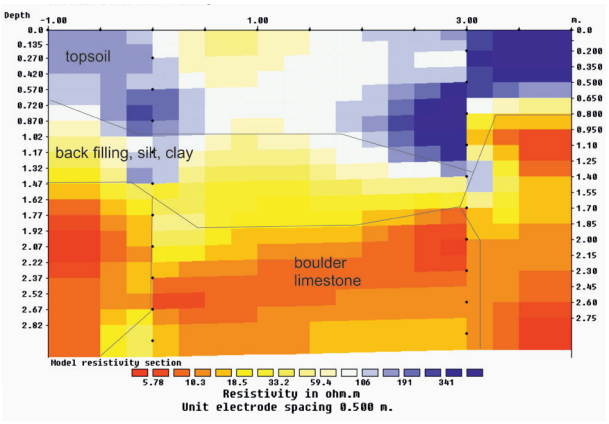
In the course of the works on the Tall Zirā"a multiple measurements from borehole to borehole were conducted to assemble a database for future processing.

The data obtained could later be processed by a mathematical inversion programme and then be converted into depth cuts. The following figure presents two selected depth cuts. The first figure shows an image along the 2 m x 6 m grid, the second one a profile running at right angles to it. Areas with low conductivity are represented red, those with better conductivity are blue. *Graph 3.8*, showing the first profile between borehole 1 and borehole 3, reveals a filling zone (yellow) approx. 1 m beneath the parched surface (blue), that clearly contains structures at 2 m, 6.5 m, and 10.5 m. During the excavations in the years 2008 to 2011, they could be identified as large edificial structures.



Figs. 3.50–3.51 Location and orientation of the drillings carried out in 2007 (Source: BAI/GPIA).

Fig. 3.52 Geoelectric depth profile at the north-eastern side of the tall (Source: BAI/GPIA).



Graph 3.7 Profile of borehole 2 and 3. Iteration 2 Abs. error = 28.4 % (Source: BAI/GPIA).

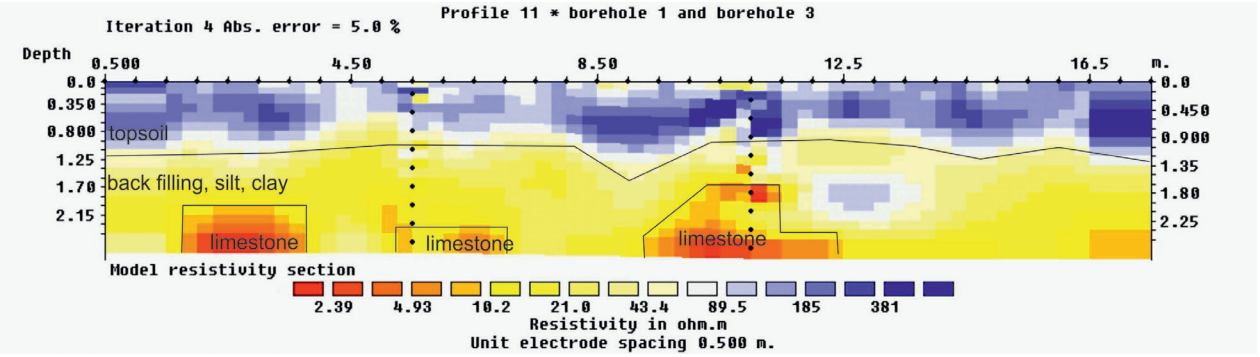
Graph 3.7 shows the same depth sounding. A surface layer of approx. 0.6 m is followed by a filling layer, which in turn is followed by a zone filled with rocks (red). In this case, however any further distinction cannot be made due to the limited resolution of the geoelectrical equipment.

When combining the depth cuts of all measurements conducted, structures consisting of single limestone rocks are discernible. Naturally, no conclusions pertaining to the form and function of possible buildings can be drawn from the single measurements.

To summarise, this method definitely appears to be very promising for future survey tasks since it yields a higher resolution of images taken in greater depths or regardless of the depth required than measurements conducted only from the surface.

However, even the method of crosshole examinations has its limits in that it cannot provide further insights when the excavation circumstances are complex since then the method-inherent resolution of the geoelectrical equipment is only approx. 0.2–0.3 m and thus cannot depict more delicate structures.

Another disadvantage of crosshole investigation is that in the process of drilling the boreholes parts of the archaeological strata are destroyed. However, this destruction is actually only very marginal.



Graph 3.8 Profile of borehole 1 and 3. Iteration 4 Abs. error = 5.0 % (Source: BAI/GPIA).

3.5.3. Seeing Beneath the Ground—Geomagnetic Prospection in 2014

by Knut Rassmann/Samantha Reiter

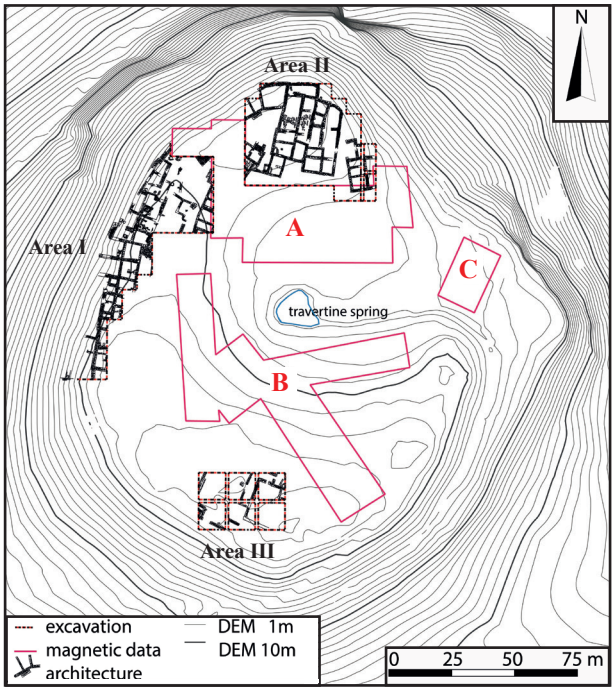


Fig. 3.53 Tall Zirā'a. Overview of the location of the magnetic prospection. Archaeological remains of Stratum 3 (Source: K. Rassmann/S. Reiter).

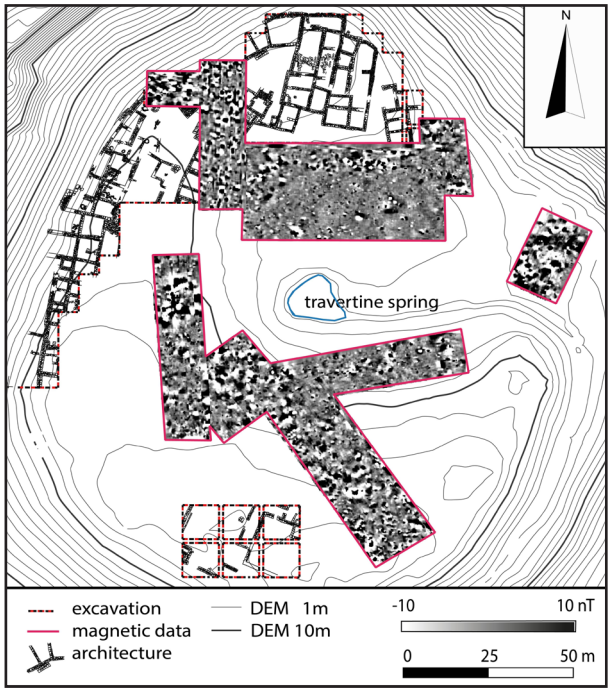


Fig. 3.54 Tall Zirā'a. Overview of the magnetic prospection (Source: K. Rassmann/S. Reiter).

The 'Technical Department of the 'Romano-Germanic Commission of the German Archaeological Institute' in Frankfurt conducted a magnetic prospection campaign on Tall Zirā'a in 2014. This campaign was intended as a means of revealing architectural remains outside the excavation area so that they might be interpolated into walls and building structures along the periphery of the excavation.

To this end, the team surveyed three disparate parts of the tall (Area A–C; see *Fig. 3.53*) by means of a high-resolution SENSYS MAGNETO ARCH five sensor array. Tall Zirā'a's magnetic prospection potential is limited by its many layers and the low magnetic contrast of the limestone which was the principle building material used on site. Despite these limitations, the magnetic prospection revealed some indications of higher concentrations of building remains and a smaller number of walls within an area of 0.5 ha.

3.5.3.1. Technical Equipment and Data Processing

The prospection was conducted by a 5-channel magnetometer (SENSYS MAGNETO ARCH) mounted on a hand-propelled fibreglass carriage. The gradiometers were set at 0.25 m or 0.5 m intervals. A walking pace of c. 4–5 km/h yielded a mesh of 0.25 m/0.50 m by approx. 0.06 m–0.08 m. The magnetometer systems used 5 FGM-650B tension band fluxgate vertical gradiometers with 650 mm sensor separation, a ±3000 nT measurement range and 0.1 nT sensitivity. The prospection was organised in small rectangular fields as close to the excavation areas as possible. Although the corner points of the prospection areas were measured by DGPS, the carriage was also combined with an odometer in order to provide the most precise location information possible for the measurment lines.

3.5.3.2. Data Processing

The SENSYS MonMX, DLMGPS and MAGNETO®-ARCH software package was used for data acquisition, primary data processing, interpolation and export. Because each track contained the measurements of the 5 or 16-channels and the DGPS data, it was saved separately. Postprocessing, however, was completed with Oasis

montage 8. To effectuate the changeover, the results were exported as surfer 7 file (which can be easily imported into GIS). The maps presented here were produced with Quantum GIS 2.8. The use of surfer 7 files enables the modification of threshold and colour scale. Based on the surfer 7 files, contour maps in two different resolutions were calculated by the GRASS too r.contour.step. The first of these was completed with a range from -100 to +100 nT in classes of 10 nT which should visualise the locations of basalt stones and iron contamination. A second map showing a range -10 to +10 nT in classes of 1 nT objects visualises objects which have less magnetic contrast. The latter can be used to analyse data with lower contrasts, such as limestone architecture.

3.5.3.3. Methodological Remarks

Magnetic prospections on multi-layer settlements (especially talls) are both complicated and challenging. The long-term use of sites leads to numerous overlapping archaeological features from different occupation periods. Magnetic prospection normally detects structures up to a depth of 1.2 m–1.5 m. Naturally, in those instances in which the structures overlap, one is faced with the problem of bringing the structures thereby revealed into the appropriate chronological order. The contrast of an anomaly depends upon the strength of its magnetic field as well as its depth (distance to the device). This means that an object with a strong magnetic field, like a burnt brick would produce a clearer signal at -0.8 m than an unburnt clay brick at a depth of 0.4 m.

A further disadvantage to the Tall Zirā'a prospection was the necessarily small size of prospection areas. The analysis and interpretation of magnetic data gets easier with larger prospection areas. The reading of magnetic data has a great deal to to do with pattern recognition. For example, it is easier to understand a Copper Age settlement with numerous burnt houses within a large prospection area stretching over dozens of ha than it is to come to grips with a small area on a multi-layer settlement. This problematic constellation often becomes even more complicated with recent contamination or destruction events. Despite these limitations, prospections on talls are often successful and deliver valuable information about the upper layers of the sites, such as in Uivar, Roumania[15], Okolište[16], Tall Chuēra[17] and Tall ar-Rauḍa (Tall al-Rawda)[18].

3.5.3.4. Results

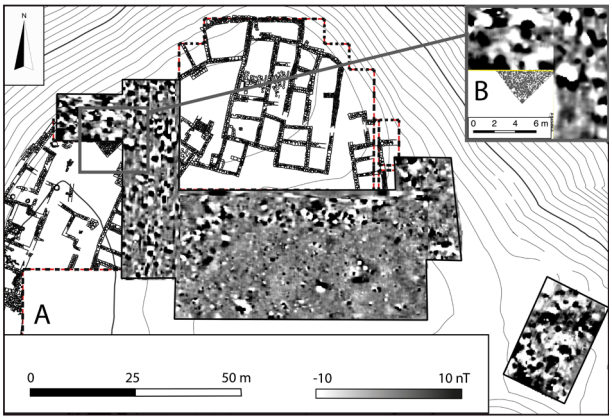


Fig. 3.55 Northern area of Tall Zirā'a. Magnetic prospection with detail of the tower base (Source: K. Rassmann/S. Reiter).

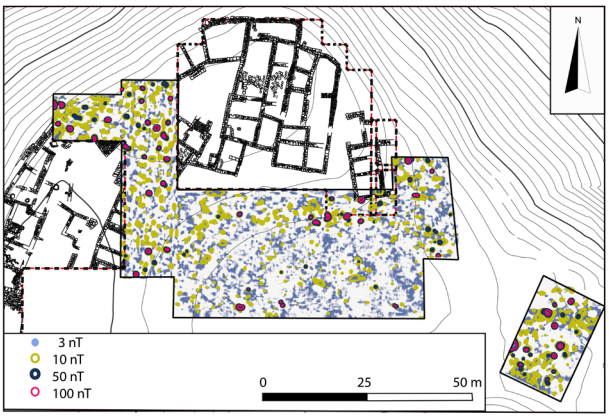


Fig. 3.56 Northern area of Tall Zirā'a. Contour map of the magnetic prospection (Source: K. Rassmann/S. Reiter).

Aside from the grey-scale maps (*Figs. 3.54, 3.55* and *3.57*) another key element for analysing the data are the contour maps, especially with a resolution of -10 to +10 nT. As was mentioned above, the coarser resolution of 10 nT can be used to reveal iron objects or larger basalt stone. The large excavation area is helpful insofar as it allows us to detect more general linear patterns (like the orientations of walls) in the magnetic data. Magnetic data immediately adjacent to the excavation are especially valuble in order to determine whether or not all walls are truly visible in the magnetic data. As mentioned, the low contrast of limestone was a serious limitation to our prospection. This is most clearly apparent in the coarse visibility of the base of the tower in the northern area (*Fig.*

15 Schier – Drașovean 2004, 151.
16 Hofmann et al. 2007, 55 f.
17 Meyer 2010, 199 ff.
18 Gondet – Castel 2004.

Fig. 3.57 Southern area of Tall Zirā'a. Magnetic prospection (Source: K. Rassmann/S. Reiter).

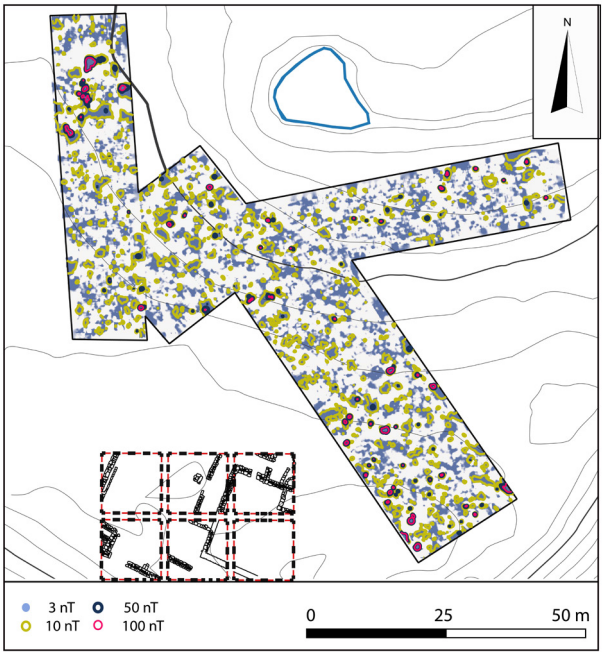


Fig. 3.58 Southern area of Tall Zirā'a. Contour map of the magnetic prospection (Source: K. Rassmann/S. Reiter).

3.55). The excavation data opens a window from which one might reconstruct the course of the tower base in the magnetic data. However, without these data, the magnetic signature is not clearly interpretable.

Another source for the analysis of the magnetic data are the architectural remains which are visible on the surface of the ground. In some spots, building materials were only partly covered by topsoil. The majority were limestone with some (much rarer) basalt stones. As expected, the limestone demonstrated low magnetic contrast which was not clearly visible in the magnetic data while the basalt elicited a clear response.

In the case of the magnetic data from Tall Zirā'a, four valuable classes has been found within the contour map (3 nT, 10 nT, 50 nT and 100 nT—*Figs. 3.56* and *3.58*) The 3 nT line represents mainly limestone while the 10 nT and 50 nT presumably represent basalt. Behind the 100 nT line, one might assume the presence of iron objects and/or larger basalt stones.

A more general trend which is remarkable would be the concentration of basalt stones close to the excavation areas (*Figs. 3.54, 3.55* and *3.57*). On the top of the tall close to excavation Area II is an area with a lower density of magnetic anomalies which exhibit readings of >10 nT. There are different explanations for this occurance. While it might be possible that the surrounding area simply exhibits fewer architectural remains, other feasible alternatives would be that either the building remains which are present were covered by a massive layer of toposoil or that the walls were principlly made of limestone.

Interestingly, the 100 nT and 50 nT contours generally deliver only point structures without noticeable structures. However, the 10 nT and especially the 3 nT contours indicate linear features (presumably wall; see *Figs. 3.56* and *3.58*). The general patterns of these linear features corresponds in part with the excavation.

In order for the architectural remains to be revealed, the 3 nT lines were selected in order to find indications of the courses of wall remains. The anomalies were mainly linear, within a general pattern of lines often with a right angle.

In the northern Area A, the general pattern revealed by the geomagnetics corresponded less with excavation Area II. Interestingly, the orientation was more similar to excavation Area I. Presumably the buildings from Stratum 3 in excavation Area II did not continue in the prospection area.

The linear structure in prospection Area C close to the southern excavation corresponded (at least in part) in terms of its direction. It is obvious that the intensity of dipols is high in the prospection area between excavation Areas I and II. The linear structures are marked by the 3 nT and 10 nT lines as well as by 50 nT.

The geomagnetic prospection revealed some coarse indications of architectural remains. The evidential value for single features is low, but the more general pattern of linear anomalies is more reliable. The evaluation of the geomagnetic data can be done by small test trenches or via the use of other geophysical methods, such as Ground Penetrating Radar (GPR). When one considers the low magnetic contrast of the limestone, GPR has more potential at Tall Zirā'a.

Fig. 3.59 Tall Zirā'a. Contour map (2 nT) with possible indications of walls (Source: K. Rassmann/S. Reiter).

3.6. Landscape Archaeology

by Patrick Leiverkus/Katja Soennecken/Linda Olsvig-Whittaker

Fig. 3.60 Tall Zirā‘a and its enviroment. Photograph taken in 2007 (Source: BAI/GPIA).

Archaeological sites are located within a landscape, the surrounding physical, cultural and biological environment which provides the context, driving factors and the system in which an ancient settlement functioned. The study of the archaeology of such environments, called landscape archaeology, came late to the Near East, in the 1970's but was well developed in Europe for much of the twentieth century[19].

Landscape archaeology attempts to describe and understand spatial and functional relationships of features such as settlements, roads, installations, fields, etc. with their physical, ecological and cultural environment. Important questions of this research discipline are, for example:

- What is the importance of water in determining site locations?
- How does political change drive the location of roads?
- What are the patterns of land use by settlements?

Sometimes there is a wealth of data already available to address such questions, which has not yet been examined in the context of landscape. This is particularly true for archaeological surface field surveys in which information about location, distribution and organisation of past human cultures across a large area are collected.

Surface survey results can be studied spatially against physical and ecological features using GIS methodology; and can also be assessed with knowledge of ancient trade routes, political boundaries, etc. For this work, GIS systems are invaluable and have become freely available for the individual user via tools such as Google Earth and QGIS, greatly enhancing such work.

In the years 2009 to 2012 a survey in Wādī al-'Arab and Wādī az-Zaḥar was carried out by the Biblical Archaeological Institute Wuppertal (BAI) and the German Protestant Institute of Archaeology (GPIA), in order to get more information on the settlement patterns in the environment around Tall Zirā'a and in different periods (*Chap. 3.6.1.*)[20]. The aim was to get a thorough understanding of the landscape in which the Tall Zirā'a is the most prominent archaeological site. At the very heart of such an exploration are the questions of settlement pattern, distribution, relations and relative importance through time. Furthermore, the Wādī al-'Arab is one of the few easily passable ascents from the Jordan Valley to the Irbid-Ramtha basin and so has always been part of trade routes from the Mediterranean coast to Dimašq (Damascus), Baġdād or 'Ammān (*Figs. 1.21–1.23*). Questions of the actual trade routes through this area and their shifting importance arise. The survey kept a special focus on evidence that could help answer these questions.

Furthermore, the location of archaeological sites and features have been mapped and preliminary results have been analysed using Correspondence Analysis (DCA) and Canonical Correspondence Analysis (CCA).

This investigations will be described in the following sections. Further and extensively presented results of the surface survey will be published in Volume 8.

19 Wilkinson 2003, 10 f.

20 Leiverkus – Soennecken 2016, 509–518.

3.6.1. The Wādī al-‘Arab Survey

by Patrick Leiverkus/Katja Soennecken

Fig. 3.61 Area of investigation: Zone A (Tall Zirā‘a hinterland) and Zone B (Wādī al-‘Arab region) (Source: BAI/GPIA).

The Wādī al-‘Arab has been surveyed several times before. The most notable surveys are the ones by N. Glueck in 1942[21], by S. Mittmann in 1963–1966[22] and by J. W. Hanbury-Tenison in 1983[23]. While all of them are valuable and gave rich sources of information, they cannot give the completeness and level of detail needed for the purpose of the ‘Gadara Region Project’. The former two surveys had a much broader area in view and therefore could only cover the major sites of the area of interest. J. W. Hanbury-Tenison’s survey in its level of detail is much closer to the ‘Gadara Region Projects’ aims, but is restricted to two areas and does not cover the full Wādī al-‘Arab (*Fig. 1.27*). Furthermore, almost 30 years later, a fresh look on all the given data seems appropriate considering the now much more elaborate stratigraphy and typology of the region is available due to the continuing efforts of the ‘Gadara Region Project’.

With the knowlegde of the previous surveys and the target of a hinterland survey in mind, the approach chosen was two-fold: On the one hand revisiting the known sites enriching the information about them, on the other hand filling gaps by surveying the areas that had not been surveyed before. During the three seasons (2009 to 2012) the hinterland of Tall Zirā‘a was examined. The area of investigation was divided into Zone A (Tall Zirā‘a hinterland; c. 20 % of the survey area) and Zone B (Wādī al-‘Arab region; c. 80 % of the survey area), together covering about 400 km^2 from Tall Zirā ʾa to Irbid in the east, and north to the Yarmūk River watershed (*Fig. 3.61*). An effort was made to cover Zone A completely, whereas in Zone B the survey concentrated on the known larger sites.

The exact location of all sites was measured by a GPS, pottery and small finds were collected for comparison and all descriptions of the current state were refreshed. Detail and overview pictures taken. All gathered information was entered into a database.

21 Glueck 1951a.

22 Mittmann 1970.

23 Hanbury-Tenison et al. 1984, 385–424; Hanbury-Tenison 1984, 230 f.

Fig. 3.62 Site 215/226-8. Ottoman penstock mill at the south side of the Wādī al-'Arab (Source: BAI/GPIA).

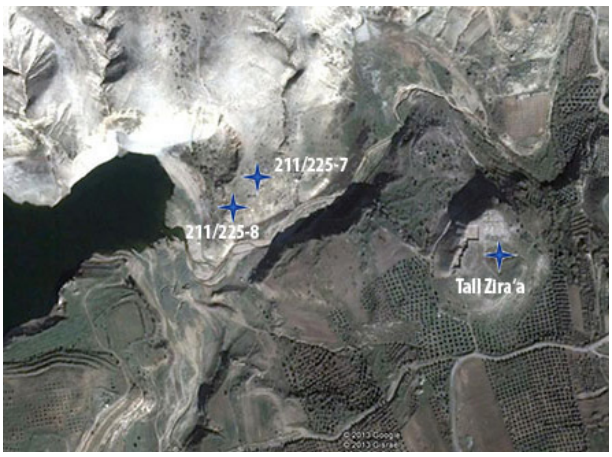


Fig. 3.63 Location of Sites 211/225-7 and 211/225-8 in relation to Tall Zirā'a and Gadara (Source: BAI/GPIA).

Fig. 3.64 Site 211/225-8. Architectural remains dated to the Middle Bronze Age (Source: BAI/GPIA).

Fig. 3.65 Site 219/227-1. Overview on Tall Kinīse (Source: BAI/GPIA).

In the 2009 campaign 78 sites were recorded; 30 of them have not been known before. Over 80 % of the sites relate to the Classical era. The other sites were inhabited in the Bronze Age, Iron Age or different Islamic periods. Lithic sites could not be discovered. The large Tall Qāq (Ḫirbet Bond) and Tall Kinīse (Ra'ān; Site 219/227-1; *Fig. 3.65*) were revisited. The area around the Wādī al-'Arab Dam was covered as well, which was partly surveyed by T. M. Kerestes in 1978 and J. W. Hanbury-Tenison in 1983 (*Chap. 1.4.3.2.*). Furthermore, the slopes of the Wādī al-'Arab from Tall Zirā'a upwards to the region of Ṣēdūr and Dōqara were surveyed. Most parts of this area had not been surveyed in detail before. While Ṣēdūr and Dōqara are mentioned by S. Mittmann, the surroundings revealed many sites which shed new light on the settlements' agricultural subsistence.

The northern slopes of the wādī directly upwards from Tall Zirā'a are characterised by a dense occurrence of water sources. Many of the sites found there relate to them. This can shed further light on water management in the region (*Fig. 3.62*). One smaller site directly across the wādī from Tall Zirā'a deserves special attention. This site was published first by T. M. Kerestes in 1978 (Site 2 in the Wādī al-'Arab; i.e. Site 211/225-8; *Fig. 3.64*) and identified to be of Middle Bronze Age date[24]. Its position relates this site directly to Tall Zirā'a. Together they control a narrow passage in the wādī and of course a direct line of sight is given between them (*Fig. 3.63*). Just 50 m up the slope another previously unknown site could be recorded with architectural remains of the Roman period (Site 211/225-7; *Figs. 3.63* and *3.65*). This site does not only overlook the lower wādī, as the nearby older one, it has also a direct line of sight to Gadara which is missing in the lower position. This gives a hint on the shifting of central settlement from Tall Zirā'a to Gadara during the Classical era.

In the Wādī al-'Arab above the Tall Zirā'a five penstock mills were recorded together with two dams (see e.g. *Figs. 1.37* and *3.62*). J. W. Hanbury-Tenison only mentioned three mills. All of them can be dated to the Ottoman period.

24 Kerestes et al. 1977/1978, 119.

Fig. 3.66 Site 214/227-3 on the edge high above the Wādī al-'Arab (Source: BAI/GPIA).

Fig. 3.67 Site 233/229-1. Ottoman mosque in Ḫarğā with a Roman or Byzantine sarcophagus (Source: BAI/GPIA).

Fig. 3.68 Site 224/217-3. Dolmen north-west of Kafr Yūbā (Source: BAI/GPIA).

Fig. 3.69 Site 228/213-5. Roman – Byzantine sarcophagus fragments and grave niches near 'Aydūn (Source: BAI/GPIA).

During the season of 2010, 57 sites were recorded. While during the first season of 2009 the lower part of the Wādī al-'Arab from North Šūna up to Dōqara was surveyed, this season the survey covered the area from Dōqara up to the vicinity of Irbid. The nature of the landscape changes while approaching the upper part of Wādī al-'Arab. The wādī is deeper incised and one can find the settlements mostly at the edges high above the wādī (*Fig. 3.66*). The majority of the ancient settlements were known before by the work of N. Glueck and S. Mittmann.

In Season 2011 the close inspection of the hinterland of the Tall Zirā'a (Zone A) was enhanced with a broad view on the Wādī al-'Arab region by revisiting the major sites in the whole area (Zone B). The exact location of all sites was measured by GPS, pottery was collected for comparison and descriptions of the current state were refreshed. Thus several caves, graves, dolmens, cisterns, water basins, and a water mill could be documented (*Figs. 3.67–3.69*).

Altogether 206 sites were identified, georeferenced and described, of which 30 were previously undescribed. It was possible to discover a representative amount of pottery from all sites, a concise overview of the occupational history of the Wādī al-'Arab can be derived.

One important result of revisiting the previously published sites during the survey in the Wādī al-'Arab is the observation of heavy destruction on many sites in the last decades. The rapid increase of deterioration is alarming. Only recently a large tall with Roman, Byzantine and Islamic occupation (no. 026 in the J. W. Hanbury-Tenison Survey[25]; Site 211/224-2; *Figs. 3.70* and *3.71*) south of Tall Zirā'a has been completely destroyed by bulldozing. Ancient remains could be seen covering an area of approx. 130 m x 90 m—some of the stones still *in situ*, but most of them shoved away. The section produced by a bulldozer showed at least two layers of Roman – Byzantine settlement, divided by layers of ash (*Fig. 3.71*).

Almost all of the modern villages date back at least to the Roman – Byzantine period, some of them to the

25 Hanbury-Tenison et al. 1984, 390.

Fig. 3.70 Site 211/224-2. Settlement on a tall (Source: BAI/GPIA).

Fig. 3.71 Site 211/224-2. Two layers of Roman – Byzantine settlement divided by layers of ash (Source: BAI/GPIA).

Fig. 3.72 Site 228/221-1. Ḫirbet Srīs. Robbery trench with a wall, around it burnt vegetation (Source: BAI/GPIA).

Fig. 3.73 Site 220/224-1. Grave entrance with robbery trench (Source: BAI/GPIA).

Iron or Bronze Age. Only very few of the ancient settlements are not covered and destroyed by modern settlements. That includes most of the Islamic history of the Wādī al-ʻArab. It is especially sad to note that none of the old mosques in the area of the wādī, some oft them dating back to the Medieval period, are in existence today. The oldest mosque in the area, to our knowledge, can be found in the village Ḫarğā (Site 233/229-1; *Fig. 3.67*). Even this one is in a very bad condition.

Despite the continuing demolition of the old sites, a huge amount of pottery from all sites could be recovered. They give us a precise insight of the wādīs' history.

Several smaller sites are destroyed by agricultural activities (especially olive tree cultivation) which leaves sites in an unrecognizable state. These observations lead the members of the 'Gadara Region Project' to the firm commitment to execute this survey not only as a necessary complement to an excavation but also as a preservation of knowledge on the history of the Wādī al-ʻArab, most of which will be lost in the near future.

Apart from the heavy destructions another problem emerged clearly: most of the unknown or at least unpublished sites showed traces of recent unauthorised excavation/digging, mainly concentrating on tombs (metal detectors) and removing most of the finds. In the following two examples will be presented.

Site 228/221-1 is first described by S. Mittmann (M 059)[26] and called Ḫirbet Srīs and comprises 1.5 ha. By visiting it, the vegetation was burnt down (*Fig. 3.72*). Pottery, *tesserae*, a cistern and a robber trench (three layers of ashlar masonry visible) could be found. The pottery could be dated to Roman, Byzantine, and Islamic (Umayyad) periods.

Site 220/224-1 was not published before and is located north of Fūʻarā, south-west of Wādī al-ʻArab. An area of approx. 2 ha (250 m x 80 m) was covered with pottery, *tesserae* and some pieces of glass. Additionally cisterns, a quarry, some natural caves and graves were found (*Fig. 3.73*). Most of the graves were only visible because of recent robber trenches and nearly all of them were shaft tombs. In one robber trench ashlar blocks could be seen. The pottery dates to Roman, Byzantine, and Islamic periods and suggest at least two phases of occupation.

