Cretan Pottery in the Levant in the Fifth and Fourth Centuries B.C.E. and Its Historical Implications

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Among the painted pottery types in the Levant during the fifth and fourth centuries B.C.E., the "East Greek" class is especially conspicuous and usually assumed to have been produced in Ionia. This pottery is the subject of a comprehensive research project, examining it from typological, analytical, and other perspectives. Our conclusion is that the "East Greek" class comprises in fact several subgroups from various other parts of the Mediterranean. Here we discuss one of these groups, including mainly hydriai, table amphoras, and jugs, which we suggest were produced on Crete, specifically in the central part of the island. These are the first Cretan ceramics of this period attested anywhere off the island, and they provide the first hint that maritime routes then linked Crete with various eastern Mediterranean regions. This pottery can perhaps be understood as a proxy for the exchange of a wider array of commodities, a possibility addressed in the concluding section of this article. Since the conventional wisdom is that Crete was largely disconnected from the rest of the Mediterranean in the Classical period, both commercially and culturally, this discovery has important implications for Cretan history and more generally for tracing ancient Mediterranean interconnections. It also adds to our understanding of the ceramic repertoire of fifth- and fourth-century B.C.E. Crete, which is still rather poorly known.[1]

INTRODUCTION

This article is the first fruit of an extensive research program, the aim of which was to reexamine the origin of the so-called East Greek decorated

[1] The project was funded mainly by Israel Science Foundation (ISF) grant 570/09, which was awarded to Gilboa and Lehmann, and by ISF grants 209/14 and 237/14. Gilboa thanks the Goldhirsh-Yellin Foundation (Encino, Calif.) for their long-lasting support of Dor-related research. Parts of this study represent the results of Shalev's unpublished Ph.D. dissertation, "'The Mighty Grain-Lands'—Demographic and Economic Aspects of 'Southern Phoenicia' Under the Achaemenid Regime" (University of Haifa), which was supported by the University of Haifa and by a Nathan Rotenstreich scholarship. We are grateful to Elisa Chiara Portale and Maria Antonietta Rizzo, who studied the Gortyn pottery and made the analyses possible. We thank the staff of the research reactor of the Reactor Institute Delft, Delft University of Technology, for their technical support; Gerwulf Schneider and Małgorzata Daszkiewicz for the X-ray fluorescence (XRF) analysis; and Paula Waiman-Barak for assisting with studying the fabrics and producing the thin-sections and the photomicrographs. Paula Perlman first opened our eyes to the significance of our finds, and Ilan Sharon, codirector of the Tel Dor Excavation Project, and Susan Rebecca Martin provided continuous collaboration and support. We thank our reviewers—Mark Lawall, Antonis Kotsonas, and a third, anonymous reviewer for the *AJA*—for their truly insightful comments and relevant references.

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ceramics prevalent in the Levant during the fifth and fourth centuries B.C.E. and reassess their significance for charting cross-Mediterranean contacts. This class of pottery is often thought to have been produced in the Aegean/Ionian area and distributed to the Levant through the same networks that carried Attic ceramics and east Aegean transport amphoras and their contents to the Levant.[2] Indeed, these decorated wares and the transport amphoras are often discussed under the same "East Greek" appellation and referred to as a single phenomenon. The "East Greek" class comprises mainly simple one-handled bowls but also kraters, various jug forms, and other small containers. They are usually coated with a yellowish-white slip and have simple decorations, mainly horizontal and undulating bands in reddish-brown dilute gloss.[3]

Doubts regarding the exclusively Greek origin of these vessels were first expressed by Hanfmann,[4] who thought that, at the very least, "East Greece" was not their sole production region. Stucky later suggested that they were produced on the Syrian coast.[5] A coastal Syrian/Cilician origin was also advocated in Lehmann's regional ceramic study, which documented the ubiquity of this pottery in Syria.[6]

Beyond Syria, this "East Greek" pottery is well documented in the southern Levant, particularly at coastal sites ("southern Phoenicia" in Elayi's terminology;[7] within modern Israel). Therefore, our study concentrated on Syria and the southern Levant. It involved a typological, distributional, and chronological reexamination of this class, accompanied by provenance analysis of selected samples with a stereomicroscope (magnification up to 500x). Provenance analysis was conducted with petrography, neutron activation analysis (NAA), and to a lesser extent X-ray fluorescence (XRF) analysis. The only northern Levantine sites from which pottery was available for sampling were Al Mina and Kinet Höyük in the Bay of Iskenderun (fig. 1).[8] As these are the Syrian sites from which this pottery is best known, we consider our Syrian sample representative of this region. In Israel, the pottery of most Persian (or Achaemenid)-period sites (ca. 538–332 B.C.E.) was available for analysis, and sampling concentrated on the coastal centers where these decorated wares are most abundant—Dor, Apollonia, Tel Michal, Jaffa, and Ashkelon—although other sites were sampled as well (e.g., ʿAkko).[9] In all, about 750 ceramic items from southern Turkey, Syria, and Israel were examined typologically as part of this larger project. We established typological groups and then selected vessels representing the main groups for further fabric analysis. Of these, 170 were analyzed by petrography, 100 by NAA, and nine by XRF.

The striking result of our research is that the lion's share of the pottery is not East Greek or Greek at all, as already suggested by Lehmann.[10] Rather, the class falls into a few categories, discrete to varying extents, that originate in other parts of the Mediterranean. This adds unexpected hues to the complex canvas of Mediterranean contacts in this period. To simplify the presentation of the data, we intend to discuss the main groups defined by origin in separate articles, to be followed by a synthesis of the trade networks embodied by them. The largest group comprises mostly open shapes that we determined were produced in Cilicia, and it is not discussed here. This article deals with three vessel types that we suggest were produced in central—probably south-central—Crete and a fourth type whose origin is less certain but possibly Cretan as well (figs. 2, 3; table 1). This group of 70 vessels,

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[2] E.g., Stewart and Martin 2005.

[3] Barnett 1940; Ploug 1973, 38–40; Stern 1978, 41; Nodet 1980, 124, 126; Marchese 1989, 146–47; Risser and Blakely 1989; Mook and Coulson 1995, 93–5. For the main shapes, see Lehmann 2000.

[4] Hanfmann 1956; 1963, 148.

[5] Stucky 1983.

[6] Lehmann 1996, 1998, 2000.

[7] Elayi 1982, 96–8.

[8] Pottery from Al Mina was sampled through the generosity and cooperation of museums and curators in Britain: the British Museum (Alexandra Villing); University College London (Rachael Sparks); and the Ashmolean Museum, Oxford (Jack Green). Marie-Henriette Gates generously allowed us access to material from her excavations at Kinet Höyük. The relevant chrono-typological sequence at Kinet Höyük is currently being assessed. Provisional dates are as follows: period 6, the late seventh and early sixth century B.C.E.; period 5, sixth century B.C.E.; period 4, the fifth and fourth centuries B.C.E. (M.-H. Gates and G. Lehmann, pers. comm. 2016).

[9] We deeply thank the Israel Antiquities Authority, especially Michael Saban and Deborah Ben-Ami, for allowing us to study and sample vessels stored in their collections. Further permissions to study, sample, and publish comparative material were granted to us by Ezra Marcus (Tel ʿAkko, Area F, in the framework of a project funded by the Shelby White and Leon Levy Program for Archaeological Publications); Avshalom Zemer and the National Maritime Museum at Haifa (Shiqmona); Samuel Wolff (Tel Megadim); Orit Tzuf (Jaffa); and Dan Master and Josh Wolton (Ashkelon). We thank them all.

