In search of Early Bronze Age potters at Tell eṣ-Ṣâfi/Gath: A New Perspective on Vessel Manufacture for Discriminating *Chaînes Opératoires*

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ABSTRACT: Current *chaîne opératoire* 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 filtered out of the study sample. This approach is therefore not well-suited for small assemblages where the diversity of fashioning techniques is not represented. For the *chaîne opératoire* method to achieve its full potential in ceramic analysis, additional imaging protocols are required. This paper presents the results of a low-cost study for identifying production groups, by classifying mesoscopic signatures of fashioning techniques on freshly-cut thick sections. Data from the Early Bronze Age strata at Tell eṣ-Ṣâfi/Gath, Israel, are used to illustrate the utility of this approach for understanding how an early urban settlement was provisioned with pottery technology.

INTRODUCTION

Comparisons of *chaînes opératoires* are routinely used worldwide to discriminate between pots made by different potting communities, and in doing so understand group relatedness, historical affinities and the organisation of production. In several synthetic overviews, Roux (2013, 2016: 10) celebrates the 'worldwide success' of *chaîne opératoire* research and its methodological and epistemological strengths. In the absence of direct evidence of pottery manufacture (e.g. workshops), the challenge for the archaeologist is how to access, describe and identify material signatures indicative of forming techniques on finished objects, which are rarely found whole and are heavily worn by site formation and taphonomic processes in mixed assemblages.

Investigations into the organisation of production are often approached at regional scales of analysis through petrography and/or geochemical techniques to identify the general source locations of fabric types and 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. For example, in the Early Bronze Age (hereafter the EBA) of the southern Levant, *chaîne opératoire* approaches have [illegible] debates over the origin and cultural significance of specific wares and vessel types, such as Khirbet Kerak Ware (Iserlis 2009; Iserlis et al. 2012), wheel-made bowls (Roux 2009) and Egyptianised vessels (Dessel 2009). Such studies usually require an underlying heterogeneous geological landscape, or distinct temper types to relate pots to specific sites and production nodes.

However, the use of ceramic provenance studies is extremely limited for reconstructing patterns of production and service provision within and between settlements when potters use similar clays and assemblages are made and used locally (Reedy 2008: 156; Tomber 1998: 2; Vince 2005: 220). Similar vessel shapes 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 tens of thousands for each site assemblage. The goal of this study is to present a new approach for identifying distinct production groups at a household spatial scale in order to understand how an early urban settlement was provisioned with container technology. Data from the EBA levels at Tell eṣ-Ṣâfi/Gath will be used to illustrate the utility of this method.

IDENTIFYING FASHIONING TECHNIQUES IN POTTERY 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 the interior of the lower body through a restricted mouth once the final height is reached, particularly for large vessels.

Fashioning techniques are primarily identified on sherds and finished vessels by imaging grain and void orientation patterns (Berg 2009; Glanzman 1983; Ross et al. 2018; Rye 1977, 1981: 58-84). 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. The internal structure and organisation of the clay (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 is indicative of the fashioning technique used in the forming process. Experimental studies have repeatedly shown that secondary shaping procedures do not alter the internal structure of the preform, 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:

1. Deformation by simple compression causes minerals and voids to flatten and align perpendicular to the axis of maximal stress. Fashioning techniques characterised by simple compression include pressing, moulding, slab-forming and paddling techniques.
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.
3. Deformation by stretching a lump of clay causes 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.

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 sub-parallel to diagonal direction.

METHOD AND MATERIALS: MACRO AND MICRO SCALES OF OBSERVATION

Conventional studies of pottery manufacture have largely been conducted at the macroscopic level. Analyses are based on the visual inspection of surface features and/or the use of radiography to identify the preferred orientation of features in the clay body (Berg 2011; Greene et al. 2017; Laneri 2011; Martineau 2003). 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 fashioning techniques (Roux and Courty 1998; Santacreu 2014: 37-38, 77-79).

Multi-scalar approaches combining micro- and macro-observations are rare, with the exception of Roux's *chaîne opératoire* approach (2009, 2011, 2016). This widely published protocol prioritises surface features indicative of fashioning techniques. Microstructures identified in petrographic thin-sections are used to confirm macroscopic observations and to characterise clay recipes. The protocol is therefore more appropriate for assemblages large enough to include sherds with univocal surface characteristics indicative of specific fashioning techniques. However, these sherds are present in relatively low numbers, are hard to identify and supply indirect evidence at best (Berg 2009; Pierret et al. 1996: 419). In one such study at Tell Chuera (northern Syria), an initial sample of 1,732 sherds was reduced to 357 sherds with the relevant surface features and 69% of the sample was subsequently dismissed (Babour 2014). The large number of sherds that are excluded from the 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 fashioning techniques will not be represented.