26 Mittmann 1970, 28 no. 59.

3.6.2. Landscape Archaeology and its Methods Used in the 'Gadara Region Project'

by Linda Olsvig-Whittaker

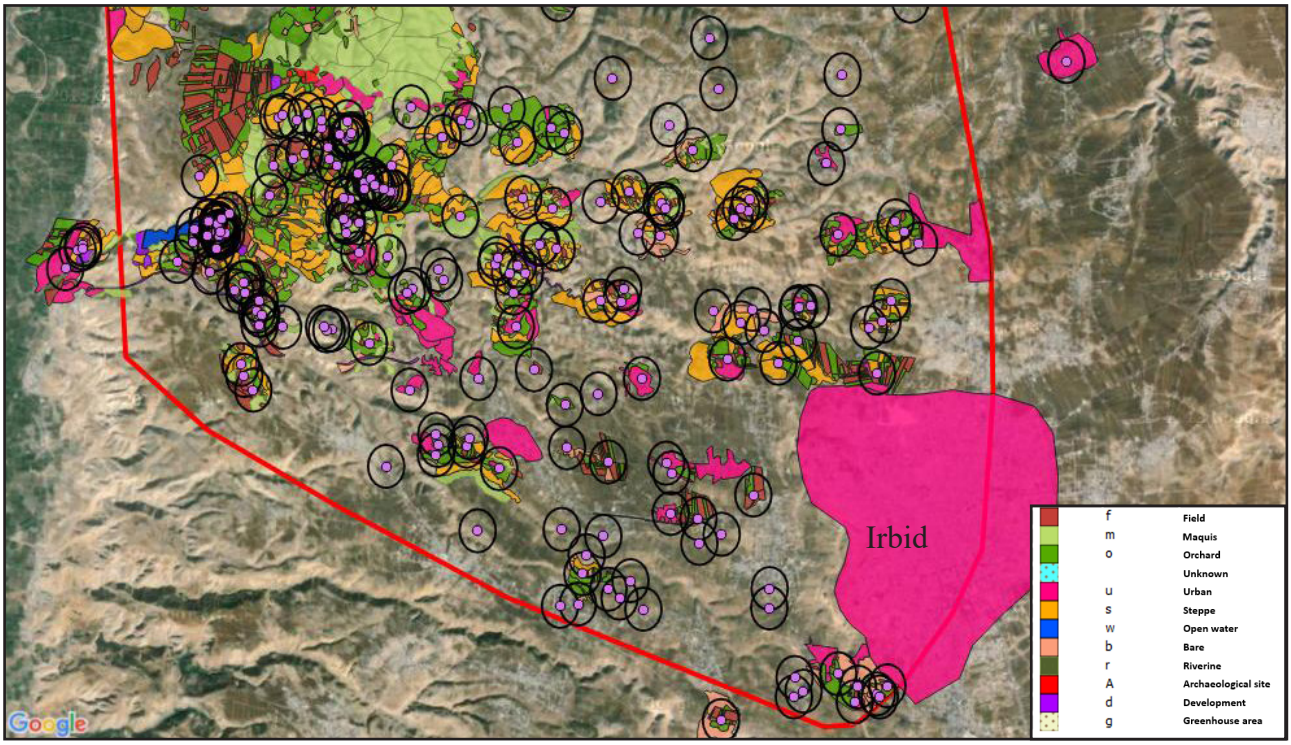


Fig. 3.74 Habitat mapping of Zone A and Zone B. Large scale (Source: L. Olsvig-Whittaker).

Within the 'Gadara Region Project' several methods of Landscape Archaeology have been used. But this work in 2016 is still in its very early stages and methods are likely to change substantially as the research continues. For this reason only preliminary results are given in this chapter. A full report of results will be presented in Volume 8. So far, habitat mapping according to methods developed in BioHab[27] and EBONE[28] as well as the multivariate analysis methods of Canonical Correspondence Analysis (CCA)[29] and Detrended Correspondence Analysis (DCA)[30] have been used as methods. They will be described in the following sections.

3.6.2.1. Habitat Mapping

Habitat mapping as developed in BioHab and EBONE uses physiognomic categories—growth form and height categories—rather than species composition as the basis for classification of habitat. The system is now widely used for European habitat monitoring since the reliance on remote sensing and orthophotos enables coverage of large areas in a standardised fashion. The mapping begins from aerial photographs or remote sensing images. In the present study, the images used were from Google Earth Satellite Imagery[31] maps at different resolutions, using the Open Layers Plugin option in QGIS 2.12[32].

The boundaries of the survey area and the sites were superimposed on a Google Earth image, and sites were mapped from their centroid coordinates on QGIS (*Fig. 3.74*). Half kilometre buffers around each site were done in QGIS.

Originally the entire area was to be mapped to habitat, but this proved very time consuming. Instead each site is currently being mapped by eye and classified based on the Google Earth images (see *Fig. 3.74* with Site 219/221-1 as an example). Polygons were drawn by eye at the 1 : 10,000 level (at time reduced to 1 : 5,000 when clarity was needed). The landscape observed by satellite was relatively simple, and was intuitively classified into crude categories as orchard, maquis, steppe (which later proved to be mostly open shrubland), urban, riverine, field, bare,

27 Bunce et al. 2011.
28 Olsvig-Whittaker et al. 2011.
29 Jongman et al. 1995, 137–144.
30 Jongman et al. 1995, 105–109.
31 https://en.wikipedia.org/wiki/Google_Earth (12.7.2016).
32 https://en.wikipedia.org/wiki/QGIS (12.7.2016).

water, archaeological site, and development (not urban, can include military bases, water installations, etc.). The ground verification started in summer 2016.

For the multivariate analysis, categorical data were used. The habitat mapping provided the environmental matrix data as the percentage of the area around each site in each habitat category. The response 'species' variables were of two types: epoch classification and size categories. These variables were provided as follows.

Habitat Categories Used in this Mapping (from QGIS Properties of the Layer)

Habitat categories used in this mapping are (see the legend in *Figs. 3.74* and *3.76*):

- Field (brown colour)
- Maquis (light green colour)
- Orchard (dark green colour)
- Unknown (turquoise colour with red point
- Urban (pink colour)
- Steppe (yellow colour)
- Open water (blue colour)
- Bare (light pink colour)
- Riverine (olive green colour)
- Archaeological site (red colour)
- Development (purple colour)
- Greenhouse area (white colour with brown point)

Visually on Google Earth satellite images, steppe, fields and bare areas are difficult to distinguish, but fields are generally rectangular, while steppe has some vegetation (obviously grading into bare areas). Maquis is more open vegetation. Orchards (presumably nearly all olive groves) are regular in form. Urban areas are quite clear with their roads. Riverine vegetation is relatively dark, dense and linear. Archaeological sites are a little difficult but can be checked as known locations. Development is a catch-all term for military camps, water systems, and other non-urban constructions. Greenhouse areas look like fields but are white from the plastic coverings.

Ground verifications started in summer 2016 for the habitats mapped from satellite images. Hence the categories used are preliminary. The site types are categorised as follows:

- Building
- Cave
- Cistern
- Installation
- Quarry
- Scatter
- Settlement
- Tall
- Tomb

Natural vegetation appeared to include a range from steppe to shrubland to riverine forest; anthropogenic landscape (which dominate) included fields, urban areas, large installations and large archaeological sites. Open water, though rare, was important.

These are only preliminary findings. The immediate next steps will be to develop automated mapping on GIS of the habitats for the entire area, based on algorithms derived from the habitat polygons drawn by eye. This will make possible the analysis of all sites much more rapidly and with different scales of relation to environment.

Epoch Classification

Epochs were used as provided from the survey database, but broader groupings were made as follows in order to provide enough sites in each class for data analysis:

- Neolithic and Chalcolithic
- Bronze Age
- Iron Age
- Hellenistic
- Roman
- Byzantine
- Islamic
- 'Undetermined' and 'modern' not into a group

Fig. 3.75 Site 220/225-1. Agricultural installation (Source: BAI/GPIA).

Size Categories

Site size is a continuous variable. However to be used as an environmental variable in the analysis, this had to be changed to a categorical variable.Three very coarse size categories are used in the analysis:

- A few metres in area
- A dunum (0.1 ha) in area or less
- Several dunums in area

An Exapmple for Habitat Mapping: Site 220/225-1

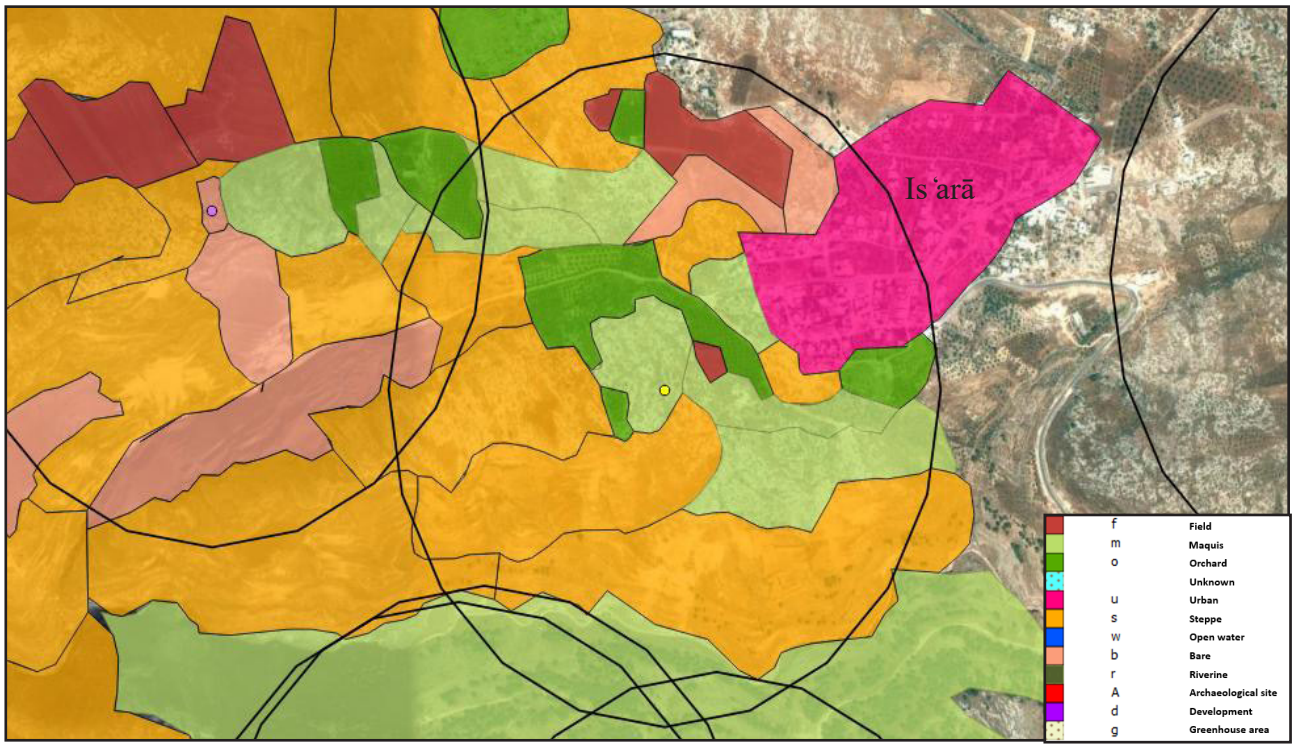


Fig. 3.76 Habitat mapping. Small scale. Site 220/225-1 in the middle (yellow) and Site 219/226-1 on the left (pink) (Source: L. Olsvig-Whittaker).

Site 220/225-1 is located south-west of the modern village of Is'arā at the western slope of Wādī al-'Arab (*Fig. 3.76*). A part of the site is still used for agriculture. Olive trees are planted in the northern part of the site. Pottery collected dates it to late Roman to Umayyad periods. Former surveyers described Iron Age and Hellenistic occupations, but this could not be verified[33]. At least six cisterns with various sizes have been found and documented as well as some agricultural installations (*Fig. 3.68*). In a 0.5 km radius, the habitat is dominated by steppe, but the direct surrounding is characterised by maquis. Towards the modern settlement, anthropogenic landscape with orchards and fields increases.

3.6.2.2. Multivariate Analysis of Assemblage Patterns

Multivariate analysis is a form of exploratory data analysis which uses multivariate statistics to observe the behavior of multiple response variables, usually in a regression based approach. In this particular case the response variables are multiple habitat types and multiple size categories for sites. The driving 'environmental' factors are site attributes of epoch and size. Multivariate analysis has been used successfully[34] in a manner similar to its more common usage in community and landscape ecology[35].

In these studies, multivariate analyses are used for the statistical correlation of archaeological sites and habitat. Multivariate analysis—indirect ordination and direct ordination—using CANOCO 5[36] was selected as

33 Mittmann 1970, 31 f. no. 67.

34 Olsvig-Whittaker et al. 2015.

35 Jongman et al. 1995.

36 Šmilauer – Lepš 2014.

the tool for assessing patterns and correlations in site attribute and habitat attribute data. While ordination has long been in use in community ecology, its application to archaeological data is somewhat more recent[37]. There is a vast literature on the subject of ordination and many algorithms to do it[38].

In general, ordination methods help to find structure in complex matrix data sets, i.e. site by attribute or habitat by attribute tables. In the case of direct ordination, this is basically a regression of the site data versus the habitat data, conceptually similar to multiple regressions. Direct ordination can be used either heuristically or as a statistical test of correlation with measured driving factors, using Monte Carlo simulations.

When a heuristic search for pattern is desired, indirect ordination is the proper tool. Most algorithms for indirect ordination calculate similarity/dissimilarity between habitats or sites and their attributes, from a single table. Results are projected onto two dimensions in such a way that similar habitats or sites and most closely correlated attributes are plotted close together, and dissimilar habitats or sites and their attributes are placed far apart[39].

Most importantly, in both direct and indirect ordinations, the scatter plots for habitat and site values can be superimposed. In this way the habitats factors driving the pattern in sites can be seen, and *vice versa*.

3.6.2.3. Detrended Correspondence Analysis (DCA)

Detrended Correspondence Analysis (DCA) was used on the habitat matrix, with site data carried passively, to determine major trends in variation of habitat distribution and the response of site factors to them. DCA is an indirect ordination method using only one matrix. It is an analytical approach in its own right, and is also a necessary first step in every CANOCO analysis, regardless of algorithm. The first information obtained in DCA is the habitat turnover along the first gradient (Axis 1, horizontal), which is either short (less than four standard deviation units in habitat composition), in which case a linear model such as PCA or RDA can be used in subsequent steps. If the gradient is longer than four standard deviation units, a unimodal model such as DCA, or Canonical Correspondence Analysis (CCA) is used in subsequent steps.

3.6.2.4. Canonical Correspondence Analysis (CCA)

Canonical Correspondence Analysis (CCA) is a direct ordination method which correlates two matrices using eigenvector methods. In this study habitat has been used as the 'species' matrix and the two factors of sites size and age as the environmental matrix factors. Monte Carlo tests can be run to determine the significance of the correlation of habitat with site factors.

3.6.2.5. Preliminary Results

A preliminary analysis using DCA and CCA was done of Roman sites, both those on previously occupied locations and those with no previous occupation. By type, the 'New Roman' sites were predominantly installation and scatter (no building). This would fit with a predominantly agricultural expansion.

DCA (*Graph 3.10*) showed a close relationship of larger archaeological sites and open water. The analysis used DCA with supplementary variables. Total variation was 0.84771, supplementary variables accounted for 2.6 % (adjusted explained variation is 0.4 %).

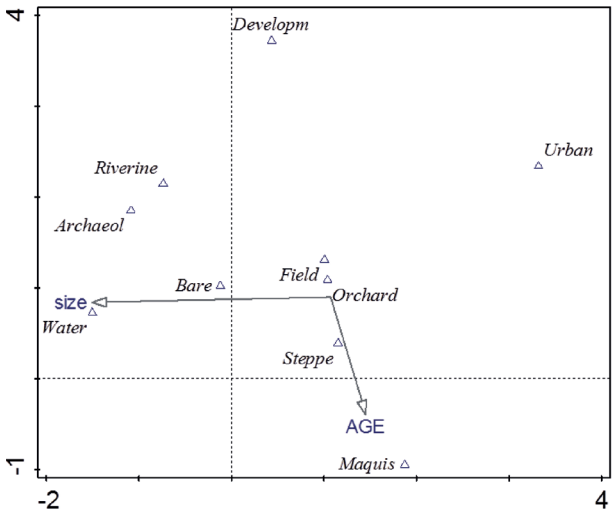
CCA (*Graph 3.9*) was run on habitat with site size and age as environmental variables. Total variation was 0.84771, explanatory variables accounted for 2.6 % (adjusted explained variation is 0.4 %). Permutation tests on all axes provided a probability of correlation of $p = 0.304$, hence the Monte Carlo testing of the correlations of site and habitat factors was not significant.

The ordinations, despite the lack of statistical significance of correlations, suggest that natural open water, riverine habitats, and large archaeological sites all seemed connected. In addition, CCA indicated a correlation of older (more successful or established?) sites with open water. Water was of course critical for human settlement, and it was reasonable that larger archaeological sites would be close to water sources. What was interesting in the CCA analysis was that new Roman sites were less related to water. We knew that Roman engineering both of cistern systems and aqueducts opened new areas (such as plateaus) for settlement and exploitation. Hence the weaker correlation of 'New Roman' sites with water also made sense.

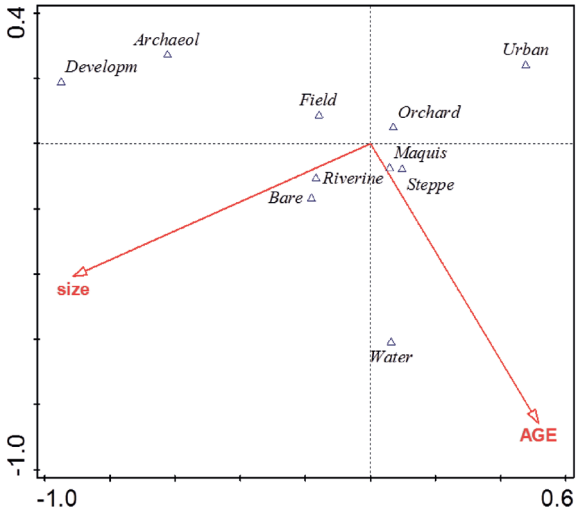
37 However, see Olsvig-Whittaker et al. 2015 for a review and case study.

38 See Jongman et al. 1995 for a review.

39 Peet 1980.



Graph 3.9 Canonical Correspondence Analysis (Source: L. Olsvig-Whittaker).



Graph 3.10 Detrended Correspondence Analysis (Source: L. Olsvig-Whittaker).

3.7. Archaeobotany

by Linda Olsvig-Whittaker

Fig. 3.77 Landscape with olive groves around Tall Zirā'a. Photograph taken in spring 2012 (Source: BAI/GPIA).

Archaeobotany, the study of plant remains from archaeological sites is a relatively new but important and necessary branch of archaeology and an integral part of archaeological projects[40]. While in some cases, plant remains may persist due to the extreme dryness of conditions, in most cases what can be obtained in sites such as Tall Zirā'a will be carbonised plant remains from destruction layers, hearths or middens where hearth remains were deposited.

Most of the findings will be carbonised seeds. These may come either from agricultural and weed species or from natural vegetation, especially where dung was used as fuel[41]. These can be extracted and identified under a microscope. From such carbonised macrofossils it can be learned which plants were raised or traded. Where dung was burned there are clues about natural vegetation.

Until now, very little was known about the botanical remains in Tall Zirā'a. The main plant remains are olive

40 Grieg 1989.

41 See Olsvig-Whittaker et al. 2015.

kernels from 22 contexts dating between the Late Bronze Age and the Umayyad period. It was originally thought that few plant macrofossils were available on Tall Zirā'a, but experience suggests this was more a matter of not sampling specifically for plant remains, and there should be plant materials if one looks for them properly[42].

Sampling for archaeobotanical macrofossils involves specialised sampling and extraction; much small material is lost in dry sifting using classical archaeological methods. In this chapter a preliminary study will be presented. Its aim was to see if more material could be obtained using methods designed for archaeobotanical sampling. While this is strictly a pilot study, the potential for future work is also discussed.

3.7.1. Ecological Background

3.7.1.1. Ecological Background of Northern Jordan

Northern Jordan has a fairly steep gradient from Mediterranean climate in the west (475 mm/year at Irbid) to arid in the east (150 mm/year in Mafraq)[43]. In response to this, according to the excellent review by S. A. Ghazanfar et al. the area around Tall Zirā'a would comprise two major vegetation zones: Mediterranean degraded non-forest vegetation to the west merging into Irano-Turanian steppe to the east, with some minor riverine vegetation in the wādīs[44]. Remote sensing images reveal a mosaic of open shrubland, steppe, farmland, orchards and riverine vegetation, with a predominance of open shrubland to the north-west and a predominance of steppe to the east. The area is generally regarded as transformed and degraded. As for the two major 'natural' vegetation types described by S. A. Ghazanfar et al.:

> "Mediterranean Non-Forest vegetation. Land classification: Northern and southern mountains and foothills. Approx. area: undetermined, Altitude range: > 1000 m; Annual rainfall: 400–600 mm. Localities: Mediterranean region not covered by forests, often treated as degraded forest. Vegetation: Dominant shrubs: *Rhamnus palaestinus, Calicotome villosa, Echinops spp, Dactylis glomerata, Teucriumpolium, Ononis natrix, Ballota undulata, Eryngium glomeratum, Noaea mucronata*".
>
> "Steppe. Land classification: This vegetation forms a strip surrounding the Mediterranean non-forest region, except in the north; excluding wooded areas and cultivations. Altitude range: 1000 m; Annual rainfall: 400–600 mm. Vegetation: Dominated by large shrubs; occasional tree species; composition varies in the north and south. Shrubs: *Pistacia atlantica, Retama raetam, Ziziphus lotus, Z. nummularia, Ferula communis (north), Anabasis syriaca, Artemisia sieberi, Sarcopoterium spinosum* (NE and S Mediterranean), *Tamarix* spp., *Noaea mucronata, Gypsophila arabica, Astragalus spinosus*; geophytes: *Crocus moabiticus. Aspodelus aestivus*, *Drimia maritima; Moraea sisyrinchium*. Biogeography: Irano Turanian; Mediterranean or Saharo-Arabian in parts"[45].

3.7.1.2. Ecological Background of Tall Zirā'a

Tall Zirā'a is situated in a region of rapid transition from Mediterranean to steppe to desert environment[46]. This area has experienced vegetation changes over time due to both climatic fluctuations and human activity, as amply demonstrated by D. Langgut et al. in their analysis of pollen records from several stations along the Jordan, Sea of Galilee and Dead Sea[47]. As already known, this region has experienced periods of extended drought as well as wetter periods, and the pattern of climate change is now available[48]. While pollen analysis gives information on the climate and vegetation of the region, plant macrofossils within a given site can give the human response to changing climate, including crops and in some cases pasture. If it is possible to obtain a good continuous record

Fig. 3.78 Flora at Tall Zirā'a (Source: BAI/GPIA).

42 Helbaek 1969.
43 http://www.jordan.climatemps.com (14.10.2015).
44 Ghazanfar et al. 2013.
45 Ghazanfar et al. 2013, 28 f.
46 Ghazanfar et al. 2013, 28 f.
47 Langgut et al. 2015.
48 Langgut et al. 2015.

of plant remains at Tall Zirā'a, one can connect this agricultural information to the climate information available from regional pollen studies that is now available.

Tall Zirā'a is a major tall which not only sits on a major caravan route and ancient highway of the Near East (see *Chaps. 1.2* and *1.3.2.)*; it is also located in a marginal, ecologically shifting environment, a finger of Irano-Turanian steppe extending into the Mediterranean[49]. If plant remains can be extracted, they should represent local agriculture, long distance trade and, possibly, shifting vegetation composition through time in response to climate change.

3.7.2 Archaeobotanical Background

While little archaeobotanical work has been done on Tall Zirā'a until now, there has been extensive work on sites around the Dead Sea-Jordan River-Sea of Galilee-area which together give a general idea of what has happened over time. Changes should be anticipated related to climatic fluctuations and to cultural changes such as the introduction of vastly improved water management and introduction of better industrial agriculture in Roman times[50].

Changing climatic regimes and anthropogenic influences should be reflected in changing vegetation of the site through time. While northern Jordan experienced the same Late Bronze Age collapse around 1200 BC that was happened around the Eastern Mediterranean, this is mostly attributed to the Sea People[51]. However, climate records around the Dead Sea suggest that a major desiccation of the environment may have also been involved. It should be possible to distinguish that by getting adequate archaeobotanical samples[52].

The work by D. Langgut indicates that drought was a major factor leading to the Bronze Age collapse[53]. Their review of recent studies show a decrease in trees requiring a great deal of water and an increase in the cultivation of dry-climate trees, such as olive trees, during the period between 1250 and 1100 BC. This is most likely a human response to changing climate.

3.7.3. Methods

In May 2014 a preliminary manual flotation sampling of 43 soil samples was conducted by the author of this chapter[54]. The soil samples had been collected at Tall Zirā'a during the past ten years and covered achaeological periods ranging from Early Bronze Age to Mameluk period (see *Tab. 3.1*)[55]. The samples had not been originally collected for flotation sampling, but were contributed for this purpose from the archived soil and soil-like samples stored at the dig house.

Most of the samples contributed for this study were contents of pots, floor fillings, mortar, etc. A detailed listing is given in *Tab. 3.1*. The most productive samples came from hearths, pits, and collapse debris, as might be expected.

The sampling was inspired by work which has been done by the Tel es-Safi/Gath team based at Bar Ilan University (BIU)[56]. The methods which were used by the author of this chapter were recommended by the archaeobotany lab under E. Weiss at BIU as suitable for pilot studies[57]. They are also described by J. Grieg as 'manual flotation' or 'washing over'[58].This is also called bucket flotation and is widely used for pilot studies[59].

Despite the primitive nature of this method it was used successfully in earlier decades and vastly increased knowledge of plant macrofossils. Since its beginnings in the 1960's different methods were developed and it is a standard procedure in excavations worldwide[60].

The bucket and wash over methods were modified by the author of this chapter somewhat to fit the equipment at hand, using local buckets and washtubs, as well as fine-meshed commercial flour sieves. Soil samples varied from a few grams to a kilogram, but no more than a half kilo could be processed at one time (for the process see *Figs. 3.79–3.84*).

The residues were inspected by using an Olympus binocular microscope. The organic residue was put in a plastic Petri plate, and any interesting objects in it (bones, shells, metal, possible and obvious seeds) were

49 Zohary 1962; Ghazanfar et al. 2013.

50 Petit et al. 2006, 179–188.

51 Cline 2014; see http://www.kinghussein.gov.jo/his_citystates.html (9.9.2015).

52 See Olsvig-Whittaker et al. 2015 for analytical methodology.

53 Langgut et al. 2015.

54 Grieg 1989, 32–39.

55 I would like to thank the staff and students of the archaeobotany laboratory at Bar Ilan University, in particular Ehud Weiss and Suembikya Frumin, for their invaluable advice and practical help on methodology and taxonomic identification. Without their help this project would have been impossible. I also wish to thank the staff of the BAI/GPIA for providing the field facilities and samples from which the seeds were extracted.

56 Cf. Frumin et al. 2015.

57 E. Weiss and S. Frumin, personal communication.

58 Grieg et al. 1989, 32–39.

59 See illustration in https://sites.google.com/site/archaeobotany/buckets and https://sites.google.com/site/archaeobotany/buckets2 (4.3.2016).

60 Neef et al. 2012

transferred to a tripartite Petri plate. Those samples which had possible or probable seeds were taken to the Bar Ilan archaeobotanical laboratory, where S. Frumin verified the identification of seeds using the accumulated fossil collection there.

Fig. 3.79. Sieving out large stones and gravel (Source: L. Olsvig-Whittaker).

Fig. 3.80. Pouring soil sample into basin of water (Source: L. Olsvig-Whittaker).

Fig. 3.81 Wash over of water and floating organic material through a sieve (Source: L. Olsvig-Whittaker).

Fig. 3.82 Moving the organic material to a filter paper for drying (Source: L. Olsvig-Whittaker).

Fig. 3.83 Sample poor in organic material (Source: L. Olsvig-Whittaker).

Fig. 3.84 Sample rich in organic material (Source: L. Olsvig-Whittaker).

3.7.4. Preliminary Results of the Archaeobotanical Researches on Tall Zirā‘a

The samples were often rich in mollusk shells and some had vertebrate bones, which have been saved. There were also modern seeds (sometimes rich collections of them) which were saved but not of interest for present concerns. According to L. Kolska, archaeozoologist on the ‘Tel es-Safi Project’, land mollusks often gather to aestivate in soil samples, and ants frequently collect modern seeds in the same samples. This may explain the large cache of modern seeds in one sample. Only carbonised seeds can be regarded as true archaeological specimens.

It should be noted that most of the carbonised seeds were in poor condition, but nearly all were cultivars or weeds[61]:

- *Olea europaea* (domestic olive)
- *Vitis vinifera* (domestic grape)
- *Ficus carica* (domestic fig)
- *Triticum aestivum* (common wheat)
- *Hordeum vulgare* (domestic barley)
- *Vicia ervilia* (domestic bitter vetch)
- *Gynandyris sp* (a wild iris-like geophyte)
- Unknown *Asteraceae* species (daisy, sunflower family)

The bitter vetch is an interesting find; originating in Anatolia and northern Iraq but not native to Jordan[62]. It was widely cultivated in the past both for animal feed and (after repeated washing to remove toxins) for human consumption as well. Most of the remaining species are typical Middle Eastern crops; *Gynandyris* may have been a weed in cereal fields. At this point in time, the data are far too sparse to say anything about vegetation, agriculture, trade or living conditions apart from the fact that the crop species found are typical for this region. Hence there are indeed archaeobotanical macrofossils at Tall Zirā‘a that are typical for Middle Eastern agriculture.

3.7.5. Potential Future Archaeobotanical Researches on Tall Zirā‘a

Fig. 3.85 At the south-western foot of Tall Zirā‘a. View to the water reservoir. Photograph taken in 2009 (Soure: BAI/GPIA).

The feasibility study demonstrated that seeds can be obtained by flotation sampling in Tall Zirā‘a. The poor condition of the seeds obtained for research may be due to preservation conditions in the site. The climatic conditions on Tall Zirā‘a are disadvantageous for the preservation of the samples.

Future surveys and excavations will include systematic archaeobotanical sampling. Archaeobotanical macrofossils should be found comparable to those found elsewhere in the region when flotation extraction has been used, most likely thousands of seeds, as F. Hole et al. described in their experience[63].

In addition, this site is in an ecologically marginal zone which experienced times of drought. One should be able to document changing environmental conditions, if we have adequate sampling spread over the long time frame represented on Tall Zirā‘a.

If wood rather than animal dung was the main cooking fuel on Tall Zira‘a, the rich collections of wild plant species found in hearth sites where dung was burned cannot be expected here. However, the presence of a weed species in this small collection is encouraging. Probably nearly all the plant species which have been found will be related to cultivation or trade.

61 Found, according to the BIU archaeobotany laboratory staff.

62 Zohary – Hopf 2000, 116.

63 Hole et al. 1969.

Period	Identification of sample	TZ-No.	Context-No. and Description	
Early Bronze Age III	/	019311-001	6327	Content of pot TZ 021630-001 // filling/pit
Late Bronze Age I–II	/	018818-001	6125	Filling
Late Bronze Age II	/	012193-001	3574	Clay // filling/fireplace?
Late Bronze Age II	/	016362-001	5129	Content of pot TZ 020405-001 // pit
Late Bronze Age II	/	018821-001	6057	Chalk // fireplace
Iron Age I	/	018819-001	5942	Seeds? // filling
Iron Age I	/	011752-001	3365	Content of pot // pit
Iron Age I	***Echium judaeum*** // modern seeds prob. from an ant. storage	**011753-001**	**3449**	**Earth/seeds // filling/fireplace?**
Iron Age I	/	016360-001	5209	Content of pot TZ 020378-013 // mudbrick-wall
Iron Age I	/	018815-001	6146	Content of pot TZ 021558-001 // filling
Iron Age I	/	018817-001	6124	filling
Iron Age IIA/B	possible ***Ficus sp***	**012191-001**	**3494**	**Pit/fireplace?**
Iron Age IIA/B	/	018816-001	5513	Content of cooking pot TZ 021560-001 // filling
Iron Age IIA/B	/	019001-001	5738	Content of pot TZ 021031-001 // chalk // filling
Iron Age IIA/B	/	012192-001	3458	Content of pot TZ 005205-001 // earth/ash
Hellenistic	/	112232-001	11186	Mortar // wall
Hellenistic	/	111855-001	11106	Earth around pot TZ 101236-001 // hearth
Hellenistic	**Wheat (*Triticum aestivium*)** // with glume attached	**111856-001**	**11106**	**Content of pot TZ 101236-001 // hearth**
Hellenistic	/	112233-001	11296	Mortar // pit
Hellenistic – Early Byzantine	**Barley (*Horduem vulgare*)** // wheat?	**110822-001**	**10611**	**Content of pot // filling**
Early Roman	/	016357-001	5095	Part of floor // filling
Early Roman	/	016358-001	5116	Part of floor // filling/fireplace?
Early Roman	/	016359-001	5189	Mortar // filling
Early Roman	/	018820-001	5522	Mortar // pit
Early Roman	possible ***Ficus***	**016361-001**	**4940**	**Content of pot TZ 020062-041 //**
Byzantine	/	112231-001	11346	Mortar // filling
Byzantine	***Gynandiris sp*** // possibly a weed in a cereal field	**012261-001**	**3539**	**Content of kernos TZ 005383-001**
Byzantine	/	310468-001	30121	Filling between two floor levels // filling
Byzantine	**Unidentifiable seed**	**310693-001**	**30416**	**Clay // floor**
Byzantine	/	310696-001	30420	Mortar // part of mosaic floor
Byzantine	/	310697-001	30420	Mortar // part of mosaic floor
Byzantine – Umayyad	***Olive fragment (Olea europaea)***	**310695-001**	**30421**	**Clay with organic material // floor**
Umayyad	/	009646-001	2502	Pottery and mortar // filling
Umayyad	/	310692-001	30398	Destroyed mosaic floor
Umayyad	/	310698-001	30398	Mortar ? // part of mosaic floor
Umayyad	**Grape (*Vitis vinifera*)**	**110931-001**	**10578**	**Content of amphora // filling/collapse debris**
Umayyad	possibly ***Asteraceae //*** shells	**110788-001**	**10571**	**Content of amphora // filling/collapse debris**
Umayyad	/	110757-001	10571	Content of pot // filling
Abbasid–Mamluk	/	310418-001	30150	Content of pot TZ 300132-001 // filling
Abbasid–Mamluk	/	111002-001	10655	filling
Abbasid–Mamluk	**Wheat (*Triticum aestivium*) and bitter vetch (*Vicia ervila*)**	**310694-001**	**30386**	**Clay // floor**
Modern	**Barley (*Horduem vulgare*)**	**310419-001**	**30023**	**Content of pot TZ 300173-001 // *colluvium***

Tab. 3.1 Samples processed in 2015 (Source: BAI/GPIA).

