

Tall Zirā'a

The Gadara Region Project (2001-2011)

1

Introduction



German Protestant Institute of Archaeology
(GPIA)

*

Biblical Archaeological Institute Wuppertal
(BAI)



Tall Zirā‘a

Gadara Region Project 2001–2011

Final Report

1

Introduction

Editors

Dieter Vieweger and Jutta Häser

With contributions by

D. Adan-Bajewitz, D. Biedermann, G. Bongartz, G. Bülow, J. Große Frericks,
J. Häser, St. Hoss, D. Keller, F. Kenkel, P. Leiverkus, L. Olsvig-Whittaker, K. Rass-
mann, A. Rauen, S. Reiter, K. Soennecken and D. Vieweger

No part of this publication may be reproduced in any form (print, photography, CD-ROM, DVD, BLUERAY, Internet or any other medium) without written permission of the German Protestant Institute of Archaeology (GPIA) and the Biblical Archaeological Institute Wuppertal (BAI).

All Tall Zirā‘a-Final Reports (Volumes 1–9) are available free of charge: <http://www.tallziraa.de/> (PDF-Version for download)

© Jerusalem/Amman/Wuppertal 2017

Cover-Layout: Patrick Leiverkus

Standard-Layout: Based on the template of the DAI-volumes ‘Menschen – Kulturen – Traditionen’/ForschungsCluster

Editorial work: Sophie zu Löwenstein

Typesetting: Sophie zu Löwenstein

Translation: Andrea Sanner, Anne Poepjes, Linda Olsvig-Whittaker

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

TABLE OF CONTENTS

LIST OF FIGURES.....	X
LIST OF TABLES.....	XVIII
LIST OF GRAPHS.....	XIX
LIST OF PLATES.....	XX
LIST OF APPENDICES.....	XXI
ABBREVIATIONS.....	XXII
PREFACE <i>by Dieter Vieweger/Jutta Häser</i>	1
ACKNOWLEDGEMENTS.....	7
INTRODUCTION <i>by Dieter Vieweger/Jutta Häser</i>	9
1. THE ‘GADARA REGION PROJECT’/TALL ZIRĀ‘A <i>by Dieter Vieweger/Jutta Häser</i>	13
1.1. The ‘Gadara Region Project’ <i>by Dieter Vieweger/Jutta Häser</i>	14
1.2. Tall Zirā‘a <i>by Dieter Vieweger</i>	14
1.2.1. Morphology of Tall Zirā‘a	15
1.2.2. Emergence of the Natural Hill.....	19
1.3. The Wādī al-‘Arab and its Environment <i>Dieter Vieweger/Jutta Häser</i>	20
1.3.1. The Natural Conditions in the Wādī al-‘Arab.....	21
1.3.2. The Wādī al-‘Arab as a Trade Route.....	21
1.4. Research History for Tall Zirā‘a <i>by Dieter Vieweger/Jutta Häser</i>	23
1.4.1. Records of Gottlieb Schumacher.....	23
1.4.2. Observations of Nelson Glueck.....	24
1.4.3. Modern Surveys Preceding the ‘Gadara Region Project’.....	24
1.4.3.1. The 1978 Survey.....	25
1.4.3.2. The 1983 Survey.....	26
1.4.4. Archaeological Excavations on Tall Zirā‘a, Surveys and Study Campaigns 2001–2016.....	27
1.4.4.1. The Three Excavation Areas on Tall Zirā‘a.....	27
1.4.4.2. Archaeological Seasons from 2001 to 2016. An Overview.....	29
1.4.4.3. The 2001 Survey of Tall Zirā‘a and in its Hinterland.....	29
1.4.4.4. The 2001 and 2002 Test Trench Excavation.....	30
1.4.4.5. The Summer 2003 Excavation Season with Geophysical Prospection.....	30
1.4.4.6. The Spring 2004 Excavation Season.....	32
1.4.4.7. The Summer 2004 Excavation Season.....	33
1.4.4.8. The Spring 2005 Excavation Season.....	33
1.4.4.9. The Summer 2005 Excavation Season.....	34
1.4.4.10. The Spring 2006 Excavation Season.....	35

1.4.4.11. The Summer 2006 Excavation Season.....	36
1.4.4.12. The Spring 2007 Excavation Season.....	37
1.4.4.13. The Summer 2007 Excavation Season.....	39
1.4.4.14. The Spring 2008 Excavation Season.....	40
1.4.4.15. The Summer 2008 Excavation Season.....	41
1.4.4.16. The Spring 2009 Excavation Season.....	43
1.4.4.17. The Summer 2009 Excavation and Survey Season.....	46
1.4.4.18. The Spring 2010 Excavation Season.....	46
1.4.4.19. The Summer 2010 Excavation and Survey Season.....	48
1.4.4.20. The Spring 2011 Excavation Season.....	49
1.4.4.21. The Summer 2011 Excavation and Survey Season.....	50
1.4.4.22. The Summer 2012 Study Season.....	51
1.4.4.23. The Summer 2013 Study Season.....	52
1.4.4.24. The Summer 2014 Study and Excavation Season.....	52
1.4.4.25. The Summer 2015 Study Season.....	53
1.4.4.26. The Summer 2016 Study Season.....	54
1.5. Aims of the ‘Gadara Region Project’ by Dieter Vieweger/Jutta Häser.....	55
1.6. Bibliography.....	56
2. THE 2001 SURVEY ON TALL ZIRĀ‘A by Dieter Vieweger/Frauke Kenkel/Daniel Keller/Stefanie Hoss	59
2.1. Methodology by Dieter Vieweger.....	59
2.2. Finds by Dieter Vieweger/Frauke Kenkel/Stefanie Hoss/Daniel Keller.....	59
2.2.1. Pottery from the 2001 Survey by Frauke Kenkel.....	59
2.2.1.1. Typological Studies of the Pottery.....	60
2.2.1.2. Two Sherds with a Stamp from Tall Zirā‘a.....	64
2.2.1.3. Early Bronze Age Pottery from Tall Zirā‘a.....	65
2.2.1.4. Early and Middle Bronze Age Pottery from Tall Zirā‘a.....	68
2.2.1.5. Middle and Late Bronze Age Pottery from Tall Zirā‘a.....	69
2.2.1.6. Late Bronze Age Pottery from Tall Zirā‘a.....	71
2.2.1.7. Late Bronze Age/Iron Age and Iron Age Pottery from Tall Zirā‘a.....	73
2.2.1.8. Iron Age Cooking Pots from Tall Zirā‘a.....	75
2.2.1.9. Iron Age IIA/B and Iron Age IIC Pottery from Tall Zirā‘a.....	77
2.2.1.10. Hellenistic and Early Roman Pottery from Tall Zirā‘a.....	79
2.2.1.11. Hellenistic – Roman and Roman Pottery from Tall Zirā‘a.....	81
2.2.1.12. Late Roman and Byzantine Pottery Imports from Tall Zirā‘a.....	84
2.2.1.13. Roman – Byzantine, Byzantine and Byzantine – Early Islamic Pottery from Tall Zirā‘a.....	85
2.2.1.14. Late Byzantine – Early Islamic, Umayyad and Mamluk Pottery from Tall Zirā‘a.....	88
2.2.1.15. Islamic Pottery from Tall Zirā‘a.....	90
2.2.1.16. Islamic and Ottoman Pottery from Tall Zirā‘a.....	92