[10] Lehmann 2000.

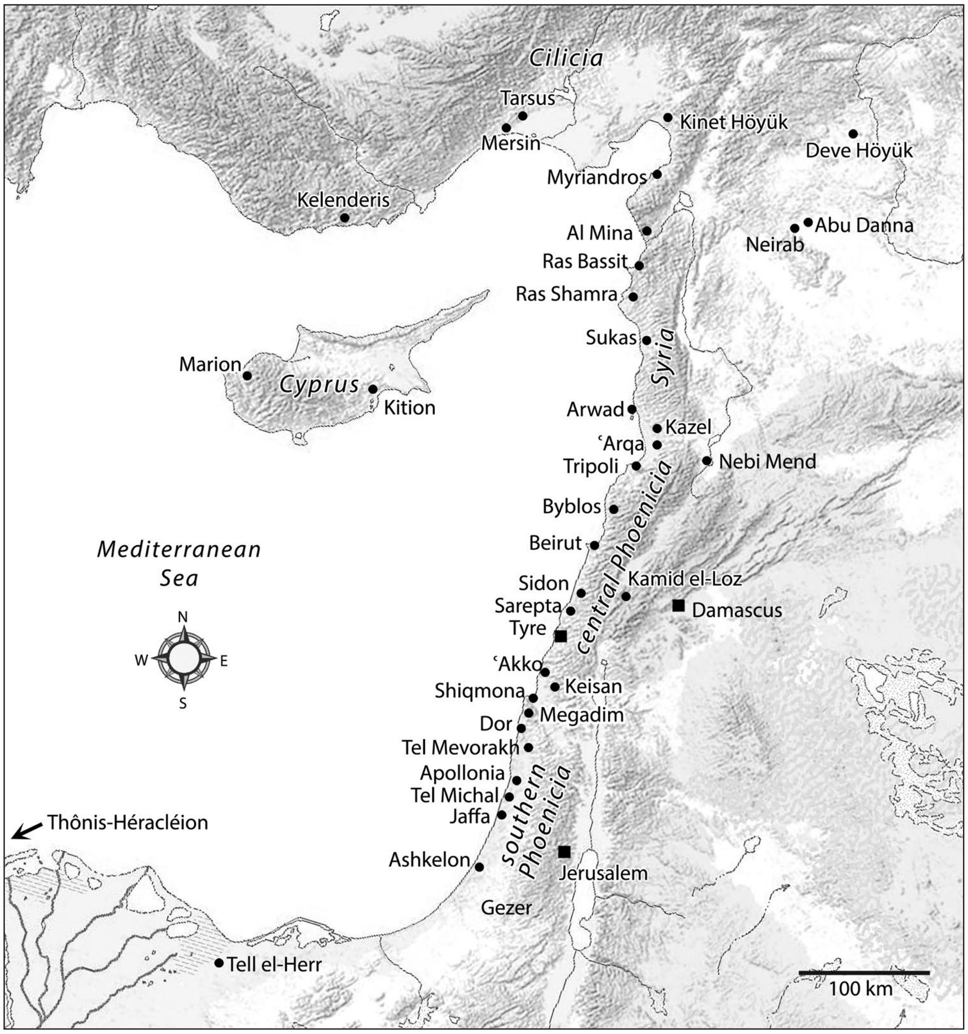

FIG. 1. Map of the Levant, showing the regions and main sites mentioned in the text.

all closed shapes (i.e., containers), forms the second-largest group identified among the sample of about 750 we examined. Thirteen of them, analyzed by petrography and NAA, are defined here as Cretan; three of these also underwent XRF examination. No Cretan vessels have been identified among the numerous open vessels examined in the "East Greek" project.

Our results provide the first concrete evidence for maritime routes linking Crete and the eastern Mediterranean in the fifth and early fourth centuries B.C.E., an unexpected conclusion with significant repercussions for both regions. The initial indication that the pottery under consideration here came from Crete stemmed from a typological consideration of the hydriai (discussed below). Since, however, the most important evidence for a Cretan attribution was provided by NAA, we start with these findings before presenting the conclusions of other fabric analyses. We next consider vessel typology, distribution, and chronology of the proposed Cretan exports. The final section presents wider conclusions stemming from this identification of Cretan exports in the Levant.

NEUTRON ACTIVATION ANALYSIS

Chemical analysis of the elemental composition of pottery by NAA is today a well-established and generally accepted method for provenancing pottery. This composition provides—in addition to the archaeological assignations according to typology, shape, decoration, and fabric—an additional parameter for the differentiation of a series of related products. It reflects the clay composition of the production center,

