What Makes a Pot: Transformations in Ceramic Manufacture and Potting Communities in Early Urban Societies of the 3rd Millennium BCE - a *Chaîne Opératoire* Perspective from Tell eṣ-Ṣâfi/Gath (Israel)

by

Jon Ross

A Thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfilment of the requirements of the degree of

DOCTOR OF PHILOSOPHY

Department of Anthropology

University of Manitoba

Winnipeg

Copyright © 2020 by Jon Ross

Abstract

Pottery is ubiquitous on Near Eastern excavations and materializes many dimensions of economic and social life. This thesis follows a long line of anthropological research in stylistic analysis aimed at enhancing viable method and theory for the identification of communities, social belonging, and identities in archaeological datasets. A major problem is that in the absence of workshops, identifications are limited to fuzzy regional scales of analysis. Production groups are cautiously proposed when vessel fabrics are standardised for select types found at a string of dispersed sites. This provides a broad regional perspective on patterns of production, but does not readily inform on how individual sites and neighbourhoods were provisioned with their wares. The solution is to improve identifications of potting techniques and methods on sherd assemblages, with the aim of differentiating potting communities. With this challenge in mind, this thesis pilots an alternative 'mesoscopic' protocol for classifying traces of vessel manufacture on freshly cut and scanned sherds.

The study sample originated from an Early Bronze Age neighbourhood exposed in Area E, at Tell eṣ-Ṣâfi/Gath. By characterising the organisation of production at a major regional centre following the transition to town culture, this study will further clarify the debate over the economic foundations and social organisation of settlements in the Levantine Early Bronze Age. 'Mesoscopic' signatures of manufacture are combined with thin-section petrography and inspection of surface features. In total, four specialist potting communities were identified, with one group largely dominating supply (71% of the sample). The remaining groups are attested in far smaller quantities and are restricted to select shapes/forms, which complete the overall repertoire. Techno-stylistic groups crosscut the buildings and alleyway and are stable overtime. These results suggest that the domestic economies at major early urban sites in the Levantine foothills were served by specialist potting communities, who generated a surplus for exchange. This contradicts the claims of some, who propose that pottery production in the EB III was largely structured around domestic replacement where the producing households are the principle consumers. This PhD thesis further develops techno-stylistic analyses through the use of novel approaches that more reliably identify potting methods from sherd assemblages. Shaping techniques were identified on an incredible 82% of the study sample (a far greater return compared to most studies). The analysis is low-cost and benefits from clear images in full colour. The methodological advances are such that the refined techno-stylistic analysis can be broadly applied wherever archaeological ceramics are present.

Acknowledgements

I wish to thank the Area E staff and the many volunteers on the Tell eṣ-Ṣâfi/Gath excavation project, who supplied excellent data for this thesis. In particular, I thank the co-directors Prof. Haskel Greenfield (my advisor) and Prof. Aren Maeir for providing me with the opportunity, support, and encouragement to work on a great assemblage. I also thank former Area E supervisors, particularly Prof. Itziq Shai and Dr. Shira Albaz, as well as the Israel Antiquities Authority for granting generous permissions to export sherds for this thesis. Thanks goes to my steering committee Prof. Haskel Greenfield, Prof. Kent Fowler, and Prof. Mark Lawall for their unceasing patience and detailed comments on long rambling drafts. I owe thanks to Prof. Ina Berg (the external reviewer) for generous comments and feedback. I've greatly enjoyed my time at the Ceramics Technology Lab and the Near Eastern and Biblical Archaeology Lab. I look forward to future collaborations in the many side projects generated over the course of this PhD, especially the fingerprint project. I'm particularly indebted to Prof. Kent Fowler for his guidance, vision, and key role in conceptualising the study on pottery production and the fingerprint research.

The PhD journey was a long one and the topic was ambitious. The transition to Canadian life in Winnipeg was an adventure with many ups and downs. I thank Tiffany Okaluk for her patience and loving support. There are a host of people who deserve thanks for their help and support and I apologise for any names I have missed. My parents (Mark and Angela Ross), Matthew Coleman, and Ben Collins were endless sources of encouragement, advice, and general sounding boards for life's many challenges (both thesis and non-thesis related). Conversations and pressures were often vented over strong drinks that helped fortify my general wellbeing. In that regard, I must also thank Deland Wing, Sara Richardson, Luther Eleuterio, Rachel ten Bruggencate, Jeremy Beller, David Walker and many others who I've shared Winnipeg pitchers and ideas with over the years.

Infrastructure and funding for the research was through the Social Sciences and Humanities Research Council of Canada (410-2009-1303 to H. Greenfield and # 895-2011-1005 to H. Greenfield and A. Maeir), The University of Manitoba, St. Paul's College, and a University of Manitoba Graduate Fellowship. Lastly, I once again thank my advisor Prof. Haskel Greenfield for his continual support and financial backing.

"…What will clay reply, a thing formed by hand?
What counsel will it understand?"

In Closing Psalm, The Community Rule (1QS)
/Serekh Yahad, Dead Sea Scrolls,
Ein Feshkha, NW shore of the Dead Sea,
Circa 1st to 3rd century CE

"*It may require a level of commitment only possible in dissertation research to resolve these questions*"

In Craft Specialization's Penumbra: things,
persons, action, value, and surplus
(Clark 2007: 32)

Table of Contents

Abstract ..... **I**

Acknowledgements ..... **II**

List of Tables ..... **IX**

List of Figures ..... **XII**

Chapter 1: Introduction **1**

I. Purpose and scope of the study 1

II. Research questions, hypotheses, and contributions 2

III. Summary of the thesis 5

PART I: RESEARCH CONTEXT AND METHODS **8**

Chapter 2: Craft Production and Specialisation **9**

I. Introduction 9

II. The wide lens of craft production 10

III. Stage-model typologies of production 11

IV. Parametric typologies of production 13

IVA. Sociopolitical context *14*

IVB. Geographic concentration *18*

IVC. Intensity *19*

IVD. Scale *22*

IVE. Parametric variables and targeted approaches to specialisation *23*

V. Confounding influences on the parameters of production 27

VI. The standardisation hypothesis 28

VII. Anthropological approaches to the study of prehistoric technology 31

VIIA. Why the patterned process of making has an identity dimension *32*

VIIB. The technical system *34*

VIII. Social network influence on technical knowledge in potting traditions 35

VIIIA. Technical knowledge part 1: motor habits and apprenticeship *37*

VIIIB. Technical knowledge part 2: the boundedness of technical knowledge *40*

VIIIC. Classifications of fashioning techniques and actualistic research *42*

VIIID. Technical specialisation reconsidered *44*
IX. Conclusion 45

Chapter 3: Methods 48

I. Introduction – defining the chaîne opératoire 48
IA. Describing techniques in ceramic analysis *49*
II. Classifying shaping techniques on archaeological assemblages 50
IIA. Deformation and decompression patterns *50*
IIB. Macro and micro scales of observation *51*
IIC. The mesoscale: imaging shaping techniques in thick-section *54*
IID. The limitations of destructive data recovery *57*
III. Ethnographic and experimental model for mesoscopic diagnostics 58
V. Conclusion 60

Chapter 4: Urban Process and Economy in the Early Bronze Age Southern Levant 62

I. Introduction 62
IA. The debate over social organisation in the southern Levant *62*
IB. The defining features of city-states *63*
IC. The classification of city-states in the archaeological record *64*
II. Chronology: time-space frameworks 66
IIB. The delayed impact of radiocarbon dating *69*
III. Settlement patterns and agriculture 71
IV. EB I settlement expansion and site organisation 73
V. EB II-III settlement expansion and site organisation 77
VA. Egyptian impact and settlement fluctuation in the alluvial lowlands *78*
VB. Settlement crisis, instability, and punctuated growth in the valleys *83*
VC. The Negev highlands, the Sinai, and the 'New Paradigm' *86*
VD. Settlement expansion in the uplands and arid zones *92*
VE. The first cycle of urban complexity in the Levant *93*
VI. Economic strategies and pottery production 98
VIA. Early Bronze I pottery: regionalisms and decentralised production *99*
VIB. Early Bronze II-III pottery: the urban economic system *101*

VIC. The simplification of the repertoire and urban identity *104*
VII. Contextualising urban life and economy in the southern Levant 106
VIIA. Closing the gap: urban process and 'secondary' state-formation re-considered *106*
VIIB. Clarifying the debate over social organisation *108*
VIIC. Similarity and difference with the Mesopotamian model *112*
VIID. Urban origins and the consensus over the lack of consensus *113*
VIII. Conclusions: social complexity and pottery production 114
PART II: SITE BACKGROUND AND THE ASSEMBLAGE 117
Chapter 5: Tell eṣ-Ṣâfi/Gath in the Early Bronze Age 118
I. The excavation project at Early Bronze Age Tell eṣ-Ṣâfi/Gath 118
II. Settlement size and geopolitical significance 119
III. The phasing in Area E 119
IV. Architecture and settlement organisation in the neighbourhood 121
IVA. The E5 buildings *121*
IVE. The narrow street/alleyway *124*
IVD. The built environment *125*
IVF. Central courtyards *128*
IVG. Rooms *130*
V. The small finds 130
VI. The pottery sample: data recovery from the neighbourhood 132
VIA. Sherd distribution by building and phase *132*
VIB. Additional limitations on sampling *132*
Chapter 6: The Early Bronze pottery from Tell eṣ-Ṣâfi/Gath 134
I. Introduction 134
II. The shape repertoire from Area E 134
IIA. Bowls *135*
IIB. Platters *137*
IIC. Jugs *138*
IID. Storage jars *139*

IIE. Vats *140*
IIF. Holemouth cooking pots *141*
III. The E5 and E6 domestic assemblage 143
IV. Sherd counts in analysis: quantities by functional vessel type 143
Chapter 7: Research Questions and Hypotheses 145
I. Chaîne opératoire studies on 'product specialisation' and the limitations 145
II. The hypotheses and expectations for an urban EB domestic assemblage 147
III. The null hypotheses and distinctions in fine grained spatial and temporal distribution studies 149
PART III: THE RESULTS 151
Chapter 8: Petrographic Analysis 152
I. The role of thin-section petrography in this thesis 152
II. Fabric classification vs. typology of clay recipes 152
III. The major EB petrofabrics at Tell eṣ-Ṣâfi/Gath 154
IIIA. Cookware (Petrofabrics 2c, 2d and 3d) *155*
IIIB. Common ware (Petrofabric Groups 3a and 3b) *158*
IIIC. Coarse ware (Petrofabric Group 3g) *159*
IIID. Fine ware (Petrofabric Group 3c) *159*
IV. Clay sourcing 160
IVA. Local production: the lithology and soil sources around Tell eṣ-Ṣâfi/Gath *160*
IVB. Minority of imports (Table 8.1 and Appendix A) *162*
V. Clay processing 162
VI. Vessel-shaping 163
VII. Firing Technology 164
VIII. Conclusion 164
Chapter 9: The Mesoscopic Classification of Vessel Shaping Techniques 167
I. Introduction 167
II. Classification of techniques: the identifications 167
IIA. Technique 1: coiling *167*

IIB. Technique 2: drawing *169*
IIC. Technique 3: pressing in a concave mould or vessel support *170*
IID. Technique 4: luting *171*
IIF. Technique 5: pinching *172*
IIC. Technique 6: wheel-fashioning *173*
III. Distributions of individual techniques: counts and frequencies 174
IV. Classification of potting methods 174
IVA. Potting Method 1: super-positioning coils in a mould *174*
IVB. Potting Method 2: spiral-coiling *175*
IVC. Potting Method 3: wheel-shaping a coil-built rough-out *178*
IVD. Potting Method 4: super-positioning of coils and the flat-bottomed pot tradition *179*
V. Spatial and temporal analysis of the study sample (Tables 9.1 and 9.2) 183
VA. Distribution of Potting Method 1 ..... *183*
VB. Distribution of Potting Method 2 ..... *184*
VC. Distribution of Potting Method 3 ..... *184*
VD. Distribution of Potting Method 4 ..... *185*
VI. Summary discussion 185

PART IV: CONCLUSIONS 188

Chapter 10: Conclusions 189

I. The overall aims of the thesis 189
The significance of variability in vessel shaping *189*
II. Importance and contribution of research 190
IIA. EB economies in the Shephelah and the southern Levant *190*
IIB. Wider theoretical implications for specialisation *192*
III. Concise summary of the findings 193
IIIA. The shaping methods on the Tell eṣ-Ṣâfi/Gath assemblage *193*
IIIB. Vessel shaping methods and the petrofabric groups *196*
IIIC. Vessel shaping methods and morpho-stylistic types *199*
IV. The economic foundations of major EB settlements 200

IVA. Early urban landscapes and changes to economic strategies *200*
IVB. Shaping techniques and the identity of potters *202*
V. The benefits and directions for current and future research 202
VA. For chaîne opératoire research and the organisation of production *202*
VB. For structural analysis and the preferred orientation of fabric features *205*
VC. For broader application(s) in ceramic analysis *205*
Bibliography **208**
Figures **252**
Tables **340**
Appendix A: The Petrography Sample **353**
I. The stratified distribution of the non-local fabrics (Table 8.1) 353
II. The stratified distribution of the local fabrics (Groups 2 and 3) 354
Appendix B: Experimental Vessel Shaping Results (The Images) **358**
I. Outcomes and Directives of the Experimental Study 367
Appendix C: Pottery Catalogue of the Study Sample from Area E, Tell eṣ-Ṣâfi/Gath 368
Appendix D: Codes **389**

List of Tables

Table 2.1. Production types after Van der Leeuw (1977), Peacock (1982), and Costin (1991) © Jon Ross. **341**
Table 2.2. Summary of 12 interrelated variables (left-hand column) that result in discrete social and technical pressures on different steps in the pottery production sequence, with reference to African, Mexican, and Indian potters (after Fowler 2016: Fig. 26.4; Berg 2007: 248; Gosselain 1998, 2000; Roux and Corbetta 1989; Arnold 1999; Mahias 1993) © Jon Ross. The data summarised in the table primarily concerns low to medium fired pottery (terracotta and stoneware) made by low income potters with relatively simple surface treatments for common household containers (intended for either unrestricted market

distribution and/or domestic replacement within the producing household). The modelled relationships therefore have little, if any, relevance for ceramics considered 'prestige objects' or 'status indicators' for elite consumption. When craft specialisation is 'attached' to an elite, most stages of production can be associated with highly specialised skills and costly ingredients (from paste preparation to firing and decoration) intended to add/enhance value on a product controlled by elite appetites for status display. Such ceramics are usually prized by antiquity collectors (again serving as a display of status) and many aspects of the model summarised above will be wildly inaccurate and misleading for the ceramics in question (e.g. Ming dynasty vases, Fabergé porcelain eggs, bejewelled bohemia amphora, Nikosthenic amphora, Onggi pottery and so forth)……**342**

Table 3.1. Summary of macroscopic attributes diagnostic of forming techniques © Jon Ross..**344**

Table 4.1. Chronology for the southern Levant for the 4th and 3rd millennium BCE showing the c. 200 year inconsistency between the high chronology, traditional phasing, and the Jericho sequence (adapted from Regev et al. 2012, 2014; Shalev 2017: Table 3-1; Nigro 2018: Table 9; Finkelstein 2018: 69, Tables 1-2; Cohen 2016: 27-8)…….**347**

Table 5.1. The main phases in Area E, Tell eṣ-Ṣâfi/Gath…….. **347**

Table 6.1. Vessel counts according to phase in the sampled assemblage from Area E, Tell eṣ-Ṣâfi/Gath.…….**348**

Table 8.1. Imported vessels identified in the thin-section petrography for Area E, Tell eṣ-Ṣâfi/Gath. Samples extracted from the petrography reports by Ben-Shlomo (2012, 2017, forthcoming) and re-organised according to phase and building…….**348**

Table 9.1. Distribution of the potting methods in the Area E neighbourhood relative to the alleyway. Quantities in this table represent sherd material from primary contexts (material on the floor and accumulations above the floor, n = 259 sherds). This reduced the sample size by 43.6%, since 200 sherds cannot be securely attributed to a specific building assemblage within a specific phase. Sherds from collapse layers (thick deposits sealing accumulations above a floor) are likely to be residual (originate from the make-up of building walls). Percentages are relative to total counts per phase for the potting method in question (the column on the far right)……..**349**

Table 9.2. Distribution of the potting methods in the neighbourhood. Counts specified for each potting method according to Building Number and Phase in the Area E neighbourhood. Quantities in this table represent sherd material from primary contexts.……**351**

List of Figures

Figure 1.1. Satellite image (Google Earth, Landsat 2019) facing southwest. The East Mediterranean coastline with the Jordan Valley and southern Israel in the foreground and the Nile Delta in the background. Annotated image is © Jon Ross……..**252**

Figure 1.2. Topographic map of the southwest Levant showing the location of Tell eṣ-Ṣâfi/Gath and key Early Bronze Age sites discussed in Chapter 4. Image reprinted from Fowler et al. 2020: Fig. 1 (under a Creative Commons Attribution License). Annotated by Jon Ross……..**253**

Figure 1.3. Regional map (© Jon Ross) with watercourses and wadis showing the location of Tell eṣ-Ṣâfi/Gath and neighbouring EB III sites.…….....**254**

Figure 3.1. Classification of roughing out (primary) and preforming (secondary) techniques (graphic is © Jon Ross). RKE = rotative kinetic energy..……**255**

Figure 3.2. Diagnostic surface features taken into account for reconstructing EB shaping sequences on the Tell eṣ-Ṣâfi/Gath assemblage: Bumpy wall with linear features and fissures indicating discontinuous pressures on assembled elements (A); undulations and bulges (corrugations) from coil deformations (B); rough micro-topography (C); concentric overthickness (D); hairline fissures and coil joints/seams (E); vertical scraping/drawing up of coils (F); thick coil added to corner of base (G). All coils are approximately a finger width in thickness regardless of vessel type. Photo credit: Jon Ross.……..……...**256**

Figure 3.3. Diagnostic surface features taken into account for reconstructing EB shaping sequences on the Tell eṣ-Ṣâfi/Gath assemblage: Drawing/scraping in diagonal/oblique directions (A); undulations and bulges (corrugations) from coil deformations (B); rough micro-topography (C); bumpy interior wall with shallow depressions, hollows, and cavities from potter's fingertips ('digital depressions') along coil joints (D); wavy/curvilinear and oblique laminations, fissures, and clay domains in the break (E); non-stretched clay walls (F); shallow depressions, hollows, and cavities located at regular intervals from pinching the clay (G); jars possibly used as *ad hoc* moulds to shape holemouth jars (H). Photo credit: Jon Ross.…….……**257**

Figure 3.4. Surface diagnostics of EB wheel fashioning techniques on the Tell eṣ-Ṣâfi/Gath assemblage: Rilling and deep subparallel grooves with spiral effects (A); decreasing thickness from base (B); circular symmetrical bases and walls (C); spiral form string cut

base (D); continuous concentric striations with a tight structure (E). Photo credit: Jon Ross.……...……...**258**

Figure 3.5. Additional surface diagnostics of fashioning techniques on vessels from Beth Yerah (north Israel), Cyprus, Arad (south Israel), and Tell eṣ-Ṣâfi: Groove/carination possibly from the lip of a mould on the underside of EB platter rims (A); mat impressions (used as tournettes and mobile chucks) on the reverse side of EB jugs from Arad (B); long deep grooves from dragging and drawing the clay on an EB jug (red polished ware) from Cyprus (C) and the same technique on an EB jar from Arad (D); homogenous fabric and stretched walls in the section of a Late Bronze Age wheel-thrown chalice (E, voids are small, uniform, evenly distributed, and diagonally oriented). Photo credit: Jon Ross..…….....**259**

Figure 3.6. Schematic diagram (© Jon Ross) summarising known preferred orientation of non-plastics and voids for different shaping techniques imaged radiographically (graphic after Berg 2008: 1178; Carr 1990: 17; Rye 1981: 61-81; Ross et al. 2018) ……...**260**

Figure 3.7. Different scales of observation. Note signatures of forming techniques are most apparent in thick sections where patterns in the distribution of non-plastics appear with regularity (graphic is © Jon Ross). Sections are from Area E Tell eṣ-Ṣâfi/Gath ceramic assemblage……..…….....**261**

Figure 3.8. Different scales of observation (graphic is © Jon Ross)...…….....**262**

Figure 3.9. Deformation by simple compression combined with a rolling motion. Solid cylinder rotating about an axis and the equation for the moment of inertia. Clay will stretch along the axis of minimal stress (graphic is © Jon Ross). ……**262**

Figure 3.10. Deformation by simple compression. Clay will flatten along axis of maximal stress (graphic is © Jon Ross)…….**263**

Figure 3.11. Compression/deformation of clay during the shaping process (graphic is © Jon Ross)..…….....**263**

Figure 3.12. The *chaînes opératoires* of the experimental type set (graphic is © Jon Ross) ……...**264**

Figure 5.1. Location of Tell eṣ-Ṣâfi/Gath (left - (© Jon Ross) with a Google Earth image (right)……...….....**265**

Figure 5.2. Tell eṣ-Ṣâfi/Gath from the Elah Valley. Photo credit: Jon Ross, 2015..……...**265**
Figure 5.3. The Elah valley from Area E. Photo credit: Jon Ross, 2016……..…….……...**265**
Figure 5.4. Map and photos showing east face of the mound with fortification wall on contour map (bolded). Photos and maps reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project……..……**266**
Figure 5.5. Fortification wall in Area F on the western ridge of the mound (2015). Middle Bronze overbuild on an EB III city wall foundation. The arrows point to an EB III outset. Excavation areas P (south ridge) and J (east ridge) exposed additional stretches of an EB III circuit wall. Stone foundations measure between 1.5 to 2 m in height and 2.7 m in width (see Katz 2017; Chadwick et al. 2017). Photos and maps reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Photo annotated by Jon Ross …….**267**
Figure 5.6. Aerial photograph (2013) of Area E showing the rows of E5 buildings and the alleyway. Photos and maps reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project.……..**268**
Figure 5.7. E5a phase plan, Area E (2019 version), Tell eṣ-Ṣâfi/Gath. Dotted lines are reconstructions of putative walls that were either robbed out or destroyed in antiquity. Plan reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project.……..**269**
Figure 5.8. E5b phase plan, Area E (2019 version), Tell eṣ-Ṣâfi/Gath. Dotted lines are reconstructions of putative walls that were either robbed out or destroyed in antiquity. Plan reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project…..……..**270**
Figure 5.9. E5c phase plan, Area E (2019 version), Tell eṣ-Ṣâfi/Gath. Dotted lines are reconstructions of putative walls that were either robbed out or destroyed in antiquity. Plan reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project……..**271**
Figure 5.10. North facing photograph of the upper terrace, west of the alleyway, with a close up of the NW profile showing the typical stratigraphic progression of deposits in the E5 buildings, Tell eṣ-Ṣâfi/Gath. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Photo credit: Area E camera, 2008.. ……..**272**
Figure 5.11. The SE corner of Building 104311 in the west profile of Square 93A, Tell eṣ-Ṣâfi/Gath. The full sequence of E5a deposits is visible and includes building collapse with mud brick and plastered walls sealing accumulation on a floor and floor make-up. The faint outline of mudbrick from wall W104107 (and the direction of collapse) is visible in

section. Photo credit: Area E camera, 2008. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. …….....**273**

Figure 5.12. West facing in Square 82D showing Room 104108 (E5a) with *in situ* vessels (large storage jar and holemouth jar), west of the alleyway, Tell eṣ-Ṣâfi/Gath. Six complete restorable vessels were found smashed in this room on two pebbled hearths. Photo credit: Area E camera, 2011. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project.……..**274**

Figure 5.13. South profile of Square 93A, west of the alleyway, Tell eṣ-Ṣâfi/Gath. Examples of large LB pits cutting E5 deposits. Photo credit: Area E camera, 2015. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project..……..**275**

Figure 5.14. Northeast downslope photograph showing the E5c phase of the EB III neighbourhood, Tell eṣ-Ṣâfi/Gath. Building 17E82D08 is in the foreground, Building 134307 is pictured in the centre, and Building 18E84A02 is in the background. Photo credit: Photo credit: Area E camera. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project…….……..**275**

Figure 5.15. West facing photograph of Building 74512 (E5b phase) showing courtyard (foreground) and entrance to narrow Room E15AQ09, Tell eṣ-Ṣâfi/Gath. Photo credit: Area E camera, 2008. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project…….....……..**276**

Figure 5.16. Southeast facing photograph of Area E showing the lower terrace, Tell eṣ-Ṣâfi/Gath. The alleyway is flanked by two rows of buildings with narrow rooms and courtyards (E5a-b phases). Photo credit: Area E camera. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project..…….**276**

Figure 5.17. West facing photograph (2012) of Area E showing the layout of buildings east of the alleyway, lower terrace (E5a-b phase), Tell eṣ-Ṣâfi/Gath. Photo credit: Area E camera. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project……..**277**

Figure 5.18. Northwest facing photograph of Area E showing the alleyway with two rows of buildings. Building 134817 and Inst. 134413 (E5c phase) is pictured in the immediate foreground (Room 134817), Tell eṣ-Ṣâfi/Gath. Photo credit: Area E camera, 2010. Photos reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project……...……**277**

Figure 5.19. Northwest facing photograph in Square 83B showing the sequence of floor and building collapse layers associated with W74511 (E6 and E7 phases), Tell eṣ-Ṣâfi/Gath. Collapse layers are packed with chalk and plaster debris. Photo credit: Area E camera, 2017. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project……**278**

Figure 5.20. South facing photograph in Square 83D showing mudbrick and mortar in wall WE15AS11, associated with platform 20E83D09 (E7 phase), Tell eṣ-Ṣâfi/Gath. Also note the thick E6 building collapse layer packed with plaster debris visible in foreground profile. Photo credit: Area E camera, 2017. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project……..…….**278**

Figure 5.21. East facing downslope photograph of Area E, end of the final 2017 season of excavation (E7 exposures in foreground and the deep probe is centre right in Square 93B), Tell eṣ-Ṣâfi/Gath. Photo credit: Area E camera, 2017. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project……..**279**

Figure 5.22. Histogram showing sherd counts in the study sample according to phase in Area E, Tell eṣ-Ṣâfi/Gath……..**280**

Figure 5.23. Histogram showing sherd counts in the study sample according to phase for Building 1 in Area E, Tell eṣ-Ṣâfi/Gath……...**280**

Figure 5.24. Histogram showing sherd counts in the study sample according to phase for Building 2 in Area E, Tell eṣ-Ṣâfi/Gath……..**281**

Figure 5.25. Histogram showing sherd counts in the study sample according to phase for Building 3 in Area E, Tell eṣ-Ṣâfi/Gath……...**281**

Figure 5.26. Histogram showing sherd counts in the study sample according to phase for Building 4 in Area E, Tell eṣ-Ṣâfi/Gath……..**281**

Figure 5.27. Histogram showing sherd counts in the study sample according to phase for Building 5 in Area E, Tell eṣ-Ṣâfi/Gath……...**282**

Figure 5.28. Histogram showing sherd counts in the study sample for Building 6 in Area E, Tell eṣ-Ṣâfi/Gath……..**282**

Figure 5.29. Histogram showing sherd counts in the study sample for Building 7 in Area E, Tell eṣ-Ṣâfi/Gath……..**282**

Figure 5.30. Aerial photograph of Area E showing the EB III residential neighbourhood with rows of houses and alleyway. Walls that span all 3 sub-phases of the E5 are dashed in white.

Walls that last a single phase are dashed in black. For simplicity, the buildings have been relabelled from 1 to 7 and correspond with the preceding histograms that show the sampled repertoire from each occupational horizon, in each of the buildings (primary contexts only for the building histograms). Aerial photo reprinted with permission of the Tell eṣ-Ṣâfi/Gath archaeological project……..**283**

Figure 6.1. Vessel silhouettes of the main EB III forms from Tell eṣ-Ṣâfi/Gath. Graphic © Jon Ross……...……**284**

Figure 6.2. A formal classification of the open vessels (right) and the closed EB vessels (left) from Tell eṣ-Ṣâfi/Gath. Graphic is © Jon Ross…….....**285**

Figure 6.3. Classification of vessel function. Graphic is © Jon Ross. ……**285**

Figure 6.4. Classification of EB vessel function from Tell eṣ-Ṣâfi/Gath. Graphic is © Jon Ross. Photos reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project..……..**286**

Figure 6.5. Rim and wall morphology of the EB bowls (top 3 rows) and platters (bottom row) sectioned in this study from Tell eṣ-Ṣâfi/Gath. Top row shows the small hemispherical bowls with plain simple rims. The second row shows the deep bowls with inverted rims and straight walls. The third row shows the large shallow bowls with inverted rims and rounded walls. The bottom row shows the platters with plain and up-turned rims and most did not have a carination (seen second from the right). These rim and wall silhouette profiles were imaged using the scanned thick sections discussed in Chapter 3. Graphic is © Jon Ross……...……**287**

Figure 8.1. Magnified sub-rounded and sub-angular chalk and micrite (right) in scanned pottery thick sections, catalogue no. 387 (left) and 393 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.……..**288**

Figure 8.2. Magnified coarse angular chalk inclusion showing signs of wear and diagenesis from repeated heating (left). Large ferrous inclusion, with a clay pellet, and crushed chalk (right) in scanned pottery thick sections, catalogue nos. 417 (left) and 393 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross……**288**

Figure 8.3. Magnified ferrous inclusions, with sub-rounded chalk, and a mollusc shell (left) in scanned pottery thick sections, catalogue nos. 135 (left) and 62 (right), from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross……...……..**288**

Figure 8.4. Magnified large sub-angular sandstone inclusions otherwise known as ‘kurkar’ or ‘eolianite’ in scanned pottery thick sections, catalogue no. 209 (left) and 307 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.…….....**289**

Figure 8.5. Magnified large examples of coarse angular grog and grog within grog (left) in scanned pottery thick sections, catalogue no. 425 (left) and 170 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross. Grog is more heterogenous than sandstone, lacks ‘bedding’, and usually has similar fabric(s) to the rest of the assemblage……...**289**

Figure 8.6. These examples show large grog inclusions with a ‘relic surface’ from the pottery vessel it originally came from in scanned pottery thick sections, catalogue nos. 205 (left) and 197 (middle), and 415 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross……..……**290**

Figure 8.7. The ring of circulation is visible around most of the grog inclusions, which have a similar fabric to the clay body. Scanned pottery thick section catalogue no. 159 from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.……**290**

Figure 8.8. A variety of microfossil inclusions, foraminifera, and marine bioclasts in scanned pottery thick sections from Area E, Tell eṣ-Ṣâfi/Gath. First row of catalogue nos: 310 (left), 232 (centre), and 329 (right). Second row of catalogue nos: 417 (left), 224 (centre), 317 (right). Third row of catalogue numbers: 484 (left), 170 (second left), 412 (second right), and 309 (right). Fourth row of catalogue nos: 470 (left) and 454 (right). Photo credit: Jon Ross…….……**291**

Figure 8.9. Circular round cavities from fibre temper (chaff?), burnt out organics, seeds, and legumes/ agricultural by-products? Catalogue nos. 139 (top left), 393 (top middle), 76 (top right), 69 (bottom left), 81 (bottom middle), and 207 (bottom right) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit Jon Ross……...……..**292**

Figure 8.10. Additional images of dune sandstone (kurkar), catalogue no. 207, from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross…….…….....**292**

Figure 8.11. Abundance of carbonate minerals, micrite (fine micro-crystalline calcite), and the fossilised skeletons of marine microorganisms (typically shells or ‘tests’ from foraminifera) in EB ceramics, catalogue no. 1, from Area E, Tell eṣ-Ṣâfi/Gath. The presence of these inclusions confirm that these fabrics were made from marine marl clay

deposits. These scanned sections are an excellent tool for illustrating the clay body/fabric of a vessel. Photo credit: Jon Ross.……...**293**

Figure 8.12. 'Fire clouding' on the exterior surface of an EB platter and a jar from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross……...…….**294**

Figure 8.13. Select thick-sections of the EB III common ware (fabric group 3) from Area E, Tell eṣ-Ṣâfi/Gath. The top image (no. 224) is a body sherd of a storage jar and bottom image (no. 66) is a body sherd of a platter. Grey cores with yellow margins. Incomplete oxidation of the fabric in a non-reducing atmosphere. Photo credit: Jon Ross.……...**294**

Figure 8.14. Thick-sections of an EB lime plastered jar (catalogue nos. 204 and 194) from Area E, Tell eṣ-Ṣâfi/Gath showing grey sections and highly porous fabric. Insufficient/poor penetration of oxygen. Photo credit: Jon Ross.…….....**295**

Figure 8.15. Thick-section of a EB small hemispherical bowl (catalogue no. 22) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross……...…….**295**

Figure 8.16. Petrofabric groups 2 and 3. Graphic is © Jon Ross. Images reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project.……...**296**

Figure 8.17. Select thin-sections of holemouth sherds (catalogue no. 383) prepared by the author at the CTL lab. Images show a heavily tempered lean clay. The fabric is dominated by poorly sorted, large, angular, crushed chalk in a dark brown silty loess matrix – group 2 cookware. Photo credit: Jon Ross..……...**297**

Figure 8.18. Thin-sections of holemouth sherds (at low magnification) showing the preferred orientation of the crushed chalk inclusions in the fabric, highlighted areas show coil joins. Photo credit: Jon Ross…….....**298**

Figure 8.19. One contiguous section of a holemouth sherd, catalogue no. 383, stitched together from three separate images of a thin-section. Photo credit: Jon Ross…….....……..**299**

Figure 8.20. Select thin-sections of storage jar sherds prepared by the author at the CTL lab. Inclusions include: coarse grog with ring of separation (top left), opaque ferrous inclusions (bottom left), and crushed chalk fragments in a calcareous unvitrified matrix, with a light brown to reddish-yellow colour. Photo credit: Jon Ross…….....……..**299**

Figure 8.21. Alleged bone inclusions or what I believe to a type of carbonate eolianite in holemouth sample no. 137 in thin-section. The inclusions in these images are comparable to some of the microstructures described in Frebourg 2008. Photo credit: Jon Ross…...**300**

Figure 8.22. A section of a proximal end of a femur showing the porous trabecular bone or 'spongy' bone. Photo credit: Jon Ross. ……**301**

Figure 8.23. Thick section of holemouth with alleged bone inclusions or carbonate eolianites (catalogue no. 137). Photo credit: Jon Ross. ……..**301**

Figure 8.24. Ferruginous clay and clay pellets in Abydos juglet no. 27 in thin-section, from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross……..……...**302**

Figure 8.25. SEM image of a fissure in an Abydos jug, catalogue no. 27 (courtesy of the NEBAL SEM). Image shows the sheet like structure of illite clay minerals, consisting of small stacked amorphous flakes, roughly 0.3 to 0.1 um in diameter. Illite clays have good plasticity due to the small particle size and their fine texture promotes a natural lustre, excellent for slips (Rice 2015: 50, 56). Illite clays are usually calcareous marine marls formed offshore and are a highly weathered type of clay (although not as weathered as kaolinite). They are more stable than smectities, but have a low refractoriness (poor heat resistance). The diagenesis of smectites, caused by the "microbial bio-reduction of iron", results in illite clays, but the process is reversible and illites can revert back to smectites after several millennia (Rice 2015: 56)…….**303**

Figure 8.26. SEM image of Abydos juglet (catalogue no. 27), from Area E, Tell eṣ-Ṣâfi/Gath. Present in the matrices are fragments of mollusc shells, from bivalves or brachiopods, in addition to other multi-chambered marine protozoa common in marine marls. Calcareous inclusions show up as lighter shades of grey when compared to quartz, voids are black, and ferrous inclusions are white. Clay domains are unvitrified. Note the contrast in the regularity of the burnished surface compared. Photo credit: Jon Ross.……**304**

Figure 8.27. SEM image of a bowl rim, catalogue no. 330 (left) and Abydos juglet base, catalogue no. 27 (right). Close-up of the unvitrified clay domains on jar catalogue no. 209 (bottom), from Area E, Tell eṣ-Ṣâfi/Gath.. ……..**305**

Figure 9.1. Technique 1 on holemouth rim catalogue no. 107 (left) and holemouth body sherd no. 18 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Red scale line = 10 mm: A) shows preferred

orientation of voids; B) shows orientation of inclusions; and white arrows point to prominent central cavities at the centre of a coil. Photo credit: Jon Ross.……...**306**

Figure 9.2. Technique 1 on bowl rim sherd catalogue no. 183 (left), jar body sherd catalogue no. 319 (top right), and holemouth body sherd (bottom right) catalogue no. 319, from Area E, Tell eṣ-Ṣâfi/Gath. Sections show wall morphology diagnostic of coil construction on open and closed vessels. Photo credit: Jon Ross.……..……**306**

Figure 9.3. Technique 3 on holemouth bases catalogue nos. 458 (bottom right), 393 (top right), 16 (top left) and 421 (bottom left) from Area E, Tell eṣ-Ṣâfi/Gath. Sections reveal the difference in the morphology and regularity of the walls between freehand coiling and coiling with a vessel support. Photo credit: Jon Ross.……..**307**

Figure 9.4. Macroscopic traces of pinching on a shallow pinch bowl used as a lamp (Basket 17E83C031) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit Jon Ross.……..**307**

Figure 9.5. Wheel-shaping vs. wheel-throwing in section. The sections show differences in the regularity of vessel walls and void distribution on a bowl sherd, catalogue no. 505 (left) and a jug body sherd, catalogue no. 289 (right), from Area E, Tell eṣ-Ṣâfi/Gath. Bowl sherd no. 505 is intrusive from the Late Bronze levels sealing the E5 neighbourhood. Bottom left is a section of a Late Bronze disk base showing a torsion crack (unstratified surface material from Tell eṣ-Ṣâfi/Gath). Photo credit: Jon Ross.……...**308**

Figure 9.6. Bases of holemouth jars (catalogue no. 13) set in the bases of pithoi (no 3.88) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross……....**308**

Figure 9.7. Section of a platter body sherd (catalogue no. 166) from Area E, Tell eṣ-Ṣâfi/Gath. Section shows the preferred orientation of non-plastics (top) and voids (bottom) indicative of coiling including large poly-concavities in the bottom image. Photo credit: Jon Ross. ……..**309**

Figure 9.8. Platter sherds showing concavity under the rim highlighted by the white arrows on the top row of images, catalogue nos. 482 (left and centre) and Basket 16P50A066 (right). Bottom row shows roughly textured bases, from baskets 13450748 (left), 1045028 (centre), and 20E93B012 (right), Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross. ..…….....**309**

Figure 9.9. Thick coil running around the base of holemouths and jars from Area F, Basket 18F26C015 (left) and Area E, catalogue nos. 388 (top right) and 462 (bottom right) Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross…….**310**

Figure 9.10. Classification of vessel types from Area E, Tell eṣ-Ṣâfi/Gath, according to fashioning methods/shaping dendrogram © Jon Ross.…….**310**

Figure 9.11. Histogram showing the overall percentages and counts for the four main fashioning sequences identified on the sampled assemblage from Area E, Tell eṣ-Ṣâfi/Gath © Jon Ross.……..**311**

Figure 9.12. Scanned thick sections of holemouth rims from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 477 (top) and 121 (bottom), coil built. Photo credit: Jon Ross……...**312**

Figure 9.13. Scanned thick sections of holemouth body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 18.4 (top) and 500 (bottom), coil built. Photo credit: Jon Ross…….**313**

Figure 9.14. Scanned thick sections of holemouth body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 492 (top) and 431 (bottom), coil built. Photo credit: Jon Ross……..**314**

Figure 9.15. Scanned thick sections of holemouth body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 370, coil built. Photo credit: Jon Ross ……...**315**

Figure 9.16. Scanned thick sections of holemouth base and lower body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 467 (top) and 462 (bottom), coil built. Photo credit: Jon Ross……..**316**

Figure 9.17. Scanned thick sections of holemouth base and lower body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 480, coil built. Photo credit: Jon Ross…….....**317**

Figure 9.18. Scanned thick section of platter rim sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 482, spiral coiled. Photo credit: Jon Ross……..……**318**

Figure 9.19. Scanned thick section of platter body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 166, spiral coiled. Photo credit: Jon Ross……...**319**

Figure 9.20. Scanned thick section of platter body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 166, spiral coiled. Photo credit: Jon Ross…….……..**320**

Figure 9.21. Scanned thick section of platter body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 66, spiral coiled. Photo credit: Jon Ross…….....**321**

Figure 9.22. Scanned thick section of bowl profile (rim to base) from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 20.1, coiled. Photo credit: Jon Ross……**322**

Figure 9.23. Scanned thick section of bowl body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 164, coiled. Photo credit: Jon Ross……..……...**323**
Figure 9.24. Scanned thick section of bowl base and lower body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 325, coiled. Photo credit: Jon Ross……..…….**324**
Figure 9.25. Scanned thick section of bowl base and lower body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 325, coiled. Photo credit: Jon Ross……...**325**
Figure 9.26. Scanned thick section of bowl rim and body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 63 (top) and 344 (bottom), coiled. Photo credit: Jon Ross…….**326**
Figure 9.27. Scanned thick section of bowl rim and base sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 504 (top) and 22 (bottom), coiled and wheel-shaped. Photo credit: Jon Ross…….....**327**
Figure 9.28. Scanned thick section of bowl base sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 505, wheel-thrown. Photo credit: Jon Ross……**328**
Figure 9.29. Scanned thick section of juglet base sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 484, coil built. A large elongated cavity/fissure crosscuts the entire width of the vessel wall. Photo credit: Jon Ross……..**329**
Figure 9.30. Scanned thick section of juglet base sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 506, coil built. Photo credit: Jon Ross……**330**
Figure 9.31. Scanned thick section of juglet shoulder and body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 473 (top) and 289 (bottom), wheel-shaped. Photo credit: Jon Ross……..**331**
Figure 9.32. Scanned thick section of large storage jar rim and shoulder sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 39 (top) and 497 (bottom), coil built. Photo credit: Jon Ross……...**332**
Figure 9.33. Scanned thick section of large storage jar body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 152 (top) and 204 (bottom), coil built. Photo credit: Jon Ross……...**333**
Figure 9.34. Scanned thick section of large storage jar body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 194 (top) and 152 (bottom), coil built. Photo credit: Jon Ross……...**334**

Figure 9.35. Scanned thick section of a storage jar body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 224, coil built. Photo credit: Jon Ross……..……..**335**

Figure 9.36. Scanned thick section of a storage jar body and base sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 219 (top) and 299 (bottom), coil built. Photo credit: Jon Ross…….…….**336**

Figure 9.37. Scanned thick section of a storage jar base sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 209 (top) and 196 (bottom), coil built. Photo credit: Jon Ross……...**337**

Figure 10.1. The EB III 'techno-stylistic' trees for the Tell eṣ-Ṣâfi/Gath repertoire showing techno-petrofabric groups (2nd row from the bottom) and techno-morphological groups (bottom row). Photo credit: Jon Ross……...**338**

Figure 10.2. Flow diagram showing the production sequences/*chaînes opératoires* for the main EB III morpho-stylistic types in the Tell eṣ-Ṣâfi/Gath repertoire (excluding drying and surface treatments). Thin-section petrography was more useful for identifying clay sources and preparation techniques, whereas thick sections were more useful for identifying vessel shaping. Both thick and thin sections inform on firing and were used in combination to reinforce identifications, at each step in the sequence. Photo credit: Jon Ross…….**339**

Chapter 1: Introduction

I. Purpose and scope of the study

The technological study of pottery from Tell eṣ-Ṣâfi/Gath aims to understand how production was organised to meet the need for containers in daily economic and social life at a major Early Bronze Age settlement in the southern Levant (Figs. 1.1-3). This study is especially relevant in view of the wider debates over the economic strategies of early urban economies, the centralisation of political power, and the nature/type of social organisation during the Levantine Early Bronze Age (Chesson 2019; Greenberg 2019; de Miroschedji 2009; 2018; Savage et al. 2007; Philip 2003; Richard 2003; Harrison 2011).

Ethnographic and experimental research conducted over the past three decades has demonstrated the value of understanding the technical, social and environmental factors that influence the manufacture of pottery containers (Arnold 1988; Arnold and Nieves 1992; Costin 2000; Gosselain 1992, 1998, 2002; Gosselain and Livingstone-Smith 2005; Livingstone-Smith 2007; Kramer 1985; Longacre et al. 1988; Matson 1965; Stark 1995, 2003). These factors shape the organisation of pottery production systems. Before such influences on manufacturing can be inferred for the study of archaeological pottery, analysts must first accurately identify: 1) the techniques used in manufacture; 2) how these were arranged into methods during each stage of production, and; 3) how methods were arranged into entire manufacturing sequences (*chaînes opératoires*).

Pottery production is composed of seven main stages of manufacture: 1) the acquisition of ingredients (procurement of raw materials); 2) the processing of the clay recipe to obtain a usable and acceptable pot; 3) fashioning techniques and methods; 4) finishing and/or decorative operations; 5) drying; 6) firing; and 7) post-firing treatments (Fowler 2011: 180; 2016: 474-80; Rice 2015: 129-85; Roux 2016: 103). In the absence of direct evidence of pottery manufacture (e.g. workshops), the challenge for the analyst is how to access, describe, and identify material signatures indicative of potting techniques and methods based on finished vessels. These vessels are rarely found whole and can be heavily worn by site formation and taphonomic processes in mixed assemblages. An additional problem is the challenge of studying an additive technology where each sequential step in the manufacture chain has potentially obscured, or obliterated evidence of techniques used in previous ones (Gosselain 2000; Ross et al. 2018). It is therefore

less problematic to infer how pottery was fired or decorated, than how vessels were shaped, or the ways clays were processed.

This doctoral thesis will distinguish discrete *chaînes opératoires* (production sequences) through a study of clay sourcing, processing, vessel fashioning, and firing techniques identified on thin and thick sections prepared from sampled sherds. A classification of shaping techniques is combined with a classification of fabric groups (clay recipes) identified through petrographic analysis (Ben-Shlomo et al. 2009; Ben-Shlomo 2012; 2018). Current protocols that integrate macroscopic observations (inspection of surface features) with microscopic observations (petrographic features in thin-section) filter out the majority of the study sample for individual site assemblages (Roux 2011, 2016; Babour 2014). Such protocols are not well suited for intrasite analyses and small assemblages sampled at small spatial scales, such as the neighbourhood or structure. It is likely the original diversity of shaping methods will not be identified in the analysis of a targeted sample (Ross et al. 2020).

For the *chaîne opératoire* method to achieve its full potential in ceramic analysis, additional imaging protocols are required. This thesis pilots an alternative low-cost method for identifying production groups, by classifying *mesoscopic* signatures of vessel shaping on freshly cut sherds (Ross et al. 2018; 2020). Deformation patterns in the cross-section of the sherd are scanned at a high resolution onto a computer using an ordinary office flatbed scanner. The images are enhanced using standard photo-editing software to visualise new diagnostics of vessel construction in the walls of the pot, which are confirmed using a combination of established identification criteria and known ethnographic and experimental standards.

II. Research questions, hypotheses, and contributions

By directing greater attention on the technical variability of handmade methods of vessel construction, this thesis moves away from wheel focused typologies that have dominated studies of 'technical specialisation' and pottery production generally. This thesis provides additional data for modelling the development of the ceramic industry in the Near East, with a focus on the dynamics structuring production in early urban household contexts. The overarching research questions are as follows:

1. Can different technological traditions be differentiated on an assemblage from a major fortified and planned Early Bronze Age settlement in the southern Levant?

2. Do technological traditions correspond with select vessel types and/or wares, or do they crosscut these vessel categories?

3. Do the same or different technological traditions occur within early urban dwellings and buildings, or are they found across the exposed neighbourhood?

The answers to these questions have implications for understanding the organisation of production and the provisioning of ceramic containers in an early urban neighbourhood. If a single technological tradition is discernible then all ceramics were made based upon the same shared set of operations and knowledge. Thus, there is a single community of potters, or production group. If multiple technological traditions are discernible then ceramics were made by different sets of operations using different knowledges. Thus, there are multiple production groups. The scale of production can vary between different production groups in a contemporary setting and is inferred (in this thesis) by relating technological traditions to buildings in the neighbourhood and vessel types in the repertoire:

1. If different buildings and domestic dwellings contain ceramics made using the same *chaînes opératoires* then the occupants obtained them ultimately from a single production community. That production community produces all of the vessels needed in daily social and economic life. The occupants may belong to that production community, or not if separate distributors supplied the household. Both options are possibilities in the absence of direct evidence of production.

2. If different buildings and domestic dwellings contain ceramics made using different *chaînes opératoires* then the occupants obtained them from different production communities. The occupants may belong to one of these production communities, but no single production group produced all of the vessels needed in daily social and economic life.

A production group or community is an entity composed of any number of individual potters (and any number of production events) linked by direct transmission of shared technical knowledge. This knowledge is shared, established, and reinforced by the identity of producers and their networks of relations that simultaneously consolidate craft knowledge and group identity. These social networks maintain tradition in potting behaviours as knowledge is passed from one generation to the next, innovated within a group, or borrowed from another (Chapter 2, section VII). A study of tools, materials, gestures, and the organisation of operations (or techniques) involved in technical practice (regular routinised goal oriented activities) describes shared or alternative ways of 'making' and 'doing' and thus identifies the "social perimeters" of shared knowledge (Roux 2016: 103; Naj and Douny 2009). The transcription of production sequences (*chaînes opératoires*) or components (stages, operations) provides the empirical basis for comparing and contrasting technical practice and the underlying knowledge required to undertake them (Lemonnier 1992; Haudricourt 1987). In the aggregate, the resulting potting traditions combine to represent the complete repertoire of motor habits and cognitive skills of the community of potters active in the domestic economy at the site in question (Early Bronze Age Tell eṣ-Ṣâfi/Gath).

The interpretative challenge is to conceptualise the dynamics between production sequences (or its components) and the production entities at different spatial scales (intra-, inter-site, regional) and indicate how the tradition changes over time at various temporal scales. The goal in such studies is to examine the stylistic stability of a potting tradition over space and time. The interpretive challenge was (and is) the central thrust and motivation of much ethnoceramic research over the past 30 years that was (and is) designed to build and expand conceptual frameworks, typologies, and models for explaining sources of variation in potting practices and identify communities of potters (Arnold 1991; Dean and Nieves 1992; Costin 2000; Gosselain 1998; Gosselain and Livingstone-Smith 2005; Roux 2013; Fowler 2016). The methodological challenge is how to distinguish tools, materials, gestures, and techniques and discern the sequence of operations on an archaeological sherd assemblage, in the absence of direct evidence of manufacture (surviving workshops). The main contribution(s) of my doctoral thesis concerns the methodological challenges regarding the definition of *chaînes opératoires* in archaeological contexts. This is approached through an integrated multi-method analysis (Chapter 3) of stratified

sherd assemblages (Chapter 6) associated with urban dwellings in a partially exposed neighbourhood (Chapter 5).

III. Summary of the thesis

The dissertation is divided into ten chapters. Chapters 2 to 4 (Part I) address the context of research and provide background on the major issues that have driven studies on the organisation of production, techno-stylistic analyses, and *chaîne opératoire* research. These chapters serve to clarify a robust framework for studying pottery manufacture from an inherently anthropological perspective in order to complement regional perspectives of Early Bronze Age ceramic production in the southern Levant.

Chapter 2 situates the present study in the context of the larger body of theoretical research on production, specialisation, and stylistic analysis. The distinctive contribution of this study is emphasised in view of the limitations of past and present approaches to these topics and the difficulty of approaching manufacture (and by extension economies) in archaeological contexts. The chapter reviews the role of the 'Anthropology of Techniques' school in re-centring stylistic analysis and framing a holistic study of technology and manufacture. The dynamics that connect the stages of manufacture in a production chain with the identity of the production groups are explained and illustrated by the Pottery Production Model. This ethnographic model was originally developed in West Africa, but has since taken on global significance for the study of archaeological pottery (Fowler 2016). The limited progress in classifying forming techniques on archaeological assemblages is discussed and reveals a need for continued 'actualistic research' to expand criteria for the identification of fashioning techniques. Progress in this direction has been stifled by misconceptions over the use of the pottery wheel and the need to reconsider 'technical specialisation' in relation to 'economic specialisation'.

Chapter 3 dissects the *chaîne opératoire* methodology in relation to the description and identification of techniques in pottery manufacture. The difficulty of describing techniques for an additive technology (such as pottery) are discussed and the importance of multiple scales of observation are stressed for securely identifying potting methods. The various techniques for identifying deformation patterns (the preferred orientation of features in the fabric) are summarised and the strengths and limitations of each technique are discussed in relation to different physical scales of observation. Current *chaîne opératoire* approaches for classifying assemblages prioritise macroscopic techniques, particularly visual inspection of surface features. Microstructures

identified in petrographic thin-sections confirm macroscopic observations and characterise clay recipes. Surface features indicative of vessel fashioning are rare in most assemblages and thin-sections expose a very small area of the vessel walls. Consequently, most of the assemblage is usually removed from the study sample and potentially obscures the observable variation. This thesis experiments with an alternative low cost scanning protocol for improving the detection of traces of vessel forming on ceramic thick sections at the mesoscopic scale. The strengths and limitations are considered and the protocol is integrated into a multi-scale analytical procedure for classifying vessel fashioning on archaeological sherds and replica vessels.

Chapter 4 contextualises the site assemblage and summarises the larger culture history setting of the southern Levant for the Early Bronze Age. The chapter engages with larger debates on social complexity in regards to the presence/absence of early city-states and urbanisation. These debates are reviewed in relation to changes in pottery production that include: the simplification of the repertoire, the occurrence of larger potting industries, apparent 'commoditisation', and the development of the earliest 'consumer culture'. Chapters 5 to 7 (Part II) describes the site, the pottery assemblage, and the hypotheses. Chapter 5 summarises the Early Bronze excavations at Tell eṣ-Ṣâfi/Gath and describes the phasing, layout and organisation of the domestic neighbourhood, and the architecture. The sherd distribution of the pottery sample is summarised according to building and phase. Chapter 6 presents the shape/form repertoire and specifies the quantities of vessel types in the study sample. Chapter 7 revisits the research questions and hypotheses in light of the findings in previous chapters on the research context, the site, and the assemblage.

The results of the method detailed in Chapter 3 are presented in Chapters 8 and 9 (Part III). This section begins with a classification of vessel fabrics that were characterised using thin-section petrography. Chapter 8 provides petrographic insights on the main stages of the *chaîne opératoire* including: clay sourcing, processing, vessel forming/shaping, and firing regimes. The limitations of thin-section petrography are discussed for identifying forming techniques, distinguishing potters/workshops, and characterising the organisation of production. This dissertation approaches the definition of production groups at the site level by combining the petrographic groups in Chapter 8, with the mesoscopic classification of vessel shaping in Chapter 9. The mesoscopic results of the shaping classification are first described according to individual techniques. The analysis identified traces of coiling, drawing, concave moulds/vessel supports, luting (attachment

of separate straps of clay), and wheel fashioning. Deformation patterns recognised on the ceramic thick sections showed additional diagnostics of vessel shaping that are not usually visible at conventional macro and micro scales of observation. These traces of vessel shaping are characterised in detail and many were recognised on the sections of experimental replicas included in this study (Appendix B). The fashioning techniques are subsequently organised into potting methods which consist of combinations of individual techniques.

Chapter 10 (Part IV) integrates the results of the shaping classification with the petrofabric groups and morpho-stylistic types in the repertoire, in order to differentiate the technological traditions of discrete production groups. The resulting discussion of the results interprets the organisation of production in view of the hypotheses and expectations, which were confirmed in this technological study. The dissertation concludes that potting was an activity pursued by a minority of professional potters serving the domestic economy, with four stable and enduring production groups recognised on the study sample. These potting groups broadly align with the main wares and functional classes in the repertoire, with limited overlap between them. Potting traditions centred on the surplus production of a select range of functional types made by a different community of specialised producers. These social groups were linked by direct transmission of technical knowledge, using locally sourced clays with recipes adapted to vessel function. Chapter 10 explores the larger implications of the study and relates the results to the economies of major Early Bronze settlements in the region and the identity of potters.

The dissertation concludes by discussing the strengths and limitations of the study for identifying pottery production groups and lays out directions for future research. The mesoscopic protocol for imaging ceramic thick sections significantly improved the identification of fashioning techniques and unlike previous studies, only a minority of sherds were classed as ambiguous. The research design, method, and the expanded diagnostics for vessel shaping are applicable to any sherd assemblage in the world and demonstrably improves standards for the archaeological study of ceramics.

PART I: RESEARCH CONTEXT AND METHODS

Chapter 2: Craft Production and Specialisation

I. Introduction

The literature on craft production and specialisation encompasses a vast expanse of archaeological research. The present chapter surveys major developments, viewpoints, and theoretical touchstones used to study the organisation of production through archaeological datasets. The resulting overview contextualises the thesis and highlights its substantive contributions to the larger literature, particularly with regard to stylistic analysis. Stage-model and parametric typologies are discussed and establish a consistent terminology and criteria for describing production and economic systems (§III-IV). These typologies provide general models in the anthropological study of production. However, the confounding influences and limitations posed by archaeological contexts opens up a conceptual chasm between the 'statics' of the archaeological record and the 'dynamics' of observed human behaviour (the dynamics structuring production) (§V). How archaeologists access indirect evidence of production is explained with regard to the standardisation hypothesis, but prompts immediate questions over the selection of relevant artefact attributes for study (§VI). Such questions highlight the need for an integrated anthropological framework for linking and *explaining* behavioural change through artefact variability, specifically ceramic variability (Roux and Corbetta 1989: 4-5; Skibo and Schiffer 2001, 2008: 1-16).

Correlations are weak when propositions are not verifiable using 'material facts' and the kind of data supplied by the archaeological record (Roux and Corbetta 1989: 4-5; Rice 1987: 170). In Binfordian terminology, 'middle range theory' (MRT) is required to bridge anthropological models of production (generated in the ethnographic present) with the material residues of past societies (Binford 1983: 24; Johnson 2010: 59, 128-35). In doing so, the "multiplicity of interpretations of material facts" is eliminated, or at least greatly reduced and the results are not constantly resisted by ethnographic 'cautionary tales' (Roux and Corbetta 1989: 5; David and Kramer 2001: 16).

This chapter proposes that the Anthropology of Techniques School can supply such a framework for bridging the conceptual gap and explaining behavioural change through ceramic variability (§VII). Extensive ethnographic research on 'technical systems' demonstrates the nature of technical knowledge and shows how such knowledge influences patterned activities in a

production sequence. These activities are studied through the *chaîne opératoire* (the production sequence), which provides an excellent tool for: 1) parsing out all the links between production and wider society; and 2) isolating the 'material correlates' in the archaeological record and the related behaviour(s). Through the concentrated efforts of the Ceramic and Society Project (in conjunction with numerous other ethnographic and experimental projects), a new pottery production model was proposed, based on substantial *chaîne opératoire* ethnographic research (§VIII). This model shows how technical knowledge and variation in potting practices responds to different social and technical pressures that influence specific techniques (and therefore certain features of a pot) in the production sequence. It conceptualises and classifies the dynamics between potting communities and production sequences (or its components) at different spatial scales (intra-, inter-site, regional) and indicates how potting traditions endure and transform over time.

The main goal in techno-stylistic analysis is to mimic the *chaîne opératoire* classifications observed from ethnographic studies of potting traditions, in an effort to differentiate past potting communities inferred from archaeological sherd assemblages. A major limitation in techno-stylistic analysis is methodological. Criteria and diagnostics for identifying fashioning techniques are underdeveloped and the resulting filter clearly privileges wheel shaping and throwing abilities (§VIIID). This thesis is intended to make a substantive contribution by further developing techno-stylistic analysis through novel methodological protocols that more reliably identify fashioning techniques from archaeological sherd assemblages. While the geographic and temporal focus of this research is the Levantine Early Bronze Age (phase III), the methodological advances are such that my techno-stylistic analysis can be broadly applied across space and through time, wherever archaeological ceramics are present.

II. The wide lens of craft production

The process of crafting goods for exchange intersects with all the classic 'Hawkesian' levels of inference from technological, economic, and social fields of interaction to political and ritual domains of activity in society (Hawkes 1954; Costin 1998; Dobres 2000: 37-8; 2001; Insoll 2005; Renfrew and Bahn 2008: 176). Studies on craft production provide a wealth of knowledge on a multitude of varied topics, such as material culture and subsistence strategies, resource exploitation and cultural ecology, the division of labour and economic organisation, political strategy and social reproduction, and so forth. All goods made and used by specialists and dependent consumers are the result of crafting and by studying the 'formal variation' in the

resulting products, we hope to recognise different dimensions of social and individual identity (the marking and 'materiality' of group boundaries). This is the appeal, rationale, and incentive for stylistic analysis and is the reason for a varied terminology to specify different kinds of style and the corresponding social entities (Wiessner 1983: 256; Sacket 1977, 1990; Wobst 1977: 321; Hegmon 1992). Group boundaries can range from close kin to production groups and communities to much broader cultural and linguistic identities and economic systems (Costin 1998: 3; Hegmon 1992, 1998; Gosselain 2000; Nissen 2001; Algaze 2001; David and Kramer 2001: 168-224). This is why an archaeology without style is an archaeology that has "little or nothing to say" (Conkey and Hastorf 1990: 2).

Generally, studies on the ties linking craft production to socioeconomic and political organisation follow one of three overlapping directions in archaeological research, covered in this chapter (Costin 2001: 273; Flad and Hruby 2007; Rice 2015: 209, 212-15; 350-4, 368-75). One direction concentrates on the role of production and specialisation in the formation and reproduction of complex hierarchical societies and processes in social evolution. A second direction focuses on the social (and material) relationships and interactions created and negotiated throughout production. Craft production (at the very least) is a social activity and process that structures how individuals participate in societies, access services and goods, negotiate relationships, navigate power structures, and so forth. A third direction is the study of meaning and function of crafted goods and explores how these objects are imbued with power, ideology, values, and meaning. Scholars have developed various anthropological models for unlocking the explanatory power of craft production. These models are used as a lens for detecting shifts in the structure and evolution (social change) of past societies. They can be divided into fixed stage-model typologies and fluid parametric ones.

III. Stage-model typologies of production

In Near Eastern archaeology and the general literature on social complexity, 'workshop' or 'specialised' production is frequently used in opposition to 'household' or 'domestic production' (Babour 2014; Ben-Shlomo et al. 2009; Blackman et al. 1993; Doherty 2015; Rotem 2012: 166-7). This distinction was popularised by Peacock's classification of Roman pottery production (Peacock 1982) and is very similar to a typology by Van der Leeuw (1977; Table 2.1). Ethnographic and historical data were used to construct a general hierarchical stage-model typology for classifying production practices and exchange relations. Peacock characterised a total

of seven production types, ranging from domestic replacement at the household level to the large-scale workshops and manufactories characteristic of more complex redistributive economies (Table 2.1). Economic expansion was correlated with a linear evolution of increasingly complex technological hardware in a 'quasi-evolutionary typology' (Rice 2015: 355). Handmade and low-fired pottery were generally considered non-specialised and confined to domestic replacement for the household.

Peacock's classification was widely praised for encouraging a shift away from art historical perspectives that had fixated on specific classes of pottery types (Fulford 1984: 373). He refocused attention on social processes and anthropological concerns related to larger production systems and how to recognise them in the archaeological record. As a result, his classification gained the interest of a broader scholarly audience and was applied to pottery studies around the world. The main problem with fixed stage-model typologies is the inability to cope with variability in production arrangements, since they were restricted to a handful of monolithic and impressionistic types derived from limited ethnographic data (Arnold 1991; David and Kramer 2001: 305-9; Rice 1987: 182-91). The diversity of production arrangements past and present is such that there is no universal mode of production and division of labour (Costin 2015: 2). In the Prehispanic history of Mesoamerica for instance, there was never a *non-residential* workshop for large-scale production. Peacock's typology is simply not relevant. According to Feinman (2013: 445), "almost all data for craft activities in Prehispanic Mesoamerican contexts, from the advent of sedentary settlements (2000-1500 bce) to the Aztec world, have been found in domestic contexts". Yet the intensity of production was extremely variable with households often practicing multiple crafts in addition to agricultural production, but were nonetheless capable of significant output (Feinman 2000, 2013; Feinman and Nicholas 2007, 2011).

Extensive household archaeology exposed uncritical applications of traditional economic stage model typologies and highlighted the need to address the economy from the perspective of the ordinary household in daily life (and therefore contextualise the economic strategies of the nonelite).[1] Excavations of numerous Classic Period households (including entire terraces at

[1] Feinman and Nicholas achieved this goal through large aerial exposures of entire terraces (over six terraces were excavated at one site) and this was done at a range of sites across the Oaxaca valley that they were able to survey and excavate themselves. This kind of exposure is simply not possible at Tell eṣ-Ṣâfi/Gath (and tel sites in general across the Near East). Intensive settlement activity (past and present) inhibits access

Palmillo) in the Oaxaca Valley showed they were not self-sufficient, but interdependent in a market economy. There was a clear increase in production for exchange based on the recovery of direct evidence for manufacture in domestic compounds. High volumes of diverse goods were in unrestricted circulation both within and between sites and regions. The traditional belief in a 'state administered' command economy (an elite controlled redistributive economy) crumbled, due to the mounting evidence for house to house exchange and indirect evidence for market places (Feinman 2013: 454-5; Feinman and Nicholas 2007a, 2007b). These markets were inferred largely based on direct evidence recovered from domestic contexts that showed unrestricted manufacture and distribution of both utilitarian and exotic/prestige items. Such evidence was also combined with the conspicuous absence of centralised storage facilities suggesting that the elites were not interested in controlling distribution through managing stockpiles and commodity flows. Feinman (2013: 455-6) predicts that similar progress will occur in Bronze Age Aegean archaeology. The dominance of palatial command economies is similarly being challenged by additional evidence for market exchanges (and 'diverse economic transfers'), due to the results (and excavation methods) implemented through household archaeology programs.

The most widespread and powerful social categories that determine who does what in most societies are gender and endogamous groups, such as castes (Costin 2015; David and Kramer 2001: 306). Yet these factors are either underdeveloped and/or simply invisible in most of the analogues. Far greater emphasis was placed on identifying large-scale productive industries enshrined in static stage model categories. They are split into many more types, for example, Peacock specifies nucleated workshops, the manufactory, estate production, and military/official production (Table 2.1). The greater investment in technology rendered these production types easier to characterise in the archaeological record compared to the ephemeral traces of low-rate production that were presumed to have exclusively characterised household production.

IV. Parametric typologies of production

Costin (1991, 2005) brought a more flexible and nuanced perspective to the study of production and developed a multidimensional 'parametric' approach. Unlike traditional stage-model approaches, the production system is dismantled into various components and the analyst

to deeply buried EB deposits (Islamic burials, crusader fortresses, metres of Iron Age and Late Bronze deposit etc.).

looks for broad agreement between multiple parameters of variability on sliding scales (Flad and Hruby 2007: 6). These parameters include:

A. Sociopolitical context – producer/consumer relations
B. Geographic concentration – nucleated or dispersed
C. Intensity – part-time or fulltime
D. Scale – size of the workforce and recruitment

IVA. Sociopolitical context

The sociopolitical context of production describes the nature of producer-consumer relations and the degree of elite control over manufacture, distribution, and consumption (the production system). At one end of the scale is 'attached specialisation'. Production is closely associated with an elite class and governmental institutions, who organise and manage production in a controlled command economy. In these production types, the elite have a monopoly over production and control the circulation of status-defining prestige goods through active sponsorship and patron-client relationships (Costin 1991: 11-12). Prestige goods are elite symbols and objects of power that legitimise and reinforce political authority, especially in societies that do not have codified laws to reinforce the sociopolitical order (Peregrine 1991; Flad and Hruby 2007: 9-10). These prestige goods generate (and are a measure of) wealth, luxury, and status and are therefore integral to the political economy and power structures in society. Hence, Earle's concept of wealth finance (1981) defined as "special products" used as a form of "primitive money, and currency… a means of payment" and storable wealth by centralised institutions (D'Altroy and Earle 1985: 188). Wealth finance promotes "interregional economic integration" binding local nobility together across large territories, without disrupting and redirecting the local flow and exchange of bulky staples, perishable products, and necessities for 'biological reproduction' and everyday household needs (D'Altroy and Earle 1985: 196; Brumfiel and Earle 1987: 4).

The circulation of prestige goods are restricted to a small ('sanctioned') minority of the population, or they risk being devalued and are therefore useless as status indicators. Sociopolitical models of production treat 'attached specialists' as intrinsic to the emergence and maintenance of elite power. Attached forms of production serve to legitimise and reproduce the social hierarchy and inequality. When prestige goods start to flood unrestricted forms of nonelite exchange than this can cause the entire social and political order to collapse and reconfigure. Such a scenario is believed to have occurred on a significant scale at the end of the Late Bronze Age across the entire

East Mediterranean (Sherratt 1994, 1998, 2003, 2017: 610-15). Sherratt suggests this process of economic reconfiguration (the disruption and re-direction in the flows of prestige goods) was one of the fundamental causes of instability during this 'crisis' period in Mediterranean history (Muhly 1992; Cline 2015). It fuelled two related sociopolitical and economic consequences: 1) the retreat and/or collapse of traditional Bronze Age palatial economies and kingdoms (Hittite, Egyptian, Babylonian, and Mycenaean); and 2) the growth of new forms of regional identities in former 'peripheries' that prospered in the Early Iron (Phoenicians, Neo-Hittites, Phrygians, Philistines, Israelites, Edomites and various other 'ites').[2]

The proposed mechanisms through which elites lose control of 'wealth finance' are varied and provide insight on how power dynamics (and elite identity) is constructed, maintained, and altered in such societies. In the former case of the Eastern Mediterranean, it included the evolution of new decentralised forms of mercantile trade (port power) associated with Cyprus and the Levantine coast (new mercantile trade networks); import substitution (local imitation products of high value exotics); the opening up of new sources of raw materials outside of the control of traditional elite power bases (e.g. exploitation of new copper and tin sources, as well as prolific recycling); innovation in new manufacture techniques, technologies, and consumables; and the creation of new markets amongst emergent elites outside of traditional royal courts (Artzy 1998; Bauer 1998; Sherratt 1994, 1998, 2003; 2017: 610-15). This key period in the history of the East Mediterranean is an excellent illustration of how social relationships and identities are (re)negotiated as a result of control over the crafting process. When viewed from the perspective of the *longue duree*, loss of control over key production systems (from manufacture to consumption) directs the trajectories of entire 'civilisations'.

[2] This broad perspective suggests that the emergence of new regional Iron Age identities stem from economic realignments following the disintegration of old empires. Traditional narratives tended to portray these emergent groups as essentialised "ethnicities" often dislodged from a previous homeland, or temporary residence. The resulting origin stories (or ethnogeneses) typically featured epic migrations and battles of some kind (Silberman 1998). Debate no longer occurs at such grand and speculative geographic and temporal scales in a culture history(ish) framework. Instead, an array of competing and nuanced anthropological models for identity formation are proposed and tested, based on the long-term excavation results from select sites (e.g. Beit Shemesh, Qeiyafa, Tell eṣ-Ṣâfi etc.). Debate on social change is no longer polarised by reductionist migration vs. trade centred perspectives that had questionable efficacy and explanatory power in the first place. The debate often lacked compelling 'bridging' arguments with regards to how identity was negotiated through variability in local material culture. This is why debate had a tendency to be elevated to sweeping overarching theoretical positions, which were often distanced from a grounded discussion in the stylistic variability of artefacts.

At the opposite end of the scale to attached specialisation is 'independent' production for markets where producers are structured by economic forces of supply and demand (Costin 1991: 11). These types of goods tend to be more utilitarian (a low exchange value relative to prestige goods) and are needed in daily social, economic, and ritual life by most households (e.g. cooking pots, clothes and textile products, tools, basketry, containers for beverages and so forth). These staple goods circulate across the whole of society and are not tightly controlled, monitored, or restricted in their distribution. They are not part of a command economy and therefore do not require centralised or elite control over their production and distribution. Thus the power derived from production and commodity-exchange is in the hands of nonelite, including gender and exogamous groups of different overall social standing. Both producers and consumers benefit from cost cutting and labour saving strategies and greater efficiency (Costin 1991: 11). Producers have incentive to turn a profit and economic motives are more likely to structure production arrangements.

Independent and attach specialisation(s) evolve under very different conditions, are subject to very different pressures, and the resulting products differ according to how they function in the political economy and their role in wider society (Costin 2001: 297). Stein proposed that craft production in Mesopotamian prehistory was initially independent and unrestricted until the Uruk period when a 'dual craft economy' developed in connection with the growth of centralised institutions (Stein 1996: 32-3). His survey of the material evidence is primarily based on the distribution of pottery, metals, and semi-precious stones at Uruk and the surrounding satellite sites. The semi-precious stones and finished metal objects (including production tools) are only found in elite contexts and are a key concern in elite economic cuneiform texts (Stein 1996: 32-35). He argues that this restricted distribution (and link with administrative texts) suggests an 'attached specialisation' developed around the manufacture of select status markers and prestige items for elite consumption. This 'dual craft economy' is very different from traditional models of state formation that assumed a temple-based theocratic elite controlling *the entire economy*, reallocating food surplus to support increased occupational specialisation and dependent producers (Childe 1950).

The earliest direct evidence for large-scale specialist production in the Near East is based on pottery manufacture from the Ubaid site of Tell Abada. Sixteen pottery kilns were found, ranging from single chamber installations to complex double-chambered updraft kilns (Stein 1996:

28-29). The high density of production facilities and the sophisticated firing technology indicates a scale of production consistent with specialised production of a surplus for exchange. There was no indication of restricted distribution and elite control over the production facilities, or the products that they manufactured (both common and fine wares). There is little doubt that occupational specialisation did intensify once temple/palace economies either sponsored/contracted producers to make luxury items and/or simply consumed more products made by independent producers. However, craft production was not strictly 'attached' and the overall economy was never wholly monopolised by a single temple estate/elite institution, as implied by a minority of Assyriologists (Khurt and Millard 2006: 28-29; Liverani 2006).

There are two problems with Stein's argument in favour of an Uruk 'dual economy' for southern Mesopotamia. First, only elite contexts have been intensively excavated and investigated at Uruk and neighbouring sites. It is therefore not surprising that metals are primarily found in elite contexts. Second, 'attached specialisation' is a very specific pattern of production where the elite completely monopolise manufacture and distribution. Until the hinterland is intensively investigated then the alternative scenario is equally valid, where independent producers simply marketed more of their high value goods to elite consumers, who could afford them. Evidence for 'attached specialisation' in certain parts of the economy (i.e. metals), as early as the Uruk period is still not conclusive in southern Mesopotamia.

The physical settings, the built environment, and the contexts in which workshops and products are actually found (and distributed across the social spectrum) inform on producer/consumer relations, the degree of elite control, and the sociopolitical context. Therefore, when archaeological exposures are *restricted* to certain social strata and types of contexts (i.e. elite architecture to the exclusion of everyday households) then any understanding of the production system (and the overall craft economy) is highly tentative. It raises the tedious issue of a banal problem in archaeology, which is the incompleteness of the archaeological record. Our vison of past economies is highly constrained by the limited samples produced by excavation trenches. Hence the need for targeted research designs prior to excavation and the general movement in the direction of household archaeology across the Near East (Buccellati et al. 2014; Baker 2013; Chesson 2000 ; Müller 2013; Parker 2012).

IVB. Geographic concentration

The degree/scale of concentration describes the distribution and spatial arrangements of producers across the landscape and their proximity to consumers and other producers in that landscape (Costin 2001: 295). Production can be dispersed and evenly spaced, or concentrated and restricted to specific areas/zones where specialist producers have 'aggregated' in 'nucleated' workshops. In such cases, workshops, tools, and facilities are found at a restricted number of specialist sites. The aggregation of specialist producers suggests that manufacture is presumably oriented around regional and interregional exchange (Costin 1991: 13). A variety of factors can influence the distribution and organisation of producers across the landscape including: environmental reasons (proximity to raw materials), transport costs (proximity to trade/caravan routes), consumership (proximity to consumers and markets) and political (territoriality and political frontiers). The overall pattern may well be a negotiation amongst a mix of these variables. Nucleated production may exploit efficiencies by locating production either closer to sources of raw materials, or production may be moved closer to lucrative markets. In the case of attached specialisation, production is typically located in close proximity to elite/palatial architecture. Attached specialists produce near their patrons, who control production, the acquisition of raw materials, and the finished goods.

The identification of the degree of concentration requires a regional approach to the study of production. This parameter is usually built into standard provenience studies (Chapter 4, §VC and VI). Site specialisation or community specialisation describes sites with limited functions oriented around the production of a specific product (or set of goods) in a regional system (Stark 1991; Rice 1991: 262, 277; 2015: 357-61). Resource specialisation describes the selective use of specific resources in manufacture. Studies of this kind give "behavioural utility to the findings of archaeometric studies" (Rice 1991: 262; Wilson and Day 1994). The convention in Near Eastern archaeology is to identify resource and product specialisation. Stylistic analysis is combined with petrography to relate vessel types to the nearest geological sources in the landscape. Specialist production groups and workshops are proposed when fabrics show consistency in clay recipes, processing techniques, shaping methods, and firing practices for the manufacture of a select range of forms consistently found at various sites (Greenberg and Porat 1996; Milevski 2011: 39-88; Ben-Shlomo et al. 2009; Roux and Courty 2005). A chronological delay is often observed as the wares and stylistic types appear at locations further away at lower frequencies, graphically

represented by fall off curves (Earle 1999: 614; Costin 1991: 41-2; Rice 2015: 371-3). In this way, a technological 'homeland' is defined by mapping the relative abundance of carefully defined vessel types and wares at regional scales of interaction.

This approach is not without its problems and limitations. The homogeneity of local geological profiles and the lack of distinctive temper types makes it problematic to securely provenance common vessel types within a regional setting, especially in the absence of known workshops. Hypothetical resource zones often fall back on the principles of least cost and ethnographic analogy (Rice 2015: 360). To distinguish between individual workshops (and producers) operating in the same landscape is often unattainable under such conditions (Ross et al. 2020). The number of production groups and workshops cannot be specified or differentiated according to the general paste properties of the ceramic (mineral identifications and textural properties).

IVC. Intensity

The intensity of production describes the time invested in manufacture, with a distinction drawn between part-time specialists and fulltime specialists (Costin 1991: 17-18). The amount of time dedicated to a particular economic task has always been considered a critical factor for identifying specialist production (Rice 2015: 355; Baysal 2013: 236; Flad and Hruby 2007: 3-4; Childe 1950, 1951). Yet this parameter is arguably the most difficult and problematic to measure. Intensity may be inferred from the degree to which the production process is efficient and routinized (a reflection of specialist skill and knowledge invested into the craft). Independent producers are usually 'risk minimisers' and their livelihood and wellbeing is usually supported by a combination of economic strategies to stay generalised (Costin 1991: 16). Independent producers are therefore more likely to maintain a balance between a range of productive activities (multi-crafting and task symbiosis) that are needed in day-to-day economic and social life. Attached specialists are supported by revenues from elite patrons and are not subject to the ebb and flow of markets (thus greater job security). They are therefore more likely to dedicate greater time and investment to highly skilled specialist production.

Time commitments and scheduling remain the "thorniest criteria in discussions of production in antiquity" (Rice 2015: 357). A common approach is to take into consideration the volumes of production debris and artefacts to estimate intensity and regularity in product replacement and manufacture (Clark 2007: 22; Joffe 2018: 52; Roux 2003b: 21-22). But these

broad generalisations are usually nonspecific and highly tentative, since the archaeological record is treated as a reflection of the living systemic context unaffected by discard behaviour, recycling, and a host of site formation processes. In addition, the concept of 'fulltime production' may have less relevance for understanding specialisation in antiquity considering the impact of seasonality on most agrarian and pastoral societies. Numerous studies on 'multi-crafting' and 'task-scapes' have shown that producers preferred to diversify and were often involved in several types of work (Ingold 1993; Inomata 2007; Logan and Dores-Cruz 2014; Rice 2015: 361-2). For most Canaanite households in the Late Bronze and Early Iron, specialisation did not preclude heavy involvement in direct food production and agricultural labour, which contributed to a significant portion of the domestic economy (Schloen 2001). Spanish accounts on the Classic Maya document as many as four to six trades per person and these have since been verified by excavations of numerous houses (Inomata 2007; Rice 2015: 362).

The intensity of production is problematic even when superb direct evidence of manufacture is available. An excellent example is Feinman's excavations of a Classic Period shell ornament and pottery workshop at Ejutla in the Oaxaca valley. One modest sized house produced over 23,000 pieces of marine shell, in various states of manufacture, for the mass production of shell discs, beads, and mosaic pieces (Feinman and Nicholas 2007: 101; Feinman 2000; 1993). The site is not in close proximity to the coast yet this one building produced more beads, tools, and manufacture debris for marine shell production than the entire excavated terraces at major neighbouring sites. The quantity and relative amounts of product and manufacture debris suggested to the excavators that this household may have supplied beads for exchange throughout (and possible beyond) the entire region. This same household also specialised in pottery production. Pottery manufacture concentrated mostly on figurines and over 2000 were recovered (usually broken or malformed) in addition to figurine moulds (Feinman and Nicholas 2007: 105). Over 900 pottery wasters were found (including wasters of bowls, incense burners, jars, and griddles) in conjunction with considerable quantities of kiln furniture buried in pits. Partial excavation of this one house generated well over 1.75 metric tons of ceramic artefacts and manufacture debris (Feinamn and Nicholas 2007a: 107). Petrographic and ICP analyses confirmed that the clay was locally sourced from the nearby stream bed (Carpenter and Feinman 1999).

Middens were packed with debris from both pottery production and shell ornament manufacture, with lower amounts of debris from lapidary working and chert production (Feinman

and Nicholas 2007: 105-6; Feinman 2000). While the evidence from Ejutla clearly points to the occurrence of 'production for exchange' and 'high intensity' manufacture, the usual problems surface in regards to the biases on sample size and the apparent unknowns that surround production intensity. The assemblage from this one site belonged to one domestic compound that was not fully excavated. The possibility of community/site specialisation cannot be ruled out (or tested), since no other households were excavated. Unknown quantities of product were presumably exported from the production site and much may have been recycled. No data is provided on time scales/time inputs. Chronological resolution is poor like most archaeological sites (Rice 2015: 351). The quantities produced in a single production cycle are unknown (or not specified), as is the regularity of the production cycles themselves. The actual time-span of the 'household' and the number of potting generations (and individuals active in the craft) is neither specified, nor related to the volumes of manufacture that have been recovered. Therefore, the actual intensity (and scale) of production is rather ambiguous *except* that manufacture was clearly not oriented around the internal needs of the producing household. Product output (and the quantity of tools, manufacture debris, and finished goods) are assessed in highly relative terms, with bulk comparisons based on rough estimates with neighbouring sites that Feinman and Nicholas have surveyed and excavated, such as the Palmillo Terrace (Feinman 2001b, 2004; Feinman and Nicholas 2007).[3]

Nevertheless, the excavators are convinced that production was always "part time" due to the limitations on transport, which was restricted to 'human carriage' (2007a: 113). The implication (and assumption) is that the links between the producers and the consumer base were not strong enough to sustain 'fulltime production'.[4] This is a rather tentative assumption that arguably underestimates human mobility. It is not at all clear why this mode of transport ('human carriage') exerts such a powerful hypothetical influence on economic strategies at these sites. Handcarts and even hand pulled sledges (as well as numerous other contraptions and carrying techniques) are widely used worldwide to transport goods (and people) in bulk. 'Human carriage'

[3] Clark (2007) is perhaps making an overly extreme statement (out of frustration?) when he states that such estimates and comparisons are utterly 'meaningless' in light of the aforementioned unknowns. These quantities are not totally meaningless, but the rhetorical point was nonetheless well made. The actual problem (that Clark does little to address it seems) is how to control or circumnavigate those unknowns in the archaeological record without simply ignoring it, or complaining about it.

[4] Very similar conclusions are reached for Aztec society in Feinman 2001a: 192-3

can be a highly efficient means of transport in many regions and environments, past and present. What the argument does show is the apparent difficulty of making specific and concrete statements about the intensity of production even when substantial direct evidence of manufacture is available from excavated production loci.

Archaeological datasets are prone to 'cumulative blurring', since they conflate numerous production cycles and are already in the aggregate (Kotsonas 2014: 13). A host of processes have likely intervened in the formation of each assemblage irrespective of the 'Pompei effect' and regardless of the degree to which production was intensive and centralised. Consequently, accurate and specific time inputs for production activities are virtually "impossible" to ascertain in most archaeological contexts, but even if such estimates were possible, time calculations are not necessarily as important as we may think they are for identifying specialists in a premodern world (Rice 2015: 355-6; Baysal 2013: 234, 238; Clark 2007: 22). A strong feature of western modernity is a near total commitment to one specific economic pursuit on a year-round basis. It results in a hyper-specialised society, yet it is a high-risk strategy to pursue at both the individual and collective level. For the individual, a sudden drop in sales, or disruption to markets and the supply chain will (and often does) equal sudden impoverishment. At the level of the collective, the overall economic system can become increasingly volatile with many unforeseen far reaching ill effects (Comaroff 2005).

IVD. Scale

Scale describes the inputs of labour and resources, specifically the size and composition of the workforce, the nature of recruitment (the relationship between producers), and the level or quantity of the output (Costin 1991: 15-16; Rice 2015: 351; David and Kramer 2001: 305-9). At one end of the scale, production is small and kin-based. Producers are directly related to each other and the output is usually relatively low (domestic/household production). At the opposite end of the scale are large labour forces where production is no longer structured around kin relations and is based on skill and need. Producers are not necessarily related to each other, workers are involved in contractual relationships/obligations, and output is relatively high (see Table 2.1 for specific analogues).

Traditionally, archaeologists usually identify scale on the basis of whether production occurs in domestic, or non-domestic settings. But as Feinman (2013: 445; 2000) has shown across Mesoamerica, this is not a reliable indicator when taken by itself. A combination of the following

factors are typically taken into consideration: the size, spatial extent, and location of production facilities; regularity in production cycles (production rate); and the investment in manufacture technology (drying spaces, specialised firing structures/kilns, wheels, and other workshop structures). The difficulty of quantifying output in archaeological contexts (in the absence of texts) has already been discussed and is typically assessed in highly relative terms (bulk comparisons based on rough estimates with neighbouring sites). When kilns are present it is possible to gain an idea of firing loads, but the frequency of firings is usually unknown (Rice 2015: 351). For independent specialists, the scale of production is usually limited by such factors as scheduling (seasonality and other tasks that impose constraints on work), efficiency (a measure of technology and output), and the instability of markets/economic forces (demand). Attached specialists under elite patronage are subject to reliable and regular demand for their products and therefore usually enjoy greater stability. As a result, there is a tendency for greater investment in raw materials, technology, and the size and organisation of the workplace.

IVE. Parametric variables and targeted approaches to specialisation

In summary, production types are broadly differentiated in parametric typologies by the intensity and scale of production. The scale of production is based on the amounts produced (total output) and production intensity encompasses the combined inputs of resources, technology (capital investment), and time/intensity (dichotomised between part-time and full-time producers). Craft production (specifically the manufacture aspect) is intrinsically connected to distribution and consumption. Crafting defines social relationships. It is a social and economic process that constructs and consolidates the identities of individuals connected across the entire production system (manufacture, distribution, to consumption). Hence, crafting is a "socially integrating mechanism" that (re)negotiates social networks at different scales from supra household to interregional to supraregional (Costin 1998: 10; Flad and Hruby 2007: 2-3, 7; Niessen 2001; Wengrow 2010). This interplay is crucial for any study on craft production interested in the economic strategies binding society together at different spatial scales (Costin 2001: 277; Chesson 2019: 178).

In Costin's original study (1991), parametric criteria broadened the concept of specialisation to include eight different types of production (Table 2.1). Specialisation was broadly defined as the various ways in which production is organised to promote "extra-household exchange relationships" where producers and households no longer produce all the goods they

consume (Costin 1991: 4; 2001: 276; 2005: 1038; Cross 1993; Flad and Hruby 2007: 3). Specialisation was therefore understood to encompass "many different ways of organising production" and was no longer treated as "a one-dimensional phenomenon" (Costin 2005: 1038). Rice tailored Costin's parameters to cover a list of 13 variables[5] for pottery production and this larger list is still not comprehensive (Rice 2015: 356). If each variable includes 15-20 property states, then Rice calculates 1,307,674,368,000 possible combinations and permutations of production variables. Hence, the futility of matching ancient production systems with "precise present-day analogues" in traditional fixed stage model typologies. The latter usually included less than 10 modes of production (Table 2.1; Rice 2015: 355; David and Kramer 2001: Table 11.1, 11.2).

Rather than using fixed generalised types, Rice (2015: 362, 357-361) calls for more targeted inductive approaches that use the term 'specialisation' with greater specificity and caution. Hence, the appeal of parametric approaches where production is measured across multiple dimensions of variability on sliding scales. The multiplicity of potential production arrangements and the varied forms of material evidence (as well as corresponding methods), has broadened the category of 'specialisation' to such an extent that some scholars now believe the designation is meaningless and has simply "outlived its usefulness" (Smith 2004: 82; Clark 2007: 31). The reluctance to explicitly use the term 'specialisation' is best exemplified by the fact that Costin (2005) dropped the term when she republished her parametric craft production model. The term specialisation is certainly meaningless in the absence of *specificity* (no accompanying explanation on how it has been defined, studied/measured, and operationalised for archaeological datasets).

Arguably, not even Costin's parametric approach is flexible enough to accommodate the full variety of craft production in human experience (and related ontologies), especially when 'ritual knowledge' influences the value of specialised products. The production of ritual products are often very difficult to place on Costin's 'context parameter', which envisioned a continuum with independent producers at one end and attached specialisation at the other (Hruby 2007; Carter 2007; Flad 2007; Spielmann 2002; Cross 1993). Some scholars proposed alternative dimensions, craft categories, and production modes to explain the social role and distribution of ritual goods,

[5] Frequency/scheduling; intensity; remuneration; skill level; number of workers; age, sex, status, and kin relations; degree of labour division or task division; technology investment; kinds and quantities of output; uniformity of output; investment in special space and tools; location, numbers, and spatial proximity; consumers' location, numbers, and spatial proximity

since these types of product often do not fulfil the expectations of either independent or attached production (e.g. Spielmann 2002). It prompts questions over the usefulness of 'attached' or 'independent' specialisation as universally applicable categories and opens up the possibility for alternative 'types' to understand (and complement) this parameter of production. Furthermore, notions of 'independent' production (Costin 1991: 11-12) often presumed that the goods in question were 'alienable' objects for 'commodity transactions', as opposed to 'social objects' that affirm intangible social and ritual bonds (Flad and Hruby 2007: 8-9; Clark 2007).

The various problems with the context parameter were symptomatic of a broader neglect for value(s), meaning(s), and the social role(s) of crafted goods within society (Dobres 2000, 2001, 2010, Clark 2007). These topics were not theorised and incorporated into the original formulations of parametric approaches to craft production. Consequently, Flad and Hruby (2007: 6) add an extra parameter to address this disconnect on "the meaning of production (religious, ritualised, secular, and so on)". They provide rich definitions and critiques of the contrasting roles, meanings, and 'states' of objects within and across societies. For example, they compare and contrast commodities, gifts, prestige/luxury objects, enclave products, utilitarian goods and necessities. Clark (2007: 24) envisions a similar parameter or "continuum of possibilities" based on whether products are first and foremost valued as commodities or gifts. Yet in both cases there is depressingly little guidance on how to apply and differentiate these idealised categories on archaeological material, aside from paying close attention to use, consumption, and "dissimilar distribution[s] in society" (Flad and Hruby 2007: 10-11). Presumably, this is because hermeneutic approaches centred on value and meaning are always highly context specific (require an emic perspective), hinge on "socially negotiated symbolism", and relate to a host of other factors (Flad and Hruby 2007: 11; Hodder 1987a, 1987b). Any emphasis on meaning is invariably problematic when developing general models that are broad enough to cope with the versatility of human experience, yet specific enough to adequately explain human behaviour in a particular context.[6] Thus, an old and timeless debate resurfaces over the use of analogues, what qualifies as an adequate explanation in archaeological discourse, and archaeology's place within the larger division of academic labour (David and Kramer 2001: 33-62; Wylie 1982, 1985, 1989; Hodder 1992).

[6] This tension appears to lie at the heart of Clark's frustration with "current categories of craft specialization" that "are neither general enough nor specific enough to handle interpretive challenges" (2007: 22).

Costin's parametric approach directed greater attention to sociopolitical context, consumer/producer relations, and the role of goods in wider society (despite oversimplifications about the value and social meaning of objects). It pre-empted and no doubt encouraged a growing interest in object biographies and life history approaches (Gosden and Marshall 1999; Rice 2015: 213-14; Blanco-Gonzalez 2014; Clarke 2007a). Simplified notions of 'staple' and 'wealth' finance are not fixed, static, and mutually exclusive categories, as implied by the dichotomised types of output frequently attributed to 'attached' and 'independent' specialists. A key ontological development is the recognition that objects can shift identities throughout their lives and therefore have multiple/different roles in political, social, and surplus economies and arenas of interaction. These roles (and associated values) are not inherent physical attributes or essential qualities and are not always relatable to the original mode of production. Objects can assume various "social roles" that are "contextually dependent and therefore relationships between object "types" and production "types" cannot be assumed" (Flad and Hruby (2007: 2). Artefacts are situated in particular historic settings and understood in relation to the action of agents. Instead of an endless search for the best analogies in a given typology, the aim is to understand the webs of relations between people and things, which may change throughout the use life of an object.

Contrary to Clark (2007), the foregoing discussion on the sociopolitical context(s) of production does suggest that scholarship has wrestled about the social functions and identities of objects. Relationships between producers and consumers were not always presumed, but reflexively considered with regards to changing social and political economies. Clark's reiteration of these issues and rebuttal of formalist economic criteria was not a fresh turning point in research. Calls for greater emphasis on gift giving economies (*the spirit of the gift*) are nothing new and are inspired by developments in economic anthropology. The sceptical 'word smithing' is repetitive, lacks support in actual data, and does little to advance archaeological theory on craft production and specialisation in general (see critique in Costin 2007).

Nevertheless, Clark (2007) is right to assert that unless we understand how knowledge(s), value(s), and meanings are socially constructed, transcribed, and materialised (encoded) in crafted products then any larger discussion on craft specialisation is problematic. Discussion on specialisation usually presupposes answers to such questions and were the weak pressure points in Costin's original formulation of parametric typologies of production. As a result, "most productive analytical work now takes place several levels below" current categories of craft specialisation

(Clark 2007: 22). This is why Clark believes the term specialisation has "outlived its usefulness" in current scholarship (Clark 2007: 31). He prioritises other "topics of greater importance" (kinds of value, the nature of things, personhood, surplus and so forth) and reiterates the need for "an integrated theory of persons, things, actions, and objectification" (Clark 2007: 31-2). Contrary to Clark's self-confessed pessimism, these are not valid reasons or justifications for discarding the term 'specialisation' and abandoning over half a century of scholarship. The verdict is premature and overlooks alternative research traditions that directly focus on craft knowledge and offer a productive way forward (§VII-VIII). Rather than shutting down the entire discourse, the topics Clark has prioritised are still "derived from concerns with specialised crafting" and represent fresh directions in research for a "criminally under-theorized" subject (Clark 2007: 31-2). An integrated theory of 'persons, things, actions, and objectification' is now available and discussed below (§VII-VIII).

V. Confounding influences on the parameters of production

Parametric typologies have formalised consistent terminology and criteria for describing production systems and supply a much needed conceptual framework for studying production. However, there is great difficulty operationalising categories of specialisation and production in the archaeological record. Not all the inputs and outputs of production systems are visible and amenable for study in archaeological contexts. Our vision of the past economy is heavily restricted by the narrow exposures of excavation trenches. Discard behaviour and reuse, site formation processes, sampling strategies, and methods of recovery combine to greatly obscure the visibility of production, or else result in discrete spatial patterning of material that can be confused with activity areas (Costin 2005: 1058-66; Rice 1987: 174; Orton and Hughes 2013: 146). The fundamental problem in any study of production is transcending the "differences in observables" between models based on the ethnographic present and the material residues of the archaeological record (Rice 2015: 354).

Production typologies often prioritised location (household vs separate workshop), investment in technology and consumership as the main criteria for defining types. However, much of this information is either unavailable, distorted, or extremely partial in the archaeological record. There is a heavy focus on the physical settings and spatial distributions of *in situ* production materials (Charlton et al. 1991; Costin 1991: 1-32; Rice 1987: 177). Yet actual workshops and production loci are rare discoveries. No kilns or workshops have yet been found at any medieval

settlement in southern England, or in the whole Vijayanagara kingdom of southern India, despite the presence of high fired ceramics that attest to their existence (Orton and Hughes 2013: 146; Ur 2010: 34). In the southern Levant, no *in situ* pottery workshop has been found for the entire Chalcolithic period, only one kiln was found dating to the Early Bronze Age, and the earliest complete (*in situ*) potters workshop dates to the Late Bronze age at Tell Lachish (Magrill and Middleton 2004). Wattenmaker (1998: 53) believes the "paucity of workshops" so far identified in the ancient Near East is partly because "archaeologists have traditionally neglected houses and site suburbs, where much craft activity may have taken place".

VI. The standardisation hypothesis

In the absence of direct evidence of manufacture, studies of production rely on the standardisation hypothesis. Production groups and the scale of manufacture are identified by assessing the degree of product similarity (Arnold and Nieves 1992: 93; Costin 1991: 32; Cross 1993: 70-1; Rice 2015: 365-7). Standardisation is often closely associated with economic intensification and mass manufacture by specialists. For example, Peacock associated standardisation with the 'nucleated workshop' and 'manufactory' (1982:9). Similarly, Van der Leeuw associated product standardisation with 'village industry' (1984: 756; Table 2.1). In 'specialised systems', smaller groups of producers make product for a broader array of consumers (Costin 2015, 1991: 3-4, 32; Flad and Hruby 2007). The reduction in the number of producers generally results in less product variability derived from individual decisions (and preferences) on form and function; unconscious motor habits (routinised behaviours and formalised techniques); and access to raw materials (Costin 1991: 32; Rice 2015: 363-7, 1991, 1981; Peacock 1982: 121-22; Roux 2003a). Skill and motor habits mastered and internalised through habitual repetition and the routinization of tasks causes a significant reduction in variability (Roux 2003a). Materials and morphologies of specific types are therefore expected to be far more uniform among intensive (high-rate) producers, with a possible exception made for attached specialisation where prestige items are often tailor-made to individual elite consumers (Kotsonas 2014: 12). Such product uniformity is generally (and widely) associated with a more streamlined production process pressured by "efficiency" and "a shift toward increased rates of production" (Harrison 2011: 282).

Ethnographies on Mexican potters have observed that conservatism increases in unstable economic environments, resulting in a reluctance to depart from known (tried and tested) procedures and resources (Arnold and Nieves 1992: 93-5; Kotsonas 2014: 12). Whether this

observation is relevant for other pottery producing societies invariably depends on the socioeconomic context. Rice (2015: 363-4) conceptualises production as a process of "variety generation" and consumption as a process of "variety selection" and together they "create cultural patterns distinctive of different socioeconomic arrangements". Relevant attributes *must* be selected for measurement, since not all traits vary in response to production organisation and economic intensification (Rice 1991: 275; 2015: 366).

At this point, the literature on the standardisation hypothesis branches (bifurcates) between the general and the specific (David and Kramer 2001: 303-59). Some studies seek to establish *specific* indexes for measuring variability in select attribute(s) considered to be sensitive (whether implicit or explicit) to the needs and aims of the standardisation hypothesis (e.g. Roux and Corbetta 1989, 2003a, 2011). Other studies are more general, but tend to rely more heavily on ethnoarchaeology to stress the complexity of the relationships involved in production and specialised systems (e.g. Arnold and Nieves 1992; Longacre 1999; Stark 1995). Such studies typically conclude by emphasizing additional factors that promote standardisation (and even specialisation) in addition to (and often irrespective of) intentional economic intensification. For example, homogeneous products can be linked to any number (and combination) of factors, such as the nature of the raw materials (Reedy 2008: 156; Costin 2000: 385-9; Arnold 2000); function in a particular sociocultural context (Arnold and Nieves 1992: 101-2; Fowler 2015: 105; Kotsonas 2014: 15); the use of simple tools and methods of measurement during production (Arnold and Nieves 1992: 100); the scope of variability in specific manufacture techniques (Arnold and Nieves 1992: 108-9); consumer expectations/preferences coupled with fluctuating consumer demand (Arnold and Nieves 1992: 109, 111; Longacre 1999: 49; Underhill 2003: 262, 265); and the meaning(s)/values underlying the variability in certain kinds of 'active' style involved in 'information exchange' (Sackett 1990: 36; 1977: 321; Hodder and Hutson 2003: 3; David and Kramer 2001: 189-93). The list goes on.

The overarching message is essentially always the same in that any study applying the standardisation hypothesis must *justify* the links, address the problem of 'equifinality', and not just assume any of those relationships (between the attributes being measured, how they are measured, and the organisation of production) (Kotsonas 2014: 12). Arguably, 'good archaeology' has not changed in that it has always sought to do this by questioning (and investigating) the 'common sense' assumptions from the perspective of the interpreter (Johnson 1999, 2010). The aim has

always been to strengthen and justify a specific interpretation (and convince an intelligent audience), in view of numerous possibilities (*known and unknown)*, with due respect to the richness and diversity of human experience. Arguably, most social sciences have this issue in common (to a greater or lesser degree), but unlike most social sciences, archaeology has to address this issue through diverse datasets derived from the surviving material residues of past activities (an epistemological and ontological gordian knot).

At present, types and wares are usually based on the properties of pots that are most susceptible to change and idiosyncrasy. The surface finish, size, and shape of a vessel can have "infinite variation" in low fired assemblages, with little to no relevance for identifying producers (Barlow 1991; Merrillees 1991: 238). Conventional typologies (based on shape and decoration) are sensitive to chronological and functional concerns, but are problematic when the goal is to identify production groups. Orton had little success using conventional typologies to identify production groups when working on ceramic material from the medieval site of Novgorod, Russia (Orton and Hughes 2013: 147). The same pottery type can be emulated and manufactured in different ways by different producers. On the one hand, types are useful for defining cultural frontiers between groups, establishing relative chronologies, and meeting the classification needs for an assemblage of a specific site and period. However, they can become 'conceptual straightjackets' when attempting to understand craft production from 'an anthropological angle' (Roux 2011: 80).

Ceramics vary in all sorts of ways and there are all kinds of qualitative and quantitative techniques available to measure variability for a given attribute (Hunt 2016; Michelaki 2007; Orton and Hughes 2013: 147). Advances in archaeometry have greatly expanded the number of instruments for source finger-printing, compositional, and structural characterisation (geochemical, mineralogical, and radiographic techniques) (Berg 2008; Earle 1999: 611-14; Greene et al. 2017; Tite 1999). New digital morphometric approaches have greatly enhanced formal analysis, such as 3D laser scanning techniques that can measure variability in complex metric variables through automated capture and mathematical curve fitting routines (Karasik and Smilansky 2008; Orton and Hughes 2013: 15; Sholts et al. 2012). The relevance and utility of different artefact attributes/properties, instruments, and methods are much debated when addressing production organisation and have generated a large and extensive body of literature (Arnold 2000; Blackman et al. 1993; Roux 2003a). The challenge is to ensure that the forms of

variation being measured are theoretically well grounded and are responsive to the specific behaviours and economic pressures that are the real target of study. Models of human behaviour (in this case models of production) must correspond with variability in the traits being measured. Confidence in this relationship is derived through rigorous and directed 'actualistic' research in guided ethnographic and experimental studies.

VII. Anthropological approaches to the study of prehistoric technology

Studies on craft production require a coherent approach for bridging the above theory on craft production (parametric production typologies and the standardisation hypothesis) with the material residues in the archaeological record. Only then can the analyst overcome the aforementioned difference in 'observables' between the 'statics' in the archaeological record and the 'dynamics' of observed human behaviours (Johnson 2010: 59, 128-35). Why and how does variability in the specific traits (and properties of artefacts) being measured articulate with the social landscape, the larger economic picture, and societal change?[7] Archaeology is essentially the study of patterned human behaviours across space and time through the study of artefact variability (Schiffer 1992: 7). Therefore, it is critical to effectively describe and explain sources of artefact variability, showing how and why artefacts (and properties of artefacts) vary within and between societies (Skibo and Schiffer 2001, 2007).

The Francophone Anthropology of Techniques school provides a well-established theoretical framework for understanding behavioural change through artefact variability. This school is also known as the French school of comparative technology (*technologie culturelle*) and is centred around the Musee de l'Homme and the Techniques et Culture team under Creswell at the CNRS in Paris (Creswell 1976, 1983, 1993, 2010; Gosselian 2011: 245; Roux 2013: 27-8; Roux 2016; Naj and Douny 2009). The Anthropology of Techniques developed from a commitment to an explicit ethnographic comprehension of technology and material culture ordinarily neglected by cultural anthropology (Gosselain 2011: 245; Tostevin 2011: 354-5; Roux 2013: 27-28). Artefact variability and materiality is approached from the perspective of 'performing bodies' that are conditioned by interrelated social fields/spheres of activity. Participation in these social spheres not only guides technical practice/behaviours for the activities in question, but they define identity and group boundaries. Through extensive research it rapidly

[7] At best, appeals were made to *ad hoc* ethnographies rather than proper testable models.

became apparent that technology and 'technical practice' (the patterned process of making) has 'style' that reliably correlates with social groups and identity in ways that traditional stylistic attributes (decoration and form) simply never did (Lemonnier 1992: 7-8, 96-101; 1989: 156; Pfaffenberger 1992; Martinón-Torres 2002; Dobres 2000).[8]

VIIA. Why the patterned process of making has an identity dimension

Ethnological case studies range from cooking soufflé and New Guinea pig traps to stone axes, waterwheels, and industrial aeronautics (Creswell 1993; Lemonnier 1992; Roux 2013: 27-8; Schlanger 1994). In every instance, there is rarely if ever a single best technological solution, since there is always latitude for arbitrariness and variability in how techno-functional questions are resolved. This latitude provides a channel for social conventions, habits, and representations that are derived from other social fields of activity, to influence the artisan's decision-making for the technical features in question (Gosselain 2011: 246; Lemonnier 1992: 7-11). The net-effect of these discursive influences is to form a distinctive *habitus*[9] of technological practice. When approached from this perspective, manufacture (and technology as a whole) is *both* a "technical process" guided by the "functional requirements of the user" and a "socialization process embedded with meaning" that may (or may not) be actively manipulated by the artisan (Fowler 2016: 471; Gosselain 2008; Dobres 2001; Lemonnier 1992; Roux 2013: 27; 2016; Creswell 2010; Naj and Douny 2009: 423-4; Hegmon 2000: 131). Here in lies the central unifying link in 'French intellectual heritage' that extends back from the likes of Creswell (1976, 1983), Bourdieu (Bourdieu 1977), and Leroi Gourhan (1943, 1964, 1993) to Marcell Mauss (1935, 1992) in the early 20th century (the golden age of early social scientific thinkers with the likes of Emile Durkheim, Karl Marx, Max Weber and so forth.).[10]

The hallmark publication of *Techniques of the Body* (Mauss 1935, 1992) firmly established that basic bodily movements, postures, and gestures (ways of digging, ways of walking, eating habits, sleeping habits, bathroom habits etc.) are not universally shared, but are learned socialised actions conditioned by social tradition (Mauss 1992: 460, 465-70; Lemonnier 1992: 1, 3; 1989: 156). It follows then that the transformation of "natural matter" into "cultural product" through a

[8] Hence Lemmonier's frequent criticism of Hodder and the 'Cambridge School' (1989; 1992).

[9] The shared, unconscious skills, tastes, memories, and knowledge that provide coherence, order, and structure to everyday life and are reinforced by repetition (Rice 2015: 213-13; Bourdieu 1977).

[10] This French intellectual tradition has progressed directly from tutor to pupil in Paris (Durkheim taught Mauss, who taught Leori-Gourhan, who taught Creswell and others currently at the CRNS).

successive series of techniques is (and must be) stylistic and thus, embodies (and materialises) aspects of the social world in which those particular set of techniques were conditioned, learnt, and mastered (hence *fait social total*) (Mauss 1992: 458; De La Fuente 2011: 225-6; Dobres 2000). Leroi-Gourhan's contribution (a student of Marcell Mauss) was essential in this regard. He spent most of his career applying the study of bodily techniques to the study of prehistory and in doing so, pioneered *chaîne opératoire* research (1943, 1964, 1993; Audouze 2002). The term *chaîne opératoire* is occasionally translated 'operational chain/sequence' or 'production sequence'. The original French term is often preferred, since the nuance refers to operations "enchained" to other social spheres/fields of activity that condition production (Lemonnier 1992: 25-26; Bar-Yosef and Van Peer 2009: 105; David and Kramer 2001: 140; Fowler 2008: 481).

Leroi-Gourhan considered tools as inseparable from the gestures (and bodily techniques) used to wield them and early in his career had devised an elaborate classification (4,000+ entries) of technical processes, based on the different types of "action on matter" (Leroi-Gourhan 1943, 1945). He established a fundamental distinction between technical tendencies that were considered universal (*la tendance technique*) and particular 'degrees of fact' (*les faits techniques*) distinctive of specific ethnic/social groups (Leroi-Gourhan 1993: 283; Audouze 2002: 282-6; Schlanger 2005: 27). The broad distinction between the universal and the particular is echoed in Lemonnier's discussion of 'strategic' and 'flexible' operations in a production sequence. Flexible operations are prone to greater variation and cultural idiosyncrasy as opposed to strategic ones, which are universal and constrained more heavily by 'natural law' (Lemonnier 1992: 21-3; Schlanger 1994: 144). This distinction is emphasised again in Roux's 'two level' description of potting *chaînes opératoires*: 1) the universal generic stages of pottery production defined by object physics; and 2) the specific techniques used and distinctive of a particular potting community (Roux 2016, Chapter 4 §1).

Leori-Gourhan's focus on techniques was a significant turning point compared to the usual ethnological classification of listing tools by type. Techniques were (and are) classified as combinations of "gestures and tools organised in sequence by a true syntax which gives the operational series both their stability and their flexibility" (1993: 114, 230, 234; 1964: 164). This close attention to *gesture* enabled Leroi-Gourhan to relate the properties of materials (and tools) to performing bodies and was the unifying principle that allowed him to extend Mauss's insights

on *Techniques of the Body* to material culture and the archaeological record (de la Fuente 2011: 225; Audouze 2002; Miller 2007 : 30).

VIIB. The technical system

The main goal of traditional Francophone ethnography was (and still is) to track the arbitrary webs of relationships connecting various tools, materials, knowledges, and actions in the study of techniques. These arbitrary 'webs of relationships' channel patterned behaviour and coalesce to form a "technical system", which has a particular configuration for a particular social group (Coupaye 2009; Gosselain 2010: 197-8; 2011: 246; Lemonnier 1992: 51-77). An intrinsic property of any technique is its *interrelatedness* in the technical system, since a technique cannot be isolated or detached from the social world in which it is practiced and shared. This is the quintessential difference between the *chaîne opératoire* and other productive sequence studies in the "Americanist" tradition that prioritise function from an etic perspective, for example, behavioural chains and reduction sequences (Tostevin 2011; Skibo and Schiffer 2001, 2008: 11-12). Hence, David and Kramer's criticism of Schiffer's 'behavioural chain' where the artisan is treated as an "engineer-handyman" preoccupied with "the weightings of performance characteristics" (2001:141).

The interrelatedness (or 'systemness') of techniques empowers the *chaîne opératoire* to provide a "research frame" that can potentially embrace "the investigation of past society as a whole" (Mentesana et al 2015: 2).[11] Comparable claims are not (and cannot) be made by other more narrowly defined types of productive sequence studies, which are usually less interested (if at all) in the larger links between technology and society. Such studies do not have the same expansive and holistic scope and are more restricted to certain artefact types and subfields, such as reduction sequence in lithic analysis (Tostevin 2011: 363; Schlanger 2005: 25, 29; Martinón-Torres 2002: 37-8; Dobres 2000: 168; Skibo and Schiffer 2008: 11). Every technique and stage of manufacture in a *chaîne opératoire* (regardless of the technical practice under study) is an avenue

[11] From the perspective of the 'French School', the argument for extending the *chaîne opératoire* to encompass the entire use life (e.g. Roe 2009: 85; Skibo and Schiffer 2008: 20) is nonsensical. Such arguments misunderstand (or else reject) the concept of the 'technical system' and how the *chaîne opératoire* is used in the Anthropology of Techniques. The *chaîne opératoire* remains "the most known and misunderstood notion in anthropology" (Naji and Douny 2009: 414; Gosselain 2011:245-6).

for investigating subjectivity, stylistic expression, and the society within which the act(s) had meaning (Martinón-Torres 2002: 30; Pfaffenberger 1992; Fowler 2016: 471).[12]

VIII. Social network influence on technical knowledge in potting traditions

The Anthropology of Techniques school had a formative impact on ceramic analysis through Gosselain's early work on 'technical practice' among the Bafia of Cameroon in West Africa (1992; 1998; 2000; 2002; 2010). His work on 82 potters from twenty-one ethnic groups drew attention to both the diversity of forming techniques and the countless ways of combining different techniques in a production sequence. Manufacture was not monolithic, divested of meaning, or locked on a linear path forced by mechanistic adaptations to environmental pressures and performance characteristics. Rather the choice of manufacture techniques was influenced by a rich constellation of community values and social conventions. The resulting production sequence, when mapped out using the *chaîne opératoire*, consistently distinguished between different potters and social groups.

The Ceramics and Society Project[13] identified reasons for this technical stylistic variation between potting communities. The project documented techniques that connect various stages of pottery manufacture with other 'domains of behaviour' and social fields of activity related to the nourishment, treatment, and care of the human body (Gosselain 2002: 199-211; 2010; Fowler 2016: 474). Identical tools, gestures, and operation sequences are attested in different contexts of production and relate diverse activities in everyday life, such as bread making and clay processing techniques. How the body is fed, decorated, clothed, and cured/healed determines membership in a particular social group and a way of being in the world. These conventions also structure and pattern discursive knowledge systems, such as the technological knowledge embodied in making an acceptable everyday pot.[14] Technical knowledge, manufacture, and identity are therefore

[12] The classic dichotomy between function and style is wholly misleading for the above reasons. The preceding (and following) discussion clearly shows that 'function has style', 'style has function', 'style has meaning', and 'meaning has function' (Hegmon 1998: 265).

[13] Harmonised data on 650+ potters from over 72 linguistic groups across sub-Sahara Africa (Gosselain 2000:194-5).

[14] If these conventions are conscious in the mind of the potter then the influence(s) in question may have arisen through "inspiration" from "activities unrelated to potting" and is not uncommon (Fowler 2016: 474). From a biocultural perspective, these discursive knowledge systems likely have a role in facilitating and shaping adaptive success and Darwinian fitness. They make patterned techniques 'generalizable' and coherent with previous experience, in order to innovate and solve basic life problems related to the health and provision of the physical and social body. The scale at which this occurs in the human primate clearly differentiates us from other tool using primates.

inseparable and involve an active process of recurring negotiation, which is fed by exposure to diverse social practises experienced over the lifetime of an individual (Gosselain 2008: 176; Hegmon 2000: 130-2). The "interrelatedness" of activities in everyday life and how it constrains potting is surprisingly "little explored territory in ceramic ethnography" (Fowler 2016: 474). Although promising work on 'taskscapes' is beginning to open up a direction for current and future studies on multi crafting and task symbiosis (Ingold 1993; Logan and Dores-Cruz 2014).