2.2.2.	Glass Finds from the 2001 Survey	<i>by Stefanie Hoss/Daniel Keller</i>	124
2.2.2.1.	Typology of the Glass Finds		124
2.2.2.2.	Analysis of the Glass Finds		126
2.2.2.3.	Catalogue of the Glass Finds		127
2.2.3.	Stone/Mineral Finds from the 2001 Survey	<i>by Dieter Vieweger</i>	134
2.2.3.1.	Stone/Mineral Finds of Different Types		134
2.2.3.2.	Catalogue of the Stone/Mineral Finds		134
2.2.3.3.	Two Early Roman Limestone Vessels		139
2.2.3.4.	Catalogue of the Early Roman Limestone Vessels		141
2.2.4.	Bone Finds from the 2001 Survey	<i>by Dieter Vieweger</i>	141
2.3.	The 2001 Survey Results	<i>by Dieter Vieweger</i>	142
2.3.1.	Results of Find Distribution		142
2.3.2.	Comparison of Different Survey Methods		146
2.4.	Bibliography		150
3.	SCIENTIFIC METHODS	<i>by Dieter Vieweger/Jutta Häser/Patrick Leiverkus/Götz Bongartz/Gilles Bülow/Johannes Große Frericks/Dietmar Biedermann/Armin Rauen/Knut Rassmann/Samantha Reiter/Katja Soenneken/Linda Olsvig-Whittaker/David Adan-Bajewitz</i>	157
3.1.	Animated 3D-Models of Archaeological Excavation Contexts		
	from Tall Zirā'a	<i>by Dieter Vieweger/Jutta Häser</i>	157
3.1.1.	Reconstruction of an Iron Age I Four Room House		158
3.1.2.	Reconstruction of the Late Bronze Age City		159
3.2.	Aerial Survey and Photogrammetry	<i>by Patrick Leiverkus/Götz Bongartz</i>	163
3.2.1.	Photogrammetry and Documentation of Archaeological Features	<i>by Patrick Leiverkus</i>	164
3.2.1.1.	Digital Photogrammetry		164
3.2.1.2.	Representation of a Spatial Structure by Means of Image-Based 3D-Reconstructions		165
3.2.2.	Aerial Photogrammetry for the Creation of Maps	<i>by Patrick Leiverkus</i>	166
3.2.3.	Three Application Examples	<i>by Götz Bongartz</i>	167
3.2.3.1.	Large Scale: The Tall Zirā'a		167
3.2.3.2.	Medium Scale: Areas and Squares		167
3.2.3.3.	Small Scale: Objects		168
3.3.	Colorimetric Examination of Ceramic	<i>by Gilles Bülow/Johannes Große Frericks</i>	168
3.3.1.	The L*a*b*-Colour System		169
3.3.2.	The Program ('BAI-Computer')		169
3.3.2.1.	Method of Classification of Pottery Ware Groups by Means of the 'BAI Computer'		169
3.3.2.2.	Method of Allocation of Munsell Value by Means of the 'BAI Computer'		170
3.3.3.	Methods of Measurements and Definition of L*a*b* Tolerances		170
3.3.3.1.	Determination of L*a*b* Tolerances		171
3.3.3.2.	Calculation of Target Value		172

3.3.3.3.	Comparison of Pottery Ware Groups.....	172
3.3.4.	Conclusions.....	172
3.3.4.1.	Measuring Methodology.....	172
3.3.4.2.	Classification into Pottery Ware Groups.....	172
3.3.4.3.	Statistical Evaluation.....	173
3.3.4.4.	Classification of Munsell Values.....	173
3.4.	Experimental Archaeology <i>edited by Dieter Vieweger/Jutta Häser</i>	173
3.4.1.	Reconstruction of a Tabun.....	174
3.4.2.	Construction of Pottery Kilns.....	175
3.4.2.1.	Construction of an Updraft Kiln in 2001.....	175
3.4.2.2.	Ethno-Archaeology as an Approach to Better Understanding Technical Procedures.....	175
3.4.2.3.	Construction of an Updraft Kiln in 2006.....	176
3.4.2.4.	Construction of a Quadruple-Shelled Kiln in 2012.....	177
3.4.3.	Experiments on Melting Glass and the Processing of Raw Materials	178
3.4.3.1.	Production of Raw Glass.....	178
3.4.3.2.	Melting Raw Glass.....	179
3.4.3.3.	Glass Production in the Quadruple-Shelled Kiln.....	180
3.4.3.4.	The Glass Production on Tall Zirā'a.....	180
3.5.	Geophysics <i>by Patrick Leiverkus/Armin Rauen/Dieter Vieweger/Dietmar Biedermann/Knut Rassmann/Samantha Reiter</i> ...	189
3.5.1.	Geophysical Survey in 2001 <i>by Patrick Leiverkus/Armin Rauen/Dieter Vieweger</i>	189
3.5.2.	Crosshole Investigations in 2007 <i>by Dietmar Biedermann</i>	191
3.5.3.	Seeing Beneath the Ground—Geomagnetic Prospection in 2014 <i>by Knut Rassmann/Samantha Reiter</i>	193
3.5.3.1.	Technical Equipment and Data Processing.....	193
3.5.3.2.	Data Processing.....	193
3.5.3.3.	Methodological Remarks.....	194
3.5.3.4.	Results.....	194
3.6.	Landscape Archaeology <i>by Patrick Leiverkus/Katja Soennecken/Linda Olsvig-Whittaker</i>	197
3.6.1.	The Wādi al-‘Arab Survey <i>by Patrick Leiverkus/Katja Soennecken</i>	198
3.6.2.	Landscape Archaeology and its Methods Used in the ‘Gadara Region Project’ <i>by Linda Olsvig-Whittaker</i>	202
3.6.2.1.	Habitat Mapping.....	202
3.6.2.2.	Multivariate Analysis of Assemblage Patterns.....	204
3.6.2.3.	Detrended Correspondence Analysis (DCA).....	205
3.6.2.4.	Canonical Correspondence Analysis (CCA).....	205
3.6.2.5.	Preliminary Results.....	205
3.7.	Archaeobotany <i>by Linda Olsvig-Whittaker</i>	206
3.7.1.	Ecological Background.....	207
3.7.1.1.	Ecological Background of Northern Jordan.....	207
3.7.1.2.	Ecological Background of Tall Zirā'a.....	207

3.7.2.	Archaeobotanical Background.....	208
3.7.3.	Methods.....	208
3.7.4.	Preliminary Results of the Archaeobotanical Researches on Tall Zirā'a.....	210
3.7.5.	Potential Future Archaeobotanical Researches on Tall Zirā'a.....	210
3.8.	Archaeometry <i>edited by Dieter Vieweger/Jutta Häser/with a contribution by David Adan-Bajewitz</i>	212
3.8.1.	Pottery <i>edited by Dieter Vieweger/Jutta Häser/with a contribution by David Adan-Bajewitz</i>	213
3.8.1.1.	Provenance Study.....	213
3.8.1.2.	Typology.....	215
3.8.1.3.	Compositional and Provenance Study of Roman Period Pottery <i>by David Adan-Bajewitz</i>	216
3.8.2.	Glass, Glass Frit, and Faience <i>edited by Dieter Vieweger/Jutta Häser</i>	217
3.8.2.1.	Glass.....	217
3.8.2.2.	Glass Frits and Faience.....	218
3.8.3.	Production of Glass and Faience <i>edited by Dieter Vieweger/Jutta Häser</i>	220
3.8.3.1.	Glass.....	220
3.8.3.2.	Glass Frit and Faience.....	221
3.8.4.	Metals <i>edited by Dieter Vieweger/Jutta Häser</i>	221
3.8.4.1.	Copper (Ore/Slags) and Bronze.....	221
3.8.4.2.	Metal Artefacts.....	221
3.8.4.3.	Silver and Gold Objects.....	223
3.8.4.4.	Metal Processing on Tall Zirā'a.....	223
3.8.5.	Stones and Minerals <i>edited by Dieter Vieweger/Jutta Häser</i>	224
3.8.5.1.	Minerals.....	224
3.8.5.2.	Balance Weights.....	227
3.9.	Bibliography.....	228
4.	FRAMEWORK OF ARCHAEOLOGICAL WORK ON TALL ZIRĀ'A <i>by Dieter Vieweger/Jutta Häser</i>	235
4.1.	The Grid System Used at the Excavation <i>by Dieter Vieweger/Jutta Häser</i>	235
4.2.	Stratigraphic Nomenclature and Definition of Areas, Contexts and Finds <i>by Dieter Vieweger/Jutta Häser</i>	238
4.2.1.	Stratigraphic Nomenclature.....	238
4.2.2.	Definition and Numbering System of Areas, Contexts and Finds.....	241
4.3.	Archaeological Periods in the Southern Levant (a Short Chronology) <i>by Dieter Vieweger/Jutta Häser</i>	242
4.4.	Radiocarbon Samples from Tall Zirā'a <i>by Dieter Vieweger/Jutta Häser</i>	244
4.4.1.	Area II.....	244
4.4.2.	Area I.....	244
4.4.2.1.	Ottoman Period (Stratum 1).....	244
4.4.2.2.	Early Roman Period (Stratum 7 c).....	245
4.4.2.3.	Iron Age (Strata 13–10).....	245
4.4.2.4.	Late Bronze Age II (Stratum 14).....	249