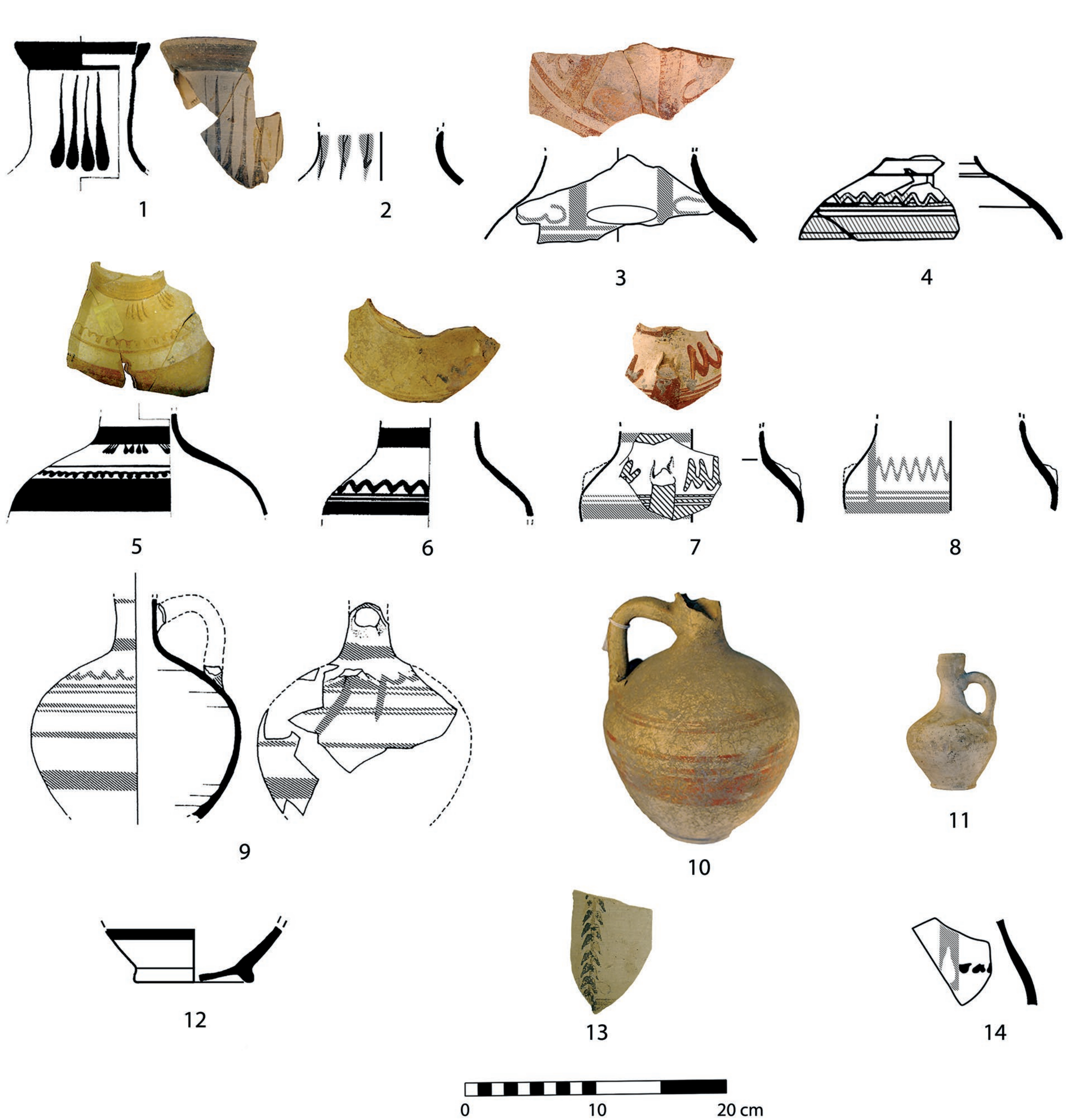

FIG. 2. Containers belonging to the NAA Knossos group KnoL (*1–3, 6–8*, and probably *13, 14*, table amphoras; *4, 5*, hydriai; *9, 10, 12*, jugs; *11*, juglet): *1*, Al Mina (London, British Museum, inv. no. 1995,1226.68; courtesy The Trustees of the British Museum); *2, 3*, Dor (courtesy Tel Dor Excavations); *4*, Apollonia (after Tal 1999, pl. 4.16, no. 3; courtesy Sonia and Marco Nadler Institute of Archaeology of Tel Aviv University); *5, 6*, Al Mina (British Museum, inv. nos. 1995,1226.27, 1995,1226.9; courtesy The Trustees of the British Museum); *7, 8*, Dor (courtesy Tel Dor Excavations); *9*, Tel Michal (after Marchese 1989, fig. 10.1, no. 3; courtesy Sonia and Marco Nadler Institute of Archaeology of Tel Aviv University); *10, 11*, Al Mina (British Museum, inv. nos. 1968,0325.21; 1995,1228.31; courtesy The Trustees of the British Museum); *12*, Shiqmona; *13*, Al Mina (London, University College London, cat. no. 55/1830; courtesy UCL Institute of Archaeology Collections); *14*, Kinet Höyük (courtesy Kinet Höyük Excavation). Except for the vessels in the British Museum (*1, 5, 6, 10, 11*) and the University College London (*13*), the ceramics are in the respective excavation storerooms.

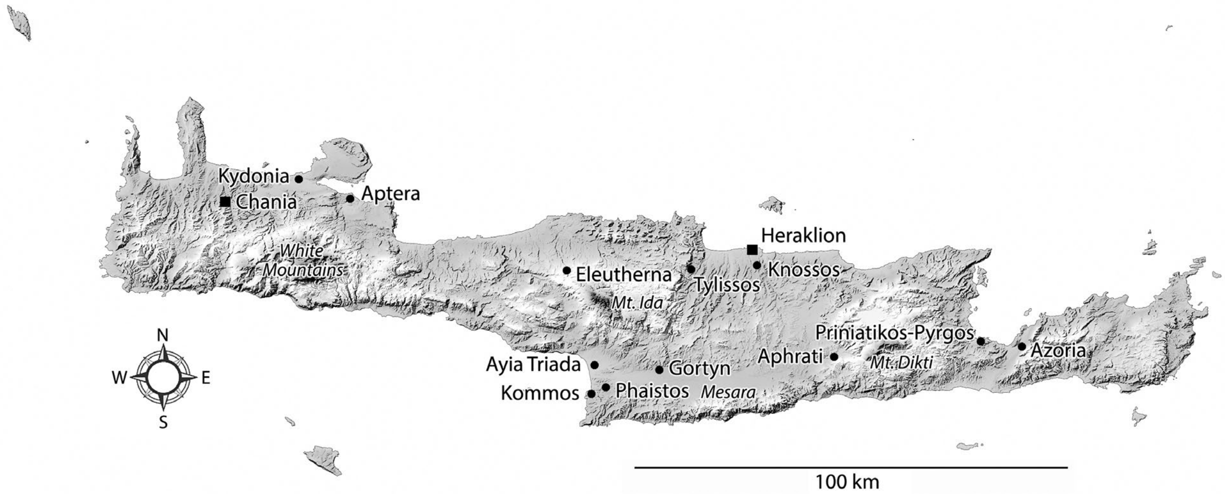

FIG. 3. Map of Crete, showing the main sites mentioned in the text.

TABLE 1. Details of the Knossos Group L (KnoL) samples examined by NAA at the Helmholtz-Institut für Strahlen- und Kernphysik in Bonn between December 2010 and 2011 (see fig. 2).

No.	Site	Excavation Area/ Collection	Registration No.	Locus	Stratum/ Phase	Vessel Type	NAA No.
1	Al Mina	BM	1995.1226.68	–	MN 5-6	table amphora	AlmP 44
2	Dor	Area G	94051/2	9460	G/4	table amphora	DorP 35
3	Dor	Area G	97708	9772	G/4-5?	table amphora	DorP 32
4	Apollonia	Area H	3179	1124	Persian 2	hydria	MichP 3
5	Al Mina	BM	1995.1226.27	–	MN2-4	hydria	AlmP 42
6	Al Mina	BM	1995.1226.9	–	MN 3-4	table amphora	AlmP 37
7	Dor	Area G	91563/4	9168	G/4	table amphora	DorP 36
8	Dor	Area D2	171640/1	17112	D2/5?	table amphora	DorP 33
9	Tel Michal	High Tell	2470/3	415	XI	jug	MichP 2
10	Al Mina	BM	1968.0325.21	–	–	jug	AlmP 11
11	Al Mina	BM	1995.1228.31	–	–	juglet	AlmP 46
12	Shiqmona	–	50 2	–	stratum P	table amphora	ShiP 6
13[a]	Al Mina	UCL	55/1830	–	–	table amphora	AlmP 2
14	Kinet Höyük	–	KT-24757-01	U141, lot 181	period 4	table amphora	KinP 51

BM = British Museum; UCL = University College London

[a] Sample might belong to KnoL, but the identification is not certain.

Note: Registration numbers of items from Dor, Apollonia-Arsuf, Tel Michal, Shiqmona, and Kinet Höyük are the field registration numbers. For references to published materials, see the fig. 2 caption.

assuming that the transport of clays over long distances in antiquity can be considered negligible, although it is not altogether unknown, especially via marine/riverine routes. Therefore, it is highly probable that all ceramic objects having the same composition were produced in the same workshop or in several neighboring workshops exploiting the same clay beds and using similar clay-refining recipes. The elemental concentration pattern can even be assumed to be unique if many (at least 20) weight concentrations of minor and trace elements are measured with high experimental precision; the more, the better. This chemical provenancing method has been compared to human fingerprint testing and is also called chemical fingerprinting. The first and obvious result of an elemental analysis of a set of pottery vessels or fragments is the ability to determine which pieces have a similar composition and hence can be assumed with high probability to have the same origin. The concomitant question—where the workshop or workshops were geographically situated—is much more difficult to answer.[11] To determine the geographic location of a clay with a specific composition, a large data bank must be available with many concentration patterns of pottery-production sites as references for comparison. The best way to obtain these reference patterns is to analyze pottery vessels or fragments known to have been produced locally, such as kiln wasters; objects that with high probability were made locally, such as loomweights or, as in our case, a beehive (discussed below); or very large pithoi that are difficult to transport. The analysis of local clay beds is also occasionally useful as reference, but only if the clay was used by the potter as found in situ without special refining procedures that change the elemental (chemical) composition, such as the addition of basaltic temper with many trace elements. If reference material is not available, distribution arguments may help. If a certain elemental pattern is measured in many pottery fragments at one site or region and not in significant numbers elsewhere, the assignment of this pattern to this site is very probable. This probability is increased if pottery pieces from other time periods from the same site also show this chemical pattern. If these vessels were not locally produced, one would have to assume that they were imported during these different periods from the same external production site, which is not very probable.[12] However, given the general similarity of all clays, it can never be proven that a certain elemental compositional pattern did not exist at a certain site or region.

