

The ‘Combed Ware’ storage and transport vessels from Khirbet ez-Zeraqon: a reappraisal of the EB II-III evidence in light of recent 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 that have been traditionally grouped under the label of “Combed Ware”. The results contribute to our understanding of the role played by these vessels in relation to wider ceramic production, as documented at the site. On a larger scale, and thanks to the recent chronological reassessment of the Khirbet ez-Zeraqon’s stratigraphic sequence, our study offers further evidence from which to evaluate the developments of pottery manufactures through time at a local level, and also in terms of the broader phenomenon of Levantine combed containers.

KEYWORDS

Early Bronze Age Levant, Khirbet ez-Zeraqon, combed vessels, petrographic analyses, ceramic production

1- Introduction¹

The investigation of the role played by the Levantine pottery manufactures is central for understanding the socio-economic trajectories that characterised the Levant and the south-eastern Mediterranean during the Early Bronze Age (henceforth EBA or EB; Fig. 4)². In this sense, the study of the material offered by the site of Khirbet ez-Zeraqon, in northern Jordan, contributes to the examination of transformations that took place in the area between the end of the fourth and the first centuries of the third millennium BC. 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 that mostly falls within the local EB II³. As suggested by recent research, the site did not adapt to the changes that took place at the transition to the EB III and, after some decades of decline, it was completely abandoned at the beginning of the latter stage. 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 the Levantine pottery industries during the late fourth and third millennium BC and their change through times, 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-

¹ This article is the result of a joint work. V. Tumolo has written the introduction, the archaeological context of Khirbet ez-Zeraqon, the topic of the Levantine Combed Ware (sections 1-3), the assessment of materials and results (sections 4.1, 4.5-4.6), and the discussion (section 5). K. Badreshany has addressed the analytical methods of the petrographic analysis (sections 4.2-4.3). Section 4.4 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 sub-regions, 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.

Zeraqon provides further support for the definition of a broad central and southern Levantine horizon. Around 2900/2800 BC a change in the ceramic industry associated to these types of containers took place, with a shift 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-Šellāle⁴ in an area that was characterized by an average rainfall between 300 and 400 mm per year during the fourth and the third millennium BC⁵. This would have been sufficient for supporting rainfed agriculture, but additional water supply could have been necessary in more arid years⁶. 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 (Biblich-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 that took place at the beginning of EB II, creating a well-defined outline of a town surrounded by a massive defense wall and consisting of a lower city to the south and an upper city to the north (Fig. 1). Through time, this plan was only slightly modified by some secondary re-buildings and adjustments, which primarily pertained to the city gates and the reinforcement of the city wall⁸. The upper town (Fig. 2), on the northern side of the mound, was dominated by two main architectural complexes: the “temple complex” consisting of what are believed to be cult-buildings, a circular altar and subsidiary structures⁹, and the “palace complex”, which was a large unit formed by at least four juxtaposed sectors characterized by different layouts and likely devoted to diverse functions, such as administrative, economic-industrial, and representative¹⁰. Among these sectors, building B0.8 included small irregular rooms with installations for food-processing and stockpiling, and with a pottery repertoire largely comprised of storage vessels¹¹. In the lower city (Fig. 3), most of the buildings uncovered were residential¹², while the function of Building B1.3 – if private or collective – remains unclear¹³.

Within the occupational sequence of this settlement, three main chronological stages have been identified on the base of their distinctive pottery assemblages and, for this reason, have been defined 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 re-constructions, the last phase of occupation was characterized by signs of instability: the city gates were reinforced, and several gates’ entrances were blocked. At the same time, some sectors of the

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.

city were no longer kept in repair, such as the parts of the defence wall in the lower town that had started to collapse into the open space B1.5¹⁵. After this stage of decline, the site was completely abandoned without any 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 by scattered ceramics and small structures, as stone-lined silos, which partially reused the ruins of the previous buildings¹⁶. 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 III¹⁷. More specifically, the early horizon can be set in the EB II, as suggested by ceramic comparisons from Phase C of Tel Bet Yerah¹⁸ and Strata XIIC-A and XIIE-D at Tel Qashish¹⁹. 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 repertoire finds strong comparisons with Period C and early Period D at Tel Bet Yerah, while later EB III shapes, such as oversized platters that are characteristic of the late Period D of Tel Bet Yerah and Megiddo level J-6, are instead absent²⁰. As found in the very earliest EB III stages at Tel Bet Yerah, the ceramic repertoire of this horizon includes only a few Khirbet Kerak Ware sherds²¹. The relative chronological assessment made on the base of the stratified ceramic repertoires is supported by radiocarbon data, which suggest a date for the early horizon to *ca.* 3100/3050 – 3000 cal. BC, for the middle horizon to *ca.* 3000 – 2950 cal. BC, and the late horizon to *ca.* 2950 – 2850 cal. BC (Fig. 4)²². These absolute dates are in agreement with recent proposals on the high absolute chronologies for the EBA in the southern Levant²³, 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 1st Dynasty in Egypt²⁴; 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 the settlement of Khirbet ez-Zeraqon 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 technologies²⁵. The location of the site along the middle Wādī eš-Šellāle²⁶, placed along major east-west and north-south routes²⁷, 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 to the broader transformations which affected the settlements across the upper Jordan Valley, the Galilee and 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

