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BACK TO NAṢBEH: NEW COMPOSITIONAL ANALYSIS OF PHILISTINE BICHROME POTTERY FROM TELL EN-NAṢBEH*

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Philistine Bichrome pottery is one of the most important, well-known, and easily identifiable features of the Philistine material culture of the early Iron Age (ca. 1,200–1,000 BCE) in the southern Levant. The Philistines were probably a group of immigrants from the Aegean region and Cyprus arriving at several sites in the southern coastal plains of Palestine. More than 25 years ago, results from Neutron Activation of several Philistine Bichrome vessels from the site of Tell en-Nabeh were published by Gunneweg and others. The results were surprising because some of the typical Philistine vessels were found to be locally produced at this hill-land Judean site. Several vessels found to have been from an un-localized source. This study follows up on this issue, incorporating both petrographic and new chemical analysis, and enlarging the sample size. Consequently, we can provenance most Philistine vessels from this site more clearly to the central hills, the southern coastal plains (Philistia), and the central coastal plains of Israel. The significance of the distribution of the provenance of the Philistine pottery is further discussed.

KEYWORDS: TELL EN-NAṢBEH, PHILISTINE BICHROME, PETROGRAPHY, NEUTRON ACTIVATION ANALYSIS, IMMIGRANT SOCIETY

INTRODUCTION

Philistine Bichrome pottery is one of the most important, well-known, and easily identifiable features of the Philistine material culture of the early Iron Age (ca. 1,200–1,000 BCE) in the southern Levant (e.g., Ben-Shlomo 2006; Dothan 1982; Yasur-Landau 2010). The Philistines were probably a group of immigrants from the Aegean region and Cyprus arriving at several sites in the southern coastal plains of Palestine (denoted also Philistia). Their material culture is especially evident in the five major sites of Ashkelon, Ashdod, Gaza, Ekron, and Gath (Fig. 1), where, when archaeological excavations were carried out, Bichrome pottery comprised up to 50% in late 12th and early 11th centuries BCE strata (e.g. Dothan 1982, 25–93; Faust 2019,113–116). Lower quantities of this pottery appear in other regional sites as at Tel Qasile, Beth Shemesh, Tell Jemmeh and other sites (‘Philistia’, Fig. 1; e.g., Gilboa *et al*. 2006, 305; Faust 2019, fig. 8, table 1). Philistine Bichrome pottery is characterized by an array of forms, some with Aegean

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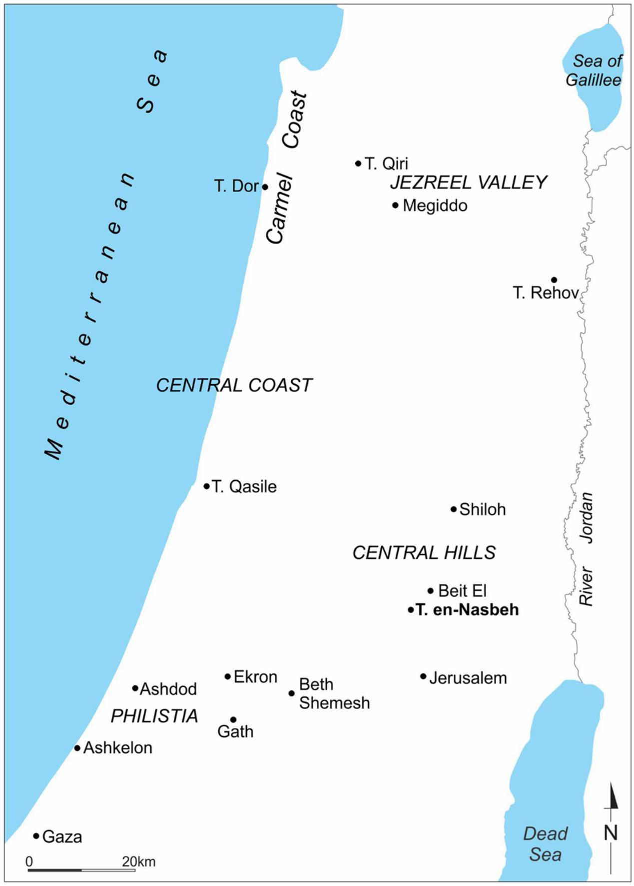

Figure 1 *Map with sites mentioned in text.*

or Mycenaean prototypes (bell-shaped bowls, kraters, and several jug types are the most common), and decorated in red and black paint over a chalky white slip. Decoration motifs are variable, with some of the more common and well-known being various spirals and birds (Ben-Shlomo 2006; Dothan 1982).

Philistine Bichrome pottery appears in smaller quantities also outside the 'Philistine region' (e.g., Gunneweg *et al*. 1994; Faust 2019, table 1), in particular at several sites at the central hills and sites in northern Israel as in the northern coast and the Jezreel Valley (see Dothan 1982, 70–84; Gilboa *et al*. 2006; Martin 2017 and below). Philistine Bichrome pottery is attested at Tell en-Naṣbeh (Fig. 1, Wampler 1947, pls. 80, 86–87; Gunneweg *et al*. 1994), Bethel (Kelso 1968, pl. 38:b; Dothan 1982, 54), and at Shiloh to the north (Dothan 1982:54), all these in the central hills of Israel, as well as in southern Judah at Tel Masos and Beersheba (Dothan 1982, 86–87). In addition, some Iron Age I Philistine Bichrome pottery was found at the Shephelah sites of Tel 'Eton, Tel Beth Shemesh, and Tell Beit Mirsim (Faust 2019, table 1), which lie on the border between Philistia and the hill country.

The issue of Philistine Bichrome pottery was treated by several scholars as a typical 'pots and people' case, that is, seeing this pottery as representing people from the Philistine ethnic group (see discussion at Faust 2019, 110–114), yet clearly the ancient reality is more complex. If these

Table 1 *Philistine Bichrome Vessels Analyzed from Tell en-Naṣbeh, Petrographic, and NAA Results*