A limitation of this provenancing method using trace elemental compositions is the difficulty of comparing data from different laboratories, since accurate measurements of trace elements are difficult and must be ascertained by an interlaboratory calibration.[13]

NAA has routinely been applied at the Helmholtz-Institut für Strahlen- und Kernphysik (HISKP) at the University of Bonn for more than 25 years. The measurement protocol, following the procedure in the Lawrence Berkeley National Laboratory,[14] has been explained at length in the past.[15] It is briefly summarized in appendix 1.

In the framework of the "East Greek" project, 32 containers were examined by NAA at the HISKP in Bonn between December 2010 and November 2011. Of these, about 40% (13, possibly 14; see fig. 2; tables 1–3) had a chemical compositional pattern that clustered with 50 samples in the Bonn data bank that belong to different studies, partly still unpublished, carried out during the last 20 years or so.[16] With the 13 vessels in this study, the group now has 63 members. The realization that this group should be assigned to one or more workshops on Crete developed gradually. At the Bonn laboratory, the group was named "KnoL" (Knossos Group L), since the first members with this pattern were samples from the Knossos excavations (unpublished, in the collections of the Akademisches Kunstmuseum, Bonn University).[17] The stepwise increase in the number of samples in this group, which, prior to the current study had no proven provenance, is summarized here briefly: (1) In 1995, the KnoL

[11] We use the phrase "workshop or workshops" if it is unclear whether the vessels of the group were produced in one or several neighboring pottery workshops using the same clay paste.

[12] For descriptions and summaries of the principles of pottery provenancing, see, e.g., Perlman and Asaro 1969; Harbottle 1976; Wilson 1978; Mommsen 2007, 2011.

[13] See Mommsen (2012) for an example of an interlaboratory calibration.

[14] Perlman and Asaro 1969.

[15] By Mommsen et al. (1991) and more recently by Jung et al. (2015), who considered the changes in the procedure necessary for using the reactor in Delft instead of the one used previously in Geesthacht.

[16] The remaining 18 containers will be published separately.

[17] Today groups are no longer named after the excavation site where they were found before the local provenance is proven analytically.

TABLE 2. Part 1 of the chemical analysis of the KnoL samples from the Levant shown in table 1 and the five Byzantine reference pieces considered to be locally made in the region of Gortyn (south-central Crete), showing elemental composition in µg/g (ppm) or weight percent (%).

No.	Sample	Factor	Ca%	Ce	Co	Cr	Cs	Eu	Fe%	Hf	K%	La
1	AlmP 44	1.026	6.62	57.9	29.1	294.	5.76	1.11	5.25	3.87	2.44	26.2
2	DorP 35	0.990	–	55.2	30.2	348.	6.87	1.13	5.26	3.63	–	26.5
3	DorP 32	0.969	–	59.9	30.1	213.	6.65	1.09	5.23	3.81	–	28.0
4	MichP 3	0.994	11.8	57.0	28.5	331.	6.14	1.06	4.89	3.74	2.54	28.1
5	AlmP 42	1.065	6.86	56.7	29.7	431.	5.67	1.09	5.45	3.84	2.37	25.7
6	AlmP 37	1.056	9.34	56.6	30.2	313.	6.79	1.03	5.30	3.61	2.59	28.0
7	DorP 36	1.084	–	52.8	29.2	327.	6.60	0.96	5.62	3.85	–	28.3
8	DorP 33	1.086	–	56.6	28.5	339.	6.38	1.11	5.05	3.90	–	29.1
9	MichP 2	1.111	16.5	54.3	29.5	539.	5.60	1.08	5.10	3.68	2.15	27.0
10	AlmP 11	1.069	12.5	54.9	29.7	341.	5.70	1.09	4.94	4.01	2.64	27.2
11	AlmP 46	1.189	13.2	58.0	30.2	315.	4.10	1.08	5.28	3.71	2.38	28.2
12	ShiP 6	0.991	12.5	55.1	31.2	408.	6.95	1.13	5.37	3.80	2.15	27.6
13	AlmP 2 ass.	0.970	–	57.6	31.0	366.	6.33	1.11	5.19	3.70	–	31.9
14	KinP 51	1.007	7.86	57.1	30.2	349.	5.89	1.09	5.15	3.74	2.56	26.2
1	Gort 1	0.950	10.6	56.1	30.5	316.	7.37	1.02	5.05	3.81	1.93	26.4
2	Gort 2	0.865	8.57	57.8	26.6	280.	7.47	0.98	4.90	4.06	1.94	27.0
3	Gort 4	0.866	10.7	55.5	28.5	292.	8.20	1.00	4.96	3.63	2.04	26.0
4	Gort 5	0.940	10.3	54.8	30.0	375.	6.06	1.05	5.07	4.11	2.05	26.3
5	Gort 6	0.950	10.9	54.3	34.5	422.	6.43	1.10	5.32	3.80	1.81	26.6
	avg. error		0.42	0.42	0.14	1.2	0.11	0.022	0.016	0.059	0.026	0.45
	in %		4.0	0.7	0.5	0.4	1.8	2.1	0.3	1.6	1.2	1.7
	avg. value M		11.	56.	30.	347.	6.4	1.1	5.2	3.8	2.3	27.
	spread		2.7	1.7	1.5	70.	0.88	0.050	0.19	0.14	0.28	0.89
	in %		25.	3.0	5.2	20.	14.	4.7	3.7	3.7	12.	3.3

Gort 1 and 2 = amphoras; Gort 4 = lamp; Gort 5 = beehive; Gort 6 = lamp

Note: Gort 3 (terra sigillata dish) is a chemical loner and thus is not shown. The average elemental uncertainties (average error = counting error) and the average concentration values M and their spreads (root mean square deviations = standard deviation) are provided, also as a percentage (%). "Factor" is the best relative fit factor of the sample with respect to the average concentration value that has been applied to the raw data; ass. = associated only.

pattern was named "KP" (Knossos/Phaistos).[18] (2) In 2002, Mommsen and coresearchers presented results of a statistical evaluation of Berkeley NAA data with the Bonn statistical procedure.[19] There, a pattern named PHAP (after the site of Phaistos), which comprised many members from excavation sites in central Crete, could be formed. Statistically, it was similar to the Bonn KnoL group pattern. The Bonn data can be compared directly with the Berkeley data, since, as mentioned, the standard used in Bonn has been calibrated with the Berkeley pottery standard. (3) In 2004, Hein and coinvestigators presented compositional

[18] Mommsen et al. 1995, 519–20, table 3.
[19] Mommsen et al. 2002a, 626, table appx. 1, fig. 6.

TABLE 3. Part 2 of the chemical analysis of the KnoL samples from the Levant shown in table 1 and the five Byzantine reference pieces considered to be locally made in the region of Gortyn (south-central Crete), showing elemental composition in μg/g (ppm) or weight percent (%).