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 Beth Yerah (Greenberg and Iserlis 2020, 40 with references therein). The radiocarbon data recently published by Regev and colleagues for Tel Bet Yerah 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.

ez-Zeraqon, by the thickening of the city walls and blocking the entrance of the gates. As suggested by Greenberg, this situation might have been the result of 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 activities²⁸. On the other hand, due to the location of the site in close proximity to an area characterized by fluctuating ecological conditions, environmental aspects may have played a role in its abandonment²⁹.

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. 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 wine³⁰. 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 contained³¹. On the other hand, the combing can be considered the result of technological actions comprised in – and developed together with – the manufacturing process, with the aim of reinforcing the structure of the vessels and, at the same time, helping to join and mask the coils of the handmade bodies. The primary technical – and not esthetical – purpose would explain the application of combing also on the inner surfaces of vessels, as documented from the coastal Levant³².

From a chronological and spatial viewpoint, vessels with combed surface 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 BC, in the local EB II (ESL 4) (Fig. 4), in some instances already at the EB I/EB II transition³³ (ESL 3, *ca.* 3150–3100/3050 BC), and they continued during the EB III (ESL 5). Also in the central Levant, combed vessels appeared during the local EB II (Early Coastal Levant 2, henceforth ECL), around the same time as in the south, possibly slightly later³⁴. During this stage, such containers were documented to the south of Tell ‘Arqa, where they began to be attested for

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 true 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).

only from the EB II/III transition³⁵. In contrast to the southern Levant, the production continued after 2500 BC, in the EB IVA (ECL 5) and EB IVB (ECL 6) and, contemporarily to these stages, vessels with combed surface appear 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 sites³⁶. Vessels of this type found in contexts of the Dynasty 0 and 1st Dynasty might originate from both the southern and the central Levant³⁷. 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 from the central Levant, which was the main economic partner for Egypt as a supplier of Levantine products in this period³⁸. 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 transport³⁹.

As already stressed by several scholars⁴⁰, 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, vessels are grouped together that shared the combed treatment on their surfaces, but were characterised by heterogeneous fabrics, manufacturing techniques and formal features, and these show regional and chronological differences⁴¹. They were in fact produced by several similar – but differentiated – ceramic industries active across the Levant. These show degrees of independent development, and each also manufactured other vessel types, both open and close shapes, that demonstrate diverse surface treatments, such as burnishing⁴². Among these larger manufactures, the “North Canaanite Metallic Ware”⁴³ is included, as well as similar “Metallic Ware” types with burnished surface on the Lebanese coast⁴⁴. Further combed vessels made of local fabrics were widespread in the Levant⁴⁵, such as the “South Canaanite Lime-Coated Ware”, a production typical of the central and southern part of the southern Levant during EB III and characterised by vessels mostly distinguished by a lime coating applied after firing⁴⁶. Focusing on 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 production⁴⁷.

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 Yerah (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.

3.2 The combed pottery from Khirbet ez-Zeraqon

Combed vessels are documented at Khirbet ez-Zeraqon during the EB II-IIIa: while combed jars and pithoi are present in the ceramic repertoire throughout the three phases, the spouted vats with two vertical loop handles are absent in the earliest stage⁴⁸. Through time, the absolute number of stratified vessels and sherds with combed surface increases from the earlier to the later stage of occupation⁴⁹. 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 combing⁵⁰. These 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 characterized 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 surface 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 d⁵⁴. 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 the diagnostic pottery from the three phases, representing almost 50% of the corpus, while Ware g represents only about the 12%, and Ware d the 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 horizon⁵⁷. Ware g is a highly fired ware, made of a fine orange to reddish and grey fabric, with many small mineral inclusions (0.2-2 mm), the thicker sherds have a reduced grey 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 vats⁵⁹. 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 surface⁶⁰. Ware c is a highly fired beige to red fabric with many fine mineral inclusions (0.2-1 mm), and Ware d is very similar, sometimes greyish with many medium-fine mineral inclusions (0.5-1 mm)⁶¹. Ware

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 jars 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.

c has been considered as largely associated with open shapes, vats⁶², and closed shapes such as pithoi, especially those with vertical combing and applied plastic rope decoration, and with a vast number of jars, some of which show horizontal-plus-vertical combing⁶³, as documented by items found *in situ* below the collapse layers of the late horizon⁶⁴. Similarly, Ware d jars, some of which have a combed surface, mostly come from contexts of the last stage of occupation of the site⁶⁵.