Sample no.	*Bade cat. no.*	*Shape*	*Petrog. group*	*Soil type*	*Bonn/Vienna NAA group*	*Gunneweg 1994 ref. and prov.*	*Suggested provenance*
Naṣbeh 193		Krater	1	Moẓa	X176	#11 – 'Moza'	Central hills
Naṣbeh 194		Krater	5	Alluvial/ Hamra	X174		Central coast
Naṣbeh 195	2010.1.140	Krater	5	Alluvial/ Hamra	Single		Central coast?
Naṣbeh 196	2010.1.157	Krater	1	Moṣa	X176	#12- 'Moza'	Central hills
Naṣbeh 197	2018.1.75	Krater	5?	Alluvial/ Hamra	X174	#4 - Single	Central coast
Naṣbeh 198		Krater	4	Loess & Moẓa mix?	X175, =dw1		Shephelah/ southern coast?
Naṣbeh 199	2018.1.76	Krater	4?	Loess & Moẓa a mix?	X175, =dw2	#6- Ashdod	Shephelah/ southern coast?
Naṣbeh 200		Krater	2	Terra rossa	X175, =dw3	#3- Ashdod	Shephelah
Naṣbeh 201	2010.1.154	Sherd	1	Moẓa	X176	#15- 'Moza'	Central hills
Naṣbeh 215	2018.1.92	Jug	3	Loess	X175,=dw2		Shephelah/ southern coast
Naṣbeh 290	2010.1.148	Sherd	3	Loess	X175, =dw1		Shephelah/ southern coast
Naṣbeh 291	2010.1.153	Krater	5	Alluvial/ Hamra	X174	#2- Jerusalem?	Central coast
Naṣbeh 292	2010.1.156	Krater	5	Alluvial/ Hamra	X174		Central coast
Naṣbeh 293	2010.1.137	Sherd	5	Alluvial/ Hamra	X174	#5- Jerusalem?	Central coast
Naṣbeh 294	2010.1.149	Krater	5	Alluvial/ Hamra	X174		Central coast
Naṣbeh 295	2018.1.145	Sherd	5	Alluvial/ Hamra	X174	#7- Jerusalem?	Central coast
Naṣbeh 296	2018.1.139	Sherd	2	Terra rossa	X175, =dw3		Shephelah?
Naṣbeh 297	2018.1.140	Jug	1	Moẓa	Edom		Central hills?
Naṣbeh 298	2018.1.141	Krater	4	Loess& Moẓa mix?	JleC		?
Naṣbeh 299	2018.1.144	Krater	1	Moẓa	Single	#8- Single	Central hills?
Naṣbeh 300	2018.1.146	Sherd	5	Alluvial/ Hamra	X174		Central coast

sherds (which have not been analyzed) represent vessels made at one of the Philistine cities, their presence at sites in the central hills could indicate sporadic trade connections. If they are locally made vessels, they could either indicate Philistine potters working in the region (Gunneweg *et al*. 1994, 236) or some degree of influence of Philistine material culture on that of Judah or the central hills (even Philistine control of the region was suggested [Knauf 2001]). Note, no pottery made in the central hills has thus far been recognized in Iron Age I sites at Philistia proper (see Ben-Shlomo 2018). The article will focus on the provenance of the Philistine Bichrome pottery at Tell en-Naṣbeh.

Altogether, at least 60 Philistine Bichrome sherds were found at the site of Tell en-Naṣbeh (McCown 1947, 180; Wampler 1947, pls. 80, 86–87; Gunneweg *et al*. 1994). The site is a fortified Iron Age hilltop settlement 12 km northwest of Jerusalem in the region of Benjamin located on the main road that ran north–south through the central Hill Country (Fig. 1). The walled nature of the site helps identify it as biblical Mizpah (e.g., Albright 1923; McCown 1947), which, according to the Bible, was fortified by King Asa of Judah (together with Geba; 1 Kings 15:22; 2 Chr. 16:6). The excavation was published in final reports, but the excavation methods rarely separated floor levels; therefore, it is very difficult to associate finds from the dig stratigraphically to chronological phases (see Zorn 1993). Furthermore, no architectural remains at the site were dated to the Iron Age I (most of the Philistine sherds were attributed to Stratum II [McCown 1947, 85–86, 180–183], dated to the late Iron Age, where they were residual). Yet, pottery vessels which are typologically clearly dated to this period were unearthed. Philistine Bichrome sherds are very easily distinguished due also to their distinct painted decoration and typologically unquestionably belong to the Iron Age I. No complete Philistine Bichrome vessel was found at Tell en-Naṣbeh, yet, many of the sherds are typologically indicative. Most of these belong to bell-shaped kraters with wide thickened rims (see also Dothan 1982, 54); few belong to jugs (strainer spouted); others were defined as ‘sherds’ (see Table 1).

More than 25 years ago, results of Neutron Activation of 17 Philistine Bichrome vessels from the site of Tell en-Naṣbeh were published by Gunneweg and others (Gunneweg *et al*. 1994). The results were surprising because some of these typical Philistine vessels have been found to be locally produced at this hill-land Judean site. The geographic source of several vessels could not be identified. This study follows up on this issue, incorporating both petrographic and new chemical analysis, and enlarging the sample size. In this study 21 Philistine Bichrome vessels from Naṣbeh were analyzed by thin section petrography (TSPA) and Neutron Activation Analysis (NAA), of these ten were already analyzed by the Gunneweg team and reanalyzed and studied by us, and 11 are new. This issue was restudied here for several reasons. Aside of enlarging the sample, employing the additional method of petrography enabled us to geographically locate production sources (generally) in cases where no reference data exists for compositional matching. Second, in the past 25 years additional provenance studies have enlarged the data base, and un-located chemical groups may be linked with new and located groups now.

PREVIOUS COMPOSITIONAL ANALYSIS

Gunneweg and others analyzed 16 or 17 Philistine sherds from Tell en-Naṣbeh (Gunneweg *et al*. 1994). The compositional results indicated several groups, some were locally made, whereas others not. These results indicated that five sherds matched the ‘Moẓa clay’ chemical profile (Gunneweg *et al*. 1994: table 1, columns 1–3) and therefore were manufactured locally or in the central hills region (Gunneweg *et al*. 1994, 232–234, table 2). Another four sherds, though somewhat similar to a group of ‘local’ style pottery from Tell Qasile (Gunneweg

Table 2 *Raw Weight Concentration Data Measured in Vienna of the 21 Samples of Bichrome Pottery Samples from Tell en-Naṣbeh in µg/g (ppm), if not Indicated otherwise*