No.	Sample	Factor	Lu	Nd	Rb	Sc	Sm	Ta	Tb	Th	U	Yb
1	AlmP 44	1.026	0.36	22.5	111.	20.1	4.44	0.83	0.71	9.08	2.00	2.45
2	DorP 35	0.990	0.38	25.7	98.9	20.8	4.52	0.86	0.53	10.5	2.33	2.33
3	DorP 32	0.969	0.40	22.8	110.	20.0	4.46	0.80	0.62	9.74	2.35	2.39
4	MichP 3	0.994	0.38	23.4	109.	20.2	4.12	0.79	0.63	10.0	2.07	2.34
5	AlmP 42	1.065	0.36	23.0	105.	19.8	4.38	0.83	0.66	9.11	1.85	2.44
6	AlmP 37	1.056	0.34	21.3	108.	21.4	4.30	0.73	0.65	10.4	2.24	2.36
7	DorP 36	1.084	0.35	20.1	114.	21.5	3.99	0.87	0.61	10.1	1.37	2.25
8	DorP 33	1.086	0.37	21.9	111.	19.9	4.28	0.81	0.67	10.0	1.67	2.23
9	MichP 2	1.111	0.37	20.2	99.4	19.9	4.11	0.85	0.70	9.76	1.75	2.31
10	AlmP 11	1.069	0.41	21.3	98.5	19.1	4.20	0.65	0.55	10.0	2.97	2.36
11	AlmP 46	1.189	0.40	23.6	85.6	21.5	4.26	0.76	0.63	10.0	2.41	2.51
12	ShiP 6	0.991	0.37	22.6	102.	21.1	4.57	0.75	0.59	10.7	2.03	2.32
13	AlmP 2 ass.	0.970	0.40	22.3	73.6	20.2	4.50	0.84	0.52	10.4	2.17	2.29
14	KinP 51	1.007	0.41	22.5	104.	19.7	4.43	0.91	0.67	9.11	1.79	2.38
1	Gort 1	0.950	0.38	22.8	107.	19.8	4.11	0.81	0.58	9.70	3.10	2.50
2	Gort 2	0.865	0.41	22.1	114.	19.6	4.13	0.89	0.61	10.2	2.85	2.50
3	Gort 4	0.866	0.42	21.3	122.	20.1	3.98	0.88	0.60	9.64	2.57	2.39
4	Gort 5	0.940	0.41	21.5	105.	19.7	4.10	0.80	0.74	9.01	2.01	2.47
5	Gort 6	0.950	0.41	24.6	100.	20.3	4.09	0.84	0.53	9.02	1.79	2.53
	avg. error		0.014	1.2	2.6	0.023	0.040	0.046	0.060	0.071	0.22	0.067
	in %		3.5	5.2	2.5	0.1	0.9	5.7	9.7	0.7	9.8	2.8
	avg. value M		0.39	22.	104.	20.	4.3	0.82	0.62	9.8	2.2	2.4
	spread		0.025	1.3	11.	0.67	0.18	0.061	0.063	0.54	0.46	0.080
	in %		6.4	5.8	10.	3.3	4.3	7.5	10.	5.5	21.	3.3

Gort 1 and 2 = amphoras; Gort 4 = lamp; Gort 5 = beehive; Gort 6 = lamp

Note: Gort 3 (terra sigillata dish) is a chemical loner and thus is not shown. The average elemental uncertainties (average error = counting error) and the average concentration values M and their spreads (root mean square deviations = standard deviation) are provided, also as a percentage (%). "Factor" is the best relative fit factor of the sample with respect to the average concentration value that has been applied to the raw data; ass. = associated only.

NAA data, measured in the National Centre for Scientific Research "Demokritos" in Athens, pertaining to clays of Upper Miocene deposits from the Mesara Basin in south-central Crete.[20] They proposed that these clays could have been used to produce the vessels of the KnoL group of the Bonn laboratory (they called their group "L"), but they did not present a comparison of their clay concentration data with that of the Bonn KnoL group. (4) In 2006, Mountjoy and Mommsen reported the presence of the KnoL compositional pattern in a set of Minoan stirrup jars from Troy, hinting

[20] Hein et al. 2004, 380, fig. 8.

at a Cretan provenance (but they did not present the concentration data).[21]

However, as explained above, the secure assignment of a compositional group to a certain site is only possible with reliable reference material. Although the origin of the KnoL group in Crete (probably central Crete) was considered highly probable, it had not been proven: none of the analyzed samples in this group was known with certainty to originate from a workshop at any known site or region.

Therefore, since we did not consider the arguments based on the geographic distribution of the KnoL sherds and vessels and the assumed provenance deduced from this distribution satisfying enough from the archaeometric point of view, we decided to analyze reference material from central Crete. We chose six Early Byzantine samples from Gortyn in the south-central part of Crete. They are kept at the INSTAP Study Center for East Crete and had been analyzed first by petrography there.[22] The fabric of five samples is the most common one in Gortyn in Early Byzantine contexts studied for medium and small fine and semi-fine vessels. Also, the fabric of these samples is one of the most commonly found Early Byzantine ceramic products at Gortyn (see below for a detailed description of these samples and the petrographic results). Importantly, these samples include a beehive (Gort 6), which was probably made locally and is thus an excellent reference piece for local clays, in addition to five ceramic vessels (Gort 1–5). The legitimacy and even the advantage of using reference samples from a time period different from that of the vessels under discussion has been pointed out above.

The analysis indeed produced the results we expected and hoped for: five of the six samples (Gort 1, 2, 4–6) matched the KnoL pattern.[23] This can be seen in tables 2 and 3, where the NAA concentration data for the 14 "East Greek" containers and for the five Gortyn samples are presented for 20 elements. After multiplication of each data set with its best relative fit factor, the average concentration values M for these 18 samples have been calculated and are also shown in tables 2 and 3 together with the spreads (root mean square deviations = standard deviations) for the different elements. For 13 of the 20 elements, these deviations are less than or equal to 7.5%, often even less than 4%, showing how similar the compositions of the samples from the Levant and from Gortyn are. The assignment of the KnoL NAA pattern specifically to a workshop or workshops somewhere in central Crete, probably in the Mesara Plain, can now be established, finally justifying the initial tentative appellation "KnoL." The Mesara Plain is known to have been a major production center of pottery since the earlier Prepalatial period and throughout the Bronze Age.[24] Since, however, the exact extension of the clay bed with the KnoL composition and the location of the workshop or workshops using this clay paste are still unknown, we assign for the time being central Crete as the general origin for all pottery vessels of this group.[25]

Yet there exists in the Bonn data bank a very similar chemical pattern, named "TheB," that is assigned by reference pieces to a workshop or workshops at or close to Thebes in Boeotia.[26] Instead of comparing the concentration values of the KnoL and TheB patterns visually, element by element, and considering for each element the different ± spread values, the small differences in composition between the patterns of the two groups are more easily seen in the plot in figure 4. In this figure, the differences in the concentrations, normalized to (i.e., divided by) the corresponding average spread values, have been plotted for the 20 elements presented in tables 2 and 3. Except for rubidium (Rb), all the elements agree statistically, and rubidium is only slightly higher in the TheB group. This close compositional similarity is already well known from other

[21] Mountjoy and Mommsen 2006, 114.

[22] They are part of the Pythagoras II project funded by the European Union and the Aristotle University of Thessaloniki (project director: Poulou-Papadimitriou). For the pottery, see Portale and Romeo 2001; Portale 2014. They consist of two amphoras (GOR 08/2 and GOR 08/41), a terra sigillata dish (GOR 08/87), a lamp (GOR 08/115), and a beehive (GOR 08/169).

[23] Sample Gort 3 is a chemical loner, regarding which nothing can be concluded.

[24] Wilson and Day 1994. On the Bronze Age, Belfiore et al. 2007; Nodarou 2015.