Furthermore, Berg (2009) found that ceramicists contradicted each other as much as 25% of the time when relying on observations based on ambiguous surface features. Her findings (Berg 2008; 2009) suggest that radiography is more reliable because the ceramicist can see the inner structure of the vessel. Signatures of vessel fashioning are not blurred by secondary forming and surface treatments, which contributes to a higher success rate (60% to 80%). However, the drawback is the amount of machine time needed to calibrate radio-density differentials and x-ray a single pot,[1] which can significantly drive-up costs, as well as limit sample sizes and the contexts sampled. Every analytical protocol suffers from "its own areas of weakness", hence the need for "mixed methods research" (Jeffra 2013: 16). In every case, observations based primarily on a single scale, using only one analytical technique, are insufficient for classifying production sequences, especially given the 'equifinality' of ceramic attributes (Roux 1998; 2016). Because

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[1] Variables include kilovoltage, miliamperage, integration time, object position, tube source, filtration, object to film distance, focal spot to film distance, film type and focal spot size.

time constraints, cost and expertise act as a barrier to mixed methods research, 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 (Berg 2009; Jeffra 2013; Laneri 2011).

For the *chaîne opératoire* approach to reach its full potential in ceramic analysis, additional imaging methods and protocols are needed. Therefore, this study aims to expand identification criteria by piloting a simple low-cost imaging method for classifying mesoscopic signatures of forming techniques on freshly cut thick sections. Data from the EBA strata at Tell eṣ-Ṣâfi/Gath are used to illustrate the utility of this approach for understanding how an early urban settlement organised pottery production.

THE ARCHAEOLOGICAL SAMPLE

The EBA marks the first cycle in the fluorescence of complex urban societies in the region. During the EBII-III, settlement size and density increases across the southern Levant resulting in a regional hierarchy with varying degrees of sociopolitical integration. Heavily fortified townships were dispersed between smaller sites, small and large villages and transitory settlements (seasonal camps and cave dwellings) inhabited by mobile pastoralists (Chesson 2019; de Miroschedji 2018; Greenberg 2014). There are clear indications of town planning that differ from the village-like layout of earlier periods. Sites are usually heavily fortified with well-defined housing blocks, street networks, industrial spaces, storage facilities, civic buildings and organised public spaces.

This study comprises 459 sherds sampled from the later EBIII strata from Tell eṣ-Ṣâfi/Gath, Israel. The site is located on the western fringes of the Judean foothills and overlooks the main east-west pass through the Elah valley linking the southern coastal plain with the central hills (fig. 1). A substantial fortification system surrounded the site and at 24ha Tell eṣ-Ṣâfi/Gath is comparable to other fortified EBIII urban centres in the regional settlement system, such as Tell el-Hesi and Erani (both 25ha).

Excavation on the eastern slope (area E) focused on the exposure of a late EBIII neighbourhood, with primary remains from the E5 and E6 strata (Greenfield et al. 2016, 2017; Shai et al. 2014). The E5 stratum represents the terminal phase of EBA occupation which lasted for more than a century. Radiocarbon dating for the termination of the final EBA phase indicates a date range of c.2550-2600 BC, with EBA pottery chronologically diagnostic of the EBIIIB (Greenfield et al. 2016: 480, 2017: 248). Two rectilinear rows of buildings were exposed, separated by a narrow street, and gridded out on a northwest/southeast orientation. The E5 stratum includes walls and floors from three sub-phases, each one reusing earlier wall stubs and modifying building plans, but preserving the layout of the domestic quarter. The E6 and E7 exposures (and EBA strata below them) were too limited to determine the nature of continuity in the architectural footprint. The E5 buildings were small multi-roomed units, with rectangular plans and courtyards sharing parti-walls that differentiate the remains of six partially exposed

Figure 1: Map showing location of Tell eṣ-Ṣâfi/Gath (authors own image).

buildings.[2] All the material remains within the E5 and E6 strata are related to the household consumption of food, daily refuse, and contain a variety of everyday items, including both mundane and exotic trade goods (see Arnold et al. 2017; Greenfield et al. 2017).

The pottery assemblage is typical of the EBIII domestic repertoire (fig. 2) and includes flat-bottomed holemouth cooking pots, a variety of large and small ovoid storage jars with everted rims, vats, platters decorated on the interior with red slip and web pattern-burnished designs, bowls with rounded profiles and burnished jugs (table 1 lists quantities by phase). Sampled contexts include accumulations directly on or above the floors of buildings sealed by deposits of building collapse and subsequent floor make-up. Every room and courtyard was sampled, with over 100 vessels sampled from each of the E5 horizons, including the full shape repertoire to compare differences in manufacture between sub-phases and buildings.

PROTOCOL FOR IDENTIFYING FASHIONING TECHNIQUES IN THICK-SECTION

We imaged grain and void orientation patterns at the mesoscopic scale using high resolution scans of freshly cut pottery thick sections. Our imaging protocol

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[2] Comparable EBA house plans include stratum IIIb2 in trench III at Jericho, level G2 at Yarmuth, period C in area EY at Tell Beth Yerah and stratum 19 in field X at Tall al-ʿUmayri, Jordan.

followed four steps. For the first step, sherds were correctly oriented. 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 were viewed and compared parallel to vessel height, in order to better distinguish the signatures of fashioning techniques.

For the second step, each sherd was thick sectioned using a wet precision saw to expose cross-sections perpendicular to wall surfaces. Scans of multiple sections along a sherd wall would serve to identify techniques along the length of a complete vessel cross-section. No predetermined blade speed was used, but we found that a range of 200-300rpm worked well. Sanding the freshly cut section will destroy the integrity of voids and pores, as well as blur features in the section. Therefore, jagged projections were removed with a sharp knife.