Sample	*As*	*Ba*	*Ce*	*Co*	*Cr*	*Cs*	*Eu*	*Fe%*	*Hf*	*K%*
NAS193	6.06	198.	45.1	13.7	93.0	5.60	1.02	4.23	3.20	4.05
NAS194	3.53	381.	40.5	11.6	109.	1.27	1.07	2.43	5.57	0.63
NAS195	3.57	793.	49.2	15.6	107.	1.97	1.19	2.68	5.18	0.90
NAS196	6.82	177.	45.1	14.3	94.4	5.54	1.06	3.85	3.22	4.12
NAS197	3.94	460.	46.4	13.3	104.	1.29	1.12	2.78	4.89	0.71
NAS198	3.84	341.	59.0	15.0	98.9	1.30	1.25	3.35	16.3	0.95
NAS199	3.40	377.	46.8	11.5	74.4	1.13	0.98	2.52	10.5	1.25
NAS200	5.54	426.	67.0	16.7	108.	1.19	1.44	3.79	14.6	1.41
NAS201	7.96	208.	42.6	13.0	91.7	4.62	0.95	3.63	3.05	3.56
NAS215	3.02	388.	45.2	9.12	75.6	0.75	0.91	2.18	9.09	0.85
NAS290	3.89	348.	58.4	15.3	100.	1.33	1.27	3.42	15.4	0.93
NAS291	4.67	706.	50.5	14.0	117.	1.71	1.23	2.90	6.13	0.90
NAS292	3.52	506.	42.7	11.6	104.	1.37	1.06	2.42	5.88	0.75
NAS293	3.41	1,470.	52.3	14.8	126.	2.08	1.31	3.19	5.45	0.73
NAS294	4.33	935.	43.5	12.9	110.	1.96	1.13	2.61	6.36	0.70
NAS295	4.38	1,110.	45.2	12.2	103.	1.46	1.10	2.52	5.17	0.75
NAS296	3.95	347.	73.1	18.5	122.	1.91	1.62	4.40	16.1	1.50
NAS297	6.07	191.	40.8	11.7	80.6	3.36	0.99	3.44	3.28	2.49
NAS298	4.28	263.	55.4	13.5	108.	3.18	1.17	3.53	8.70	2.18
NAS299	4.94	154.	27.7	5.41	63.9	2.18	0.65	2.59	2.03	2.33
NAS300	4.02	724.	44.7	12.0	107.	1.60	1.15	2.60	6.47	0.70
Ave. error	0.19	12.	0.85	0.20	1.8	0.030	0.029	0.053	0.11	0.019
in%	4.1	2.4	1.8	1.5	1.8	1.4	2.5	1.7	1.5	1.2

Table 2 *Continued*

Sample	*La*	*Lu*	*Na%*	*Nd*	*Ni*	*Rb*	*Sb*	*Sc*	*Sm*
NAS193	21.3	0.31	0.16	19.8	70.2	99.6	0.37	16.7	4.25
NAS194	25.2	0.38	0.22	22.2	102.	27.3	0.28	9.71	3.92
NAS195	29.0	0.50	0.28	24.3	1,050.	34.3	0.35	10.8	4.27
NAS196	21.6	0.29	0.18	16.5	157.	97.2	0.25	17.3	4.07
NAS197	27.9	0.41	0.26	17.4	262.	31.1	0.35	10.6	4.49
NAS198	28.9	0.43	0.48	27.0	219.	38.0	0.31	11.4	4.88
NAS199	22.5	0.32	0.37	20.8	160.	30.2	0.28	8.73	3.90
NAS200	32.7	0.51	0.60	28.4	108.	41.9	0.32	12.6	5.55
NAS201	19.6	0.28	0.15	13.8	505.	85.6	0.31	16.2	3.71
NAS215	22.4	0.31	0.31	19.0	74.7	25.6	0.21	7.82	3.71
NAS290	28.2	0.40	0.48	25.4	175.	36.8	0.32	11.7	4.77
NAS291	31.5	0.38	0.26	21.2	149.	34.0	0.37	11.7	4.88
NAS292	26.3	0.38	0.23	27.0	117.	29.1	0.29	10.1	4.13
NAS293	32.5	0.41	0.27	22.3	150.	36.3	0.44	12.7	5.06
NAS294	28.2	0.36	0.22	21.6	--	31.6	0.32	10.8	4.36
NAS295	27.7	0.38	0.29	21.3	135.	29.8	0.38	10.2	4.20
NAS296	34.8	0.48	0.74	30.9	122.	51.9	0.36	14.9	5.80
NAS297	19.9	0.28	0.14	14.1	185.	59.9	0.25	14.3	3.84
NAS298	25.4	0.30	0.23	25.6	81.4	64.6	0.46	13.9	4.36
NAS299	13.3	0.15	0.13	8.12	86.8	53.8	0.16	11.5	2.59

(*Continues*)

Table 2 (*Continued*)

Sample	*La*	*Lu*	*Na%*	*Nd*	*Ni*	*Rb*	*Sb*	*Sc*	*Sm*
NAS300	27.8	0.41	0.22	19.4	104.	31.2	0.36	10.7	4.25
Ave. error	0.54	0.006	0.007	0.65	5.0	1.3	0.014	0.24	0.083
in%	2.1	1.7	2.4	3.1	2.5	2.7	4.4	2.0	1.9

Table 2 *Continued*

Sample	*Sr*	*Ta*	*Tb*	*Th*	*U*	*W*	*Yb*	*Zn*	*Zr*
NAS193	116.	0.63	0.55	6.71	2.24	1.42	2.09	67.8	99.3
NAS194	308.	0.61	0.64	4.64	1.95	0.71	2.70	85.4	183.
NAS195	471.	0.67	0.69	5.67	2.17	0.80	2.94	90.4	178.
NAS196	129.	0.63	0.56	6.59	2.44	1.03	2.11	62.7	109.
NAS197	339.	0.69	0.68	5.39	2.26	0.85	2.84	112.	166.
NAS198	217.	1.12	0.73	7.64	1.77	1.18	3.15	61.6	481.
NAS199	293.	0.83	0.60	5.60	1.74	1.11	2.53	59.1	312.
NAS200	228.	1.22	0.85	8.21	1.80	1.04	3.57	85.2	436.
NAS201	133.	0.59	0.53	6.20	2.21	1.45	2.01	55.2	93.4
NAS215	336.	0.71	0.55	5.88	1.66	0.74	2.27	70.3	274.
NAS290	220.	1.13	0.76	7.49	1.87	0.76	3.21	65.3	476.
NAS291	309.	0.72	0.71	6.19	2.64	0.96	3.04	107.	199.
NAS292	309.	0.62	0.65	4.97	2.42	0.70	2.49	99.4	213.
NAS293	376.	0.79	0.76	6.27	3.01	0.74	3.10	122.	182.
NAS294	409.	0.74	0.68	6.81	2.73	1.06	2.84	102.	219.
NAS295	316.	0.63	0.61	5.24	2.47	1.01	2.58	103.	191.
NAS296	269.	1.38	0.93	8.94	2.21	1.22	3.86	83.8	507.
NAS297	142.	0.54	0.53	5.66	2.09	1.53	2.02	67.5	106.
NAS298	166.	0.88	0.67	6.89	2.45	1.25	2.73	80.6	260.
NAS299	140.	0.39	0.35	4.14	1.67	--	1.35	77.1	70.7
NAS300	325.	0.67	0.65	5.44	2.33	1.06	2.73	105.	212.
Ave. error	11.	0.019	0.018	0.091	0.11	0.052	0.066	1.7	19.
in%	4.3	2.5	2.7	1.5	5.2	5.0	2.5	2.0	8.0

