IRON AGE PHOENICIAN POTTERY AT TEL ACHZIV: TWO COMMERCIAL SNAPSHOTS BASED ON OPTICAL MINERALOGY

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Abstract: Our research focuses on Phoenician containers at Tel Achziv from two periods: Ir1|2-Ir2a and Ir2c and on some Phoenician production and consumption customs. Two primary assemblages of the most typical ceramic containers circulating within Phoenicia and distributed elsewhere throughout the Iron Age were selected for technological and provenance analysis using Optical Mineralogy analysis (ceramic petrography). During the Ir1|2-Ir2a the main circulating containers were small decorated flasks and Phoenician Bichrome jugs. In Ir2c the prevailing circulating containers were entirely different: carinated-shoulders transport jars were the prevalent commercial ceramic containers of the maritime markets of the Eastern Mediterranean. At Achziv, in both periods, vessels of two main production centers were identified: the local production of the coast of Western Galilee and imports from the Southern Lebanese Coast. Technological observation of production show the use of a variety of clay recipes as well as different firing temperatures applied. We offer here a snapshot of maritime commercial containers specifically produced to accommodate different commodities within the complex Phoenician exchange systems.

Keywords: Phoenician pottery; Phoenician Trade; Iron Age; Petrography; Optical Mineralogy; Ceramic Technology

1. Introduction

Iron Age Phoenician pottery of the Levant has usually been studied as one ensemble, with little regard to the way(s) specific sites may have differed (or not) in the ceramics they produced and used. This has clouded a plethora of cultural phenomena that could have been revealed by this pottery, such as localized cultural preferences/idiosyncrasies, symbolic expressions, specific ceramic exchange networks among the Phoenician sites and between them and other regions, and more. This is all the more acute since, as widely acknowledged but still all too often disregarded, "Phoenician" is a late construct, and the value of the application of this inclusive epithet to the Iron Age Levant has to be argued for rather than taken for granted.

Surprisingly, provenance analyses of Iron Age pottery in Lebanon are practically nonexistent.[1] Recent scholarship has started to change the picture mainly regarding the region we term Southern Phoenicia, the area south of Lebanon, within modern Israel – from the Ladder of Tyre (Rosh Ha-Niqrah/Ras al-Naqoura) to Israel's Carmel coast (Fig. 1). Based on fabric analysis of large ceramic assemblages – mainly optical mineralogy – it has been shown, for example, that the most extensively circulating transport containers in *early* Iron Age Phoenicia were small flasks and not the quintessential "Phoenician Bichrome" jugs that are usually considered the Phoenician commercial containers *par excellence*, and not transport jars; that such flasks (or rather, of course, their contents) were intensively consumed at Philistine temples; that Dor, on Israel's Carmel coast, was a main producer, perhaps the main producer of such vessels and of "Phoenician Bichrome"

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1 But see Miguel Gascón – Buxeda i Garrigós 2013; Schmitt – Badreshany – Tachatou forthcoming.

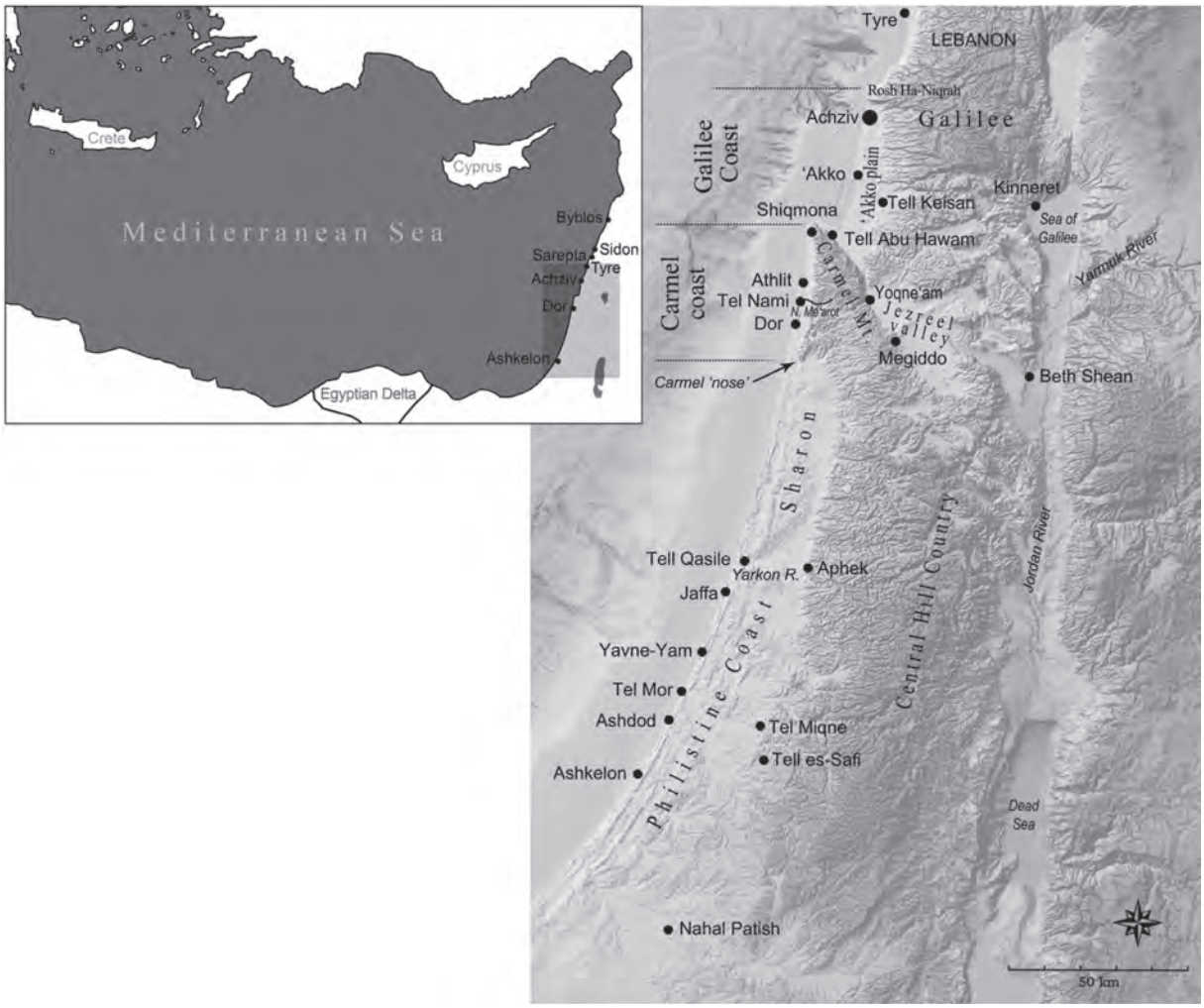

Fig. 1. Location Map (Anat Regev-Gisis, The Zinman Institute of Archaeology, University of Haifa)

containers; that the latter ware also produced in Western Jezreel Valley sites, not normally considered "Phoenician"; that the main suppliers of both small flasks and Bichrome containers (and their contents) to Cyprus were Dor and one or more yet unidentified sites in the Tyre/Sidon stretch and that other "Phoenician" regions are hardly represented in Cyprus.[2]

Our aim in this paper is to integrate into this picture Phoenician pottery from Tel Achziv, another major site in Southern Phoenicia. In its ceramics and in other cultural phenomena, this site is very similar to polities in southern Lebanon, especially Tyre.