For the third step, high-resolution digital images (1200-2400dpi) were created using a standard flatbed scanner. Multiple thick sections can be scanned at once to speed up the process. Dampening the surface of the thick section improves the visibility of features in the image and including a scale allows measurements of features in section using the calibration tool and ruler function on Macnification® or the line tool in Photoshop®. The resulting digital image can be analysed as a raw file, or cleaned 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. We recommend

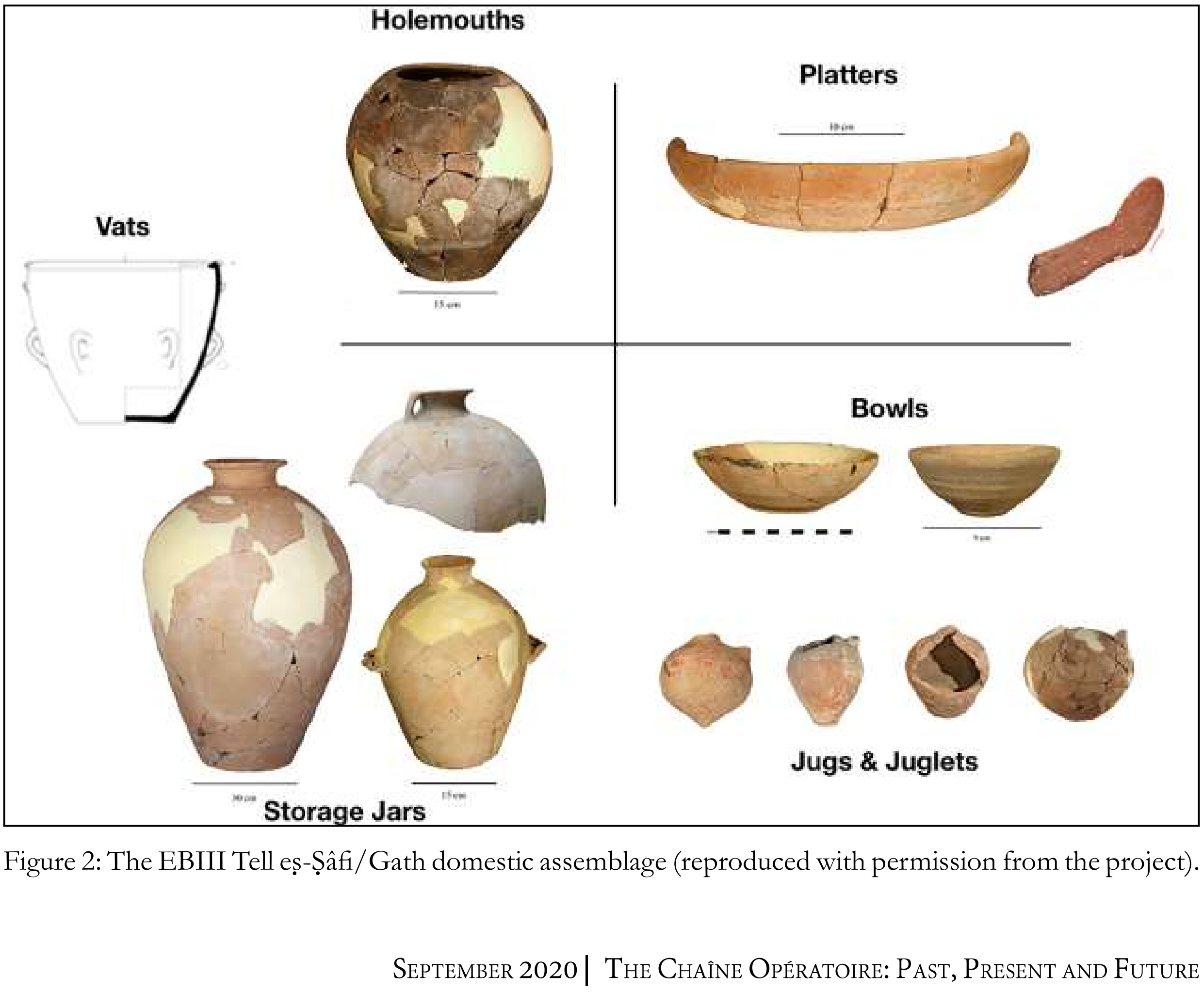

Figure 2: The EBIII Tell eṣ-Ṣâfi/Gath domestic assemblage (reproduced with permission from the project).

Table 1: Quantities of vessel types sampled by phase.

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

the filters in Photoshop because changes are easily reversible. Annotations can be stored on separate layers to maintain the original raw image. The line tool in Photoshop is useful for highlighting the direction of individual inclusions and the background and binder can be eliminated or stored on a different layer. Similar functions are also possible in ImageJ. In this way, features indicative of fashioning become increasingly visible on the scanned image of the section. Hypothetically, this process can be automated by machine learning, which would further reduce time taken for image processing.

RESULTS

Fashioning techniques were identified on 80% of the total study sample including all vessel categories (fig. 8). Jugs (43.5%) and bowls (28.7%) had the highest percentage of sherds classed as ambiguous, whereas holemouths had the lowest percentage (5.8%). For most vessel types, the most common fashioning 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.