3.8. Archaeometry

edited by Dieter Vieweger/Jutta Häser[64]

with a contribution by David Adan-Bajewitz

Archaeometry evaluates scientific data yielded by the excavated artefacts. This allows conclusions on an object's manufacture, the technologies used, the place of manufacture, and the trade route it has followed. Basically, the aim was finding out how the Tall Zirā'a's inhabitants managed in the course of thousands of years to adapt their survival strategies to the natural conditions of the wādī, and in what manner they reacted to changing resources. In the field of skilled crafts and trades, this can be inferred from the raw materials they were able to work, from the goods that were manufactured, and from the extent of improvement of the finished products' serviceability. Over the centuries, all this necessitated technical knowledge, mechanical skills, and novel ideas, combined with target-oriented experiments, as well as innovation.

The archaeometrical project conducted by the Biblical Archaeological Institute Wuppertal (BAI) was started in 2003. The cooperation partners are:

- German Mining Museum Bochum (A. Hauptmann, M. Prange, and D. Kirchner; especially with regard to studies of ceramics in the years 2003 and followings)
- Leibniz University of Hannover, Institute of Inorganic Chemistry, Work Group Archaeometry (C. Vogt, R. Lehmann, and M. Schulze; pottery studies and metal examinations since 2009)
- Martin (Szusz) Department, Land of Israel Studies and Archaeology, Bar Ilan University (D. Adan Bayewitz, and M. Osborn; studies on Hellenistic and Roman ceramics since 2010)[65]
- The Austrian Academy of Sciences, OREA – Department of Europe, and University Bonn (R. Jung, H. Mommsen; analyses of the origin of Mycenaean ceramics)[66]
- University of Massachusetts Amherst, Department of Anthropology (graduate student Mary Larkum; analyses of the contents of Iron Age cooking pots)[67]
- The Hashemite University, Department of Conservation Science, Queen Rania Institute of Tourism and Heritage (Ph.D. student A. Mayyas; analyses of the contents of Early Bronze Age ceramic vessels)

Thanks to the kind support of the 'Department of Antiquities (Jordan)' (DoA), important finds could be exported to Germany (Wuppertal). Here, they were cleaned—and, if necessary, also restored—, photographed, sampled for further scientific examination and/or given to experts such as numismatists, osteologists, botanists, etc. for inspection. Finally the finds were returned to Jordan.

The abundance of finds on the Tall Zirā'a allowed the comprehensive examination of various artefacts as well as raw materials, such as different types of ore, rocks, and minerals. A representative selection was taken from the multitude of finds on the Tall Zirā'a, made of ceramic, glass, faience, metal, or minerals, and analyzed both chemically and mineralogically. Among these, particular focus was placed on the archaeometrical examinations of pottery and glass finds.

First results from the archaeometrical testings—regarding glass beads and ceramics—have already been published in the following articles:

- Auge – Vieweger 2006, 54–56
- Lehmann – Schulze 2015, 28–30
- Schulze et al. 2013, 294–296
- Schulze et al. 2014, 13
- Schulze et al. 2015, 219–221
- Vieweger et al. 2009, 245–258
- Vieweger 2013, 231–242
- Vieweger et al. 2014, 57–77

Since the archaeometrical examinations of the various materials can supply important insights into the skilled crafts and trades on Tall Zirā'a, a separate volume of the final report of the excavations on Tall Zirā'a, Volume 9, written by W. Auge, who was in charge of the Biblical Archaeologival Institute's (BAI) investigations and advanced them vigorously, will be solely dedicated to this topic. The objectives of these examinations will therefore only be introduced and broadly outlined below.

64 This article is edited by D. Vieweger and J. Häser and is based on the research results of W. Auge. They are published on http://www.tallziraa.de/Gadara-Region-Project/Archaeometrie/0_415.html and http://www.bai-wuppertal.de/arch%C3%A4ometrie; written by W. Auge and M. Schulze (BAI Wuppertal) as well as R. Lehmann and C. Vogt (both Leibniz University Hannover, Institute of Inorganic Chemistry, WG Archaeometry).

65 The detailed results of these examinations will be published in the Volume 6 of this publication series.

66 The detailed results will be published in Volume 3 of this publication series.

67 The detailed results will be published in Volume 4 of this publication series.

3.8.1. Pottery

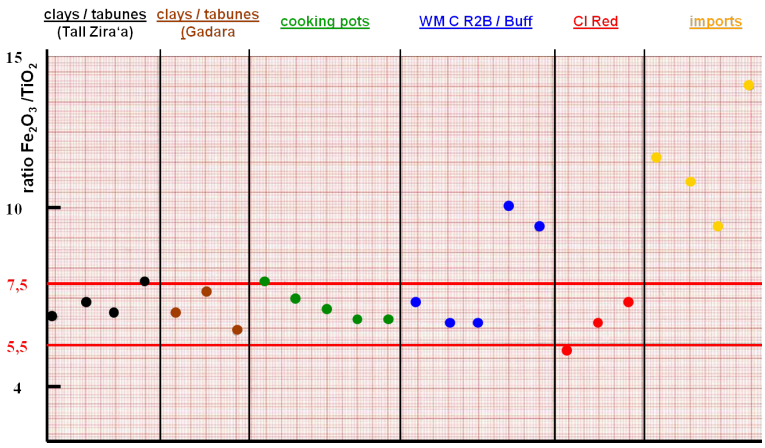
edited by Dieter Vieweger/Jutta Häser[68]

Fig. 3.86 Pottery from Tall Zirā'a (Source: BAI/GPIA).

The Biblical Archaeological Institute's (BAI) most comprehensive archaeometrical project deals with the examination of pottery since ceramics dating from all periods represented on Tall Zirā'a are remarkably abundant and can be allocated to almost every 'sphere of life': domestic home (application and decoration), crafts, and cult. The project was started in 2003. By 2012, eighteen excavation campaigns had yielded 350,000 ceramic sherds and objects, 80,000 of them diagnostics, that were divided into 90 ware groups (groups with specific unique characteristics) by D. Vieweger, A. Schwermer, and F. Kenkel. Of this bulk, so far approx. 300 that were deemed representative, and some further, particular sherds could be analyzed chemically and mineralogically by means of the ICP, RFA, and XRD methods. Likewise, 60 samples of clay bricks, tabuns, kilns as well as soils, minerals, and clays that had been collected in the course of geological explorations in the tall's surroundings were subjected to similar testings. The material analyses were performed at the German Mining Museum Bochum, Research Field Archaeometallurgy/Laboratory of Materials Science (A. Hauptmann, M. Prange, D. Kirchner) and, from 2009, at the Leibniz University of Hannover (C. Vogt, R. Lehmann, M. Schulze).

3.8.1.1. Provenance Study

In order to determine an object's provenance, not only ceramics from the tall were analysed but also more than a hundred pieces of pottery that had been found during various surveys conducted in its immediate and distant surroundings (survey by P. Leiverkus and K. Soennecken [BAI Wuppertal]), or that, thanks to the kind support of the German Archaeological Institute (DAI) (C. Bührig [DAI] und B. Liesen [Römermuseum Xanten]), were made available to the researchers from the nearby Decapolis city of Gadara. A comparison of the ceramics' chemical/mineralogical compositions and of further, deduced geochemical 'fingerprints' allowed assigning them to different groups, each with common characteristics (*Graph 3.11*).



Graph 3.11 Geochemical fingerprint of some ware groups (BAI/GPIA).

68 This article has been translated from the German language. It is based on http://www.bai-wuppertal.de/keramikprojekt and http://www.tallziraa.de/Gadara-Region-Project/Archaeometrie/Keramikprojekt/0_416.html, written by W. Auge, BAI Wuppertal (5.6.2016).

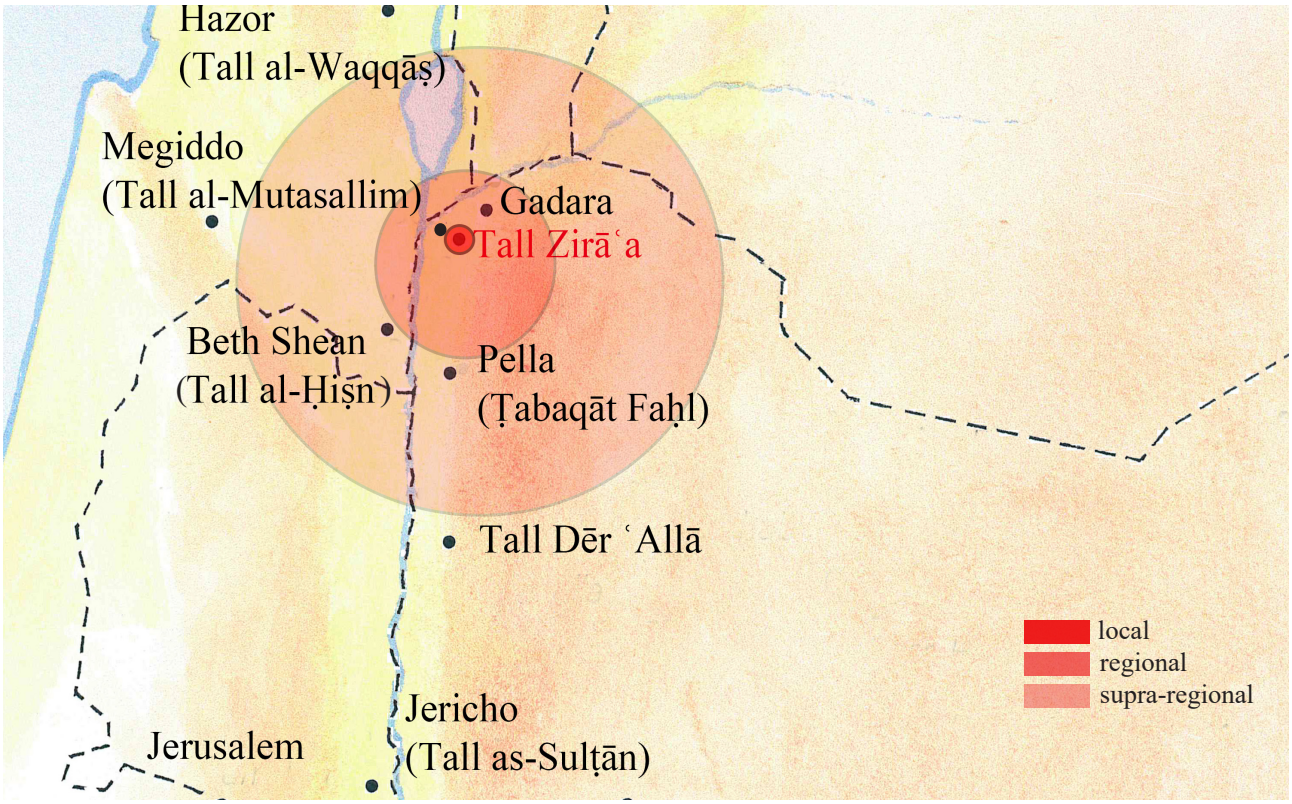


Fig. 3.87 Provenance of the pottery found on Tall Zirāʿa (Source: BAI/GPIA).

Moreover, these data often also enabled the researchers to determine whether a piece of pottery was of local, regional, or supraregional origin or whether it had been 'imported' from even farther away.

The determination of a piece of pottery's origin is based on the postulate of provenance:

> "If ceramics and clays match in terms of their chemical and mineralogical compositions then the place of storage is regarded as the likely place of manufacture"[69].

Following this rule, the analytical data of soils or clays, non-ceramic clay products, and ceramics that had been found 'regionally', i.e. within a 20 km radius, 'supra-regionally', i.e. within a radius of 20 to 100 km, or that had even been imported from beyond Palestine, were compared with those of the ceramics that had been excavated on the tall (*Figs. 3.87–3.91*).

Unfortunately, due to the large variability of the clays' chemical and mineralogical composition, resulting from their often very complex formation, statements regarding the origin of ceramics are only rarely scientifically valid. Even the application of different analytical methods or of mathematical programmes such as the multivariate cluster analysis, cannot resolve this shortcoming.

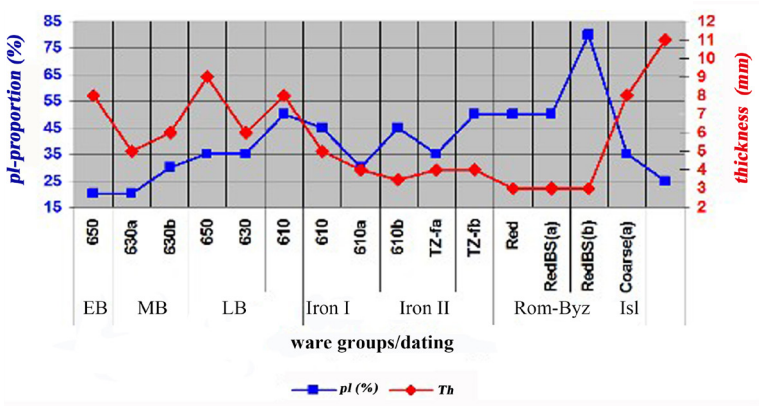
Figs. 3.88–3.91 Pottery from Tall Zirāʿa. Left: Iron Age pyxis, TZ 002926-001 (local). Dimensions: W 10.5, H 8.0; centre-left: Pyxis, TZ 002863-001 (Mycenaean, imported). Dimensions: H 9.0; centre-right: Late Bronze Age jar, TZ 005556-001 (regional). Dimensions: H: c. 25, D (opening) 12.5, D (foot) 3.5; right: Iron Age II jar, TZ 001212-001 (local). Dimensions: H 45, W 35 (Source: BAI/GPIA).

69 McGovern 1997, 69–108.

3.8.1.2. Typology

Extensive sequences of development, reaching from the Early Bronze Age to Islamic periods, and comprising more than 100 types and subtypes, can be established for cooking pots as a category of pottery that has been specifically manufactured and that meets particular requirements[70].

Since the ceramics' 'plastic' and the 'non-plastic' components (pl/npl) that were deduced from analytical data with respect to their types and percentages can be correlated fairly well to the time-dependent parameters such as ware groups (type and colour of the clay), shape variability (typology), wall thickness, opening diameter, and vessel size, as well as firing temperatures, they can serve as instruments in reconstructing the technical history of the cooking pots found on the Tall Zirā'a and in its surrounding environs.



Graph 3.12 Relation between plastic components and wall thickness of cooking pots from Tall Zirā'a (Source: BAI/GPIA).

The firing temperatures were ascertained by means of multiple tests designed to reenact the firing processes of former times, and by further firing experiments.

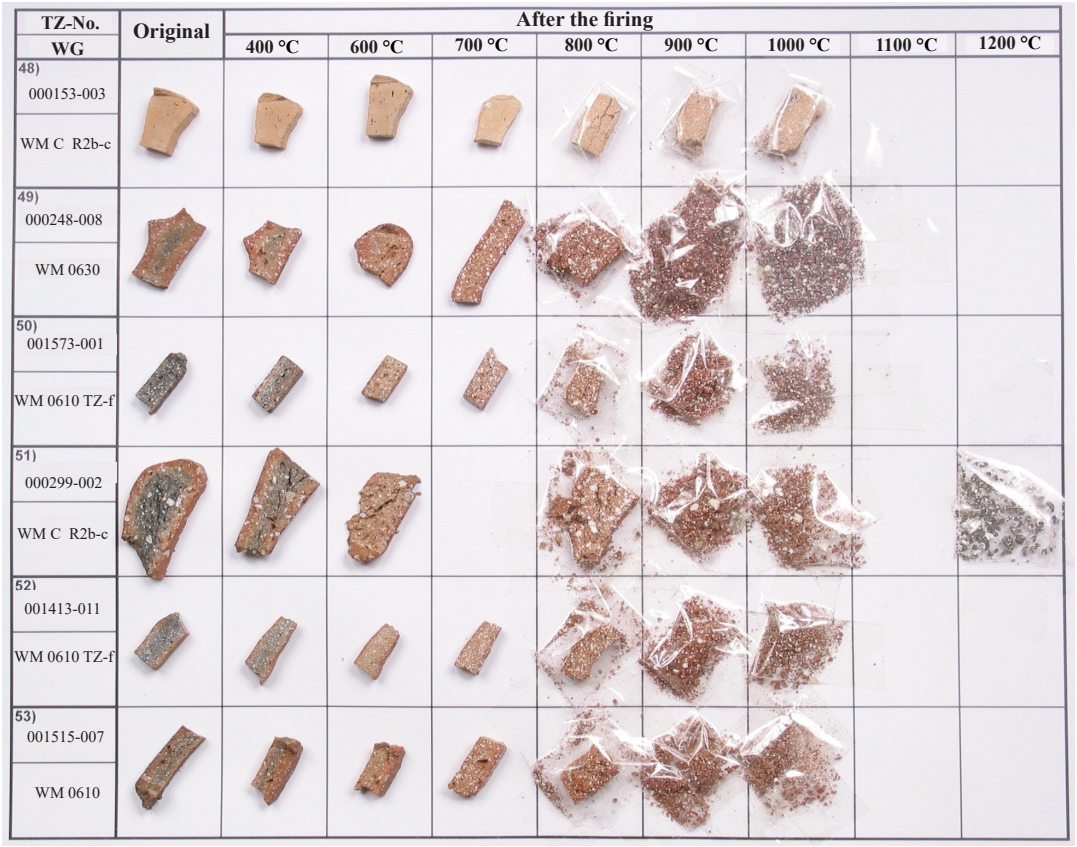


Fig. 3.92 Refiring of ceramics (Source: BAI/GPIA).

70 Schwermer 2014.

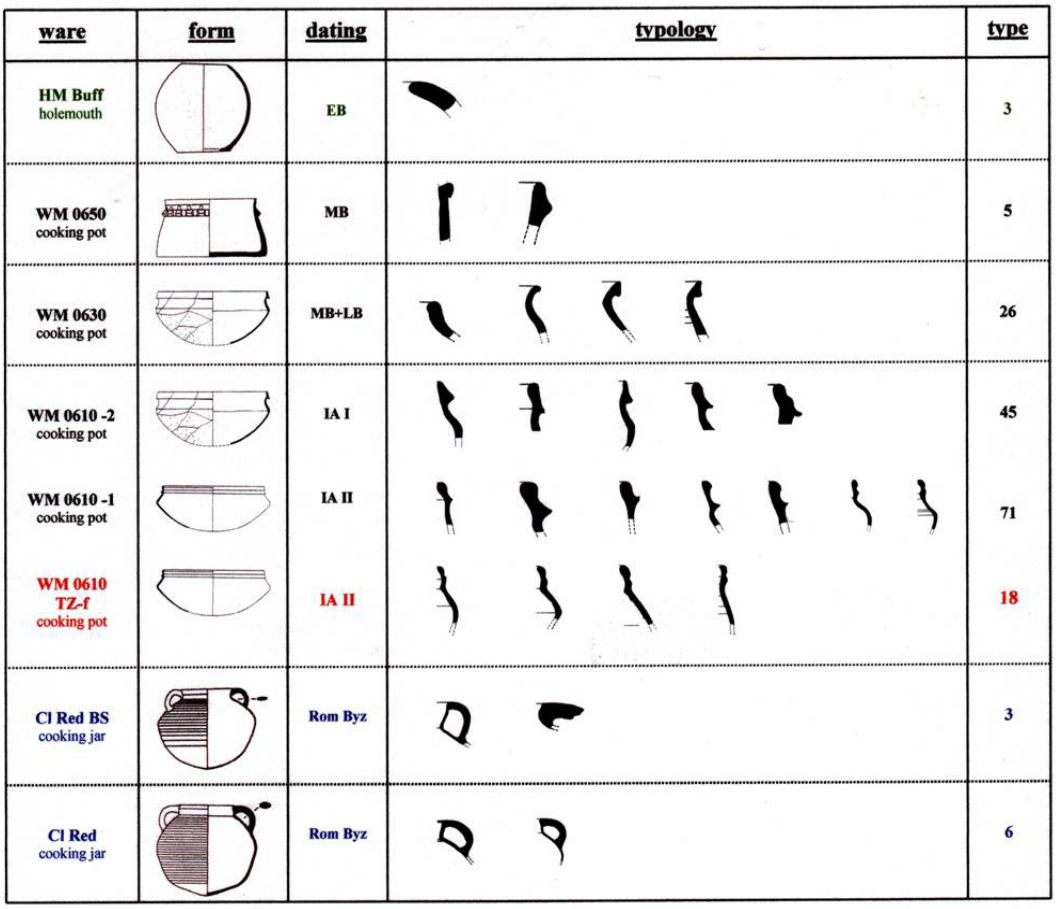


Fig. 3.93 Typology of cooking pots (Source: BAI/GPIA).

3.8.1.3. Compositional and Provenance Study of Roman Period Pottery

by David Adan-Bajewitz

Under the auspices of the Biblical Archaeology Institute Wuppertal (BAI), the German Protestant Institute of Archaeology Amman/Jerusalem (GPIA) and Bar-Ilan University, Ramat-Gan, an extensive compositional and provenance study of the common, utilitarian pottery found in Roman-period levels at Tall Zirā'a was begun in 2012. The Principal Investigator are Prof Dr D. Adan-Bayewitz, Dr S. Krauthammer (Professor of Archaeology at Bar-Ilan University), and, from 1999–2013, Senior Guest Scientist at the Lawrence Berkeley National Laboratory, with Dr M. Osband as Co-Investigator, in close collaboration with Prof Dr Dr Dr D. Vieweger and Dr J. Häser (Directors of the Tall Zirā'a excavations), and Dr F. Kenkel. The goals of the project include determining the sources of the Roman-period pottery used at Tall Zirā'a from the early through the late Roman periods (the first through fourth centuries AD) and documenting diachronic change in the trade contacts of the settlement. This work will contribute to clarifying the production and distribution networks of everyday pottery in the Southern Levant during the Roman period.

The analytical methods employed include Instrumental Neutron Activation Analysis (INAA) of the sampled Tall Zirā'a pottery at the Missouri University Research Reactor, under the direction of Dr M. D. Glascock, multivariate statistical analysis of the chemical element data, and micromorphological analysis. The chemical element data will be compared with a large data base from measurements, by Dr F. Asaro and Prof Dr D. Adan-Bayewitz at the Lawrence Berkeley National Laboratory, of pottery from many other sites in the Southern Levant. The work is still in progress.

3.8.2. Glass, Glass Frit, and Faience

edited by Dieter Vieweger/Jutta Häser[71]

3.8.2.1. Glass

Figs. 3.94–3.96 Left: female figurine, TZ 015318-001. Dimensions: H 4.9, W 2.2; centre: zoomorphic pendant, TZ 015314-001. Dimensions: L 2.1, W 1.3; right: spacer with floral motiv, TZ 010337-001. Dimensions: L 3.1, H 1.8, Th 0.9 (Source: BAI/GPIA).

Glass was an object of trade, especially for jewellery making, as early as the Late Bronze Age. It was a very precious material that was being produced only in a few places in Egypt, Mesopotamia, Syria, and Anatolia. In those times, its value was similar to that of the noble metals silver and gold.

The Late Bronze and Iron Age glass finds on Tall Zirā'a included numerous beads, a female figurine (TZ 015318-001; *Fig. 3.94*), a zoomorphic pendant (TZ 015314-001; *Fig. 3.95*), five spacers (e.g. TZ 014558-001), objects with floral motivs (e.g. TZ 010337-001; *Fig. 3.96*), and several rod-shaped beads (e.g. TZ 013881-001; *Fig. 3.46*). A considerably larger number of glass finds, dating from the Classical periods, are mainly vessel sherds.

Moreover, raw glass (e.g. TZ 015494-001; *Fig. 3.105*), spherical glass granules (TZ 016622-001; *Fig. 3.106*), a spherical bead without piercing (TZ 007546-001; *Fig. 3.40*), and a wound bead the clay core of which had notbeen removed (TZ 016663-001; *Fig. 3.39*), were found.

About 10 % of the 350 glass objects found in the Middle Bronze Age to the Iron Age II strata were analyzed with the aid of the ICP, OES, and RFA methods (status quo: 2011).

Based on the examinations carried out so far, the glass finds can be grouped into four categories (*Tab. 3.2*):

- Soda-lime glass ('normal'): spherical beads and faulty bead cast
- Cupriferous (Cu): raw glass, spherical beads, figurine, bangle, and faulty bead cast
- Antimonial (Sb): raw glass, spherical beads, disc-shaped beads, and pendants
- Plumbiferous (Pb): spherical bead and bangle

Material	**Quartz**	**Fluxing agent**					**Colour**			
	Si	Al	Na	K	Ca	Mg	Fe	Cu	Sb	Pb
normal	64–94	2–5	1–14	1–4	1–7	0–8		< 1	-	-
Cu-bearing	48–74	1–7	nn	1–2	1–33	2–6	1–4	2–17	-	-
Sb-bearing	58–82	2–4	nn	1–2	2–6	0–8	1–3	2–10	4–19	-
Pb-bearing	68–73	2–7	nn	1	2–9	0–11	2–3	1–2	0–4	6–9

Tab. 3.2 Chemical composition of glass types on Tall Zirā'a (all data are expressed in grams) (Source: BAI/GPIA).

71 This article of W. Auge has been translated from the German language. It is based on http://www.bai-wuppertal.de/glasprojekt; and http://www.tallziraa.de/Gadara-Region-Project/Archaeometrie/Glas/0_429.html (5.6.2016), written by W. Auge, BAI Wuppertal.

3.8.2.2. Glass Frit and Faience

All cylinder seals (38) and scarabs (10)[72] that have been found on the tall to date, along with a selection of faiences, were analyzed with respect to their mineralogical and, in some instances, also chemical compositions.

Cylinder Seals

The cylinder seals are typical of the 'Common Style' of the Mitanni glyptics that was common in Mesopotamia, Syria, and Palestine between the fifteenth and twelfth century BC[73] (see *Figs. 3.97* and *1.55*).

Of the 38 cylinder seals, 35 are made of glass frit (85 %; predominantly SiO_2), and many of them have a green or blue (faience) coating in varying degrees of perceptibility. One of the cylinder seals is made of calcite, and two consist of black stone (chlorids?) (*Tab. 3.3*).

Fig. 3.97 Cylinder seal, TZ 008558-001. Dimensions: H 2.4, D (max.) 1 (BAI/GPIA).

Scarabs

Among the scarabs, eight consist of glass frits of which-most of the cylinder seals are made of. Two are composed of the mineral enstatite ($MgSiO_3$). The material analyses show that several of these scarabs could definitely be of regional or local provenance.

The analyses of some faience artefacts, such as the scarab TZ 015313-001 (*Fig. 3.99*), showed that the cores of these objects was mostly made of glass frit or of stone (*Tab. 3.3*).

Figs. 3.98–3.99 Left: Scarab, TZ 010112-001. Dimensions: L 3.7, W 2.4, H 1.4; scarab, TZ 015313-001. Dimensions: L 2.3, W 1.6, H 1 (BAI/GPIA).

Find No.	Object	Material	SiO_2	Al_2O_3	MgO	CaO	K_2O	Fe_2O_3
TZ 010334-001	Cylinder Seal	Frits	97.1	0.5	< 0.1	0.6	0.1	0.1
TZ 012357-001	Cylinder Seal	Calcite	51.8	11.4	-	20.0	0.2	0.1
TZ 012203-001	Scarab	Frits	96.1	1.8	-	0.6	0.1	<0.1
TZ 015313-001	Scarab	Steatite	69.0	5.6	19.4	1.5	0.3	3.0
TZ 011778-001	Billet	Frits	94.8	2.3	-	0.6	0.2	0.3

Tab. 3.3 Chemical composition of cylinder seals, scarabs, and billet (all data are expressed in grams) (Source: BAI/GPIA).

72 See for example: Häser et al. 2016, 497–507; Häser – Vieweger 2007a, 13 Fig. 9; Häser – Vieweger 2007b, 68 Fig. 9; Häser – Vieweger 2007c, 26 Fig. 6; Häser – Vieweger 2009, 488 f. Fig. 4 (drawing of the seal TZ 008972-001 and impression). Fig. 5; Vieweger – Häser 2007, 12 Fig. 2; Vieweger – Häser 2008a, 1842 f.; Vieweger – Häser, 2008b, 64; Vieweger – Häser 2008c, 151–162; Vieweger – Häser 2008d, 382 f. Fig. 8; Vieweger – Häser 2009a, 15–17, Fig. 11 (photograph of the scarab). Fig. 14 (photograph of several cylinder seals). Fig. 15 (photograph of a silver amulet). Abb. 28 (drwaing of the cylinder seal TZ 008558-001 with impression); Vieweger – Häser 2009b, 670 Fig. 9 (drawing of the cylinder seal TZ 008558-001 with impression). 672 Fig. 12; Vieweger – Häser 2010, 9–11, Pl. 6 B. Vieweger 2010, 758 Fig. 7d.

73 For the cylinder seals, see Häser et al. 2016, 497–507.

Glass Beads[74]

Glass beads have always played an important role in the cultural life of a multitude of peoples and tribes. They were worn as jewellery, used as an instrument of payment, applied for ritual purposes, and they were indicators of their wearer's social status and wealth. For this reason, glass beads are precious archaeological finds that can allow a detailed insight into a nation's, a tribe's, or a family's traditions, economic standing, and trade connections, as well as those of the region where they were excavated.

In the spring campaign of 2009, two Ottoman bead complexes consisting of 51 and 920 beads, respectively, were found on Tall Zirā'a (*Fig. 3.100*). The beads, displaying a large spectrum of colours, sizes, and forms, had been manufactured from amber, semiprecious stones, shells, corals, ivory, and bones. It was particularly the glass beads, though, that were examined by means of state-of-the-art analytical methods (p-RFA, µ-RFA, LA-ICP-MS, ICP-OES, PIXE) in the context of a bachelor thesis written at the Leibniz University of Hannover's Institute of Inorganic Chemistry[75].

Fig. 3.100 Beads found on Tall Zirā'a in spring 2009 (Source: HTW Berlin/BAI/GPIA).

Fig. 3.101 Late Bronze Age glass beads, TZ 010757-001. Dimensions: D (max.) c. 1.5 (Source: BAI/GPIA).

Apart from examinations regarding manufacturing techniques (*Fig. 3.102*) and the identification of the chromophoric components, the main focus was placed on trying to find out the place of manufacture and on an approximate age determination. These questions are important for reconstructing the development of trade connections and the transfer of technology in the Tall Zirā'a's immediate and distant surroundings.

Fig. 3.102 Production of beads by winding technique (Source: M. Schulze/BAI/GPIA).

With the aid of elemental mapping images that were generated by means of µ-XRF (Micro X-ray Fluorescence), the chromophoric elements could be impressively detected (*Fig. 3.103*).