4.4.2.5.	Constructional Stratum (Stratum 15).....	250
4.4.2.6.	Middle Bronze Age (Strata 19–16).....	251
4.4.2.7.	Transitional Period from Early Bronze Age IV to Middle Bronze Age I (Strata 21 and 20).....	258
4.4.2.8.	Early Bronze Age II and III (Strata 24–22).....	260
4.5.	Bibliography.....	266

LIST OF FIGURES

Figures of Preface and Introduction

Fig. 0.1	Tall Zirā'a. View from west to east. Photograph taken in 2011.....	1	Fig. 0.3	Tall Zirā'a and its geographic location.....	3
Fig. 0.2	Map showing the area around Tall Zirā'a.....	2	Fig. 0.4	The Tall Zirā'a. View to the east showing the excavation at Area I and II. Photograph taken in Spring 2011.....	9

Figures of Chapter I: The 'Gadara Region Project'/Tall Zirā'a

Fig. 1.1	The Tall Zirā'a. View to the east showing Area I and II. Photograph taken in summer 2009.....	13	Fig. 1.20	Wādī al-'Arab with the water reservoir... ..	20
Fig. 1.2	The Biblical Archaeological Institute (BAI) in Wuppertal.....	14	Fig. 1.21	The Wādī al-'Arab-system.....	21
Fig. 1.3	The German Protestant Institute of Archaeology (GPIA) in Jerusalem.....	14	Fig. 1.22	Map showing the trade routes.....	21
Fig. 1.4	The German Protestant Institute of Archaeology (GPIA) in Amman.....	14	Fig. 1.23	Ascent from the Jordan Valley to the Irbid-Ramtha basin.....	22
Fig. 1.5	The stalactites and stalagmites in a cave on the tall's eastern slope.....	15	Fig. 1.24	The Wādī al-'Arab. View from west. Photograph taken in 2011.....	22
Fig. 1.6	Modern ascent to the tall's plateau.....	15	Fig. 1.25	Gottlieb Schumacher.....	23
Fig. 1.7	Modern water channel within olive groves and vineyards on the tall's south slope.....	15	Fig. 1.26	Tall Zirā'a looking south-south-west. Photograph taken by N. Glueck in 1942.....	24
Fig. 1.8	The water channel on the tall's north-east side.....	16	Fig. 1.27	Areas surveyed in 1983.....	26
Fig. 1.9	The stretcher-header-wall on the tall's east side.....	16	Fig. 1.28	Tall Zirā'a. View from north to south. Overview with the Areas I, II and III. Photograph taken in 2011.....	27
Fig. 1.10	The Roman/Byzantine bath on the tall's east side.....	16	Fig. 1.29	Aerial view of Area I. Photograph taken in 2011.....	27
Fig. 1.11	Building substructure; in later times reused as a cistern. Area III, Squares W-X 124-126.....	17	Fig. 1.30	Aerial view of Area II. Photograph taken in 2012.....	28
Fig. 1.12	The artesian spring on Tall Zirā'a.....	17	Fig. 1.31	Overview of Area III. Photograph taken in 2008.....	28
Fig. 1.13	One of the cave at the foot of Tall Zirā'a; north-west side.....	17	Fig. 1.32	General plan of the excavation areas on Tall Zirā'a.....	28
Fig. 1.14	Tall Zirā'a. Overview on the plateau. Photograph taken in 2011.....	18	Fig. 1.33	General plan of the Excavation grid on Tall Zirā'a.....	28
Fig. 1.15	The northern terrace below Tall Zirā'a....	18	Fig. 1.34	Survey work in 2001.....	30
Fig. 1.16	The western terrace of Tall Zirā'a.....	18	Fig. 1.35	Trench opened by K. Vriezen in 2001. Strata 4 and 3, Area I, Square AF 115-116.....	30
Fig. 1.17	Agricultural installation on the tall's east side. Square AM 145.....	19	Fig. 1.36	Stone-lined opening of a drainage. Stratum 14, Area I, Square AM 116, Context 4776.....	31
Fig. 1.18	Tall Zirā'a. Chalk-sinter terrace on the tall's north-east side.....	19	Fig. 1.37	Penstock mill in The Wādī al-'Arab.....	31
Fig. 1.19	The Wādī al-'Arab and Tall Zirā'a. View from the Gadara-plateau. Photograph taken in 2007.....	20	Fig. 1.38	Aerial photograph of Area I. Photograph taken in 2003 from a helium filled balloon.....	31
			Fig. 1.39	Excavation at Area I. Summer 2003.....	32

