Journal of Ancient Egyptian Interconnections

The "Combed Ware" Storage and Transport Vessels from Khirbet ez-Zeraqon: A Reappraisal of the EB II–III Evidence in Light of Recent Petrographic Studies

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Abstract
The present study offers new petrographic data on selected pottery from the EB II-III site of Khirbet ez-Zeraqon in northern Jordan, which includes storage and transport vessels with combed surfaces traditionally grouped under the label "Combed Ware." The results contribute to our understanding of the role played by these vessels in relation to the wider ceramic production documented at the site. On a larger scale, and thanks to the recent chronological reassessment of Khirbet ez-Zeraqons's stratigraphic sequence, our study provides further evidence for evaluating the developments of the broad phenomenon of Levantine combed vessels.

Keywords
Early Bronze Age Levant; Khirbet ez-Zeraqon; Combed Ware vessels; petrographic analyses; ceramic production

1. Introduction[1]

The investigation of the role played by the Levantine pottery manufacture is central to understand the socio-economic trajectories that characterized the Levant and the southeastern Mediterranean during the Early Bronze Age (henceforth EBA or EB; Fig. 4).[2] In this sense, the study of the material from the site of Khirbet ez-Zeraqon, in northern Jordan, contributes to the examination of the transformations that occurred in the area between the end of the fourth and the first centuries of the third millennium BCE. The reappraisal of the evidence brought to light by the excavations conducted at the site in the 1980s and 1990s establishes the life of the main EB settlement within a short time frame mostly falling within the local EB II.[3] As suggested by recent research, the site did not adapt to the changes at the transition to the EB III and, after some decades of decline, was completely abandoned at the beginning of this latter phase.

Our petrographic study, conducted on selected samples that include combed storage and transport vessels, offers new information on ceramic manufacture at the site. The evidence that emerges from this analysis is consistent with a revised understanding of the regional pattern of Levantine pottery industries during the late fourth and third millennium BCE and their change through time, connected to both internal socio-economic trajectories and the dynamics of short- and long-distance exchange. More specifically, the repertoire of combed storage and transport vessels at Khirbet

ez-Zeraqon provides further support for the definition of a broad central and southern Levantine horizon. Around 2900/2800 BCE, a change occurred in the ceramic industry associated with these types of containers, shifting from specialized and nucleated manufactures to small-scale ones that made use of locally available raw materials.

2. The Archaeological Context: Khirbet ez-Zeraqon

Khirbet ez-Zeraqon (lat/long: 32.58638/35.948439) lies in the northern Transjordanian plateau, on a hilltop rising above the Wādī eš-Šellāle.[4] This area was characterized by an average rainfall between 300 and 400 mm per year during the fourth and the third millennium BCE.[5] This would have been sufficient for supporting rain-fed agriculture, but additional water supply could have been necessary in more arid years.[6]

The archeological site consists of a mound that covers an area of about 8 ha, which was the subject of systematic excavations conducted between 1984 and 1994 under the direction of Siegfried Mittmann (Biblisch-Archäologisches Institute of the Eberhard Karls University of Tübingen, Germany) and Moawiyah Ibrahim (Institute of Archaeology and Anthropology of the Yarmouk University of Irbid, Jordan).[7] These investigations revealed a major occupation dated by excavators to the local EB II–III.

The settlement was established in a single phase of construction at the beginning of EB II, creating a well-defined outline of a town surrounded by a massive defense wall, with a lower city on the south and an upper city on the north (Fig. 1). Through time, this plan underwent only slight modifications due to some secondary rebuilding and adjustments primarily pertaining to the city gates and the reinforcement of the city wall.[8] The upper town (Fig. 2), on the northern side of the mound, was dominated by two main architectural complexes: the "temple complex," comprising what are believed to be cult buildings, a circular altar and subsidiary structures;[9] and the "palace complex," which was a large unit formed by at least four juxtaposed sectors characterized by different layouts and likely served diverse functions, such as administrative, economic-industrial, and representative.[10] Among these sectors, building B0.8 included small irregular rooms with installations for food-processing and stockpiling, with a pottery repertoire largely composed of storage vessels.[11] In the lower city

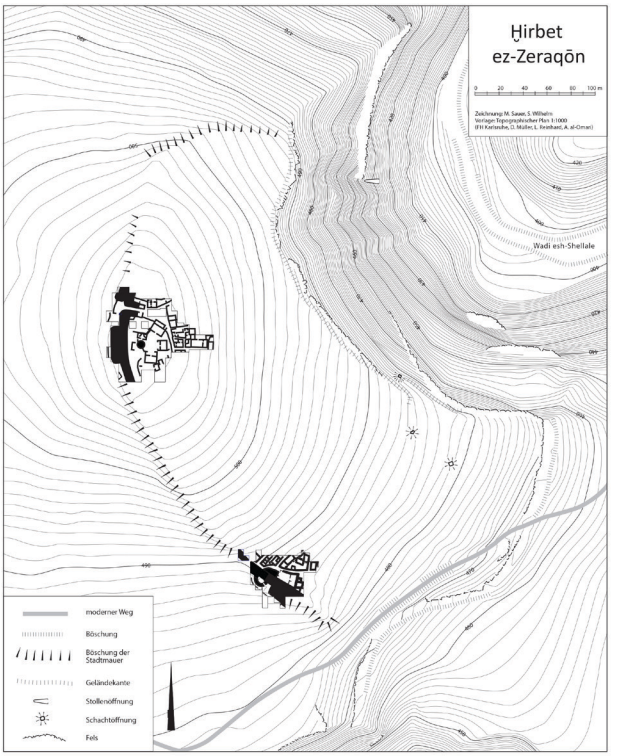

Figure 1: Khirbet ez-Zeraqon, topographic plan (courtesy of the Khirbet ez-Zeraqon archeological expedition).

(Fig. 3), most of the revealed buildings were residential,[12] while the function of Building B1.3—whether private or collective—remains unclear.[13]

Within the occupational sequence of this settlement, three main chronological stages have been identified based on their distinctive pottery assemblages and defined, for this reason, as "ceramic horizons," respectively named "early horizon," "middle horizon," and "late horizon."[14] Each of these broad periods is associated with stratigraphic phases, sub-phases, and architectural activities. The foundation of the town took place in the early horizon and, after some reconstructions, the last phase of occupation was characterized by signs of instability: the city gates were reinforced, and the entrances were blocked. At the same time, some sectors of the city were no longer kept in repair, such as parts of the defense wall in the lower town that had started to collapse into the open B1.5 space.[15] After this stage of decline, the site was completely abandoned, with no evidence of destruction. Following a gap of about four hundred years, the site was reoccupied in the EB IV, probably by small groups of temporary settlers, as suggested

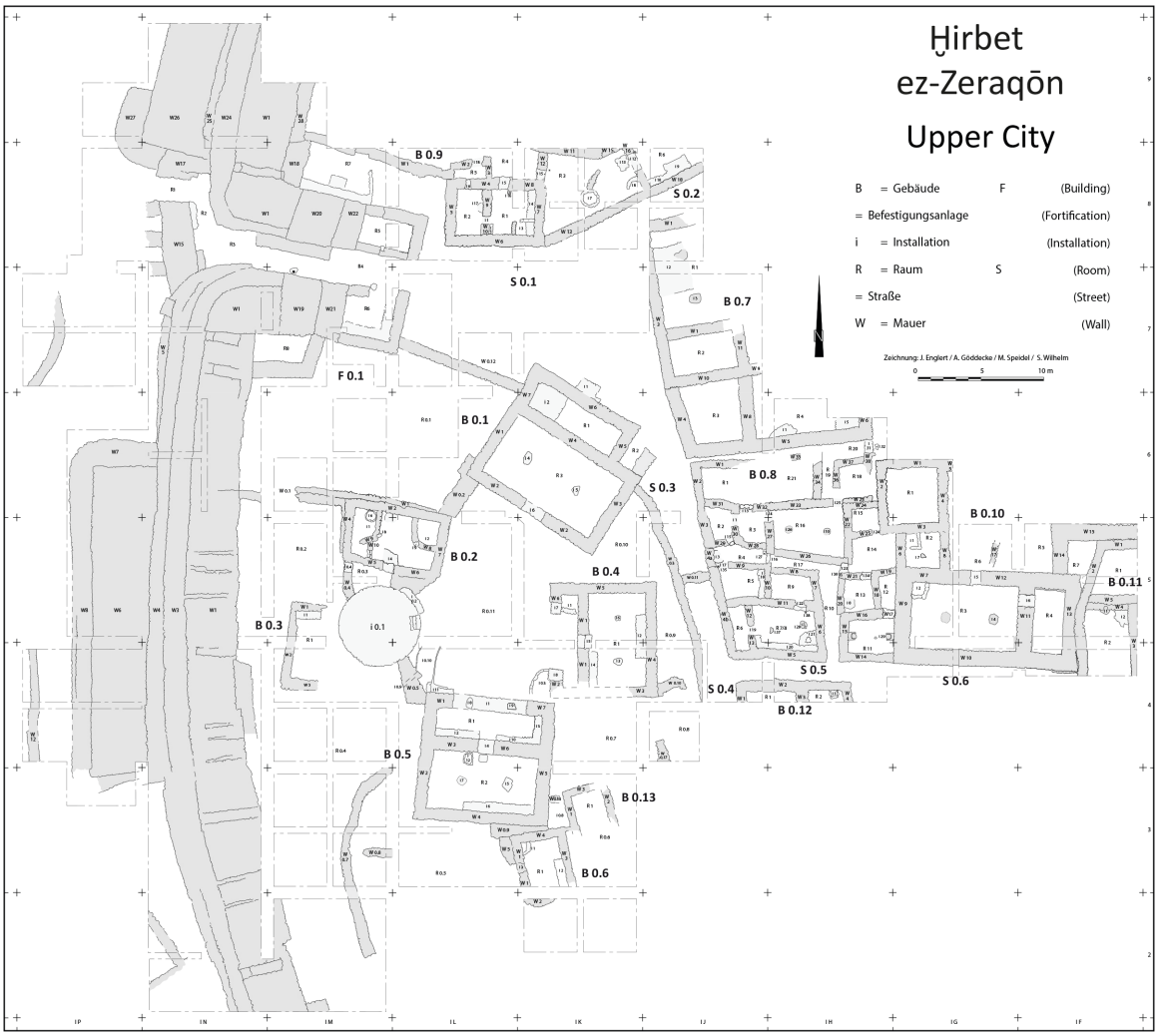

Figure 2: Khirbet ez-Zeraqon, upper city plan (courtesy of the Khirbet ez-Zeraqon archeological expedition).