The term 'sociotechnical aggregate' was coined to describe the sum influences of the social world on technical choices and potting behaviours. The process of manufacture intersects with both the material and the social landscape and is therefore a 'fully stylistic phenomenon' (Gosselain 1998: 82; 2000: 190). Production sequences incorporate diverse social and technical influences of diverse origin and the overall combination ('the technical system') is always distinctive for a given social entity. This is why a 'techno-stylistic analysis' of the production sequence (the *chaîne opératoire*) is such an effective ethnological approach for identifying production groups and understanding the dynamics of pottery producing cultures. How technical and stylistic variability in potting intersects with the social landscape is far from random. These dynamics have been extensively modelled by African case studies investigating the stability of potting traditions, with a focus on the learning/transmission process (augmented by additional projects in India, Mexico, and the Philippines).

Certain stages of the production sequence (and therefore certain technological features of a pot) are demonstrably more prone (exhibit a greater *tendency*) to change than others and are affected by different social spheres that vary according to size, magnitude, and composition (Gosselain 1998: 102; 2000: 189; Fowler 2011: 196-99; 2016: 473-4). Using harmonised ethnographic data on the spatial distribution of potting techniques, Gosselain (2000, 1998) was able to show that smaller networks of people influence more complicated, technical, and inflexible tasks of manufacture (the African pottery production model). He devised a tripartite classification of potting techniques that has now become a working ethnographic model in ceramic analysis, for investigating "social network influence on technical knowledge" (Fowler 2016: 481):

1. Decorative techniques are the most visual, public, and technically malleable (or least difficult) category of techniques. The distributions of these techniques are characterised by constant fluctuations and rapid diffusion, as exemplified by the spread of rouletting

across large parts of sub-Saharan Africa (Gosselain 2000: 197-208). These techniques are sensitive to the predilections of large diverse groups of people and express the more situational, fleeting, and superficial aspects of identity (Fowler 2011: 196).

2. Tempering and firing techniques involve technical behaviours influenced by a far more restricted group of people (other potters, neighbours, and family members) and therefore have a far more restricted spatial distribution. These techniques materialise more local and regional networks of social interaction (Gosselain 2000:192; Fowler 2016: 481).

3. Fashioning techniques are unique in the production sequence since they rely on sensorimotor habits and specialised gestures internalised over time through constant guidance provided by the master potter(s) (Gosselain 2000: 192; 2010: 208-210, 214; Fowler 2011: 198; Roux 2016). Fashioning is learnt on an individual basis and does not involve collaboration in a public setting. The skill is sheltered from public view and is therefore less open to 'borrowing' and emulation. Furthermore, subsequent techniques in the production sequence obscure and eradicate evidence of the vessel fashioning. In this case, it is not only the most technically challenging stage of manufacture, but it is the least visible. In southern Cameroon, despite the diversity of fashioning techniques among the Adamawa-Ubangi and Bantu people[15] potters were oblivious to the existence of alternative techniques and insisted there was only one way to shape a pot (Gosselain 1998). When plotted regionally, shaping techniques and/or methods often coincide with the most enduring facets of social identity, such as social status, linguistic boundaries, and kinship boundaries (Fowler, 2008, 2011, 2015; Gosselain, 1998:92; 2000:192–193).

VIIIA. Technical knowledge part 1: motor habits and apprenticeship

Assumptions about knowledge and technological choice underpin every explanation of technology, craft, and technological change (Schiffer 1992: 45; Dobres 2000; 2001). Technical knowledge is acquired through apprenticeship and explains how and why an artefact gained

[15] A minimum of 14 functionally equivalent techniques were identified in one study.

specific properties and traits in the course of production. The above pottery production model highlighted the significance of shaping/fashioning techniques in the learning process. In every ethnographic case, the true moment of apprenticeship commences with learning the fashioning techniques (the 'roughing out'). This requires a long and intensive period of training to develop and consolidate the requisite muscle memory. A ten year period of learning is considered "the golden rule for mastering any category of motor and/or cognitive activity" (Roux 2013: 23).[16]

Vessel fashioning is the only stage in the production chain that is not reliant on flexible, transposable, and generalisable techniques/skills that are linked with (or appropriated from) other social fields of activity. The motor habits are specialised and physically embody a task specific skill anchored or 'scaffolded' by muscle memory. These motor habits take time and repetition to internalise and establish. Mastery of the shaping stage therefore marks an important transition in the learning process from 'legitimate peripheral participation' to expert and requires intensive one-on-one tutorship to 'internalise' the specialised gestures (Gosselain 2010: 208, 212). It is the only step in the production sequence that is completely reliant on specialised hand gestures without chemically transforming the clay (nothing physically added or subtracted from the actual clay itself). Ethnographic observations of New Delhi potters indicate apprenticeship should start at a young age (8-10 years in the Khumar caste) when sensorimotor habits are more pliable and specialist skills are learnt with greater ease (Roux and Corbetta 1989: 28, 69). When apprenticeship is postponed and occurs later in adult life, learners struggle to hone and perfect the requisite sensorimotor habits associated with shaping. Older apprentices are usually limited to forming less technically challenging vessels as a result (simple geometric shapes no greater than 20 cm in height).

Rice (2015: 212) states "the conservative force of motor patterns is most significant in forming vessels" and involves "a highly coordinated set of movements learned by experience over a long period". The scope and *tendency* to innovate and experiment with fashioning techniques is demonstrably far more restricted/constrained when compared to the *tendency* to innovate with other stages of production, such as decorative techniques and tempering strategies (as shown in Table 2.2). The choice of clay processing and/or decorative techniques can usually be substituted

[16] Other stages in manufacture do not rely on task-specific motor habits and are therefore more open to influence from innovation, alternative techniques, new ideas and values that can channel in from the surrounding social context (Gosselain 1998: 102).

for other techniques with far greater ease (they are 'transposable' and more easily transmitted), thus there is a greater tendency to innovate with these stages of production. These steps in the production chain also have far greater visual (and tactile) impact on the finished vessels and are more readily effected by consumer preferences. Thus, much larger social networks/groups of people influence the choice of techniques at these steps/stages in production when compared to the shaping/fashioning stage.

Unlike other steps in the potting *chaîne opératoire*, shaping/fashioning techniques are not transposable or generalisable. No technical transfers link it with other activities and routines are reliant on the strength of muscle memory. Hence, the acquisition of specialist motor habits acts as a real barrier to transmission of shaping/fashioning techniques outside of a given community of potters, who are linked by direct transfer of technical knowledge. Other stages in the production sequence are more prone to change in post-learning environments because they are usually performed in public, influenced by larger networks of people, and the tasks in question are less complicated and more flexible or 'malleable' (Gosselain 2000; Fowler 2008; 2011).

Studies on learning in experimental psychology point to 'bio-behavioral rules' that influence how task-specific skills are shared and transmitted between individuals (Roux 2016: 102). Throughout apprenticeship, learners build and establish a series of specific 'mental templates', 'mental representations', or 'schemas' on the right way to make a given object, especially during the active learning process (Roe 2009 : 83-4; Roux 2011; Bril 2002a, 2002b). Schlanger (2005: 29; 1994) describes "a structured and generative interplay between mental and material possibilities, involving planning and decision-making as well as more tacit and routine reactions" (i.e. a situated action/practice). Novel experiments using a position emission tomography scanner to measure brain activity show that when knapping a complex stone tool like a hand axe, parts of the brain used for language, abstract thought, and hierarchical organisation are active and consistently light up (Normille 2012).[17]

The schemas (or whatever you want to call them) are flexible conceptions of a prototype or design in the mind of the artisan. They are established and reinforced through repetition and as a result, it is very difficult for the individual to envision and make objects using task-specific skills

[17] The results suggest that a brain capable of making complex stone tools was also capable of language and abstract thought. The evolution of language and complex tool making behaviours may have been co-dependent.

in a contrary way to the method(s) and technique(s) they were originally taught. This would explain why potters *tend* to stick to the task specific fashioning techniques they were originally taught and rarely modify or change them over their lifetime. The latter happens only under rare conditions of stress, such as, when the potter embraces a foreign social context (post-marital re-socialisation) (Gosselain 2000: 192; 2008). Forming techniques are highly stable and unlikely to change in post-learning environments, thus maintaining tradition in potting communities (Rice 2015: 212; Fowler 2016: 476-7).

VIIIB. Technical knowledge part 2: the boundedness of technical knowledge

Technological boundaries often conform to potting communities and social group boundaries because apprentices learn from tutors, who belong to the same social circles (Gosselain 1998: 94, 101; Roux and Corbetta 1989: 28, 69). All individuals learn 'the right way' to act in a community and make things a certain way according to pre-existing ideas about how things should be and what is appropriate in terms of resources, tools, and techniques (Fowler 2008: 485; 2011: 180). What potters actually do and how they make decisions is thoroughly embedded in the wider process of being a community member. Regardless of the craft under study, learners gradually acquire their knowledge and skills through active participation in 'communities of practice' (Lave and Wenger 1991; Ingold 2000; Gosselain 2008; 2010; Roux 2011: 82).[18] Learners progressively construct (or perhaps reinforce) a social identity over the course of apprenticeship through their interactions, shared practices, and experiences with the group in everyday activities. Consequently, the learner's self-image and identity is shaped by the distinctive behaviours and beliefs of the group, within which learning has taken place. These communities share and participate in a specific combination of habits, techniques, and specialised gestures that usually relate to a set of discourses/beliefs about the wider world (Gosselain 2008). The outcome is a distinctive 'sociotechnical aggregate' that can be materialised by the *chaîne opératoire* (Gosselain 1998).

Technical traditions are therefore a powerful force on the individual and embody an inherited way of making vessels particular to a specific community. The potter actively *affiliates* with this community/social sphere upon which their very social identity is built and negotiated

[18] Such studies are opposed to the passive, disembodied, and mechanical views of learning and cognitivism prevalent in traditional psychology that primarily centred on the individual. Instead, learning is conceived as "a continuous construction" and involves an ongoing dialectic between people, situation, and context of activity" (Naji and Douny 2009: 413; Ingold 2000, 2001).

(Roux 2016: 103; Fowler 2016). This is why there is "meaning in the making" and the choice of techniques is not simply a case of the individual potter cherry picking what is perceived to be 'the best' technique(s) from a sterile menu of different functional options (Berg 2007; Dobres 2000, 2001). Such a view represents 'the Standard View' and was widely rejected following extensive critiques by phenomenological and agentive perspectives in archaeology.

The concept and power of tradition emphasises continuity in the learning and mastery of the craft and encompasses "specific and general knowledge" that underpins manufacture and situates the potter in space and time (Gosselain and Livingstone Smith 2005; Fowler 2016: 471-2). It provides a crucial frame of reference not only for the execution of a set of mundane tasks (e.g. making an ordinary pot), but for experiencing, understanding, and reproducing the social and cultural world in which the potter inhabits, dwells, and participates ("the production and reproduction of everyday life") (Schlanger 2005: 29; Dobres 2000; Gosselain 2011: 249). By "acknowledging shared behaviours between themselves, their elders, and ancestors" this frame of reference acts as a filter and simplifies great complexity. Hence, tradition determines "what is perceived as the range of possibilities open to potters" and therefore shapes/constrains technical choice (Fowler 2016: 472).

Potting traditions are clearly not static, homogenous, totalising forces that crush individual agency (the usual complaint against any approach vaguely associated with 'total social facts'). Technological boundaries are subject to non-random flux and how they transform/evolve across space and time (in relation to the definition of social networks) was modelled for pottery production and summarised in Table 2.2. The beauty of the aforementioned pottery production model is that it shows how potting choices in a given tradition are negotiated, "framed and contextualised by multiple constraints" to produce *tendencies* in the patterning of different potting techniques (Rice 2015: 212; Bleed 2001 :159). These tendencies generate testable expectations and replicable patterns at different spatial scales (intra-, inter-site, regional) showing the relationship(s) between production sequences (or its components) and potting communities. The model does not claim to be 'universal', but provides a basis for examining "the intersection of ethnographically identified constraints on pottery making" in past societies (Fowler 2016: 481). The findings continue to promote ever greater interest and focus on the significance of 'technique', which promises a deeper 'anthropological' understanding of ceramic assemblages to complement

conventional fabric analyses and typological, morphological, and decorative studies (Berg, 2013; Lemonnier, 1992; Roux, 2011; Ross et al. 2018).

In archaeological contexts, we may never fully understand the elaborate webs of discursive influences acting on production, or the various interconnections that existed with other activities conditioning technical behaviours.[19] Our view of 'the technical system' is invariably incomplete and pales by comparison to the privileged access enjoyed by cultural anthropologists. Yet techniques amount to more than just action on matter to make usable objects. They incorporate and internalise social norms through embodied performance to navigate ontological boundaries between self, us, and other (Naji and Douny 2009; Dobres 2010). Consequently, the spatial and temporal distribution of techniques, especially fashioning techniques, are "powerful chrono-cultural markers" (Roux 2016: 103). They are a sensitive indicator of group boundaries, social networks, and identity in the archaeological record. At the very least, potting communities can be reliably differentiated through classifying the diversity and distribution of techniques, especially fashioning techniques, identified on an archaeological assemblage.

This new direction in stylistic analysis extends well beyond the materiality of conventional object-centred approaches to explore how craft production is organized and structured by technological choice, the social context of learning networks, and the "way potters configure themselves as individuals participating in society" (Santacreu 2014; Dobres 2000, 2001). The theoretical framework (and ethnographic model) is well developed for conceptualising and explaining the dynamics structuring pottery production. The ongoing challenge is how to apply it to the archaeological record and operationalise its study in archaeological contexts. As stated in the introduction, the methodological challenge is how to distinguish tools, materials, gestures, and techniques and discern the sequence of operations on an archaeological sherd assemblage.

VIIIC. Classifications of fashioning techniques and actualistic research

The study of forming techniques brought into sharper relief a set of challenges for stylistic analysis and the identification of production groups (Schlanger 1994: 143; Van der Leeuw 1994; Soressi and Geneste 2011: 336). These challenges centre on how to identify intangible manufacture techniques based on surviving material residues of the finished product. These

[19] Ingold's concept of 'taskscapes' conceptualizes multiple overlapping productive activities which archaeologists separate out and study in relative isolation from each other. There is also growing interest in multi-craft studies, as well as the traditional concern over scheduling and seasonality.

products are usually broken, damaged, and warped by use, lateral cycling, and taphonomy, before they enter the hands of archaeologists. The application of *chaîne opératoire* research to past societies was understandably delayed by impoverished datasets, no means of direct observation, and the paucity of production loci.

This new direction in technological style is still in its infancy in ceramic analysis due to a limited understanding of the material signatures indicative of forming techniques and the host of variables that impact the visibility of manufacture marks. Stylistic research on vessel manufacture has to consider the varying effects of the clay water system, firing strategies, the form/shape of the vessel, and the ingredients in clay recipes, which all contribute to the uneven expression of technological markers. Hope (1987: 105) warned of a multitude of factors in the making process that can imitate, exaggerate, and confuse characteristic manufacture marks. He emphasised the need to work closely with trained potters to clarify physical features in actualistic research.

Subsequent potting experiments by Roux and her colleagues (Roux and Corbetta 1989; Roux and Courty 1995, 1998) has shown that different technical gestures can generate similar looking surface attributes. Conventional attributes considered typical of wheel-throwing were found to be misleading and associated with at least four additional modes of wheel-shaping techniques. Experimental replicas were studied with reference to specific deformations of the clay paste under controlled mechanical and hydric constraints. They combined different scales of observation (macro, micro, and sub-micro) to identify distinct structural changes in the clay material, which were found to directly relate to primary forming compression forces (e.g. coiling, wheel-coiling, and wheel-throwing). Distinct surface features and the organisation of temper particles and voids were grouped into a typology designed to identify forming techniques (see Table 3.1 and Fig. 3.6). This shaping typology (as well as the research design) has been repeatedly applied to assemblages across the Near East and the Mediterranean world, in order to classify techno-stylistic variation (Baldi and Roux 2016; Berg 2007; Jeffra 2013).

Roux's ethnographic work and field experiments on apprentice potters in New Delhi reinforced a general acceptance that specialisation is associated with the use of the pottery wheel (Roux and Corbetta 1989; Roux 2003a; 2003b; 2009). This linkage is attributed to the long and intensive training (and supposedly continuous practice) needed to acquire and maintain task specific perceptual motor skills. Both wheel-shaping and wheel-throwing require strong stable forearms, application of constant and regular pressures, bilateral movements, and a heightened

degree of control over the gestures of each arm; two-handed complementariness and two-handed associativeness (Roux and Corbetta 1989: 67-8). Multi-staged field experiments demonstrated a direct connection between these technical abilities and dimensional standardisation in the regularity of vessel walls and the absolute size of the vessel (height, diameter, thickness) (Roux and Corbetta 1989: 71-84; Roux 2003). Observations were tested in multiple cultural contexts across Spain, the Philippines, and India to ensure that this skill based definition of specialisation was/is truly transcultural and based on universal bio-mechanical constraints. The overarching conclusion was that only specialists are in a position to learn, practice, and master the wheel-shaping and wheel-throwing technique, regardless of cultural context.

Roux and her colleagues ('the Paris school') were among the first researchers to systematically investigate the variables involved in the study of vessel manufacture, but they focused primarily on the pottery wheel. An understanding of the ceramic markers for technological features is still largely underdeveloped. Other hand-built methods such as coiling and moulding are poorly understood, yet encompass a considerable array of techniques. Arguably, progress in this direction was stifled by how 'technical specialisation' had been defined in relation to the pottery wheel (the proxy used for studying the origin and development of pottery specialisation).

VIIID. Technical specialisation reconsidered

Roux's skill based approach to specialisation contrasts with Costin's broad economic definition, as simply any mode of production that involves extra-household exchange relationships (Costin 1991, 2005). In this respect, it is no surprise that vague economic definitions of specialisation have allowed the term to drop out of common usage, with fine distinctions no longer kept between craft production and specialisation *except* by those focusing on skill. It is widely known that economic intensification does not necessarily correlate with task-specific motor habits or skill level. A "clearer terminological separation" must be made between economic specialisation and technical specialisation (i.e. potters' know-how and skill) (Rice 1991: 265). Peacock's original typology confused the two by assuming a direct one-to-one relationship between economic expansion and technical expertise. Handmade vessels and open firings were generally considered low-rate and non-specialised, in contrast with wheel made and kiln fired potteries. Roux does not confuse technical with economic specialisation (she focuses purely on the former), but the overall outcome is the same. Specialisation is foremost defined by use of pottery wheel technology and

handmade techniques are neglected and do not receive the same treatment (essentially dismissed as a fairly homogenous category characteristic of non-specialised production).

Roux's original comparative study of the potter's wheel did not subject coiling techniques to comparable scrutiny (1989; 2003). The aforementioned ethnographic research by the Ceramic and Society Project found that specialised gestures and psychomotor habits were not unique to the use of the wheel, but encompass a broader range of fashioning methods that include different kinds of coiling techniques (Gosselain 2010). All such shaping techniques involve "a highly coordinated set of movements learned by experience" with senses carefully trained to recognise minuscule variations in appropriate thickness, size, and texture (Rice 2015: 212). Kalinga potters in the Philippines (where shaping was not restricted to pottery wheel technology) were able to consistently identify the products of different potters, based on these variations (Longacre et al. 1988). This throws into question whether the use of the wheel can be the signal criterion for tracing the origin of specialist production and whether Roux's etic transcultural definition is simply too narrow.

Hand built construction methods are disregarded as non-specialised (both technically and economically) despite known cases in the historical record that suggest otherwise. For example, specialist workshops in Old Kingdom Egyptian estates used hand-built coiling techniques for the mass production of beer jars (Doherty 2015: 24). One of the earliest images of a potter's workshop in the Near East (and likely the world) is depicted in the tomb of Ty at Saqqara, Egypt. These mid-3rd millennium BCE tomb reliefs (almost contemporary with Tell eṣ-Ṣâfi/Gath) show potters skilled in different manufacture techniques specialising in the production of certain vessel types. The vast majority of ceramics in early Near Eastern sites were not wheel-made before the mid-2nd millennium BCE. Wheel shaped pottery represents a small percentage of site assemblages (less than 3% at Yarmouth). Limiting studies of craft specialisation to wheel production ignores the vast majority of data that exists. This thesis aims to go beyond the usual concern for wheel-made manufacture traditions to focus on the technical diversity of common hand-built vessels.

IX. Conclusion

Conventional typologies of production organisation alerted archaeologists to illustrative characteristics and acted as a useful guide. However, they did not clearly link production arrangements with archaeological patterning to ensure reliable identifications that eliminate rival explanations for the same trace (the role of middle range theory). The ethnographic literature is

full of ‘cautionary tales’ that contradict the expectations of these typologies and in other instances there is agreement (Arnold and Nieves 1992; Arnold 1991; Longacre 1999; Roux 2003a). The main challenge is to control for the problem of ‘equifinality’ by establishing the relevance of the identification criteria and ‘indicators’ without tautologically imposing potentially inappropriate analogues described by a given object-centred typology. The issue is not that various typologies of production and/or variants of the standardisation hypothesis are wrong or misleading. The difficulty is to effectively apply and operationalize them for the study of ancient production systems in a particular region. This need is felt more than ever given the recent interest in ‘materiality’ studies, ‘cultural reason ontologies’, and object biographies (Clark 2007; Dobres 2010; Flad and Hruby 2007; Gosden and Marshall 1999). Quantifying the inputs and outputs of manufacture to characterise the organisation of production is invariably problematic when using archaeological datasets. The incompleteness of the archaeological record often frustrates attempts to characterise the production system effectively in this way (§V).

Rather than linking a handful of potentially anachronistic and ambiguous material correlates (whether parametric or not) with overarching socioeconomic ‘types’, this thesis takes a more grounded and inductive approach inspired by the Anthropology of Techniques School. A parametric *chaîne opératoire* approach keys in technological knowledge and craft skills to create multi-trait typologies for distinguishing potting communities. The chains of inference are not short-circuited by leaping straight to a production mode based on the analysis of select attributes of the finished product. Instead, patterning and variability are investigated with respect to the definition of individual techniques, the manufacture sequence, and technological traditions. This thesis investigates variability along the following parameters:

1) how fashioning techniques are distributed/patterned across the entire study sample as a whole;
2) how fashioning techniques intersect/crosscut with the fabrics and clay recipes identified in the petrography;
3) how fashioning techniques intersect/crosscut with morpho-stylistic vessel types sampled from the domestic compounds across the neighbourhood.

Unlike petrographic or morphometric approaches, the resulting techno-stylistic classification is tailored to differentiate potting traditions that, based on patterns seen in ethnographic research, likely correspond to individual production groups. Once potting traditions

have been classified then the distribution of these traditions across the neighbourhood further informs on the organisation of production and the potential relationships between the producer(s) and consumer(s). The conventional variables in parametric typologies are redeployed at the spatial scale of individual buildings in a neighbourhood (see Klassen 2009). The spatial scale of analysis has changed from intersite to intrasite, but the actual parameters are the same and the questions are similar. For example, are potting traditions evenly dispersed across the neighbourhood or 'concentrated' in specific buildings? If potting traditions are concentrated in specific buildings, then the occupants may belong to one of these production communities, but in the absence of actual production tools and facilities we cannot know.

The dynamics structuring pottery communities and the stylistic stability of potting traditions are ethnographically modelled (§VIII). The considerable body of ethnographic *chaîne opératoire* research generated by the Anthropology of Techniques school and the Ceramic and Society Project has repeatedly shown that: (1) 'technological traditions' correlate with potting communities and; (2) techno-stylistic classifications can consistently differentiate the products made by different producers. However, this new direction in stylistic analysis has by and large not moved beyond a concern for wheel-made manufacture traditions in the archaeological record, particularly in Near Eastern Archaeology (§VIIIC-D). This is largely due to limited diagnostics and identification criteria for recognising fashioning techniques on sherds. Potting methods that do not involve the use of the pottery wheel are understudied by comparison. This thesis experiments with an alternative imaging protocol, congruent with existing macroscopic (radiography) and microscopic (thin section petrography) analyses to improve identifications of techniques and potting methods on sherd assemblages. By expanding the diagnostics for vessel construction, the thesis aims to differentiate communities of potters servicing the early urban domestic economy at Tell eṣ-Ṣâfi/Gath. The multi-scale analytical procedure for identifying vessel fashioning on archaeological sherds and replica vessels is described in the following chapter.

Chapter 3: Methods

I. Introduction – defining the chaîne opératoire

This thesis employs a *chaîne opératoire* methodological approach to structure the collection, organisation, and comparison of data on pottery fashioning techniques. A *chaîne opératoire* is both a research strategy for guiding and systematising data collection, as well as an analytic method. The aim is to describe the manufacture sequence of an object from the selection of raw materials to the finished cultural product, with a focus on the producers' behaviour and technological choices (Coupaye 2009: 439; Cresswell and Hanning 1976: 6; Fowler 2011: 174; Lemonnier 1992: 26). As such, *chaînes opératoires* usually take the form of a stem diagram or 'decision making tree', listing the actions of agents in chronological sequence (Lemonnier 1992: 30-33; Coupaye 2009: 440; Fowler 2015: 106). The surviving by-products of manufacture and material traces on the finished objects supply the empirical data needed to reverse-engineer the operations and techniques used to transform raw materials into usable cultural goods (Dobres 2000: 166; Schlanger 2005: 25).

Every *chaîne opératoire* analysis involves two levels of description; the general operations and stages in manufacture and the specific techniques used at each stage of the production sequence. Pottery manufacture consists of five groups of operations that structure the transformation of clay into a finished vessel: 1) the acquisition of ingredients (procurement of raw materials); 2) the processing of the clay recipe to obtain a usable and acceptable pot; 3) fashioning techniques and methods; 4) finishing and/or decorative operations; 5) drying; 6) firing; and 7) post-firing treatments (Fowler 2011: 180; 2016: 474-80; Rice 2015: 129-85; Roux 2016: 103). With the exception of optional decorative treatments, these operations are universal. The linear sequence is immutable, fixed by a mix of material properties (object physics), practical constraints, and the ultimate end goal (a usable container) (Coupaye 2009: 440; Roux 2016: 103).

The specific *techniques* used at each stage of pottery manufacture vary considerably and these choices do not predetermine subsequent techniques in the production chain. For example, paste preparation operations always precede fashioning and firing operations, but the specific techniques used (e.g. winnowing, mashing, grinding, picking, wedging, puddling, levigation, combining clays etc.) do not dictate how the vessel is then fashioned (Gosselain 1998; 2001). It is this second level of description, the description of *techniques*, that captures a specific technological tradition distinctive of a particular set of producers. The ongoing challenge for the archaeologist

is how to access, describe, and identify material signatures indicative of techniques on finished objects, which are usually incomplete and heavily worn by site formation and taphonomic processes.

IA. Describing techniques in ceramic analysis

Techniques consist of tools and gestures defined by a limited number of physical parameters, which condition how the clay material is transformed and shaped by the potter into a hollow volume. These parameters have been repeatedly laid out and described for pottery production by V. Roux and 'the Paris School' (1998; 2005; 2012; 2016) and include the following: the source of energy (presence/absence of rotative kinetic energy), the nature of the clay mass (heterogenous mass of assembled elements vs. a homogenous mass), the types of forces and pressures applied to the clay mass (continuous, discontinuous, and percussive), and the moisture content of the clay paste (wet, humid, or leather hard). Based on these variables, six major groups of roughing out techniques are differentiated in addition to eight major groups of preforming techniques, summarised in Fig. 3.1. A rough out refers to the hollow volume or basic shape of the vessel, whereas the preform has been further worked by secondary ('preforming') techniques to create the final geometric shape of the container. Together the roughing out (primary) and preforming (secondary) operations combine to constitute the shaping stage of the pottery production sequence.

The classification of forming techniques is a problem in archaeological ceramic analysis because pottery is an additive technology, one in which each subsequent step in manufacture may obscure or obliterate evidence of previous techniques in the sequence (Gosselain 2000). Therefore, it is less problematic to infer how pottery was fired or decorated, than how vessels were shaped, or the ways clays were processed. This is the main reason why the *chaîne opératoire* has taken far longer to become widely applied in ceramic analysis compared to other artefact domains, such as lithics, which are reductive technologies (objects made by removing raw materials, not adding or compounding different materials together). Potting experiments and replicative studies have repeatedly drawn attention to the difficulty of securely isolating diagnostic signatures of specific shaping techniques (Berg 2008; Jeffra 2013; Roux and Courty 1995, 1998). The same vessel shape with the same fabric can be made according to a multitude of different *chaînes opératoires* and the diagnostic attributes are rarely visible on the surfaces of sherds, which can number in the thousands, or tens of thousands for a particular site assemblage.

II. Classifying shaping techniques on archaeological assemblages

Vessel fashioning consists of two main steps. Roughing out, or primary shaping, is when the clay is roughly shaped into a hollow container. Secondary shaping, or preforming, is when the vessel (or 'preform') is smoothed and scraped into its final geometric shape. These operations are not necessarily sequential, since potters can and do alternate between them, especially for closed forms. This is because it is impractical to finish (e.g. by scraping or wiping) the interior of the lower body through a restricted mouth once the final height is reached, particularly for closed vessels of large dimension (Fowler et al. 2019: 1480-1481).

IIA. Deformation and decompression patterns

Fashioning techniques are primarily identified on sherds and finished vessels by imaging grain and void orientation patterns (Berg 2009; Glanzman 1983; Livingstone Smith 2007: 24-6, 56; Ross 2018; Rye 1977; 1981: 58-84). During the rough out stage, the direction of pressure and degree of compression applied to plastic clay by the potter causes the minerals and voids to take up a preferred orientation (Fig. 3.6). The internal structure and organisation of the clay material (coarse particle distribution, void pattern, and the general aspect of the fine mass) shows a deformation that corresponds to primary forming compression forces. Different fashioning techniques mechanically deform the clay in different ways. Therefore, the particular arrangement and orientation of grains and voids in the fabric are indicative of the fashioning technique used in the forming process. Just as the orientation distributions (*ODs*) of grains, minerals, and crystals are key to understanding rock formation[20] and deformation in structural geology, the ODs of the clay body are likewise key to understanding the forming process in pottery production (Borradaile and Jackson 2010; Enkin 2007).

Experimental studies have repeatedly shown that secondary shaping and finishing procedures, usually applied at the leather-hard stage, do not significantly alter the internal structure of the pot, with the sole exception of the paddle and anvil technique (Berg 2008). As a result, fashioning techniques are theoretically described and classified into four main categories, based on similarities in mechanical pressures and related clay paste deformations:

[20] The geological processes in question include, "paleocurrent directions in sedimentary rocks, emplacement flow directions in igneous rocks, and strain directions in deformed and metamorphosed rocks" (Enkin 2007: 76).

1. Deformation by simple compression causes the minerals and voids to flatten and align perpendicular to the axis of maximal stress. Shaping techniques characterised by simple compression include pressing, moulding, slab-forming, and paddling techniques (Figs. 3.6, 10).
2. Deformation by simple compression combined with a rolling motion stretches the clay along the axis of minimal stress, causing curvilinear folds and alignments of pores, clay domains, and non-plastics. These pressures and deformations are specific to the entire spectrum of coiling techniques (Figs. 3.6, 9).
3. Deformation by stretching a lump of clay causes the minerals and voids to align in the same direction as the shear force, which encompasses modelling and drawing techniques. Alignment of features typically follow a vertical direction on vessels that have been drawn up (Fig. 3.6).
4. Deformation by shearing along a relative horizontal motion is specific to wheel-throwing and wheel-coiling techniques. Minerals and voids have a more homogenous distribution and tend to align in a subparallel to diagonal direction (Fig. 3.6).

IIB. Macro and micro scales of observation

Conventional studies of vessel manufacture have largely been conducted at the macroscopic scale of observation. Analyses are either based on the visual inspection of surface features and/or the use of radiography to clarify the preferred orientation of features in the clay body (Berg 2011; Greene et al. 2017; Laneri 2011; Livingstone Smith 2007: 24-6; Martineau 2003). Radiographs are useful because hidden joints, cavities, and seams can be detected with relative ease. The larger amounts of air trapped between the joined elements show up as radiolucent gaps. Additional macroscopic attributes indicative of shaping include: fracture patterns, variations in vessel thickness, symmetry and regularity of wall profiles, and a variety of surface markings such as seams, fissures, ridges, hollows, drag marks, and facets (Berg 2009: 143-4; Carr 1990: 15-18; Pierret et al. 1996). These macroscopic diagnostics are summarized in Table 3.1 and Figs. 3.2-5.

High magnification analytical instruments (petrographic microscopes and scanning electron microscopes) are more expensive and less commonly employed, but the detailed images of vessel microstructures can differentiate grain and void orientation patterns characteristic of different shaping techniques (Roux and Courty 1998; Santacreu 2014:37-8, 77-9; Fig. 3.7-8).

Multi-component research programs combining micro and macro observations are rare, with the exception of the *chaîne opératoire* approach developed by 'the Paris school' (Roux and Courty 1998; 2005; Roux 2011; 2015; 2016). This widely published hierarchical system of classification prioritises surface features indicative of shaping techniques. Deformation patterns identified in petrographic thin-sections are used to confirm macroscopic observations and to characterise the clay recipes (usually in collaboration with a geologist). The macroscopic observations are actually reductive in that sherds without obvious macro features are removed from further analysis. The microstructures imaged in thin section confirm the shaping techniques and 'technical groups' that were already established during the first sort of the material. This protocol is therefore more appropriate for assemblages large enough to include sherds with surface characteristics indicative of specific shaping operations. However, these sherds are often present in relatively low numbers, are hard to spot, and supply indirect evidence at best (Pierret et al. 1996: 419; Berg 2009; Babour 2014).

For example, a large sample of 1,732 sherds from the EB levels of 'Area B' (the main street), at Tell Churea (north Syria) was reduced to 607 sherds with surface markings (Babour 2014: 2-3). Over 60% of the assemblage was immediately discarded as ambiguous with no surface markings and only 40% of this subsample was linked with a particular fashioning technique. Consequently, a study sample of 1,732 sherds (from both primary and secondary contexts) was quickly reduced to 357 sherds grouped into 5 fashioning sequences, which equates to a success rate of < 31 %. The great number of sherds that are processed and filtered out of the study sample means that current protocols are not well suited for small assemblages sampled at the spatial scale of the household, especially if the analysis is restricted to specific deposits in primary contexts. The diversity of shaping techniques will not be represented. This is why the majority of Roux's studies are inter-site analyses focusing on regional distributions, as opposed to fine-grained intra-site analyses focused on the local pottery economy.

Berg (2009) discovered that ceramicists contradicted each other as much as 25% of the time when identifying shaping techniques based on macroscopic surface features. Her findings suggest that radiography is generally far more reliable because the ceramicist can see the inner structure of the vessel and signatures are not blurred by secondary forming and surface treatments. Berg's (2008) experimental data on 101 pots demonstrated that radiography has a far higher success rate, ranging between 60% to 80%. Far less of the assemblage was filtered out when

compared to classifications based on surface features. The major drawback is the amount of machine time needed to calibrate radio-density differentials[21] and x-ray a single pot, which can significantly drive-up costs, as well as limit sample sizes and the contexts sampled. Radiographic studies are usually based on samples well below a hundred whole or reconstructed vessels of mixed contexts and temporal horizons. The largest known radiographic study of a ceramic assemblage from the Mediterranean was 95 vessels from Knossos, spanning multiple horizons from the Early to Late Minoan (Beg 2008; 2011).

Every analytical protocol suffers from "its own areas of weakness" hence the need for mixed methods research (Jeffra 2013: 16). In every case, observations primarily based on a single scale, using one analytical technique are insufficient for classifying fashioning sequences, especially given the equifinality of ceramic attributes (Roux 1998; 2016). Nevertheless, time constraints, cost, and expertise act as a barrier to mixed methods research. As a result, macroscopic techniques dominate the literature. Studies of construction methods are either limited to radiography of a relatively small collection of vessels and/or identification of surface features derived from an enormous initial sample, both of which can be misleading and inaccurate (Laneri 2011; Berg 2009; Jeffra 2013).

For the *chaîne opératoire* to reach its full potential in ceramic analysis, additional imaging methods and protocols are needed for characterising orientation distributions (ODs) in clay bodies. This need is felt in neighbouring disciplines interested in measuring ODs in rock samples (the geosciences, paleomagnetic studies, and structural geology). Long-axis counts using optical stage microscopes, oriented thin-sections, and/or radiographs are likewise considered "tedious and time-consuming and only account for the orientations of small numbers of grains" (Enkin 2007: 76). Alternative geoscience approaches are far more complex, indirect, and centre on AMS determination (anisotropy magnetic susceptibility) (Borradaile and Jackson 2010; Enkin 2007).[22] No such study using AMS has ever been performed on archaeological pottery, which is likely to

[21] Variables include kilovoltage, milliamperage, integration time, object position, tube source, filtration, object to film distance, focal spot to film distance, film type, and focal spot size (see Carr 1990).

[22] AMS involves characterising the 'magnetic fabric' by measuring the direction of magnetisation in a sample (essentially rotating and energising the sample in changing magnetic fields), which takes just 3 minutes of machine time (Borradaile and Jackson 2010: 1523; Enkin 2007: 76). The resulting 'polar plots' show preferred orientations of 'fabric ellipsoids' plotted on cartesian axes (Borradaile and Jackson 2010: 1520).

encounter additional problems with sample preparation (lack of homogeneity in the sample[23] and sample sizes). Hypothetically, AMS determination will only work on 'red clays' with high iron content, which are capable of providing a magnetic signature. The technique only measures the ODs of ferromagnetic minerals and iron oxides and will not pick up on the distributions of other minerals and temper types, such as fibre, chalk, and grog (crushed sherds used as grog). Hence, these more technical and costlier approaches have not been applied to ceramics. The relationship between the 'magnetic fabric' and the actual ODs visible on radiographs (or in thin section) is indirect and not always congruent (Enkin 2007: 76).

This doctoral thesis aims to expand identification criteria by piloting a simple *low-cost* imaging method for rapidly classifying *mesoscopic* signatures of forming techniques on freshly cut thick sections. Unlike AMS, the protocol proposed here is not limited to certain types of inclusions, but provides a direct measurement of ODs, and is therefore fully congruent with conventional macroscopic and microscopic analytical methods. This protocol has real potential for wider application in the earth sciences to address the same method related problems when imaging the Preferred Orientation of Minerals (POM), Crystals (POC), and Grains (POG) in petrofabrics.

IIC. The mesoscale: imaging shaping techniques in thick-section

In this study, grain and void orientation patterns were imaged at the mesoscopic scale using high resolution scans of freshly cut pottery thick sections on material from an experimental type set, ethnographic standards, and an archaeological assemblage. The imaging protocol followed four basic steps. In the first step, sherds were oriented properly. Prior to scanning, it is essential to determine the orientation of a sherd so the correct plane of the thick section is exposed. Grain and void orientation patterns are typically viewed and compared parallel to vessel height, in order to better distinguish the signatures of shaping techniques.

In the second step, each sherd was thick sectioned using a Buehler Isomet 1000 precision saw to expose cross-sections perpendicular to wall surfaces. The sherds we sampled were < 60 mm in length to fit the size of our largest chuck. Alternative cutting tools are also possibilities, such as a tile cutter, a dremmel drill, jig, or bench saw. A wet precision saw is preferred for the smooth, clean, and even cut that inflicts minimum damage on the rest of the sherd/vessel. Scans of multiple sections along a sherd wall would serve to identify techniques along the length of a

[23] Clays are extremely heterogenous and fabrics are influenced by potting behaviours, such as clay processing and firing techniques.

complete vessel cross-section. Vessels can be sectioned, without the use of a chuck, to expose the whole profile of a pot in one continuous cut. This involves rotating the vessel by hand directly over the cutting blade in the absence of a protective screen. Note that the pot can fracture if hand movements are not steady and too much pressure is exerted on the saw. This is not recommended for all cutting equipment, others must be present, and removing the interlock safety mechanisms on any tool is ill-advised.

Delicate sherds were cushioned in the chuck using foam and modelling clay for extra support. For larger sherds, a simple vice was used to grip the fragment, which was then inserted into the chuck. The weight on the arm is then reduced to compensate for the extra weight on the chuck. No predetermined blade speed was used for the saw and anywhere between 200 and 300 rpm worked well for most sherds. On thick flat sherds, it was possible to reach blade speeds as high as 500 rpm. Speeds needed to be decreased for more fragile sherds, or those with greater curvature to avoid shattering. I discovered that sanding, or polishing the freshly cut section tends to destroy the integrity of voids and pores, as well as blur the features in the section. Instead, any jagged projections were removed with a sharp knife and a damp kimtech wipe was used to clean the section of any remaining residue. This was done to ensure the section sat flush on the flatbed scanner. Most sherds were cleanly cut without jagged projections.[24]

In the third step, high-resolution digital images of the thick sections (1600–2400dpi) were created using an ordinary desktop printer- scanner (Epson® WF 2540). It is possible for multiple thick sections to be scanned at once to speed up the process. Lightly dampening the surface of the thick section can improve the contrast and visibility of features in the scanned image. A scale was included with each scan, in order to facilitate measurements of features in thick section using the calibration tool and ruler function on Macnification®, or the line tool in Photoshop®. Cutting the sherds takes very little time, but scanning sherds can be highly time-consuming depending on the specifications of the scanner and the dpi settings. Therefore, multiple back-ups of the original scanned image are strongly recommended to avoid repeating this stage. Duplicates of hundreds of high definition images require copious amounts of digital storage (potentially terabytes worth of data). Fortunately, memory has become increasingly cheap, with terabyte hard-drives available at

[24] Jagged projections tended to occur in the corners of the sherds, in cases where the sherd dropped from the chuck before it was fully cut by the saw. This was more of a problem for crumbly coarse wares that were at greater risk of fracturing in the chuck.

low-cost, as well as middle-out compression platforms for secure online storage solutions (Pied Piper®). Three terabytes worth of digital memory was more than sufficient for two back-ups of 370 high def. images. The digital image can either be analysed as a raw file, or can be cleaned and manipulated in a fourth step, using photo-editing software to highlight features in section.

Filters on any photo-editing platform can enhance the clarity of the image by applying contrast, exposure, and negative pre-sets. I recommend the filters in Photoshop® because the operator has complete control over the settings and any actions are *reversible*. Annotations can be stored on separate layers to maintain the original raw image.[25] I did not use Preview® (Mac program), Paint® (Word program), or any software incapable of easily undoing changes to the original image. The selection tool in Photoshop® is useful for picking out voids and pores in the fabric when set at tolerance level one. The background can be removed with the colours of the voids adjusted (we preferred black and white for maximum contrast) to give a clear picture of the poral structure. This only works when scans are taken at 1600 dpi minimum with no acetate used to protect the glass screen on the scanning bed. The acetate fills in the empty space on the scan. Very small features with low pixel density cannot be easily differentiated from the binder with the magic wand selection tool.

The line tool in Photoshop® is useful for emphasising the direction of individual inclusions and the background/binder can be eliminated, or stored on a different layer. Similar functions are also possible in ImageJ®. In this way, features indicative of shaping become increasingly visible on the scanned image of the section and 'noise' is greatly reduced and/or eliminated. Editing and annotating images can be time consuming, but it is not necessary for every section. The variation in forming techniques can be represented by a reduced number of thick sections selected during the analysis and then further annotated. This entire process can be automated by machine learning, which would further reduce time taken for image processing and the initial analysis. Koval (2018) achieved 90 to 95% accuracy using a supervised machine learning application (Wndchrm) to classify fabrics produced by modern Zulu potters and production communities on an ethnographic pottery collection. Vessel bodies made from slab-drawn bases and coiled and scraped vessel bodies generated a classification with lower accuracy at 65-70% (within the range of radiography).

[25] It is time consuming rescanning the original sherd because the file was either corrupted, or the original image was irreversibly marked by poor annotations.

Livingstone Smith (2007: 80-119) previously indicated the rich potential for identifying fashioning techniques on ceramic thick sections in his doctoral thesis on African potting traditions. Ceramic breaks from West African vessels (mainly Cameroon, Togo, and Burkina Faso) were polished and imaged using a combination of photography and radiography to show traces of vessel fashioning in section. The 'mesoscopic' perspective on vessel structure proved to be highly effective at identifying fashioning techniques (more insightful than the macro radiography done on each vessel type in the 'normal' object view). Yet this scale of analysis is still very much neglected and overshadowed by mainstream macro- and micro- approaches detailed above.[26] The mesoscopic protocol piloted in this doctoral thesis experiments with a number of simple improvements for imaging vessel fashioning on pottery thick sections. High quality digital images of ceramic sections are achieved using a conventional flatbed scanner on sherds that are carefully cut using a wet precision saw. Sherds did not have to be polished and digital images are further processed using photo editing software to further enhance traces of vessel fashioning in section. This thesis refocuses attention on the utility of thick sections for identifying potting methods in *chaîne opératoire* research (Ross et al. 2018; 2020).

IID. The limitations of destructive data recovery

The protocol for our mesoscopic investigation is highly destructive, since sherds and parts of vessels are cut in half with a wet precision saw. Permission is required for destructive analysis from local antiquity authorities and site director(s). The Israel Antiquities Authority granted approvals for our analysis and permitted our entire study sample to be exported to the University of Manitoba. Hypothetically, this work can be conducted in a field or ceramic laboratory and incorporated into the workflow of an excavation. However, we had an excellent co-operative relationship with the Antiquities Authority and they were willing to grant export permits. This allowed us to work on the sampled assemblage throughout the year unencumbered by tight time frames and other distractions during the field season. Sorting through vast amounts of pottery to collect the study sample was time consuming. To run a dedicated portable field laboratory (or rent/use local facilities or instruments) was impractical, but not impossible (others have done it). Exporting the material allowed us to focus purely on sampling and excavation during the field

[26] Possibly one reason for this is that the study in question is buried in the Francophone literature on African archaeology and has not been replicated elsewhere.

seasons. The work cannot be carried out under normal field conditions without greatly lengthening the duration of stay at a host institution near the site.

No specialist equipment or laboratory facilities are required. The work can be conducted in any facility that has space to go through the assemblage, with an appropriate area to set up a wet saw, a computer/laptop with photo editing software, and an ordinary flatbed scanner. The actual data acquisition is rapid, since large numbers of sherds can be cut and scanned in batches. Scanning takes longer than cutting, but no longer than a few minutes at most (even when scanning at high dpi's). Processing the data is highly time consuming, depending on the effort invested in generating clean annotated images that highlight the trace evidence of vessel shaping. As stated previously, the last step can be automated by machine learning, or dropped from the workflow completely, since images do not have to be cleaned and annotated for a visual inspection.

The destructive nature of the protocol will limit access to assemblages and curated collections, and will invariably limit sample sizes, especially at sites where pottery is less common and permission is needed from local indigenous groups. Scanning the sherds with a micro-CT (Computed Tomography) will show the orientation distributions of inclusions and voids without harming sherds and vessels, with the added advantage of a 3D image (Applbaum and Applbaum 2005). Research is still very much possible, but at significantly greater cost, expertise, and additional machine time. Alternatively, smaller subsamples of sherds and discards can be cut and sectioned when stricter antiquity laws prevent mass export and/or destructive analysis of large sherd assemblages. At Tell eṣ-Ṣâfi/Gath, the sections of large body sherds and bases were more useful for identifying fashioning techniques than the rims. Rims are retained as indicatives for typological studies. The majority of the base and body sherds were therefore available for a technological study. Often, however, such sherds are discarded even at Tell eṣ-Ṣâfi/Gath.

III. Ethnographic and experimental model for mesoscopic diagnostics

Ethnographic pottery and experimental replicas were utilised to refine and develop new diagnostics for identifying hand-built potting techniques, based upon the above mesoscopic method. Coiling is one of the most common shaping techniques used in sub-Saharan African pottery traditions and has been widely studied ethnographically. Our reference sample draws from two cultural groups–Zulu potters from eastern South Africa (Fowler, 2008, 2011, 2015) and Shona potters from Zimbabwe (Lindahl and Pikirayi 2010). The shaping methods of the latter group has been previously studied. Lindahl and Pikirayi (2010) identified grain and void orientation patterns

diagnostic of coiling on polished thin-section ceramic breaks from the Buhera district of eastern Zimbabwe. Ethnographic and archaeological fragments were impregnated with a fluorescence agent and araldite plastic and viewed under a stereomicroscope with UV light (Lindahl and Pikirayi, 2010:138). Distinct compression patterns were visually identified in the pore structure and were linked to different forming techniques through simulation experiments. The porous structures and the curvilinear alignments of mineral inclusions associated with the "u-technique", a subcategory of coiling, had a discrete u-shaped curving orientation in the cross section.

Using the method outlined above, we analysed a modern Zulu ethnographic ceramic reference collection at the University of Manitoba collected by Prof. Kent Fowler between 2008 and 2014 (Fowler 2008, 2011, 2015). Polished thick sections of coarse-paste beer brewing vessels and finer-paste beer drinking vessels were used for this purpose. Zulu tempering practices exhibit distinctive grain and void orientation patterns that can be linked to the coiling and finishing (e.g., scraping) techniques observed during shaping. In section, larger grains cluster on the periphery of coils and some non-plastics and elongated voids indicate the direction of pressure as potters drew upwards from a lump to shape the lower body, drew up from coils to form rims, or pushed downwards to join coils when shaping the body of vessels. The size, density, and roundness of non-plastics affect the visibility of these techniques.

In addition to ethnographic standards, experimental replicas were made to serve as additional comparative reference for confirming diagnostics of shaping techniques (Appendix B). Restricted and unrestricted bowls were built using the following fashioning techniques: coiling, slabs pressed into a concave mould, slabs pressed onto a convex mould, pinching, and drawing from a clay lump. Combinations of these techniques were also investigated and different clay temper combinations were tested, using the same ingredients as those identified in the EB ceramic fabrics at Tell eṣ-Ṣâfi/Gath. The *chaînes opératoires* are described in dendrograms in Fig. 3.12. The experimental and ethnographic pots were analysed according to the sectioning and scanning method described above. Based upon a refined set of identification criteria, we then used the same method to analyse the domestic repertoire from Tell eṣ-Ṣâfi/Gath, in order to distinguish the orientation of voids, non-plastic inclusions, and the presence of other diagnostic criteria of shaping techniques.

V. Conclusion

This thesis experiments with an alternative *chaîne opératoire* classification that hierarchically prioritises inner structural features of the clay body exposed in thick section. The results are combined with conventional surface and micro traces of forming techniques. Thin-section petrography was previously carried out on the Area E assemblage by Ben Shlomo (2012, 2018, in press; Ben Shlomo et al. 2009). His provenance study characterised the recipes for the different vessel types. This thesis aims to combine a classification of shaping techniques with the petrographic data on fabrics to discriminate between the *chaînes opératoires* and technical traditions of different production groups.

The sherds in the study sample were initially sorted according to morpho-stylistic vessel types to ensure that the full shape repertoire was sampled from each phase and building. Any surface features indicative of manufacture were carefully recorded for each sherd, before each sample was cut and scanned to reveal trace features indicative of shaping in thick section. While a far smaller section of the vessel is visible in thin-section (1-2 cm), analysts are likely to miss key technological markers associated with shaping techniques. Thin-section petrography is excellent at identifying clay recipes, but its value for identifying shaping techniques is much more limited and usually auxiliary to other techniques in ceramic analysis (Santacreu 2014; Roux 2011, 2016). We prepared a subsample of thin-sections to contrast meso and macro traces of forming techniques with microstructures observed down a binocular stage microscope and a scanning electron microscope. The result is a multi-scalar analytical method that combines observations made at multiple physical scales (Figs. 3.7-8), in order to discriminate the *chaînes opératoires* of production groups with greater rigour on a single site assemblage:

1. Macroscopic observation with the naked eye;
2. Mesoscopic observation of digitally enhanced images of thick sections;
3. Microscopic observation of thin sections under a petrographic microscope;

The proposed multi-scalar method is designed to effectively differentiate producers on a single site assemblage and facilitate a systematic study of the internal organisation of production, at the spatial scale of a neighbourhood. As outlined in the next chapter, debate on urban origins and complexity in the southern Levant is limited by research on patterns of production, which are restricted to broad regional views of the economy. The economic foundations of individual sites and the degree to which early urban neighbourhoods were served by specialists is poorly

understood. Hence, this thesis provides a fresh perspective on vessel manufacture to understand production organisation, in view of wider debates on the evolution of social complexity for the Levantine Early Bronze Age.

Chapter 4: Urban Process and Economy in the Early Bronze Age Southern Levant

I. Introduction

IA. The debate over social organisation in the southern Levant

Early urban settlements first appeared in the southern Levant[27] during the late 4th and early 3rd millennium BCE (the EB IB-II transition, Table 1.2). Material evidence for a change in social organisation and an increase in complexity are largely based on settlement patterns, site organisation, and new ways of organising the procurement, production, and consumption of resources (de Miroschedji 2009, 2013, 2018; Greenberg 2013, 2019; Richard 2003).

The definition and evidence for early city-states in the Early Bronze (EB henceforth) is debated and some have questioned whether Syro-Mesopotamian city-states are fitting analogues. Over the past 25 years, scholars mostly working in Jordan have proposed alternative models of social organisation to the classic city-state (Chesson 2003; Chesson and Philip 2003; Falconer and Savage 1995; Savage et al. 2007; Harrison and Savage 2003; Philip 2001, 2003, 2008). These models are based on heterarchical views of societal change and 'inclusionary' corporate village identity. Heterarchical or non-hierarchical perspectives emphasise the role of corporate villages and household economies in settlement systems that are predominantly understood to be rural in character. It is argued that settlements reflect an 'inclusionary' organisation, with negligible social hierarchy, variable sociopolitical integration, and no form of state apparatus. Life in the 'walled communities' of the EB Levant is considered a direct 'incremental extension' of Chalcolithic traditional village life and not a sudden change as implied by the term 'urban revolution'. The traditional city-state model implied a hierarchical perspective of a centralised authority entrenched in urban enclaves governing a top-down surplus economy, with elites controlling the flow of staple goods (Philip 2008: 163-6; Rosen and Rosen 2001: 544).

The debate appears to be divided between those that work on material from the western half of the southern Levant from those who study the eastern half. The scale of complexity is different as one moves westward from the highlands of Jordan through the Jordan Valley, mountain region, and into the rolling hills and coastal plain of modern Israel. Similarly, there is a transition as one moves from south to north in the Jordan Valley. Hence, this helps to explain some

[27] The modern day regions of Israel and the Palestinian territories, Jordan, and southern Syria/Lebanon.

of the variability in the scholarly debate, since different scholars derive their data from different geographic regions with their unique ecological regimes (Chesson 2019: 164).

The goal of this chapter (and overall thesis) is to contextualise this vivid debate in light of recent excavations and show how pottery production can contribute to these larger anthropological issues in social archaeology, by providing fresh insights into the nature and scale of domestic economies. This chapter lays out comparative data on changes to settlement patterns, site organisation, and pottery production to show how emergent early urban communities and incipient city-states varied across the southern Levant. Failure to appreciate this variety results in simplistic arguments over the presence or absence of city-states. Relevant settlement data is extensive. Israel and Jordan are the most intensively excavated and explored landscapes in the Near East. As a result, this chapter compares regional developments across agricultural lowlands and river basins[28], the drier uplands[29], and the fringes of the semi-arid zone[30] (Figs. 1.1-2). The settlement picture presented here draws attention to the discoveries of recent excavations at Assawir, Megiddo, Ashkelon, Erani, and es-Sultan, which are combined with the findings of older excavations by the Israel Antiquities Authority (henceforth IAA) at sites such as Qyriat Ata, Qashish, Te'o, and Beth-Yerah among others.

The organisation of production has long been considered a marker for broader social, economic, and political changes associated with urbanisation and state-formation. Pottery in particular is the most abundant material type on Near Eastern excavations, widely used in daily life by all members of society, mainly for the storage, processing, and consumption of food (among other functions). Pottery production therefore constitutes a potentially key line of inquiry to investigate changes to domestic economies, especially for the preliterate world of the southern Levant.

IB. The defining features of city-states

City-states are small autonomous political organisations centred on a fortified settlement and in control of a well-defined surrounding territory (de Miroshedji 2018: 113, 115, 135-6; Garfinkel 2013). The distribution of the population over the landscape differentiates a city-state from other forms of state level organisation (Trigger 2001: 9). Settlement size and density swells

[28] The Huleh valley, Jezreel valley, the Central and Southern Coastal Plains, the Jordan valley, and the Lower Galilee
[29] The Central Hill Country and the Shephelah
[30] The Negev, Transjordan, and the Judean Desert

due to the concentration of the population at fewer sites resulting in a nucleated settlement pattern (Adams and Nissen 1972). This process of settlement aggregation (or 'synoecismus') promotes urbanisation at regional centres, which are usually protected by towering fortifications (de Miroshedji 2018: 115; Garfinkel 2013). The inability to dominate neighbouring city-states prevents the formation of larger sociopolitical units (such as territorial empires) and encourages peer polity interaction. Landscapes are therefore carved up into a mosaic of smaller territories dominated by regional site hierarchies. At the top are the large and small fortified towns and cities, served by large and small outlying villages and farmsteads, usually accompanied by seasonal settlements occupied by mobile pastoralists (Johnson 1973; Wright and Johnsons 1975).

Unlike city-states, territorial states primarily consist of low-density agricultural settlements thinly dispersed over a much larger area/territory. The ruling class is concentrated in exclusive enclaves that are removed from the rest of the population (Trigger 2001: 11, 77; Redford 1997: 212-13, 217; Maisels 2003: 71, 346). Examples would include Egypt, Shang dynasty China, the Maya, and the Inka. The defining features of states in general are the loss of egalitarianism and the weakening of kinship as the sole structuring principle (Feder 2014: 344-49; Rothman 2001: 11; Service 1975: 3-10). Centralised institutions assume control over public decision making for some key activities. The centralised decision-making body has the power to impose its decisions and laws through sanctioned force and coercion. Membership and identity are negotiated and expressed along lines of residence, with distinctions according to class, occupation, and wealth (Renfrew and Bahn 2008: 213; Trigger 2001: 6-7).

IC. The classification of city-states in the archaeological record

The discovery of a settlement hierarchy is usually the first step in understanding the 'political geography' and identifying the nature and scale of organisation in state level societies. Regional intensive surface surveys have a long history in the Near East (Adams 1981, 2012; Algaze 2008: 102-109; Rothman 2002: 262; Wright 1986; Wright and Johnson 1975). They are undertaken to catalogue sites, define site hierarchies, and identify the primary centres. Site categories are usually based on size and density, which are used as proxies for the degree of urbanisation and complexity. In recent studies, these proxies are usually 'air truthed' using increasingly sophisticated multispectral aerial and satellite remote sensing technologies, such as LiDAR, SRTM, and IKONOS (Lawrence et al. 2016: 1-4; Lawrence and Wilkinson 2015). Site functional size hierarchy is generally equated with social stratification so the "more hierarchical

the settlement pattern, the more hierarchical the society" (Renfrew 2008: 184; Johnson 1973, 1975; Wright and Johnson 1975). Non-hierarchical societies exhibit a smaller range of functional variation in sites and are usually relatively small in size. Hence, the classic indicators of social complexity encompass transformations in settlement patterns showing population booms and a broad variety of settlement functional types, usually implied by a hierarchy of site sizes. At a minimum, states will have a three tier site functional/size hierarchy with stronger integration and 'connectivity' between various regional (cities) and local centres (towns) and outlying villages (Adams 1981; Johnson 1973; Wright and Johnson 1975). This results in a more uniform and widely shared material culture, reflecting greater economic and social interaction. These settlement patterns mark a significant break with the rural, dispersed, and isolated communities of earlier village life that typically lack a clear site hierarchy beyond two levels (i.e. large and small villages) with scant evidence for external community contacts.

In addition to settlement expansion, conspicuous indicators of centralised societies and urban environments require intrusive methods of reconnaissance and intensive excavation. The construction and maintenance of major ceremonial and public buildings (temples, palaces, and store houses), monuments, and elaborate fortification systems attest to the large-scale recruitment and organisation of labour (and by extension a concentration of power). The layout of residential blocks, buildings of standardised form, street organisation, and overall city plans give an impression of urban design and site organisation showing deliberate town planning principles. Artefacts of administration (counters, seals, and tablets) provide evidence of controlled economies with more developed contacts for regular trade and exchange in a distributive economy (Rothman 2000, 2004; Wright 1975; Wright and Johnson 1975; Blanton 1976). Glyptics, art representations, and iconography may communicate an ideology of power in a ranked society and reflect a common symbolic language with emblems of authority. Much of the above requires surplus labour freed from food production in larger societies. Evidence for intensified food production (irrigation canals, waterways, terraces etc.) is also a key variable that facilitates economic growth, specialisation, and state level infrastructure (Adams 1966). Virtually all of the above indicators can be teased out of V. G. Childe's original list of comparative criteria for characterising 'civilisations', or what we now call large-scale urban centres with state-level organisation (Childe 1950; Smith 2009a; Maisels 1999; Adams 2012: Renfrew 2008: 179-80, 207-19).

II. Chronology: time-space frameworks

The Early Bronze Age periodisation of the southern Levant was never ideal, since alloying is not attested until the very end of the period in the EB IV (Ben-Yosef and Shalev 2019: 538; Yahalom-Mack and Eliyahu-Behar 2015). Copper remained the dominant metal technology throughout all the EB phases. Unlike the major surrounding powers (Egypt and Mesopotamia), the southern Levant remained a non-literate society for the duration of the 3rd millennium BCE (Chesson 2019: 173; Coogan 2001: 18-9; Cohen 2019; Pitard 2001: 30, 33). Therefore, the usual mechanics of chronology building, based on local historical records of ruling royal dynasties, was not an option. Basic terminology was needed to classify the broad sweeping social and economic transformations evident in the material culture of the region (§ III-VI). Thus, the adoption of C. J. Thomsen's three age system that resulted in a Levantine Early Bronze Age despite the general absence of bronze technology (Fischer 2006: 31).

The introduction of the three age system in what was formerly Mandate Palestine is often credited to William Foxwell Albright of the American School (Mazar 1992: 29-30; Richard 1987; Ben-Yosef and Shalev 2019: 538). When in fact the terminology was first used consistently by the Scotsman Duncan MacKenzie of the British School at Beth Shemesh, prior to WWI in Ottoman Palestine (MacKenzie et al. 2016: vii).[31] He was the protégé of Arthur Evans and the first to systematically study the Philistines, establish ceramic links with the Aegean, and advocate open plan excavation methods (MacKenzie et al. 2016: vii-viii; Tubb 2003: 138; Bunimovitz and Lederman 2009, 2016). The three age system was later taken up by W. F. Albright and the Early Bronze was applied to 3rd millennium bce deposits in Palestine that were broadly contemporary with the Early Dynastic in Mesopotamia, the Old Kingdom period in Egypt, and the Early Helladic in Greece (Wright 1936: 12; Albright 1949; Richard 1987).

Under the direction of W. F. Albright (1938) of the American School, Wright (1936: 12, 1937, 1958) developed the familiar fourfold division of the EB in his published Ph.D. dissertation, hence the 'Albright-Wright paradigm' (Dessel and Joffe 2000; Braun 2009: 26-7). Comparisons were primarily based on pottery styles ('pottery defines the period') from Megiddo, Beth Shean, Ai, Jericho, and Gezer (Fig. 1.3). Typological indicators were limited to a consideration of highly distinctive (and instantly recognisable) decorative and formal features. The *fossiles directeurs*

[31] MacKenzie's 1911-1912 excavation was published posthumously (1861-1934) by the PEF some 82 years after his death.

included Gray Burnished Ware[32] (EB I), Abydos Ware[33] (EB II), and Khirbet Kerak Ware (EB III) (see §VIA-B). It was cutting edge research for the 1930's and the WWII era when the emphasis was on locking down and consolidating time-space systematics, as opposed to explaining change and providing 'thick descriptions' of social and economic life (Johnson 2010: 61-72; Trigger 2009: 311-13; Hodder and Hutson 2003: 12; Childe 1929). Wright himself was well aware of the narrow goals of typo-chronology and the limitations on his ceramic analysis. He anticipated (with remarkable foresight) that thick descriptions and more holistic approaches would come later and his research was designed to eventually facilitate these "overarching deductions" (Wright 1937: 1).

Following the major internationally acclaimed excavations at Jericho (1952-8), Kenyon's contributions to EB typo-chronology proved to be far less influential compared to her pioneering stratigraphic digging methods.[34] The Wheeler-Kenyon method (box grid excavation) 'revolutionised' excavation in the Near East and is the foundation of modern tel excavation (Davis 2008: 152-3; Dever 2004; Herr 2002: 53). Compared to Wright (1937), Kenyon's typo-chronology was invariably more detailed, but only really differed over the subdivision of the late 4th millennium bce. This was mainly due to differences between settlement and tomb pottery assemblages, compounded by the sheer diversity (regionalisms) of EB I vessel types (Kenyon 1960a: 84-100, 1960b; Amiran 1970: 44, 50, 52; Braun 2009: 26-7; Davis 2008: 148; Esse 1984: 327; Hendrix et al. 1997: 96; Mazar 1992: 93-4, 100-1; Rast and Schaub 2003: 98-9; Dessel and Joffe 2000).

Kenyon proposed the term 'Proto-Urban' as a period horizon or 'stage' to firmly situate the region cross-culturally, in the context of the predynastic and proto-literate periods of the surrounding powers (Egypt and Mesopotamia), ca. 3300-3050 bce (Kenyon 1960a: 84-100). Her Proto-Urban (a-c) was the equivalent of Wright's EB I (a-b) and "what other scholars still more

[32] 'Esdraelon Ware' in Wright's original terminology (1937: 44).
[33] Wright's 'Syrian pottery'
[34] Her habit of dating buildings based on floor 'makeup' drew criticism amongst her contemporaries (de Vaux and Albright) and sparked an ongoing debate, since her pottery periods and building buildings were arguably not contemporary (Dever 2004). Sadly, her multi-stage excavations were rarely translated with success into finished integrated publications needed to 'vindicate' her meticulous methods, hence why Kenyon's contributions are primarily limited to innovations in field methods, rather than actual results and interpretation (Davis 2008: 100 151-2, 7, 209; Herr 2002: 53; Dever 2004; Parr 2000).

generally term Late Chalcolithic" (Parr 1969: 140).[35] The terminology was retained in subsequent scholarship, but was (and is) mostly used with reference to the Jericho stratigraphy (Ben-Tor 1975; Nigro 2007; Parr 2000; Rast and Schaub 2003). We now know that the Proto-Urban A (plainly decorated red slipped/wash ware), B (line painted ware), and C (Grey Burnished Ware) distinctions are not sequentially linear, but significantly overlapped (Mazar 1992: 100-3; Dessel and Joffe 2000).[36] If anything, subsequent excavations at Bab edh-Dhra and elsewhere have shown that B (now designated EB IB) came after A and C in southern and central Palestine (Rast and Schaub 2003: 99). These broad categories have since undergone considerable refinement, with greater standardised descriptions of wares that are consistent with studies in ceramic technology (Braun 2012; Eisenberg 2001; Golani 2003; Milevski 2011; Zuckerman 2003; Herr 2002). Subtypes now correspond to increasingly precise chronological and geographic niches, yet still broadly conform to Wright's (1936, 1937, 1958) and Kenyon's (1960a, 1960b) original observations.

The broad typo-chronological skeleton first developed by Wright (EB I-IV) has weathered over 80 years of excavation and scholarship, but has generally withstood the test of time. It survived remarkably well as a framework for understanding the economic and social transformations of the 3rd millennium BCE (Esse 1984; Mazar 1992; Ben-Torr 1992; Chesson 2019; Greenberg 2019).

Table 4.1. Chronology for the southern Levant for the 4th and 3rd millennium BCE showing the c. 200 year inconsistency between the high chronology, traditional phasing, and the Jericho sequence (adapted from Regev et al. 2012, 2014; Shalev 2017: Table 3-1; Nigro 2018: Table 9; Finkelstein 2018: 69, Tables 1-2; Cohen 2016: 27-8).

	Conventional phasing	**The High Chronology date ranges**	**The radiometric transitions from Jericho**	**Egypt**
EB IA	3500-3000 bce	3700-3300 BCE	3500-3200 BCE	Naqada II
EB IB		3300-3050/3000 BCE	3200-3050/3000 BCE	Naqada II / Dynasty 0-early Dynasty I
EB II	3000-2700 bce	3050/3000-2900 BCE	3050/3000 - 2700/2650 BCE	Late Dynasty I-Dynasties II/III

[35] Precise correlation with Wright does vary over the course of Wright's publishing career, especially the before and after of the el-Farah north excavations (Mazar 1992: 93-4, 100-3).
[36] A and B are decorative styles and only C fulfills the modern definition of a ware in ceramic technology, hence why only the latter is capitalized (Braun 2012).

EB III	2700 - 2200 bce	2900-2500 BCE	2700/2650 - 2300 BCE	Dynasties II/III – Dynasties VI/V

IIB. The delayed impact of radiocarbon dating

The impact of radiocarbon dating on the 4th and 3rd millennium bce was not truly felt until recently (the last 10 years). The new 'High Chronology' is anchored in high precision bayesian modelled radiocarbon dates for the EB transitions, based on harmonised sequences from a growing number of EB sites (see Table 4.1) (Regev et al. 2012; Regev et al. 2014). It undermined established ceramic synchronisms established through loose cross-dating with Egyptian tomb deposits and the use of *serekh* bearing sherds in Levantine contexts (the insignia/crest of historically dateable Pharaohs) (Wright 1937: 59; Braun 2009). The classic 'find a pharaoh' method of cross-dating was first introduced by Flinders Petrie (1891) at el-Hesi in Ottoman Palestine. The long-term methodological reliance on Egypt to anchor time-space systematics has now ended. Local independent chronologies based on absolute dating methods are now available for the 4th and 3rd millennium BCE. Arguably, the dependence on Egypt to fix cultural horizons led to an over emphasis on Egypt's influence in the region. Thus, Weinstein states "it is widely accepted that any reconstruction of the history, chronology and culture of Bronze Age Canaan is heavily dependent on that region's contacts with Egypt" (2003: 145).

Under the new High Chronology, the EB III phase was expanded and pushed back with the EB II/III transition placed around 2900 BCE and ending sometime before c. 2500 BCE (200 years earlier than the traditional date range). This significantly reduced the EB II to a short interval that began sometime around 3000 BCE and lasted for roughly one century, where it can be recognised as a distinct phase and this is an ongoing issue. The EB IB is now squarely in the later 4th millennium BCE and overlaps with the LC 5 ('the Uruk Phase'), in northern Syria (Wilkinson et al. 2014: 85) and Late Naqada in Egypt (Regev et al. 2012; Regev 2013, Table 4.1). The major revisions to chronology were largely based on controlled sampling of stratigraphically secure radiocarbon specimens from Megiddo and Yarmuth harmonised with existing data from four principle sites (Ashkelon, Kabri, Abu al-Kharaz, and Bab edh-Dhra). Strict criteria over context, sample preparation, and preference for short-lived samples eliminated well over 100 radiocarbon samples from over 29 other EB sites in the published literature. Consequently, less than 200 individual samples were incorporated into the new radiocarbon skeleton of the High Chronology. The chronological scheme has since been extended to include phases from Tell eṣ-Ṣâfi/Gath, Arad

(the renewed excavations), and Tel Yaqush, but the scheme also fits recent results from Pella, Beth Yerah, el-Hesi, Beth-Shean (EB IB phases only), and Khirbet es-Zeraqun (Bourke et al. 2009; Finkelstein et al. 2018: 69, Tables 1-2; Greenberg 2019: 26, 71-2, 97-9; Mazar 2012: 18-20; Regev et al. 2014: 259; Rotem et al. 2019: 137-8; Shai et al. 2014).

The new absolute date ranges from Jericho suggest caution is in order, since they "contradict" Regev's High Chronology, showing a 200 year inconsistency (Nigro 2018: 2, Table 9; see Table 4.1). Nigro argues in favour of prioritising the radiometric dating at Jericho for three reasons: 1) Jericho is one of the very few sites to have a complete and continuous sequence for the entire EBA, periods I-IV; 2) the site has excellent stratigraphic phasing (comprehensively reappraised by the Italian-Palestinian expedition), and 3) his radiocarbon skeleton (based on 45 samples) supports "the already-established chronological relationships between Jericho and Palestine with Pre- and Early Dynastic Egypt" (Nigro 2018: 26). The reasons for the major disparities between Jericho and the proposed High Chronology are not entirely clear beyond the usual caveats[37] and perils "concealed in the use of C14 to date stratigraphies and related archaeological chronologies" (Nigro 2018: 26). For these reasons, Table 4.1 (below) separates the High Chronology date ranges from the traditional phasing and the Jericho sequence. Nonetheless, both schemes place the beginning of the EB in the southern Levant as contemporary with the beginning of the Late Chalcolithic of Mesopotamia, the northern Levant, and Egypt.

According to Wilkinson et al. (2014), the scale of Regev's chronological revision is "no great surprise" given the problematic assumptions that underpinned the traditional phasing that relied upon cross-dating of ceramic styles with historically dateable royal Egyptian tombs. In the traditional chronology, there was no way to control for time-lags within and between regions. The High Chronology date ranges are supported by an increasing number of samples from an increasing number of sites, and include results integrated from different radiocarbon laboratories. The Jericho sequence is the odd one out. Most scholars are inclined to support the High Chronology, but adopt a 'wait and see' position.

One solution is to treat the EB II as a regional phase restricted to certain areas, rather than a uniform pan-Early Bronze Age phase for the entire southern Levant. A similar argument was

[37] The usual caveats include 'lab error potentials', screening procedures, several plateaus in the EBA production rates of C14, sampling strategies based on high quality contexts, and correct archaeological assignment of the stratified material culture.

made by Finkelstein in favour of his lower chronology for the Iron Age (Finkelstein 1996, 2005; Finkelstein and Piasetzky 2011). Advocates of the High Chronology at Megiddo have already proposed that the start of the EB II at some sites was contemporary with the EB IB at sites elsewhere, such as Beth Yerah (Regev et al. 2014: 258-9). The visibility of a distinct EB II phase has always been problematic ever since it was first defined based on a heterogenous collection of decorated vessels ('Abydos Ware') found in 1st Dynasty tombs in Egypt (Amélineau 1902; Amiran 1970 : 59, 64-66; Braun 2012: 20-27; Finkelstein et al. 2018: 69-70). Subsequent research has shown that many of these ceramic types were also produced in the EB III.

New radiocarbon dates (combined with a reanalysis of the stratigraphy) at some sites originally thought to have been deserted in the EB III, such as Arad, suggest that they were in fact continuously occupied throughout the period (Finkelstein et al. 2018: 76-77). If this is the case, it is plausible that occupations classified as EB II in some regions may well have been contemporary (or significantly overlapped) with EB III occupations elsewhere. Since ceramic indicatives are not uniform across space or time, resulting in chronologies with 'fuzzy boundaries' even when assemblages are underpinned with occasional absolute radiometric dates (Lawrence et al. 2016: 5). Phases can start and end at different times in different places, hence the larger problem of contemporaneity (Schact 1984; Sherratt 2005). Irrespective of the new radiocarbon chronologies, recent large-scale rescue excavations have pushed back the occurrence of the first fortified and planned settlements in the southern Levant, which now occur during the EB IB in the latter half of the 4th millennium BCE, c. 3300-3050 BCE (Finkelstein et al. 2018; Golani 2003: 243-7; Nigro et al. 2018; Regev et al. 2012, Regev et al. 2014, Shai et al. 2014; Shalev 2017).

III. Settlement patterns and agriculture

The EB Levant is broadly differentiated from the Chalcolithic period by a settlement break (Ben-Tor 1992 : 51). Settlement gravitates away from the core areas of the Chalcolithic, which centred on the Judean desert, the Golan Heights, the lower Jordan Valley region, and the northern Negev. The densest Chalcolithic settlement clusters of the 5th millennium BCE were concentrated in the northern Negev and the Jordan Valley (Rowan and Golden 2009; Wilkinson et al. 2014: 86-7). When settlement is re-established in these regions after a lengthy hiatus (roughly the duration of the EB I), major fortified EB sites (such as Arad and Jawa) are located in different areas than the major occupations of Chalcolithic villages. Settlement shifts from the semi-desert peripheries to the arable soils of the Mediterranean zone marked by the isohyet of 250 mm rainfall (de

Miroschedji 2009: 101-5). There is a greater emphasis on settling temperate, fertile, and high crop yielding landscapes, such as the Northern Plain, the Shephelah, the Central Hill Country, the Coastal Plains, and the Jordanian Plateau (Mazar 1992: 59-90).

These changes in settlement patterns coincide with the introduction of the Mediterranean regime of mixed farming and orchard based agriculture (de Miroschedji 2009: 101-5; Levy-Reifer 2012; Milevski 2011: 142-5; Richard 2003: 288). Terracing, irrigation techniques, water management strategies, and the plough[38] enabled more intensive cultivation of flax, fruit, and cereal crops at small and large sites throughout Israel and Jordan (Chesson 2019: 168, 170, 179; de Miroschedji 2013: 308; Fischer 2008b, 2011b). From the EB IB onwards, the botanical data from numerous sites attests to intensified staple food production to support larger settlements up to 30 ha in size, ranging from Arad and Halif in southern Israel to Abu al-Kharaz on the Jordan Plateau (Chesson 2019: 175-6; de Miroschedji 2006: 66; Herr and Clark 2009: 73-4; Salavert 2008; Seger et al. 1990). The Sea of Galilee pollen sequence shows "extremely high *Olea* [olive] values for the EB IB" suggesting a "specialised economy focused on olive orchards and their secondary products" (Langgut et al. 2016: 8). Crushing floors and substantial archaeobotanical evidence is attested at EB sites such as Yarmuth, which also produced large quantities of standard sized vats, pithoi, and jars for surplus storage in the palace and public buildings (Salavert 2008; de Miroschedji 2006).

A broad ecological distinction is clearly apparent between the western part of the southern Levant (20 to 24 site clusters) and the Jordanian highlands (6 site clusters). Rainfall from the westerly Mediterranean winds significantly drops east of the Jordan Valley, owing to the rain shadow on the leeward side of the Levantine Hill Country (Wilkinson et al. 2014: 86). The potential for farming is therefore sub-optimal when compared to the wet lowlands and basins on the west side of the Jordan Valley. As a result, fortified settlement and 'agro-towns' were more intense and an earlier occurrence *west* of the Jordan river, with the remarkable exception of Jawa in the Jordanian Black Desert (Kafafi 2011: 55).

[38] The earliest evidence of yoked animals in representational art date from the EB I in the southern Levant. Bowl(s) from el-Farah (N) have molded yoked oxen attached to the interior (Mazar and Rotem 2012: 350-1) and a stylized ox-drawn plough is shown on a stamp seal from Tel Kitan (Greenberg 2019: 51, 54). Assemblages at sites with Khirbet Kerak Ware also have miniature terracotta carts (e.g. Megiddo, Beth Shean, and Bet Yerah). These wheeled models constitute the only evidence for the use of vehicles in the 3rd millennium bce.

Mediterranean crops (olives, dates, and grapes) require intensive long term labour investments to achieve reliable harvests. Olive trees take over ten years to fruit[39] and require constant maintenance (Joffee 1998: 300; Rosen 1995: 38). Vines require a minimum of three years to fruit. Regular pruning is essential and they are more susceptible to crop failure. A farming economy based on these crops suggests that very clear concepts of land ownership, management, and tenure were in place, with a suitable labour organisation to ensure successful long term harvests. It implies a complete reorganisation of the landscape which becomes "the most salient feature of the Early Bronze Age" (Joffe 1998: 301). Hence, there is a crucial change between the Chalcolithic and EB – a "shift from prestige goods, embodying power and authority, to a focus on staple products in both settlement and cemetery contexts" (Chesson 2019: 169). Power in the EB is foremost based on the recruitment of labour/people and control over land, surplus staples, and livestock (Greenberg 2014: 270; de Miroschedji 2018; Wilkinson et al. 2014: 86-7). The new standard of power centres on the loss of individual freedoms, autonomy, and independence, reflected across many aspects of the material culture (from standardised city walls to house plans, tools in daily life, and pottery) (Shalev 2017: 58). Social status and power is no longer expressed individually through unusual exotics (Aegyptiaca), prestige items (maces, crowns, and sceptres), and other social symbols that were used to differentiate higher status individuals in the Late Chalcolithic. With the economic foundations in place to feed larger populations, other indications of large scale labour inputs are increasingly visible over the course of the EB including: fortifications, public buildings, town planning and 'place-making', and the intensification of craft production.

IV. EB I settlement expansion and site organisation

During the first half of the EB I (~3700 - 3300 BCE), settlement was dispersed and rural in character, with a variety of small farming villages (c. 1-5 ha. in size) and seasonal camps occupied by semi-nomadic groups. Agricultural villages at sites, such as Jericho (Sultan IIIa1-2), cultivated a range of agricultural produce including chick-peas, lentils, beans, grapes, and other fruits (Nigro 2010: 2; 2019: 82). Settlements were loosely occupied by scattered elliptical and curvilinear dwellings of relatively large dimension. These structures do not have a regular orientation or distribution at settlements that are rarely enclosed by perimeter walls. Examples are

[39] Modern varieties take a minimum of five years.

numerous and include Teo (Strata V-IV), Yiftahel (Stratum II), En Shadud, Kabri, Mezer, Palmahim Quarry, es-Sultan (Stratum IIIa1-2), Ashkelon, and el-Far'ah North (Ben-Tor et al. 1992: 60-1; Eisenberg et al. 2001: 207-13; Golani 2003: 245; Nigro 2010: 2; Sebag 2005: 226; Shalev 2017: 40).

The majority of EB IA sites reflect a subsistence level economy implied by the general absence of industrial facilities, storage facilities, dispersed and apparent random settlement organisation, and lack of external contacts (Eisenberg et al. 2001: 210; de Miroschedji 2009). Pottery is highly regionally distinctive, low-fired, and locally manufactured indicating poor connectivity and regional interaction. Larger farming villages approached c. 5 ha. in size, such as Teo in the Huleh valley (Strata V-IV) (Eisenberg et al. 2001: 209-10). These larger villages formed through a process of settlement 'coalescence' or 'aggregation' where the inhabitants of multiple villages merged into one settlement and were likely joined by mobile pastoralists settling down, as was the case at Teo and Jericho among other sites (de Miroschedji 2018: 110; Nigro 2010: 2-3; Sharon 2003: 7).

The process of settlement aggregation and expansion greatly intensified during the EB IB in the later 4th millennium BCE. There is a marked increase in site growth and density, with the development of large settlement clusters in alluvial lowland areas. The first mega-sites date to this period and appear in the northern wet lowlands of the southern Levant. The largest by far is Esur/Ain el-Assawir at c. 60 ha. (de Miroschedji 2018: 110; Yannai 2006), followed by Megiddo at c. 50 ha. (Finkelstein and Ussishkin 2006: 20), Beth-Yerah at c. 35 ha. (Greenberg et al. 2012), and esh-Shuna North at 20-25 ha. (Wilkinson et al. 2014: 88).

At present, the IAA is completing one of the largest rescue excavations on record at Esur/Ain el-Assawir in the northern Hasharon region, at the ecotone between the Coastal Plain and rolling foothills. The following observations are based on my visit to the site in the summer of 2018 and complement the results of previous rescue excavations at this site (Yannai 2006). Over 1000 squares (each 5x5 m) were under year round excavation and provide a 25,000 lateral sq. m. exposure of an early EB IB megalopolis (larger than the Tabqa dam rescue excavations at Habuba Kabira in North Syria). The settlement has produced substantial public architecture including a temple (with unusual installations of unknown function), a large fortification wall, webs of roads and paved walkways, and extensive domestic architecture. Excavation reports are forth coming, but the scale of urban planning is considerable with domestic buildings organised into well-defined

blocks. Systematically laid out buildings are separated by wide streets and protected by a city wall of several metres. Scepticism over the original site size proposed by Yannai (2006) questioned whether his initial estimates were greatly "exaggerated by horizontal displacement over time" (Wilkinson et al. 2014: 87). This remains a possibility, but the discovery of a circuit wall around the settlement would limit and contain the degree of lateral displacement depending on when the wall was built. In a press release to the Jerusalem Post, the site directors (Paz, Shalem, and Elad) state that this megalopolis was home to at least 6,000 people and "will change everything scholars know about the urbanisation process in the Land of Israel" (Tercatia 2019: 14).

Similar settlement expansion in other wet lowland areas suggests that Esur was by no means unparalleled. The rapid increase in settlement density across the Jezreel Valley indicates that the EB IB was one of the most prosperous periods in the history of the valley and characterised by a "well integrated regional network" (Adams et al. 2014: 40; Finkelstein and Ussishkin 2006). Surveys and excavation throughout the valley identified a clear three level site size hierarchy centred at Megiddo, which dominates the SE entrance to the valley. This site had a catchment area that included c. 45 sites (c. 0.1-20 ha. in size) including Hazorea and 'En Shadud (Finkelstein and Ussishkin 2006: 21). Older surveys[40] report as many as 100 EB I sites "although some of these attributions should be treated with caution" (Zuckerman 2003: 8). The extensive settlement cluster rivalled the Iron Age II settlement patterns when the area was under the domain of the northern kingdom of Israel (Adams et al. 2014). The total built-up area in the Jezreel Valley during the EB IB "marks the peak of occupation" until Roman times (Finkelstein and Ussishkin 2006: 21).

The majority of sites throughout the Jezreel Valley were located along the edges of the valley "due to drainage problems…soil instability…and seasonal swamps" (Zuckerman 2003: 7). Such conditions continued well into the 19th and 20th century CE. The resulting pattern was rather distinctive, with settlement on the periphery encircling fertile soils and alluvium down the middle of the valley, as opposed to the reverse (i.e. fertile farmland ringing concentrated settlement) (Zuckerman 2003: 8). Low lying sites in the centre of any valley are more vulnerable to attack compared to sites that overlook the alluvium on higher ground. Qiryat Ata (on the outskirts of Haifa) was founded on virgin soil roughly 35 km north of Megiddo and experienced similar

[40] The region was previously surveyed by Raban in the 1980's before Finkelstein (Zuckerman 2003: 8). One wonders how repeated surface surveys and field walking influences the results of subsequent surveys, especially when material is bagged, tagged, and removed from sites.

growth, with a fourfold increase in site size over the EB IB. This site was newly founded in Stratum III (early EB IB) and expanded by moving up the adjacent slope in Stratum II, the late stage of the EB IB (Golani 2003: 243).

The lowlands in the south also show strong indications of increased EB I settlement activity on the Coastal Plain at various excavations around Ashkelon (e.g. Afridar, Barnea, and the Marina – Faust and Golani 2008; Golani 2013, 2014; Golani and Nagar 2011). Settlement here is thought to represent "the material culture of Chalcolithic groups that had relocated northwards to the southern coastal plain after the collapse of the Chalcolithic geo-cultural sphere of the northern Negev" (Golani and Nagar 2011: 84). The high frequency of donkey remains[41] and industrial metal working led the excavators to suggest that EB I Ashkelon was a major caravan destination (as well as a seaport) that would have supplied markets as far away as the Egyptian Delta, where similar copper tools were found (Golani 2014; Stager 2001: 632-3).

Ashkelon was connected to other regional EB I emporia (such as the Halif terrace) and formed part of a circuitous and trans-regional trading network with Pre-dynastic Egypt. Donkeys require between 18-35 litres of water per day, which rules out direct transit through deserts. A line of unwalled and sparsely settled EB sites form what may have been 'the southern frontier' on the 'drought line' and include Bir Gamla/Ein el-Qamla and Bir Abu-Jukheidim (Gophna and Gazit 2006). Sites such as these had deep wells that were "a stable source of water in all periods" and were presumably the stopping points for donkey caravans (Gophna and Gazit 2006: 37). Problems sourcing metal artefacts makes much of this trade route hypothetical. Previous studies have emphasised that the increase in connectivity and intensified long distance trade should be seen in the context of donkey domestication (Milevski 2011: 178-188; de Miroschedji 2018: 12). Donkey transport is closely associated with 'power' in the EB, which centred on the control over the distribution of surplus agricultural staples (Wilkinson et al. 2014: 88).

Further inland at the eastern edge of the coastal plain, the southern site of Erani is under excavation by an Israeli-Polish expedition (in conjunction with rescue excavations by the IAA). This expedition confirmed that the site was a large fortified regional centre as early as the EB IB1.[42] Consequently, the excavators now claim that this site was "the earliest urban city" in the

[41] Roughly 20% of the faunal assemblage was donkey.
[42] Also known as 'the Erani C phase' after the pottery.

Levant (Shalev 2017: 46, 60).[43] The site shows substantial planning with settlement extending over the steep acropolis, expansive upper terrace, and the lower terrace encompassing an area of c. 25 ha. (Shalev 2017: 43; Czarnowicz et al. 2019). Massive fortifications surrounded the site with mud brick walls over 8 m thick. These walls foreshadow the massive fortification systems in EB II levels at Beth Yerah, which have produced walls of similar thickness (Czarnowicz et al. 2019; Shalev 2017: 45; Greenberg et al. 2012). Consequently, there is growing uncertainty over how to characterise the EB IB. Some scholars still prefer Kenyon's terminology and refer to the EB IB as the 'proto-urban' period, following a long period of 'gestation' in the EB IA (Nigro 2007: 01, 14; 2010: 1-2; 2012: 8; Yamafuji 2019 : 125; Mazar 2012: 22-3; Cohen 2016: 26). Alternatively, others consider the EB IB as the start of full blown urban culture that intensified in the EB II-III. The combined evidence from recent excavations conducted by the IAA (and various institutions) in combination with the new 'high chronology' is encouraging more scholars to see the EB IB as the inception of urban processes that become widespread in the EB II and III (Golani 1999, 2003; Faust and Golani 2008; Shalev 2017; Finkelstein et al. 2018: 73; Braun 2002; Rotem el al. 2019).

V. EB II-III settlement expansion and site organisation

Strong similarity in material culture and continuity in settlement patterns makes it difficult to differentiate the EB II and III phases, especially in the absence of certain types of decorative pottery (Golani 2003: 246; Ben-Tor 1992: 51-2; Mazar 2012: 2, 23-4; Finkelstein et al. 2018: 69-70; Ben-Tor and Bonfil 2003: 10; Greenberg 2019: 71; Cohen 2016: 74-81). Researchers have had great difficulty in separating the two periods, which are usually grouped together especially for surface survey material. According to Zuckerman (2003: 7), the reconstruction of the resulting "settlement picture" is "groundless" and "of little value" in these already broad chronological period distinctions (2003: 7). Long phases encompassing several centuries will amalgamate successive settlements (Lawrence and Wilkinson 2016: 331). This is a major problem for surface survey data when finer time slices based on stratification are not possible.

Site size and density vary according to how the surveyors have subdivided the period and the number of time slices (Wilkinson et al. 2014: 79). When the data are mapped, the resulting visuals suggest that all sites were contemporary in real time and existed for the full phase, with no warning to the contrary – hence the 'problem of contemporaneity' in the archaeological record

[43] Tel Esur/Ein el-Assawir is also competing for this title and we await dating evidence (other than pottery styles). Unfortunately, the site of Esur is not producing good samples for C14 dating.

(Lawrence and Wilkinson 2014: 331; Schact 1984; Sherratt 2005). This has clear implications for how site hierarchies are conceptualised and potentially (mis)understood, especially in the absence of absolute high-precision radiometric dating evidence. The size and density of built-up areas, number of city-states, and site hierarchies may have been conflated and over-estimated with settlement expansion depicted as occurring in dramatic 'waves' with 'overfilled' distribution maps. Hence Graham Philip's critique of EB II-III settlement patterns in the Levant (Philip 2001; 2008). The same critique was previously made by Pollock (2001: 210; 2008) in regards to the early work done on Uruk Mesopotamia by Adams and his colleagues.

According to Khafafi (2013), the alleged absence of well-defined EB site hierarchies in Jordan (Savage et al. 2007) is due to over-reliance on old datasets, traditional surface survey methods (field walking in the absence of subsurface reconnaissance), and uneven recovery rates for the Badiya (North-Eastern Desert), hill country, and Jordan Valley. His reassessment (Khafafi 2013) identifies a 3 tier site size hierarchy from the EB II onwards with some sites transitioning to urban complexity as early as the EB I (Jawa in the Black desert). Many of the aforementioned issues are mitigated by reconstructing settlement patterns based on excavated sites, using well dated stratified assemblages, and relying less on the results of traditional surface survey.

VA. Egyptian impact and settlement fluctuation in the alluvial lowlands

Environmental research at Esur suggests that the growth of marshland led to a collapse of agriculture and late EB I settlement in wet lowland areas (alluvial fans) with poor drainage (Horowitz 2006: 268). This scenario fits well with the recent paleoenvironmental results derived from the isotopic record at Soreq cave and the Sea of Galilee pollen record – both indicate a very wet climate with elevated levels of moisture (Bar-Matthews and Ayalon 2011; Clarke et al. 2016; Langutt et al. 2016). In addition to Esur, settlement also drops dramatically in the western half of the Jezreel valley, with only a handful of sites reporting EB II surface sherds (Zuckerman 2003: 8). Similar abandonments at wet lowland sites occur across the Coastal Plains, including the former prosperous site of EB I Ashkelon and es-Sakan (Golani 2013; Faust and Ashkenazy 2009; Mazar 2012: 24; de Miroschedji and Sadek 2000).

The collapse of an EB IB Egyptian presence in SW Canaan is followed by a settlement hiatus at a number of key sites across the Coastal Plain and its periphery. These sites include es-Sakan, Ashkelon, Nizzanim, Poran, Halif, and el-Hesi among others (de Miroschedji 2006: 71-73; 2012: 275-6; Seger 1990; Cohen 2016: 28-33; Gophna 1998: 276). Es-Sakan (south of modern

Gaza on the Gaza river) was the major fortified centre of Egyptian settlement, but was abandoned around 3000 BCE (sometime during Dynasties 0 to 1) (de Miroschedji 2012: 275; 2015). All of the aforementioned sites follow the same pattern and make a strong resurgence in the EB III when former Egyptian outposts are transformed into large heavily fortified settlements that dominate important headlands and river estuaries. At es-Sakan, fortifications were re-built to measure over 7.8 m thick, with an enormous 10 m wide glacis (de Miroschedji 2012: 276; 2015). The substantial refortification at these coastal sites may relate to the earliest known cases of piracy and internecine city-state warfare mixed with periodic Egyptian raids. Egyptian aggression was apparently provoked by recurrent raids on Pharaoh's trading fleets to and from Byblos during the EB III. The reciprocal raiding evidently peaked during the 4th to 6th dynasties (EB III) of the Pyramid Building Age and is vividly described in tomb reliefs at Saqqara (de Miroschedji and Sadek 2000; de Miroschedji 2012; 2015).[44]

Scholarship has always been split over the degree of Egyptian involvement and influence on settlement patterns, site hierarchies, and urbanisation in the Levant (Cohen 2016: 30-36; Finkelstein 1995: 52; Greenberg 2011a, 2013; Levy-Reifer 2012: 558; Nigro 2007; Richard 2003: 289; Sowada 2009). Some maintain Egyptian trade was the very catalyst for urbanisation and others argue that the growth of local economies was held back by the Egyptian presence (Greenberg 2011b; van den Brink and Levy 2002).[45] Advocates of the latter scenario maintain that

[44] The Egyptian military campaigns are described in detail with the typical royal bombast at Saqqara. A 6th Dynasty governor of Upper Egypt called 'Uni' served under four consecutive pharaohs. His tomb reliefs describe how he levied and led troops for six campaigns against the 'Amu Heryu-sha'. Current scholarly opinion holds that the latter is a derogatory term referencing the rebellious Amorite/Asiatic 'sand dwellers', who are now identified with the early Canaanite city-states along the flat sandy seashores of southern Palestine and the Sinai coast (de Miroschedji 2012). Exactly what is meant by the term 'rebellion' and its causes are debated, but reasons centre on the disruption of trade. de Miroschedji (2012; 2015) prefers the mercantile trade hypothesis wherein powerful Canaanite cities dominated the main river estuaries and harbours along the EB III coastline. The hypothesis suggests that these local city-states either sponsored competing trade, periodically denied access to harbours, and/or actively raided heavily laden Egyptian trade vessels on the 'Byblos run'. The Egyptian mercantile trade was critical for resourcing Old Kingdom pyramid projects and the royal court. The seven to ten day sea journey involved stopping points along the coast. Ships did not sail at night, especially between the Gaza and Yarkon rivers, due to the heightened risk of shifting sand dunes jack knifing the bend in the Mediterranean. It constitutes the earliest case for widespread piracy on trade and such activities had to be kept in check along this stretch of coastline in virtually every kingdom period in Egyptian history.

[45] Did the prosperous EB IB townships draw the Egyptians to these areas, or did these townships develop as a result of an Egyptian presence? This is the key question currently motivating much fieldwork at Erani and elsewhere in SW Canaan (Shalev 2017).

the diminished Egyptian influence after Narmer provided a 'window of opportunity' for 'local power brokers' in the Levant to reap the benefits of trade, which grew the local economies (Greenberg 2014: 4). Nigro suggests 'the Egyptian impact' was a 'decisive factor' in driving Levantine societies toward 'full urbanisation' (Nigro 2007: 37-8). He maintains a modified version of the traditional view, but pushes the process back to the second half of the 4th millennium BCE. According to this position, a mutual exchange of goods and 'international trade' early in the EB I propelled the formation of 'incipient towns' (exemplified by EB I Jericho and Byblos), which set them on a path to city-state formation achieved in the EB II. Braun (2002) downplays the Egyptian impact altogether and believes the 'colonial' presence has been greatly overstated. Throughout this period, there are Egyptian communities living in Canaan and Canaanite communities living in Egypt[46] (Doherty 2015: 55-69). The areas that first manifest urban characteristics are well outside of Egyptian control (areas to the north and further inland from the coast). The former heartlands of Egyptian settlement on the Coastal Plains were precisely where a local urban settlement system took far longer to develop (only after a hiatus lasting the entire EB II [Braun 2002]). The new radiocarbon chronology at sites such as EB I Megiddo suggests that the Egyptian colonies (the EB IB2 phase in the south) had already disappeared prior to the significant increase in construction activity, as exemplified by the 'Great Temple' (dated to ca. 3090-2920 cal BCE) (Regev et al. 2014: 258).

Evidence for bonafide Egyptian exchange relations are scant in the southern Levant and are restricted to varying handfuls of Aegyptiaca at select sites. The items in question (cosmetic palettes, lotus vessels, alabaster, Egyptian style maces, and perhaps crescent axes) mostly relate to personal adornment and are perhaps 'status indicators' showing gift exchange between leading families (Greenberg et al. 2012: 95-6). The Aegyptiaca in the Levant continues unchanged from the 4th to the 3rd millennium BCE, with the same kinds of items found in EB II-III regional centres (Sala 2014). However, they are no longer imbued with the symbolism and power they once had, since the language of power in the EB clearly shifts from prestige goods and exotics (personal power in social economies) to staple goods, surplus, and control of labour (economic power in

[46] These etic terms have geopolitical connotations that clearly did not exist early in the EB and I use them to purely denote the geographic origin of the inhabitants (how they self-identified is a separate and much more problematic issue, especially prior and during the state building process, ancient and modern). Sizable Canaanite communities are known from Naqada II-III settlement and tomb contexts at Buto, the Ma'adi regions, Minshat Abu Omar, Hierkonopolis, Naqada, Abydos, and Tell el Farkha (Doherty 2015: 55-57).

commercial economies) (Greenberg 2014: 270; de Miroschedji 2018; Wilkinson et al. 2014: 86-7; Shalev 2017: 58).

Levantine exports to Egypt always centred on horticultural products (timber, wines, resins, unguents, and oils) that are largely invisible, but the containers occasionally feature in royal Egyptian tombs and were imbued with cosmological significance. For example, funerary barges are made from Lebanese cedar and Canaanite pots contained various types of semi-precious liquids (residues suggest wine and resin) for a comfortable afterlife, some of which came from the Kinneret (Galilee) region, as well as copper from the Arabah (Greenberg 2011b; Thalmann and Sowada 2014; Sowada 2009; Golani 2014; Nigro 2007; Porat 1997).[47] The scale of the exchange and its effects on the southern Levant is highly debatable and much is hypothetical (Finkelstein and Gophna 1993). The Egyptians were nonetheless exposed to revolutionary innovations including viticulture and the plough (Greenberg et al. 2012: 97). Golani (2015, 2013) emphasises the pull of the copper trade and the export oriented metallurgical production at Ashkelon. In addition to agrarian and metallurgical innovations, Egypt was also exposed to high fired wheel-shaped pottery for the first time (Doherty 2015: 55-56).

Regardless of the 'Egyptian impact', the southern Levant was a technologically sophisticated society and not an underdeveloped backwater. Horticultural goods and copper imported from this region are in short supply on the mudflats of 'river valley civilisations' and have always been considered an important factor in the emergence and maintenance of the Pharaonic state (Doherty 2015: 46; Greenberg 2011b: 234; Andelkovic 2008: 1040-1042). However, there is slender indication to suggest that the reverse was also true (i.e. Egyptian interactions inspired the emergence and maintenance of Levantine city-states). While it is clear that Egyptian trade did occur throughout the 4th to the mid 3rd millennium BCE, the role it played (if any) in Levantine urban complexity seems at best tangential. The wine and oil infrastructure in the Levant was likely oriented around "intrasocietal distribution and consumption", with negligible amounts of unknown quantity exported to Egypt (Genz 2003; Joffe 1998: 301).

[47] Some burnished jugs at Levantine sites, such as Tell Beth Yerah, were incised with Egyptian hieroglyphs and pot marks "indicating knowledge of their final destination" (Joffe 1998: 301). Offering lists in Old Kingdom Egypt are rare in tombs containing Levantine jars, but there are references to 'sweet oil' and *sefjet* oil (one of the seven sacred oils for mummification). The latter 'probably' alludes to an imported coniferous resin, which finds some support in the limited residue analysis that has been done, but not all tests were conclusive (Sowada 2009: 161).

There is little indication for an *intensification* of trade relations that coincided with the consolidation of early city-states. Proper quantitative studies are still lacking, but Levantine imports found in Egyptian tomb contexts spiked in the Predynastic and Dynasty 0, then *significantly dropped* overtime (Greenberg 2011b: 234; Joffe 1998: 301; Genz 2003). For example, over 400 Levantine vessels were found in Tomb U-j from Dynasty 0, which is more than double the total approximate amount found in tombs from Dynasties 1-6 (n = c. 200). Notwithstanding the usual biases of chance survival and discovery, the pattern suggests Egyptian trade became less important, as Levantine economies expanded in the early 3rd millennium BCE. This inverse relationship has been noted in multiple publications (Braun 2005; Wengrow 2006: 135-50; Gophna 1998: 275).

Despite prolonged exposure to Egyptian political, social, and economic strategy, Egyptian practices do not take hold in the EB southern Levant. As mentioned previously, sites with strong Egyptian features and representations of power (e.g. es-Sakan and Megiddo) do not survive the transition to the EB II. Aside from trivial amounts of Aegyptiaca, no major aspect of EB II urbanism (e.g. town plans, residential architecture, fortifications and monumentality, sealing practices, and so forth) betrays an Egyptian origin or hint of influence (Greenberg 2011b: 234-5; Kempinski 1992; Golani 2003; Yamafuji 2019). Even measurements were typically based on the 'Canaanite' cubit and not the Egyptian cubit (Chadwick et al. 2017). Diffusionist trade based explanations are deficient, rest on presumption, and do not explain the local trajectories of early southern Levantine city-states, which were already emerging in the latter half of the EB I.

The early Levantine city-state is a settlement type (and form of social organisation) that is completely foreign to the hierarchical estate based economic management of the Egyptian territorial state. The territorial state of Pharaonic Egypt excluded most of the population from walled administrative regional centres. Similar to Shang China, these sites were reserved almost entirely for the ruling class (scribes, royal retinues, and priesthoods) that governed rural populations in dispersed unfortified villages. This is precisely why Egypt is traditionally known as a 'civilisation without cities' (Trigger 1993: 9, 11, 72; Maisels 1999; Gates 2011; Redford 1997). Under this socioeconomic system, elite power is consolidated by distancing the ruling classes from the ruled and maintaining a rigid social hierarchy that depended heavily on the role of scribes. Despite exposure to this innovation in record-keeping, EB society in the southern Levant remained preliterate for the entire period. Chesson (2019) suggests that early Canaanite

society actively rejected the use of writing, which would further indicate that the economy was managed very differently compared to Egyptian practice.

Jennings and Earle (2016) used data from Polynesia and the Andes to show that state formation "was quicker and more effective where environments kept people more dispersed" (2016: 474). Rural and dispersed settlement patterns in territorial states promote far more stability and continuity, when compared to the volatile settlement histories typical of crowded city-states across Mesopotamia and the Levant. In contrast, most innovations in SW Asia (from fortifications and weapons to water management strategies, the plough, and viticulture) occurred in the context of urban growth in city-states and not in the dispersed rural contexts of a territorial state. It seems that 'city life' has always encouraged innovation and instability (a melting pot of people, ideas, and influences), past and present (United Nations Human Settlement program 2004).

VB. Settlement crisis, instability, and punctuated growth in the valleys

Climate change and the Egyptian withdrawal from SW Canaan were not the only contributors to a settlement crisis that marks "the dissolution of EB I village society" (Rotem et al. 2019: 140). A string of sites were either destroyed, abandoned, or shrank at the end of the EB I, but the precise causes remain unknown (Rotem et al. 2019: 139; Zuckerman 2003: 125, 179; Mazar 2012: 23-4; Cohen 2016: 26; Greenberg 2019: 48, 64-5; Gophna 1998: 273). The central Jordan Valley (well outside of the Egyptian EB IB 'contact zone') was severely affected with thick destructions and/or abandonment at Abu al-Kharaz, es-Sa'idiya, Shalem, Kitan, esh-Shuneh (North), Beth-Shean and Beth Yerah. There is no indication in the material culture that any of these sites were under strain prior to their destruction and/or abandonment.

Fischer (2011a, 2011b) and Mazar (2012: 23-4) discuss a wide range of hypothetical agents from natural disasters to invaders/territorial warfare and epidemics. Notably, only two of the aforementioned sites pull through this phase of political chaos to develop into prominent EB II urban settlements e.g. Beth Yerah (Greenberg et al. 2006; 2012) and Abu al-Kharaz (Fischer 2008, 2011a, 2011b). Similar situations are paralleled in other sub-regions, such as the Soreq River drainage basin, where sedentary settlement simply ceases at prosperous unfortified EB I villages, such as Horvat 'Illin Tahtit and Palmahim Quarry (Braun 2002). Es-Sultan in the Jericho Oasis is the only site (*west* of the Jordan River, but still in the Jordan Valley) to survive multiple destructions and has a complete Early Bronze sequence from EB I-IV (the fortifications were built

and repaired some 17 times in the EB).[48] The site suffered major earthquake damage in the EB II, was twice destroyed (a major 'conflagration') in the EB III, and each time was rebuilt with enlarged fortifications that culminate with an enormous double lined city wall and a glacis (Nigro 2016; Nigro et al. 2018; Davis 2008: 148).

Earthquakes are blamed for significant damage at EB IB Megiddo, which sits on the Carmel fault line in the Jezreel Valley (Finkelstein and Ussishkin 2006: 15-16). The cracked façades on Megiddo's 'Great Temple' was the likely cause for a ritual abandonment at this regional sanctuary in the EB IB. Similarly, the 'conflagration' of the large and 'unique' two-story pillared hall (over 55 sq m floor space) at Beth Shean (Straum M3 of 'Building MA') is attributed to a 'heavy fire' from alleged earthquake(s) dated to the mid-31st century BCE (Mazar 2012: 15-22; Mazar and Rotem 2009; Greenberg 2019: 47-8). Unlike the 'Great Temple', Building MA continued in use and was rebuilt on a less grand scale, but the finds suggest an increase in social hierarchy with a change in building function. The large public building in M3 was a 'non-residential' storage and processing centre for agricultural goods. In the M2 phase, the structure was repurposed as a residential dwelling for an elite family.

The Dead Sea transform fault, where the Sinai subplate meets the Arabishe plate, is one of the most active tectonic regimes in the Middle East. Large earthquake cracks are distinctive and have been confirmed by seismologists at most sites where earthquake damage has been reported (sometimes used to link up settlement phases). Evidence for earthquake strikes are recognised in late EB I and EB II levels at numerous sites, most of which are located in the Jordan Valley or along its fringes, including Jericho (Nigro 2019: 83; 2016: 9; 2010: 326-7), early EB II Khirbet al-Batrawy, Ai/et-Tell, et Mutesellim, Pella, Tell Abu Kharaz, Beth-Yerah (Stratum M3), and es-Sa'idiyeh (Nigro 2010: 326-7, 329-337; Greenberg et al. 2006: 247; Greenberg 2019: 50, 65; Fischer 2008: 383-5). Radiocarbon dates from EB IB sites with a major 'conflagration' always place the destruction in the mid-31st century BCE. Nigro (2010: 30) suggested that the frequent occurrence of 'structural gaps' (of roughly 0.5 m) between stretches of EB II fortification walls (at Jericho and elsewhere) were not just passageways, but were designed to limit earthquake collapse.

The task of deciding how localised are each of these destructive agents (harvest failure on saturated low lying soils, earthquakes, invading Egyptian armies, territoriality, and internecine

[48] East of the Jordan river, Tell Zira'a and Khirbet Iskander both in Jordan overlooking the Jordan Valley also have EB I-IV sequences.

warfare/raids) are difficult to disentangle. According to Sherratt (2005), the temptation for archaeologists is to assume destruction levels are contemporary in real time, which becomes the basis for weaving together an elaborate event centred history and fictitious meta-narrative that centres on simplistic 'prime-movers' (seemingly humdrum reasons for destruction staggered over time are overlooked to favour imaginative grand narratives). Whatever the precise real-time causes of settlement destruction, decline at some sites is clearly matched by considerable growth at others. Settlement aggregation was greatly intensified by population dispersals from EB IB 'megasites' and the increased movement of people (immigration) from abandoned and/or destroyed rural sites to larger walled settlements that dominated strategically defensive positions in the landscape (de Miroschedji 2018: 110; Yannai 2006; Greenberg 2002; Rotem et al. 2019: 139-40; Mazar 2012: 2, 24).

The main outcome of the settlement crisis was the temporary eclipse of a village level settlement system, which was replaced by an urban one in the EB II (Portugali and Gophna 1993; Gophna 1998: 274-5; Joffe 2013 ; Rotem et al. 2019: 140; Mazar 2012: 24). The transformation from village to urban settlement occurred in the context of unstable settlement histories, widespread social dislocation, and upheaval. This suggests a very different path to urban complexity when compared with the relatively smooth progression described for 'LC hubs' across northern and southern Mesopotamia in the late 4th millennium BCE (Wilkinson et al. 2014; Lawrence and Wilkinson 2015). The EB settlement trajectory in the southern Levant foreshadows the 'floruit of citadel cities' that later appear across northern Syria in the latter half of the 3rd millennium BCE. These 'citadel cities' were highly volatile and are characterised by explosive cycles of growth, economic boom, and collapse. This volatility is caused in-part by over-reliance upon fertile dry-farming strategies and sheep/goat herding in 'zones of uncertainty' (Wilkinson et al. 2014; Lawrence and Wilkinson 2015; Lawrence et al. 2016). Zones of uncertainty are drought prone sub-optimal areas with marginal agro-pastoral potentials. When early city-states farmed and pastured these zones, they benefitted from 'high pay-offs' (especially in periods of wet climate), but suffered when subsistence became too reliant on the productivity of these zones. The risk(s) to subsistence were high, since even marginally drier conditions can devastate local economies; hence, the explosive cycles of growth and collapse first attested in the EB southern Levant.

VC. The Negev highlands, the Sinai, and the 'New Paradigm'

In the Negev highlands, urban growth at the Arad site cluster peaked in the EB II. The economies at these sites were boosted by a flourishing trade network associated with both Feinan copper and the mines of the south Sinai (Amiran et al. 1978: 114; Cohen 2016: 26-7; Greenberg 2019: 81, 88-92; Mazar 1992: 114-7; Stager 2001: 631-2). Intensive exploitation of the copper mines coincided with the growth of Negev highland sites that acted as 'intermediaries' and 'gateways' in the supply chain and transhipment of copper and other valuable resources obtained from the southern and eastern deserts. Long-distance trade and exchange in metals is rather self-evident given the scarcity (nonexistence) of ore in the local geology across most of the southern Levant, yet the end products (identical types of axe heads, pins, and daggers) are found widely distributed across upland and lowland areas on both sides of the Jordan Valley. Trade links are further supported by provenance studies (petrographic and stylistic analyses) on arkose sand tempered ceramics linking gateway sites in the Negev (namely Arad) with distant sites involved in copper production at ore field locations in the south Sinai (Milevski 2011: 58-64; Goren and Porat 1989; Porat 1989; Mazar 1992: 114). Some vessels of identical form and fabric were transported over a 400 km distance. Close and regular contact is further substantiated by general settlement data and house types surveyed and excavated by Beit-Arieh at 'Aradian sites' in the south Arabah and south Sinai regions (over 50 EB II 'Aradian' sites were recorded in the St. Catherine region alone) (Beit-Arieh 2003; Mazar 1992: 116; Greenberg 2019: 75, 80).

Based on finds from Har Haruvim in the southern Jezreel Valley, Greenberg (2019: 91) proposes that EB II ceramic exchange probably "piggy-backed" off a pre-existing EB I trade in flints (Canaanean blades) and copper (items with presumably greater exchange value) that were disseminated over distances as great as 20,000 sq km. Nigro (2014: 41-2) makes the same general argument for the southern Levant as a whole. Finds from the EB III neighbourhood at Tell eṣ-Ṣâfi/Gath appear to support a similar scenario for the long-distance exchange of a range of utilitarian and exotic goods in the EB III. The chemistry of some (not all) of the basalt artefacts (Beller 2016; Arnold et al. 2017) and the thick bitumen residues on some of the jars suggest trade contacts with the southern Dead Sea region (Arnold et al. 2017). This region is also the probable 'transhipment' point of the small number of copper artefacts found in the Area E houses and alleyway (damaged pins/awls, ring, and axe head). The diverse range of goods (e.g. bitumen, copper, ceramics, and even basalt and possibly jewellery and Nile perch) moving along these

supply lines makes the tentative identification of a "merchant class" at sites such as Tell eṣ-Ṣâfi/Gath plausible (Greenfield et al. 2012; Greenfield and Maeir 2017; Arnold et al. 2016, 2017). The commodity flows of varied goods (including invisibles such as oils and resins) further reinforces the potential identification of "market places" as early as the EB II at sites such as Arad (Greenberg 2019: 81).