Fig. 1.40	Excavation at Area I. Spring 2004.....	32		
Fig. 1.41	Measurement of a pit in summer 2004. Stratum 6, Area I, Square AN 119.....	33		
Fig. 1.42	Aerial photograph of Area I. Photograph taken in spring 2005.....	33		
Fig. 1.43	Ceramic figurine, TZ 007430-001. Dimensions: L 9.2, W 7.2, H 4.4. 3D-model: App. 3.4 a.....	34		012657-001. Dimensions: L 8. 3D-model: App. 3.4 b.....
Fig. 1.44	Late Bronze Age tower and a sanctuary. Stratum 14, Area I, Squares AI–AK 115–117, AL 115–117.....	34		
Fig. 1.45	Team member at work. Summer 2005....	34		
Fig. 1.46	Residential building with casemate wall. Stratum 14, Area I, Square AM 117.....	35		
Fig. 1.47	Building structures. Strata 3 and 4, Area II, Squares AV–AW 128–129.....	36		
Fig. 1.48	Jutta Häser (director of project). Summer 2006.....	36		
Fig. 1.49	Mazebbe (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.....	37		
Fig. 1.50	Archaeological experiment: firing the kiln in summer 2006.....	37		
Fig. 1.51	Architectural scetch of the southern part of Area I. Stratum 13. Spring 2007	38		
Fig. 1.52	Architectural scetch of the excavation in Area I. Stratum 14. Spring 2007.....	38		
Fig. 1.53	Aerial photograph of Area I. View from north-west. Photograph taken in summer 2007.....	39		
Fig. 1.54	Silo made of clay. Stratum 13, Area I, Squares AG 115–116, Context 1922.....	39		
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.....	40		
Fig. 1.56	Byzantine/Umayyad building, Stratum 4 and 3, Area II, Square AT 128, Context 10571.....	40		
Fig. 1.57	Aerial photograph of Area II. Photograph taken in spring 2008.....	41		
Fig. 1.58	Visit of Her Royal Highness Princess Sumaya bint al-Hassan at GPIA Amman in summer 2008.....	41		
Fig. 1.59	Excavation in Area III. Summer 2008....	42		
Fig. 1.60	Small shrine, TZ 005552-010. Dimensions: H 23.5, D (max.) 21.5.....	42		
Fig. 1.61	Ushebti figurine made of faience, TZ			
Fig. 1.62	Stone-lined pit. Stratum 14, Area I, Square AG 116, Context 3701.....	43		
Fig. 1.63	The big Nothing—layers of rubble under the casemate wall. Remains of Strata 16, 15 and 14.....	43		
Fig. 1.64	Rubble and paving layers in the profil; on the top centre: remains of Strata 15 and 14.....	43		
Fig. 1.65	Aerial photograph of Area II. Photograph taken in spring 2009.....	44		
Fig. 1.66	Iron Age II kiln. Stratum 10, Area I, Square AT 121, Context 4100 left and 4133 right.....	45		
Fig. 1.67	Part of Byzantine building. Strata 4 and 3, Area II, Square AX 127.....	45		
Fig. 1.68	Tall Zirā'a. Landslide on the east side. Photograph taken in 2009.....	45		
Fig. 1.69	Landscape of Wādī al-‘Arab. View to the north. Photograph taken in 2003.....	46		
Fig. 1.70	Aerial photograph of Area I and a part of Area II. Photograph taken in spring 2010.....	47		
Fig. 1.71	Late Bronze Age water channel and grain silo. Stratum 14, Area I, Squares AG–AH 115–116.....	47		
Fig. 1.72	‘Ceramic basket’ TZ 006835-016 with a <i>mazzebe</i> (cultic stone, TZ 310339-001). Stratum 13, Area I, Square AP 120, Context 4852.....	48		
Fig. 1.73	Middle Bronze Age furnace. Stratum 15, Area I, Square AM 119.....	48		
Fig. 1.74	Early Iron Age votive plate with the representation of a king, TZ 018181-001. Dimensions: W 12.5, H 19.1	49		
Fig. 1.75	Hellenistic and roman structures. Stratum 8 and 7/6, Area II, Squares AU–AT 126–127.....	49		
Fig. 1.76	Late Bronze Age channel (Strata 15 and 14) running through the Early Bronze Age city wall (Stratum 25).....	49		
Fig. 1.77	Temple. Stratum 14, Area I, Squares AP 118–122 and AS 119–122. Photograph taken in summer 2011.....	50		
Fig. 1.78	Excavation in summer 2011. Area I, Square AO 118–119.....	51		
Fig. 1.79	Excavation team. Summer 2011.....	51		
Fig. 1.80	The modelling of a quadruple-shelled kiln in 2012.....	51		

Fig. 1.81	3D-model of Tall Zirā'a.....	51	Fig. 1.86	Destruction on the tall's south slope in 2016.....	54
Fig. 1.82	Team of the 2012 study season.....	52	Fig. 1.87	Destruction on the tall's south slope in 2016 with a lime-plastered floor visible..	54
Fig. 1.83	Team members of the 2013 study season.....	52	Fig. 1.88	Destruction on the tall's south slope in 2016 with a wall visible.....	54
Fig. 1.84	Salvage of the mosaic in spring 2014. Stratum 3, Area III, Square X 125, Context 30124.....	53			
Fig. 1.85	Destruction on the tall's south slope in 2016.....	54			

Figures of Chapter II: The 2001 Survey on Tall Zirā'a

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.....	59	Fig. 2.24	Bowl/Krater, TZ 000403-001.....	71
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.....	59	Fig. 2.25	Milk bowl, TZ 000163-008.....	71
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)	61	Fig. 2.26	Bowl/Krater, TZ 000434-001.....	71
Fig. 2.4	Base sherd, TZ 000206–001.....	64	Fig. 2.27	Storage jar, TZ 000334-002.....	72
Fig. 2.5	Base sherd, TZ 000206–001.....	64	Fig. 2.28	Pithos, TZ 000127-003.....	72
Fig. 2.6	Base sherd, TZ 000396-013.....	65	Fig. 2.29	Jug, TZ 000014-008.....	72
Fig. 2.7	Base sherd, TZ 000396-013.....	65	Fig. 2.30	Bowl, TZ 000397-002.....	73
Fig. 2.8	Cooking pot, TZ 000373-004.....	66	Fig. 2.31	Bowl, TZ 000268-001.....	73
Fig. 2.9	Cooking pot, TZ 000349-001.....	66	Fig. 2.32	Bowl/Krater, TZ 000340-001.....	73
Fig. 2.10	Cooking pot, TZ 000452-006.....	66	Fig. 2.33	Jar/Jug, TZ 000333-001.....	74
Fig. 2.11	Cooking pot, TZ 000375-002.....	67	Fig. 2.34	Jar/Jug, TZ 000330-004.....	74
Fig. 2.12	Jug, TZ 000285-002.....	67	Fig. 2.35	Jar/Jug, TZ 000340-002.....	74
Fig. 2.13	Jug, TZ 000290-003.....	67	Fig. 2.36	Jug/Krater, TZ 000471-008.....	74
Fig. 2.14	Jar/Jug, TZ 00263-008.....	68	Fig. 2.37	Cooking pot, TZ 000397-003.....	75
Fig. 2.15	Bowl, TZ 000375-001.....	68	Fig. 2.38	Cooking pot, TZ 000020-004.....	75
Fig. 2.16	Bowl, TZ 000333-005.....	68	Fig. 2.39	Cooking pot, TZ 000476-007.....	76
Fig. 2.17	Jar/Jug, TZ 000367-001.....	69	Fig. 2.40	Cooking pot, TZ 000238-007.....	76
Fig. 2.18	Bowl, TZ 000187-004.....	69	Fig. 2.41	Cooking pot, TZ 000018-002.....	76
Fig. 2.19	Bowl, TZ 000126-002.....	69	Fig. 2.42	Cooking pot, TZ 000298-012.....	77
Fig. 2.20	Krater, TZ 000045-003.....	70	Fig. 2.43	Cooking Jar, TZ 000075-006.....	77
Fig. 2.21	Cooking pot, TZ 000357-005.....	70	Fig. 2.44	Holemouth jar, TZ 000391-001.....	77
Fig. 2.22	Bowl/Krater, TZ 000403-005.....	70	Fig. 2.45	Jar/Jug, TZ 000356-004.....	78
Fig. 2.23	Bowl/Krater, TZ 000336-005.....	70	Fig. 2.46	Jug, TZ 000388-004.....	78
			Fig. 2.47	Bowl, TZ 000356-002.....	79
			Fig. 2.48	Bowl, TZ 000045-007.....	79
			Fig. 2.49	Bowl, TZ 000196-001.....	79
			Fig. 2.50	Bowl, TZ 000111-004.....	79
			Fig. 2.51	Base, TZ 000119-009.....	80
			Fig. 2.52	Bowl, TZ 000075-011.....	80
			Fig. 2.53	Bowl, TZ 000168-007.....	80