by scattered ceramics and small structures such as stone-lined silos, which partly reused the ruins of the previous buildings.[16]

Based on comparisons with ceramic inventories of the northern Transjordan and Cisjordan, and the upper and middle Jordan Valley, the three EB II–III chronological horizons have been ascribed respectively to the EB II, the EB II/III transition, and the EB III.[17] More specifically, the early horizon can be set in the EB II, as suggested by ceramic comparisons from Phase C of Tel Bet Yeraḥ[18] and Strata XIIC-A and XIIE-D at Tel Qashish.[19] The same appears to apply to the middle horizon, which can be assigned to the late EB II or the EB II/III transition. For the late horizon, it is possible to suggest an attribution to the EB II/III transition or the early EB III, since the repertory finds strong analogies with Period C and early Period D at Tel Bet Yeraḥ, while later EB III shapes, such as oversized platters that are characteristic of the late Period D of Tel Bet Yeraḥ and Megiddo level J-6, are instead absent.[20] As found in the very earliest EB III stages at Tel Bet Yeraḥ, the ceramic repertoire of this horizon includes only a few Khirbet Kerak Ware sherds.[21]

The relative chronological assessment made on the base of the stratified ceramic repertoires is supported by radiocarbon data, which suggest a date of ca. 3100/3050–3000 cal. BCE for the early horizon, ca. 3000–2950 cal. BCE for the middle horizon, and ca. 2950–2850 cal. BCE for the late horizon (Fig. 4).[22] These absolute dates concur with recent proposals on high absolute chronologies

Figure 3: Khirbet ez-Zeraqon, lower city plan (courtesy of the Khirbet ez-Zeraqon archeological expedition).

for the EBA in the southern Levant,[23] and hint at a length of the settlement at Khirbet ez-Zeraqon of about two or three hundred years. This occupation mostly corresponds to the EB II, or Early Southern Levant 4 (henceforth ESL) according to the new Arcane periodization and is contemporary with the First Dynasty in Egypt;[24] its abandonment took place at the end of the transition between EB II and EB III, or the very beginning of the EB III (EB IIIA or ESL 5a).

The life of Khirbet ez-Zeraqon's settlement appears consistent with the socioeconomic trajectories that characterized the northern part of the southern Levant during the EB II, when sites were rebuilt or newly founded, intense inter-sites exchanges were established, and a simplification and standardization of material culture took place, also embodied by new ceramic technologies.[25] The location of the site along the middle Wādī eš-Šellāle,[26] placed along major east-west and north-south routes,[27] had a strategic significance in relation to the regional networks of connectivity.

The abandonment of the site after only a few hundred years of occupation implies the town did not survive the broader transformations which affected the settlements across the upper Jordan Valley, the Galilee and the Golan. The sense of instability that characterized the end of the EB II is testified by the reinforcement of the defense system during the latest phase of occupation of Khirbet ez-Zeraqon, by the thickening of the city walls and blocking the gates' entrances. As suggested by Greenberg, this situation might have resulted from structural transformations of EBA society that brought about the abandonment of several EB II settlements. Such changes were underlined by the contraction of exchange networks and manufacturing industries, which resulted in the reduction in scale and the loss of specialization of craft activities.[28] On the other hand, due to the location of the site in close

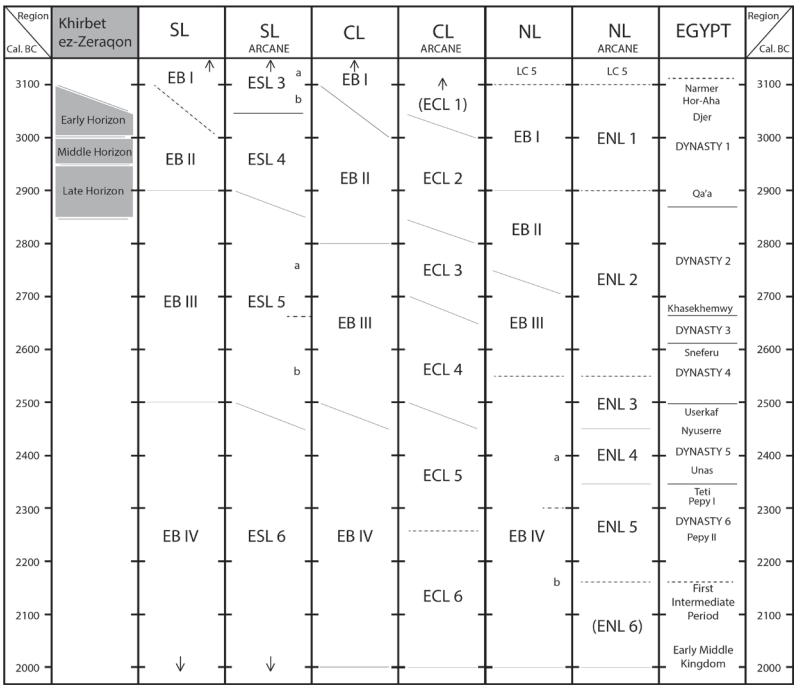

Figure 4: Chronological setting of the early, middle and late horizons occupation at Khirbet ez-Zeraqon, in relation with third millennium Levantine and Egyptian regional chronologies, based on the traditional Early Bronze Age and the ARCANE terminologies (after Lebeau and de Miroschedji 2013: xi), and Sowada's proposal for Egyptian-Levantine synchronization (after Sowada 2020; Sowada *et al.* 2021). SL = Southern Levant; CL = Central Levant; NL = Northern Levant.

proximity to an area characterized by fluctuating ecological conditions, environmental aspects may have played a role in its abandonment.[29]

3. The Levantine Combed Ware and the Combed Vessels at Khirbet ez-Zeraqon

3.1. Levantine Combed Ware

The definition of "Combed Ware" has been traditionally used to designate a variety of storage and transport vessels—jars and pithoi—but also vats with combed treatment on the external (and sometimes internal) surface, characteristic of the EBA Levant. Due to both for their physical features and their presence in Egyptian elite funerary contexts, these vessels have been interpreted as containers for high-value liquid products, such as oil and wine.[30] Besides the exact nature of the content(s), the central role played by the combed jars in the exchanges between the Levant and Egypt is unquestionable.

The combing treatment on the surface has been variously interpreted as a form of decoration, a distinctive "branding" of vessels, or a functional treatment aimed at reducing porosity and, consequently, the evaporation of the liquids contained.[31] On the other hand, the combing can be considered the result of technological actions comprised in—and developed together with—the manufacturing process, aimed at reinforcing the structure of the vessels and, at the same time, helping to join and mask the coils of the handmade bodies. This primary technical—and not esthetical—purpose would explain the application of combing also on the inner surfaces of vessels, as documented from the coastal Levant.[32]

From a chronological and spatial viewpoint, vessels with combed surfaces represented a broad and complex Levantine phenomenon, which had a long duration and diverse regional characteristics. Combed vessels first appeared in the northern part of the southern Levant at the end of the fourth millennium BCE, in the local EB II (ESL 4) (Fig. 4), sometimes already at the EB I/EB II transition[33] (ESL 3, c. 3150–3100/3050 BCE), and they continued during the EB III (ESL 5). In the central Levant, combed vessels also appeared during the local EB II (Early Coastal Levant 2, henceforth ECL), around the same time as in the south, possibly slightly later.[34] During this stage, such containers were documented to the south of Tell 'Arqa, where they began to be attested for only from the EB II/III transition.[35] In contrast to the southern Levant, the production continued after 2500 BCE, in the EB IVA (ECL 5) and EB IVB (ECL 6) and, contemporarily to these stages, vessels with combed surfaces appeared

in the northern Levant as well, particularly along the coast and, to a lesser extent, in the inland.

In Egypt, combed containers have been uncovered at several sites.[36] Vessels of this type found in contexts of the Dynasty 0 and First Dynasty might originate from both the southern and the central Levant.[37] After a gap in the documentation for the 2nd and 3rd Dynasties, the containers found in contexts dated from the 4th Dynasty are more uniform than before, consisting of vessels originating in the central Levant, which was the main economic partner for Egypt as a supplier of Levantine products in this period.[38] Seafaring became the prevalent mode of transport, and the containers assumed shapes more suitable for maritime shipping than the earlier southern Levantine items, which were instead clearly designated for terrestrial transport.[39]

As already stressed by several scholars,[40] the unitary definition of Combed Ware is misleading as these vessels were neither part of a single production nor manufactured using a single fabric. Under this label are grouped vessels that shared the combed treatment on their surfaces but characterized by heterogeneous fabrics, manufacturing techniques and formal features, thus showing regional and chronological differences.[41] They were in fact produced by several similar—but differentiated—ceramic industries active across the Levant showing various degrees of independent development, each also manufacturing other vessel types, both open and close shapes showing diverse surface treatments, such as burnishing.[42] Among these larger manufactures, the North Canaanite Metallic Ware[43] and similar Metallic Ware types with burnished surfaces on the Lebanese coast are included.[44] Further combed vessels made of local fabrics were widespread in the Levant,[45] such as the South Canaanite Lime-Coated Ware, a production typical of the central and southern part of the southern Levant during the EB III and characterized by vessels mostly distinguished by a lime coating applied after firing.[46]