Unfortunately, provenance studies on the metal finds (always unalloyed copper[49]) are far less conclusive. It is too early for Cypriot ore (exploited in the late second millennium BCE), but potential sources include the Feinan and Timnan ore fields. Both ore fields were not only active in this period, but experienced a substantial increase in mining activity, especially when compared with the Chalcolithic (for summaries see Segal and Yahalom-Mack 2012; Levy et al. 2002; Ben-Yosef et al. 2016). New techniques in metal working (casting, forging, and annealing[50]) are attested as early as the EB IA at coastal sites supplied with considerable quantities of imported copper e.g. Ashkelon-Afridar (Golani 2013). There are problems matching distinct signatures of heavy isotopes in archaeological metals with specific source locations, within and between, neighbouring ore fields in the East Mediterranean (although rarely admitted with clarity in the actual published data). Evidence for frequent recycling of metals is a problem, since the re-melting (and the mixing of scrap) invariably confuses the results of a provenance study (Montanari 2020: 115). One recent study on 5 copper objects (including three EB I axe heads) from Beth-Shean reported some success differentiating between Timnan and Feinan ore sources based on cobalt content (Segal and Yahalom-Mack 2012).

Whatever the case, if one reasonably rules out Anatolia (entertained in Philip et al. 2003), then copper was certainly a valuable commodity imported from the nonurban desert regions to the south. But the question remains how far south was the copper obtained (Timna in southern Israel, the Feinan in the Arabah Region of southern Jordan, and/or the southern Sinai). Most provenance studies on EB metals tend to favour the Feinan, especially given the extensive evidence of EB copper production facilities in that region at well documented sites, such as Hamra Ifdan (Ben-Yosef et al. 2016; Segal and Yahalom-Mack 2012: 396; Levy et al. 2002). Casting molds at Hamra Ifdan indicate copper was exported as crescent shaped ingots, simple axe-shaped ingots, and

[49] Tin bronze was not introduced until the EB IV (and then only in small quantities) following the collapse/decline of the EB III urban economies.
[50] Throughout the Chalcolithic metal working was based on the lost wax technique.

cylindrical pins, with no apparent changes in the typology of tools over the entire EB I-III period. Although, the aforementioned heavy isotope results from Beth Shean suggests that no single source exclusively monopolised the markets in the southern Levant (although the sample size is obviously tiny).

Presumably caravan trade from all three major copper sources converged along the same circuitous trade routes heavily traversed by nomadic pastoral communities, who were no doubt the purveyors of much of this trade with Egypt (including bitumen and 'invisible' goods, such as oils and resins that were always in demand in Egypt from the early Naqada II onwards[51]) (Nigro 2014: 42). As mentioned previously, caravan routes through the arid and treacherous rocky terrain are foremost determined by access to limited water sources 'below the drought line' such as, wadi beds, and wells in rural outposts (Gophna and Gazit 2006). A trail of sherd scatters and temporary campsites identified by Yekutieli (2009) connect the valley bottom of the Dead Sea Plains with the Arad plateau in the Negev highlands and marks out a mountain pass route ('the Zohar pass') taken to the Feinan. In addition, the dwellings and mobile camps inhabited by nomadic pastoralists are numerous (they 'proliferate') and dot the landscape along the northern Sinai route (Cohen 2016: 29; Greenberg 2019: 62-3). Such sites are well known to have linked the Egyptian Delta with southern Palestine and are dated to the EB IB and early EB II based on a mix of both Egyptian (Dynasty I) and Levantine pottery (including 'Erani C' pottery).[52]

A recent paper proposing a 'new paradigm' by Finkelstein et al. (2018) summarises a collection of new radiocarbon dates and rich finds from a spate of recent expeditions at Negev Highland sites (Arad included). The findings show that settlement activity continued to prosper throughout the EB III phase. Occupation in the Negev highlands was not restricted to the EB II, as traditionally thought. Previous scholarship had related economic decline at Arad (and the surrounding sites) with a disruption to trade allegedly caused by the retreat of the Egyptians from southern Palestine (Cohen 2016: 29; Rosen and Rosen 2001: 544). However, such a scenario was always an awkward fit with the data, since it struggled to cope with significant delays in the sequence of events and the timeline was way out. The Egyptian withdrawal occurred late in the EB IB (Dynasty 0 to early Dynasty 1). Urban prosperity did not peak at Arad until the EB II and

[51] Small-scale exchange occurred as early as the Badarian and Naqada I periods (equivalent to the Chalcolithic period in the Levant) (see Cohen 2016: 28; Wengrow 2006).
[52] The sites reflect an economy based on regular patterns of seasonal movement and migration.

the site cluster supposedly declined into a non-entity by the EB III. Surely, urban growth would not have peaked in the EB II and economic decline would have occurred far sooner, if the true cause of Arad's demise was somehow the Egyptian withdrawal in EB IB Canaan (note that these phases are significant spans of time that encompass many human generations). Once again, good data from stratified contexts in Israel and Jordan was forced to conform to an Aegypto-centric interpretation[53] that never did properly fit, yet remained popular in scholarship until it was proven false *de facto*.

One wonders whether EB settlement activity from parts of the Sinai (especially the south Sinai) will similarly be re-assigned to include the EB III if the data can be revisited. Much of the region was surveyed (with no radiocarbon dates) around the same time that Arad was originally excavated almost 50 years ago. These regions have always been very closely linked in the literature (Beit-Arieh 2003; Mazar 1992: 117; Greenberg 2019: 75; Stager 2001: 631-2). The pottery dating evidence (especially at the time those sites were surveyed) was (and still is) far from clear cut for the EB II-III transition, especially in the absence of certain decorated fine wares.[54] If this is the case, then there was no abrupt termination of the over land caravan routes by the EB III. Rather nonelite merchant activity and the seasonal movement of pastoral nomads simply continued at a low-level as it always had done. Arguably, the isotope results on the donkey burials (showing an Egyptian origin) and 'merchant activity' at Tell eṣ-Ṣâfi/Gath (and neighbouring sites) suggests (although does not 'prove') the high likelihood of such a scenario. The continuity of thriving trade-centres at highland Negev sites, such as Arad, further suggests that goods from the southern Dead Sea region were still being funnelled through these very same sites (and routes) in the EB III. In which case, EB II trade networks were still supplying distant sites with their bitumen, copper, and basalt in the EB III, as exemplified by the finds from nonelite houses at Tell eṣ-Ṣâfi/Gath and other such sites.[55]

[53] Where Egypt is the 'core' and the Levant is the so-called 'periphery'.

[54] Unfortunately, the Sinai is a hotbed for major terrorist groups and organisations (the region has always been a liminal space) that may disrupt current and future expeditions to the area.

[55] Arguably, this has implications for Greenberg's portrayal (2019: 94-131) of the EB II as the peak of urban growth and the EB III as a period of general economic decline that cannot be fully explored in this chapter. It is clear from southern sites across the coastal plain and the Shephelah that settlement growth and local urban concepts do not hit a peak until the EB III. This is also true for some major northern sites that either experience a contraction, or a full hiatus for the EB II (e.g. Beth Shean and Megiddo).

This is not to deny that there was a major restructuring in trade once the Egyptian royal court assumed direct control over the copper and turquoise mining operations in the south Sinai by the 3rd Dynasty (Cohen 2016: 32-3; Mazar 1992: 117; Stager 2001: 632).[56] These developments would clearly lessen foot/hoof traffic to the southern Levant, especially when combined with the growth in Egyptian maritime trade that increasingly centred on Byblos and the northern Levant (Greenberg 2019: 124-5, 2014; Stager 2001: 632; Bass 1995: 1425). The cargo capacity of a trading fleet far outstrips the capacity of a donkey caravan that would struggle to haul large quantities of timber[57] (among other goods in high Egyptian demand). 'Port power' is quicker, cheaper, potentially less dangerous, and more direct (Stager 2001: 632). It is therefore hardly surprising that Egyptian material sharply drops ("virtually disappears") in EB II-III levels at sites across the southern Levant (Cohen 2016: 32; Sowada 2009: 48-9, 246; Greenberg 2019: 94-5).[58]

If maritime piracy was an occasional major hindrance for Old Kingdom pharaohs (e.g. the autobiographical Uni/Weni tomb inscriptions), then presumably overland caravan trade was at even greater risk. The intensification of maritime trade with Byblos can be seen as an attempt to secure supply lines for the bulk import of Levantine horticultural products that became increasingly important during the Pyramid Building Age. These supply lines were invariably tempting targets for raiders and the pestilential 'sand dwellers' denigrated in the aforementioned tomb reliefs at Saqqara. It is not inconceivable that the reduction in Pharaoh's overland caravan trade with the southern Levant adversely impacted the economies of semi-nomadic groups in the Sinai and adjacent regions, who had grown accustomed to that trade (either as intermediaries, merchants, hosts, or raiders) (Stager 2001: 632). Many likely resorted to raiding Pharaoh's ships once they were bypassed in the supply chain. The evident success of these raids implies a well organised force that were enough of a threat to provoke repeated Egyptian military campaigns (Cohen 2016: 32-3; Goedicke 1963; de Miroschedji 2012). For the Egyptians, these campaigns

[56] Stager associates the Egyptian take-over of the Sinai mines with the development of Egyptian 'port power' (large seaworthy vessels) that allowed Egyptian forces to regularly and directly cross the Red Sea to the south Sinai in large numbers.

[57] The large solar ships and the colossal wooden beams in many of the Old Kingdom pyramids (e.g. Faidum pyramid) were made from Lebanese timber. These beams were clearly not transported on the back of a donkey. Egypt's appetite for imported Levantine goods was no longer sustainable via donkey caravan.

[58] This is why 'tight synchronization' between Egypt and the southern Levant is not possible for the EB III (Greenberg 2019: 97).

were invariably costly and it appears they were never able to deliver a definitive retaliatory blow, despite grandiose claims to the contrary.

The sedentarisation of pastoral nomads is considered a key factor in settlement expansion and urban growth throughout the EB I-III in the southern Levant (comparable to the 'sedentarisation hypothesis' proposed for Mesopotamia [Adams 1981: 63-68, 70, 140]). The aforementioned settlement revival and urban growth in the EB III across the southern Coastal Plains was no doubt fuelled in part by nomadic populations (from the Sinai and southern deserts) reluctantly abandoning a lifestyle that was no longer attractive following the rise of the Egyptian territorial state. Aggressive expansionist policies had led to the seizure of the Sinai mines, new patterns of state sponsored trade with the northern Levant, growing Egyptian hostility toward Asiatic 'sand dwellers', and presumably tighter 'border control' over Egyptian territory. Rock reliefs at the Egyptian controlled mines in the Sinai show Pharaohs smiting humiliated Asiatics (Mazar 1992: 117). Given the location of these reliefs, the identity of these Asiatics were presumably the local nomads that settled the St. Catherine region of the Sinai that moved seasonally up and down the Sinai corridors in considerable numbers in historic and recent periods. It is likely that it was they who started the original mining and export of copper from these very same locations.

These unilateral actions by the new Egyptian state exemplify the timeless characteristics (and priorities) of state level societies that aggressively pursue self-preservation and wealth creation through economic and military coercion.[59] The net effect was the marginalisation and alienation of nomadic pastoral communities that formerly inhabited the Sinai and southern deserts in great numbers. The subsequent sharp drop in Egyptian material at south Levantine sites is hardly surprising for the later EB II and III periods (Sowada 2009). The disruption to pastoral nomadic economies, the restrictions on mobility, and the increased sedentarisation of these communities accelerated the growing "decline in southern Levantine and Egyptian interaction" (Cohen 2016:

[59] The symbols of state power on Egyptian artefacts (maces, cosmetic plates, knife handles etc.) depict horrific treatment of the 'enemies of the state' (prostrated prisoners flayed alive etc.). The iconography clearly shows that the new pan-regional identity drew tighter boundaries around 'insider' vs 'outsider' that no doubt directed greater hostility toward communities at the intersection of those boundaries, such as pastoral nomads. The graphic military imagery of the early state (characteristic of both Egypt and Uruk Mesopotamia) was largely absent in the art representations of the southern Levant.

33). This decline in Egyptian contact is coterminous with the spread of major fortified settlement and urban growth across the southern Coastal Plains and neighbouring regions.

VD. Settlement expansion in the uplands and arid zones

Settlement expansion in the EB II clearly shifts from the wet lowlands to the drier uplands – areas that are more easily defended. Increased risk and pressures associated with agriculture over land/territory, labour, and water has led many scholars to suggest resource wars were recurrent (Nigro 2014: 42). The punctuated settlement patterns, with decline at some sites matched by growth at others, are best explained by sites knocking out rival neighbours (Greenberg 2014: 4; Wilkinson et al. 2014). The territoriality of expansionist city-states further explains the sharp rise in major fortification systems (Kempinski 1992; Miroschedji 2013: 314; 2018: 112-3 Katz 2017: 282; Ben-Tor 1992: 52; Nigro 2010: 25-8; Shalev 2017) and the increased frequencies of new types of weapons, such as crescent and flanged axes, daggers, lances, and scaled armour (Montanari 2020; Nigro 2014; Sass and Sebbane 2006). The collapse of EB IB Megiddo as a major centre in the Jezreel Valley has been linked to the growth of a "territorial entity in the Jordan Valley, possibly centred at Beth Yerah" (Regev et al. 2014: 259; Greenberg 2003).

EB II sites stress protection/defence, storage of agricultural surplus, and water security. New settlements are typically founded on virgin soil in more isolated areas, such as the fringes of the arid zone in the Negev and Transjordan (Wilkinson et al. 2014: 88). Such sites include Bab edh-Dhra (Transjordan), Numeira (Transjordan), Ai (eastern ridge), Arad (northern Negev), Khirbet ez-Zeraqon (northern Transjordan), and Labwe (southern Syria). This is maybe due to protection and/or their role in a regional trade network, specifically the copper route that was clearly booming at this time (Nigro 2014; Finkelstein et al. 2018). The expansion of fortified settlements into the arid zone was "the first largescale occupation" of these sub-optimal regions "by communities practising intensive agriculture" (Wilkinson et al. 2014: 88). The settlement pattern likely represents "an opportunistic response" to a combination of increased precipitation, competition over farming land, and control over agricultural products by 'incipient elites' (Wilkinson et al. 2014: 88).

The number of overall sites decreases as settlement continues to converge and climb at key centres, many of which have significant public architecture (Greenberg 2019: 99-112). Major regional centres develop, for example, Dan in the Huleh basin (Zuckerman 2003: 7-8), Yarmuth in the Central Shephelah (de Miroschedji 2006), Tell eṣ-Ṣâfi/Gath in the western Shephelah

(Greenfield et al. 2017; de Miroschedji 2006: 71), el-Hesi on the southern approaches to the Shephelah (Fargo 1979), Beth-Yerah in southern Galilee (Greenberg et al. 2012), es-Sultan on the northern shores of the Dead Sea (Nigro 2010; 2016; 2019), Arad in the northern Negev (Amiran 1978; Finkelstein et al. 2018); and Khirbet el-Batrawy in the valley of Upper Wadi Zarqa (Nigro 2008) among others. There are over 20 top tier EB II-III sites with a settlement size greater than 20 ha (de Miroschedji 2000). Out of the aforementioned sites, the following are all between 24-27 ha. with estimated populations between 4,800 and 5,400 people: Ai, Arad, Bet Yerah, el-Hesi, Erani, the Halif Terrace, and Tell eṣ-Ṣâfi/Gath.[60] Bet Yerah on the Sea of Galilee is only marginally larger at 27 to 30 ha. It is currently the largest fortified and planned urban settlement in the entire southern Levant during this period (Chesson 2019: 165, 172).

By the EB II-III transition, there is a very clear regional site hierarchy with at least four levels. At the top are a dozen large, heavily fortified, and planned urban centres interspersed among medium to small fortified towns, villages, and seasonal encampments occupied by pastoral nomads with varying degrees of sociopolitical integration (Finkelstein 1995: 55-64; Richard 2003: 292; de Miroschedji 2018; 2009: 106-9; 2013: 314; Chesson 2019; Greenberg 2014; Levy-Reifer 2012). Hence, the EB II-III marks the first florescence of complex urban societies in the Levant and reflects a significant break from the rural village societies typical of the EB IA and Chalcolithic periods. EB sites are positioned on raised hilltop locations in close proximity to arable soils, major water sources, and key transit routes. Settlements are fortified (even those that are less than 5 ha.), they dominate rich arable hinterlands, and occupy strategic positions in the landscape. The determinants for site location not only endure through the various subphases of the EB, but constantly draw people back to the site in subsequent periods, thus creating "a landscape of tells" (Greenberg 2011b: 239).

VE. The first cycle of urban complexity in the Levant

The prevailing theories on urban complexity have increasingly moved away from specifying external causes brought about by the neighbouring major powers (Levy and van den Brink 2002; Finkelstein and Gophna 1993; Richard 2003; Mazar 1992: 92, 110; Ben-Tor 1992; Levy-Reifer 2012) and instead emphasise local internal factors that centre on the role of 'organisational change' *within* society (Paz and Greenberg 2016; Chesson 2003; 2019; Rotem et

[60] Based on very rough estimates of 200 people per ha (Adams and Nissen 1972: 28-9).

al. 2019: 140; Braun 2002; Greenberg et al. 2012; Greenberg 2019: 65; Katz 2017; Wilkinson et al. 2014; Nigro 2010: 1-5; Harrison 2011: 281). The transition to early urban centres and incipient city-states grew out of a need to consolidate stability and infrastructure for expanding populations and economies in unstable and high-risk environmental and political contexts. The implication is that the EB I village society was not sustainable and gave way to a new order because the social organisation was unable to adapt and respond to managing the increased pressures on resources by burgeoning populations. The scalar stress rendered existing mechanisms or regulative bodies ineffective for coordinating public decision-making between the mass of competing households in competitive (and increasingly territorial) polities. Presumably, a tipping point was reached and the resulting instability led to "rapid reorganisation into new political centres" based on "new urban ideologies" (Rotem et al. 2019: 140; Greenberg 2011b, 2019: 65).

The 'growing dimensions' of society combined with the lack (or insufficiency) of 'levelling mechanisms' to maintain the 'corporate' or 'heterarchical' (egalitarian) village system, resulted in the transformation of village society into an urban one, with new political centres and a new collective urban identity. This process of reorganisation was uneven and maintained in varied ways by the local inhabitants of new 'townships'. To borrow classic Marxist terminology (Hodder 1991: 59-61; Johnson 1999: 92-7), there was a growing disconnect between the growth (and strain) on the forces of production (means of production and organisation of production) and the social relations of production (the kin-based system of village society). The two were increasingly out of step ('structural incompatibility') and the tension fuelled a crisis that gave way to a new social entity (i.e. the early city-state). The early city-state in the southern Levant had its own distinctive styles and ideology that suppressed local identities and regionalisms distinctive of EB IA village society (hence the distribution of Metallic Ware and the process of 'simplification' in the pottery repertoire, as well as other trends in material culture, §VI).

The early city-state was unstable due to social contradictions caused by the transition from old kin-based identities to new collective identities in larger urban settlements (Greenberg 2017). Unlike Mesopotamian city-states, inequality and 'class' lines were never consolidated and institutionalised (centralised infrastructure was weak). Hence, the sparse evidence for *heightened* inequality and social differentiation when compared with Syro-Mesopotamian city-states (Philip 2001, 2003, 2008; Rotem et al. 2019: 108; Greenberg et al. 2012; Harrison 2011: 281). The

resulting friction between individual households and the larger urban collective[61] increased with continued economic growth and is considered a key factor as to why the early 'urban experiment' reverted to a non-urban society by the mid-3rd millennium BCE (Greenberg 2017).

As opposed to a sudden systemic collapse (de Miroschedji 2009; 2013; Rosen 1995), Greenberg describes a slow decline into a 'posturban' existence, (Greenberg 2017; Greenberg et al. 2012). Rather than suffer the 'penalties' associated with urban life, such as increased 'marginalisation' and 'material poverty', "people simply walked away from town life and did not look back" (Greenberg 2017: 48). If so, then the classic contradiction between the 'interests of social groups' (the root of 'class struggle') did not in this case favour an *emergent* urban elite (Hodder 1991: 60). Power structures were not invisible (the premise in Foucauldian analysis) and people exercised their agency. The masses were conscious of exploitation and walked away (voting with their feet and/or riding off on their donkeys under a 'velvet revolution' sky).

The long-term "instability of EB III urbanism" has been attributed in large part to the unpredictable relationships with 'mobile groups' continually moving through the blank spaces on settlement maps (Greenberg 2019: 123; Mazar 1992: 117). These groups can facilitate trade and the diffusion of ideas, but at the same time can turn hostile and asset strip the economic base of major fortified settlements. The collapse of EB III urban life has been associated with a resurgence in the kin-based nomadic pastoral lifestyle and the growing appeal of this lifestyle when compared to the potential material impoverishment (and economic insecurity) in emergent class based societies attached to 'town culture' (Greenberg 2017; Joffe 2013).[62] In that case, where did all the people go toward the end of the EB III? The abrupt rise of the mid-3rd millennium Eblaite kingdom and the 'urbanisation' of northern Syria is linked to a vast textile industry (attested both archaeologically and by royal archives found at the palace) (Wilkinson et al. 2014; Lawrence et al. 2015). It has already been suggested that the quantities of wool in circulation must have sucked in agro-pastoral communities of the southern Levant to seasonally manage and resource "vast animal herds" in the "zones of uncertainty" (Wilkinson et al. 2014: 92). The fact that this occurs on the heels of an economic collapse at urban centres across the southern Levant suggests that such

[61] Autonomy versus control; decentralised social economies versus centralised commercial economies etc.
[62] This would suggest that the long term reduction in physical mobility had eventually capped living standards and social mobility for the majority of the population.

a scenario is plausible. The towns in the southern Levant were emptied as the shift in the economic centre of gravity moved northwards in the EB IV.

These fluid interactions with pastoral nomads played a decisive role in the timing and regional variability in 'explosive' urban growth cycles across the entire Levant (north and south) and clearly contributed to the "highly differentiated patterns of development" (Cohen 2016: 22; Wilkinson et al. 2014; Lawrence et al. 2015, 2016). This new perspective recognises the dynamic(s) between sedentary and non-sedentary populations in driving societal change, with regards to the cycles of urban growth and collapse. These identities and relationships (between town dweller and nomad) were far less dichotomous in a preindustrial world and reveals the potential positives of the first urban 'collapse' (not simply an end to 'civilisation' nor a 'dark age' as such, but an exit from urban inequality in the south and the start of urban life in the north). A balanced perspective of the dynamic between mobile and sedentary communities is invariably difficult, since the latter are far more visible in the archaeological record.[63] There are additional deep seated reasons why 'the invisible nomad' has been neglected (made further invisible) in the history of archaeological (and anthropological) research (Abu-Lughod 1986, 1991). At present, migrant communities and the interactions between nomads, tribes, and the state is now rapidly turning into a hot topic, especially with regards to early state-formation and 'urban development' in Mesopotamia and the Levant (Szuchman 2009; Abu Jayyab 2019; Wilkinson et al. 2014; Greenberg 2019: 121-2).

Greenberg's scenario for a long urban decline better fits the settlement data at sites such as Beth-Yerah in the north. There is little evidence for a gradual decline at southern sites, such as Tell eṣ-Ṣâfi/Gath, where abandonment was far more abrupt toward the end of the EB III. Phytolith, palynological, and isotopic evidence (combined with sedimentation rates) from Lakes Hula and Kinneret (Galilee) suggest that the transition to a 'posturban' society occurred in the context of a drier environmental setting in the EB III (Rosen 1995; Rosen and Rosen 2001: 544-6). Climatic degradation and the social responses to environmental stress "undermined the intensive agricultural system" (Rosen 1995: 26). The 'downfall' of the agricultural sector was likely more abrupt at sites in the south and east where conditions are naturally more arid. In either case, the

[63] Traditionally, nomads were (and still are) primarily identified by the chance discovery of their above ground burial markers. Burial grounds constitute the most conspicuous material evidence for their presence in the landscape. Indirect evidence is limited to the movement of goods, seasonal management of animal herds, and the apparent 'connectivity' between regions.

rise and demise of the 'urban revolution' in the Levant no longer hangs on interactions with Egypt and/or Syro-Mesopotamia and is no longer treated as a scaled down repeat of timeworn processes external to society and the region (Greenberg 2011b; Philip 2003; 2008; Philip and Chesson 2003).

Cohen (2016: 32-4) emphasised a sharp (and questionable) dichotomy between two types of models on urban development in the Early Bronze southern Levant: 1) those that emphasize interactions with Egypt and the impact of its withdrawal from the southern Levant (exogenous models of societal change) and 2) 'indigenous' (endogamous) models of societal change that prioritise internal developments within Levantine society. The foregoing discussion on regional settlement patterns has more in common with the second view whilst acknowledging that the Levant was not a 'closed system' detached from Egypt's influence. The increased emphasis on the agency of 'invisible' mobile groups (pastoral nomads and merchants) and the impact they had on the trajectories of urban life is a stark contrast to traditional Levantine scholarship that traced complexity (its rise and demise) back to the towering physical monuments of Egypt and/or Mesopotamia (the terminals of the Fertile Crescent).

Cohen still prefers the first option in which Egypt's role is privileged above all else. She is of the opinion that indigenous models "fail to identify the cause of the initial crisis that led to the internal population movements so necessary to the structure of the model itself" (2016: 35). The constellation of varied causes (both immediate and long term) discussed in the foregoing analysis of regional settlement patterns suggests otherwise. Second, she advocates a rather simplistic monocausal model riddled with classic assumptions that favour Egyptian dominance and hierarchy.[64] Without rehearsing all the weaknesses of Cohen's view, the original premise was (and still is) not substantiated, especially in light of the new data available from recent excavations. In what way was the southern Levant "economically dependent" on Egypt at this early stage in Egyptian and Levantine regional interaction? Her discussion on colonialism (and what it looks like archaeologically) is brief in light of the varied forms it can take; the sheer scope of this topic in anthropological archaeology; and the alternative explanations that are on offer (Lyons and Papadopoulos 2002; Greenberg 2019: 57-64). The main challenge in any discussion on EB 'urban development' has to be the multifaceted and "highly differentiated" regional settlement patterns

[64] Most scholars would agree that the Egyptian withdrawal from parts of southern Palestine would not have led to destructions and "massive transformations" in areas such as the Hulah and Central Jordan Valleys. These areas are well beyond the Egyptian "contact zone" and therefore an "internally generated crisis" is considered more plausible (Greenberg 2019: 65).

that defy simplified summary and monocausal explanation (Cohen 2016: 22; Chesson 2019: 168). Under these conditions, homogenous pan-EB models on social complexity are increasingly rejected regardless of the wider debates over hierarchy, state-formation, and core-periphery relationships (Mazar 2012: 22-3; Klassen and Harrison 2019).

VI. Economic strategies and pottery production

The transition to an increasingly urban way of life sees changes to settlement patterns, town and building plans, as well as monumentality – all of which converge to form new built environments and 'townscapes'.[65] The outward appearance and diversity in most aspects of material culture (pottery, everyday tools, domestic architecture, public buildings) drops and becomes more homogenous, as site specific traditions and regionalisms fade in the EB IB and disappear in the EB II. Changes to the pottery repertoire are a part of this process and express the formation of new collective urban identities linked to changes in food production, consumption, and social display. Local and regionally specific styles are streamlined and replaced by homogenous dinner sets and storage containers that unify the region with a similar material culture. This section reflects on these processes, the increased connectivity across the region, and evaluates the evidence for changes in production, economic strategy, and pottery provisioning over the course of the EB.

Direct evidence of manufacture is almost non-existent. One updraft kiln was found at el-Far'ah North attached to building 272 in the *Période 3* settlement, and dating to the EB II (Medeghini et al. 2019; Mazar 1992: 130). Pottery tools such as tournettes have been found at many sites, but they are usually found in storage areas and not in actual workshops (see Roux and de Miroschedji 2009 for summary). An exceptional discovery was the 'bario workshop' and 'southern potter' in Area EY (250 sq. m.), found two blocks away from the main gate at Beth Yerah (Greenberg 2011a: 46-7). Excavations in this area date to the 1980's when over 14 fragments of tournettes were recovered, yet it is unclear whether these came from primary contexts given the very broad date range (EB II-III). Excavators found pits containing scraps of clay coils,

[65] For detailed summaries on the standardisation of elite architecture, fortifications, and public buildings see descriptions and summaries in: Miroschedji 2006; 2018a,b; Nigro 2010, 2019; Greenberg 2019: 99-112; Mazar and Rotem 2009; Philips 2008; Kempinski 1992; Dever 1995; Katz 2017; Chadwick et al. 2017; Ben-Tor 1992; and Shalev 2017. For detailed summaries on the standardisation of domestic architecture and changes to town planning see descriptions and summaries in: Golani 1999; 2003; Faust and Golani 2008; Yamafuji 2019; Zuckerman 2003; Greenberg 2019: 76-86; Greenberg et al. 2012; and Adams et al. 2014.

parts of unfired vessels, figurine fragments, as well as flint knives with a wear pattern consummate with working leather-hard clay (Greenberg 2011a: 46-7). The most complete *in situ* workshop dates to the Late Bronze at Lachish, a millennium after the EB II (Doherty 2015: 65-6; Magrill and Middleton 2004). Studies on the pottery economy are therefore limited to stylistic analyses of shape and decoration combined with petrography to characterise fabrics and provenance the vessels.

VIA. Early Bronze I pottery: regionalisms and decentralised production

EB I ceramic traditions were difficult to define for a variety of reasons that include: 1) strong regionalisms and site-specific styles; 2) similarities with Late Chalcolithic assemblages and; 3) vague definitions of wares (Braun 2006; 2012; Braun and Roux 2013; Eisenberg 2001; de Miroschedji 2009: 105; Mazar 1990: 100-3). One of the most distinctive wares of the EB I is Grey Burnished Ware (GBW), which was originally considered a northern intrusive influence ('Proto-Urban C' in the Kenyon classification). GBW is comprised of diverse 'families' of thick-walled bowls and fenestrated chalices with coarse fabrics and grey to black and sometimes ivory lustrous burnished surfaces. Broad horizontal conoid projections/knobs are attached at the midline of the body. They are usually carinated, but some are hemispherical[66] and include shallow and deep vessels (Eisenberg 2001: 117-8; Milevski 2011: 42-9; Mazar 1990: 101, 103). These bowls have similar shapes, colours, and sizes to the basalt bowls of the Chalcolithic. They may have performed a similar social function, as a prestige item for the collective consumption of food and drink in ceremonial settings (Greenberg 2019: 36).

Red slipped bowls are similar in form to the grey burnished wares, but differ in surface treatment (knobs are less common with no lustrous surfaces), with a slight carination toward the rim (Eisenberg 2001: 118). In settlement contexts, the appearance of red slips/washes and new serving vessels (mainly bowls, high loop-handled cups, and amphoriskoi) differentiate the EB I strata from the preceding Chalcolithic. Problems imitating the finer surfaces of the GBW apparently led to a localised EB IB appearance of red slipped crackled and mottled bowls in the Jezreel valley and lower Galilee region (Milevski 2011: 76; Greenberg et al. 2012: 95). Surfaces of these vessels are covered by a fine cracking of the thick red slip from the drying and firing process.

[66] A northern variant of Wright's 'Type 1 bowls'

These EB I wares are made in regionally distinctive and often site specific styles, with high variability (low standardisation in form and fabric), suggesting multiple local producers and small-scale decentralised production (local household workshops).[67] Petrography combined with stylistic analyses of vessel form and decoration shows scant evidence for significant exchange of EB I ceramics beyond sites and regions (Golani 2003: 82-3, 148-150; de Miroschedji 2009: 105; Eisenberg 2001; Goren and Halperin 2001; Greenberg et al. 2012: 95; Milevski 2011: 49; Goren and Zuckerman 2000; Rotem et al. 2019: 117-8; Rotem 2012: 123-4, 139, 166).[68] Stylistic types usually reflect a variety of clay sources, within a 10 km resource zone, or catchment of the excavated site. The strong regionalisms and quirky 'parochial' vessel types,[69] especially during the EB IA, indicate "extreme regional fragmentation" typical of village level societies with negligible external contact (Braun 2006: 6).[70]

Some types are more standardised than others and were the focus of more specialised production toward the end of the period (terminal EB IB or Early Southern Levant 3). During the late EB IB, ovate jugs, carinated bowls, and high necked storage jars represent "the zenith of the local EB I ceramic industries" (Rotem et al. 2019: 118-9). At this point, the pottery wheel makes a comeback and is used for wheel smoothing carinated bowls (this technology temporarily disappeared with the collapse of Chalcolithic society). There is also a greater correspondence between fabric, form, and function for some vessel types, such as thickened rim holemouth jars and pithoi. Assemblages are therefore described as 'transitional', reflecting a shift from rural to urban society (Rotem 2012: 123, 132, 167).

---

[67] Unlike the EB II-III, there is almost no relationship between shape, surface treatment, fabric and function for pottery assemblages until the end of the EB I (Rotem 2012: 139, 166-7). Regionally distinctive decorative treatments are numerous and include: the splash and drip style painting (EB IA) across the central and southern Jordan valley; painted grain wash or 'bandslip' jars (EB IB) common across the north; various families of lustrous GBW (EB IA-B) across the central hill country and northern areas; red slip and 'crackled' or 'mottled' wares (EB IB) across the lower Galilee and adjacent Jordan valley; the 'archaic' styles of 'Pre-Urban D' (EB IB) reminiscent of the Chalcolithic in the central Jordan Valley; the punctate and incised decorative styles of 'Erani C' pottery in the south; the Line Painted Group (EB IB) imitating the woven fibres of basketry across the south (usually on Dolomitic Wares); and the fine red slipped and burnished finishes typical of Tel Aphek Bowls across central Israel.

[68] Exceptions are the basket style pottery, jars, and NCMW found in pre-dynastic Egyptian tombs attributed to limited gift exchange between elites, as well as the Eranic C pottery found in Egyptian settlement contexts (see Braun 2012; Greenberg et al. 2012).

[69] e.g. 'the safi cup' from the Palmahim quarry, kernoi, and punctate bowls from Bab edh-Dhra, and sauces from Tell Teo (Eisenberg 2001: 118; Braun 2006).

[70] Appears to rule out a migration scenario introducing new incomers, 'the bearers of a new culture', traditionally associated with the inception of the EBA (Braun 2006 *contra* Eisenberg et al. 2001: 120).

VIB. Early Bronze II-III pottery: the urban economic system

The EB II-III is marked by the appearance of new iconic EB serving vessels including heavy set platters. Platters developed from large bowls with sloping walls and inverted rims (classified as Type B IIc bowls at Qiryat Ata), which continued in production (Golani 2003: 84-5; Braun 2006; Nigro 2010: 167, 263). These proportionally large shallow vessels have wide diameters (a base to wall ratio of at least 4: 1) and usually have extended/moulded rims (Golani 2003: 121; de Miroschedji 2000: 322). In addition to new serving vessels, the EB II is characterised by a more centralised production, with "a broader-based north to south bifurcation" (Braun 2006: 6). Workshops distributed standard wares and finer products over increasingly larger areas, in what may have been the earliest 'consumer culture' and market based economies in the Levant (Faust and Golani 2008; Greenberg 2006b; 2011a: 237; 2019: 86-93; Greenberg et al. 2012: 95; Paz and Iserlis 2009; Rotem 2012: 167).

Southern Levantine Metallic Ware (SLMW) is one of the most distinctive ceramic traditions of the EB II and exemplifies major changes to ceramic production and economic strategy that coincided with the growth of early urban centres.[71] Vessels made with SLMW fabric were manufactured from clay specific to the lower cretaceous outcrops in eastern Lebanon, with the most southerly source located in the foothills around Mount Hermon (Greenberg and Porat 1996; Milevski 2011: 52; Philip 2008: 207-8). These vessels have a distinctive metallic ring when struck (properties approaching stoneware) and are fired at higher temperatures (850-950 degrees), suggesting the use of kilns to achieve fabrics with superior physical and chemical properties (Braun 2012 : 27-8; Rotem 2012: 160-2). The best examples have the appearance of tarnished copper, thin durable walls, and they vary in size and shape, ranging from large pithoi to diminutive juglets. Forms duplicate the entire household and industrial shape repertoire and include donkey figurines, with the only exception being the absence of cooking pots (Milevski 2011: 50). The missing part of the repertoire was (for the most part) supplied by another major potting industry centred in the Golan, specialising in thin-walled and round bottomed cooking pots (Paz and Iserlis 2009; Greenberg 2006a). SLMW platters and necked storage jars are the most common types

[71] Small quantities of Metallic Ware sherds are known from Late EB IB contexts at several northern sites where it first occurs, as sites transitioned into a new urban economic system (Tel Beth Yerah, Megiddo, Tell Abu al-Kharaz, and Tel Yaqush [Megiddo 2013: 300; Rotem et al. 2029: 120-1; Rotem 2012: 162, 166). This distribution adds another dimension to the ongoing debate over the timing of urbanisation and makes it difficult to sharply distinguish between late EB I and early EB II at some northern sites.

showing a concern for liquid storage (oil and wine) and food presentation (shared communal meals) (Greenberg 2011b: 238).

SLMW represents between 50% to 80% of the assemblages known across the Israel and Jordan Valley[72], with vessels distributed over an area of 10,000 sq. km (Greenberg 2011b: 238; Philip 2008: 207-8; Golani 2003: 150-152; Milevski 2011: 53-6).[73] Examples were found in Egyptian tombs of Dynasty I, particularly the Abydos tombs (Braun 2012: 28; Greenberg et al. 2012: 95-96). Fabrics reflect a single clay source, consistent forming techniques, and a high-temperature firing strategy to make a consistent range of products wherever it is found. This ware was imported in large amounts to distant sites, such as Qiryat Ata (81.9 % of the Str. I assemblage). In the EB II horizons, local household and village industries were clearly suppressed by imported and homogenous SLMW. For instance, when SLMW appears at Qyriat Ata, the red slipped vessels made from local foraminiferous and undifferentiated marls drop dramatically from < 75% to < 5 % (Golani 2003: 150-2). The so-called 'southern potter' at Beth-Yerah (Area EY) is a rare example of a local industry surviving the deluge of imported SLMW in the Kinneret region, despite the inferior quality of locally made products (Greenberg et al. 2012: 95; 2011a). The 'southern potter' used the same techniques and shapes as NCMW, but the clay was unquestionably local.

Teo is roughly a day march south of Mt. Hermon and was identified as a potential 'way station' for caravans delivering these exports from the vicinity of the Hermon Massif (Greenberg 2001: 134). At this site, SLMW amounts to over 85% of the indicatives (Str. II) in a highly homogenous assemblage found in large refuse pits (no architecture associated with these pits), perhaps representing "the breakage of pots in the course of transit" (Greenberg 2001: 134). The overall spread of SLMW strongly implies that pottery production was no longer "a regional phenomenon or the product of itinerant potters, but appears to have been linked with a centralised trade and distribution network" (Golani 2003: 246). Whether this trade was under the control of a single political entity (or city-state) is highly debateable given the geographic expanse, but it does reflect a well-developed trade and distribution system for a large scale centralised export oriented industry (Philip 2008; Faust and Golani 2008). According to Greenberg (2011: 239; 2012: 95), the appearance of SLMW represents a pronounced shift in pottery production when containers are no

[72] High concentrations in the Huleh and upper Jordan valleys, the Golan Plateau, the Lebanese Biq'a, the highlands and coast of southern Lebanon, Jezreel valley, and the Galilee (Milevski 2011: 53-6).
[73] Jordanian sites include Tell Abu al-Kharaz, Tell Handaquq, and Tell as-Sukhne (Philip 2008: 208).

longer prized just for their contents, but become desirable 'commodities' in and of themselves (a consumer culture is apparent). The centralised and highly specialised production of this ware is considered a key feature characteristic of the new 'EB II urban economic system' (Rotem et al. 2019: 119; Rotem 2012: 162). In Kenyon's original classification, Metallic Ware marked the start of the 'true' Early Bronze Age urban society following the Proto-Urban phase. Her EB I was the equivalent of Wright's EB Ic phase (Kenyon 1960: 10; Dessel and Joffe 2000: 35).

The EB II-III marks the first time in the history of the southern Levant when assemblages appear 'interchangeable' with a 'striking similarity' in the pottery between different regions (de Miroschedji 2006: 73; Milevski 2012; Hendrix et al. 1997: 99; Philip 2001: 208). A common material culture is apparent, unifying the Shephelah, the Judean hills, the Coastal Plains, and the Negev, linking distant areas as far away as the Jordanian Plateau, the Dead Sea Plain, the southern Sinai, and the northern coast of Lebanon. Not only are there strong similarities and conventions in vessel form and decoration, but temper strategies are comparable and reflect normative practices that are not dissimilar from modern village potters in the region (Medeghini et al. 2019; Ben-Shlomo 2012 : 396; Iserlis et al. 2012; Klassen 2009; Ali 2010).

During the EB III, vessels become increasingly coarse in appearance and manufacture, especially among the smaller size categories. de Miroschedji relates this trend to the increasing use of the pottery wheel in manufacture (2000: 320, 330). Pattern combing is used on pithoi, jars, and vats and a white lime wash is used to cover coarse vessels from large pithoi to small bowls (de Miroschedji 2000: 320-21; Philip 2008: 209-210; Greenberg 2019: 113). Less care is invested in the manufacture and overall appearance of different vessel types. The increased frequency of jugs and jars suggest a greater emphasis on precious liquid products (wines, oils, resins, bitumen, *sefjet*-oil, etc.). The EB II-III corpus is a far more standardised repertoire, especially in the EB III when the variety of shapes and wares are further reduced and simplified (de Miroschedji 2000: 321). In the EB III, vats double in capacity at Yarmuth and there is comparable jump in the size of platters, with some types showing a six-fold increase in capacity (Greenberg 2019: 114; Miroschedji 2000). These trends emphasise the strength and power of agro-economies at major fortified settlements.

Greenberg's claim (2019: 113) that the EB III is characterised by a "renewal of local, site specific production" is a misleading assertion. He views the organisation of production from the angle of consumption at regional scales of analysis, based on stylistic and petrographic research (standard pottery provenance studies). The problems with this perspective were highlighted in

Chapter 2, Section VI. Current limitations on ceramic provenance studies prevent attributing assemblages to specific sites when the sites in question share the same (or similar) geologies, especially when temper strategies are not distinctive at the site (i.e. potters adding sand, grog, chalk, limestone, or removing the coarse fraction). This is why petrography is mostly used to identify long distance trade and exchange, but is often hopeless for characterising more local forms of exchange within a region, especially between neighbouring sites with the same geology.

Certainly there is a clear contraction in the consumer base for highly distinctive EB potting industries that fade out in the EB III, namely SLMW (formerly distributed on a massive supra-regional scale). However, that does not mean pottery production uniformly shrank down to the site level and potters ceased marketing their wares at a string of neighbouring sites within a given region (inside a 'geological unit'). Forms and fabrics are still highly standardised throughout the EB III, with a clear relationship between form and fabric (see Chapters 6 and 8). This strongly contrasts with the situation in the EB I when site assemblages were highly variable in form and fabric and production certainly was site specific. The implication(s) are significant because it casts doubt on a key line of evidence in Greenberg's general portrayal of the EB III, as a homogenous period of urban economic decline. In addition, the use of *specific* ceramic industries as proxies for evaluating the health of entire settlement systems and urban economies is certainly questionable. Ceramic industries can easily go boom and bust without the entire urban economy going boom and bust for the whole region. The aforementioned 'New Paradigm' for the Negev Highlands and the economic indicators at Tell eṣ-Ṣâfi/Gath (and neighbouring sites) suggests significant continuity in trade networks from the EB II, with many sites flourishing in the EB III throughout the Shephelah, Negev, and southern Coastal Plain.

VIC. The simplification of the repertoire and urban identity

A defining feature of early urban culture in Mesopotamia was conformity to a widely shared standard repertoire and the mass manufacture of homogenous goods distributed over large areas, i.e. *commoditisation* (Algaze 1989; 2001; 2008; Wengrow 2010). The same processes are apparent in the Levant by the EB II. Local village and community level distinctions characteristic of the Chalcolithic and EB IA assemblages were suppressed and 'simplified' by increasingly homogenous repertoires of standard types distributed across large swathes of the Levantine landscape. In the case of pottery, uniform assemblages imply uniform 'culinary habits' that likely

centred on wine and oil storage and exchange, with feasting as a purported mechanism for labour recruitment and 'social adhesion' (Greenberg 2011b: 239; Greenberg 2014; Chesson 2019).

Food production and pottery production are intrinsically related, since pots are the ceramic wrapping for food and drink. The consensus of scholarly opinion has always maintained that SLMW, brightly burnished jugs, combed jars, and vats were used for Levantine consumables now produced in bulk that include: oils, wines, resins, and scented perfumes (Joffee 1998: 301; Philips 2008; Thalmann and Sowada 2014; Sowada 2009: 160-161; Stager 2002). These horticultural products are traditionally associated with agrarian societies in the Levantine Hill Country where the local ecology (hydrology, pedology, terrain, temperature, and general climate conditions) strongly favours viticulture, olive farming, and tree cropping (Falconer and Fall 2006; Wilkinson et al. 2014: 51; Langgut et al. 2016). In fact, new studies suggest that olives were domesticated locally, i.e. in the Levantine hill country, as early as the Late Neolithic to early Chalcolithic (Langgut et al. 2016: 14).

The pottery repertoire is simply one component in an entire interrelated 'labour-scape' and 'material package' that was increasingly binding people together over the course of the EB II-III (Chesson 2019). The rapidity of societal change is clearly apparent at many sites that show a fundamental shift between the end of the EB I and the start of the EB II. For example, the 'Period C' settlement at Beth-Yerah was rebuilt 'from scratch' with massive fortifications, planned streets, and smaller boxy houses, with "the entire ceramic corpus replaced" by products made in large centralised workshops (Greenberg et al. 2012: 95). All of which happened in the span of a generation "expressed as mere inches in the excavated deposits" (Greenberg et al. 2012: 91). This pattern is repeated at dozens of tell sites across the southern Levant. There is no question that urban planning was preconceived and deliberate, reflecting a 'cognitive map' or 'urban mindset' that was altogether different from the prosperous, but fragmented village life of the EB IA landscape.

The simplification of the pottery repertoire signifies the widespread adoption of new modes of consumption and food customs analogous to the spread of Uruk containers for bread and beer, across much of Syro-Mesopotamia (Badler et al. 1990; Goulder 2010; Joffe 1998: 303; Michel and Badler 1992; Ur 2010b: 217, 247-9). Convergence in the shape repertoire was similarly streamlined by a taste for widely consumed staples produced in greater quantities, which in the EB Levant included an abundance of horticultural products (wines, oils, and fruits), as well as cereal

products (bread and beer).[74] Identity was re-shaped by new urban values that reflect an 'ideology of uniformity' levelling local individuality and controlling status differences in favour of a collective affiliation with a new homogenising urban way of life that was distinctly Levantine (Greenberg 2011b; Greenberg et al. 2012: 92-5). Hence, the total absence of differentiation within the pottery repertoire and assemblages generally, which become highly depersonalised by the EB II. The consolidation of a new urban identity and 'mindset' in newly founded urban sites was bound together by a "shared ethos concerning the [acceptable] outward appearance of the community" reflected in almost every sphere of material culture – from fortifications and settlement plans to domestic architecture and pottery (Greenberg 2011b: 237; 2019: 70-131).

VII. Contextualising urban life and economy in the southern Levant

'Sociological' or 'functional' definitions of urbanism take into consideration the role of the site in relation to a larger hinterland (Smith 2002; Cowgill 2004). Various institutions and activities performed at the site in question effect the larger settlement system and sites may have a range of political, economic, and religious functions. This flexible approach allows for "different types of city" and "different levels of urban settlement" (Smith 2002: 5; 2009a). A functional or sociological understanding of urbanism is little different to the relative hierarchy approach for understanding settlement patterns in relation to the range of functions and services (storage and redistribution, administration, ritual, trade, craft specialisation and so forth) performed at a centre (Renfrew 2008: 209). Sites are treated as urban when they "dominate their surroundings and provide services for the satellite sites" (Shalev 2017: 52). When we take a 'relative hierarchy' or 'functional approach' then the urban city-state character of many Levantine polities is clearly apparent by the EB II and possibly as early as the EB IB.

VIIA. Closing the gap: urban process and 'secondary' state-formation re-considered

The late 4th millennium BCE marks the starting point for the intensification of urbanism across the Near East encompassing both Late Chalcolithic Mesopotamia and the EB southern Levant. The new radiocarbon dates for the Levantine EB ('the high chronology') combined with expanded datasets from numerous IAA rescue excavations has pushed back the date for the first early urban centres and 'agro towns' in this region. The chronological gap between the florescence of urbanism in Syro-Mesopotamia and the Levant is greatly diminished. The growth of an urban

[74] Diet was more varied, but surplus was far smaller when compared to the wide open irrigated flood plains of 'river valley civilisations' that can sustain larger populations on a reduced repertoire of foods.

culture is signalled by regional site hierarchies and a marked population increase sustained by intensive farming methods (changes to the subsistence economy); a complete reorganisation of space showing well organised town plans with housing blocks and street networks; major fortifications and defensive structures; centralised administrative, religious, and even palatial structures; standardised repertoires of household items and artefacts; and greater connectivity and regional interaction showing long-range contacts.

The emergence of urban centres in the southern Levant predates the unification of Egypt (c. 3050 bce) and is now contemporary with the LC 5 phase (the so-called 'Uruk' phase) in Syria. In which case, urbanism and 'incipient' city-states in the southern Levant cannot be treated as a later 'secondary' occurrence. The 4th millennium BCE was a period in which new forms of identity were constructed across diverse regions of the Fertile Crescent and North Africa. Planned and fortified townships and incipient city-states appear in the Levant, the first territorial state appears in Egypt, sprawling regional 'hubs' appear in North Mesopotamia, diverse forms of early state control are found along the Tigris-Euphrates River system, and the classic Uruk style 'city-states' appear on the alluvial lowlands of southern Iraq.

Urban processes transcend imagined borders and developments clearly overlapped with simultaneous change happening everywhere across the Fertile Crescent of the 4th millennium bce. Varying levels of urban intensity (and sociopolitical integration) are apparent and are expressed through local changes to material culture. The proliferation in the range and frequency of new consumables was presumably driven in-part by an appetite for desirable goods and perceived improvements to organisation and general living. Innovations and consumables are diverse and include: smelted and cast metals; high-fired and wheel-finished pottery; alcoholic drinks; demand for fleecy woollen textiles over flax; local intensification and transfer of tree crop horticultural techniques; and crowded urban living in planned fortified settlements with greater investment in public amenities (reservoirs, grain silos, drains built into main streets, proper paved roads for 'down town' areas etc.) (McMahon 2013: 32, 35, 43-4; Khurt and Millar 2006: 23-5; Moorey 1994; Maisels 1999; Joffe 1998; Rothman 2000; Stein 1996; Greenberg 2011a; 2011b; Roux and Courty 1998; Nocera 2010).

A single point of origin for all of these techniques will continue to be debated and current scholarship no longer assumes a core urban 'heartland' in southern Iraq (Ur 2010; Frangipane 2017; Rothman and Peasnall 2000; Wilkinson et al. 2014: 45, 48; Stein 2001; Rothman 2001;

Oates et al. 2007). The real significance is the wide dissemination and intensity of these techniques and consumables, signalling new modes of shared consumption and social display, associated with the earliest 'agro-towns' and city-states in the world (Wengrow 2010: 55, 58-61). People want what their neighbours have and 'keeping up with the Joneses' seems to be a universal habit. New interactions and social identities were consolidated in urban settings through the performance of common activities (cereal agriculture, beer drinking, textile and pottery production, accounting, and so on). The combined effect of all these changes to social life gave rise to what Wengrow has termed the first 'global village', marked by the collapse of previous regional distinctions and the growth of an increasingly shared urban culture across much of the Fertile Crescent (Wengrow 2010: 54-65). This is perhaps the clearest indicator that a new threshold in settlement organisation was reached (whether or not we decide to call it an 'incipient city-state', 'a township', a new network or 'interaction sphere', a 'community site cluster' or even a 'global village') (Chesson 2019; Wengrow 2010: 54-65; Nissen 2001; Harrison 2011: 284). It is a strong move away from essentialist arguments and binary language that pit some cultures, regions, and societies as inherently 'active' and others as 'passive' in the spread of societal traits that did not necessarily originate with a single event in a single location.

Nissen (2001) has long suggested that the spread of 'Uruk traits' and structural elements across 4th millennium BCE Mesopotamia should no longer be understood as the imposition of outside force (i.e. predatory economic imperialism, e.g. Algaze 1989, 2001). Rather he sees a cross-regional network where locals adopted tools and techniques because they provided 'satisfying solutions' to common social needs, organisational issues, and economic and political problems (Nissen 2001: 171). Examples range from the cylinder seal to the plough and the pottery wheel. Arguably, it is time to expand the paradigm and include the rest of the Fertile Crescent in that process for the 4th millennium BCE.

VIIB. Clarifying the debate over social organisation

At present, the largest and earliest city-states are located in northern Mesopotamia at sites such as Brak (Oates et al. 2007; McMahon 2013: 31, 34; Wilkinson et al. 2014). The social organisation at many of these sites has nevertheless proven difficult for excavators to classify and for many sites, such as Arslantepe, the excavators remain undecided (Frangipane 2010: 5, 2019). Sites often betray a confusing mix of characteristics traditionally associated with both complex chiefdoms and states. Perhaps this is to be expected for incipient states and urban communities

that are 'emergent' and are in the process of evolution and therefore not fully formed, or do not have the conventional hallmarks of a urban state. The high quality datasets from recently excavated 4th millennium BCE sites on the 'periphery' of Mesopotamia ignited considerable debate in the early 2000s over how 4th and 3rd millennium BCE societies were classified[75], across the entire Fertile Crescent, with ancillary debate over the proposed mechanisms driving societal change (Rothman 2001; Pollock 2001; Philip 2001; Chesson and Philip 2003; Savage et al. 2007; Ur 2012, 2014).

The debate on urban origins in North Mesopotamian and Levantine archaeology amounted to a reflexive theoretical critique of 'city-states' and 'urbanisation' (Nigro 2010: 2). This rethink coincided with a broader distaste for 'unitary theoretical paradigms' and 'unilineal' neo-evolutionary categories, in favour of more historically contingent models of societal change tailored to the needs of individual datasets (Yoffee 2004; Cohen 2016: 22). Rather than slotting societies into traditional universal categories (as exemplified by Service 1975[76]), some scholars abstained from the comparative approach and retreated into a Boasian particularism and shying away from (or else actively shunning) 'the macro' perspective (Faust and Golani 2008; Greenberg 2003). Projects such as the Fragile Crescent Project (Wilkinson et al. 2014; Lawrence and Wilkinson 2015; Lawrence et al. 2016) did embrace a macro geographical perspective, but neglected explicit comparison of key variables related to political hierarchy and economic control. Others combed the ethnographic literature for fresh analogies and social types, such as 'household societies', subsequently applied to both northern Mesopotamia and the southern Levant (Chesson 2003; Ur 2014). Collectively, these attitudes and approaches reflected a growing unease over traditional categories of complexity that potentially masked and homogenised cultures, social change, and settlement trajectories (Falconer and Savage 1995).

Such developments were symptomatic of a broader shift in the scholarly climate to prioritise the local over the global, thereby making room for alternative types of social organisation that emphasised the variation of urban life. Hence, the recurrent critique over how city-states and complexity are conceptualised in Levantine and Northern Mesopotamian studies, in relation to the classic southern Mesopotamian model of state level societies. This critique usefully highlighted

[75] Debate centred on whether existing conceptual categories were still fit for purpose/appropriate.
[76] The fourfold classification of societies into bands, segmentary societies (tribes), chiefdoms and early states.

two growing concerns that the majority of past theories and models held in common, with regards to early state formation in the Near East.

First, social complexity was almost always approached from a top-down elitist perspective that focused on the "role of the ruler in shaping urbanism" (Stone 2013: 1). The development of the urban form was portrayed as "episodic" and "large-scale" defined by a "series of historically documented planned acts associated with the building of certain individual structures or complexes" (Stone 2013: 1; Foster 2009: 5-6; McMahon 2013: 33). Almost two centuries of archaeological exploration in the Middle East has largely bypassed patterns of non-elite behaviour in the earliest urban communities and state level societies (Adams 2012: 11; Emberling 2015: 261; Frangipane 2018: 11; Khurt and Miller 2006: 10-11; Rothman 2004: 92; Stone and Zimansky 2016; Stone 2013; Ur 2012: 536; 2014: 253). Only recently has this started to change with the growth of 'household archaeology' as a distinct disciplinary field space within Near Eastern archaeology (Yasur-Landau 2011; Baker 2013; Parker et al. 2012; Buccellati et al. 2014; Foster 2009; Greenfield et al. 2017). Consequently, we remain largely ignorant of the internal 'bottom-up' dynamics of consumption and production (the everyday domestic economy) that is far less visible in the archaeological record (Pollock 2001: 185-7).

The second major concern was the mechanism for societal change. Ever since the hyper-diffusionist models of the *Oriente lux* school of the early 20th century, less and less emphasis is placed on privileging interactions with the surrounding powers (Egypt and Syro-Mesopotamian city-states). Greater agency has been attributed to internal developments and processes with research increasingly moving away from the binary language of core and periphery and world system perspectives. In the history of research, the Levant has always been characterised as a 'corridor' connecting North Africa with Europe and passively absorbing influences from the 'high civilisations' of Egypt and Mesopotamia. Arguably, this attitude can still be detected in some parts of modern scholarship that privilege these interactions as the main source of accelerated societal change in the 4th and early 3rd millennium BCE (e.g. Cohen 2016; Weinstein 2003: 145). Such a position has become increasingly untenable in light of continued excavations, early evidence of local social complexity, the High Chronology, the distinctive 'profoundly local' material culture traditions of the southern Levant, and the decades of head-scratching over exactly Egypt's and Mesopotamia's perceived impact on the Levantine Early Bronze Age. Neither southern Mesopotamian city-states, nor political unification in Egypt has convincing temporal primacy for

the jump in social complexity in the 4th millennium BCE. There is no longer any reason to relegate the Levant to a secondary backseat position.

In wishing to stress difference over similarity, certain scholars moved beyond caution by abandoning the term 'city-state' altogether for large swathes of the Fertile Crescent, preferring neutral (and somewhat vague) terminology that has little meaning outside of the immediate context in which it has been applied, for example, 'walled communities', 'walled sites', and 'hubs' (Philip 2001; 2008; Chesson 2003; Lawrence and Wilkinson 2016; Savage et al. 2007). Most of these scholars pursue fieldwork in the arid environs of the Jordan Plateau and/or the Dead Sea Plain. They often refrain from using the terms 'urbanisation' and 'city' for small-scale complex societies in the Levant and downplay the impact of urbanism across the region. According to the Italian team presently excavating Jericho, the resulting "ultra-critical" debate over social complexity has become trapped "at a theoretical level", while "finds and investigations in the field continue to accumulate data and allow one to consider the early urban experience in Palestine and Jordan" (Nigro 2010: 1-2).

In this respect, the search for alternative terms and non-hierarchical terms and models is premised on a narrow definition of 'urban' and 'city-state' that is reserved for certain localities in southern Mesopotamia, with institutionalised inequality and pronounced social differentiation (if it is applied at all) (Savage et al. 2007; Kafafi 2011: 48). Elsewhere in SW Asia, the term 'city' and 'urban' is freely used to refer to non-hierarchical settlements, such as the mega-sites and 'egalitarian cities' of Trypillia (Chapman and Gaydarska 2016). There is more than one type of city, past and present (e.g. economic cities, political cities, imperial capitals, regal-ritual cities and theatre states and so forth). Urbanism does not necessitate highly centralised political control, since towns and cities can and do exist independent of states and vice versa (Stoddart 1999: 909; Kradin 2009; Trigger 1993: 6; Cowgill 2004; Jennings and Earle 2016). This is true ethnographically and is also true for North Mesopotamia, at sites such as Arslantepe, where state-level mechanisms for control and social differentiation were divorced from urban growth (Frangipane 2010: 5). In this respect, the denial of cities and states in the Early Bronze Levant (e.g. Savage et al. 2007) disregards the larger theoretical debate over definitions of a city, dismisses the multilinear character of social evolution, and is based on a strict Mesopotamian standard (Kafafi 2011: 48-9).

The transition to an urban way of life is clearly apparent, but it was uniquely southern Levantine and materialised through local traditions of material culture ranging from fortifications,

temples, and building plans to containers for the wine and oil infrastructure that supported larger settlement sizes. People reorganised themselves in planned and fortified centres that impacted every aspect of daily life from domestic architecture to container technology (Kafafi 2013: 48; Greenberg 2011a; 2011b; Chesson 2019). The convergence of all these changes to social life indicate a radical departure from the traditional village communities and loose settlement organisation of preceding periods. Thus, life in the Early Bronze Age Levant cannot be characterised as a gradual incremental extension of the Chalcolithic village lifestyle, as implied by heterarchical models of social organisation.

VIIC. Similarity and difference with the Mesopotamian model

There has always been healthy scepticism over whether Uruk Mesopotamia is an appropriate 'yard stick' to compare against the Levant, or whether better analogies should be sought elsewhere in the Mediterranean where organisation is more 'corporate' and inclusionary (Chesson and Philip 2003). Few cities attained the colossal size of Uruk-Warka, whose only rivals in antiquity are the Trypillia 'mega sites', Imperial Rome, and the Aztec capital of Tenochtitlan (Smith 2002; Wengrow 2015). Uruk-Warka is exceptional even by Mesopotamian standards.

From the standpoint of the southern Levant, limited populations and smaller economies of scale imposed tighter constraints on inequality, site size, and monumentality, with greater restrictions on the administrative mechanism for organising collective projects and intensifying long-range contacts (amounting to a weaker centralised infrastructure). When compared with the Middle Euphrates River valley, most fortified EB II-III sites in the Levant are the same, if not larger than sites such as Qanas and Hacinebi (Stein 1999; 2001). EB IB 'megasites' are of a comparable order to the LC urban 'hubs' in northern Mesopotamia. Despite limited administrative artefacts, site hierarchies have more levels in the southern Levant when compared with most LC regions in northern Mesopotamia. The spatially constrained and highly variegated environments of the Levantine landscape (Mediterranean coast, uplands, desert, and much smaller river valleys) led to a very different set of 'physical affordances' (Wilkinson et al. 2014: 86, 91). Smaller agricultural lowlands and basins, the limited size of 'zones of uncertainty', and modest reductions in precipitation (following an unusually wet period in Levantine history) all combined to:

> "…deprive elites in southern communities of the substantial additional (pastoral) resources necessary to support the increase in the scale and complexity of major polities that is evident in Syria from 2500 BC onwards" (Wilkinson et al. 2014: 91).

As a result, the intensive agricultural model that formed the basis of the regional economy was relatively short-lived and the formation of a clearly definable elite class never fully crystallised for the EB in the southern Levant. Cities and their social make-up varied across the Fertile Crescent according to environmental and geographic contexts (Kafafi 2013: 49). The critique of traditional models of state-formation was clearly justified for portraying a 'trickle-down effect' from an urban heartland in southern Iraq, with Uruk erroneously treated as the blueprint of a city-state (Philp and Chesson 2003). Subsequent excavation throughout the Near East (and the world) has expanded our comparative reference, as well as our definitions and criteria for urbanisation, which was first systematised by V.G. Childe. Uruk is no longer treated as 'the standard' and there is significant variability in the pathways to complexity, local urban forms, and settlement trajectories (Cowgill 2004; Frangipane 2018; Wilkinson et al. 2014). Pan-EB models of hierarchy and heterarchy homogenise and are clearly not appropriate for all 4th millennium BCE sites, regions, and settlement clusters in the diverse terrains and ecologies of the Fertile Crescent and the Levantine landscape.

VIID. Urban origins and the consensus over the lack of consensus

Behind the diverse terms and models for societal change is a strong and resilient consensus in scholarly opinion. This consensus maintains that urbanisation and state formation is not an immutable and irreversible 'stage' in a single homogenous trajectory that can be measured through universalised and normative trait lists (as exemplified by V. G. Childe [1934; 1950]). Rather it should be viewed as a fluid process that involves different components in dynamic interaction, at the interface between physical reality (landscapes and climate) and the social world (Wilkinson et al. 2014; Rothman 2004; Philip 2003; McMahon 2013; Katz 2017; Wengrow 2015; Rotem et al. 2019; Paz and Greenberg 2016; Smith 2002, 2009a, 2009b). Urban centres and early states are a highly multifaceted mode of settlement organisation involving ecological, demographic, economic, sociopolitical, and religious/ideological spheres of interaction (Rothman 2004: 76; Gates 2011: 2-3). In an effort to unpick and explain 'the building blocks of civilisation', each new theory on social complexity has reconfigured the evidence to emphasise certain sets of determinants and kinds of interaction over others. This is a continuous scholarly exercise that navigates between conflict driven (Marxist) and integrationist (Durkheimian) views of state and society, whilst simultaneously complying with the shifting criteria of what constitutes a

satisfactory explanation in contemporary archaeological theory and the social sciences as a whole (Bernbeck 2006).

The recent upsurge in 'macro history' is encouraging a renewed focus on similarities across space and time, ending the current fetishizing of difference (and uniqueness) between sites and subregions. In this case, we can expect another return to large-scale comparisons, but with a more nuanced understanding of how the local articulates with broader regional (even global) processes, such as urbanisation and commoditisation. Arguably, publications on urban origins have started heading in this direction, with a growing amount of research using archaeological datasets to inform and reflect on contemporary social grievances in metropolitan worlds that pertain to migration, social dislocations, globalisation, environmental change, inequality, spread of disease, and political fragmentation (Wengrow 2010, 2015, 2016; Clark et al. 2016; Greenberg 2011b). Mechanisms for societal change in the 4th millennium BCE will continue to be vividly debated and re-worked into larger 'big picture' scenarios. Meaningful comparative research highlights differences as well as similarities in urban life, economic organisation, and political structures for contrasting regions and ecologies of the Fertile Crescent. This rich perspective is often lost in the details of studies centred on specific sites, periods, and regions and as a result sweeping claims are made regarding the presence or absence of political and economic structures within and between societies.

VIII. Conclusions: social complexity and pottery production

The EB of the southern Levant experienced a pronounced increase in social complexity as regional polities transitioned to an increasingly urban way of life in incipient city-states. The recruitment and organisation of labour, control of resources, and economic growth differentiates the first early urban centres of the EB II-III from the village level society of the Chalcolithic and EB IA. The evidence is diverse and encompasses: 1) settlement expansion showing population booms and 3 to 4 tier regional site hierarchies; 2) monumental architecture (major fortification systems, temples, public buildings, and a minority of palaces); 3) clear town planning and changes in domestic architecture adapted to new built environments; 4) increasingly centralised pottery production with standard products distributed over larger areas; and 5) the replacement of local heterogeneous ceramic traditions by 'simplified' homogenous assemblages, with standard types found at sites everywhere in the southern Levant.

Current scholarly opinion agrees that urbanisation and state-formation was a local 'secondary process', but views are split over whether northern Mesopotamia or Egypt had the greatest sphere of influence 'catalysing' the process (Levy and van der Brink 2002: 18-21; Mazar 1992: 92, 110; Greenberg 2011b; Sowada 2009; Finkelstein and Gophna 1993; Nigro 2007; Cohen 2016; Greenberg 2019: 128-131). This chapter argues that such a perspective no longer fits with the increased data on the Levantine Early Bronze Age. The new High Chronology and expanded datasets from recent excavations suggest that urbanisation was not delayed or postponed in the Levant. Early urban growth is already apparent in the second half of the 4th millennium BCE at select sites and is consolidated in the EB II. Societal change was driven by local appetites and tastes for desirable consumables, as well as shared organisational concerns, that are realised through local traditions of material culture, with varying degrees of intensity.

The organisation of pottery production has long been a marker for broader economic and sociopolitical changes that accompanied urbanisation and state-formation in the Levant. However, these topics are almost always discussed in broad and general terms in light of the simplification of the repertoire into standard types and indirect evidence for centralised production, market economies, and a consumer culture. Stylistic analyses are typically combined with petrography (and/or geochemical techniques) to source the locations of fabric types and delimit production zones. This approach can be useful for identifying locational nodes of production from which models of the larger regional production systems and economies can be inferred. Such approaches have resolved long-term debates over the origin and cultural significance of specific EB wares and vessel types, such as Grey Burnished Ware (Goren and Zuckerman 2000), SLMW (Greenberg and Porat 1996), Khirbet Kerak Ware (Iserlis 2009; Iserlis et al. 2012), wheel-made bowls (Roux 2009; Roux and de Miroschedji 2009), and Egyptianized vessels (Dessel 2009).

However, these studies usually require an underlying heterogeneous geological landscape, or distinct temper types to relate pots to specific sites and production nodes. Investigations are therefore restricted to regional scales of analysis and are extremely limited for reconstructing patterns of production and service provision *within* and between settlements and city-states. As a result, the economic foundations of early city-states and townships continue to elude scholars with a lack of consensus over whether local economies were served by specialists generating a surplus,

or largely subsistence based in a household economy with very limited specialisation[77] (de Miroschedji 2018; Chesson 2017; Faust and Golani 2008; Greenberg 2011b; Philips 2008). The nature of the economy is a key question in light of the protracted debate over social complexity in the region. Hence, the goal of this study is to pilot an alternative approach for identifying production groups at the spatial scale of individual buildings in a neighbourhood, in order to understand how an early urban settlement was supplied with container technology. Such a fine-grained analysis provides a crucial perspective for developing a more complete picture of production, economic strategy, and pottery provisioning at a time when the first urban societies were appearing in the region.

Data from the EB levels at Tell eṣ-Ṣâfi/Gath will be used to illustrate the utility of this approach. Most published research in the Near East on early state formation is based on data gathered from elite administrative and religious contexts often showing significant inequality and rigid hierarchy. A new generation of studies have highlighted the need for 'alternative datasets' and a 'fresh perspective' based foremost on the domestic economy and residential neighbourhoods (Foster 2009: 91-98). Hence, this thesis will contribute to the ongoing debate(s) on social complexity through a study of the organisation of pottery production in a residential neighbourhood, at a site of major geopolitical significance, Tell eṣ-Ṣâfi/Gath described in the next chapter.

[77] The producers are the consumers (manufacture based on domestic replacement) with negligible exchange beyond the household.

PART II: SITE BACKGROUND AND THE ASSEMBLAGE

Chapter 5: Tell eṣ-Ṣâfi/Gath in the Early Bronze Age

This chapter presents an overview of the Early Bronze Age excavation project at Tell eṣ-Ṣâfi/Gath. A detailed site description of the EB layers/stratigraphy shows why this site is appropriate for investigating pottery production in an early urban neighbourhood. The contexts sampled for this doctoral dissertation are summarised and the sherd distribution of the study sample is discussed.

Tell eṣ-Ṣâfi/Gath is a large multi-period site (ca. 50 ha. in total size with a 24 ha. surface area for the upper mound) that has been continuously investigated since 1996 under the directorship of Aren Maeir, of the Institute of Archaeology, Bar Ilan University (henceforth BIU). The site sits on the border of the western edge of the Judean foothills (the *Shephelah*) where it touches the eastern edge of the flat arable Coastal Plains (Figs. 1.3, 5.1-2). It is located approximately halfway between Jerusalem and the Ashkelon coastline, and overlooks the Elah River Valley, which is the main route inland toward Bethlehem and the central Judean Highlands of Israel (Figs. 1.1-2). This strategic location explains why the site was almost continuously occupied from the Chalcolithic to the present. In recent years, the site has become increasingly famous for its well-preserved Iron Age levels, which show the main developmental stages of Philistine material culture (Maeir 2012a, 2012b; Hitchcock and Maeir 2018).

I. The excavation project at Early Bronze Age Tell eṣ-Ṣâfi/Gath

The EB levels were first discovered in 2004 with the opening of Area E at the eastern end of the upper mound, using the box square method of excavation, under the supervision of Itzick Shai (Fig. 5.3-4). Prof. Shai continued supervising the excavation of the area until 2013. From 2012 to 2017, Professors Aren Maeir (Bar Ilan University) and Haskel Greenfield (University of Manitoba) co-directed the investigation of the EB occupation in this area, funded through their SSHRC Partnership Grant. The overall goal of the fieldwork in Area E was to integrate an array of specialist perspectives that allow investigation of the microarchaeology of households. It is through a collaborative and interdisciplinary enterprise that it becomes possible to increase our understanding of how the ordinary inhabitants of an early city organised their space and daily lives, beyond the limits of traditional archaeological research methods. The project excavated with high levels of precision, recording, and on-site expertise, and featured the latest technologies in both laser-scanning and photogrammetry. The data from this site are high quality from excellent stratigraphic contexts that were well documented. Sites with significant exposures of urban

domestic contexts from this period are not common, especially from a large tel site. EB levels are usually buried deep under subsequent settlement layers and therefore unreachable without long excavation over many seasons.

II. Settlement size and geopolitical significance

Excavations on the upper tel have exposed substantial evidence for a major fortification system that encircles the upper mound (Figs. 5.4-5). It has been exposed in Areas F (on the western edge of the upper tell), P (near the centre of the upper tell), and below E (beyond the eastern terrace), and matches the "Judaean" fortification system exposed by Macalister and Bliss in 1899. The fortification wall was ca. 2.7 m in thickness (5 cubits) with 3.25 m (6 cubits) outsets and insets, measured on opposite sides of the upper mound (Chadwick et al. 2017). The fortifications surrounded the entire upper mound and include a glacis (earthen rampart). EB pottery and architecture have been recovered from all excavation areas of the upper mound, further indicating that the whole upper tell was occupied during the EB. This corroborates well with the original findings from the surface survey (c. 24 ha – Uziel and Maeir 2012). There is currently no evidence of public buildings in the excavated parts of the site. They are likely located elsewhere, such as buried deeply under subsequent strata on the western ridge of the site (Greenfield et al. 2014: 479). The settlement size and fortifications suggest that Tell eṣ-Ṣâfi/Gath was a major regional settlement during the Early Bronze Age III.

III. The phasing in Area E

On the eastern part of the tell in Area E, large-scale excavations have exposed multiple Early Bronze Age levels of a non-elite domestic neighbourhood, covering an area of c. 300 sq. m, with exposures across 10 ½ excavation squares (5x5 m each). At present, nine main building phases have been defined (Table 5.1). Phases E5 to E9 represent the latter half of the EB III and the earlier EB III. A clear transition from the EB II was not recognised at this site, but some EB II pottery traditions were more frequent in lower levels. The E8 to E9 strata are limited to small exposures and finds from probes.

Table 5.1. The main phases in Area E, Tell eṣ-Ṣâfi/Gath. Duplicated in table list.

Phase	Period
E0	Unstratified surface
E1	Modern activity

E2	Iron Age IIA
E3	Iron Age I
E4	Late Bronze II-III
E5 to E9	Early Bronze III

This thesis focuses on the better contextualised material from the E5 and E6 strata since they were exposed over a larger area than E8-9 which came only from the deep probe. Stratum E7 was exposed in various sections, but not in its entirety across the excavation area. Household assemblages from the E5 stratum are best represented, since it was completely excavated, whereas exposures were more limited for the E6 and E7. The E5 stratum was subdivided into three sub-phases (E5a, E5b, and E5c), based on the architectural remodelling of the buildings across the neighbourhood.

The stratigraphic phasing of the E5 was complicated by substantial Late Bronze Age pits and wall foundations, as well as Iron Age walls whose construction dug deeply through the E5 layers. At least 8 large LB pits (middens sealed by the 'Patrician House', Building 66323), 4 LB walls, and 3 large Iron Age walls cut into the EB levels (Figs. 5.7-9 and 5.13). The pits were often several metres in diameter. The high concentration of large pits is puzzling and suggests this area was used for refuse disposal in the subsequent E4 period (prior to the construction of the large LB building in the E4b phase since the pits do not cut the E4b floors[78]). As a result, the east wings of the E5 buildings across the edge of the slope were not well preserved. This area is vulnerable to downslope erosion and also suffered from LB and IA trenching and pit digging.

The excavation project was plagued by typical tell stratigraphy where the upper phases in the EB sequence were more disturbed by later occupation, the far eastern edge of the slope was attacked by downslope erosion, and the western end was best preserved but deeply buried under many metres of (c. 4-6) of later deposits. The lower levels had more limited exposure. Opening up

[78] This monumental building preserved a large part of the EB neighbourhood and many of the walls were built on E5 walls, effectively using the E5 architecture as a foundation for many parts of the LB structure (especially east of the alleyway). The dismantling of many of the LB walls immediately exposed EB architecture, which was sealed by the LB foundation stones. In the same way, the EB fortification wall was reused as a foundation in subsequent MB, LB, and IA periods on the far west side of the tell (Area F).

the "belly" of the site (the middle and back squares on the phase plans) required many more field seasons of targeted excavation than originally anticipated.[79]

IV. Architecture and settlement organisation in the neighbourhood

Excavation in Area E exposed two to three rows of contiguous rectilinear buildings and a narrow street (alley), built and maintained over a long time and spanning multiple phases (Fig. 5.6). We did not reach the natural ('sterile basement') except in a small (2x2 m) probe, which was over 6 m deep from the surface in square 93B (Fig. 5.21). It was over 12 m deep beneath the level of the terrace along the western edge of the excavation area (in Area A). The pottery from the earliest levels, cut by the probe, still yielded EB III pottery, and attests to the density and longevity of the EB III sequence in this area. The neighbourhood was gridded out on a NE to SW orientation, following the natural gradient of the tel. The overlying Late Bronze and Iron Age architecture followed the direction of cardinal compass points (NS and EW) and were therefore easily differentiated from the Early Bronze.

IVA. The E5 buildings

The E5 buildings consist of small and sturdy multi-roomed units. Buildings have boxy and rectangular plans, with courtyards flanked by narrow rooms, and numerous installations. The elevations of the buildings from west to east suggests that the area was terraced down slope, since the floors in each building were horizontal (Figs. 5.10, 14, 18, and 21). A narrow street separated buildings on the upper terrace in the far west, from buildings lower down the terraced slope in the east. The number of buildings and domestic units is difficult to specify, mostly due to the lack of doorways[80] (door sockets and thresholds) and the disturbances caused by Late Bronze and Iron

[79] Other factors also problematised the phasing and interpretation of stratigraphy. The nature of the soil (very fine chalky rendzina) meant there was often poor contrast and visibility between different types of deposit. Sun-baked mudbrick architecture can be difficult to differentiate and trace when most of the deposits consist of degraded mudbrick. Visibility of stratigraphy was particularly poor when the sun was directly overhead. Cobbled floors were easy to identify, but earth beaten floors were often dug through and recognised in profiles. Prior to the arrival of the Canadian team from Manitoba, Area E had been dug by many different teams over a long time – each with varying styles of excavation, precision, recording, experience, expertise, and so forth. Much of the E5a phase of the EB III neighbourhood was already exposed by the LB excavators before the arrival of the Canadian team.

[80] Excavators at Ugarit identified houses based on doorways to differentiate a total of seven houses in the 'centre de la ville' of the exposed area. We only have one clear example of an internal doorway facing NE in Building 2 (Figs 5.7-8, 16-17) and one door socket on the opposite side of the alleyway. Internal doorways at Jericho and Yarmuth are usually off-centre where the partition wall stops ca. 1 m before abutting a perpendicular wall that would close the room.

Age deposits (pitting and trenching). The perimeter walls of buildings were not fully exposed for any of the buildings, since walls disappeared into terminal baulks and further exposure would require years of excavation to remove the overhanging settlement layers. We did not have full exposure of a complete building complex, which problematises the differentiation of individual dwellings.

Boundaries between domestic complexes are difficult to determine in a built-up neighbourhood and is a familiar problem at EB urban sites including Yarmuth and Beth-Yerah. The fluid character of Near Eastern urban households (and the 'oscillating fluctuations' in the lifecycle of a house) makes them difficult to excavate and define (Stone 2013; Harrison 2011: 289). The construction materials and the versatility of mud brick technology allows buildings to be remodelled with ease and these rebuilds (and their associations with other architectural and stratigraphic features) are difficult to trace. Living spaces are easily rearranged by blocking and unblocking doorways, subdividing spaces, raising floors, installing and removing installations, partition walls, and so forth. Houses expand or contract depending on the needs and circumstances of the inhabitants and therefore change shape (exemplified by Area E neighbourhood, see below). For these reasons, the housing block bounded by alleyways and streets are usually considered the fundamental unit of urban organisation and planning – not individual structures.

Analysis of the E5 architecture suggests four to six buildings spatially (Shai et al. 2014; Greenfield et al. 2016; 2017; Figs. 5.6-9). Exposures do vary with a large areal exposure on three buildings and trace exposure on an additional three structures (essentially corners of buildings with no clear room plans). The E5 includes walls and floors from three sub-phases (a-c), each one reusing earlier wall stubs and modifying building plans, but preserving the general layout of the domestic quarter (Figs. 5.7-9). Exterior house wall foundations are built directly atop the underlying and standing E6 and E7 mudbrick walls. This would imply residential and property line continuity over time (Greenfield et al. 2016) . The E6 and E7 exposures (and EB strata below them) were too limited to determine the nature of continuity in the architectural footprint.

EB III broad room houses at sites such as Tel Yaqush (Stratum II) are clearly interconnected. Rooms and courtyards[81] were accessible without gaining entry via a street, hence the decision by the excavators to treat the architecture as one building/compound with over 15

[81] Courtyards are assigned rooms numbers which is confusing.

rooms (squares N12-13, P12-13, and Q12-13) (Rotem et al. 2019: 126-8). In our case, the situation is more problematic, since hardly any doorways were found. Building 1 in the far west is separated by a street and is clearly differentiated from the dwellings east of the alleyway. The structures east of the alleyway (Buildings 3, 4, 5, and 7) do not appear to be interconnected. No trace of an entrance was recognised in any of the main NE to SW cross-walls in any of the phases. Some of these partition walls were relatively thick and long lasting, and endured multiple building phases. For example, partition wall W74511 (separates Building 2 from Building 3) was originally built in the earlier E6 phase, featured seven large courses of foundation stones, and continued in use until the terminal abandonment of the EB neighbourhood. The wall was comparable in thickness and depth to the exterior building walls defined west of the alleyway where there were stone foundations of identical dimension for wall W104107 (seven courses deep and two courses wide). This would suggest that W104107 is a boundary between two buildings, but in the absence of where external doorways were located, we cannot be sure. Fragments of a second building were also excavated on the west side of the alleyway, south of Building 1.

At least two (possibly three) main courtyards were identified east of the alleyway. Based on the assumption that a single house usually has one courtyard, with one or two side rooms attached, then a minimum of two to three individual buildings existed east of the alleyway and shared exterior walls. Close architectural parallels are the rectangular 'double roomed' units identified at Qashish, Kishon, el-Farah north, and Khirbet Zeiraqoun (Zuckerman 2003: 125). Individual dwellings are small, with an average width of just ca. 6-7 m (NW to SE) and a length of ca. 8-9 m (SW to NE) at Tell eṣ-Ṣâfi/Gath. The length/long axis of the buildings is difficult to estimate due to the limited exposures and poorer preservation along the east flank of the neighbourhood. The long sequence of EB housing at Tel Beth Yerah does show a clear transition in the Period C settlement when the site became a town in the EB II. Buildings changed from spacious broad room rectangular structures to smaller boxy dwellings (the 'cellular' type in Yamafuji's 2019 typology). Comparable EB house plans include Stratum 19 in Field X at Tall al-'Umayri (Jordan); Stratum IIIb2 in Trench III at Jericho; Stratum XII at Tell Qashish; and Level G2 at Yarmuth, thus reflecting a common layout for EB II-III domestic houses at fortified and planned sites. Houses were smaller boxier versions of the typical EB broadroom house originally defined at Arad (Amiran 1978: 14-17; Ben-Tor 1992) and modified to suit the space, layout, and topography of the site in question.

The appearance of dense rectangular domestic architecture coincides with the appearance of thick fortifications ringing most sites, which limited space for growing populations and forced a more compact arrangement (a more efficient use of space in a well organised settlement). Dwellings at some rural villages appear to have continued in the classic EB tradition of more open and spacious broad room houses, such as those at Tel Yaqush (Rotem et al. 2019) and ʻUmaryi (Harrison 2011). Numerous studies have repeatedly established the domestic character of these types of architecture (variants of the broad room house) that widely occur across the southern Levant and can sometimes dramatically vary in size within a single site (Sebag 2005; Ben-Tor 1992; Ben-Tor and Bonfil 2003; Yamafuji 2019; Nigro 2010; Ilan 2001; Golani 2003; Faust and Golani 2008; Adams et al. 2014).

Smaller houses imply smaller family units in each building, but proximate houses in the same building block may represent extended kinship groups. This is the current working hypothesis originally derived from the excavations at Beth Yerah (Greenberg et al. 2012). Ongoing research at Tell eṣ-Ṣâfi/Gath aims to integrate spatial data for the architecture, installations, and associated small finds (artefactual and ecofactual). The overall goal is to identify patterns in their distribution that may indicate, with more certainty, boundaries between individual dwellings. Applications of traditional definitions of households are problematic unless the full extent of the building is exposed. Households can and often do transcend a single built structure. For example, the seven large multi-phase houses in Stratum I (EB IB) at Tell Yaqush are thought to have served one extended family "that grew over the years and adjusted the compound to their needs" (Rotem et al. 2019: 115).

IVE. The narrow street/alleyway

Street networks structure neighbourhoods, define blocks of housing, and typically endure through multiple phases of occupation. The horizontal exposure in Area E was not large enough to fully expose a complete rectilinear housing block bound by streets, especially with the destruction around the north, east and south perimeters of the excavation. Settlement organisation involving urban planning is still apparent, with the non-random layout of buildings in rows, and the architectural footprint was preserved across all three phases of E5 strata and possibly the E6. The alleyway was resurfaced in each subphase and likely connected with a larger main street. The main street may lie directly underneath the abandoned road to the former Palestinian village, immediately north of Area E (visible on aerial photographs of the east side of the tel). This path is

maintained by the National Park Authority to this day for visitors to climb the mound from its eastern perimeter.

The alleyway descends gradually in elevation from NW to SE and follows the natural contour/topography of the slope (same direction as the rows of housing), but without declining too steeply (Figs. 5.6, 10, 16, and 18). In every phase of the E5, the alleyway was purposefully packed with highly fragmented sherds, loose rubble, broken flints, detritus, and ashy sediments. This packing material provided a firm surface for walking and promotes water movement away from the houses downslope. In section, the alleyway deposits in each phase had a slightly concave cross-section (profile) presumably hollowed out by heavier foot traffic down the centre of the alleyway with build-up along the adjacent walls. The material from the alleyway was always in a highly weathered and eroded condition (some sherds were water rolled with a slight green tinge).

The average width of the alleyway was ca. 1.5 m, but the width was temporarily narrowed by ca. 0.5 m in the E5b phase, by the addition of an extra row of stones on either side of the alleyway.[82] Mudbrick houses occupied for long periods are prone to creep and subsidence. Repairs and revetments can be made to reinforce walls fronting streets and alleyways. The SE corner of Building 1 was thickened and reinforced along the downslope east facing wall in the E5b, which narrowed the alleyway. Similar repairs, revetments, and 'thickened walls' are known from EB III buildings at sites, such as Beth Shean and Qashish and usually occurs along corners (Zuckerman 2003: 128). The construction and dimension of the narrow EB side street(s) at Beth Shean (Strata M1-M2, SQ S-R/2-3) are comparable to the alleyways exposed in Area E (Mazar 2012: 55, 92-6). The large main streets at Beth Yerah were more than twice as wide and were paved with large stone flags, as opposed to the small cobbles, rubble, and sherds (domestic waste) used on side-streets and alleyways.

IVD. The built environment

The walls of the buildings were built from sundried mudbrick on several courses of large roughly shaped fieldstones with no tooling marks (Figs. 5.10, 14, 15, 17, 19, and 20). These field stones are usually chalkstone, limestone, and conglomerate that are common to the local landscape. The stone foundations were two courses wide in each phase and set into a thick layer of mud at

[82] It almost appears as if it would have been to close off the alleyway with a door, but there was no evidence of a door socket or a wall across the alleyway.

the base.[83] Exterior building walls have a width no greater than 0.5 to 0.6 m and endured all three phases of the E5. There are no foundation trenches. The stone courses were positioned directly at ground level and the floors abutted the bottom of the stone course in each consecutive phase. Large field stones were interspersed with smaller cobbles or 'chinking stones' used to fill in gaps to stabilise and lock the wall, directing weight and pressure inward toward the centre (otherwise it collapses). Smaller stones can be used along the interior faces of the wall, which was clearly seen in building 1 (west of the alley). In some instances, beds of smaller stones and mud alternate with larger stones, firmly packing and seating the main courses (Figs. 5.14 and 5.19). This greatly strengthens the structure and helps level it off. The bottom most course (the bonding stone) usually had larger stones and is faced relatively even, especially in the SE corner of building 1, west of alleyway (closer to the edge of the upper terrace).

The construction and unity of these stone wall foundations indicates that they were built in a single construction phase (the E5c for the perimeter walls of the main buildings), as opposed to consecutive rebuilds across several sub-phases. In which case, the original stone wall foundations in the E5c rose to a considerable height of at least 1.0 to 1.5 m above ground level, with some walls having seven courses (compensating in part for the slope), before topped with a mudbrick superstructure. Presumably, finishing the entire wall with stone was far costlier in materials and labour. Mud brick walls are superior at retaining a constant internal temperature, but are more prone to erosion. Hence, these composite walls combine desirable properties associated with both materials to create a long-lasting building complex. The thickness of the accumulations on the floor in each phase suggest long phases of continuous activity.

Plastered mud brick surfaces and lenses were visible in sections (Figs. 5.11, 19, and 20) and the thick building collapse layers were packed with mudbrick and plaster debris (often called 'chalk chips' on loci cards). The plaster would complement the white to buff coloured stone foundations, which may have been left naked. The mud brick walls on the stone stubs were anchored in place using mortar. Mortar is clearly visible between some of the intact surviving mud brick walls (visible in the photographs). In which case, these are 'wet walls' and not 'dry walls'. Similar building techniques are evidenced in the fortification wall, with stone foundations varying

[83] This mud layer foundation appears to have been used like mortar to level off the ground surface, with the bottom course of stones placed/inserted *in* the mud.

between 1.5 m to 2.0 m in standing height, topped with several courses of mudbrick, to create a wall estimated to be ca. 8 metres high (Chadwick et al. 2017).

The thickness of the walls suggests that these buildings were small one-story structures, especially if we use a conservative 3:1 ratio for height to foundation width (Chadwick et al. 2017: 288), which likely underestimates the height of domestic structures. The walls are less than half the thickness of multi-story structures at EB temple sites and elite dwellings at Megiddo, Jericho, and the palaces at Yarmuth. There was no evidence of stairways leading to a second story and no foundation trenches to enhance structural integrity. A multi-story structure generates thicker building collapse layers, with additional stratigraphy and material from the collapse of upper floors and levels (not visible in any of our profiles). Earlier EB housing such as the apsidal and curvilinear buildings were typically thatched. Roof material from EB II and III levels at Tell Beth Shean[84], Qyriat Ata, Jericho, and Tall Abu al-Kharaz further indicates that buildings were thatched with bundles of reeds over a light timber frame (usually supported by pillars). This is based on the reed impressions preserved in some of the plaster and mudbrick (laid when wet), as well as the configuration of stone pillar bases and surviving timbers/wood beams (reduced to charcoal) at some sites (Harrison 2011: 288; Nigro 2016: 9-10; Mazar 2012: 41, 43, 49-51).

Some interior walls in the Area E neighbourhood were short-lived and restricted to either one or two sub-phases. In later phases, rooms are split and the interior space is divided up into smaller areas creating narrow rooms. These partition walls were noticeably thinner when compared with exterior perimeter walls, but were built using the same techniques (often only one or two courses deep and two stones wide). It appears that the E5c (and possibly the E6) was a more open built environment and the division of subsequent phases may indicate population pressure and/or more specialised use of space (specific activities restricted to specific spaces perhaps).

The lack of doorways to the north and south would allow one to argue that these were separate buildings. The absence of doorways from the alleyway to the eastern line of building is preferable to prevent rainwater washing downslope into the house. An eastern orientation and doorway would also maximise early morning sunlight. Access onto the narrow street was presumably more restricted and indirect. Buildings did not open up directly onto the alleyway, which was probably reached via another route/side street. These side streets were privately owned

[84]The beams and planks from Building MA in Str M3 (EB IB) were not conserved, but consisted of local tree species including olive.

in Mesopotamian cities based on the house sales documented in the cuneiform corpus (Stone 2013).

IVF. Central courtyards

Courtyards are standard features of Mediterranean and Near Eastern housing from the Old Babylonian city of Ur in Iraq, to Bronze Age Ugarit on the Syrian coast, to the Roman villas of Cadiz and Brunel in southern Spain. They are an enduring form of architecture at Tell eṣ-Ṣâfi and span the Early Bronze to Ottoman periods. Courtyards allow light and ventilation to flood into the surrounding roofed rooms and sheltered spaces. They provide spacious areas for socialising[85], food preparation (cereal grinding), animal care, and cooking. Courtyards are also convenient spaces for certain kinds of storage and presumably the location for some productive activities that can take place in a well-lit and ventilated space. Fumes and smells from cooking, animals, and other daily activities are not trapped within the houses. Clean air circulation was important in densely inhabited areas where disease can spread rapidly.

In Area E, courtyards have a rectangular plan, with no clear evidence of pillar bases (except possibly one in Building 1, E5c Phase) and are approximately 4-5 m wide (too wide for local trees to span). Many installations are found in these areas such as hearths, silos, and work platforms (Figs. 5.15-18). Twin pebbled hearths in association with grinding equipment (mortars, pounding stones, upper and lower grinding stones) and cooking pots suggest that much of the cooking and food preparation happened in the unroofed part of the building. Twin hearths in courtyards are also attested at EB III domestic complexes at other sites, such as Tel Beth Shean (Area R, courtyard 28306) (Mazar 2012: 93). Hearths (and an oven?) were also found in the narrow rooms. Perhaps different types of cooking were performed in different parts of the building. There is no evidence for fast cooking over open flame (i.e. roasting). In the outdoor area, cooking was relatively slow (stewing) and conducted over a low banked bed of dung on a pebble surface. In a few small rooms, there is some evidence for pits used for heating and cooking over a low banked fire. Perhaps outdoor cooking was contingent on weather conditions and indoor hearths were primarily used for heating. The fact that twin hearths were always located in courtyards suggests the bulk of the cooking occurred outdoors. Building 134817 at the south end of the excavation area had a large

[85] Several game boards and pieces were found in the neighbourhood

cooking installation, presumably an oven (134413). But, its precise function is unclear. Maybe it was for bread baking.

Houses in the urban environment at Tell eṣ-Ṣâfi/Gath were equipped with their own facilities for food production. Large restorable pithoi and grain silos (fixed grain installations) suggest that courtyards were used for the cereal storage of threshed grains. Grain silos had raised circular stone foundations (of c. 1 m diameter) to support a mudbrick superstructure where the threshed grain was stored. This mud brick superstructure was shaved off by the LB occupation. Courtyards in Area E also had 'work platforms' (solid tables) shown in Fig. 5.15 (Platform 84109). These square installations were of solid stone construction and measured 1.3 m high and 1 m in diameter. These installations provide appropriate surfaces with a good height for working dough, grinding cereals, and general food preparation (grinding equipment often found in the courtyards). A raised surface is preferable for a range of domestic tasks.

Good examples of silos, 'work platforms', and ovens (among other facilities) were found together in a complex, interpreted as the earliest bakery, in the EB IB levels at Abu al-Kharaz, in Jordan (Fischer 2008, 2011a, 2011b). Botanical data from EB II levels at sites such as Abu al-Kharaz (northern Jordan) and Beth Yerah (northern Israel) clearly show a decrease in weeds and chaff in the courtyards and houses when compared to the EB I houses at the same sites. The pattern suggests that by the EB II some basic crop processing (e.g. threshing) was no longer performed in the domestic compound (Greenberg 2019: 75-6). These proposed changes to the use of domestic space also coincide with an overall reduction in house size (and wall thickness) at fortified urban sites (Faust and Golani 2008; Yamafuji 2019; Greenberg et al. 2012).

A minimum of four complete articulated donkey skeletons (all female subadults or young adults) were found buried beneath the courtyards on both sides of the alleyway in the E5c phase. They were not cut into the floor, but were sealed by the floor in shallow pits and intentionally buried in the foundations of the building. The unusual anatomical position of one of these donkeys suggests a deliberate sacrifice. The legs were bound together and bent in an abnormal position, the head was placed on the stomach, the neck was bent and twisted around, with all bones present. An area of 4-5 m is a very restricted space to pen a donkey (a large and noisy mammal). It is highly unlikely these courtyards were used to keep large mammals (not to mention the smell), but certainly smaller animals. The space is already crowded with other installations and the donkey burials are interpreted as foundation deposits (Greenfield et al. 2018).

IVG. Rooms

Narrow rooms with a rectangular plan are accessed from the courtyards, with presumably only one entrance from the courtyard (Figs. 5.6-10). These narrow rooms are always adjacent to the alleyway. They do not connect directly with the outside suggesting these areas were private spaces for secure dry storage (among other functions). This layout is paralleled in Area G2 at Yarmuth (comparable dimensions, arrangement, and urban plan). Narrow rooms are sometimes paved with fist sized cobbles, as opposed to the earth beaten floor of the courtyards. The restricted space (less than 2 m in width) suggests that these spaces were not family sleeping quarters. They were filled with domestic debris and pebbled hearths were found in some. Live animals were probably restricted to the courtyards, which were also used for cooking, storing, and congregating. The ground floor rooms provide privacy, secure dry storage, and sheltered living space.

Plastered surfaces were rarely found intact, but we can surmise that the interior wall surfaces of all rooms were covered to a greater or lesser degree in a light coloured plaster-like substance that is more akin to lime plaster on ceramics in the same deposits (Eliyahu-Behar et al. 2016, 2017). White walls reflect the light better in dimly lit rooms and they appear more spacious as a result. Proofing the walls with plaster prevents dampness and deterioration. White and cream appear to have been the typical choice colours for interior design. At Beth Shean and Abu al-Kharaz, some of the EB plastered surfaces preserved the original herringbone design, the same design that is found on the combed white slip pottery and the earliest textiles of the period (Mazar 2012: 50-1; Schick 1998). The white walls invariably complemented and enhanced the aesthetic look of the bright red slipped and painted platters and bowls, as well as the brightly burnished colourful jugs (usually a thick homogenous red, but we also have brown and black examples). The larger storage vessels were decorated with a chalk slip and patterned combing. Presumably similar patterned decoration was visible on the matting and even the basketry giving these rooms an attractive look when furnished.

V. The small finds

The buildings and street were rich with diverse finds of a domestic character including grinding and pounding stones, mortars, chipped stone tools, bone tools, jewellery beads (carnelian, faience, and mother of pearl – all nonlocal), alabaster, zoomorphic figurines, fragments of game boards (*senet*), and gaming pieces. Evidence of administration is based on a clay sealing/bulla (with a fingerprint) and a finely carved cylinder seal depicting a lion and made of hippopotamus

ivory. Other small finds of significance include mace heads made from nonlocal stone and a small collection of fragmented metal objects (a copper pin and axe head) (Greenfield et al. 2014; Shai et al. 2014). The inhabitants were clearly not poverty stricken and the finds suggest a modest economic standing. They sacrificed expensive animals, had access to mundane and exotic trade goods, kept recording equipment, and owned donkeys (valuable pack animals first domesticated in the EB). The Egyptian origin of some of the donkeys (at least two based on the isotope analysis), with evidence of bit wear, has raised the possibility that some inhabitants were merchants.

There is evidence for production of chipped stone tools[86] and textiles[87] occurring in the houses (Ben-Shlomo et al. 2017; Manclossi and Rosen 2018). The remaining durable goods (ceramics, ground stone objects, jewellery, figurines, metal objects and so forth) were always found as finished objects, with no evidence of manufacture, production tools, and debris in any of the buildings and courtyards. Some of the objects recovered were non-local and point to widespread trade connections, such as the carnelian beads with distant sources in the Indus Valley (Arnold et al. 2017; Eliyahu-Behar 2017). Utilitarian commodities of exchange include the ground stone artefacts. Provenance studies (Beller 2016) indicate they were transported from distant sources around the Sea of Galilee, the Jezreel Valley (over 100 km), and the eastern Dead Sea region (60 km). Recent research on olive oil production suggests the existence of major industries in the Shephelah that were presumably not oriented around domestic consumption of individual households (Langgut et al. 2016; Salavert 2008). Additional productive activities were likely performed away from the houses and ephemeral evidence may not have survived, or was discarded elsewhere. de Miroschedji readily admits that it is "difficult to determine to what extent the economy was redistributive at the level of the settlement" (2018: 127). The evidence suggests a well provisioned neighbourhood with a surplus economy served by specialists meeting the needs of the inhabitants. The only exception is the possibility of thread production, since some of the EB sherds show evidence of secondary use as loom weights and/or spindle whorls. The distribution of small finds and domestic debris across the E5 and E6 (E7 exposures too limited) suggests that the same range of domestic activities took place throughout the life history of the houses. The architecture and finds in general indicate strong continuity throughout the EB III sequence for this part of the tel.

[86] All phases of manufacture present
[87] Sherds showing secondary use as spindle whorls

VI. The pottery sample: data recovery from the neighbourhood

VIA. Sherd distribution by building and phase

In total, 459 sherds were sampled from the EB neighbourhood over a period of five field seasons from 2013 to 2017. Contexts include the alleyway, all buildings, rooms, and courtyards. As can be seen from the histograms shown in Figs. 5.22-29, the sampling was uneven between phases and buildings due to recovery bias. More vessels were sampled from buildings and rooms with larger exposures (Fig. 5.6). Hence, Buildings 2 and 5 each averaged more than 30 sherds per phase in the study sample, with most of the shape repertoire represented (Figs. 5.24, 27). However, parts of buildings and rooms that were only partially exposed had far fewer sherd counts and only part of the repertoire was sampled (usually holemouth cooking pots or jars). Hence, Buildings 74808, 114805, 19E73D02, 94118, and 134309 each had 14 sherds or less per phase in the sample. Fewer sherds were sampled from Building 104311 because most of the vessels were reconstructed. Over 100 vessels were sampled for each of the E5 horizons including a minority of vessels from the E6 and E7 (> 20), which were far more restricted in areal exposure (Fig. 5.22). The sample also included 42 unstratified sherds, 20 sherds from the alleyway, and 45 sherds from deposits that were not sub-phased within the E5 strata. Half of the overall sampled sherd assemblage came from primary contexts (accumulations directly on or above a floor) and the remaining material came from secondary[88] and tertiary contexts[89].

VIB. Additional limitations on sampling

The sampling strategy for this thesis had to adapt to the contingencies of working on an assemblage from an ongoing excavation. Samples and contexts grew and changed each year. Artefact catalogues were continuously updated and the interpretation of the stratigraphy was modified with each season (the phasing and definition of many deposits are not yet finalised). Ceramics from loci marked for restoration (accumulations above/on a floor) were generally not accessible for up to two years following excavation and access depended on how rapidly the conservator processed the material. Any indicatives for export needed to undergo a full typo-chronological study by the BIU team. All of these had to be analysed, drawn, and photographed before they were permitted to be exported for destructive analysis. For expediency, some of the EB sherds had to be swapped out of the original sample for sherds that were already processed and analysed. These sherds were not

[88] Secondary contexts primarily include floor make-up and building collapse layers.

[89] Tertiary contexts primarily include baulk dismantle, unphased probes, and ‘winterwash’.

always from primary contexts. Only non-indicative sherds (body sherds and discards from the pottery reading) were available for immediate export. Not all types were represented in each context and some of the types could not be exported, since they were necessary for the typo-chronological study and were present in low amounts (such as the pinch pot lamps). The histograms in Figs. 5.22-29 show total sherd counts for vessel types from the various contexts sampled in the neighbourhood across the phases. The following chapter presents the EB III pottery repertoire at Tell eṣ-Ṣâfi/Gath.

Chapter 6: The Early Bronze pottery from Tell eṣ-Ṣâfi/Gath

I. Introduction

This chapter contextualises the Tell eṣ-Ṣâfi/Gath EB assemblage and provides a morphological description of the shape repertoire from Area E (Figs. 6.1-5). Descriptive criteria relate to geometric shapes, relative size, and vessel proportions. Description occurs at two levels: (1) the complete profile (overall form); and (2) form elements and attachments (e.g. shape of the rim, neck, body, base, handles, spouts etc.). An advantage of pottery classes based on form (size and shape) is that the resulting categories not only establish 'equivalent units' for comparison through standardised descriptions (the goal of any classification), but categories are also functional and partly accommodate for vessel use (Rice 2015: 232, 237, 245; Fowler 2006).

Early Bronze age pottery has a long history of research in Israel. The first stratified sequence was published by Flinders Petrie at Tell el-Hesi in 1891 (Fargo 1979: 23; Petrie 1891). Petrie was the first to publish vessel profiles to clarify chronological and regional affinities, through the typological study of vessel forms and decorative styles. Petrie's sequence was expanded, sub-phased, renamed, and pushed back to the 3rd millennium BCE. By the late 1970's, over 888 sites were recorded as having EB occupations, but with only a small fraction excavated (Richard 1987: 23). Expeditions at sites such as Arad (Amiran 1978), Tell el-Farah North (de Vaux 1952), and Yarmuth (de Miroschedji 1981; 2000) had a formative impact on the understanding of the general character of the period and refined conventional typo-chronology. The recent High Chronology (Chapter 4, § II) exposed considerable time lags in ceramic cross-dating, but has not yet won full acceptance (Nigro et al. 2018).

After more than a century of archaeological investigation of the Early Bronze by diverse expeditions from diverse theoretical backgrounds there is a clear need to standardise description and classification (Braun 2012; Thalman and Sowada 2014; de Miroschedi 2000). At present, the key goals in numerous publications and projects are to synthesise the data, expand high-precision C-14 dating, and clean up pottery terminology, styles, and ware definitions. The shape classification presented here is therefore purely form based and intentionally omits ill-defined and misleading ware names used in traditional reports, such as 'Abydos' ware and 'Combed' ware.

II. The shape repertoire from Area E

The EB pottery repertoire from Area E is abundant and well documented from secure stratigraphic contexts. Pottery forms have distinctive shapes that approximate the function of the

vessels and include containers for the storage, preparation, and serving of food (Figs. 6.2-3). The repertoire is reflective of domestic daily-life household functions and compares well typologically with other late EB III sites across the southern Levant, including Yarmuth (de Miroschedji 1988, 1993, 2003), Lachish (Gophna and Blockman 2004: 880-891), Tell el-Hesi (Fargo 1979), Tel Ira (Beit-Arieh 1999), Megiddo (Adams 2013; Greenberg 2006b), and Tell Beth-Shean (Ziv-Esudri 2012). The E5 and E6 assemblages can be securely placed in the late EB III and is typical of the region showing a preference for wavy handles, thick-walled and flat bottomed holemouths, serving bowls with thickened inverted rims, deep vats, storage jars with flaring rims, and large decorative serving platters up to 60 cm in size, some red slipped with web-pattern burnishing (Shai et al. 2014; Uziel and Maeir 2012). Many vessels were coated with a white lime-based plaster-like matrix after firing (more common across central and southern sites), some combined with pattern combing, likely to reduce porosity (Eliyahu-Behar et al. 2016).

IIA. Bowls

Following de Miroschedji (1989; 2000), bowls at Tell eṣ-Ṣâfi/Gath can be divided into two main categories: (1) small hemispherical bowls with simple rounded rims and (2) bowls with larger capacities and thickened profiled rims (*écuelles* or rolled rim bowls, Fig. 6.5). The simple hemispherical bowl is a very common type found at all contemporary sites extending from the Negev desert in the south to Tell Dan in the far north of Israel (de Miroshedji 2000: 321-2; Fargo 1979: 23; Gophna and Blockman 2004: 881; Zuckerman 2003: Fig. 62; Ziv-Esudri 2012: 241-2; Greenberg 2006b: 162). The northern coast of Lebanon has also produced examples of this type at Arqa, Phase S (Thalman 2010: 90). Small hemispherical bowls can be subdivided into shallow types with thin walls and deeper types with thicker walls. Both have a simple rounded rim. The deeper types have a coarser finish described as ‘rough’ at Lachish (Gophna and Blockman 2004: 881). Some examples of the latter have exterior surfaces that are lightly combed with traces of a lime wash, or are plainly finished with wet smoothed surfaces. Surface treatment is variable, but the majority of the shallow hemispherical bowls are decorated with a red brown slip on the interior that extends to the outside rim (or the red band around the outside rim is painted). In addition to the slip, some have concentric radial painted designs (similar to the platters) or crisscross patterns on interior surfaces. Occasional soot marks around the rim were presumably from a wick suggesting some were used as lamps. Identical sooting patterns are widely documented at most EB III sites for this type (Greenberg 2006b: 162; Ziv-Esudri 2012: 241-2; Gophna and Blockman

2004: 881). These soot marks are usually not very heavy and these bowls likely had additional functions. They are an ideal size and shape for use as a drinking bowl. The large bowls (*écuelles*) in the shape repertoire are not suitable drinking containers partly because of the thickened and inverted rims, which would clearly prevent a smooth pour.

The large serving bowls with thickened profiled rims (*écuelles*) have quite distinctive inverted rims (sometimes described as a 'ledge' rim). There is some variability in the angles of inflection, since some are more rounded in profile and others are more pinched (Fig. 6.5). Hence, the 'rolled', 'inverted', 'knobbed', and 'flattened' varieties differentiated in other assemblages, such as Tell el-Hesi (Fargo 1979: Fig. 1:8, 11, 15, 24) and Bab edh-Dhra (Johnston and Schaub 1978: 34; Rast and Schaub 2003: Figs. 11.7: 2; 11.11: 16). Some diversity in the execution of the thickened rim is to be expected given the broad distribution of these bowls across the southern Levant and the individual motor habits honed by potters. The thickened rim bowls can be subdivided into large shallow bowls with rounded walls and deep bowls with straight walls (Fig. 6.5). Surface treatments are identical to the hemi-spherical bowls, except plainer surface treatments are more common (wet smoothed surfaces, lime washes, and red slips).

One type of bowl that does not conform to any of the above categories are the very small undecorated pinch pot bowls. These vessels typically fit into the palm of the hand (the 'miniature vessels' in the petrography reports). These vessels are immediately distinguishable from the rest of the repertoire, due to their crude appearance and simple manufacture. These bowls are very poorly fired, covered in fingerprint impressions, and are very roughly shaped. Walls lack regularity and symmetry. The small quantity of these vessels meant they were not included in the sample for destructive analysis. However, it is clear from the surface features that they were formed by simply squeezing the clay between finger and thumb, while rotating the clay in the hand. The surfaces are covered in digit impressions, which were left unsmoothed. The presence of thick scorch marks around the rims were presumably from a wick, which suggests they functioned as lamps.

Carinated and cyma-shaped bowls with sinuous walls are absent in the repertoire. None of the bowl shapes characteristic of the classic Khirbet Kerak ware (*fossil directeur* of the EB III in the north of the country) were found in the Area E neighbourhood, except for one bowl sherd in Area F. This single occurrence parallels el-Hesi, further to the south where extensive excavations similarly produced one unstratified rim belonging to a Khirbet Kerak ware bowl (Fargo 1979: 26). These bowls were generally found in very small quantities at southern sites, such as Halif (Seger

1989: 130, no. 9) and Yarmouth (de Miroshedji 2000: 328). The vast majority of bowls at Tell eṣ-Ṣâfi/Gath have simple flat bases with no distinctive morphology to differentiate types. Wall profiles are either rounded or straight-sided.

Vessels with coarser finishes are characteristic of late EB III assemblages when the same surface treatments are applied to a wider range of vessel types. Miroschedji (2000: 330) attributes this trend to an increase in workshop production in the EB III period, when manufacture was apparently extended to include more vessel forms mass-produced in one workshop. Generally, the bowls from Area E are plainly decorated either with wet smoothed surfaces, or other simple surface treatments. These include the use of red slips that extend to the outer face of the rim, lime washes, or faint combed decoration (treatments associated with the large, coarse, utilitarian vessels of the EB II period at Yarmuth). Burnishing is not common.

IIB. Platters

Platters are large flat serving vessels with thick walls and are often decorated on the interior with a red-brown slip and painted web pattern designs. These decorative platters are common throughout the EB III period at northern and southern sites across the southern Levant (Greenberg et al. 2004: 18-19; Getzov et al. 2006: Fig. 3.45; Fargo 1979: 38; Amiran 1969: 71; de Miroschedji 2000: 323, 327, 333; Gophna and Blockman 2004: 880, 887; Fargo 1979: 38). None of the fabrics from Area E have a metallic consistency and are low-fired. Burnishing is not common and the outside surface is undecorated with wet smoothed shoulders. The large flat bases are coarse and roughly finished on the exterior. Some examples are less shallow and more convex in shape with rounded walls, hence the term ‘platter-bowl’ at EB sites elsewhere in the region (de Miroshedji 2000: 322, 333; Greenberg et al. 2012: 94).

Upright and inverted profiled rims with a concavity at the joint with the wall are not common in the Area E assemblage (although not absent), despite their abundance at northern and southern sites across the southern Levant (Fargo 1979: fig. 7; de Miroshedji 2000: 323, 327, 333; Getzov et al. 2006: Fig. 3.45; Greenberg 2004: Fig. 11, 15; Rast and Schaub 2003: Fig. 236: G1; 257: G1a-b; Rotem et al. 2019: Figs. 15, 23; Zuckerman 2003: 146). Area P at Tell eṣ-Ṣâfi/Gath did produce more examples of these rim types, near the fortification wall, but they are likely not contemporary with the E5 levels in Area E. Rather, most platters have simple rounded rims with no carination and have moderate size ranges. The average rim diameter at Tell eṣ-Ṣâfi/Gath is between 35 cm and 38 cm, with the largest example measuring 60 cm (Albaz, *personal*

communication.). Restored whole forms are rare in the excavated assemblage and the majority of platters recovered and sampled were flat decorated base sherds. The domestic assemblage has relatively few platter types and the scarcity of restorable forms limits a detailed treatment of the most common type at the site. Platter shapes at Tell eṣ-Ṣâfi/Gath closely parallel examples from Late EB III contexts at Yarmuth (de Miroshedji 2000: Fig. 18.8:8, 13), Bab edh-Dhra (Hendrix et al. 1997: 110), Megiddo (Greenberg 2006b: Fig 10.4: 7-8; 10.7: 5), and Beth Yerah (Getzov et al. 2006: Fig. 3.45: 8-9, 11). Platters of exceptional size were recovered from Yarmuth and Beth Yerah, with diameters up to a metre wide and up to 20 kg in weight. These types required two people to safely lift and carry when loaded with food (Greenberg et al. 2012: 103; de Miroschedji 2000: 328-330).