Note: Below the average experimental uncertainties (measurement errors), also in % of C, are recorded to indicate the measurement precisions of the NAA procedure. Missing values are below the detection limit.

et al. 1994, 234, the writers indicate this resemblance is not sufficient), were suspected to be produced in the hill country as well or in an unknown Levantine source. Four additional sherds seemed to match an Ashdod area profile (Gunneweg *et al*. 1994, table 1, column 7), thus, imported from Philistia. The other four vessels analyzed were 'outliers' not clearly grouped or assigned to a provenance indicating additional production centers (Gunneweg *et al*. 1994, 235). Thus, according to the NAA results, five to nine of the Philistine Bichrome sherds were manufactured locally or in the central hills region. Thus, the study demonstrates that Philistine Bichrome pottery was both exported from Philistia to the central hills and produced outside of Philistia in the central hills, as well as indicating the existence of several additional production centers not yet identified geographically (probably including Gaza). Although the actual finding of Philistine sherds in this region may be surprising, the compositional provenance determination was even more surprising for many scholars (see Gunneweg *et al*. 1994, 229), because apparently part of the vessels were made locally or the highlands region. Previously it was assumed that these vessels can only be an indication of trade with the Philistine region (e.g., Kenyon 1970, 230, Gunneweg *et al*. 1994, 229 for more references).

PETROGRAPHIC ANALYSIS

Sampling and geology

The 21 Philistine Bichrome sherds from Tell en-Naṣbeh were analyzed during 2018–2019 by petrography.[1] Standard thin section petrography methodology was used (see Ben-Shlomo 2009). The geology of Tell en-Naṣbeh (in modern Ramallah) and its vicinity will be described shortly. The site itself lies on the Kisalon Formation (Shachnai 2000) with dolomite and quartzolite. In the 5 km radius of the site of Sorek (to north, chert marl, and dolomite), Beir Meir, Aminadav, Moza, and Menuha formations are exposed (Shachnai 2000); the Menuha formation is later and is composed of chalk. The Moẓa and Aminadav formations are especially well known in this region for pottery production, resulting in a calcareous clay matrix and dolomite sand natural temper (see e.g., Glass *et al*. 1993). This area is also dominated by terra rossa type soil (Dan *et al*. 1976) composed of dust and worn hard calcareous rocks (mostly limestone).

Results

The petrographic results indicate four or five fabrics, some reflecting different sources; these were denoted as petrographic groups, listed below (Table 1, Fig. 2).

Various sources of production for the Philistine pottery include:

Petrographic Group 1. This is a fabric characterized by a fine calcareous matrix, rich with rhombic dolomite silt and sand (usually 80–300 ?m, Fig. 2, 1, "DL"), and hardly anything else in the coarse fraction (one of the samples is richer in microfossils): Moẓa type clay with dolomite sand (five examples, 'Group 1', Fig. 2, 1). This clay is common in the various regions of the central hills of Palestine (including the vicinity of Tell en-Naṣbeh). Additional non-plastics include chalk and calcareous concentrations and few clay pellets. Dolomite sand comprises 30–35% of the slide area and appears mostly worn on edges rather than as perfect rhombs. The fabric is related to the Moẓa clay or Moẓa marl formations (e.g., Arkin *et al*. 1965) and can also be described as 'Moẓa clay with Aminadav dolomite sand' (e.g., Cohen-Weinberger *et al*. 2017, 9–10, Group A, fig. 10; Ben-Shlomo and Mommsen 2018, 356, Group 2b; also Goren and Halperin 2004, 2,556–2,557; LCP Petrofabric No. 36).[2] It is generally assigned to a provenance from the central hills and/or Judah (see, e.g., Ben-Shlomo and Mommsen 2018, 355). Many storage vessels and table ware forms from Tell en-Naṣbeh are made of this clay, though tableware is usually made of terra rossa type clay (see below).

Petrographic Group 2. This fabric has a reddish-brown matrix. The coarse fraction is usually single spaced and contains mainly well sorted quartz silt (Fig. 2, 2, "QZ"), limestone fragments (Fig. 2 2, "LS"), chalk, rounded quartz sand, chert, and clay pellets: terra rossa clay (3 examples, 'Group 2', Fig. 2,). This fabric could fit terra rossa related clays, a soil developing from dust on hard limestone rocks (nari) (e.g., Singer 2007, 26; Uziel *et al*. 2015, 81–82), common in the Central Hills and Shephelah, bordering Philistia, but also in northern Israel. At Tell en-Naṣbeh as well as at Jerusalem this is the major cooking ware fabric (Ben-Shlomo 2019, 232–233).

[1] The Philistine Bichrome pottery were part of a group of 200 pottery vessels, mostly from the Iron Age, that were sampled and analyzed by petrography. A detailed report on the results will be published elsewhere.

[2] *levantineceramics.org/petrofabrics/moza-clay-aminadav-sand-sized-dolomite-crystals*, accessed on 27 August 2020.