Regarding the fabrics used, it is apparent that the ceramic industries producing combed vessels in the Levant can be divided into two broad groups, both already documented from the EB II: one using shale-derived clay sources, and the other employing calcareous clays. Within the shale-derived fabric groups, which seems to be mostly related to the EB II, falls the North Canaanite Metallic Ware and some Lebanese manufactures. Conversely, during the EB III, combed vessels were made of calcareous clays derived from numerous sources available close to their loci of production.[47]

3.2. The Combed Pottery from Khirbet ez-Zeraqon

At Khirbet ez-Zeraqon, combed jars and pithoi are present in the ceramic repertoire throughout the three phases of occupation, while the spouted vats with two vertical loop handles and combed surface are absent in the earliest stage.[48] Through time, the absolute number of stratified vessels and sherds with combed surface increases from the earlier to the later stage of occupation.[49] From the restorable vessels uncovered, two types of combing treatments can be recognized: a vertical combed pattern and a horizontal-plus-vertical one; the latter consists of horizontal strips of combing interrupted by patches of vertical combing.[50] These two distinct patterns show a clear association with specific vessel-types (Fig. 5): the vertical pattern is exclusively applied to pithoi with flat base and out-flared rim (type L),[51] while the horizontal-plus-vertical style of combing characterizes handled jars with a flat base (type K)[52] and the outer surface of the spouted vats with two vertical loop handles (type D).[53]

Vessels with combed surfaces are associated at the site with three out of the thirteen ware types identified by Genz on the base of macroscopic inspection: Ware g, Ware c and Ware d.[54] Broadly speaking, these wares are polyvalent at the site; in addition to combed vessels, they are also associated with open (bowls, platters) and close forms of different types (jars, pithoi, jugs, and juglets).[55] As a whole, Ware c is the most frequent in the repertoire of diagnostic pottery from the three phases, making up almost 50% of the corpus, while Ware g makes up only about the 12%, and Ware d 6%.[56] From a chronological viewpoint, Ware g decreases through time, as does Ware d, while Ware c increases dramatically from the early to the late horizon.[57]

Ware g is a highly fired ware, made of a fine orange to reddish and gray fabric, with many small mineral inclusions (0.2–2 mm); the thicker sherds have a reduced gray core. This ware has been considered as corresponding to the North Canaanite Metallic Ware as defined by Greenberg and Porat (1996),[58] and at the site it is associated with diverse functional types, especially pithoi, and platters (type B), but not with vats.[59] Pithoi with vertical combing associated with Ware g are documented through the entire occupation of the site, as well as jars with a horizontal-plus-vertical combed surface.[60] Ware

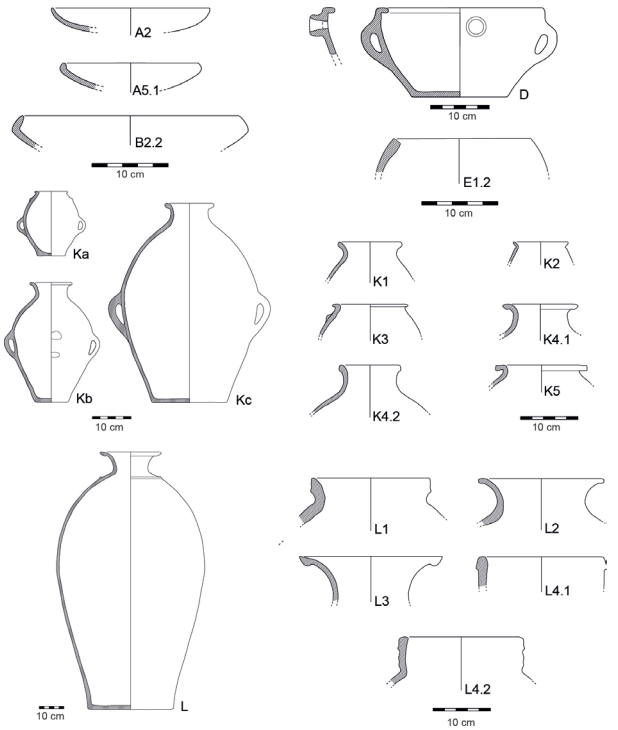

Figure 5: Main ceramic types from Khirbet ez-Zeraqon, as mentioned in the text (after Genz 2002).

c is a highly fired beige to red fabric with many fine mineral inclusions (0.2–1 mm); Ware d is very similar, sometimes grayish with many medium-fine mineral inclusions (0.5–1 mm).[61] Ware c has been considered as largely associated with open shapes, vats,[62] and closed shapes such as pithoi, especially those with vertical combing and applied plastic rope decoration, and with a vast number of jars, some showing horizontal-plus-vertical combing[63] as documented by items found *in situ* below the late horizon collapse layers.[64] Similarly, Ware d jars, some with a combed surface, mostly came from contexts of the last stage of occupation of the site.[65]

4. Petrographic Analysis of Selected Early Bronze Age II–III Pottery from Khirbet ez-Zeraqon

4.1. Materials

For the present study, analysis was undertaken on 45 selected samples from the site, including both complete/restorable vessels and single pottery sherds[66] consisting mostly of jars and pithoi. Examples of bowls, platters, and one holemouth pot were also included, characterized by surface treatments other than combing, such as burnishing and painting (Table 1, at the end of this chapter). The jars and pithoi comprised in the study are correlated with Genz's Wares g, c, and d, all the open shapes with Ware g, except for one holemouth jar, correlated with Ware j2,[67] a type that is never associated with combing at the site. This full repertory was examined to contextualize the combed containers within the broader spectrum of ceramic production documented at the site. These include eight restorable examples, as well as twelve rim sherds of pithoi that, from a typological viewpoint (Type L3), are likely to have derived from vessels with combed surface.[68]

As for the find contexts, most of the analyzed material (26 samples), including all the restorable vessels, is dated to the late horizon, and comes both from the upper and the lower city, being found either *in situ* or collected from tumble layers. All the items associated with the early/middle horizon were recovered from fill or tumble layers of the palace and the temple area, while those attributed to the middle horizon belonged to various contexts in the lower city.

4.2. Aims

Petrographic analysis of the selected samples was undertaken to reassess the conclusions on their typological/macroscopic study along three specific lines of enquiry. The goals of these analyses were as follows:

(1) To better our understanding of raw material preferences, manufacturing processes, firing temperature, degrees of standardization and the production centralization level of these vessels during the EB II and EB III. A key aspect of this study was to gain an understanding of how ware variability, as observed macroscopically, can be linked to the wares composition. Furthermore, this study offers evidence allowing to investigate the changes observed between EB II–III and EB IV ceramics from the site through the analysis of petrographic sections.
(2) To suggest possible production location(s) for the various ware groups based on their petrographic characteristics.
(3) To investigate the features of the combed storage and transport vessels at the site and place their development within the wider regional context of the Levantine Combed Ware industries.

4.3. Analytical Methods

The samples were first studied by transmitted light using a Leitz petrographic microscope. Light micrographs were taken with a Leica EC3 digital camera mounted on the microscope. The thin-sections were described using terminology and values proposed by Stoops (2003), Quinn (2013), and Klein and Philpotts (2013).[69] The measurement and quantification of the aplastic fraction of each sample and grain measurements were completed using the digital image analysis software, Jmicrovision.[70] Tiled images of an area on each thin-section measuring 1 cm^2 were produced for this purpose.

4.3.1. A Note on Nomenclature

It should be noted that the petro-fabric nomenclature presented here is integrated with that of the EB IV assemblage.[71] As that study was published first, the fabric groups 1–5 date to the EB IV. For the EB IV, fabric group 1 was further divided into three sub-fabrics (1A, B, and C). Fabric 1 also occurs during the EB II–III and represents the only overlap between the two periods at Khirbet ez-Zeraqon. The main Group 1 EB II–III sub-fabrics are labeled 1D and 1E, reflecting the disparity in preparation between the EB II–III and EB IV fabrics. One EB II–III sample (termed Fabric 1A) represents the only petrographic overlap between the two periods.

4.4. Petrographic Analysis Results

The petrographic analysis of the EB II–IIIA ceramic materials shows the existence of two distinct categories of petro-fabrics and preparations: a quartz-calcareous-basalt fabric, and a shale-derived fabric. Variations of the latter are commonly found in the central and northern part of the southern Levant during the EB II and EB II/III transition.[72] At Khirbet ez-Zeraqon, the most common fabrics utilized were quartz and limestone rich, with fragments of Pliocene basalts, rich in silty quartz along with unrelated coarser calcareous and shale derived fabrics. During the EB IV, the most common fabric is similarly quartz and limestone rich, with fragments of Pliocene basalts, though notably lacking in silty quartz. Also, shale fabrics are no longer found. Thus, the common EB II and EB IIIA fabrics at Khirbet ez-Zeraqon are distinct from those of the EB IV, suggesting a significant break with later ceramic traditions at the site, even when vessels were sometimes manufactured using similar locally available materials.[73]

Fabric 1: The Quartz-Limestone-Basalt Fabric

The dominant fabric in the EB II–III samples is Fabric 1, which can be described broadly as a Quartz-Limestone-Basalt Fabric, in most cases dominated by silty quartz (Fig. 6). Fabric 1 was used for jars and pithoi and on the whole it maps mostly onto the main macroscopic Ware groups c and d. Most samples of this fabric date to the late horizon, though a good number date to the middle horizon. Fabric 1 consists of a clay-rich matrix with a fine texture. The ground mass is brown to reddish-brown in plane polarized light, indicating firing, at least at some stage, in an oxidizing atmosphere. The groundmass is rich in microcrystalline calcite and, in some cases, an optically active crystallic b-fabric is observed. The groundmass is sometimes well-sintered and elongate channel voids can occur. Fabric 1 samples are composed of a similar suite of aplastic inclusions. Three sub-fabrics were identified (1A, 1D, and 1E); these can be distinguished by differences in the texture and frequency of particular inclusions. Texturally, the samples present aplastic inclusions that are subangular to subhedral. Less commonly, rounded spherical and elongate grains are noted. Equant grains of very fine to medium sand-sized micritic limestone occur most commonly (5–10%). Fossiliferous chalks occur occasionally. Fine to medium sand-sized grains of basalt occur commonly (3–5%). These are mostly subangular to subhedral and, rarely, rounded with finer texture. The basalts are composed of plagioclase feldspar, augite, olivine and opaque metal oxide phases (probably Fe-Ti). Fabric 1 is also composed of silt to fine sand-sized grains of quartz to varying degree, occurring rarely (1–2%) in a few cases, but commonly 10–20%. Fine sand-sized grains of chert (1–2%) can also occur. Grains of fine sand-sized calcite occur rarely, often exhibiting zoning. Rarely, rounded red optically active fine sand-sized grains occur, which are in high relief. These bodies are clay rich and are likely glauconite, chlorite, or some form of iddingsite.