Fig. 2.54 Bowl/Plate, TZ 000021-026.....	80	Fig. 2.93 Jar/Jug, TZ 000304-012.....	94
Fig. 2.55 Amphora, TZ 000348-004.....	81	Fig. 2.94 Pipe bowl, TZ 000098-001.....	94
Fig. 2.56 Amphora, TZ 000003-003.....	81	Fig. 2.95 Stone ring, TZ 000115-002.....	135
Fig. 2.57 Amphora, TZ 000281-002.....	81	Fig. 2.96 Foot of a stone bowl, TZ 000164-001....	136
Fig. 2.58 Cup, TZ 000011-005.....	81	Fig. 2.97 Grinding stone?, TZ 000006-002.....	137
Fig. 2.59 Bowl, TZ 000204-002.....	82	Fig. 2.98 Grinding stone, TZ 000006-001.....	137
Fig. 2.60 Bowl, TZ 000370-002.....	82	Fig. 2.99 Grinding stone/mortar, TZ 000053-001	138
Fig. 2.61 Amphora, TZ 000333-002.....	82	Fig. 2.100 Hammer stone, TZ 000115-001.....	138
Fig. 2.62 Casserole, TZ 000014-001.....	83	Fig. 2.101 Hammer stone, Beth Shean.....	138
Fig. 2.63 Cooking pot, TZ 000255-007.....	84	Fig. 2.102 Pecked hammer stone, TZ 000383-001..	138
Fig. 2.64 Bowl, TZ 000061-002.....	84	Fig. 2.103 Ecofact, TZ 000003-013.....	138
Fig. 2.65 Bowl, TZ 000049-001.....	84	Fig. 2.104 Ecofact, TZ 000415-001.....	139
Fig. 2.66 Bowl, TZ 000269-001.....	85	Fig. 2.105 Ecofact, TZ 000172-001.....	139
Fig. 2.67 Bowl, TZ 000262-005.....	85	Fig. 2.106 Foot of a vessel or table, TZ 000406- 001.....	139
Fig. 2.68 Mortarium, TZ 000280-005.....	86	Fig. 2.107 Limestone vessel, TZ 000497-001.....	141
Fig. 2.69 Cooking bowl, TZ 000013-011.....	86	Fig. 2.108 Limestone vessel, TZ 000497-001.....	141
Fig. 2.70 Casserole, TZ 000153-004.....	86	Fig. 2.109 Limestone vessel, TZ 000495-001.....	141
Fig. 2.71 Cooking pot, TZ 000101-003.....	87	Fig. 2.110 Limestone vessel, TZ 000495-001.....	141
Fig. 2.72 Cooking pot, TZ 000325-001.....	87	Fig. 2.111 Tall Zirā'a. Survey squares and areas of search: north (yellow), south (red), east (blue), west (green) and plateau (grey)...	145
Fig. 2.73 Amphora, TZ 000325-002.....	87	Fig. 2.112 Pottery sherd distribution. Early Bronze Age. Distribution between 0 (white) and 15 (black) (black) finds per 400 m ²	145
Fig. 2.74 Jar/Jug, TZ 000261-004.....	87	Fig. 2.113 Pottery sherd distribution. Iron Age. Distribution between 0 (white) and 15 (black) (black) finds per 400 m ²	145
Fig. 2.75 Bowl, TZ 000455-001.....	88	Fig. 2.114 Pottery sherd distribution. Hellenistic – Roman. Distribution between 0 (white) and 15 (black) (black) finds per 400 m ² ...	145
Fig. 2.76 Krater, TZ 000324-005.....	88	Fig. 2.115 Pottery sherd distribution. Roman – By- zantine. Distribution between 0 (white) and 15 (black) (black) finds per 400 m ² ...	146
Fig. 2.77 Amphora, TZ 000398-001.....	88	Fig. 2.116 Pottery sherd distribution. Late Islamic. Distribution between 0 (white) and 15 (black) finds per 400 m ²	146
Fig. 2.78 Cooking pot, TZ 000110-003.....	89	Fig. 2.117 Survey participants applying the Portu- gali Method.....	147
Fig. 2.79 Jar/Jug, TZ 000467-001.....	89	Fig. 2.118 Survey participants sampling in one square.....	147
Fig. 2.80 Bowl, TZ 000040-003.....	89		
Fig. 2.81 Jar/Jug, TZ 000021-016.....	89		
Fig. 2.82 Jar/Jug, TZ 000042-011.....	90		
Fig. 2.83 Jar/Jug, TZ 000138-014.....	90		
Fig. 2.84 Bowl, TZ 000165-003.....	90		
Fig. 2.85 Bowl, TZ 000067-007.....	91		
Fig. 2.86 Bowl/Plate, TZ 000389-002.....	91		
Fig. 2.87 Cooking pot, TZ 000311-003.....	91		
Fig. 2.88 Cooking pot, TZ 000216-006.....	91		
Fig. 2.89 Cooking pot, TZ 000348-001.....	92		
Fig. 2.90 Storage jar, TZ 000195-004.....	92		
Fig. 2.91 Jar/Amphora, TZ 000075-001.....	93		
Fig. 2.92 Jar/Jug, TZ 000430-009.....	93		

Figures of Chapter III: Scientific Methods

Fig. 3.1.	3D-reconstruction of the Late Bronze Age city on Tall Zirā'a.....	157	Fig. 3.24	Iron Age I tabun. Stratum 13, Area I, Square AE 115, Context 3258.....	174
Fig. 3.2	3D-reconstruction of an Iron Age Four Room House.....	158	Fig. 3.25	Construction of an updraft kiln.....	175
Fig. 3.3	3D-reconstruction of the courtyard of an Iron Age I Four Room House.....	158	Fig. 3.26	The replica of an updraft kiln.....	175
Fig. 3.4	3D-reconstruction of the sanctuary in the tower.....	159	Fig. 3.27	Reconstruction of a pottery kiln on the Tall Zira'a in 2006.....	176
Fig. 3.5	3D-reconstruction of a temple type used in the Southern Levant.....	159	Fig. 3.28	Hanna Brückelmann forming ceramic vessels.....	177
Fig. 3.6	3D-reconstruction of the Late Bronze Age city on Tall Zirā'a. The western side of the city (Area I).....	160	Fig. 3.29	Quadruple-shelled kiln. Stratum 10, Area I, Square AT 121, Context 4100.....	178
Fig. 3.7	3D-reconstruction of the Bronze Age city on Tall Zirā'a. The south side (with Area III).....	160	Fig. 3.30	Above: Quartz gravel as raw material; below: silex as raw material.....	178
Fig. 3.8	3D-reconstruction of the main gate.....	160	Fig. 3.31	Raw glass made from mixture of 13 g SiO ₂ (silex) and 1.7 g Na ₂ CO ₃ (Na ₂ O 10 %).....	179
Fig. 3.9	Aerial view of Tall Zira'a. Mosaic of rectified photographs taken from a helium filled balloon in 2003.....	163	Fig. 3.32	Raw glass made from mixture of 1.5 g SiO ₂ (silex) and 0.3 g Na ₂ CO ₃ suspended with water.....	179
Fig. 3.10	Photographing with a telescope pole....	164	Fig. 3.33	Glass made from the reaction mixture 10 g glass, Na ₂ CO ₃ and 1.7 g in a plastic bag and 10 % Na ₂ O 10 %.....	179
Fig. 3.11	Unrectified image of Square AL 117....	165	Fig. 3.34	Glass made from 4,2 g glass, 0.3 g Na ₂ CO ₃ and 5 % Na ₂ O in a plastic bag...	179
Fig. 3.12	Rectified image of Square AL 117.....	165	Fig. 3.35	Filling the kiln with glass samples.....	180
Fig. 3.13	Application of a helium filled balloon...	166	Fig. 3.36	Glas production in the kiln.....	180
Fig. 3.14	Aerial photograph of Area I, taken from a helium filled balloon. Photograph taken in 2005.....	166	Fig. 3.37	Raw glass found on Tall Zirā'a, TZ 012474-001. Area I, Square AQ 120, Context 3421.....	180
Fig. 3.15	Airborne octocopter.....	167	Fig. 3.38	Glass granulate, TZ 016622-001.....	180
Fig. 3.16	Aerial photograph of Area II, taken from the octocopter in 2011.....	167	Fig. 3.39	Bead with its clay core still intact, TZ 016663-001. Dimensions: H 0.8, D (max.) 1.4.....	180
Fig. 3.17	3D-model of Tall Zirā'a.....	167	Fig. 3.40	Bead, TZ 007546-001. Dimensions: H 1, D (max.) 3.....	180
Fig. 3.18	Workflow for image-based 3D-reconstruction in an archaeological context.....	167	Fig. 3.41	Working area with mazzebe and basket-shaped vessel. Stratum 13, Area I, Square AP 120, Context 4852.....	181
Fig. 3.19	Workflow for a 3D-image of an object, TZ 006835-016:1. Point cloud 2. Model without texture 3. Model with texture.....	168	Fig. 3.42	Basket-shaped ceramic vessel, TZ 006835-016. Dimensions: L 51, W 30, H 6.3.....	181
Fig. 3.20	The CIE-L*a*b* colour system.....	169	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....	181
Fig. 3.21	Method of classification of pottery ware groups by means of the 'BAI Computer'.....	170	Fig. 3.44	Spacer bead, TZ 014558-001. Dimensions: L 3.3, W 3.5, H 1.5.....	181
Fig. 3.22	Method of allocation of Munsell value by means of the 'BAI Computer'.....	170	Fig. 3.45	Rod-shaped bead, TZ 013881-001. Dimensions: H 2.2, D (max.) 0.6.....	181
Fig. 3.23	Reconstructed tabun.....	174			