Serving platters are a local innovation iconic of the Early Bronze age in the southern Levant and are characteristic of the EB II-III concurrent with the emergence of urban culture (Braun 2009: 28; Fargo 1979: 37; Rotem et al. 2019: 124). The form supposedly developed from a shallow type of bowl with an incurving thickened rim, which was common toward the end of the EB I and continued into the EB II (Braun 2009: 28; Zuckerman 2003: 145). Platters appear, proliferate, and disappear in tune with the development, prosperity, and collapse of early urban society in the southern Levant. As a result, this vessel type has attracted much discussion in the literature regarding its chronocultural and behavioural significance (de Miroschedji 2009: 108; 2014: 320; Greenberg et al. 2012: 103-4; 2014; Joffe 2018).

IIC. Jugs

Jugs have oval to pyriform shaped bodies, long slender necks, and spouts for pouring. A vertical loop handle joins the everted lip with the shoulder. Bases are narrow, flat, and circular. The outside surfaces are sometimes covered in a thick vertically burnished red or brown slip, without the line painted decoration typical of jugs at Arad (Braun 2012: 22-24). Jugs with a black burnish are attested, but are far less common. The burnished surfaces still have a brilliant sheen despite their antiquity. The white plastered interior walls of the E5 buildings would have greatly enhanced their visually striking appearance. Smaller juglets vary from spherical to ovoid in shape, with well-rounded bases and a short neck. Burnishing is less common on the juglets.

The jugs range in size from small dipper juglets, presumably for pouring olive oil and scented products, to much larger receptacles that need a two-handed support for pouring liquids in larger quantities (water, oil, and wine). The oval shaped jugs, sometimes with a ‘stump-base’ and

burnished surfaces, are reminiscent of the so-called 'foreign ware groups' found in 1st Dynasty Egyptian tombs, which are easily differentiated by their non-Egyptian attributes (Braun 2009: 27-8; 2012: 20-27; Greenberg et al. 2012: 95-97). These jugs were first discovered in quantity in the royal Saqqara and Abydos tomb assemblages, south of the Nile delta (500 km south of Cairo), during the largescale Petrie excavations of the late 1800's. They resemble in form and decoration examples found in quantity at Tell Arqa, Sidon, and Tell Fadous on the Lebanese coast (Thalmann 2010: 89-90; Genz 2010: 104, 107; Doumet-Serhal 2010: 117). The amount of effort invested in burnishing many of these jugs is likely functional, as well as aesthetic. Burnishing closes and seals the pores in the body, compacts the surface, and creates a more impermeable surface (Rice 2015: 317, 453; Ionescu et al. 2015). These properties are desirable when storing and pouring highly valued liquid products, such as olive oil, resins, and perfumed scents.

IID. Storage jars

The Area E repertoire includes a variety of storage containers of various sizes ranging from small 'jarlets' to large pithoi. Jars are usually plainly decorated and ovoid in shape. They have everted rims on a short neck, sloping shoulders, and flat horizontal bases. The rims on medium sized jars are less flared and are usually not thickened when compared to the large storage jars. Medium sized jars have a pair of scalloped wavy ledge handles attached at the midline/point of widest diameter. Some are more globular in shape with a small loop handle at the rim, joining a flaring lip with the top of the shoulder. At Tell Yarmuth, the medium sized jars have a standardised capacity of roughly 16 litres (de Miroschedji 2006: 65), which is comparable to the restored versions from Area E, at Tell eṣ-Ṣâfi/Gath.

In EB III Canaan, the wavy-handle jar is "the commonest type current", especially at southern sites across Israel and Jordan, where vertical loop handle jars typical of northern sites, are generally absent (Amiran 1970: 67; de Miroschedji 2000: 334; Fargo 1979: 26-27; Philip 2008; Gophna and Blockman 2004: 891; Ziv-Esudri 2012: 248-50). The 'pushed up' scalloped handles are considered a classic EB III feature across the southern Levant, with earlier forms first appearing in the EB I (Fargo 1979: 26-27; Amiran 1970: 36-40). These handles first appear on vessels belonging to the 'Gerzean complex' in the predynastic Egyptian delta (Amiran 1970: 36). At Tell eṣ-Ṣâfi/Gath, wavy handle jars are well represented in the EB III domestic assemblage. These containers are an appropriate size and circumference for storage and transport. The more restricted openings and short-mouth suggest liquid and semi-liquid storage, as well as the storage of small

solids. At sites in northern Canaan, high fired vertical loop handle jars are associated with wine and oil storage and exchange (Greenberg 2011b: 239). In which case, the wavy handle jar likely had an equivalent function across southern Canaan.

The large handless storage jars/pithoi (0.8 to 1.0 m high) have coarser fabrics, elongated ovoid bodies, narrow flat bases, and flaring thickened rims. They stand almost a metre high and they are decorated with rope relief at the neck, plastic bands around the shoulder at the point of maximum diameter, and usually have horizontal combing across the body (lightly executed). One semi-restored vessel is covered in a thick lime wash, applied after firing, with pattern combed decoration executed in a herringbone design on the plastered surface. These bulky vessels cannot be moved with ease, especially when full. At Yarmuth, pithoi have a highly standardised capacity of 90 litres and remain constant across all 3 sub-phases of the EB III levels (de Miroschedji 2006: 65). In households, large capacity pithoi had to be stationary vessels and were often dug into the floor. The low-fired and very porous fabric suggests that this type was highly unsuitable for liquid storage unless the vessel was plastered. The prevalence of the thick lime washes on vessel types at this site has been linked to reducing porosity (Eliyahu-Behar et al. 2016).

In the Area E neighbourhood at Tell eṣ-Ṣâfi/Gath, sediment from six restorable jars in courtyard 104108 (E5a building 104311) contained a mix of charcoal, cereal grains, and olive pits. The restorable vessels from this courtyard were smashed around two hearth installations (E15AT05 and E15AT06). The sediments sealing the installations and the surrounding floor were rich in lentils, wheat, and olive pits, presumably from the smashed jars, which had mixed with the floor material. In the earlier E5b Phase, the ashy sediments in the accumulation above Floor 144507 in Room 16E83C05 (building 74512) were similarly rich in olive pits, wheat, lentils, barley, and chickpeas – the usual repertoire of cereal and legumes at post-Neolithic sites in SW Asia (macroscopic identifications in Ross 2014 field report).

IIE. Vats

Vats are large thick-walled deep vessels with steep sides. At some EB III sites, they are referred to as ‘kraters’ and/or basins (Zuckerman 2003: 132, 147; Ziv-Esudri 2012: 244; Gophna and Blockman 2004: 880). Types at Tell eṣ-Ṣâfi/Gath are made from gritty coarse ware, with plain pattern-combed surfaces, and a prominent inverted ledge rim. Spouted vats are usually deeper with plain rims, whereas vats without a spout often have loop handles, applied knobs (for attaching a cloth cover roped to the knob?), and an inverted rim. The latter are distinctive of the final phase of

the EB III at Yarmuth (de Miroschedji 2000: 334, 337). According to the metrics done on the Yarmuth assemblage, some of the large vats and basins with handles have a capacity greater than the pithoi at 180 litres (de Miroschedji 2006: 65). In shape, the vat looks like a large pithos sliced in half at the point of maximum diameter. Unlike EB III types from Tell Beth-Shean, none of the vats from Area E had traces of a red slip on the exterior surface (Ziv-Esudri 2012: 244).

Traditionally, vats were closely linked with intensive olive oil production in the Levantine economy (Esse 1991). The spouted versions are comparable in shape to the well-known Late Bronze Age vats from Crete, which were used as separators in the production of oil. Similar vats at Ras Shamra (Ugarit) were associated with an olive press installation (Fargo 1979: 38). Combed vats and combed jars were treated as a package for the production and distribution of olive oil – a key commodity in the Levantine Early Bronze Age. More recent studies suggest more general functions as a large mixing vessels, or simply for storage (Chesson 2000: 375). The numerous vats found at Tel Yarmuth were found in a variety of domestic contexts and were not closely associated with olive press installations (de Miroschedji 2000: 326). The wide mouths and large capacities make them an ideal container for the storage of dry goods that are less perishable and/or used in significant quantities on a daily basis, such as grain. The ease of accessibility allows the contents to be scooped in large amounts. de Miroshedji (2000: 326) suggests vats functioned as water containers.[90] They are a common and distinctive vessel type in the EB III repertoire across Israel and Jordan. Examples from Area E parallel standard types from Tell Erani, Lachish, Tell Beit Mirsim, Tell el-Hesi, Ai, and Yarmuth (Fargo 1979: 38; Uziel and Maeir 2012: 236; Hendrix et al. 1996: 113; Gophna and Blockman 2004: 881, 884, 889).

IIF. Holemouth cooking pots

Holemouth jars are one of the most common types of vessel in the domestic assemblage at Tell eṣ-Ṣâfi/Gath. Whole forms are coarse, undecorated, closed vessels with no neck. They are squat and globular in shape, with flat horizontal bases and a pale brown fabric. The holemouths are usually covered with soot marks and carbon deposits on both surfaces, reinforcing their identification as cookware. There is less standardisation in the manufacture of the rim comparable to the diversity known at other local sites (Amiran 1978: plates 18-21; Fargo 1979: Fig. 4; Getzov

[90] EB I vats and basins from recent rescue excavations in downtown Tel Aviv were used to brew stronger beverages, such as beer (Gannon 2015).

et al. 2006: Fig. 3.47). Inverted rims are either tapered or thickened to a greater or lesser degree[91], but the style of the rim is not time sensitive. A variety of incised 'potter's marks' made prior to firing are a common occurrence on the shoulders of these vessels. Similar potter's marks are well documented on holemouths at other major sites, such as Lachish (Gophna and Blockman 2004: 880, 889), Yarmuth (de Miroschedji 2000: 326), el-Hesi (Fargo 1979: 27), the Halif Terrace (Jacobs and Seger 2017: 155, 161); Beth-Shean (Rotem 2012: 139), Arad (Amiran 1978: 49), and Megiddo (Greenberg 2006b: 162). There is no clear consensus regarding the meaning of these marks despite extensive research (typological and petrographic study), which has not detected any relationship between the marks, the incised vessels, specific fabrics, and a particular provenience.

Holemouth jars with flat bases are the archetypal Canaanite cooking pot of the Early Bronze Age (Greenberg 2006a: 39, 41). These vessels similarly dominate assemblages (up to 50% in quantitative studies) at other sites and adjacent regions, including the Jordan Valley and the Jordanian central-southern plateau (Philip 2008: 210; Rotem et al. 2019: 23, 133; Rotem 2012: 138-9; Ziv-Esudri 2012 : 245, 269). They first appear in the Late Neolithic and continue until the end of the 3rd millennium BCE. Stylistic changes over time and space are negligible and the vessel shape has little chronological significance (Fargo 1979: 27; Uziel and Maeir 2012: 237). At Arad (Amiran 1978: 48-49) and Yarmuth (de Miroschedji 2000: 326, 334), flat bottomed holemouths with thick walls were defined as storage containers, whereas round bottomed holemouths with thin walls and more globular bodies were treated as cooking pots. Heavy sooting and carbonised deposits found on the surfaces of both vessels indicates that both types were used for cooking (Amiran 1978: 48-9). The round bottomed holemouths are absent from the repertoire at many sites across central Israel, including Tell eṣ-Ṣâfi/Gath (Greenberg 2006a; Fargo 1979: 27, 30). Elsewhere in the Near East, cooking pots often doubled up as storage containers in domestic contexts (D'Anna 2010: 183).

Greenberg (2006) equates the two different forms of holemouth with different styles of cooking. Cooking pots with thin rounded walls are more suitable for fast cooking where the vessels are placed directly over open flames. Holemouths with flat bases, thicker-walls, and more end points are far more prone to thermal fracturing (Rice 2015: 330-331). These pots were presumably heated in a more indirect fashion by resting the vessel on the ground, immersed in a bed of coals

[91] Square-cut rims made with a cutting tool, such as those found at Bab edh-Dhra (Johnston and Schaub 1978: 34, 45), Arad, and Tell Beth-Shean (Ziv-Esudri 2012: 246, 288-9) are not common in Area E.

(Greenberg 2006a: 43). In this case, the flat bottomed holemouths were likely used for low-temperature slow-cooking i.e. stewing. The fuel types identified in the ash micro-remains and the phytolith assemblage at Tell eṣ-Ṣâfi/Gath confirm the occurrence of low-temperature cooking in the Area E neighbourhood (Eliyahu-Behar et al. 2017). Future research can presumably develop these findings on food preparation further through a proper use-wear analysis of the soot marks and carbonisation patterns on the vessels themselves (Skibo 2013: 63-110).

III. The E5 and E6 domestic assemblage

The large stratified assemblages from the nearby site of Yarmuth remains the best site for typological comparison and was used to construct an EB III ceramic sequence for SW Canaan, with three distinct phases labelled A, B, and C (de Miroschedji 1999; 2000). Ongoing typological study of the Tell eṣ-Ṣâfi/Gath assemblage confirms the original attribution with the EB IIIC phase (Uziel and Maeir 2012: 237-238; Shai et al. 2014). Significant in this regard are the large vats with loop handles and no spouts, large decorated red-slipped platters with coarse fabrics, and the use of thick chalky slips and pattern combing on both serving vessels and coarse wares. The carbon dates from the E5a horizon in Area E indicates that the EB IIIC at Tell eṣ-Ṣâfi/Gath dates to c. 2550–2600 cal BCE (Shai et al. 2014).

IV. Sherd counts in analysis: quantities by functional vessel type

All the major functional categories and vessel types were sampled for this thesis, with the exception of the miniature pinch pot bowls for reasons already stated. In the site assemblage, the most common vessel types were holemouths, bowls, and storage jars. These types were sampled in larger numbers from secure contexts. Holemouth jars have a very recognisable fabric and are present in higher frequencies. Jugs, platters, and vats were present in much lower quantities. Jugs are relatively rare in EB assemblages and examples sampled from Tell eṣ-Ṣâfi/Gath (n = 21) mainly consist of base and lower body fragments. Likewise, platter sherds (n = 36) are mostly from the base, and rims are few. Vats are usually a minority type, but low counts may have been influenced in this study by their similarity to coarse jars in the absence of rims. It is difficult to differentiate between medium and large jars/pithoi when dealing with sherd material. Similar rates of recovery are reported for domestic contexts at EB II-III sites elsewhere (Ziv-Esudri 2012: 243-4, 252; Nigro 2010; Greenberg 2019: 88, 90). Table 6.1 shows the quantities of functional vessel classes sampled for this dissertation research. The sherd counts correspond to the minimum number of individual whole vessels.

Table 6.1. Vessel counts according to phase in the sampled assemblage from Area E, Tell eṣ-Ṣâfi/Gath. Duplicated in table list.

	Primary					Secondary	Tertiary	Totals
Form	**E5a**	**E5b**	**E5c**	**E6**	**E7**	**E5**	**E4-E5**	
Bowls	23	32	14	1	-	7	8	85
Holemouths	28	34	37	4	3	16	16	138
Jars	58	34	45	-	3	18	14	172
Jugs/Juglets	7	6	5	-	-	1	2	21
Platters	11	11	6	1	-	3	4	36
Vats	4	-	-	1	-	-	1	6
Totals	131	117	107	7	6	45	45	459

Chapter 7: Research Questions and Hypotheses

In this short chapter, the overarching research questions and hypotheses binding this study together are revisited in more detail with respect to: 1) contemporary approaches to these topics and the major limiting factors (Chapters Two and Three); 2) the debates surrounding economic strategies in the Levantine Early Bronze Age (Chapter Four); 3) and the associated expectations for sampled material from a large early urban site at the apex of the EB settlement hierarchy in the region (Chapters Four to Six).

I. Chaîne opératoire studies on 'product specialisation' and the limitations

In any given pottery producing society, potters usually strive to emulate common vessel types to produce functional pots that appeal to the sociocultural tastes of the consumer. Potting techniques are shaped by the learning environment, participation in potting communities, and consumer demand (Chapter 2). Over time and with repetition, individual potters hone their specific recipes and repertoire of motor habits within a distinctive potting community (Chapter 2, §VIIIA-B). Hence this is why Kalinga potters can consistently recognise seemingly identical pots made by their associates, based on simple 'touch' and 'feel' (Longacre et al. 1988). Specialist potters readily recognise miniscule stylistic variability in the textural properties of the fabric and vessel morphology (tactile and even acoustic properties) that are often characteristic of a particular potter within a specific community and tradition (Fowler 2008, 2011, 2014; Fowler et al. 2017). This variability is quite often unnoticed and/or imperceptible to the non-specialist (and perhaps most consumers too). This variability is quite often unnoticed and/or imperceptible to the non-specialist (and perhaps most consumers too), hence the importance of ethnographic and experimental studies (contra Gosselain 2016). Such variability often falls under 'passive', 'vernacular', and 'isochrestic' categories of style (Sacket 1990: 36-7, 39, 1982: 73), rather than 'iconological' or 'active' categories (Sacket 1982: 59, 1990: 36).

Costin and Hagstrum (1995) have since classified attributes into two categories depending on the *intentionality* of the producer. Intentional attributes are the product of consciously made decisions controlled and/or manipulated by the potter to express information/group affiliation of some kind (essentially Wiessner's [1983] assertive and emblematic categories of style). These attributes encompass technical and stylistic (morphological and decorative) properties and are often the most conspicuous and highly visible properties of a vessel. In the pottery production model described in Chapter 2 (§VIIIA-B), the temporal and spatial patterning of these attributes

often correspond to the most superficial and situational (fleeting) dimensions of economic and social identity and are more prone to rapid and sudden change and fluctuation across time and space.

Unintentional attributes are *not* consciously made *nor* 'purposefully invested with symbolic content' by the potter and usually encompass mechanical attributes stemming from the production process. These attributes derive from the specific motor habits of individual potters, and therefore provide a more reliable and direct window on the production sequence and potting tradition. The aforementioned pottery production model supports this classification and suggests prioritising variability in such attributes that primarily include *fashioning techniques*. A clear correspondence is apparent between the distribution of these specific techniques and the deep and enduring aspects of social identity in potting communities (Chapter 2, §VIIIA-B and Table 2.2). A comprehensive classification of the variability in fashioning techniques should at the very least provide an indication of the number of potting communities involved in the manufacture of a household assemblage.

While some studies report varied levels of success applying the standardisation hypothesis through statistical measures of vessel morphology, such studies are *always* based on large collections of whole (or at the very least highly restorable) vessels (e.g. Roux 2003; Roux and Corbetta 1989; Kvamme et al. 1996; Longacre et al. 1988; Harrison 2011). They are therefore beyond the usual limits imposed by most archaeological contexts and fragmented sherd assemblages, irrespective of any secondary doubt over the veracity (and epistemological strength) of their findings (e.g. Kotsonas 2014; Arnold and Nieves 1992). Hence, the goal (and importance) of the current thesis is to pilot new methodological protocols in multi-method analyses to discriminate potting communities on sherd assemblages, sampled from ordinary domestic contexts. For the *chaîne opératoire* method to achieve its full potential in ceramic analysis, additional imaging protocols are required, especially when sampling is restricted to specific primary contexts at the spatial scale of a household (Ross et al. 2020). As stated in the introduction and reiterated here, this thesis has three main overarching and intertwined research questions:

1. Can multiple technological traditions be identified on an assemblage from an early urban neighbourhood in the southern Levant?
2. What is the relationship between technological traditions (classifications of potting methods) and select vessel types/forms in the repertoire?

3. What is the relationship between technological traditions (classifications of potting methods) and the urban dwellings in the neighbourhood? Are distributions concentrated in specific buildings and phases or are they evenly dispersed in the EB III strata?

II. The hypotheses and expectations for an urban EB domestic assemblage

The corporate village model previously stressed the importance of kinship as the main "organizing principle in Early Bronze Age (EBA) Levantine society" (Harrison 2011: 281). Rather than largescale specialised industries making homogenous goods for a larger group of consumers in distributive surplus economies, the 'corporate village' model hypothesizes production was always structured at the household or community level (Philip 2001: 167-8; Chesson 2003; Klassen 2009; Harrison 2011: 281-2; Chesson 2019). Manufacture is oriented around small-scale and part-time domestic replacement *within* the producing household in highly decentralised, diversified, and dispersed pottery producing 'corporate village' economies. Therefore, the explicit *expectation* is to find a higher degree of variability in the *chaînes opératoires* (clay recipes and forming techniques) of specific vessel types within a site assemblage. At the same time, individual household assemblages can be expected to show significant *homogeneity*, as the same set of technical knowledge and operations were used to make all the ceramics in the standard repertoire of a household assemblage. This was clearly apparent at the rural EB site of al-ʿUmayri in the Jordanian Central Highlands (Harrison 2011; Klassen 2009). A single production community produced all of the vessels needed in the daily social and economic life of each household. The occupants may have belonged to that production community, or not if separate distributors supplied the household. Both options are possibilities in the actual absence of direct evidence of production. The tendency (and perhaps reasonable assumption) is to assume the occupants were the producers and therefore directly responsible for the variability (or lack of) in the household ceramics. This is the probable case at al-ʿUmayri where households are arguably much easier to define, since 'domestic compounds' do not share partition walls in a densely packed urban arrangement (Harrison 2011: 285-9).

If production was organised as a largescale specialised industry in a surplus distributive economy, we should expect to encounter a far lower degree of variability in the *chaînes opératoires*

of specific vessel types, regardless of where they were used and deposited in the site.[92] At the same time, household assemblages can exhibit significant *heterogeneity*, as multiple specialist industries and potting communities concentrated on the production of select vessel types (applying different technical knowledges and operations). The theoretical and methodological problem distinguishing buildings and defining households in a dense neighbourhood is circumvented and a secondary issue. Variability is not expected to correspond to building and household boundaries (however defined). In this scenario, no single potter or industry produced the entire repertoire of vessels in a household assemblage, irrespective of the specific distributive mechanism(s) operative in society. This is the main hypothesis and expectation for a large densely settled urban EB site, such as Tell eṣ-Ṣâfi/Gath, located on the far western edge of the southern Levantine Hill Country, in a more temperate climate far closer to the Mediterranean sea.

Arguably, there is no reason to assume it has to be all of one and none of the other, since the organisation of production can vary significantly between producers in any given society and economy. This was entertained as a possibility in the most recent petrography report for the EB III ceramics at Tell eṣ-Ṣâfi/Gath (Ben-Shlomo *forthcoming*). The holemouth fabrics appear to be quite variable and may reflect a corresponding elevation in the number of producers relative to other types in the repertoire (Chapter 8). Initial reports at al-ʿUmayri identified two different types of local production (household and specialised) that provisioned the ceramics used in a standard household repertoire (London 1991, 1995, London et al. 1991) and such a scenario is widely supported in the ethnographic literature (London and Sinclair 1991; London 1991: 394; Ali 2010; Arnold 1991; Doherty 2015: 23-37).

Unlike petrographic or morphometric approaches, my techno-stylistic classification (Chapter 3) is tailored to differentiate potting traditions that, based on patterns seen in ethnographic research, likely correspond to individual potting communities (Chapter 2). Moreover, the aforementioned research questions and hypotheses easily translate into highly practical and testable 'parametric' guides (and aims), regarding the temporal, spatial, and typological distribution of fashioning techniques:

[92] Controlling for any potential diachronic variability by focusing on an assemblage from a well dated short-lived settlement phase that was well defined within and across the buildings in the neighbourhood (Itzick et al. 2014; Chapter 5).

1. how are fashioning techniques distributed/patterned across the entire assemblage/study sample as a whole;
2. how do fashioning techniques intersect/crosscut with the fabrics and clay recipes identified in the site petrography;
3. how do fashioning techniques intersect/crosscut with morpho-stylistic vessel types sampled from the domestic compounds across the neighbourhood.

III. The null hypotheses and distinctions in fine grained spatial and temporal distribution studies

This PhD research has two null hypotheses. Null hypothesis one is that potting communities cannot be recognised based on different potting methods because identification criteria and diagnostics of pottery manufacture are not sufficiently developed for an archaeological assemblage (forming techniques cannot be clearly differentiated from one another on sampled sherds). The second null hypothesis favours the alternative 'corporate village' expectation, outlined above, where different households were responsible for making their own pottery. The conditions for the null hypothesis are met if diverse technical knowledge and operations are apparent for the manufacture of a specific vessel type (a high level of variability for a specific vessel type sampled from different buildings across the neighbourhood). Different *chaînes opératoires* exist (hence a high level of variability) for the same morpho-stylistic type from different domestic complexes in the neighbourhood. The *chaînes opératoires* represented in each household assemblage are clearly linked and interrelated by a shared repertoire of *inherited* techniques, technical gestures, and materials. Household potters apply the same technical knowledge and operations to make the entire repertoire of vessels needed by the household. Technical differences, if present within the household assemblage, are functional (Roux 2016). The assemblage is considered homogenous, since only one manufacture tradition is present for making the entire assemblage. According to this scenario, differences in the EB III typology do not align with techno-stylistic classifications of vessel manufacture.

Notably, the condition(s) of the second null hypothesis presupposes a sampling strategy that included more than one building and household. Given that I extensively sampled buildings *on both sides of a street*, I have certainly met and fulfilled this minimal requirement. However, it does *not* involve establishing concrete boundaries between all the respective buildings in the neighbourhood. The distinction is an important one. Arguably, if the conditions for the second null

hypothesis are met, then the results can be used to further hypothesize more specific and meaningful boundaries between buildings and households in a future (and separate) spatial analysis of the neighbourhood.

Now the research questions, hypotheses, and expectations have been covered, the next part of the thesis moves on to the results. The following chapter focuses attention on the results of the fabric analysis of the EB III sherds sampled from the neighbourhood – the first stage in a multi-method analysis to identify potting communities and trace the scale at which they likely operated in the neighbourhood.

PART III: THE RESULTS

Chapter 8: Petrographic Analysis

I. The role of thin-section petrography in this thesis

Studies on pottery production routinely use thin-section petrography to characterise fabrics and understand clay sourcing, processing techniques (temper and homogeneity), methods of vessel forming, firing techniques, and even surface treatments (Quinn 2013; Reedy 2008; Rice 2015: 292-6, 342-5; Peuramaki-Brown 2009: 109; Kibaroglu et al. 2013: 44; Ben-Shlomo et al. 2009; Roux 2011; 2016; Fitzpatrick et al. 2003). The results are used to address larger questions about potting choices, the physical and mechanical use-related properties of vessels (function), trade and exchange (societal interaction and group mobility), and the organisation of production (patterns of subsistence and economies).

Current 'anthropological approaches' to the classification of ceramics sort assemblages according to shaping techniques and petrography is used to characterise the recipes within those groups (Roux 2011; 2016; Babour 2014; Berg 2013: 118; Ross et al. 2017; 2018). As stated in the method chapter, this thesis aims to integrate petrographic data on fabrics (provided by the site petrographer Ben-Shlomo) with a classification of shaping techniques to discriminate the *chaînes opératoires* and 'technical traditions' of different production groups. By combining both datasets, the thesis can determine whether different clays, temper combinations, processing, and firing strategies were used by different producers and establish which parts of the repertoire were made by different potting communities. Further, the thesis can compare trace evidence of vessel-shaping at different scales of observation to confirm identifications and clarify the relationship between variability in petrofabrics (compositional groups) and variability in shaping techniques. The petrography on the Tell eṣ-Ṣâfi/Gath assemblage was comprehensive and carried out by Ben-Shlomo on a total of 199 vessels sampled from the EB levels (Shlomo et al. 2009; Shlomo and Maeir 2012; 2017; in press).[93]

II. Fabric classification vs. typology of clay recipes

Well defined fabric and ware categories are critical for any study on pottery manufacture, since the identification of shaping techniques is contingent on the size, shape, orientation, and sorting of inclusions and voids in the clay body of the finished vessels (Ross et al. 2017; 2018;

[93] The most recent petrography site report lists 169 samples. However, there are 199 samples/vessels listed in the master spreadsheet. This discrepancy is due to the fact that Dr Albaz from the BIU part of the team sent more samples for petrography, since the last report was written for the excavation volume.

2019). A ware is a well-defined class of vessels, based on a combination of agreed common attributes, such as particular surface treatments, firing techniques, manufacture technology, and/or composition (Rice 2015: 230; Braun 2012: 5; Thalman and Sowada 2014: 355; D'Anna 2010: 169). The choice of classificatory criteria is somewhat subjective because pots vary in more ways than can be embraced by any single classificatory system and certain variables are therefore prioritised over others (Michelaki 2007). But the resulting classes of vessels are easily replicable, distinctive, and have a chronocultural association (i.e. they are a meaningful unit in time-space systematics and have a behavioural dimension). Braun insists wares must always be clearly replicable using "macroscopic observation based, non-scientific means" (2012: 5). Wares defined in this way are more transparent and have greater utility in archaeological research and excavation. Time and money usually preclude the definition of wares derived solely from scientific compositional analyses

Fabric and compositional groups/classifications are based on mineral optics (thin-section petrography), or the detection of certain elements (geochemical techniques) and do not automatically have meaningful chronocultural associations. This is especially true if the causes of the chemical and/or mineral variability are unknown, or raw materials lack distinctive characteristics and/or were widely exploited for millennia by multiple societies, such as, the use of calcite temper and the preference for motza clays in the southern Levant. Some EB vessels at Tell eṣ-Ṣâfi/Gath overlap and fall into the same petrofabric groups as Philistine vessels from the 9th century destruction layer (Petrofabric Group 1), as well as vice versa. These fabric groups are not distinct 'wares' and are simply a function of attempting to source the raw materials, using standard granulometrics, with no chronocultural significance attached.

Different geoscientific instruments and techniques invariably provide contrasting classifications, since they detect patterns in different forms of variation (Rice 2015: 291; Costin 2000; Arnold 2000). These different forms of variation are often responsive to specific economic pressures and social spheres that allow the development of testable models and hypotheses. Substantial ethnoarchaeological research has repeatedly demonstrated this basic point (Gosselain 1998; 2000; Fowler 2011; 2015; Costin 2000; Michelaki 2007).[94] Consequently, the research potential for exploring all sorts of social and economic interactions in past societies is considerable

[94] Hence, the term "sociotechnical aggregate" in stylistic analyses of manufacture and technology.

and a great variety of typologies are now possible for answering increasingly specific and diverse research questions. However, the challenge has always been to ensure that the artefact attributes being measured and classified are sensitive to the social/behavioural processes that are the real target of the study (Rice 2015: 224, 245). This is the quintessential difference between an ordinary classification of objects based on the degree of similarity and a meaningful typology with chronocultural associations/significance. Typologies are "theoretically oriented" classifications that structure the data to target specific research questions (Fowler 2006: 104; Rice 1986: 276) . For this thesis, we are interested in whether variation in clay recipes maps on to different rooms, buildings, and/or phases in the neighbourhood, and/or different vessel types in the shape repertoire. Sorting the petrographic data according to stratigraphic context and vessel type will provide greater insight into patterns of production for the provision of containers.

The quality and utility of any classification is whether the categories are replicable, well defined, and are a good fit with the increasing size of the data pool. In total, Ben-Shlomo has defined 46 petrofabric categories for the single site of Tell eṣ-Ṣâfi/Gath. The petrographic sample of the Early Bronze age levels includes 199 vessels from the domestic neighbourhood, which were sorted into 19 fabric subcategories. It is a highly comprehensive classification, based on a qualitative and semi-quantitative classification of the minerals, their various textural properties (size, shape, frequency, sorting etc.), and matrix characteristics (porosity, optical activity), observed down a high-powered petrographic microscope. Petrographic attributes are not visible to the ordinary eye and the resulting classes are not replicable at meso- or macro- scales of observation. In some of the EB buildings, every vessel studied under thin-section is attributed to its own subcategory. The strong similarity between many of the fabric groups meant some samples (*n = 45*) were left unassigned or the designation is uncertain (either two possible fabrics are suggested, or the entry has a question mark with the fabric), possibly due to some redundancy in the groupings (16 samples are left blank). Hyper-splitting can obstruct the identification of general patterns that "may be masked by small differences in parameters" (Reedy 2008: 159).

III. The major EB petrofabrics at Tell eṣ-Ṣâfi/Gath

Two major petrographic groups dominated the petrographic analysis of the Early Bronze assemblage at Tell eṣ-Ṣâfi/Gath: clays derived from dark brown loess type soils (Group 2 with 49

samples[95]) and clays derived from rendzina type soils (Group 3 with 105 samples). Both have calcareous matrices, respond to hydrochloric acid with profuse effervescent action, and are found in the local vicinity of the site. The abundance of carbonate minerals, micrite (fine micro-crystalline calcite), and the fossilised skeletons of marine microorganisms (usually shells or 'tests' from foraminifera) confirm that both petrographic groups were made from marine marl clay deposits common in the Judean foothills (Ben-Shlomo 2012; Quinn 2013 45, 53-4, 122, 160; Figs. 1.1-3, 6-9, 11). When thin-sections are viewed in an SEM (Scanning Electron Microscope), there are numerous fragments of mollusc shells, from bivalves or brachiopods, in addition to other multi-chambered marine protozoa in the fabric (Fig. 8.26). The size and shape of the clay minerals and the relatively high levels of potassium and iron, detected by the microprobe, indicate that these clays belong to the illite group (see Fig. 8.25; Rice 2015: 55-56).

The two main fabric categories in Ben-Shlomo's petrography correspond to distinct soil types and rock formations, but within these groups are many variants. These variants may correspond to the tempering strategies of particular potters, workshops, or simply variation in recipes following each round of potting (inter-batch variation). Ben-Shlomo entertains the possibility of multiple production centres for the holemouths (Fabrics 2c, 2d, and 3d), possibly even 'domestic production' (Ben-Shlomo forthcoming: 6). However, he refrains from a definitive conclusion given the diversified nature of the clay source. The tableware is more standardised and is generally made of finer clay (Fabric 3c), which is more difficult to provenance, but is considered a variant of the local rendzina. Jars are variable, which is to be expected given their role in commodity commerce, but the majority of fabrics belong to Group 3 (local rendzina).

IIIA. Cookware (Petrofabrics 2c, 2d and 3d)

i. Calcareous inclusions (Figs. 8.1-3, 16-19)

The EB cookware is a coarse-tempered, brown-firing ware, with poorly sorted calcareous inclusions that cover at least 10 to 20 % of the slide area. The fabric contains angular crushed chalk in abundant quantity, with very coarse size ranges over 2000 microns in length. The grainy white colour and hardness (1 on the mohs scale) supports the identification of chalk, as the dominant inclusion. Other forms of calcium carbonate appear in minor amounts and include limestone, nari, calcite, and kurkar.

[95] These counts also include samples with question marks accompanying the entry and often attributed to more than one subcategory

Nari is a local Israeli term for calcrete (or caliche) and refers to the weathered hardened crust in a calcareous soil layer that forms in Mediterranean sub-humid climate zones[96] (Boness et al. 2016: 199). Calcrete primarily consists of secondary calcite that has dissolved in groundwater and re-crystallised on the exposed surfaces of a calcareous bedrock (chalk or limestone). Visible in the exposed chalk cliff face at Tell eṣ-Ṣâfi/Gath is a thick and distinct layer of calcrete. Kurkar is a local Israeli term for eolianite or dune sandstone (Boness et al. 2016: 185; Figs. 8.4, 10, 16). Eolianite is a clastic conglomerate rock formed by the lithification of sand dunes, beach rocks, and sediments deposited by wind action in predominantly coastal environs. The clasts usually consist of weathered marine sediments bound together in a calcareous cement, which can be mistaken for grog. However, grog is usually more heterogenous with more distinct boundaries and does not contain bedding with pore spaces (Quinn 2013: 47, 58; Figs. 8.5-7). There are kurkar deposits on the tell (quaternary calcareous sandstone), but a larger outcrop is located 2 km SW of the mound. The presence of kurkar distinguishes 2c from 2d fabrics in Shlomo's petrography of the holemouth jars.

Carbonate eolianites with more unusual shapes and segmented micro-structures were misidentified as crushed bone in Fabrics 2c and 3d. Bone has a fibrous micro-structure with osteons that are usually yellow in plain polarised light (Quinn 2013: 56). Cancellous bone is solid, dense, and homogenous, whereas trabecular bone has a distinctive mesh-like internal division formed by interconnecting rods (Fig. 8.22). Neither of which resemble the symmetrical ovate and elongate micro-segmented structures observed in the photomicrographs (Figs. 8.21, 23). Instead, these inclusions appear identical to marine fossils present in carbonate eolianites, which often go unrecognised in petrology reports (Frebourg et al. 2008). These structures are much smaller, narrower, and more uniform than intact trabecular bone fragments. Thin-sections prepared at the Ceramic Technology Laboratory (University of Manitoba), sampled from holemouth sherds from Tell eṣ-Ṣâfi/Gath, confirm these observations (Fig. 8. 21). Unlike crushed bone, the microfossils in carbonate eolianites were not added as intentional temper and are present in marls rich in naturally occurring eolianite inclusions (Group 2 and 3 clays).

A variety of marine bioclasts (foraminifera, bi-valves, ostracods, and an ammonite) are present in minor quantities (less than 1% under a binocular microscope) and are common to all of

[96] Nari is generally not found in the Negev to the south despite the occurrence of Eocene chalk, due to the relative lack of precipitation. The Negev is outside of the Mediterranean sub-humid zone.

the EB fabrics at Tell eṣ-Ṣâfi/Gath (Fig. 8.8). When thin-sections are viewed at sub-microscopic magnification using an SEM, bioclasts are much more abundantly visible. The shells of foraminifera usually belong to the genus globigerina, which are well attested in the marine clays of the east Mediterranean. Foraminifera of the same genus are routinely identified in Bronze Age vessels from Cyprus, the Levantine littoral, and Greece (Quinn 2013: 53-54**,** 141). The identification of specific morphospecies in microfossil assemblages have allowed some petrographers to be increasingly specific regarding the provenience of clay sources in the Aegean, where the geology is more heterogenous (Quinn 2013: 140-2).

ii. Non-calcareous inclusions

Non-calcareous inclusions of diverse shapes and sizes were identified in both thick and thin-sections and are far less frequent in the cookware. These infrequently encountered inclusions are common to all of the wares at Tell eṣ-Ṣâfi/Gath and are naturally occurring impurities in the rendzina.[97] These include medium sand to pebble size opaque and dark red ferruginous grains and nodules (up to 4 mm across), which often have rounded or amorphous shapes (Figs. 8.2-3). When characterised with an SEM microprobe, the chemistry of these inclusions tested positive for haematite - Fe_2O_3.

The occasional phantoms of burnt-out vegetal inclusions (chaff and spherical husks or seeds) are either naturally occurring in the clay deposits, or were unintentionally introduced during the clay preparation stage (Fig. 8.9). According to ethnographies of recently active Jordanian potters (Ali 2010: 356), burlap bags used to transport wheat were also used to collect clay. Secondary clays (derived from sedimentary processes) do tend to have much higher organic content than primary clays formed in-situ and this may also explain the source of the organics. However, the presence of possible by-products from threshing cereals suggests contamination by human agents. In which case, pottery workshops were likely located outside of urban areas in closer proximity to where grains were threshed in the hinterland. Agricultural by-products are not only a potential source of fibre temper (more abundant in the common ware and coarse ware), but provide a fast burning fuel for the firing of the vessels.

[97] In the reports, Shlomo used soil maps as his reference data. Need to compare with actual geological samples from EB clay deposits, in order to confirm and differentiate some temper types from what is naturally occurring.

iii. Clay matrix

The cookware is characterised by a brown silty amorphous calcareous matrix with varied porosity (5 to 30% voids). The matrix is not vitrified and is not birefringent under XPL. The clay is likely derived from the brown loess type soils located south of the site (Fig 8.16.). No mixing of clays from different sources is apparent from the clay domains ('the b-fabric'). The heavily chalk tempered fabric is resistant to thermal shock and was used almost exclusively for flat bottomed holemouth jars, which were the main cooking vessels of the Early Bronze Age. The cookware fabric corresponds with petrographic Group E2 (Ben-Shlomo 2012), which was expanded to include Fabrics 2c, 2d, and 3d in the most recent site petrography report (Ben-Shlomo forthcoming).

IIIB. Common ware (Petrofabric Groups 3a and 3b)

i. Calcareous inclusions

The common ware is a pink/reddish-yellow to light brown firing ware, with darker grey cores and lighter margins of varying thickness (Fig. 8.11, 13). This fabric does not contain an abundance of angular crushed chalk. There are far fewer calcareous inclusions, which are more rounded in shape and smaller size ranges dominate (2-10 % of the slide area). Micrite (microcrystalline calcite in the silt to sand-sized range) dominates the calcareous component (Fig. 8.11). The micrite most likely derives from the diagenesis of the chalk and limestone bedrock, however, micrite is also a major constituent of windblown loess, which may have similar textural properties[98] (Weiner 2010: 78). Generally, the common ware fabric (Group 3) is far richer in microfossils containing as much as 25 % abundance.

ii. Non-calcareous inclusions

The non-calcareous inclusions include moderate quantities of coarse angular grog temper (c. 5 % of slide area), with clay very similar to that of the matrix, and the ring of separation is often visible (Figs. 8.5-7, 20). Some opaque amorphous minerals and silt sized quartz are also present in low amounts (5 %). The amorphous bodies include haematite grains and nodules also found in the cookware, but with smaller size ranges. Phantoms of burnt out vegetal inclusions are generally more frequent and the shapes suggest ground chaff was more commonly used (small spherical and irregular shaped voids).

[98] Comparison with geological samples is needed to confidently ascertain the geogenic origin of the micrite.

iii. Clay matrix

The common ware has a more open spaced matrix compared to the cookware and non-plastic inclusions are more moderately well sorted. No mixing of clays from different sources is apparent from the clay domains ('the b-fabric'). The clay is unvitrified and comparable to the rendzina soils and Pliocene marl very common in the immediate vicinity of the site – likely derived from the outcrops of the Peleshet formation found immediately north and south of the site (Ben-Shlomo et al. 2009: 12; 2012: 392). This clay was intensively exploited in the Early Bronze at Tell eṣ-Ṣâfi/Gath and was used to make a variety of open forms (platters and bowls), as well as some of the jars. The common ware corresponds with petrographic Group E1 (Ben-Shlomo 2012), but has since been split into multiple subcategories in subsequent reports (2017; forthcoming).

IIIC. Coarse ware (Petrofabric Group 3g)

The coarse ware also consists of clays derived from rendzina soils, with the same inclusions as the common ware. The only difference is the firing. The fabric is almost entirely grey in section with very narrow oxidised margins and no indication of initial vitrification (Fig. 8.14). The matrix is optically active, with far greater porosity, and charred voids and burnt-out organics are more noticeable. The insufficient escape of carbon and the poor penetration of oxygen may indicate a shorter firing at lower-temperatures.[99] The coarse ware mostly consists of lime plastered jars and appears to correspond with petrographic Group 3g described in Shlomo's petrography report (forthcoming).

IIID. Fine ware (Petrofabric Group 3c)

The fine ware fires to a buff colour with no grey cores and no coarse calcareous inclusions (Fig. 8.15). The open spaced matrix has fewer inclusions, which are moderately well sorted. These inclusions have sizes in the fine to medium sand size range with more rounded shapes, suggesting the clay was processed to remove coarse material (sieved, picked, winnowed, or puddled) and then well homogenised (treading, kneading, wedging). Alternatively, the clay was collected from a different source. Consequently, both the provenience and the shaping techniques are much harder to determine. Inclusions are harder to identify due to the smaller sizes and relative scarcity, but they include calcite, quartz, opaque minerals, and microfossils. Generally, the fine ware is restricted to open vessels and tableware (mostly bowls).

[99] Or the vessel was not removed from the fire to cool down (sucking in oxygen)

IV. Clay sourcing

Clay is an common mineral in the lithosphere derived from weathered sedimentary rocks. Given the wide availability of the raw materials needed for pottery production, extensive ethnographic research has shown that the majority of potters will source their clays within a catchment area ('resource zone') of 7 to 10 km from the production site (Arnold 1988, 2005). In the absence of workshops, provenience is usually determined by comparing the composition of ceramic vessels with the characteristics of potential sources of raw materials in the landscape surrounding the site (Quinn 2013: 118-9; Weiner 2010: 199-200;). If there is a match then it is assumed that the vessels were made locally and if not, then the ceramics were presumably brought in from a location outside of the region. When source locations can be specified, based on a match with a distinctive mineralogical or chemical signature, trade and exchange networks can be inferred, specialist industries are identified, and group mobility can be assessed.

IVA. Local production: the lithology and soil sources around Tell eṣ-Ṣâfi/Gath

The soil composition and pedological environment of the Lower Shephelah and the area surrounding Tell eṣ-Ṣâfi/Gath have been well-defined (Ben-Shlomo et al. 2012: 388; 2009: 10). The site is located in a geological transition zone where the calcareous, micro-fossil rich, rendzina soils, of the chalk-nari Shephelah (the Judean foothills), merge and mix with the dark brown soils and aeolian loess of the coastal plain. The quaternary soils of the coastal plain are fairly homogenous and include coastal sands from sand dunes (quartz rich with more rounded grains c. 0.1 – 0.4 mm), calcareous sandstone from kurkar ridges, fine alluvial deposits, and dark-brown soils from aeolian wind-blown sediments (Ben-Shlomo et al. 2012: 386-9; Ben-Shlomo et al. 2009: 10). The Group 2 fabrics (the cook ware) reflect a mixture of both loess type soils, typical of the southern coastal plain and rendzinas (typical of the Shephelah). This composition is typical of the soils found within a 10-km catchment south of the site.

Tell eṣ-Ṣâfi/Gath is located on a c. 70 m high chalk mound of the Maresha formation (Eocene), which extends over both the Upper and Lower Shephelah, and contains Pliocene marl and chert formations (Ben-Shlomo et al. 2009; Boness et al. 2016: 188; Ackermann et al. 2017). This lithology is covered by rendzina soils, which are the most abundant soils on site and are a match for petrographic Group 3 (both the common ware and coarse ware). The Shephelah region is roughly 13 km wide (east to west) and 60 km long (north to south). Petrography reports generally refer to the chalky soil composition of the Shephelah region (and the fabrics made from these

clays) as 'Shephelah loess' (e.g. Porat 1996; Boness et al. 2016). Shephelah loess is differentiated from the coastal loess to the southwest, Negev loess to the south, and the motza clays[100] of the central hill country. Taqiye marls (Paleogene formation) are of a little use for provenience studies since this marine rock formation is widely found throughout the entire east Mediterranean (Israel, Jordan, Egypt etc.).

Exactly where in the Shephelah region the common ware and coarse ware originated (Group 3) is not clear, beyond the general assumption that they are local to the site. When interpreting ceramic provenience, the local and regional geological variability determines the accuracy and scale of resolution. In this instance, fine-scale 'micro-provenance' attribution is not possible in light of: (1) the rather general petrographic features identified in the calcareous fabrics; (2) the Shephelah lithology; and (3) the absence of workshops/production sites, presumably located in the hinterland of urban sites and villages. No EB workshops have been found in the entire region of the Shephelah. Exactly how far containers in petrographic Group 2 (the cookware) travelled northwards to the site is not clear for the same reasons.

In the vast majority of cases, petrography on prehistoric assemblages is a broad level guide limited to defining the general area/region of the production zone. A broad distinction is often made between local and non-local fabrics, aided in part by the criterion of abundance. Petrography is therefore better suited to addressing research questions oriented around long-distance trade and exchange relationships (Quinn 2013: 124). The local social and economic interactions between sites, located in the same or similar geological setting, is far more problematic to disentangle. When production groups use the same or similar clay deposits, ingredients, and firing technology then they cannot be differentiated through conventional classifications of petrofabrics. For example, the clastic minerals in sediments at coastal sites between Gaza and Ashdod are indistinguishable, with the same minerals and textural properties (Weiner 2010: Colour plate 4). Unless potters are using radically different paste preparation techniques, or specialising in unusual forms, it is not possible to differentiate production groups operating within this region. Petrography and geochemical techniques are not informative when clays and temper lack distinctive characteristics for the sites in question (Reedy 2008: 156; Tomber et al. 1998: 2; Vince 2005: 220).

[100] Motza clay (Fabric 8) is a fine-textured superior potting clay used in most periods from the EB onwards. At least 2 of the samples in Shlomo's petrography were made from Mozta marl clays (a jug and an incised sherd).

The movements of pottery between sites are masked when there is geological homogeneity (Knappet 2005: 695). As a result, the nature of the organisation of production, service provision, and the number of potters active within a site or region is often invisible and rarely (if ever) addressed at the level of a single site assemblage, especially in the absence of workshops.

IVB. Minority of imports (Table 8.1 and Appendix A)

The petrography reports (Ben-Shlomo 2012, 2017, forthcoming) list a total of 24 sherds with fabrics that were clearly identified as not local, which amounts to 12% of the overall petrographic sample (199 sherds). Sherds identified as imports were not included in the study sample for this thesis. Among the identified imports, no single location dominates in the suggested provenance. Further, there are no correlations between the imported containers and the morphological vessel types. The imports include 2 holemouths, 6 incised body sherds, 4 jars, 1 platter, 1 twin vessel, 4 jugs, 1 juglet, 1 vat, 1 small handmade bowl, 2 decorative body sherds (most likely jars), and 1 miniature vessel. Imports are attested in every phase of the neighbourhood except the E5c, which is likely due to recovery bias (fewer sherds were sampled from this E5 phase). Imported vessels are not restricted to specific buildings and are present in very low amounts (no more than three vessels per building). The vast majority of imports are sourced within an 85 to 90 km radius of the site (17 to 18-hour geodesic walking time), from areas north and west of the site including the Central Hill country, the Sharon coast, the lower Galilee/east Samaria, and the Levantine coast. The furthest vessels may have travelled is roughly 170 km from the lower Galilee (roughly 36-hour geodesic walking time), or the Levantine coastline north of Acco. Table 8.1 provides a summary of the imports and their context in the neighbourhood. Appendix A provides a detailed summary and commentary on the distribution of the local and nonlocal fabrics in the Tell eṣ-Ṣâfi/Gath neighbourhood.

V. Clay processing

There is a relationship between petrofabric groups and the functional vessel type, which remains constant across all the phases of the Early Bronze age neighbourhood. Petrofabrics 2c and 2d are virtually identical except the presence of kurkar (sandstone), which characterises Group 2d. These two fabrics are very similar to Group 3d, which uses the same tempering strategy – an abundance of crushed chalk. The only difference is the quantity of microfossils and the smaller amounts of quartz that differentiates Group 3d. All three of these fabric groups were used to make holemouth vessels and are specific to this functional vessel type. The high concentrations of inert

inclusions, low-fired body (non-glassy structure), and large pores (open texture) enhance thermal shock resistance and render these coarse fabrics ideal for cookware (Orton and Hughes 2013: 249-252; Rich 2015: 327-8). These fabrics are evenly distributed across all the buildings in the E5 phases. There is no temporal and/or spatial relationship between buildings and the cookware fabrics, which would suggest production was oriented around domestic replacement at the household level.

Groups 3a and 3b are almost identical and are differentiated by use of grog temper and grits (including silty quartz and amorphous minerals). Group 3b has less grog and in some cases quartz is more frequent. Both fabric groups were used to make the same broad range of vessels (tableware and jars), but serving vessels (bowls and platters) dominate in each group. When combined, Groups 3a and 3b are the most common ware in the neighbourhood and dominate the petrography sample (29.7 % of the overall sample). Whereas Group 3c corresponds with the fine ware (fewer inclusions with an open spaced matrix), which was predominantly used for bowls, jugs, and platters (the tableware). This fabric must have been treated to remove coarse inclusions (either by picking, winnowing, sieving, or puddling) and improve homogeneity (greater kneading, wedging, treading etc.).

Group 3e is present in very low quantities, but is dominated by jars and closed vessels with petrographic characteristics that suggest these containers were coming from further afield in the local area (finer quartz and more ferruginous clay). The low quantities of high fired ware (Group 3f) was mostly used on the Abydos jugs (this is odd given that higher firings negatively affect the burnishing). The only fabrics that do not seem to correlate with a functional/morphological vessel type are those that are present in very low quantities (less than 10 vessels). These fabrics may correspond to different extraction points in the clay source used by competing groups of potters (Groups 2a, 2b, and 3e).

VI. Vessel-shaping

Evidence of vessel shaping was recognised on a minority of thin-sections of the holemouth vessels. The highlighted areas on Figs. 8.18-19 show where coarse inclusions cluster with varying orientations on the periphery/edge of a coil/seam and inclusions arc toward wall surfaces. Slides show preferred orientations of inclusions that match the folds and curves of a coil. In some instances, coarse inclusions with oblique to vertical orientations correspond with a depression on

the exterior wall surface (white arrow on Fig. 8.18, no. 215), showing where the seam/join was pinched off, and not thoroughly erased by smoothing operations.

However, the main limitation with identifying shaping techniques in thin-section is the very limited area of the sherd vessel wall that is available for analysis. Consequently, key features of vessel shaping may be missed, or obscured. Even at lower levels of magnification, only one coil, or parts of a coil are visible (Figs. 8.17-18). Patterns are not as clear and only when images of thin sections are stitched together along a section (Fig. 8.19), do patterns emerge with any convincing regularity. As stated in the method chapter, thin-section petrography is an excellent method for clarifying clay-recipes and characterizing provenience based upon mineralogy, but its value for characterising shaping techniques is much more limited and usually secondary to other techniques in ceramic analysis (Santacreu 2014; Roux 2011, 2016). Larger patterns and features in the distribution of the clay material are not clearly visible (Fig. 3.7).

VII. Firing Technology

The general condition of the fabrics clearly indicates that no kilns were used to fire the vessels. None of the fabrics have the properties of Metallic Ware. Soot marks on some of the vessels show where the fuel was in direct contact with the vessel surface, resulting in a characteristic fire cloud (Fig. 8.12). The good preservation of calcite crystalline structures, the optical properties of the calcareous matrices, and the frequency of thick unoxidised grey cores are consistent with low-temperature open firing regimes well under 750°C[101] (Figs. 8.1, 3, 9, 11, 13, 14, 17; Quinn 2013: 65, 94-6, 191; Reedy 2008; London 2011: 234; Weiner 2010: 204). The only exception is Fabric 2f, which has no calcareous inclusions and the matrix is dark, glassy, and isotropic under crossed polars. This indicates the vessel was fired at high enough temperatures for vitrification to occur at around 900-1100°C (Quinn 2013: 190). Only 6 samples have this fabric including Abydos jugs, an incised sherd, and a platter.

VIII. Conclusion

The pottery fabrics show a strong and well established pattern of local pottery production that continues uninterrupted across the phases and the buildings of the E5 neighbourhood. The site was largely self-reliant with its pottery needs met by producers using local raw materials, found

[101] The pottery was therefore fired at a lower temperature than the lime plaster production process (minimum temperature of 780°C). Lime plaster was frequently applied to installations and large closed storage vessels apparently to decrease permeability and protect vessel contents (Behar et al. 2017).

within a 10-km catchment of the site. In total, 10% of the vessels sampled were definitive long-distance imports. It suggests participation in the wider exchange networks of the EB III with some varied interregional connections (Ben-Shlomo 2018, forthcoming; Uziel and Maeir 2012: 238; Arnold et al. 2017). There is low diversity in clay sourcing, with all vessel shapes made with rendzina type clays. The only exception are the majority of the holemouth cooking pots. These are derived from neighbouring soils consisting of an admixture of dark brown loess and grumosols perhaps selected because coarse, porous pastes were preferred for these cooking vessels. Clay recipes do not change between rooms, buildings, and phases. There is no spatial or temporal progression in the use of particular raw materials, clay, and temper. However, recipes were modified and processed differently to suit the use related properties of the vessel forms. As a result, the fabrics can be aggregated into larger groupings that differentiate the main functional wares of the domestic assemblage. Cook ware (2c, 2d, and 3d) is differentiated by the large quantities of crushed chalk and sandstone. Common table ware (3a and 3b) is differentiated by potters adding grog temper and possibly grits (including silty quartz and amorphous minerals). Fine ware serving vessels (3c) have undergone greater processing techniques to remove coarse material and improve homogeneity. Coarse ware storage containers (3e and 3g) are little different from the common ware except the grey cores are thicker, with poor penetration of oxygen in the firing process. The potters likely used the same firing regime (fuel and time) but because the wall was thicker, the fabric was incompletely oxidized. Porosity is also greater and voids are more varied suggesting the clay was not well homogenised relative to other fabrics.[102]

Evidence of shaping techniques is harder to identify under a high-powered microscope, due to the very limited exposures of the pottery section. Trace evidence of coiling was clearly visible on some of the cookware. All fabrics and vessel shapes show evidence of low temperature open firing regimes under 750°C, with the only exception being Fabric 2F, which was found in very low amounts (6 samples). Therefore, the petrofabric data suggests a fairly homogeneous assemblage with low variability in clay sources and firing regimes. Clay processing techniques broadly differ within the assemblage according to functional vessel type, but follow the same generic tempering strategies (i.e. grog, crushed calcite, and purifying techniques) seen at EB sites on both sides of the Jordan river, including Tel el-Farah north (Medeghini et al. 2019) and Tell el-

[102]These ware categories are replicable macroscopically.

'Umeiri (Klassen 2009). Moreover, these techniques differ little from recently active modern Jordanian potters (Ali 2010). The limited evidence for forming techniques visible in thin-section suggests that containers were coiled, but evidence for diversity in vessel shaping is otherwise limited at this scale of observation. The limitations of the petrography are such that it is difficult, if not impossible, to differentiate between producers and workshops using the same/similar clay deposits, temper types, and firing strategies. Hence, we now turn to a consideration of shaping techniques, identified on high quality scans of large pottery thick sections, with the goal of discriminating *chaînes opératoires* indicative of different production groups.

Chapter 9: The Mesoscopic Classification of Vessel Shaping Techniques

I. Introduction

This study examined 459 sherds in thick section in addition to 30 sections of 10 experimental pots and 10 ethnographic standards. The archaeological sample includes the full repertoire of domestic vessel types from Early Bronze Age Tell eṣ-Ṣâfi/Gath. A selection of annotated ceramic thick section images are provided under Figures 9.12-27 and represent the standard types of deformation patterns studied in the analysis. Shaping techniques were identified on 80% of the total study sample including all vessel categories. Jugs (43.5 %) and bowls (28.7 %) had the highest percentage of sherds classed as ambiguous, whereas holemouths had the lowest percentage (5.8%). In total, six shaping techniques and four potting methods were identified in the study sample. For most vessel types, the most common shaping technique was superposition coiling recognised on 77 % of the study sample. Different kinds of coiling were identified in combination with additional forming techniques that vary depending on the functional vessel type.

This chapter describes the mesoscopic results of the shaping classification, which are detailed according to individual techniques. The analysis identified traces of coiling, drawing, concave moulds/vessel supports, luting (attachment of separate straps of clay), and wheel fashioning techniques. Joints and deformation patterns recognised on ceramic thick sections revealed additional diagnostics of vessel shaping not visible at conventional macro and micro scales of observation. The traces of vessel shaping are described in detail and shaping diagnostics were also recognised on the sections of experimental replicas (Appendix B). The second half of the chapter organises the fashioning techniques according to potting methods, which consist of combinations of individual techniques used to shape vessels. The chapter concludes with summarising the distribution of potting methods according to buildings in the neighbourhood and functional vessel types.

II. Classification of techniques: the identifications

IIA. Technique 1: coiling

Coiling techniques were recognised when the preferred orientations of voids and non-plastics marked the outline of the curves and folds of a coil (Fig. 9.1, below). The long axes of non-plastics were aligned in a radial direction, or followed the spiralling folds of a coil. When present, large circular cavities in the centre of the wall (Fig. 9.1, below) were surrounded by spiralling non-plastics, indicating this part of the coil was not fully compressed. Coils were further

differentiated by the varied quantities and texture of coarse inclusions, with discontinuities in the fabric marking the coil joints. The distributions of non-plastics and voids form wavy, undulating, elliptical patterns in section. Open spaces dominated by binder had edges bordered and encircled by clusters of coarse non-plastics. In these open spaces, non-plastics tend to be smaller in size and sparse in quantity. When this pattern appeared with recurring regularity across the section, the sherd was classed as moderate or strong. Clusters of non-plastics visible at regular intervals across the section mark the outer periphery and interface between coils where they were joined to the rough-out.

Vessel shape is primarily determined by how the coil is affixed to the body. Stacking and super-positioning coils one on top of the other was the most common joining operation to make open and closed vessels. Distinctive deformation patterns were identified on the experimental reference collection when paddles were used to flatten coils after they were added to the rough-out. The impact of the paddling causes the non-plastics to align perpendicular to the direction of the force applied to the superior surface of the coil, which is immediately recognisable in section (Appendix B). Coils that have not been fully thinned and smoothed are instantly recognised in section by uneven thicknesses, bumps, and bulges resulting in irregular corrugated wall profiles (Fig. 9.2). There is a lack of symmetry on either side of the vertical axis when both sides of the vessel profile are preserved and imaged in the same scan. These features are more common on the interior of closed vessels, but were recognised on all vessel categories in the sample.

Fig. 9.1. Technique 1 on holemouth rim catalogue no. 107 (left) and holemouth body sherd no. 18 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Red scale line = 10 mm: A) shows preferred orientation of voids; B) shows orientation of inclusions; and white arrows point to prominent central cavities at the centre of a coil. Photo credit: Jon Ross. Duplicated in Figures.

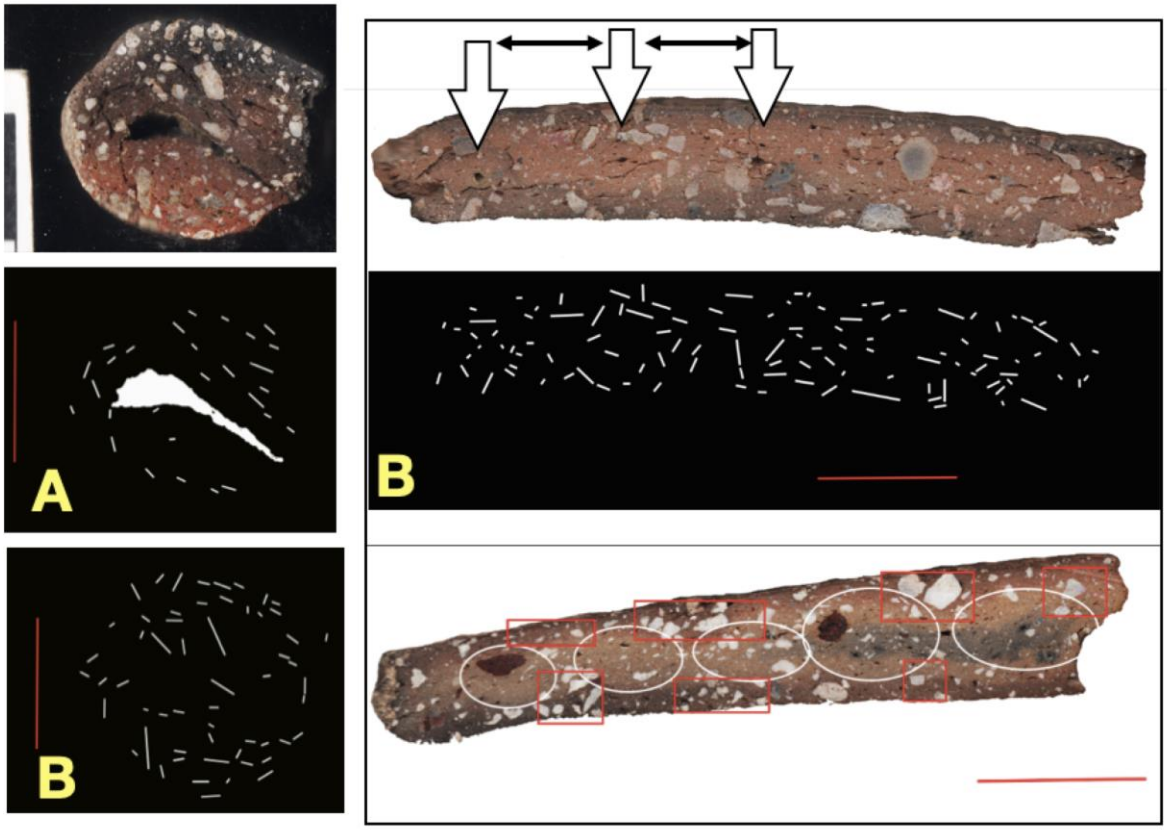


Fig. 9.2. Technique 1 on bowl rim sherd catalogue no. 183 (left), jar body sherd catalogue no. 319 (top right), and holemouth body sherd (bottom right) catalogue no. 319, from Area E, Tell eṣ-Ṣâfi/Gath. Sections show wall morphology diagnostic of coil construction on open and closed vessels. Photo credit: Jon Ross. Duplicated in Figures.



IIB. Technique 2: drawing

The drawing technique involves pulling and stretching the clay to shape vessel walls. The walls taper in the direction the clay was pulled and drawn out. The stretching forces from drawing

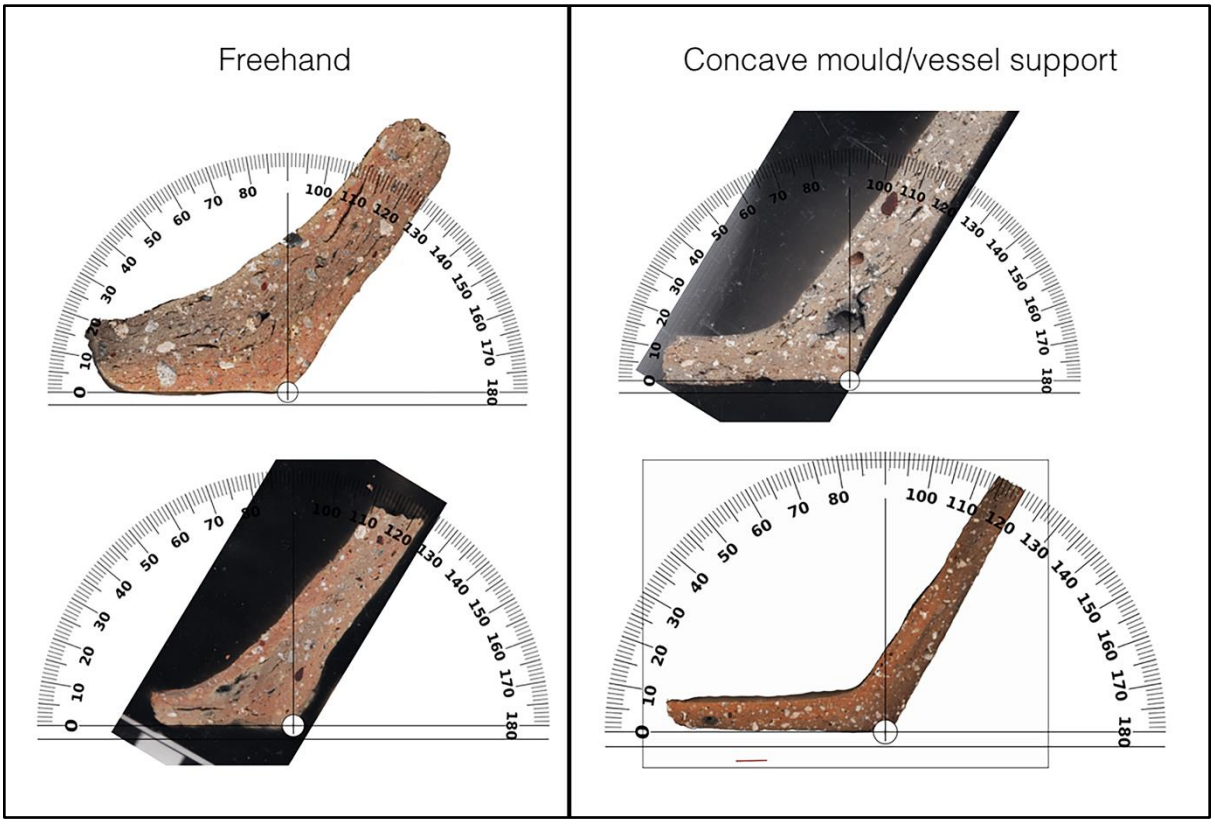
up the clay can leave stress marks, long narrow voids visible in section that indicate application of vertical pressure and displacement. Structural features consistent with the drawing technique include high frequencies of voids and fissures, oriented vertically, subparallel to the walls of closed vessels, with large linear dimensions. Non-plastics generally align in the same direction (see Fig. 9.3, left image shown below).

IIC. Technique 3: pressing in a concave mould or vessel support

Grain and void alignments are aligned subparallel to the wall surfaces. Voids and pores are narrow, more linear, and less frequent, since the walls are more compressed. The sections show significant regularity of the wall profile, with very consistent angles (Fig. 9.3). The use of a concave mould support allows the potter to easily move and turn the vessel during fabrication and evenly compress the clay, by pressing and applying pressure against the support (Rye, 1981:63). This technique facilitates construction of regular walls with consistent inflection points, angles, and contours - all of which is difficult to achieve freehand. When measured, angles were always consistent at 120 degrees with no deviation (Fig. 9.3). Moulds are generally associated with standardised vessels and permit a reduction in manufacture time (Rice, 1987:126). The high regularity in wall angles is surprising, since you would expect some variation caused by sagging during the drying process. This regularity can be attributed to either the stiffness of the heavily tempered lean clay, or that the vessel was left to dry in a concave vessel support. The latter is risky, since drying when attached to a mould greatly increases the likelihood of cracking.

Sections of moulded vessels generally have thinner walls (relative to the size of the vessel), as well as an even/uniform micro-relief along the surface pressed against the mould/vessel support. On the sections of experimental replicas, the point at which the clay walls left the mould was often visible, due to a marked reduction in wall regularity. Vessel walls increased in thickness and were less uniform. The use of moulds to form at least part of the vessel body, usually the base, is well documented in the ethnographic literature (Rice, 1987:125; Rye, 1977:206; 1981:63). The potter may have used master moulds specific for this purpose, or utilised worn and re- purposed materials (ad hoc moulds) to serve as a simple concave vessel support (Rice, 1987:125).

Fig. 9.3. Technique 3 on holemouth bases catalogue nos. 458 (bottom right), 393 (top right), 16 (top left) and 421 (bottom left) from Area E, Tell eṣ-Ṣâfi/Gath. Sections reveal the difference in the morphology and regularity of the walls between freehand coiling and coiling with a vessel support. Photo credit: Jon Ross. Duplicated in Figures.



IID. Technique 4: luting

Luting is when vessel elements formed from separate pieces of clay are bonded together to form one piece. Evidence of the join is often clearly visible in section. Discontinuities in the fabric are evidenced by large hairline voids and seams oriented vertically at the interface. These range from narrow linear shapes (on sections of wavy handles) to the large triangular voids (on sections of loop handles). Coarse inclusions sometimes align at the interface and have a different orientation to those seen in the body. In addition, some handles have a higher quantity of fibre temper, which is known to improve adhesion properties and drying times (Lepère 2014: 145). The loop handles/braces often lack the temper that was added to make the body. In some cases, it is surprising the handle did not pop off from firing considering the large sizes of the triangular voids at the juncture between the body and the handle (another indicator of low temperature firing). Loop handles such as these were used to steady the vessel, with the base resting in the hip, the arm wrapped around the vessel, and the thumb passing through the loop, in order to brace the vessel. The diameter of the loop is large enough to comfortably fit one adult sized thumb, or two fingers.

The vast majority of the wavy handles have sticky thumb prints located on the scalloped part of the handle. Many prints are found on the assemblage as a whole (particularly on the interior of closed vessels) and enabled a fingerprint study to ascertain demographics on the potters (Fowler et al. 2019, 2020). However, only the prints on the jar handles are sticky prints (deformed prints due to excess water) that are indicative of a high moisture content. The clay was extra wet to lute the handle to the leather-hard body and push up the scallops. Therefore, the handles were *not* made from excess clay scraped up from the body. Large irregular shaped cavities where the clay tapers in the handle and is pushed up indicate these elements were often rapidly and roughly worked and attached. London suggested apprentices may have assisted potters by applying certain elements and accessory pieces, such as the jar handles (London 1988: 123). The adult sized prints on most of the examples would preclude children and adolescents.

IIF. Technique 5: pinching

Pinching was macroscopically identified on a vessel type that was intentionally not sectioned (see Chapter 6, §IIA). The digital depressions/finger indentations were spaced regularly around the circumference of the pot and the pinch marks match the finger size of a child. The clay was squeezed between fingers and rotated in the hand. Significant variations in wall thickness, the simple shape, lack of symmetry/uniformity, and the simple forming technique differentiate them from the rest of the assemblage. The pinch pot technique was also attested in EB II-III levels at Yarmuth where it was used to make the same vessel type - small flat bottomed and hemi-spherical lamps (London 1988: 120).

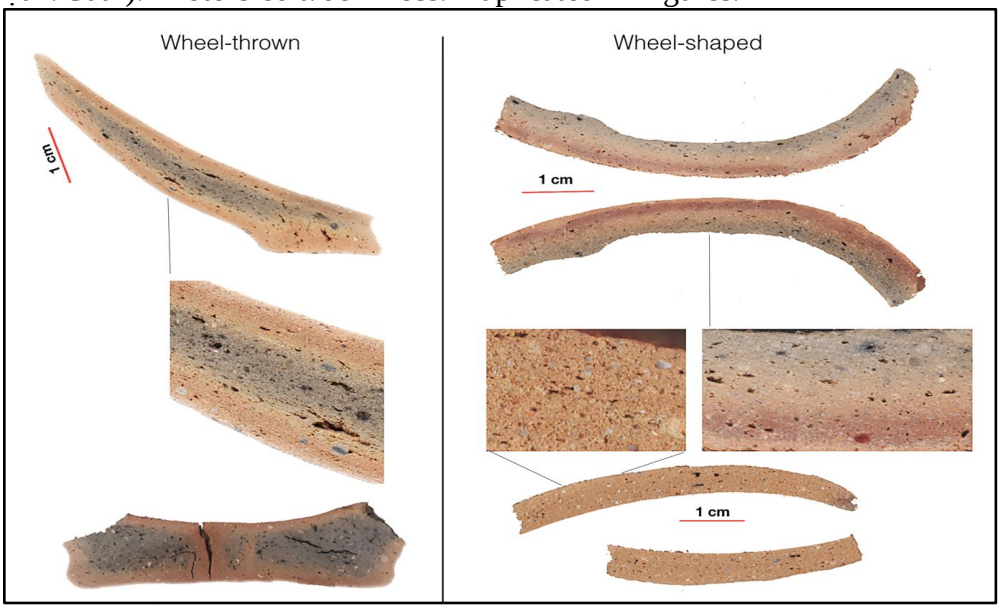
Fig. 9.4. Macroscopic traces of pinching on a shallow pinch bowl used as a lamp (Basket 17E83C031) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit Jon Ross. Duplicated in Figures.



IIC. Technique 6: wheel-fashioning

Wheel fashioned vessels have higher frequencies of small elongated pores. These pores/voids are better sorted, with consistent size ranges, and stronger horizontal alignments. Non-plastics are less frequent, smaller sizes dominate, with a stronger sub-parallel orientation. These non-plastics still have wavy, curvilinear, and elliptical configurations indicative of coils (Figs. 9.27, 28, 32). In addition, sections occasionally preserve the original outline ('bump') of a coil when the pottery wheel dropped speed (Fig. 9.5, below). These diagnostics reliably differentiate wheel-throwing and wheel-shaping techniques. Sections have a smooth micro-topography on undecorated surfaces and high wall regularity, with compressed 'stretched' walls. Sherds are significantly thinner and have a much finer well-fired buff fabric. These traits co-occurred with surface features indicative of RKE (continuous concentric striations, 'sticky prints' from extra wet clay, symmetrical walls, and rilling, Table 3.1). In the past, the distinction between wheel-shaping and wheel-throwing was notoriously tricky to differentiate and was often confused (Roux and Courty 1998). Surface features tend to bias throwing, whereas no clear signature of wheel-shaping is visible in an x-ray (Jeffra 2014). The most reliable way to differentiate between these fashioning operations is by comparing patterns in section.

Fig. 9.5. Wheel-shaping vs. wheel-throwing in section. The sections show differences in the regularity of vessel walls and void distribution on a bowl sherd, catalogue no. 505 (left) and a jug body sherd, catalogue no. 289 (right), from Area E, Tell eṣ-Ṣâfi/Gath. Bowl sherd no. 505 is intrusive from the Late Bronze levels sealing the E5 neighbourhood. Bottom left is a section of a Late Bronze disk base showing a torsion crack (unstratified surface material from Tell eṣ-Ṣâfi/Gath). Photo credit: Jon Ross. Duplicated in Figures.



III. Distributions of individual techniques: counts and frequencies

Coiling (Technique 1) was identified on 355 vessels, but was not limited to specific vessel types (77% of the study sample). With the exception of small pinch pot lamps, all functional vessel categories were made using a variant of the coiling technique to form the rough-out. Drawing (Technique 2) was clearly identifiable on storage jars and holemouths. This technique was restricted to either tapered rims (HM 2 subtype), or the lower body of the vessel. Pressing in a concave mould or vessel support was identified on the base and lower body of 12 holemouth vessels (32 % of the holemouth bases) in the study sample. Clear evidence of luting was identified on wavy handle storage jars. Both wavy handles and loop handles were fashioned from separate straps of clay and affixed to a leather hard body/preform. Pinching (Technique 5), when used as the main primary forming technique to form the vessel, was restricted to very small and shallow bowls used as lamps (excluded from destructive analysis and therefore not part of the study sample). Traces of wheel-fashioning (Technique 6) were identified on sherd sections from fine ware bowls, jugs, and small jars. Rough-outs were fashioned by super-positioning coils, which were then wheel-shaped on a tournette. These vessel types were made the same way at Yarmuth (Roux and Miroschedji 2009).

IV. Classification of potting methods

Individual shaping techniques aggregate into potting methods used to shape a particular set of functional vessel types. Four potting methods were identified in this analysis and are described in the following classification.

IVA. Potting Method 1: super-positioning coils in a mould

The super-positioning of coils (Technique 1) combined with the use of a concave vessel support (Technique 3) was consistently identified on sections from holemouth vessels. Base, body, and rim sherds all show clear evidence of coil construction, however, there was a significant difference in the regularity of the walls. This regularity always concerned the base and lower body of the holemouths and never the upper body or rim.

The possibility that the bases and lower body of these holemouths were formed using a mould is supported by the following observations. The angles of inflection were measured by superimposing a protractor template over the scanned image of the thick section, which was faster and more accurate than conventional measurements by hand (see Fig. 9.3). Twelve of the

holemouth bases had identical angles of 120° with highly uniform micro-topography along the exterior edge/surface of the vessel. The vessel walls had no undulations and were as straight as the edge of a ruler, with relatively thinner walls. An additional 23 measurements of base angles were done by hand in the pottery storage rooms at Bar Ilan laboratory. The mean of these base angles was 118.81° with a standard deviation of 4.5°. Such a low standard deviation is an indication of low variance in holemouth base angles and suggests that concave mould supports were used to achieve such consistency.

Evidence that a rigid container was used in shaping EB III holemouth jars comes from the fact that the base of holemouth jars fits within the bases of the thick 'white washed' storage jars with lightly 'combed' surfaces found at Tell eṣ-Ṣâfi/Gath (Fig. 9.6 below). This type of pithos is characteristic of southern Levantine sites in general, on both sides of the Jordan valley (Eliyahu-Behar et al. 2016; Philip 2008: 210; Shai et al. 2014: 33). If broken bases of storage jars were used as moulds for the flat-based holemouth jars then this would explain the similarity in base morphology between the two types of jar and the similarity in their spatial and temporal distribution throughout the southern Levant (de Miroschedji 2000: 334, 336–337; Thalmann and Sowada 2014: 369).

Fig. 9.6. Bases of holemouth jars (catalogue no. 13) set in the bases of pithoi (no 3.88) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross. Duplicated in Figures.



IVB. Potting Method 2: spiral-coiling

Continuous spiral-coiling was consistently identified on sections from 28 platters (6 % of the study sample). Non-plastics have a distribution profile corresponding to coils, with grain and void alignments indicative of pressed coils, tending more to the horizontal. This pattern is seen in

the sections across the base, shoulder, and rims of platters and matches the replica spiral-coiled platters in the experimental sample (Figs. 9.18-21; Appendix B). Voids and pores are narrow, more linear, and less frequent, with poly-concavities diagnostic of coiling pressures. Spiral-coiling is distinct from super-positioning of coils, since the rough-out is formed by positioning and joining the coils in a lateral or sub-horizontal direction.

The identification of distinct coils was unexpected for this vessel type, since the literature on platters repeatedly emphasises pressing and moulding techniques for the body, but not coiling (de Miroschedji 2000: 322; London 1988). There are three main reasons why moulding is thought to have been used for making platters. All originate in a preliminary technological study on EB vessel types from Yarmuth (London 1988: 119, 123). First, many platters have a shallow concentric groove or concavity under the profiled rim, which was attributed to the lip of a rigid mould or vessel support (Fig. 9.8 below). Second, thick open vessels of such large size (up to 1 metre in diameter) "most likely" needed a vessel support to inhibit sagging during manufacture, allowing the potter to achieve symmetry of the overall vessel shape (London 1988: 119). Many platters were also burnished before they were fired. Therefore, a mould will also inhibit deformations when decorating the vessel at the leather hard stage.[103] Third, the flat bases usually have a very rough texture and micro-relief, with embedded grits, possibly from using grit temper as a releasing agent from the mould/vessel support.

However, evidence of pressing and moulding was not clearly apparent in the sections of the Tell eṣ-Ṣâfi/Gath examples and the aforementioned evidence for these techniques is inconclusive. The roughly textured bases can easily result from being left to dry in the upright position on a hard-roughened surface, similar to the holemouths and comparable to some of the bases in the experimental study (Fig. 9.8 below and Appendix B). In addition, there are platter types at Tell eṣ-Ṣâfi/Gath and elsewhere (Megiddo and Beth Yerah) that lack a concavity (e.g. Adams 2013: Fig. 8.8). This feature may simply be the result of running a finger (or two fingers) around the underside of the profiled rim (see Fig. 9.8). Some EB III platters at Yarmuth were also rotated on a tournette, which is a shaping and finishing technique almost exclusively associated with coil-built rough-outs (Roux and de Miroschedji 2009).

[103] If the vessel is leather hard, it will deform when burnished without supports. However, if fully dried (a bone dry state) and a fat (oil or rendered fat/tallow) is added to the surface, then burnishing (with a stone) will work without vessel supports. London is correct but assumes burnishing happened prior to drying.

Overall, there is no compelling reason why skilled potters could not make platters without moulds. The clay recipe for platters includes larger quantities of fibre temper, which is well known for improving the adhesion of clay and the drying process (Lepere 2014). My findings do not completely rule out the use of a vessel support, since potters may have coiled in a mould, similar to fashioning sequence 1 for the holemouths. However, the evidence for vessel supports is currently indeterminate. The very limited number of whole and reconstructed platters prevented measuring dimensional standardisation to reliably infer the use of moulds. In addition, the most common type of rim in the Area E assemblage has a simple rounded profile and the few reconstructed vessels are not comparable in size to the large platters known from Beth Yerah and Yarmuth. Therefore, a mould was likely not needed for these smaller versions, which may also explain why there is no concavity under the rim on some of the platter types.

Fig. 9.7. Section of a platter body sherd (catalogue no. 166) from Area E, Tell eṣ-Ṣâfi/Gath. Section shows the preferred orientation of non-plastics (top) and voids (bottom) indicative of coiling including large poly-concavities in the bottom image. Photo credit: Jon Ross. Duplicated in Figures.

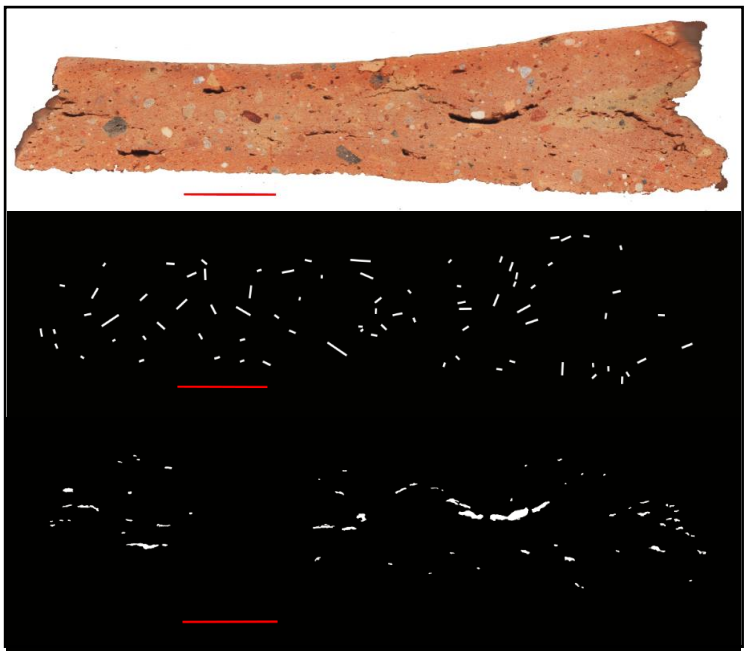


Fig. 9.8. Platter sherds showing concavity under the rim highlighted by the white arrows on the top row of images, catalogue nos. 482 (left and centre) and Basket 16P50A066 (right). Bottom row shows roughly textured bases, from baskets 13450748 (left), 1045028 (centre), and 20E93B012 (right), Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross. Duplicated in Figures.



IVC. Potting Method 3: wheel-shaping a coil-built rough-out

Traces of coiling and wheel-shaping (Techniques 1 and 5) were identified on sherd sections from fine ware bowls, jugs, and small jars. Rough-outs were fashioned by super-positioning coils, which were then wheel-shaped on a tournette. These vessel types were made the same way at Yarmuth (Roux and Miroschedji 2009). Fabrics have higher frequencies of small elongated pores. These pores/voids are better sorted, with consistent size ranges, and stronger horizontal alignments. Non-plastics are less frequent, smaller sizes dominate, with a stronger sub-parallel orientation. These non-plastics still have wavy, curvilinear, and elliptical configurations indicative of coils (Figs. 9.27, 28, 31). This is a reliable criterion for differentiating between wheel-throwing and wheel-shaping techniques.

In addition, sections have a smooth micro-topography on undecorated surfaces and high wall regularity, with compressed 'stretched' walls. Sherds are significantly thinner and have a much finer well-fired buff fabric. These traits co-occurred with surface features indicative of RKE (continuous concentric striations, 'sticky prints' from extra wet clay, symmetrical walls, and rilling, Table 3.1). In the past, the distinction between wheel-shaping and wheel-throwing was notoriously tricky to differentiate and was often confused (Roux and Courty 1998). Surface

features tend to bias throwing, whereas no clear signature of wheel-shaping is visible in an x-ray (Jeffra 2014). The most reliable way to differentiate between these fashioning operations is by comparing patterns in section.

IVD. Potting Method 4: super-positioning of coils and the flat-bottomed pot tradition

The majority of the assemblage (316 vessels) was made by super-positioning coils (Technique 1), without vessel supports (Technique 3), and without rotative kinetic energy (i.e. the 'fast pottery wheel' (Technique 5). The range of vessel types includes jars, vats, holemouths, bowls, and jugs. With the exception of the luted handles, all form elements of every vessel type in this group show clear patterns of coil construction. This category can be further subdivided based on functionally related technological features, which distinguish larger storage and food processing containers from tableware and food serving vessels. These features include the presence/absence of luting (Technique 5), drawing (Technique 2), and an extra thick coil around the edge of the base (Fig. 9.9 below).

Flat bases dominate the majority of vessel types and are a hallmark feature of EB assemblages as a whole. The completion of a circular flat base was the first operation during the shaping of the preform and therefore comparable to the late 3rd millennium BCE flat-bottomed pot tradition characterised at Jericho and Jebel Qa'aqir (London 2014). The roughened texture and inserted grits on the majority of the larger vessels indicate that the base was made first and the vessel was left to dry in the upright position on a gritted stone surface. This convention was unusual given that potters in the second millennium BCE down to the present day typically finish the base last with additional thinning and scraping operations. Instead, the bases on the majority of the vessels from Tell eṣ-Ṣâfi/Gath show minimum care and attention. In many cases, bases were not thin relative to the walls and some were considerably uneven, varying in thickness across a single vessel.

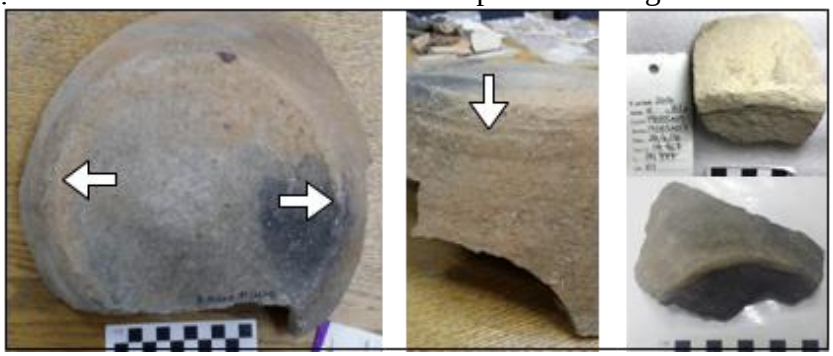
The sections of all the bases in our sample clearly increase in thickness with distance from the midpoint. This suggests that bases were coiled and flattened by hand. Flattening a coiled disk of clay by hand to make a flat circular base can result in the disk being thinner at the centre and thicker at the edges because the clay is being dispersed outwards from the centre, even though potters will attempt to make the disk a uniform thickness (Fowler, 2008, 2011, 2015).

London (2014: 254), in contrast, has observed a "tendency to pull or roll clay thinner at the edges than in the middle" for EB IV tall flat-bottomed jars from Jebel Qa'aqir (London, 2014:254).

She (2014) argues that flat bases required superior skill and ingenious solutions to overcome significant problems posed by almost every stage of manufacture (forming, drying, firing, transporting). In my experience, forming flat bases is simple and posed no problems making the experimental type set (Appendix B). Swazi potters in southern Africa form flat bases by standing the round-bottomed pots upright once the preforms are complete and are removed from the vessel supports. The operation is quick and simple, since the weight of the vessel flattens the base (Fowler 2014). The form of the flat base poses no unusual problems during the forming, drying, and firing procedures. Flat bottomed cooking pots, made by 20th century Jordanian potters, were fashioned using segmental coiling (Ali 2015). The completion of the base was the first stage in forming the rough-out. During the drying stage, these cooking pots were protected from direct sunlight by a wet blanket and/or left to dry upright under the shade of a tree. This simple measure was enough to prevent them from cracking by drying too quickly (over sun-baked).

Unlike the vessel types at Yarmuth (London 1988), the larger vessels (vats, jars, pithoi) showed no indication of slab construction and differences in shaping techniques do not neatly correspond to the thickness of the walls and the size of the vessel. The only main difference between large and small vessels concerns the base. Storage and food processing containers have thicker coils running around the outside edge of the base, which is usually visible with the naked eye (Fig. 9.9, below). These coils were drawn upwards to build up the lower walls of the rough-out. The operation was repeated to fashion some of the tapered rims for the holemouth vessels and storage jars. A thick coil is added to the body and then pulled and stretched to create either a tapered edge (on some of the holemouths), or a flaring rim (on the jars). Holemouths with a thickened and inverted rim (type 2 in Maeir et al. 2012) have not been pulled and drawn out, hence they are shorter, thicker, and more rounded compared to the ‘Type 1’ examples in the excavation report (Uziel and Maeir 2012).

Fig. 9.9: Thick coil running around the base of holemouths and jars from Area F, Basket 18F26C015 (left) and Area E, catalogue nos. 388 (top right) and 462 (bottom right) Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross. Duplicated in Figures.



Large ovoid jars/pithoi have an extra clay band running around the shoulder of the vessel at the point of maximum diameter. This band was not just a decorative feature, but increased the strength of the vessel and may have prevented warping during the drying stage. Cypriot potters tied ropes around the shoulders of large pithoi to limit sagging when drying vessels (London 2014: 262). EB potters at Tell eṣ-Ṣâfi/Gath may have used the same solution to prevent deformation of pithoi, which may have been the inspiration for 'rope decoration'. Rope decoration was an extremely common surface treatment applied to the shoulders of large storage jars, which first began in the Chalcolithic (Yannai 2006: 91).

For all vessel types in this category, the size of the coils approximates the average thickness of the thumb. Coils are sometimes visible macroscopically where surface finishing was minimal (Fig. 3.2), for example, the interior of closed vessels near the base, under the neck, or the reverse side of handles. In this study, measurements of coil diameters viewed in section were taken on a subsample of 27 coils, using calibrated scale images. The average size was 8.951 mm, with a standard deviation of 1.904.[104] In many cases, it was difficult to visually identify the complete outer circumference of the coil. Deformity caused by shaping operations and shrinkage rates have to be taken into account, especially in the dry climes of a semi-arid environment. In all likelihood, the original coils were larger than the aforementioned measurements indicate and approximate the

[104] In London's original 1989 study at Yarmuth, coil size is described in purely relative terms (wide vs. narrow) approximated by the general thickness of vessel walls. She differentiates between the repertoire of manufacture techniques used to make thick-walled vessels from those used to make thin-walled vessels. The scanning method based on thick-sections proposed here allows one to clearly see actual coils and calculate metrics in cross-section. Quantifying coil thickness would permit a refinement of the broad two-fold division in manufacture originally proposed by London (1989).

average width of a thumb. The width of coils measured on EB IV open containers from Jebel Qa'aqir (west of Hebron) were significantly larger, measuring between 25 and 30 mm (London 2014:262).

Regardless of the size of the coils, it may be problematic to infer a potter's skill from the degree of coil uniformity. For instance, Arnold's (1991) ethnographic study among the Mexican potters of Veracruz, warns of the high level of metric standardization that can be achieved by low-rate, part-time, producers using very simple measuring devices close at hand, such as the finger, thumb, palm, or flexed hand. Fingers, palms (hands), and forearms (cubits) are extremely common forms of linear measurement (past and present) and are attested in the earliest records from Egypt and Mesopotamia (although how these basic units are grouped to form larger measurements varies considerably between neighbouring societies). The convention likely goes back to the Palaeolithic period (Powell 1992).[105]

In addition to uniformity in coil size, there is some consistency in the diameter of bases for the storage and food processing containers. These typically measure between 16-18 cm in diameter which conforms to the average size of an adult's hand-span. Research has shown a reliable correlation between hand length and overall height/stature (Islam et al. 2014; Tandon et al. 2016; Oria et al. 2016; Mohamed 2013; Sanli et al. 2005). As a result, there is an extensive literature on the anthropometrics of hand length for different populations and demographics (with distinctions between biological sex, age range, and dominant hand). Studies on populations from East India (Islam et al. 2014; Tandon et al.) and Bangladesh (Laila et al. 2009) overlap with the lower limits of the 16 to 18 cm range, whereas Turkish (Sanli 2005) and Nigerian (Oria et al. 2016) populations overlap with the very upper limits of this range. The population with the best fit appears to be Egypt (Mohamed 2013).[106] Hand length varies between populations presumably due to

[105] Formalised distance measures based on the foot are not common until much later, during the Greek and Roman periods (Powell 1992).

[106] The metrics on hand breadth indicate that Early Bronze Age potters (and presumably the population in general) were not significantly shorter in stature when compared to modern populations in neighbouring regions (perhaps suggests a healthy population where food insecurity was not an issue). Caution is necessary in regards to the archaeological data used as a proxy for hand breadth. Base diameters are effected by clay shrinkage and the bases are not separated according to the biological sex of the potter (the difference between male and female hand lengths can be as great as 2 cm for individuals in the same demographic group). Hypothetically, controlling for biological sex (and age range) is possible if the study is combined with a fingerprint analysis when/if prints are preserved on the assemblage and the specific pots in question, see our recently published articles Fowler et al. 2019, 2020.

environmental pressures that affect height/stature and body proportions (e.g. Bergmann's rule and Allen's rule).

Potting Method 4 includes vessels with greater variation in wall thickness and regularity when compared with Manufacture types 3 and 5, with some examples showing distinct evidence of drawing techniques (Technique 2). The drawing technique is incompatible with the use of moulds, since clay cannot be drawn up in a concave mould. Aside from the forming techniques, there are no further differences between holemouths made with a mould versus those made without, both kinds have identical fabrics and use-wear. This is not true for bowls and jugs, since the wheel-shaped versions belonging to Method 3 have a finer and lighter coloured paste, with fewer inclusions and thinner walls.

At Arad and possibly Yarmuth, jugs and amphoriskoi were made in three stages as individually formed pieces, which were then assembled and luted into one piece (London 1988: 120**)**. Whether this was also the case at Tell eṣ-Ṣâfi/Gath is not currently known. Whole forms of large burnished jugs are absent and only the bases with occasional body sherds were found and included in the sample. However, if this was the case, then the manufacture of jugs is distinct from other vessels in manufacture type 4 and qualifies as a separate techno-stylistic group. Arguably, the break patterns on the bases do seem to indicate that jugs were made in sections, but so far the evidence is inconclusive.

V. Spatial and temporal analysis of the study sample (Tables 9.1 and 9.2)

Despite uneven data recovery, the spatial and temporal distribution of fashioning techniques clearly crosscuts the building complexes in each phase (see Table 9.1 and 9.2). The removal of sherds from secondary and tertiary contexts significantly reduced counts for a spatial analysis (Chapter 6, Section IV outlines restrictions on sampling). Yet it is clearly apparent from the study sample that none of the fashioning techniques were restricted to single rooms, building(s), or occupational phases. There is a broad correlation between potting methods, functional vessel types, and wares. Potting Method 1 is specific to coarse holemouths (cook ware), Method 2 is specific to platters (common and coarse ware), and Method 3 is specific to small open fine ware bowls and jugs (Fig. 9.10).

VA. Distribution of Potting Method 1

Potting Method 1 is differentiated purely by the characteristics of the base and lower body of the holemouths, which is partly why this category is represented by low counts (3% of the

overall sample). Out of a total of 38 holemouth bases, 12 of them showed clear evidence of coil construction in a mould, which equates to 32% out of the total number of bases sampled for this vessel type. Despite the limitations imposed by a small sample size, potting Method 1 was found in all phases, with increasing frequency in later phases. This technique was not found in all buildings, but neither was it restricted, or preferred by specific buildings across the phases. These holemouths represent a minor component of the domestic repertoire in each building across all three subphases. Holemouths made according to potting Method 4 were more common in every building for every phase. Shaping is the only variable that distinguishes holemouths made with a mould (Method 1) from those made without (Method 4). Both manufacture types had identical recipes, vessel shapes and sizes, surface treatments, firing, and use-wear.

VB. Distribution of Potting Method 2

Potting Method 2 is attested on 6% of the study sample (28 sherds) and was limited to platters. Platters are relatively uncommon in the domestic assemblage. The majority of the platters in the sample consist of body/base sherds. Building 2 in the E5b phase had the highest count (n = 5) followed by Building 4 in the E5a phase (n = 3). The remainder of the Buildings each had one sherd, with no examples from Buildings 1 and 3 in the E5b and E5c phases. There are no major fluctuations between the phases and the absence of this potting method from Buildings 1 and 3 are likely due to the limited exposures and sampling constraints. The platter sherds were reconstructed from Building 1 and were therefore not available for destructive analysis.

VC. Distribution of Potting Method 3

Potting Method 3 is attested on just 3% of the overall sample (12 sherds) and was restricted to fine ware bowls and jugs. These vessel types are relatively few in number. There are no whole or reconstructed jugs from the area. Method 3 was not attested on any of the material sampled from E5c and was only found in two of the buildings in the E5a and the E5b phases[107]. The sample size is small, which cautions against generalised statements regarding the absence of this potting method in Buildings I and IV. More common in the domestic assemblages for each household were the bowls and jugs made according to Method 4.

[107] Buildings II and V for the E5a, Buildings II and III for the E5b

VD. Distribution of Potting Method 4

The largest category by far is Method 4, which was identified on 69% of the overall sample (316 sherds, Fig. 9.11 above) and encompasses jars, vats, bowls, jugs, and cooking pots. Method 4 is attested in every building in all phases *except* Building 6 in the E5b and Building 7 in phases E5a and E5c, but this was because of the constraints on sampling. Method 4 was a stable and enduring technological tradition. There are no major fluctuations in frequency over the three phases (Table 9.1). Spatially, Buildings 2 and 5 dominate the counts for each type, especially in earlier phases, since these buildings had the largest areal exposures and were therefore sampled more intensively.

VI. Summary discussion

Four shaping methods were recognised in the Tell eṣ-Ṣâfi/Gath study sample. The site assemblage is therefore heterogenous and vessel types were not all made the same way. Super-position coiling (stacking coils) in a concave mould was used to shape holemouth vessels (Method 1), whereas platters were clearly spiral-coiled (Method 2; Fig. 9.7). This was unexpected given that the literature on EB III vessel types emphasises the use of moulds and makes no mention of coiling to form the actual body (de Miroschedji 2000: 322; London 1988: 119, 123). Evidence of moulds to make platters was inconclusive at best on this assemblage (few complete platters in the assemblage), but it remains a possibility that a vessel support was used for spiral-coiling. A minority of fine ware bowls and jugs were coil-built and shaped on the wheel (Method 3). However, the majority of the study sample (71%) was made by super-positioning coils, without vessel supports, and without pottery wheels (Method 4).

Method 4 includes jars, vats, holemouths, bowls, and jugs. With the exception of handles, all form elements of every vessel type in this group show clear patterns of coil construction. This category can be further subdivided based on functionally related technological features, which separate the larger storage and food processing containers from tableware and food serving vessels. These technological features include the presence/absence of an extra thick coil around the edge of the base and the drawing technique. The roughened texture and inserted grits on the bases of the majority of the larger vessels indicate that the base was made first and the vessel was left to dry in the upright position on a gritty stone surface. Spatially, shaping methods and vessel types were not restricted to specific rooms, courtyards, houses, or sub-phases. Changes in architecture and use of space do not correspond with the patterning of forming techniques. There were no major

fluctuations in the way vessel types were made and they endure through all three sub-phases of the E5 (late EB III) neighbourhood.

Fig. 9.10: Classification of vessel types from Area E, Tell eṣ-Ṣâfi/Gath, according to fashioning methods/shaping dendrogram © Jon Ross. Duplicated in Figures.

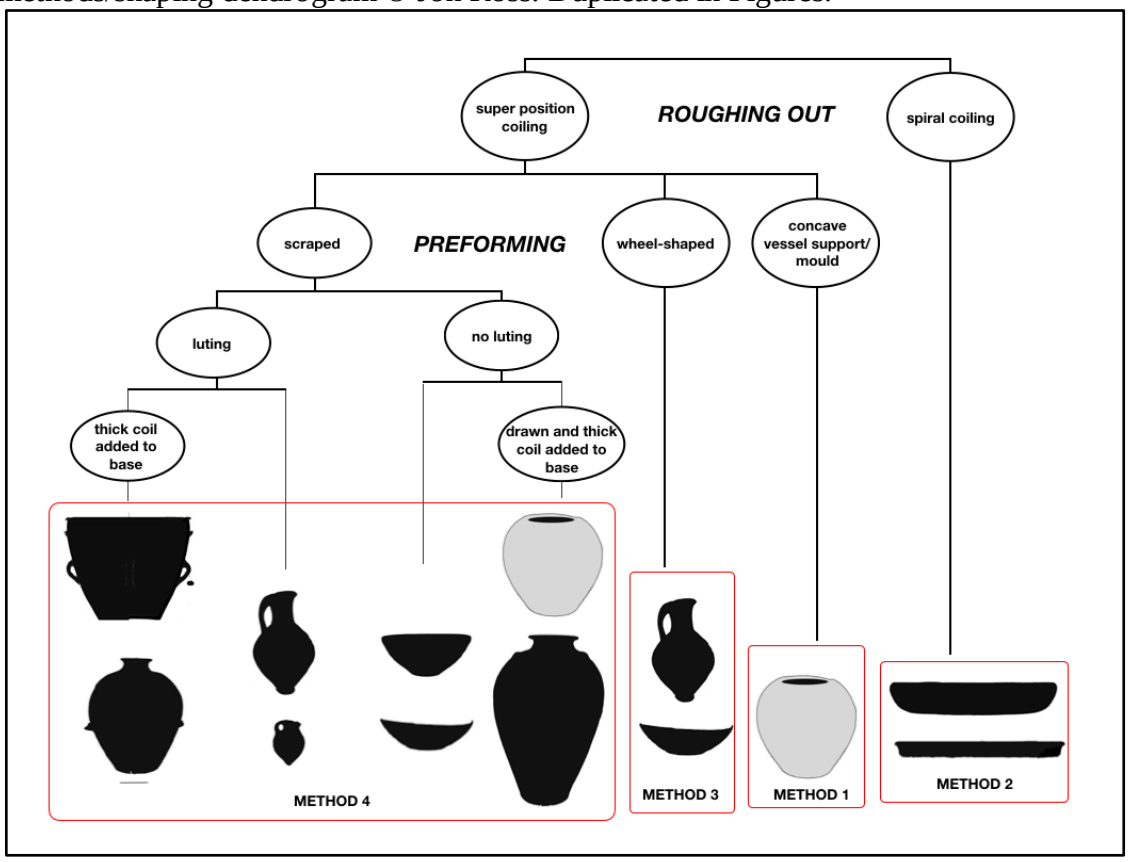
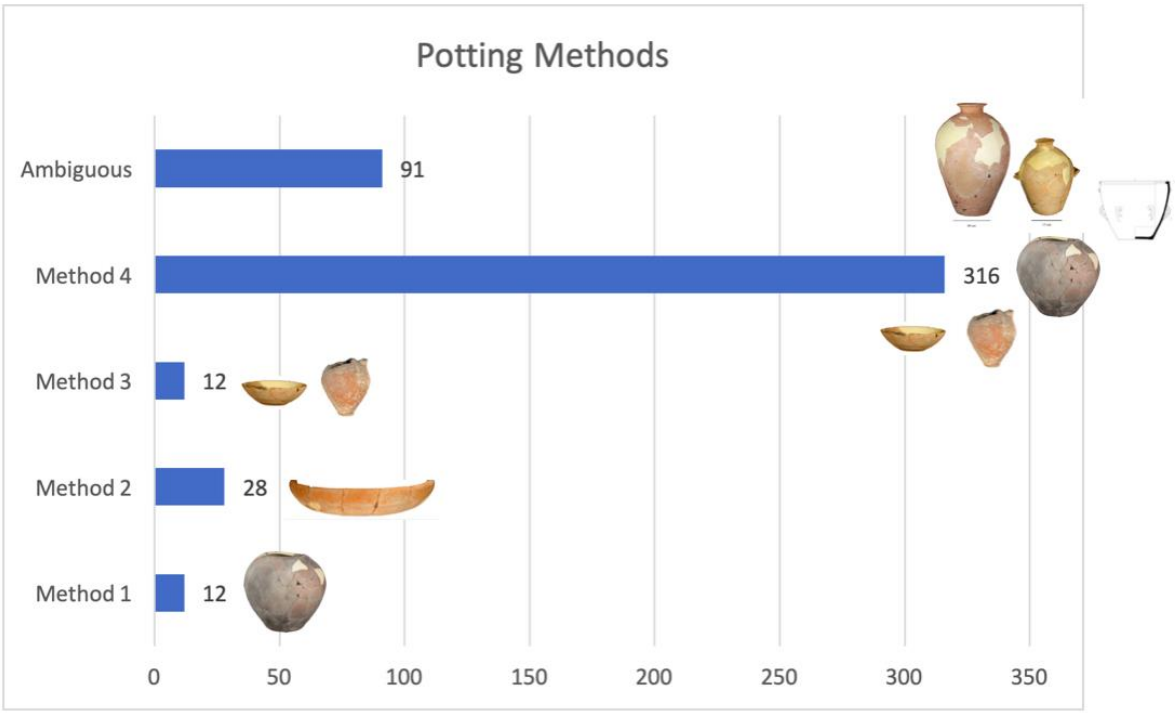


Fig. 9.11: Histogram showing the overall percentages and counts for the four main fashioning sequences identified on the sampled assemblage from Area E, Tell eṣ-Ṣâfi/Gath © Jon Ross. Duplicated in Figures.



PART IV: CONCLUSIONS

Chapter 10: Conclusions

I. The overall aims of the thesis

The overall objective of this thesis was to characterise the organisation of production, specialisation, and service provision in a non-elite residential quarter of an early urban complex society. This thesis focused on the classification of pottery forming techniques at Early Bronze Age Tell eṣ-Ṣâfi/Gath to understand how an early urban neighbourhood in the Levant was provisioned with household containers. Continuities and discontinuities in forming techniques provide a reliable index to track the degree to which technological knowledge, skills, and learned behaviours were standardised, routinized, shared, or constrained to particular vessel types in the repertoire, within and between individual buildings, and across occupational horizons.

Consequently, the main aims of this thesis were: 1) to understand how different vessel types were made and by extension the variability/diversity in manufacture traditions; 2) to determine whether the same repertoire of skills and technological knowledge was responsible for the manufacture of different functional classes; 3) to identify the number of manufacture traditions and therefore, how many potting communities are evidenced on the assemblage; 4) to provide insight on the social and economic organisation of early urban economies in the prehistory of the Levant; and 5) to clarify and expand diagnostic criteria for identifying shaping techniques on archaeological pottery.

The significance of variability in vessel shaping

Vessel shaping is the only stage in the production process that relies on specialised gestures and distinctive sensorimotor skills. These motor habits require a long and intensive period of training to fully master and, as such, are highly resistant to change and outside influence in post-learning environments (Gosselain 2000: 192; 2010: 208-210, 214; Fowler 2011: 198; Roux and Corbetta 1989). Such techniques are not easily 'transmittable' and are carried out on an individual basis. Secondary forming and finishing techniques usually obliterate evidence of shaping on vessel surfaces. Shaping is therefore not only the most technical, inflexible, and difficult stage of production, but it is the least visible stage of manufacture and influenced by a small minority of potters, who are linked by a direct transmission of knowledge. Hence, differences in the production process, especially with regard to shaping techniques, imply different social groups of potters. Comparisons of *chaînes opératoires* have now become routine in archaeological ceramic analysis to reliably discriminate between the pots made by different potting communities. Researchers have

gained considerable insights into group relatedness, historical affinities, and the organisation of production (Fowler 2015; Iserlis 2009; de la Fuente 2011; Berg 2009; Roux 2016; Babour 2014).

II. Importance and contribution of research

IIA. EB economies in the Shephelah and the southern Levant

One of the defining features of early urban culture in Mesopotamia and the southern Levant was the shift in economic strategies with increased manufacture of homogenous goods distributed over larger areas and conformity to a widely shared repertoire (Algaze 2001; 2008; Wengrow 2010). The EB II-III marks the first time in the history of the southern Levant when assemblages look 'interchangeable' with a 'striking similarity' in the pottery between different regions (de Miroschedji 2006: 73; Philip 2001: 208). Local village and community level distinctions characteristic of the Chalcolithic and EB IA assemblages were suppressed and 'simplified' by increasingly homogenous repertoires of standard types distributed across large areas of the Levantine landscape. Some scholars maintained that pottery production was essentially fulltime manufacture by a limited number of specialists in larger centralised workshops (Faust and Golani 2008; de Miroschedji 2014: 319-320; 2009: 108; 2000: 330). Others suggest that craft production was mostly seasonal and part-time, with limited specialisation in some industries that generally do not include pottery, with the possible exception of SLMW (Chesson 2019: 173, 179; Greenberg and Porat 1996).

The stalemate points to larger limitations regarding the study of production at the site level, which is usually restricted to regional scales of analysis. According to de Miroschedji, it is "difficult to determine to what extent the economy was redistributive at the level of the settlement" (2018: 127). At present, EB scholars in the southern Levant have employed very indirect means to address this problem. Inferences are usually based on rough storage capacity estimates associated with public buildings at select sites, such as the circles building at Tell Beth Yerah (Mazar 2001), 'Building MA' at Beth Shean (Mazar and Rotem 2009: 148-9), and the palaces at Yarmuth (de Miroschedji 2006: 64-7; 2018: 127-8). The meagre evidence led de Miroschedji to conclude that the economy was still fundamentally organised at the household level, in a subsistence economy based on farming. In a further interpretive leap, he argues that EB fortified settlements were just too small to support fulltime specialists (2018: 128). Stylistic similarities and the need for 'regular practice' to maintain a high level of skill in certain crafts, suggests to Roux and de Miroschedji (2009) that itinerant specialists circulated between sites and regions, but only for certain sectors of

the economy (an elite clientele is implied). Exactly how the economy then differs from earlier EB IA and Chalcolithic village life is not entirely clear, since these features were also typical of earlier societies in the Chalcolithic.

The rough storage capacities calculated for EB public buildings suggests that such facilities were mostly for internal dissemination of product within powerful households and centralised institutions that were economically and politically dominant (de Miroschedji 2018: 127-8). This argument is largely premised on the absence of storage facilities being present at these sites, despite the relatively small exposures. Neither do we know how often they were filled, emptied, and restocked. Perhaps these facilities serviced individual communities and cooperative groups within the larger settlement and not just wealthier households? Elsewhere in the Near East, when food surplus was redistributed on a supra household basis, it was to mobilise significant labour needed for largescale building projects from among the local inhabitants (Alvaro 2010; Frangipane 2010). This did not require enormous storerooms at Arslantepe, since they were restocked on a frequent basis, with continuous flows of goods in and out of the public building complex. Rooms can be refitted, repurposed, or temporarily left unused according to the needs of the community and the flow of demand.

With the exception of chipped stone tools (Manclossi and Rosen 2018), most durable goods at Tell eṣ-Ṣâfi/Gath were always found as finished objects, with no evidence of manufacture, production tools, and debris in any of the buildings and courtyards. Sherds showing secondary reuse as spindle whorls attest to the limited manufacture of thread and the faunal assemblage features the usual repertoire of bone tools (awls and scrapers) for working hides and leathers. Some of the objects recovered were non-local and point to widespread trade connections, such as the carnelian beads with distant sources in the Indus Valley (Arnold et al. 2017; Eliyahu-Behar 2017). Utilitarian commodities of exchange include the ground stone artefacts. Provenance studies (Beller 2016) indicate they were transported from distant sources around the Sea of Galilee, the Jezreel Valley (over 100 km), and the eastern Dead Sea region (60 km). Recent research on olive oil production suggests the existence of major industries in the Shephelah that were presumably not oriented around domestic consumption of individual households (Langgut et al. 2016; Salavert 2008). Additional productive activities were likely performed away from the houses and ephemeral evidence may not have survived, or was discarded elsewhere. The results on pottery production

therefore take on additional significance in light of the general uncertainty surrounding the overall economic infrastructure and foundations of these early urban neighbourhoods.

IIB. Wider theoretical implications for specialisation

A strong case has been made for itinerant specialist potters, skilled in the wheel, supplying a restricted number of fine ware serving vessels, for EB II-III sites throughout the Levant (Roux 2009; Roux and de Miroschedji 2009; Baldi and Roux 2016). Current studies on vessel shaping in the Near East (and the wider Mediterranean) have tended to focus more narrowly on wheel-shaping, owing to the significant level of skill and the close association with workshops by traditional 'stage-model' typologies of production (Babour 2014: 1; Wattenmaker 1998; Doherty 2015: 77; Roux 2003). Definitions of specialisation that emphasise the learning of lifelong task-specific craft skills continue to privilege pottery wheel technology. Wheel-shaping and throwing abilities require long apprenticeships, as well as regular practice, for the learner to become and remain proficient (Roux and Corbetta 1989; Roux and Courty 1998). It is then assumed that wheel-shaping and throwing skills entail year-round and fulltime production in contradistinction to hand forming techniques. The clear implication is that potters not skilled in the wheel were not 'specialists' and hand-forming techniques are neglected, even though most of the repertoire was not fashioned with the aid of a wheel, prior to the 2nd millennium BCE (and populations across entire continents did not use this device). Ethnographic research on recently active Jordanian potters (skilled in the pottery wheel) suggests otherwise – a highly seasonal craft restricted to certain times of the year in the agricultural calendar (Ali 2010). Low outputs and seasonality did not interfere with their skill on the pottery wheel and the correlation did not hold (i.e. the use of the fast wheel does not equal full time production).