Sub-fabric 1A is represented by only one sample. It is relatively coarse but contains very little silty quartz when compared to 1D and 1E. The sample, similar to the most common EB IV fabric, represents the only potential petrographic overlap between the EB II–III and EB IV. Fabrics 1D and 1E are quite similar to each other and the groupings should be regarded more as part of a spectrum than a clear division. They are the most common sub-fabrics

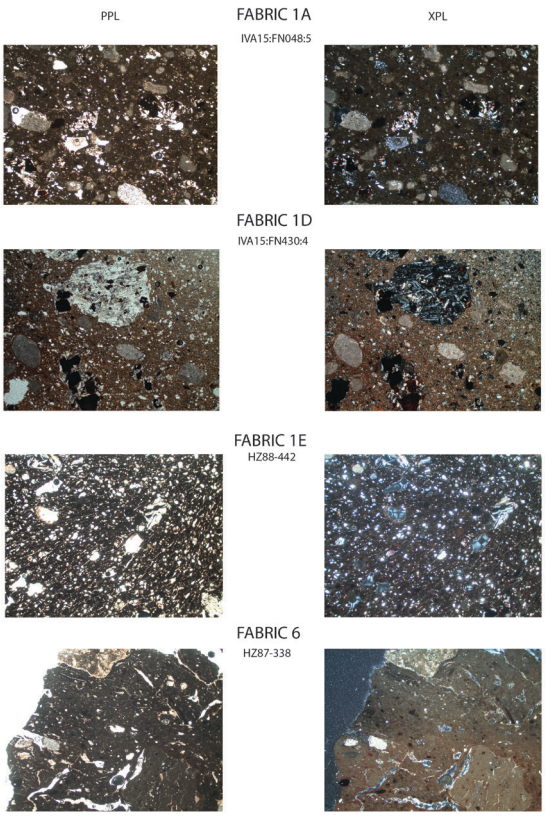

Figure 6: Photomicrographs of samples from Fabrics 1A, 1D, 1E and 6 in plane polarized light (PPL) and cross polars (XPL). Field of view is 2 × 2 mm for each photomicrograph. The image of 1A shows a number of limestone grains, fragments of basalt, fragments of chert, and silty quartz. 1B details large sand-sized grains of basalt and a few limestone fragments along with silty to fine sand-sized quartz. The image of 1C depicts frequent grains of silty to fine sand-sized quartz along with a few fragments of basalt. The image of Fabric 6 shows a large grain of limestone (top-left) and a large grain of white (kaolinite-rich) shale (bottom-right).

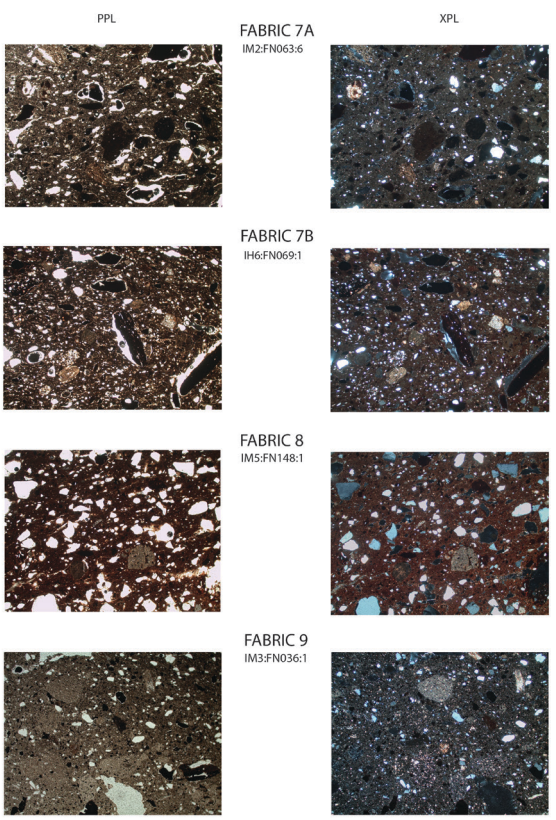

Figure 7: Photomicrographs of samples from Fabrics 7A, 7B, 8 and 9 in plane polarized light (PPL) and cross polars (XPL). Field of view is 2 × 2 mm for each photomicrograph. The image of 7A details frequent shale fragments and a few grains of fine to medium sand-sized quartz. 7B shows shale fragments and frequent silt and fine-sand sized grains of quartz. The image of Fabric 8 illustrates that it is dominated by fine to large grains of quartz. The image of Fabric 9 shows silty quartz and a fragment of fine-grained basalt.

during the middle and late horizons at the site. Both contain large amounts of silty quartz, differentiating them from 1A and the EB IV fabrics. Fabric 1D samples are coarser grained and the samples of fabric 1E tend to be finer grained relative to the other two fabrics.

Fabric Groups 6 and 7: Shale Fabrics

Shale fabrics consist of a clay–rich matrix with a fine texture. As mentioned above, fabrics of this type are relatively common during the EB II and EB II/III transition throughout the central and the northern part of the southern Levant, generally disappearing during the EB III. The groundmass is mostly well-sintered, sometimes vitrified, and optically inactive. Elongate channel voids occur. The samples belonging to this petro-fabric are composed of closely related materials but can be divided into two main fabrics: 6 and 7. Fabric 6 (Fig. 6), represented by only three samples, consists of white firing shales. Fabric 7 (Fig. 7), composed of reddish-firing shales, is represented by 11 samples; it can be divided into two quite similar sub-fabrics (7A and 7B), with 7B presenting much more fine-sand and silty quartz (similar in quantity to Fabric 1E).

All the samples belonging to these fabrics contained fine-grained moderate to coarse sand-sized shales or argillaceous rock fragments (ARFs), occurring moderately in the samples (10–25%). They are most commonly highly rounded and elongate,

often containing silt to fine sand-sized quartz grains and sometimes carbonates and Fe-Ti oxide phases. They are most commonly Fe rich, though composed of variable amounts. SEM-EDS analysis on several samples showed that an iron content of 5–10% is frequent.[74] A fraction of non-iron bearing shales, probably composed of kaolinite, can be found in some samples, though these are dominant only in Fabric 6. These fragments can be identified as they are white even in partially oxidized or reduced zones. Overall, these shales are poorly compacted and poorly lithified, as further indicated by splitting along the long axis of many of the elongated ARFs. The elongated shales often show a preferred orientation. Well-rounded grains of quartz found in both spherical and more elongated shapes occur occasionally to moderately in the shales. Within the matrix of the samples, quartz most commonly occurs in silt to medium sand-sized grains that are anhedral, although some larger grains also occur. Many samples contain larger fragments of quartz-rich sandstones. Pieces of micritic lime mudstone and siltstones occur in varying amounts but are generally rare (1–5%); they occur in medium or coarse sand-sized grains. Some finer rounded grains of fine sand sized calcite occur in trace amounts.

Fabric group 6 is represented by three samples: two pithoi and a holemouth pot. The 11 samples of fabric group 7 are mostly pithoi, with only one jar and two bowls amongst them. All the samples dated from the EB II–IIIA; the items from late-horizon contexts are residual sherds and one restorable pithos, which might be a long-lived heirloom. However, if those four items were actually produced during the late horizon, vessels made of Fabrics 6 and 7 from Khirbet ez-Zeraqon may represent one of the few clear examples of the continued use of shale-wares for large jar forms during the very earliest stage of the EB III in the southern Levant. Most evidence suggests shale wares are concentrated in the EB II throughout the Levant, yet they are found, to a much lesser degree, in the central Levant at least, at Tell 'Arqa and Tell Koubba in EB III phases, although their usage is restricted to fine-ware jugs.[75]

Fabric Group 8: Quartz-Calcareous

Fabric 8 can be described as a Quartz-Calcareous fabric with all samples exhibiting a similar suite of non–plastic inclusions (Fig. 7). Fabric group 8 is represented by 10 samples and largely used for bowls and platters, though the samples also include two jars and one pithos. The fabric occurs throughout the EB II–IIIA at the site. All the samples of this fabric are composed of a clay-rich groundmass rich in microcrystalline calcite that in most cases has an optically active crystallic b–fabric. Less commonly, a highly sintered optically inactive fabric is noted, indicating a relatively high firing temperature. The samples are composed of a clay-rich matrix with elongate and channel voids which occur rarely. The aplastic inclusions are always poorly sorted but can exhibit a bimodal distribution. The grains exhibit a high to moderate sphericity. Larger grains are sometimes subangular. Rarely, grains are elongated. Pieces of carbonate rock, micritic mudstone (dunham classification) or fossiliferous chalks occur occasionally (1–5%) in the samples.

Rounded to subangular fine to coarse sand-sized grains of quartz with a moderate to high sphericity occur occasionally to moderately in the samples (10–20%). Quartz most commonly occurs in fine to medium sand-sized grains that are anhedral. Carbonate rocks occur in fine to coarse sand-sized grains. Rarely, some samples are silty in texture. Medium to coarse sand-sized grains of cryptocrystalline rocks, including chert, and discrete bodies dominated by phyllosilicates (in some cases kaolinites as determined by EDS) occur rarely. Sandstones and rounded grains of fine sand-sized calcite occur rarely. Trace amounts of microcline are present. Fine-grained moderate to coarse sand-sized shales and other discrete iron oxide bodies occur rarely in the samples; they were most commonly elongate and highly rounded, and they often contain coarse silt sized quartz and carbonate grains. Trace amounts of silt-sized grains of zircon occur in some samples.