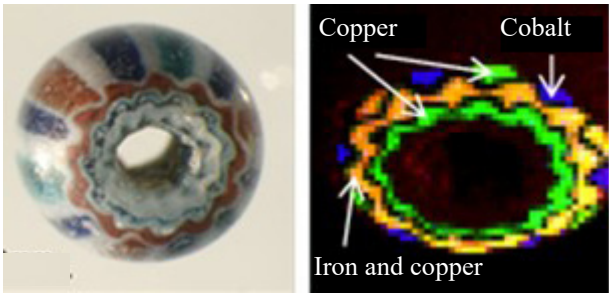


Fig. 3.103 Elemental mapping. 'Chevron bead' (Source: M. Schulze/BAI/GPIA).

Among the glass beads, there are two 'chevron beads'. This type of beads is particularly precious and was manufactured in Venice in the fifteenth century; from the seventeenth century on it was also produced in Amsterdam. In order to verify the assumption that the chevron beads found on Tall Zirā'a originated from either of these places of manufacture, glass beads of known Amsterdam, Venetian, or Near Eastern provenance were examined in the Allard Pierson Museum in Amsterdam (*Fig. 3.104*).

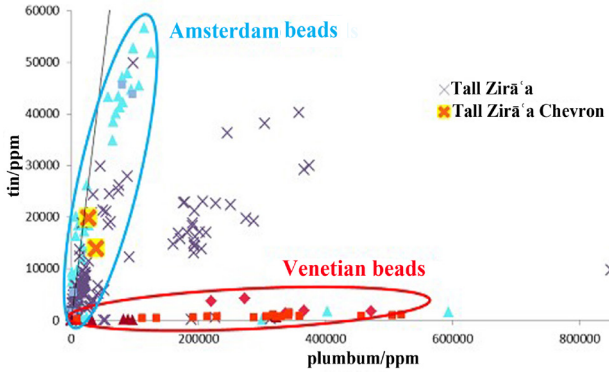
In addition, several beads were subjected to measurements of isotope ratios in order to determine the origin of plumbiferous components in the raw material. These

74 This article has been translated from the German Language. It is based on http://www.tallziraa.de/Gadara-Region-Project/Archaeometrie/Glas/Osmanische-Glasperlen/0_465.html; written by M. Schulze, R. Lehmann, C. Vogt. See Schulze 2012; Schulze et al. 2013, 294–296.

75 Schulze 2012.

revealed that the beads found on the Tall Zirā'a had obviously been collected from different places of manufacture and that the 'chevron beads' in all likelihood do indeed originate from an Amsterdam manufacturing site. Characteristic differences in the glass quality almost certainly rule out a Venetian provenance since the glassblowers of Venice used higher-quality raw materials with a higher lead content for bead manufacturing, thus enhancing light refraction and adding a particular lustre to the glass (*Graph 3.13*). Consequently, the bead complexes as they were found cannot have been compiled earlier than the seventeenth century.

Fig. 3.104 Beads in the Allard Pierson Museum Amsterdam (Source: BAI/GPIA/M. Schulze).



Graph 3.13 Beads in the Allard Pierson Museum Amsterdam (Source: BAI/GPIA/M. Schulze).

3.8.3. Production of Glass and Faience

edited by Dieter Vieweger/Jutta Häser[76]

3.8.3.1. Glass

Figs. 3.105–3.106 Left: Raw glass, TZ 015494-001. Dimensions: L 1.5, W 1.2, H 0.7; right: glass granule, TZ 016622-001. Dimensions: D 0.3 in average (Source: BAI/GPIA).

Figs. 3.107–3.108 Left: Hammer stone, TZ 015313-001. Dimensions: L 7.7, W 6.3, H 4.4; right: faience knob, TZ 015317-001. Dimensions: H 5.6, D (max.) 7.4 (Source: BAI/GPIA).

Evidence in favour of a local glass processing facility are the finds of raw glass (e.g. TZ 015494-001; *Figs. 3.105* and *Fig. 3.37*), amorphous and spherical glass granules (TZ 016622-001; *Fig. 3.106*), a spherical bead without piercing (TZ 007546-001; *Fig. 3.40*), and a wound bead, the clay core of which was not removed (TZ 001666-001; *Fig. 3.39*).

A room with very special finds like a well-insulated kiln (Stratum 13, Area I, Square AP 120, Context 4850), a working stone (TZ 015991-001) surrounded by thick layers of ashes was excaveted in the reused and altered entrance area of the Late Bronze Age temple in the north of Area I. On the floor of this room, a two-chambered basket-shaped vessel (TZ 006835-001; *Fig. 3.43*) was detected. Its specific function is unknown. Moreover, further working stones (TZ 015343-001), and a faience knob (TZ 015317-001; *Fig. 3.108*) were uncovered.

This ensemble of findings and the finds of glass and faience in its vicinity lead to the assumption that the place might have been used as glass processing work-

76 This article has been translated from the German language. It is based on http://www.tallziraa.de/Gadara-Region-Project/Archaeometrie/Glas/-Glasherstellung/0_432.html; written by W. Auge, BAI Wuppertal.

shop. However, a definit prove of this suggestion cannot be given. The experiments comcerning glass production or processing on Tall Zirā'a have shown that both was possible with local means, in respect to technology (kiln) and raw materials (flint and quartz) (see *Chap. 3.4.3.4.*).

3.8.3.2. Glass Frit and Faience

The multitude of finds like vessel sherds, cylinder seals and (raw) glass, all composed from similar base materials, of characteristic equipment such as cylindrical 'industrial vessels', working stones, grinding balls, and mortars, and, finally, the existence of copper minerals are indicative of corresponding local processing facilities. The presence of faulty and flawed faience beads (e.g. TZ 011143-001; *Fig. 3.109*) may point to a local faience manufacture.

Figs. 3.109–3.110 Left: Faience bead, TZ 011143-001. Dimensions: H 1.3, D (max.) 2.2; right: vessel sherd, TZ 004295-003. Dimensions: H 7, W. 5.5 (Source: BAI/GPIA).

3.8.4. Metals

edited by Dieter Vieweger/Jutta Häser[77]

3.8.4.1. Copper (Ores/Slags) and Bronze

Along with a number of copper and bronze finds there were also smaller chunks of copper ores as well as several pieces of copper slags. The chemical analyses of three chunks of ore (TZ 009459-001, TZ 007572-001, and TZ 007756-001; *Fig. 3.111*) revealed that some of them contain a high percentage of copper; the mineralogical analysis showed that the predominant mineral enclosed in the ores TZ 009459-001 is malachite. The specific use the ore was assigned to could not yet be established with certainty. Possibly, it generally served as a source of copper or it was used as a colouring component (blue) for the manufacture of glass or faience.

Figs. 3.111–3.112 Left: Copper ore, TZ 009459-001. Dimensions: L c. 2; right: copper slag, TZ 012480-001. Dimensions: L 6.5, W 4.5 (Source: BAI/GPIA).

3.8.4.2. Metal Artefacts

The most important Bronze and Iron Age copper and bronze objects that have been discovered on the tall are a sitting idol TZ 007367-001 (of the El-type figurines known in the Levant and Syria; *Figs. 3.121* and *3.122*), a skilfully crafted wine sieve TZ 010281-001 (*Fig. 3.115)* comparable with a Late Bronze Age find from Tall as-Sa'īdīya, and an amulet representing a female idol with Hathor hairstyle (TZ 012618-001; *Figs. 3.113* and *3.114*)

Most of the approx. 500 metal objects found so far can be assigned to one of the realms of household, craft, hunt/war, cult, and numismatics.

The chemical analyses of several objects revealed that quite a number—including daggers, needles, and knives—are made of copper and that the bronze objects

Figs. 3.113–3.114 Amulet with a female idol, TZ 012618-001. Dimensions: W (max.) 3.2, H 6.1 (Source: BAI/GPIA).

77 This article has been translated from the German language. It is based on http://www.tallziraa.de/Gadara-Region-Project/Archaeometrie/Metalle/0_430.html and http://www.bai-wuppertal.de/kupferbronze (16.5.2016); written by W. Auge, BAI Wuppertal.

usually have a tin content of 2 to 10 weight per cent. The composition of the wine sieve TZ 010281-001 (*Fig. 3.115*) and of the axe TZ 007992-001 (*Fig. 3.116*) is particularly interesting: they are made of bronzes with unusually high contents of SiO_2 (8 to 10 weight per cent). The SiO_2 may have reduced the material's flexibility[78] and thus made it possible to pierce the bronze sheet in the case of the wine sieve.

The little head of a bear TZ 010004-001 (*Fig. 3.117*) may have been a drawer knob or balance weight; the arm TZ 010019-001 (*Fig. 3.120*) could have formed part of an idol or warrior figure made of organic matter, and held a spear in its hand.

Figs. 3.115–3.116 Left: Wine sieve, TZ 010281-001. Dimensions: H 4.3, D (max.) 9.8; right: axe, TZ 007992-001. Dimensions: L 8, W 5.3, H 0.2 (Source: BAI/GPIA).

Figs. 3.117–3.120 Left: Head of a bear (balance weight?), TZ 010004-001. Dimensions: L 2.2, W 2, H 1.5; centre left: restored Iron Age I bowl, TZ 007082-001. Dimensions: D (max.) c. 14; centre right: Late Bronze Age mirror, TZ 001612-001. Dimensions: D (max.) c. 9; right: arm of a Late Bronze Age figurine, TZ 010019-001. Dimensions: L 5, W 5.9 (Source: BAI/GPIA).

Find No.	Object	Period	Cu	Sn	SiO_2	CaO	Al_2O_3
TZ 009459-001	Copper ore	Iron Age IIA/B	14–20	< 0.01	67–72	0.3–1.5	1.9–4.7
TZ 007756-001	Copper ore	Iron Age IIA/B	14–20	< 0.01	67–72	0.3–1.5	1.9–4.7
TZ 007572-001 MN 005	Copper ore	Iron Age I	49–50	< 0.01	9–17	0.1–3.8	0.2–0.4
TZ 001611-001	Needle	Late Bronze Age	97–98	0.03–0.8	ND	ND	ND
TZ 008878-001	Needle	Iron Age IIA/B	93	5.6	ND	ND	ND
TZ 001508-001	Knife	Late Bronze Age	97–98	0.03–0.8	ND	ND	ND
TZ 010117-001	Knife	Late Bronze Age	97–98	0.03–0.8	ND	ND	ND
TZ 001004-001	Bears's head (Balance weight?)	Iron Age IIA/B Late Bronze Age	91.6	7.8	ND	ND	ND
TZ 001612-001	Mirror	Late Bronze Age	94–97	2.0–3.8	ND	ND	ND
TZ 007366-001	Dagger	Late Bronze Age	94–97	2.0–3.8	ND	ND	ND
TZ 007992-001	Axe	Iron Age A IA/B Late Bronze Age	77–80	9.3	8.0–9.9	0.8–1.0	0.03–0.09
TZ 010281-001	Wine sieve	Iron Age IA/B Late Bronze Age	77–80	9.3	8.0–9.9	0.8–1.0	0.03–0.09
TZ 015262-001	Content of melting vessel	Middle Bronze Age	8.6	6.5	33.6	20.3	3.1

Tab. 3.4 Chemical composition of copper and bronze (weight per cent; elements As, S, Pb, and Fe < 1 weight per cent) (all data are expressed in grams) (Source: BAI/GPIA).

78 Bienkowski 1991.

3.8.4.3. Silver and Gold Objects

The upper part of the bronze figurine TZ 007367-001 (*Fig. 3.121* and *3.122*) is plated with gold, and the lower part with silver. Both are executed as an alloy: Au 39.1, Ag 38.4, Cu 22.5, and Ag 71.5, Au 3.9, Cu 24.7 (weight per cent). The unusually high copper content in both alloys probably results from the underlying bronze as some small flat plates that were also discovered (e.g. TZ 010447-001: 52−65 weight per cent Au und 38−44 weight per cent Ag) had a significantly lower copper content of 2 to 5 weight per cent.

Moreover, an earring (TZ 012889-001; *Fig. 3.123*), a pendant (TZ 012871-001), and two bead bezels (TZ 006992-001; *Fig. 3.125*) made of gold were excavated. The silver amulet TZ 010114-001 (*Fig. 3.124*) and the bottom of a little silver bowl (TZ 012479-001; *Fig. 3.126*) have corroded almost completely, so that more or less only silver sulphides and silver oxides were detectable.

Figs. 3.121–3.122 Iron Age IIA/B bronze figurine, TZ 007367-001. Dimensions: H 7.5, W 1.5 (Source: BAI/GPIA).

Figs. 3.123–3.126 Left: Earring, TZ 012889-001. Dimensions: D (max.) 1.8; centre left: silver amulet, TZ 010114-001. Dimensions: W 3.4, H 5.8; centre right: bead bezel and stone bead, TZ 006992-001. Dimensions: D (max.) 1; right: silver bowl, TZ 012479-001. Dimensions: L 4.3, W 3.6, H 1 (Source: BAI/GPIA).

3.8.4.4. Metal Processing on Tall Zirā'a

The presence of smaller chunks of copper ores (TZ 009459-001; *Fig. 3.111*) and of several pieces of copper slag (TZ 012480-001; *Fig. 3.112*) seems to indicate the existence of workshops where copper ore was either fused in order to extract copper, or exploited otherwise. The fact that copper ores were processed in small quantities is also evidenced by a crucible (bowl of coarse pottery, TZ 020229-019; *Fig. 3.127*) that was discovered in the spring of 2010. On its inside, on top of a thick black layer, a thin molten layer containing particles of copper (ore) was discernable. On its outside, the bowl shows no black fire traces. Quite obviously, the material was heated directly by mingling the minerals with the fuel (= reduction agent).

It is known that up to the third millennium BC, copper ores were smelted inside the settlements and that from the Middle/Late Bronze Age at the latest, the smelting took place in the close vicinity of ore deposits[79].

Fig. 3.127 Crucible, TZ 020229-019. Dimensions: H 12, D (opening) 20, D (foot) 8.5. Stratum 17, Area I, Square AN 118, Context 4726/7 (Source: BAI/GPIA).

79 Hauptmann 2007, 115–137; Hauptmann 2008, 125–140.

3.8.5. Stone and Minerals

edited by Dieter Vieweger/Jutta Häser[80]

A further project comprised examination of the minerals found on Tall Zirā'a—especially those not naturally occurring at this location—with respect to their origin, their immediate applicability, or regarding the question whether they could be processed to become any of the artefacts that were also discovered.

The number of different minerals is relatively high: alabaster ($CaSO_4$), various types of basalt, pumice stone, bitumen, iron minerals (haematite, magnetite, red haematite, pyrite, and slags) and copper minerals (ores, but also slags), calcite/chalk, quartzes (carnelian, obsidian, flint), and others.

These examinations were extended to some of the 40 balance weights made of stone that had been found to date.

3.8.5.1. Minerals

Bitumen

Bitumen is a mixture of high-molecular hydrocarbons. It has been utilised in almost every era, from the Bronze Age until today. It probably originates from the Dead Sea and was traded as a coveted sealing compound for vessels, houses, ships, etc.

Fig. 3.128 Bitumen, Iron Age, TZ 007433-001. Dimensions: L c. 7, W c. 5 (Source: BAI/GPIA).

Fig. 3.129 Bitumen, TZ 012660-001. Dimensions: L 3.5, W 2 (Source: BAI/GPIA).

Calcite/Chalk/Limestone

To date, approx. 1,200 artefacts made of calcite/chalk/limestone have been found. Since vessels from this material are heavier than pottery and neither heat-resistant nor acidoresistant, they were almost certainly produced for ornamental, cultic, or religious purposes rather than for everyday use.

A number of miniature vessels are noteworthy, e.g. TZ 002900-001 and TZ 011565-001 (*Fig. 3.130*; libation vessels?), as well as two fragments of a bowl (TZ 009802-001; *Fig. 3.131*) that display two birds (cranes?), two figurines (TZ 007282-001 and TZ 015417-001; *Fig. 3.132*), and a cylinder seal (TZ 012357-001; *Fig. 3.134*).

Of particular importance are vessels made of chalk that were predominantly used by Jewish communities (*Fig. 3.133*)[81]. Around the beginning of the Common Era, they were used in the daily lives of Jewish persons because they conformed to the Jewish purity requirements.

The chemical analysis of some calcite/chalk artefacts shows that they are made of a $CaCO_3$ that is essentially impurified with larger or smaller amounts of SiO_2. Moreover, there are particularly strong disparities regarding the objects' magnesium levels. As hardly any magnesian sediments can be found in the tall's surroundings it can be assumed that the artefacts containing magnesium were not manufactured locally. However, in order to resolve the question pertaining to these artefacts' provenance, further examinations are necessary.

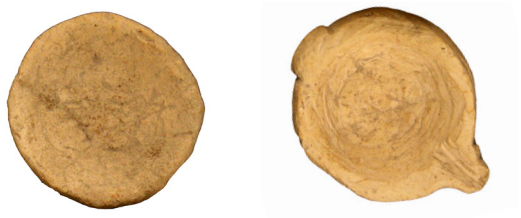


Fig. 3.130 Late Bronze Age miniature vessels. Left: TZ 002900-001. Dimensions: H 1.5, D (max.) 4; right: TZ 011565-001. Dimensions: H 2.3, D (opening) 3 (Source: BAI/GPIA).

80 This article has been translated from the German language. It is based on http://www.bai-wuppertal.de/mineralien and http://www.tallziraa.de/Gadara-Region-Project/Archaeometrie/Stein-und-Mineralien/0_431.html (16.5.2016); written by W. Auge, BAI Wuppertal.

81 Vieweger – Häser 2014; Häser – Vieweger 2015, 20–23.

Figs. 3.131–3.134 Left: Fragment of an Iron Age bowl, TZ 009802-001. Dimensions: D (max.) 10, H 7.2; centre left: Conical figurine, TZ 007282-001. Dimensions: H 7.2; centre right: Fragment of Early Roman mug, TZ 111726-001. Dimensions: H 10.5, D (foot) 8; right: cylinder seal, TZ 012357-001. Dimensions: H 3.2, D (max.) 1.6 (Source: BAI/GPIA).

Find No.	Object	Period	CaO	SiO_2	Al_2O_3	MgO
TZ 007282-001	Figurine	Finding context Ottoman	42.3	18.9	0.6	08
TZ 012357-001	Cylinder seal	Late Bronze Age (Finding context Early Roman)	23.2	39.5	9.8	-
TZ 111443-001	Mug	Early Roman	21.8	46.8	9.0	-
TZ 015378-001	Mug	Early Roman	18.6	45.2	11.0	7.6
TZ 011565-001	Miniature vessel	Finding context Iron Age IIC	18.9	46.4	12.7	6.5

Tab. 3.5 Chemical composition of calcite/chalk objects (all data are expressed in grams) (Source: BAI/GPIA).

Alabaster

On various occasions, alabaster (chemically: Ca_2SO_4; mineralogically: gypsum, anhydrite) was found as a mineral. The analysis of such a sample showed that chemically it was almost pure Ca_2SO_4 (impurified with 0.8 % SiO_2), and mineralogically a mixture of gypsum, anhydrite, and stelite.

A small, unfinished jug (TZ 015416-001; *Fig. 3.135*) suggests that indeed several objects were manufactured from the locally occurring material. Other alabaster objects are not only made of a finer substance but also more intricately wrought, such as a stand (TZ 001511-001 or the possible decorative knob of a chariot's axle (TZ 009176-001; *Fig. 3.136*)[82].

Figs. 3.135–3.136 Left: Alabaster jug, TZ 015416-001. Dimensions: H 6.2, D (max.) 4.2; alabaster knob, TZ 009176-001. Dimensions: H 3.2, D (max.) 5.3 (Source: BAI/GPIA).

Pumice Stone

Pumice could be found in large quantities and dating from all eras. The way that some of the excavated pieces are shaped suggests that it was applied both for washing laundry and for personal hygiene. Many of these pieces lie comfortably in one's hand and are pierced—presumably for suspending them. Since pumice is a porous, glassy volcanic rock, this material can very well originate from the Gadara plateau and its surroundings.

82 Koenen 2010.

Silex

Silex was used for the fabrication of weapons and tools for a very long time, even into the Roman Age; accordingly, large numbers of artefacts made of this material could be found (*Figs. 3.37* and *3.38*). As a result of a compaction process in chalk formations, silex often occurs in the shape of nodules (similar to iron nodules) or in layers, hence the excavations also yielded a multitude of crude pieces. Silex is a cryptocrystalline quartz (chalcedony) and may have been used as a base material for the production of glass frits which has been shown by experiments (cf. *Chap. 3.4.3.1.*). Flint can be found on the tall in large quantities but of minor quality.

Figs. 3.137–3.138 Left: Silex, Late Bronze Age scraper, TZ 012482-001; right: Silex, Iron Age II arrowhead, TZ 009202-001 (Source: BAI/GPIA).

Carnelian

Carnelian is a quartz that is coloured by iron oxide (a variety of chalcedony). It plays an important role in mysticism, and since it does not naturally occur in Palestine, it is very precious. The XRD analysis of one of the pieces of carnelian (TZ 009648-001) shows it to be pure quartz. As carnelian does not occur naturally on Tall Zirāʿa or in its surroundings these pieces must have arrived there by trade for further processing (maybe for manufacturing beads).

Larger pieces of this mineral (e.g. TZ 001613-001; *Fig. 3.139*) and 20 beads in different shapes suggest that, among other minerals, carnelian was also processed on the tall. They were found in strata dating from the Middle Bronze Age to the Ottoman period.

Figs. 3.139–3.140 Left: Iron Age I red coloured carnelian as mineral, TZ 001613-001. Dimensions: H c. 2, W c. 3.5; right: Iron Age beads, TZ 011780-001, TZ 011781-001 and TZ 011782-001. Dimensions: D 0.9 (Source: BAI/GPIA).

Iron (Sulfide) Nodules

The iron (sulfide) nodules that are abundant on Tall Zirāʿa can be found as pyrite concretions in the surrounding chalk formations. In several instances, light or dark red iron oxide from completely corroded (oxidised) nodules (TZ 012504-001; *Fig. 3.142*) was discovered. Since red iron oxide could also be traced on a basalt pestle (TZ 015449-001; *Fig. 3.144*) and on various grinding bowls or stones, this material was obviously used as a mineral colour for cosmetics, wall paintings, or ceramics. Accordingly, an SEM analysis carried out by the German Mining Museum Bochum revealed that the red paint on the coloured ceramic jug TZ 002989-001 (*Fig. 3.141*) contains 36 % of Fe_2O_3 (the black paint 9 % and 7 % of MnO and Fe_2O_3, respectively, and the white paint 45 % of CaO).

Figs. 3.141–3.144 Left: Ceramic jug, TZ 002989-001. Dimensions: H 40, D (max.) 32; centre left: corroded (oxidised) Late Bronze Age nodules, TZ 012504-001. Dimensions: L 2.5, B 2, H 0.5; centre right: Iron sulfid nodules; right: Late Bronze Age basalt pestle, TZ 015449-001. Dimensions: L 7.8, W 4.7, H 3.8 (Source: BAI/GPIA).

Red Haematite

Some light, intensely red, soft pieces of mineral were discovered that had clearly been used for painting. One of them is distinctively ashlar-shaped and pierced at one end so that it could be either suspended or hung around one's neck. With these crayons, it was very easy to apply an intense hue of red. The chemical analysis showed that it is red haematite, a clay mineral (sheet silicate) with a relatively high content of Fe_2O_3. A different red, ferruginous mineral, such as TZ 015333-001 and TZ 0185334-001 (*Fig. 3.145*), is much harder and thus not suitable for reddening objects.

Fig. 3.145 Late Bronze Age red haematite. Left: TZ 015333-001. Dimensions: L 6.0, W 4.2, H 4.1; right: TZ 015334-001. Dimensions: L 3.0, W 3.4, H 2.5 (Source: BAI/GPIA).

Find No.	Object	Period	Fe_2O_3	SiO_2	Al_2O_3	CaO	K_2O
TZ 015334-001	Red haematite	Late Bronze Age	28.1	44.3	18.5	2.9	1.6
TZ 015333-001	Rock	Late Bronze Age	3.3	64.0	24.4	5.6	2.1

Tab. 3.6 Chemical composition of red haematit (Source: BAI/GPIA).

3.8.5.2 Balance Weights

Almost all of the c. 40 weights discovered so far are made of stone, usually a hard, slightly abrasive/corrosive matter, in various but characteristic shapes such as cubes, discs, balls, cones, and double cones with flattened ends.

Apart from a number of basalt and calcite weights that may be of local/regional manufacture those made of haematite, goethite, and jadeite count among the more valuable objects as these minerals do not occur naturally in the region, moreover some of the objects had to be wrought laboriously.

The weights weigh between 2.3 g (TZ 007373-001; *Fig. 3.147*) and 433 g (TZ 001388-001; *Fig. 3.146*). Four of them are of biconical shape (TZ 007373-001, made of goethite; TZ 007374-001, TZ 012317-001, TZ 012322-001, made of haematite, *Figs. 3.148* and *3.149*) circulating in the Mediterranean and in the Levant, found for example in Ugarit in Syria, on the island of Cyprus and on the shipwreck of Uluburun on the Turkish shore, in Late Bronze Age contexts[83]. On Tall Zirā'a all of them were found in the Late Bronze Age stratum.

Figs. 3.146–3.149 Balance weights: Left: TZ 001388-001. Dimensions: H 4.8, D (max.) 5.7; centre left: TZ 007373-001. Dimensions: L 1.2, D 0.8; centre right: TZ 007374-001. Dimensions: L 2.7, D (max.) 1.4, H 1.1; right: TZ 012317-001. Dimensions: L 2.5, D (max.) 1.1, H 0.9 (Source: BAI/GPIA).

83 Pulak 2005, 87 f. 616–619; Petrusco 1984, 296. 302 f.

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IV. Framework of Archaeological Work on Tall Zirā‘a

by Dieter Vieweger/Jutta Häser

4.1. The Grid System Used at the Excavations

The regional Israel or Palestine Grid is generally used for archaeological mapping in the Southern Levant. This system (was originally established by the the British Army during World War I and later designed for the English Mandate Administration in 1923) is orientated towards a triangulation station located on the Alī al-Munṭār Mountain, to the south-east of Gaza (fixed point: East 100000 m, North 100000 m). All coordinates given in this volume are in the order of ‘East.North’, whereby the eastern and northern coordinates are separated by a period or full stop. If the coordinates are rounded to 100 m, the last two points are not written. According to the Israel or Palestine Grid 1923, the coordinates of Tall Zirā‘a are 2119.2252 (rounded to 100 m; 32°37’14.19´N; 35°39’ 22.01´O).

The Tall Zirā‘a excavation grid is also orientated by this coordinate system. In autumn 2001, the tall was divided into 5 m x 5 m squares (*Fig. 4.2*). The x-coordinate running from west to east is labeled with numbers, and begins with 101. The y-coordinate of the excavation grid is labeled with the letters A to Z; however, the letter J was not assigned to remove the chance of confusion between the letters I and J. As the system required futher coordinates after the letter Z had been assigned, the system first used AA, AB, AC to AZ, and then continued with BA, BB, BC to BZ. The excavation squares are named as ‘y-coordinate x-coordinate’, for example, A 101.

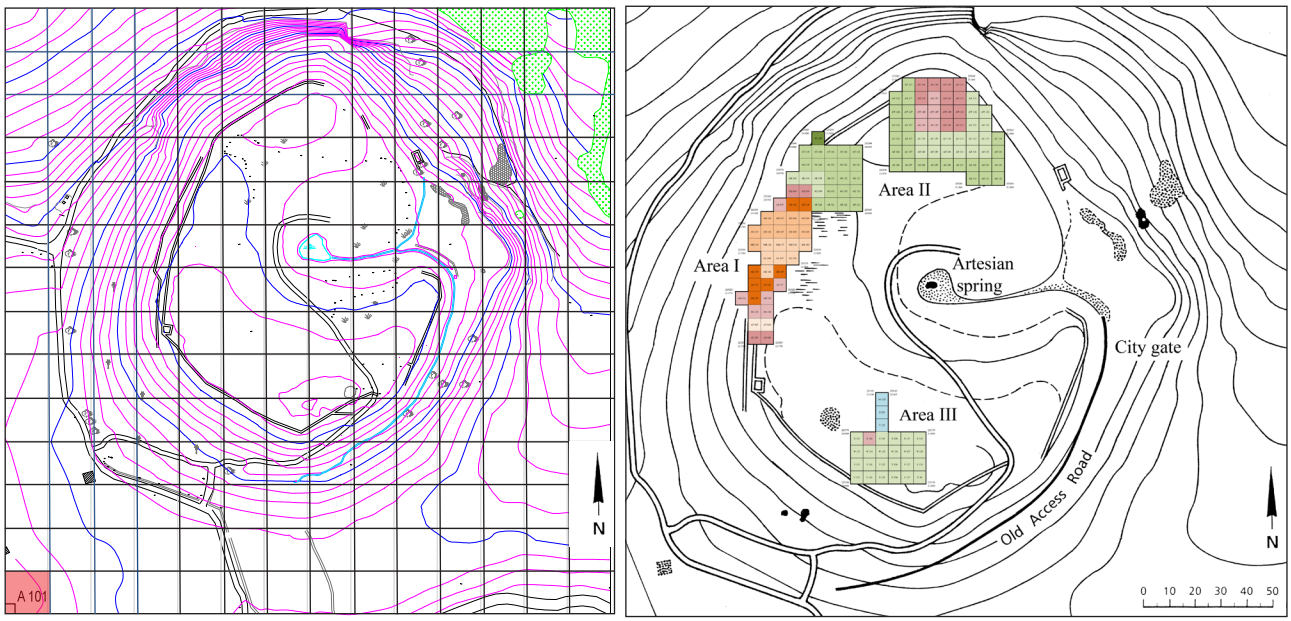
Square A 101 is located in the south-western part of the tall. It was deliberately located at some distance from the hill (*Fig. 4.2*), in order to include any extant installations or lower cities/suburbs into the same grid system, so that all squares or site locations are directly connected with the excavation. The south-western edge of Square A 101 has the Israel or Palestine Grid coordinate 211700.225060.

For the purpose of the Tall Survey, 16 squares comprised one survey square of 20 m x 20 m. To simplify matters, survey squares were labeled with the name of the south-westernmost 5 m x 5 m. Thus, Survey Square V 117, for example, identifies all squares on the coordinates V–Y 117–120 (see *Fig. 4.1*)

Y 117	**Y 118**	**Y 119**	**Y 120**
X 117	**X 118**	**X 119**	**X 120**
W 117	**W 118**	**W 119**	**W 120**
V 117	**V 118**	**V 119**	**V 120**

Fig. 4.1 Survey squares and their denotation

The *Fig. 4.2* provides an overview of the excavation grid and *Fig. 4.3* of the excavation Areas I–III (*Figs. 4.4–4.6*).



Figs. 4.2–4.3 Tall Zirā‘a. Left: Topographical map with the starting point Square A 101 (red), survey squares: 20 m x 20 m; right: with Areas I–III, excavation squares: 5 m x 5 m (Source: BAI/GPIA).