2 For all these issues, see mainly Bikai 1987a; 1987b; Karageorghis – Iacovou 1990, p. 90; Gilboa – Sharon – Boaretto 2008; Gilboa – Goren 2015; Gilboa – Namdar 2015; Gilboa – Waiman-Barak – Sharon 2015; Hancock – Harrison 2004, Table 2, nn. 5, 8-10, 80; Arie – Buzaglo – Goren 2006, pp. 562-563; Arie 2011, pp. 332, 341, 342, figs. 8. 2:4; 8. 7:8; Waiman-Barak 2016; Waiman-Barak – Gilboa 2016; all with references to earlier studies.

2. Tel Achziv (Achzib) and its Iron Age – A Very Short Introduction

Tel Achziv (Tell ez-Zib)[3] is a medium-sized mound (5.5-7.0 hectares), situated on a sandstone (*kurkar*) ridge overlooking the Mediterranean coast of upper Galilee, ca. 25 km south of Tyre. Today it is in the north of modern Israel, ca. 6 km south of the Lebanon/Israel border, the Rosh Haniqra/Ras Al-Naqoura ridge. Regarding the Iron Age, the site is best known for the cemeteries flanking it.[4] The modes of inhumation and cremation burials in them, various other burial practices, and the ceramics related to the burials closely associate Achzib with the Iron Age societies of south Lebanon.[5] They also suggest that occupation at the site lasted from the Ir1|2 transition to Ir2c, which parallel Early Age Iron IIA to Iron Age IIC in the Southern Levant. In absolute terms this would mean from ca. the second half of the 10th century BCE (depending on one's stance in the debate regarding Iron Age Levantine chronology) to a certain point in the 7th century. Though the use of several tombs at Achzib was claimed to extend into the 6th century – the Neo-Babylonian period,[6] this to our minds still requires an explicit demonstration.

Achzib's political status and that of the upper Galilee coast in general, and the processes through which this region became "Phoenician" are not agreed upon and this issue will not be discussed here. It is commonly assumed that at a certain point in the Iron Age, either in the 11th century, or in the 10th century in the days of Hiram of Tyre,[7] or even later, this region came under Tyrian domination.[8]

Excavations on the mound itself, carried out by Moshe Prausnitz in 1963-1964, have never been published beyond short notes and are currently being prepared for publication.[9] Prausnitz (in collaborataion with Sabatino Moscati in 1963) excavated four main areas on the mound, including three cist tombs in Area E (Fig. 2).[10] Since 2013 the mound is excavated anew by an expedition headed by Yifat Thareani and Michael Jasmin.[11]

3. Ceramic Assemblages Investigated in the Present study

In our study of Tel Achziv ceramics we aim at fabric analyses that also provide some quantitative perspective in order to try to define phenomena of some regularity and not random occurrences. We thus chose two relatively large primary assemblages representing *grosso modo* the two extremities of the Iron Age and to a large extent also the main ceramic categories that were most frequently exchanged in their respective periods.

Our "early" assemblage comprises 23 Phoenician Bichrome and Phoenician monochrome-black vessels[12] (Fig. 3, Table 1), originating in two rather rich built cist tombs (nos. 1015, 1029) excavated by Moshe Prausnitz in 1963 during his first season on the *tell*. They were unearthed in Area E on the *tell*'s eastern slope (see Fig. 2) and to date are only preliminarily published.[13] By the pottery in them (partly still unpublished)

3 These are the names of the mound in Hebrew and Arabic, respectively. The ancient name of the site is transliterated Achzib.

4 Chiefly Mazar 2001; 2004; 2013; Dayagi-Mendels 2002.

5 Cfr. Dixon 2013 with earlier bibliography.

6 E.g., Dayagi-Mendels 2002; Mazar 2013.

7 Respectively Stern 1990; Lehmann 2008; Elayi 2013, p. 132.

8 For the debated status of the region under the Assyrians, see summary and references in Yasur-Landau – Press – Arie 2016, p. 193.

9 This is done as part of The Moshe Prausnitz Excavation Publication Project currently directed by Assaf Yasur-Landau (University of Haifa) and Eran Arie (The Israel Museum), funded by The Shelby White and Leon Levy Program for Archaeological Publications.

10 For a presentation and discussions of all these issues, see Yasur-Landau – Press – Arie 2016.

11 https://telachziv.wordpress.com/30-2/

12 For these definitions see Gilboa 1999.

13 Prausnitz 1993; 1997.

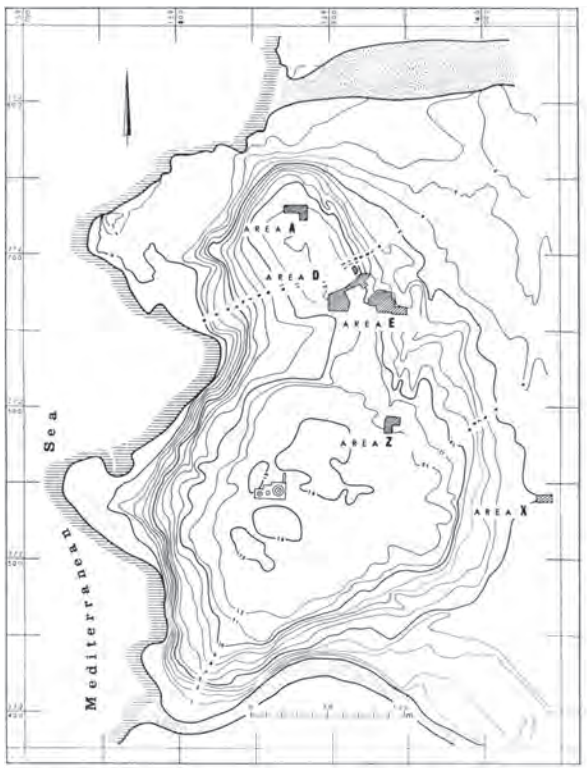

Fig. 2. Tel Achziv with areas excavated by M. Prausnitz (after Prausnitz 1975 Fig. 2 and Yasur-Landau *et al.* 2016 Fig. 1).

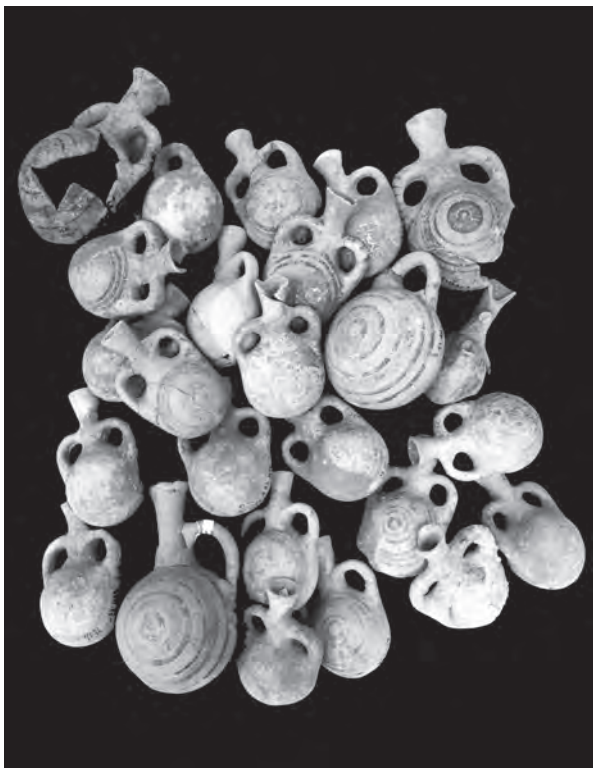

Fig. 3. A selection of Tel Achziv's early Iron Age Phoenician monochrome-black and Bichrome flasks from Tombs 1015 and 1029 (Authors).