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 sites, including both complete/restorable vessels and single pottery sherds⁶⁶ mostly consisting of jars and pithoi. Examples of bowls, platters, and one hole mouth pot were also included, characterised by diverse surface treatments other than combing, such as burnishing and painting (Tab. 1). The jars and pithoi comprised in the study were correlated by Genz with Wares g, c, and d, all the open shapes with Ware g, while a hole-mouth jar with Ware j2⁶⁷, which is never associated with combing at the site. This full repertoire was considered in order to contextualise the combed containers within the broader spectrum of ceramic production documented at the site. As for the vessels with combed surface, these include eight restorable vessels, as well as twelve rim sherds of pithoi that, from a typological viewpoint (Type L3) are likely to have come from vessels bearing combing⁶⁸. As for the find contexts, the majority of the material analyzed (26 examples), including all the restorable vessels, is dated to the late horizon, and come 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

The analysis of the selected samples was undertaken through ceramic petrography with the aim of reassessing the conclusions of their typological/macrosopic study along three specific lines of enquiry. The goals of these analyses were as follows:

- 1) To better inform our understanding of raw material preferences, manufacturing processes, firing temperature, degrees of standardization and the level of the centralization of production of these vessels during the EB II and EB III. A key aspect of this study was to gain an understanding of how the variability in wares, as observed macroscopically, can be linked to their composition. Moreover, this study offers evidence to investigate the changes observed between the EB II-III and EB IV ceramics from the site through the analysis of petrographic-sections.

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 red slip or by red painting strips (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.

- 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 in 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, Quinn and Klein and Philpotts⁶⁹. The measurement and quantification of the aplastic fraction of each sample and grain measurements were completed using the digital image analysis software, Jmicrovision⁷⁰. Tiled images of an area on each thin-section measuring 1 cm² 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 assemblage⁷¹. 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 EB II-III sub-fabrics are here labelled 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.

4.3.2 Results of the Petrography

The petrographic analysis of the EB II-III ceramic materials shows the existence of two distinct categories of petrofabrics and preparations. The first is a quartz-calcareous-basalt fabric and the second is 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 transition⁷². 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. Additionally, the 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 in general, suggesting a significant break with later ceramic traditions at the site, even if in some cases vessels were manufactured using similar locally-available materials⁷³.

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). Three sub-fabrics were identified (1A, 1D, and 1E). Fabric 1 was used for jars and pithoi and by and large it maps mostly on to the main macroscopic Ware groups c and d. Most of the 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 crystalline b-fabric is observed. The groundmass is sometimes well-sintered and elongate channel voids can occur. Fabric 1 samples are

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.

composed of a similar suite of aplastic inclusions. The three subfabrics 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 occurred most commonly (5-10%). Fossiliferous chalks occurred occasionally. Fine to medium sand sized grains of basalt occurred commonly (3-5%). These were mostly subangular to subhedral and rarely were rounded with finer texture. The basalts were 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% in others. Fine sand sized grains of chert (1-2%) can also occur. Grains of fine sand sized calcite occurred rarely, often exhibiting zoning. Rarely, rounded red optically active fine sand sized grains occurred, which were in high relief. These bodies are clay rich and are likely glauconite, chlorite, or some form of iddingsite.

Subfabric 1A is represented by only 1 sample, and is relatively coarse, but contains very little silty quartz when compared to 1D and 1E. The sample is 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 subfabrics 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. The samples of fabric 1D 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: The Shale Fabrics

The fabric group “shale fabrics”, consists 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 petrofabric are composed of closely related materials but can be divided into two main fabrics 6 and 7. Fabric 6 (Fig. 6), represented by only 3 samples, consists of white firing shales. Fabric 7 is composed of reddish-firing shales is represented by 11 samples. Fabric 7 (Fig. 7) can be divided into two subfabrics (7A and 7B) with 7B presenting much more fine-sand and silty quartz, (similar in quantity to Fabric 1E), but the subgroups are otherwise quite similar. All samples belonging to these fabrics contained fine-grained moderate to coarse sand sized shales or argillaceous rock fragments (ARFs), which occurred moderately in the samples 10-25%. They were 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 a number of these samples indicated that an iron content of 5-10% is frequent⁷⁴. A fraction of non-iron bearing shales, probably composed of kaolinite, can be found in some samples, though these are dominant 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 that takes place along the long axis of many of the elongated ARFs. The elongated shales often show a preferred orientation. Well-rounded grains of quartz that were found in both spherical and more elongated shapes occurred 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 do occur. Many samples contained 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 occurred in trace amounts.

⁷⁴ Badreshany 2013; Badreshany *et al.* 2020.

Fabric group 6 is represented by 3 samples, including two pithoi and a hole-mouth pot. Fabric group 7 is represented by 11 samples, mostly consisting of pithoi, with only one jar and two bowls amongst them. The samples are found throughout the EB II-III A, but the items from late horizon contexts are residual sherds and one restorable pithos, which might be a long-lived heirloom. On the other hand, if those four items were actually produced during the late horizon, vessels made of Fabric 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, however they are found to a much lesser degree, in the central Levant at least, at Tell 'Arqa and Tell Koubba in EB III phases, but their usage is restricted to fine-ware jugs⁷⁵.