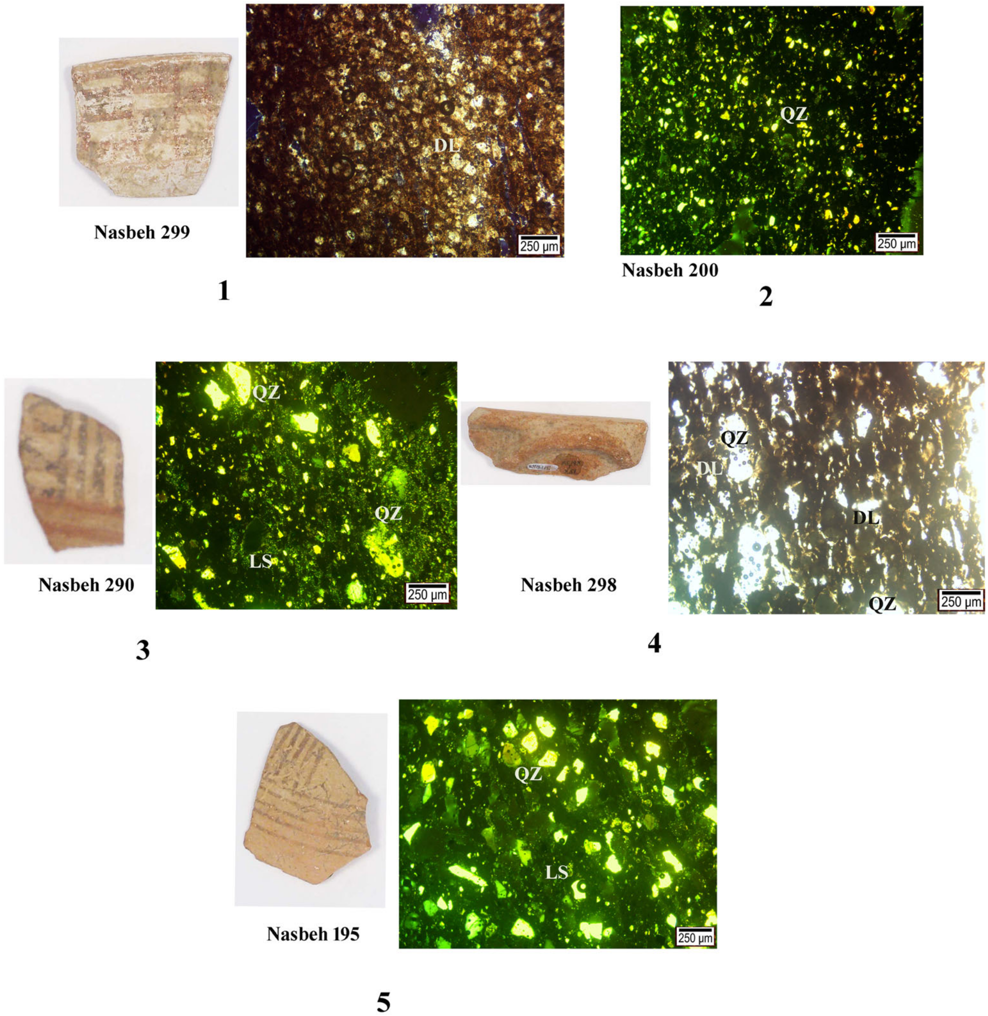

Figure 2 *Photographs of sherds and of petrographic thin sections. Note: Nos. 1–3,5 in crossed polarized light, No. 4 in plain polarized light (sherd photographs are courtesy of the Badé Museum).*

Similar clay that also contains dolomite silt is the most common fabric in Iron Age II Jerusalem (Ben-Shlomo and Mommsen 2018, 353); yet, according to petrography alone, it is often difficult to link this fabric to a narrow geographic area in Israel (e.g., Martin 2017, PG3, suppl. 1, 4–6). This is probably the most common clay used for Iron Age pottery at Tell en-Naṣbeh, mostly for cooking pots. Note, that these examples were grouped by NAA together with vessels made of loess type soil (see below Group 3).

Petrographic Group 3. This fabric is characterized by a reddish calcareous matrix, bimodal quartz inclusions (silty angular fragments and sand-sized rounded fragments, about 25–30% of slide area, Fig. 2, 3, "QZ"), and calcareous inclusions (Fig. 2, 3, "LS"), as well as clay pellets and feldspar in smaller quantities: loess clay (2 examples, 'Group 3', Fig. 2, 3) The clay is possibly derived from loess type soil originating in the western Shephelah and coastal plains (e.g. Master 2003, 55, Goren *et al*. 2004, 9,112; Martin 2017, PG1, suppl. 1, 1–3; LCP Petrofabric No. 31).[3] Thus, these vessels are likely to be imports from Philistia.

Petrographic Group 4. This group (3 examples, 'Group 4', Fig. 2, 4) possibly represents a mixture of Moẓa and loess type clays, because it contains both dolomite sand and silty and sand quartz (including rounded grains) in large quantities. It is not clear whether they represent different clay sources or natural or anthropogenic mixtures (possibly loess type clay with added dolomite sand). A possibly similar group was defined in the Iron Age pottery of Jerusalem (Ben-Shlomo 2019, 205–7, Group 5), yet this petrographic group is not well-defined in research.

Petrographic Group 5. This is a fabric characterized by a dark to reddish-brown matrix. Main non-plastics are quartz (usually 30% of slide area, Fig. 2, 5, "QZ"), mostly silt sized with some rounded sand (sized up to 0.3 mm) and some calcareous inclusions (10–15% of slide area). The calcareous inclusions are usually rounded limestone, chalk, and microfossils fragments, sand sized up to 0.5 mm; several feldspar grains appear as well: Hamra or alluvial type clay (8 or 9 examples, 'Group 5', Fig. 2, 5). This fabric may represent a Hamra or alluvial coastal clay originating from central coast of Israel (Ashdod up to the Carmel coast), because it combines quartz sand and feldspar originating from the Nile delta and kurkar-derived calcareous sand (see e.g., Goren *et al*. 2004, 292–294; Ben-Shlomo and Gorzalczany 2010; Martin 2017, PG4, suppl. 1, 6–7; Ben-Shlomo 2019, 222, Group 18; *LCP Petrofabric No. 40*).[4] Notably although this is the most common fabric for the Philistine Bichrome pottery at Naṣbeh, it hardly appears in any other wares or forms sampled from the site (only one Phoenician-style jug from the site was also made from this fabric).

NEW CHEMICAL ANALYSIS

Method

The samples that were analyzed by NAA were drilled by a diamond drill point (having a metal shaft) and weighed to about 80 mg, sufficient also for coarse wares if clay dilutions or enrichments are corrected. The irradiations were done according to the standard procedure for ceramics as established at the research reactor of the TRIGA Center Atominstitut in Vienna (Sterba 2018). The Bonn pottery standard (Mommsen and Sjöberg 2007) calibrated with the Berkeley pottery standard (Perlman and Asaro 1969) was used. Therefore, the obtained concentration values of the chemical groups can be compared to values in the Bonn and Berkeley databanks.

The assignment of the individual samples to the chemical groups was made according to the statistical filtering method developed at Bonn (e.g., Beier and Mommsen 1994), which uses a modified Mahalanobis distance as a dissimilarity measure. Experimental uncertainties and also best relative fit (dilution) factors are considered per each sample (Mommsen and Sjöberg 2007) and applied for corrections. A recent summary is given in Gilboa *et al*. 2017 or Lis *et al*. 2020, and references therein. The Bonn Laboratory data bank of over 12,500 samples from the central and eastern Mediterranean enables one to assign samples and whole groups of samples to a geographic provenance, according to given reference materials.

[3] *levantineceramics.org/petrofabrics/shephelah-alluvial-clay-calcareous-sand-quartz-silt*, accessed on 27 August 2020.
[4] *levantineceramics.org/petrofabrics/central-coastal-plain-calcareous-clay-quartz-and-tuff,* accessed on 27 August 2020.