they date in the Ir1|2–Ir2a range (= Early to Late Iron Age IIA).[14] This means somewhere between the second half of the 10th and the 9th century BCE, depending again on the absolute chronology framework embraced. Since Tel Achziv was apparently not inhabited during Iron Age I (Ir1a–Ir1b in Phoenician terminology), these tombs are probably associated with the earliest settlement at the site. The flasks investigated here are the commonest artifacts in these tombs which otherwise contained mainly a few Cypriot imports, for example barrel-shaped juglets and metal objects, including weapons and objects of personal adornment.[15]

The "late assemblage" comprises 15 carinated-shoulders transport jars (Figs. 4, 5, Table 2), from three consecutive phases (6-4) in a storage facility in Area D, west of Area E. The lion's share was found in a single room in Phase 5 (R-D 5-4 [L231]). The pottery uncovered in primary deposition in these three phases can quite easily be dated to 7th century BCE, but here our opinions differ: A. Gilboa advocates a date in the second half of the 7th century, even slightly later than that and E. Arie and A.Yasur-Landau would allow for a longer range in the 7th century. The prevalent jar type in Phases 6-4 is the well-known carinated "bullet shaped jar" (Fig. 5: all jars excluding nos. 2, 10, 12) with a variety of short vertical or horizontal rims.[16] In both morphology and rim shape they herald the typical Persian-period Phoenician transport jar.[17] In south Lebanon, the closest comparable assemblages are from Tell el-Burak, dated by the excavators to the second

14 And not in Iron Age I As maintained in Prausnitz 1997 and in Singer-Avitz 2012, pp. 182-183.

15 Prausnitz 1997.

16 Summary and references in Yasur Landau – Press – Arie 2016, p. 213.

17 Bettles 2003a; 2003b.

Fig. 4. Late Iron Age carinated-shoulder transport jars from Area D (Authors).

half of the 7th century.[18] In Southern Phoenicia the "bullet-shaped jars" are the dominant jars in destruction contexts convincingly attributed to the Babylonian destructions (Kabri 2a and Tell Keisan 4a), while examples are also known in levels terminating with the Babylonian conquest in Philistia.[19] All these contexts also produced a fair number of the so-called "wasp-shaped" Phoenician jar with flat rims, similar to Fig. 5:12. It is unclear whether the fact that the latter type is rare in the Tel Achziv building is accidental or might have some chronological significance. The "bullet shaped jar", usually with more elaborate rim treatments, also occurs in somewhat earlier contexts, starting with the Assyrian occupation period, for example at Tell Keisan 5 and at Dor,[20] but they only become dominant in the second half of the 7th century BCE. The jar in Fig. 5: 2 is a rare shape.

4. Method of Analysis

Optical Mineralogy analysis (OM; also called petrography) was applied to the above-mentioned 37 vessels. This method of analysis is widely used in studies of ancient ceramics and thus requires no extensive introduction. It implements traditional laboratory techniques borrowed from the field of geology, where the ceramic samples are cut to 30 micrometers (μm) to create a thin section which is then analyzed under a petrographic microscope using polarizing light.[21] The clay recipes of the vessels are then described according to their mineralogical compositions and classified to appropriate petro-fabric groups. A petro-fabric group represents ceramics that were manufactured from clay sources in a specific geographic region.

18 Kamlah 2016; Kamlah – Sader – Schmitt 2016, pp. 96, 114, pls.1, 13.

19 Respectively Lehmann 2002, figs. 5.82: 8-10; 5.83:15, the latter nearly identical to fig. 5:11; Briend – Humbert 1980, pls. 26; 27: 9, 9a; e.g. Stager – Master – Schloen 2011, fig. 6:11.

20 Briend – Humbert, pl. 47:6; the jars from Dor are yet unpublished.

21 E.g., Peacock 1982; Day 1989; Goren – Porat 1989; Tite 2008; Quinn 2013.

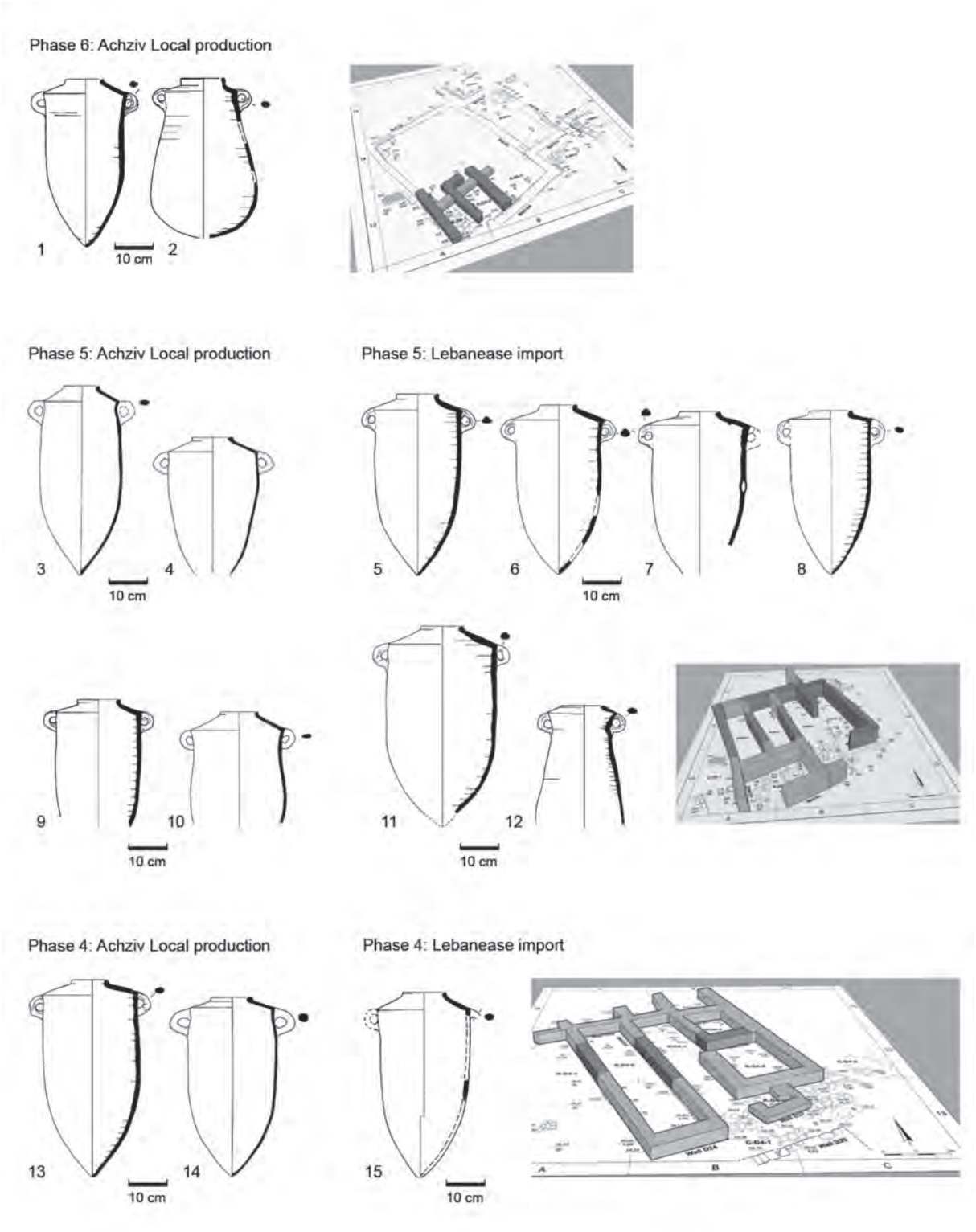

Fig. 5. Late Iron Age carinated-shoulder transport jars examined, according to stratigraphy and suggested provenance (Authors).