COILING AND DRAWING

Coiling techniques were recognised when the preferred orientations of voids (fig. 3a) and non-plastics (fig. 3b) marked the outline of the curves and folds of a coil. 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 (white arrows, fig. 3) were surrounded by spiralling non-plastics. The distributions of non-plastics and voids form wavy, undulating, elliptical patterns when seen in section. Open spaces dominated by clay binder had edges bordered and encircled by clusters of coarse non-plastics. 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. In addition, 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. There is a lack of symmetry on either side of the vertical axis when both sides

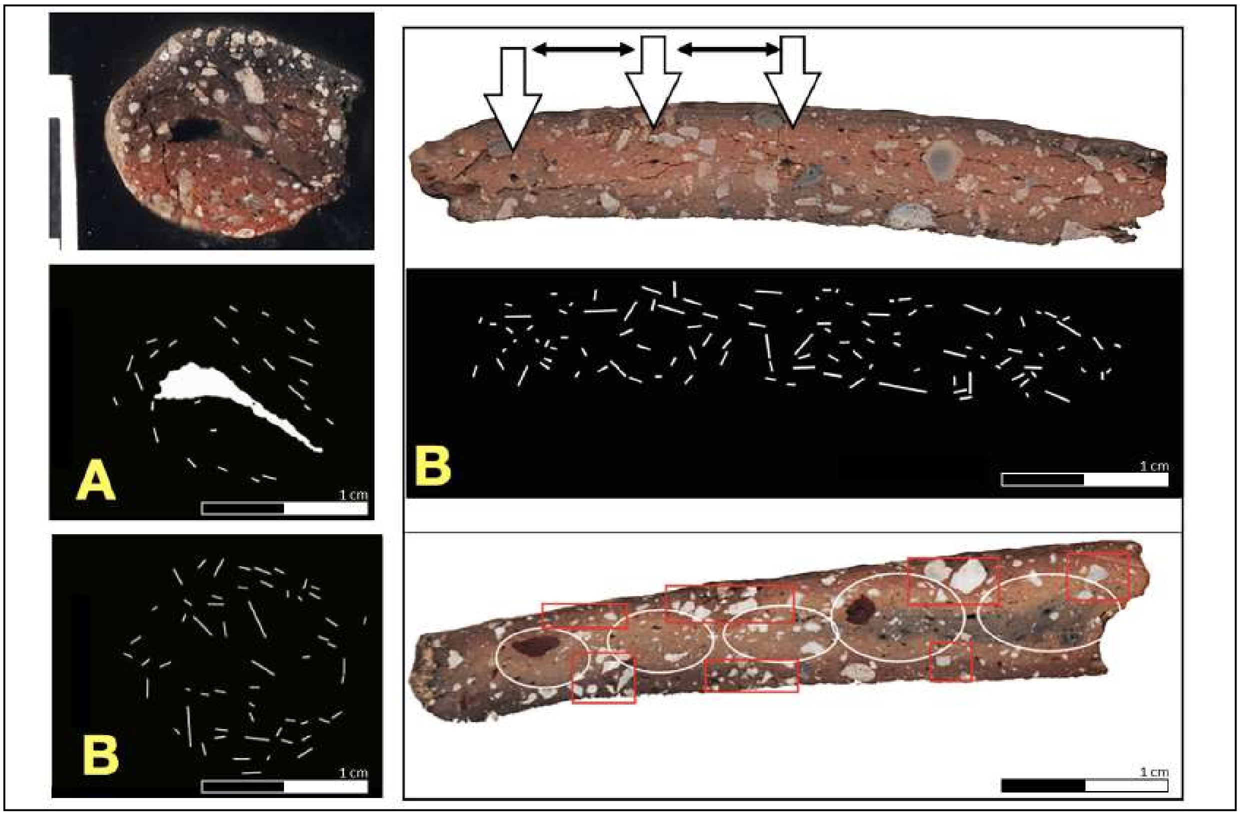

Figure 3: Mesoscopic signatures of coiling in section on a holemouth body and rim sherd: A) shows the orientation of voids; B) shows the orientation of inclusions. White arrows show voids in the centre of a coil surrounded by spiralling inclusions, red boxes highlight coil joints marked by clusters of inclusions (authors own image).