The Ceramic and Society Project amassed impressive ethnographic and experimental evidence (Gosselain 1992; 1998; 2000; 2002; Fowler 2008; 2011; 2016; Livingston Smith 2007) showing that task-specific psychomotor habits are not unique to wheel-shaping and wheel-throwing abilities (contra Roux and Corbetta 1989). Exclusively targeting wheel-shaped and wheel-thrown wares in the archaeological record is therefore not a reliable proxy for tracing the origins of specialisation and provides an incomplete picture of the social and economic organisation of early pottery production. Economic specialisation (surplus production for exchange) does not strictly depend on technical specialisation (acquisition of specialist gestures), but technical specialisation usually results in economic specialisation. The literature has always

been unclear on this issue. Past scholarship routinely conflated economic specialisation and technical specialisation in simple stage model typologies (Peacock 1982; Babour 2014: 1; Costin 2005). Roux and the 'Paris School' have successfully 'operationalised' the study of technical specialisation, with respect to pottery wheel technology, but not for other hand-forming methods in pottery production. Technical specialisation does not and should not exclude potters skilled in other shaping techniques, which also involve specialised gestures. This is the main limitation with Roux's overall methodology and theoretical framework for interpreting archaeological ceramic assemblages. Economic and technical definitions of 'specialisation' are not purely confined to pottery wheel technology and the use of 'rotative kinetic energy' in the forming process. The results of this doctoral study show that the residents of these EB urban neighbourhoods had choices in a domestic economy served by pottery specialists, who did generate surplus product for exchange (beyond the immediate needs of the household). Clearly, this does not mean that households ceased being "self-sufficient in basic commodities" that include farming and pastoral products for subsistence and exchange (de Miroshedji 2018: 127-8).

III. Concise summary of the findings

IIIA. The shaping methods on the Tell eṣ-Ṣâfi/Gath assemblage

The analysis shows that by the EB III period in the Shephelah vessel production was not structured at the household level and oriented around domestic replacement for any of the major functional containers in the domestic repertoire, with the sole exception of the small pinched pot lamps. But neither is there evidence for a single industry, production group, or centralised workshop making the full spectrum of vessel types for any of the E5 (sub)phases. The distribution of different recipes and shaping techniques, including the full range of hand forming techniques, is largely consistent across the neighbourhood, and does not fluctuate between rooms, buildings, and phases. Rather, potting methods broadly align with the main wares and functional classes in the repertoire and differentiate a minimum of four manufacture traditions.

The bulk of the repertoire (71%) was shaped according to Method 4, but not all the containers in the assemblage were fashioned this way. Potting methods 1, 2, and 3 are found in much smaller quantities and are far more restricted to select forms, which complete the overall repertoire. The context in which these vessels are consumed in an urban setting and the range of techniques identified in this study would favour large scale production oriented around select forms. The fundamental question then is whether these four methods represent four production

groups composed of any number of individual potters (and any number of production events) linked by direct transmission of technical knowledge. The alternative is that potters adapted techniques to create objects of different function.

Wheel-shaping, as Roux argues, involves a different skillset, knowledge, tools, and a different set up of labour (Roux 2009; Roux and Corbetta 1989). However uncommon in the ethnographic record, the remaining techniques are presumably not beyond the capability of a single master potter (use of vessel supports/moulds, super position coiling, spiral coiling, and drawing techniques). Nevertheless, the fact that we have multiple manufacture traditions with three types consistently made two different ways (holemouths, jugs, and hemispherical bowls) suggests that the variety of shaping techniques matches an equivalent number of production groups (Figs. 10.1-2). Each production group was defined by a particular inherited way of doing for making standard containers that were supplied to the residents of the Early Bronze Age neighbourhood. Such a scenario fits well with what we know ethnographically and historically from Jordan to Mexico where some potters make a broad range of common ware serving and storage vessels and others specialise in select forms to complete the overall repertoire (London and Sinclair 1991; London 1991: 394; Ali 2010; Arnold 1991; Doherty 2015: 23-37). The 'itinerant' potters (skilled in the pottery wheel – Method 3) and the makers of some of the holemouths (skilled in the use of a mould – Method 1), both made fewer vessel types, but produced more standardised containers with thinner, more regular walls, and highly symmetrical profiles.

Figure 10.1. The EB III 'techno-stylistic' trees for the Tell eṣ-Ṣâfi/Gath repertoire showing techno-petrofabric groups (2nd row from the bottom) and techno-morphological groups (bottom row) © Jon Ross. Duplicated in Figures.

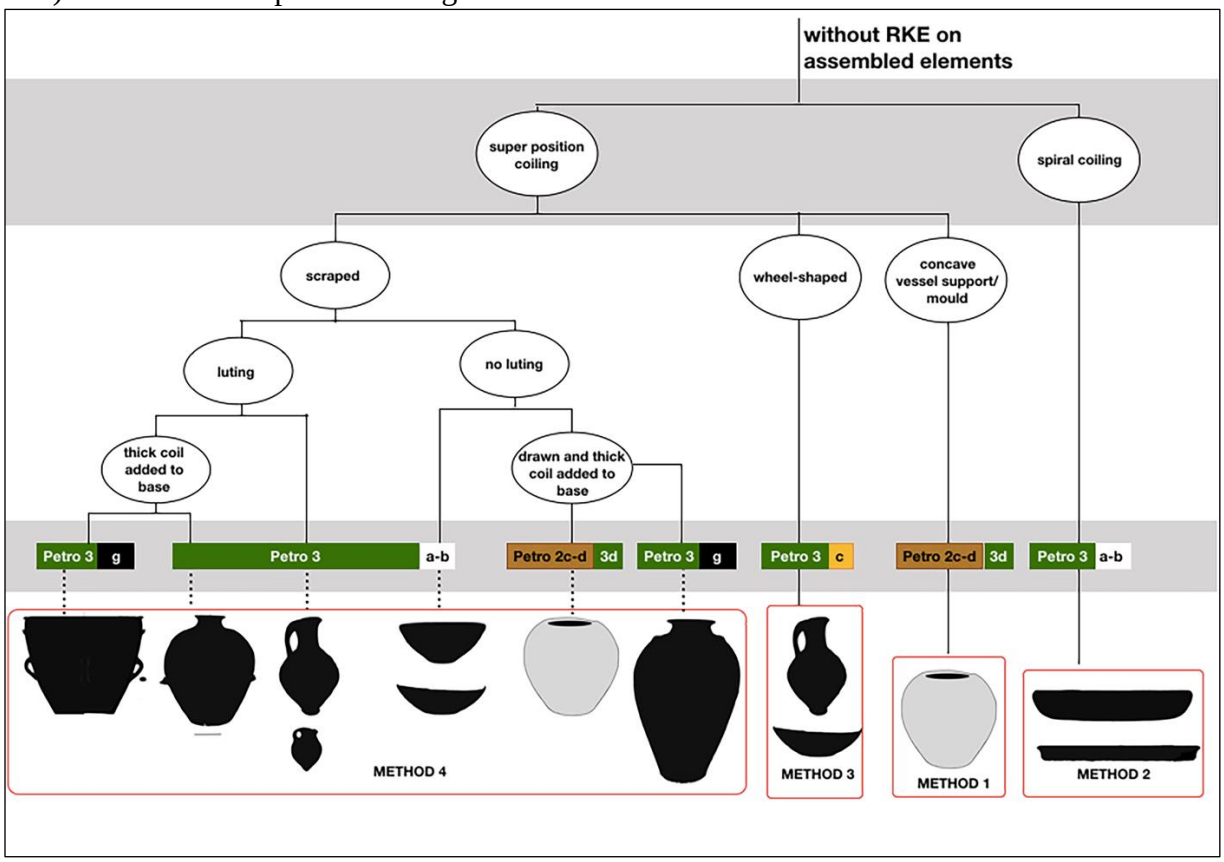
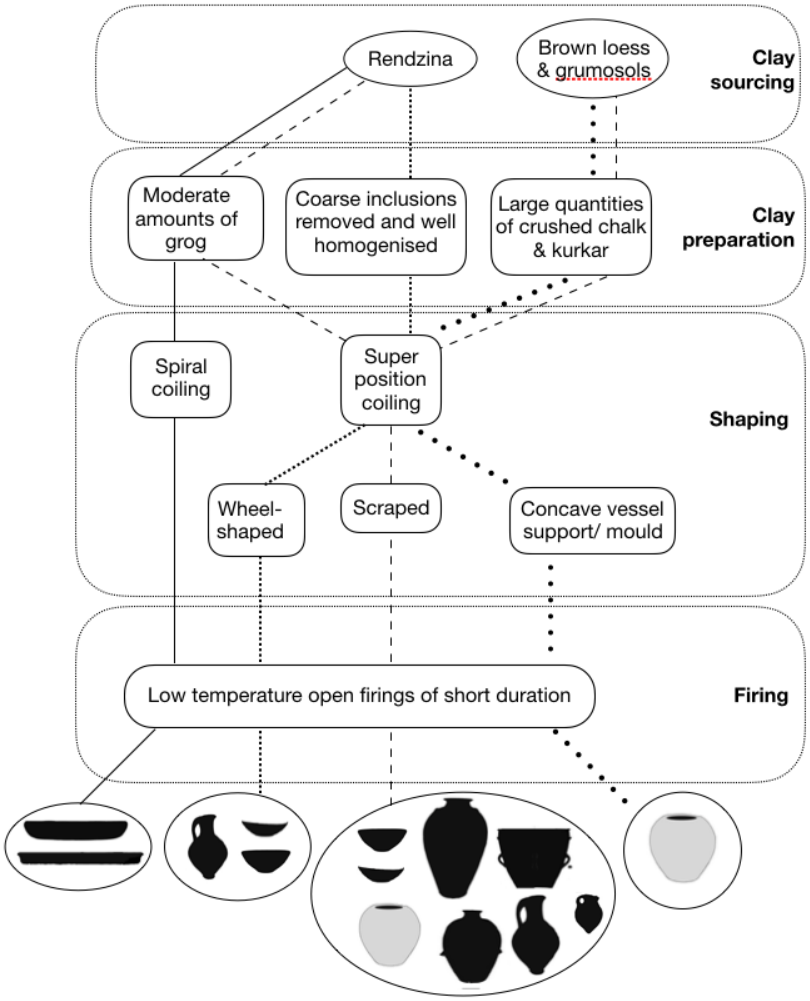


Figure 10.2. Flow diagram showing the production sequences/*chaînes opératoires* for the main EB III morpho-stylistic types in the Tell eṣ-Ṣâfi/Gath repertoire (excluding drying and surface treatments). Thin-section petrography was more useful for identifying clay sources and preparation techniques, whereas thick sections were more useful for identifying vessel shaping. Both thick and thin sections inform on firing and were used in combination to reinforce identifications, at each step in the sequence © Jon Ross. Duplicated in Figures.



IIIB. Vessel shaping methods and the petrofabric groups

The petrographic analyses showed that a small minority of sherds had fabrics of nonlocal origin (c. 10 % of the petrographic sample) and these were not included in the present study. The vast majority of production was local, with low diversity in clay sourcing, which remained consistent between phases and buildings. All vessel shapes and functional classes were made with rendzina clay (petrofabric group 3), which is the most abundant soil type at the site (Fig. 10.1). However, many of the holemouth cooking pots were also made with brown loess type clay mixed

with grumusols, found south of the site (petrographic group 2). Despite low variability in clay sources, processing techniques were modified to suit vessel function in three main ways. The cookware (Fabrics 2c, 2d, and 3d) was heavily tempered with large quantities of coarse crushed chalk and sandstone ('kurkar'). The fineware serving vessels had smaller and fewer inclusions and voids that were well sorted with an open-spaced matrix, suggesting coarse inclusions were intentionally removed using cleaning and purifying techniques (picking, crushing, puddling, sieving, or winnowing).[108] Moderate quantities of grog differentiates the common ware (groups 3a and b), which was widely used to make serving and storage vessels. Fabrics are otherwise very similar and typical of the Shephelah marl. No mixing of clays from different sources is apparent from any of the clay domains ('the b-fabric') on any of the thick and thin sections.

The final stage of clay preparation is homogenising and kneading the paste to evenly distribute moisture and inclusions, as well as eliminate unwanted air pockets in the clay mass. Therefore, the sorting and size ranges of the voids and inclusions (the textural features of the fabric) generally provides a rough indicator of how well the paste was mixed and blended (Reedy 2008: 5). Subsequent, forming techniques will also influence the void pattern and distribution of inclusions. For instance, when discontinuous pressures are applied to assembled elements (coils or slabs) then air will often become trapped in joins. This results in very characteristic patterns previously discussed in Chapter 3.

The greater abundance of voids of diverse sizes and the poor sorting of the inclusions in the cookware suggests kneading was less thorough for the holemouth cookware, when compared to the well homogenised fabrics of the fineware serving vessels shaped on a wheel (Method 3, Figs. 8.1-2, 17, 19, 23; 9.12-18). The latter had small, uniform, and well sorted inclusions and voids (Fig. 8.15; 9.27, 30; Chapter 8 §V). Greater clay processing is required for clays when the forming process involves 'rotative kinetic energy' (the pottery wheel). Stiff dry clays with large amounts of inclusions of large and diverse sizes cannot be shaped, drawn, and thinned on a pottery wheel. The thick and thin sections of the cook ware, coarse ware, and common ware, often showed coils containing different amounts/quantities of coarser inclusions of diverse sizes. This was most pronounced on the cookware, but also visible on platters, bowls, and other vessel types. Greater quantities of coarse temper are preferable when the aim is to stiffen the humid clay to enable

[108] Or the clay was simply collected from a different extraction point in the landscape.

construction of larger (and more robust) thicker-walled vessels in the repertoire (large storage jars, vats, and cooking pots).

Firing technology was clearly restricted to low temperature open-firings of short duration, with no clear evidence for the use of a kiln. Hence, the abundance of thick grey cores, preservation of calcite crystalline structures in the petrofacies, and the fire clouds on some vessel surfaces. Vessels with thicker walls generally have thicker grey cores (i.e. the coarse ware) when compared to thin-walled vessels, which is hardly surprising. There is little overall variation in the firing regimes and clay recipes in general. None of the manufacture traditions and production groups worked with a unique clay or firing structure, but the clay was processed in a variety of ways depending on vessel function. Potting methods 1, 2, and 3 processed their clays differently (using alternative tempers), with relatively low variation within those groups (Fig. 10.1-2). However, potting Method 4 encompassed a much wider selection of functional vessel types and used the same recipes and processing techniques as methods 1 and 2, for cookware (groups 2c-d; 3d) and serving vessels (groups 3a-b), respectively. The only potting method characterised by a unique clay processing strategy is potting Method 3 (wheel-shaped coil built rough outs), which focused on the manufacture of fineware serving vessels.

Current projects and excavation volumes prioritise petrography to provenance ceramics, differentiate production groups, and by extension infer trade and exchange (Shlomo et al. 2012; Uziel and Maeir 2012; Ben-Shlomo et al. 2009). Such studies are useful for locating general areas of production, usually at regional scales of analysis, but depend on the heterogeneity of the underlying geology of the landscape. As stated in Chapters 4 and 5, these provenance studies are extremely limited for reconstructing patterns of production and service provision within and between settlements, especially when potters and workshops used similar clays and assemblages are made and used locally (Reedy 2008: 156; Vince 2005: 220; Tomber 1998: 2). This is why current ‘anthropological approaches’ to the classification of pottery assemblages prioritise the classification of vessel shaping (Roux 2011; 2016; Berg 2013: 118; Ross et al. 2018). Petrography is then used to characterise the recipes within those shaping groups. The resulting ‘techno-stylistic’ groups show which vessels were manufactured according to a single *chaîne opératoire*/production sequence, which corresponds to a distinct social entity/group of potters (Roux 2011: 84; Roux 2016; Fig. 10.1-2).

IIIC. Vessel shaping methods and morpho-stylistic types

Some vessel types in the repertoire cross-cut potting methods, since three of the vessel types were made in two different ways (Figs. 9.10-11; 10.1-2). Holemouths were coil built, but differ depending on whether the bottom half of the vessel was supported and pressed in a mould. This distinction is not functional and these containers are otherwise identical, with regards to shape/form and fabric. Similarly, small hemispherical bowls and jugs were coil-built, but vary depending on whether the rough-out was subsequently thinned and shaped on a wheel. This variability is considered significant because sites settled by one social group have homogenous assemblages characterised by a single shared manufacture tradition (i.e. one group sharing the same inherited way of making vessels). Any differences in the *chaîne opératoire* are due to vessel function and the need to accommodate for different use-related performance characteristics (e.g. cooking pot vs. serving vessel) (Roux 2016). However, when differences in the *chaîne opératoire* cannot be explained in functional terms, then the variability is considered "cultural by default" and ascribed to social and cultural borders between groups (Roux 2016: 108). The assemblage in question is therefore 'heterogenous'.

Heterogenous assemblages, such as the EB III assemblage at Tell eṣ-Ṣâfi/Gath, exhibit multiple manufacture traditions that suggests the settlement was occupied by a diverse mix of social groups, with different inherited ways of doing, for making standard containers (Roux 2016; Roux and Baldi 2016). Multi-site studies have identified a "strong correlation" between specific pottery products and shaping techniques, "as well as between products and social groups" (Roux and Baldi 2016: 13). The findings are always limited to specific types and/wares, such as wheel coiled conical bowls associated with ceremonial behaviour in Late Chalcolithic and Early Bronze Age assemblages. This vessel type disappeared and reappeared following the collapse and re-emergence of local complex polities, in north Mesopotamia and the Levant. The apparent "strong correlation" was a bold statement when the analysis was restricted to a single vessel type in the repertoire.

Inspired by Roux's and Gosselain's *chaîne opératoire* approach to vessel-shaping, this study restricted the analysis to a single stratified assemblage, from three phases of an EB III residential neighbourhood. This intra-site analysis meant the thesis was able to expand the focus to include the full range of functional containers in the household repertoire. In particular, this thesis concentrated on the variability of hand-forming techniques and investigated whether

multiple manufacture traditions are evidenced on a single assemblage, sampled from controlled exposures of an early urban residential quarter, at a major site in the southern Levant. The manufacture of vessel types at Tell eṣ-Ṣâfi/Gath did indeed conform to technological norms that materialised enduring boundaries, between four production groups. As a result, we can confirm a "correlation between techniques and specific products, as well as between products and social groups" for a major early urban settlement in the EB Shephelah (Roux and Baldi 2016: 13). The transmission of technical knowledge was stable and did not fluctuate between the phases, or between rooms and buildings. This pattern suggests strong and well established continuity in the social networks of endogamous potters. Such stability in potting methods contrasts with EB III assemblages at other central and northern sites that evidence significant disruption, bifurcation, and change in potting methods, following population influxes associated with the appearance of Khirbet Kerak Ware (Iserlis 2009; Iserlis et al. 2012).

IV. The economic foundations of major EB settlements

IVA. Early urban landscapes and changes to economic strategies

Potting was an enterprise pursued by a minority of independent specialised producers, with four stable and enduring production groups recognised on the Tell eṣ-Ṣâfi/Gath assemblage. These potting groups broadly align with the main wares and functional classes in the repertoire, with limited overlap between them. Manufacture traditions centred on the surplus production of a select range of functional vessel types made by a different community of professional potters. These social groups were linked by direct transmission of technical knowledge, using locally sourced clays with recipes tailored to vessel function. When combined, these production groups supplied the full repertoire of vessel types needed by residents of the neighbourhood, with a certain amount of choice amongst them. There is no good evidence to suggest distribution was controlled by a larger regulatory body, or administrative apparatus. Access to goods, wares, and services was not restricted across the neighbourhood, especially for pottery containers. Direct evidence of intensive administrative activity controlling household consumption is absent (the excavation produced one cylinder seal and a clay sealing). Public buildings and administrative areas (if they exist) are likely located elsewhere on the mound.

My findings further suggest that the growth of 'town culture' (Joffe 2013) was sustained by structural changes to certain sectors of the domestic economy that became more specialised and oriented around supra household exchange in the domestic economy. Unlike the Chalcolithic,

surplus production for exchange was extended to include additional goods used for daily domestic functions in everyday life and not just special purpose ceremonial items (obsidian, v-shaped bowls, maces, copper crowns etc.), or ground stone objects.

These changes to the potting industry were a consequence of new and increased social interactions in larger settlements, following intensified and punctuated settlement expansion during the later 4th and early 3rd millennium BCE. These larger settlements were already experiencing radical changes in site reorganisation associated with agricultural intensification and territorial competition (de Miroschedji 2018: 127; Chesson 2019; Wilkinson et al. 2014: 85-90; Faust and Golani 2008; Greenberg et al. 2012; Greenberg 2014; Nigro 2014). The new social settings in larger settlements presumably offered economic opportunities that likely eased mounting pressure on valuable farmland in expanding settlements. Ethnographic work among the Kalinga in the Philippines has already shown that marginalised households with limited access to quality farmland will diversify and potting presents an attractive opportunity (Stark 1991). Potting requires minimal financial investment (access to dirt, water, and kindling for a fire) with flexible time commitments and can be scheduled around other activities, such as food production (Skibo 2013: 3; Logan and Dores 2014).[109] Perhaps pottery production and specialisation in the EB Shephelah was also an opportunistic response to resource shortages, population pressures, and the new social fabric in aggregated settlements?

Ali's study (2010) of recently active Jordanian potters describes a highly seasonal craft concentrated between the dry months of June to September, with agricultural activities interspersed between work. There is every reason to believe that EB pottery production was similar considering the constraints imposed by seasonality in rainfall, scheduling, and the agricultural calendar. Some skilled Jordanian potters made no more than 10 large water jars per season, as well as a range of smaller vessels varying in response to demand. Production was still for market by 'specialised households' and not for internal subsistence needs. Further, practice was not continuous throughout the year for the potters to retain their specialist skills and this includes the use of the fast pottery wheel. Production was certainly small-scale in these modern villages (greatly reduced by factory made plastic and metal containers), but manufacture was nonetheless directed toward

[109] The link between potters, poverty, and low social status is widely attested, both historically and ethnographically. Potters usually "turn to this craft when other opportunities are not available" (Skibo 2013: 3).

exchange in a local farming market economy. Professional potters do not have to be constantly engaged in the craft over the year to participate in wider economic networks, beyond the household, as skilled specialist producers.

IVB. Shaping techniques and the identity of potters

As stated in Chapter 2, ethnographic research has repeatedly demonstrated that shaping techniques are far more stable and enduring over time than techniques used in other stages of manufacture (such as decoration, firing and clay processing techniques). When plotted regionally, potting methods and shaping techniques coincide with the most enduring and deeply rooted facets of social identity and group affiliation, such as social status/class, learning networks, linguistic, and kinship boundaries (Fowler 2008, 2011, 2015; Gosselain, 1998: 92; 2000:192–193). Therefore, the existence of multiple shaping techniques and multiple traditions of manufacture on a single domestic assemblage points to a diverse early urban community composed of multiple social groups.

Current studies on specialisation in the region already suggest a marked degree of co-operation between sites and regions at this time. I agree with Roux and de Miroschedji that specialised technical knowledge "was unlikely to have been acquired, developed, and transmitted for the sole satisfaction of the needs of one city" (2009: 171). Potting groups and the transmission of technical knowledge likely originated over a considerable geographic area that extended well beyond the territory of a single site. Comparable results from neighbouring sites (in a future study) would suggest that potters and social groups were not restricted by geopolitics to the immediate territory, irrespective of the large and imposing fortifications that encircled many settlements.

V. The benefits and directions for current and future research

VA. For chaîne opératoire research and the organisation of production

In several synthetic overviews, Roux (2011, 2013, 2016) celebrates the 'worldwide success' of *chaîne opératoire* research and its methodological and epistemological strengths for addressing the organisation of production (among other issues). Current approaches for classifying ceramic assemblages prioritise surface features indicative of fashioning techniques. Microstructures identified in petrographic thin-sections confirm macroscopic observations and are used to characterise clay recipes. However, surface features indicative of vessel fashioning are rare in most ceramic assemblages. Consequently, the majority of the assemblage is typically filtered out of the study sample. Such approaches are therefore not well-suited for an intrasite analysis of

small assemblages where the original diversity of fashioning techniques is likely not represented. Analyses are often restricted to regional scales of analysis and are extremely limited for reconstructing patterns of production and service provision *within* and between settlements and city-states. Hence why the economic foundations of early city-states and townships continues to elude scholars with a lack of consensus over whether local economies were served by specialists generating a surplus, or largely subsistence based in a household economy with very limited specialisation (de Miroschedji 2018; Chesson 2017; Faust and Golani 2008; Greenberg 2011b; Philips 2008).

For the *chaîne opératoire* method to achieve its full potential in ceramic analysis, additional imaging protocols are required to expand (and clarify) diagnostic criteria for recognising shaping techniques on sherd assemblages. Hence, the low-cost 'mesoscopic' imaging method piloted in this thesis (Chapter 3) was combined with standard macroscopic (inspection of surface features) and microscopic (thin-section petrography) analyses. As a result, over 80% of the original study sample was clearly associated with a shaping technique. This is much higher than conventional radiographic studies and much higher than visual inspection of surface features. Our results show that multiple shaping techniques were often combined to shape most of the vessel types in the assemblage. These combinations are easily missed, especially when one shaping technique is more salient at a given scale of observation. This may explain why the use of vessel supports or moulds was not recognised for the manufacture of holemouths at Yarmuth in the preliminary technological analysis, or alternatively different potting methods were used (London 1988).

The vast majority of sherds in our sample did not have surface markings indicative of shaping and the minority that did were only relatable to a single technique. Combinations of techniques and shaping methods present in low quantities are likely to be missed entirely by other more limited methods of observation (and investigation), especially taking into account the quantity of material that is usually dismissed as ambiguous. Shaping methods 2 (coiling and drawing), 3 (coiling in a vessel support/mould), and the attachment of handles and applied elements were only clearly recognisable in section and left no discernible macroscopic trace.

The analytic method piloted in this study was most effective on the coarse ware fabrics of the holemouths, due to the abundance of large elongated angular crushed chalk in the fabric (Chapter 6), which orients well in response to shaping pressures. As a result, fashioning techniques

were positively identified on 94.2% of the holemouth sections. Trace signatures were less pronounced on the bowls (71.3%), platters (79.5%), and jugs (56.5%) because large crushed chalk for temper was generally absent (Chapter 6). Different fabric types are therefore more amenable for identifying deformation patterns and the orientation of inclusions.

Nevertheless, shaping techniques were positively identified on all fabrics present in the assemblage and only a minority of sherds were deleted from the original study sample (less than 20%). Consequently, the thesis was able to track the distribution of different forming techniques across a multi-phase non-elite neighbourhood and understand how an early urban domestic quarter was provisioned with container technology. This is beyond the scope of conventional research on vessel manufacture that is often limited to regional comparisons between sites. Limited identifications, at either micro and/or macro scales of observation, typically filter out the majority of individual site assemblages. Therefore, a complete intra-site analysis is often impossible (or at the very least problematic), especially for all vessels shapes in the repertoire. Our simple scanning method can now extend the focus to include an entire repertoire of handmade vessels from a single site.

The method led us to different conclusions on the economies of early city-states during the EB of the southern Levant. We suggest pottery production was aimed beyond domestic replacement for pottery vessels (de Miroschedji 2018: 127-9). This study has demonstrated that there are multiple communities of professional potters that specialised in the production of different parts of the pottery repertoire. At the Tell eṣ-Ṣâfi/Gath, four production groups are recognised as forming the vessel assemblage. This pattern holds true over time as evident by the analysis of each of the sequential temporal phases. Three of the vessels type are made by more than one single production group. This implies that the residents of early urban neighbourhoods had choices in an economy served by production specialists. It is unlikely that this pattern was created by a single, extended family who, over four generations, produced their own wares using a range of entirely different methods. This seems unlikely provided what we know about contemporary and historically recent household- and community-based pottery production.

The growing body of research from Tell eṣ-Ṣâfi/Gath suggests that production in EB society involved specialists and specialised potting communities. The appearance of fortified settlements and small-scale urbanisation appears to be related to greater economic specialisation, at least in some key sectors of the economy such as the potting industry. Future studies at other

contemporary sites, both urban and village, will help develop a more complete picture of production and pottery provisioning, during this period of profound social change. This body of research makes a substantive contribution developing techno-stylistic analysis through the use of novel approaches that more reliably identify fashion techniques from archaeological sherd assemblages.

VB. For structural analysis and the preferred orientation of fabric features

The analysis of structural features in cross-section provides new evidence of compression patterns not previously discussed in the literature on preferred orientation — much of which is dated, coarse-grained, and suited to radiography at the macroscopic scale of analysis. The imaging of mesoscopic compression patterns provides a high level of detail, resolution, and full-coloured scaled images. Conventional radiographs of ceramics are usually taken normal to the surface (*en face*) and do not clearly show traces of manufacture visible in the cross-section of the vessel (perpendicular to wall surfaces). The superimposition of a 3D object onto a 2D image further exacerbates this problem, regarding the visibility of individual features in the cross-section, with the exception of micro-CT imaging (Applbaum and Applbaum 2005:236).

Microscopic analytical methods, such as thin section analysis, also yield considerable information and can be subjected to the same kind of analyses of grain and void orientation patterns that we undertook in this study (Figs. 3.7; 8.17, 19). However, a far smaller area of the sherd is visible (a few cm's at most) and such studies require specialised equipment to prepare and view slides. Thin section analysis is far better suited to characterising clay recipes, identifying sources, and preparation techniques, which requires/necessitates microscopic levels of observation and crossed polarised light for accurate mineral identifications. The simple and economic approach piloted in this thesis extracts more substantial information on different modes of vessel forming at lower cost than the preparation of thin-sections. Features and deformation patterns in the clay body are less ambiguous on high quality scans of large pottery sections, when compared to conventional radiography, visual inspection of surface features, and the small exposures on thin-sections. As such, mesoscopic thick section analysis can exceed the results of existing approaches and, at the very least, complement them (when the goal is to classify vessel shaping).

VC. For broader application(s) in ceramic analysis

The 'mesoscopic' scanning protocol is ideal for illustrating petrofacies (e.g. Fig. 8.1-11, 13-15), visualising/imaging the inner structure of a clay body, and characterising the textural

features of large areas of the fabric. The mesoscopic scale of observation complements conventional macroscopic and microscopic approaches and augments the "very little data from archaeological sources for the recognition of pottery forming techniques of the past" (Martineau 2003: 210). The clear trade-off is that this is a highly destructive protocol where sherds and parts of vessels are cut in half with a wet saw. This will invariably restrict access to certain assemblages and will limit sample sizes. The same kind of study can still be undertaken, but at greater cost (in terms of time and money), through application of micro-ct imaging (a direction for current and future research).

The digital images of ceramic thick sections proved useful for accurately illustrating and classifying vessel shapes (morphology, e.g. Fig. 6.5). Scanned sections can be dropped into software programs (e.g. Macnification) to take simple and complex measurements of thicknesses, angles, and geometric profile points (providing a scale was included in the original scan, e.g. Fig. 9.3). Digitised profiles can be overlapped to visualise variation in rim form ('the slice method'). The digitized profiles were far simpler, easier, and cheaper to create when compared to the '3D laser scanning system' for archaeological pottery analysis described by Karasik and Smilansky (2007). Yet the advantages are comparable. In both cases: 1) the imaging method is *more accurate and rapid* compared to manual drawings done by hand; 2) files are stored in an accessible digital format and can easily be shared, disseminated, and incorporated into projects, reports, databases, and other media; 3) the image files are useful for additional typological and comparative work; and 4) there are "novel archaeological applications", such as the analysis of wall regularity and deformation patterns to reconstruct manufacture (Karasik and Smilansky 2007: 1162). Despite the success reported in the original study, the scanning system was not widely adopted by subsequent excavation projects that instead chose to prioritise other areas of application in laser scanning technology. Although it is a destructive technique, scanning pottery thick sections to create digitised profiles is a simple, quick, cheap, and compatible alternative to the system proposed by Karasik and Smilansky (2007). The resulting digital images have numerous applications that extend well beyond formal analysis, without the need to re-tool or re-skill, and without interfering with (or significantly adding to) existing protocols for processing site assemblages.

While the geographic and temporal focus of this research is the Levantine Early Bronze Age, the methodological advances are such that the techno-analysis approach can be broadly applied across space and through time where archaeological ceramic are present. The research

design, method, and the refined diagnostics of vessel shaping are applicable to any pottery assemblage in the world and therefore have potential to improve standards for the archaeological analysis of ceramics in a global context.

Bibliography

Abu Jayyab, Ahmed Khaled

2019 *Nomads in Late Chalcolithic Northern Mesopotamia: Mobility and Social Change in the 5th and 4th Millennium BC*. Unpublished Ph.D. dissertation, Department of Near and Middle Eastern Civilizations University of Toronto.

Abu-Lughod, Lila

1986 *Veiled Sentiments: Honour and Poetry in a Bedouin Society*. University of California Press, Berkley.

1991 Writing Against Culture. In *Recapturing Anthropology: Working in the Present*, edited by Richard Fox, pp. 137-154, 161-132. School of American Research Press, Santa Fe.

Adams, Matthew J., Jonathan David, Robert S. Homsher, and Margaret E. Cohen

2014 The Rise of a Complex Society: New Evidence from Tel Megiddo East in the Late Fourth Millennium. *Near Eastern Archaeology* 77(1): 32-43.

Adams, Mathew J.

2013 The Early Bronze Age Pottery from Area J. In *Megiddo V. The 2004-2008 Seasons. Volume II*, edited by Israel Finkelstein, David Ussishkin, and Eric Cline, pp. 295-334. Eisenbrauns, Winoa Lake, Indiana.

Adams, Robert McCormick

1981 *Heartland of Cities: Surveys of Ancient Settlement and Land Use on the Central Floodplain of the Euphrates*. University of Chicago Press, Chicago.

2012 Ancient Mesopotamian Urbanism and Blurred Disciplinary Boundaries. *Annual Review of Anthropology* 41: 1-20.

Adams, Robert McCormick, and Hans J. Nissen

1972 *The Uruk Countryside: The Natural Setting of Urban Societies*. University of Chicago Press, Chicago.

Albright, William Foxwell

1938 Reviewed Work(s): The Pottery of Palestine from the Earliest Times to the End of the Early Bronze Age by G. Ernest Wright. *Journal of Biblical Literature* 57(4): 441.

1949 *The Archaeology of Palestine*. Pelican Books, Harmondsworth.

Algaze, Guillermo

2001 The Prehistory of Imperialism: The Case of Uruk Period Mesopotamia. In *Uruk Mesopotamia & Its Neighbours Cross-Cultural Interactions in the Era of State Formation*, edited by Mitchell S. Rothman, pp. 27-84. School of American Research Press, Santa Fe.

2008 *Ancient Mesopotamia at the Dawn of Civilization: The Evolution of an Urban Landscape*. University of Chicago Press, Chicago.

Algaze, Guillermo, Burchard Brenties, A. Bernard Knapp, Philip L. Kohl, Wade R. Kotter, C. C. Lamberg-Karlovsky, Glenn M. Schwartz, Harvey Weiss, Robert J. Wenke, Rita P. Wright, and Allen Zagarell
1989 The Uruk Expansion: Cross-Cultural Exchange in Early Mesopotamian Civilization [with Comments and Reply]. *Current Anthropology* 30(5): 571-608.

Ali, Nabil
2010 Regionalism and Social Landscape as Inferred from an Ethnoarchaeological Study of Pottery Production in Jordan. *Journal of Anthropological Research* 66: 351-373.

Alvaro, C.
2010 Architecture and the Organisation of Space. In *Economic Centralisation in Formative States. The Archaeological Reconstruction of the Economic System in 4th millennium Arslantepe*, edited by Marcella Frangipane, pp. 45-71. Sapienza Universita di Roma, Roma.

Amélineau, Émile
1887 *Les Nouvelles Fouilles d'Abydos, 1896-1897*. Leroux, Paris.

Amiran, Ruth
1970 *Ancient Pottery of the Holy Land: from its Beginnings in the Neolithic period to the End of the Iron Age*. Rutgers University Press, New Brunswick.

1978 *Early Arad: First-fifth Seasons of Excavations, 1962-1966: The Chalcolithic Settlement and Early Bronze City*. Israel Exploration Society, Jerusalem.

Applbaum, N., and Y. H. Applbaum
2005 The Use of Medical Computed Tomography (CT) Imaging in the Study of Ceramic and Clay Archaeological Artifacts from the Ancient Near East. In *X-rays for Archaeology*, edited by M. Uda, G. Demortier, and I. Nakai, pp. 231–245. Springer, Dordrecht.

Andelkovic, Branislav
2008 Parameters of Statehood in Predynastic Egypt. In *Egypt at its Origins 2*, edited by B. Midant-Reynes, and Y. Tristant, pp. 1039-1056. Uitgeverij Peeters en Departement Oosterse Studies, Paris.

Arnold, Dean
1988 *Ceramic Theory and Cultural Process*. Cambridge University Press, Cambridge.

1999 Advantages and Disadvantages of Vertical- Half Molding Technology: Implications for Production Organization. In *Pottery and People*, edited by James M. Skibo, and Garry Feinman, pp. 59-80. University of Utah Press, Salt Lake City.

2000 Does the Standardization of Ceramic Pastes Really Mean Specialization? *Journal of Archaeological Method and Theory* 7(4): 333-375.

2005 The Threshold Model for Ceramic Resources: A Refinement. In *Ceramic Studies. Papers on the Social and Cultural Significance of Ceramics in Europe and Eurasia from Prehistoric to Historic Times*, edited by Dragos Gheorghiu, pp. 3-9. BAR, Oxford.

Arnold, Dean, and Alvaro L. Nieves
1992 Factors Affecting Ceramic Standardization. In *Ceramic Production and Distribution: An Integrated Approach*, edited by George J. Bey, and Christopher A. Pool, pp. 93-113. Westview Press, Boulder.

Arnold, E., J. Beller, A. Behar, D. Ben-Shlomo, T. Greenfield, and H. Greenfield
2017 Interregional Trade and Exchange at Early Bronze Age Tell eṣ-Ṣâfi/Gath. *Near Eastern Archaeology* 80(4): 264-267.

Arnold, Elizabeth R., Gideon Hartman, Haskel J. Greenfield, Itzhaq Shai, Lindsay E. Babcock, and Aren M. Maeir
2016 Isotopic Evidence for Early Trade in Animals between Old Kingdom Egypt and Canaan. *PLoS One* 11(6). Doi: 10.1371/journal.pone.0157650.

Arnold, Philip J.
1991 *Domestic Ceramic Production and Spatial Organization: A Mexican Case Study in Ethnoarchaeology*. Cambridge University Press, Cambridge.

Artzy, M.
1998 Routes, Trade, Boats and "Nomads of the Sea". In *Res Maritimae. Cyprus and the Eastern Mediterranean from Prehistory to Late Antiquity*, edited by S. Swiny, R. L. Hohlfelder, and H. W. Swiny, pp. 439-448. Cyprus American Archaeological Research Institute, Atlanta.

Audouze, Francoise
2002 Leroi-Gourhan: A Philosopher of Technique and Evolution. *Journal of Archaeological Research* 10(4): 227-304.

Babour, Taos
2014 The Organization of Pottery Production at Tell Chuera: a Technological Approach. In *House and Household Economies in 3rd Millennium B.C.E. Syro-Mesopotamia*, edited by Federico Buccellati, Tobias Helms, and Alexander Tamm, pp. 1-8. BAR International Series 2682. Archaeopress, Oxford.

Badler, Virginia R, Patrick E McGovern, and Rudolph H Michel
1990 Drink and be Merry! Infrared Spectroscopy and Ancient Near Eastern Wine. *MASCA Research papers in Science and Archaeology* 7: 25-36.

Baker, Heather D.
2013 Family Structure, Household Cycle, and the Social Use of Domestic Space in Urban Babylonia. In *Household Studies in Complex Societies: (Micro) Archaeological and Textual Approaches*, edited by Miriam Müller, pp. 371-408. The University of Chicago Press, Chicago.

Baldi, J., and V. Roux
2016 The Innovation of the Potter's Wheel: A Comparative Perspective Between Mesopotamia and the Southern Levant. *Levant* 48(3): 236-253.

Bar-Matthews, M., and A. Ayalon
2011 Mid-Holocene Climate Variations Revealed by High-Resolution Speleothem Records from Soreq Cave, Israel and their Correlation with Cultural Changes. *Holocene* 21(2): 163-172.

Bar-Yosef, Ofer, and Philip Van Peer
2009 The Chaine Operatoire Approach in Middle Palaeolithic Archaeology. *Current Anthropology* 50(1): 103-131.

Barlow, Jane A.
1991 New Light on Red Polished Ware. In *Cypriot Ceramics: Reading the Prehistoric Record*, edited by Jane A. Barlow, Diane L. Bolger, and Barbara Kling, pp. 51-57. The A.G. Leventis Foundation, Pennsylvania.

Bass, George
1995 Sea and River Craft in the Ancient Near East. In *Civilisations of the Ancient Near East*, Vol 3, edited by Jack M. Sasson, pp. 1421-1432. Charles Scribner's Sons, New York.

Bauer, Alexander A.
1998 Cities of the Sea: Maritime Trade and the Origin of Philistine Settlement in the Early Iron Age Southern Levant. *Oxford Journal of Archaeology* 12(2): 149-168.

Beit-Arieh, Itzhaq
2003 *Archaeology of Sinai: The Ophir Expedition*. University Press, Tel Aviv.

Beller, Jeremy, Haskel Greenfield, Mostafa Fayek, Itzhaq Shai, and Aren Maeir
2016 Provenance and Exchange of Basalt Ground Stone Artefacts of EB III Tell eṣ-Ṣâfi/Gath, Israel. *Journal of Archaeological Science: Reports* 9:226-237.

Ben-Shlomo, David
2012 Chapter 16: Provenience and Technological Studies of Pottery. *In Tell eṣ-Ṣâfi/Gath I: The 1996-2005 Seasons*, Vol 1, edited by Aren M. Maeir, pp. 383-428. Harrassowitz Verlag, Wiesbaden.

2018 Petrographic and Technological Analysis of the Tell eṣ-Ṣâfi/Gath Pottery. *Near Eastern Archaeology* 81(1): 63-65.

Ben-Shlomo, David, Joe Uziel, and Aren M. Maeir
2009 Pottery Production at Tell eṣ-Ṣâfi/Gath: A Longue Duree Perspective. *Journal of Archaeological Science* 36(10): 2258-2273.

Ben-Tor, Amnon

1975 *Two Burial Caves of the Proto-Urban Period at Azor 1971 and The First Season of Excavations at Tell Yarmuth 1970*. Institute of Archaeology, Hebrew University, Jerusalem.

1992 Introduction: the Early Bronze Age. In *The Architecture of Ancient Israel from the Prehistoric to the Persian Periods: In Memory of Immanuel (Munya) Dunayevsky*, edited by Aharon Kempinski, and Immanuel Dunayevsky, pp. 51-52. Israel Exploration Society, Jerusalem.

Ben-Tor, Amnon, and Ruhama Bonfil

2003 The Stratigraphy of the Early Bronze Age II-III. In *Tel Qashish: A Village in the Jezreel Valley*, edited by A. Ben-Tor, N. Goren-Inbar, N. Goring-Morris, S. Gorodetsky, and L. I. Levine, pp. 61-124. Old City Press, Jerusalem.

2003 The Stratigraphy of the Early Bronze Age. In *Tel Qashish: A Village in the Jezreel Valley*, edited by A. Ben-Tor, N. Goren-Inbar, N. Goring-Morris, S. Gorodetsky, and L. I. Levine, pp. 10-30. Old City Press, Jerusalem.

Ben-Tor, Amnon, Aharon Kempinski, Itzhaq Beit-Arieh, Rudolph Cohen, and Dan Bahat

1992 The Early and Intermediate Bronze Age. In *The Architecture of Ancient Israel: From the Prehistoric to the Persian Periods*, edited by Aharon Kempinski, and Ronny Reich, pp. 51-96. Israel Exploration Society, Jerusalem.

Ben-Yosef, E., A. Gidding, L. Tauxe, U. Davidovich, M. Najjar, and T. E. Levy

2016 Early Bronze Age Copper Production Systems in the Northern Arabah Valley: New insights from Archaeomagnetic Study of Slag Deposits in Jordan and Israel. *Journal of Archaeological Science* 72: 71-84.

Ben-Yosef, Erez, and Sariel Shalev

2019 Social Archaeology in the Levant Through the Lens of Archaeometallurgy. In *The Social Archaeology of the Levant*, edited by A. Yasur-Landau, E. Cline, and Y. Rowan, pp. 536-550. Cambridge University Press, Cambridge.

Berg, Ina

2007 Meaning in the Making: The Potter's Wheel at Phylakopi, Melos (Greece). *Journal of Anthropological Archaeology* 26: 234-252.

2008 Looking Through Pots: Recent Advances in Ceramics X-radiography. *Journal of Archaeological Science* 35(5): 1177-1188.

2009 X-Radiography of Knossian Bronze Age Vessels: Assessing our Knowledge of Primary Forming Techniques. *The Annual of the British School at Athens* 104: 137-173.

2011 Exploring the Chaine Operatoire of Ceramics Through X-Radiography. In *Archaeological Ceramics: A Review of Current Research*, edited by Simona Scarcella, pp. 57-63. Archaeopress, Oxford.

Bernbeck, Reinhard
2006 The Rise of the State. In *Handbook of Archaeological Theories* edited by A. Bentley, H. Maschner, and C. Chippindale, pp. 533-542. Altamira, New York.

Binford, Lewis
1983 *In Pursuit of the Past: Decoding the Archaeological Record*. Thames and Hudson, London.

Blackman, M. James, Gil J. Stein, and Pamela B. Vandiver
1993 The Standardization Hypothesis and Ceramic Mass Production: Technological, Compositional, and Metric Indexes of Craft Specialization at Tell Leilan, Syria. *American Antiquity* 58(1): 60-80.

Blanco-Gonzalez, A.
2014 Tracking the Social Lives of Things: Biographical Insights into Bronze Age Pottery in Spain. *Antiquity* 88(340): 441-455.

Blanton, Richard E
1976 Anthropological Studies of Cities. *Annual Review of Anthropology* 5:249-264.

Bleed, P.
2001 Artifice Constrained: What Determines Technological Choice? In *Anthropological Perspectives on Technology*, edited by M. B. Schiffer, pp. 151-162. University of New Mexico Press, Albuquerque.

Borradaile, Graham J., and Mike Jackson
2010 Structural Geology, Petrofabrics and Magnetic Fabrics (AMS, AARM, AIRM). *Journal of Structural Geology* 32: 1519-1551.

Bourdieu, Pierre
1977 *Outline of a Theory of Practice*. Cambridge University Press, Cambridge.

Bourke, S. J. , U. Zoppi, J. Meadows, Q. Hua, and S. Gibbins
2009 The Beginnings of the Early Bronze Age in the North Jordan Valley: New 14C Determinations from Pella in Jordan. *Radiocarbon* 51(3): 905-913.

Braun, Eliot
2002 The First Transformation from Village to Urbanized Settlement: A View from the Southern Levant. Paper Presented at the ICAANE, Paris.

2005 Identifying Ethnicity from Prehistoric Pottery in Ancient Egypt and the Southern Levant. In *Archaeological Perspectives on the Transmission and Transformation of Culture in the Eastern Mediterranean*, edited by J. Clarke, pp. 140-154. Oxbow, Oxford.

2006 Parochialism in Early Bronze Age I Ceramic Traditions: the Case of a 'Safi Cup' from the EBI Site at Palmahim Quarry, Israel. In *'I will Speak the Riddles of Ancient Times':*

Archaeological and Historical Studies in Honour of Amihai Mazar, edited by Aren M. Maeir, and Pierre de Miroschedji, pp. 3-6. Eisenbrauns, Winona Lake.

2012 On Some South Levantine Early Bronze Age Ceramic 'Wares' and Styles. *Palestine Exploration Quarterly* 144(1): 5-32.

Braun, Eliot, and Valentine Roux

2013 The Late Chalcolithic to Early Bronze Age I Transition in the Southern Levant: Determining Continuity and Discontinuity or "Mind the Gap.". *Paléorient* 39(1): 15-22.

Bril, Blandine

2002a Apprentissage et Contexte. *Intellectica* 2(35): 251-268.

2002b L'Apprentissage de Gestes Techniques: Ordre de Contraintes et Variations Culturelles. In *Le Geste Technique. Réflexions Méthodologiques et Anthropologiques. Technologies/ Idéologies/ Pratiques*, pp. 113–150. Editions érès. Ramonville Saint-Agne.

Brumfiel, Elizabeth M., and Timothy K. Earle

1987 Specialization and Exchange in Complex Societies: An Introduction. In *Specialization and Exchange in Complex Societies*, edited by Elizabeth M. Brumfiel, and Timothy K. Earle, pp. 1-9. Cambridge University Press, Cambridge.

Buccellati, Federico, Tobias Helms, and Alexander Tamm

2014 *House and Household Economies in 3rd Millennium B.C.E. Syro-Mesopotamia*. BAR International Series 2682. Archaeopress, Oxford.

Bunimovitz, Shlomo, and Zvi Lederman

2009 The Archaeology of Border Communities. Tel Beth-Shemesh Renewed Excavation, Part I: The Iron Age. *Near Eastern Archaeology* 72: 116-144.

2016 A Tale of Three Expeditions: Tel Beth-Shemesh Excavators, Excavations and Site Reports in Context. In *Tel-Beth Shemesh: A Border Community in Judah: Renewed Excavations 1990-2000: The Iron Age*, Vol 1, edited by Shlomo Bunimovitz, and Zvi Lederman, pp. 3-39. Emery and Claire Yass Publications in Archaeology.

Carpenter, Andrea, and Garry Feinman

1999 The Effects of Behaviour on Ceramic Composition: Implications for the Definition of Production Locations. *Journal of Archaeological science* 26: 783-796.

Carr, Christopher

1990 Advances in Ceramic Radiography and Analysis: Applications and Potentials. *Journal of Archaeological Science* 17(1): 13-34.

Carter, Tristan

2007 The Theatrics of Technology: Consuming Obsidian in the Early Cycladic Burial Arena. *Archeological Papers of the American Anthropological Association* 17(1): 88-107.

Chadwick, Jeff, Joe Uziel, Eric Welch, and Aren Maeir
2017 Walled up to Heaven! Early and Middle Bronze Age Fortifications at Tell eṣ-Ṣâfi/Gath. *Near Eastern Archaeology* 80(4): 285-291.

Chapman, John, and Gaydarska Bisserka
2016 Low-Density Urbanism: the Case of the Trypillia Group of Ukraine. In *Eurasia at the Dawn of History: Urbanization and Social Change*, edited by Manuel Fernández-Götz, and Dirk Krausse, pp. 81-105. Cambridge University Press, Cambridge.

Charlton, Thomas H., Deborah L. Nichols, and Cynthia Otis Charlton
1991 Aztec Craft Production and Specialization: Archaeological Evidence from the City-State of Otumba, Mexico. *World Archaeology* 23(1): 98-114.

Chesson, Meredith S.
2000 Ceramics and Daily Life in the EBA Household: Form, Function, and Action in Residential Compounds at Tell el—Handaquq South, Jordan. In *Ceramics and Change in the Early Bronze Age of the Southern Levant*, edited by D. Baird, and G. Philip, pp. 365-378. Sheffield Academic Press, Sheffield.

2003 Households, Houses, Neighborhoods and Corporate Villages: Modeling the Early Bronze Age as a House Society. *Journal of Mediterranean Archaeology* 16(1): 79-102.

2019 The Southern Levant during the Early Bronze Age I-III. In *The Social Archaeology of the Levant*, edited by A. Yasur-Landau, E. Cline, and Y. Rowan. Cambridge University Press, Cambridge.

Chesson, Meredith S., and Graham Philip
2003 Tales of the City? 'Urbanism' in the Early Bronze Age Levant from Mediterranean and Levantine perspectives. *Journal of Mediterranean Archaeology* 16(1): 3-16.

Childe, V. Gordon
1929 *The Danube in Prehistory*. Clarendon Press, Oxford.

1934 *New Light on the Most Ancient Near East*. Routledge and Kegan, London.

1950 The Urban Revolution. *Town Planning Review* 21:3-17.

1951 *Social Evolution*. C. A. Watts and Co., London.

Clark, John E.
2007 In Craft Specialization's Penumbra: Things, Persons, Action, Value, and Surplus. *Archeological Papers of the American Anthropological Association* 17(1): 20-35.

Clarke, Joanne, Nick Brooks, Edward B. Banning, Miryam Bar-Matthews, Stuart Campbell, Lee Clare, Mauro Cremaschi, Savino di Lernia, Nick Drake, Marina Gallinaro, Sturt Manning, Kathleen

Nicoll, Graham Philip, Steve Rosen, Ulf-Dietrich Schoop, Mary Anne Tafuri, Bernhard Weninger, and Andrea Zerboni
2016 Climatic Changes and Social Transformations in the Near East and North Africa during the 'Long' 4th millennium BC: A Comparative Study of Environmental and Archaeological Evidence. *Quaternary Science Reviews* 136: 96-121.

Cline, Eric H.
2015 *1177 BC: The Year Civilization Collapsed*. Princeton University Press, Princeton.

Cohen, Susan
2016 *Peripheral Concerns: Urban Development in the Bronze Age Southern Levant*. Equinox, Sheffield.

Cohen, Yoram
2019 Cuneiform Writing in Bronze Age Canaan. In *The Social Archaeology of the Levant*, edited by A. Yasur-Landau, E. Cline, and Y. Rowan, pp. 245-264. Cambridge University Press, Cambridge.

Comaroff, J., and J. Comaroff
2005 Millennial Capitalism and the Culture of Neoliberalism. In *Anthropology of Development and Globalization From Classical Political Economy to Contemporary Neoliberalism*, edited by M. Edelman, and A. Haugerud. Blackwell Publishing, Oxford.

Conkey, M. W., and C. A. Hastorf
1990 Introduction. In *The Uses of Style in Archaeology*, edited by M. W. Conkey, and C. A. Hastorf, pp. 1-4. Cambridge University Press, Cambridge.

Coogan, Michael D.
2001 In the Beginning: the Earliest History. In *The Oxford History of the Biblical World*, edited by Michael D. Coogan, pp. 3-24. Oxford University Press, Oxford.

Costin, Cathy L.
1991 Craft specialization: Issues in Defining, Documenting, and Explaining the Organization of Production. *Archaeological Method and Theory* 3: 1-56.

2000 The Use of Ethnoarchaeology for the Archaeological Study of Ceramic Production. *Journal of Archaeological Method and Theory* 7(4): 377-403.

2001 Craft Production Systems. In *Archaeology at the Millennium: A Sourcebook*, edited by G. M. Feinman, and T. D. Price, pp. 273-328. Kluwer, New York.

2005 Craft Production. In *Handbook of Archaeological Methods*, edited by H. D. G Maschner, and C. Chippindale, pp. 1034-1107. AltaMira Press, Lanham, MD.

2007 Thinking About Production: Phenomenological Classification and Lexical Semantics. *Archeological Papers of the American Anthropological Association* 17(1): 143-162.

2015 Craft Specialisation. In *The International Encyclopedia of Human Sexuality. First Edition*, edited by Patricia Whelehan, and Anne Bolin. John Wiley & Sons, New York.

Costin, Cathy L., and Melissa B. Hagstrum
1995 Standardization, Labor Investment, Skill, and the Organization of Ceramic Production in Late Prehispanic Highland Peru. *American Antiquity* 60(4): 619-639.

Coupaye, Ludovic
2009 Ways of enchanting Chaines Operatoires and Yam Cultivation in Nyamikum Village, Maprik, Papua New Guinea. *Journal of Material Culture* 14(4): 433-458.

Cowgill, George L.
2004 Origins and Development of Urbanism: Archaeological Perspectives. *Annual Review of Anthropology* 33: 525-549.

Cresswell, Robert, and Gerald Hanning
1976 *Transferts de Techniques et Chaîne Opératoires: Note sur L'Habitat Traditionnel*. Unesco, Paris.

Creswell, Robert
1976 Techniques et Culture, Les Bases d'un Programme de Travail. *Techniques et Culture* (1): 7-59.

1983 Transferts de Techniques et Chaînes Opératoires. *Techniques et Culture* (2): 143-164.

1993 Of Mills and Waterwheels: The Hidden Parametres of Technological Choice. In *Technological Choices: Transformation in Material Cultures since the Neolithic*, edited by Pierre Lemonnier, pp. 1183-1213. Routledge, London.

2010 Techniques et culture: Les Bases d'un Programme de Travail. *Techniques et Culture* (54/55): 20-45.

Cross, John R.
1993 Craft Specialization in Nonstratified societies. In *Research in Economic Anthropology*, edited by B. Isaac, pp. 61-84. Jai Press inc., London.

Czarnowicz, Marcin, Ianir Milevski, Yuval Yekutieli, Agnieszka Ochał-Czarnowicz, Jacek Karmowski, and Marecelo Campagno
2019 New Implications to the Process of Urbanization and Foreign Relations during the Early Bronze Age in the Southern Levant As Seen From Tel Erani. Paper presented at the Asor Annual Meeting.

D'Altroy, Terrence, and Timothy Earle
1985 Staple Finance, Wealth Finance, and Storage in the Inka Political Economy [and Comments and Reply]. *Current Anthropology* 26(2): 187-206.

David, Nicholas, and Carol Kramer
2001 Specialist Craft Production and Apprenticeship. In *Ethnoarchaeology in Action*, pp. 303-359. Cambridge University Press, New York.

Davis, Miriam C.
2008 *Dame Kathleen Kenyon. Digging up the Holy Land*. Left Coast Press, Walnut Creek, California.

Dessel, J. P.
2004 In Search of the Good Book: A Critical Survey of Handbooks on Biblical Archaeology. In *Between Text and Artifact. Integrating Archaeology in Biblical Studies Teaching*, edited by M. Moreland, pp. 67-98. Brill, Leiden.

Dessel, J. P., and Alexander Joffe
2000 Alternative Approaches to Early Bronze Age Pottery. In *Ceramics and Change in the Early Bronze Age of the Southern Levant*, edited by Graham Philip, and Douglas Baird, pp. 31-58. Sheffield Academic Press, Sheffield, England.

Dever, William
2004 Kathleen Kenyon (1906-1978). In *Breaking Ground: Pioneering Women Archaeologists*, edited by Getzel M. Cohen, and Martha S. Joukowsky, pp. 525-553. University of Michigan Press, Ann Arbor.

de Miroschedji, Pierre
1988 *Yarmuth I, Rapport sur les Trois Premières Campagnes de Fouilles à Tel Yarmouth, (Israel) (1980-1982)*. Editions Recherche sur les Civilisations, Paris.

2000 An Early Bronze Age III Pottery Sequence for Southern Israel. In *Ceramics and Change in the Early Bronze Age of the Southern Levant*, edited by Graham Philip, and Douglas Baird, pp. 315-345. Sheffield Academic Press, Sheffield, England.

2001 Notes on Early Bronze Age Metrology and the Birth of Architecture in Ancient Palestine. In *Studies in the Archaeology of Israel and Neighbouring Lands in Memory of Douglas L. Esse*, edited by Douglas L. Esse, and Samuel Richard Wolff, pp. 465-492. Oriental Institute of the University of Chicago, Chicago.

2006 At the Dawn of History: Sociopolitical Developments in Southwestern Canaan in Early Bronze Age III. In *'I Will Speak the Riddles of Ancient Times': Archaeological and Historical Studies in Honour of Amihai Mazar*, edited by Aren M. Maeir, and Pierre de Miroschedji, pp. 55-78. Eisenbrauns, Winona Lake.

2009 Rise and Collapse in the Southern Levant in the Early Bronze Age. *Scienze Dell'Antichita Storia Archaeologia Anthropologia* 15: 101-129.

2012 Egypt and Southern Canaan in the Third Millennium BCE: Uni's Asiatic Campaigns Revisited. In *All the Wisdom of the East: Studies in Near Eastern Archaeology and History in Honor of Eliezer D. Oren*, edited by Mayer I. Gruber, Shmuel Ahituv, Gunnar Lehmann, Zipora Talshir, and Eliezer D. Oren, pp. 265-292. Fribourg: Academic Press, Göttingen.

2013 The Southern Levant (Cisjordan) during the Early Bronze Age. In *The Oxford Handbook of the Archaeology of the Levant c. 8000-362 BCE*, edited by Ann E. Killebrew, and Margreet L. Steiner, pp. 307-329. Oxford University Press, Oxford.

2015 Les Relations Entre l'Egypte et le Levant aux IV et III Millenaires a la Lumiere des Fouilles de Tell es-Sakan. In *Comptes Rendus des Séances de l'Académie des Inscriptions et Belles-Lettres*, Vol II (avril-juin), pp. 1003-1038. Diffusion de Broccard, Paris.

2018 The Urbanization of the Southern Levant in its Near Eastern setting. In *Origini XLII Prehistory and Protohistory of Ancient Civilisations*, edited by M. Frangipane, and L. Manzanilla, pp. 109-148. Gangemi Editore, Rome.

de Miroschedji, Pierre, and Moain Sadek

2000 Tell es-Sakan, un site du Bronze Ancien Découvert dans la Région de Gaza. *Comptes Rendus des Séances de l'Académie des Inscriptions et Belles-Lettres* 144 (I janv.-mars):123-144.

De Vaux, Roland

1952 La Quatrieme Campagne de Fouilles a Tell el-Far'ah, Pres Naplouse. *Revue Biblique* 62: 551-583.

Dessel, J.P.

2009 *Lahav I. Pottery and Politics: The Halif Terrace Site 101 and Egypt in the Fourth Millennium BCE*. Eisenbrauns, Winnoa Lake.

Di Nocera, G. M.

2010 Metals and Metallurgy. Their Place in the Arslantepe Society between the End of the 4th and Beginning of the 3rd Millennium BC. In *Economic Centralisation in Formative States. The Archaeological Reconstruction of the Economic System in 4th Millennium Arslantepe*, edited by M. Frangipane, pp. 255-274. Sapienza Universita di Roma, Roma.

Dobres, Marcia-Anne

2000 *Technology and Social Agency: Outlining a Practice Framework for Archaeology*. Blackwell Publishers, Oxford.

2001 Meaning in the Making: Agency and the Social Embodiment of Technology and Art. In *Anthropological Perspectives on Technology*, edited by M. B. Schiffer, pp. 47-76. University of New Mexico Press, Albuquerque.

2010 Archaeologies of Technology. *Cambridge Journal of Economics* 34: 103-114.

Dobres, Marcia-Anne, and Christopher R. Hoffman

1999 Introduction: A Context for the Present and Future of Technology Studies. In *The Social Dynamics of Technology: Practice, Politics, and World Views*, edited by Marcia-Anne Dobres, and Christopher R. Hoffman, pp. 1-19. Smithsonian Institution Press, Washington.

Doherty, Sarah K.
2015 *Origins and Use of the Potter's Wheel in Ancient Egypt*. Archaeopress, Oxford.

Earle, Timothy
1981 Comment on P. Rice, "Evolution of Specialized Pottery Production: a Trial Model". *Current Anthropology* 22: 230-231.

1999 Production and exchange in prehistory. In *Companion Encyclopedia of Archaeology*, edited by Graeme Barker, pp. 606-636. Routledge, London.

Eisenberg, Emanuel
2001 Pottery of Strata V-IV, the Early Bronze Age I. In *Tel Te'o: A Neolithic, Chalcolithic, and Early Bronze Age Site in the Hula Valley*, edited by Emanuel Eisenberg, Avi Gopher, and Raphael Greenberg. Israel Antiquities Authority, Jerusalem.

Eisenberg, Emanuel, Avi Gopher, and Raphael Greenberg
2001 *Tel Te'o: A Neolithic, Chalcolithic, and Early Bronze Age Site in the Hula Valley*. Israel Antiquities Authority, Jerusalem.

Eliyahu-Behar, Adi, Itzhaq Shai, Lior Regev, David Ben-Shlomo, Shira Albaz, Aren M. Maeir, and Haskel J. Greenfield
2016 Early Bronze Age Pottery Covered with Lime-Plaster: Technological Observations. *Tel Aviv* 43: 27-42.

2017 Lime Plaster-Covered Pottery: Technological Observations. *Near East Archaeology* 80(4): 277.

Emberling, Geoff
2015 Mesopotamian Cities and Urban Process, 3500-1600 BCE. In *Early Cities in Comparative Perspective, 4000 BCE-1200 CE*, Vol III, edited by Norman Yoffee, pp. 253-278. The Cambridge World History. Cambridge University Press, Cambridge.

Enkin, Randolph J.
2007 Magnetic Fabric: Methods and Applications (A Review). *Geoscience Canada* 34(2): 76-77.

Esse, Douglas
1984 A Chronological Mirage: Reflections on Early Bronze IC in Palestine. *Journal of Near Eastern Studies* 43(4): 317-330.

1991 *Subsistence, Trade, and Social Change in Early Bronze Palestine*. The Oriental Institute, Chicago.

Falconer, Steven E., and Patricia L. Fall
2006 Chapter 1: Village Communities in the Bronze Age Levant: Ecology and History. In *Bronze Age Rural Ecology and Village Life at Tell el-Hayyat, Jordan*, pp. 1-15. Archaeopress, Oxford.

Falconer, Steven E., and Stephen H. Savage
1995 Heartlands and Hinterlands: Alternative Trajectories of Early Urbanization in Mesopotamia and the Southern Levant. *American Antiquity* 60(1): 37-58.

Fargo, Valerie M.
1979 Early Bronze Age Pottery at Tell el-Ḥesi. *Bulletin of the American Schools of Oriental Research* 236: 23-40.

Faust, A., and Y. Ashkenazy
2009 Settlement Fluctuations and Environmental Changes in Israel's Coastal Plain during the Early Bronze Age. *Levant* 41: 19-39.

Faust, Avi, and Amir Golani
2008 A Community in Transition: The Early Bronze Age Site of Qiryat Ata as a Test Case. *Tel Aviv* 35(2): 215-243.

Feder, Kenneth L
2014 *The Past in Perspective: An Introduction to Human Prehistory*. Oxford University Press, Oxford.

Feinman, Garry
1993 Shell Ornament Production in Ejutla: Implications for Highland-Coastland Interaction in Ancient Oaxaca. *Ancient Mesoamerica* 4: 103-119.

2000 High-Intensity Household-Scale Production in Ancient Mesoamerica: A Perspective from Ejutla, Oaxaca. In *Cultural Evolution: Contemporary Viewpoints*, edited by Gary M. Feinman, and Linda Manzanilla, pp. 119-142. Plenum Publishers, London.

2001a Craft and Craft Specialization. In *Archaeology of Ancient Mexico and Central America: An Encyclopedia*, edited by S. Toby Evans, and David L. Webster, pp. 191-195. Garland Publishing, Inc., New York.

2001b Excavations at El Palmillo: A Hilltop Terrace Site in Oaxaca, Mexico. *In the Field* 72(2): 2-5.

2004 *Hilltop Terrace Sites of Oaxaca, Mexico: Intensive Surface Survey at Guirun, El Palmillo, and the Mitla Fortress*. Anthropology Field Museum of Natural History, Chicago.

2013 Crafts, Specialists, and Markets in Mycenaean Greece. Reenvisioning Ancient Economies: Beyond Typological Constructs. *American Journal of Archaeology* 117(3): 453-459.

Feinman, Garry, and Linda Nicholas
2007 Household Production and the Regional Economy in Ancient Oaxaca: Classic Period Perspectives from Hilltop El Palmillo and Valley Floor Ejutla. In *Pottery Economics in Mesoamerica*, edited by Christopher A. Pool, and George J. Bey III, pp. 184-211. The University of Arizona Press, Tucson.

2011 Domestic Craft Production and the Classic Period Economy of Oaxaca. In *Produccion Artesanal Y Especializada en Mesoamerica*, edited by L. Manzanilla, and Kenneth G. Hirth. Instituto Nacional de Antropología e Historia-Universidad Nacional Autónoma de México, Mexico City.

Finkelstein, Israel
1995 Two Notes on Early Bronze Age Urbanization and Urbanism. *Tel Aviv* 1995(1): 47-69.

1996 The Archaeology of the United Monarchy: An Alternative View. *Levant* 28: 177-187.

2005 A Low Chronology Update: Archaeology, History and Bible. In *The Bible and Radiocarbon Dating: Archaeology, Text and Science*, edited by T. Levy, and T. Higham, pp. 31-42. Equinox, London.

Finkelstein, Israel, Matthew J. Adams, Zachary C. Dunseth, and Ruth Shahack-Gross
2018 The Archaeology and History of the Negev and Neighbouring Areas in the Third Millennium BCE: A New Paradigm. *Tel Aviv* 45(1): 63-88.

Finkelstein, Israel, and Eli Piasetzky
2011 The Iron Age Debate: Is the Gap Narrowing? *Near Eastern Archaeology* 74(1): 50-54.

Finkelstein, Israel, and David Ussishkin
2006 Two Notes on Early Bronze Age Megiddo. In *"I will Speak the Riddles of Ancient Times": Archaeological and Historical Studies in Honor of Amihai Mazar on the Occasion of his Sixtieth Birthday*, edited by Aren M. Maeir, and Pierre de Miroschedji, pp. 7-23. Eisenbrauns, Winona Lake, Ind.

Finkelstein, Israel Gophna, Ram
1993 Settlement, Demographic, and Economic Patterns in the Highlands of Palestine in the Chalcolithic and Early Bronze Periods and the Beginning of Urbanism. *Bulletin of the American Schools of Oriental Research* 289: 1-22.

Fischer, Peter
2006 Copper and Bronze Objects from Tell Abu al-Kharaz and Sahem, Jordan: Some Reflections on the Results of Atomic-Absorption Spectroscopy. In *"I will Speak the Riddles of Ancient Times": Archaeological and Historical Studies in Honor of Amihai Mazar on the Occasion of his Sixtieth Birthday*, edited by Aren M. Maeir, and Pierre de Miroschedji, pp. 25-32. Eisenbrauns, Winona Lake, Ind.

2008 *Tell Abu al-Kharaz in the Jordan Valley. Volume I.* Verlage der Österreichischen Akademie der Wissenschaften, Vienna.

2011a The Early Bronze Age Societies of Tell Abu al-Kharaz, Central Jordan Valley. In *Daily Life, Materiality, and Complexity in Early Urban Communities of the Southern Levant: Papers in Honor of Walter E. Rast and R. Thomas Schaub*, edited by Meredith S. Chesson, Walter Emanuel Aufrecht, Ian Kuijt, Walter E. Rast, and R. Thomas Schaub, pp. 23-40. Eisenbrauns, Winona Lake.

2011b Tell Abu al-Kharaz: A Bead in the Jordan Valley. *Near Eastern Archaeology* 71(4): 196-213.

Flad, Rowan K., and Zachary X. Hruby

2007 "Specialized" Production in Archaeological Contexts: Rethinking Specialization, the Social Value of Products, and the Practice of Production. *Archeological Papers of the American Anthropological Association* 17(1): 1-19.

Flad, Rowan K.

2007 Rethinking the Context of Production through an Archaeological Study of Ancient Salt Production in the Sichuan Basin, China. *Archeological Papers of the American Anthropological Association* 17(1): 108-128.

Foster, Catherine Painter

2009 Household Archaeology and the Uruk Phenomenon: A Case Study from Kenan Tepe, Turkey. Unpublished Ph.D. dissertation, Department of Near Eastern Studies, University of California, Berkeley.

Fowler, Kent

2008 Zulu Pottery Production in the Lower Thukela Basin, KwaZulu-Natal, South Africa. *Southern African Humanities* 20(2): 477-511.

2011 The Zulu Ceramic Tradition in Msinga, South Africa. *Southern African Humanities* 23(1): 173-202.

2014 Ceramic Production in Swaziland. *Anthropos* 109: 411-428.

2015 Zulu pottery technology and group identity in the Phongolo Basin, South Africa. *South African Humanities* 27: 81-111.

2016 Chapter 26: Ethnography. In *The Oxford Handbook of Archaeological Ceramic Analysis*, edited by Alice Hunt, pp. 469-486. Oxford University Press, Oxford.

2017 Acoustic Perceptions of Vessel Fitness in Southern Africa. *Journal of Material Culture* 22(3): 261-280.

Fowler, K. , E. Walker, J. Ross, H. Greenfield, and A Maeir

2019 The Identity of Potters in Early States: Determination of the Age and Sex of Fingerprints on Early Bronze Age Pottery from Tell eṣ-Ṣâfi/Gath, Israel. *Journal of Anthropological Method and Theory* 26(4): 1470-1512.

Fowler, Kent, Jon Ross, Elizabeth Walker, Christian Barritt-Cleary, Haskel Greenfield, and Aren Maeir
2020 Fingerprint Evidence for the Division of Labour and Learning Pottery-Making at Early Bronze Age Tell eṣ-Ṣâfi/Gath, Israel. *PLoS ONE* 15(4): 1-27.

Frangipane, Marcella
2010 Arslantepe. Growth and Collapse of an Early Centralised System: The Archaeological Evidence. In *Economic Centralisation in Formative States. The Archaeological Reconstruction of the Economic System in 4th Millennium Arslantepe*, edited by M. Frangipane, pp. 23-42. Sapienza Universita di Roma, Roma.

2018 Different Trajectories in State Formation in Greater Mesopotamia: A View from Arslantepe (Turkey). *Journal of Archaeological Research* 26: 3-63.

Fulford, M.
1984 Review: Pottery in the Roman World: An Ethnoarchaeological Approach. *Britannia* 15: 373-375.

Gannon, Megan
2015 Egyptians Brewed Beer in Tel Aviv 5,000 Years Ago. *LiveScience,* accessed October, 10, 2019.

Garfinkel, Steven J.
2013 Ancient Near Eastern City-States. In *The State in the Ancient Near East and Mediterranean*, edited by Peter Fibiger Bang, and Walter Scheidel, pp. 94-119. Oxford University Press, Oxford.

Gates, Charles
2011 *Ancient Cities: The Archaeology of Urban Life in the Ancient Near East and Egypt, Greece, and Rome*. Routledge, New York.

Genz, Hermann
2003 Cash Crop Production and Storage in the Early Bronze Age Southern Levant. *Journal of Mediterranean Archaeology* 16(1): 59-78.

Glanzman, William
1983 Examination of Xeroradiographic Pottery Manufacturing Techniques: A Test Case from the Baqah Valley, Jordan. *Masca Journal* 2(6): 163-169.

Goedicke, H.
1963 The Alleged Military Campaign in Southern Palestine in the Reign of Pepi I (VIth Dynasty). *Rivista Degli Studi Orientali* 38: 187-197.

Golani, Amir
1999 New Perspectives on Domestic Architecture and the Initial Stages of Urbanization in Canaan. *Levant* 31(1): 123-133.

2003 Salvage Excavations at the Early Bronze Age Site of Qiryat Ata. Israel Antiquities Authority, Jerusalem.

2013 The Transition from the Late Chalcolithic to the Early Bronze I in Southwestern Canaan - Ashqelon as a case for Continuity. *Paleorient* 39(1): 95-110.

2014 Ashkelon during the EB I Period - A Centre for Copper Processing and Trade. In *The Nile Delta as a Centre of Cultural Interactions between Upper Egypt and the Southern Levant in the 4th Millennium BC*, Vol 13, edited by Agnieszka Mączyńska, pp. 119-137. Studies in African Archaeology. Poznań Archaeological Museum, Poznań.

Golani, Amir, and Yossi Nagar
2011 Newly Discovered Burials of the Chalcolithic and the Early Bronze Age I in Southern Canaan - Evidence of Cultural Continuity? In *Culture, Chronology and the Chalcolithic: Theory and Transition*, edited by J. L. Lovell, and Y. M. Rowan, pp. 84-96. Levant Supplementary Series 9. Oxbow, Oxford.

Gophna, Ram
1998 Early Bronze Age Canaan: Some Spatial and Demographic Observations. In *The Archaeology of Society in the Holy Land*, edited by Thomas E. Levy, pp. 269-280. Leicester University Press, London.

Gophna, Ram, and N. Blockman
2004 The Neolithic, Chalcolithic, Early Bronze and Intermediate Bronze Age pottery. In *The Renewed Archaeological Excavations at Lachish (1973-1994)*, edited by David Ussishkin, pp. 873-899. Institute of Archaeology, Tel Aviv.

Gophna, Ram, and Dan Gazit
2006 The Southern Frontier of Canaan during the Early Bronze Age III: Some Neglected Evidence. In *'I will Speak the Riddles of Ancient Times': Archaeological and Historical Studies in Honour of Amihai Mazar*, edited by Aren M. Maeir, and Pierre de Miroschedji, pp. 33-38. Eisenbrauns, Winnoa Lake.

Goren, Yuval, and Netta Halperin
2001 Pottery Technology. In *Tel Te'o: A Neolithic, Chalcolithic, and Early Bronze Age Site in the Hula Valley*, edited by Emanuel Eisenberg, Avi Gopher, and Raphael Greenberg, pp. 157-162. Israel Antiquities Authority, Jerusalem.

Goren, Yuval, and Sharon Zuckerman
2000 An Overview of the Typology, Provenance and Technology of the Early Bronze Age I 'Gray Burnished Ware' In *Ceramics and Change in the Early Bronze Age of the Southern*

Levant, edited by Graham Philip, and Douglas Baird, pp. 165-182. Sheffield Academic Press, Sheffield.

Gosden, C., and Y. Marshall
1999 The Cultural Biography of Objects. *World Archaeology* 31(2): 169-178.

Gosselain, Olivier
1992 Technology and Style: Potters and Pottery Making Among the Bafia of Cameroon. *Man.* 27: 559-586.

1998 Social and Technical Identity in a Clay Crystal Ball. In *The Archaeology of Social Boundaries*, edited by Miriam T. Stark, pp. 78-106. Smithsonian Institution Press, Washington.

2000 Materializing Identities: an African perspective. *Journal of Archaeological Method and Theory* 7(3): 187-217.

2002 *Poteries du Cameroun Méridional. Styles Techniques et Rapports à L'Identité*. CNRS Editions, Paris.

2008 Mother Bella was not a Bella: Inherited and Transformed Traditions in Southwestern Niger. In *Cultural Transmission and Material Culture: Breaking Down Boundaries*, edited by Miriam T. Stark, Brenda J. Bowser, and Lee Horne, pp. 150-177. The University of Arizona Press, Tuscon, AZ.

2010 Exploring the Dynamics of African Pottery Cultures. In *The Archaeology of Regional Technologies: Case Studies from the Palaeolithic to the Age of the Vikings*, edited by Barndon Randi, Asbjorn Engevik, and Ingvild Oye, pp. 193-224. The Edwin Mellen Press, New York.

2011 History of Science and Technology and Anthropology. In *Oxford Handbook of the Archaeology of Ritual and Religion* edited by Timothy Insoll, pp. 243-260. Oxford University Press, Oxford.

2016 To Hell with Ethnoarchaeology. *Archaeological Dialogues* 23(2): 215-228.

Gosselain, Olivier, and Alexander Livingstone-Smith
2005 The Source: Clay Selection and Processing Practices in Sub-Saharan Africa.

Goulder, Jill
2010 Administrators' Bread: An Experiment-Based Re-Assessment of the Functional and Cultural Role of the Uruk Bevel-Rim Bowl. *Antiquity* 84(324): 351-362.

Greenberg, Raphael
2002 *Early Urbanizations in the Levant: A Regional Narrative*. Leicester University Press, London.

2003 Early Bronze Age Megiddo and Bet Shean: Discontinuous Settlement in Sociopolitical Context. *Journal of Mediterranean Archaeology* 16(1): 17-32.

2006a What's Cooking in Early Bronze Age II? In *'I will Speak the Riddles of Ancient Times': Archaeological and Historical Studies in Honour of Amihai Mazar*, edited by Aren M. Maeir, and Pierre de Miroschedji, pp. 3-6. Eisenbrauns, Winona Lake.

2006b Notes on the Early Bronze Age Pottery (the 1998-2000 seasons). In *Megiddo IV: The 1998: 2002 Seasons*, edited by Israel Finkelstein, David Ussishkin, and Baruch Halpern, pp. 149-165. Emery and Claire Yass Publications in Archaeology, Tel Aviv.

2011a Life in the City: Tel Bet Yerah in the Early Bronze Age. In *Daily Life, Materiality, and Complexity in Early Urban Communities of the Southern Levant: Papers in Honor of Walter E. Rast and R. Thomas Schaub*, edited by Meredith S. Chesson, Walter Emanuel Aufrecht, Ian Kuijt, Walter E. Rast, and R. Thomas Schaub, pp. 41-54. Eisenbrauns, Winona Lake.

2011b Travelling in (World) Time: Transformation, Commoditization, and the Beginnings of Urbanism in the Southern Levant. In *Interweaving Worlds Systemic Interactions in Eurasia, 7th to 1st Millennia BC*, edited by Toby C. Wilkinson, Susan Sherratt, and John Bennet, pp. 231-242. Oxbow Books, Oakville.

2013 Introduction to the Levant during the Early Bronze Age. In *The Oxford Handbook of the Archaeology of the Levant c. 8000-362 BCE*, edited by Ann E. Killebrew, and Margreet L. Steiner, pp. 269-277. Oxford University Press, Oxford.

2019 *The Archaeology of the Bronze Age Levant: from Urban Origins to the Demise of City-States, 3700-1000 BCE*. Cambridge World Archaeology. Cambridge University Press, Cambridge.

Greenberg, R., E. Eisenberg, S. Paz, and Y. Paz

2006 *Tel Bet Yerah: The Early Bronze Age Mound. Volume I. Excavation Reports, 1933-1986 (IA Reports 30)*. The Israel Antiquities Authority, Jerusalem.

Greenberg, Raphael, Sarit Paz, David Wengrow, and Mark Iserlis

2012 Tel Bet Yerah: Hub of the Early Bronze Age Levant. *Near Eastern Archaeology* 75(2): 88-107.

Greenberg, Raphael, and Naomi Porat

1996 A Third Millennium Levantine Pottery Production Center: Typology, Petrography, and Provenance of the Metallic Ware of Northern Israel and Adjacent Regions. *Bulletin of the American Schools of Oriental Research* (301): 5-24.

Greene, A. F., C. W. Hartley, P. N. Doumani Dupuy, and M. Chinander

2017 The Digital Radiography of Archaeological Pottery: Program and Protocols for the Analysis of Production. *Journal of Archaeological Science* 78: 120-133.

Greenfield, H., Shai, I., and Maeir, A.
2017 The Early Bronze Age at Tell eṣ-Ṣâfi/Gath. *Near Eastern Archaeology* 80(4): 247-254.

Greenfield, Haskel, Shai Itzick, and Aren Maeir
2012 Being an "Ass": An Early Bronze Age Burial of a Donkey from Tell eṣ-Ṣâfi/Gath, Israel. *Bioarchaeology of the Near East* 6:21-52.

Greenfield, Haskel J., Itzhaq Shai, and Aren M. Maeir
2016 Understanding Early Bronze Urban Patterns from the Perspective of an EB III Commoner Neighbourhood: The Excavations at Tell eṣ-Ṣâfi/Gath, Israel. In *Proceedings of 9th International Congress on the Archaeology of the Ancient Near East (June 9-13, 2014, Basel), Vol. 3*, edited by Rolf A. Stucky, Oskar Kaelin, and Hans-Peter Mathys, pp. 479-485. Harrassowitz Verlag, Wiesbaden.

Harrison, Timothy P.
2011 Community Life, Household Production, and the Ceramic Industry at EBA Tall al-ʿUmayri. In *Daily Life, Materiality, and Complexity in Early Urban Communities of the Southern Levant: Papers in Honor of Walter E. Rast and R. Thomas Schaub*, edited by Meredith S. Chesson, Walter Emanuel Aufrecht, Ian Kuijt, Walter E. Rast, and R. Thomas Schaub, pp. 281-297. Eisenbrauns, Winona Lake.

Harrison, Timothy P., and Steven H. Savage
2003 Settlement Heterogeneity and Multivariate Craft Production in the Early Bronze Age Southern Levant. *Journal of Mediterranean Archaeology* 16:33-57.

Haudricourt, A. G.
1987 *La Technologie Science Humaine. Recherches d'Histoire et d'Ethnologie des Techniques*. Editions de la Maison des Sciences de l'Homme, Paris.

Hawkes, Christopher
1954 Archaeology Theory and Method: Some Suggestions from the Old World. *American Anthropologist* 56: 155-168.

Hegmon, Michelle
1992 Archaeological Research on Style. *Annual Review of Anthropology* 21: 517-536.

1998 Technology, Style, and Social Practices: Archaeological Approaches. In *The Archaeology of Social Boundaries*, edited by Miriam T. Stark, pp. 264-279. Smithsonian Institution Press, Washington, D.C.

2000 Advances in Ceramic Ethnoarchaeology. *Journal of Archaeological Method and Theory* 7(3): 129-137.

Hendrix, Ralph E., Philip R. Drey, and J. Bjornar Storfjell

1997 *Ancient Pottery of Transjordan: An Introduction Utilizing Published Whole Forms, Late Neolithic through Late Islamic*. Institute of Archaeology/Horn Archaeological Museum, Andrews University, Berrien Springs, MI.

Herr, Larry G.
2002 W. F. Albright and the History of Pottery in Palestine. *Near Eastern Archaeology* 65(1): 51-55.

Herr, Larry, and Douglas. R. Clark
2009 From the Stone Age to the Middle Ages in Jordan: Digging up Tall al-'Umayri. *Near Eastern Archaeology* 72(2): 68-97.

Hitchcock, Louise A., and Aren M. Maeir
2018 New Insights into the Philistines in light of Excavations at Tell eṣ-Ṣâfi/Gath. *Near Eastern Archaeology* 81(1): 6-14.

Hodder, Ian
1987a The Meaning of Discard: Ash and Domestic Space in Baringo, Kenya. In *Method and Theory for Activity Area Research: An Ethnoarchaeological Approach*, edited by S. Kent, pp. 424-448. Columbia University Press, New York.

1987b The Contextual Analysis of Symbolic Meanings. In *The Archaeology of Contextual Meanings*, Vol 1, edited by I. Hodder, pp. 1-10. Cambridge University Press, Cambridge.

1991 *Reading the Past: Current Approaches to Interpretation in Archaeology*, Second Edition. Cambridge University Press, Cambridge.

1992 *Theory and Practice in Archaeology*. Routledge, London.

2003 *Reading the Past: Current Approaches to Interpretation in Archaeology*, Third Edition. Cambridge University Press, Cambridge.

Hope, C. A.
1987 Experiments in the Manufacture of Ancient Egyptian pottery. In *Ceramics from the Dakhleh Oasis: Preliminary Studies*, edited by W. I. Edwards, C. A. Hope, and E. R. Segnit, pp. 103-105. Victoria College Press, Melbourne.

Horowitz, Aaron
2006 Palynology at 'En Sur: The Advance of Marshes as a Possible Cause for Settlement Dispersion. In *'En Esur ('Ein Asawir) I: Excavations at a Protohistoric Site in the Coastal Plain of Israel*, Vol 31, edited by Eli Yannai, pp. 267-268. IAA Reports 31. Israel Antiquities Authority, Jerusalem.

Hruby, Julie
2007 Ritualized Chipped-Stone Production at Piedras Negras, Guatemala. *Archeological Papers of the American Anthropological Association* 17(1): 68-87.

Hunt, Alice
2016 Introduction to the Oxford Handbook of Archaeological Analysis. In *The Oxford Handbook of Archaeological Ceramic Analysis*, edited by Alice Hunt, pp. 3-6. Oxford University Press, Oxford.

Ilan, Ornit
2001 Household Archaeology at Arad and Ai in the Early Bronze Age II. In *Studies in the Archaeology of Israel and Neighbouring Lands in Memory of Douglas L. Esse*, edited by Douglas L. Esse, and Samuel Richard Wolff, pp. 317-354. Oriental Institute of the University of Chicago, Chicago.

Ingold, Tim
1993 The Temporality of the Landscape. *World Archaeology* 25(2): 152-174.

2000 *The Perception of Environment: Essays on Livelihood, Dwelling and Skill*. Routledge, London.

Inomata, Takeshi
2007 Classic Maya Elite Competition, Collaboration, and Performance in Multicraft Production. In *Craft Production in Complex Societies: Multicraft and Producer Perspectives*, edited by I. Shimada, pp. 120-133. University of Utah Press, Salt Lake City.

Insoll, Timothy
2005 Archaeology of Cult and Religion. In *Archaeology The Key Concepts*, edited by Colin Renfrew and Paul Bahn, pp. 33-36. Routledge, London.

Ionescu, C., V. Hoeck, O. N. Crandell, and K. Saric
2015 Burnishing versus Smoothing in Ceramic Surface Finishing: a SEM study. *Archaeometry* 57(1): 18-26.

Iserlis, Mark
2009 Khirbet Kerak Ware at Bet Yerah: Segregation and Integration through Technology. *Tel Aviv* 36(2): 181-195.

Iserlis, Mark, Raphael Greenberg, and Yuval Goren
2012 A Technological Study of the Early Bronze Age III Pottery. In *Excavations at Tel Beth-Shean 1989–1996*, edited by Amihai Mazar, pp. 318-337. The Israel Exploration Society, Jerusalem.

Islam, Manirul, and H. P. Sarma
2014 Anthropometric Measurements of the Hand Length and Their Correlation with the Stature of Ethnic Tribal Adult Males of Tripura. *Journal of Evidence Based Medicine and Healthcare* 1(13): 1589-1594.

Jeffra, Caroline

2013 A Re-Examination of Early Wheel Potting in Crete. *The Annual of the British School at Athens* 108: 31-49.

Jennings, Justin, and Timothy Earle
2016 Urbanization, State Formation, and Cooperation: A Reappraisal. *Current Anthropology* 57(4): 474-493.

Joffe, Alexander
1998 Alcohol and Social Complexity in Ancient Western Asia. *Current Anthropology* 39: 297-322.

2013 Review of Daily Life, Materiality, and Complexity in Early Urban Communities of the Southern Levant: Papers in Honour of Walter E. Rast and R. Thomas Schaub, ed. M. S. Chesson *Bulletin of the American Schools of Oriental Research* 370: 230-234.

2018 Notes on Early Bronze Age Commensality. In *Tell it in Gath: Studies in the History and Archaeology of Israel: Essays in Honor of Aren M. Maeir on the Occasion of his Sixtieth Birthday*, edited by Itzhaq Shai, Jeffrey R. Chadwick, Louise Hitchcock, Amit Dagan, Chris McKinny, and Joe Uziel, pp. 41-70. Zaphon, Munster.

Johnson, Gregory A.
1973 *Local Exchange and Early State Development in Southwestern Iran*. Museum of Anthropology, University of Michigan, Ann Arbor.

1975 Locational Analysis and the Investigation of Uruk Local Exchange Systems. Ancient Civilization and Trade. *Ancient Civilization and Trade* 285-339.

Johnson, Matthew
1999 *Archaeological Theory: An Introduction*. Wiley-Blackwell Publishers, Malden.

2010 *Archaeological Theory: An Introduction. 2nd Edition*. Wiley-Blackwell, Malden.

Kafafi, Zeidan
2011 Jordanian-Egyptian Interaction during the Third Millennium B.C.E. as Evidenced by the Abydos Ware. In *Daily life, Materiality, and Complexity in Early Urban Communities of the Southern Levant: Papers in Honor of Walter E. Rast and R. Thomas Schaub*, edited by Meredith S. Chesson, Walter Emanuel Aufrecht, Ian Kuijt, Walter E. Rast, and R. Thomas Schaub, pp. 139-152. Eisenbrauns, Winona Lake, Ind.

Karasik, Avshalom, and Uzy Smilansky
2008 3D Scanning Technology as a Standard Archaeological Tool for Pottery Analysis: Practice and Theory. *Journal of Archaeological Science* 35: 1148-1168.

Katz, Jill C.
2017 Building a City Wall: An Administrative Perspective. *Near Eastern Archaeology* 80(4): 282-284.

Kenyon, Kathleen
1960a *Archaeology in the Holy Land*. Benn, London.

1960b *Excavations at Jericho I: The Tombs Excavated in 1952-4*. British School of Archaeology in Jerusalem, London.

Kempinski, Aharon
1992 Fortifications, Public Buildings, and Town Planning in the Early Bronze Age. In *The Architecture of Ancient Israel from the Prehistoric to the Persian Periods: In Memory of Immanuel (Munya) Dunayevsky*, edited by Aharon Kempinski, and Immanuel Dunayevsky, pp. 68-80. Israel Exploration Society, Jerusalem.

Khurt, Amélie, and Fergus Millar
2006 *The Ancient Near East c. 3000-330 BC*. Routledge, London.

Klassen, Stanley
2009 Petrographic Analysis of EB III Ceramics from Tall al-'Umayri, Jordan: A Re-Evaluation of Levels of Production. In *Interpreting Silent Artefacts: Petrographic Approaches to Archaeological Petrography*, pp. 189-210. Archaeopress, Oxford.

Klassen, Stanley, and Timothy Harrison
2019 The Madaba Settlement Cluster and the Nature of Early Bronze Age Urbanism in the Central Highlands of Jordan. Paper presented at the ASOR Annual Meeting.

Kotsonas, Antonis
2014 *Understanding Standardization and Variation in Mediterranean Ceramics: Mid 2nd to Late 1st Millennium BC*. Peeters, Leuven.

Koval, Oksana
2018 *Using Supervised Machine Learning to Classify Ceramic Fabrics. Unpublished M.A. Thesis*, Department of Anthropology, University of Manitoba.

Kradin, Nikolay N.
2009 State Origins in Anthropological Thought. *Social Evolution & History* 8(1): 25-51.

Kramer, Carol
1985 Ceramic Ethnoarchaeology. *Annual Review of Anthropology* 14: 77-102.

Laila, S., R. Ferdousi, A. Nurunnobi, A. Islam, S. Holy, and F. Yesmin
2009 Anthropometric Measurements of the Hand Length and their Correlation with the Stature of Bengali Adult Muslim Females. *Bangladesh Journal of Anatomy* 7(1): 10-13.

Laneri, Nicola

2011 The Life-History of the Potter's Wheel in the Ancient Near East. In *Archaeological Ceramics: A Review of Current Research,* Vol 2193, edited by Simon Scarcella, pp. 64-72. BAR International Series.

Langgut, Dafna , Matthew J. Adams, and Israel Finkelstein
2016 Climate, Settlement Patterns and Olive Horticulture in the Southern Levant during the Early Bronze and Intermediate Bronze Ages (c. 3600–1950 BC). *Levant* 48(2): 1-18.

Lave, J., and E. Wenger
1991 *Situated Learning: Legitimate Peripheral Participation*. Cambridge University Press, Cambridge.

Lawrence, Dan, Graham Philip, Hannah Hunt, Lisa Snape-Kennedy, T. J. Wilkinson, and Peter F. Biehl
2016 Long Term Population, City Size and Climate Trends in the Fertile Crescent: A First Approximation. *PLoS ONE* 11(3): 1-16.

Lawrence, Dan, and T. J. Wilkinson
2015 Hubs and Upstarts: Pathways to Urbanism in the Northern Fertile Crescent. *Antiquity* 89(344): 328-344.

Lemonnier, Pierre
1989 Bark Capes, Arrowheads and Concorde: On Social Representations of Technology. In *The Meanings of Things: Material Culture and Symbolic Expression*, edited by Ian Hodder, and World Archaeological Congress, pp. 156-171. Unwin Hyman, London.

1992 *Elements for an Anthropology of Technology*. Anthropological Papers, Museum of Anthropology, University of Michigan, No.88. Ann Arbor, Michigan.

Lepère, Cédric
2014 Experimental and Traceological Approach for a Technical Interpretation of Ceramic Polished Surfaces. *Journal of Archaeological Science* 46: 144-155.

Leroi-Gourhan, Andre
1943 *Evolution and Techniques I-Man and Matter*. Albin Michel, Paris.

1945 *Evolution and Techniques II-Medium and Techniques*. Albin Michel, Paris.

1964 *Le Geste et la Parole. Technique et Langue*. Albin Michel, Paris.

1993 *Gesture and Speech*. MIT Press, Cambridge, Mass.

Levy, Thomas E., Russell B. Adams, Andreas Hauptmann, Michael Prange, Sigrid Schmitt-Strecker, and Mohammad Najjar
2002 Early Bronze Age Metallurgy: A Newly Discovered Copper Manufactory in Southern Jordan. *Antiquity* 76: 425-437.

Levy-Reifer, A.
2012 The Early Bronze Age in the Judean Shephelah. In *Tell eṣ-Ṣâfi/Gath I: The 1996-2005 seasons*, edited by Aren M. Maeir, pp. 557-566. Harrasowitz Verlag, Wiesbaden.

Lindahl, Anders, and Innocent Pikirayi
2010 Ceramics and Change: An Overview of Pottery Production Techniques in Northern South Africa and Eastern Zimbabwe during the First and Second Millennium AD. *Archaeological Anthropological Sciences* 2(3): 133-149.

Livingstone Smith, Alexandre
2007 *Chaîne Opératoire de la Poterie: Références Ethnographiques, Analyses et Reconstitution*. Musée royal de l'Afrique centrale, Tervuren.

Logan, A., and M. Dores-Cruz
2014 Gendered Taskscapes: Food, Farming, and Craft Production in Banda, Ghana in the Eighteenth to Twenty-First Centuries. *African Archaeological Review* 31: 203-231.

London, Gloria
1988 The Organization of the Early Bronze II and III Ceramics Industry at Tel Yarmuth - A Preliminary Report. In *Yarmouth I: Rapport sur les Trois Premières Campagnes de Fouilles à Tel Yarmouth, Israël. Editions Recherche sur les Civilizations 76*, edited by P. de Miroschedji, pp. 117-124. Recherche sur les Civilizations, Paris.

1991 Aspects of Early Bronze and Late Iron Age Ceramic Technology at Tell el-'Umeiri. In *Madaba Plains Project 2: The 1987 Season at Tell el-'Umeiri and Vicinity and Subsequent Studies*, Vol 2, edited by L. Geraty, L. Herr, Ø. LaBianca, and R. Younker, pp. 383-419. Andrews University Press, Berrien Springs.

1995 A Comparison of Bronze and Iron Age Pottery Production on Material from the Madaba Plains Region. *Studies in the History and Archaeology of Jordan* 5: 603-606.

2014 Appendix ID: Manufacturing Technique of the Third Millennium BCE Flat-Bottomed Pots. In *Excavation at the Early Bronze IV sites of Jebel Qa'aqir and Be'er Resisim*, edited by William G. Dever, pp. 253-277. Eisenbrauns, Winona Lake.

London, G. , H. Plint, and J. Smith
1991a Preliminary Petrographic Analysis of Pottery from Tell el-'Umeiri and Hinterland Sites. In *Madaba Plains Project 2: The 1987 Season at Tell el-'Umeiri and Vicinity and Subsequent Studies*, edited by L. Geraty, L. Herr, Ø. LaBianca, and Younker R., pp. 429-439. Andrews University Press, Berrien Springs.

London, Gloria, and Marlene Sinclair
1991b An Ethnoarchaeological Survey of Potters in Jordan. In *Madaba Plains Project 2: The 1987 Season at Tell el-'Umeiri and Vicinity and Subsequent Studies*, Vol 2, edited by L. Geraty, L. Herr, Ø. LaBianca, and R. Younker, pp. 420-428. Andrews University Press, Berrien Springs.

Longacre, William A.
1999 Standardization and Specialization: What's the Link? . In *Pottery and People: A Dynamic Interaction*, edited by James M. Skibo, and G. Feinman, pp. 44-58. University of Utah Press, Salt Lake City.

Longacre, William A., Kenneth L. Kvamme, and Masashi Kobayashi
1988 Southwestern Pottery Standardization: An Ethnoarchaeological View from the Philippines. *Kiva* 53(2): 101-112.

Lyons, Claire, and John Papadopoulos
2002 Archaeology and Colonialism. In *The Archaeology of Colonialism*, edited by John Papadopoulos, and Claire Lyons, pp. 1-26. The Getty Research Institute, Los Angeles.

Mackenzie, Duncan, Shlomo Bunimovitz, Zvi Lederman, and Nicoletta Momigliano
2016 *The Excavations of Beth Shemesh, November-December 1912. PEF Annual XIII*. Routledge, London.

Maeir, Aren M.
2012 The Tell eṣ-Ṣâfi/Gath Archaeological Project 1996-2010: Introduction, Overview and Synopsis of Results. In *Tell eṣ-Ṣâfi/Gath I. Report on the 1996–2005 Seasons. Ägypten und Altes Testament 69 (vol. 1/text)*, edited by Aren M. Maeir, pp. 1-88. Harrassowitz Verlag in Komnmission, Wiesbaden.

Magrill, Pamela, and Andrew Middleton
2004 Studies in Pottery, Petrography, Geology, Environment and Technology. Section A: Late Bronze Age Pottery Technology: Cave 4034 Revisited. In *The Renewed Archaeological Excavations at Lachish (1973-1994)*, edited by David Ussishkin, pp. 2514-2549. Emery and Claire Yass Publications in Archaeology, Tel Aviv.

Maisels, Charles Keith
1999 *Early Civilizations of the Old World: The Formative Histories of Egypt, the Levant, Mesopotamia, India, and China*. Routledge, London.

Martineau, Remi
2003 Methodology for the Archaeological and Experimental Study of Pottery Forming Techniques. In *Proceedings of the 6th European Meeting on Ancient Ceramics*, edited by S. Di Pierro, V. Serneels, and M. Maggetti, pp. 209-216. Ceramics in the Society Fribourg.

Martinón-Torres, Marcos
2002 Chaîne opératoire: The Concept and its Applications within the Study of Technology. *Gallaecia* 21: 29-44.

Matson, Frederick R.
1965 Ceramic Ecology: An Approach to the Study of the Early Cultures of the Near East. In *Ceramics and Man*, pp. 277-287. Wenner-Gren Foundation for Anthropological Research, New York.

Mauss, Marcel
1992 Techniques of the Body: Introduction. In *Incorporations*, edited by Jonathan Crary, and Sanford Kwinter, pp. 455-477. Zone, New York.

Mazar, Amihai
1992 *Archaeology of the Land of the Bible 10,000-586 BCE*. Doubleday, London.

2001 On the Significance of the Early Bronze Age III Granary Building at Beit Yerah. In *Studies in the Archaeology of Israel and Neighbouring Lands in Memory of Douglas L. Esse*, Vol 59, edited by S. Wolff, pp. 447-464, Vol. SAOC. The Oriental Institute, The University of Chicago Press, Chicago.

2012 Chapter 1: Introduction and Synthesis. In *Excavations at Tel Beth-Shean 1989-1996 Volume IV: The 4th and 3rd Millennium BCE*, edited by Amihai Mazar, pp. 1-33. Israel Exploration Society, Jerusalem.

Mazar, Amihai, and Yael Rotem
2009 Tel Beth Shean during the EB IB Period: Evidence for Social Complexity in the Late 4th Millennium bc *Levant* 41: 131-153.

2012 The Small Finds from the Early Bronze and Intermediate Bronze Ages. In *Excavations at Tel Beth-Shean 1989-1996 Volume IV: The 4th and 3rd Millennium BCE,* edited by Amihai Mazar, pp. 350-390. Israel Exploration Society, Jerusalem.

McMahon, Augusta
2013 Mesopotamia. In *The Oxford Handbook of Cities in World History*, edited by P. Clark, pp. 31-48. Oxford University Press, Oxford.

Medeghini, Laura, Maura Sala, Caterina De Vito, and Silvano Mignardi
2019 A Forgotten Centre of Ceramic Production in Southern Levant: Preliminary Analytical Study of the Early Bronze Age Pottery from Tell el-Far'ah North (West Bank). *Ceramics International* 45: 457-467.

Merrillees, R.
1991 The Principles of Cypriot Bronze Age Pottery Classification. In *Cypriot Ceramics: Reading the Prehistoric Record*, edited by Jane A. Barlow, Diane L. Bolger, and Barbara Kling, pp. 237-240. The A.G. Leventis Foundation, Pennsylvania.

Michel, R. H. , and V. R. Badler
1992 Chemical Evidence for Ancient Beer. *Nature* 360: 24.

Michelaki, Kostalena
2007 More than Meets the Eye: Reconsidering Variability in Iroquoian Ceramics. *Canadian Journal of Archaeology* 31(2): 143-170.

Milevski, Ian
2011 *Early Bronze Age Goods Exchange in the Southern Levant: A Marxist Perspective*. Equinox, London.

Miller, Heather M. L.
2007 *Archaeological Approaches to Technology*. Elsevier, New York.

Mohamed, M. H.
2013 Measurement of Foot and Hand Dimensions and Their Correlation with Height in Adult Upper Egyptian. *Asian Academy of Management Journal* 10(4): 300-316.

Montanari, Daria
2020 Metal Weapons and Social Differentiation at Bronze Age Tell es-Sultan. In *Digging up Jericho*, edited by R. Thyrza Sparks, B. Finlayson, B. Wagemakers, and J. M. Briffa, pp. 115-127. Archaeopress, Oxford.

Moorey, P. R. S.
1994 *Ancient Mesopotamian Materials and Industries: The Archaeological Evidence*. Oxford University Press, Oxford.

Muhly, J. D.
1992 The Crisis Years in the Mediterranean World: Transition or Cultural Disintegration? In *The Crisis Years: The 12th century B.C. from beyond the Danube to the Tigris*, edited by W. A. Ward, and M. S. Joukowsky, pp. 10-26. Kendall/Hunt, Dubuque.

Müller, Miriam
2013 Introduction: Household Studies in Complex Societies: (Micro) Archaeological and Textual Approaches. In *Household Studies in Complex Societies: (Micro) Archaeological and Textual Approaches*, edited by Miriam Müller, pp. XIII-XLIII. The University of Chicago Oriental Institute Seminars. The University of Chicago Press, Chicago.

Nigro, Lorenzo
2007 Aside the Spring: Byblos and Jericho from Village to Town in the Second Half of the 4th Millennium BC. In *Byblos and Jericho in the Early Bronze I: Social Dynamics and Cultural Interactions*, Vol 4, edited by L. Nigro, pp. 1-45. Rosapat Sapienza, Roma.

2008 *Khirbet al-Batrawy II: The EB II City-Gate, the EB II-III Fortifications, the EB II-III Temple; Preliminary Report of the Second (2006) and Third (2007) Season of Excavations*. Rosapat Sapienza, Roma.

2010 *Tell es-Sultan/Jericho in the Early Bronze II (3000-2700 BC): The Rise of an Early Palestinian city; a Synthesis of the Results of Four Archaeological Expeditions*. Studies on the Archaeology of Palestine & Transjordan, Vol. 5. Rosapat Sapienza, Roma.

2014 The Copper Route and the Egyptian Connection in the 3rd Millennium BC Jordan seen from the Caravan City of Khirbet Al-Batrawy. *Vicino Oriente* 28:39-64.

2016 Tell es-Sultan 2015: A Pilot Project for Archaeology in Palestine. *Near Eastern Archaeology* 79(1): 4-17.

2019 Tell es-Sultan/Ancient Jericho in the Early Bronze Age II-III. In *Conceptualizing Urban Experiences: Tell es-Sultan and Tall al-Hammam Early Bronze Cities across the Jordan*, edited by Elisabetta Gallo, pp. 79-108. Rosapat Sapienza, Roma.

Nigro, Lorenzo, Lucio Calcagnile, Jehad Yasin, Elisabetta Gallo, and Gianluca Quarta
2018 Jericho and the Chronology of Palestine in the Early Bronze Age: A Radiometric Re-Assessment. *Radiocarbon* 2018: 1-31.

Nissen, Hans J.
2001 Cultural and Political Networks in the Ancient Near East during the Fourth and Third Millennium B.C. In *Uruk Mesopotamia & Its Neighbours Cross-Cultural Interactions in the Era of State Formation*, edited by Mitchell S. Rothman, pp. 149-180. School of American Research Press, Santa Fe.

Normille, D.
2012 Experiments Probe Language's Origins and Development. *Science* 336: 408-411.

Oates, Joan, Augusta McMahon, Philip Karsgaard, Salam Al Quntar, and Jason Ur
2007 Early Mesopotamian Urbanism: A New View from the North. *Antiquity* 81(313): 585-600.

Oria, R.S. , A.O. Igiri, O.A. Egwu, and M.E. Nandi
2016 Prediction of Stature from Hand Length and Breadth – Anthropometric Study on an Adult Cross River State Population. *Annals of Bioanthropology* 4: 12-16.

Orton, Clive, and Michael Hughes
2013 *Pottery in Archaeology*. 2nd ed. Cambridge University Press, Cambridge.

Parr, Peter J.
1969 The Foreign Relations of Palestine During the Early Bronze Age. By J. B. Hennessy. I i\ X 9f. Pp. xx+ 122+77 pis.+9 charts. London: Quaritch for Colt Archaeological Institute,1967. Price not stated. Review. *The Antiquaries Journal* 49(1): 140-141.

2000 Proto-Urban Jericho: The Need for Reappraisal. In *The Archaeology of Jordan and Beyond*, edited by Lawrence Stager, pp. 389-397. The Harvard Semitic Museum, Harvard.

Parker, Bradley J., and Catherine P. Foster (editors)
2012 *New Perspectives on Household Archaeology*. Eisenbrauns, Winona Lake.

Paz, Yitzhak, and M. Iserlis
2009 Golanite Production and Distribution Center of Cooking Pots during the Early Bronze Age II In *Techniques and People: Anthropological Perspectives on Technology in the*

Archaeology of the Proto-Historic and Early Historic Periods in the Southern Levant, edited by S. Rosen, and V. Roux, pp. 99-110. De Boccard, Paris.

Peacock, D. P. S.
1982 *Pottery in the Roman World: An Ethnoarchaeological Approach*. Longman, London.

Petrie, W. M. F.
1891 *Tell El Hesy (Lachish)*. Palestine Exploration Fund, London.

Pfaffenberger, Bryan
1992 Social Anthropology of Technology. *Annual Review of Anthropology* 21: 491-516.

Philip, Graham
2003 The Early Bronze Age of the Southern Levant: A Landscape Approach. *Journal of Mediterranean Archaeology* 16: 103-132.

2008 The Early Bronze Age I-III. In *Jordan: An Archaeological Reader*, edited by Russell Adams, pp. 161-226. Equinox, London.

Philip, G., P.W. Clogg, and D. Dungworth
2003 Copper Metallurgy in the Jordan Valley from the 3rd to the 1st Millennia BC: Chemical, Metallographic, and Lead Isotope Analyses of Artifacts from Pella *Levant* (35):71-100.

Pierret, A., C. J. Moran, and L. M. Bresson
1996 Calibration and Visualization of Wall-Thickness and Porosity Distributions of Ceramics Using X-radiography and Image Processing. *Journal of Archaeological Science* 23(3): 419-428.

Pitard, Wayne T.
2001 Before Israel: Syria-Palestine in the Bronze Age. In *The Oxford History of the Biblical World*, edited by Michael D. Coogan, pp. 25-57. Oxford University Press, Oxford.

Pollock, Susan
2001 The Uruk Period in Southern Mesopotamia. In *The Uruk Period in Southern Mesopotamia. In Uruk Mesopotamia and Its Neighbors: Cross-cultural Interactions in the Era of State Formation*, edited by Mitchell S. Rothman, pp. 181-231. School of American Research, Santa Fe.

2008 *Ancient Mesopotamia: The Eden that Never Was*. Cambridge University Press, Cambridge.

Porat, Naomi
1989 Petrography of Pottery from Southern Israel and Sinai. In *L'Urbanisation de la Palestine a l'Age du Bronze Ancien*, edited by Pierre de Miroschedji, pp. 169-188, BAR International Series 527. BAR, Oxford.

Portugali, Juval, and Ram Gophna

1993 Crisis, Progress and Urbanization: The Transition from Early Bronze I to Early Bronze II in Palestine. *Tel Aviv* 20(2): 164-186.

Powell, Marvin
1992 Weights and Measures. In *The Anchor Yale Bible Dictionary (ABD)*, Vol 6, edited by David Noel Freedman, pp. 897-908. Doubleday, New York.

Rast, Walter, and R. Thomas Schaub
2003 The Shaft Tomb Pastoralists of Stratum V. The Stratum III Town. In *Bâb edh-Dhrâ: Excavations at the Town Site (1975–1981)*, edited by Walter Rast, and R. Thomas Schaub, pp. 62-218. Eisenbrauns, Winoa Lake.

Redford, Donald B.
1997 The Ancient Egyptian 'City': Figment or Reality. In *Urbanism in Antiquity: from Mesopotamia to Crete*, edited by Walter E. Aufrecht, Neil A. Mirau, and Steven W. Gauley, pp. 210-220. Sheffield Academic Press, Sheffield.

Reedy, Chandra L.
2008 *Thin-Section Petrography of Stone and Ceramic Cultural Materials*. Archaeopress, London.

Regev, Johanna, Pierre de Miroschedji, Raphael Greenberg, Eliot Braun, Zvi Greenhut, and Elisabetta Boaretto
2012 Chronology of the Early Bronze Age in the Southern Levant: New Analysis for a High Chronology. *Radiocarbon* 54: 525-566.

Regev, Johanna, Israel Finkelstein, Matthew J Adams, and Elisabetta Boaretto
2014 Wiggle-Matched ^{14}C Chronology of Early Bronze Megiddo and the Synchronization of Egyptian and Levantine Chronologies. *Egypt and the Levant* 24: 243-266.

Renfrew, Colin, and Paul Bahn
2008 *Archaeology: Theories, Methods, and Practice*. Fifth ed. Thames & Hudson, London.

Rice, Prudence M.
1987 *Pottery Analysis: A Sourcebook*. University of Chicago Press, Chicago.

1991 Specialization, Standardization, and Diversity: A Retrospective. In *The Ceramic Legacy of Anna O. Shepard*, edited by R. Bishop, and F. Lange, pp. 258-279. University Press Colorado, Colorado.

2015 *Pottery Analysis: A Sourcebook, Second Edition*. University of Chicago Press, Chicago.

Richard, Suzanne
2003 The Early Bronze Age in the Southern Levant. In *Near Eastern Archaeology: A Reader*, edited by Suzanne Richard, pp. 286-302. Eisenbrauns, Winona Lake.

Roe, Jason
2009 Making and Understanding Embarras Bipoints: The Replication and Operational Sequencing of a Newly Defined Diagnostic Stone Tool from the Eastern Slopes of Alberta. In *Tools of the Trade: Methods, Techniques and Innovative Approaches in Archaeology*, edited by Jane Wilkins, and Kirsten Anderson, pp. 75-90. University of Calgary Press, Calgary

Rosen, Arlene, and Steve Rosen
2001 Determinist or Not Determinist?: Climate, Environment, and Archaeological Explanation in the Levant. In *Studies in the Archaeology of Israel and Neighbouring Lands in Memory of Douglas L. Esse*, edited by Douglas L. Esse, and Samuel Richard Wolff, pp. 535-550. Oriental Institute of the University of Chicago, Chicago.