5. Petro-fabrics Identified at Tel Achziv

5.1. *Petro-Fabric Group A: Coastal Alluvium Clay Mixed with Terra Rossa Soil. Tel Achziv Local Production*

The clay is carbonatic, rich in iron and silt (~30%), porous, dark brown to red in PPL, with some iron accumulations and iron ooids (50-100μm). The silt contains mostly well-sorted angular quartz, fragments of calcrete (*nari*) and limestone, chert and feldspars. The a-plastic components consist of different micro-fossils, shell and coralline algae that are well preserved. Also visible are spherical terra rossa balls with silty quartz inclusions (~3%, some up to 200μm and some ~500μm), poorly-sorted very angular chert (~5%, 100–400μm), sub-angular well-sorted quartz (~50μm) and limestone (~5% up to 300μm). It is also possible to see eroded basalt and occasionally scattered alkaline feldspars (up to 50μm). One of the flasks (Ac_20) also includes a significant amount of crushed shell fragments (~20%).

Technological observations and estimated firing temperature. The early Iron Age decorated flasks of this group seem to be made on a wheel, their surface is usually covered with a light-colored slip and they are carefully smoothed and decorated with red and black or just black pigments. The late Iron Age jars attributed to this group are clearly made on a wheel, since wheel-marks are evident on both their inner and outer surfaces. The surfaces seem to be severely damaged by post-depositional processes, viz. exposure to salt and other coastal elements. The surface treatments are therefore badly preserved, but traces of slip are still observable, especially in the more protected parts such as the surface inside the handles. Evidence for careless smoothing of the surface of the jars was also observed.

Vessels of this petro-fabric group were exposed to various firing temperatures. The early Iron Age Bichrome and monochrome flasks retained the light color of the matrix. All of the carbonatic components were preserved intact, which probably suggests a firing temperature below 750°C. The late Iron Age jars were exposed to higher firing temperatures, of over 750°C, which caused the matrix to be much darker. Though most of the carbonatic components in the fabric started to disintegrate, they seem to have retained most of their original form and are still identifiable. In some cases, the firing temperature caused the matrix to become isotropic and the carbonatic components to dissolve into the matrix.

Interpretation and suggested provenance. Along the northern Israeli coast, terra rossa is found from ʼAkko to Rosh Ha-niqra and on the southern Lebanese coast up to Ras el-Bayada (~15km south of Tyre). Tel Achziv, as mentioned, is located on the northern Israeli coast west of the foothills of Western Galilee. It is situated between two rivulets: Nahal Keziv on the north and Nahal Shaʼal on the north, which flow over the Bina and Sakhnin formations, picking up limestone, dolomite and chert particles and red-brown terra rossa soil.

Recently, it has been demonstrated that the ʼAkko plain just south of Tel Achziv was subjected to extensive environmental changes that go back about 6000 years, mainly due to changes in the eco-system caused by fluctuations in sea level. As a result, lowlands of this region alternated between brackish wetlands and shallow marine environments.[22]

It is therefore very likely that Tel Achziv's environment during the Iron Age was also different from the present. We do not know, for example, whether the Keziv and Shaʼal rivulets flowed near the *tell*, whether the site was surrounded by brackish waters in between the *kurkar* ridges, and whether the coastland was located further to the east, and if so, how far east? All we can say at present is that petro-fabric A reflects an environment of both sea and brackish water and the presence of alluvial sediments from the rivers.

22 Kaniewski *et al*. 2013; 2014; Elyashiv *et al*. 2016; cfr. Morhange *et al*. 2016.

This petro-fabric group has also been identified in early Iron Age vessels deduced as being local at Tell Keisan in the nearby Akko plain.[23] It is probably also typical to other sites in the region, such as ʿAkko and Nahariya.[24] At this point, until much more comparative data are produced and published, the petrographic analysis does not allow for a distinction between all these coastal sites. Therefore, though we indeed assume that vessels of petro-fabric A found at Tel Achziv were produced on site (or in the immediate vicinity), a source in another nearby site (e.g., ʿAkko) cannot be totally excluded for the time being.

In addition to Tel Achziv and Tell Keisan, petro-fabric group A has been identified and described in the past regarding Late Bronze Age/Iron Age Canaanite/Phoenician transport jars at other sites. For example, carinated "Canaanite jars" that reached Memphis (Egypt) in the Late Bronze Age, were produced from this fabric.[25] During the early Iron Age, this petro-fabric was found to be very common in Phoenician containers (both Phoenician Bichrome ware and carinated jars) which transported goods inland and down the coast to Philistia.[26] Moreover, among the Phoenician transport jars (mostly of unclear shapes) that were found at Kommos in Crete in 9th-century contexts, several were composed of this fabric.[27] The same is true specifically regarding transport jars of the late Iron Age from Tel Achziv itself as well as from Shiqmona and Dor.[28] A similar petro-fabric was also identified in Phoenician jars of the Persian period uncovered at Sarepta.[29]

5.2. *Petro-fabric Group B: Neogene Marl and/or Soil Derived from Neogene Marl with Silt and Inclusions of Quartz and Marine Biogenic Debris – the Southern Lebanese Coast*

This petro-fabric group (Pl. II) is found in several forms: some are of consolidated clay and others are of unconsolidated soil derived from it. In general, the clay is carbonatic with iron ooids, yellowish to tan in PPL. The matrix is very rich in microfossils, including planktonic foraminifera such as *Globigerinella*. In some cases the foraminifera are filled or surrounded by iron-rich minerals. This petro-fabric also includes benthonic foraminifera such as *Brizalina*, and coralline algae such as amphiroa and *Bryozoan*.[30] The inclusions consist of sub-angular to angular coastal quartz (5-15%, 50-150μm), limestone (~5%, to 200μm), occasional dolomites and chert in different levels of erosion. These well-levigated vessels with their smooth and light-yellow ("golden") color are exceptional among the common Iron Age ceramics in the Levant. This might be the reason why these vessels are not slipped (below).

Estimated firing temperature and technological observations. Vessels of this group demonstrate the same production technology and range of firing temperatures as in petro-fabric group A. The main distinction, as mentioned, is the general absence of slips, which were most likely considered redundant due to the natural golden color of this group. This phenomenon typifies the two assemblages investigated here, and thus seemingly lasts throughout the Iron Age.[31] In both groups, some of the flasks were burnished.

The estimated firing temperature is the same as in petro-fabric group A: below 750˚C for the early Iron Age flasks and over 750˚C for the late Iron jars.

23 Waiman-Barak – Gilboa 2016.

24 Anat Cohen-Weinberger, personal communication.

25 Ownby 2010, some of the vessels ascribed to group 3.

26 Waiman-Barak 2016.

27 Gilboa – Waiman-Barak – Jones 2015, Table 1: 6, 10, 16, 19.

28 Respectively, Aznar 2005, group 4D and unpublished data.

29 Bettles 2003a; 2003b, group FC1B.

30 Nolet – Corliss 1990; Clark – Boudagher-Fadel 2001.

31 In Ir1a contexts at Dor, a few Phoenician monochrome flasks of petro-fabric B were identified. They are the only examples encountered of Phoenician vessels from this (Lebanese) petro-fabric to bear slips in this period (Waiman-Barak 2016).