Fabric 9: Silty Quartz—Calcareous-Fine-Grained Basalt Fabric

Fabric 9 is represented only by one jar sherd from the tumble layer associated with the abandonment of the site. The fabric is similar in description to Fabric 8 but dominated by silty quartz (Fig. 7). The sample also contains a number of carbonate fragments rich in iron oxide bodies and fine-grained basalt fragments. Hopefully, more examples of this fabric will be discovered in the future so that it can be better defined.

4.5. Provenance, Comparative Petrography and Technological Considerations

The petrographic analyses demonstrate that most samples were made using a similar set of ingredients—calcareous clays and limestone, basalt, and fine-sand and silty quartz tempers. Shale-wares were also used during the site's occupation, placing the site of Khirbet ez-Zeraqon within the sphere of shale-ware distribution characteristic of the central Levant during the EB II and EB II/III transition. The results, showing relatively few fabrics and a general lack of sub-fabrics, suggest high-degree centralization in the dominant production modes used to make these vessels during the EB II–IIIA. Most fabrics are represented by several samples, with only one 'petro-loner' ascribed to Fabric 9. This differs from the EB IV ceramic repertory, which showed a larger number of minor fabrics, although these were mostly associated with cooking pots.[76]

In terms of provenance, Fabric 1 is consistent with materials available in the area surrounding Khirbet ez-Zeraqon[77] and a similar fabric was used during the EB IV, suggesting that the fabric reflects local production (see below for discussion). The precise production location, in the absence of kilns, remains unclear, as the raw materials can be found across the Irbid Plateau and in many locations in the nearby Jordan Valley. The fabrics are, for example, similar to some EB II–III examples described at Tel Bet Yeraḥ, although they occur less commonly at that site.[78] A larger programme of geo-prospection around Khirbet ez-Zeraqon and petrographic and geochemical analyses focused on EB II–IIIA may shed further light on the production location and distribution of Fabric 1.

Fabrics 6 and 7 are composed of shales, typically ascribed to Lower Cretaceous outcrops, which are not found near Khirbet ez-Zeraqon, and thus represent either imported vessels or raw materials. The samples are petrographically identical to the Fabrics 1B, 1D, and 1E as described in Badreshany et al. 2020, showing also that these shared a geochemical signature. Badreshany et al. proposed itinerant production modes for these shale-derived wares to explain the distribution of very large vessels made in this material, which occur at quite some distance from the required clay sources.[79] The evidence from Khirbet ez-Zeraqon might support this interpretation as the most common type of vessel made using shale fabrics is the pithos, which is difficult to transport safely over large distances. This study reinforces the notion that during the EB II sites across the central and northern part of the southern Levant were linked, at least, by communities of ceramic practice that drew upon similar materials to supply vessels to important centers.

Fabric 8, documented through the entire development of the site, is dominated by quartz. It is difficult to assign a provenance, but, given the technological departure from the most common fabric (1) during the EB II–III and IV, it can be suggested that either the vessels or the material used are non-local. Unlike the pithoi made of shale, most vessels produced of Fabric 8 are smaller bowls and platters that could have been transported more easily over a distance. Another feature of Fabric 8 vessels are the well-rounded fragments of quartz used as temper, which suggests beach sand from a coastal, lacustrine, or riparian environment. Quartz-rich fabrics are described at Tell el-Farah,[80] dating to the EB II, but these present quartz grains that are finer in texture than the samples from Khirbet ez-Zeraqon and, typically, the quartz is more angular. Fabric 8 is somewhat similar to the dominant fabrics of the EB III on the northern Lebanese coast,[81] yet the latter often exhibit foraminifera which were not noted in samples from Khirbet ez-Zeraqon.

Firing temperatures were found to be relatively low, not exceeding 800–850 C in most cases, though a vitrified ground mass was noted on some samples in all fabric groups, indicating that some vessels may have been fired toward the higher end of this spectrum. These temperatures are in line with those noted by other commentators studying ceramics of the period.[82]

The trajectory of EB ceramic development as noted at Khirbet ez-Zeraqon involves the appearance, during the EB II, of vessels made of non-local materials (represented by Fabrics 6, 7 and 8) and, in a lesser quantity, of a class of ceramics made of locally available materials (Fabric 1), this latter increasing in quantity through time and becomes more common into the EB III. This mirrors the trajectory described for the central[83] and the southern Levant,[84] where ceramics produced using locally available materials are present alongside shale-rich fabrics from an early point in the EB II, with the former becoming more prominent over time. In a central Levantine context, Badreshany et al.[85] explain this trajectory as indicative of a "local-capture" of ceramic production for vessels intended to hold products of economic value as these became increasingly important to emerging regional

political economies. The petrographic analysis of materials from Khirbet ez-Zeraqon suggests a similar process where local production ramps up considerably after the initial EB II phases.

4.6. Association with Types, Surface Treatments, and Wares

From the material analyzed, it is apparent that no exclusive uses of ceramic fabrics for specific pottery shapes and surface treatments existed at the site, although certain preferences can be noted. The local Fabric 1 is mostly employed for jars, followed by pithoi. Of the two sets of non-local materials, the shale-rich fabrics (Fabrics 6 and 7) were prevalently used for storage and—less often—for transport vessels, with relatively few open shapes,[86] while the quartz-rich fabric (Fabric 8) was largely employed for bowls and platters with burnished surfaces (Table 1).

Surface treatments seem to be more associated with shapes than with the fabric types and applied independently from the latter. The vessels with burnished surface—including all the open shapes and two jars—are mostly made of the quartz-rich Fabric 8 and to a lesser extent from shale-derived fabrics (Fabrics 7A and 7B). In contrast, most jars and pithoi are mostly divided between the local Fabric 1 and the shales-derived Fabrics 7 and 6, the latter being used also for the holemouth pot HZ87-338. The ceramic industry that used local clays was especially active in the production of storage and transport jars largely characterized by pattern combing, as it appears from the complete items. Moreover, combing was also applied on pithoi made of shale fabrics. Therefore, our results suggest that the containers with combed surface were produced by using two sets of raw materials, one consisting of local clays and one of non-local origins. These might have been associated with different ceramic industries. On the other hand, the strong typological and technological similarity of combed vessels made of both local and shale-derived fabrics—as also suggested by the presence of silty quarts—hints at one same ceramic tradition which developed through time, with a shift in preference toward more locally available raw materials.

The petrographic analysis also suggests that the items associated with Genz's Ware c and d—including all the restorable jars and pithoi with combed surface and a jar with painted surface—are made of the Quartz-Limestone-Basalt local Fabric 1. As for the materials associated with Ware g, these can be mostly divided between close forms, which were predominantly produced using the shale Fabrics 7 and 6, and open shapes made of the quartz-calcareous Fabric 8. These results agree with Genz's classification, which pinpointed that Ware g was prevalently associated with pithoi and bowls,[87] but also suggest that his Ware g incorporates at least two different production types, both using non-local materials, namely the shales (Fabrics 6 and 7) and the quartz-rich (Fabric 8) fabrics.

4.7. Chronological and Spatial Patterns

The earliest sherds included in our dataset—assigned to the early/middle horizon—belong mainly to the shale-rich Fabrics 7 and, to a lesser extent, the quartz-rich Fabric 8, while only one sample is associated with the quartz–limestone–basalt local Fabric 1E. In contrast, most of the items dated to the middle horizon belong instead to the fabric group 1, which is also used for a large number of items, both sherds and restorable vessels, associated with the late horizon. This testifies to a growing use of the local fabrics over time. On the other hand, both quartz-rich Fabric 8 and shale Fabrics 6 and 7 continued to be present in the later stage, although some samples might be residual sherds or heirlooms. This might be the case, for example, of the large pithos IM2:FN034:22, which could have been in use for several generations before the abandonment of the site leading to its burial beneath the collapse of the city.[88]

5. Discussion: The Combed Vessels within the EB II–III Ceramic Industries at Khirbet ez-Zeraqon and in Levantine Context

In line with other recent studies, the petrographic analyses of the ceramic repertoire from Khirbet ez-Zeraqon revealed that the combed vessels formed part of larger pottery productions that included diverse shape types and surface treatments. Most of the analyzed restorable combed containers were made of the local quartz-and-limestone rich Fabric 1, in the most common variant 1E. Combed pithoi were also produced from shale-rich clays, which were used to manufacture vessels characterized by other surface treatments as well, such as burnishing. This might suggest that surface treatments were linked more to shapes than fabrics. In any case, it is apparent that there was not a unique relationship between fabrics and surface treatments.

Contextualizing the data regionally, the developments through time identified by the petrographic characterization of the combed containers from Khirbet ez-Zeraqon can be linked to—and fits within—the dynamics documented elsewhere in the central and the southern Levant during the EB II–III. At Khirbet ez-Zeraqon, storage and transport jars with combed surface are associated with two main fabric groups, both employed for other ceramic types as well: one using shale-rich clays, the other using locally available raw materials. In the central and northern part of the southern Levant, for the local/calcareous fabrics, the diverse petrographic aspects and geochemical data point to the use of many and distinct local outcrops in the various subregions.[89] In contrast, at least two different main sets of shale-rich clays, from the Lower Cretaceous outcrops of the Lebanon and Anti-Lebanon Mountains and surrounding areas,[90] were used respectively in the Bekaa area and along the coastal Lebanon and Jordan Valley.[91] The shale group of this latter region matches the sub-fabric 7B at Khirbet ez-Zeraqon, characterized by fine-sand and silty quartz.[92] This composition supports the production of vessels with high-quality technological features, as well as further types of shale clays, which create hard and durable vessels that can be fired to higher temperatures than those made by using calcareous fabrics. On the other hand, the activities surrounding the transport of the shale-rich clays from the specific outcrops would have been time-consuming in terms of their logistical arrangements, while the pottery production would have required high artisanal skills. As such, the entire *chaîne opératoire*, from the clay mining and transport to the final production, was likely associated with specialized producers. These might have been active close to the few locations of the shale clays outcrops,[93] or they might have operated in an itinerant way[94] (see above).