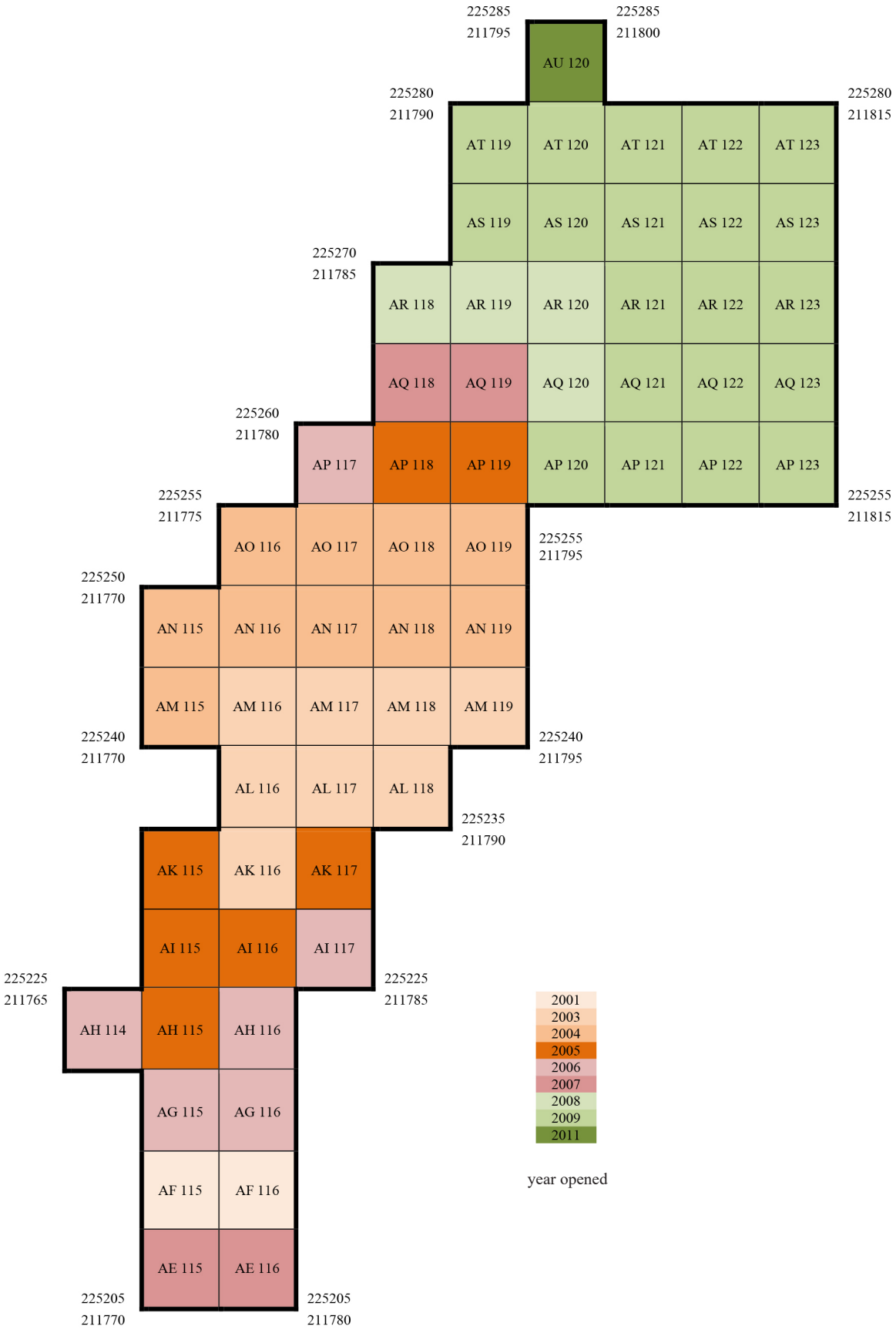


Fig. 4.4 Area I and its excavation squares (Source: BAI/GPIA).

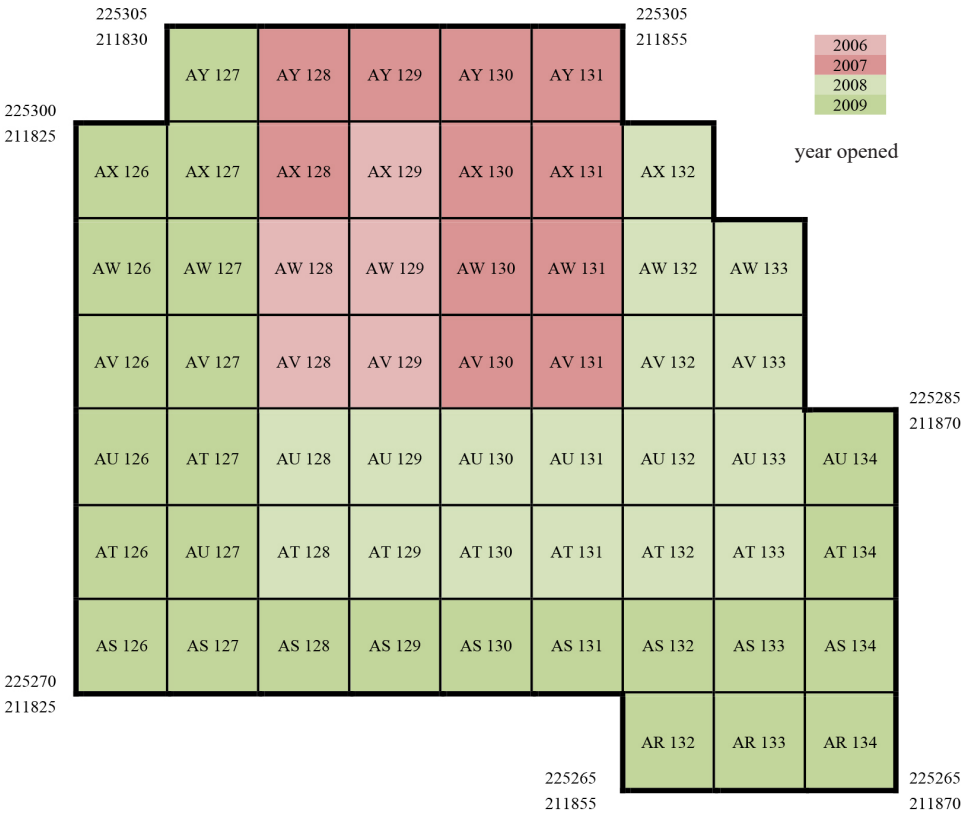


Fig. 4.5 Area II with its excavation squares (Source: BAI/GPIA).

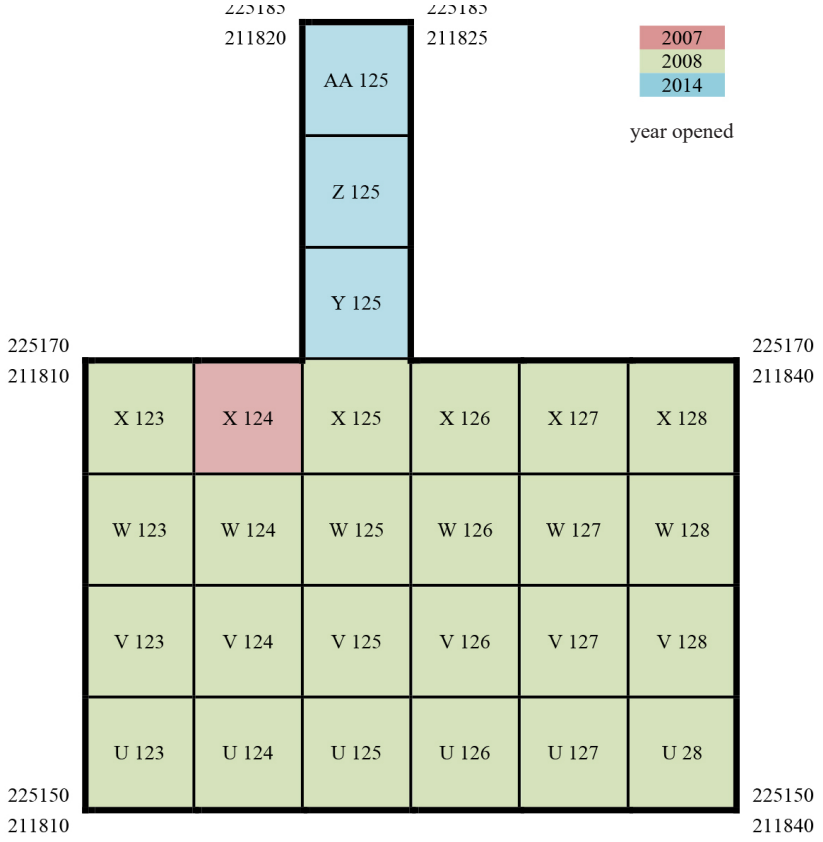


Fig. 4.6 Area III with its excavation squares (Source: BAI/GPIA).

4.2. Stratigraphic Nomenclature and Definition of Areas, Contexts, and Finds

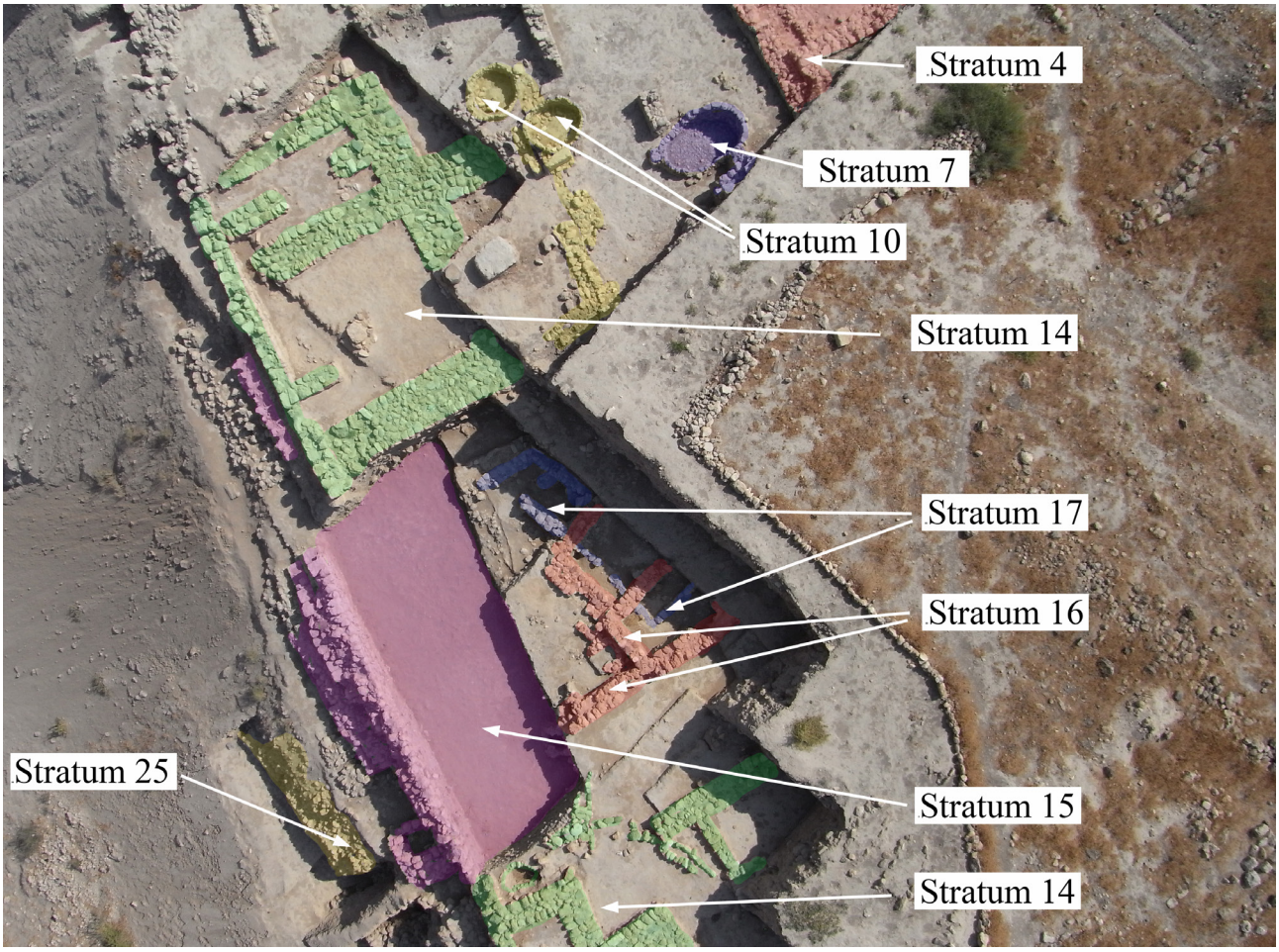


Fig. 4.7 Strata 25, 17–14, 10, 7, and 4 in Area I. Photograph taken in 2009 (Source: BAI/GPIA).

4.2.1. Stratigraphic Nomenclature

Tall Zirā'a provides the opportunity to explore settlement layers from the Early Bronze Age to the Ottoman period. There are no real settlement gaps within a 5,000 year time span, because:

- The artesian spring (*Fig. 1.12*) delivered a continuously fresh water supply throughout summer and winter (see *Chaps. 1.2.1.* and *1.2.2.*).
- The sinter hill provided a natural protective barrier for the settlement (see *Chaps. 1.2.1.* and *1.2.2.*)
- The fertile and water-rich Wādī al-'Arab provided sufficient arable land (see *Chap. 1.3.*)
- The access to (trans-)regional trade routes (see *Chap. 1.3.2.*)

J. W. Hanbury-Tenison has already written about the temporal classification for finds he found on the Tall Zirā'a:

> „Tell Zira'a (…) Large tell 150.00 m. (n/s) x 100 m. (e/w) on top of steepsided natural crag above Wadi Arab. Strong natural spring in the centre of the top of hill. Occupation of all periods, Chalco/EB to mediaeval. Cisterns, casemate walls (?), and mediaeval structures. The early material is mainly on the west slope"[1].

In fact, the settlements on Tall Zirā'a differ widely during these five millennia. Historic-cultural changes, climatic variations and political situations are reflected in continuity and discontinuity of cultural development on the tall, for example, the succession of walled or open cities, and some small settlements or hamlets, and also

1 Hanbury-Tenison et al. 1984, 389.

a relatively sedentary population during the Transitional period in the Early Bronze Age IV and Middle Bronze Age I.

The excavations on Tall Zirā'a were conducted in three Areas (I–III) (*Chap. 1.4.4.1.; Fig. 4.3*). These areas were correlated according to finds dating, as well as survey works. In total 25 strata have been identified so far (see *Tab. 4.1*; see also *Figs. 4.7* and *4.8*).

It was initially intended to excavate the whole stratigraphic sequence of Tall Zirā'a in Area I; however, nearly all of this area was affected by a landslide which occurred around 1500 BC and which destroyed large sections of the western area of the settlement (Stratum 16; *Chap. 1.4.4.16.*). The inhabitants of the hill, however, were obviously unable to leave the western part of the tall unused, which is why they put a great deal of effort into carefully rebuilding the lost area (Stratum 15; *Fig. 1.64*). On top of this reconstructed area of the hill, a completely new part of the settlement was built (Stratum 14). It comprises a city wall, a tower with a integrated small temple, a casemate wall, a large temple area, and several courtyard houses (*Fig. 1.52*).

In order to evaluate the thickness of the filling of Stratum 15 and the possibility of reaching remains of earlier strata below this filling, a trench was opened in the centre of Area I. Since there was no end of the filling layers recognizable after 4.5 m, it was decided to stop excavations in most parts of Area I, and to leave Stratum 14 at the point where the excavation had already reached; this stratum has not been further excavated until the present time, and is still visible on the tall.

Earlier strata than Stratum 15 could be reached in small parts of Area I which were not effected by the landslide. Remains of Stratum 16 (Late Bronze Age) were found north of the large temple area of Stratum 14. Remains of Strata 24 to 16 (Middle to Early Bronze Age) could be excavated in a small section in the centre of Area I just east of the test trench for the evaluation of the filling of Stratum 15.

Another area with earlier remains was the western slope of Area I. In a step trench a massive Early Bronze Age city wall with its glacis came to light (Stratum 25). However, it was not possible to complete the excavation, as this wall could not be correlated with the excavated settlement layers of the Early Bronze Age in this area. Furthermore, it was not possible to explore earlier strata because of the possible collapse of the trench.

The natural shape of Tall Zirā'a together with the results of the survey conducted on the tall surface suggest there may be some earlier settlement layers beneath Stratum 24. Depending on the local situation on the tall, a further settlement layer of at least 3 m can be expected.

Tab. 4.1 illustrates the strata, and the period to which each has been assigned:

In general, a destruction layer was associated with the related horizon, as well as the fill immediately above the same destruction layer; that is, the destruction and levelling debris of Stratum 5 were designated as Stratum 5. Only rebuilding or construction activities of the new settlement were associated with the new stratum above.

Strata are complex archaeological horizons; for example, a widely disseminated level of common art and artefacts at an archaeological site or area. Each stratum is a distinctive level in that site or area's archaeological sequence, and as such can be understood as a break in context, which denotes a change in epoch on a given site by delineation in time of the finds found within each context.

If there are different layers (e.g. floors) in one architectural unit, or smaller changes in architectural style/architectural modifications in a large complex, these layers or changes are designated as different phases in one single stratum. Larger building activities in one complex are designated as a new stratum if they are accompanied by a change in period, which is demonstrated by the finds.

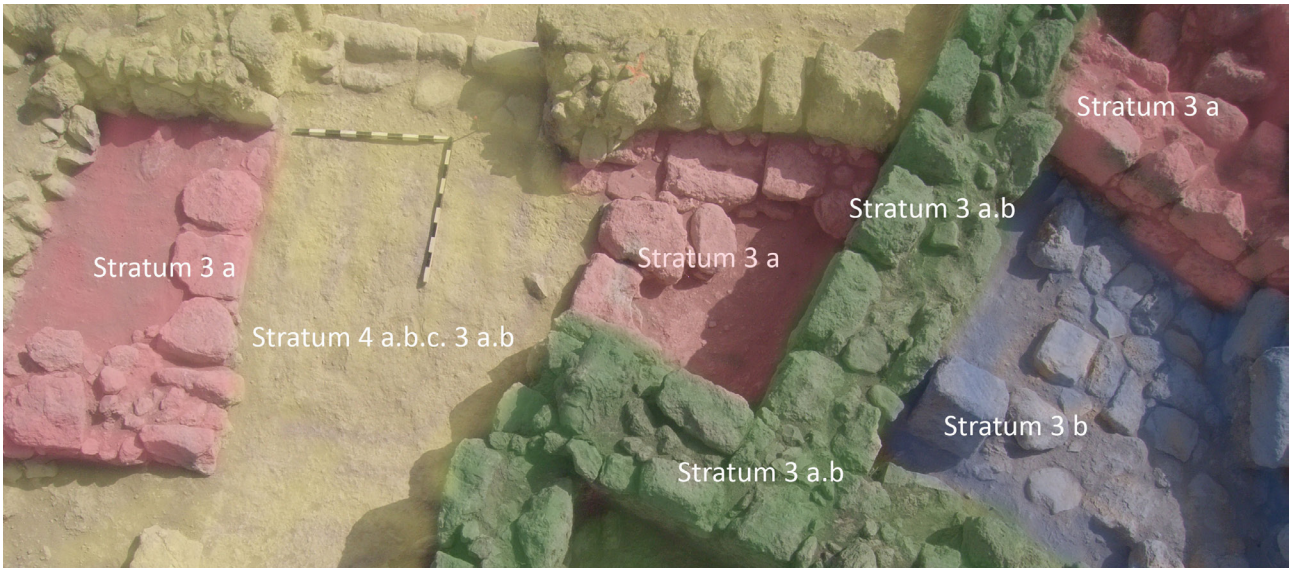


Fig. 4.8 Strata 3 a, 3 a.b. and 4 a.b.c. in Area II, Square AT 126 (Source: BAI/GPIA).

Strata	Period		Area I	Area II	Area III
0	-	colluvium	x	x	x
1	Ottoman	hamlets/tombs	x	x	x
2	Abbassid–Mamluk	open settlement	x	x	x
3 a	Umayyad: 1. Phase	monastery	x	x	x
3 b	Umayyad: 2. Phase	monastery	x	x	x
4 a	Byzantine – 1. Phase	monastery	x	x	x
4 b	Byzantine – 2. Phase	monastery	x	x	x
4 c	Byzantine – 3. Phase	monastery	x	x	x
5	Late Roman–Early Byzantine	small settlement	x	x	x
6 a	(Early-)Roman – 1. Phase	roman villa	x	x	-
6 b	(Early-)Roman – 2. Phase	roman villa	x	x	-
6 c	(Early-)Roman – 3. Phase	roman villa	x	x	-
7 a	Early Roman – 1. Phase	roman villa	x	x	-
7 b	Early Roman – 2. Phase	roman villa	x	x	-
7 c	Early Roman – 3. Phase	roman villa	x	x	-
8	Hellenistic	fortified structure	x	x	-
9	Persian(–Hellenistic)	fortified structure? and ceramic sherds	x	x	-
10	Iron Age IIC	open settlement	x	x	-
11	Iron Age IIA/B (younger)	walled settlement	x	-	-
12	Iron Age IIA/B (older)	walled settlement	x	-	-
13	Iron Age I	open settlement	x	-	-
14 a	Late Bronze Age II – 1. Phase	walled settlement	x	-	-
14 b	Late Bronze Age II – 2. Phase	walled settlement	x	-	-
14 c	Late Bronze Age II – 3. Phase	walled settlement	x	-	-
14 d	Late Bronze Age II – 4. Phase	walled settlement	x	-	-
15	Late Bronze Age/Repair layer	constructional stratum	x	-	-
16	Middle Bronze Age IIC/Late Bronze Age I	settlement	x	-	-
17	Middle Bronze Age IIB	settlement	x	-	-
18	Middle Bronze Age IIA (younger)	settlement	x	-	-
19	Middle Bronze Age IIA (older)	settlement	x	-	-
20	Early Bronze Age IV/Middle Bronze Age I (younger)	(permanent?) settlement	x	-	-
21	Early Bronze Age IV/Middle Bronze Age I (older)	(permanent?) settlement	x	-	-
22	Early Bronze Age III	settlement (walled?)	x	-	-
23	Early Bronze Age II/III	settlement (walled?)	x	-	-
24	Early Bronze Age II	settlement (walled?)	x	-	-
25	Early Bronze Age	walled settlement	x	-	-

Tab. 4.1. Strata on Tall Zirāʿa in correlation with the periods (Source: BAI/GPIA).

4.2.2. Definition and Numbering System of Areas, Contexts, and Finds

The excavations on Tall Zirā'a were carried out in three different excavation areas, which were named with Roman numerals: Area I in the west and in the north-west, Area II in the north, and Area III in the south (*Fig. 4.3*)[2]. The excavation started with squares of 5 m x 5 m, which were sometimes extended to 10 m x 10 m when very large building complexes came to light[3]. The baulks had to be removed after recording, due to security reasons.

The material dug out during the excavations was dumped west of the road stretching along the western foot of the tall, ground owned by the 'Water Authority of Jordan'.

All archaeological features were designated as 'contexts' without differentiation between e.g. walls, installations, fillings, etc. Each context received a 'context number'. The numbering of the contexts started separately for each excavation area in order to avoid confusing the numbers and thus the contexts. The context numbers in Area I went from 1 to 6,516, in Area II from 10,000 to 11,477, and in Area III from 30,000 to 30,427[4]. The finds were collected and recorded on a daily basis. The pottery of each context was given an 'assemblage number'. When registering the sherds of each assemblage, each sherd received the appropriate assemblage number, and each diagnostic sherd was moreover assigned an 'extension number'. Thus, the pottery of Context 1234 received the assemblage number 2809 and diagnostic sherds the consecutive numbers 1, 2, 3, and so forth. The complete number of a diagnostic sherd is cited in the publication as, e.g. TZ 002809-001. This way, each diagnostic sherd can be identified and found under its specific number.

If the excavation of a context continued, e.g. the next day or later, the pottery from this new dig received a new assemblage number. It is therefore possible that several pottery assemblage numbers belong to one context number, e.g. Context 2236 yielded the pottery assemblages 3935, 3950, 3953, 3960, 3968, 3988, 3999, and 4017.

This kind of numbering system has been used for all find groups containing many single objects in one context, e.g. flint assemblages. However, small finds of metal, faience, glass, bone, ivory, etc., were normally registered with an individual find number for each single find.

Similar to the assignation of the context numbers, also the numbering system of the finds is based on the area where they were found[5]. In Area I the numbering for the pottery and small finds started with 1001 and ended with 21,815. In Area II the numbering of the pottery went from 100,000 to 112,238 and the numbering of the small finds from 110,000 to 112,757. In Area III the numbering of the pottery sherds went from 300,000 to 300,238 and that of the small finds from 310,000 to 310,703.

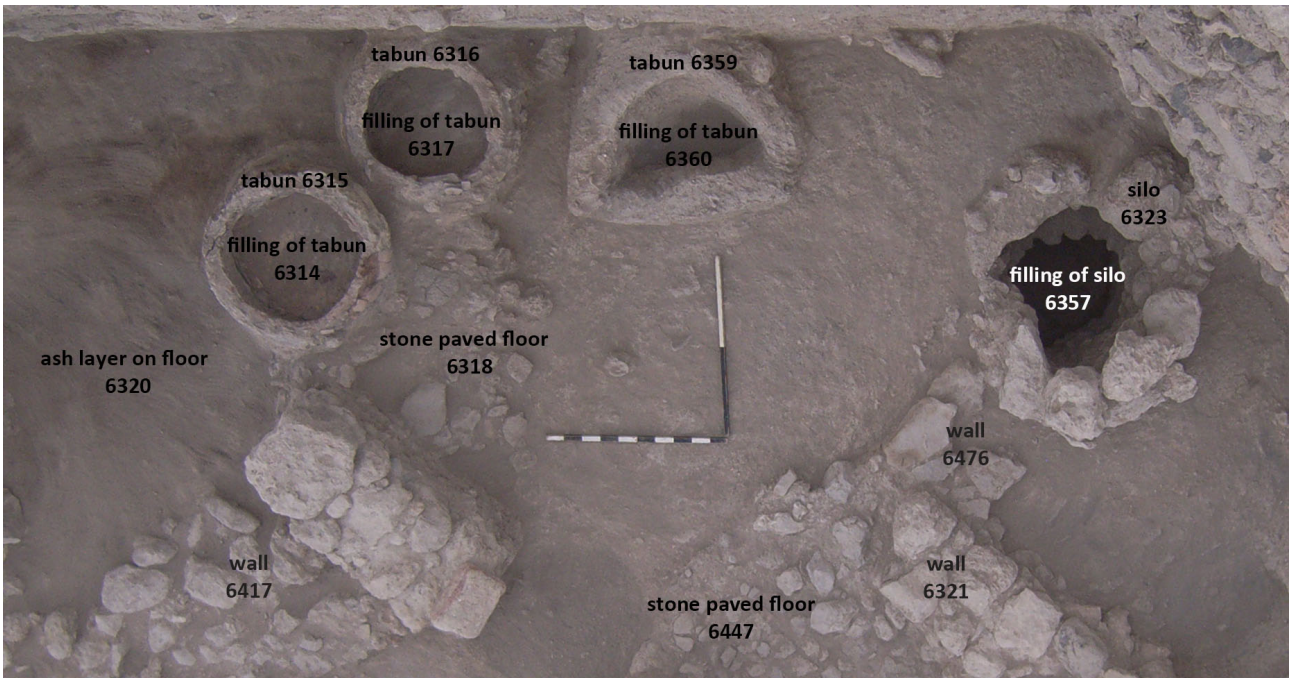


Fig. 4.9 Contexts in Area I, Square AT 122, Complex A2–B1 (Source: BAI/GPIA).

2 The scientific aims for opening these three areas are explained in *Chap. 1.4.4.1*.

3 For the grid system and the numbering of the squares cf. *Chap. 4.1*.

4 The data are the status of 2016.

5 The data are the status of summer 2016.

4. 3. Archaeological Periods in the Southern Levant (a Short Chronology)

The time data table *Tab. 4.3* illustrates the chronology for the Southern Levant in an historical context. The absolute year dates are determined by examination of a variety of sources to determine duration or time of historical events, in particular from:

- Written records, astronomical data and coin finds, i.a.
- 'Classical' dating methods (e.g. stratigrafic results, knowledge of typology and seriation)
- Scientific dating methods for age determination (e.g. radiocarbon dating, dendrochronology)
- Synchronism (e.g. between Egypt, Mesopotamia and Syria/Palestine) with area-covering correlations

Reliable dates can only be ascertained if several methodological steps consistently secure an age determination. However, uncertainty factors for each method must always be taken into consideration; even with scientific measurement results, diverse chronological variabilities are to be taken into account.

The chronological dates for Egypt and Mesopotamia are used as decisive for the early periods. Both systems are used for the 'Short Chronology'.

For detailed explanations of the chronology of the Southern Levant in the scope of history of Egypt, Syria and Mesopotamia, see Vieweger 2012, 459–507. An extract of this publication, with a chronological table (in German) is found in the appendices of this volume (*App. 4.1*).

There is no justified necessity for the first half of the third millennium to lower further the available dates of the Southern Levant 'Short Chronology'. The scientific results gained by radiocarbon dating do not allow such conclusion in its entirety.

A further problem can be illustrated concerning the dating of the beginning of the Early Bronze Age. The date of 3600 BC represented here is derived from the archaeological context of Tall 'Arād. There the oldest, still unwalled, Bronze Age settlement (Stratum IV) had ceramic of Egyptian origin and thus already had trade contacts with the land of the Nile in its early periods. An Egyptian vessel fragment with the Sereḫ sign of Narmer, the last pharaoh of the Predynastic period (Negade III), enables the temporal synchronisation between the Negade II/III period in Egypt and the Early Bronze Age I in Palestine, according to R. Amiran (*Tab. 4.2*)[6].

Furthermore, this is the earliest possible chronological synchronization between Egypt and Palestine.

Inevitably, all attempts to classify dates for Prehistory remain schematic. The flat time span presented in this volume for Tall Zirā'a and in Vieweger 2012, should be regarded as approximate. Generally, one has to expect an uncertainty factor of decades (or perhaps more) for the third millennium BC, and of several years (up to decades), for the second millennium BC. Secure, absolute dating is possible only from the second third of the first millennium BC.

All dates in this volume are recorded and marked as BC or AD.

Selected literature for the chronological problems described above are:

- Bietak 1989, 78–120.
- Dever 1980, 35–64.
- Matthiae 1989, 163–169.
- Reade 1981, 1–9.
- Schwartz – Weiss 1992a, 221–24 and Schwartz – Weiss 1992b 185–202.
- Stager 1992a, 22–41 and Stager 1992b, 46–60.
- Wright 1959, 13–29.

'Arād	Southern Levant	Egypt
'Arād Stratum V	Chalcolithic	Badārī-/Negade I–IIb period
	Early Bronze Age IA	End of Negade IIc–d2 period
'Arād Stratum IV	Early Bronze Age IB	Negade III period (incl. Narmer)
'Arād Stratum III	Early Bronze Age II	Thinite period (beginning of 1. Dynasty)
'Arād Stratum II/I	Early Bronze Age II	Thinite period (1. Dynasty – end of 2. Dynasty)

Tab. 4.2 Temporal Synchronisation between the Negade II/III period in Eypt and the Early Bronze Age in Palestine (Source: BAI/GPIA).

6 Amiran 1974, 4–12; Amiran – Ilan 1992, 76.

Palaeolithic	1.76 Mio–16000 BC	
Epipalaeolithic	16000–9300/8500 BC	
Neolithic	9300/8500–3600 BC	
Chalcolithic	5000/4500–3600 BC	
Bronze Age	3600–1200/1150 BC	
Early Bronze Age I–III	3600–2300 BC	
Early Bronze Age I	3600–3000 BC	
Early Bronze Age II	3000–2700 BC	
Early Bronze Age III	2700–2300 BC	
Transitional period	2300–1950 BC	
Early Bronze Age IV	2300–2150 BC	
Middle Bronze Age I	2150–1950 BC	
Middle Bronze Age II	1950–1550 BC	
Middle Bronze Age IIA	1950–1750 BC	
Middle Bronze Age IIB	1750–1630 BC	
Middle Bronze Age IIC	1630–1550 BC	
Late Bronze Age	1550–1200/1150 BC	
Late Bronze Age I	1550–1400 BC	
Late Bronze Age IIA	1400–1300 BC	
Late Bronze Age IIB	1300–1200/1150 BC	
Iron Age	1200/1150–520 BC	
Iron Age I	1200/1150–980 BC or 1200/1190–930/20 BC	
Late Bronze Age IIB/Iron Age IA	after 1200/1190 BC (Modified Conventional Chronology according to A. Mazar)	1200/1190–1140/1130 BC (Low Cronology according to I. Finkelstein])
Iron Age IA	1200/1150–1040/1030 BC	1140/1130–1050 BC
Iron Age IB	1040/1030–980 BC	1050–930/920 BC
Iron Age II	980–520 BC or 930/20–520 BC	
Iron Age IIA	980–830 BC	930/920–800 BC
Iron Age IIB	830–700 BC	800–700 BC
Iron Age IIC	700–520 BC	
Persian period (Iron Age III)	520–332 BC	
Hellenistic period	332–63 BC	
Early Hellenistic	332–167 BC	
Late Hellenistic	167–63 BC	
Ptolemaic Rule	301–198 BC	
Seleucid Rule	198–63 BC	
Hasmonean Rule	166–63 BC	
Roman period	63 BC–324 AD	
Early Roman	63 BC–132 AD	
Late Roman	132–324 AD	
Byzantine period	324–638 AD	
Islamic period	638–1516/17 AD	
Early Islamic	638–1099 AD	
Umayyad period	638–749/750 AD	
Abbasid period	749/750–1258 AD	
Fatimid period	969–1171 AD	
Crusader/Ayyubid	1099–1291 AD	
Ayyubid period	1171–1251/1262 AD	
Late Islamic	1291–1516/1517 AD	
Mamluk period	1291–1516/1517 AD	
Ottoman period	1516/1517–1918 AD	

Tab. 4.3 Time data for the Southern Levant (Source: BAI/GPIA).