Table 3A *Average weight concentration values M in µg/g (ppm), if not indicated otherwise, of groups of Philistine Bichrome pottery samples from Tell en-Naṣbeh. σ is the standard deviation (root mean square deviation) in %. The individual samples have been corrected with a best relative factor with respect to the grouping values (given below). Missing values are below the detection limit, Sr not measured in Bonn.*

	X174		*X175*		*X176*		*Edom*		*JleC*	
	8 samples factor1.00		*6 samples factor1.00*		*3 samples factor1.00*		*26 samples factor1.00*		*12 samples factor1.00*	
	M	*σ(%)*	*M*	*σ(%)*	*M*	*σ(%)*	*M*	*σ(%)*	*M*	*σ(%)*
As	3.96	(12.)	3.93	(15.)	6.95	(17.)	--		8.05	(41.)
Ba	773.	(43.)	380.	(22.)	195.	(11.)	296.	(62.)	265.	(17.)
Ce	45.5	(3.4)	57.9	(3.5)	44.2	(2.1)	56.1	(4.6)	67.4	(3.7)
Co	12.7	(3.7)	14.1	(8.9)	13.6	(2.0)	17.6	(13.)	16.9	(8.9)
Cr	109.	(3.4)	96.0	(5.2)	92.9	(2.6)	113.	(15.)	115.	(6.8)
Cs	1.58	(14.)	1.25	(16.)	5.24	(6.9)	3.94	(22.)	3.82	(16.)
Eu	1.14	(2.5)	1.23	(5.1)	1.01	(2.5)	1.28	(5.6)	1.41	(3.8)
Fe\%	2.67	(4.0)	3.23	(8.6)	3.89	(5.4)	4.43	(7.8)	4.28	(3.6)
Hf	5.74	(11.)	13.5	(12.)	3.15	(1.8)	4.75	(15.)	8.83	(11.)
K\%	0.73	(9.0)	1.14	(18.)	3.90	(4.2)	2.11	(26.)	2.87	(13.)
La	28.3	(2.6)	28.1	(4.3)	20.8	(2.2)	26.2	(5.5)	30.7	(4.1)
Lu	0.39	(6.5)	0.41	(7.6)	0.29	(1.8)	0.42	(6.1)	0.46	(9.5)
Na\%	0.25	(10.)	0.49	(14.)	0.16	(6.4)	0.62	(84.)	0.32	(54.)
Nd	21.5	(16.)	25.1	(3.0)	16.6	(15.)	25.2	(7.3)	29.0	(4.9)
Ni	145.	(37.)	144.	(36.)	250.	(98.)	57.6	(48.)	147.	(70.)
Rb	31.1	(2.7)	36.8	(7.3)	93.8	(4.4)	74.2	(16.)	78.8	(5.0)
Sb	0.35	(10.)	0.30	(6.5)	0.31	(20.)	0.43	(41.)	0.47	(20.)
Sc	10.8	(2.4)	11.1	(6.7)	16.7	(2.2)	19.3	(8.9)	16.6	(5.2)
Sm	4.39	(2.7)	4.74	(3.1)	4.00	(3.6)	5.12	(4.3)	5.72	(4.6)
Sr	335.	(9.9)	236.	(24.)	126.	(10.)	--		--	
Ta	0.68	(4.1)	1.05	(7.7)	0.62	(2.6)	0.78	(14.)	1.09	(9.9)
Tb	0.68	(2.8)	0.73	(4.2)	0.55	(1.4)	0.71	(7.6)	0.82	(5.3)
Th	5.59	(9.3)	7.26	(5.8)	6.49	(1.3)	7.45	(7.6)	8.70	(4.1)
U	2.44	(8.7)	1.85	(11.)	2.29	(4.5)	2.33	(31.)	2.23	(16.)
W	0.87	(18.)	1.02	(18.)	1.30	(20.)	2.13	(20.)	1.73	(18.)
Yb	2.78	(3.8)	3.07	(3.6)	2.07	(2.1)	2.79	(5.8)	3.21	(4.0)
Zn	104.	(5.8)	71.5	(16.)	61.7	(7.1)	74.6	(33.)	93.0	(24.)
Zr	193.	(12.)	404.	(12.)	100.	(5.1)	183.	(39.)	331.	(10.)

Best relative fit factors for the samples in the Tell en-Naṣbeh groups:
X174: NAS 194(1.09), 197(1.00), 291(0.94), 292(1.05), 293(0.89), 294(0.99), 295(1.04), 300(1.00)
X175: NAS 198(0.97), 199(1.16), 200(0.90), 215(1.31), 290(1.00), 296(0.80)
X176: NAS 193(0.98), 196(0.98), 201(1.04)

Results

The raw NAA concentration data are shown in Table 2 and can be downloaded from the website https://mommsen.hiskp.uni-bonn.de/data.html. The chemical grouping of these data resulted in three new groups X174, X175, and X176 still un-localized (Table 3).

Eight vessels belonged to chemical group **X174** (Table 3; Fig. 3). This is a relatively well-defined group, yet without any reference material and still not assigned to a production

Table 3B *Average weight concentration values M in µg/g (ppm), if not indicated otherwise, of the group X175 of 6 samples (see Table 1) compared with its 3 subgroup pairs =dw1, =dw2, and =dw3 (see text). σ is the standard deviation (root mean square deviation) in %. The subgroups have been corrected with the best relative fit factor with respect to the sum group X175. The individual samples of the pairs have been corrected with a best relative factor with respect to the pair grouping values (given below).*