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 utilized on bowls and platters, though the samples include two jars and one pithos. The fabric occurs throughout the EB II-III A at the site. All samples of this fabric are composed of a clay-rich groundmass rich in microcrystalline calcite that in most cases has an optically active crystalline 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 occur that are elongated. Pieces of carbonate rock, micritic mudstone (dunham classification) or fossiliferous cherts occur occasionally (1-5%) in the samples. Rounded to subangular fine to coarse sand sized grains of quartz with a moderate to high sphericity occurred 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, examples are found that 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) occurred rarely. Sandstones and rounded grains of fine sand sized calcite occur rarely. Trace amounts of microcline are noted. Fine-grained moderate to coarse sand sized shales and other discrete iron oxide bodies occurred rarely in the samples. They were most commonly elongate and highly rounded. They often contain coarse silt sized quartz and carbonate grains. Trace amounts of silt-sized grains of zircon occurred in some samples.

Fabric 9: Silty Quartz-Calcareous-fine-grained basalt fabric

Fabric 9 is only represented by one sherd of a jar 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.

4.4 Provenance, Comparative Petrography and Technological Considerations

The petrographic analyses demonstrate that the majority of samples were made utilizing a similar set of ingredients – calcareous clays and limestone, basalt, and fine-sand and silty quartz tempers. Shale-wares are also utilized 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 subfabrics, suggest a high degree centralization in the dominant modes of production utilized to make these

⁷⁵ Jean 2020.

vessels during the EB II-III A. Most of the fabrics are represented by several examples 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 pots⁷⁶.

In terms of provenance, Fabric 1 is consistent with materials available in the area surrounding Khirbet ez-Zeraqon⁷⁷ and a similar fabric was used during the EB IV, suggesting that the fabric represents a 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 Yerah, although they occur less commonly at that site⁷⁸. A larger programme of geoprospection around Khirbet ez-Zeraqon and petrographic and geochemical analyses focused on EB II-III A 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 by Badreshany *et al.* 2020, who also showed they share a geochemical signature. Badreshany *et al.* proposed itinerant production modes for these shale-derived wares in order to explain the distribution of very large vessels made in this material, that occur at quite some distance from the required clay sources⁷⁹. 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, which is 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 is non-local. Unlike the pithoi made of shale, the majority of vessels produced of Fabric 8 are smaller bowls and platters that could have been transported more easily over a distance. Another feature of the Fabric 8 vessels are the well-rounded fragments of quartz used as temper, which suggests a beach sand, from a coastal, lacustrine, or riparian environment. Quartz-rich fabrics are described at Tell el-Farah⁸⁰ 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 coast⁸¹, however 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

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.

vessels may have been fired towards the higher end of this spectrum. These temperatures are in line with those noted by other commentators studying ceramics of the period⁸².

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), which increases in quantity through time and becomes more common into the EB III. This mirrors the trajectory described for the central⁸³ and the southern Levant⁸⁴, where ceramics produced utilizing 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.

4.5 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, and secondly for pithoi. Of the two sets of non-local materials, the shale-rich fabrics (Fabrics 7 and 6) were prevalently used for storage and – less often – for transport vessels, with relatively few open shapes⁸⁶, while the quartz-rich fabric (Fabric 8) is largely employed for bowls and platters with burnished surfaces (Tab. 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, the majority of 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 hole-mouth pot HZ87-338. The ceramic industry that used local clays was especially active in the production of storage and transport jars that were 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 towards 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 on the one hand with Genz’s classification, which pinpointed that Ware g was prevalently associated with pithoi and bowls⁸⁷, but also suggest that his Ware g incorporates at least two

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 are used for bowls and platters also at Tel Beth Yerah (Greenberg and Iserlis 2014, 59-50).

⁸⁷ Genz 2002, Tab. 7.

different production types both using non-local materials, namely the shales (Fabrics 6 and 7) and the quartz-rich (Fabric 8) fabrics.

4.6 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. Differently, 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 their abandonment at the site leading to its burial beneath the collapse of the city⁸⁸.

5 – Discussion: the combed vessels within the EB II-III ceramic industries at Khirbet ez-Zeraqon and in the Levantine context

In line with other recent studies, also the petrographic analyses of the ceramic repertoire from Khirbet ez-Zeraqon revealed that the combed vessels were parts of a larger pottery production, which included diverse types of shapes and surface treatments. Most of the restorable combed containers analysed 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 produce vessels characterised by other surface treatments as well, such as burnishing. This might suggest that the surface treatments were linked more to shapes than to fabrics. In any case, it is apparent that there was not a unique relationship between fabrics and surface treatments.