Interpretation and suggested provenance. In Lebanon, a number of successions that are characterized by accumulated marine deposits have been subjected to some microfacies investigations.[32] Neogene marls were found in the vicinity of Tyre and in the harbor bed of Beirut, and they are also known from the Lebanese Beka'a valley.[33] However, the coastal quartz, the shell fragments and coralline algae indicate that petro-fabric B is southern Lebanese and does not originate further to the north, around Beirut, where there is evidence for volcanic activity which is absent from this petro-fabric.[34]

This petro-fabric was the dominant one in Bettles' study of late Iron Age and (mainly) Persian-period Phoenician transport carinated-shoulder jars, identified as originating in Sarepta. She based her identification on a comparison with waste products of the kilns at that site.[35] This type of marl is well documented in other petrographic and archaeometric studies, and commonly identified as originating on the southern Lebanese coast.[36] In the early Iron Age, this fabric is especially common in Phoenician flasks decorated in monochrome and Bichrome, found in various sites along the Levantine coast, in Phoenicia, Philistia and various inland regions of the Southern Levant.[37]

The suggested provenance for this petro-fabric group is the Lebanese coast between Tyre and Sidon, about 50 km north of Tel Achziv.

5.3. *Petro-fabric Group C (?): Calcareous Clays from Pleistocene Wetlands – Early Holocene, Mixed with Crushed Calcite – Possibly the Carmel Coast*

One flask does not belong to either petro-fabric A or B (Table 1: Ac. 19). The clay is carbonatic, silty (~10%), tan in PPL with some iron oxides. The silt is mostly quartz, but also contains some feldspars and shell fragments. The inclusions consist mainly of well-sorted sub-angular quartz sand (~30% up to 200 μm), crushed calcite, and poorly-sorted limestone. Also present are eroded *kurkar* (calcarenite, calcareous aeolianite sandstone) fragments, algae fragments, foraminiferal-chalk, seashells and other micro-fauna.

Estimated firing temperature and technological observations. The clay this vessel is very dark and other than the crushed calcite there are not many calcareous components normally found is this petro-fabric group. It is possible that these calcareous components, typically consisting of limestone, chalks and microfilms, were dissolved by the heat, which would suggest a firing temperature of over 750˚C. However, since the calcite is very well preserved, the firing temperature of this vessel remains inconclusive.

Interpretation and suggested provenance. Petro-fabric group C is well known in ancient ceramics in the Southern Levant and overseas (Pl. III). It is the prevalent fabric at Dor in different periods[38] and therefore represents the production of this site, though for the time being it is unclear whether and to what extent potential productions of other Iron Age sites on the Carmel coast (mainly 'Athlit and Shiqmona) differ in their composition. Petro-fabric C has also been identified beyond the Carmel coast in various transport vessels

32 E.g., Basson – Edgell 1971; Walley 1998; Nader – Abdel-Rahman – Haidar 2006; Nader – Swennen – Keppens 2008; Nader 2011, fig. 2; Pearson – Matthews 2011; Ownby – Griffiths 2009, p. 63, fig. 6.

33 Respectively, Marriner *et al*. 2006; Ownby – Griffiths 2009; Marriner *et al*. 2012.

34 Nader *et al*. 2007; Marriner *et al*. 2008; see also Goren 2013, fig. 3.

35 Bettles 2003a; 2003b; group 1A.

36 Griffiths 2003; 2004; Aznar 2005: Fabric 4A; Ownby – Griffiths 2009; Ownby 2012, p. 25, fig. 2e; Miguel Gascón – Buxeda i Garrigós 2013; Gilboa – Goren 2015, group Mi1, fig. 4: 4; Gilboa – Waiman-Barak – Jones 2015, group B.

37 Waiman-Barak 2016.

38 E.g., Gilboa – Goren 2015, fabric Hm 2; Waiman-Barak 2016, petro-fabric C; Ben-Shlomo 2011, group A; cfr. https://www.levantineceramics.org/wares/carmel-coast-persian-hellenistic-table-ware

from different periods.[39] In the present case, this flask most resembles the fabric of cooking pots and baking trays produced at Dor (unpublished data), which makes it a clear anomaly not only among the Tel Achziv assemblage but among Phoenician Bichrome ware in general.

The Carmel coastal plain is a narrow elongated strip in modern-day Israel between the Haifa/ʿAkko plain in the north and the southern tip of the Carmel mountain range in the south. It is characterized by calcareous aeolianite sandstone of upper Pleistocene ridges (*kurkar*) and red loamy soils (*hamra*). Sites on the Carmel coast are surrounded by alluvial sediments that include clay, coastal sand and eroded limestone from the Carmel.[40] Several geological cores have revealed that beneath the coastal sand in this region lie brown sandy clay units from the end of the Pleistocene and the beginning of the Holocene. They represent a short-lived episode of wetlands of brackish water.[41] These ancient marshes preceded the Kabara marshes that prevailed here until the modern era.[42] Occasionally, these clay units are rich in silt and contain micro-fauna comparable with that found in the ceramics of this petrographic group.

6. A Synthesis of the Early Iron Age Flasks Assemblage

As mentioned, 23 vessels were analyzed from Tombs 1015 and 1029, mostly Phoenician Bichrome and Phoenician monochrome-black flasks, alongside a Phoenician Bichrome juglet and bowl (Table 1; Fig. 3). Most of the analyzed vessels (17) were locally produced at Tel Achziv, represented by petro-fabric group A. They include the one bowl, several Bichrome flasks, and one monochrome-black flask. There are five imports from the coastal region of south Lebanon (petro-fabric B): the one Bichrome juglet and four flasks, two Bichrome and two monochrome-black. One flask was imported from the Carmel coast, probably from Dor (petro-fabric C).

No.	Registration number	Vessel	Ware	Surface Treatment and Decoration	Petro-fabric Group
Ac. 1	1015/31	Bowl	Phoenician Bichrome	Thick oily slip, red and black decoration	A
Ac. 2	1015/7	Flask	Phoenician Bichrome	No slip, red and black decoration	B
Ac. 3	1029/18	Juglet	Phoenician Bichrome	Thick oily slip, red and black decoration	A
Ac. 4	1029/41	Flask	Phoenician Bichrome	Thick oily slip, burnished, red and black decoration	A
Ac. 5	1029/40	Flask	Phoenician Bichrome	Thick oily slip, red and black decoration	A
Ac. 6	1029/50	Globular Jug	Phoenician Bichrome	Thick oily slip, burnished, red and black decoration	A
Ac. 7	1029/42	Flask	Phoenician Bichrome	Thick oily slip, burnished, red and black decoration	A
Ac. 8	1015/11	Flask	Phoenician Bichrome	Thick oily slip, burnished, red and black decoration	A
Ac. 9	1029/31	Flask	Phoenician Bichrome	Thick oily slip, red and black decoration	A

39 Bronze Age: e.g., Marcus 1995, group A, p. 599. Fig. 2; Cohen-Weinberger – Goren 2004; Smith *et al.* 2004, group 1 and probably part of 2; Day *et al*. 2011, group 3; and see comments in Gilboa – Waiman-Barak – Jones 2015, pp. 91-92. Iron Age: e.g., Gilboa – Goren 2015, fabric Hm 2. Persian period: Bettles 2003a; 2003b.