[25] The average concentration pattern M of 18 samples (see table 2) can be compared with the average pattern of the whole group, now consisting of the 68 samples stored in the Bonn data bank and published recently in Jung et al. 2015 (see their table 2, lower part, second column, for the values of the full pattern of the KnoL group consisting of these 68 samples). The authors showed that several ceramics from Punta di Zambrone (Calabria, south Italy) have the composition of the KnoL pattern and thus appear to have been imported from central Crete to Calabria in Mycenaean times.

[26] Mommsen and Maran (2000–2001) called this group "Theb-b"; see also Mommsen et al. 2002b; Schwedt et al. 2006; Mommsen and Schöne-Denkinger 2009.

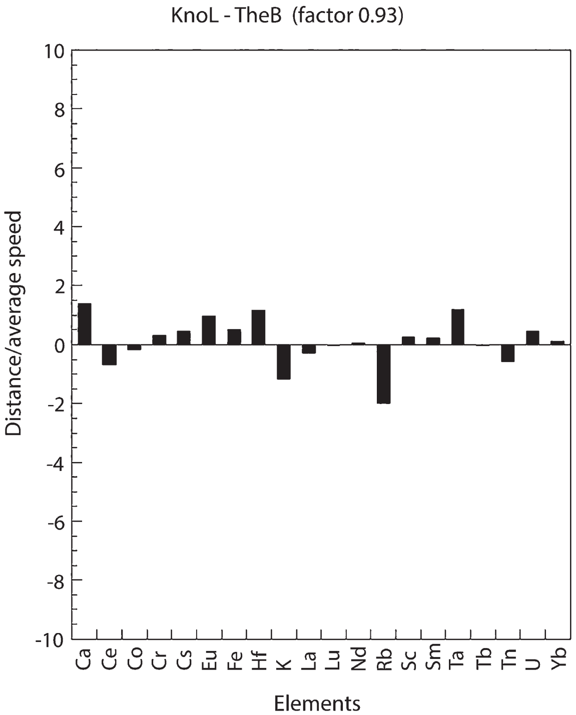

FIG. 4. Graphic comparison of the chemical compositions of the KnoL and TheB groups. The differences of the concentration values, normalized by the average standard deviations (spreads), are plotted (see text). The values of the TheB group have been multiplied first by the best relative fit factor 0.93 with respect to group KnoL. The concentrations are statistically similar except for rubidium (Rb), since only values of normalized differences above approximately ±2 have to be considered as statistically significant.

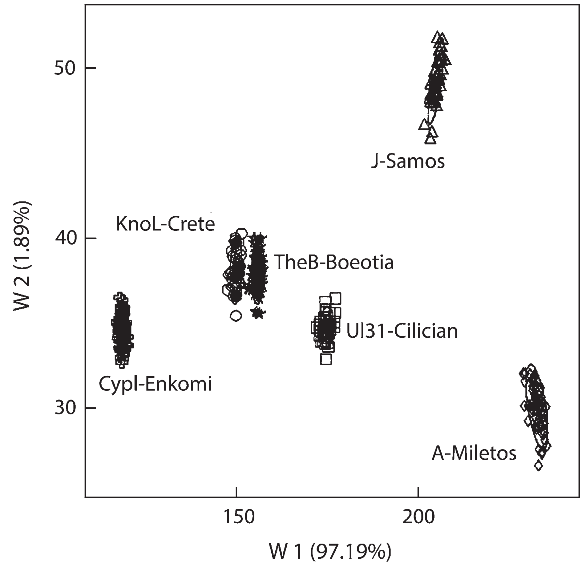

FIG. 5. Result of a discriminant analysis of 379 samples, corrected for dilution, assuming six groups of samples using all the 20 elements presented in tables 2 and 3 (KnoL-Crete = samples from workshop(s) in south-central Crete [the matching Byzantine reference samples from Gortyn in the KnoL group are shown as filled symbols]; TheB-Boeotia = samples from Thebes in Boeotia; J-Samos = samples from Samos; CypI-Enkomi = samples from Enkomi/Salamis in Cyprus; A-Miletos = samples from the Kalabaktepe workshop at Miletos; Ul31-Cilician = samples from one or several Cilician workshops). Pottery from all these regions reached the Levant in the Persian period. The first and second discriminant function W 1 and W 2 are plotted, covering 97.19% and 1.89% of the between-group variance. The ellipses drawn are the 2σ boundaries of the groups (σ is the standard deviation = spread). The analysis shows good separability between the groups.

archaeometric elemental analyses. Jones, measuring the elemental composition in samples from Boeotia and Crete by optical emission spectroscopy (OES), reported the difficulty in distinguishing the two compositions already in 1986.[27] The compositional similarity could suggest that the vessels we analyzed from the Levant were produced in Boeotia. However, we dismissed this possibility for two reasons. First, no examples whatsoever of the shapes or decoration of the Levant vessels are known in Boeotia. Furthermore, we used here discriminant analysis[28] to depict the results of the Bonn statistical grouping package (fig. 5). Because of the high precision of the NAA data, it shows that, beyond the general similarity, the KnoL group is well separated from the TheB group and also from other groups identified among other things in the course of our general "East Greek" study, originating in Cilicia, Samos, Miletos,[29] and the region of Enkomi/Salamis in Cyprus.

Because of the newly available reference sherds from central Crete (Gortyn) and because of the good separability of the KnoL pattern from all other patterns in the Bonn data bank, a Cretan origin for the pottery of the KnoL chemical signature is almost certain, considering

[27] Jones 1986, 737.

[28] In statistics, discriminant analysis is a separation procedure that allows discrimination between two or several groups of statistical data with several parameters (here, the concentration values of elements); it is implemented in cases where separation by a single parameter is not possible.

[29] Samian and Milesian clays were identified in transport amphoras and not in the decorated vessels with which we are concerned here.

the large number of about 12,000 samples from the Aegean and eastern Mediterranean measured in Bonn. The possibility that in some other, yet-unknown location pottery with this pattern was also produced is rather small but can never be totally excluded.

In the framework of the current project, we also reinspected the compositional data published by Ashton and Hughes regarding pottery from Al Mina (see fig. 1).[30] They presented the composition of 45 samples from Al Mina, which they assigned to eight different wares. Initially, the NAA data suggested to us that one compositional group (in which they observed some subgroups) comprising 17 samples from different wares,[31] all considered by Ashton and Hughes to be locally made, revealed a close similarity to the KnoL group. However, when the data obtained by Ashton and Hughes for individual pieces in this proposed group was reevaluated using the Bonn grouping procedure (including a best relative fit—i.e., dilution correction),[32] the results showed that their suggested group of 17 samples should in fact be reduced to a smaller but well-defined group with small spreads comprising only 10 samples.[33] Assuming that the data of Ashton and Hughes can be compared with ours (since no interlaboratory calibration exists between the two laboratories), after adjusting this group with the best relative fit factor with respect to the KnoL group (a factor of 1.15 in this case), we find that this reduced Al Mina local group of 10 samples differs from our KnoL group. The difference is mainly in higher potassium (K) and also in higher samarium (Sm) and europium (Eu) values, both rare earth elements (REEs). The concentrations of all the other elements, especially those of the other REEs, are statistically not very different, indicating that a special calibration for the REEs is not needed and that the difference is real and distinguishes the KnoL and the Al Mina elemental patterns.

To sum up, after considering all the NAA data available to date, we conclude that NAA shows that the vessels belonging to the KnoL group were produced in central Crete. A more specific production locale—in south-central Crete—is proposed here, but more work will be needed to clarify the chemical signature of pottery produced in different regions of Crete before such a specific origin can be accepted with certainty for the pottery presented in this article.