	X175		*=dw1*		*=dw2*		*=dw3*	
	6 samples factor1.00		*2 samples factor0.97*		*2 samples factor1.27*		*2 samples factor0.83*	
	M	*σ(%)*	*M*	*σ (%)*	*M*	*σ (%)*	*M*	*σ (%)*
As	3.93	(15.)	3.75	(4.0)	4.06	(5.2)	3.96	(28.)
Ba	380.	(22.)	332.	(1.5)	486.	(5.2)	323.	(19.)
Ce	57.9	(3.5)	56.8	(1.5)	58.4	(2.1)	58.5	(1.5)
Co	14.1	(8.9)	14.7	(1.5)	13.1	(13.)	14.6	(2.8)
Cr	96.0	(5.2)	96.8	(1.3)	95.2	(4.3)	95.9	(4.1)
Cs	1.25	(16.)	1.28	(1.5)	1.19	(25.)	1.28	(29.)
Eu	1.23	(5.1)	1.22	(2.5)	1.20	(2.5)	1.27	(3.9)
Fe\%	3.23	(8.6)	3.30	(1.3)	2.98	(7.1)	3.40	(6.1)
Hf	13.5	(12.)	15.3	(4.0)	12.4	(7.0)	12.8	(2.4)
K\%	1.14	(18.)	0.91	(1.3)	1.32	(24.)	1.21	(1.0)
La	28.1	(4.3)	27.6	(2.0)	28.5	(2.9)	28.1	(2.0)
Lu	0.41	(7.6)	0.40	(6.1)	0.40	(0.6)	0.41	(9.4)
Na\%	0.49	(14.)	0.47	(1.8)	0.43	(9.5)	0.55	(9.6)
Nd	25.1	(3.0)	26.0	(2.8)	25.2	(3.2)	24.5	(2.4)
Ni	144.	(36.)	191.	(16.)	148.	(49.)	95.2	(4.2)
Rb	36.8	(7.3)	36.3	(2.5)	35.3	(8.5)	38.8	(11.)
Sb	0.30	(6.5)	0.30	(4.3)	0.31	(17.)	0.28	(4.9)
Sc	11.1	(6.7)	11.3	(1.7)	10.5	(4.6)	11.4	(7.4)
Sm	4.74	(3.1)	4.65	(1.5)	4.83	(2.4)	4.69	(1.5)
Sr	236.	(24.)	213.	(3.0)	399.	(13.)	208.	(7.0)
Ta	1.05	(7.7)	1.09	(2.4)	0.98	(7.7)	1.08	(4.3)
Tb	0.73	(4.2)	0.72	(2.5)	0.72	(3.0)	0.73	(1.9)
Th	7.26	(5.8)	7.35	(1.4)	7.29	(6.6)	7.11	(1.6)
U	1.85	(11.)	1.75	(5.0)	2.16	(4.5)	1.65	(10.)
W	1.02	(18.)	0.94	(31.)	1.17	(26.)	0.90	(4.6)
Yb	3.07	(3.6)	3.08	(2.3)	3.04	(4.5)	3.08	(2.3)
Zn	71.5	(16.)	61.5	(4.1)	82.3	(15.)	70.3	(5.6)
Zr	404.	(12.)	465.	(5.9)	371.	(6.0)	381.	(5.9)

Best relative fit factors forthe samples in the subgroups of X175:
=dw1: NAS 198(1.00), 290(1.00)
=dw2: NAS 199(0.98), 215(1.02)
=dw3: NAS 200(1.03), 296(0.97)

place. All eight examples also belong to petrographic group 5, presumably originating from the central coast (possibly clay derived from Hamra soil). These vessels showed a similar profile to four Naṣbeh sherds in the previous analysis (Gunneweg *et al*. 1994, 234, table 1 column 4). There, three were linked with a Philistine Bichrome pottery profile previously published from Tell Qasile, and one was a single, yet, eventually the authors concluded this was a ‘suspected local ware’ (or linked with the Jerusalem reference group, Gunneweg *et al*. 1994, 235). Yet, indeed the Tell Qasile group (32 samples, 15 elements, Yellin and Gunneweg 1985, 114 table 16,

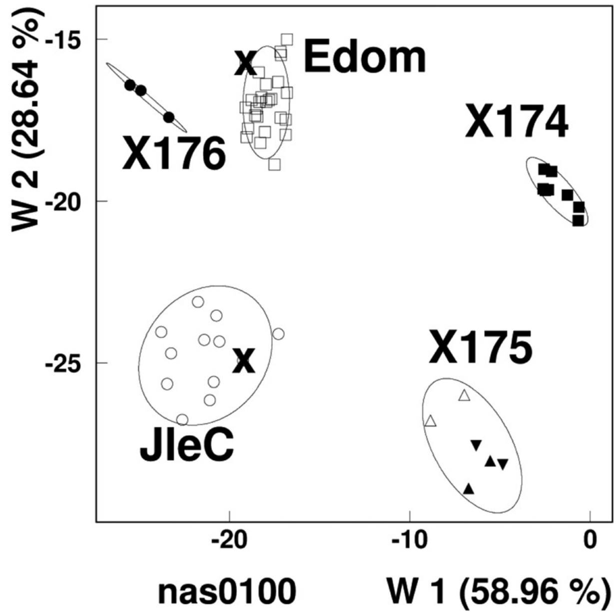

Figure 3 *Result of a discriminant analysis of 55 samples, corrected for dilution, assuming 5 clusters using all elements given in Table 3 except As, Ba, and Na. Note: Plotted are the discriminant functions W1 and W2, covering 59% and 29%, respectively, of the between-group variance. The ellipses drawn are the 2σ boundaries of the groups. The three subgroup pairs of X175 are indicated by different types of triangles. The data point of the Naṣbeh samples in the Edom and in the JleC groups are indicated. The different groups are well separated.*

column 5, also compared to Tel Mevorakh pottery, idem table 18) is quite similar to our group X174, if multiplied with a factor of 1.11 (in Gunneweg *et al*. 1994, 14 elements, Ni is missing). The petrographic analysis can also indicate a possible provenance in the Tell Qasile area or more to the north on the central coast. This clearly is not a local group to the site of Tel en-Naṣbeh.

Six vessels could be grouped as a new group, X175. This is a poorly defined group with quite large spreads of Cs16%, Hf 12%, K 18%, Ni 36%, Sr 24%, and Zn 16%. The six members can be divided into three possible subgroups, the pairs = dw1, = dw2, and = dw3 (Table 3B, we mark pairs with labels beginning with a =). These pairs differ mainly in their clay parts, = dw2 is diluted with an unknown material (Ca concentration was not measured) by 27% with respect to the sum group X175, and pair = dw3 shows an enriched clay part, the concentrations have to be lowered by a factor of 0.83 (17%) to match the sum group. In the discriminant analysis projection shown in Figure 3, the three pairs are indicated by different types of triangles and are close to each other.

The pair = dw1 of the samples NAS198 and NAS 290 have concentrations values close to the sum group (factor 0.97). Both sherds have nearly identical concentration values resulting in unusually low spreads (root mean square deviations) for many elements below 2%. This can occur if these two sherds were produced simultaneously from the same clay ball or even belong to the same vessel. According to petrography this group is also very variable, pair = dw3 belongs to Group 2 (terra rossa). Pair = dw1 and pair = dw2 have each one sample in Group 3 (loess) and in Group 4 (mixture loess/Moẓa?). Therefore, at this stage the provenance of some of these vessels is less clear, though it is more likely to be in the southern coastal plains or the Shephelah, in relation to the main Philistine territory. The previous analysis also linked two of these vessels to Ashdod (Gunneweg *et al*. 1994, 235, table 1, column 7).

Three vessels belong to Group X176. This group is statistically very similar to group X006 (the main differences are in Co, K, which are lower in group X006, while Zn in higher) that was previously published in relation to Iron Age pottery of Jerusalem (Ben-Shlomo and Mommsen 2019, 326) and was linked to a source in the central hills because it is probably related to Moẓa clay according to petrographic analysis. In this study all the vessels belonging to chemical group X176 also belonged to Petrographic Group 1 related to Moẓa clay with dolomite sand (two of these were previously analyzed and grouped with NAA "Moẓa" group, Gunneweg *et al*. 1994, 232). Therefore, this group represents a local production of Tell en-Naṣbeh.