From a chronological viewpoint, the earliest ceramic samples from Khirbet ez-Zeraqon are mostly associated with the shale Fabric 7, together with the non-local quartz-rich Fabric 8, while the local Fabric 1 became increasingly prevalent through time, being largely present in association with the last stage of life of the site. A comparable dynamic characterized the EB II–III ceramic inventory of the near site of Tel Bet Yeraḥ, which finds great similarities to that of Khirbet ez-Zeraqon.[95] At Tel Bet Yeraḥ, the shale clays, broadly present in the local Period C and used for the same type of vessels as the calcareous fabrics—including combed containers[96]—were almost completely replaced by the latter fabrics in the following Period D.[97] This does not seem to happen at Khirbet ez-Zeraqon, perhaps due to the nature of the remains analyzed, which consisted of residual single sherds and a complete pithos that could have been an heirloom from previous generations (see § 4.7). On the other hand, such evidence might be attributed to the chronological setting of the site. In fact, the presence of the shale fabrics among the remains of the last stage of occupation is not surprising considering the short duration of the EBA settlement and its abandonment at the beginning of the EB IIIA.[98] On a broader level, the decrease over time in shale fabrics, and the concomitant increase in those made using locally available material, is consistent with patterns visible across much of Levant, with shale-rich fabrics being mostly used during the EB II in relatively centralized modes of production, while diverse local fabrics becoming progressively more predominant in the EB III.[99] At northern sites of the southern Levant, such as Dan, most of the EB II ceramic assemblage consisted of vessels made of shale fabrics,[100] and at Tell Koubba and Fadous-Kfarabida, the calcareous fabrics predominated in EB III.[101] At Tell 'Arqa, combed jars were not documented during the EB II (Phase T – ECL2), and their production began during the EB II/III transition (Phase S – ECL3), using exclusively limestone fabrics. They represented the only type of jars and pithoi produced at the site from this phase onward.[102] The gradual replacement of the shale fabrics by calcareous ones was not associated in central Levant with any technological change. In fact, the manufacturing process was characterized by a certain continuity, consistent with the existence of specialized potters, or at least a well-defined body of ceramic knowledge. The shift, observed consistently between sites, is a change in preferences in raw material sources, which could be a consequence of changes in the organisation and/or the *loci* of productions. This happened together with a transformation of the formal typological repertoire, which can be associated with a general trend towards greater technological homogeneity.[103] In the northern part of the southern Levant, the decline of the shale-derived ceramic industries at the end of the EB II and the predominance of the local ceramic fabrics, linked to the diversification of local productions, might be associated with a reduction in the specialized

manufactures that characterized the transition to the EB III.[104] The different trajectories of southern and central Levantine ceramic manufactures and the diverse roles played by the two regions in the exchange with Egypt are mirrored by the origin of the Levantine containers found in Predynastic, Proto-Dynastic and Early Dynastic contexts.[105]

6. Conclusions

During the late fourth and third millennia BCE, Levantine ceramic manufacturing associated with combed vessels underwent transformations, with the gradual replacement of shale-rich fabrics by locally sourced material and the multiplication of production centers, also further south than in the early stages.[106] The evidence from Khirbet ez-Zeraqon concurs with this broader scenario.

The petrographic analyses conducted on selected samples from the site suggest that most of the jars and pithoi with combed surface were made of two main fabric types, using shale-rich clays and quartz-and-limestone ones, respectively. As in the rest of the Levant, these fabric types were not limited to the production of vessels with combed surface but were also used for other vessel types with diverse surface treatments, such as burnishing. Moreover, the presence of fine sand-sized quartz associated with both fabric groups suggests a technological similarity among different industries. The silty quartz shale sub-fabric matches petrographically with evidence from several sites in coastal Lebanon, Beqaa and northern Transjordan, placing Khirbet ez-Zeraqon at the southern borders of a larger phenomenon of related productions that mostly developed to the north.

From a diachronic viewpoint, it is possible to suggest that the use of the shale fabrics at the site decreased though time and the locally available clays became more frequent during the last stages of occupation. This is consistent with the broad development of ceramic production in the Levant. Moreover, comparing the EB II–III materials from Khirbet ez-Zeraqon to those of the EB IV yields an overlap suggesting that some aspects of production developed around similar locally available materials, though not necessarily reflecting a direct continuity in production.

Further extensive studies on the use of raw materials through time, combined with strong stratigraphic sequences and short interval radiocarbon determinations, are needed to better evaluate the regional patterning of technological changes in relation to the combed storage and transport jars, and to fully understand the role played by the diverse productions of these containers within the broader scenario of eastern Mediterranean economy. This discussion of the new data from Khirbet ez-Zeraqon, when considered in light of the broader regional context, offers a further step in our understanding of the puzzling phenomenon of the combed vessels and the diverse roles played by the various regions of the Levant in the production, distribution, and consumption of these containers across a variety of spatial scales.

Acknowledgements

The authors would like to acknowledge with great appreciation the directors of the excavation at Khirbet ez-Zeraqon, Siegfried Mittmann and Mohawiah Ibrahim, for entrusting us with the study of the materials from the site. A special thanks goes to Jens Kamlah for his continuous support of these investigations. We wish to warmly thank Karin Sowada and Matthew J. Adams for kindly inviting us to join the Egypt & the Mediterranean World conference and publication. We wish to express our gratitude to Graham Philip, Dan Lawrence, and the two anonymous reviewers for their valuable comments and suggestions. The work of Valentina Tumolo was supported by the CLaSS Project (the CLaSS project has received funding from the European Research Council under the European Union's Horizon 2020 research and innovation programme, grant agreement No 802424, award holder Dan Lawrence).

Table 1: List and description of samples analyzed in the study.

Sample ID	Shape	Type	Part	Preservation	Surface	Ware	Petrofabric	Find Context	Chronological Horizon	Chronological Attribution	Reference
IM5:FN148:1	Bowl	A, A2	Rim	Sherd	Burnished inside	Ware g	8	R0.2	Early/Middle horizon	EB II/EB II–III trans.	Genz 2002, Taf. 14:8
IH6:FN039:6	Bowl	A, A2	Rim	Sherd	Burnished	Ware g	8	Palace complex; B0.8	Late Horizon	EB IIIA	Genz 2002, Taf. 43:2
IH6:FN020:1	Bowl	A, A2	Rim	Sherd	Burnished inside	Ware g	8	Palace complex; B0.8	Late Horizon	EB IIIA	Genz 2002, Taf. 45:1
IM5:FN146:1	Bowl	A, A2	Rim	Sherd	Burnished inside	Ware g	7B	R0.2	Early/Middle horizon	EB II/EB II–III trans.	Genz 2002, Taf. 14:7
IM3:FN034:2	Bowl	A, A5.1	Rim	Sherd	Burnished	Ware g	7A	R0.4	Late Horizon	EB IIIA	Genz 2002, Taf. 15:12
IM2:FN034:25	Platter	B, B2.2	Rim	Sherd	Burnished	Ware g	8	Palace complex; B0.8	Late Horizon	EB IIIA	Genz 2002, Taf. 41:11
IM2:FN034:26	Platter	B, B2.2	Rim	Sherd	Burnished	Ware g	8	R0.2	Late Horizon	EB IIIA	Genz 2002, taf. 13:5
IM2:FN034:24	Platter	B, B2.2	Rim	Sherd	Burnished inside	Ware g	8	Palace complex; B0.8	Late Horizon	EB IIIA	Genz 2002, Taf. 44:2
IM2:FN034:27	Platter	B, B2.2	Rim	Sherd	Burnished inside	Ware g	8	B1.2	Middle Horizon	EB II–III trans.	Genz 2002, Taf. 78:5
IIIC15:FN207:4	Close shape	-	Body sherd	Sherd	-	Ware c	1E	B1.3	Late Horizon	EB IIIA	-
HZ87-338	Holemouth Jar	E1.2	Rim	Restorable vessel	Pre-firing incised mark	Ware j2	6	B1.2	Late Horizon	EB IIIA	Genz 2002, Taf. 72:2
IVA15:FN482:1	Jar	K, K1	Rim	Sherd	-	Ware d	1D	F1.1	Middle Horizon	EB II-III trans.	-
IH6:FN111:16	Jar	K, K1	Rim	Sherd	-	Ware g	1E	Palace complex; B0.8	Early/Middle horizon	EB II/EB II–III trans.	Genz 2002, Taf. 44:12
IVA15:FN315:3	Jar	K, K1	Rim	Sherd	-	Ware c	1E	F1.1	Middle Horizon	EB II–III trans.	-
IVA15:FN048:5	Jar	K, K4.1	Rim	Sherd	-	Ware d	1A	S1.2	Late Horizon	EB IIIA	-
IVA15:FN121:1	Jar	K, K4.1	Rim	Sherd	-	Ware c	1E	S1.2	Late Horizon	EB IIIA	-
IM2:FN034:6	Jar	K, K4.1	Rim	Sherd	Burnished	Ware g	7B	R0.4	Early/Middle horizon	EB II/EB II–III trans.	Genz 2002, Taf. 19:7
IH6:FN099:160	Jar	K, K4.2	Rim	Sherd	-	Ware g	8	Palace complex; B0.8	Early/Middle horizon	EB II/EB II–III trans.	Genz 2002, Taf. 47:1
IM3:FN036:1	Jar	K, K4.2	Rim	Sherd	-	Ware g	9	R0.4	Late Horizon	EB IIIA	Genz 2002, Taf. 16:12
IVA15:FN155:15	Jar	K, K4.2	Rim	Sherd	-	Ware c	1E	S1.2	Mixed phases	-	-
IVA15:FN296:1	Jar	K, K4.2	Rim	Sherd	-	Ware d	1E	F1.1	Middle Horizon	EB II–III trans.	-
IVA15:FN179:11	Jar	K, K4.2	Rim	Sherd	-	Ware d	1E	S1.2	Middle Horizon	EB II–III trans.	-
IH6:FN046:1	Jar	K, K5	Rim	Sherd	Burnished	Ware g	8	Palace complex; B0.8	Late Horizon	EB IIIA	Genz 2002, Taf. 43:11
IVA15:FN430:4	Jar	K, K5	Rim	Sherd	-	Ware c	1D	F1.1:R4	Middle Horizon	EB II–III trans.	-