40 E.g., Frechen *et al*. 2002; Sivan – Porat 2004; Galili *et al*. 2007; Avnaim-Katav *et al*. 2017; Tyuleneva *et al* in press.

41 Cohen-Seffer *et al.* 2005.

42 Flako-Zaritsky *et al.* 2011.

Ac. 10	1029/16	Flask	Phoenician Bichrome	Badly-preserved slip, red and black decoration	A
Ac. 11	1029/30	Flask	Phoenician Bichrome	Thick oily slip, polished, red and black decoration	A
Ac. 12	1015/71	Flask	Phoenician Bichrome	Thick oily slip, polished, red and black decoration	A
Ac. 13	1015/48	Flask	Phoenician Bichrome	Thick oily, polished, red and black decoration	A
Ac. 14	1015/27	Flask	Phoenician Bichrome	Thick oily slip, red and black decoration	A
Ac. 15	1029/46	Flask	Phoenician Bichrome	Thick oily slip, red and black decoration	A
Ac. 16	1029/48	Flask	Phoenician Bichrome	Badly-preserved slip, red and black decoration	A
Ac. 17	1015/39	Flask	Phoenician Bichrome	No slip, red and black decoration	B
Ac. 18	1015/34	Flask	Phoenician Bichrome	No slip, red and black decoration	B
Ac. 19	1015/49	Flask	Phoenician Bichrome	Thick oily slip, burnished, red and black decoration	C
Ac. 20	1029/43	Flask	Phoenician Bichrome	Thick oily slip, burnished, red and black decoration	A + shell
Ac. 21	1029/49	Flask	Phoenician monochrome-black	Slip? Black decoration	A
Ac. 22	1015/59	Flask	Phoenician monochrome- black	No slip, black decoration	B
Ac. 23	1015/36	Flask	Phoenician monochrome- black	No slip, black decoration	B

Table 1 - Summary of OM results of vessels from Tel Achziv Tombs 1015 and 1029

6.1. *Petro-fabrics Versus Slips*

As mentioned, there are visual differences between, on the one hand, the yellowish smooth marls of the south Lebanese coast (petro-fabric B), and on the other, the clays in the vicinity of ʿAkko–Achziv (petro-fabric A) and the Carmel coast (petro-fabric C), which are darker, murky and coarser. It is therefore surprising that Phoenician decorated vessels from Tel Achziv and the Carmel coast display a golden external appearance like their Lebanese counterparts, and not, as would be expected, the brownish surface that typifies other vessels produced in those regions.

In order to produce this golden surface, a slip was applied to these flasks. This slip is clearly visible in the fresh breaks, using a zoom stereo-microscope (binocular) with at least X20 magnification. It is also visible in the thin sections, under a polarizing microscope (e.g. Pl. I: a, c, d). The application of the slip rendered their appearance similar to the Lebanese flasks. Such an application has never been encountered on Lebanese flasks examined here or at any other site; the clay of these flasks is itself of golden hue and the painted decorations are applied directly to the burnished surface.

The OM analysis showed that the slips on the local flasks are highly carbonatic and resemble in their composition petro-fabric group B, the south Lebanese "golden" clay. It is therefore likely that such clays were imported to Tel Achziv and possibly also to the Carmel coast to produce these slips. To confirm this observation additional mineralogical and chemical analysis are required.

6.2. *Decoration Patterns and Hues*

Based on the production regions identified by the OM analysis, we attempted to define more differences between the groups, especially those that would have been evident to the consumers of these evidently ex-

changeable commodities. We could not find any correlation between the flasks' provenance and most of the features of their decoration, such as the number of concentric bands, both red and black, their thickness and the distance between them. All of these vary between individual vessels. Similarly, visually at least, the pigmentation seems highly variable: the "black" colors range from dark brown to deep black; the "reds" vary from orange to deep purple. This difference could be caused by the variations in the elemental composition of the pigments (iron oxides for the red and most probably ferromanganese for the black)[43] or exposure to post-depositional processes, and one cannot preclude technological choices as well.

Some difference between the flasks of the three production centers might be defined by decorations on and under the handles. In the cases were the decoration on the narrow sides of the vessels was preserved, the two vessels imported from the south (petro-fabrics A and C) are notably similar to each other in that both have a striped pattern ǂ on the handle and a "star" design ❋ below it (Pl. IV).

The only Phoenician Bichrome Lebanese example, in contrast, bears only the striped pattern ǂ, which continues to the bottom of the flask. Here again, more research is needed to ascertain whether these outstanding designs on these containers are indicative of origin and if this was their function in antiquity.

7. A Synthesis of the Late Iron Age Jar Assemblage

Most of the vessels were found complete or nearly complete, which provides an exceptional opportunity to closely inspect technological aspects of production and the surface treatments applied.

No.	Registration number	Phase, context	Dimensions	Capacity in Liters	Surface treatment	Petro-fabric group	Reference[44]
Fig. 5:1	Ac. J6, 1964/D-162 (IAA 1964-2273)	D-6	Length 42cm; max diam. 21cm; diam. of aperture 10cm	7.5	Slip	A	Fig. 6:13
Fig. 5:2	Ac. J7, 1964/DII-702 (IAA 1997-720)	D-6	Length 42cm; shoulder diam. 19cm; diam. of aperture 10cm	14	Slip	A	Fig. 6:15
Fig. 5:3	Ac. J1, 1964/D-241/7 (IAA 1997-723)	D-5, Room 231	Length 50cm; max diam. 20cm; diam. of aperture 8cm		Slip	A	
Fig. 5:4	Ac. J2, 1964/D-231/3 (IAA 1997-721)	D-5, Room 231	Length ~40cm; max diam. 24cm; diam. of aperture 8cm	~10	Slip	A	
Fig. 5:5	Ac. J12, 1964/D-241 (IAA 1964-2353)	D-5, Room 231	Length 43 cm; max diam. 24.5cm; diam. of aperture 9.5cm	7	No slip	B	

43 For such variabilities see Shoval – Gilboa 2016; Shoval, in press.

44 Yasur-Landau – Press – Arie 2016.

Fig. 5:6	Ac. J13, 1964/D-215 (IAA 1997-716)	D-5	Length 44.7cm; max. diam. 22cm; diam. of aperture 8cm	10	Diluted light wash	B	
Fig. 5:7	Ac. J11, 1964/D-231/241/15	D-5, Room 231	Length: 44.7cm; max diam.: 24.5cm, diam. of aperture 8cm	10	No slip	B	
Fig. 5:8	Ac. J9, 1964/D-231/241/3 (IAA 1997-722)	D-5, Room 231	Length 46cm; max diam. 21cm, diam. of aperture 8cm	12	Diluted light wash	B	
Fig. 5:9	Ac. J4, 1964/D-231/25 (IAA 1964-2352)	D-5, Room 231	Length 42cm; max diam. 21cm; diam. of aperture10cm	~9	Slip	A	
Fig. 5:10	Ac. J3, 1964/D-231/241/2	D5, Room 231	Length >37cm; max diam. 25cm; diam. of aperture 9cm	~12	Slip	A	
Fig. 5:11	Ac. J10, 1964/D-231/241/4	D-5, Room 231	Length: ~52cm, max diam. 28cm, diam. of aperture 10cm	20	No slip	B	Fig. 8.1:15
Fig. 5:12	1964/D-231/68+ 1964/D-241/22	D-5, Room 231	Length >33cm; max diam. 18cm; diam. of aperture 10cm		No slip	B	Fig. 8.2:1
Fig. 5:13	Ac. J5, 1963/D-409/2	D-4	Length 42cm; shoulder diam. 19cm; diam. of aperture 10cm	14	Slip	A	Fig. 10.1.13
Fig. 5:14	Ac. J8, 1964/D-149 (IAA 1964-2271)	D-4	Length 43cm; max diam. 23cm; diam. of aperture 10cm	10.5	Slip	A	
Fig. 5:15	Ac. J15, 1963/D-409/1	D-4	Length ~50 cm; max. diam.: 24.5cm; diam. of aperture 10cm	-	No slip	B	