One sample belonged to Group JleC (Table 3A). This group was also noted in relation to clay sources of the Jerusalem region (Ben-Shlomo and Mommsen 2019, 322–323) and may be linked with Moẓa clay, possibly from the vicinity of Jerusalem. Five of the wasters analyzed from the late workshop of the Jerusalem Convention Center belong to this group. According to petrography, this vessel was made of mixed loess/Moẓa.

One vessel was grouped to the 'Edom' group (Table 3A); this group was previously also associated with Moẓa clay (here also Petrographic Group 1). Two additional vessels were chemical singles (see Table 1; these belong to Petrographic Groups 1 and 5).

DISCUSSION

In general, the new compositional analysis of Philistine Bichrome pottery from Tell en-Naṣbeh support the main results of the previous study. This pottery included vessels that were likely locally produced and others imported from Philistia. The addition of petrographic analysis to existing and new chemical analysis of the Naṣbeh Philistine pottery proved to be instrumental in further exploring the sources of this ware at the site, in particular, because with petrographic analysis it is possible to achieve a geographic provenance determination, at least a general one, even without reference material. Therefore, the group that was suspected to be local proved to be sourced in the central coast of Israel (Group 5 and NAA Group X174).

In most cases the chemical and petrographic grouping, and if relevant, the provenance determinations are compatible (as in NAA groups X174 and X006). Nevertheless, in few cases there is some disagreement between the petrographic and chemical grouping, especially in the case of NAA group X175. This possibly results from several causes: the terra rossa soil type (Petrographic Group 2) has several sources in Israel, which may be difficult to separate petrographically. Also it is also possible that the chemical composition of terra rossa soils from the Jerusalem region and Tell en-Naṣbeh region may be somewhat different. Furthermore, one of the groups (Petrographic Group 4) may have represented some non-natural mixture of soils. Thus, according to the chemical grouping, one might suggest that vessels belonging to Group 4 were made in the Shephelah or southern coast (Philistia) and were tempered by the potters for some reason by dolomite sand.

The previous and new compositional results indicate that although some Philistine Bichrome pottery was imported to Naṣbeh from Philistia, most of it was either locally produced or imported from outside Philistia. Interestingly, the sherds coming from Philistia are the smallest group, less than 10%, while the largest group probably comes from the central coast, which is not the core area of the Philistine settlement. Note for example that some Bichrome pottery excavated at Beth Shemesh were found to have a provenance also from the central coast (Goren 2016, 246). These results indicate that the distribution and production of Philistine Bichrome pottery is rather complex and may not always reflect a typical 'pots and people' case (Faust 2019). Philistine pottery both occurs and is also produced in non-Philistine sites.

Gilboa *et al*. (2006) have studied the Philistine Bichrome from the northern coast of Israel, in particular at the sites of Tel Dor and Tel Keisan. Sources for this pottery (only sherds from Dor were analyzed) came from the central or Carmel coast, the Lebanese coast, and Philistia (the southern coast). However, they conclude that the small quantities of Philistine Bichrome in these sites, which are mostly imported from Philistia, indicate that there was not a market for this tableware in the northern coast (Gilboa *et al*. 2006, 323–4, 326). In a more recent study, Martin (2017) analyzed by petrography Philistine Bichrome pottery from Iron Age I sites in northern Israel. A total of 155 vessels were sampled or discussed from Megiddo, Tel Qiri, Tel Dor, Tel Rehov, and other sites (Fig. 1; Martin 2017, table 1). Interestingly, larger quantities of Philistine Bichrome pottery are evidenced in northern valleys sites than in sites on the northern coast. About two-thirds were found to be imported from mostly coastal sites in Philistia (many from Megiddo, Martin 2017: Group PG1 and PG2, brown and loess soils). However, another sizable group was produced in the Jezreel Valley and other northern inland regions (Martin 2017, Groups PG8 and PG9). Other Philistine vessels were sourced to the Carmel and central coastal plain (Martin 2017: fig. 3, PG4, PG5, Hamra and alluvial soils, see also Gilboa *et al*. 2006, 307, table 1, Group Hm1, "Yarkon basin to Haifa bay") and to the central hills (Martin 2017, 218, table 4, PG3, terra rossa soils; though note that Moẓa type clay with dolomite sand does not appear).

The results of Gilboa et al. and Martin seem to contradict the notion of significant 'northern Sea Peoples' entities on the northern coast producing Bichrome pottery, because the majority of these vessels were imported from Philistia. Nevertheless, the results are in many ways rather similar to those from the study of Philistine pottery at Tell en-Naṣbeh, though, the percentage on imports from Philistia is lower there (see above).

The question is what the Philistine vessels, not produced in Philistia proper, signify or reflect: exchange of ideas and cultural influence, trade, movement of people or occupation (Philistine dominance). Although cultural influences related to trade and other contacts are more likely, movement of groups of people between the regions of the central hills, northern Israel, and Philistia cannot be excluded. Such possibly small groups may be responsible for the occurrence of the Philistine Bichrome pottery at Tell en-Naṣbeh, or at sites in northern Israel. It is possible that at some stage of the Iron Age I, this decorated pottery ware became a popular or fashionable one in the southern Levant due its special appearance and potential uses (for wine mixing, see e.g., Martin 2017, 222–5). That could explain both more extensive trade in this pottery as well as a wider group of potters from several regions of the country producing it.

It has been suggested on the basis of the biblical story on the one hand and linguistic reasoning on the other that Philistine control expanded to include the central hills/Judah in the Iron I and possibly later, and thus strongly influenced Judean culture (e.g., Knauf 2001; Niesiołowski-Spanò 2013). This was related to the view of the Philistines as an elite and military group, in line with various biblical records and descriptions of the Sea Peoples in Egyptians texts and biblical passages. Based on archaeological evidence from Philistia, several studies have shown that it is more likely that the Philistines were a community of immigrants with fewer military- and elite-related affinities (Yasur-Landau 2010; Ben-Shlomo 2010, 195). If this version of the Philistines as an immigrant society is adopted, it is hardly likely that this group managed to control the entire area of Palestine in the early Iron Age. Alternatively, the evidence of the early connections and influences between the Philistine culture and other regions of Israel may indicate links between various ethnic groups that were probably in "pre-state" stage in terms of their political institutions. These connections may have also included movement of artifacts and people between the various regions: Philistia, the central and Carmel coast, the central hills, the Jezreel Valley, and northern Israel. If the Philistines were basically an immigrant society, these movements, could have been part of their cultural habits during the early Iron Age.

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PEER REVIEW

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