Sample ID	Shape	Type	Part	Preservation	Surface	Ware	Petrofabric	Find Context	Chronological Horizon	Chronological Attribution	Reference
HZ88-506	Jar	Kb	Base + body + handles	Restorable vessel	Pattern combed; pre-firing incised mark	Ware c	1E	Palace complex; B0.8	Late Horizon	EB IIIA	Genz 2002, Taf. 29:1
HZ88-442	Jar	Kb K4.2	Complete	Restorable vessel	Large irregular painted strips	Ware d	1E	B1.4:R1	Late Horizon	EB IIIA	Genz 2002, Taf. 108:3
HZ88-508	Jar	Kc	Base + body + handles	Restorable vessel	Pattern combed	Ware c	1E	B0.8	Late Horizon	EB IIIA	Genz 2002, Taf. 34:3
HZ91-789	Jar	Kc	Base + body + handles	Restorable vessel	Pattern combed	Ware c	1E	Palace complex; B0.8	Late Horizon	EB IIIA	Genz 2002, Taf. 29:4
IM2:FN034:7	Pithos	L	Base + body	Restorable vessel	Vertically combed	Ware c	1E	R0.11	Late Horizon	EB IIIA	Genz 2002, Taf. 8:1
IM2:FN034:8	Pithos	L	Base + body	Restorable vessel	Vertically combed	Ware c	1E	B1.3	Late Horizon	EB IIIA	Genz 2002, Taf. 85:1
IM2:FN034:9	Pithos	L	Base + body	Restorable vessel	Vertically combed	Ware c	1E	Palace complex; B0.8	Late Horizon	EB IIIA	Genz 2002, Taf. 31:1
IM2:FN034:10	Pithos	L	Base + body + neck	Restorable vessel	Vertically combed; plastic rope application	Ware c	1E	B1.3	Late Horizon	EB IIIA	Genz 2002, Taf. 84:1
IM2:FN034:22	Pithos	L	Complete	Restorable vessel	Vertically combed	Ware g	7B	B1.6	Late Horizon	EB IIIA	Genz 2002, Taf. 126:1
IM2:FN034:11	Pithos	L, L3	Rim	Sherd	Combed?	Ware g	6	S1.2	Late Horizon	EB IIIA	-
IM2:FN034:12	Pithos	L, L3	Rim	Sherd	Combed?	Ware g	6	S1.2	Middle Horizon	EB II–III trans.	-
IM2:FN034:13	Pithos	L, L3	Rim	Sherd	Combed? Pre-firing incised mark	Ware g	8	R0.4	Early/Middle horizon	EB II/EB II–III trans.	Genz 2002, Taf. 19:12
IM2:FN034:14	Pithos	L, L3	Rim	Sherd	Combed?	Ware g	1E	R0.2	Late Horizon	EB IIIA	Genz 2002, Taf. 14:4
IM2:FN034:15	Pithos	L, L3	Rim	Sherd	Combed?	Ware g	1E	S1.2	Middle Horizon	EB II-III trans..	-
IM2:FN034:16	Pithos	L, L3	Rim	Sherd	Combed?	Ware g	7A	R0.4	Early/Middle horizon	EB II/EB II–III trans.	Genz 2002, Taf. 19:10
IM2:FN034:17	Pithos	L, L3	Rim	Sherd	Combed?	Ware g	7A	R0.4	Early/Middle horizon	EB II/EB II–III trans.	Genz 2002, Taf. 19:11
IM2:FN034:18	Pithos	L, L3	Rim	Sherd	Combed?	Ware g	7A	R0.4	Late Horizon	EB IIIA	Genz 2002, Taf. 17:7
IM2:FN034:19	Pithos	L, L3	Rim	Sherd	Combed?	Ware g	7A	R0.4	Late Horizon	EB IIIA	Genz 2002, Taf. 17:6
IM2:FN034:20	Pithos	L, L3	Rim	Sherd	Combed?	Ware g	7B	Palace complex; B0.8	Early/Middle horizon	EB II/EB II–III trans.	Genz 2002, Taf. 44:1
IM2:FN034:21	Pithos	L, L3	Rim	Sherd	Combed?	Ware g	7B	R0.1	Early/Middle horizon	EB II/EB II–III trans.	Genz 2002, Taf. 13:2
IM2:FN034:23	Pithos	L, L3	Rim	Sherd	Combed?	Ware g	7B	R0.4	Late Horizon	EB IIIA	Genz 2002, Taf. 17:3

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Notes

[1] This article is the result of a joint work. V. Tumolo has written the introduction, the archaeological context of Khirbet ez-Zeraqon, the overview on the Levantine Combed Ware (sections 1-3), the assessment of materials and results (sections 4.1, 4.6-4.7), and the discussion (section 5). K. Badreshany has addressed the petrographic analysis (sections 4.2-4.4). Section 4.5 and the conclusions (section 6) have been jointly written.

[2] The chronological framework for the Levant used in this paper follows the proposals on high absolute dates recently suggested by

several scholars for the specific subregions and supported by radiocarbon determinations (see Höflmayer et al. 2014; Regev et al. 2012a; Regev et al. 2012b; Regev et al. 2014; Regev et al. 2020; Tumolo and Höflmayer 2020; Vacca and D'Andrea 2020) and by the ARCANE project (Lebeau and de Miroschedji 2013, xi). The synchronization between Egypt and the Levant is based on the proposals of Sowada 2020 and Sowada et al. 2021.

3 Tumolo and Höflmayer 2020.

4 Ibrahim and Mittmann 1987, 3; 1988, 7; 1989, 642; 1991, 3; 1994, 11–12; 1997, 388; Genz 2002, 7, Abb. 1; Douglas 2007, 3.

5 Hewett et al. 2022.

6 Riehl et al. 2008, 1015, 1017–1018; Deckers et al. 2021.

7 Ibrahim and Mittmann 1987, 3; 1988, 7; 1989, 643; 1991, 3; 1994, 11–12; 1997, 388; Mittmann 1994, 12; Genz 2002, 7; Douglas 2007, 4.

8 Douglas 2007; 2011.

9 Mittmann 1994, 13–14; Genz 2002, 95–96; Genz 2010, 48; D'Andrea 2020.

10 Ibrahim and Mittmann 1994, 14; Mittmann 1994, 14; Genz 2002, 96–98.

11 Genz 2002, 96, 102–104, Tab. 71, Taf. 24–47; 2010b, 49. Vats were also uncovered, possibly employed for processing liquid products (Genz 2002, 92, 104).

12 Building B1.1, on the north–western limits of the excavated area, was only very partially exposed (see Genz 2002, 99).

13 Mittmann 1994, 14–15; Ibrahim and Mittmann 1994, 15; Genz 2002, 100, Tab. 67, Taf. 80–10.

14 Genz 2002, 39–49, 79–84.

15 Genz 2002, 13, 101.

16 Ibrahim and Mittmann 1987, 6; 1989, 645; 1997, 388; Kamlah 2000, 193; Genz 2002, 10; D'Andrea et al. 2022.

17 Genz 2002, 39–49, 77–88, 221.

18 Greenberg and Iserlis 2014, 70–76, 110–125.

19 Ben-Tor and Bonfil 2003, figs 24–36, 46–51; Zuckermann 2003, 134–142.

20 Tumolo and Höflmayer 2020, 253–254 with references therein.

21 Genz 2002, 30, 44; Regev et al. 2020, 19.

22 Tumolo and Höflmayer 2020, 255–259.

23 Regev et al. 2012.

24 Lebeau and de Miroschedji 2013: xi; Sowada 2020, 149–154. The same applies to the EB II of Tel Bet Yeraḥ (Greenberg and Iserlis 2020, 40 with references therein). The radiocarbon data recently published by Regev and colleagues for Tel Bet Yeraḥ set the transition between the Period D and Period C between 2902 and 2888 BC (Regev et al. 2020, 16–18), contemporary with part of the late horizon at Khirbet ez-Zeraqon.

25 Greenberg 2017, 34.

26 Mittmann 1970, 11–15; Kamlah 2000, 189–192.

27 D'Andrea 2020, 12.

28 Greenberg 2017, 35, 48–50; see also D'Andrea 2020, 13.

29 Wilkinson et al. 2014, 53, 88–91; Deckers et al. 2021; Lawrence et al. 2021. Although the site was placed in an area potentially suitable for rainfed agriculture and arboriculture, it was in close proximity with the zone characterized by values of annual rainfall lower than 300 mm (M. De Gruchy personal communication; Welton et al. forthcoming).

30 Badreshany et al. 2020, 162; de Miroschedji 2021, 61 with references therein. See Genz et al. 2011, 161–163 for Organic Residue Analysis.

31 Badreshany et al. 2020, 173 with references therein. De Miroschedji considered hardly convincing that combing could have been considered as a branding, because many of the vessels exported to Egypt were only lightly combed and some were covered by lime coating (de Miroschedji 2021, 43, contra Badreshany et al. 2020, 173). The combing could have had the advantage of providing tactile grip, rendering the surface less slippery.