Fig. 3.46	Tomography.....	189	Fig. 3.69	Site 228/213-5. Roman – Byzantine sarcophagus fragments and graves niches near ‘Aydūn.....	200
Fig. 3.47	Geoelectrics.....	189	Fig. 3.70	Site 211/224-2. Settlement on a tall.....	201
Fig. 3.48	Geological depth profile.....	191	Fig. 3.71	Site 211/224-2. Two layers of Roman – Byzantine settlement divided by layers of ash.....	201
Fig. 3.49	Insertion of the borehole equipment.....	191	Fig. 3.72	Site 228/221-1. Ĥirbet Srīs. Robbery trench with a wall, around it burnt vegetation.....	201
Fig. 3.50	Location and orientation of the drillings carried out in 2007.....	192	Fig. 3.73	Site 220/224-1. Grave entrance with robbery trench.....	201
Fig. 3.51	Location and orientation of the drillings carried out in 2007.....	192	Fig. 3.74	Habitat mapping of Zone A and Zone B. Large scale.....	202
Fig. 3.52	Geoelectric depth profile at the north-eastern side of the tall.....	192	Fig. 3.75	Site 220/225-1. Agricultural installation	203
Fig. 3.53	Tall Zirā‘a. Overview of the location of the magnetic prospection. Archaeological remains of Stratum 3.....	193	Fig. 3.76	Habitat mapping. Small scale: Site 220/225-1 in the middle (yellow) and Site 219/226-1 on the left (pink)	204
Fig. 3.54	Tall Zirā‘a. Overview of the magnetic prospection.....	193	Fig. 3.77	Landscape with olive groves around Tall Zirā‘a. Photograph taken in spring 2012	206
Fig. 3.55	Northern area of Tall Zirā‘a. Magnetic prospection with detail of the tower base.....	194	Fig. 3.78	Flora at Tall Zirā‘a.....	207
Fig. 3.56	Northern area of Tall Zirā‘a. Contour map of the magnetic prospection.....	194	Fig. 3.79	Sieving out large stones and gravel.....	209
Fig. 3.57	Southern area of Tall Zirā‘a. Magnetic prospection.....	195	Fig. 3.80	Pouring soil sample into basin of water...	209
Fig. 3.58	Southern area of Tall Zirā‘a. Contour map of the magnetic prospection.....	195	Fig. 3.81	Wash over of water and floating organic material through a sieve.....	209
Fig. 3.59	Tall Zirā‘a. Contour map (2 nT) with possible indication of walls.....	196	Fig. 3.82	Moving the organic material to a filter paper for drying.....	209
Fig. 3.60	Tall Zirā‘a and its enviroment. Photograph taken in 2007.....	197	Fig. 3.83	Sample poor in organic material.....	209
Fig. 3.61	Area of investigation: Zone A (Tall Zirā‘a hinterland) and Zone B (Wādī al-Arab region).....	198	Fig. 3.84	Sample rich in organic material	209
Fig. 3.62	Site 215/226-8. Ottoman penstock mill at the south side of the Wādī al-‘Arab.....	199	Fig. 3.85	At the south-western foot of Tall Zirā‘a. View to the water reservoir. Photograph taken in 2009.....	210
Fig. 3.63	Location of Site 211/225-7 and Site 211/225-8 in relation to Tall Zirā‘a and Gadara.....	199	Fig. 3.86	Pottery from Tall Zirā‘a.....	213
Fig. 3.64	Site 211/225-8. Architectural remains dated to the Middle Bronze Age.....	199	Fig. 3.87	Provenance of the pottery found on Tall Zirā‘a.....	214
Fig. 3.65	Site 219/227-1. Overview on Tall Kinīse.....	199	Fig. 3.88	Iron Age pyxis, TZ 002926-001 (local). Dimensions: W 10.5, H 8.....	214
Fig. 3.66	Site 214/227-3 on the edge high above the Wādī al-‘Arab.....	200	Fig. 3.89	Pyxis, TZ 002863-001 (Mycenaean, imported). Dimensions: H 9.0.....	214
Fig. 3.67	Site 233/229-1. Ottoman mosque in Ĥarġā with a Roman or Byzantine sarcophagus.....	200	Fig. 3.90	Late Bronze Age jar, TZ 005556-001 (regional). Dimensions: H c. 25, D (opening) 12.5, D (foot) 3.5.....	214
Fig. 3.68	Site 224/217-3. Dolmen north-west of Kafr Yūbā.....	200	Fig. 3.91	Iron Age II jar, TZ 001212-001 (local). Dimensions: H 45, W 35.....	214
			Fig. 3.92	Refiring of ceramics.....	215
			Fig. 3.93	Typology of cooking pots.....	216