4.4. Radiocarbon Samples from Tall Zirā‘a

All samples originate from burnt wooden finds. Grains, seeds and other ephemeral botanical remains (which can also be used for radiocarbon sampling) were either not available on the tall or did not occur in the required condition or stratified spots. The reason for the poor state of preservation for the botanical remains appears to be the microclimate; the deposits on Tall Zirā‘a underwent an annual change from wet to dry and then back to wet again because of the presence of the artesian spring in the centre of the tall.

A total of 48 radiocarbon samples were sent for analysis, most of them at the Poznań Radiocarbon Laboratory[7]; T. Goslar was responsible for most of the processing. The ‘Institute for Isotope Research and Nuclear Physics’ in Vienna was assigned not only to control the acquired results, but also to analyse some of the samples; E. M. Wild was responsible for this. Sample analysis results were consistent from both the laboratories, with no significant differences.

In all 47 samples were analysed from Area I, which is the major area for determining stratification of the tall; one sample has been analyzed from Area II[8]. Specific measurements will be discussed in detail in the context of their respective strata; in this chapter, the radiocarbon dates and their interrelation will be discussed briefly, followed by conclusions drawn from the results.

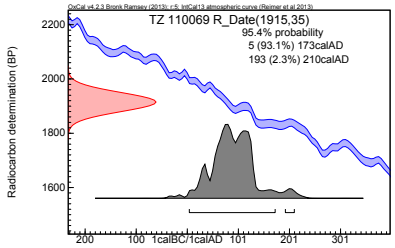
4.4.1. Area II

The radiocarbon sample from Area II was used to ensure the chronological reference of the stratigraphy of Areas I and II, based on the stratigraphic sequence and the artefacts that were found. Sample TZ 110069-001 (charcoal) was found in Context 11110 (Square AW 128; Strata 6 and 5, which underlay the chalk bed [Context 10041, Strata 4 and 3] for the paving [Context 10022] of a courtyard, which was located in Strata 4 and 3 [assigned to the Byzantine and Umayyad period]). Thus, the sample belongs to the destruction and fill layer of the Early to Late Roman architecture. The ceramic finds from this context date to the Hellenistic and Early Roman periods[9].

Sample TZ 110069-001

Context 11110 from Square AW 128:
The sample dates to 1915 ±35 BP:

- 57–127 AD (= 1 Sigma: 68.2 %)
- 5–173 AD (93.1 %); 193–210 AD (2.3 %) (= 2 Sigma: 95.4 %)
- 39 BC–230 AD (= 3 Sigma: 99.7 %)



4.4.2. Area I

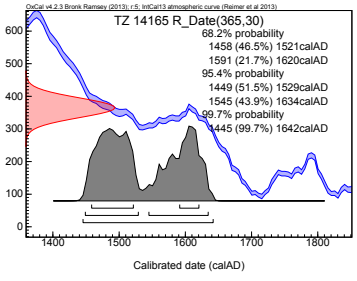
4.4.2.1. Ottoman Period (Stratum 1)

Sample TZ 014165-001 (charcoal) comes from Context 3940 (Square AR 121) and was found in Stratum 1[10]. This suggests a dating of the sample to the Ottoman period.

Sample TZ 014165-001

Context 3940 from Square AR 121
The sample dates to 365 ± 30 BP:

- 1458–1521 AD (46.5 %); 1591–1620 AD (21.7 %) (= 1 Sigma: 68.2 %)
- 1449–1529 AD (51.5 %); 1545–1634 AD (43.9 %) (= 2 Sigma: 95.4 %)
- 1445–1642 AD (= 3 Sigma: 99.7 %)



7 Prof Dr Tomasz Goslar, Poznań Radiocarbon Laboratory, ul. Rubież 46, 61612 Poznań, Poland.

8 All calibration details are given according to OxCal v4.2.2 Bronk Ramsey – Lee 2013; r:5; Atmospheric data from Reimer et al. 2013.

9 Finding place -20.35 m below NN. The associated ceramic with the find numbers TZ 100048 and TZ 100058 are mainly Late Hellenistic to Early Roman/Roman period mixed with some Early Bronze Age and Iron Age material caused by pits and building activities.

10 In terms of height (-21.21 m), Context 3940 lies above medieval graves Contexts 4315 and 4290 (-21.31 m and -21.24 m resp.).

4.4.2.2. Early Roman Period (Stratum 7 c)

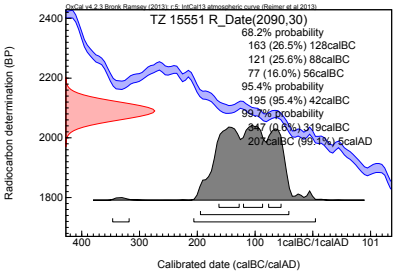
Sample TZ 015551-001 proves that Context 5201 (Square AQ 123) can be assigned to the Classical periods; radiocarbon dating points to a time in the second or first century BC, thus confirming the context dating from Stratum 7 c as Early Roman.

Context 5201 belongs to the rubble of a workshop or kitchen. The coin TZ 015292-001 from Context 5201 depicts a *cornucopia,* and has an inscription which may mention the name Yehohanan (135–104 BC).

Sample TZ 015551-001

Context 5201 from Square AQ 123
The sample dates to 2090 ± 30 BP:

- 163–128 BC (26.5 %); 121–88 BC (25.6 %); 77–56 BC (16 %) (= 1 Sigma: 68.2 %)
- 195–42 BC (= 2 Sigma: 95.4 %)
- 347–319 (0.6 %); 207–5 BC (99.1 %) (= 3 Sigma: 99.7 %).



4.4.2.3. Iron Age (Strata 13–10)

In the following Pre-Classical periods, ceramic artefacts provided the main dating for the contexts. They are on the whole consistent with the radiocarbon dating presented in this chapter, thereby confirming the stratigraphically obtained image. Some specific differences between the assigned date of the stratigraphic layer and the sampled radiocarbon data do occur in some cases, and are discussed below.

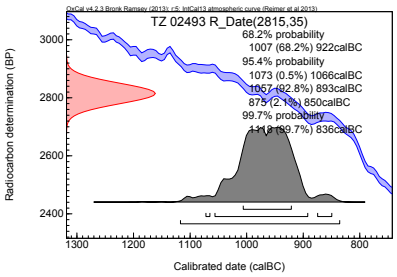
Stratum 10

Three samples were found in the Stratum 10 (in the Squares AO 118 and AP 121); they are assigned to Iron Age IIC: TZ 002493-001, TZ 014126-001 and TZ 015539-001.

Sample TZ 002493-001

Context 820 from Square AO 118
The sample dates to 2815 ± 35 BP:

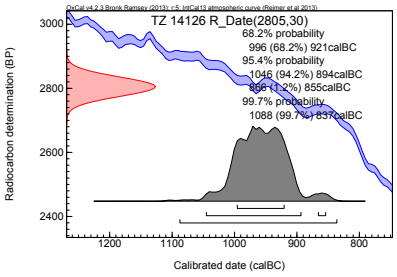
- 1007–922 BC (= 1 Sigma: 68.2 %)
- 1073–1066 BC (0.5 %); 1057–893 BC (92.8 %); 875–850 BC (2.1 %) (= 2 Sigma: 95.4 %)
- 1,118–836 BC (= 3 Sigma: 99.7 %)



Sample TZ 014126-001

Context 4418 from Square AP 121
The sample dates to 2,805 ± 30 BP:

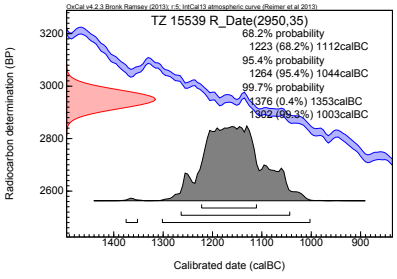
- 996–921 BC (= 1 Sigma: 68.2 %)
- 1046–894 BC (94.2 %); 866–855 BC (1.2 %) (= 2 Sigma: 95.4 %)
- 1088–837 BC (= 3 Sigma: 99.7 %)



Sample TZ 015539-001

Context 4674 from Square AP 121
The sample dates to 2950 ± 35 BP:

- 1223–1112 BC (= 1 Sigma: 68.2 %)
- 1264–1044 BC (= 2 Sigma: 95.4 %)
- 1376–1353 BC (0.4 %); 1302–1003 BC (99.3 %) (= 3 Sigma: 99.7 %)



Stratum 10 belongs to the Iron IIC settlement that followed the once thriving urban Iron Age IIA/B (Stratum 11), fortified by an impressive zigzag city wall. Stratum 11 and 12 represent the timeframe from the tenth to the eighth century BC.

There is a significant chronological difference between the radiocarbon dating for the samples TZ 002493-001 and TZ 014126-001 on the one hand, and Sample TZ 015539-001 on the other. The first two samples can be dated to the era of the Iron Age IIA/B (Strata 12 and 11). However, the last one, with a radiocarbon date to the Iron Age I (Stratum 13) is much earlier. Therefore it can be assumed that the reoccupied smaller Iron Age IIC settlement (without a city wall) reused extant wood residues from preceding settlements.

The archeological evidence for the Iron Age IIC settlement on Tall Zirā'a, is consistent with the evidence from other Iron Age IIC settlements (e.g. Tall al-Ǧuḥfīya) in the region where mostly villages can be found; this is in sharp contrast to the high level of culture found in the contemporary cities and kingdoms from the central area of Transjordan, such as Ammon, Moab and Edom.

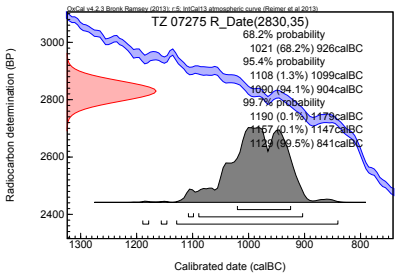
Stratum 11

Two samples were found in Stratum 11 (Squares AL 118 and AP 119); they are assigned to Iron Age II A/B younger phase: TZ 007275-001 and TZ 007253-001.

Both samples represent a prosperous walled city, which was built around 1000 BC (see Stratum 12), according to the evidence from the ceramics and other finds, with a partly existing horizon of destruction of stratum 12 during the tenth century (TZ 007275-001). Some contexts may have been rebuilt with reused material (TZ 007253-001) from the strata 12 or 11.

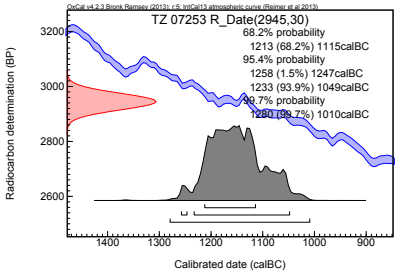
Sample TZ 007275-001
Context 1138 from Square AL 118
The sample dates to 2830 ± 35 BP:

- 1021–926 BC (= 1 Sigma: 68.2 %)
- 1108–1099 BC (1.3 %); 1090–904 BC (94.1 %) (= 2 Sigma: 95.4 %)
- 1190–1179 BC (0.1 %); 1157–1147 (0.1 %); 1129–841 BC (99.5 %) (= 3 Sigma: 99.7 %)



Sample TZ 007253-001
Context 1267 from Square AP 119
The sample dates to 2945 ± 30 BP:

- 1213–1115 BC (= 1 Sigma: 68.2 %)
- 1258–1247 BC (1.5 %); 1233–1049 BC (93.9 %) (= 2 Sigma: 95.4 %)
- 1280–1010 BC (= 3 Sigma: 99.7 %)

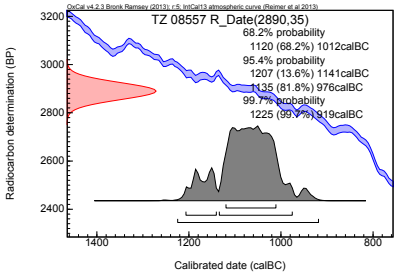


Stratum 12

Samples TZ 008557-001, TZ 002149-001, TZ 002391-001 and TZ 008668-001 are from Stratum 12 (Iron Age IIA/B older phase). The contexts of Stratum 12 describe a city built around 1000 BC, which was surrounded by a wall and marked an impressive change from the open settlement of Iron Age I (Stratum 13) to the flourishing city of Iron Age IIA/B (Strata 12 and 11).

Sample TZ 008557-001
Context 1996 from Square AM 119
The sample dates to 2890 ± 35 BP:

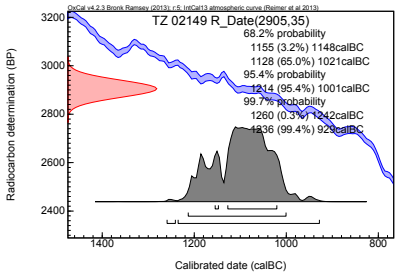
- 1120–1012 BC (= 1 Sigma: 68.2 %)
- 1207–1141 BC (1.5 %); 1135–976 BC (93.9 %) (= 2 Sigma: 95.4 %)
- 1225–919 BC (= 3 Sigma: 99.7 %)



Sample TZ 002149-001

Context 555 from Square AN 117
The sample dates to 2905 ± 35 BP:

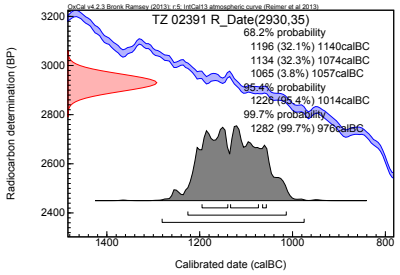
- 1155–1148 BC (3.2 %); 1128–1021 BC (65 %) (= 1 Sigma: 68.2 %)
- 1214–1001 BC (= 2 Sigma: 95.4 %)
- 1260–1242 BC (0.3 %); 1236–929 BC (99.4 %) (= 3 Sigma: 99.7 %)



Sample TZ 002391-001

Context 599 from Square AN 117
The sample dates to 2930 ± 35 BP:

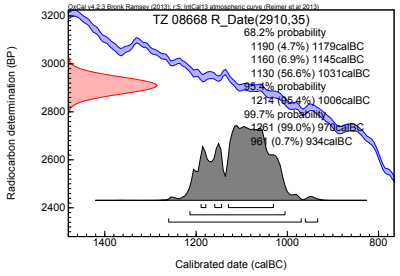
- 1196–1140 BC (32.1 %); 1134–1074 BC (32.3 %); 1065–1057 BC (3.8 %) (= 1 Sigma: 68.2 %)
- 1226–1014 BC (= 2 Sigma: 95.4 %)
- 1282–976 BC (= 3 Sigma: 99.7 %)



Sample TZ 008668-001

Context 2069 from Square AH 116
The sample dates to 2910 ± 35 BP:

- 1190–1179 BC (4.7 %); 1160–1145 BC (6.9 %); 1130–1031 BC (56.6 %) (= 1 Sigma: 68.2 %)
- 1214–1006 BC (= 2 Sigma: 95.4 %)
- 1261–970 BC (99 %); 961–934 BC (0.7 %) (= 3 Sigma: 99.7 %)



Stratum 13

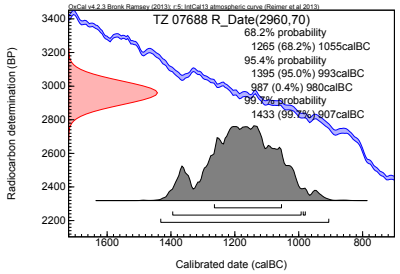
The samples from Stratum 13 (Iron Age I) suggest that the Early Iron Age settlement was established around 1200 BC; it followed the Late Bronze Age settlement immediately with no hiatus in habitation. Existing architectural units as well as building material (Sample TZ 007257-001) were reused in the new stratum. The other samples, (TZ 007688-001 and TZ 008858-001) have been assigned to Iron Age I. Context 1413 continues from the Iron Age I to Iron Age IIA/B (older phase).

Sample TZ 007688-001

Context 1413 from Square AO 118
The sample dates to 2960 ± 70 BP/Second examination to 2960 ± 30 BP:

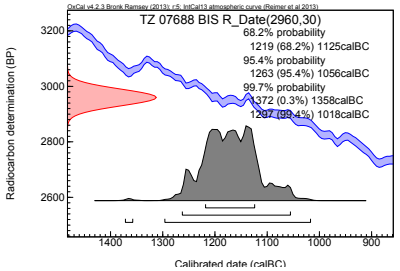
First examination:

- 1265–1055 BC (= 1 Sigma: 68.2 %)
- 1395–993 BC (95 %); 987–980 BC (0.4 %) (= 2 Sigma: 95.4 %)
- 1433–907 BC (= 3 Sigma: 99.7 %)



Second examination:

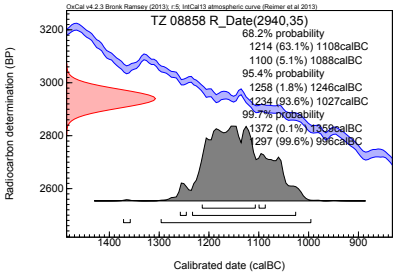
- 1219–1125 BC (= 1 Sigma: 68.2 %)
- 1263–1056 BC (= 2 Sigma: 95.4 %)
- 1372–1358 BC (0.3 %); 1297–1018 BC (99.4 %) (= 3 Sigma: 99.7 %)



Sample TZ 008858-001

Context 2115 from Square AN 119
The sample dates to 2940 ± 35 BP:

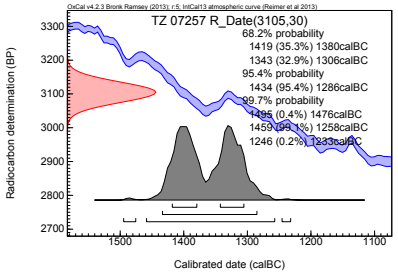
- 1214–1108 BC (63.1 %); 1100–1088 BC (5.1 %) (= 1 Sigma: 68.2 %)
- 1258–1246 BC (1.8 %); 1234–1027 (93.6 %) (= 2 Sigma: 95.4 %)
- 1372–1359 BC (0.1 %); 1297–996 (99.6 %) (= 3 Sigma: 99.7 %)

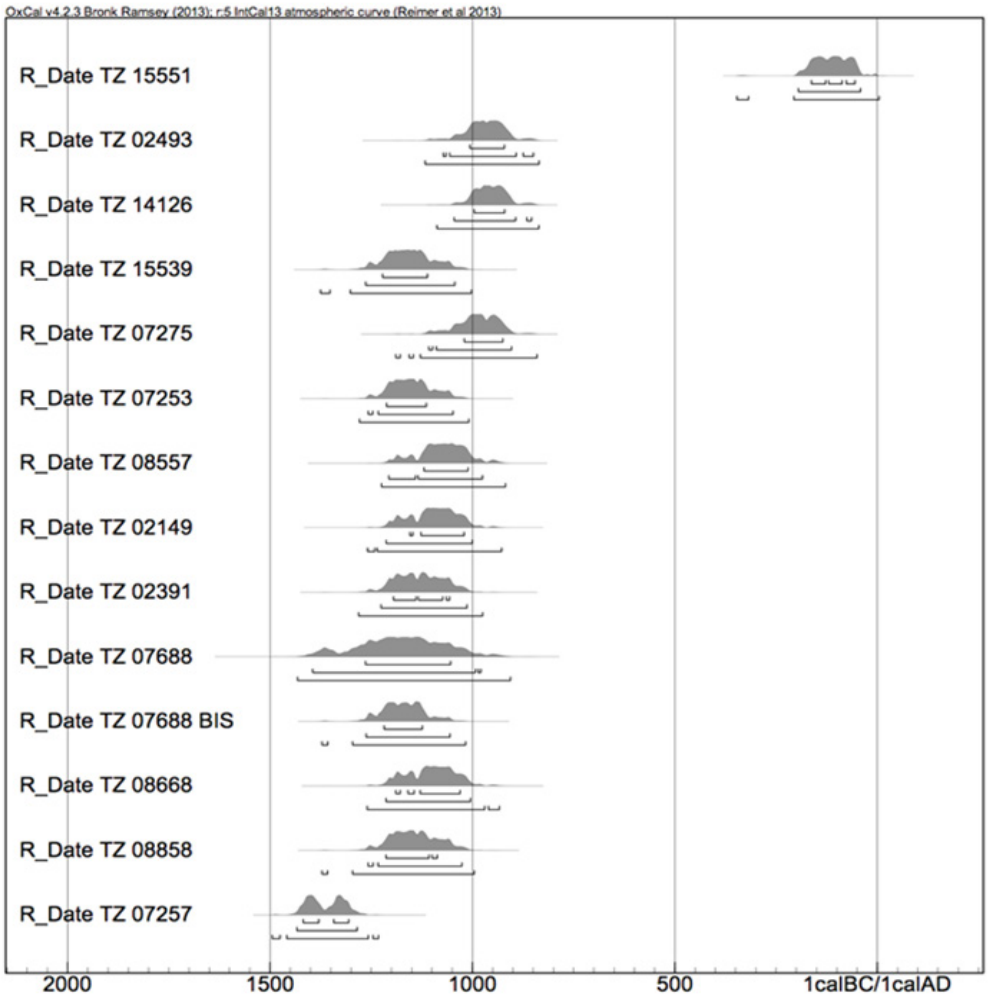


Sample TZ 007257-001

Context 1298 from Square AH 115
The sample dates to 3105 ± 30 BP:

- 1419–1380 BC (35.3 %); 1343–1306 BC (32.9 %) (= 1 Sigma: 68.2 %)
- 1434–1286 BC (= 2 Sigma: 95.4 %)
- 1495–1476 BC (0.4 %); 1459–125 BC (99.1 %); 1246–1233 BC (0.2 %) (= 3 Sigma: 99.7 %)





Graph. 4.1 Calibrated date (calBC/calAD): Radicarbon samples from the Early Roman and Iron Age (Source: BAI/GPIA).

4.4.2.4. Late Bronze Age II (Stratum 14)

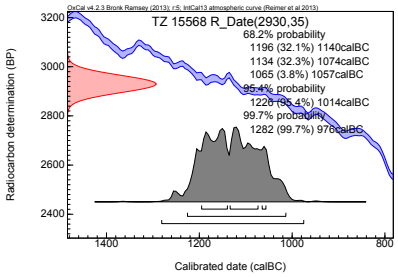
The samples from Stratum 14 are TZ 015568-001, TZ 007269-001, TZ 014477-001 and TZ 015531-001.

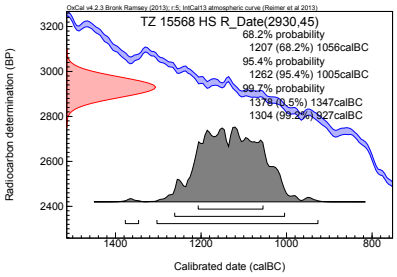
These samples cover the entire time period of Stratum 14, which has evidence of rebuilding no less than three times in some places. The reconstruction of the Late Bronze Age city after Stratum 16 which was destroyed by a large landslide, took place before 1500 BC. The following building activieties correspond with sample TZ 007269-001. Several rebuilding activities of Stratum 14 occurred during the fourteenth and thirteenth centuries BC. They are proven by the Samples TZ 014477-001, TZ 015568-001, and TZ 015531-001.

Sample TZ 015568-001

Context 4792 from Square AL 118
The sample dates to 2930 ± 35 BP/HS (Humic Acid) 2930 ± 45 BP:

- 1196–1140 BC (32.1 %); 1134–1074 BC (32.3 %); 1065–1057 BC (3.8 %) (= 1 Sigma: 68.2 %)/HS: 1207–1056 BC (= 1 Sigma: 68.2 %)
- 1226–1014 BC (= 2 Sigma: 95.4 %)/HS: 1262–1005 BC (= 2 Sigma: 95.4%)
- 1282–976 BC (= 3 Sigma: 99.7%)/HS: 1378–1347 BC (0.5%); 1304–927 BC (99.2%) (= 3 Sigma: 99.7 %)

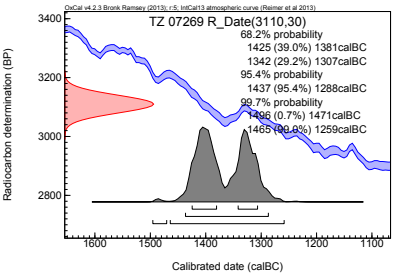




Sample TZ 007269-001

Context 1172 from Square AI 115
The sample dates to 3110 ± 30 BP:

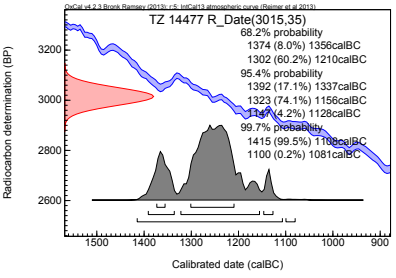
- 1425–1381 BC (39 %); 1342–1307 BC (29.2 %) (= 1 Sigma: 68.2 %)
- 1437–1288 BC (= 2 Sigma: 95.4 %)
- 1496–1471 BC (0.7 %); 1465–1259 BC (99.0 %) (= 3 Sigma: 99.7 %)



Sample TZ 014477-001

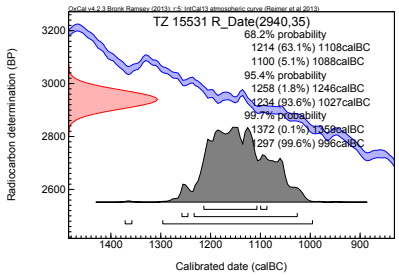
Context 3701 from Square AF 116
The sample dates to 3015 ± 35 BP:

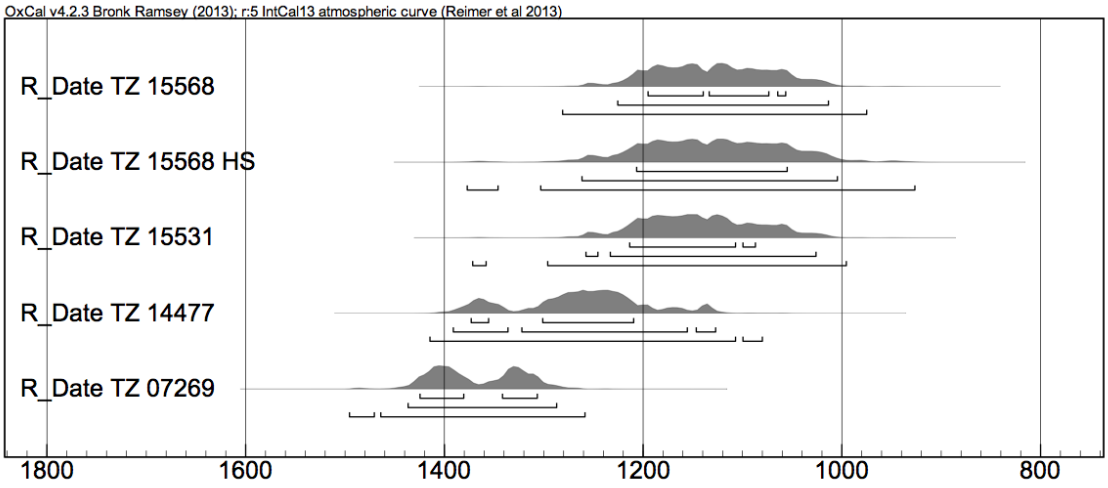
- 1347–1356 BC (8 %); 1302–1210 BC (60.2 %) (= 1 Sigma: 68.2 %)
- 1392–1337 BC (17.1 %); 1323–1156 BC (74.1 %); 1147–1128 BC (4.2 %) (= 2 Sigma: 95.4 %)
- 1415–1108 BC (99.5 %) 1100–1081 BC (0.2 %) (= 3 Sigma: 99.7 %)



Sample TZ 015531-001
Context 4793 from Square AL 118
The sample dates to 2940 ± 35 BP:

- 1214–1108 BC (63.1 %); 1100–1088 BC (5.1 %) (= 1 Sigma: 68.2 %)
- 1258–1246 BC (1.8 %); 1234–1027 BC (93.6 %) (= 2 Sigma: 95.4 %)
- 1372–1359 BC (0.1 %); 1297–996 BC (99.6 %) (= 3 Sigma: 99.7 %)





Graph. 4.2 Calibrated date (calBC): Radicarbon samples from the Late Bronze Age (Source: BAI/GPIA).

4.4.2.5. Constructional Stratum (Stratum 15)

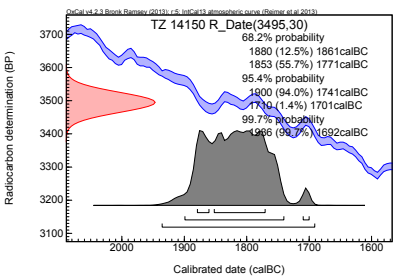
Samples TZ 014150-001, TZ 009090-001, TZ 007402-001, and TZ 014158-001 belong to the repair stratum immediately after the landslide, Stratum 15; this stratum restored lost areas of Stratum 16.

The samples of Stratum 15 analyzed here prove that the damaged Middle Bronze Age/Late Bronze Age city (Stratum 16) was repaired with existing material from the earlier strata. The filling layers contain ceramic finds dating from the Early Bronze Age to the Late Bronze Age. The sample TZ 007402-001 from the Context 5288 comes from a fire place. It was found on one of the constructional layer's top. It gives a glimpse of the repair activities which was undertaken most probably during the second half of the sixteenth century BC. The wooden waste from the fill (which do not have a constructive relevance) can be assigned to the Middle Bronze Age Contexts TZ 014150-001 and TZ 014158-001.

In the first analysis at the Poznań Radiocarbon Laboratory, the estimated date for sample TZ 009090-001 was 14500–13650 BC. As this was deemed to be an unreliable result, a second measurement was made, which points to a Chalcolithic origin (3946–3659 BC; 99.7 %). The latter date is quite better credible, because the majority of the ceramic finds in the repair layer date from the Early Bronze Age II and III; but under the circumstances, it was also deemed to be an unreliable result.