Ross, J., Fowler, K., Shai, I., Greenfield, H., and Maeir, A.
2018 A Scanning Method for the Identification of Pottery Forming Techniques at the Mesoscopic Scale: A Pilot Study in the Manufacture of Early Bronze Age III Holemouth Jars and Platters from Tell eṣ-Ṣâfi/Gath. *Journal of Archaeological Science Reports* 18: 551-561.

Ross, Jon, Haskel Greenfield, Kent Fowler, and Aren Maeir
2020. In Search of Early Bronze Age Potters at Tell eṣ-Ṣâfi/Gath: A New Perspective on Vessel Manufacture for Discriminating *Chaînes Opératoires*. *Archaeology Review Cambridge* 35(1): 74-89.

Rotem, Yael
2012 The Early Bronze Age IB Pottery from Strata M-3 and M-2. In *Excavations at Tel Beth-Shean 1989–1996*, edited by Amihai Mazar, pp. 123-236. The Israel Exploration Society, Jerusalem.

Rotem, Y., M. Iserlis, F. Hoflmayer, and Y. M. Rowan
2019 Tel Yaqush - An Early Bronze Age Village in the Central Jordan valley, Israel. *Bulletin of the American Schools of Oriental Research* 381(1): 107-144.

Rothman, Mitchell S.
2000 The Commoditization of Goods and the Rise of the State in Ancient Mesopotamia. In *Commodities and Globalization: Anthropological Perspectives*, edited by M. Priscilla Stone, and Peter D. Little, pp. 163-178. Rowman & Littlfield Publishers, Inc., Oxford.

2001 The Local and the Regional: Introduction. In *Uruk Mesopotamia and Its Neighbours: Cross-Cultural Interactions in the Era of State Formation*, pp. 3-26. SAR Press, Santa Fe.

2004 Studying the Development of Complex Society: Mesopotamia in the Late Fifth and Fourth millennia BC. *Journal of Archaeological Research* 12(1): 75-119.

Rothman, Mitchell S., and B. Peasnall
2000 Societal Evolution of Small, Pre-State Centers and Polities: The Example of Tepe Gawra in Northern Mesopotamia. *Paléorient* 25(1): 101-114.

Roux, Valentine
2003a Ceramic Standardization and Intensity of Production: Quantifying Degrees of Specialization. *American Antiquity* 68: 768-782.

2003b A Dynamic Systems Framework for Studying Technological Change: Application to the Emergence of the Potter's Wheel in the Southern Levant. *Journal of Archaeological Method and Theory* 10(1): 1-30.

2009 Wheel Fashioned Ceramic Production during the Third millennium BCE in the Southern Levant: A Perspective from Tel Yarmuth. In *Techniques and People: Anthropological Perspectives on Technology in the Archaeology of the Proto-Historic and Early Historic Periods in the Southern Levant*, edited by Steven A. Rosen, and V. Roux, pp. 195-212. de Boccard, Paris.

2013 Ethnoarchaeology in France: Trends and Perspectives. In *Contesting Ethnoarchaeologies: Traditions, Theories, Prospects*, edited by A. Marciniak, and N. Yalman, pp. 17–34. One World Archaeology 7. Springer, New York.

Roux, Valentine, and Daniela Corbetta
1989 *The Potter's Wheel: Craft Specialization and Technical Competence*. Oxford & IBH Pub. Co, New Delhi.

Roux, Valentine, and M. A. Courty
1995 Identification of Wheel Throwing on the Basis of Ceramic Surface Features and Microfabrics. *Journal of Archaeological Science* 22: 17-50.

1998 Identification of Wheel-Fashioning Methods: Technological Analysis of 4th-3rd Millennium BC Oriental Ceramics. *Journal of Archaeological Science* 25: 747-763.

Roux, Valentine, and Pierre de Miroschedji
2009 Revisiting the History of the Potter's Wheel in the Southern Levant. *Levant* 41(2): 155-173.

Rowan, Yorke M., and J. Golden
2009 The Chalcolithic Period of the Southern Levant: A Synthetic Review. *Journal of World Prehistory* 22: 1-92.

Rye, Owen S.
1977 Pottery Manufacturing Techniques: X-ray Studies. *Archaeometry* 19(2): 205-211.

1981 *Pottery Technology: Principles and Reconstruction*. Taraxacum, Washington, D.C.

Sackett, J. R.
1977 The Meaning of Style in Archaeology: A General Model. *American Antiquity* 42: 369-380.

1982 Approaches to Style in Lithic Archaeology. *Journal of Anthropological Archaeology* 1: 59-112.

1990 Style and Ethnicity in Archaeology: The Case of Isochrestism. In *The Uses of Style in Archaeology*, edited by M. W. Conkey, and C. A. Hastorf, pp. 32-43. Cambridge University Press, Cambridge.

Salavert, Aurâelie

2008 Olive Cultivation and Oil Production in Palestine during the Early Bronze Age (3500-2000 BCE): The Case of Tel Yarmouth, Israel. *Vegetation History & Archaeobotany* 17: 53-61.

Sass, Benjamin, and Michael Sebbane

2006 The Fourth Millennium BCE Origin of the Three-Tanged "Epsilon" Axe. In *'I will Speak the Riddles of Ancient Times': Archaeological and Historical Studies in Honour of Amihai Mazar*, edited by Aren M. Maeir, and Pierre de Miroschedji, pp. 79-88. Eisenbrauns, Winona Lake.

Savage, S. H., S. E. Falconer, and T. P. Harrison

2007 The Early Bronze Age City States of Southern Levant. Neither Cities nor States. In *Crossing Jordan. North American Contributions to the Archaeology of Jordan*, edited by T. Levy, Daviau P., R. Younker, and M. Shaer, pp. 285-297. Routledge, London.

Schact, R. M.

1984 The Contemporaneity Problem. *American Antiquity* 49: 678-695.

Schick, T.

1998 *The Cave of the Warrior: A Fourth Millennium Burial in the Judean Desert*. IAA Reports. Israel Antiquities Authority, Jerusalem.

Schiffer, M. B.

1992 *Technological Perspectives on Behavioral Change*. University of Arizona Press, Tucson.

Schlanger, Nathan

1994 Mindful technology: Unleashing the Chaine Operatoire for an Archaeology of Mind. In *The Ancient Mind: Elements of Cognitive Archaeology*, edited by Colin Renfrew, and Ezra B. W. Zubrow, pp. 143-151. Cambridge University Press, New York.

2005 The Chaîne Opératoire. In *Archaeology: The Key Concepts*, edited by Colin Renfrew, and Paul G. Bahn, pp. 25-31. Routledge, London.

Schloen, J. D.

2001 *The House of the Father as Fact and Symbol: Patrimonialism in Ugarit and the Ancient Near East*. Eisenbrauns, Winona Lake, Ind.

Sebag, Deborah

2005 The Early Bronze Age Dwellings in the Southern Levant. *Bulletin du Centre de Recherche Français à Jérusalem* 16: 222-235.

Segal, Irina, and Naama Yahalom-Mack
2012 Chapter 10B: Lead Isotope Analysis of Five Copper Objects. In *Excavations at Tel Beth-Shean 1989-1996 Volume IV: the 4th and 3rd Millennium BCE*, edited by Amihai Mazar, pp. 396-402. Israel Exploration Society, Jerusalem.

Seger, Joe D., Brent Baum, Oded Borowski, Dan P. Cole, Harold Forshey, Eugene Futato, Paul F. Jacobs, Mark Laustrup, Patti O'Connor Seger, and Melinda Zeder
1990 The Bronze Age Settlements at Tell Halif: Phase II Excavations, 1983-1987. *Bulletin of the American Schools of Oriental Research. Supplementary Studies* (26): 1-32.

Seger, Joe D.
2003 Footsteps in the Dust: A Century of ASOR Discoveries in the Ancient Near East. In *100 years of American Archaeology in the Middle East. Proceedings of the American Schools of Oriental Research Centennial Celebration, Washington, DC, April 2000*, edited by D. R. Clark, and V. H. Matthews, pp. 429-434. ASOR, Boston.

Service, Elman R.
1975 *Origins of the State and Civilization: The Process of Cultural Evolution.* Norton & Company, Inc., New York.

Shai, Itzick, Haskel Greenfield, Johanna Regev, Elisabetta Boaretto, Adi Eliyahu-Behar, and Aren M. Maeir
2014 The Early Bronze Age Remains at Tell eṣ-Ṣâfi/Gath: An interim report. *Tel Aviv* 41:20-49.

Shalev, Omer
2017 The Urbanisation Process in Early Bronze Age Canaan: A View from Tel Erani, Israel. In *The Land of Fertility II* edited by Łukasz Miszk, and Maciej Wacławik, pp. 37-67. Cambridge Scholars Publishing, Newcastle upon Tyne.

Sherratt, Susan
1994 Commerce, Iron, and Ideology: Metallurgical Innovation in 12th - 11th Century Cyprus. In *Cyprus in the 11th Century BC*, edited by V. Karageorghis, pp. 59-106. A. G. Leventis Foundation/University of Cyprus, Nicosia.

1998 "Sea Peoples" and the Economic Structure of the Late 2nd Millennium in the Eastern Mediterranean. In *Mediterranean Peoples in Transition*, edited by Seymour Gitin, Amihai Mazar, and Ephraim Stern, pp. 292-313. Israel Exploration Society, Jerusalem.

2003 The Mediterranean Economy: "Globalisation" at the End of the Second Millennium BCE. In *Symbiosis, Symbolism, and the Power of the Past*, edited by William Dever, and Seymour Gitin, pp. 37-62. Eisenbrauns, Winoa Lake.

2005 High Precision Dating and Archaeological Chronologies: Revisiting an Old Problem. In *The Bible and Radiocarbon Dating: Archaeology, Text, and Science*, edited by T. E. Levy, and T. Higham, pp. 114-125. Routledge, London.

Sholts, Sabrina B. , Dennis J. Stanford, Louise M. Flores, and Sebastian K.T.S. Wärmländer
2012 Flake Scar Patterns of Clovis Points Analyzed with a New Digital Morphometrics Approach: Evidence for Direct Transmission of Technological Knowledge Across Early North America. *Journal of Archaeological Science* 39: 3018-3026.

Silberman, Neil Asher
1998 The Sea Peoples, the Victorians, and Us: Modern Social Ideology and Changing Archaeological Interpretations of the Late Bronze Age Collapse. In *Mediterranean Peoples in Transition*, edited by Seymour Gitin, Amihai Mazar, and Ephraim Stern, pp. 268-275. Israel Exploration Society, Jerusalem.

Skibo, James M., and Michael B. Schiffer
2001 Understanding Artifact Variability and Change: A Behavioral Framework. In *Anthropological Perspectives on Technology*, edited by Michael B. Schiffer, pp. 139-150. University of New Mexico Press, Albuquerque.

2008 *People and Things. A Behavioral Approach to Material Culture*. Springer, New York.

Smith, M. E.
2002 The Earliest Cities. In *Urban Life Readings in the Anthropology of the City*, edited by G. Gmelch, and W.P. Zenner, pp. 3-19. Waveland Press, Illinois.

2009a V. Gordon Childe and the Urban Revolution: An Historical Perspective on a Revolution in Urban Studies. *Town Planning Review* 80: 2-29.

2009b Ancient Cities. In *The Encyclopedia of Urban Studies*, edited by R. Hutchinson, pp. 24-28. Sage, California.

Soressi, Marie, and Jean-Michel Geneste
2011 The History and Efficacy of the Chaine Operatoire Approach to Lithic Analysis: Studying Techniques to Reveal Past Societies in an Evolutionary Perspective. *PaleoAnthropology*: 334-350.

Sowada, Karin
2009 *Egypt in the Eastern Mediterranean during the Old Kingdom: An Archaeological Perspective*. Academic Press Fribourg, Fribourg.

Spielmann, Katherine
2002 Feasting, Craft Specialization, and the Ritual Mode of Production in Small-Scale Societies. *American Anthropologist* 104: 195-207.

Stager, Lawrence

2001 Port Power in the Early and the Middle Bronze Age: The Organization of Maritime Trade and Hinterland Production. In *Studies in the Archaeology of Israel and Neighbouring Lands in Memory of Douglas L. Esse*, edited by Douglas L. Esse, and Samuel Richard Wolff, pp. 625-638. Oriental Institute of the University of Chicago; American Schools of Oriental Research, Chicago.

Stark, Miriam T.

1995 Economic Intensification and Ceramic Specialization in the Philippines: A View from Kalinga. In *Research in Economic Anthropology*, Vol 16, edited by B. Isaac, pp. 179-226. Jai Press Inc., London.

2003 Current Issues in Ceramic Ethnoarchaeology. *Journal of Archaeological Research* 11(3): 193-242.

Stein, Gil J.

1996 Producers, Patrons, and Prestige: Craft Specialists and Emergent Elites in Mesopotamia from 5500-3100 B.C. In *Craft Specialization and Social Evolution: In Memory of V. Gordon Childe*, edited by B. Wailes, pp. 25-38. University Museum Symposium Series, Volume VI. University of Pennsylvania, Philadelphia.

2000 Material Culture and Social Identity: The Evidence for a 4th Millennium BC Mesopotamian Uruk Colony at Hacinebi, Turkey. *Paléorient* 25(1): 11-22.

2001 Indigenous Social Complexity at Hacinebi (Turkey) and the Organisation of Uruk Colonial Contact In *Uruk Mesopotamia & Its Neighbours Cross-Cultural Interactions in the Era of State Formation*, edited by Mitchell S. Rothman, pp. 265-306. School of American Research Press, Santa Fe.

Stoddart, Simon

1999 Urbanisation and State Formation. In *Companion Encyclopedia of Archaeology*, edited by G. Barer, pp. 908-949. Routledge, London.

Stone, Elizabeth C.

2013 Social Conditions in the Ancient Near East: Houses and Households in Perspective. In *Household Studies in Complex Societies: (micro) Archaeological and Textual Approaches*, edited by Miriam Müller, pp. 437-446. The University of Chicago Oriental Institute Seminars, Vol. 10, Leslie Schramer, and Thomas G. Urban, general editor. The University of Chicago Press, Chicago.

Stone, Elizabeth C, and Paul Zimansky

2016 Archaeology Returns to Ur: A New Dialog with Old Houses. *Near Eastern Archaeology* 79(4): 246-259.

Szuchman, Jeffrey

2009 Integrating Approaches to Nomads, Tribes, and the State in the Ancient Near East. In *Nomads, Tribes, and the State in the Ancient Near East*, edited by Jeffrey Szuchman, pp. 1-14. Oriental Institute, Chicago.

Tandon, R. , S. M. Yunus, N. A. Faruqi, and A Asghar
2016 Measurements of Hand and Foot – A Predictor of Stature in Adult Human Population of Uttar Pradesh. *International Journal of Anatomy Radiology and Surgery* 5(1): 12-15.

Tengberg, Margareta, Naomi Sykes, Laurence Naggiar-Moliner, Virginie Boulez, Dina Faltings, M. De Sadek, and Pierre De Miroschedji
2001 Les Fouilles de Tell es-Sakan (Gaza): Nouvelles Données sur les Contacts Egypto-Cananéens aux IVe-IIIe Millénaires. *Paléorient* 27(2): 75-104.

Tercatia, Rossella
2019 5,000-Year-Old Metropolis Uncovered in North. *The International Jerusalem Post* October 11 - 14. Jerusalem.

Thalmann, Jean-Paul
2010 Tell Arqa: A Prosperous City during the Bronze Age. *Near Eastern Archaeology* 73: 86-101.

Tite, M. S.
1999 Pottery Production, Distribution, and Consumption - The Contribution of the Physical Sciences. *Journal of Archaeological Method and Theory* 6(3): 181-233.

Tomber, Roberta and J. N. Dore
1998 *The National Roman Fabric Reference Collection: A Handbook.* Museum of London Archaeology Service, London.

Tostevin, Gilbert B.
2011 Levels of Theory and Social Practice in the Reduction Sequence and Chaine Operatoire Methods of Different Approaches to Lithic Analysis. *PaleoAnthropology*: 351-375.

Trigger, Bruce G.
1993 *Early Civilizations: Ancient Egypt in Context*. The American University in Cairo Press, Cairo.

2001 *Early Civilizations: Ancient Egypt in Context*. The American University in Cairo Press, Cairo, Egypt.

2009 *A History of Archaeological Thought. Second edition*. Cambridge University Press, Cambridge.

Tubb, Jonathan N.
2003 Canaan as a Cultural Construct. In *100 years of American Archaeology in the Middle East. Proceedings of the American Schools of Oriental Research Centennial Celebration, Washington, DC, April 2000*, edited by D. R. Clark, and V. H. Matthews, pp. 137-144. ASOR, Boston.

Underhill, Anne
2003 Investigating Variation in Organization of Ceramic Production: An Ethnoarchaeological Study in Guizhou, China. *Journal of Archaeological Method and Theory* 10(3): 203-275.

United Nations Human Settlement Program
2004 *The State of the World's Cities 2004/2005: Globalization and Urban Culture*. UN-HABITAT.

Ur, Jason A.
2010 Cycles of Civilization in Northern Mesopotamia, 4400-2000 BC. *Journal of Archaeological Research* 18(4): 387-431.

2010 *Urbanism and Cultural Landscapes in Northeastern Syria: The Tell Hamoukar Survey, 1999-2001*. Oriental Institute of the University of Chicago, Chicago.

2012 Southern Mesopotamia. In *A Companion to the Archaeology of the Ancient Near East*, edited by Daniel T. Potts, pp. 533-555. Wiley-Blackwell, Malden, Mass.

2014 Households and the Emergence of Cities in Ancient Mesopotamia. *Cambridge Archaeological Journal* 24(2): 249-268.

van den Brink, C. M. Edwin, and Thomas Evan Levy (editors)
2002 *Egypt and the Levant: Interrelations from the 4th through the Early 3rd Millennium B.C.E.* Leicester University Press, London.

van der Leeuw, S.
1984 Dust to Dust. A Transformational View of the Ceramic Cycle. In *The Many Dimensions of Pottery: Ceramics in Archaeology and Anthropology*, pp. 707-778. Amsterdam University Press (Cingular VII), Amsterdam.

1994 Cognitive Aspects of 'Technique'. In *The Ancient Mind: Elements of Cognitive Archaeology*, edited by Colin Renfrew, and Ezra B. W. Zubrow, pp. 135-142. Cambridge University Press, Cambridge.

Vince, Alan
2005 Ceramic Petrology and the Study of Anglo-Saxon and Later Medieval Ceramics. *Medieval Archaeology* 49: 219-245.

Wattenmaker, Patricia
1998 Craft Production and Social Identity in Northwest Mesopotamia. *Archaeological Papers of the American Anthropological Association* 8(1): 47-55.

Wengrow, David
2006 *The Archaeology of Early*. Cambridge University Press, Cambridge.

2010 *What Makes Civilization? The Ancient Near East and the Future of the West*. Oxford University Press, Oxford.

2015 Cities Before the State in Early Eurasia. Paper presented at the Goody Lecture 2015, Halle, Saale.

Wiessner, Polly
1983 Style and Social Information in Kalahari San Projectile Points. *American Antiquity* 48: 253-276.

Wilkinson, T. J., Graham Philip, J. Bradbury, R. Dunford, D. Donoghue, N. Galiatsatos, D. Lawrence, A. Ricci, and S. L. Smith
2014 Contextualizing Early Urbanization: Settlement Cores, Early States and Agro-Pastoral Strategies in the Fertile Crescent during the Fourth and Third Millennia BC. *Journal of World Prehistory* 27(1): 43-109.

Wilson, D. E., and P. M. Day
1994 Ceramic Regionalism in Prepalatial Central Crete: The Mesara Imports at EM I to EM II A Knossos. *The Annual of the British School at Athens* 89: 1-87.

Wobst, H. M.
1977 Stylistic Behavior and Information Exchange. In *Papers for the Director: Research Essays in Honor of James B. Griffin*, edited by C. Cleland, pp. 317-342. Museum of Anthropology, University of Michigan, Ann Arbor, MI.

Wright, G. E.
1936 The Chronology of Palestine in the Early Bronze Age. *Bulletin of the American Schools of Oriental Research* 63: 12-21.

1937 *The Pottery of Palestine from the Earliest Times to the End of the Early Bronze Age.* American Schools of Oriental Research, New Haven, CT.

1958 The Problem of the Transition between the Chalcolithic and Bronze Ages. *Eretz-Israel* 5: 37-45.

Wright, Henry T.
1986 The Evolution of Civilizations. In *American Archaeology Past and Future: A Celebration of the Society for American Archaeology 1935-1985*, edited by David J. Meltzer, Don D. Fowler, and Jeremy A. Sabloff, pp. 323-365. Smithsonian Institution Press, Washington, DC.

Wright, Henry T., and Gregory Alan Johnson
1975 Population, Exchange and Early State Formation in Southwestern Iran. *American anthropologist* 77: 267-289.

Wylie, Alison

1982 An Analogy by Any Other Name is just as Analogical: A Commentary on the Gould-Watson dialogue. *Journal of Anthropological Archaeology* 1: 382-401.

1985 The Reaction Against Analogy. *Advances in Archaeological Method and Theory* 8: 63-111.

1989 The Interpretive Dilemma. In *Critical Traditions in Contemporary Archaeology*, edited by V. Pinsky, and A. Wylie, pp. 18-27. Cambridge University Press, Cambridge.

Yahalom-Mack, N., and A. Eliyahu-Behar
2015 The Transition from Bronze to Iron in Canaan: Chronology, Technology, and Context. *Radiocarbon* 57: 285-305.

Yamafuji, Masatoshi
2019 Domestic Dwellings during Early Bronze Age, Southern Levant. In *Decades in Deserts: Essays on Near Eastern Archaeology in Honour of Sumio Fujii*, edited by Shin'ichi Nakamura, Takuro Adachi, and Masashi Abe, pp. 119-152. Rokuichi Syobou, Tokyo.

Yannai, Eli
2006 *'En Esur ('Ein Asawir) I Excavations at a Protohistoric Site in the Coastal Plain of Israel*. IAA Reports. Israel Antiquities Authority, Jerusalem.

Yasur-Landau, Assaf, Jennie R. Ebeling, and Laura B. Mazow (editors)
2011 *Household Archaeology in Ancient Israel and Beyond*. Brill, Leiden; Boston.

Yekutieli, Yuval
2009 The Har Hemar Site: A Northern Outpost on the Desert Margin? *Tel Aviv* 36(2): 218-240.

Yoffee, Norman
2004 *Myths of the Archaic State: Evolution of the Earliest Cities, States and Civilizations*. Cambridge University Press, New York.

Ziv-Esudri, Adi
2012 The Early Bronze Age III Pottery from Areas M and R. In *Excavations at Tel Beth-Shean 1989–1996*, edited by Amihai Mazar, pp. 236-311. The Israel Exploration Society, Jerusalem.

Zuckerman, Sharon
2003 Tel Qashish and the Jezreel Valley in the Early Bronze Age. In *Tel Qashish: A Village in the Jezreel Valley*, edited by A. Ben-Tor, N. Goren-Inbar, N. Goring-Morris, S. Gorodetsky, and L. I. Levine, pp. 7-9. Qedem Reports Vol 5. Old City Press, Jerusalem.

2003 The Early Bronze Age II-III Architecture In *Tel Qashish: A Village in the Jezreel Valley*, edited by A. Ben-Tor, N. Goren-Inbar, N. Goring-Morris, S. Gorodetsky, and L. I. Levine, pp. 125-129. Qedem Reports Vol 5. Old City Press, Jerusalem.

2003 The Early Bronze Age II-III Pottery. In *Tel Qashish: A Village in the Jezreel Valley*, edited by A. Ben-Tor, N. Goren-Inbar, N. Goring-Morris, S. Gorodetsky, and L. I. Levine, pp. 130-160, Qedem Reports Vol 5. Old City Press, Jerusalem.

Figures

Figure 1.1. Satellite image (Google Earth, Landsat 2019) facing southwest. The East Mediterranean coastline with the Jordan Valley and southern Israel in the foreground and the Nile Delta in the background. Annotated by Jon Ross.

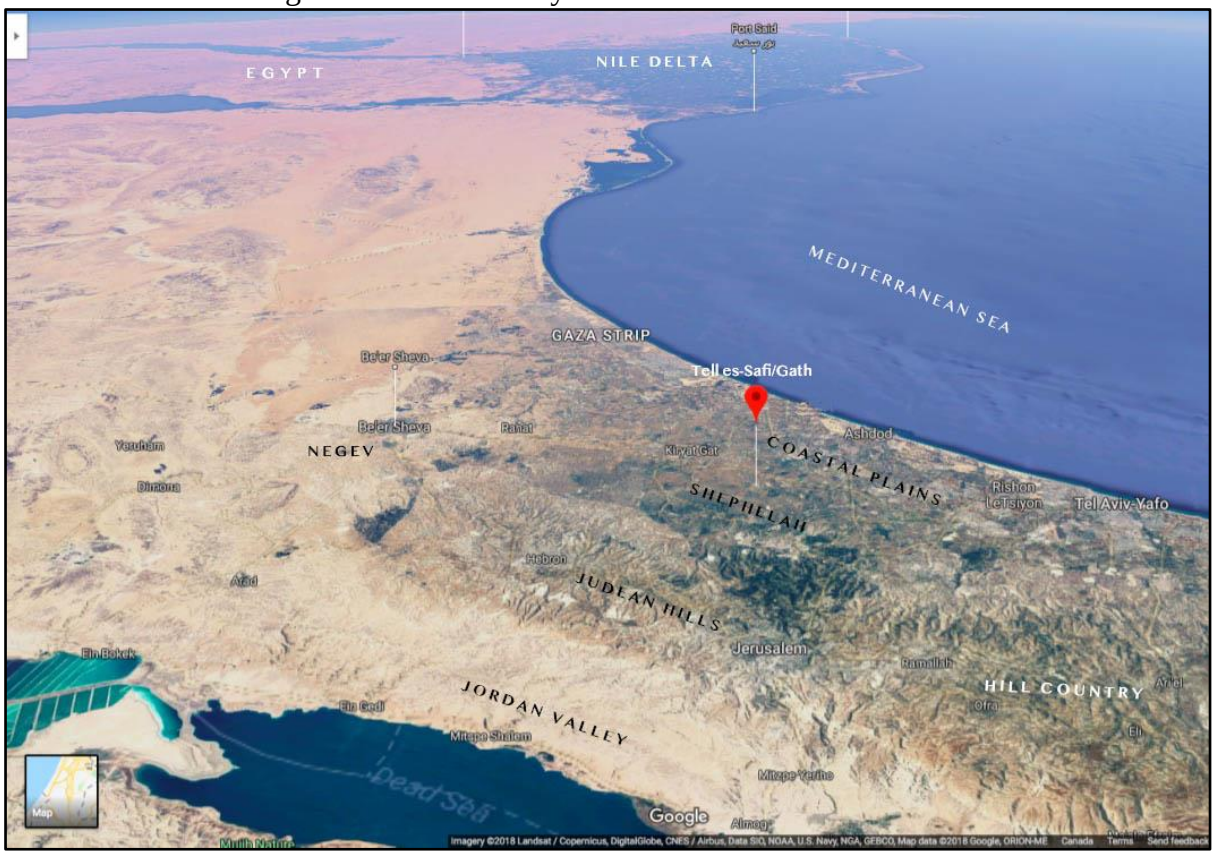


Figure 1.2. Topographic map of the southwest Levant showing the location of Tell eṣ-Ṣâfi/Gath and key Early Bronze Age sites discussed in Chapter 4. Image reprinted from Fowler et al. 2020: Fig. 1 (under a Creative Commons Attribution License). Annotated by Jon Ross.

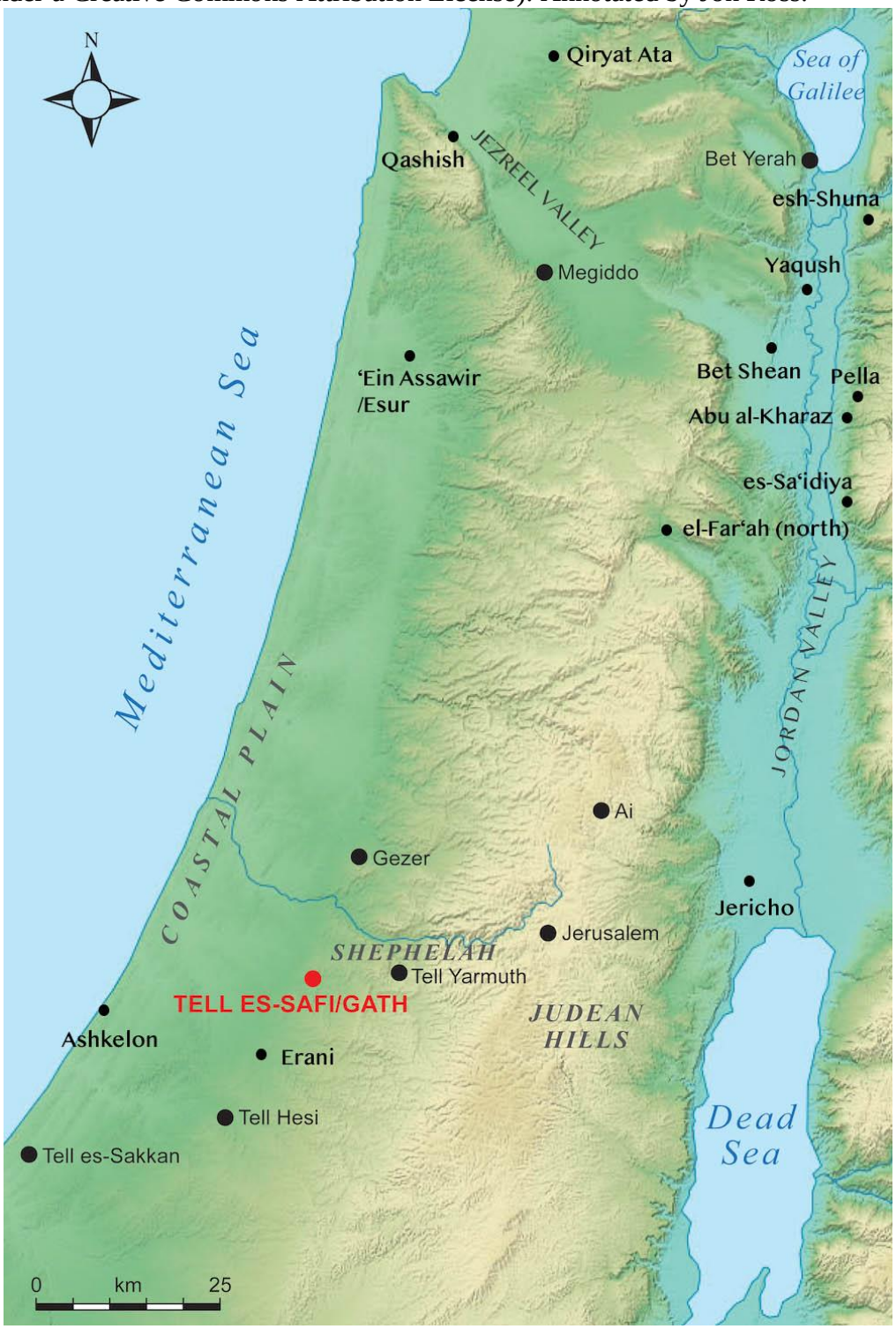


Figure 1.3. Regional map (© Jon Ross) with watercourses and wadis showing the location of Tell eṣ-Ṣâfi/Gath and neighbouring EB III sites. Annotated by Jon Ross.

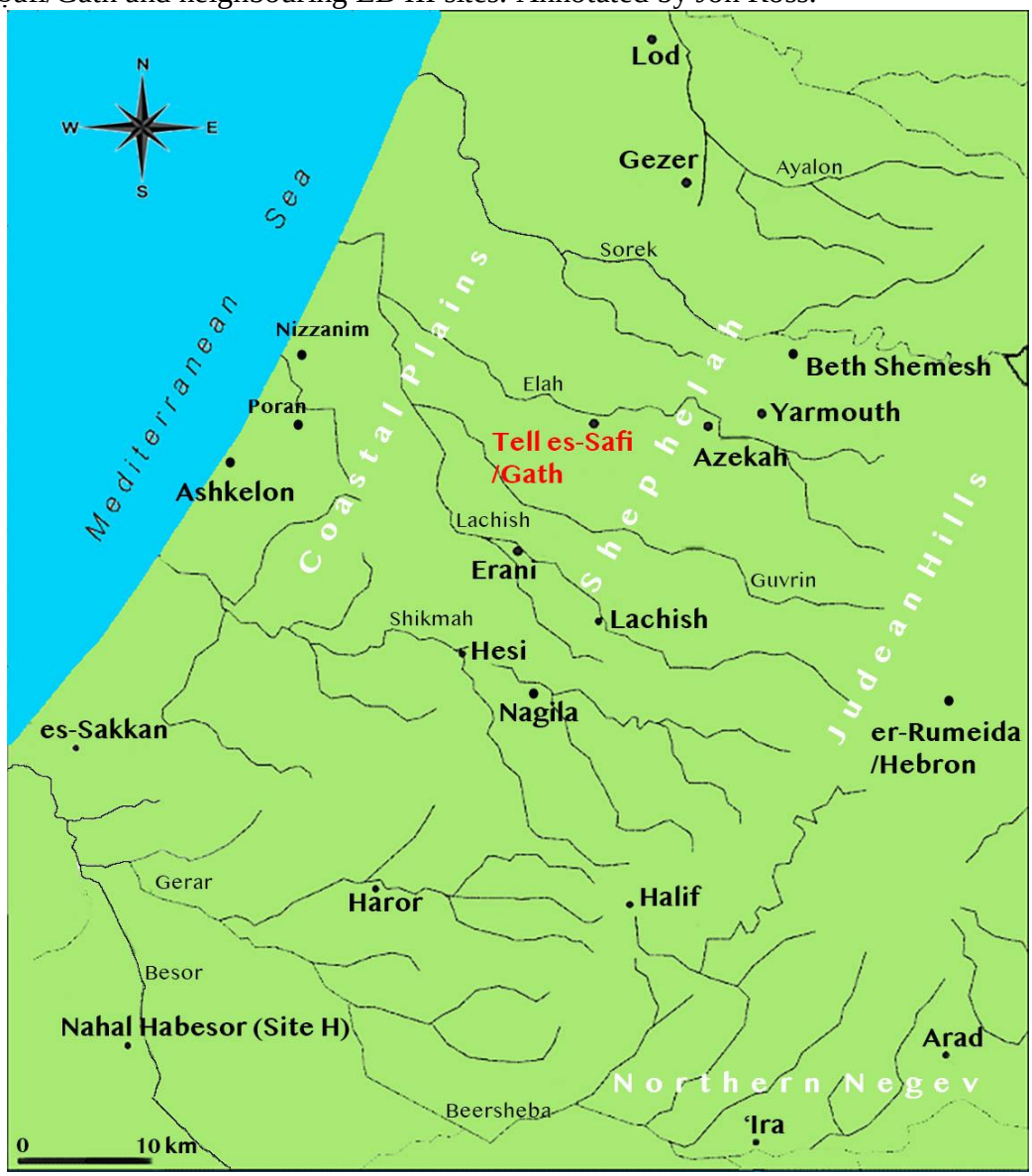


Figure 3.1: Classification of roughing out (primary) and preforming (secondary) techniques (graphic is © Jon Ross). RKE = rotative kinetic energy.

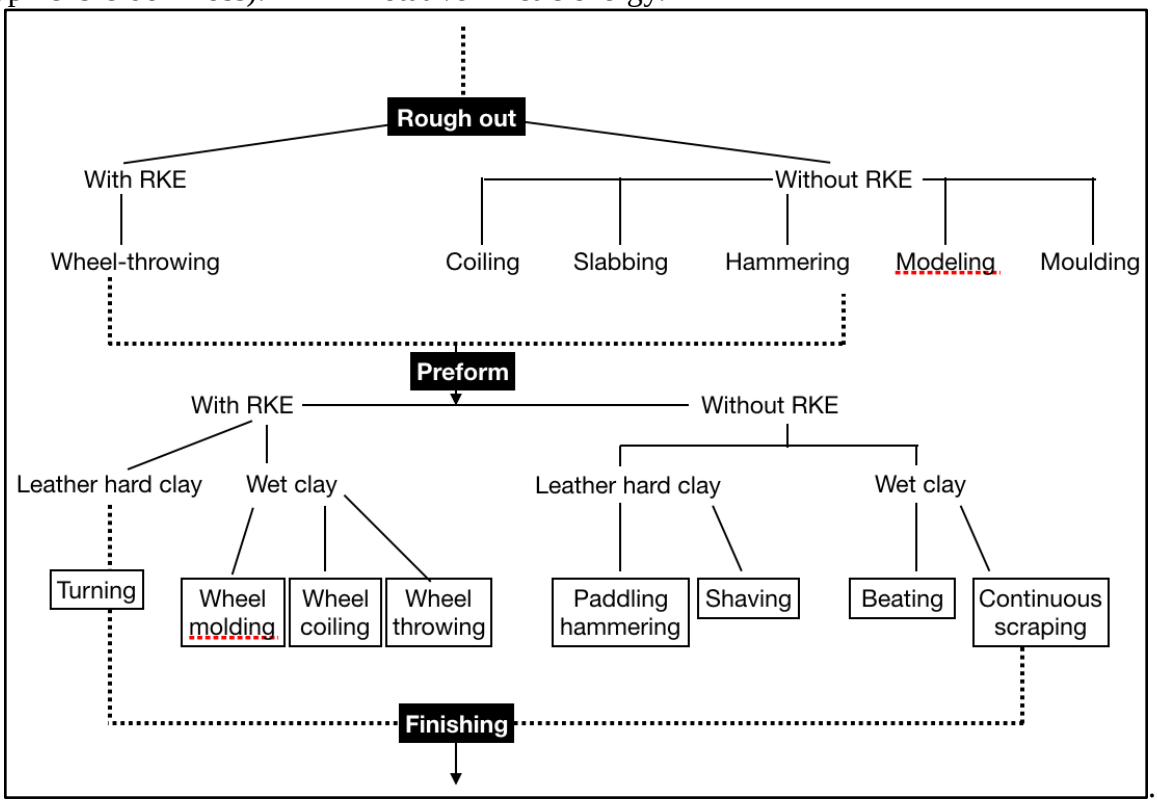


Figure 3.2. Diagnostic surface features taken into account for reconstructing EB shaping sequences on the Tell eṣ-Ṣâfi/Gath assemblage: Bumpy wall with linear features and fissures indicating discontinuous pressures on assembled elements (A); undulations and bulges (corrugations) from coil deformations (B); rough micro-topography (C); concentric overthickness (D); hairline fissures and coil joints/seams (E); vertical scraping/drawing up of coils (F); thick coil added to corner of base (G). All coils are approximately a finger width in thickness regardless of vessel type. Photo credit: Jon Ross.



Figure 3.3. Diagnostic surface features taken into account for reconstructing EB shaping sequences on the Tell eṣ-Ṣâfi/Gath assemblage: Drawing/scraping in diagonal/oblique directions (A); undulations and bulges (corrugations) from coil deformations (B); rough micro-topography (C); bumpy interior wall with shallow depressions, hollows, and cavities from potter's fingertips ('digital depressions') along coil joints (D); wavy/curvilinear and oblique laminations, fissures, and clay domains in the break (E); non-stretched clay walls (F); shallow depressions, hollows, and cavities located at regular intervals from pinching the clay (G); jars possibly used as *ad hoc* moulds to shape holemouth jars (H). Photo credit: Jon Ross.



Figure 3.4. Surface diagnostics of EB wheel fashioning techniques on the Tell eṣ-Ṣâfi/Gath assemblage: Rilling and deep subparallel grooves with spiral effects (A); decreasing thickness from base (B); circular symmetrical bases and walls (C); spiral form string cut base (D); continuous concentric striations with a tight structure (E). Photo credit: Jon Ross.



Figure 3.5. Additional surface diagnostics of fashioning techniques on vessels from Beth Yerah (north Israel), Cyprus, Arad (south Israel), and Tell eṣ-Ṣâfi: Groove/carination possibly from the lip of a mould on the underside of EB platter rims (A); mat impressions (used as tournettes and mobile chucks) on the reverse side of EB jugs from Arad (B); long deep grooves from dragging and drawing the clay on an EB jug (red polished ware) from Cyprus (C) and the same technique on an EB jar from Arad (D); homogenous fabric and stretched walls in the section of a Late Bronze Age wheel-thrown chalice (E, voids are small, uniform, evenly distributed, and diagonally oriented). Photo credit: Jon Ross.



Figure 3.6. Schematic diagram (© Jon Ross) summarising known preferred orientation of non-plastics and voids for different shaping techniques imaged radiographically (graphic after Berg 2008: 1178; Carr 1990: 17; Rye 1981: 61-81; Ross et al. 2018).

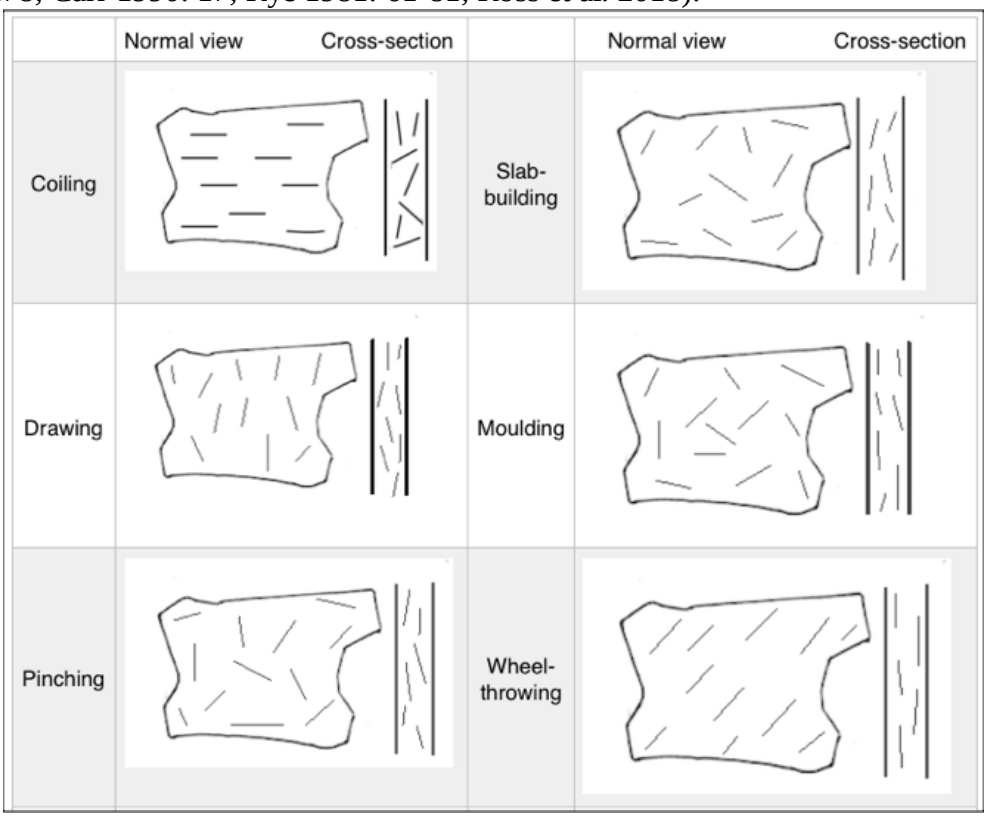


Figure 3.7. Different scales of observation. Note signatures of forming techniques are most apparent in thick sections where patterns in the distribution of non-plastics appear with regularity (graphic is © Jon Ross). Sections are from Area E Tell eṣ-Ṣâfi/Gath ceramic assemblage.

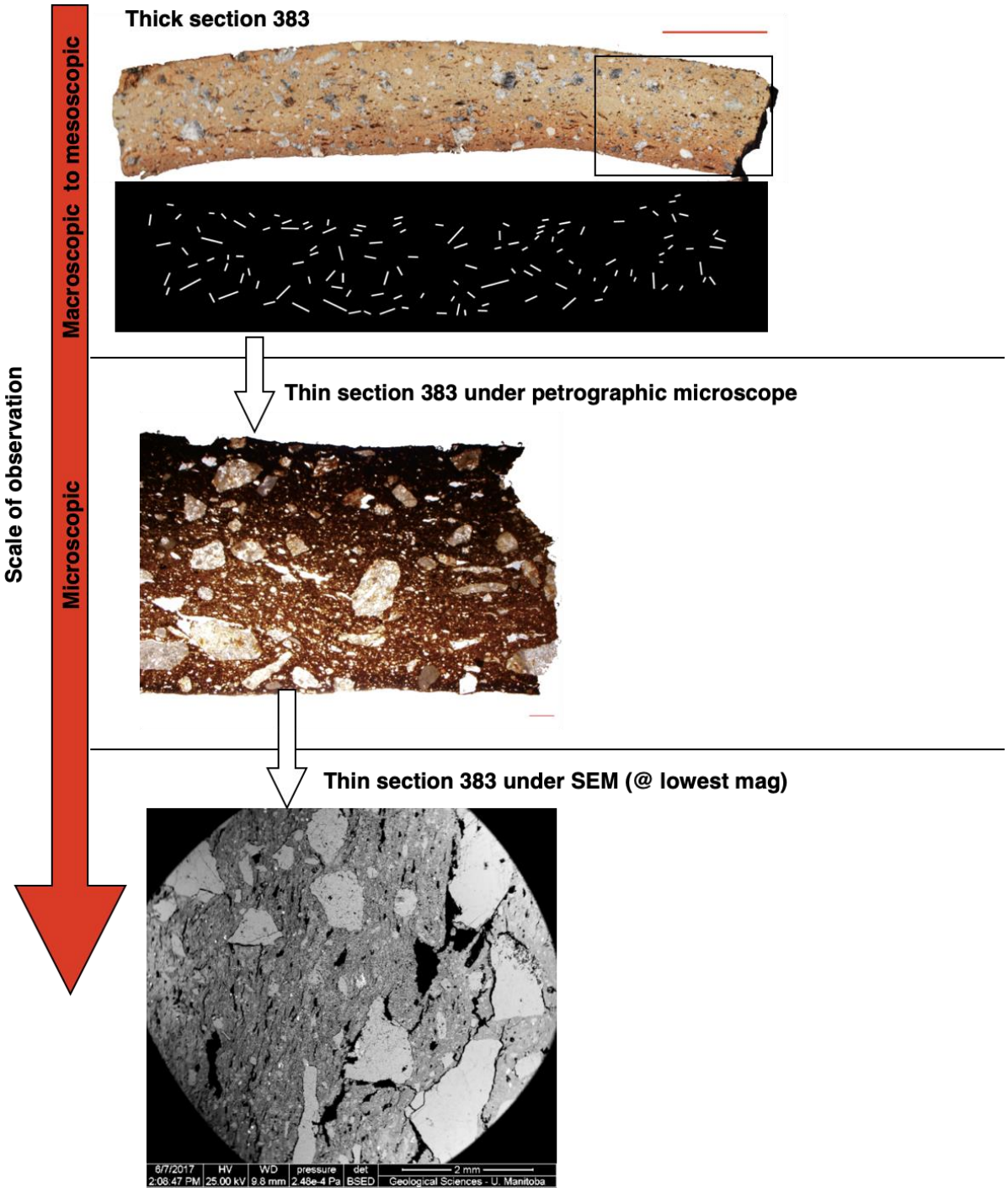


Figure 3.8. Different scales of observation (graphic is © Jon Ross).

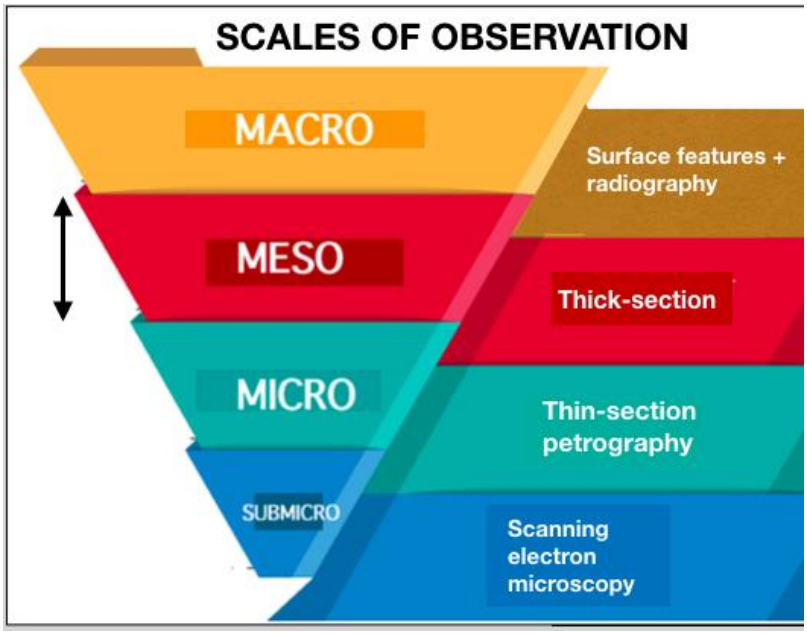


Figure 3.9. Deformation by simple compression combined with a rolling motion. Solid cylinder rotating about an axis and the equation for the moment of inertia. Clay will stretch along the axis of minimal stress (graphic is © Jon Ross).

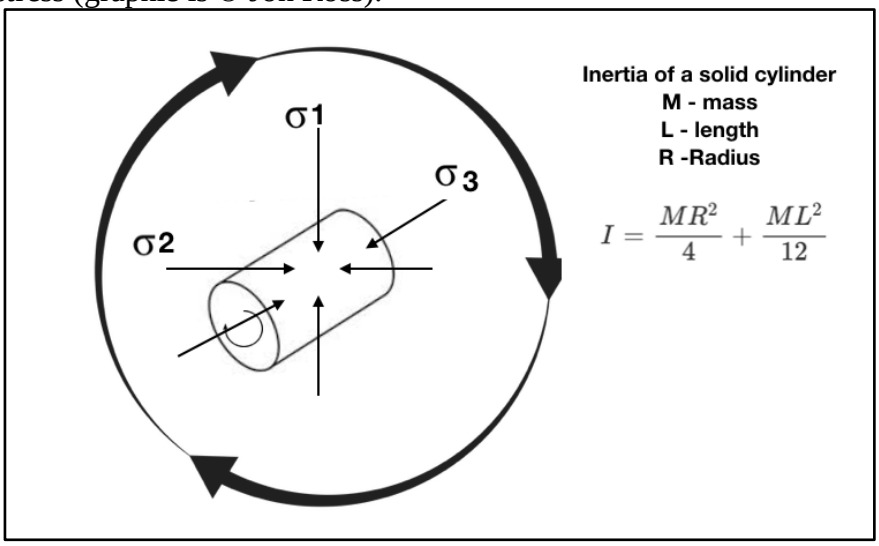


Figure 3.10. Deformation by simple compression. Clay will flatten along axis of maximal stress (graphic is © Jon Ross).

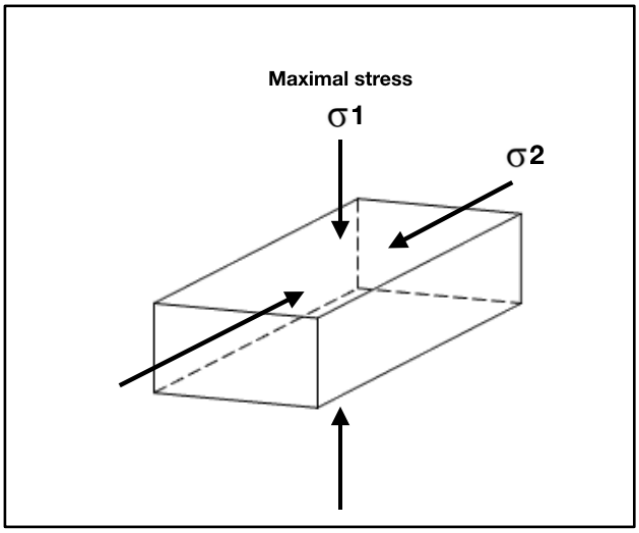


Figure 3.11. Compression/deformation of clay during the shaping process (graphic is © Jon Ross).

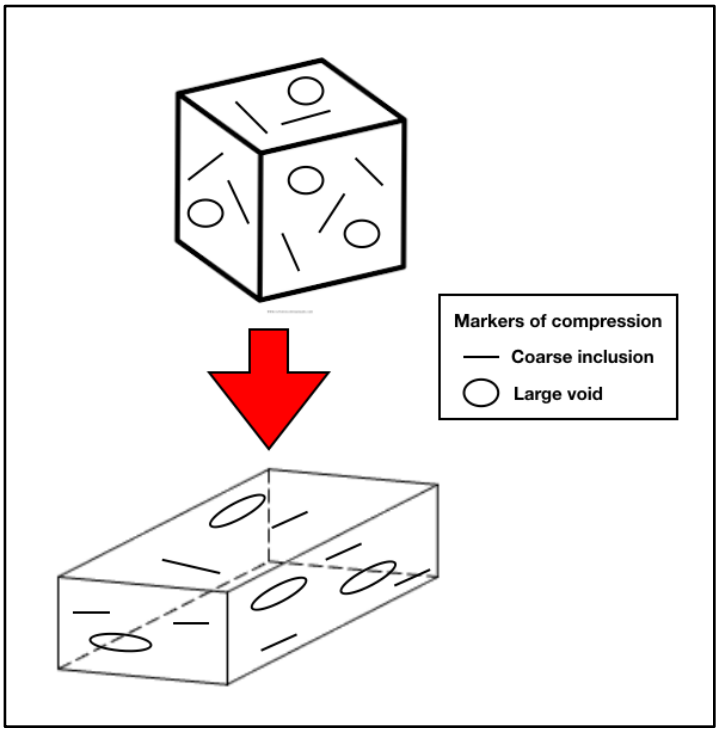


Figure 3.12. The *chaînes opératoires* of the experimental type set (graphic is © Jon Ross).

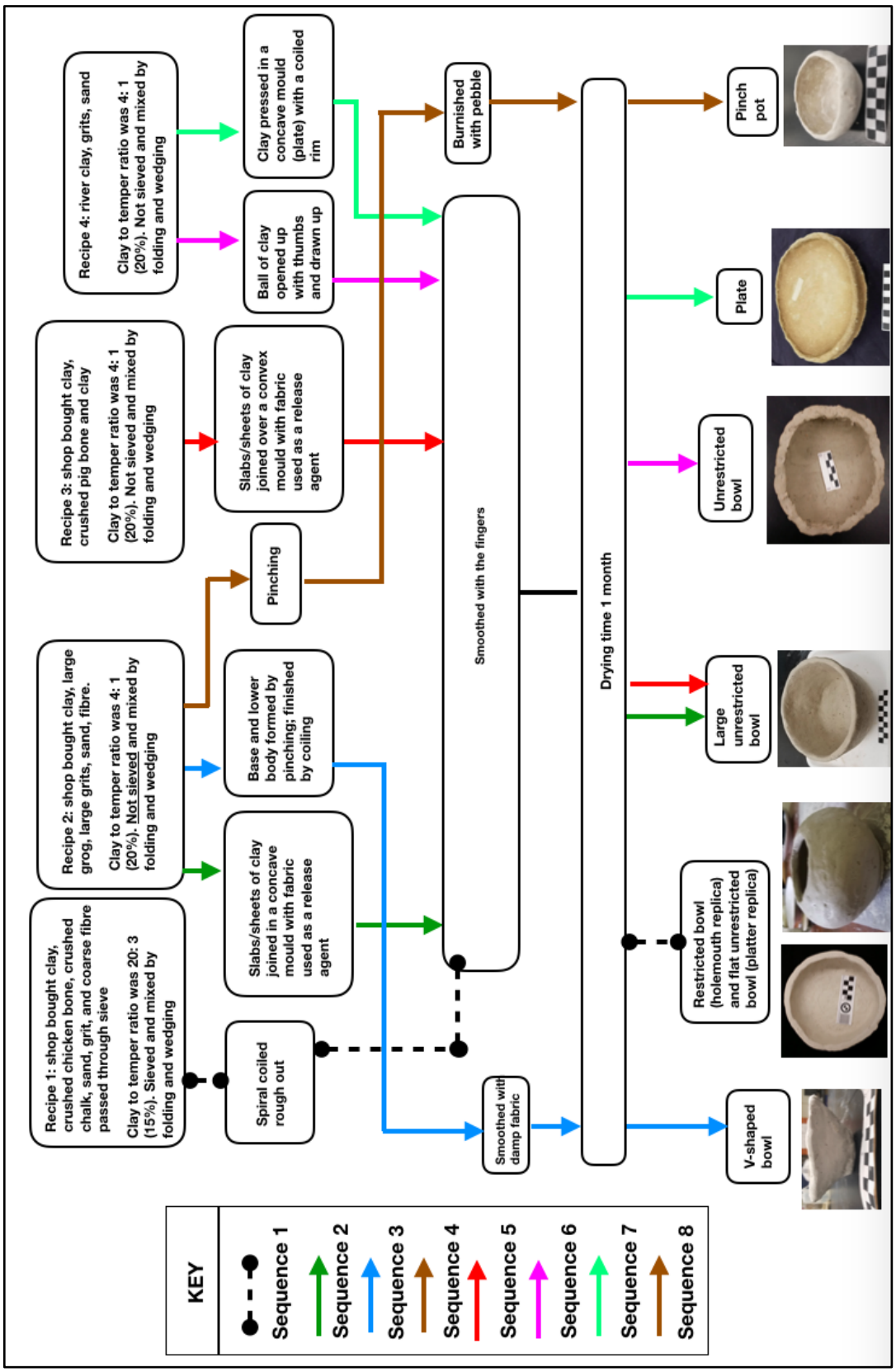


Figure 5.1. Location of Tell eṣ-Ṣâfi/Gath (left) with a Google Earth image (right). Annotated by Jon Ross. Left image reprinted from Fowler et al. 2020: Fig. 1 (under a Creative Commons Attribution License). Annotated by Jon Ross.

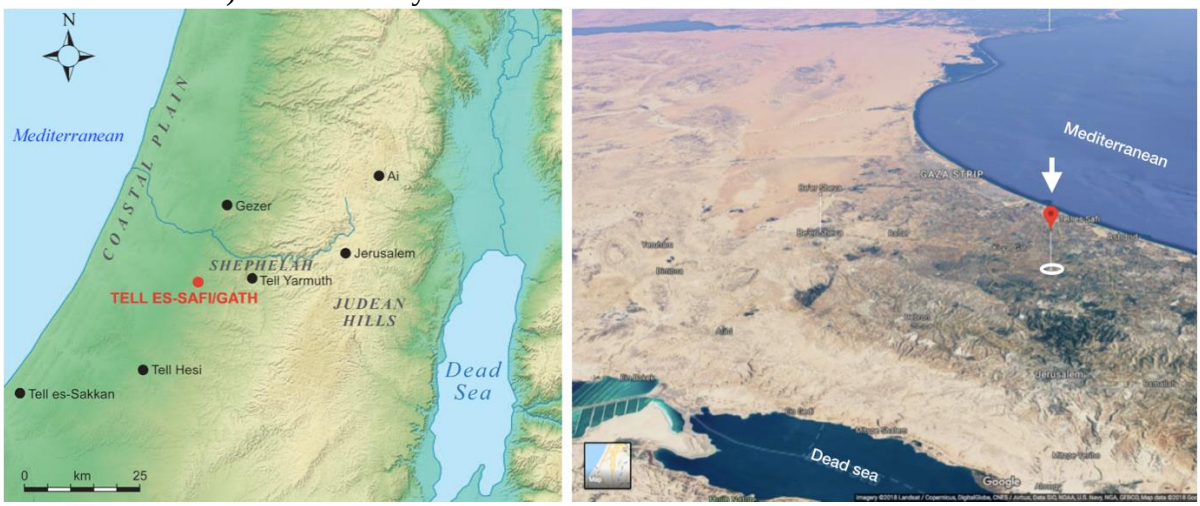


Figure 5.2. Tell eṣ-Ṣâfi/Gath from the Elah Valley. Photo credit: Jon Ross, 2015.



Figure 5.3. The Elah valley from Area E. Photo credit: Jon Ross, 2016.



Figure 5.4. Map and photos showing east face of the mound with fortification wall on contour map (bolded). Photos and maps reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Annotated by Jon Ross.

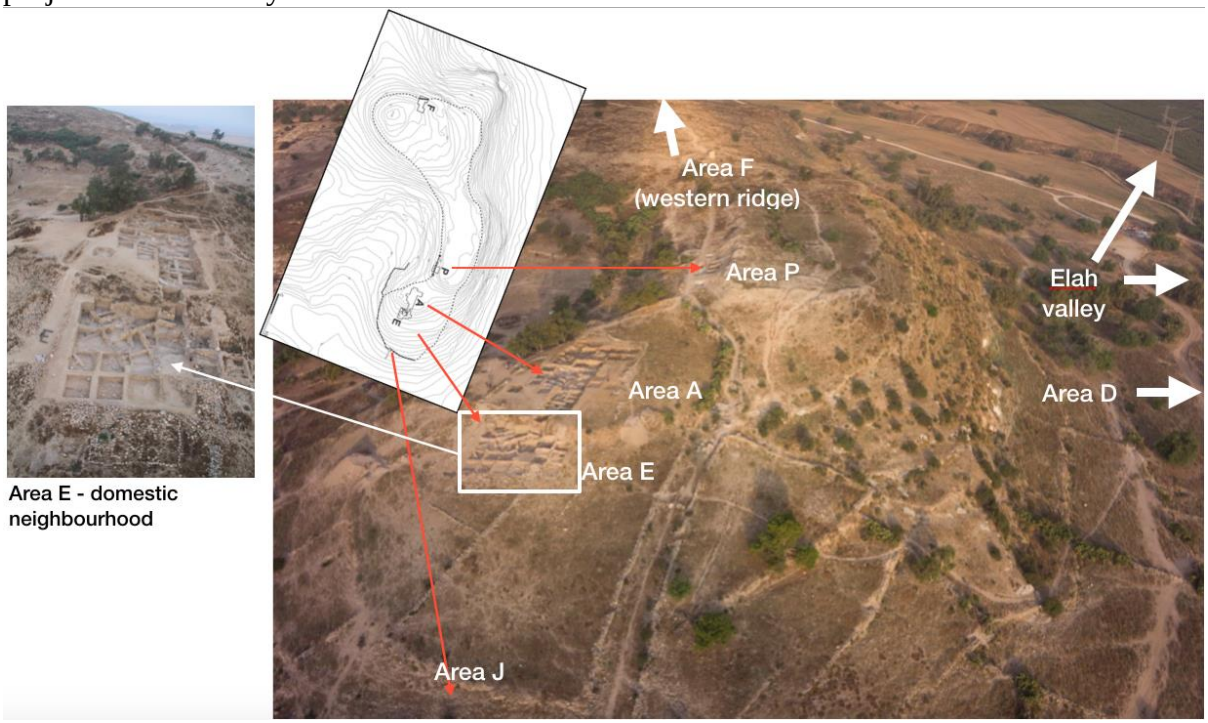


Figure 5.5. Fortification wall in Area F on the western ridge of the mound (2015). Middle Bronze overbuild on an EB III city wall foundation. The arrows point to an EB III outset. Excavation areas P (south ridge) and J (east ridge) exposed additional stretches of an EB III circuit wall. Stone foundations measure between 1.5 to 2 m in height and 2.7 m in width (see Katz 2017; Chadwick et al. 2017). Photos and maps reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Photo annotated by Jon Ross.



Figure 5.6. Aerial photograph (2013) of Area E showing the rows of E5 buildings and the alleyway. Photos and maps reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Annotated by Jon Ross.

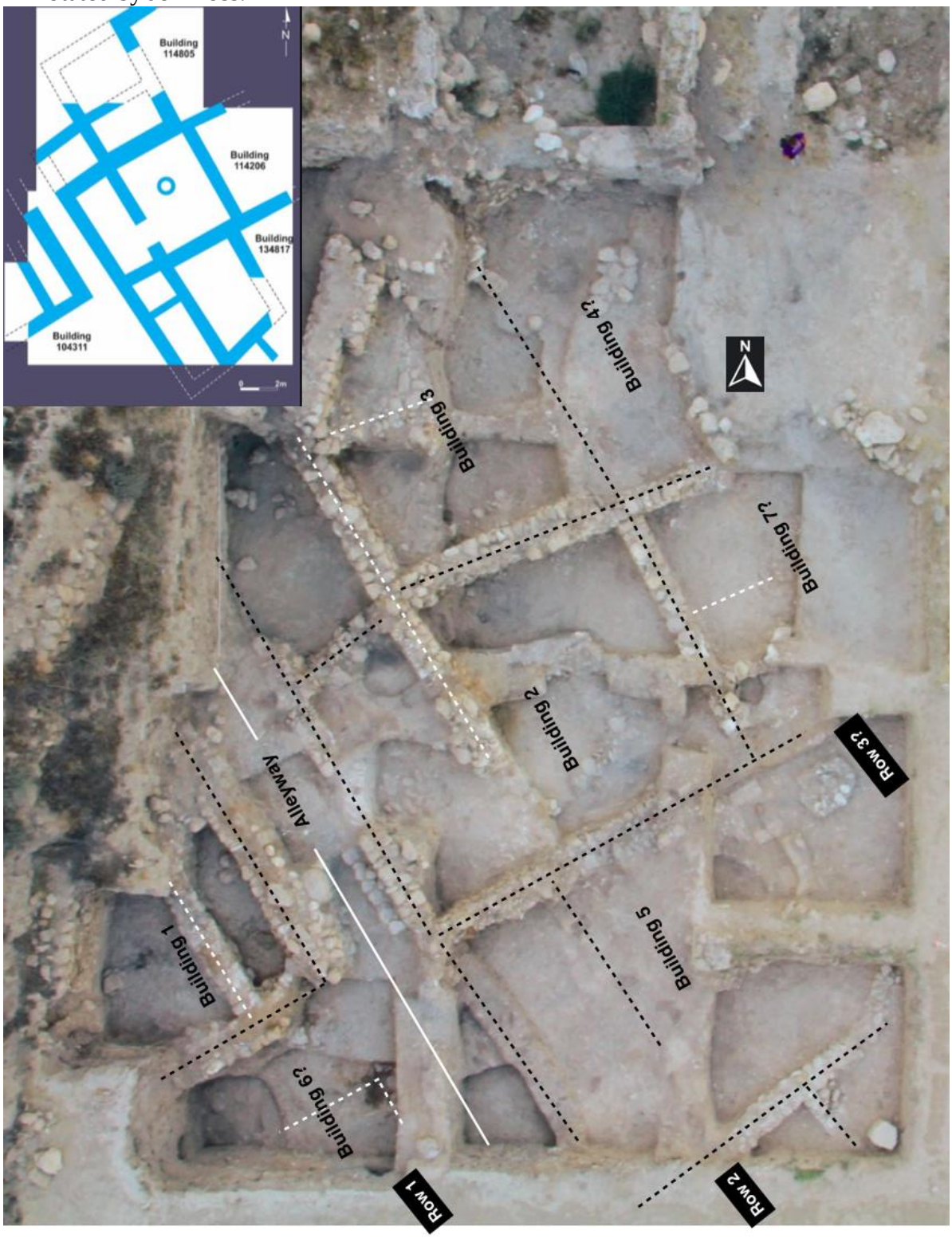


Figure 5.7. E5a phase plan, Area E (2019 version), Tell eṣ-Ṣâfi/Gath. Dotted lines are reconstructions of putative walls that were either robbed out or destroyed in antiquity. Plan reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project.

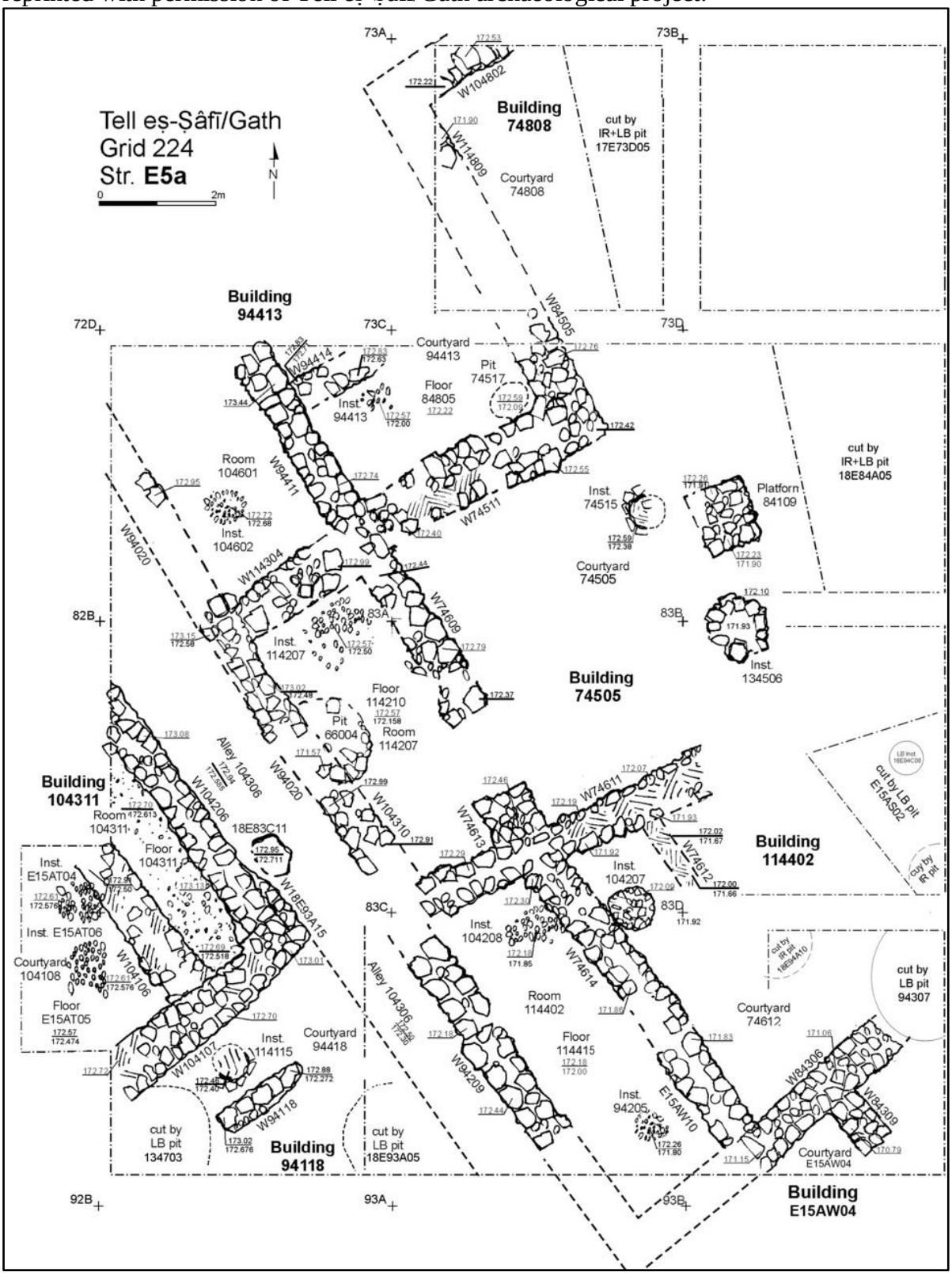


Figure 5.8. E5b phase plan, Area E (2019 version), Tell eṣ-Ṣâfi/Gath. Dotted lines are reconstructions of putative walls that were either robbed out or destroyed in antiquity. Plan reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project.

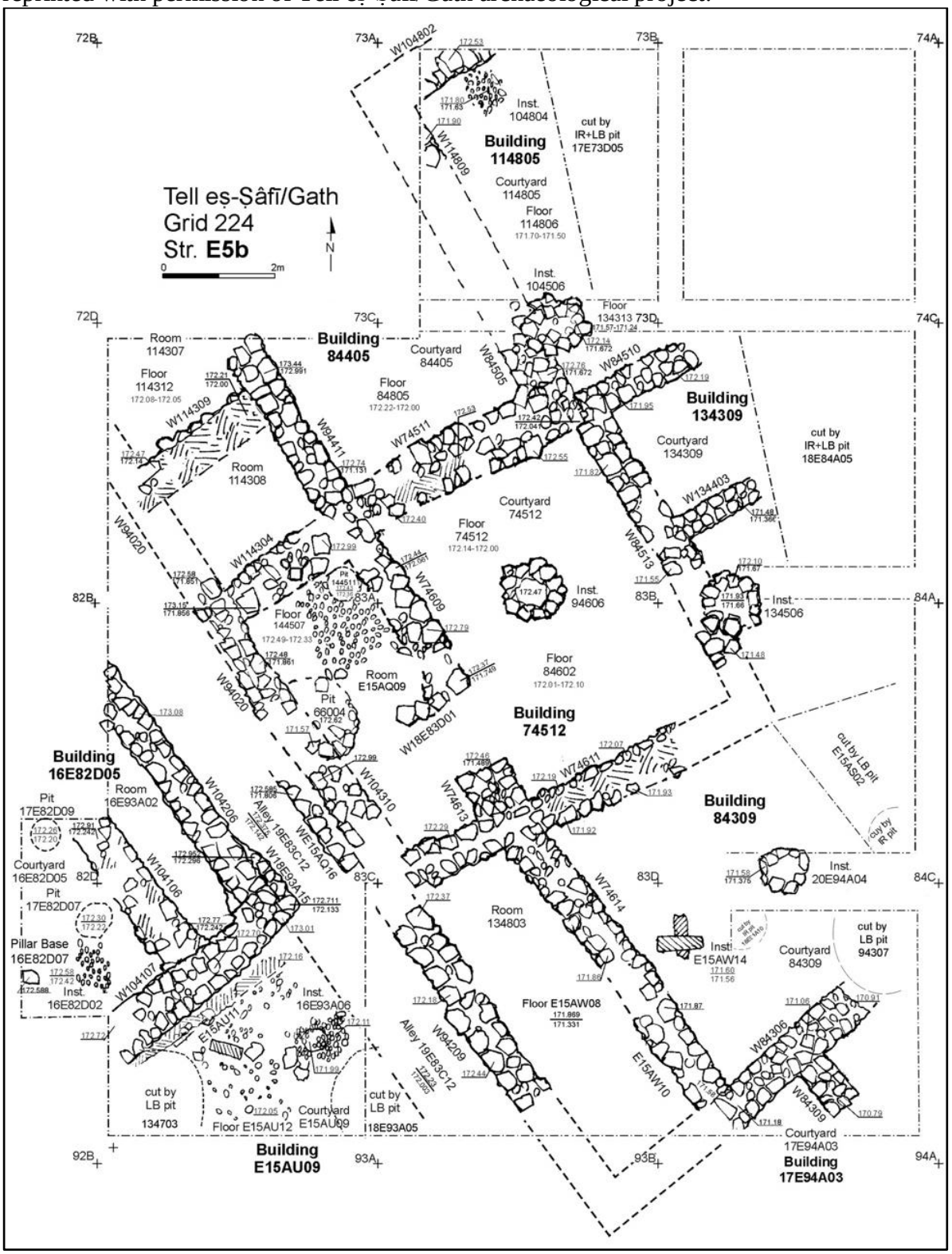


Figure 5.9. E5c phase plan, Area E (2019 version), Tell eṣ-Ṣâfi/Gath. Dotted lines are reconstructions of putative walls that were either robbed out or destroyed in antiquity. Plan reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project.

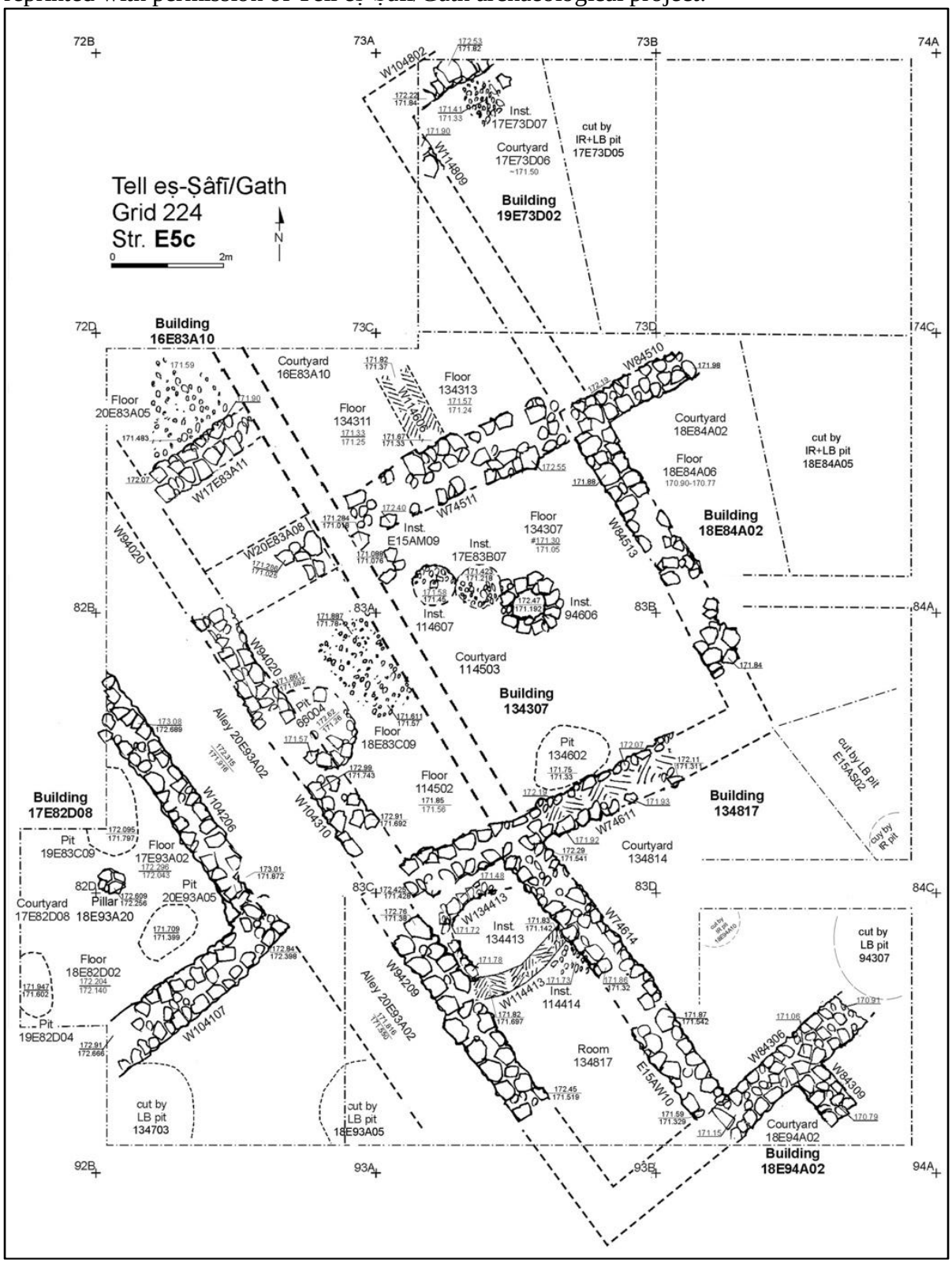


Figure 5.10. North facing photograph of the upper terrace, west of the alleyway, with a close up of the NW profile showing the typical stratigraphic progression of deposits in the E5 buildings, Tell eṣ-Ṣâfi/Gath. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Photo credit: Area E camera, 2008. Annotated by Jon Ross.

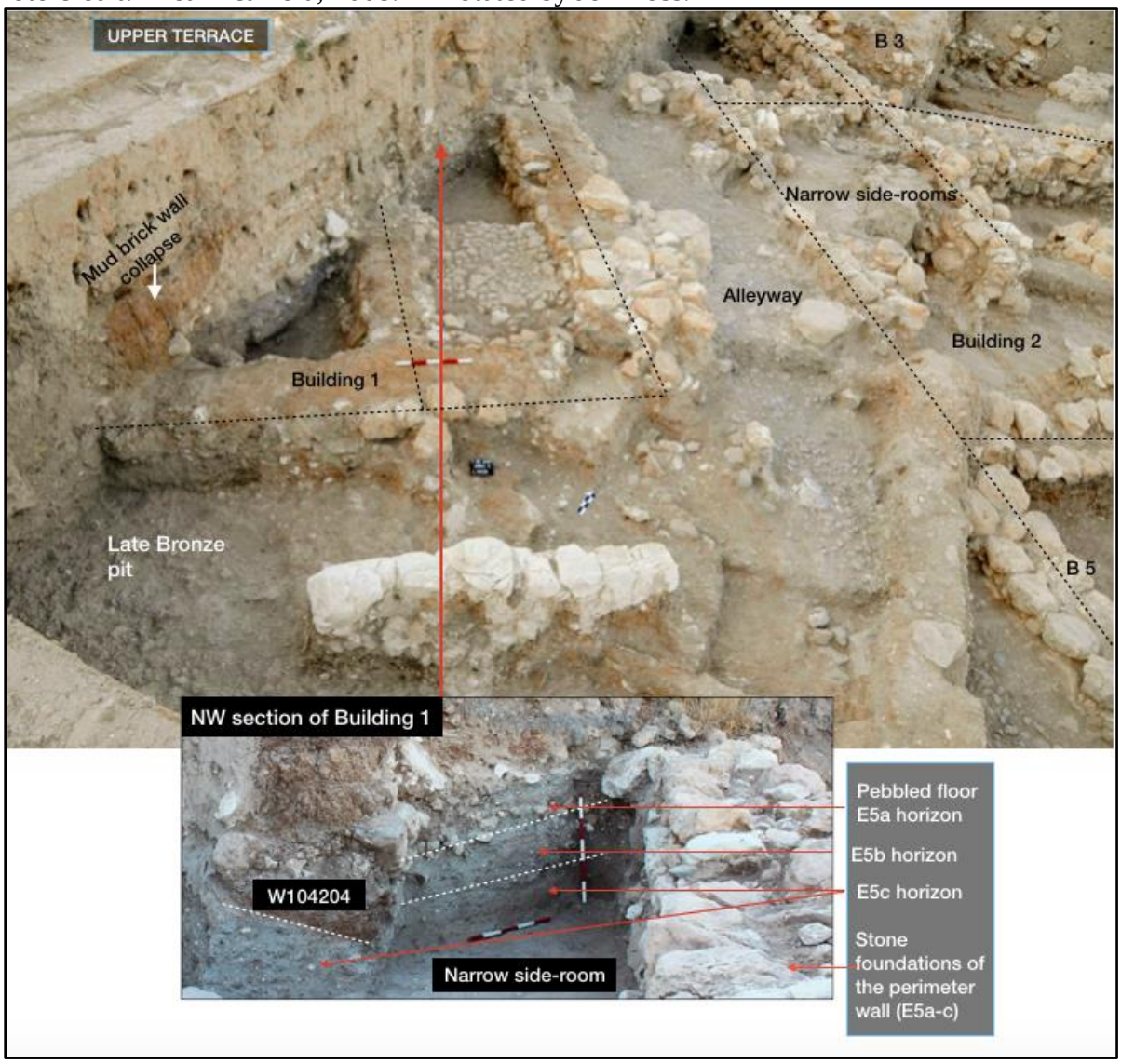


Figure 5.11. The SE corner of Building 104311 in the west profile of Square 93A, Tell eṣ-Ṣâfi/Gath. The full sequence of E5a deposits is visible and includes building collapse with mud brick and plastered walls sealing accumulation on a floor and floor make-up. The faint outline of mudbrick from wall W104107 (and the direction of collapse) is visible in section. Photo credit: Area E camera, 2008. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project.



Figure 5.12. West facing in Square 82D showing Room 104108 (E5a) with *in situ* vessels (large storage jar and holemouth jar), west of the alleyway, Tell eṣ-Ṣâfi/Gath. Six complete restorable vessels were found smashed in this room on two pebbled hearths. Photo credit: Area E camera, 2011. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Annotated by Jon Ross.

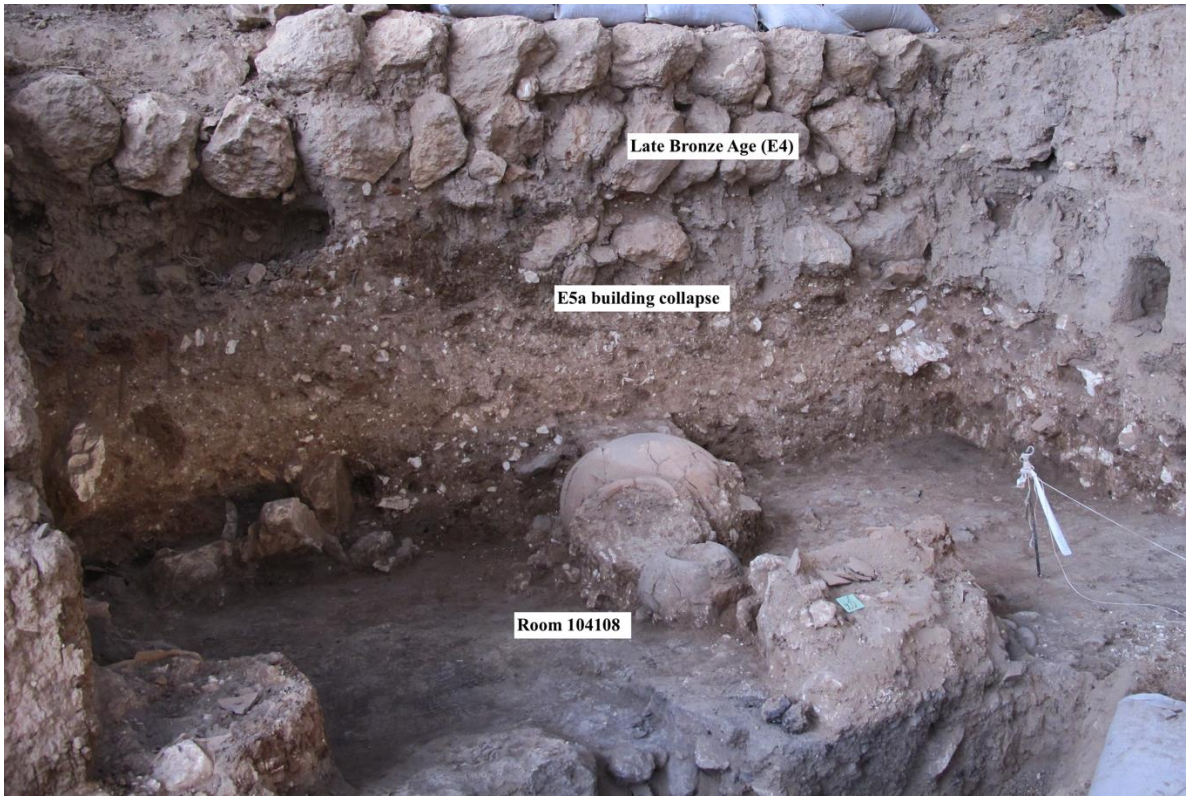


Figure 5.13. South profile of Square 93A, west of the alleyway, Tell eṣ-Ṣâfi/Gath. Examples of large LB pits cutting E5 deposits. Photo credit: Area E camera, 2015. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Annotated by Jon Ross.

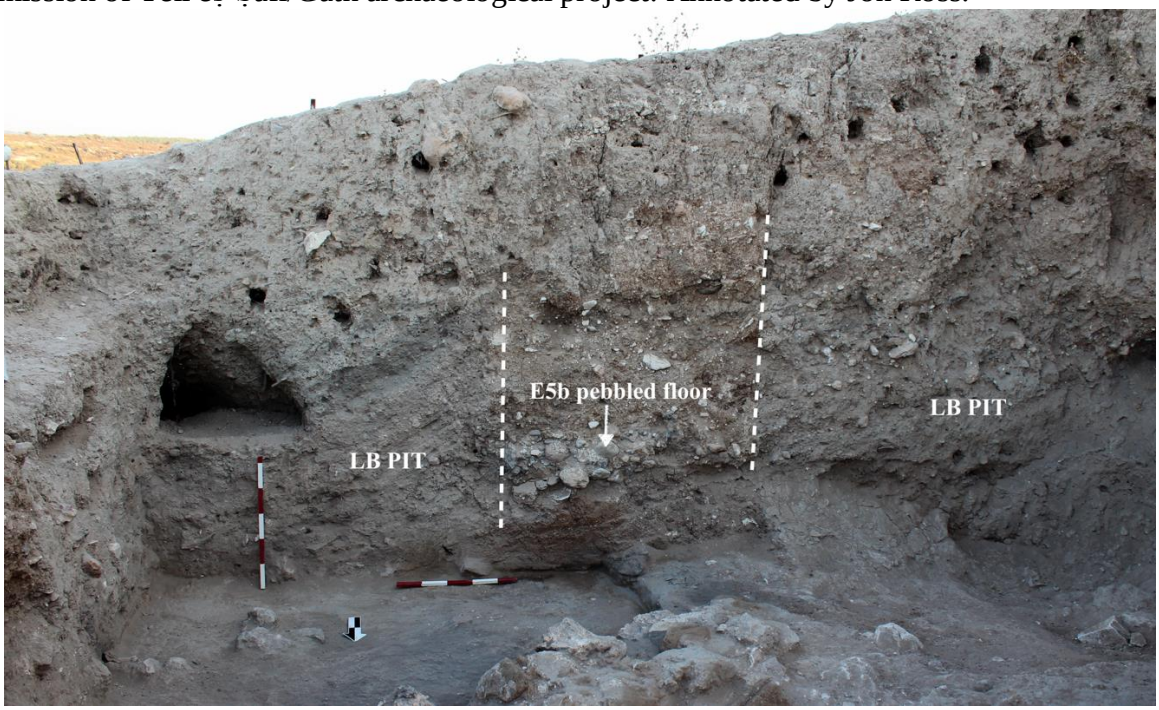


Figure 5.14. Northeast downslope photograph showing the E5c phase of the EB III neighbourhood, Tell eṣ-Ṣâfi/Gath. Building 17E82D08 is in the foreground, Building 134307 is pictured in the centre, and Building 18E84A02 is in the background. Photo credit: Photo credit: Area E camera. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Annotated by Jon Ross.



Figure 5.15. West facing photograph of Building 74512 (E5b phase) showing courtyard (foreground) and entrance to narrow Room E15AQ09, Tell eṣ-Ṣâfi/Gath. Photo credit: Area E camera, 2008. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Annotated by Jon Ross.



Figure 5.16. Southeast facing photograph of Area E showing the lower terrace, Tell eṣ-Ṣâfi/Gath. The alleyway is flanked by two rows of buildings with narrow rooms and courtyards (E5a-b phases). Photo credit: Area E camera. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Annotated by Jon Ross.

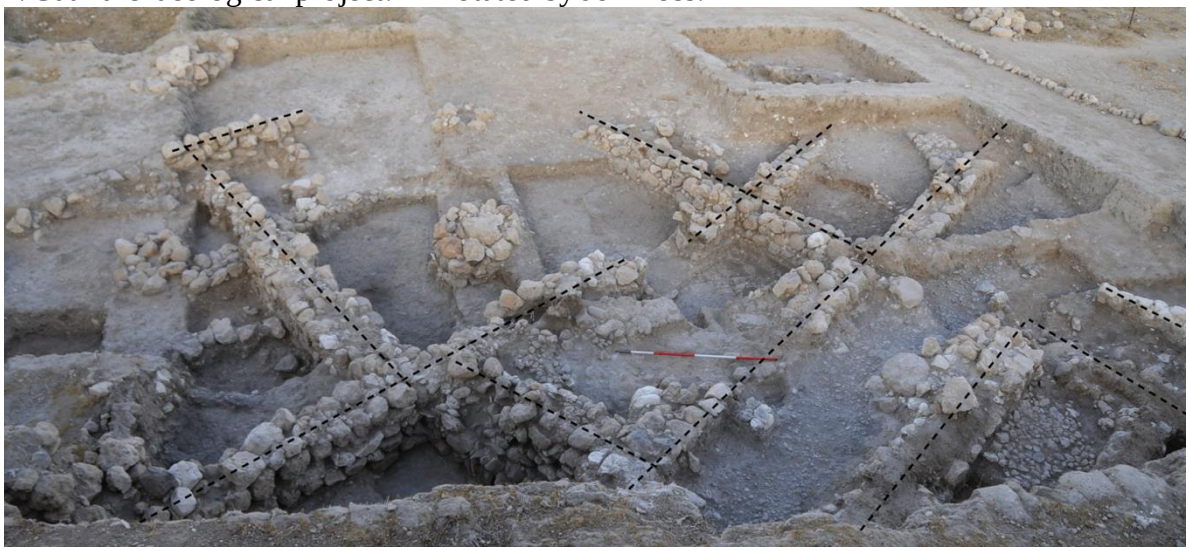


Figure 5.17. West facing photograph (2012) of Area E showing the layout of buildings east of the alleyway, lower terrace (E5a-b phase), Tell eṣ-Ṣâfi/Gath. Photo credit: Area E camera. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Annotated by Jon Ross.



Figure 5.18. Northwest facing photograph of Area E showing the alleyway with two rows of buildings. Building 134817 and Inst. 134413 (E5c phase) is pictured in the immediate foreground (Room 134817), Tell eṣ-Ṣâfi/Gath. Photo credit: Area E camera, 2010. Photos reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Annotated by Jon Ross.



Figure 5.19. Northwest facing photograph in Square 83B showing the sequence of floor and building collapse layers associated with W74511 (E6 and E7 phases), Tell eṣ-Ṣâfi/Gath. Collapse layers are packed with chalk and plaster debris. Photo credit: Area E camera, 2017. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project. Annotated by Jon Ross.



Figure 5.20. South facing photograph in Square 83D showing mudbrick and mortar in wall WE15AS11, associated with platform 20E83D09 (E7 phase), Tell eṣ-Ṣâfi/Gath. Also note the thick E6 building collapse layer packed with plaster debris visible in foreground profile. Photo credit: Area E camera, 2017. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project.



Figure 5.21. East facing downslope photograph of Area E, end of the final 2017 season of excavation (E7 exposures in foreground and the deep probe is centre right in Square 93B), Tell eṣ-Ṣâfi/Gath. Photo credit: Area E camera, 2017. Photo reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project.



Figure 5.22. Histogram showing sherd counts in the study sample according to phase in Area E, Tell eṣ-Ṣâfi/Gath.

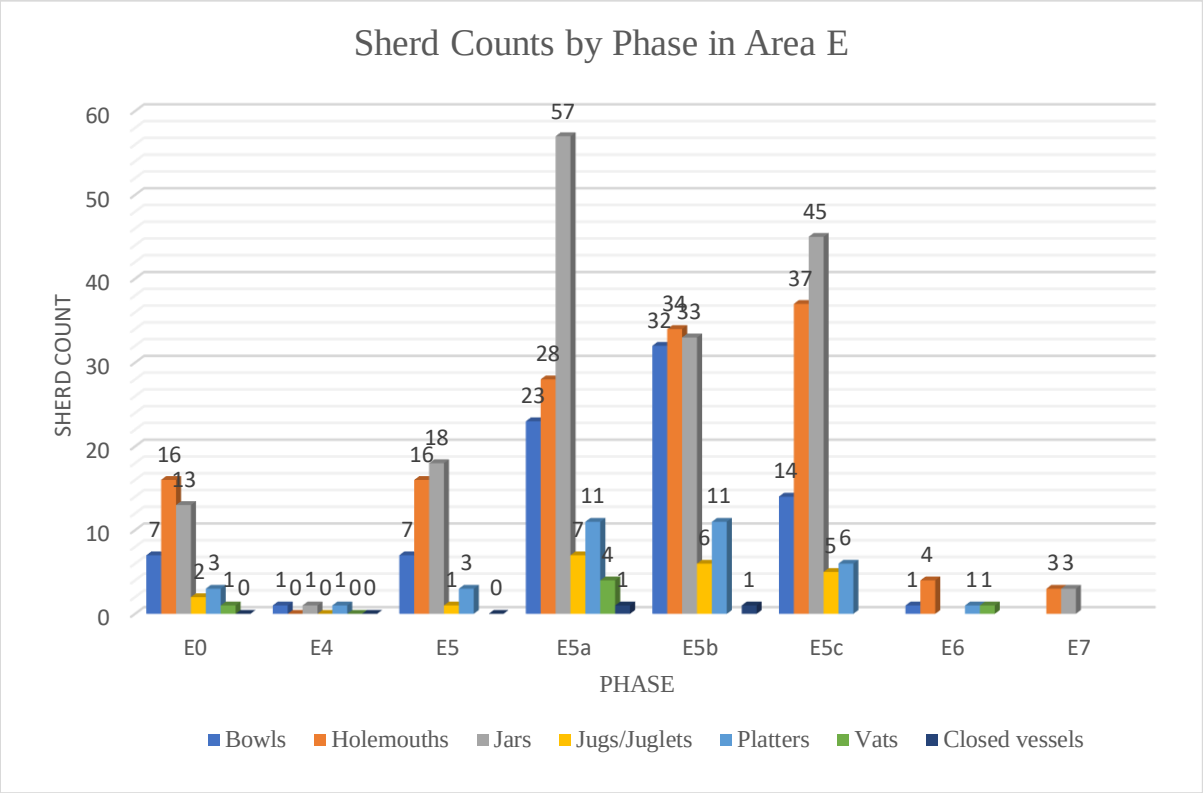


Figure 5.23. Histogram showing sherd counts in the study sample according to phase for Building 1 in Area E, Tell eṣ-Ṣâfi/Gath.

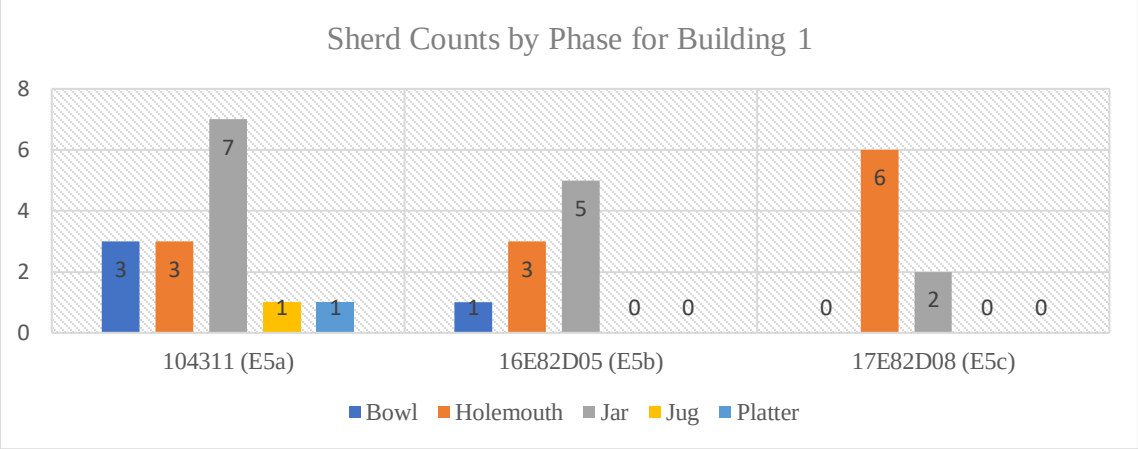


Figure 5.24. Histogram showing sherd counts in the study sample according to phase for Building 2 in Area E, Tell eṣ-Ṣâfi/Gath.

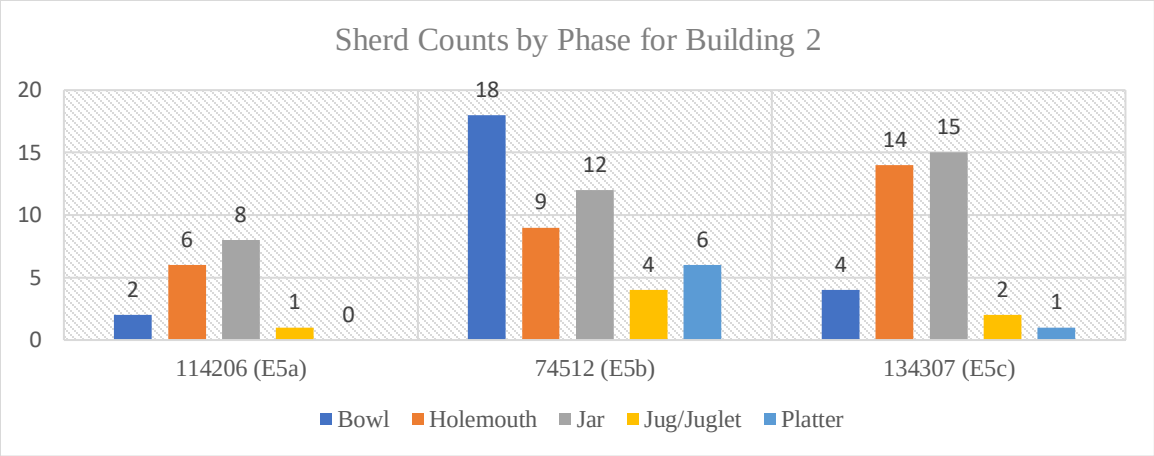


Figure 5.25. Histogram showing sherd counts in the study sample according to phase for Building 3 in Area E, Tell eṣ-Ṣâfi/Gath.

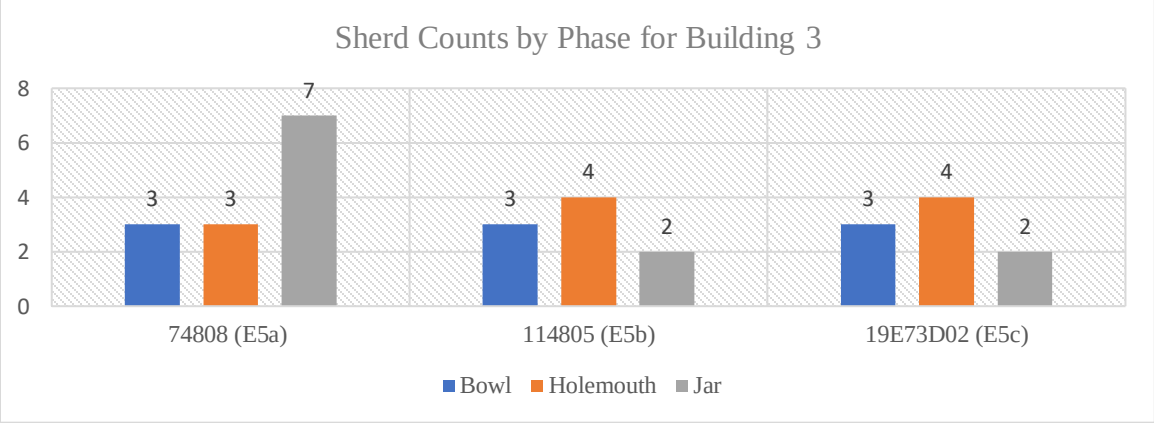


Figure 5.26. Histogram showing sherd counts in the study sample according to phase for Building 4 in Area E, Tell eṣ-Ṣâfi/Gath.

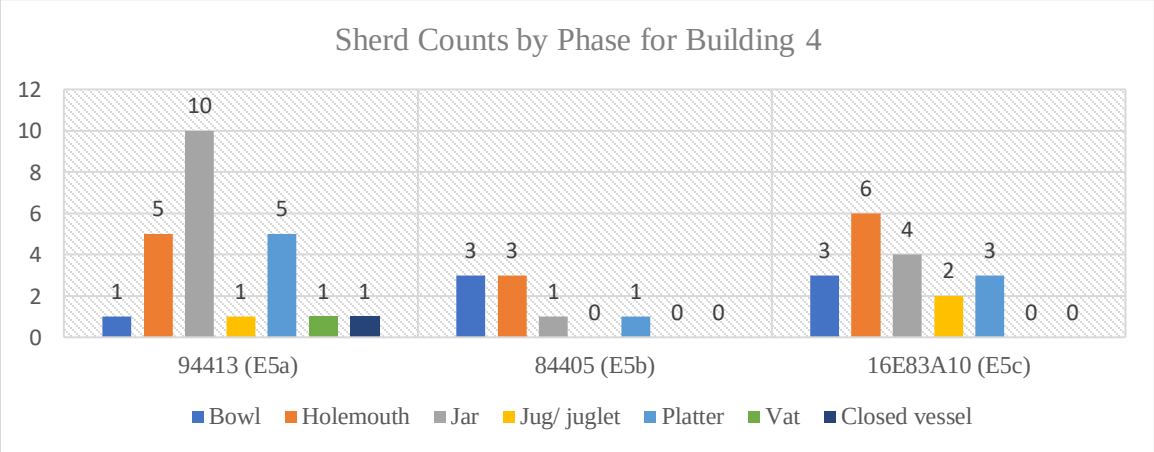


Figure 5.27. Histogram showing sherd counts in the study sample according to phase for Building 5 in Area E, Tell eṣ-Ṣâfi/Gath.

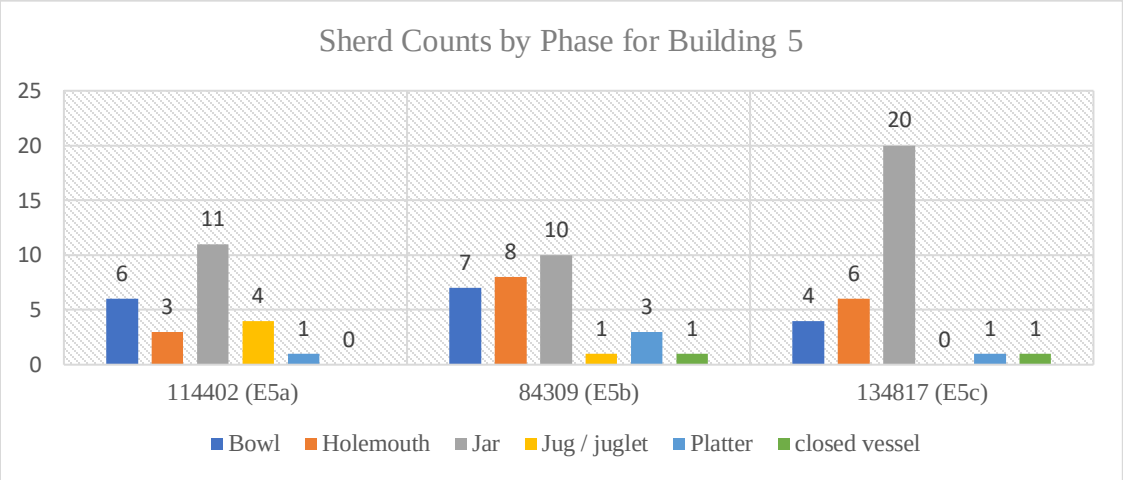


Figure 5.28. Histogram showing sherd counts in the study sample for Building 6 in Area E, Tell eṣ-Ṣâfi/Gath.

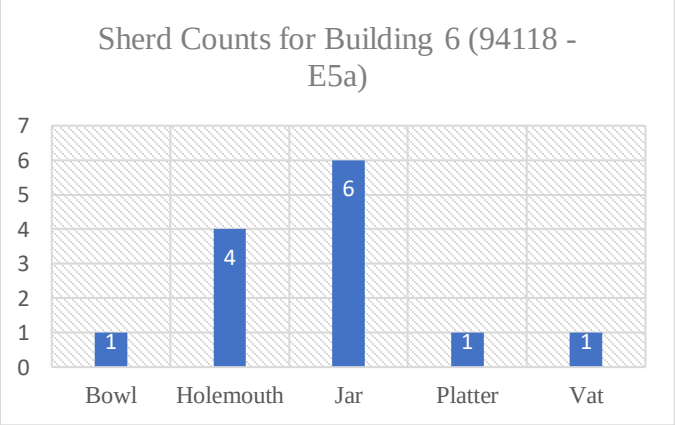


Figure 5.29. Histogram showing sherd counts in the study sample for Building 7 in Area E, Tell eṣ-Ṣâfi/Gath.

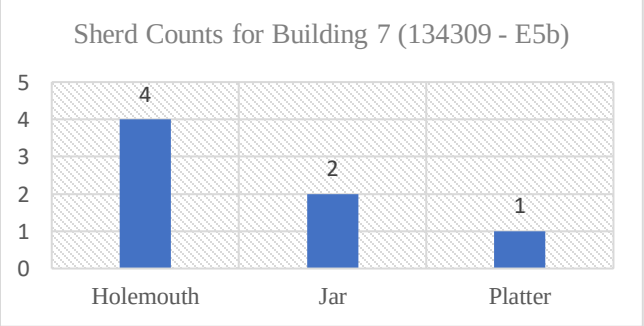


Figure 5.30. Aerial photograph of Area E showing the EB III residential neighbourhood with rows of houses and alleyway. Walls that span all 3 sub-phases of the E5 are dashed in white. Walls that last a single phase are dashed in black. For simplicity, the buildings have been relabelled from 1 to 7 and correspond with the preceding histograms that show the sampled repertoire from each occupational horizon, in each of the buildings (primary contexts only for the building histograms). Aerial photo reprinted with permission of the Tell eṣ-Ṣâfi/Gath archaeological project.



Figure 6.1. Vessel silhouettes of the main EB III forms from Tell eṣ-Ṣâfi/Gath. Graphic © Jon Ross.

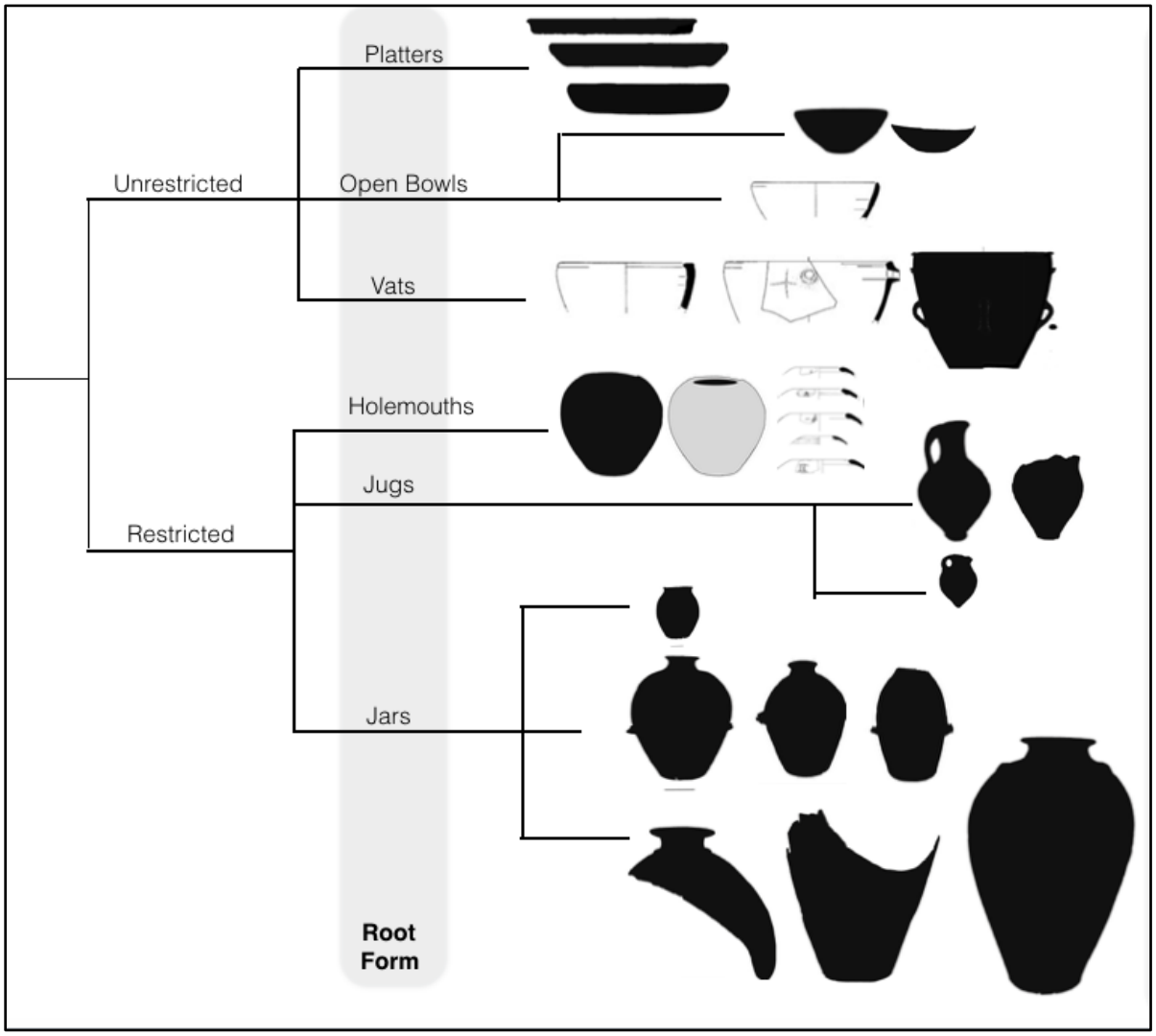


Figure 6.2. A formal classification of the open vessels (right) and the closed EB vessels (left) from Tell eṣ-Ṣâfi/Gath. Graphic is © Jon Ross.

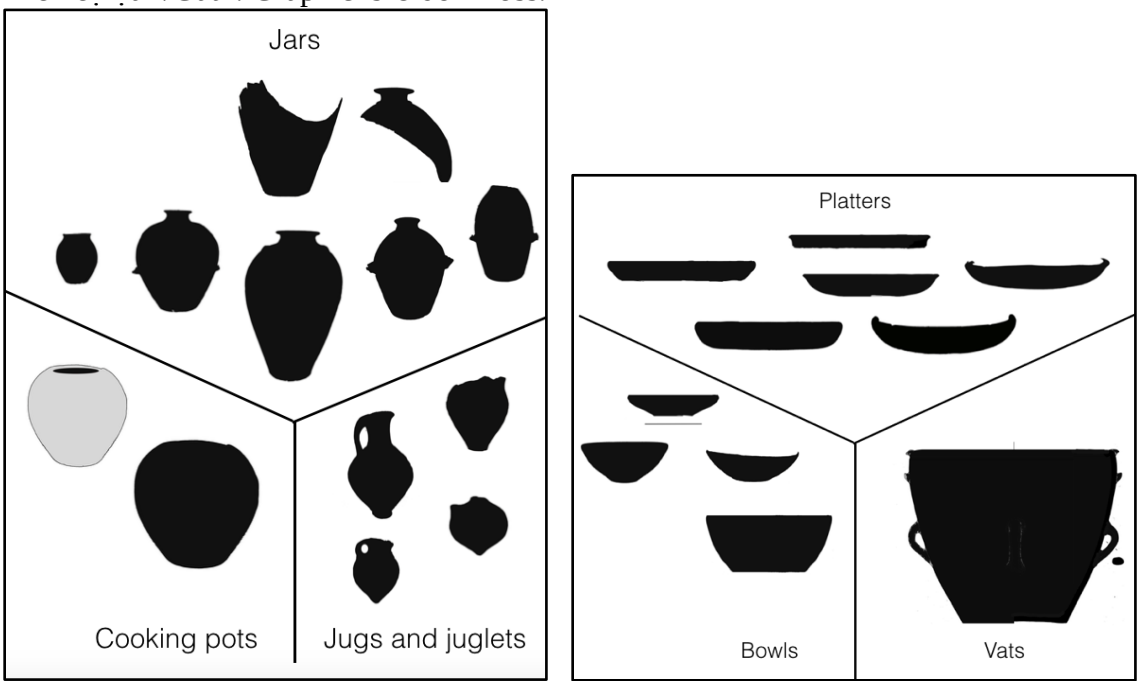


Figure 6.3. Classification of vessel function. Graphic is © Jon Ross.