- Fig. 3.94 Female figurine, TZ 015318-001. Dimensions: H 4.9, W 2.2..... 217
- Fig. 3.95 Zoomorphic pendant, TZ 015314-001. Dimensions: L 2.1, W 1.3..... 217
- Fig. 3.96 Spacer with floral motif, TZ 010337-001. Dimensions: L 3.1, H 1.8, Th 0.9... 217
- Fig. 3.97 Cylinder seal, TZ 008558-001. Dimensions: H 2.4, D (max.) 1..... 218
- Fig. 3.98 Scarab, TZ 010112-001. Dimensions: L 3.7, W 2.4, H 1.4..... 218
- Fig. 3.99 Scarab, TZ 015313-001. Dimensions: L 2.3, W 1.6, H 1..... 218
- Fig. 3.100 Beads found on Tall Zirā'a in spring 2009..... 219
- Fig. 3.101 Late Bronze Age glass beads, TZ 010757-001. Dimensions: D (max.) c. 1.5..... 219
- Fig. 3.102 Production of beads by winding technique..... 219
- Fig. 3.103 Elemental mapping. 'Chevron bead'..... 219
- Fig. 3.104 Beads in the Allard Pierson Museum Amsterdam..... 220
- Fig. 3.105 Raw glass, TZ 015494-001. Dimensions: L 1.5, W 1.2, H 0.7..... 220
- Fig. 3.106 Glass granule, TZ 016622-001. Dimensions: D 0.3 in average..... 220
- Fig. 3.107 Hammerstone, TZ 015313-001. Dimensions: L 7.7, W 6.3, H 4.4..... 220
- Fig. 3.108 Faience knob, TZ 015317-001. Dimensions: H 5.6, D (max.) 7.4..... 220
- Fig. 3.109 Faience bead, TZ 011143-001. Dimensions: H 1.3, D (max.) 2.2..... 221
- Fig. 3.110 Vessel sherd, TZ 004295-003. Dimensions: H 7, W 5.5..... 221
- Fig. 3.111 Copper ore, TZ 009459-001. Dimensions: L c. 2..... 221
- Fig. 3.112 Copper slag, TZ 012480-001. Dimensions: L 6.5, W 4.5..... 221
- Fig. 3.113 Amulet with a female idol, TZ 012618-001. Dimensions: W (max.) 3.2, H 6.1 221
- Fig. 3.114 Amulet with a female idol, TZ 012618-001. Dimensions: W (max.) 3.2, H 6.1 221
- Fig. 3.115 Wine sieve, TZ 010281-001. Dimensions: H 4.3, D (max.) 9.8..... 222
- Fig. 3.116 Axe, TZ 007992-001. Dimensions: L 8, W 5.3, H 0.2..... 222
- Fig. 3.117 Head of a bear (balance weight?), TZ 010004-001. Dimensions: L 2.2, W 2, H 1.5..... 222
- Fig. 3.118 Restored Iron Age I bowl, TZ 007082-001. Dimensions: D (max.) c. 14..... 222
- Fig. 3.119 Late Bronze Age mirror, TZ 001612-001. Dimensions: D (max.) c. 9..... 222
- Fig. 3.120 Arm of a Late Bronze Age figurine, TZ 010019-001. Dimensions: L 5, W 5.9... 222
- Fig. 3.121 Iron Age IIA/B bronze figurine, TZ 007367-001. Dimensions: H 7.5, W 1.5 223
- Fig. 3.122 Iron Age IIA/B bronze figurine, TZ 007367-001. Dimensions: H 7.5, W 1.5 223
- Fig. 3.123 Earring, TZ 012889-001. Dimensions: D (max.) 1.8..... 223
- Fig. 3.124 Silver amulet, TZ 010114-001. Dimensions: W 3.4, H 5.8..... 223
- Fig. 3.125 Bead bezel and stone bead, TZ 006992-001. Dimensions: D (max.) 1..... 223
- Fig. 3.126 Silver bowl, TZ 012479-001. Dimensions: L 4.3, W 3.6, H 1..... 223
- Fig. 3.127 Crucible, TZ 020229-019. Dimensions: H 12.0, D (opening) 20.0, D (foot) 8.5. Stratum 17, Area I, Square AN 118, Context 4726/7..... 223
- Fig. 3.128 Bitumen, Iron Age, TZ 007433-001. Dimensions: L c. 7, W c. 5..... 224
- Fig. 3.129 Bitumen, TZ 012660-001. Dimensions: L 3.5, W 2..... 224
- 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) 3 224
- Fig. 3.131 Fragment of an Iron Age bowl, TZ 009802-001. Dimensions: D (max.) 10, H 7.2..... 225
- Fig. 3.132 Conical figurine, TZ 007282-001. Dimensions: H 7.2..... 225
- Fig. 3.133 Fragment of an Early Roman mug, TZ 111726-001. Dimensions: H 10.5, D (foot) 8..... 225
- Fig. 3.134 Cylinder seal, TZ 012357-001. Dimensions: H 3.2, D (max.) 1.6..... 225
- Fig. 3.135 Alabaster jug, TZ 015416-001. Dimensions: H 6.2, D (max.) 4.2..... 225
- Fig. 3.136 Alabaster knob, TZ 009176-001. Dimensions: H 3.2, D (max.) 5.3..... 225
- Fig. 3.137 Silex, Late Bronze Age scraper, TZ 012482-001..... 226
- Fig. 3.138 Silex, Iron Age II arrowhead, TZ 009202-001..... 226
- Fig. 3.139 Iron Age I red coloured carnelian as mineral, TZ 001613-001. Dimensions:

	H c. 2, W c. 3.5.....	226			
Fig. 3.140	Iron Age beads, TZ 011780-001, TZ 011781-001 and 011782-001. Dimensions: D 0.9.....	226	Fig. 3.145	Late Bronze Age red haematite, TZ 015333-001. Dimensions: L 6, W 4.2, H 4.1; TZ 015334-001. Dimensions: L 3, W 3.4, H 2.5.....	227
Fig. 3.141	Ceramic jug, TZ 002989-001. Dimensions: H 40, D (max.) 32.....	226	Fig. 3.146	Balance weight, TZ 001388-001. Dimension: 4.8, D (max.) 5.7.....	227
Fig. 3.142	Corroded (oxidised) Late Bronze Age nodules, TZ 012504-001. Dimensions: L 2.5, B 2, H 0.5.....	226	Fig. 3.147	Balance weight TZ 007373-00. Dimensions: L 1.2, D 0.8.....	227
Fig. 3.143	Iron sulfid nodules.....	226	Fig. 3.148	Balance weight, TZ 007374-001. Dimensions: L 2.7, D (max.) 1.4, H 1.1....	227
Fig. 3.144	Late Bronze Age basalt pestle, TZ 015449-001. Dimensions: L 7.8, W 4.7, H 3.8.....	226	Fig. 3.149	Balance weight, TZ 012317-001. Dimensions: L 2.5, D (max.) 1.1, H 0.9....	227

Figures of Chapter IV: Framework of Archaeological Work on Tall Zirā'a

Fig. 4.1	Survey squares and their denotation.....	235	Fig. 4.6	Area III with its excavation squares.....	237
Fig. 4.2	Tall Zirā'a. Topographical map with the starting point Square A 101 (red), survey squares: 20 m x 20 m.....	235	Fig. 4.7	Strata 25, 17–14, 10, 7, and 4 in Area I. Photograph taken in 2009.....	238
Fig. 4.3	Tall Zirā'a with Areas I–III.....	235	Fig. 4.8	Strata 3 a, 3 a.b. and 4a.b.c in Area II, Square AT 126.....	239
Fig. 4.4	Area I and its excavation squares.....	236	Fig. 4.9	Contexts in Area I, Square AT 122, Complex A2–B1.....	241
Fig. 4.5	Area II with its excavation squares.....	237			

LIST OF TABLES

Tables of Chapter I: The ‘Gadara Region Project’/Tall Zirā‘a

Tab. 1.1	Survey 2001 on Tall Zirā‘a and in its immediate vicinity.....	25	Tab. 1.2	Overview of the archaeological seasons from 2001 to 2016.....	29
----------	---	----	----------	---	----

Tables of Chapter II: The 2001 Survey on Tall Zirā‘a

Tab. 2.1	Chronological classification of all pottery sherds found on Tall Zirā‘a according to survey area (excluding the Portugali Method survey).....	143	Tab. 2.2	Sequence of deviations (all values are percentages and rounded off to the closest whole integer).....	149
----------	---	-----	----------	---	-----

Tables of Chapter III: Scientific Methods

Tab. 3.1	Samples processed in 2015.....	211	Tab. 3.5	Chemical composition of calcite/chalk objects (weight per cent; elements As, S, Pb, and Fe < 1 weight per cent) (all data are expressed in grams).....	225
Tab. 3.2	Chemical composition of glass types on Tall Zirā‘a.....	217	Tab. 3.6	Chemical composition of haematit.....	227
Tab. 3.3	Chemical composition of cylinder seals, scarabs and billet.....	218			
Tab. 3.4	Chemical composition of copper and bronze (all data are expressed in gram)....	222			

Tables of Chapter IV: Framework of Archaeological Work on Tall Zirā‘a

Tab. 4.1	Strata on Tall Zirā‘a in correlation with the periods.....	240	Tab. 4.3	Time data for the Southern Levant.....	243
Tab. 4.2	Temporal Synchronisation between the Negade II/III period in Egypt and the Early Bronze Age in Palestine.....	242			

LIST OF GRAPHS

Graphs of Chapter II: The 2001 Survey on Tall Zirā'a

Graph 2.1	Chronological classification of all ceramics found on Tall Zirā'a (excluding the Portugali Method survey).....	142	Graph 2.5	Survey results from systematically selected surface areas; Selection 2 (Baseline: 15 squares; 2,998 sherds).....	148
Graph 2.2	Proportional distribution of chronologically classified pottery on Tall Zirā'a (excluding the Portugali Method survey).....	142	Graph 2.6	Survey results from systematically selected surface areas; Selection 1 (Baseline: 15 squares; 2,941 sherds).....	148
Graphs 2.3 a-e	Overview of the distribution of sherds for the main areas on Tall Zirā'a.....	144	Graph 2.7	Survey results from the Portugali Method area (Baseline: 15 squares; 2,490 sherds).....	148
Graph 2.4	Survey results from randomly selected surface areas; Selection b 1 (Baseline 15 squares; 2,266 sherds).....	148			