Contextualising the data regionally, the developments through time identified by the petrographic characterisation 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 numerous, and distinct, local outcrops in the various sub-regions⁸⁹. Differently, at least two different main sets of shale-rich clays, from the Lower Cretaceous outcrops of the Lebanon and Anti-Lebanon Mountains and surrounding areas⁹⁰, were used respectively in the Bekaa area, and along the coastal Lebanon and Jordan Valley⁹¹. The shale group of this latter region matches with the subfabric 7B at Khirbet ez-Zeraqon, characterised by fine-sand and silty quartz⁹². This composition supports the production of vessels with high-quality technological features, as further types of shale clays as well, 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

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).

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 specialised producers. These might have been active close to the few locations of the shale clays outcrops⁹³, or they might have operated in an itinerant way⁹⁴ (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 characterised the EB II-III ceramic inventory of the near site of Tel Beth Yerah, which finds great similarities to the one of Khirbet ez-Zeraqon⁹⁵. At Tel Beth Yerah, the shale clays, which were largely present in the local Period C and used for the same type of vessels as the calcareous fabrics - including combed containers⁹⁶, were almost completely replaced by the latter fabrics in the following Period D⁹⁷. This does not seem to happen at Khirbet ez-Zeraqon, and this may result from the nature of the remains analysed, which consisted of residual single sherds and a complete pithos that could have been an heirloom from previous generations (§ 4.6). On the other hand, such evidence might be due 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 in light of the short duration of the settlement as a whole, and its abandonment now placed at the beginning of the EB IIIA⁹⁸. On a broader level, the decrease over time in shale fabrics, and the concomitant increase in those made using material available locally, is consistent with patterns visible across much of Levant, with shale-rich fabrics being mostly used during the EB II in relatively centralised modes of production, while diverse local fabrics becoming progressively more predominant in the EB III⁹⁹. At northern sites of the southern Levant, such as Dan, most of the EB II ceramic assemblage consisted of vessels made of shale fabrics¹⁰⁰, and at Tell Koumba and Fadous-Kfarabida, the calcareous fabrics predominated in EB III¹⁰¹. At Tell 'Arqa, combed jars were not documented during the EB II (Phase T – ECL2), and their production began from the EB II/III transition (Phase S – ECL3), made exclusively with limestone fabrics, and representing the only type of jars and pithoi produced at the site from this phase onward¹⁰². The gradual replacement of the shale fabrics by calcareous ones was not associated in central Levant with any technological

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 Yerah, 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). For Phase C in area EY, at the southern side of the settlement, evidence of a ceramic industry was uncovered that employed local fabrics for manufacturing shapes 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 Bet Yerah, 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).

change. In fact, the manufacturing process was characterised by a certain continuity, consistent with the existence of specialised 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 homogeneity¹⁰³. 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 III¹⁰⁴. 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. Following a gap in the documentation that corresponds to the 2nd and the 3rd Dynasties, the large variety of southern Levantine pottery of the previous periods disappeared, while the combed jars from the central parts of the Levant coast became the typical Levantine containers found in Egypt from the 4th Dynasty.¹⁰⁵

6- Conclusions

During the late fourth and third millennia BC, Levantine ceramic manufacturing associated with combed vessels undertook transformations, with the gradual replacement of shale-rich fabrics by locally-sourced material and the multiplication of the production centres, also further south than in the early stages¹⁰⁶. In this broader scenario, the site of Khirbet ez-Zeraqon offers further evidence on the Transjordanian industries of combed storage and transport jars. In fact, following the recent chronological reassessment of the EB II-III stratigraphic sequence at the site, it is possible to date the occupation of the permanent settlement in the EB II and the very beginning of the EB III. 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, respectively using shale-rich clays and quartz-and-limestone ones. As in the rest of the Levant, these fabric types are 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 subfabric 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 were used more frequently during the last stages of occupation. This is consistent with the broad development of the ceramic production in the Levant. Moreover, comparing the EB II-III materials from Khirbet ez-Zeraqon to those of the EB IV yields 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

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 a specialised production of combed jars made with iron-rich calcareous clays originating from the area around Byblos. 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.

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 in the broader scenario of the 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.

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References

- Badreshany, Kamal, Graham Philip, and Melissa Kennedy. 2020. "The development of integrated regional economies in the Early Bronze Age Levant: new evidence from 'Combed Ware' jars." *Levant* 52:1-2, 160–196.
- Badreshany, Kamal, Sowada, Karin, Ownby, Mary, Jean, Mathilde, de Vreeze, Michel, McClymont, Alice and Philip, Graham. 2022. "The characterisation of ceramic production from the central Levant and Egyptian trade in the Pyramid Age." *Journal of Archaeological Science: Report* 41: 103309. <https://doi.org/10.1016/j.jasrep.2021.103309>
- Ben-Tor, Amnon, and Ruhama Bonfil. 2003. "The Stratigraphy of the Early Bronze Age II–III." In Amnon Ben-Tor, Ruhama Bonfil, and Sharon Zuckerman (eds.), *Tel Qashish: A Village in the Jezreel Valley; Final Report of the Archaeological Excavations (1978–1987)*. Qedem Reports 5, 61–124. Jerusalem: The Israel Exploration Society.
- Botticelli, Michela, Silvano Mignardi, Caterina De Vito, Maura Sala, Giacomo Mazzotta, Leticia Da Silva Gondim, and Laura Medeghini. 2022. "The 'metallic ware' from Tell el Far'ah North (West Bank): Petrography, technology, and provenance of a hidden ceramic industry." *Ceramics International* 48:1: 1366–1374. <https://doi.org/10.1016/j.ceramint.2021.09.222>
- D'Andrea, Marta. 2020. "The Religious Complexes of Megiddo and Khirbet ez-Zeraqon and the Early Bronze Age Interregional Connectivity." *Studa Eblaitica* 6: 1–39.
- D'Andrea, Marta, Khaled Douglas, Hermann Genz, and Kamal Badreshany. 2022. "The 'post-urban' occupation at Hirbet ez-Zeraqon, Jordan: new insights into the Early Bronze Age IV on the northern plateau." *ZDPV* 138.