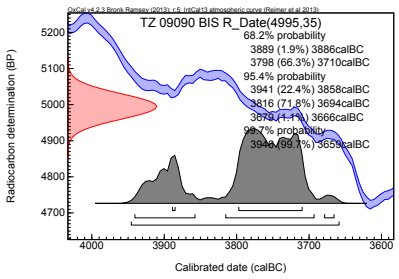
Sample TZ 014150-001
Context 4025 from Square AO 118
The sample dates to 3495 ± 30 BP:

- 1880–1861 BC (12.5 %); 1853–1771 BC (55.7 %) (= 1 Sigma: 68.2 %)
- 1900–1741 BC (94 %); 1710–1701 BC (1.4 %) (= 2 Sigma: 95.4 %)
- 1936–1692 BC (= 3 Sigma: 99.7 %)



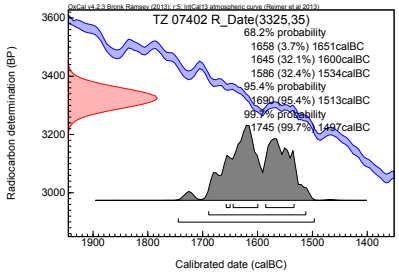
Sample TZ 009090-001
Context 2194 from Square AN 116
The sample dates to 4995 ± 35 BP (second sample)[11]:

- 3889–3886 BC (1.9 %); 3798–3710 BC (66.3 %) (= 1 Sigma: 68.2 %)
- 3941–3858 BC (22.4 %); 3816–3694 BC (71.8 %); 3679–3666 BC (1.1 %) (= 2 Sigma: 95.4 %)
- 3946–3659 BC (= 3 Sigma: 99.7 %)



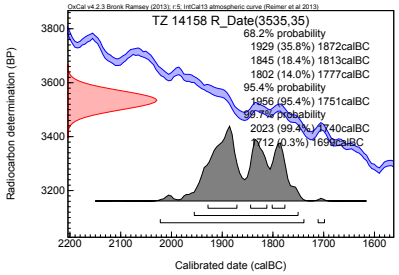
Sample TZ 007402-001
Context 5288 from Square AH 115 (fire place)
The sample dates to 3325 ± 35 BP:

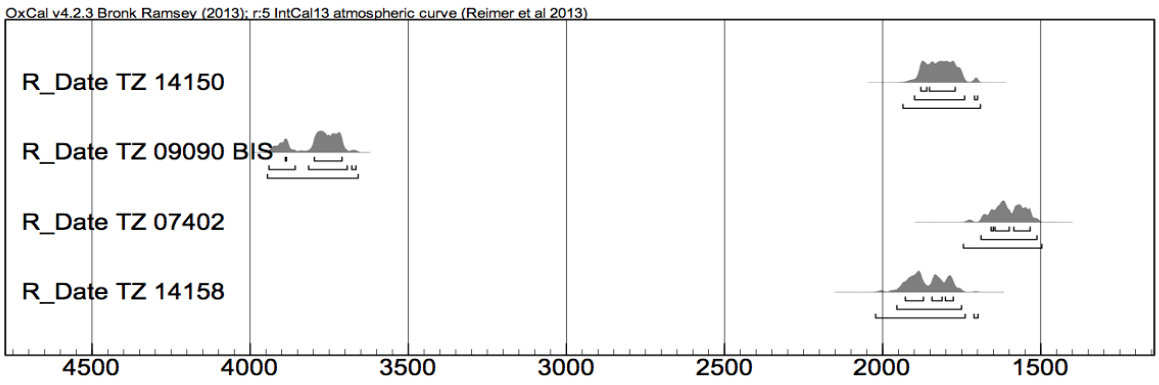
- 1658–1651 BC (3.7 %); 1645–1600 BC (32.1 %); 1586–1534 BC (32.4 %) (= 1 Sigma: 68.2 %)
- 1690–1513 BC (= 2 Sigma: 95.4 %)
- 1745–1497 BC (= 3 Sigma: 99.7 %)



Sample TZ 014158-001
Context 4586 from Square AO 118
The sample dates to 3535 ± 35 BP:

- 1929–1872 BC (35.8 %); 1845–1813 BC (18.4 %); 1802–1777 BC (14 %) (= 1 Sigma: 68.2 %)
- 1956–1751 BC (= 2 Sigma: 95.4 %)
- 2023–1740 BC (99.4 %); 1712–1699 BC (0.3 %) (= 3 Sigma: 99.7 %)





Graph. 4.3 Calibrated date (calBC): Radicarbon samples from the Constructional Stratum (Source: BAI/GPIA).

4.4.2.6. Middle Bronze Age (Strata 19–16)

On Tall Zirā'a four different layers of Middle Bronze Age occupation could be identified. Their dating range from the transition period Middle Bronze Age IIC/Late Bronze Age I in Stratum 16 to Middle Bronze Age IIB (Strata 19–17; 1950–1630 BC). All these samples from wooden remains cover a wide time span from the twentysecond

11 First sample: 13460±70 BP; 14240–13830 (68.2%); 14500–13650 (95.4 %).

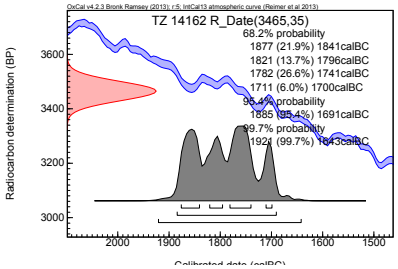
to the twentyfirst centuries BC down to the seventienth century BC. Therefore the differentiation of the Middle Bronze Age layers is not only based on radiocarbon samples but also on other evidence and on pottery.

Stratum 16 (Middle Bronze Age IIC/Late Bronze Age I)

Sample TZ 014162-001

Context 3847 from Square AM 119
The sample dates to 3465 ± 35 BP:

- 1877–1841 BC (21.9 %); 1821–1796 BC (13.7 %); 1782–1741 BC (26.6 %); 1711–1700 BC (6.0 %) (= 1 Sigma: 68.2 %)
- 1885–1691 BC (= 2 Sigma: 95.4 %)
- 1921–1643 BC (= 3 Sigma: 99.7 %)

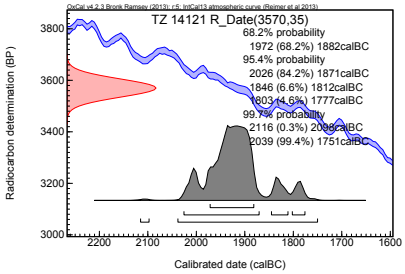


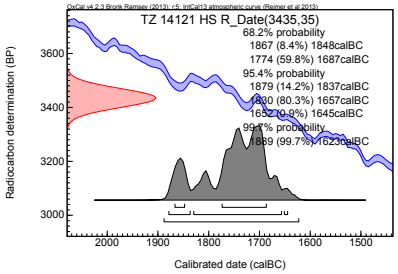
Sample TZ 014121-001

Context 3979 from Square AN 118
The first sample dates to 3570 ± 35 BP/HS (Humic acid): 3435 ± 35 BP; the second sample dates to 3550 ± 35 BP/HS (Humic acid): 3590 ± 40 BP:

First sample:

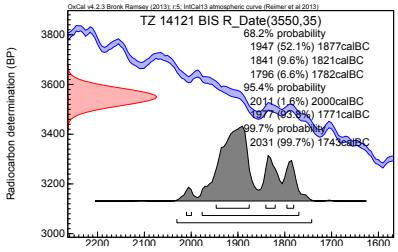
- 1972–1882 BC (= 1 Sigma: 68.2 %)/ HS: 1867–1848 BC (8.4 %); 1774–1687 BC (59.8 %) (= 1 Sigma: 68.2 %)
- 2026–1871 BC (84.2 %); 1846–1812 BC (6.6 %); 1803–1777 BC (4.6 %) (= 2 Sigma: 95.4 %)/HS: 1879–1837 BC (14.2 %); 1830–1657 BC (80.3 %); 1652–1645 BC (0.9 %) (= 2 Sigma: 95.4 %)
- 2116–2098 BC (0.3 %); 2039–1751 BC (99.4 %) (= 3 Sigma: 99.7 %)/HS: 1889–1623 BC (= 3 Sigma: 99.7 %)

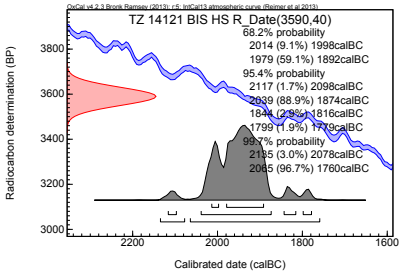




Second sample:

- 1947–1877 BC (52.1 %); 1841–1821 BC (9.6 %); 1796–1782 BC (6.6 %) (= 1 Sigma: 68.2 %)/HS: 2014–1998 BC (9.1 %); 1979–1892 BC (59.1 %) (= 1 Sigma: 68.2 %)
- 2011–2000 BC (1.6 %); 1977–1771 BC (93.8 %) (= 2 Sigma: 95.4 %)/ HS: 2117–2098 BC (1.7 %); 2039–1874 BC (88.9 %); 1844–1816 BC (2.9 %); 1799–1779 BC (1.9 %) (= 2 Sigma: 95.4 %)
- 2031–1743 BC (= 3 Sigma: 99.7 %)/HS: 2135–2079 BC (3 %); 2065–1760 BC (96.7 %) (= 3 Sigma: 99.7 %)

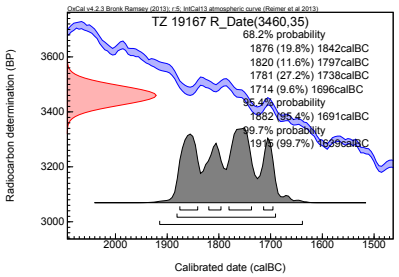




Sample TZ 019167-001

Context 6311 from Square AT 122
The sample dates to 3460 ± 35 BP:

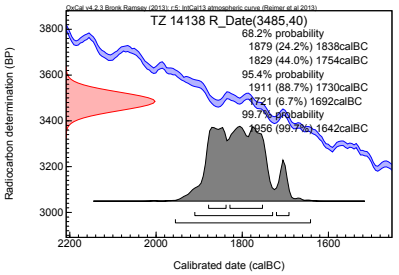
- 1876–1842 BC (19.8 %); 1820–1797 BC (11.6 %); 1781–1738 BC (27.2 %); 1714–1696 BC (9.6 %) (= 1 Sigma: 68.2 %)
- 1882–1691 BC (= 2 Sigma: 95.4 %)
- 1915–1639 BC (= 3 Sigma: 99.7 %)



Sample TZ 014138-001

Context 4398 from Square AN 119
The sample dates to 3485 ± 40 BP:

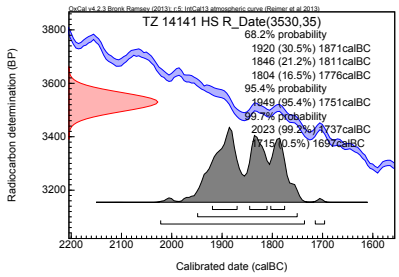
- 1879–1838 BC (24.2 %); 1829–1754 BC (44 %) (= 1 Sigma: 68.2 %)
- 1911–1730 BC (88.7 %); 1721–1692 BC (6.7 %) (= 2 Sigma: 95.4 %)
- 1956–1642 BC (= 3 Sigma: 99.7 %)

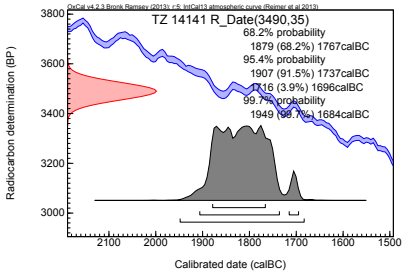


Sample TZ 014141-001

Context 4364 from Square AN 119
The sample dates to 3490 ± 35 BP/HS (Humic Acid) 3530 ± 35 BP:

- 1879–1767 BC (= 1 Sigma: 68.2 %)/ HS: 1920–1871 BC (30.7 %); 1846–1811 BC (21.1 %); 1804–1776 BC (16.5 %) (= 1 Sigma: 68.2 %)
- 1907–1737 BC (91.5 %); 1716–1696 BC (3.9 %) (= 2 Sigma: 95.4 %)/HS: 1949–1751 BC (95.4 %) (= 2 Sigma: 95.4 %)
- 1949–1684 BC (99.7 %) (= 3 Sigma: 99.7 %)/ HS: 2023–1737 BC (99.2 %); 1715–1697 BC (0.5 %) (= 3 Sigma: 99.7 %)



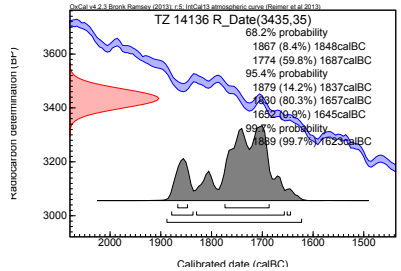


Stratum 17 (Middle Bronze Age IIB)

Sample TZ 014136-001

Context 4480 from Square AN 119
The sample dates to 3435 ± 35 BP:

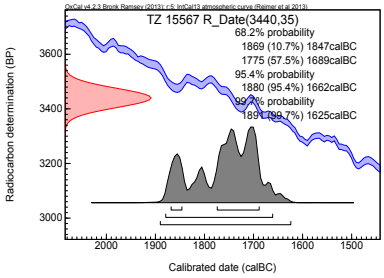
- 1867–1848 BC (8.6 %); 1774–1687 BC (59.8 %) (= 1 Sigma: 68.2 %)
- 1879–1837 BC (14.2 %); 1830–1657 (80.3 %) 1652–1645 BC (0.9 %) (= 2 Sigma: 95.4 %)
- 1889–1623 BC (= 3 Sigma: 99.7 %)

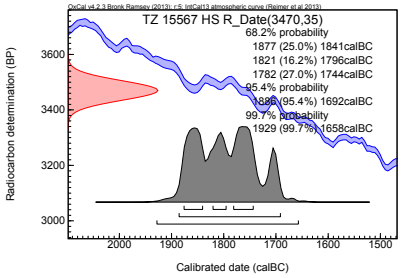


Sample TZ 015567-001

Context 4727 from Square AN 118
The sample dates to 3440 ± 35 BP/HS (Humic Acid) 3470 ± 35 BP:

- 1869–1847 BC (10.7 %); 1775–1689 BC (57.5 %) (= 1 Sigma: 68.2 %)/HS: 1877–1841 BC (25 %); 1821–1796 BC (16.2 %); 1782–1744 BC (27 %) (= 1 Sigma: 68.2 %)
- 1880–1662 BC (= 2 Sigma: 95.4 %)/HS: 1886–1692 BC (95.4 %) (= 2 Sigma: 95.4 %)
- 1891–1625 BC (= 3 Sigma: 99.7 %)/HS: 1929–1658 BC (= 3 Sigma: 99.7 %)

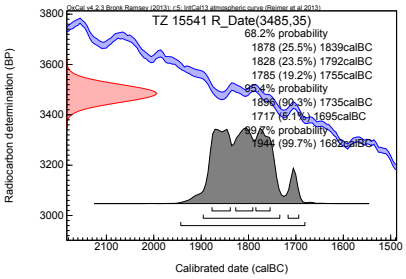




Sample TZ 015541-001

Context 4727 from Square AN 118
The sample dates to 3485 ± 35 BP:

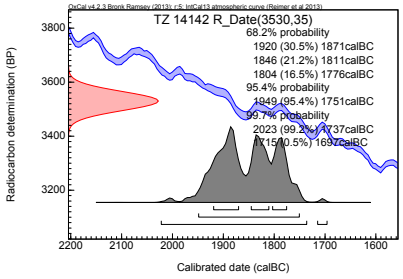
- 1878–1839 BC (25.5 %); 1828–1792 BC (23.5 %); 1785–1755 BC (19.2 %) (= 1 Sigma: 68.2 %)
- 1896–1735 BC (90.3 %); 1717–1695 (5.1 %) (= 2 Sigma: 95.4 %)
- 1944–1682 BC (= 3 Sigma: 99.7 %)

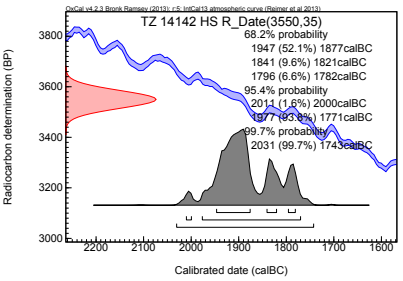


Sample TZ 014142-001

Context 4107 from Square AO 119
The sample dates to 3530 ± 35 BP/HS (Humic Acid) 3,550 ± 35 BP:

- 1920–1871 BC (30.5 %); 1846–1811 BC (21.2 %); 1804–1776 (16.5 %) (= 1 Sigma; 68.2 %)/HS: 1947–1877 BC (52.1 %); 1841–1821 BC (9.6 %); 1796–1782 BC (6.6 %) (= 1 Sigma: 68.2 %)
- 1949–1751 BC (= 2 Sigma: 95.4 %)/HS: 2011–2000 BC (1.6 %); 1977–1771 BC (93.8 %) (= 2 Sigma: 95.4 %)
- 2023–1737 BC (99.2 %); 1715–1697 BC (0.5 %) (= 3 Sigma: 99.7 %)/HS: 2031–1743 BC (= 3 Sigma: 99.7 %)

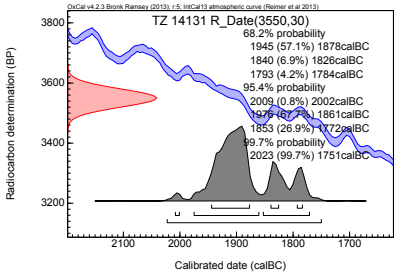


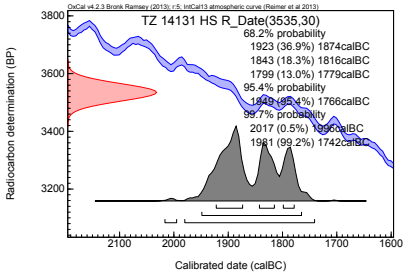


Sample TZ 014131-001

Context 4256 from Square AO 119
The sample dates to 3550 ± 30 BP/HS (Humic Acid) 3535 ± 30 BP:

- 1945–1878 BC (57.1 %); 1840–1826 BC (6.9 %); 1793–1784 (4.2 %) (= 1 Sigma: 68.2 %)/HS: 1923–1874 BC (36.9 %); 1843–1816 BC (18.3 %); 1799–1779 BC (13 %) (= 1 Sigma: 68.2 %)
- 2009–2002 BC (0.8 %); 1976–1861 BC (67.7 %); 1853–1772 BC (26.9 %) (= 2 Sigma: 95.4 %)/HS: 1949–1766 BC (= 2 Sigma: 95.4 %)
- 2023–1751 BC (= 3 Sigma: 99.7 %)/HS: 2017–1996 BC (0.5 %); 1981–1742 BC (99.2 %) (= 3 Sigma: 99.7 %)





Sample TZ 014128-001

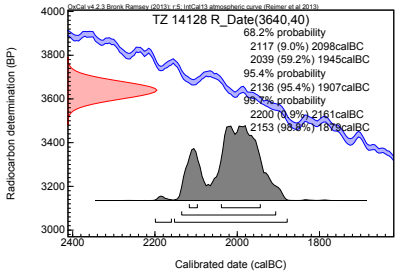
Context 3987 from Square AN 118
The first sample dates to 3,640 ± 40 BP/the second sample dates to 3685 ± 35 BP/
HS (Humic Acid) first sample: 3555 ± 40 BP/HS second sample: 3685 ± 35 BP:

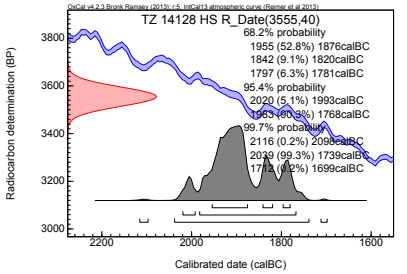
First sample:

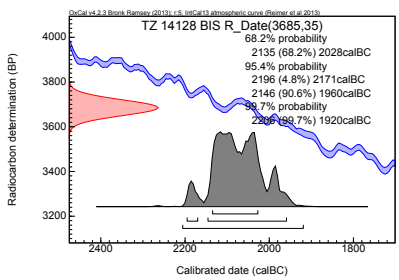
- 2117–2098 BC (9 %); 2039–1945 BC (59.2 %) (= 1 Sigma: 68.2 %)/HS: 1955–1876 BC (52.8 %); 1842–1,820 BC (9.1 %); 1797–1781 BC (6.3 %) (= 1 Sigma: 68.2 %)
- 2136–1907 BC (= 2 Sigma: 95.4 %)/HS: 2020–1993 BC (5.1 %); 1983–1768 BC (90.3 %) (= 3 Sigma: 95.4 %)
- 2200–2136 BC (0.9 %); 2153–1879 BC (98.8 %) (= 3 Sigma: 99.7 %)/HS: 2116–2098 BC (0.2 %); 2039–1739 BC (99.3 %); 1712–1699 (0.2 %) (= 3 Sigma: 99.7 %)

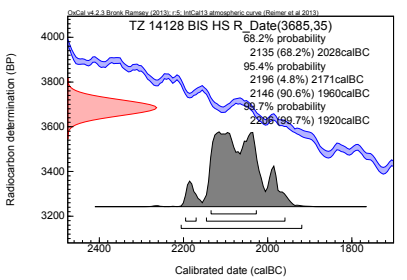
Second sample:

- 2135–2028 BC (= 1 Sigma: 68.2 %)/HS: 2135–2018 BC (= 1 Sigma: 68.2 %)
- 2196–2171 BC (4.8 %); 2146–1960 BC (90.6 %) (= 2 Sigma: 95.4 %)/HS: 2196–2171 BC (4.8 %); 2146–1960 BC (90.6 %) (= 2 Sigma: 95.4 %)
- 2206–1920 BC (= 3 Sigma: 99.7 %)/HS: 2206–1920 BC (= 3 Sigma: 99.7 %)







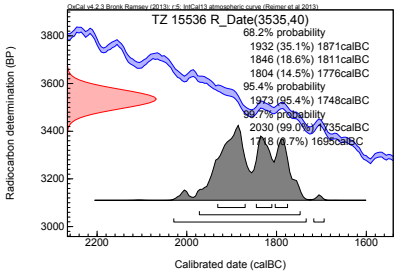


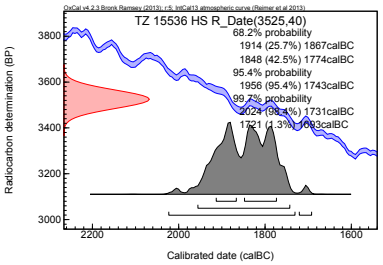
Stratum 18 (Younger Stratum from Middle Bronze Age IIA)

Sample TZ 015536-001

Context 4958 from Square AN 118
The sample dates to 3535 ± 40 BP/HS (Humic Acid) 3,525 ± 40 BP:

- 1932–1871 BC (35.1 %); 1846–1811 BC (18.6 %); 1804–1776 BC (14.5 %) (= 1 Sigma: 68.2 %)/HS: 1914–1867 BC (25.7 %); 1848–1774 BC (42.5 %) (= 1 Sigma: 68.2 %)
- 1973–1748 BC (= 2 Sigma: 95.4 %)/HS: 1956–1743 BC (= 2 Sigma: 95.4 %)
- 2030–1735 BC (99 %) 1718–1695 BC (0.7 %) (= 3 Sigma: 99.7%)/HS: 2024–1731 BC (98.4 %); 1721–1693 BC (1.3 %) (= 3 Sigma: 99.7 %)

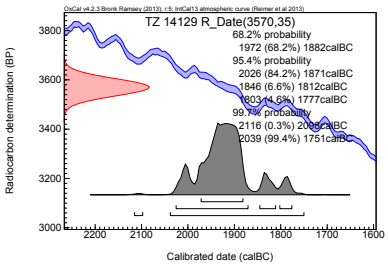




Sample TZ 014129-001

Context 4303 from Square AO 119
The sample dates to 3570 ± 35 BP:

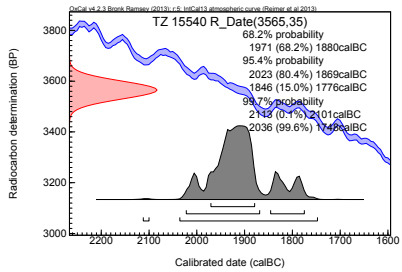
- 1972–1882 BC (= 1 Sigma: 68.2 %)
- 2026–1871 BC (84.2 %); 1846–1812 BC (6.6 %); 1803–1777 BC (4.6 %) (= 2 Sigma: 95.4 %)
- 2116–2098 BC (0.3 %); 2039–1751 BC (99.4 %) (= 3 Sigma: 99.7 %)

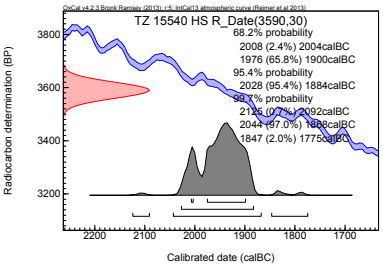


Sample TZ 015540-001

Context 4888 from Square AN 119
The sample dates to 3565 ± 35 BP/HS (Humic Acid) 3590 ± 30 BP:

- 1971–1880 BC (= 1 Sigma: 68.2 %)/HS: 2008–2004 BC (2.4 %); 1976–1900 BC (65.8 %) (= 1 Sigma: 68.2 %)
- 2023–1869 BC (80.4 %); 1846–1776 BC (15 %) (= 2 Sigma: 95.4 %)/HS: 2028–1884 BC (= 2 Sigma: 95.4 %)
- 2113–2101 BC (0.1 %); 2036–1748 BC (99.6 %) (= 3 Sigma: 99.7%)/HS: 2125–2092 BC (0.7 %); 2044–1868 BC (97 %); 1847–1775 BC (2 %) (= 3 Sigma: 99.7 %)



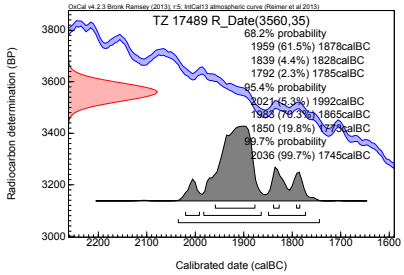


Stratum 19 (Older Stratum from Middle Bronze Age IIA)

Sample TZ 017489-001

Context 5685 from Square AL 118
The sample dates to 3560 ± 35 BP:

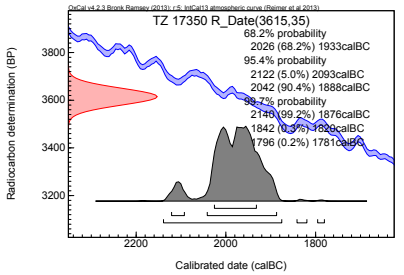
- 1959–1878 BC (61.5 %); 1839–1828 BC (4.4 %); 1792–1785 BC (2.3 %); (= 1 Sigma: 68.2 %)
- 2021–1992 BC (5.3 %); 1983–1865 BC (70.3 %); 1850–1773 BC (19.8 %) (= 2 Sigma: 95.4 %)
- 2036–1745 BC (= 3 Sigma: 99.7 %)

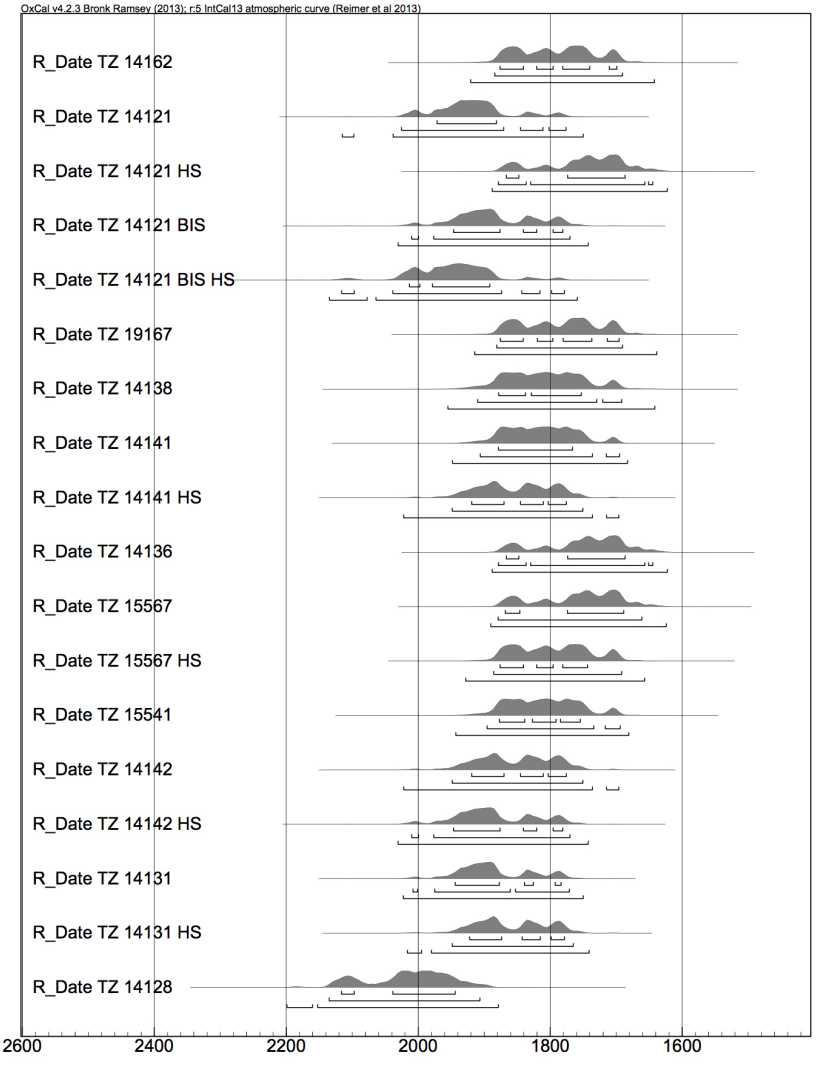


Sample TZ 017350-001

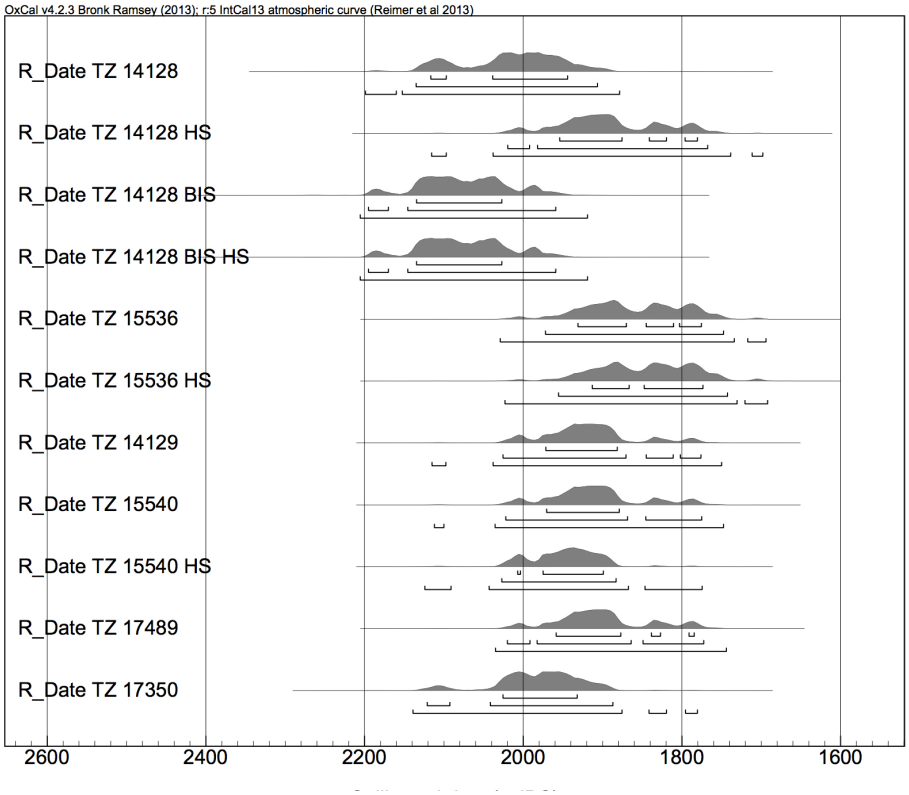
Context 5658 from Square AM 118
The sample dates to 3615 ± 35 BP:

- 2026–1933 BC (= 1 Sigma: 68.2 %)
- 2122–2093 BC (5 %); 2042–1888 BC (90.4 %) (= 2 Sigma: 95.4 %)
- 2140–1876 BC (99.2 %); 1842–1820 BC (0.3 %); 1796–1781 (0.2 %) (= 3 Sigma: 99.7 %)





Graph. 4.4 Calibrated date (calBC): Radicarbon samples from the Middle Bronze Age (Source: BAI/GPIA).



Graph. 4.5 Calibrated date (calBC): Radicarbon samples from the Middle Bronze Age (Source: BAI/GPIA).

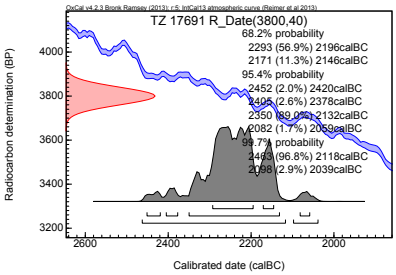
4.4.2.7. Transitional Period from Early Bronze Age IV to Middle Bronze Age I (Strata 21 and 20)

Remarkably, Tall Zirā'a has two transitional strata from Early Bronze Age IV to Middle Bronze Age I: Strata 21 and 20. Analysis of the wooden remains indicate dates of this period (TZ 017691-001; TZ 017693-001; TZ 018647-001) or Early Bronze Age (TZ 018648-001).