Table 2. Summary of OM results of Late Iron Age transport jars from area D. Order in table follows Fig. 5

7.1. *OM Results, Petro-fabric Groups and Technological Aspects*

About half (eight of 15) of these transport jars proved to belong to petrofabric group A, which, as mentioned above, is probably local to Tel Achziv (Pl. V). Surprisingly, then, the other seven are not. They are made of various clays designated as petro-fabric group B from the south Lebanese coast (Pl. VI). Previous analyses of this specific type also pointed to a source in Lebanon.[45]

Jars of the two distinctly different petro-fabrics groups are wheel made. Not only do they represent the same general morphological types, but there are also nearly identical in minutiae of rim shaping. The exterior surface of most of the jars was smoothed on the wheel before firing, with fingers or with tools, for example sponges or cloth. As with the Early Iron Age Achzivian flasks discussed above, the late Iron Age jars of Tel Achziv's local fabrics usually exhibit some evidence of being coated. In contrast, the south Lebanese jars either have a thin diluted wash or are un-coated altogether. The firing temperature of the jars exceeds 750°C. Under the stereoscope we observed traces of a calcareous lining that was applied inside the jars after firing.

8. Notes on Capacities of Jars

We measured the jars using software developed by Jean-Paul Thalmann and Stefania Mazzoni as part of the ARCANE project.[46] We measured heights (at the center), maximum diameter (at the shoulder; except for the bag-shaped jar Fig. 5:2, the belly of which is wider than the shoulder; the inner diameter of the vessels' apertures, and their capacities when possible. Here, however, we discuss only the capacities of the measurable "bullet-shaped" jars.[47] Although the sample base is very small, there are still some conclusions to be drawn from the data in Table 2 and from Fig. 6.

The first thing to be said is that the 7th century Phoenician transport jar *par exellence* is a rather small container. There seems to be a largest "group", five of the 11 jars, which are between 9-10.5 liters, but there are also larger and smaller jars, but only one jar exceeds 14 liter. In fact, when one considers these data versus earlier and later Phoenician jars, a preliminary trajectory may be detected, viz. a reduction in capacities. Phoenician jars of the early Iron Age (mainly 11th-early 10th century) range between 15-30 liters, and it seems that those travelling by sea seldom held less than 20 liters.[48] The Phoenician jars of the 8th century were ca. 18 liters in capacity.[49] In the Persian period, Phoenician jars continued to be small, most of them around 7-10 liters.[50] Though more jars need to be measured (*inter alia* to try to assess standardization), both differences and trajectory seem rather clear.

Such changes in capacities of maritime transport containers were probably caused by changing transport modes, or commodities – but this is beyond our study here. As an aside, all these are a far cry from other types of jars that circulated in the Levant (terrestrially!) such as the well-known *lmlk* jars of Judah (8th century BCE) that are usually about 43 liters and the "hippo" jars (9th century BCE), most of which range between 35-65 liters.[51]

45 E.g. Master 2003 and see also *The Levantine Ceramics Project*, https://www.levantineceramics.org/vessels/50-58-l262-8: 50.58 L318 (56), 50.58 L262 (30), uploaded by D. master, accessed 13.12.2017; Aznar 2005, Type 9d; cfr. Bettles 2003a; 2003b, but the latter two consider mainly Persian-period jars.

46 http://www.arcane.uni-tuebingen.de/database/, accessed 2.9.2017. It is based on the published line-drawings of the vessels. Jars were measured to the base of the neck/rim.

47 Fig. 5: 1, 4-11, 13, 14.

48 Waiman-Barak – Gilboa 2016; in press.

49 Finkelstein *et al.* 2011.

50 The jars we measured are Stern 1995, fig. 2.7: 1, 2; Onn 1999, figs. 7: 1, 8: 4, 9: 1-3.

51 Respectively, Zapassky – Finkelstein – Benenson 2009, table 2; Harush 2014, fig. 16.

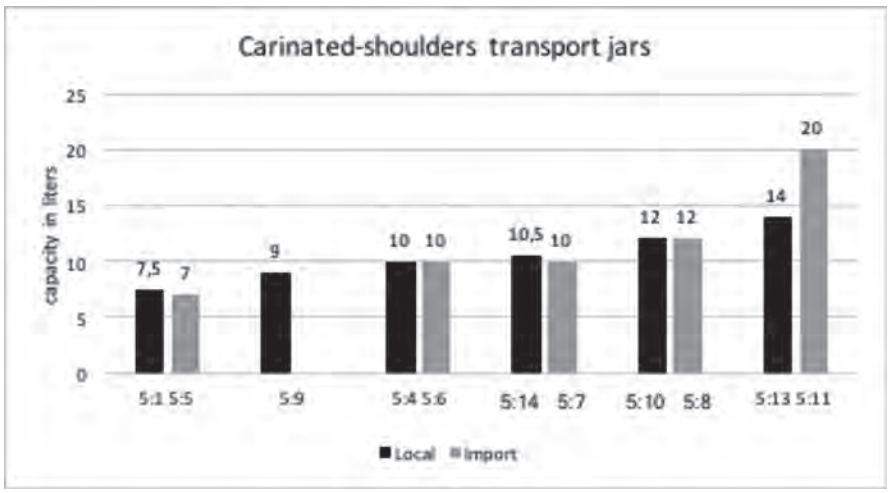

Fig. 6. Capacities of "Bullet-shaped" jars; jars are identified by their placement in Fig. 5 (Authors).

Summary and Discussion: Contextualizing the Results

Our research focused on Phoenician containers at Tel Achziv from two periods: Ir1|2–Ir2a = Early and Late Iron IIA (roughly the second half of the 10th century to some point in the ninth) and late Ir2c (the second half of the 7th/possibly the early 6th century BCE or, according to another opinion, the entire 7th century). In both periods vessels of two main similar petro-fabrics were identified. Among the locally-produced vessels (petro-fabric A), more than one clay recipe is observable. The small late Iron Age transport jars are made of clays that are levigated better and are also fired more evenly and in a higher firing temperature, probably due to the different commodities they were meant to carry, and different modes of production, including different structures of kilns, but we do not pursue the issue here.