- Deckers, Katleen, Simone Riehl, Valentina Tumolo, Hermann Genz, and Dan Lawrence. 2021. “Intensive olive production at Levantine sites. New data from Fadous-Kfarabida and Khirbet-ez Zeraqon.” *Journal of Archaeological Science: Report*: <https://doi.org/10.1016/j.jasrep.2021.102841>.
- de Miroschedji, Pierre. 2021. “On Early Bronze Age Levantine combed vessels: the view from the south.” *Levant* 53:1: 30–68.
- Douglas, Khaled. 2007. *Die Befestigung der Unterstadt von Ḥirbet ez-Zeraqōn im Rahmen der frühbronzezeitlichen Fortifikation in Palästina*. ADPV 27.3. Wiesbaden: Harrassowitz Verlag.
- Douglas, Khaled. 2011. “Beyond the City Walls: Life Activities Outside the City Gates in the Early Bronze Age in Jordan; Evidence from Khirbet ez-Zeraqon.” In Meredith S. Chesson, Walter Aufrecht, and Ian Kuijt (eds.), *Daily Life, Materiality, and Complexity in Early Urban Communities of the Southern Levant: Papers in Honor of Walter E. Rast and R. Thomas Schaub*, 3–21. Winona Lake, IN: Eisenbrauns.
- Genz, Hermann. 2001. “Early Bronze Age Potmarks from Khirbat az-Zayraqūn: some aspects concerning their meaning.” *Studies in the History and Archaeology of Jordan* VII: 217–228.
- Genz, Hermann. 2002. *Die frühbronzezeitliche Keramik von Ḥirbet ez-Zeraqōn. Mit Studien zur Chronologie und funktionalen Deutung frühbronzezeitlicher Keramik in der südlichen Levante*. ADPV 27.2; Wiesbaden: Harrassowitz Verlag.
- Genz, Hermann. 2010. “Thoughts on the Functions of ‘Public Buildings’ in the Early Bronze Age Southern Levant.” In Bolger, Diane and Louise. C. Maguire (eds.), *Development of Pre-State Communities in the Ancient Near East: Studies in Honour of Edgar Peltenburg*. BANEA monograph Series, Vol. 2, 46–52. Oxford: Oxbow Books.
- Genz, Hermann, Riva Daniel, Konstantin E. Pustovoytov, and Marshall Woodworth. 2011. “Excavations at Tell Fadous-Kfarabida. Preliminary report on the 2011 season of excavations.” *BAAL* 15: 151–174.
- Greenberg, Raphael. 2011. Travelling in (World) Time: Transformation, Commoditization, and the Beginnings of Urbanism in the Southern Levant. In Toby C. Wilkinson, Susan Sherratt and John Bennet (eds.), *Interweaving Worlds. Systemic Interactions in Eurasia, 7th to 1st Millennia BC. Papers from a conference in memory of Professor Andrew Sherratt*, 231–242. Oxford: Oxbow Books.
- Greenberg, Raphael. 2017. “No Collapse: Transmutations of Early Bronze Age Urbanism in the Southern Levant.” In Felix Höflmayer (ed.), *The Late Third Millennium in the Ancient Near East. Chronology, C14, and Climate Change*. The Oriental Institute of the University of Chicago, Oriental Institute Seminars 11, 73–85. Chicago: University of Chicago.
- Greenberg, Raphael, and Mark Iserlis. 2014. “The Early Bronze Age Pottery Industries.” In Raphael Greenberg (ed.), *Bet Yerah, The Early Bronze Age Mound, Volume II: Urban Structure and Material Culture 1933–1986 Excavations*. Edited by. IAAR 54, 53–149. Jerusalem: Israel Antiquities Authority.
- Greenberg, Raphael, and Mark Iserlis. 2020. “A Note on First Dynasty Egypt, Tel Bet Yerah, and the Origins of Commodity Exchange on the Levantine Seaboard.” *Journal of Ancient Egyptian Interconnections* 27: 38–50.