Graphs of Chapter III: Scientific Methods

Graph 3.1	Depiction of measured data as scatterplots on three layers, exemplified by ware group WM 0610.....	171			
Graph 3.2	Example of a measuring object in an overlapping zone.....	171	Graph 3.7	Profile of borehole 2 and 3. Iteration 2 Abs. error = 28.4 %.....	192
Graph 3.3	Frequency distribution of the L [*] -, a [*] -, and b [*] -values, exemplified by ware group WM 610.....	171	Graph 3.8	Profile of borehole 1 and 3. Iteration 4 Abs. error = 5.0 %.....	192
Graph 3.4	Measured values lying within the defined tolerances.....	172	Graph 3.9	Canonical Correspondence Analysis...	206
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).....	190	Graph 3.10	Detrended Correspondence Analysis..	206
Graph 3.6	West slope profile (measurement: dipol-dipol configuration, 0.5 m electrode gap, 50 electrodes; Iteration 4, RMS-fault 12.9).....	190	Graph 3.11	Geochemical fingerprint of some ware groups.....	213
			Graph 3.12	Relation between 'plastic' components and wall thickness of cooking pots from Tall Zirā'a.....	215
			Graph 3.13	Beads in the Allard Pierson Museum Amsterdam.....	220

Graphs of Chapter IV: Framework of Archaeological Work on Tall Zirā'a

Graph 4.1	Calibrated date (calBC/calAD): Radiocarbon samples from the Early Roman and Iron Age.....	248	Graph 4.4	Calibrated date (calBC): Radiocarbon samples from the Middle Bronze Age..	257
Graph 4.2	Calibrated date (calBC): Radiocarbon samples from the Late Bronze Age.....	250	Graph 4.5	Calibrated date (calBC): Radiocarbon samples from the Middle Bronze Age	258
Graph 4.3	Calibrated date (calBC): Radiocarbon samples from the Constructional Stratum.....	251	Graph 4.6	Calibrated date (calBC): Radiocarbon samples from the transitional period from Early to Middle Bronze Age.....	259
			Graph 4.7	Calibrated date (calBC): Radiocarbon samples from the Early Bronze Age.....	261

LIST OF PLATES

Plates of Chapter II: The 2001 Survey on Tall Zirā'a

Pl. 2.1	EB pottery from Tall Zirā'a—Survey 2001.....	97	Pl. 2.9	Hellenistic/Roman and Roman pottery from Tall Zirā'a—Survey 2001.....	113
Pl. 2.2	EB, EB I/EB II, EB IV/MB I pottery from Tall Zirā'a—Survey 2001.....	99	Pl. 2.10	Late Roman and Byzantine imports from Tall Zirā'a—Survey 2001.....	115
Pl. 2.3	MB, MB II/LB I, MB/LB pottery from Tall Zirā'a—Survey 2001.....	101	Pl. 2.11	Roman – Byzantine, Byzantine and Byzantine – Early Islamic pottery from Tall Zirā'a—Survey 2001.....	117
Pl. 2.4	LB and LB IIB pottery from Tall Zirā'a—Survey 2001.....	103	Pl. 2.12	Late Byzantine – Early Islamic, Umayyad and Mamluk pottery from Tall Zirā'a—Survey 2001.....	119
Pl. 2.5	LB, LB/IA and IA pottery from Tall Zirā'a—Survey 2001.....	105	Pl. 2.13	Islamic pottery from Tall Zirā'a—Survey 2001.....	121
Pl. 2.6	IA cooking pots from Tall Zirā'a — Survey 2001.....	107	Pl. 2.14	Islamic and Ottoman pottery from Tall Zirā'a—Survey 2001.....	123
Pl. 2.7	IA II, IA IIC pottery from Tall Zirā'a—Survey 2001.....	109	Pl. 2.15	Glass from Tall Zirā'a Survey 2001.....	133
Pl. 2.8	Hellenistic and Early Roman pottery from Tall Zirā'a—Survey 2001.....	111			

Plates of Chapter III: Scientific Methods

Pl. 3.1	Reconstruction stages of an Iron Age I Four Room House.....	161	Pl. 3.6	Stages of a kiln's construction. Part II (campaign 2006).....	185
Pl. 3.2	Reconstruction stages of the Late Bronze Age city on Tall Zirā'a.....	162	Pl. 3.7	Stages of a kiln's construction. Part III (campaign 2006).....	186
Pl. 3.3	Stages of a tabun's construction. Part I (campaign 2003).....	182	Pl. 3.8	Construction of a quadruple-shelled kiln	187
Pl. 3.4	Stages of a tabun's construction. Part II (campaign 2003).....	183	Pl. 3.9	Firing of ceramics in quadruple-shelled kiln.....	188
Pl. 3.5	Stages of a kiln's construction. Part I (campaign 2006).....	184			

LIST OF APPENDICES

All Appendices (films, panoramas and 3D-models) can be watched on the Tall Zirā'a-Website: http://www.tallziraa.de/Final-publication/Appendix-Vol-1/1_473.html

Appendices of Preface

- App. 0.1 Short film showing the excavations on Tall Zirā'a and an interview with Prof Dr Dr Dr hc Dieter Vieweger: 'An den Ufern der Jahrhunderte'..... Website

Appendices of Chapter I: The 'Gadara Region Project' / Tall Zirā'a

- | | | | |
|----------|--|----------|--|
| App. 1.1 | Panorama: View over Tall Zirā'a's plateau. Panorama taken in 2002... Website | App. 1.3 | Film: Overview over Tall Zirā'a and Wādī al-'Arab via an octocopter..... Website |
| App. 1.2 | Panorama: View to the Wādī al-'Arab. Panorama taken in 2003.. Website | App. 1.4 | Tall Zirā'a and Wādī al-'Arab. Overview..... Website |

Appendices of Chapter III: Scientific Methods

- | | | | |
|----------|--|-----------|--|
| App. 3.1 | 3D-model of Tall Zirā'a..... Website | App. 3.6 | Film: Construction of an Iron Age I Four Room House..... Website |
| App. 3.2 | 3D-model of an excavation area: Area I, northern part, Squares AP-AR 118-123, AS-AT 119-123. Building structures: sanctuary and houses..... Website | App. 3.7 | Film: Virtual walk through an Iron Age I Four Room House showing the areas of life: grinding, baking, stocking of food, living areas and a ceramic kiln..... Website |
| App. 3.3 | 3D-models of an excavation square: Area II, Squares AU 130-131 and AW 130-131. Lower stratum to the left: Hellenistic defensive wall; overlaying stratum: walls of a Byzantine building complex. Photograph taken in 2010..... Website | App. 3.8 | Film: Virtual walk through an Iron Age I Four Room House showing the entrance situation and the courtyard..... Website |
| App. 3.4 | 3D-models of objects..... Website | App. 3.9 | Film: Virtual walk through a Late Bronze Age city on Tall Zirā'a..... Website |
| a | Figurine, TZ 007430-001..... Website | App. 3.10 | Film: Virtual walk through a small sanctuary..... Website |
| b | Ushebtī figurine; TZ 012657-001.. Website | App. 3.11 | Film: Reconstruction stages of the Late Bronze Age city on Tall Zirā'a..... Website |
| c | Seal; TZ 008972-001..... Website | | |
| App. 3.5 | Film: Experimental archaeology. Material procurement and the construction of a pottery kiln in 2006.. Website | | |

Appendices of Chapter IV: Framework of Archaeological Work on Tall Zirā'a

- App. 4.1. Chronology of the Southern Levant in the scope of the history of Egypt, Syria and Mesopotamia..... Website

LIST OF ABBREVIATIONS

Abbreviated Journals and Series

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

General Abbreviations

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

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

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