X-RAY FLUORESCENCE ANALYSIS

XRF is the emission of characteristic X-rays from a material that has been excited by bombardment with high-energy X-rays. The phenomenon is used in archaeological research for elemental (chemical) analysis in the investigation of archaeological materials such as metals, glass, ceramics, and sediments. It provides quantitative chemical data regarding major elements and several trace elements in the composition of ceramics.[34] Three table amphoras from Dor that were identified by NAA as Cretan (see tables 1–3, nos. 2, 3, 8) were analyzed by this method (table 4, nos. 5–7), as were four bowls that we consider to be Cilician (see table 4, nos. 1–4). The analysis was conducted by Małgorzata Daszkiewicz (ARCHEA, Warsaw) and Gerwulf Schneider (Freie Universität Berlin; for the sampling and measurement protocols, see appx. 2). The XRF analysis did not contribute to the question of the provenance of the KnoL samples, but it divided the samples into the same two distinct major chemical groups identified in our study by NAA: pottery produced in Cilicia, not relevant for this article, and the KnoL samples from Crete discussed here. The two groups are distinguished especially by the concentrations of chromium (Cr), nickel (Ni), and sodium (Na). The main contribution of this analysis is that it confirms the existence of two groups by a large number of chemical elements, including particularly important elements for provenance determination such as titanium, aluminum, magnesium, nickel, and zirconium. It thus makes the grouping significantly more secure.

PETROGRAPHY

Petrography of the KnoL Group Sampled from the Levantine Sites

The petrographic analysis of 12 samples from the KnoL group, conducted by Ben-Shlomo, did not result in a conclusive provenancing since the fabric is very

[30] Ashton and Hughes 2005.

[31] Four so-called Al Mina juglets (discussed below), five red-slipped vessels, four kraters with wavy line, and four painted amphoras/hydriai. The remaining vessels were determined to be imported to Al Mina.

[32] Mommsen and Sjöberg 2007; see also appx. 1 herein.

[33] This new group includes juglet samples 6977-10, -11, and -12 (in Ashton and Hughes' Group 1); the "krater samples with wavy line" 6977-42, -44, and -45 (Group 5); and the "painted amphora/hydria" samples 6977-6, -7, -15, and -16 (Group 8). For all these groups and vessels, see Ashton and Hughes 2005, 97–8, 100–2.

[34] See, e.g., Mantler and Schreiner 2000; Shackley 2011; Speakman et al. 2011.

TABLE 4. Results of XRF analysis.

No.	Type	Sample	Lab. No.	SiO_2	TiO_2	Al_2O3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O
1	BB	DorP 14	MD5078	56.78	0.77	18.18	6.71	0.078	4.61	8.25	0.77	3.68
2	BB	DorP 11	MD5082	57.90	0.77	17.47	6.60	0.081	3.43	9.38	0.81	3.38
3	BB	DorP 24	MD5081	56.64	0.79	18.16	6.68	0.080	3.60	9.60	0.84	3.41
4	BB	DorP 26	MD5076	57.06	0.75	17.48	6.42	0.078	2.93	10.84	0.66	3.51
5	TA	DorP 32	MD5077	52.95	0.83	16.31	8.16	0.194	5.81	11.34	1.18	3.05
6	TA	DorP 33	MD5079	51.24	0.73	13.98	7.33	0.119	5.74	16.85	1.18	2.62
7	TA	DorP 35	MD5080	54.00	0.74	14.57	7.61	0.121	5.63	13.51	1.01	2.60

No.	Type	Sample	Lab. No.	P2O5	V	Cr	Ni	(Cu)	Zn	Rb	Sr
1	BB	DorP 14	MD5078	0.17	123	98	52	57	105	167	364
2	BB	DorP11	MD5082	0.19	113	98	49	41	108	157	329
3	BB	DorP 24	MD5081	0.18	101	93	52	48	101	165	438
4	BB	DorP 26	MD5076	0.27	120	92	54	39	104	160	332
5	TA	DorP 32	MD5077	0.18	131	237	198	97	112	120	428
6	TA	DorP 33	MD5079	0.22	117	365	251	98	113	101	500
7	TA	DorP 35	MD5080	0.21	135	393	284	81	86	104	419

No.	Type	Sample	Lab. No.	Y	Zr	Ba	(Ce)	(Pb)	(Th)	l.o.i. %	Total %
1	BB	DorP 14	MD5078	23	186	573	73	22	20	2.75	99.84
2	BB	DorP 11	MD5082	24	195	394	76	20	19	2.58	99.83
3	BB	DorP 24	MD5081	25	192	394	87	21	21	1.92	99.89
4	BB	DorP 26	MD5076	22	187	438	75	21	20	5.76	99.90
5	TA	DorP 32	MD5077	20	172	419	60	19	16	1.38	99.81
6	TA	DorP 33	MD5079	18	163	403	45	18	20	8.77	99.46
7	TA	DorP 35	MD5080	17	167	447	47	13	16	1.85	100.18

BB = banded bowl; l.o.i. = loss of ignition; TA = table amphora

Note: Oxides are presented in weight percent (%), elements in µg/g (ppm). Elements in parentheses could not be measured with high precision.

fine and its characteristics could fit clays from several locations in the eastern Mediterranean (this petrographic fabric was designated as fine ware Fabric 1; fig. 6). The matrix has a color range of reddish-brown to brown (in plane-polarized light) and dark brown (in cross-polarized light). This fabric is distinctly micaceous and contains in most cases a very low proportion of coarse grains. The ratios between the coarse grains (above 10 microns), fine grains, and the voids in the clay range between 10:85:5 (more frequent) and 20:65:15. The nonplastic inclusions (>0.06 mm), generally rare, include monocrystalline quartz (subangular to rounded, with some grains that are cracked or have ferruginous zones; the quartz consists of 1–10% of the slide area); limestone (up to 4–5% of the slide area); and a few calcareous concentrations (sand-sized), opaque minerals, and serpentine. More rare are calcite, polycrystalline quartz, chert, and feldspar. Textural concentration features (TCFs) also appear (dark brown, rounded with some very fine quartz inclusions). Fine, silty inclusions (<0.06 mm) include monocrystalline quartz, opaque minerals (dark reddish brown), and mica laths.

Some of the samples had a more reddish matrix in regular polarized light with higher quantities of serpentine and opaque minerals (15–20% of the slide area); these were designated as Fabric FW1[r]. Others showed a higher frequency of sand-sized limestone and calcareous inclusions. The similarity was mainly in the general appearance and color of the matrix.

The Cretan Comparative Material

Although the petrographic examination of the KnoL group from the Levant was inconclusive regarding provenance because of the fineness of the fabrics and the absence of characteristic nonplastic inclusions, it resulted in interesting parallels with the Early Byzantine material from Gortyn in south-central Crete, mentioned above (see tables 2, 3). Some of the Levantine samples displayed mineralogy and texture similar to that of the main fabric of the Gortyn assemblage (and this observation instigated the NAA analysis of the Gortyn items described above). The petrographic analysis of the Gortyn pottery was carried out by Nodarou at the INSTAP Study Center for East Crete.