Stratum 20 (Younger Stratum from Early Bronze Age IV/Middle Bronze Age I)

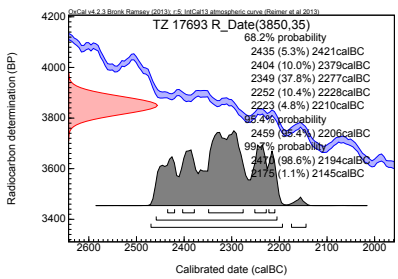
Sample TZ 017691-001
Context 5735 from Square AN 118
The sample dates to 3800 ± 40 BP:

- 2293–2196 BC (56.9 %); 2171–2146 BC (11.3 %) (= 1 Sigma: 68.2 %)
- 2452–2420 BC (2 %); 2405–2378 BC (2.6 %); 2350–2132 BC (89 %); 2082–2059 BC (1.7 %) (= 2 Sigma: 95.4 %)
- 2463–2118 BC (96.8 %); 2098–2039 BC (2.9 %) (= 3 Sigma: 99.7 %)

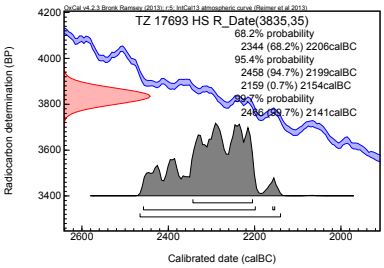


Sample TZ 017693-001
Context 5736 from Square AN 118
The sample dates to 3850 ± 35 BP/HS (Humic Acid) 3,835 ± 35 BP:

- 2435–2421 BC (5.3 %); 2404–2379 BC (10 %); 2349–2277 BC (37.8 %); 2252–2228 BC (10.4 %); 2223–2210 BC (4.8 %)



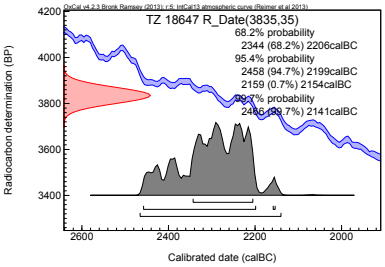
(= 1 Sigma: 68.2 %)/HS: 2344–2206 BC (= 1 Sigma: 68.2 %)
- 2459–2206 BC (= 2 Sigma: 95.4%)/ HS: 2458–2199 BC (94.7 %); 2159–2154 BC (0.7 %) (= 2 Sigma: 95.4 %)
- 2470–2194 BC (98.6 %); 2175–2145 BC (1.1 %) (= 3 Sigma: 99.7 %)/HS: 2466–2141 BC (= 3 Sigma: 99.7 %)



Stratum 21 (older Stratum from Early Bronze Age IV/Middle Bronze Age I)

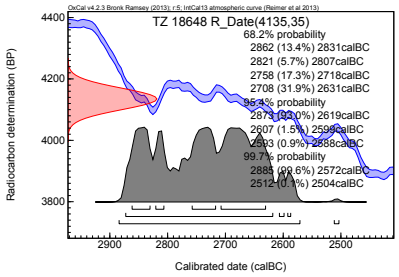
Sample TZ 018647-001
Context 5964 from Square AM 118
The sample dates to 3835 ± 35 BP:

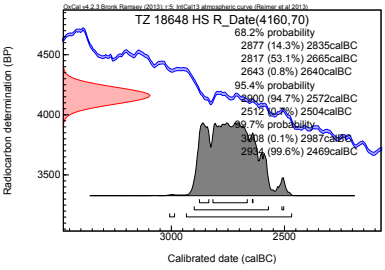
- 2344–2206 BC (= 1 Sigma: 68.2 %)
- 2458–2199 BC (94.7 %); 2159–2154 BC (0.7 %) (= 2 Sigma: 95.4 %)
- 2466–2141 BC (= 3 Sigma: 99.7 %)

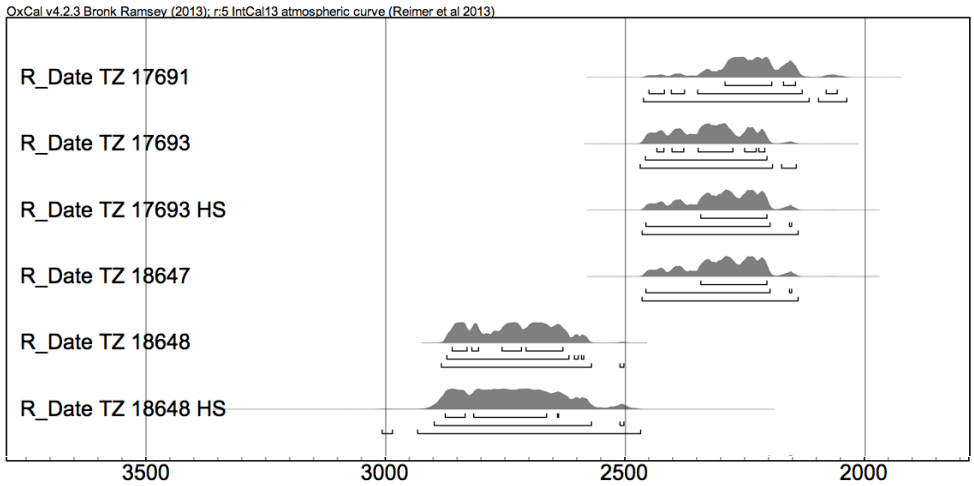


Sample TZ 018648-001
Context 5978 from Square AN 118
The sample dates to 4135 ± 35 BP/HS (Humic Acid) 4,160 ± 70 BP:

- 2862–2831 BC (13.4 %); 2821–2807 BC (5.7 %); 2758–2718 BC (17.3 %); 2708–2631 BC (31.9 %); (= 1 Sigma: 68.2 %)/ HS: 2877–2835 BC (14.3 %); 2817–2665 BC (53.1 %); 2643–2640 BC (0.8 %) (= 1 Sigma: 68.2 %)
- 2873–2619 BC (93 %); 2607–2599 BC (1.5 %); 2593–2588 (0.9 %) (= 2 Sigma: 95.4 %)/HS: 2900–2572 BC (94.7 %); 2512–2504 BC (0.7 %) (= 2 Sigma: 95.4 %)
- 2885–2572 BC (99.6 %); 2512–2504 BC (0.1 %) (= 3 Sigma: 99.7 %)/HS: 3008–2987 BC (0.1 %); 2934–2469 BC (99.6 %) (= 3 Sigma: 99.7 %)







Graph 4.6 Calibrated date (calBC): Rādiōčarbon sāmplēs frōm the transitional period from Early to Middle Bronze Age (Source: BAI/GPIA)

4.4.2.8. Early Bronze Age II and III (Strata 24–22)

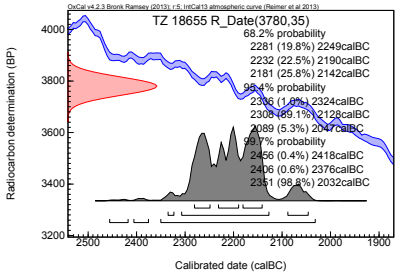
Only a small part of the Early Bronze Age settlements on Tall Zirā'a has been excavated yet. The contexts of the three strata (Strata 24–22) point to Early Bronze Age II and III.

Also earlier layers do exist, but for security reasons they could not be excavated.

Stratum 22 (Early Bronze Age III)

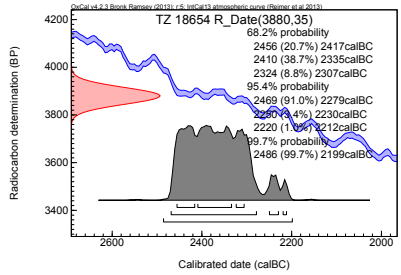
Sample TZ 018655-001
Context 6045 from Square AN 118
The sample dates to 3780 ± 35 BP:

- 2281–2249 BC (19.8 %); 2232–2190 BC (22.5 %); 2181–2142 BC (25.8 %) (= 1 Sigma: 68.2%)
- 2336–2324 BC (1 %); 2308–2128 BC (89.1 %); 2089–2047 BC (5.3 %) (= 2 Sigma: 95.4 %)
- 2456–2418 BC (0.4 %); 2406–2376 BC (0.6 %); 2351–2032 BC (98.8 %) (= 3 Sigma: 99.7 %)



Sample TZ 018654-001
Context 6045 from Square AN 118)
The sample dates to 3,880 ± 35 BP:

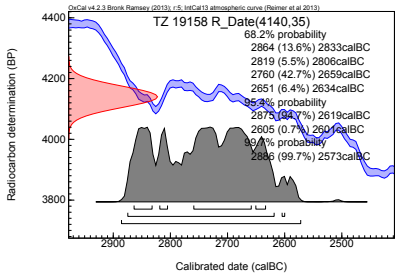
- 2456–2417 BC (20.7 %); 2410–2335 BC (38.7 %); 2324–2307 BC (8.8 %) (= 1 Sigma: 68.2 %)
- 2469–2279 BC (91 %); 2250–2230 BC (3.4 %); 2220–2212 BC (1 %) (= 2 Sigma: 95.4 %)
- 2486–2199 BC (= 3 Sigma: 99.7 %)



Stratum 23 (Early Bronze Age II/III)

Sample TZ 019158-001
Context 6462 from Square AM 118
The sample dates to 4140 ± 35 BP:

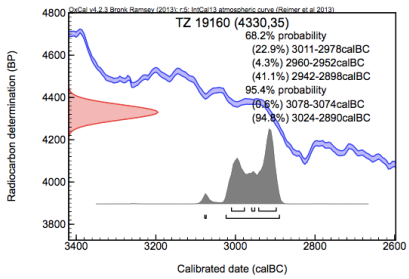
- 2864–2833 BC (13.6 %); 2819–2806 BC (5.5 %); 2760–2659 BC (42.7 %) 2651–2634 BC (6.4 %) (= 1 Sigma: 68.2%)
- 2875–2619 BC (94.7 %); 2605–2601 BC (0.7 %) (= 2 Sigma: 95.4 %)
- 2886–2573 BC (= 3 Sigma: 99.7 %)



Stratum 24 (Early Bronze Age II)

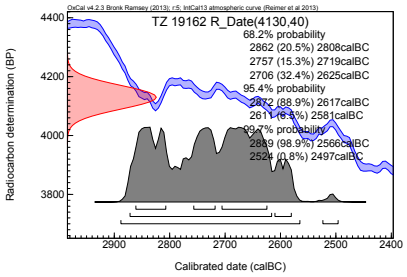
Sample TZ 019160-001
Context 6497 from Square AN 118
The sample dates to 4330 ± 35 BP:

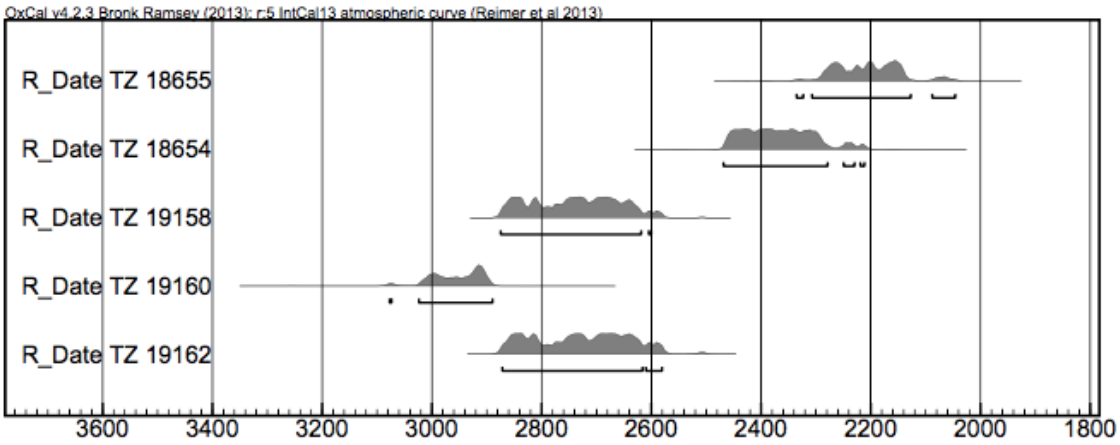
- 3011–2978 BC (22.9 %); 2960–2952 BC (4.3 %); 2942–2898 BC (41.1 %) (= 1 Sigma: 68.2 %)
- 3078–3074 BC (0.6 %); 3024–2890 BC (94.8 %) (= 2 Sigma: 95.4 %)
- 3091–2881 BC (= 3 Sigma: 99.7 %)



Sample TZ 019162-001
Context 6424 from Square AN 118
The sample dates to 4130 ± 40 BP:

- 2862–2808 BC (20.5 %); 2757–2719 BC (15.3 %); 2706–2625 BC (32.4 %) (= 1 Sigma: 68.2 %)
- 2872–2617 BC (88.9 %); 2611–2581 BC (6.5 %) (= 2 Sigma: 95.4 %)
- 2889–2566 BC (98.9 %); 2524–2497 BC (0.8 %) (= 3 Sigma: 99.7 %)





Graph 4.7 Calibrated date (calBC): Radiocarbon samples from the Early Bronze Age (Source: BAI/GPIA).

Inv.–No.	Context	Square	Year	3σ (99.7 %)	2σ (95.4 %)	1σ (68.2 %)	Uncalibrated	Stra–tum	Dating
Area II									
110069	11110	AW 128	2006	39 BC–230 AD	5–173 AD (93.1 %) 193–210 (2.3 %)	57–127 AD	1915 ± 35 BP	6	Early Roman
Area I									
014165	3940	AR 121	2009	1445–1642 AD	1449–1529 AD (51.5 %) 1545–1634 AD (43.9 %)	1458–1521 AD (46.5 %) 1591–1620 (21.7 %)	365 ± 30 BP	1	Ottoman
015551	5201	AQ 123	2013	347–319 (0.6 %) 207–5 BC (99.1 %)	195–42 BC (95.4 %)	163–128 BC (26.5 %) 121–88 BC (25.6 %) 77–56 BC (16 %)	2090 ± 30 BP	7 c	Early Roman
Iron Age II									
002493	820	AO 118	2004	1118–836 BC	1073–1066 BC (0.5 %) 1057–893 BC (92.8 %) 875–850 BC (2.1 %)	1007–922 BC	2815 ± 35 BP	10	Iron Age II C
014126	4418	AP 121	2009	1088–837 BC	1046–894 BC (94.2 %) 866–855 BC (1.2 %)	996–921 BC	2805 ± 30 BP	10	Iron Age II C
015539	4674	AP 121	2010	1376–1353 BC (0.4 %) 1302–1003 BC (99.3 %)	1264–1044 BC	1223–1112 BC	2950 ± 35 BP	10	Iron Age II C
007275	1138	AL 118	2005	1190 –1179 BC (0.1 %) 1157–1147 (0.1 %) 1129–841 BC (99.5 %)	1108–1099 BC (1.3 %) 1090–904 BC (94.1 %)	1021–926 BC	2830 ± 35 BP	11	Iron Age II A/B
007253	1267	AP 119	2005	1280–1010 BC	1258–1247 BC (1.5 %) 1233–1049 BC (93.9 %)	1213–1115 BC	2945 ± 30 BP	11	Iron Age II A/B
008557	1996	AM 119	2006	1225–919 BC	1207–1141 BC (1.5 %) 1135–976 BC (93.9 %)	1120–1012 BC	2890 ± 35 BP	12	Iron Age II A/B
002149	555	AN 117	2004	1260–1242 BC (0.3 %) 1236–929 BC (99.4 %)	1214–1001 BC	1155–1148 BC (3.2 %) 1128–1021 BC (65 %)	2905 ± 35 BP	12	Iron Age II A/B
002391	599	AN 117	2004	1282–976 BC	1226–1014 BC	1196–1140 BC (32.1 %) 1134–1074 BC (32.3 %) 1065–1057 BC (3.8 %)	2930 ± 35 BP	12	Iron Age II A/B
008668	2850	AH 116	2006	1261–970 BC (99 %) 961–934 BC (0.7 %)	1214–1006 BC	1190–1179 BC (4.7 %) 1160–1145 BC (6.9 %) 1130–1031 BC (3.8 %)	2910 ± 35 BP	12	Iron Age II A/B
Iron Age I									
007688 first examination	1413	AO 118	2005	1433–907 BC	1395–993 BC (95 %) 987–980 BC (0.4 %)	1265–1055 BC	2960 ± 70 BP	13	Iron Age I
007688 second examination				1372–1358 BC (0.3 %) 1297–1018 BC (99.4 %)	1263–1056 BC	1219–1125 BC	2960 ± 30 BP	13	Iron Age I
008858	2115	AN 119	2006	1372–1359 BC (0.1 %) 1297–996 (99.6 %)	1258–1246 BC (1.8 %) 1234–1027 (93.6 %)	1214–1108 BC (63.1 %) 1100–1088 BC (5.1 %)	2940 ± 35 BP	13	Iron Age I
007257	1298	AH 115	2005	1495–1476 BC (0.4 %) 1459–1258 (99.1 %) 1246–1233 (0.2 %)	1434–1286 BC	1419–1380 BC (35.3 %) 1343–1306 BC (32.9 %)	3105 ± 30 BP	13	Iron Age I

Late Bronze Age									
015568	4792	AL 118	2010	1282–976 BC	1226–1014 BC	1196–1140 BC (32.1 %) 1134–1074 BC (32.3 %) 1065–1057 BC (3.8 %)	2930 ± 35 BP	14	Late Bronze Age II
015568 HS				1378–1347 BC (0.5 %) 1304–927 BC (99.2 %)	1262–1005 BC	1207–1056 BC	2930 ± 45 BP	14	Late Bronze Age II
007269	1172	AI 115	2005	1496–1471 BC (0.7 %) 1465–1259 BC (99.0 %)	1437–1288 BC	1425–1381 BC (39 %) 1342–1307 BC (29.2 %)	3110 ± 30 BP	14	Late Bronze Age II
014477	3701	AF 116	2010	1415–1108 BC (99.5 %) 1100–1081 BC (0.2 %)	1392–1337 BC (17.1 %) 1323–1156 BC (74.1 %) 1147–1128 BC (4.2 %)	1374–1356 BC (8 %) 1302–1210 BC (60.2 %)	3015 ± 35 BP	14	Late Bronze Age II
015531	4793	AL 188	2010	1372–1359 BC (0.1 %) 1297–996 BC (99.6 %)	1258–1246 BC (1.8 %) 1234–1027 BC (93.6 %)	1214–1108 BC (63.1 %) 1100–1088 BC (5.1 %)	2940 ± 35 BP	14	Late Bronze Age II
Constructional Stratum									
014150	4025	AO 118	2009	1936–1692 BC	1900–1741 BC (94 %) 1710–1701 BC (1.4 %)	1880–1861 BC (12.5 %) 1853–1771 BC (55.7 %)	3495 ± 30 BP	15	Constructional
009090 first examination	2194	AN 116	2006	unreliable result			13.460 ± 70 BP	15	Constructional
009090 second examination				3946–3659 BC	3941–3858 BC (22.4 %) 3816–3694 BC (71.8 %) 3679–3666 BC (1.1 %)	3889–3886 BC (1.9 %) 3798–3710 BC (66.3 %)	4995 ± 35 BP	15	Constructional
007402	5288	AH 115	2005	1745–1497 BC	1690–1513	1658–1651 BC (3.7 %) 1645–1600 BC (32.1 %) 1586–1534 BC (32.4 %)	3325 ± 35 BP	15	Constructional
014158	4586	AO 118	2009	2023–1740 BC (99.4 %) 1712–1699 BC (0.3 %)	1956–1751 BC	1929–1872 BC (35.8 %) 1845–1813 BC (18.4 %) 1802–1777 BC (14 %)	3535 ± 35 BP	15	Constructional
Middle Bronze Age II									
014162	3847	AM 119	2009	1921-1643 BC	1885-1691 BC	1877–1841 BC (21.9 %) 1821–1796 BC (13.7 %) 1782–1741 BC (26.6 %) 1711–-1700 BC (6.0 %)	3465 ± 35 BP	16	Middle Bronze Age IIC/Late Bronze Age I
014121 first examination	3979	AN 118	2009	2116–2098 BC (0.3 %) 2039–1751 BC (99.4 %)	2026–1871 BC (84.2 %) 1846–1812 BC (6.6 %) 1803–1777 BC (4.6 %)	1972–1882 BC	3570 ± 35 BP	16	Middle Bronze Age IIC/Late Bronze Age I
014121 HS first examination				1889–1623 BC	1879–1837 BC (14.2 %) 1830–1657 BC (80.3 %) 1652–1645 BC (0.9 %)	1867–1848 BC (8.4 %) 1774–1687 BC (59.8 %)	3435 ± 35 BP	16	Middle Bronze Age IIC/Late Bronze Age I
014121 second examination				2031–1743 BC	2011–2000 BC (1.6 %) 1977–1771 (93.8 %)	1947–1877 BC (52.1 %) 1841–1821 BC (9.6 %) 1796–1782 BC (6.6 %)	3550 ± 35 BP	16	Middle Bronze Age IIC/Late Bronze Age I
014121 HS second examination				2135–2079 BC (3 %) 2065–1760 BC (96.7 %)	2117–2098 BC (1.7 %) 2039–1874 BC (88.9 %) 1844–1816 BC (2.9 %) 1799–1779 BC (1.9 %)	2014–1998 BC (9.1 %) 1979–1892 BC (59.1 %)	3590 ± 40 BP	16	Middle Bronze Age IIC/Late Bronze Age I
019167	6311	AT 122	2013	1915–1639 BC	1882–1691 BC (95.4 %)	1876–1842 BC (19.8 %) 1820–1797 BC (11.6 %) 1781–1738 BC (27.2 %) 1714–1696 BC (9.6 %)	3460 ± 35 BP	16	Middle Bronze Age IIC/Late Bronze Age I

014138	4398	AN 119	2009	1956–1642 BC	1911–1730 BC (88.7 %) 1721–1692 BC (6.7 %)	1879–1838 BC (24.2 %) 1829–1754 BC (44 %)	3485 ± 40 BP	16	Middle Bronze Age IIC/Late Bronze Age I
014141	4364	AN 119	2009	1949–1684 BC	1907–1737 BC (91.5 %) 1716–1696 (3.9 %)	1879–1767 BC	3490 ± 35 BP	16	Middle Bronze Age IIC/ Late Bronze Age I
014141 HS				2023–1737 BC (99.2 %) 1715–1697 BC (0.5 %)	1949–1751 BC	1920–1871 BC (30.7 %) 1846–1811 BC (21.1 %) 1804–1776 BC (16.5 %)	3530 ± 35 BP	16	Middle Bronze Age IIC/Late Bronze Age I
014136	4480	AN 119	2009	1889–1623 BC	1879–1837 BC (14.2 %) 1830–1657 BC (80.3 %) 1652–1645 BC (0.9 %)	1867–1848 BC (8.6 %) 1774–1687 BC (59.8 %)	3435 ± 35 BP	17	Middle Bronze Age IIB
015567	4727	AN 118	2009	1891–1625 BC	1880–1662 BC	1869–1847 BC (10.7 %) 1775–1689 BC (57.5 %)	3440 ± 35 BP	17	Middle Bronze Age IIB
015567 HS				1929–1658 BC	1886–1692 BC	1877–1841 BC (25 %) 1821–1796 BC (16.2 %) 1782–1744 BC (27 %)	3470 ± 35 BP	17	Middle Bronze Age IIB
015541	4727	AN 118	2010	1944–1682 BC	1896–1735 BC (90.3 %) 1717–1695 BC (5.1 %)	1878–1839 BC (25.5 %) 1828–1792 BC (23.5 %) 1785–1755 BC (19.2 %)	3485 ± 35 BP	17	Middle Bronze Age IIB
014142	4107	AO 119	2009	2023–1737 BC (99.2 %) 1715–1697 BC (0.5 %)	1949–1751 BC	1920–1871 BC (30.5 %) 1846–1811 BC (21.2 %) 1804–1776 BC (16.5 %)	3530 ± 35 BP	17	Middle Bronze Age IIB
014142 HS				2031–1743 BC	2011–2000 BC (1.6 %) 1977–1771 BC (93.8 %)	1947–1877 BC (52.1 %) 1841–1821 BC (9.6 %) 1796–1782 BC (6.6 %)	3550 ± 35 BP	17	Middle Bronze Age IIB
014131	4256	AO 119	2009	2023–1751 BC	2009–2002 BC (0.8 %) 1976–1861 BC (67.7 %) 1853–1772 BC (26.9 %)	1945–1878 BC (57.1 %) 1840–1826 BC (6.9 %) 1793–1784 (4.2 %)	3550 ± 30 BP	17	Middle Bronze Age IIB
014131 HS				2017-1996 BC (0.5 %) 1981-1742 BC (99.2 %)	1949–1766 BC	1923–1874 BC (36.9 %) 1843–1816 BC (18.3 %) 1799–1779 BC (13 %)	3535 ± 30 BP	17	Middle Bronze Age IIB
014128 first examination	3987	AN 118	2009	2200–2136 BC (0.9 %) 2153–1879 BC (98.8 %)	2136–1907 BC	2117–2098 BC (9 %) 2039–1945 BC (59.2 %)	3640 ± 40 BP	17	Middle Bronze Age IIB
014128 HS first examination				2116–2098 BC (0.2 %) 2039–1739 BC (99.3 %) 1712–1699 BC (0.2 %)	2020–1993 BC (5.1 %) 1983–1768 BC (90.3 %)	1955–1876 BC (52.8 %) 1842–1820 BC (9.1 %) 1797–1781 BC (6.3 %)	3555 ± 40 BP	17	Middle Bronze Age IIB
014128 second examination				2206–1920 BC	2196–2171 BC (4.8 %) 2146–1960 BC (90.6 %)	2135–2028 BC	3685 ± 35 BP	17	Middle Bronze Age IIB
014128 HS second examination				2206–1920 BC	2196–2171 BC (4.8 %) 2146–1960 BC (90.6 %)	2135–2018 BC	3685 ± 35 BP	17	Middle Bronze Age IIB
015536	4958	AN 118	2010	2030–1735 BC (99 %) 1718–1695 BC (0.7 %)	1973–1748 BC	1932–1871 BC (35.1 %) 1846–1811 BC (18.6 %) 1804–1776 BC (14.5 %)	3535 ± 40 BP	18	Middle Bronze Age IIA
015536 HS				2024–1731 BC (98.4 %) 1721–1693 BC (1.3 %)	1956–1743 BC	1914–1867 BC (25.7 %) 1848–1774 BC (42.5 %)	3525 ± 40 BP	18	Middle Bronze Age IIA
014129	4303	AO 119	2009	2116–2098 BC (0.3 %) 2039–1751 BC (99.4 %)	2026–1871 BC (84.2 %) 1846–1812 BC (6.6 %) 1803–1777 BC (4.6 %)	1972–1882 BC	3570 ± 35 BP	18	Middle Bronze Age IIA

015540	4888	AN 119	2010	2113–2101 BC (0.1 %) 2036–1748 BC (99.6 %)	2023–1869 BC (80.4 %) 1846–1776 BC (15 %)	1971–1880 BC	3565 ± 35 BP	18	Middle Bronze Age IIA
015540 HS				2125–2092 BC (0.7 %) 2044–1868 (97 %) 1847–1775 BC (2 %)	2028–1884 BC	2008–2004 BC (2.4 %) 1976–1900 BC (65.8 %)	3590 ± 30 BP	18	Middle Bronze Age IIA
017489	5686	AL 118	2013	2036–1745 BC	2021–1992 BC (5.3 %) 1983–1865 BC (70.3 %) 1850–1773 BC (19.8 %)	1959–1878 BC (61.5 %) 1839–1828 BC (4.4 %) 1792–1785 BC (2.3 %)	3560 ± 35 BP	19	Middle Bronze Age IIA
017350	5658	AM 118	2013	2140–1876 BC (99.2 %) 1842–1820 BC (0.3 %) 1796–1781 BC (0.2 %)	2122–2093 BC (5 %) 2042–1888 BC (90.4 %)	2026–1933 BC (68.2 %)	3615 ± 35 BP	19	Middle Bronze Age IIA
Transitional Period (Early Bronze Age IV/Middle Bronze Age I)									
017691	5735	AN 118	2013	2463–2118 BC (96.8 %) 2098–2039 BC (2.9 %)	2452–2420 BC (2 %) 2405–2378 BC (2.6 %) 2350–2132 BC (89 %) 2082–2059 BC (1.7 %)	2293–2196 BC (56.9 %) 2171–2146 BC (11.3 %)	3800 ± 40 BP	20	Early Bronze Age IV/Middle Bronze Age I
017693	5736	AN 118	2013	2470–2194 BC (98.6 %) 2175–2145 BC (1.1 %)	2459–2206 BC	2435–2421 BC (5.3 %) 2404–2379 BC (10 %) 2349–2277 BC (37.8 %) 2252–2228 BC (10.4 %) 2223–2210 BC (4.8 %)	3850 ± 35 BP	20	Early Bronze Age IV/ Middle Bronze Age I
017693 HS				2466–2141 BC	2458–2199 BC (94.7 %) 2159–2154 BC (0.7 %)	2344–2206 BC	3835 ± 35 BP	20	Early Bronze Age IV/ Middle Bronze Age I
018647	5964	AM 118	2013	2466–2141 BC	2458–2199 BC (94.7 %) 2159–2154 BC (0.7 %)	2344–2206 BC	3835 ± 35 BP	21	Early Bronze Age IV/ Middle Bronze Age I
018648	5978	AN 118	2011	2885–2572 BC (99.6 %) 2512–2504 BC (0.1 %)	2873–2619 BC (93 %) 2607–2599 BC (1.5 %) 2593–2588 BC (0.9 %)	2862–2831 BC (13.4 %) 2821–2807 BC (5.7 %) 2758–2718 BC (17.3 %) 2708–2631 BC (31.9 %)	4135 ± 35 BP	21	Early Bronze Age IV/ Middle Bronze Age I
018648 HS				3008–2987 BC (0.1 %) 2934–2469 BC (99.6 %)	2900–2572 BC (94.7 %) 2512–2504 BC (0.7 %)	2877–2835 BC (14.3 %) 2817–2665 BC (53.1 %) 2643–2640 BC (0.8 %)	4160 ± 70 BP	21	Early Bronze Age IV/ Middle Bronze Age I
Early Bronze Age									
018655	6045	AN 118	2013	2456–2418 BC (0.4 %) 2406–2376 BC (0.6 %) 2351–2032 BC (98.8 %)	2336–2324 BC (1 %) 2308–2128 BC (89.1 %) 2089–2047 BC (5.3 %)	2281–2249 BC (19.8 %) 2232–2190 BC (22.5 %) 2181–2142 BC (25.8 %)	3780 ± 35 BP	22	Early Bronze Age III
018654	6045	AN 118	2013	2486–2199 BC	2469–2279 BC (91 %) 2250–2230 BC (3.4 %) 2220–2212 BC (1 %)	2456–2417 BC (20.7 %) 2410–2335 BC (38.7 %) 2324–2307 BC (8.8 %)	3880 ± 35 BP	22	Early Bronze Age III
019158	6462	AM 118	2013	2886–2573 BC	2875–2619 BC (94.7 %) 2605–2601 BC (0.7 %)	2864–2833 BC (13.6 %) 2819–2806 BC (5.5 %) 2760–2659 BC (42.7 %) 2651–2634 BC (6.4 %)	4140 ± 35 BP	23	Early Bronze Age II/III
019160	6497	AN 118	2013	3091–2881 BC	3078–3074 BC (0.6 %) 3024–2890 BC (94.8 %)	3011–2978 BC (22.9 %) 2960–2952 BC (4.3 %) 2942–2898 BC (41.1 %)	4330 ± 35 BP	24	Early Bronze Age II
019162	6424	AN 118	2013	2889–2566 BC (98.9 %) 2524–2497 BC (0.8 %)	2872–2617 BC (88.9 %) 2611–2581 BC (6.5 %)	2862–2808 BC (20.5 %) 2757–2719 BC (15.3 %) 2706–2625 BC (32.4 %)	4130 ± 40 BP	24	Early Bronze Age II

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The Tall Zirā'a Final Report presents the main results of the Gadara Region Project in northern Jordan. The findings come from the excavations at the Tall Zirā'a and the field surveys in the Wādī al-'Arab, south of the ancient city of Gadara. The investigations were carried out in 2001 to 2011 and provide a multifaceted picture of the history of this region over a period of more than 5,000 years.

The present volume is the first in a series of nine planned volumes of the final report. It will introduce to the talls enviromental conditions, the research history, the excavations methodology (3D reconstructions, aerial survey, colorimetric excaminations of ceramic, experimental archaeology,, geophysics, landscape archaeology, archaeobotany and archaeometry) and to the objectives of the Gadara Region Project. Apart from that it will focus on the Tall Survey that took place in 2001 along with the examination of its appendant archaeological finds. Moreover, the main concepts and techniques that form the basis of the excavations, and that of the following volumes will be build upon—such as chronology (including also radiocarbon samples), stratigraphy, and the grid system—shall be discussed.