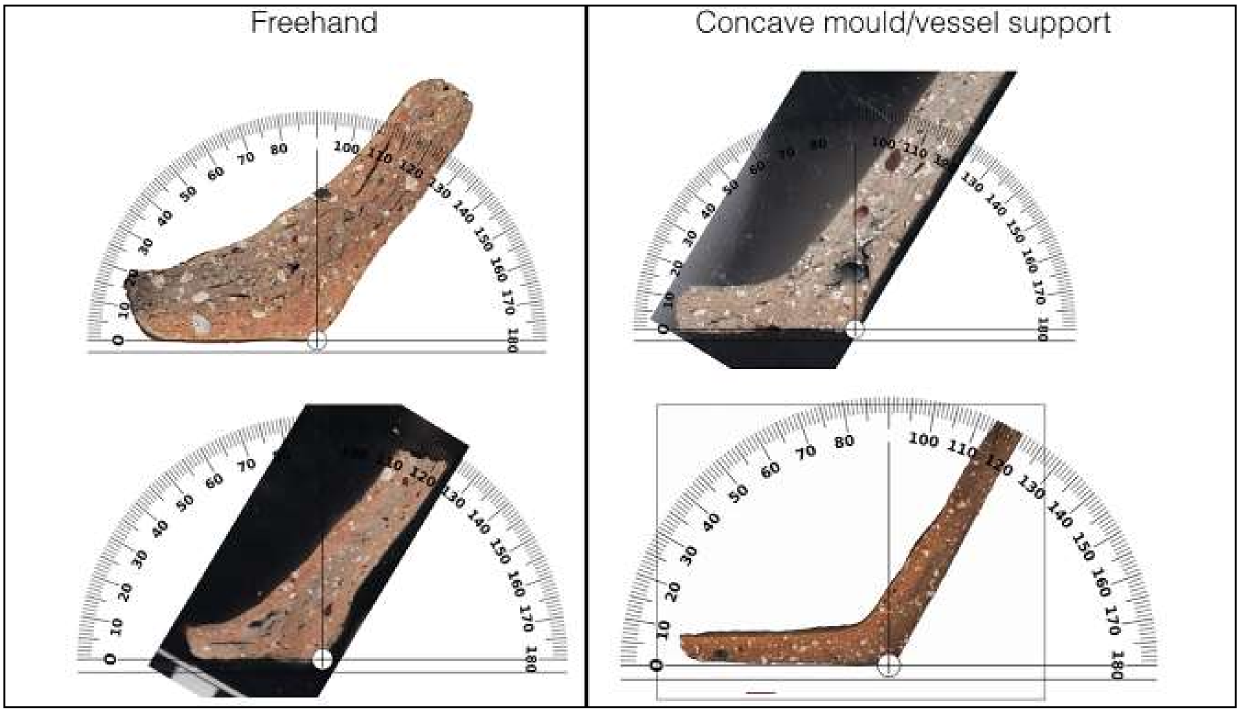

Figure 4: Mesoscopic signatures of moulds and vessel supports in section. The sections show extreme regularity in the construction of the vessel walls when shaped in a mould/vessel support (base to wall angles were always 120 degrees) (authors own image).

of the vessel profile are preserved and imaged in the same scan. These features are common on the interior of closed vessels, but were recognised on all vessel categories in the sample.

Structural features consistent with the drawing technique (fig. 4, top left) 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. The body was formed by pulling the clay upwards to form the walls of the vessel. The stretching forces from drawing up the clay leaves stress marks, long narrow voids, which indicate application of vertical pressure. The clay walls taper in the direction the clay was pulled and drawn up.

PRESSING IN A CONCAVE MOULD OR VESSEL SUPPORT

The internal structure and organisation of the clay material has grain (A) and void (B) alignments oriented subparallel to wall surfaces. Voids and pores (B) 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. 4). The use of a concave mould support allows the potter to easily move and turn the vessel during manufacture. These supports also help to evenly shape and compress the clay, since the potter can press and apply 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 consistently 120º with no deviation. Moulds are associated with standardised vessels and permit a reduction in manufacture time (Rice 1987: 126). In addition, sections of moulded vessels generally have thinner walls, as well as an even/uniform micro-relief along the surface pressed against the vessel support.

ATTACHMENT OF HANDLES

Wavy handles and loop handles were fashioned from separate straps of clay and affixed to a leather-hard body. Evidence of the join is often visible in section (fig. 5). Discontinuities in the fabric are evidenced by large hairline voids and seams oriented vertically at the interface. These range from narrow linear shapes to large triangular voids. Coarse inclusions sometimes align at the interface and have a different orientation to those seen in the body. Some of the handles show higher quantities of fibre temper, which is known to improve adhesion properties and drying times (Lepère 2014: 145).

WHEEL-SHAPING A COIL-BUILT ROUGH-OUT

Fabrics have higher frequencies of small elongated voids. These voids/pores 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. This is a reliable criterion for differentiating between wheel-throwing and wheel-shaping techniques (fig. 6).