- Greenberg, Raphael, Sarit Paz, David Wengrow, and Mark Iserlis. 2012. "Tel Bet Yerah: Hub of Early Bronze Age Levant". *Near Eastern Archaeology* 75: 88–107.
- Greenberg, Raphael, and Naomi Porat. 1996. "A Third Millennium Levantine Pottery Production Center: Typology, Petrography, and Provenance of the Metallic Ware of Northern Israel and Adjacent Regions." *BASOR* 301: 5–24.
- Hartung, E. Ulrich, Christiana Köhler, Vera Müller and Mary F. Ownby. 2015. "Imported Pottery from Abydos: a new Petrographic perspective." *Ägypten und Levante / Egypt and the Levant* Vol. 25: 295–333.
- Hewett, Zarina, Michelle de Gruchy, Daniel Hill, and Dan Lawrence. 2022. "Raincheck: A new diachronic series of rainfall maps for Southwest Asia over the Holocene". *Levant*, 54:1: 5–28.
- Höflmayer, Felix, Michael W. Dee, Hermann Genz, and Simone Riehl. 2014. "Radiocarbon Evidence for the Early Bronze Age Levant: Tell Fadous-Kfarabida (Lebanon) and the End of the Early Bronze III Period." *Radiocarbon* 56: 529–42.
- Ibrahim, Muawiyah M., and Siegfried Mittmann. 1987. "Tell el-Mughayyir and Khirbet Zeiraqoun." *Newsletter of the Institute of Archaeology and Anthropology, Yarmouk University Irbid* 4: 3–6.
- Ibrahim, Muawiyah M., and Siegfried Mittmann. 1988. "Khirbet ez-Zeraqon Excavations." *Newsletter of the Institute of Archaeology and Anthropology, Yarmouk University Irbid* 6/2: 7–9.
- Ibrahim, Muawiyah M., and Siegfried Mittmann. 1989. "Zeiraqon (Khirbet el)." In Denyse Homès-Fredericq and John Basil Hennessy (eds.), *Archaeology of Jordan: II 2; Field Reports; Sites L–Z*. Akkadica Supplement 8, 641–46 Leuven: Peeters.
- Ibrahim, Muawiyah M., and Siegfried Mittmann. 1991. "Excavations at Khirbet ez-Zeraqoun 1991." *Newsletter of the Institute of Archaeology and Anthropology, Yarmouk University Irbid* 12: 3–5.
- Ibrahim, Muawiyah M., and Siegfried Mittmann. 1994. "Excavations at Khirbet ez-Zeraqon, 1993." *Newsletter of the Institute of Archaeology and Anthropology, Yarmouk University Irbid* 16: 11–15.
- Ibrahim, Muawiyah M., and Siegfried Mittmann. 1997. "Zeiraqon, Khirbet el." In Eric M. Meyers (ed.), *The Oxford Encyclopedia of Archaeology in the Near East* vol. 5, 388–89. Oxford: Oxford University Press.
- Iserlis, Mark, Daniel Steiniger, and Raphael Greenberg. 2019. "Contact between first dynasty Egypt and specific sites in the Levant: New evidence from ceramic analysis." *Journal of Archaeological Science: Reports* 24: 1023–1040.
- Jean, Mathilde. 2020. "Pottery production at Tell Arqa (Lebanon) during the 3rd millennium BC: preliminary results of petrographic analysis." *Levant* 52:1–2, 136–159.
- Kamlah, Jens. 2000. *Der Zeraqōn–Survey 1989–1994. Mit Beiträgen zur Methodik und geschichtlichen Auswertung archäologischer Oberflächenuntersuchungen in Palästina*. Abhandlungen in des Deutschen Palästina-Vereins 27,1. Wiesbaden: Harrassowitz Verlag.

Klein, Cornelius, and Philpotts, Anthony. 2013. *Earth materials. Introduction to mineralogy and petrology*. Cambridge: Cambridge University Press.

Lawrence, Dan, Graham Philip, and Michelle de Gruchy. 2021. "Climate change and early urbanism in Southwest Asia: A review." *WIREs Climate Change*, e741. doi: <https://doi.org/10.1002/wcc.741>

Lebeau, Marc, and de Miroschedji, Pierre. 2013. "Foreword." In Marc Lebeau (ed.), *Arcane Interregional. Ceramics*. Arcane Interregional vol. I, ix–xi. Turnhout: Brepols.

Medeghini, Laura, Maura Sala, Caterina De Vito, and Silvano Mignardi. 2019. "A forgotten centre of ceramic production in Southern Levant: Preliminary analytical study of the Early Bronze Age pottery from Tell el-Far'ah North (West Bank)", *Ceramics International* 45: 9: 11457–11467. <https://doi.org/10.1016/j.ceramint.2019.03.013>

Mittmann, Siegfried. 1970. *Beiträge zur Siedlungs- und Territorialgeschichte des Nördlichen Ostjordanlandes*. Abhandlungen des Deutschen Palästina-Vereins 2. Wiesbaden: Harrassowitz Verlag.