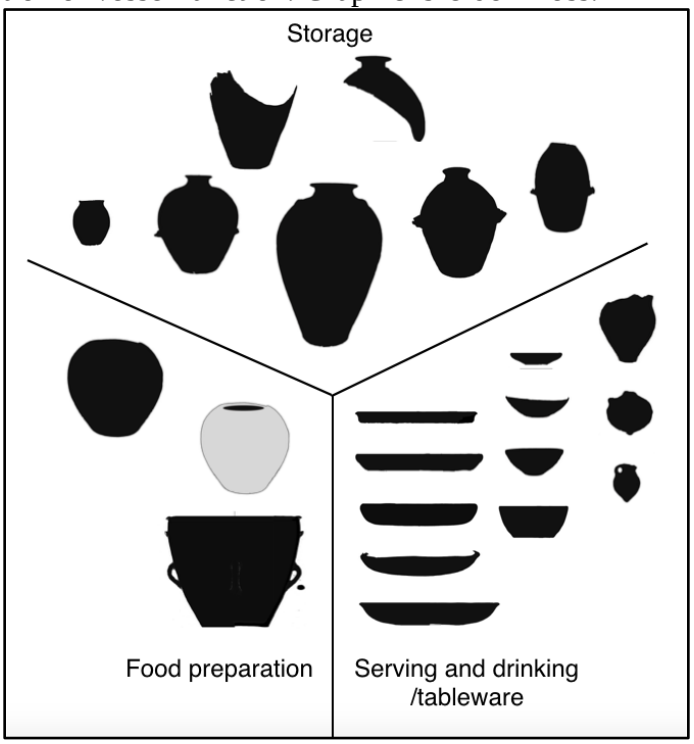


Figure 6.4. Classification of EB vessel function from Tell eṣ-Ṣâfi/Gath. Graphic is © Jon Ross. Photos reprinted with permission of Tell eṣ-Ṣâfi/Gath archaeological project.

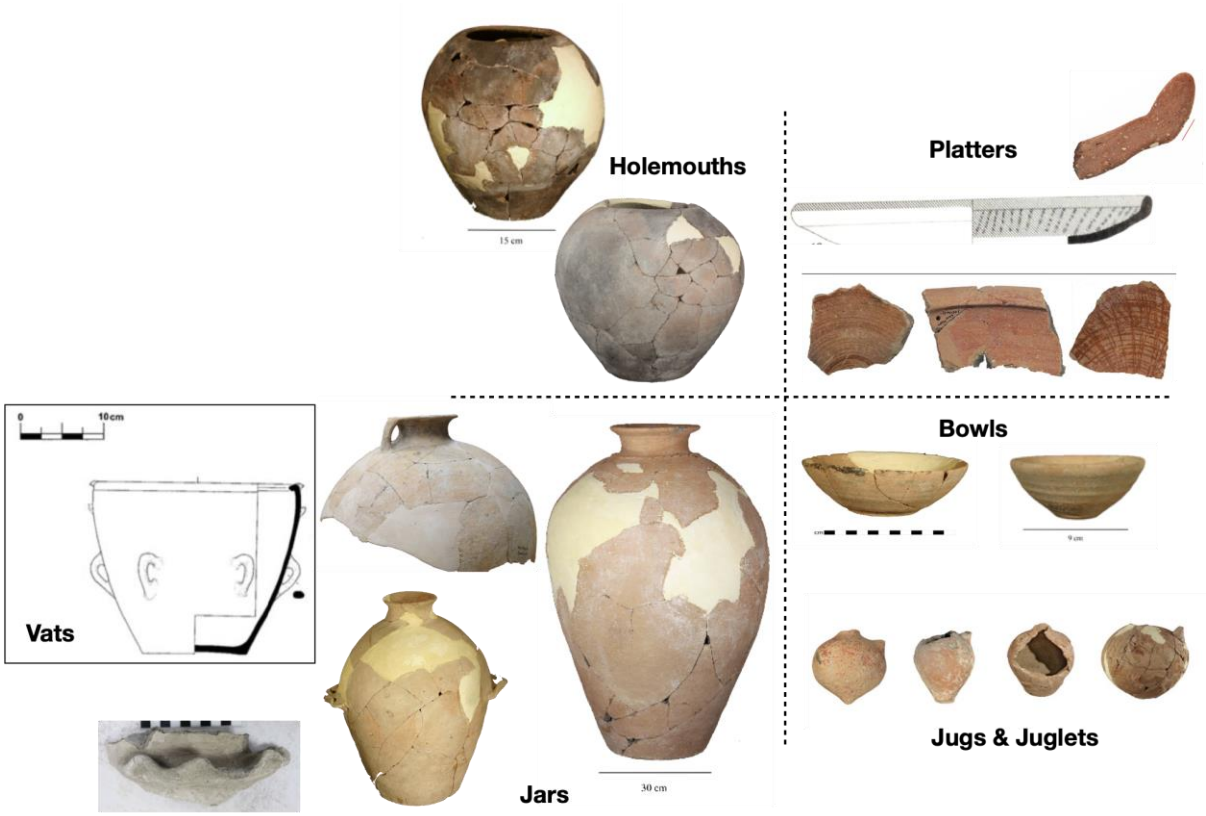


Figure 6.5. Rim and wall morphology of the EB bowls (top 3 rows) and platters (bottom row) sectioned in this study from Tell eṣ-Ṣâfi/Gath. Top row shows the small hemispherical bowls with plain simple rims. The second row shows the deep bowls with inverted rims and straight walls. The third row shows the large shallow bowls with inverted rims and rounded walls. The bottom row shows the platters with plain and up-turned rims and most did not have a carination (seen second from the right). These rim and wall silhouette profiles were imaged using the scanned thick sections discussed in Chapter 3. Graphic is © Jon Ross.

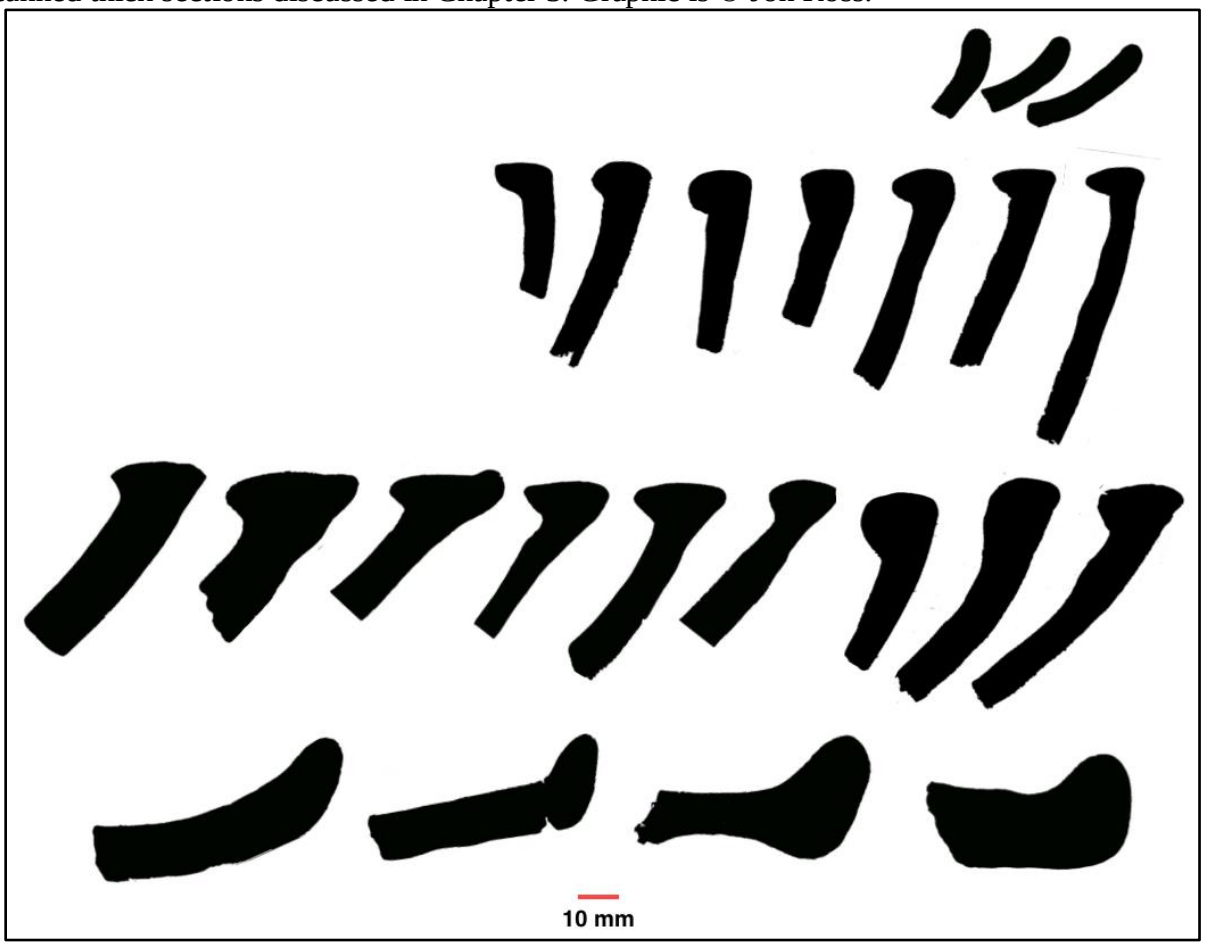


Figure 8.1. Magnified sub-rounded and sub-angular chalk and micrite (right) in scanned pottery thick sections, catalogue no. 387 (left) and 393 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.

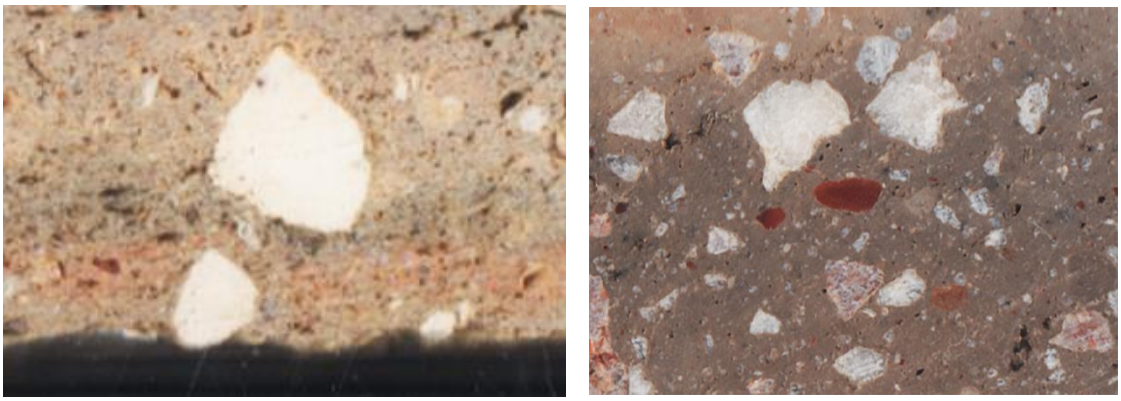


Figure 8.2. Magnified coarse angular chalk inclusion showing signs of wear and diagenesis from repeated heating (left). Large ferrous inclusion, with a clay pellet, and crushed chalk (right) in scanned pottery thick sections, catalogue nos. 417 (left) and 393 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.

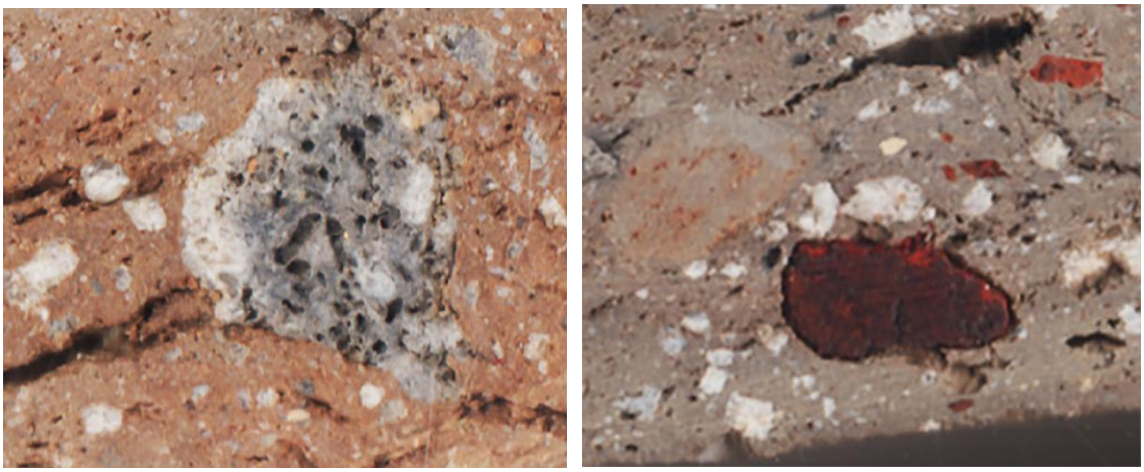


Figure 8.3. Magnified ferrous inclusions, with sub-rounded chalk, and a mollusc shell (left) in scanned pottery thick sections, catalogue nos. 135 (left) and 62 (right), from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.



Figure 8.4. Magnified large sub-angular sandstone inclusions otherwise known as ‘kurkar’ or ‘eolianite’ in scanned pottery thick sections, catalogue no. 209 (left) and 307 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.



Figure 8.5. Magnified large examples of coarse angular grog and grog within grog (left) in scanned pottery thick sections, catalogue no. 425 (left) and 170 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross. Grog is more heterogenous than sandstone, lacks ‘bedding’, and usually has similar fabric(s) to the rest of the assemblage.



Figure 8.6. These examples show large grog inclusions with a ‘relic surface’ from the pottery vessel it originally came from in scanned pottery thick sections, catalogue nos. 205 (left) and 197 (middle), and 415 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.



Figure 8.7. The ring of circulation is visible around most of the grog inclusions, which have a similar fabric to the clay body. Scanned pottery thick section catalogue no. 159 from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.



Figure 8.8. A variety of microfossil inclusions, foraminifera, and marine bioclasts in scanned pottery thick sections from Area E, Tell eṣ-Ṣâfi/Gath. First row of catalogue nos: 310 (left), 232 (centre), and 329 (right). Second row of catalogue nos: 417 (left), 224 (centre), 317 (right). Third row of catalogue numbers: 484 (left), 170 (second left), 412 (second right), and 309 (right). Fourth row of catalogue nos: 470 (left) and 454 (right). Photo credit: Jon Ross.

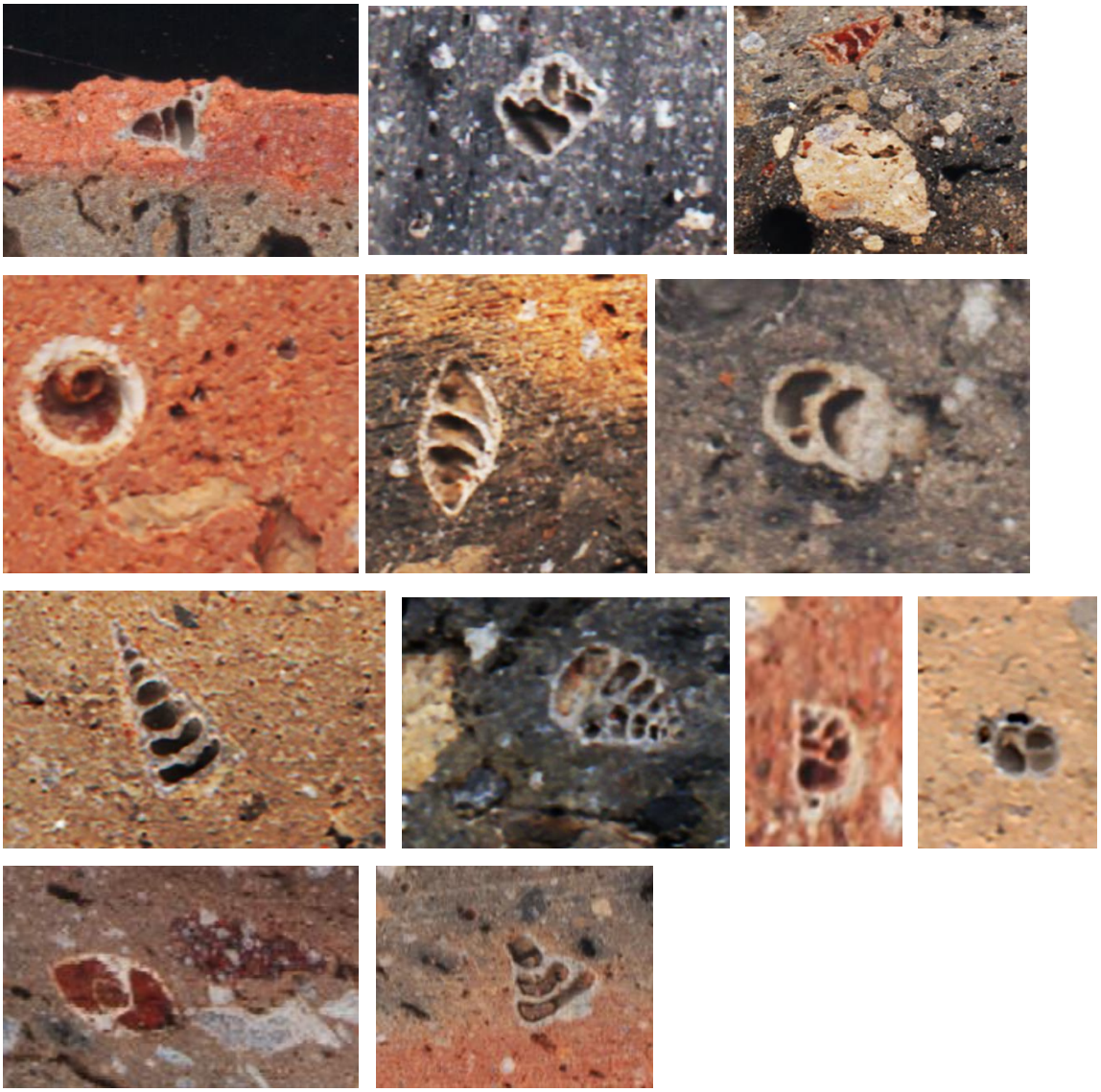


Figure 8.9. Circular round cavities from fibre temper (chaff?), burnt out organics, seeds, and legumes/ agricultural by-products? Catalogue nos. 139 (top left), 393 (top middle), 76 (top right), 69 (bottom left), 81 (bottom middle), and 207 (bottom right).



Figure 8.10. Additional images of dune sandstone (kurkar), catalogue no. 207.

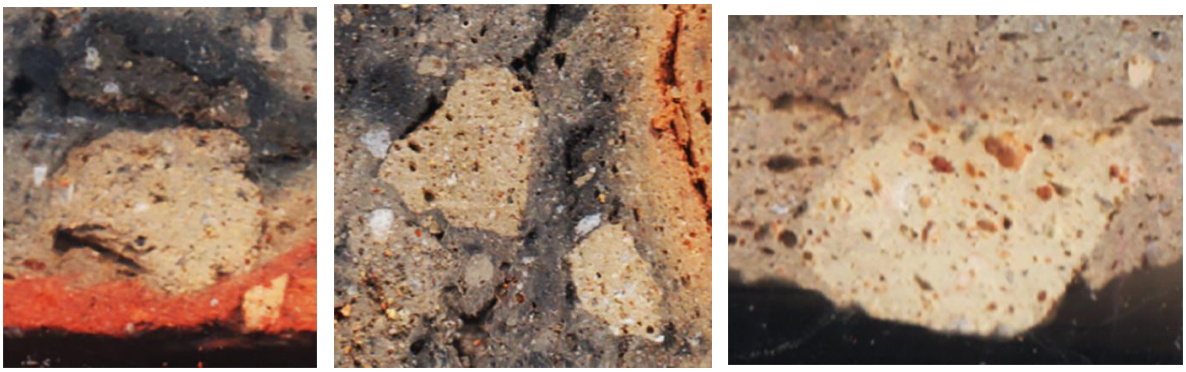


Figure 8.11. Abundance of carbonate minerals, micrite (fine micro-crystalline calcite), and the fossilised skeletons of marine microorganisms (typically shells or ‘tests’ from foraminifera) in EB ceramics, catalogue no. 1, from Area E, Tell eṣ-Ṣâfi/Gath. The presence of these inclusions confirm that these fabrics were made from marine marl clay deposits. These scanned sections are an excellent tool for illustrating the clay body/fabric of a vessel. Photo credit: Jon Ross.

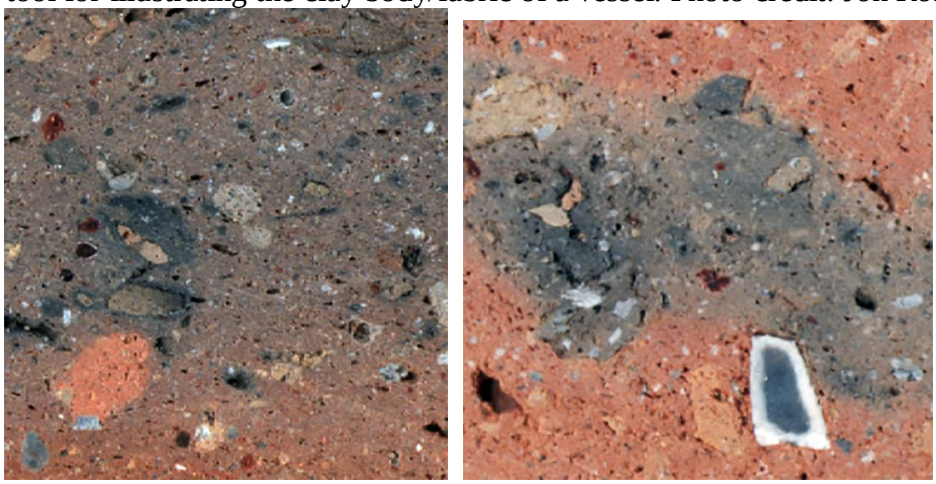


Figure 8.12. 'Fire clouding' on the exterior surface of an EB platter and a jar from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.



Figure 8.13. Select thick-sections of the EB III common ware (fabric group 3) from Area E, Tell eṣ-Ṣâfi/Gath. The top image (no. 224) is a body sherd of a storage jar and bottom image (no. 66) is a body sherd of a platter. Grey cores with yellow margins. Incomplete oxidation of the fabric in a non-reducing atmosphere. The orange layers are from reoxidation where the vessel was removed from the fire while still hot (Rye 1981). The black/grey cores are from incomplete oxidization of the vessel wall. Photo credit: Jon Ross.



Figure 8.14. Thick-sections of an EB lime plastered jar (catalogue nos. 204 and 194) from Area E, Tell eṣ-Ṣâfi/Gath showing grey sections and highly porous fabric. Insufficient/poor penetration of oxygen. Photo credit: Jon Ross.



Figure 8.15. Thick-section of a EB small hemispherical bowl (catalogue no. 22) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.



Figure 8.16. Petrofabric groups 2 and 3. Graphic is © Jon Ross.

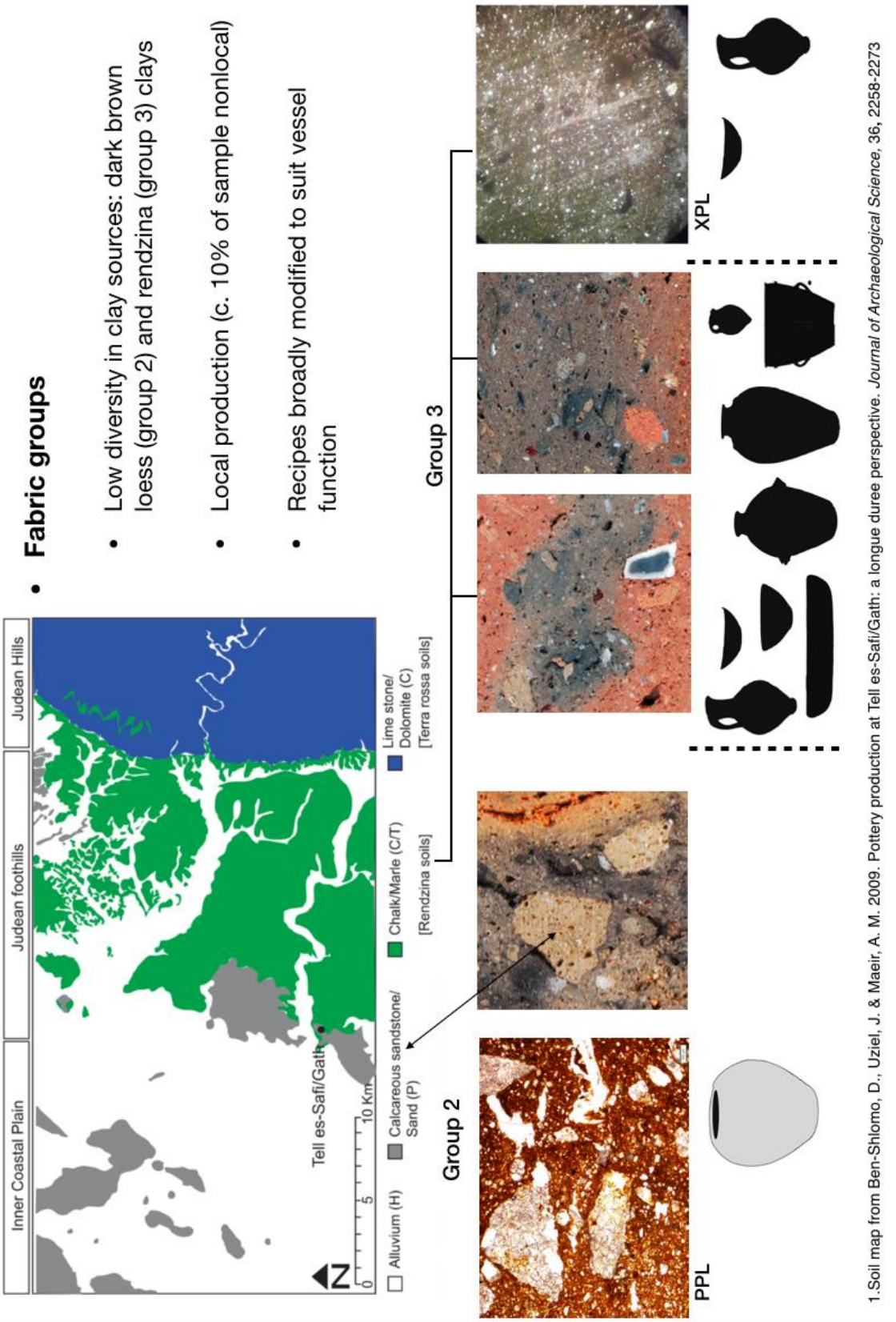


Figure 8.17. Select thin-sections of holemouth sherds (catalogue no. 383) prepared by the author at the CTL lab. Images show a heavily tempered lean clay. The fabric is dominated by poorly sorted, large, angular, crushed chalk in a dark brown silty loess matrix – group 2 cookware. Photo credit: Jon Ross.

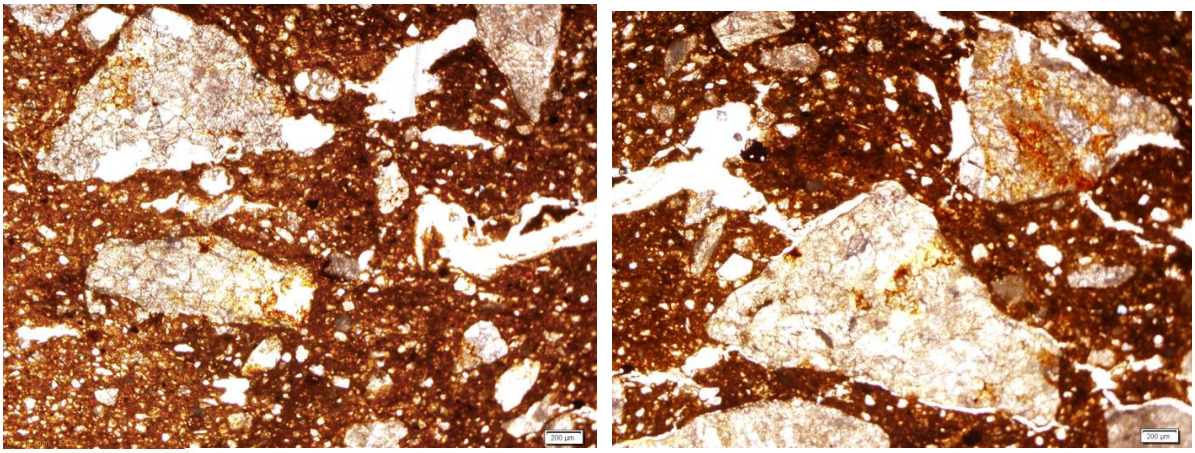




Figure 8.18. Thin-sections of holemouth sherds (at low magnification) from Area E, Tell eṣ-Ṣâfi/Gath showing the preferred orientation of the crushed chalk inclusions in the fabric. Highlighted areas show coil joins. Photo credit: Jon Ross.

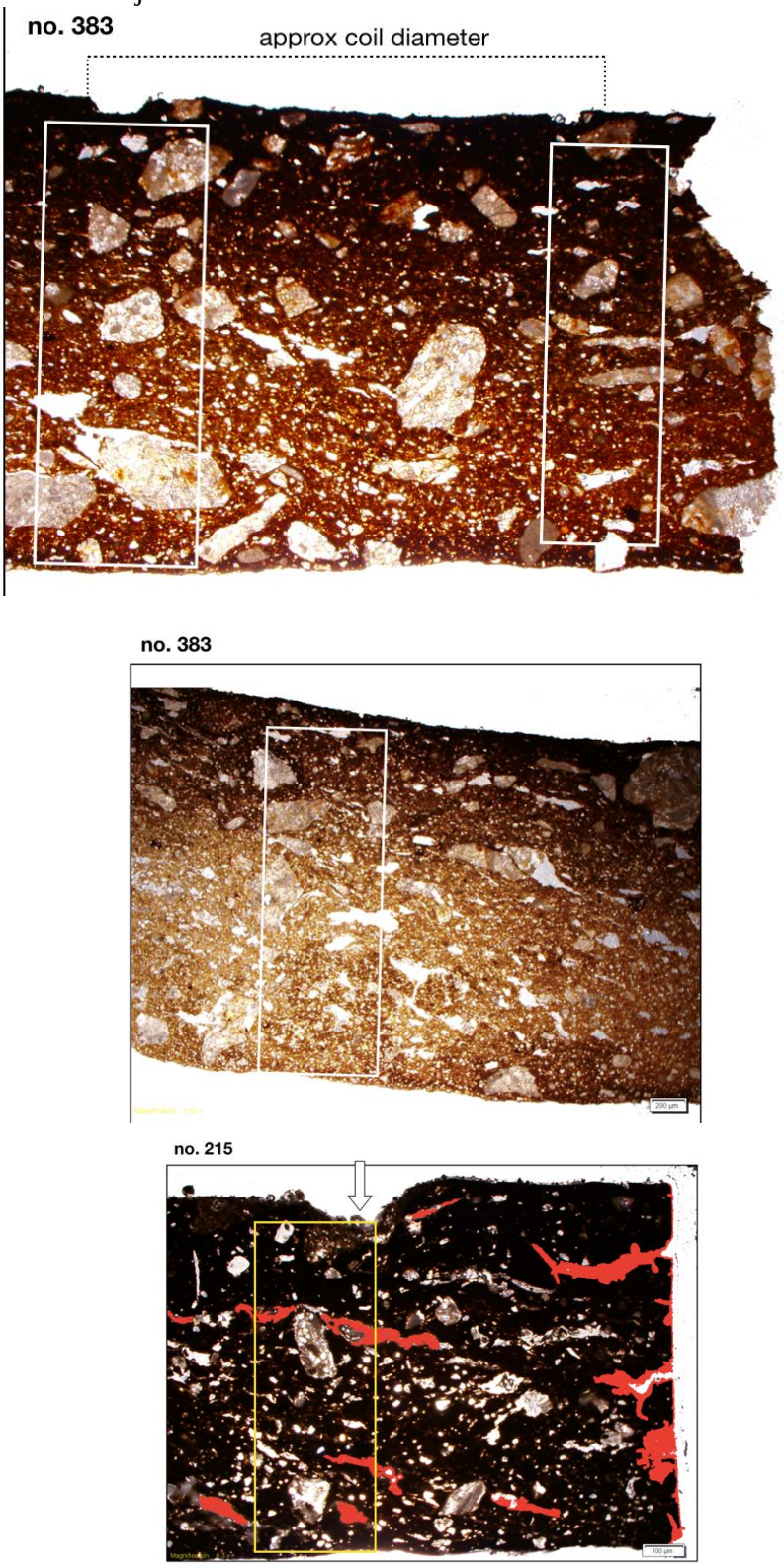


Figure 8.19. One contiguous section of a holemouth sherd, catalogue no. 383, stitched together from three separate images of a thin-section. Photo credit: Jon Ross.



Figure 8.20. Select thin-sections of storage jar sherds prepared by the author at the CTL lab (. Inclusions include: coarse grog with ring of separation (top left), opaque ferrous inclusions (bottom left), and crushed chalk fragments in a calcareous unvitrified matrix, with a light brown to reddish-yellow colour. Photo credit: Jon Ross.

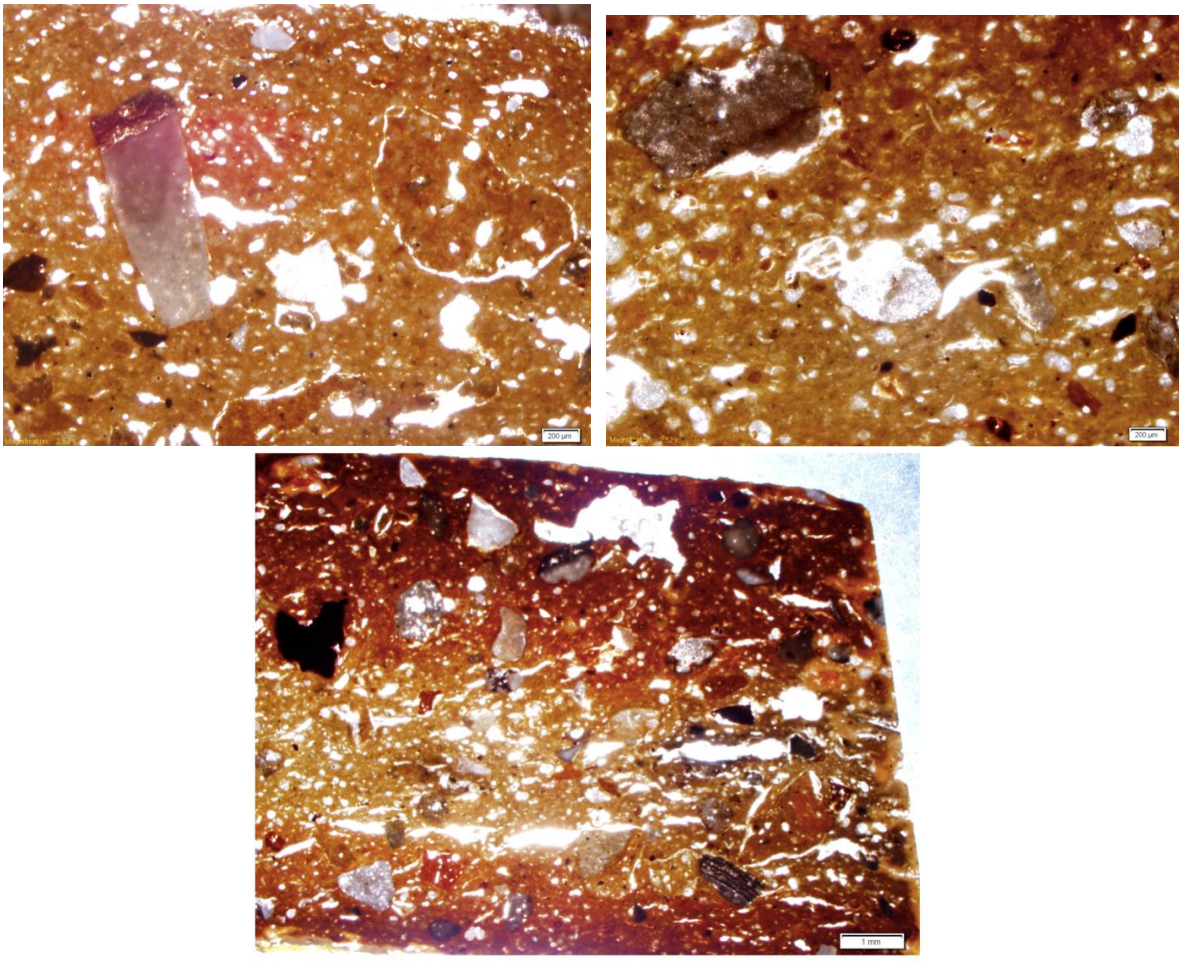
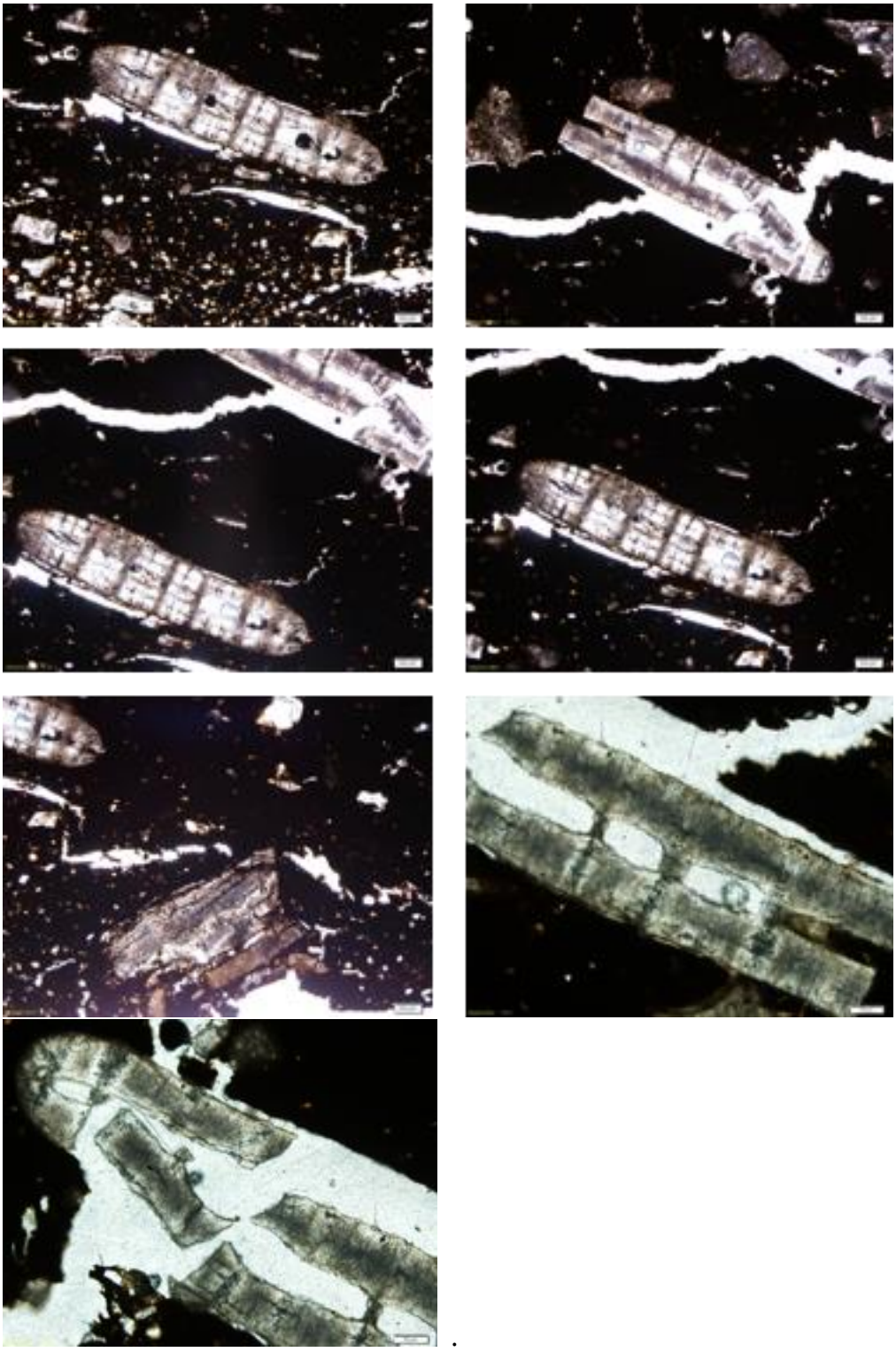


Figure 8.21. Alleged bone inclusions or what I believe to a type of carbonate eolianite in holemouth sample no. 137 in thin-section. The inclusions in these images are comparable to some of the microstructures described in Frebourg 2008. Photo credit: Jon Ross.



.

Figure 8.22. A section of a proximal end of a femur showing the porous trabecular bone or 'spongy' bone. Photo credit: Jon Ross.

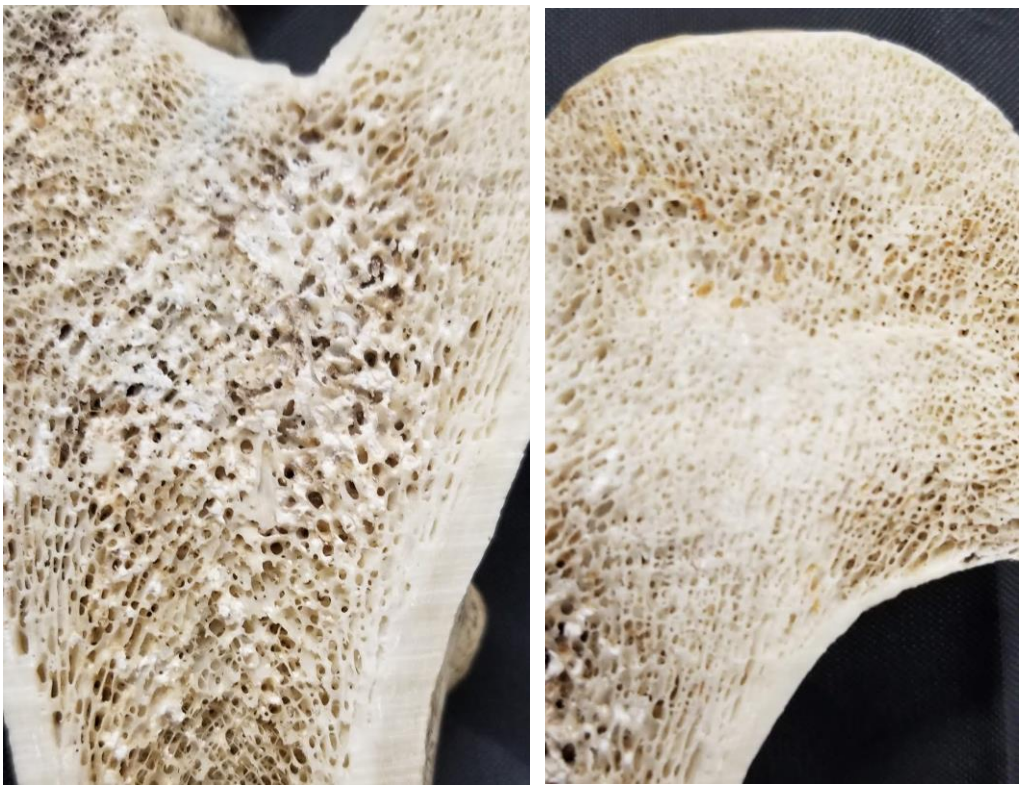


Figure 8.23. Thick section of holemouth with alleged bone inclusions or carbonate eolianites (catalogue no. 137). Photo credit: Jon Ross.



Figure 8.24. Ferruginous clay and clay pellets in Abydos juglet no. 27 in thin-section. Photo credit: Jon Ross.

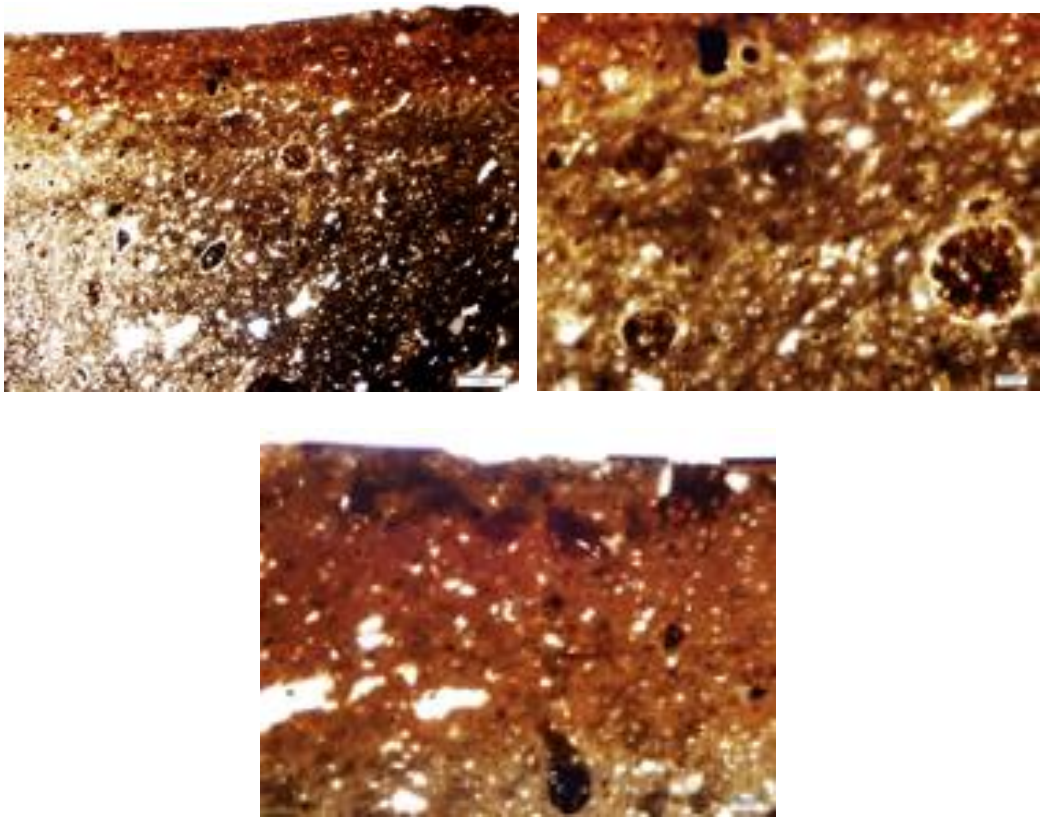


Figure 8.25. SEM image of a fissure in an Abydos jug, catalogue no. 27 (courtesy of the NEBAL SEM). Image shows the sheet like structure of illite clay minerals, consisting of small stacked amorphous flakes, roughly 0.3 to 0.1 um in diameter. Illite clays have good plasticity due to the small particle size and their fine texture promotes a natural lustre, excellent for slips (Rice 2015: 50, 56). Illite clays are usually calcareous marine marls formed offshore and are a highly weathered type of clay (although not as weathered as kaolinite). They are more stable than smectities, but have a low refractoriness (poor heat resistance). The diagenesis of smectites, caused by the "microbial bio-reduction of iron", results in illite clays, but the process is reversible and illites can revert back to smectites after several millennia (Rice 2015: 56).

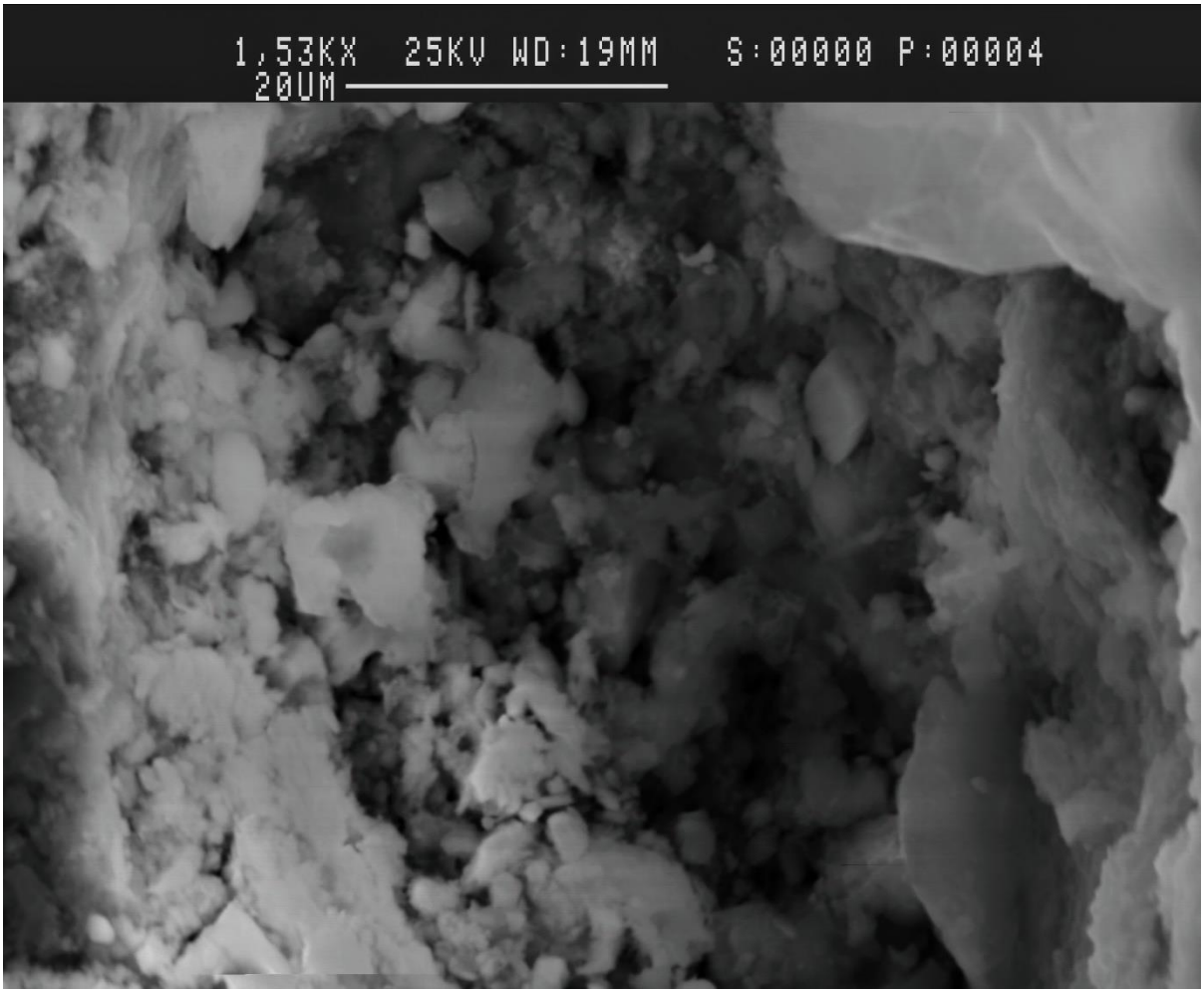


Figure 8.26. SEM image of Abydos juglet (catalogue no. 27). Present in the matrices are fragments of mollusc shells, from bivalves or brachiopods, in addition to other multi-chambered marine protozoa common in marine marls. Calcareous inclusions show up as lighter shades of grey when compared to quartz, voids are black, and ferrous inclusions are white. Clay domains are unvitrified. Note the contrast in the regularity of the burnished surface compared.

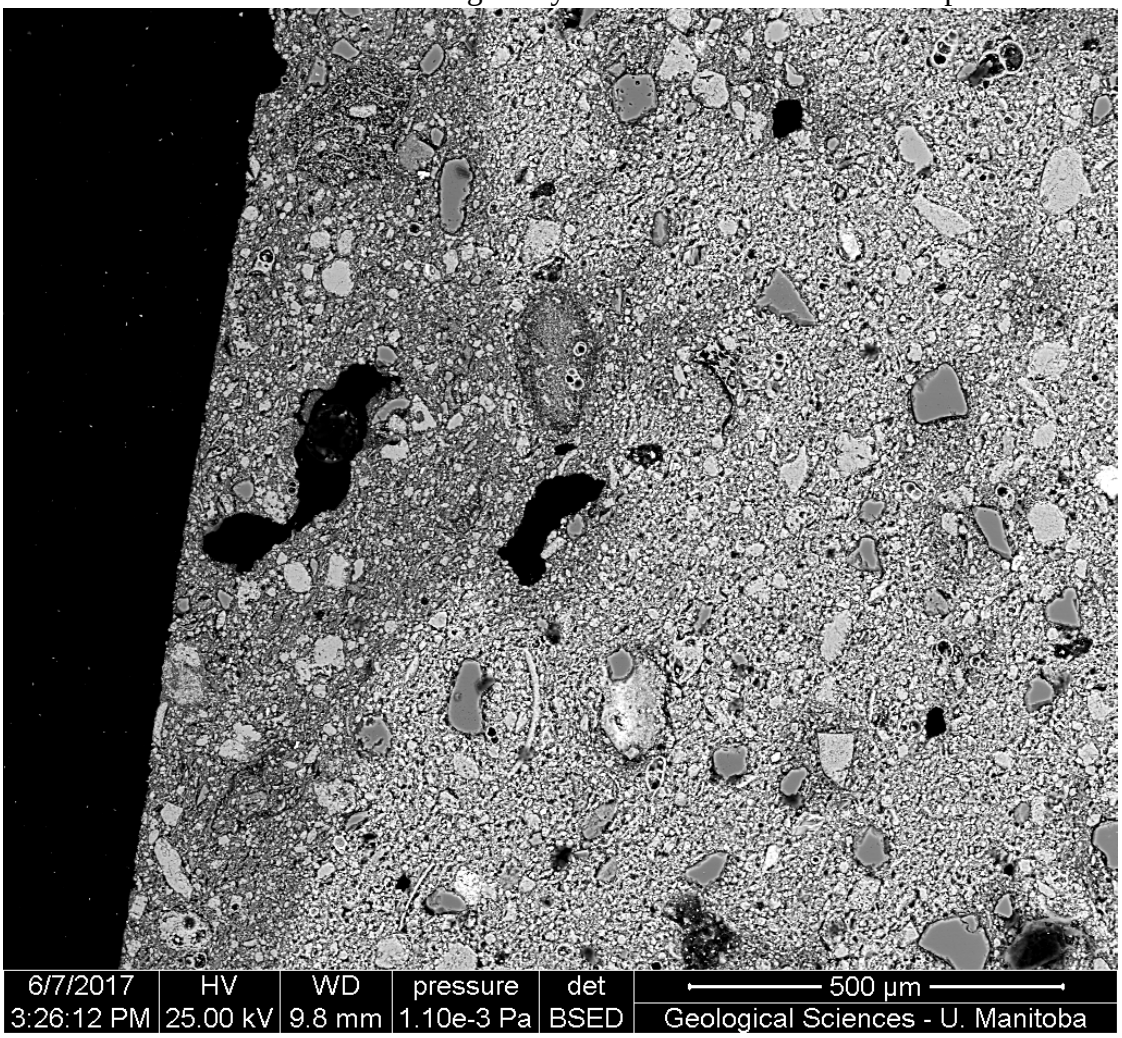


Figure 8.27. SEM image of a bowl rim, catalogue no. 330 (left) and Abydos juglet base, catalogue no. 27 (right). Close-up of the unvitrified clay domains on jar catalogue no. 209 (bottom).

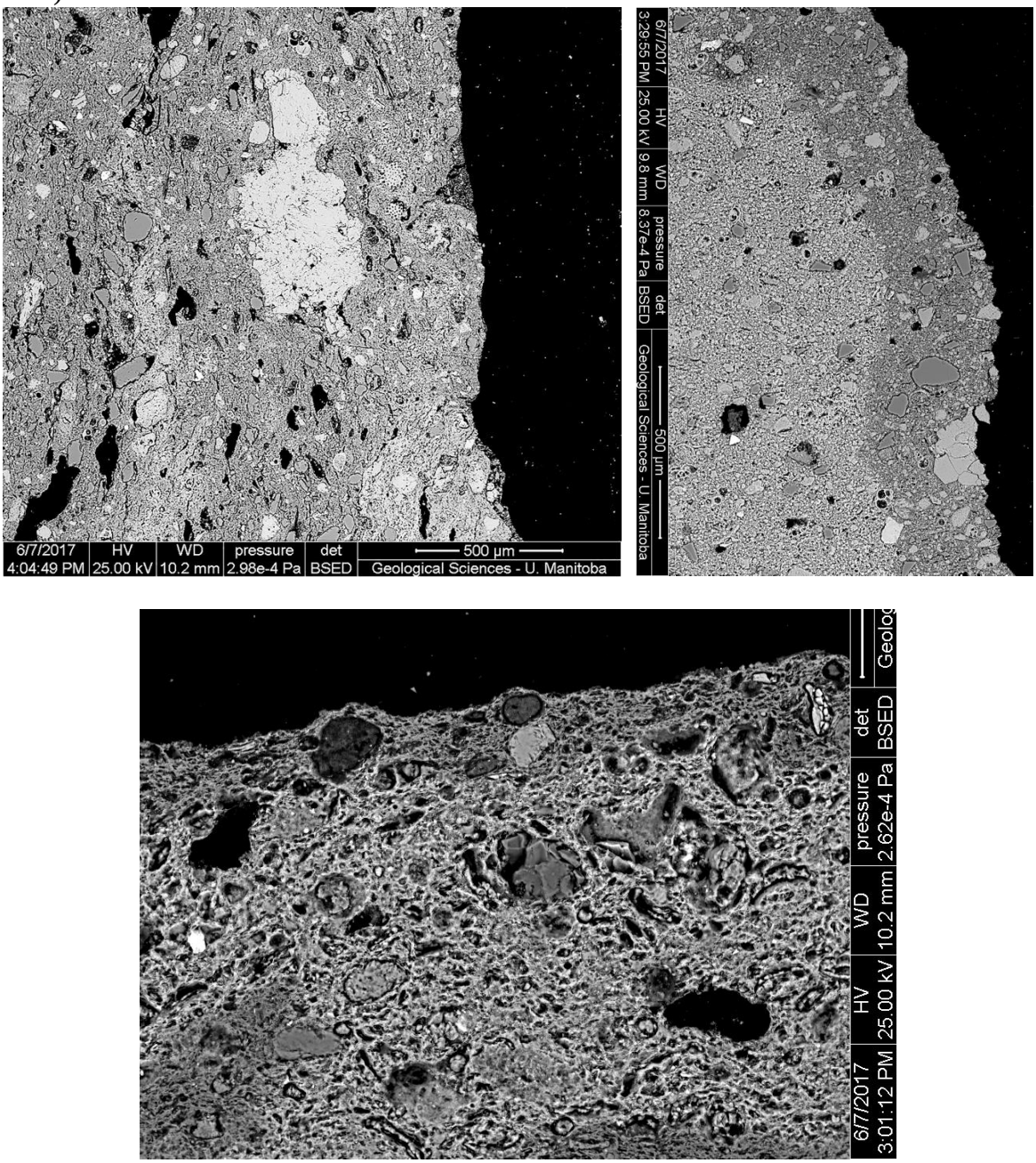


Fig. 9.1. Technique 1 on holemouth rim catalogue no. 107 (left) and holemouth body sherd no. 18 (right) from Area E, Tell eṣ-Ṣâfi/Gath. Red scale line = 10 mm: A) shows preferred orientation of voids; B) shows orientation of inclusions; and white arrows point to prominent central cavities at the centre of a coil. Photo credit: Jon Ross.

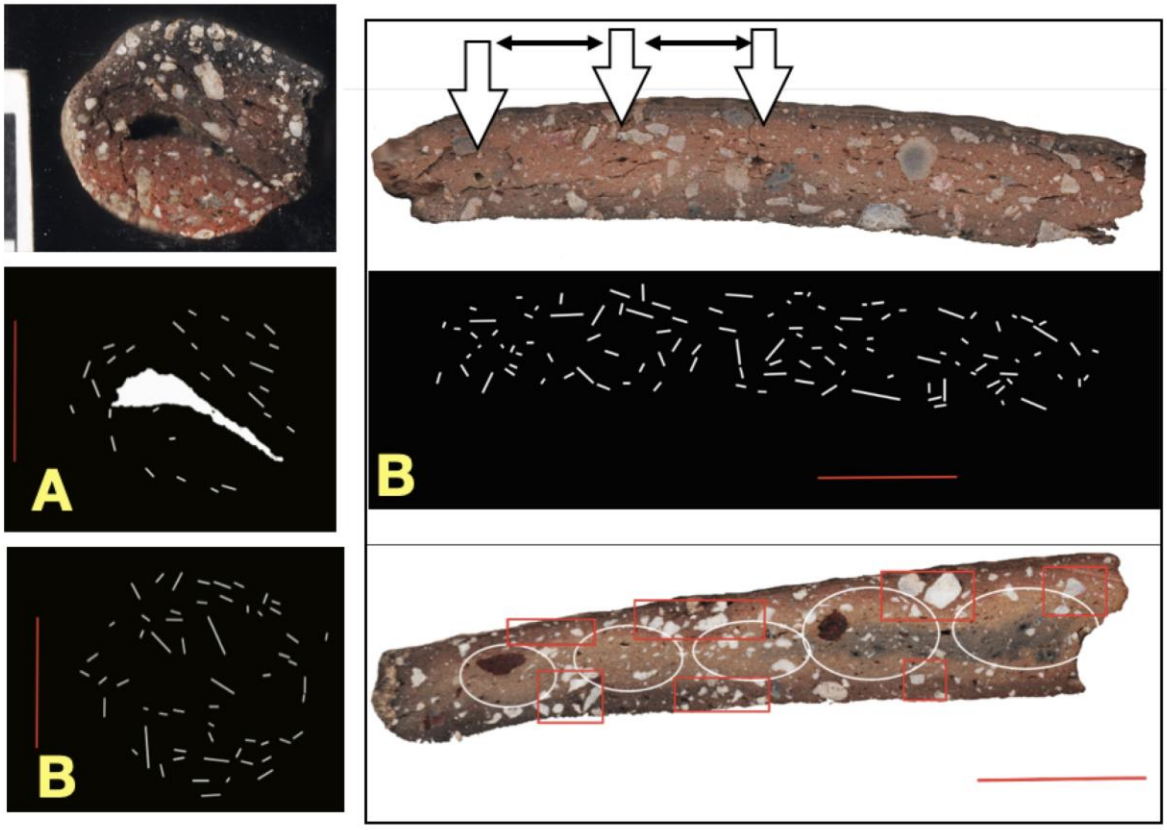


Fig. 9.2. Technique 1 on bowl rim sherd catalogue no. 183 (left), jar body sherd catalogue no. 319 (top right), and holemouth body sherd (bottom right) catalogue no. 319, from Area E, Tell eṣ-Ṣâfi/Gath. Sections show wall morphology diagnostic of coil construction on open and closed vessels. Photo credit: Jon Ross.

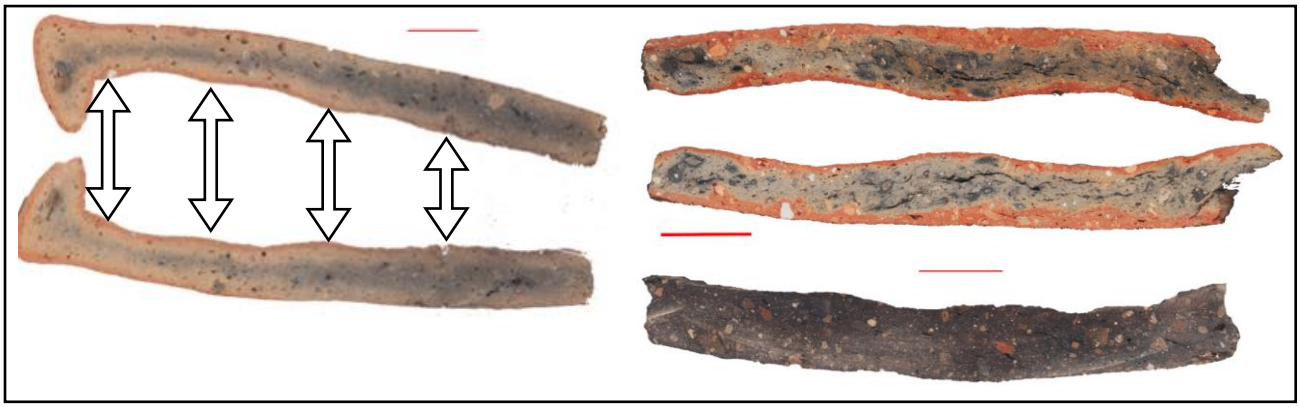


Fig. 9.3. Technique 3 on holemouth bases catalogue nos. 458 (bottom right), 393 (top right), 16 (top left) and 421 (bottom left) from Area E, Tell eṣ-Ṣâfi/Gath. Sections reveal the difference in the morphology and regularity of the walls between freehand coiling and coiling with a vessel support. Photo credit: Jon Ross.

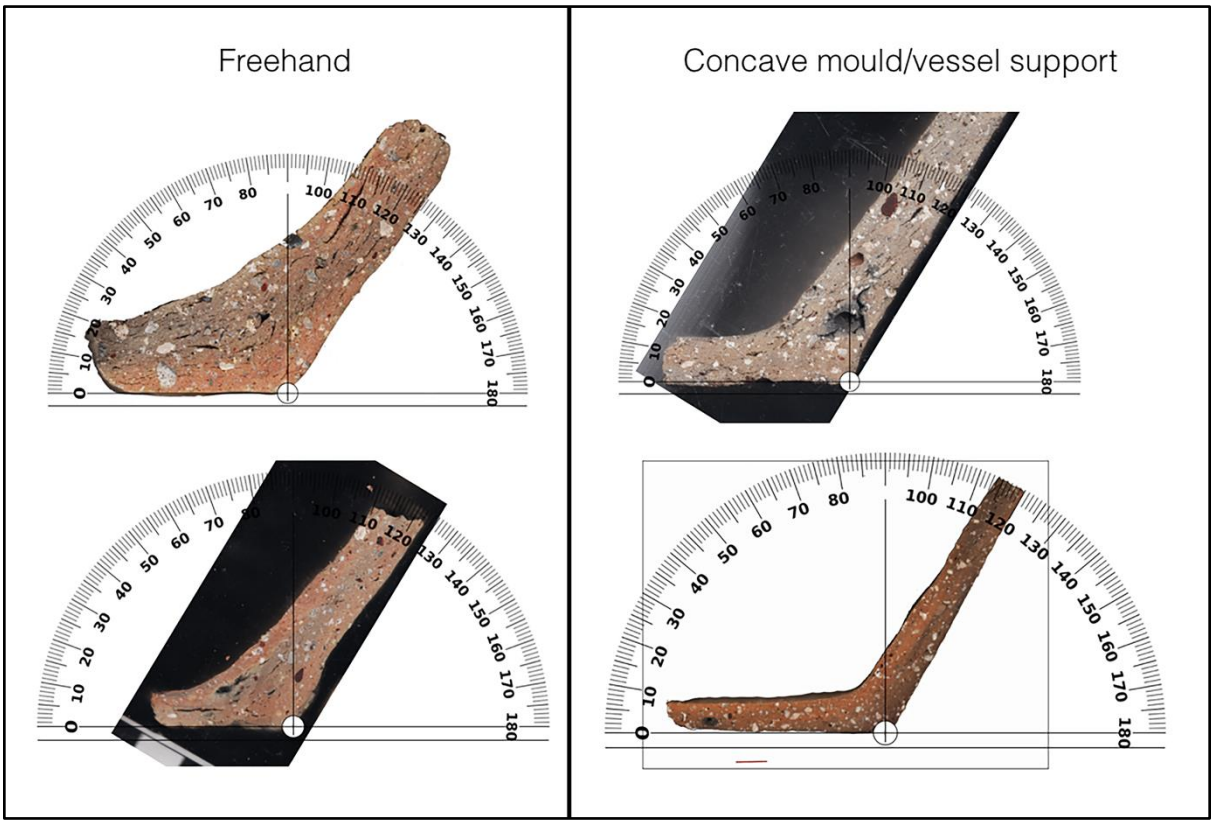


Fig. 9.4. Macroscopic traces of pinching on a shallow pinch bowl used as a lamp (Basket 17E83C031) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit Jon Ross.



Fig. 9.5. Wheel-shaping vs. wheel-throwing in section. The sections show differences in the regularity of vessel walls and void distribution on a bowl sherd, catalogue no. 505 (left) and a jug body sherd, catalogue no. 289 (right), from Area E, Tell eṣ-Ṣâfi/Gath. Bowl sherd no. 505 is intrusive from the Late Bronze levels sealing the E5 neighbourhood. Bottom left is a section of a Late Bronze disk base showing a torsion crack (unstratified surface material from Tell eṣ-Ṣâfi/Gath). Photo credit: Jon Ross.

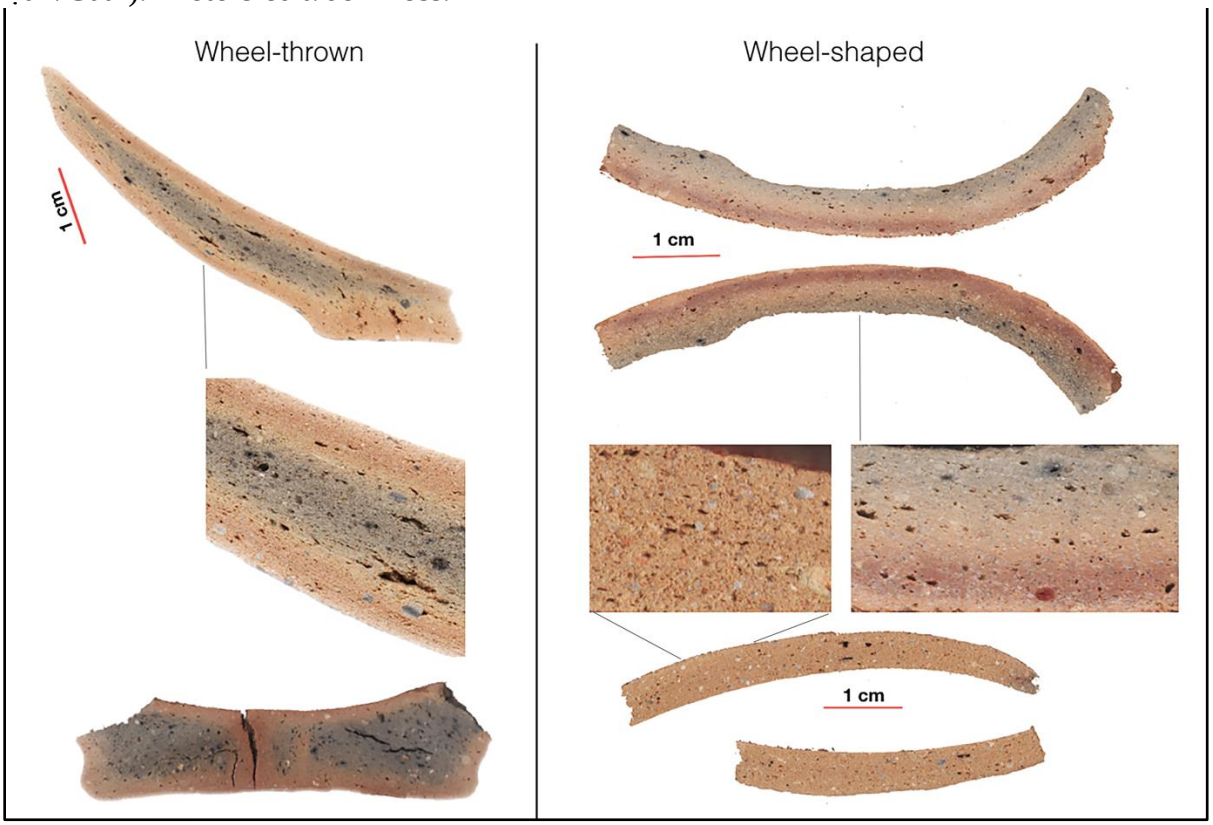


Fig. 9.6. Bases of holemouth jars (catalogue no. 13) set in the bases of pithoi (no 3.88) from Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.



Fig. 9.7. Section of a platter body sherd (catalogue no. 166) from Area E, Tell eṣ-Ṣâfi/Gath. Section shows the preferred orientation of non-plastics (top) and voids (bottom) indicative of coiling including large poly-concavities in the bottom image. Photo credit: Jon Ross.

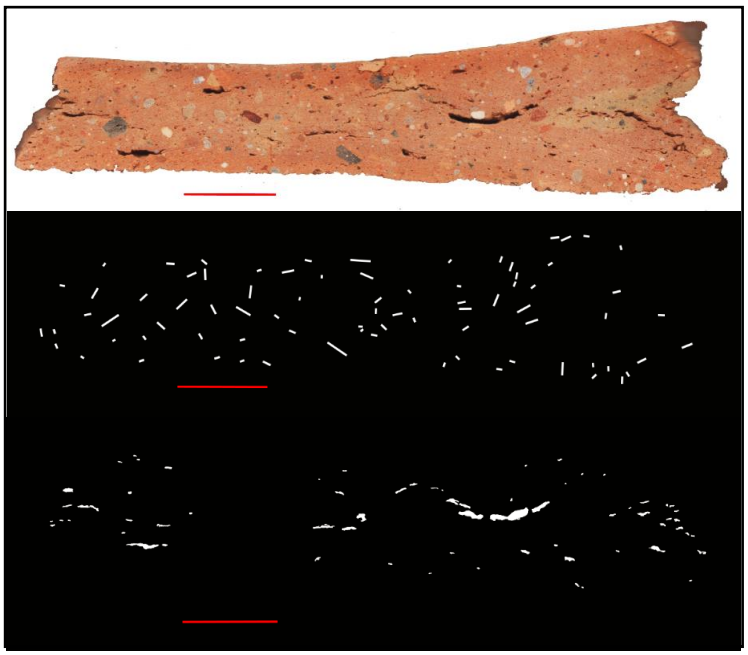


Fig. 9.8. Platter sherds showing concavity under the rim highlighted by the white arrows on the top row of images, catalogue nos. 482 (left and centre) and Basket 16P50A066 (right). Bottom row shows roughly textured bases, from baskets 13450748 (left), 1045028 (centre), and 20E93B012 (right), Area E, Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.



Fig. 9.9: Thick coil running around the base of holemouths and jars from Area F, Basket 18F26C015 (left) and Area E, catalogue nos. 388 (top right) and 462 (bottom right) Tell eṣ-Ṣâfi/Gath. Photo credit: Jon Ross.



Fig. 9.10: Classification of vessel types from Area E, Tell eṣ-Ṣâfi/Gath, according to fashioning methods/shaping dendrogram © Jon Ross.

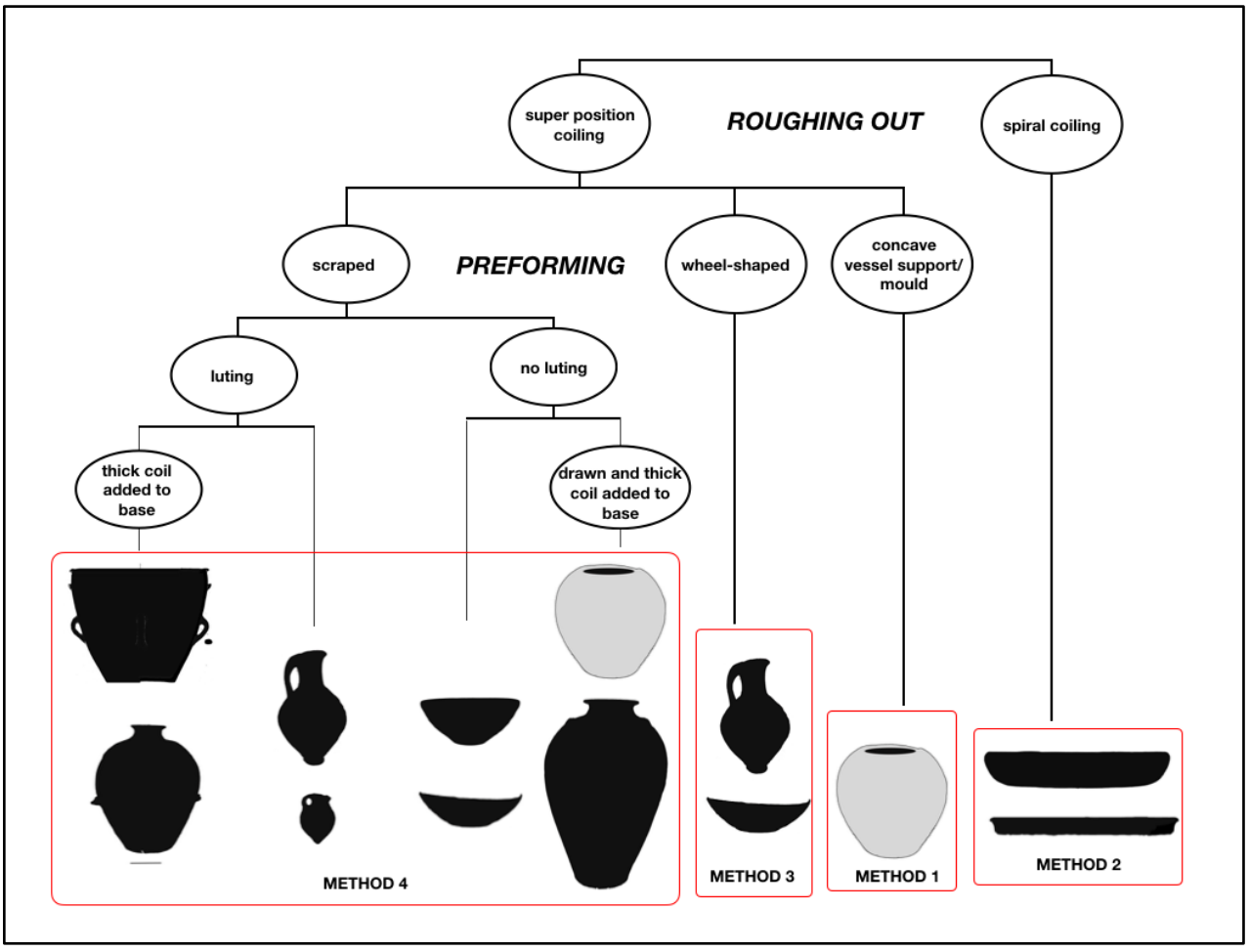


Fig. 9.11: Histogram showing the overall percentages and counts for the four main fashioning sequences identified on the sampled assemblage from Area E, Tell eṣ-Ṣâfi/Gath © Jon Ross.

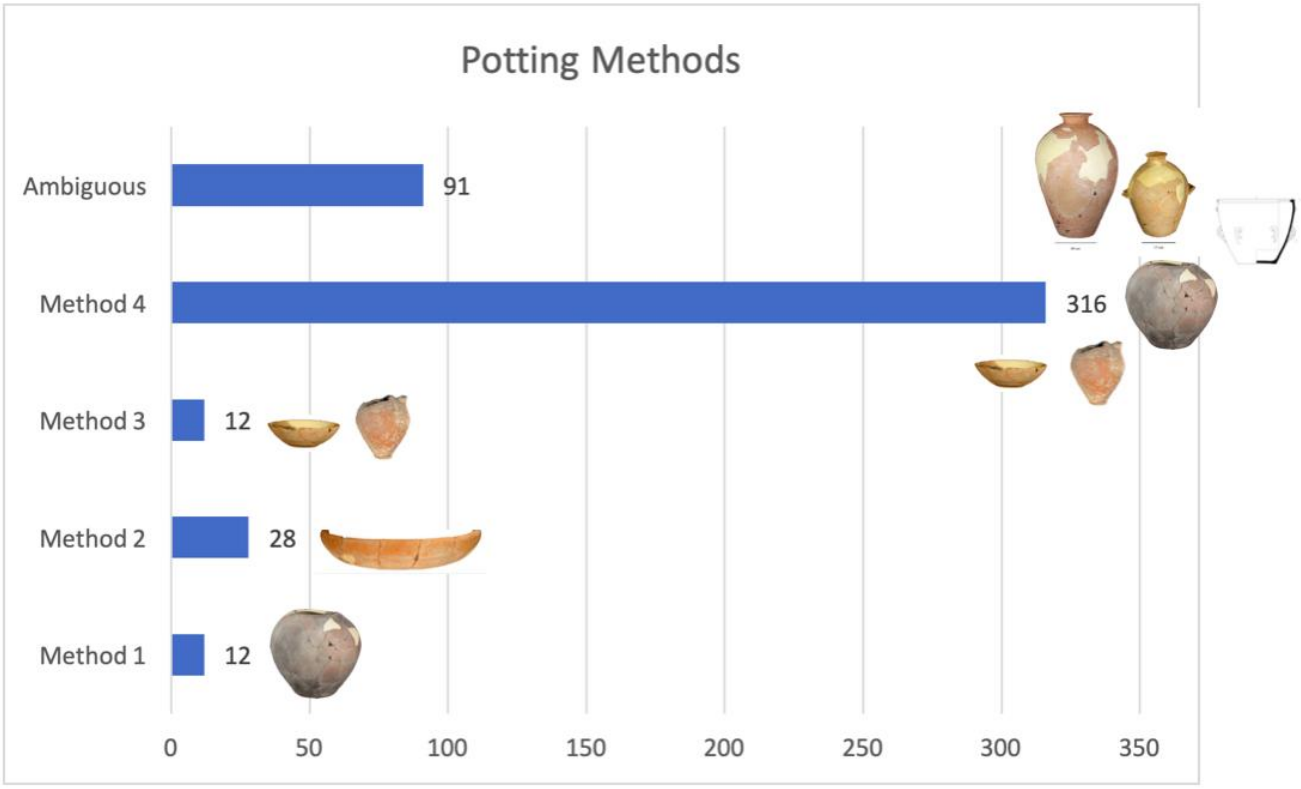


Fig. 9.12. Scanned thick sections of holemouth rims from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 477 (top) and 121 (bottom), coil built. Photo credit: Jon Ross.

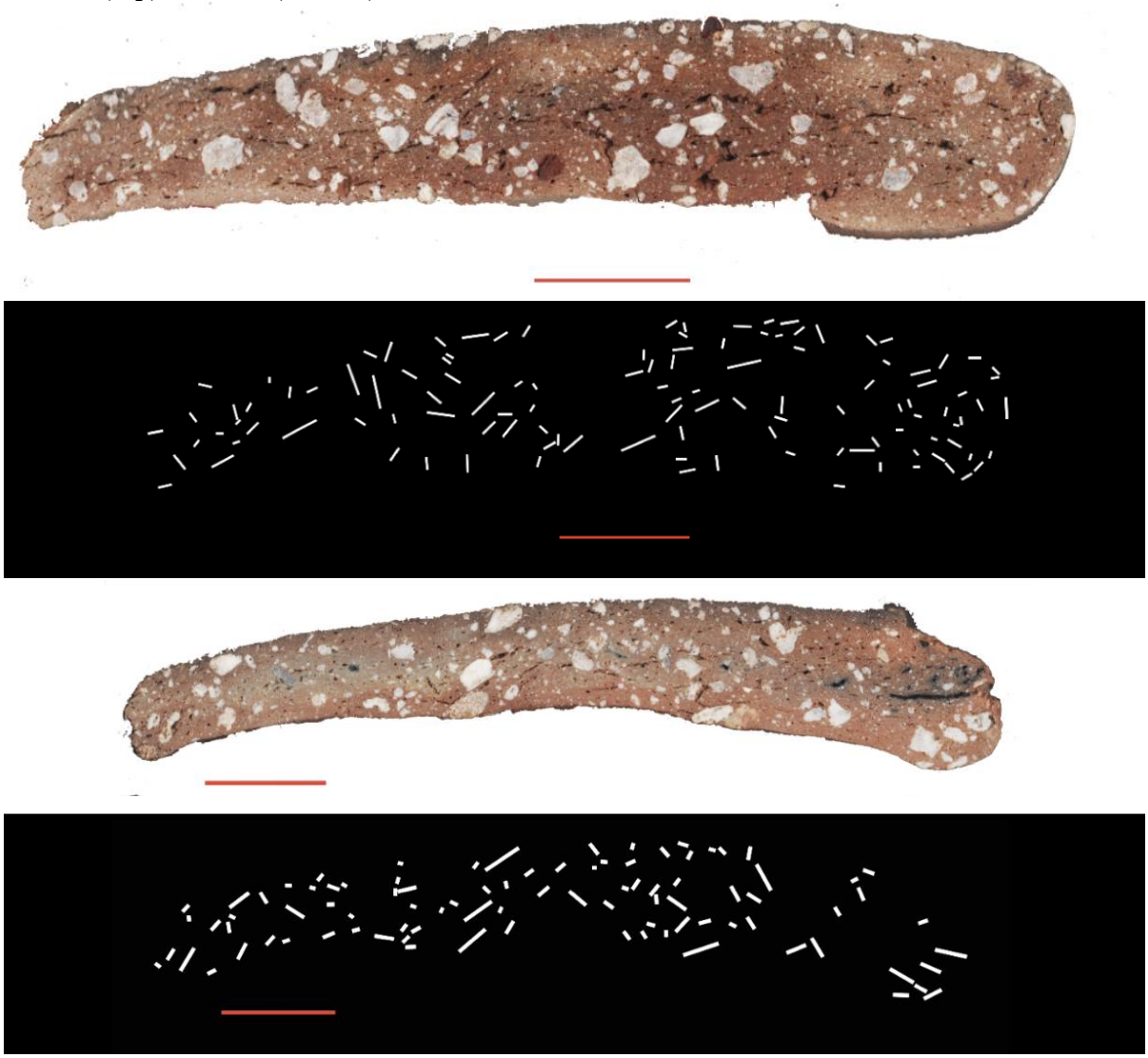


Fig. 9.13. Scanned thick sections of holemouth body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 18.4 (top) and 500 (bottom), coil built. Photo credit: Jon Ross.



Fig. 9.14. Scanned thick sections of holemouth body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 492 (top) and 431 (bottom), coil built. Photo credit: Jon Ross.



Fig. 9.15. Scanned thick sections of holemouth body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 370, coil built. Photo credit: Jon Ross.



Fig. 9.16. Scanned thick sections of holemouth base and lower body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 467 (top) and 462 (bottom), coil built. Photo credit: Jon Ross.

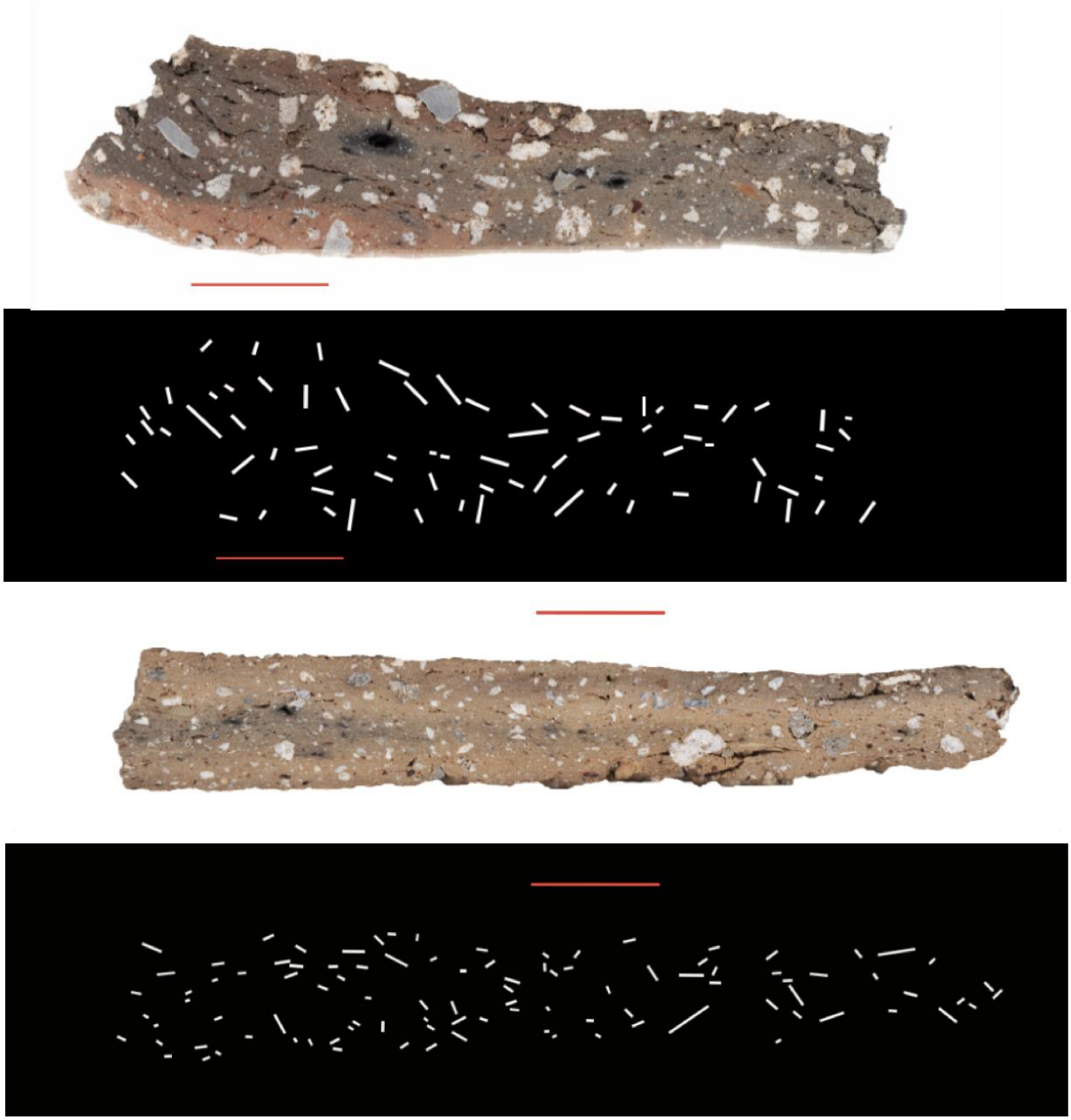
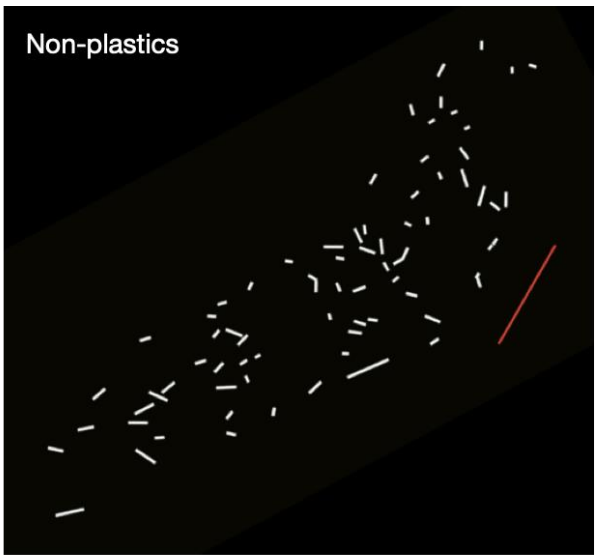


Fig. 9.17. Scanned thick sections of holemouth base and lower body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 480, coil built. Photo credit: Jon Ross.



Fig. 9.18. Scanned thick section of platter rim sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 482, spiral coiled. Photo credit: Jon Ross.





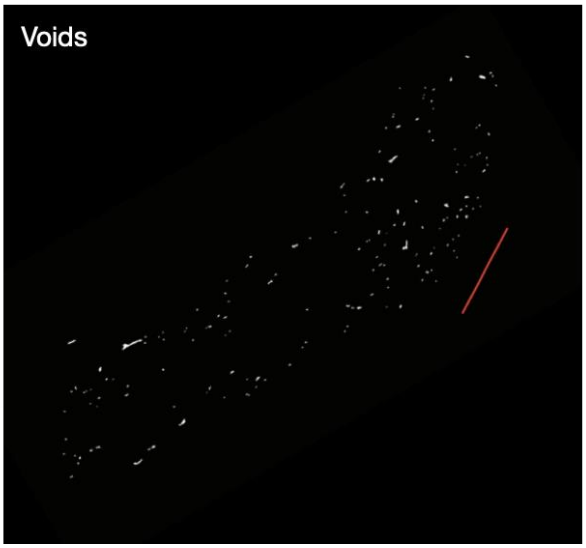


Fig. 9.19. Scanned thick section of platter body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 166, spiral coiled. Photo credit: Jon Ross.



Fig. 9.20. Scanned thick section of platter body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 166, spiral coiled. Photo credit: Jon Ross.

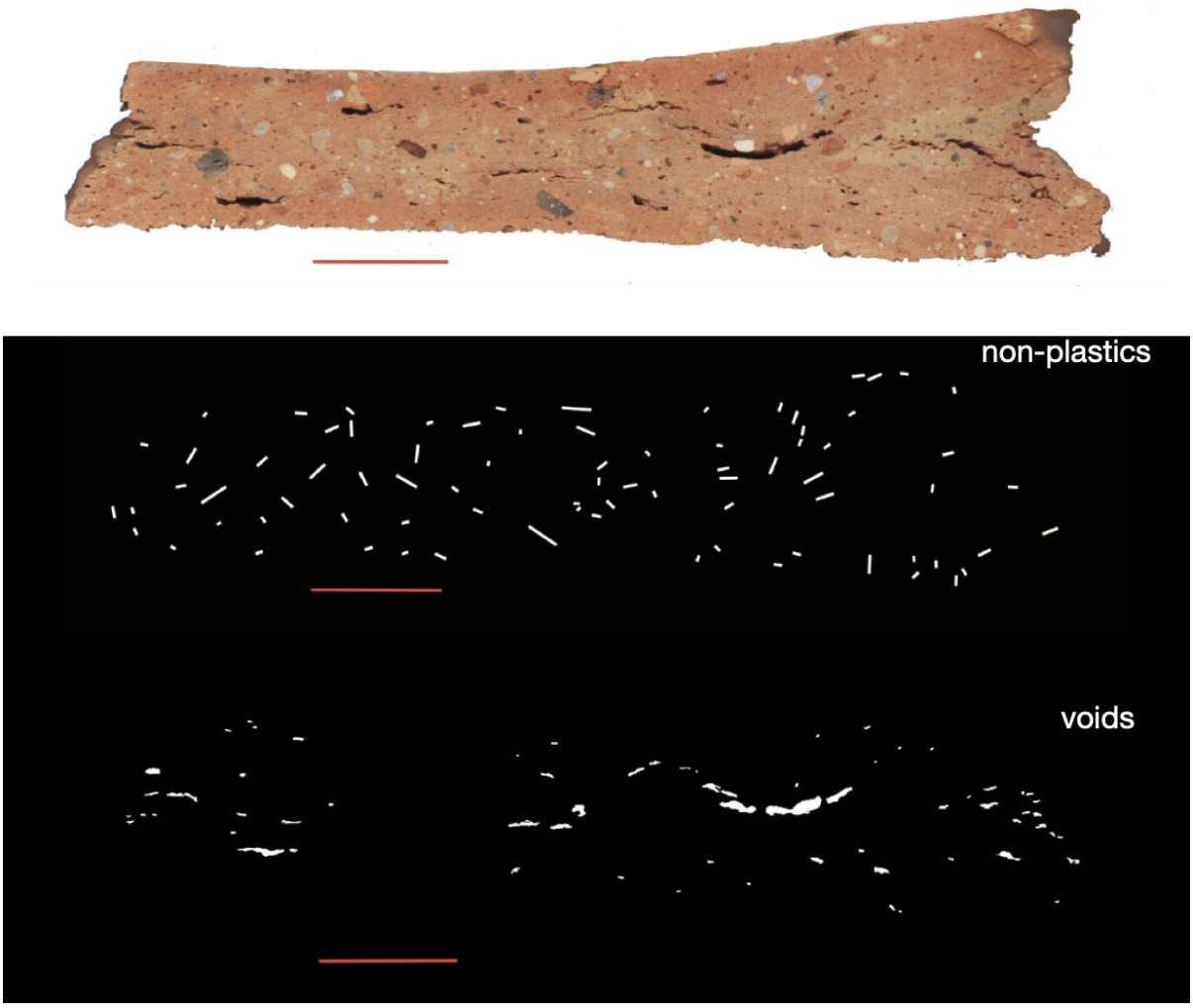


Fig. 9.21. Scanned thick section of platter body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 66, spiral coiled. Photo credit: Jon Ross.

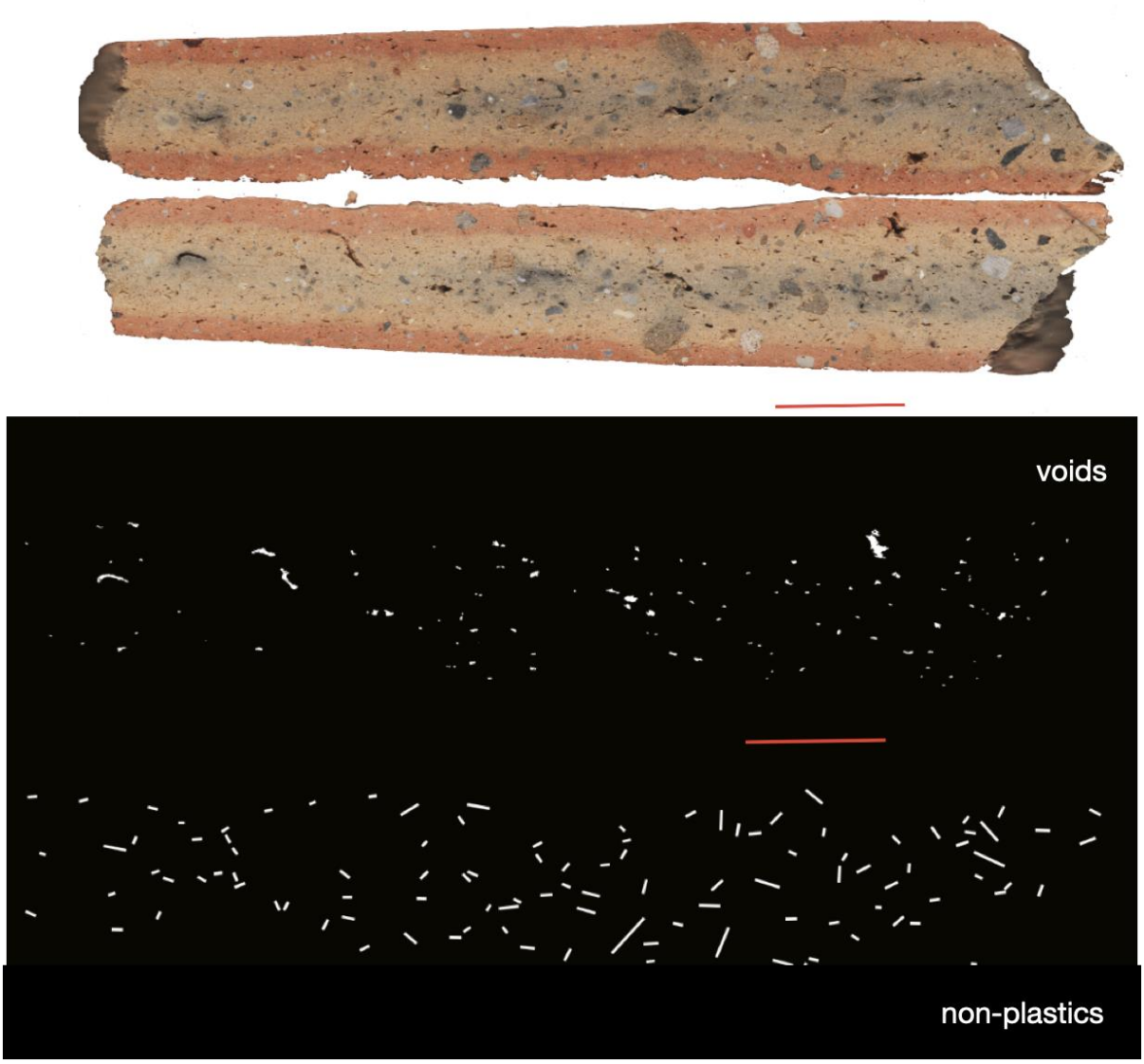


Fig. 9.22. Scanned thick section of bowl profile (rim to base) from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 20.1, coiled. Photo credit: Jon Ross.

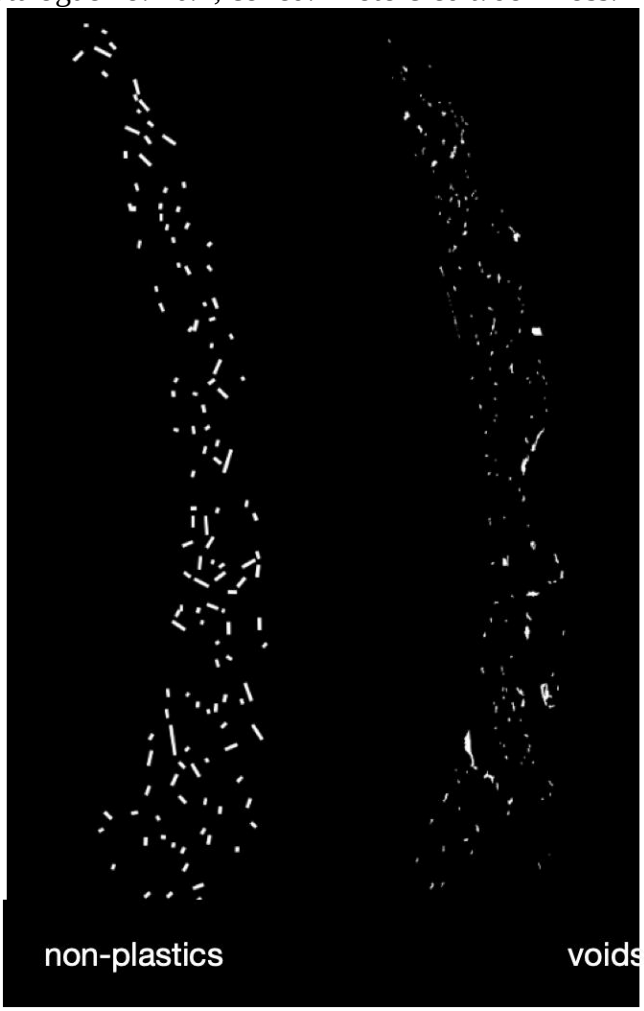




Fig. 9.23. Scanned thick section of bowl body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 164, coiled. Photo credit: Jon Ross.

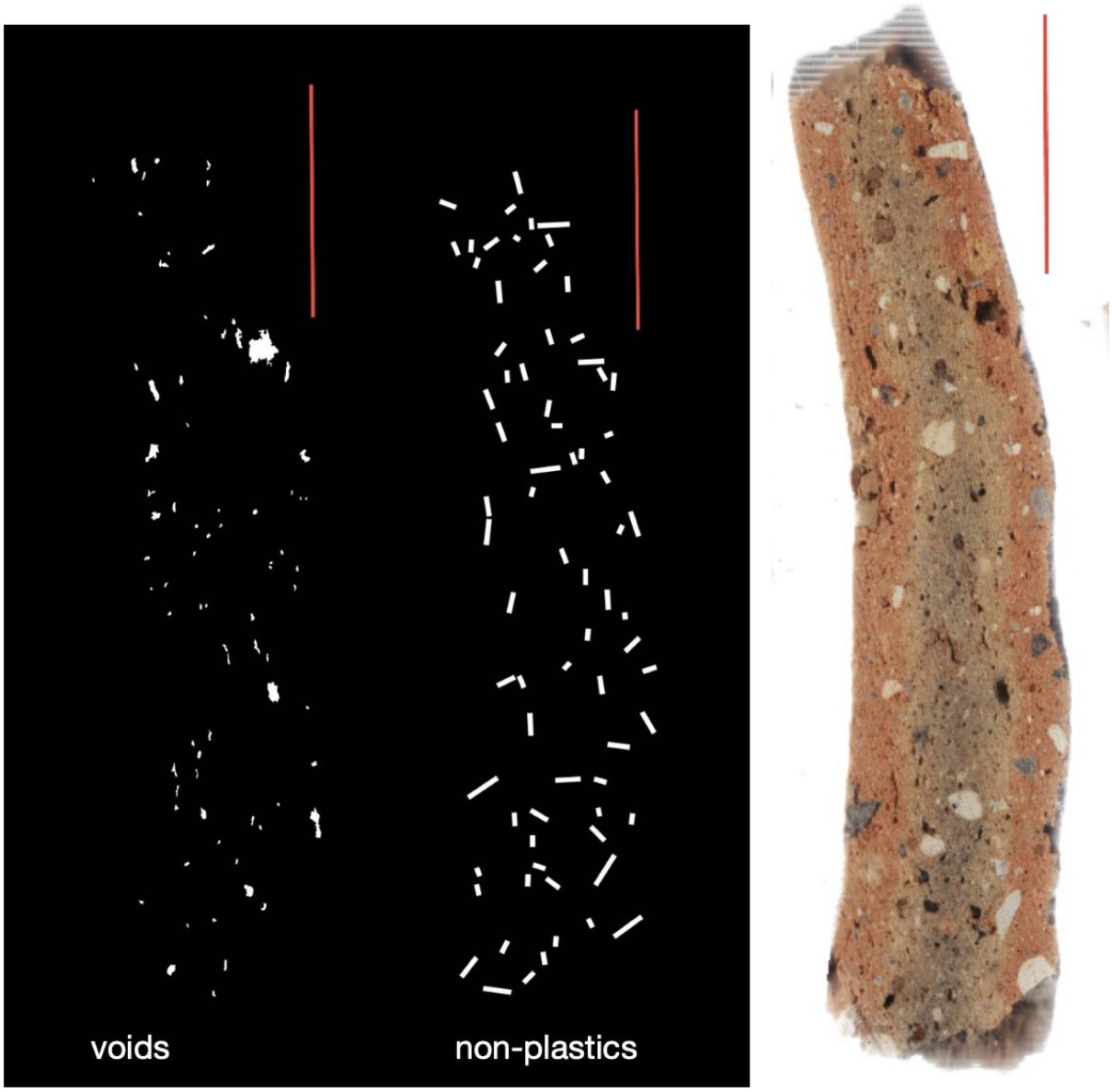


Fig. 9.24. Scanned thick section of bowl base and lower body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 325, coiled. Photo credit: Jon Ross.

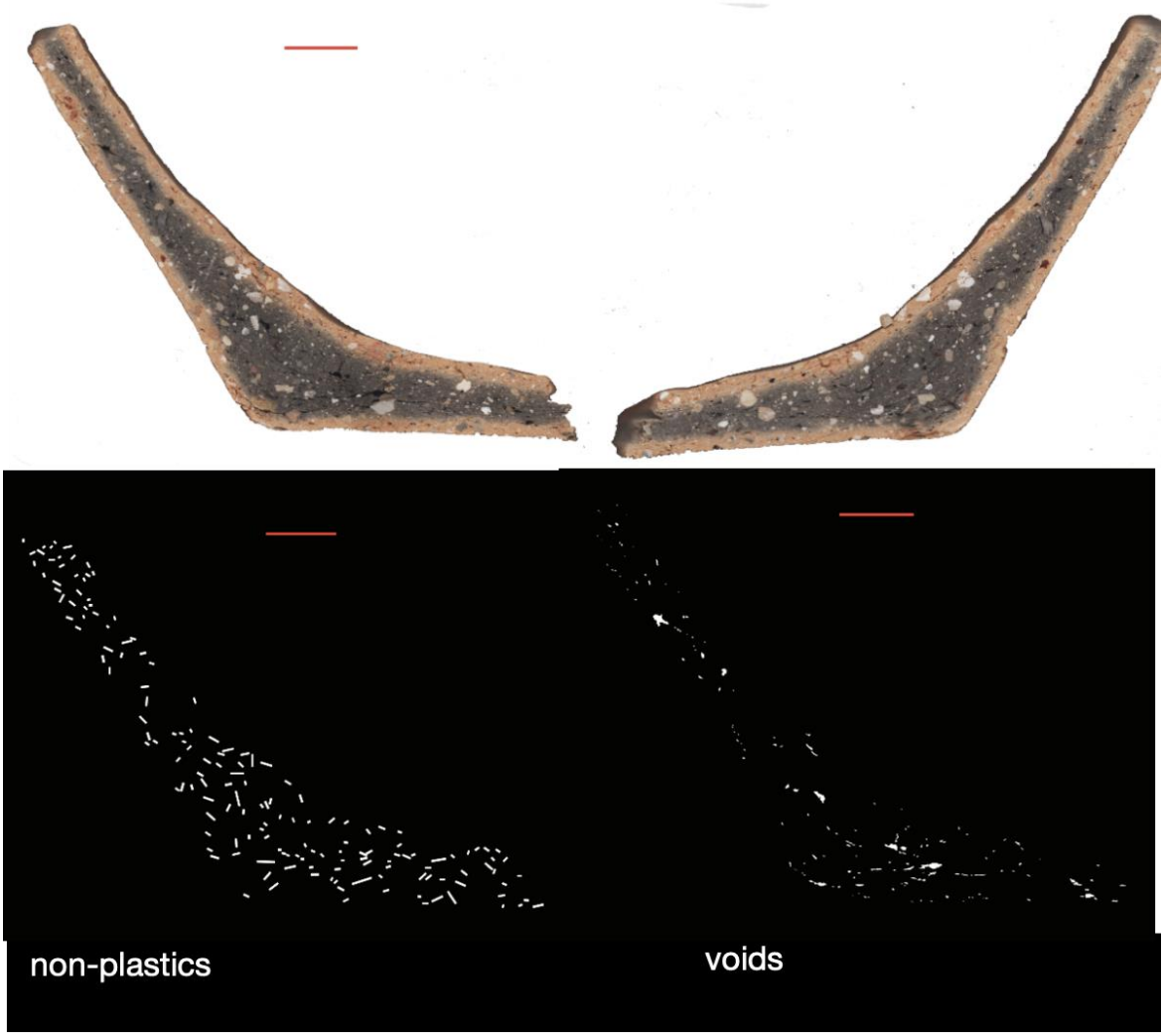


Fig. 9.25. Scanned thick section of bowl base and lower body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 325, coiled. Photo credit: Jon Ross.

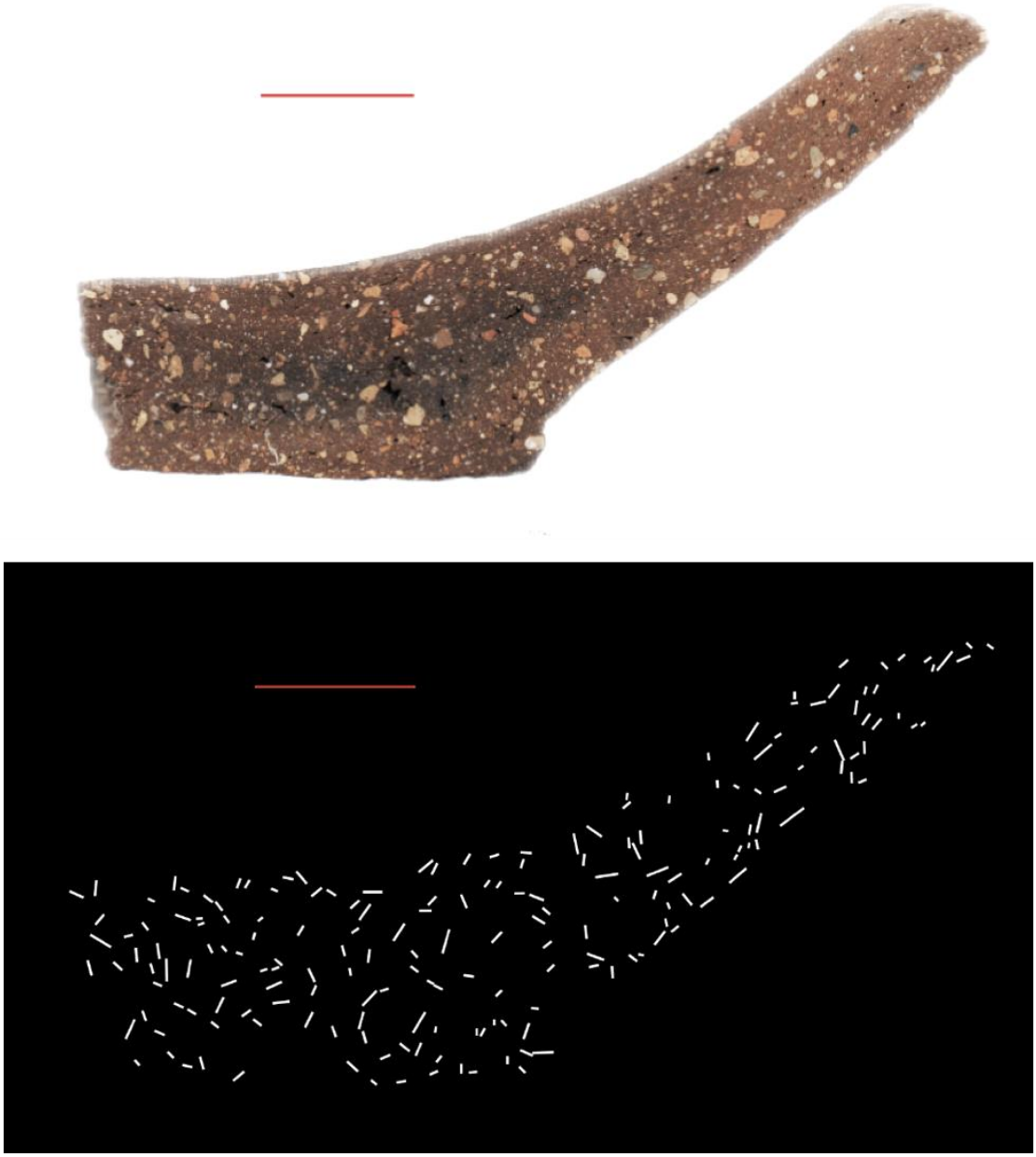


Fig. 9.26. Scanned thick section of bowl rim and body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 63 (top) and 344 (bottom), coiled. Photo credit: Jon Ross.



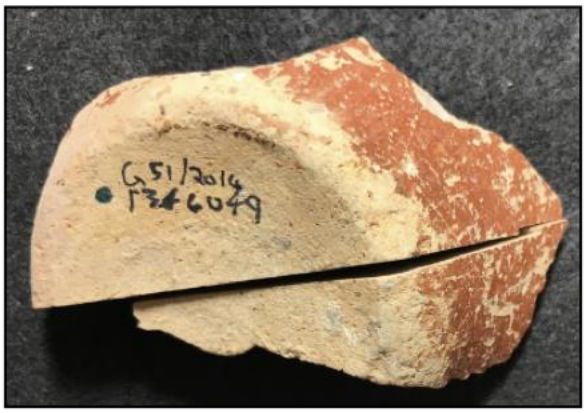
Fig. 9.27. Scanned thick section of bowl rim and base sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 504 (top) and 22 (bottom), coiled and wheel-shaped. Photo credit: Jon Ross.