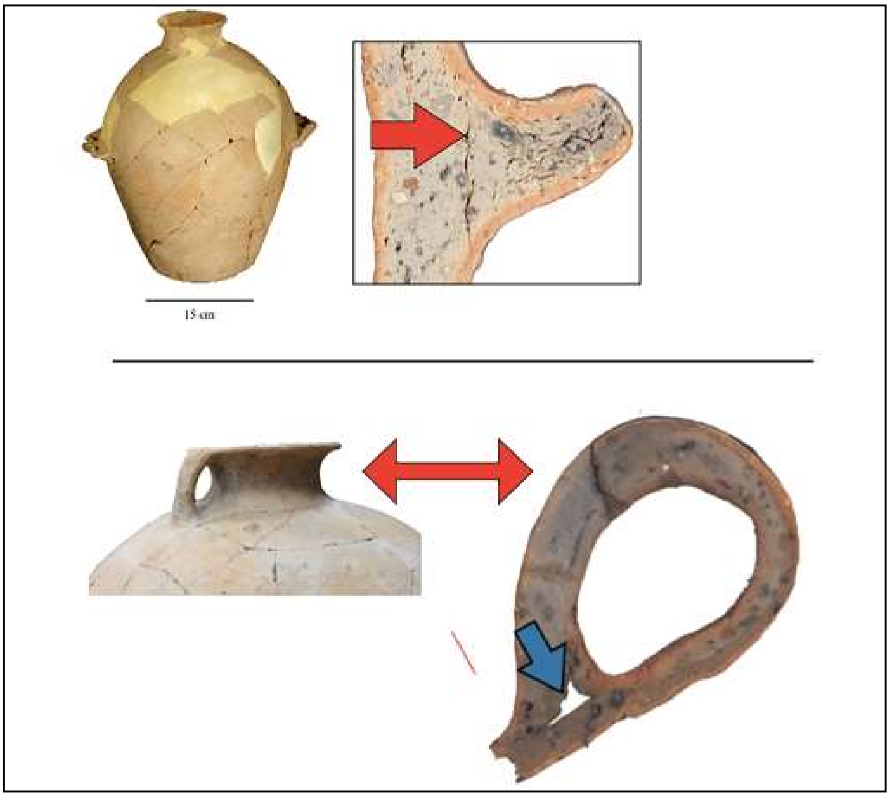

Figure 5: Mesoscopic signatures of luting in section (jar handles). Sections show the voids and cavities trapped between the clay body and the handles (authors own image.

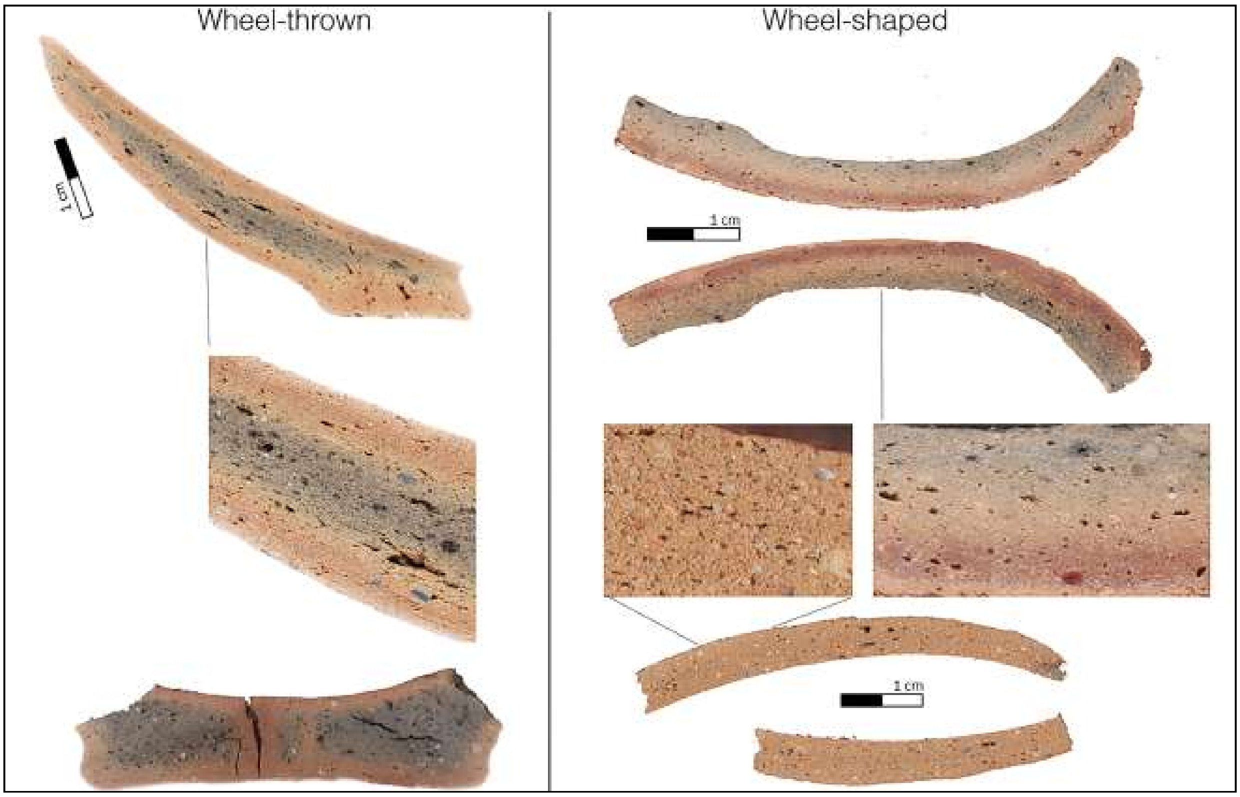

Figure 6: Wheel-shaping vs. wheel-throwing in section. The sections show differences in the regularity of vessel walls and void distribution (authors own image).

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 (rotational kinetic energy), which include continuous concentric striations, 'sticky prints' from extra wet clay, symmetrical walls and rilling

In the past, the distinction between wheel-shaping and wheel-throwing was notoriously difficult 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 2013: 3). The most reliable way to differentiate between these fashioning operations is by comparing patterns in section.

SUMMARY

Altogether four fashioning methods were differentiated in the Tell eṣ-Ṣâfi/Gath study sample (figs 7 and 8). The site assemblage is therefore heterogenous and vessel types were not all made the same way. Stacking coils in a concave mould was used to shape holemouth vessels (method 1). A third of the holemouths sampled were made this way. Platters were clearly spiral-coiled (method 2) and 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 tournettes (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 features include the presence/absence of an extra thick coil around the edge of the base and the drawing technique (fig. 4). 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 upright position on a gritty stone surface.