Mittmann, Siegfried. 1994. "Hirbet ez-Zeraqon: Eine Stadt der frühen Bronzezeit in Nordjordanien." *Archäologie in Deutschland* 2: 10–15.

Mohd, Bassem Khalil. 1997. *Geological Map of Irbid 3155 II 1:50000*. Hashemite Kingdom of Jordan: Natural Resources Authority Geological Directorate.

Quinn, Patrick Sean. 2013. *Ceramic petrography. The interpretation of archaeological pottery and related artefacts in thin section*. Oxford: Archaeopress.

Regev, Joanna, Pierre de Miroschedji, Raphael Greenberg, Eliot Braun, Zvi Greenhut, and Elisabetta Boaretto. 2012a. "Chronology of the Early Bronze Age in the Southern Levant: New Analysis for a High Chronology." *Radiocarbon* 54: 525–66.

Regev, Johanna, Pierre de Miroschedji, and Elisabetta Boaretto. 2012b. "Early Bronze Age Chronology: Radiocarbon Dates and Chronological Models from Tel Yarmuth (Israel)." *Radiocarbon* 54: 505–24.

Regev, Johanna, Sarit Paz, Raphael Greenberg, and Elisabetta Boaretto. 2020. "Radiocarbon chronology of the EB I–II and II–III transitions at Tel Bet Yerah, and its implications for the nature of social change in the southern Levant." *Levant*: DOI: 10.1080/00758914.2020.1727238

Riehl, Simone, Reid Bryson, Konstantin E. Pustovoytov. 2008. "Changing growing conditions for crops during the Near Eastern Bronze Age (3000-1200 BC): the stable carbon isotope evidence." *Journal of Archaeological Science* 35: 1011–1022.

Roudit, Nicholas. JMicroVision: un logiciel d'analyse d'images pétrographiques polyvalent. Genève.

Sowada, Karin. 2020. "Perspectives on Egypt in the Southern Levant in Light of the High Early Bronze Age Chronology." In Suzanne Richard (ed.), *New Horizons in the Study of the Early Bronze III and Early Bronze IV in the Levant*, 149–168. University Park, Pennsylvania: Eisenbrauns.

- Sowada, Karin, Mary Ownby, and Anna Wodzińska. 2020. “The petrography of imported Levantine Combed vessels from early Old Kingdom Giza.” *Levant* 52: 1-2, 197–214.
- Sowada, Karin, Mary Ownby, and Miroslav Bárta, 2021. “The Origin of Imported Jars from 6th Dynasty Abusir: New Light on Early Bronze Age Egyptian-Levantine Relations.” *Bulletin of American Society of Overseas Research* 386: 221–236. 000-000. 10.1086/715651.
- Stoops, Georges. 2003. *Guidelines for analysis and description of soil and regolith thin sections*. Madison: Soil Science Soc. of America.
- Thalmann, Jean-Paul. 2013. “Le Lion, la Chèvre et le Poisson. À propos d’une Jarre à empreintes de sceaux-cylindres de Tell Arqa (Liban).” *Syria* 90, 255–312.
- Thalmann, Jean-Paul, and Karin Sowada. 2013. “Levantine “Combed Ware.” In Marc Lebeau (ed.), *Arcane Interregional. Ceramics*. Arcane Interregional vol. I, 323–346. Turnhout: Brepols.
- Tumolo, Valentina. 2019. “The Early Bronze Age Seal Impressions on Jars from Ḥirbet ez-Zeraqōn. Preliminary Remarks on Pottery and Images.” *Studia Eblaitica* 5: 35–56.
- Tumolo, Valentina, and Felix Höflmayer. 2020. Khirbet ez-Zeraqon and Early Bronze Age chronology revisited, in: Suzanne Richard (ed.) *New Horizons in the Study of the Early Bronze III and Early Bronze IV in the Levant*, 249–264. University Park; Pennsylvania: Eisenbrauns.
- Vacca, Agnese, and Marta D’Andrea. 2020. “The Connections Between the Northern and the Southern Levant During Early Bronze Age III: Reevaluations and New Vistas in Light of New Data and Higher Chronologies, in: Suzanne Richard (ed.) *New Horizons in the Study of the Early Bronze III and Early Bronze IV in the Levant*, 120–145. University Park; Pennsylvania: Eisenbrauns.
- Welton, Lynn, Emily Hammer, Michelle de Gruchy, and Dan Lawrence. Forthcoming. “A Multi-Proxy Reconstruction of Anthropogenic Land Use in Southwest Asia at 6 kya: Combining Archaeological, Ethnographic and Environmental Datasets”. *Holocene*.
- Zuckerman, Sharon. 2003. “The Early Bronze Age II–III Pottery.” in *Tel Qashish: A Village in the Jezreel Valley; Final Report of the Archaeological Excavations (1978–1987)*. Edited by Amnon Ben-Tor, Ruhama Bonfil, and Sharon Zuckerman. Qedem Reports 5, 130–64. Jerusalem: The Israel Exploration Society.