All the imports identified, in both periods, originate on the Phoenician coast, from maximal distances of ca. 50 km to the north and south. Imports from the north (petro-fabric group B) originate on the south Lebanese coast, where the major Iron Age sites of Tyre, Sarepta, Tell el-Burak and Sidon are situated. The only import from the south (petro-fabric C) is a flask most probably from the Carmel coast, in which case it plausibly comes from the principal site there – Tel Dor. At Dor, such locally-produced flasks are well-attested and they were also demonstrated to have been shipped to Cyprus and within the southern Levant, for example to Tell Keisan, Tell Qasile and Nahal Patish.[52]

To a large extent, these two assemblages are indicative of the most typical ceramic containers circulating within Phoenicia and distributed from Phoenicia elsewhere throughout the Iron Age, and the commercial phenomena embodied by them. In these respects, a clear chronological divergence is in evidence. In the early Iron Age (Ir1a-Ir2a) the principal circulating container is the small (ca. 50 ml) flask, mostly produced on the southern Lebanese littoral and the Carmel-coast. These eclipse by far the number of jars circulating and also the well-known Phoenician Bichrome jugs, usually considered the typical Phoenician commercial containers. Within the Levant, such Phoenician flasks were extensively shipped both from south Lebanese centers, for example to Cyprus, to southern Levantine sites such as Megiddo,[53] and, as mentioned, form the Camel coast too, to various destinations (above). For the time being, no Achziv-made made flasks (namely

52 Gilboa – Goren 2015; Waiman-Barak 2016; Waiman-Barak – Gilboa 2016.

53 Gilboa – Goren 2015; Waiman-Barak – Gilboa in press, table 1, and several more.

of petro-fabric A) are known to have been distributed to other destinations.[54] This impression may of course change with more sampling.

By their restricted size, shape, and diameter of necks, these flasks must have contained prized spiced/scented liquids, exhibiting a thriving Phoenician trade in such substances, most probably *inter alia* serving Egypt's needs for them. Several such flasks were demonstrated to have served to distribute some liquid (or viscous) substances spiced with cinnamon from south/south-east Asia, embodying a secondary enterprise relating to the far-flung spice trade.[55]

Though it is rather obvious that at least between the coastal sites, to Egypt, and of course to Cyprus such flasks were distributed by sea, they cannot account for entire shiploads. Rather, they should probably be understood as secondary commodities accompanying merchandise of much more fundamental economic value, though which exactly among the "usual suspects" still needs to be determined.

All these small Phoenician flasks cease to be produced at an uncertain "point" in the course of Iron Age IIA (Ir1|2-Ir2a), though at present it is unclear whether this happens everywhere simultaneously. Subsequently, no functional equivalents are manufactured anymore, a testimony to the fact that Phoenician involvement in the distribution of these lucrative commodities had ended. At present we cannot offer an explanation for this phenomenon.

At the very end of Iron Age IIA (Ir2a/early Ir2b), altogether different types of Phoenician containers rise meteorically to commercial prominence – the famed late Iron Age Phoenician transport jars, which undergo complex morphological (and thus functional) trajectories through the remaining stretch of this timespan and into the Persian period. From a certain moment in the 8th century and onward, Phoenician jars seem to represent an export of currently unclear scope of some commodity/commodities from south Lebanon mainly to various Southern Levantine destinations, to Egypt, to Cyprus and occasionally to farther Mediterranean destinations; they are found, for example, in the earliest Phoenician holding in the west, for example in Iberia.[56] However, at present, jars in overseas destinations have not undergone fabric analysis so their exact provenance in the Levant still needs to be demonstrated.This phenomenon intensifies under Assyrian hegemony, as attested to date chiefly by the hundreds of mostly south Lebanese jars and jar fragments uncovered at Dor in this period.[57]

Regarding the historical context of the Tel Achziv Area D jar assemblage(s): even if we agree with the more restricted date proposed here, around the turn of the 7th century BCE, it is difficult to decide if these jars represent the so called "Egyptian interregnum" period in between the Assyrian withdrawal and the beginning of Babylonian hegemony in Western Asia[58] or, in turn, the Babylonian-conquest period itself. Be that as it may, the unusual percentage of nearly 50% south Lebanese jars in the Area D store-room probably indicates that the jar phenomenon mentioned above continued also after the Assyrian withdrawal from south Phoenicia at least till the Babylonian takeover and possibly even later. They provide a rare archaeological glimpse into south Lebanese economic activities in Levant in the very late Iron Age, namely the export of (agricultural?) commodities in the opposite direction than usually assumed. Whether these operations originated in Tyre or Sidon or both, and/or in other sites in their vicinity (a crucial question) remains to be determined.

54 One flask of petro-fabric A was identified at Tell Qasile, Stratum X, dating to Ir1b (Waiman-Barak 2016). Since it is earlier than the apparent foundation of the settlement at Achzib (above) it probably originates in some other site in the vicinity, possibly 'Akko.

55 Namdar *et al.* 2013; Gilboa – Namdar 2015.

56 Southern Levant: e.g. Aznar 2005, vol. II, for example figs. 19, 22, 28; Cyprus: Bikai 1987b, pl. XXIII: 588, 619, 620, 621, 622 (all from Kition floor 3) and more; Iberia: e.g., Ruíz Mata 2009, figs. 12: 8, 9; 13:7; Ruíz Mata – Pérez 1995, fig. 19: 4;

57 Gilboa – Sharon 2016 and examples in Gilboa 2015, fig. 3.1.10:10–12 (the Dor fabric analyses are yet unpublished).

58 For which see for example Kahn 2015.

What exactly were the products exported from south Lebanon during all these centuries remains to be seen and most probably they served to distribute a variety of goods. The usual assumption – wine,[59] including medicinal wine and wine mixed with resins, herbs and spices,[60] when the vineyards are usually assumed to have been situated mostly in the hilly/mountainous zones,[61] would mean embracing one of the following scenarios or some combination thereof. 1.The grapes were brought to the south Lebanese coastal center(s) from vineyards situated in the mountainous areas, the wine itself was produced in the coastal centers (as suggested for Tell el-Burak) and shipped there from; 2.Wine was brought to the coast in some (yet un-identified) clay containers, or in wineskins, for example, and was there decanted to the small coastal-made jars, and shipped; 3.Transport jars that were produced on the coast were sent to the winepresses inland, filled there and re-sent to the coast for inter-regional shipment.

This latter scenario seems to us much less cost-effective, but a consideration of all these dynamics requires another study. These transport jars could of course carry a variety of merchandize, but the calcareous lining that was applied to their inner surfaces after firing may have functioned to reduce the acidity of the stored and possibly still fermenting wine.

Our analysis is also the first indication that jars that are near identical to the Lebanese ones in general shape and in details of rim morphology were also manufactured at other Phoenician sites, at least in the 7th century at Tel Achziv (even if the degree of "sameness" may change if recording and comparison of the vessels is carried out with computerized means).[62] Even after considering the possibility of differences that elude the modern eye, it seems to us that when the slipped Achzivian jars were stored with the Lebanese jars they could not be told apart unless labeled somehow.[63]

We hope that the two cases of Tel Achziv containers discussed in this paper provide yet another example demonstrating the complexities of Phoenician ceramic systems and of the cultural phenomena embodied by them, observable once multifaceted investigations are applied to them with high resolution. Especially important for any inquiry is the fragmentation of local production and consumption within and beyond the scholarly construct we call "Phoenicia".

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59 E.g., Ballard *et al*. 2002; Kamlah 2016 for Sidonian wine. For a suggestion that identical jars at Tell el-Burak served a thriving export of locally-produced wine, see recently Sader 2018.

60 E.g. McGovern 2007; 2009; McGovern – Mirzoian – Hall 2009

61 Lehmann 2001.

62 Gilboa *et al*. 2004; Adan-Bayewitz *et al*. 2009; Harush 2014.

63 Cfr., for example, http://www.amarnaproject.com/pages/recent_projects/material_culture/canaanite.shtml, fig. 3; Bavay 2015, both on Canaanite Late Bronze Age jars in Egypt.

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