INTERPRETATION AND CONCLUSIONS

Ethnoarchaeology and experimental archaeology has repeatedly singled out vessel fashioning in the *chaîne opératoire* due to its reliance on a fixed and narrowly defined repertoire of specialised gestures and task specific sensorimotor habits (Ali 2010; Fowler 2011: 198; Gosselain 1998, 2000, 2010; Roux and Corbetta 1989). As such, they require a long, intensive apprenticeship to master and are highly resistant to change and external influence in post-learning environments. Secondary forming and finishing techniques (painting, slipping, burnishing etc.) obliterate trace evidence on vessel surfaces. Fashioning is therefore not only the most technical, inflexible and conservative stage of manufacture, but it is the least 'transmittable' and influenced by a minority of potters linked by direct transmission of technical knowledge. Hence, differences in fashioning techniques imply different social groups of potters.

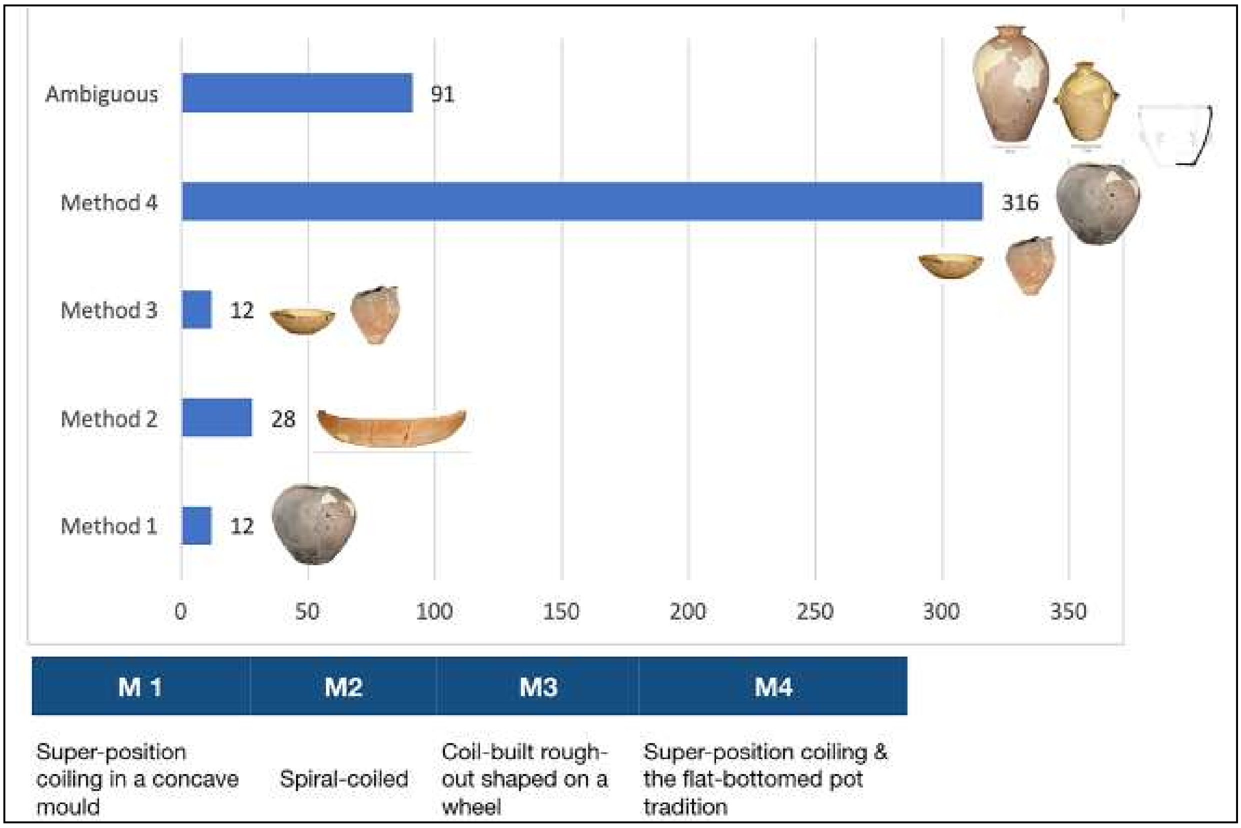

Figure 7: Histogram showing the frequency of fashioning methods according to vessel types (authors own image).