32 Jean 2020, 141–143 with references therein; de Miroschedji 2021, 44–48, 57 with references therein.

33 De Miroschedji 2021, 50.

34 Although the nature and length of the EB I cultural facies of the central Levant have not been clarified yet, the beginning of the local EB II can be placed around 3100/3000 BC (Thalmann 2013, 258, Fig. 1; Jean 2020, 139, Tab. 1). De Miroschedji suggested that there is no strong evidence unequivocally supporting the chronological priority of southern Levantine productions that used shale–rich fabrics over the central ones (de Miroschedji 2021, 55 with references therein).

35 Phase S ca. 2800–2700/2650 = ECL3 (Jean 2020, 141–142).

36 Thalmann and Sowada 2013, 337.

[37] Levantine ceramic made of both calcareous and shale fabrics is already documented in Predynastic Egypt, as in the Tomb U–j at Abydos, and this concurrence characterized also contexts of the 1st Dynasty (Hartung et al. 2015, 316–324), synchronized with the EB II /ESL4 / ECL2 from the reign of Djer onward (Sowada 2020, 153–154). According to Greenberg and Iserlis, the material from Abydos included both ceramic of the South Levantine Metallic Ware and southern potter fabrics from Tel Bet Yeraḥ (2020, 43).

[38] Sowada 2020, 155; Sowada et al. 2020; Sowada et al. 2021. Following the abandonment of the Egyptian on-the-ground presence in Sinai and on the southern coastal plain of the southern Levant, although the central Levant became the major economic partner for Egypt, the relationship between Egypt and the southern Levant continued after the 1st Dynasty (Iserlis et al. 2019; Greenberg and Iserlis 2020, 46; Sowada 2020, 153–154, 164).

[39] Badreshany et al. 2020, 162; Badreshany et al. 2022; Greenberg and Iserlis 2020, 44, 46; de Miroschedji 2021, 63 with references therein.

[40] Thalmann and Sowada 2013, 323–238; Badreshany et al. 2020, 160–163; de Miroschedji 2021, 30–31.

[41] Badreshany et al. 2020, 172; de Miroschedji 2021, 46–60.

[42] Badreshany et al. 2020, 162 with references therein.

[43] Greenberg and Porat 1996.

[44] Badreshany et al. 2020, 162.

[45] Thalmann and Sowada 2013; 356–358; Badreshany et al. 2020, 165; de Miroschedji 2021, 63.

[46] De Miroschedji 2021, 32–44, 48–54. The prevalent use of jars with ledge–handles, instead of loop–handles, would confirm that the southern EB III vessels were not involved in long–distance trades (de Miroschedji 2021, 60).

[47] Badreshany et al. 2020, 174 with references therein.

[48] Vats with combed surfaces are documented from the middle horizon and are mostly associated with the late stage of occupation of the site (Genz 2002, 41–43). Combed vessels are characterized also by the presence of incised pot marks and seal impressions applied before firing (Genz 2001; Genz 2002, 109–117; Tumolo 2019).

[49] Genz 2002, 47–49.

[50] Genz 2002, 33–35.

[51] With several subtypes, having an average volume between 112 and 141 liters (Genz 2002, 27, Abb.7, 12). Examples often show parallel smooth narrow strips horizontally or diagonally arranged on the body, which are possible impressions created by the ropes that helped hold the vessels together before firing (Genz 2002, 36).

[52] Type K, subtypes Kb and Kc, with two loop handles at the mid body and a volume between 4.5 and 9 liters, and 20.5 and 28 liters (Genz 2002, 27, Abb. 6, 11).

[53] The latter are characterized by combing only on the outer surface (Genz 2002, 26, 32, Abb.5, Tab. 8).

[54] Genz 2002, 29-31.

[55] Genz 2002, 31.

[56] Genz 2002, 30, Tab. 6.

[57] Genz 2002, 44–46, Tabb. 51–53.

[58] Genz 2002, 30.

[59] Genz 2002, 31, Tab. 7.

[60] e.g., Genz 2002, Taf. 32:3. Jars made of Ware g are also characterized by red slip and polished surfaces, or painted strips (e.g., Genz 2002, Taf. 99:7; Taf. 75:1).

[61] Genz 2002, 30.

[62] A large part of the numerous vats made of Ware c is characterized by horizontal-plus-vertical combing (Genz 2002, 31, Tab. 7, 34, Tab. 10), while they only rarely have other types of decoration (e.g., red painted large strips: Genz 2002, Taf. 108:2).

[63] Ware c jars dated to the late horizon can be covered by red slip or strips of red painting (e.g., Genz 2002, Taf. 74:2, Taf. 82:4).

[64] Genz 2002, Taf. 8:1a; Taf. 25:3, Taf. 26:1, Taf. 31:2–3, Taf. 36:1, 37:1; Taf. 52:1.

[65] Genz 2002, 31, Tab. 7; 34, Tab. 10; 44–46.

[66] Five items were included in the study conducted by Badreshany et al. 2020, 165 and Tab. 2.

[67] Genz 2002, 30.

[68] Differently from other surface treatments, at Khirbet ez-Zeraqon as at other sites (e.g., de Miroschedji 2021, 47), combing did not extend to the neck of jars and pithoi. All the rim sherds of pithoi analyzed in the present study belong to Genz's type L3 (Genz 2002, 21, Abb. 12) that is largely - although not exclusively - associated with combing at the site.

69 Stoops 2003; Quinn 2013; Klein and Philpotts 2013.
70 Roduit 2007 (www.jmicrovision.com).
71 D'Andrea et al. 2022.
72 Badreshany et al. 2020; Jean 2020; Greenberg and Porat 1996.
73 D'Andrea et al. 2022.
74 Badreshany 2013; Badreshany et al. 2020.
75 Jean 2020.
76 D'Andrea et al. 2022.
77 Mohd 2000.
78 Greenberg and Iserlis 2014.
79 Badreshany et al. (2020) suggest that the production was made by itinerant potters, transporting the powdered shale-clays with them. This would also be supported, according to de Miroschedji, by the fact that the productivity of full–time potters, whose expertise would have been necessary for the shale–derived industries such as the North Canaanite Metallic Ware, would have exceeded the needs of a single community of central and southern Levant (de Miroschedji 2021, 60–61). On the other hand, it can be suggested that the clays were sourced and transported to multiple stable production centers in the region, organized through centralized systems that exploited the strong communication networks active in the EB II.
80 Botticelli et al. 2022.
81 Badreshany et al. 2020; Jean 2020.
82 Medeghini et al 2019; Botticelli et al. 2022.
83 Badreshany et al 2020; Badreshany et al. 2022; Jean 2020.
84 de Miroschedji 2021, 31; Greenberg and Iserlis 2020.
85 Badreshany et al 2020.
86 Shale fabrics were used for bowls and platters also at Tel Bet Yeraḥ (Greenberg and Isserlis 2014, 59-50).
87 Genz 2002, Tab. 7.
88 The pithos HZ88-430 presents some ad-hoc perforations, too large to be aimed at a repair using metal clips, and likely hinting at a secondary reuse of the vessel (Genz 2002, 106).
89 Such as the Jurassic and Upper Cretaceous outcrops of northern Lebanon associated to central Levantine manufactures (Badreshany et al. 2020, 190–191).
90 Greenberg and Porat 1996.
91 Badreshany et al. 2020, 188. The industries of the Jordan Valley area possibly included the North Canaanite Metallic Ware tradition (de Miroschedji 2021, 50).
92 Group 1D of Badreshany et al. (2020, 182).
93 Greenberg and Iserlis 2020, 39.
94 Greenberg and Porat 1996; Badreshany et al. 2020, 189–190.
95 See, among others, Tumolo and Höflmayer 2020, 235.
96 In the earliest EB II phase at Tel Bet Yeraḥ, the North Canaanite Metallic Ware/South Levantine Metallic Ware repertoire, made with shale-rich clay, was limited to a restricted number of types, and expanded in the successive stages, including diverse shapes (Greenberg and Iserlis 2020, 40–41, 44). Evidence of a ceramic manufacturing area at the southern side of the settlement revealed that local fabrics were used during Phase C for fashioning types similar to those associated with the North Canaanite Metallic Ware (Greenberg et al. 2012, 95).
97 Greenberg and Iserlis 2014, 76.
98 On the base of absolute dates, the entire life of the settlement of Khirbet ez-Zeraqon (ca. 3100/3050–2850 cal. BC) mostly corresponds to the EB II at Tel Bet Yeraḥ, which spans from ca. 3150 to 2902/2888 BC (Greenberg and Iserlis 2020, 40; Regev et al. 2020, 16–18).
99 Badreshany et al. 2020, 174, 184–188.
100 Greenberg and Porat 1996, 11.
101 Badreshany et al. 2020, 187.
102 This development was part of a broader process that affected the entire ceramic manufacture at the site, with strong changes taking place during the EB II-III (Phase S – ECL3), when the shale fabrics that were used in Phase T (EB II – ECL2) were abandoned. Shale-rich Fabrics 5 and 6, documented only in phase T, were not associated with any specific type. Jars were vertically burnished during phase T, while pattern combing started from phase S. In Phase R, also horizontal combing appeared, which is the only combed treatment known for jars in the following phase P. From phase S, storage vessels were made of Fabrics 2 and 3, the latter being a multi–purpose fabric that survived into the EB IV (Phase P), when it became the predominant fabric, suggesting a general tendency toward homogenization in the ceramic production (Jean 2020, 141–142, 147–153).
103 Jean 2020, 151 with references therein.

[104] Greenberg and Isserlis 2014, 59–60; Greenberg 2017, 46.

[105] The petrographic analyses conducted by Sowada and colleagues on materials from the settlement of Heit el-Ghurab and the Giza necropolis suggested that the combed jars belonged to a specialised production of made with iron-rich calcareous clays originating from the area around Byblo. Similarly, combed vessels from the 6th Dynasty tomb complex of Qaar at Abusir appear to have been imported from the northern part of the Lebanese coast (Sowada et al. 2020; Sowada et al. 2021).

[106] De Miroschedji 2021.