Fig. 9.28. Scanned thick section of bowl base sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 505, wheel-thrown. Photo credit: Jon Ross.



Fig. 9.29. Scanned thick section of juglet base sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 484, coil built. A large elongated cavity/fissure crosscuts the entire width of the vessel wall. Photo credit: Jon Ross.



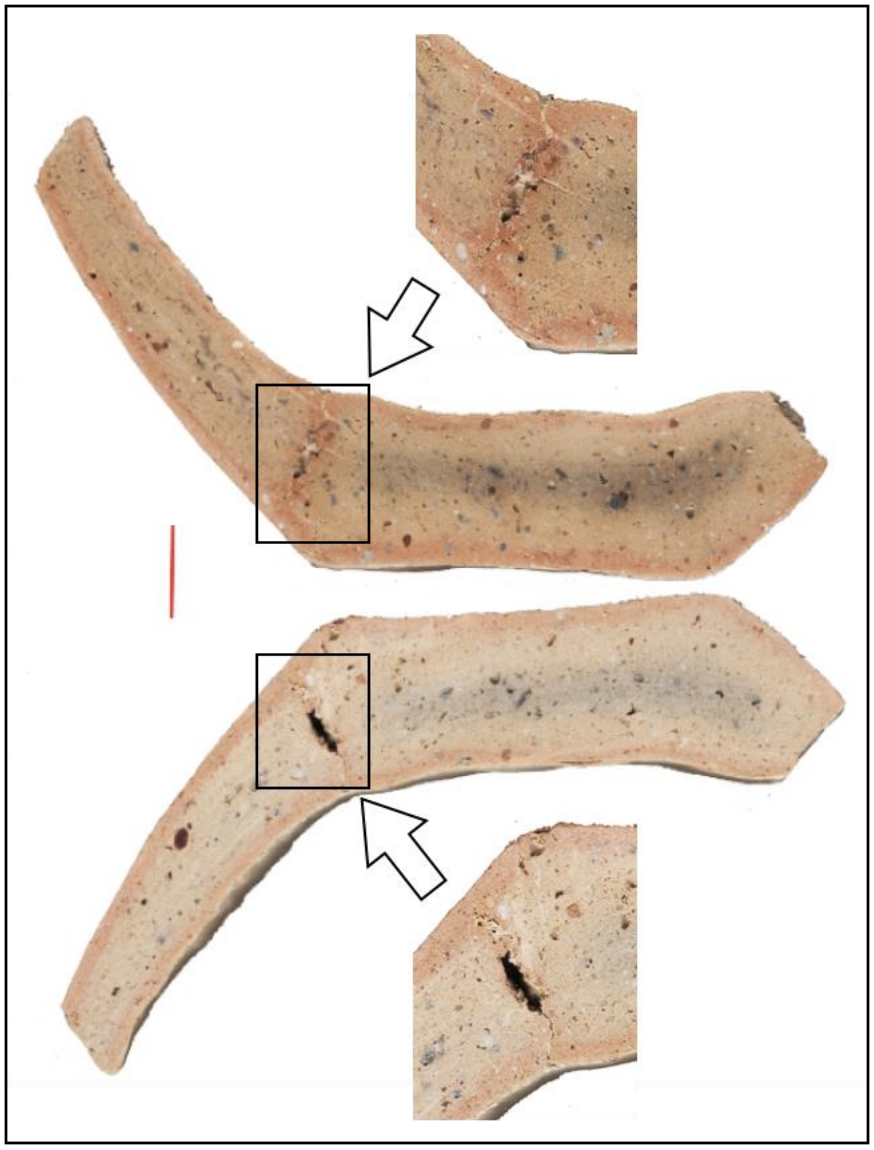


Fig. 9.30. Scanned thick section of juglet base sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 506, coil built. Photo credit: Jon Ross.



Fig. 9.31. Scanned thick section of juglet shoulder and body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 473 (top) and 289 (bottom), wheel-shaped. Photo credit: Jon Ross.



Fig. 9.32. Scanned thick section of large storage jar rim and shoulder sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 39 (top) and 497 (bottom), coil built. Photo credit: Jon Ross.



Fig. 9.33. Scanned thick section of large storage jar body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 152 (top) and 204 (bottom), coil built. Photo credit: Jon Ross.

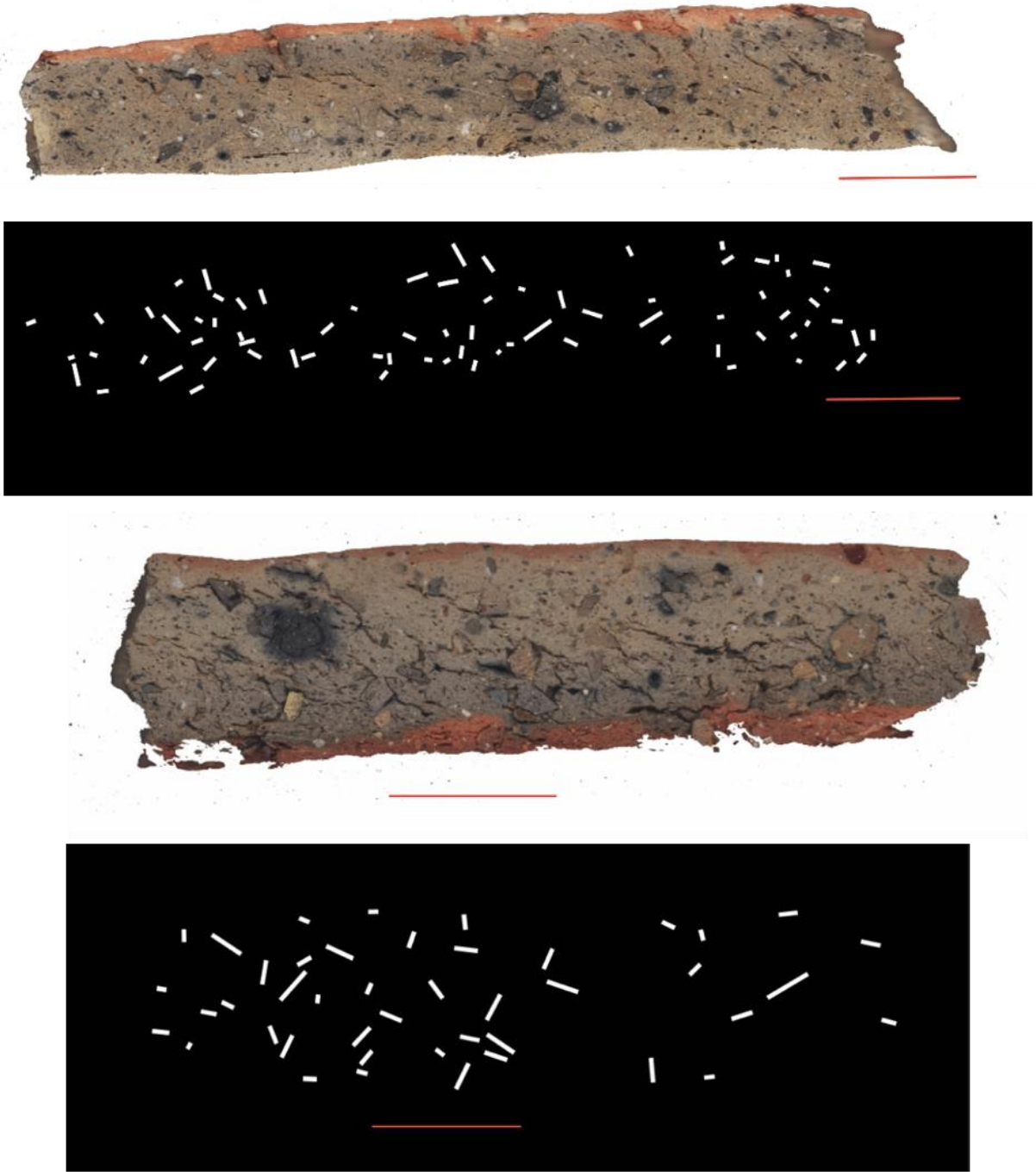


Fig. 9.34. Scanned thick section of large storage jar body sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 194 (top) and 152 (bottom), coil built. Photo credit: Jon Ross.

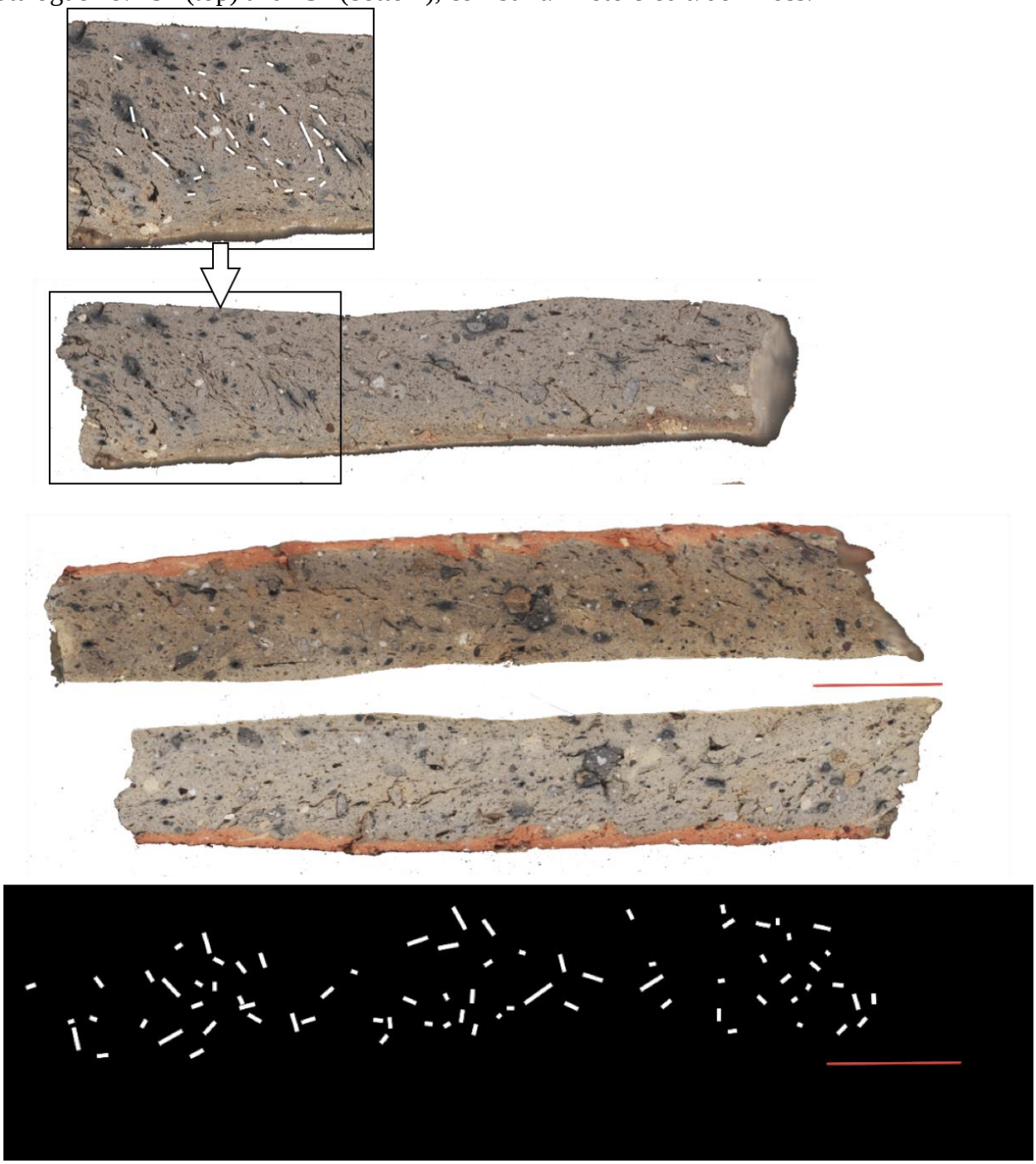
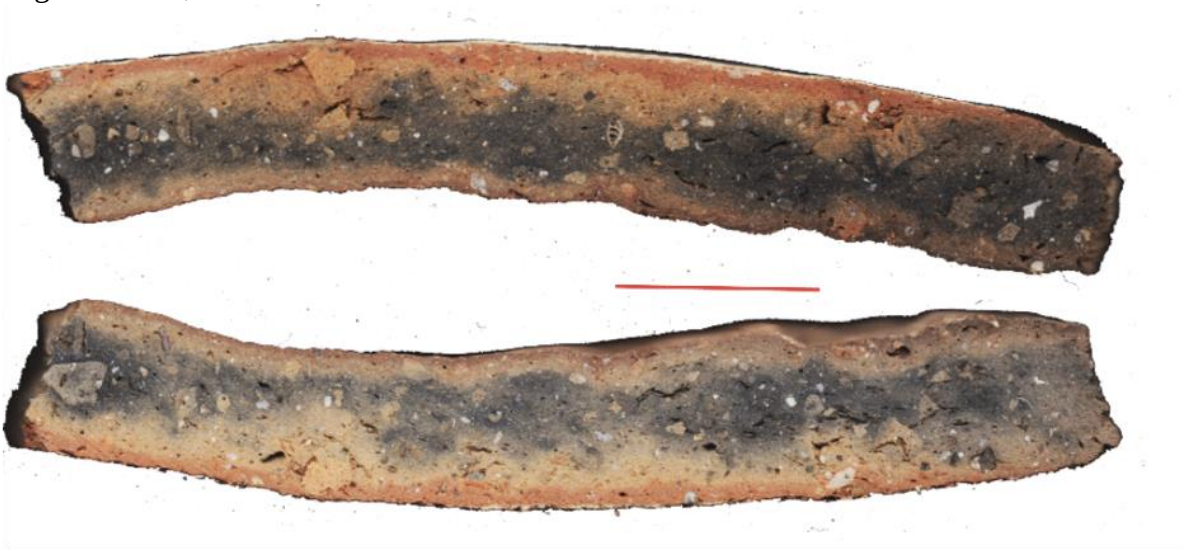


Fig. 9.35. Scanned thick section of a storage jar body sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 224, coil built. Photo credit: Jon Ross.



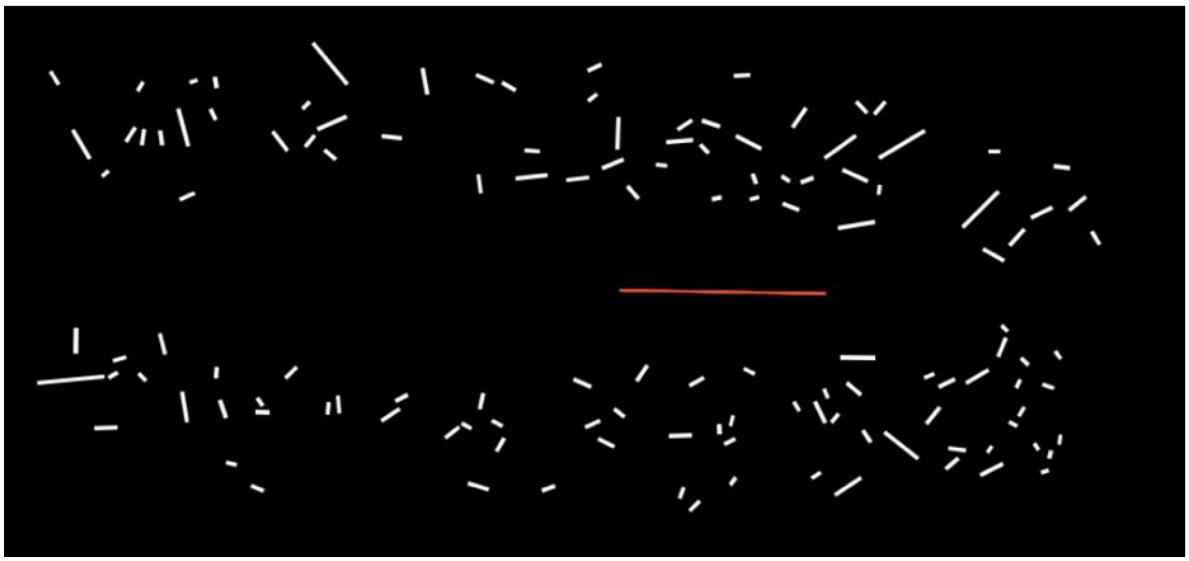


Fig. 9.36. Scanned thick section of a storage jar body and base sherd from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 219 (top) and 299 (bottom), coil built. Photo credit: Jon Ross.



Fig. 9.37. Scanned thick section of a storage jar base sherds from Area E, Tell eṣ-Ṣâfi/Gath, catalogue no. 209 (top) and 196 (bottom), coil built. Photo credit: Jon Ross.



Figure 10.1. The EB III 'techno-stylistic' trees for the Tell eṣ-Ṣâfi/Gath repertoire showing techno-petrofabric groups (2nd row from the bottom) and techno-morphological groups (bottom row) © Jon Ross.

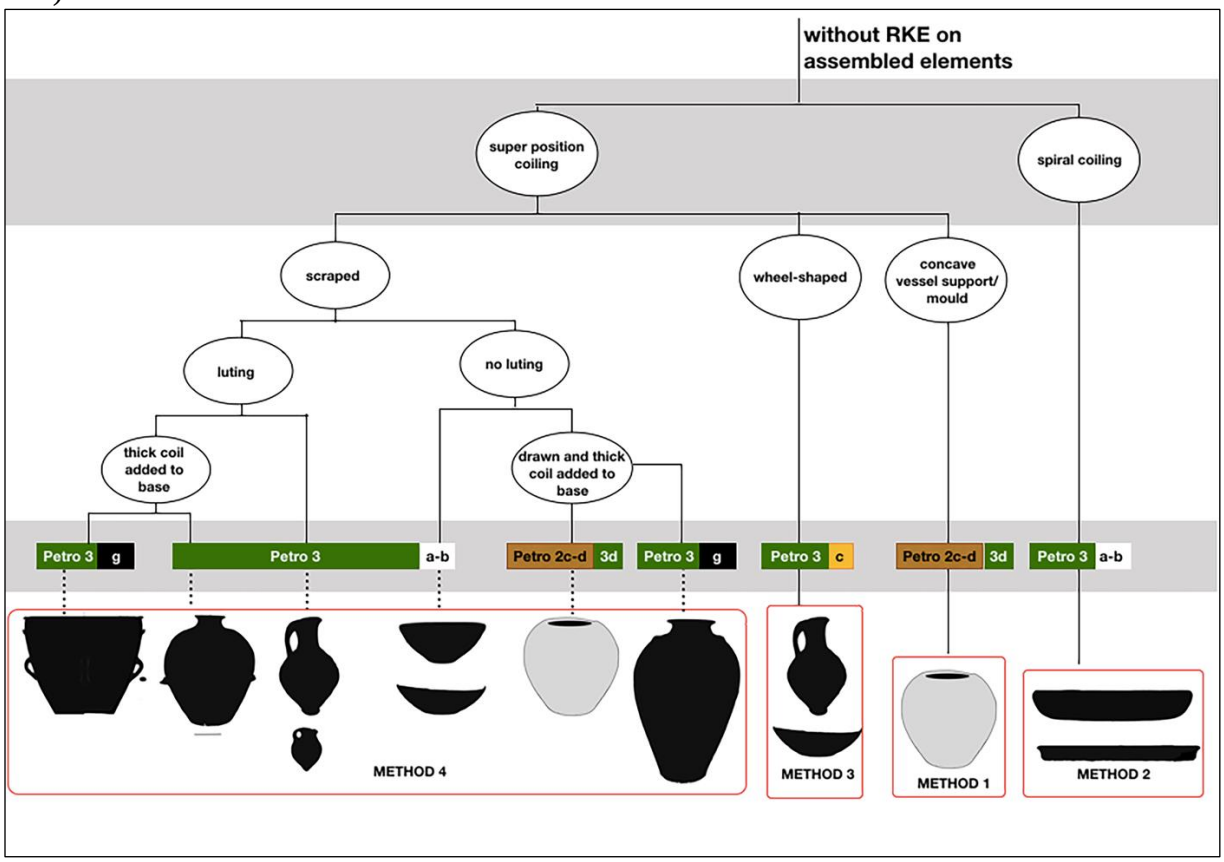
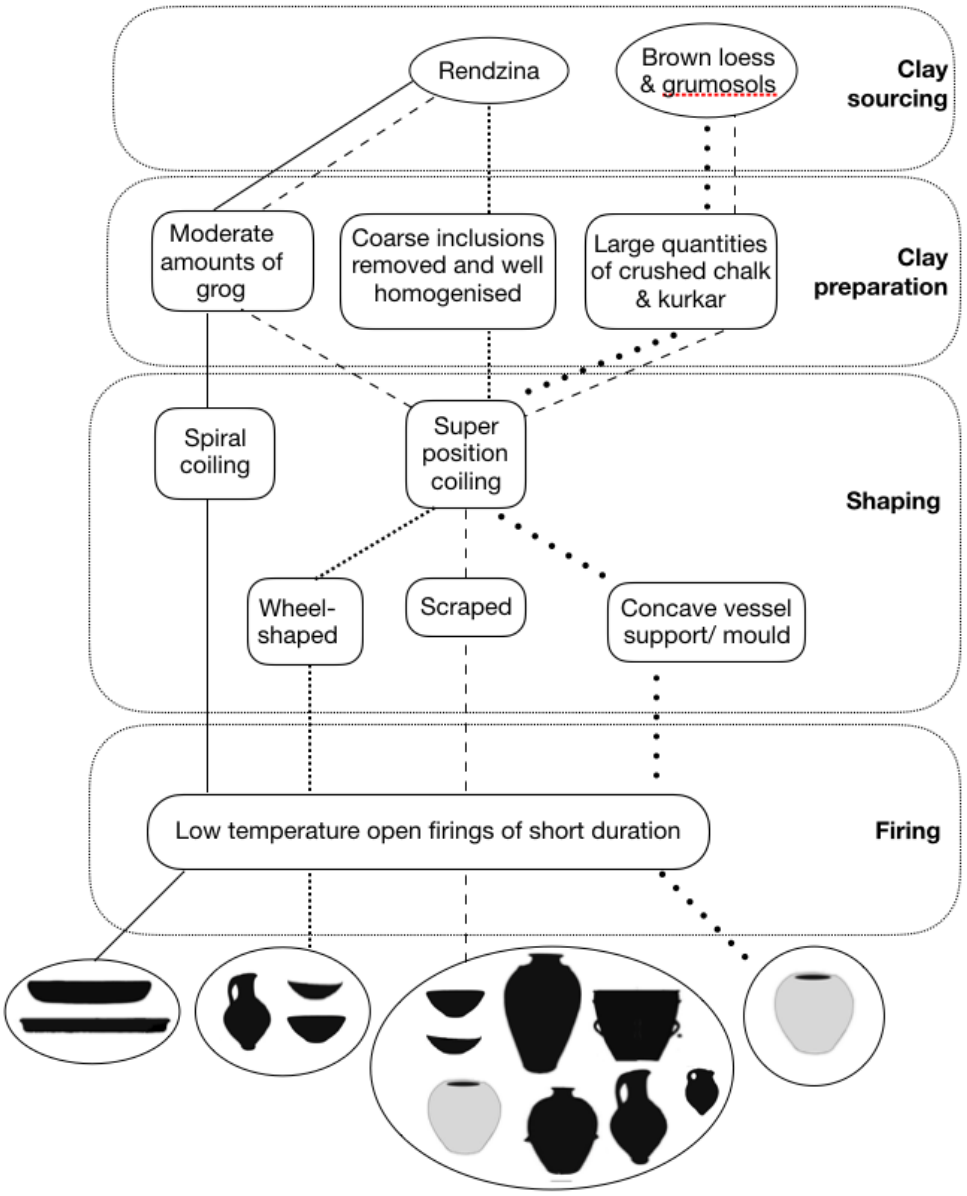


Figure 10.2. Flow diagram showing the production sequences/*chaînes opératoires* for the main EB III morpho-stylistic types in the Tell eṣ-Ṣâfi/Gath repertoire (excluding drying and surface treatments). Thin-section petrography was more useful for identifying clay sources and preparation techniques, whereas thick sections were more useful for identifying vessel shaping. Both thick and thin sections inform on firing and were used in combination to reinforce identifications, at each step in the sequence © Jon Ross.



Tables

Table 2.1. Production types after Van der Leeuw (1977), Peacock (1982), and Costin (1991) © Jon Ross.

Scale and intensity	Van der Leeuw (1977)	Peacock (1982)	Costin (1991)	Variables	Examples	
	household production	household production		Occasional domestic replacement and no labour division/kin-based	Kabyles in Berber Society, North Africa	**Independent**
	household industry	household industry	Individual specialisation	Part-time and generally no hired hands, or labour division/kin-based, for group use	Majority of hand made pottery in Roman Britain (Malvernian pottery and Dorset Black Burnished Ware). Pantellarian ware from Pantellaria in the Roman Mediterranean.	
	workshop industry	individual workshop	dispersed workshop	Full-time (all year/weather permitting and main form of subsistence) some hired hands, some/considerable labour division, investment in specific tools and processing facilities (wheel, kilns, settling basins), generally for local markets	Highgate Wood workshops and Severn Valley Ware in Roman Britain	
	village industry		community specialisation	part/full-time, some hired hands (depends), some/considerable labour division, operates all year/weather permitting, investment in specific tools and processing facilities (wheel, kilns, settling basins), generally for regional markets	The Tzintzuntzan potters in Mexico and the Kalinga potters in Philippines	
	workshop industry (aggregated)	nucleated workshops	nucleated workshops	Largely same variables as workshop industry but aggregated in one geographic locale and manufactured for export and regional markets	The post-medieval Farnham potters, Roman Colchester and Trier.	
	household or village industry (part-time for elite/institution)		dispersed corvee	Largely same variables as household/village industry but for elite/institution on part-time basis		**Attached**
			individual retainers	Recruitment of individual artisans by elite/ institution in administered/elite setting		
	large-scale industry	military/official workshops	nucleated corvee	Recruitment by elite/institution for part-time labour in task-specific settings/facilities	Rome's brick industry	
		estate production	retainer workshop	Recruitment by elite/institution in a segregated/ high specialised facility/setting, on full-time basis	Roman Brick-making on the Ashburnham estate (Sussex) and Broadmayne estate (Dorset). Manufacture of amphoras to transport estate goods?	
		manufactory		Nearest pre-industrial equivalent approaching the large-scale factory of late 18th century Europe	North Staffordshire potters of the victorian era. Giant Roman potteries of Arezzo and La Graufesenque. Wedgwood (modern UK)	**Independent**

Table 2.2. Summary of 12 interrelated variables (left-hand column) that result in discrete social and technical pressures on different steps in the pottery production sequence, with reference to African, Mexican, and Indian potters (after Fowler 2016: Fig. 26.4; Berg 2007: 248; Gosselain 1998, 2000; Roux and Corbetta 1989; Arnold 1999; Mahias 1993) © Jon Ross. The data summarised in the table primarily concerns low to medium fired pottery (terracotta and stoneware) made by low income potters with relatively simple surface treatments for common household containers (intended for either unrestricted market distribution and/or domestic replacement within the producing household). The modelled relationships therefore have little, if any, relevance for ceramics considered 'prestige objects' or 'status indicators' for elite consumption. When craft specialisation is 'attached' to an elite, most stages of production can be associated with highly specialised skills and costly ingredients (from paste preparation to firing and decoration) intended to add/enhance value on a product controlled by elite appetites for status display. Such ceramics are usually prized by antiquity collectors (again serving as a display of status) and many aspects of the model summarised above will be wildly inaccurate and misleading for the ceramics in question (e.g. Ming dynasty vases, Fabergé porcelain eggs, bejewelled bohemia amphora, Nikosthenic amphora, Onggi pottery and so forth).

	1. SHAPING. Roughing out	**2. CLAY PREPARATION & FIRING.** Selection; Extraction; Processing (pre-treatments, Removal of plastics, homogenisation); Firing structures	**3. VISUAL & TACTILE.** Processing (additives); Decoration; Shaping (preforming); Firing (post-sintering); Post firing
Visibility of technique on finished product and task collaboration	Low to zero visibility; technique usually obliterated; typically no task collaboration (technique performed individually) and usually not performed in public settings	Low to moderate visibility and observable by co-workers and kin; task collaboration is likely/the norm and activities are usually performed in public settings	High visibility; all social contacts can potentially identify the technique(s) on the finished vessel
Flexibility of techniques and motor habits	Low flexibility; techniques not transposable; specialist motor habits are task-specific	Moderate flexibility; techniques are transposable; specialist motor habits not required	High flexibility; techniques are readily transposable; specialist motor habits not required
Networks of social interaction	Senior potter(s) in a teacher-learner relationship	Local and regional networks (other potters, neighbours, relatives/immediate kin)	The entire consumer base. All social contacts

People influencing learning, practice and the social identity dimension	Very low/minimal; adjustments reflect major changes to learning networks and rooted social identities (kinship, linguistic, social class etc.)	Moderate; changes reflect adjustment to regional or local identities	Many; changes reflect adjustment to a situational, temporary, and superficial dimensions of identity (changeable economic, social, or symbolic circumstances)
Influence of the social networks on technical knowledge (post-learning)	Low/minimal	Moderate	High/maximum
Tendency to innovate and be creative	Low/minimal	Moderate	High
Time investment in craft learning and the learning strategies	High; intensive one on one tutorship; active learning	Moderate and involves passive learning (legitimate peripheral participation)	Low and involves passive learning (legitimate peripheral participation)
Stability/durability over time and space	Highly stable; resistant to change. Not easily transmittable	Moderately stable/durable	Low stability; capable of rapid diffusion and fluctuation; easily 'transmittable'

Table 3.1. Summary of macroscopic attributes diagnostic of forming techniques © Jon Ross.

	Wheel throwing from a homogenous clay mass	**Wheel-shaping a coil-built rough-out**	**Wheel-finishing a coil-built rough-out**
Wall profile / morphology of the walls	Symmetrical walls of regular/even thickness at any given elevation; compressed walls, clay is 'stretched'; regular wall profile of decreasing thickness from base to the rim	Greater wall regularity; weak to moderate compressed walls; clay is more 'stretched'; minor variation in thickness from base to rim; horizontal/oblique joints visible in section	Variations in wall thickness; irregular wall profile; horizontal/ oblique coil joints visible in section
Surfaces of walls (Rilling)	Continuous evenly distributed rilling marks, with spiral effects emanating from the inner centre of the vessel; rilling throughout body of vessel; rectilinear grooves	Great variety of rilling possible (grooves, ridges, and undulations), especially if RKE used to thin vessel walls; banding common with deep subparallel grooves; 'spiral effects' from RKE visible on bases; ripples common on compression zones	Rare if non-existent. Can be present on rims of coil-built vessels when pot rotated on a chuck, mat, or support
Surfaces of walls (Striations)	Continuous and concentric parallel striations with a tight structure; unidirectional/ horizontal with even/uniform coverage of the vessel on both interior and exterior surfaces; concentric spiral form (ellipsoid) striations on base exterior	Continuous and concentric parallel striations; unidirectional with even/uniform coverage of the vessel; striations from string cut base	Striations result purely from surface finishing operations; concentric, but often limited to certain parts of the vessel, such as the rim and/or shoulder (not all parts of the pot treated); not as well defined and usually on exterior of closed vessels
Additional comment on surface topography and relief features	Fluid, smooth, undulating topography with ripples on compression zones	Smooth and even topography. Linear features and anomalies may be present marking seams between coils	Variable/irregular topography, particularly on interior surface of closed vessels; hollows, bumps, and depressions from coil joining operations
Fracture pattern and fissures	Spiral fracture; s-shaped torsion crack (or 'dimple'), or outward spiral at base due to stresses imposed during opening of clay lump	concentric curvilinear fissures; preferential fracture	concentric curvilinear fissures; preferential fracture
Clay water content (hygrometry)	High moisture content, exceptionally wet clay evidenced by "sticky prints" and fluid micro-topography	Moistened surface "sticky" finger marks	Greenware, plastic, workable clay. Humid

Vessel shape and size	Spherical shapes; size is a function of the potter's skill level	Spherical shapes; size is a function of the potter's skill level	Spherical shapes

	Coiling	**Moulding**	**Drawing**
Wall profile / morphology of the walls	Variations in wall thickness; undulations, bumps, and bulges (regular corrugations) when coils not completely joined and smoothed; clay is non-stretched; wall profiles can be highly irregular; regular horizontal/oblique joints visible in section	Regular profile with even distribution of clay over the walls; even wall thicknesses; possibly greater compaction	Lack of discontinuity in clay walls (no seams/joints); variation in thickness from base (thicker) to rim (thinner); regular profile with decreasing thickness?
Surfaces of clay walls	Surface discontinuities, cavities, depressions and shallow hollows (finger marks) from coil joining operations. More prominent on interior of closed vessels; rough micro-topography depending on thoroughness of surface treatment; 'overthicknesses' prominent on interior of necks and bases	Negative imprints from mould on interior or exterior surface depending on whether a convex or concave mould was used; grains from parting agents (e.g. sand/grits) inserted in surfaces pressed against the mould causing roughened granular micro-topography; cut marks and seams from edges of the mould imprinted on vessel;	Prominent vertical grooves and variations from finger tips pulling and dragging the clay up to form walls
Additional comment on surface topography and relief features	Striations from finishing operations; morphology is broken/interrupted, erratic, banded, shallow, no tight organisation, multidirectional, and restricted to exterior surfaces on closed vessels. Not evenly expressed on all parts of the vessel	Nothing distinctive/none characteristic; mould side often left unfinished; rough (micro)topography?	Irregular and broken bands of parallel vertical striations?
Fracture pattern, fissures, and cracks	Linear fissures and anomalies between zones of coil joins; concentric fissures on bases; concentric fractures run around pot; oblique breaks in section with a u-junction (u-profile); parallel hairline fractures marking coil seams	Preferential between mould and joined parts	Nothing distinctive/none characteristic? Random? Check

Clay water content (hygrometry)	Greenware, plastic, workable clay; humid clay (more stiff?)	Greenware, plastic, workable clay; humid clay unless slip casting	Greenware, plastic, workable clay; humid clay (more stiff?)
Vessel shape and size	Great variety of shapes and sizes, rounded or pointed bases more common	Great diversity of shapes are possible with uniform dimensions	Any restrictions? Most shapes?

	Slab-building	**Pinching**	**Hammering**
Wall profile / morphology of the walls	Slab joins between clay sheets visible in section (more spaced out than coil joints); regular wall profile if flattened on level surface, with no/little variation in thickness; rolled slabs are thinner at the edges?	Irregular wall profile, absence of discontinuities in section (no joints/seams)	Regular topography and vessel thickness? Thinner vessel walls?
Surfaces of clay walls	Shallow depressions, hollows, and bumps where the clay slabs/sheets were joined together, seams between slabs; surfaces are smooth when slabs flattened or rolled on flat surfaces	Shallow, regular indentations, depressions and bumps around the circumference of the vessel, matching the size and shape of the potter's fingertips; clay is squeezed between finger and thumb to form the walls	Hammering on clay mats causes superimposition of mat prints; depressions/cavities from tool/hammer on worked side (usually interior)
Additional comment on surface topography and relief features	Nothing distinctive/none characteristic	Nothing distinctive/none characteristic; rough and uneven?	Micro-wrenching from repeated beating on one-side; rough and uneven
Fracture pattern, fissures, and cracks	Preferential breakage at the slab join, creating straight angular breaks??	Nothing distinctive/none characteristic	Nothing distinctive/none characteristic?
Clay water content (hygrometry)	Greenware, plastic, workable clay; humid clay (more stiff?)	Greenware, plastic, workable clay; humid clay (more stiff?)	Humid or leather hard clay

Vessel shape and size	Suited to rectangular shaped vessels but also common in shaping large vessels	Small rounded vessels	stronger flattening of the poral system with hammering; strong compression of pores

Table 4.1. Chronology for the southern Levant for the 4th and 3rd millennium BCE showing the c. 200 year inconsistency between the high chronology, traditional phasing, and the Jericho sequence (adapted from Regev et al. 2012, 2014; Shalev 2017: Table 3-1; Nigro 2018: Table 9; Finkelstein 2018: 69, Tables 1-2; Cohen 2016: 27-8).

	Conventional phasing	**The High Chronology date ranges**	**The radiometric transitions from Jericho**	**Egypt**
EB IA	3500-3000 bce	3700-3300 BCE	3500-3200 BCE	Naqada II
EB IB		3300-3050/3000 BCE	3200-3050/3000 BCE	Naqada II / Dynasty 0-early Dynasty I
EB II	3000-2700 bce	3050/3000-2900 BCE	3050/3000 - 2700/2650 BCE	Late Dynasty I-Dynasties II/III
EB III	2700 - 2200 bce	2900-2500 BCE	2700/2650 - 2300 BCE	Dynasties II/III – Dynasties VI/V

Table 5.1. The main phases in Area E, Tell eṣ-Ṣâfi/Gath.

Phase	**Period**
E0	Unstratified surface
E1	Modern activity
E2	Iron Age IIA
E3	Iron Age I
E4	Late Bronze II-III
E5 to E9	Early Bronze III

Table 6.1. Vessel counts according to phase in the sampled assemblage from Area E, Tell eṣ-Ṣâfi/Gath.

	Primary					Secondary	Tertiary	Totals
Form	**E5a**	**E5b**	**E5c**	**E6**	**E7**	**E5**	**E4-E5**	
Bowls	23	32	14	1	-	7	8	85
Holemouths	28	34	37	4	3	16	16	138
Jars	58	34	45	-	3	18	14	172
Jugs/Juglets	7	6	5	-	-	1	2	21
Platters	11	11	6	1	-	3	4	36
Vats	4	-	-	1	-	-	1	6
Totals	131	117	107	7	6	45	45	459

Table 8.1. Imported vessels identified in the thin-section petrography for Area E, Tell eṣ-Ṣâfi/Gath. Samples extracted from the petrography reports by Ben-Shlomo (2012, 2017, forthcoming) and re-organised according to phase and building.

Sample number	Phase	Building	Room	Type	Basket	Locus	TS Group	Suggested Provenance
Safi 444	E5	Fill	n/a	Holemouth (incised)	946011	94604	23	North Levantine coast
Safi 657	E5	Fill	n/a	Incised sherd	1045007/29	104502	8f	Central hills
Safi 674	E5	Winter wash	n/a	Incised sherd	1343004	134303	13/17	North Levantine coast
Safi 662	E5a	94413	94413	Incised sherd	845006	74517	13	North Levantine coast
Safi 450	E5a	94413	94413	Holemouth	745111	74517	23	North Levantine coast
Safi 579	E5a	104311	104108	Jar	1449046	144906	20b	East Samaria/Lower Galilee
Safi 634	E5a	Alleyway	104306	Platter	1141028/1	114110	3b/8e	Central hills
Safi 740	E5a	Alleyway	104306	Twin vessel	1042022	104203	3b/3h	Central hills
Safi 684	E5a	114206	114604	Incised sherd	1046020	104604	18	Sharon coast
Safi 681	E5a	114206	114604	Jug	1046017/1	104604	8b	Central hills
Safi 132	E5a	114206	114206	Jar	745092/1	74510	E5	Northern Israel
Safi 130	E5a	114206	114206	Small complete jar (‘jarlet’)	745075/1	74510	E4	?
Safi 590	E5b	E15AU09		Incised sherd	E15AU045	E15AU04	2a/g	Coastal plains
Safi 598	E5b	84509	84309	Basin	949047	94909	5a	Shephelah

Safi 616	E5b	74512	74512	Jar	1049015/10	104902	26	?
Safi 742	E5b	74512	16E83C05	Mini handmade vessel, pinched	17E83C031/7	17E83C03	29	Imported
Safi 664	E5b	74512	74512	Incised sherd	1045035	104504	8b	Central hills
Safi 763	E5b	84309	84309	Juglet	943037	943067	?	?
Safi 758	E7	n/a	n/a	Miniature vessel	20E83D154	20E83D06	24/3e	Southern Judah/Local
Safi 770	E9	Deep probe	n/a	Jug	20E93B146/1	20E93B26	21	East Samaria/Lower Galilee
Safi 772	E9	Deep probe	n/a	Jug	20E93B146/3	20E93B26	21	East Samaria/Lower Galilee
Safi 771	E9	Deep probe	n/a	Jug	20E93B146/2	20E93B26	20b	East Samaria/Lower Galilee
Safi 777	E9	Deep probe	n/a	Decorated body sherd	20E93B153/4	20E93B27	3a/21	Local?/East Samaria
Safi 778	E9	Deep probe	n/a	Decorated body sherd	20E93B153/5	20E93B27	3a/21	Local?/East Samaria

Table 9.1. Distribution of the potting methods in the Area E neighbourhood relative to the alleyway. Quantities in this table represent sherd material from primary contexts (material on the floor and accumulations above the floor, n = 259 sherds). This reduced the sample size by 43.6%, since 200 sherds cannot be securely attributed to a specific building assemblage within a specific phase. Sherds from collapse layers (thick deposits sealing accumulations above a floor) are likely to be residual (originate from the make-up of building walls). Percentages are relative to total counts per phase for the potting method in question (the column on the far right).

		West of the alley		East of the alley		Total per phase
		N	**%**	**N**	**%**	
Method 1	**E5a**	1	25	3	75	4
	E5b			2	100	2
	E5c			1	100	1
Total per side of the alley	**E5**	1	14.3	6	85.8	7
Method 2	**E5a**	2	33.4	4	66.7	6
	E5b			3	99.9	3

	E5c			3	99.9	3
Total per side of the alley	**E5**	2	16.6	10	83.4	12
Method 3	**E5a**			6	100	6
	E5b			3	100	3
	E5c					
Total per side of the alley	**E5**			9	100	9
Method 4	**E5a**	23	29	79	71	102
	E5b	7	10	64	90	71
	E5c	8	10	156	90	164
Total per side of the alley	**E5**	38	16.5	193	83.5	231
Aggregated totals /building		29		78		**259**

Table 9.2. Distribution of the potting methods in the neighbourhood. Counts specified for each potting method according to Building Number and Phase in the Area E neighbourhood. Quantities in this table represent sherd material from primary contexts.

		Building 1 (west of the alley)		**Building 2** (east of the alley)		**Building 3** (east of the alley)		**Building 4** (east of the alley)		**Building 5** (east of the alley)		**Building 6** (west of the alley)		**Building 7** (east of the alley)		**Total per phase**
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
Method 1	**E5a**	1	25			1	25	1	25	1	25					4
	E5b			1	50					1	50					2
	E5c			1	100											1
Total per building	**E5**	1	14.3	2	28.6	1	14.3	1	14.3	2	28.6					7
Method 2	**E5a**	1	16.7					3	50	1	16.7	1	16.7			6
	E5b			1	33.3			1	33.3	1	33.3					3
	E5c			1	33.3			1	33.3	1	33.3					3
Total per building	**E5**	1	8.3	2	16.7			5	41.7	3	25	1	8.3			12
Method 3	**E5a**			2	33.3					4	66.7					6
	E5b			2	66.7	1	33.3									3
	E5c															
Total per building	**E5**			4	44.4	1	11.1			4	44.4					9
Method 4	**E5a**	12	15	12	15	10	13	18	23	15	19	11	14			102
	E5b	7	10	30	42	5	7	2	3	21	30			6	8	71
	E5c	8	10	28	34	7	8	12	15	27	33					164
Total per building	**E5**	27	11.7	70	30.3	22	9.5	32	13.9	63	27.3	11	4.8	6	2.6	231
Aggregated totals /building		29		78		24		38		72		12		6		**259**

Appendices

Appendix A: The Petrography Sample 353

The stratified distribution of the non-local fabrics 353

The stratified distribution of the local fabrics (Groups 2 and 3) 354

Appendix B: Experimental Vessel Shaping Results (The Images) 358

Appendix C: Pottery Catalogue 368

Appendix A: The Petrography Sample

Appendix A provides a discussion of the stratified distribution of imports (§I) and local fabric groups (§2) identified in the ceramic petrography by Ben-Shlomo (2012, 2017, forthcoming). Petrofabric groups are discussed in relation to buildings, phase, and vessel types for the Area E assemblage at Tell eṣ-Ṣâfi/Gath. The petrographic samples prepared and analysed by Ben-Shlomo were not part of the study sample for this thesis.

I. The stratified distribution of the non-local fabrics (Table 8.1)

In the E5a phase, 9 of the 73 vessels sampled from this phase (12%) were nonlocal from sources that include the north Levantine coast (one incised sherd and holemouth jar), the Central Hill country (one jug, one platter, one twin vessel), the Sharon coast (one incised sherd from a closed vessel), northern Israel (jar), and east Samaria/Lower Galilee (jar). One vessel was non local, but of unknown origin (small jar). In the E5b phase, 6 of the 38 vessels sampled (16%) were nonlocal and include an incised sherd from the Coastal Plains and an incised sherd from the Central Hill country with motza fabric (clay with superior potting properties). Four sherds in this phase were not provenanced to a specific region. In the E5c, none of the twenty sherds sampled were imports, but fewer vessels were sampled from this horizon. Sherds sampled from the E9 phase (5 sherds from the bottom of the deep probe in 93B) were imported from East Samaria/Lower Galilee region (3 jugs and 2 decorated body sherds). No petrography has so far been done on vessels from phases E6 and E8, with only one sample from E7.

Despite uneven sampling, the E5b phase has the largest number of imports relative to sample size.[110] The diversity of imports increases in the E5a phase with vessels originating from more varied locations that include the north Levantine coast, the Central Hill country, the Sharon coast, and the Lower Galilee (areas north and west of the site within the orbit of the Via Maris). The majority originated from within an 85 to 90 km radius of the site (17 to 18-hour walking time), but there is no reason to assume this journey was made in a predetermined single trip. The furthest vessels may have travelled is roughly 170 km from the lower Galilee and the North Levantine coast (a 36-hour walking time at minimum). There is a weak relationship between source locations identified in the petrography and vessel type, but sample size is clearly limited. Most of the vessels from the north Levantine coast are holemouths and incised vessels (not mutually exclusive

[110] Imports appear to increase in the neighbourhood when buildings experience architectural changes following the creation of long narrow roofed rooms in the E5b phase.

categories since the majority of incised vessels are holemouths when sherds are indicative). Most of the vessels from the Central Hills and East Samaria/Lower Galilee are decorative serving vessels, with most of the jugs originating from the Lower Galilee region (the Tell Beth Yerah 'hub'). Jars do not dominate the imported vessels, which is perhaps contrary to expectation given the assumed role jars played in the flow of commerce (EB figurines at many sites show large jars strapped to donkeys although organic containers are surely more suited to distance transport). In addition, there is no correspondence between specific fabric types and incised vessels/pot marks. The vast majority of incised vessels have fabrics of local origin and are no different to the rest of the assemblage (most belong to groups 2 and 3).

As shown in Table 8.1, the buildings containing the most imports include: E5a Building 114206 (Sharon coast, Central Hill country, and northern Israel); E5a Building 94413 (northern Levantine coast); and E5b Building 74512 (Central Hills). Quantities are low with no more than three vessels per building. Although these amounts are very low, it nevertheless shows that the occupants had some access to everyday items produced in distant locations (i.e. produced outside of the region) that were eventually brought to the site. The results do complement other lines of evidence that more convincingly point to participation in the larger regional EB III trade and exchange network (e.g. the ground stone objects, the copper artefacts, jewellery, bitumen, and so forth) (Beller 2016; Arnold et al. 2017; Uziel and Maeir 2012). There is no clear indication of a slow economic decline at Tell eṣ-Ṣâfi/Gath.

II. The stratified distribution of the local fabrics (Groups 2 and 3)

Sample numbers in the petrography reports were re-organised and analysed according to stratigraphic contexts to strengthen inferences regarding patterns of production in the petrographic data (for example is there a temporal progression in the use of some fabrics? Are some fabrics limited to specific buildings?). The findings are summarised below for each of the fabric (sub)groups:

Petrofabric Group 2a

- Group 2a is attested in two phases of the E5 neighbourhood (E5b and E5c), but in very low quantities. This fabric was not popular in any of the EB phases. The total number of samples adds up to just five vessels, two of which were incised with potter marks. Three of the samples belong to the E5b and are from Buildings 74512, E15AU09, and 114805. One sample is from E5 fill. The vessels with this fabric include jars, platters, and incised

body fragments (the thick-walled vessels). No cooking pots, jugs, or thin walled serving vessels have this fabric.

Petrofabric Group 2b

- Group 2b is attested in all 3 phases of the E5 neighbourhood, but in very low quantities. This fabric was not popular in any of the main EB occupational horizons. The total number of samples adds up to 6 vessels, three of which were incised with pot marks. Three of the samples are from Buildings 74512 (E5b); 134817 (E5c); and 134307 (E5c). The remainder are either from the alleyway (E5a), or are from poor contexts (fill and winter wash). The vessels with this fabric include: 1 Platter (E5b), 2 jars (E5), and 2 bowls (E5a and E5c). The incised body sherd with this fabric is likely a closed vessel. No cooking pots, jugs, or thin walled serving vessels have this fabric.

Petrofabric Group 2c

- Group 2c is attested in the E5a, E5b, and E9 phases of the neighbourhood, in relatively moderate quantities (9.5% of the sample), with most of the samples belonging to the E5a phase (n = 8). The total number of samples adds up to 19 vessels, which are generally not restricted to specific Buildings (104311, 114402, 94413, 74512), with five samples from fill or alleyway contexts. This fabric was more common in E5a Building 94413 and E5b Building 74512. During the E5b phase, this fabric is only found in Building 74512, which is almost certainly due to sampling and recovery bias. The absence of this fabric from the E5c phase may simply be due to the fewer vessels sampled from this stratum. All the containers with this fabric are holemouth vessels, 14 of which were incised with pot marks.

Petrofabric Group 2d

- Group 2d is represented in all three phases of the E5, in relatively moderate quantities (9.5% of the sample), with most of the samples belonging to the E5a phase (n = 9). The total number of samples adds up to 19 vessels, which are not restricted to specific buildings. In the E5a phase, this fabric is found in all of the houses and the alleyway, suggesting unrestricted distribution. In the E5b phase, most of the samples (n = 4) come from Building 74512 (one sample from Building E15AU09), with only one example in the E5c phase (Building 134817). Counts are generally higher for Building 74512 because more vessels were sampled for petrography from this building in the E5b phase. All the containers with

this fabric are holemouth vessels, 14 of which were incised with pot marks. No other functional/morphological type has this fabric.

Petrofabric Group 3a

- Group 3a is represented in all the E5 phases, as well the E6 and E9 phases, in relatively high quantities (16.1% of the sample). Altogether, 32 vessels were studied in thin-section with this fabric, which has a fairly constant distribution across all of the phases. No single phase dominates the counts and the spatial contexts suggest unrestricted access. Six samples belong to E5a Building 94413 and 4 samples belong to E5b Building 74512 (recovery bias). A greater variety of morphological types are made with this fabric including bowls (n = 6), jars (n = 1), platters (n = 8), holemouths (at least one vessel), 6 incised body sherds, five decorated body sherds, and a jug. Platters numerically dominate this petrofabric group.

Petrofabric Group 3b

- Group 3b is represented in all 3 (sub)phases of the E5, with one example belonging to the E7 phase, in relatively high quantities (13.6 % of the sample). Altogether, 27 vessels were studied in thin-section with this fabric and the majority belong to the E5a phase (n = 12). Only one example is attested in the E5b phase and 5 examples are known from the E5c phase. Group 3b fabrics are very similar to group 3a except fewer grog inclusions and quartz is sometimes more frequent. The fabric group is not restricted to any specific building in any of the phases except the E5b phase where only one example is attested. This fabric was more common in E5a Building 104311 (n = 3) and E5c Building 134817 (n = 3). A greater variety of morphological/functional vessel types have this fabric, but it is more prevalent among the serving vessels (5 bowls, 1 krater, 2 jugs, and 3 platters). This fabric is also attested among the holemouths (n = 2), incised body sherds (n = 5), and jars (n = 3), but in smaller quantities.

Petrofabric Group 3c

- Group 3c is represented in all 3 (sub)phases of the E5, with 3 examples also attested in the E7 phase, in relatively high quantities (15.1% of the sample). Altogether, 30 vessels were studied in thin section with this fabric and the majority belong to the E5a phase. The fabrics are not restricted to any specific building in any of the phases except the E5b phase when only one example is attested in Building 74511. A greater variety of

morphological/functional vessel types have this fabric, but it is more prevalent among the fine ware serving vessels (9 bowls, 6 jugs[111], 5 platters). Only 1 holemouth has this fabric as well as 3 incised jars, 1 handmade vessel, and 3 incised sherds.

Petrofabric Group 3d

- Group 3d is represented in all 3 (sub)phases of the E5, in relatively high quantities (12.5 % of the sample). Altogether, 25 vessels were studied in thin section with this fabric and the majority belong to the E5a phase (n = 8). However, 13 vessels came from secondary or tertiary contexts (alleyway and fill layers). The fabrics are not restricted to any specific building in any of the phases except the E5b phase when 3 examples (possibly 5 - there are typos in Shlomo's spreadsheet) are attested in Building 74511. The spatial contexts suggest unrestricted distribution (E5a Buildings 94413, 114206, 104311; E5b Building 74511; and E5c Buildings 134817 and 134307). All the containers with this fabric are holemouth vessels, 12 of which were incised with pot marks. No other functional/morphological type has this fabric.

Petrofabric Group 3e

- Group 3e is represented in the E5a, E5b, and E6 phases of the neighbourhood, but in very quantities. Only 8 vessels have this fabric and the majority belong to the E5a phase (n = 5). This fabric was found in all the E5a buildings in very low quantities (one or two vessels). Closed vessels (3 incised sherds and 1 Abydos) and jars (n = 3) numerically dominate this group, which also includes a basin. This group may have originated in the northwest Negev due to the more reddish matrix (ferruginous clay with pellets) and more of the silty quartz.

Petrofabric Group 3f (high temperature fabric)

- Group 3f is represented in all the E5 (sub)phases and the E7, but in very low quantities. Only six vessels have this fabric, which is not restricted to any specific building in any of the phases, indicating unrestricted distribution. Abydos jugs numerically dominate this group (n = 3), but this subgroup also includes 2 incised body sherds and a jar.

[111] 4/6 were Abydos jugs

Appendix B: Experimental Vessel Shaping Results (The Images)

Appendix B provides the scanned sections of the experimental replicas made by Jon Ross and Tiffany Okaluk (see Fig. 3.12 for the *chaînes opératoires*). The experimental study had three aims: 1) To test the mesoscopic thick section scanning method; 2) provide additional criteria for identifying shaping techniques in thick section; and 3) show how different clay recipes impact the visibility of the preferred orientation of inclusions (the deformation/decompression patterns).

Figure 1. Replica shallow bowl showing traces of coils in section. Photo credit: Jon Ross.

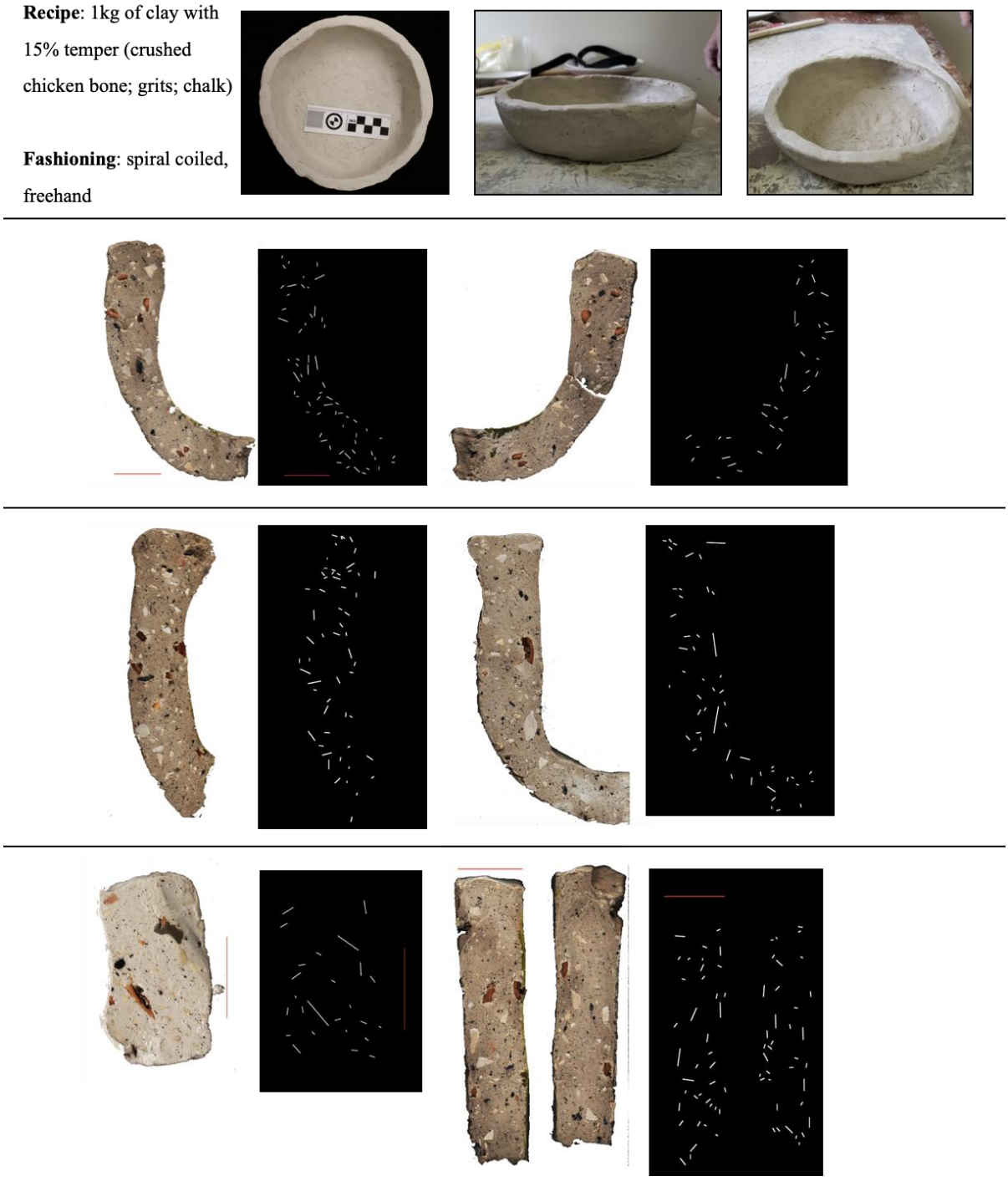


Figure 2. Three consecutive sections along the same base sherd from the replica shallow bowl. Photo credit: Jon Ross.



Recipe: 1kg of clay with 15% temper (crushed chicken bone; grits; chalk)

Fashioning: spiral coiled, freehand

Consistent patterning down the section, but specific distributions vary between and within individual coils along the same sherd. Exterior wall preserves the outline of deformed coils. Intensive smoothing has erased this trace on the interior surface. Some coils consistently have more temper than others despite fairly intensive mixing.

Figure 3. Section showing the complete profile of a closed bowl (small replica holemouth), Side A. Photo credit: Jon Ross.

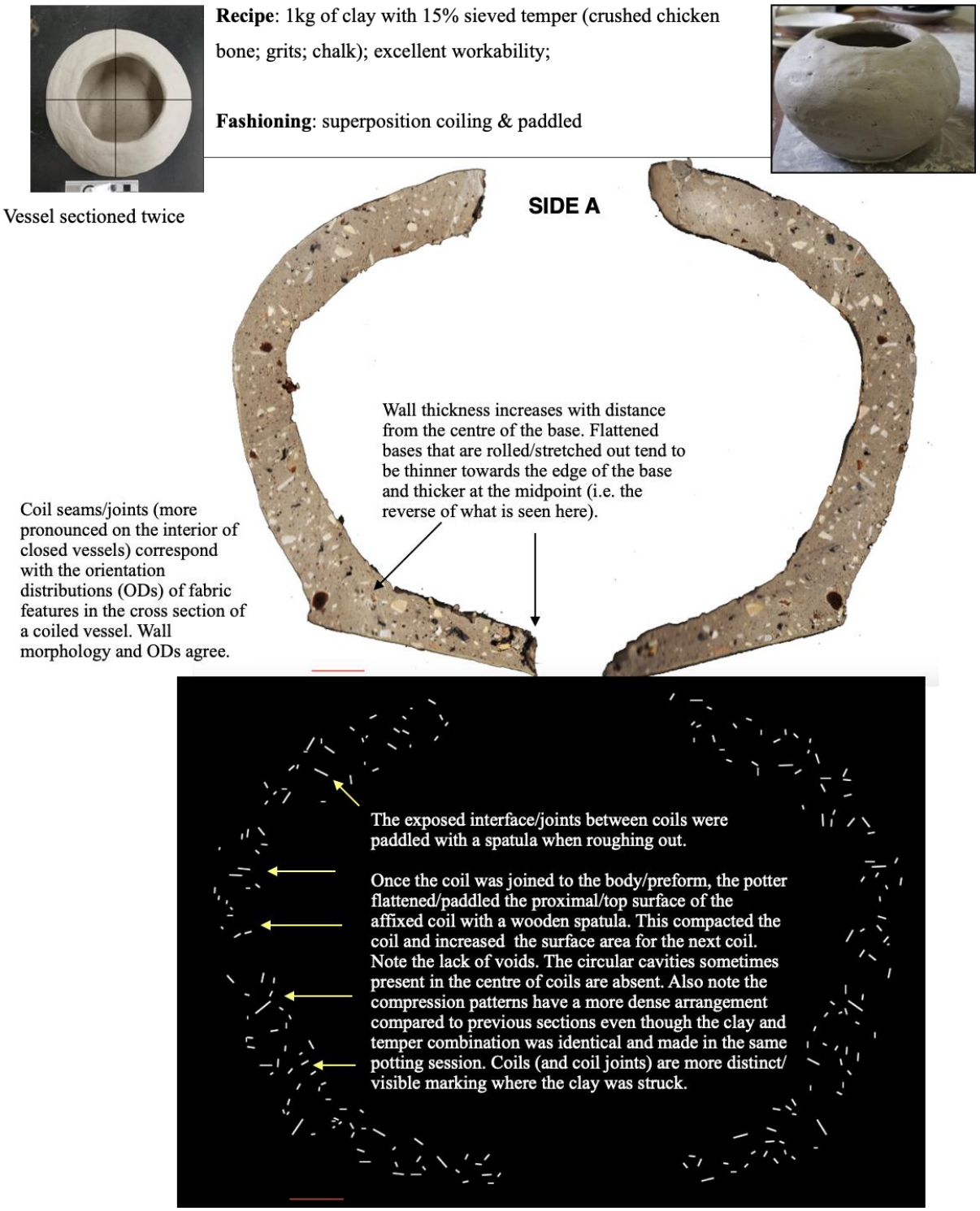


Figure 4. Section showing the complete profile of a closed bowl (small replica holemouth), Side B. Photo credit: Jon Ross.



Vessel sectioned twice

Recipe: 1kg of clay with 15% sieved temper (crushed chicken bone; grits; chalk); excellent workability;

Fashioning: superposition coiling & paddled





Figure 5. Sections from a deep bowl made using a combination of slab, mould, and coiling techniques. Photo credit: Jon Ross.



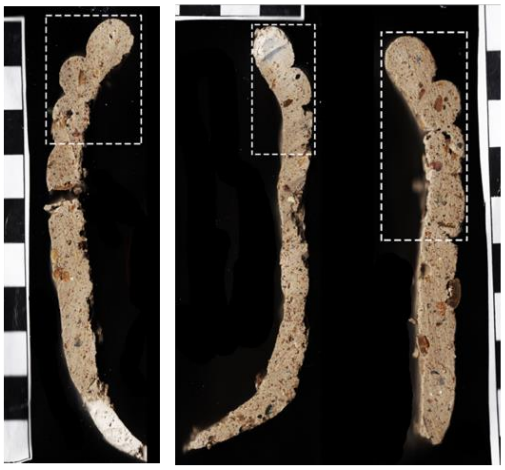
Recipe: 1kg of clay with 20% temper (large grits; fibre; grog);

Fashioning: fabric used to release pot from mould; slabs + mould, finished off with coils (above lip of mould, marked by yellow line)



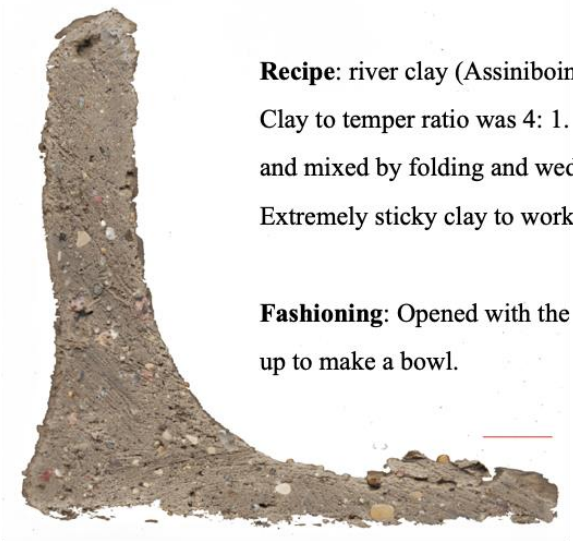
Complete vessel wall profiles

- Concave slab moulding and coiling (joined and smoothed)
- Slab built walls were consistently thinner than the coil built walls made by the same potters, with the same clay.
- Walls increase in thickness and are less regular/uniform above the lip of the mould, with coil deformations visible on exterior surface (the surface in contact with the mould). The outlines of coils are still visible despite joining and smoothing operations. Example below shows the wall morphology when coils are not smoothed at all.
- Temper was too coarse. Some of the inclusions were too large, which made coiling difficult. Low workability.



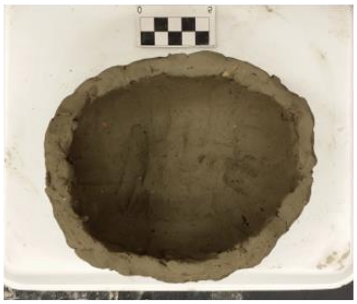
- **Fashioning**: Convex slab moulding and coiling (not thoroughly joined and smoothed on exterior surface)
- **Recipe**: large grits; grog; fibre; crushed pig bone (20%); workability was poor. Bad temper strategy.
- Coils were very fragile and greasy from the pig bones (mostly rib). Yet pig bones were washed, cleaned, and heat treated to remove as much fat as possible. Circular cavities are located in the centre of some of the coils in the dotted boxed zones. Did not achieve the same results as the bird bone temper bowls on plates 1-4

Figure 6. Sections from a bowl made using drawing techniques (top) and sections of a pressed slabs (bottom). Photo credit: Jon Ross.



Recipe: river clay (Assiniboine),grits, sand. Clay to temper ratio was 4: 1. Not sieved and mixed by folding and wedging. Extremely sticky clay to work.

Fashioning: Opened with the fist and drawn up to make a bowl.



- All inclusions point in the same direction, the direction in which the clay was pulled, stretched, and dragged out.



- The relative lack of voids and distinct clay laminations is noticeable across the entire experimental typeset, especially when compared to archaeological examples. The sticky river clay was cut in a bone dry state with a wet saw. We expect that the clay rehydrated and was smoothed by the wet saw, which erased/diminished voids (especially during prolonged cuts exposing entire wall profiles). We will test this hypothesis by firing the same specimens and re-sectioning them in a future study.



- Pressed slab bases (left) of the bone tempered bowl shown on plate 5 and a grit tempered slab shown below, with a distinctive void pattern. Elongated inclusions are sub-horizontal/sub-parallel. No joints visible in section.

Figure 7. Sections from a v-shaped bowl made using pinching and coiling techniques. Photo credit: Jon Ross.



Clay to temper ratio was 4:1. Temper includes large grits, sand, fibre and grog. Shop bought clay. Temper not sieved.

Small v-shaped bowl made by pinching the base and lower half then adding three coils to bring up the walls. Blue arrow marks where the vessel was coiled



Poor temper strategy with low workability. Inclusions were too large and in some cases are equal in size to the thickness of the vessel wall! This made coiling difficult and ODs were not distinctive of the shaping technique. Size (and mass) effected the preferred orientation. No joints between assembled elements are visible. The base and lower body was fashioned from a single clay mass, hence there should be no joints for that part of the vessel. Wall profiles are highly irregular with no consistency. Dips and finger impressions were visible on exterior wall surfaces. All sectioned pinched pots had these features in common.







Figure 8. Shaping flat bases. Photo credit: Jon Ross.













- Flat roughly finished base with embedded/inserted grits and crushed chalk used as an anti-adhesive. Vessel was coil built upright on a gritted surface. The base was fashioned first and the vessel was left to dry upright. No drying cracks or deformities. Contrary to past observations (London 2014), fashioning the flat base first did not present unusual difficulties, nor did it lead to a high failure rate during the drying process (even when left to dry upright).

- The bases on large flat vessels did not exhibit any cracking when left to dry upright on cold hard surfaces, in a well ventilated space (indirect sunlight). It was very difficult to achieve a round symmetrical base without the use of additional vessel supports and moulds. The asymmetry was exaggerated during the drying process.

- When vessels were left to dry upright on soft and highly absorbent surfaces, the bases cracked and/or flaked. This did not occur when vessels were left to dry on hard cold surfaces.

- The imprints of the moulds and vessel supports were well preserved and clearly visible on the bases of finished mould made vessels (even when released early from the mould and left to dry upright). Note the difference in vessel symmetry (example is sectioned down the middle) with vessels built freehand shown above.

I. Outcomes and Directives of the Experimental Study

- The size and mass of the temper did impact OD's seen in section. Coarse temper greater in size than half the diameter of the vessel wall produced poor results and was difficult to work. Very fine amorphous inclusions with no clear preferred orientation was equally uninformative. Crushed chalk produced great results in terms of both the workability of the clay and the OD's seen in section. Not all bone temper produced good results. Bird bone was excellent, but pig bone was very poor, despite intensive cleaning and heat treating prior to use.

- In general, clay temper combinations with good workability for hand forming techniques generated far better OD's visible in section for identifying fashioning techniques. In many instances, the results were better than expected despite intensive joining and smoothing operations. Sieved temper in well mixed clays produced better results, since size ranges and distribution was more consistent. Choice of clay processing techniques clearly impacts the OD's and therefore impacts the identification of fashioning techniques (they are not independent variables).

- Despite intensive smoothing operations (including burnishing with a stone for several hours), wall morphology (seen in section) was still a helpful index for confirming the identification of fashioning techniques. Distinct changes in wall profile were observed on sections subject to various combinations of techniques (i.e. slab and coil techniques with and without supports).

- Contrary to expectation, void distribution was not a particularly useful criterion when compared to the distribution of non-plastics. We expect this is because sections were cut when bone-dry in an unfired state and were smoothed/polished by the wet saw, which perhaps diminished the void pattern. Future experimental studies can improve on our results by firing experimental replicas and further experimenting with different types of clays and tempers.

- Finally, fashioning flat bases was not a difficult exercise and did not result in a high failure rate when left to dry upright (London 2014). The findings in this experimental study support the identification criteria outlined in Chapter 3 for classifying fashioning techniques on freshly cut pottery thick sections.





Appendix C: Pottery Catalogue of the Study Sample from Area E, Tell eṣ-Ṣâfi/Gath

Catalogue numbers correspond to separate vessels and not individual frags. This is why there are some gaps/jumps in the numerical sequence for the catalogue numbers. Pottery codes are in Appendix D for form element, decompression pattern in thick section, colour of the clay body, and fabric code.

Cat. No.	Phase	Locus	Basket	Vessel Class	Form Element[1]	No. of Sections	Decompression pattern in thick section[2]	Mould/ vessel support	Surface features indicative of shaping	Colour of the clay body[3]	Fabric Code[4]
1	E5a	104604	1046032	Platter	R+S	2	3	N	Coiled	F6	B1
2	E5c	134311	1343093	Platter	B+BA	3	1	?		F7	
3	E5c	16E73D03	16E73D005	Platter	B+BA	2	3	N	Coiled	F7	
4	E5b	104803	1048025	Bowl	R+S+(B)	4	0	N	wheel finished?	F7	B1
5	E0	104900	10490085	Platter	R+S+B+BA	6	0	N		F7	
6	E5b	114306	1143026	Bowl	R+S	2	3	N		F7	B1
8	E5b	94508	945028	Platter	R+BA	2	1	?		F1	B1
9	E5b	104803	1048024	Bowl	R+S+B	6	3 + WS	N	Coiled, wheel shaped	F3	
10	E5	114313	1143045	Holemouth	R+S	4	3	N	Coiled	F8	HM
11	E4-5	E15AQ08	E15AQ044	Holemouth	BA+LB	4	3, 2	Y	Coiled	F8	HM
12	E5c	134607		Holemouth	BA+LB		3	N		F8	HM
13	E5b	84511	845117	Holemouth	BA+LB	2	1, 2	Y		F8	HM
16	E5a	16E93B03	16E93B008	Holemouth	BA	2	3, 2	N		F8	HM
17	E3-5	16E84A04	16E84A047	Holemouth	B	2	3	N		F8	HM
18	E5c	17E73D07	17E73D088	Holemouth	B	7	3	N		F8	HM
19	E5a	144801	1448009	Bowl	R		0	N			B1

20	E5c	134817	1348123	Bowl	R+B+BA	2	3	N	Coiled	F7	BL 1
21	E5c	134313 Q	1343133	Bowl	R+UB	2	3	N	Coiled	F1-F6	B3
22	E5	134315	1343157	Bowl	R+UB		WS	N	Wheel shaped?		fine ware
23	E5	104204	1042019	Bowl	B+LB	2	WS	N	Wheel thrown?		
24	E5a	144801	1448010	Vat	R+UB	2	3	N	Coiled	F4	
25	E5a	114102	1141008	Vat	R+UB	2	0	N	Coiled	F4	
26	E4-5	104102	1041005	Jug	BA+LB	2	0	N			
27	E5c	134604	1346049	Juglet	BA+LB	2	3	N			
28	E5a	16E83C07	16E83C068	Juglet	BA+LB	2	3	N			
29	E0	16E83B01	16E83B001	Jug	B	2	3	N	Scraped with a diagonal motion (Fig)		
30	E5a	144801	1448010	Jar	R+N+S	2	luted	N	Coiled	F2	J2 (?)
31	E5a	104604	1046017 172.58	Jar	R+N+S	2	3	N	Coiled	F7	J2
32	E4-5	104102	1041005	Bowl	BA	2	3	N	Wheel finished (possibly shaped)	F3	B 1
33	E5	104204	1042010 172.13	Jar	B+H	4	3	N	Coiled	F3	
34	E5	104204	1042010 172.13	Jar	B	2	3	N	Coiled	F3	
35	E5b	94508	945028	Jar	B	2	3	N	Coiled	F7	J1
36	E5	104204	1042008 172.13	Jar	BA+B	2	3	N		F3	J2
37	E3-5	16E84D02	16E84D049	Jar	LB	3	3	N	Coiled	F2-3 in-between BUT F3 interior	J2
38	E5b	74606	746034 172.04	Jar	SH+UB	2	3	N	Coiled	F2	J3
39	E5a	114402	1144065 172.15	Jar	R+N	2	3	N		F1	

40	E0	16E73D01	16E73D001	Jar	B	2	3	N	Coiled		
41	E0	16E83B01	16E83B001	Jar	B	2	3	N			J3
42	E5c	114602	1146040 171.40	Jar	SH	2	3	N		F1	
44	E5	104104	1041010 173.09	Jar	B	2	3	N	Coiled	F1	J1
45	E3-5	16E84A04	16E84A032	Jar	B	4	3	N		F2/F3?	J2
46	E4	16E93B04	16E93B016	Bowl	Ba	2	3	N		F3	J1
47	E4	16E93B04	16E93B016	Jar	H	2	luted	N		F4	J3
48	E0	134503	1345005 171.67	Jar	B	4	3	N		F4	J3(?)
49	E0	17E94A01	17e94a019 170.674	Holemouth	BA+LB	1	3	Y		F8	HM
50	E0	17E84C01 (cancelled by registration)	17E84C002 171.009	Holemouth	B+BA	14	3, 1	Y		F8	HM
51	E0	17E83A02	17e83a006 172.142	Holemouth	BA+B	2	3	Y		F8	HM
53	E0	17E94A01	17e94a001 170.719	Holemouth	BA	6	3	N		F8	HM
54	E0	17E83C01	17e83c001 171.577	Holemouth	B	4	3	N		F8	HM
55	E0	17E83C01	17e83c001 171.577	Holemouth	B	2	3	N		F4	HM
56	E0	17E83A01	17e83a005 171.968	Holemouth	B	2	3	N		F8	HM
57	E0	17E83A01	17e83a005 171.968	Holemouth	B	2	3	N		F8	HM
58	E0	17E83A01	17e83a002 172.601	Holemouth	R	3	0, 2	N		F8	HM
60	E0	17E83A01	17e83a002 172.601	Holemouth	R	3	0	N		F8, grey section	HM
61	E5b	E15AW11	E15AW079	Platter	B (sh)	2	3, 1	?		F3	J2
62	E5a	144801	1448009	Bowl	R	2	3	N		F7	B1
63	E6	E15AR02	E15AR081	Bowl	R	4	3	N		F5	
64	E4	E15AS02	E15AS040	Platter	R	2	3, 1	?	Coiled	F3	B1

65	E5b	E15AW12	E15AW057	Bowl	R	2	3	N			
66	E5b	104504	1045028	Platter	BA	2	3, 1	?		F7	J2/J1
67	E5c	114609	1146050	Platter	BA	2	3	N		F3	
68	E5a	104603	1046031	Platter	R	2	3	N			B1?
69	?	99906	999017	Platter	BA	2	1	?		F7	
70	E5a	16E93A02	16E93A077	Bowl	R	2	3	N		F5	B1
71	E5a	144804	1448034	Platter	BA	2	3, 1	?			J2
72	E5b	134803	1348014	Bowl	R	2	3	N	Coiled	F3	B1
73	E5c	114804	1148040	Bowl	R	2	0	N	Coiled		B4
74	E6	E15AS10	E15AS087	Platter	R	2	3	N	Coiled	F5	J2/J1
75	E5b	104902	1049015	Platter	B+BA	2	0	N	Coiled	F7	B1
76	E5b	84509	845118	Platter	BA	2	3, 1	?		F7	B1
77	E5b	114306	1143025	Platter	R	4	3, 1	?	Coiled	F3	B1
78	E5a	16E93A02	16E93A075	Platter	BA	2	3	N		F7	B1
79	E5b	104504	1045033	Platter	BA		0	N		F6	B1 (?)
80	E5a	144802	1448038	vat	R+B	2	0	N	Coiled	F1	
81	E5b	144507	1445092	Bowl	R+B	2	3	N	Y		B 1 (?)
82	E5b	114608	1146034	Bowl	R+B	2	0	N	Coiled	F7	B4
83	E5a	74607	746074	Bowl	R+B	2	0	N	Coiled	F7	B3
86	E5b	74610	746069	Bowl	R	2	0	N			B3
87	E5a	74517	645013	Bowl	R		3	N			B 1
89	E5a	E15AW08	E15AW059	Bowl	R+B	2	3 + WF	N	Coil built + Wheel finished		B4
91	E5c	E15AM04	E15AM018	Bowl	R	2	3	N			J1
93	E5b-c	16E83B02	16E83B053	Bowl		2	0	N			
94	E5c	134811	1348075	Jar	B	2	3	N	Coiled	F1	J1

95	E5a	114106	1141032	Bowl	R	2	3	N	Coil built + Wheel finished		B 1
96	E5a	114106	1141032	Bowl	R	2	0				B 1 (?)
97		?	16E93A034	Bowl	R	2	3	N	Wheel finished?		B 1 (?)
98	E5B	74610	746076	Bowl	R+B	2	3	N			B3
99	E5a	74510	745063	Bowl	R+B+BA	2	3 + WF	N	Check if wheel shaped?	F7	B2
100	E6	E15AS10	E15AS087	Vat	R	2	3	N			J3
101	E5a	74512	745111	Holemouth	R	2	3	N		F8	
102	E5a	74512	745111	Holemouth	R	2	3, luted			F8	
103	E5b	104803	1048034	Holemouth	R	2	3	N		F8	HM
105	E5c	10492	1049012	Holemouth	R	2	3	N		F8	HM
106	E5c	10492	1049012	Holemouth	R	2	3	N		F8	HM
107	E5	114313	11431045	Holemouth	R	2	3	N	Coiled	F8	HM
108	E5a	74506	745032	Holemouth	B	2	3	N		F8	HM
109	E5a	74808	748089	Holemouth	BA	2	3	N		F8	HM
110	E5b	104803	1048025	Holemouth	BA + B	2	3	N		F8	HM
111	E5b	104803	1048025	Holemouth	B	2	3	N		F8	HM
112	E5a	E15AL03	E15AL009	Holemouth	BA	2	3	Y		F8	
113	E5a	94605	946021	Holemouth	B+BA	2	3	N		F8	HM
115	E5c	134817	1348123	Holemouth	R	2	3	N		F8	HM
116	E5c	114506	1145055	Holemouth	B	2	3	N		F8	HM
117	E5c	114506	1145055	Holemouth	R	2	3	N		F8	HM
118	E4-5	E15AH05	E15AH059	Holemouth	B	2	3	N		F8	
119	E4-5	E15AH05	E15AH059	Holemouth	BA+LB	2	3	N		F8	HM
120	E5a	144804	1448034	Holemouth	R	2	3	N		F8	HM

121	E5a	16E93A02	16E93A075	Holemouth	R	2	3	N		F8	HM
123	E6	E15AR02	E15AR081	Holemouth	R	2	3	N		F8	HM
124	E5b	104504	1045033	Holemouth	R	2	3	N		F8	HM
125	E5b	104803	1048025	Jar	B	2	3	N		F2	J3
126	E5c	134817	1348123	Bowl	R	2	3	N			B1
128	E5a	74808	748089	Jar	B	2	3	N	Coiled	F2	J3
130	E5a	E15AH09	E15AH011	Holemouth	BA	2	3	N		F8	HM
133	E5a	E15AH09	E15AH011	Jar	B	2	3	N	Coiled	F3	
134	E5a	74517	845013	Platter	B	2	3	N		F7	J2/J1
135	E5a	74517	845013	Holemouth	R	4	3	N		F8	HM
137	E5b	94508	945028	Holemouth	B	2	3	N	Coiled	F8	HM
138	E5b	94508	945028	Holemouth	B	2	3	N	Coiled	F8	HM
139	E5b	94508	945028	Holemouth	B	2	3	N		F8	HM
140	E5b	94508	945028	Jar	B	2	3	N	Coiled	F2 exterior, grey interior	
141	E5c	E15AM04	E15AM018	Platter	BA		3	N			B1?
142	E5c	E15AM04	E15AM018	Holemouth	B	2	3, 1	?	Coiled	F8	HM
143	E5c	114506	1145047	Jar	B	2	3	N		F2 ish exterior/ F3 interior	J2
145	E4-5	E15AH05	E15AH059	Holemouth	B	2	0			F8	
146	E4-5	E15AH05	E15AH059	Platter	BA	2	3, 1			F3	B1
147	E5A	144804	1448040	Holemouth	R	2	3	N		F8	HM
148	E5A	144804	1448040	Jar	H	8	luted		Coiled	F2	J1 (?)
149	E5a	104604	1046027	Holemouth	R	2	0			F8	
150	E5a	104604	1046027	Jar	BA	2	0			F7	J2
151	E5a	144901	1449010	Jar	SH	2	0				

152	E5a	144901	1449010	Jar	B	2	3	N	Coiled	F2 exterior, grey interior	J3
153	E5a	144901	1449010	Bowl	R	3 (but 4 altogether)	3	N	Coiled		
154	E5a	144901	1449010	Platter	BA	2	3	N			
155	E5c	134814	1348083	Holemouth	B	2	3	N		F8	HM
156	E5c	134814	1348083	Holemouth	B	2	3	N		F8	HM
157	E5c	134814	1348083	Jar	B	2	3	N			
158	E5c	134814	1348083	Jar	BA	1	3	N			
159	E5a	104604	1046017	Jar	B	6	3	N	Coiled	F2 pink	J1
160	E5a	104604	1046017	Platter	BA	2	0			F7	J2/J1
161	E5c	134814	1348057	Jar	B	4	3	N		F1	J1
162	E5c	134814	1348057	Jar	BA+LB	2	3, 2				J3
164	E5c	134814	1348057	Bowl	B	2	3	N			
165	E5b	84509	845126	Bowl	R	2	1, 2?			F1 interior F7 exterior	B1
166	E5b	84509	845126	Platter	BA	2	3	N		F6	
169	E5b	84509	845126	Holemouth	B	2	3	N		F8	HM
170	E5b	84509	845126	Jar	B	2	3	N	Coiled	F2	J2
171	E5b	104902	1049009	Holemouth	B	2	3	N		F8	HM
172	E5b	104902	1049009	Jar	B	2	0		Coiled	F4	Similar to HM J3(?)
173	E5b	104902	1049009	Jar	B	2	3	N		F1 but F3 interior	
174	E5b	74606	746036	Bowl	R+B+BA	2	3 + WS	N	Coil built and wheel finished/ possibly shaped (Fig)		B2

175	E5b	74606	746036	Jar	H+B	2	3	N		F2 exterior F1 interior	J1
176	E5b	84509	845127	Jar	B	2	3	N	Coiled	F4	J3(?)
177	E5b	84509	845127	Jar	B	2	3	N	Coiled	F2 but F3 interior	
179	E5b	84509	845127	Holemouth	BA	2	3	N		F8	HM
180	E5b	84509	845127	Holemouth	B	2	3	N		F8	HM
182	E5b	84509	845127	Bowl	R	2	0				
183	E5b	84509	845127	Bowl	R+B	2	3	N	Coiled		B4 (similar B4)
185	E5c	134814	1348099	Jar	B	2	3	N	Coiled	F4	J3
186	E5c	134814	1348099	Jar	H+B	4	3	N		F1	J2 (?)
188	E5c	134814	1348099	Jar	BA	2	3	N	Coiled		not usual HM fabric
189	E5c	134814	1348099	Holemouth	B		3	N	Coiled	F8	HM
190	E5a	E15AT02	E15AT006	Bowl	R	2	3	N		F3	B1
191	E5a	E15AT02	E15AT006	Holemouth	R	2	3	N		F8	HM
192	E5a	94605	946026	Jar	B		3	N			
194	E5a	74808	748089	Jar	B	2	3	N			J3
195	E5a	E15AW08	E15AW061	Jar	B	2	3	N	Coiled	F1	J2
196	E5a	104604	1046032	Jar	B+LB	2	3	N	Coiled	F1	J1
197	E5a	74506	745051	Jar	B	2	3	N	Coiled	F2	J3
198	E5a	74506	745051	Jar	B	2	0		Coiled	F1	J1 (?)
199	E5a	74506	745051	Jar	LB	2	3	N		F4	J3
200	E5A	E15AT05	E15AT038	Jar	R+N+S	4	2?			F1	J3 (?)
202	E5a	74808		Jar	B	2	0		Coiled	F1	
204	E5b	134803	1348088	Jar	B	2	3	N			
205	E5b	144507	1445070	Jar	BA+B	2	3	N			B1

207	E5b	144507	1445070	Jar	B	2	3	N		F3 exterior, F2 in section	J3
208	E5b	144507	1445070	Holemouth	B	2	3	N		F8	
209	E5	104103	1041006	Jar	Ba+B+H	4	3	N	Coiled	pinky, peach	
210	E5c	114502	1145004	Jar	R+N	2	3	N		F1	J2
211	E5a	84108	841025	Jar	LB+BA	2	3	N		F3	J4
212	E5a	16E93A02	16E93A028	Holemouth	R	2	3	N		F8	HM
213	E5a	16E93A02	16E93A028	Jar	H+B	2	3	N		F1	J2
214	E5a	16E93A02	16E93A028	Jar	SH	2	3	N		F1	
215	E5a	104801	1048008	Holemouth	B	6	3	N		F8	HM
216	E5a	104801	1048008	Jar	BA	2	3	N	Coiled	F2	J2
219	E5c	134313 Q	1343133	Jar	B	2	3	N	Coiled	F2 but F3 interior	J2
220	E5c	134313	1343133	Platter	B	2	0			F3	
221	E5b	134803	1348088	Platter	B	2	0			F7	
222	E5b	134803	1348088	Holemouth	B	2	3	N		F8	
223	E5b	134803	1348088	Jar	B	2	3	N	Coiled	F2	J3
224	E5b	134803	1348088	Jar	B	2	3	N		F7	J2
227	E5A	16E93A02	16E93A075	Holemouth	B	2	3	N		F8	HM
228	E5A	16E93A02	16E93A075	Jar	BA+B	2	3	N			
229	E5c	114506	1145055	Bowl	R	2	0		Wheel finished		B 1 (?)
230	E5c	114506	1145055	Jar	H+B	2	0			F1	J3 (?)
231	E5b	114310	1143051	Bowl	R	2	0				
232	E5b	114310	1143051	Bowl	R	2	0				J2
233	E5a	74808	748120	Holemouth	BA+LB	2	3	Y		F8	HM
234	E5a	74808	748120	Jar	B		3	N	Coiled		

235	E5c	134811	1348069	Bowl	BA+LB	5	3	N	Wheel finished	buff coloured	
236	E5c	134811	1348069	Jar	B	2	0		Coiled	F3	
237	E5c	134811	1348081	Jar	H+B	2	3	N		F1	J2 (?)
239	E5c	134811	1348081	Jar	B	2	3	N			J3
240	E5a	94605	946026	Bowl	Ba	2	3, 1				B 1
241	E5a	94605	946026	Holemouth	B+BA	2	3	N		F8	
242	E5a	94605	946026	Jar	BA	2	3	N	Coiled	F1	
244	E5A	144901	1449002	Holemouth	B	2	3	N		F8	HM
245	E5A	144901	1449002	Jar	B	2	3	N		F3	J2
246	E5c	134810	1348024	Jar	B	2	3	N	Coiled	F2	J3
247	E5c	134810	1348024	Jar	H+B	2	0		Coiled	F2	J3
249	E5c	134814	1348086	Jar	B+BA	4	3	N	Coiled	F1	(J2)
250	E5c	134814	1348086	Platter	B	2	3	N	Coiled	F7	B1
251	E5c	134814	1348086	Jar	B	2	3	N		F1	J1 (?)
252	E5a	104604	1046032	Holemouth	BA	2	3	N		F8	HM
253	E5a	104604	1046032	Jar	B	2	3	N		F4	J3
254	E5a	104604	1046032	Platter	B		0		Coiled	F6	J2/J1
255	E5a	104604	1046032	closed vessel	B	2	3	N	Coiled	F2 exterior, grey interior	J3
256	E5a	104604	1046032	Jar	B	2	3	N	Coiled	F1	J1
257	E5A	144901	1449002	Holemouth	B+BA	2	3	Y		F8	HM
258	E5A	144901	1449002	Jar	N+SH	2	3	N		F1	J2 (?)
259	E5A	144901	1449002	Bowl	BA	2	3	N			B1
261	E5b	104902	1049015	Holemouth	LB	2	3	N		F8	HM
262	E5b	104902	1049015	Jar	B	2	0				J2
263	E5b	94906	949017	Jar	B	2	3	N		F4	

264	E5a	74506	745135	Jar	B	2	3	N	Coiled	F4	J3
265	E5c	134814	1348086	Jar	B	2	3	N	Coiled	F3 exterior	
266	E5a	E15AT03	E15AT012	Jar	R+S	2	3	N	Coiled	F7	B1
268	E5A	74510	745068	Jar	B	6	3	N	Coiled	F2 but F3 interior	J2 (?)
270	E5A	74510	745068	Holemouth	B	2	3	N		F8	HM
271	E5b	134803	1348014	Jar	B	4	3	N	Coiled	F4	J3
272	E5b	134803	1348014	Holemouth	B	2	3	N		F8	HM
273	E5c	E15AM04	E15AM018	Holemouth	B	2	3	N		F8	HM
274	E5c	114503	1145037	Jar	H	6	luted?			F3	J4
277	E5a	E15AW08	E15AW059	Platter	B	2	3	N		F7	B1
278	E5a	E15AW08	E15AW059	Bowl	BA	2	0		Wheel finished Fig.		B3
279	E5b	16E82D03	16E82D034	Holemouth	LB+BA	2	3	N		F8	H
280	E5b	16E82D03	16E82D034	Holemouth	B	2	3	N		F8	
281	E5b	16E82D03	16E82D034	Jar	B	2	3	N		F3	J1
282	E5a-b	16E93A02	16E93A008	Holemouth	B	2	3	N		F8	HM
283	E5a	16E93A02	16E93A008	Jar	B		0		Coiled	F2	
284	E5a	16E93A02	16E93A081	Jar	LB	2	3	N		F1	J1 or J2
285	E5b	94906	949024	Bowl	BA		NOT CUT		Wheel finished	Grey fabric	
286	E5a	E15AT03	E15AT054	Jar	H	2	luted		Applied	F4	J3 (?)
287	E5a	74808	748116	Bowl	R+B	2	3	N	Coiled + wheel shaped		B3
288	E5b	104504	1045028	Juglet	B	2	0				similar to B4
289	E5b	84509	845127	Juglet	B	2	WS	N	Wheel shaped		Similar to B2. Very fine
290	E5b	104504	1045028	Juglet	SH+H	4	luted		scaped up		

294	E5b	16E84A03	16E84A005	Jar	BA	2	0			F2	J2
295	E5c	114803	1148013	Bowl	R	2	3	N	Scraped with a diagonal motion		B 1
296	E0	16E83A01	16E83A001	Holemouth	BA	2	3	N		F8	HM
297	E0	17E83D01	17E83D004	Bowl		2	3	N			J 1
298	E5c	114804	1148040	Bowl		2	3	N			B 1 (?)
299	E5c	17E83B06	17e83b055	Jar	B	2	3	N		F1	J1
300	E0	17E83A01	17E83A002	Jar	BA+LB	2	3	N		F2 exterior, grey interior	J3
302	E7	19E93A07	19E93A063	Jar	B	2	0				
303	E0	19E83C01	19E83C002	Jar	B	sectioned 2	3	N		F1-F2?	J1
304	E0	19E83A01	19E83A002	Jar	H	5	luted			F2	J2
305	E5c-6	19E83A08	(19E83A113?)	Jar	B	2	3	N	Coiled	F3	J1
306	E5b-E6	19E83B06	19E83B077	Jar	LB	2	3	N		F2	J2
307	E5c-6	19E83A08	19E83A113	Jar	N/SH	2	3	N		F3	J4
308	E5a	E15AH09	E15AH111	Bowl	BA+LB	2	0				B1
309	E0	19E83C01	19E83C007	Jar	B	2	3	N		F3	J2 (?)
310	E5b	19E83A02	19E83A012	Jar	B	2	0			F2	J1 (?)
311	E0	19E73D01	19E73D005	Jar	B	2	3	N	Coiled	F2	J3
312	E0	19E73D01	19E73D005	Jar	B	2	3	N	Coiled	F2 exterior but F3 interior	J2
313	E5c	19E73D03	19E73D011	Jar	B	2	3	N		F3	J4
314	E5a	19E84A05	19E84A020	Jar	B	2	3	N		F1	J2
315	E5a	19E84A05	19E84A020	Jar	B	2	0			F2	J2 (?)

316	E5c-6	19E83A08	19E83A113	Jar	B	2	0		Coiled	F3	J3
317	E5a	74808	748129	Jar	B+SH	4	3	N		F3	J2
319	E5c	E15AM08	E15AM072	Jar	B	2	3	N	Coiled	F2	J1
320	E5a	19E84A05	19E84A020	Jar	B	2	3	N	Coiled	F3	J3 (?)
321	E5b	134803	1348007	Jar	B	2	0			F3	J2
322	E5c	19E83C03	19E83C033	Jar	B	2	3	N		F2	J1
323	E0	19E93A01	19E93A034	Platter	B	2	3	N		F3	J2
324	E5c	134311	1343132	Jar	BA+LB	4	3	N	Coiled	F1	J1
325	E5b	17E83C02	17E83C022	Bowl	BA+LB	2	3	N	Coiled	F3	B 1 (?)
326	E5c	19E82D03	19E82D054	Jar	B	2	3	N		F3	J1
327	E5b	104803	1048025	Jar	R	2	3	N		F3	??
328	E5c-6	19E83A08	19E83A100	Jar		2	3	N	Coiled	F4	J1
329	E5b-E6	19E83B06	19E83B062	Jar	BA	4	3, 1			F1	J 2
330	E5b	104504	1045037	Bowl	R	2	3	N	Coiled	F5	B1
331	E0	19E83C01	19E83C007	Platter	BA	2	0			F7	B1
332	E5b	104902	1049015	Platter	B	2	3	N			B1
333	E5b	104504	1045035	Platter	B	2	3	N		F6	B1
334	E5a	104801	1048008	Platter	BA	2	3	N		F6	
335	E0	19E83A01	19E83A002	Bowl	R + B	4	0		Coiled	F5 (darker)	J2-3
336	E5b	74610	746069	Bowl	R	2	3	N			B 1 (?)
337	E0	19E73D01	19E73D005	Bowl	R	2	3	N			J2
338	E5b	104504	1045032	Bowl		2	0				
339	E0	19E93A01	19E93A034	Bowl	R	2	3	N	Coiled + wheel finished?	Grey section; Grey clay	
340	E5b	74610	746076	Bowl	R	2	3	N			B 1
341	E5b	104504	1045037	Bowl	R	2	0			grey section	B 1 (?)

342	E0	19E73D01	19E73D005	Bowl	R	2	0		Wheel finished/s moothed		B4
343	E0	19E83C01	19E83C007	Bowl	R	2	3	N			B 1
344	E5b	84509	845126	Bowl	R	2	3	N			J 1
345	E5a	104801	1048008	Bowl	B	2	0				
346	E0	19E73D01	19E73D005	Bowl	R	2	3	N			B4 (similar B4)
347	E5c	19E83C03	19E83C014	Bowl	BA+B	2	3	N	Wheel finished	Buff coloured	J1
348	E5c	E15AM06	E15AM059	Holemouth	B	2	3	N	Coiled	F8	HM
349	E5c-6	19E83A08	19E83A113	Holemouth	LB	2	3	N		F8	HM
350	E5	19E83C11	19E83C211	Holemouth	B	2	3	N		F8	HM
351	E5b	17E83C02	17E83C022	Holemouth	B	4	3	N		F8	HM
352	E0	19E83C01	19E83C002	Holemouth	B	2	3	N		F8	HM
353	E0	19E83C01	19E83C002	Holemouth	B	2	3	N		F8; grey section	HM
354	E0	19E83C01	19E83C007	Holemouth	B+R	4	3	N		F8	HM
356	E5a-b	18E83A04	18E83A006	Holemouth	B	2	3	N		F8	HM
357	E5c	19E82D03	19E82D054	Holemouth	B	2	3	N		F8	HM
358	E5c	19E83B06	19E83B062	Holemouth	B	2	3	N		F8	HM
359	E5b	19E83A02	19E83A012	Holemouth	B	2	0			F8	HM
360	E5b	19E83A02	19E83A012	Holemouth	B	2	0			F8	HM
361	E5b	19E83A02	19E83A012	Holemouth	B	2	3	N		F8	HM
362	E7	19E93A07	19E93A063	Holemouth	B	2	3	N		F8	HM
363	E5c	134311	1343122	Holemouth	B	2	3	N	Coiled	F8	HM
364	E5c	19E83C03	19E83C033	Holemouth	BA, B	4	3	N		F8	HM
365	E5c	19E83A06	19E83A071	Holemouth	B	4	3	N		F8	HM
366	E5c	19E83A06	19E83A071	Holemouth	B	2	3	N		F8	HM

367	E5c	19E83A06	19E83A071	Jar	B	2	3, 1	?			
368	E5b	19E83C02	19E83C179	Holemouth	B	6	3	N		F8	HM
369	E5b	19E83C02	19E83C179	Holemouth	BA	2	0			F8	HM
370	E5c	114803	1148018	Holemouth	B	2	3, 1	?		F8	HM
371	E5c	19E82D02	19E82D061	Holemouth	B	4	3	N		F8	HM
372	E5b-E6	19E83B06	19E83B050	Holemouth	B	2	3	N		F8	HM
373	E5c	17E93A02	17E82D022	Holemouth	B	2	3	N		F8	HM
374	E5c	19E73D03	19E73D011	Holemouth	R	2	3	N		F8	HM
375	E5c	19E73D03	19E73D011	Holemouth	R	2	3	N		F8	HM
376	E5b-E6	19E83B06	19E83B050	bowl	B	2	3	N		F3	J2
377	E5c	134814	1348099	JAR	B	4?	0		Coiled	F1	J2
378	E5b-E6	19E83B06	19E83B048	Holemouth	B	2	3	N		F8	HM
379	E5b-E6	19E83B06	19e83b077	Holemouth	B	2	3	N		F8	HM
380	E5b	19E83B02	19E83B010	Holemouth	B	2	3	N		F8	HM
381	E5c	19E83C03	19E83C009	Holemouth	BA+B	4	3	Y		F8	HM
382	E0	19E73D01	19E73D005	Holemouth	B	2	3	N		F8	HM
383	E5c	19E83C03	19E83C128	Holemouth	B	2	0			F8	
384	E5b	19E83C02	19E83C026	Holemouth	BA+LB	2	3	N		F8	HM
385	E5a	74808	748120	Jar	B	2	0				J1
386	E5c	134604	1346049	Jar	B	2	0				
387	E5c	19E83B06	19E83B048	Jar	B	2	3	N		F4	J3
388	E0	17E73D01	17E73D001	Jar	BA	2	0			F4	
389	E5b	17E83C02	17E83C022	Jar	B	2	0		Coiled	F1	
390	E5c	E15AM08	E15AM072	Holemouth	R+B	2	3	N	Coiled	F8	HM
391	E5a	E15AL03	E15AL009	VAT	R+B	2	3	N		F2-3 in-between	

392	E5c	19E83A05	19E83A017	Jar	BA+LB	2	0		Coiled	F4? or F2?	J3
393	E5b	17E83C02	17E83C022	Holemouth	BA+LB	2	3	Y		F8	HM
394	E5b	134803	1348007	Jug	BA+LB	2	0				
395	E5a	74606	746053	Holemouth	R	2	3	N		F8	HM
396	E4-5	17E82D04	17E82D007	Bowl	R+B	2	0				
397	E5b	134803	1348088	Bowl	R	2	3	N			
398	E5b	74610	746069	Bowl	B	2	WS	N	Coil built and wheel finished?		B2 (possibly b3)
399	E5b	19E83C02	19E83C179	Jar	B	2	3	N	Coiled	F1	J1
400	E0	17E73D01	17E73D001	Jar	B	2	3	N		F2	J2
401	E5a	104604	1046032	Jug?	BA	2	0		wheel finished		B3
402	E5c	134313 Q	1343133	Juglet	BA	2	3	N		F3	Similar to B3
403	E0	19E83B01	19E83B002	Juglet	B	2	0				similar to B4
404	E5b	16E82D03	16E82D034	Bowl		2	3	N			B 1
405	E0	19E73D01	19E73D005	Jar	B+SH	2	3	N	Coiled	F1	J2(?)
407	E5c	19E83C03	19E83C014	Holemouth	B	2	3	N		F8	HM
408	E5b	94906	949017	Holemouth	B	2	3	N		F8	HM
409	E5b	74606	746034	Bowl	B	2	0				B 1
410	E5c	19E83C03	19E83C033	Jar	B	2	3	N	Coiling	F1	J2-3?
411	E5c	114803	1148018	Jar	B	2	3	N			J1
412	E5c	19E83A06	19E83A071	Bowl	B	2	3	N		F7	Similar to B1 but reddish/pinkish clay
413	E5b	74606	746042	Bowl	R+B	3/4	0				B3
414	E5b	104504	1045037	Bowl	B	2	0				B2

415	E5c	19E83C03	19E83C128	Jar	B	2	3	N	Coiled	F2	J2 (possibly J3?)
416	E5c	19E83C03	19E83C128	Holemouth	B	2	3	N		F8	
417	E5b	94909	949047	Holemouth	BA	2	3	N		F8	HM
418	E0	19E84A01	19E84A001	Holemouth	R	2	3	N		F8	J1
419	E5c	114506	1145047	Jar	B	2	3	N	Coiled	F1	
420	E5c	19E83A06	19E83A071	Jug	B	2	0		Coiled	F2 exterior, grey interior	
421	E5c	19E83A05	19E83A017	Holemouth	B+BA	4	3	N		F8	HM
422	E5c	19E83A05	19E83A017	Holemouth	BA	2	0			F8	
423	E5a	16E93B03	16E93B008	Jar	B	2	3	N			
424	E5b	16E83A03	16E83A017	Jar	B	2	0				
425	E5a	16E93B03	16E93B008	Jar	B	2	3	N			
426	E5b	16E82D03	16E82D064	Jar	B	2	3	N			
427	E5	16E93B02	16E93B004	Jar	B (SH)	2	3	N			
428	E5	16E73D03	16E73D005	Jar	BA	2	3	N			
429	E5	16E73D03	16E73D005	Jar	B	2	0				
430	E5	16E83C06	16E83C046	Jar	B	2	3	N			
431	E5b	16E82D03	16E82D064	Holemouth	B	2	3	N		F8	HM
432	E5b	16E82D03	16E82D064	Jar	B	2	3	N			
433	E2-5	16E94B02	16E94B015	Jar	B	2	3	N			
434	E5b	16E82D04	16E82A014	Jar	B	2	0				
435	E5	16E83C06	16E83C046	Holemouth	B	2	3, 1	?		F8	HM
436	E5b	16e82D02	16E82D006	Jar	B	4	3, 1	?			
437	E5b	16E83C05	16E83C032	Jar	B	2	3	N			
438	E5a	16E93B03	16E93B008	Jar	B	4	3	N			

439	E5	16E93B02	16E93B004	Bowl	B	2	3	N			
440	E5a	16E93B03	16E93B008	Jar	B	2	0				
441	E5b	E15AW14	16E94A009	Bowl	B	2	0				
442	E5c	16E83D02	16E83D006	Jar	B	2	3	N			
443	E5a	16E93B03	16E93B008	Jar	B	2	3	N			
445	?	ID	16E93A034	Jar	B	2	3	N			J2
446	E0	17E73D01	17E73D001	Jar	B	2	3	N	Coiled	F2	
447	E5b	94508	945028	Holemouth	B	2	3	N		F8	HM
448	E5b-C	17E83A09	17E83A083	Platter	B	2	3	N		F7	B1 (organics)
449	E5b	104504	1045035	Jug	B	2	3	N			
450	E5	17E83A02	17E83A006	Platter	Ba	2	3	N		F7	B1
451	E5b	134803	1348014	Bowl	B	2	3	N	Coiled + wheel finished		J3
452	E5b	74606	746036	Jar	H+B	2	0		Coiled		J2
453	E5c	134814	1348086	Jar	BA	2	3	N		F2	
454	E5c	134311	1343132	Jar	B	2	0			F1	J1
455	E5c	134814	1348086	Jar	B	2	3	N			J1 (?)
457	E5c	134814	1348057	Jar		2	3	N	Coiled	F3 exterior	
458	E6B/E7	20E93A13	20E93A177	Holemouth	B	2	3, 1	Y	Coiled	F8	HM
459	E6B/E7	20E93A13	20E93A177	Jar	B	2	3	N		F1	
460	E6B/E7	20E93A13	20E93A177	Jar	B	2	3	N		F2	
461	E5c	20E83A04	20E83A053	Holemouth	B	2	3	N	Coiled		
462	E6	20E83A09	20E83A009	Holemouth	BA	2	3	N			HM
463	E6	20E83D06	20E83D152	Holemouth	BA	4	3	N			HM
464	E5c	20E83C10	20E83C104	Holemouth	BA+LB	4	3	N			HM

465	E5c	20E83C10	20E83C104	Holemouth	BA+B	6	3	N	Coiled		HM
466	E5c	20E83D04	20E83D140	JUG	B	4	3	N		orange-ish	
467	E5c	20E83D04	20E83D140	Holemouth	BA+B	6	3	N	Coiled	F8	HM
468	E5c	20E83D04	20E83D140	Jar	B	2	3	N		F3	
469	E5c	20E83D04	20E83D140	Jar	B	2	3	N		F2	
470	E5c	134313	1343133	Holemouth	R	3/4	3	N	Coiled	F8	
471	E0	20E82D01	20E82D001	Vat	R + B	2	3	N			
472	E5a	16E93A02	16E93A028	Jar	B	2	3	N	Coiled	F2	
473	E5a	144901	1449002	Jug	N+SH	2	0				
474	E5c	20E83C10	20E83C104	Jar	B	2	3	N			
475	E5c	19E83A06	19E83A071	Bowl	B	2	0				
476	E3-5	16E84A04	16E84A047 171.974	Holemouth	BA+B	2	3	Y	Coiled	F8	
314	E5a	19E84A05	19E84A020	Jar	B	2	3	N			J2
275	E5a	ID	E15AW089 (or4?)	Bowl	R	2	3	N	Coiled	F6	B1
90 matches 287	E5a	74808	748126	Bowl	B	2	3	N			B3
477	E5a	ID	E15AW089 (or4?)	Holemouth	R	2	3	N			
478	E5c	19E84A02	19E84A050	Bowl	Ba+B	N/A	NOT EXPORTED		Coiled + wheel shaped		
479	E5c	134307	1343082	Jug	Ba	N/A	NOT EXPORTED		Coiled + wheel shaped?		
480	E5a	114402	1144065	Holemouth	Ba+B	4	3	Y			
481	E5a	114402	1144065	Jar	B	2	3	N		F3	
482	E5a		1043070-1	Platter	R+B	2	3	N			
483	E5a	134815	1348105-20	Bowl	R+B	2	0				
484	E5a	94204	942028	Jug	Ba+LB	2	0? 3?				

485	E5a	94206	942035	Jar	B	2	3	N			
486	E5a	94206	942035	Holemouth	B	2	3	N			
487	E5a	94206	942035	Jug	B	2	3 + WS	N	Coiled and wheel shaped (fig)		
488	E5b	114406	1144032	Jar	H+B	2	0				
489	E5a	94206	942034	Jar	B	2	3	N			
490	E5a	94206	942034	Jar	B	2	3	N			
491	E5b	114406	1144010	Holemouth	Ba	2	3	N			
492	E5b	114406	1144010	Holemouth	B	2	3	N			
493	E5b	114406	1144010	Closed vessel	Ba	2	3	N	Coiled + wheel finished		
494	E5b	114406	1144010	Bowl	B	2	3	N			
495	E5a	94206	942029	Holemouth	B	2	3	N			
496	E5a	94206	942029	Jar	Ba	2	0				
497	E5a	94206	942029	Jar	B+Sh	2	3	N			
498	E5a	94206	942029	Jar	Ba+B	4	0				
499	E5a	94206	942029	Bowl	B	2	0				
500	E7	20E83A07	20E83A122	Holemouth	B	2	3	N			
501	E5c	17E93A02	17E82D022	Holemouth	B	2	3	N			
502	E5a	94204	942025	Jug	B	2	WS	N	Coil built + wheel shaped?		
503	?	20E93B13	20E93B085	Bowl	Ba+B	2	3 + WS	N	Coiled + wheel shaped	dark reddish brown	
504	E5a	94206	942029	Bowl	Ba	2	3 + WS	N	Coiled + wheel shaped	Buff	
505	E5a	94206	942029	Bowl	Ba+B	2	THROWN	N	Coiled + wheel finished	Buff	

506	E5a	94204	942025	Juglet	Ba+B	2	3	N			
507	E5b	19E83B02	19E83B010	Holemouth	B	2	3	N			
508	E6	20E83A07	20E83A113	Holemouth	Ba+B	2	3	N	Coiled		
509	E5a	94206	942035	Jar	B	2	3	N		Buff exterior	
510	E5a	94206	942035	Jar	B	2	3	N			
511	E5b	104504	1045028	Jug	B	2	0				

Appendix D: Codes

This appendix provides the codes for the Tell eṣ-Ṣâfi/Gath pottery catalogue in Appendix C for the following columns: form element[1], decompression pattern in thick section[2], colour of the clay body[3], and fabric code[4].

Form element[1]	Key
R	Rim
SH	Shoulder
B	Body
H	Handle
LB	Lower body
BA	Base

* Decompression pattern in thick section[2]	Key
0	No trace/pattern
1	Pressed
2	Drawn
3	Coiled
6	Luted/applied elements
WS	Wheel shaped
WF	Wheel finished

Colour of the clay body[3]	Key
F1	Reddish yellow 7.5YR 7/6
F2	Pink to reddish yellow 5YR 7/4 to 7/6
F3	Very pale brown to yellow (buff coloured) 10YR 8/4 to 8/6
F4	Light grey 10YR 7/1 to 7/2 to 8/2
F5	Reddish yellow 7.5YR 8/6
F6	Reddish yellow 5YR 7/6
F7	Pink 5YR 7/3 to 7/4 to 8/4. To light brown 7.5YR 6/4
F8	Medium brown

Fabric Code[4]	Frequency; sorting; size; and shape of inclusions	Further comment on inclusions; firing, and colour
J1	Inclusions are sparse to moderate in quantity; poorly to moderately sorted; sub angular to sub-rounded in shape; voids relatively rare/sparse	No organics; grog mostly dominates (more frequent); thin grey core (better fired than other jar fabrics); light brown generally (7.5 YR 6/4)
J2	Sparse to moderate in quantity (fewer than J1); poorly to moderately well sorted; fewer inclusions of larger size; sub-angular to rounded in shape; more porous than J1	Grog less frequent. Some organics but rare; grey core is thicker with pink and yellow margins
J3	Sparse to moderate in quantity (fewer than J1); SORTING; inclusions often smaller size ranges than J1-2; sub angular to sub-rounded in shape (less angular); voids more common than J1 and J2.	Organics more common than J1 & J2; almost completely unoxidised - large grey section with very thin light red exterior margins (2.5 YR 6/6 6/8); inclusions less visible because of the grey section

B1	Sparse to moderate in quantity but generally fewer than J1-3; poorly to moderately sorted; large inclusions less frequent;	Firing; pink to light brown; inclusions
B2	Inclusions rare in quantity; well to very well sorted; very small size ranges; sub rounded in shape.	Fully oxidised; pink 7.5 8/4, 7/4
B3	Inclusions sparse in quantity; moderately well sorted; small size ranges; sub-angular to rounded in shape (sub-rounded more dominant).	Core almost fully oxidised; pink 5YR 8/4
B4	Inclusions sparse in quantity; sub angular to rounded in shape (dominated by sub rounded); larger size ranges than B3.	Fully oxidised; pink 5YR 8/4
B6	Similar to B4 but more coarse	Large grey section, poorly fired, large grains, crumbly
HM	Moderate to abundant in quantity; poorly sorted; sizes vary from very fine to very coarse; coarse fraction dominates; angular to sub angular in shape (angular more dominant)	Large crushed chalk and calcite inclusions