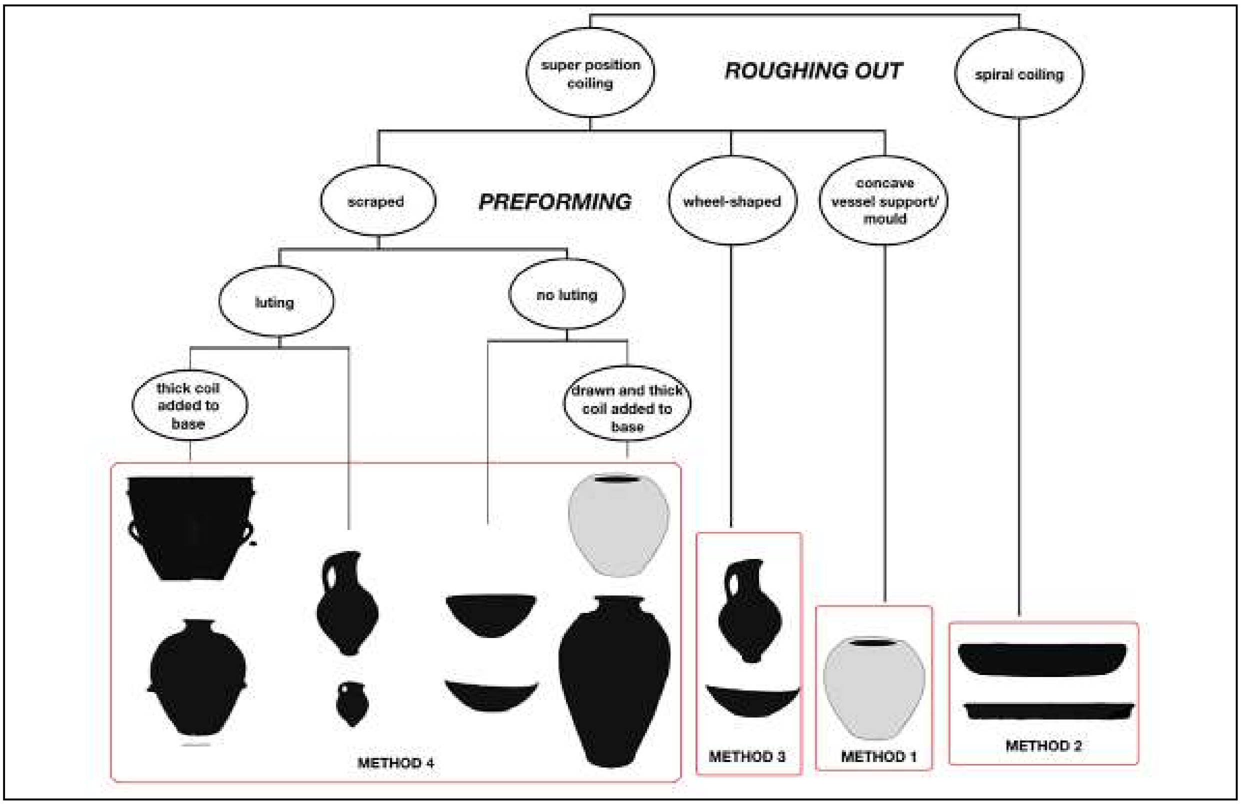

Figure 8: Dendrogram of fashioning methods and vessel types at Tell eṣ-Ṣâfi/Gath (authors own image).

The bulk of the repertoire (71%) was shaped according to method 4, but not all the containers in the assemblage were fashioned this way. 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 critical 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 with different functions. We are inclined to think the former option is more plausible. Wheel-shaping, as Roux argues, involves a different skill-set, 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, superposition coiling, spiral coiling and drawing techniques).

Nevertheless, the fact that we have multiple manufacturing traditions with three types consistently made two different ways (holemouths, jugs and hemispherical bowls) suggests that the variety of fashioning techniques matches an equivalent number of production groups. Each production group was defined by a particular inherited way of making standard containers that were supplied to the residents of the EBA 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 (Ali 2010; Arnold 1991; Doherty 2015: 23-37; London 1991: 394; London and Sinclair 1991).

This suite of fashioning techniques is not restricted in space (rooms, buildings) or time (phases). Rather, different potting methods broadly align with the main functional classes in the repertoire. Such heterogeneity in fashioning methods suggests that production was not structured at the household level and oriented around domestic replacement for any of the major functional containers in the domestic repertoire. There is also no evidence for a single industry, production group or centralised workshop making the full spectrum of vessel types for any of the E5 phases. The pottery production at Tell eṣ-Ṣâfi/Gath suggests that the residents of these early urban neighbourhoods benefitted from domestic economies that were served by pottery specialists, who generated a surplus for exchange beyond the needs of their own households. These professional potters specialised in different parts of the repertoire.

Current research on fourth and third millennium BC pottery in the Near East has largely focused on different uses of the pottery wheel, which generates distinctive surface features. In contrast our approach combines a mesoscopic scale of observation complemented by conventional macroscopic and microscopic approaches and greatly augments the "very little data from archaeological sources for the recognition of pottery forming techniques of the past" (Martineau 2003: 210).

The vast majority of sherds in our sample did not have surface markings indicative of fashioning and the minority that did were only relatable to a single technique.

Combinations of techniques and fashioning methods present in low quantities are likely to be missed entirely by more limited methods of observation, especially taking into account the quantity of material that is usually dismissed as ambiguous. 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, especially for all forms in the repertoire. Our simple scanning method can now extend the focus to include an entire repertoire of handmade vessels from a site. The trade-off is that this is a destructive protocol where sherds and parts of vessels are cut in half.

The method has also led us to different conclusions. We suggest pottery production was aimed beyond domestic replacement (de Miroschedji 2018: 127-129). The only other alternative is to treat the entire residential area as occupied by a single, extended family who, over four generations, produced their own wares using a range of entirely different methods. This seems unlikely given what we know about household- and community-based pottery production. We are certain future studies at other contemporary sites will help develop a more complete picture of production and pottery provisioning at a time when the first urban societies were appearing in the region. However, this research design, method, and the refined diagnostics of vessel fashioning 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.

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