The Cretan fabric (fig. 7) is encountered in a semi-fine and a fine variant. The matrix is fine, and its color ranges from reddish-brown to brown (in plane-polarized light) to dark red brown (in cross-polarized light). It ranges from optically moderately active to inactive. The nonplastic inclusions (>0.08 mm), although rare, consist primarily of small monocrystalline quartz fragments unevenly distributed in the clay matrix, subrounded fragments of micritic limestone, and biotite mica laths. There are rare metamorphic rock fragments (phyllite, quartzite) and very rare epidote. Rounded TCFs (clay pellets) in a dark red-brown color are characteristic of this fabric. Their regular presence indicates a rather standardized clay recipe and a fairly consistent technique of pottery manufacture. In some samples there are microfossils and shell fragments.

This composition is not diagnostic of origin, but in the case of the pottery from Gortyn the frequency of this fabric in the Early Byzantine assemblage and the typology of the vessels point toward a Cretan and broadly local origin in the area of Gortyn.[35] The site is located in a low plain composed of red sands and clays of the Quaternary, whereas the surrounding area is dominated by yellow and gray marl deposits of the Pliocene and Miocene epochs.[36] The raw materials of the area are suitable for pottery manufacture and could have been exploited over a long period.

Based on petrography alone, the association of part of the Levantine pottery with Crete is not straightforward. As well, the fineness of the fabrics and the mineralogical composition of both sets of samples (silty with small quartz fragments) make it difficult to associate them with certainty. Another constraint is the chronological difference between the two sets of materials. Our working hypothesis that the Levantine samples might be imported from Crete was based (beyond, as mentioned, typological considerations regarding the hydriai) on the following: (1) the argillaceous matrix of the samples has a similar color and silty composition containing abundant TCFs; (2) in the assemblage from Gortyn, this is the most common fabric for medium and small fine and semi-fine vessels that are also typologically compatible with a local origin; and (3) the raw materials and recipes of pottery manufacture do not change much over time, especially in areas where there is availability of clayey sediments. As explained above, to test our hypothesis that the Levantine material is Cretan in origin we selected five samples from the Gortyn assemblage for NAA analysis, which demonstrated the compatibility of the Levantine samples with a central, probably south-central, Cretan origin.

TYPOLOGY, DISTRIBUTION, AND DATE

While, as mentioned, most of the "East Greek" decorated vessels in the Levant are open shapes (predominantly bowls), the vessels identified here as Cretan are all containers: hydriai, table amphoras, jugs, and possibly juglets.[37] We start with the hydriai, which provide the strongest argument for a Cretan origin for the group

[35] A wide range of shapes were sampled for petrographic analysis as part of a broader analytical project on the Early Byzantine pottery from Gortyn undertaken at the INSTAP Study Center for East Crete; a large number of amphoras, painted vessels, and terra sigillata dishes proved to have been manufactured in this fabric.

[36] Papavassiliou 1984.

[37] In addition, a neck fragment of an unidentified container was clustered with the KnoL group with less certainty; see tables 1–3, no. 13 herein.

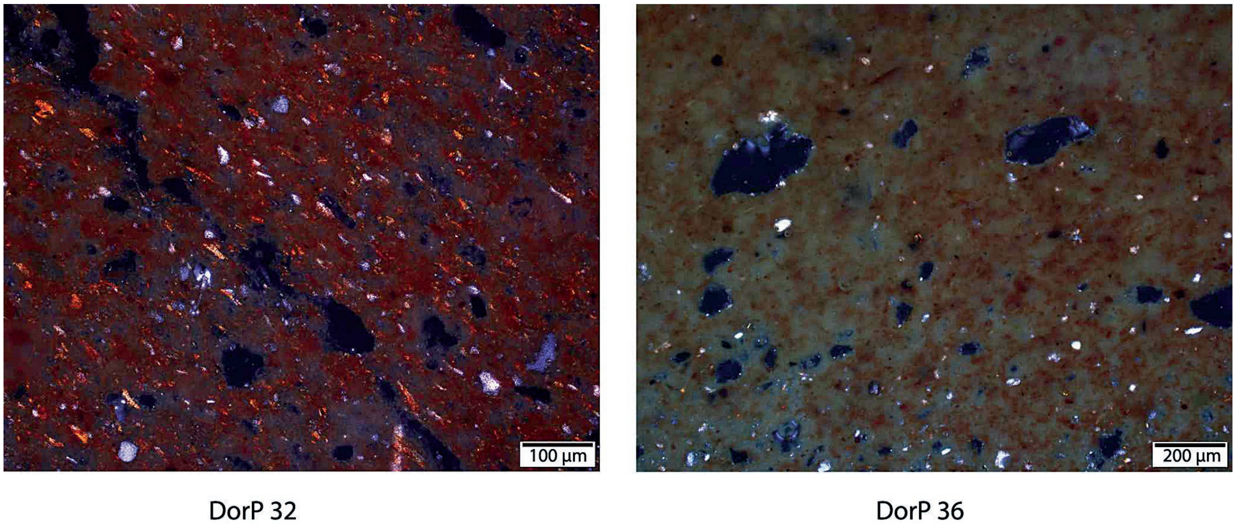

FIG. 6. Thin-sections of two table amphoras of fine ware Fabric 1 under cross-polarized light: *left*, DorP 32; *right*, DorP 36 (D. Ben-Shlomo). For details on these two vessels, see table 1, nos. 3, 7.

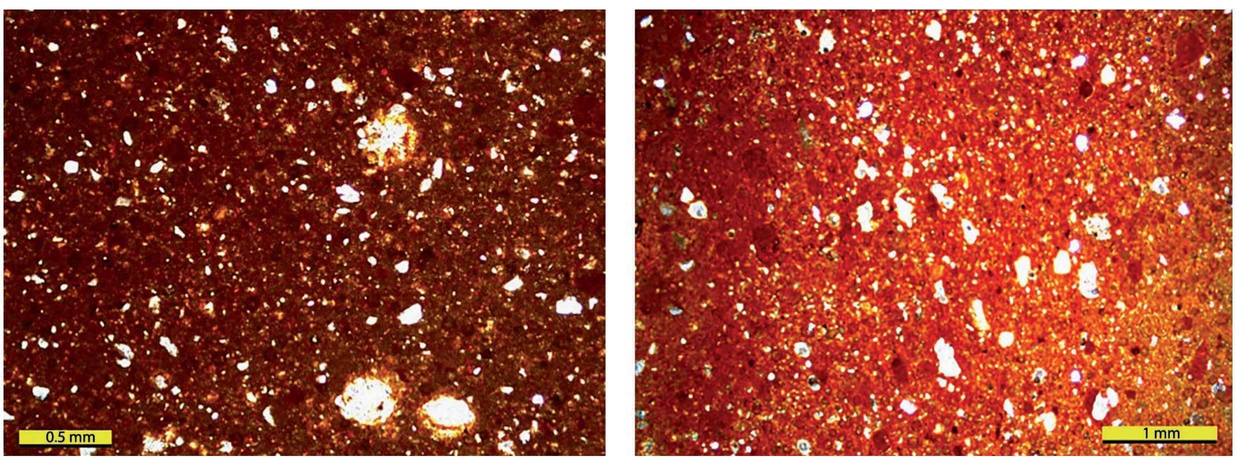

FIG. 7. The Early Byzantine fabric from Gortyn: *left*, fine domestic vessel; *right*, semi-fine amphora (E. Nodarou).

of vessels discussed here since the identification in this case is buttressed by both typological and chemical considerations.

Hydriai

Two upper body and neck fragments we identify as belonging to hydriai were analyzed by NAA and determined to be Cretan since they belong to the KnoL group (see tables 1–3; fig. 2, nos. 4, 5).[38] One is from Apollonia-Arsuf, Area H, stratum 2, dating to the fifth century B.C.E. (see fig. 2, no. 4),[39] and the other is from Al Mina, strata 4–2, and therefore only generally datable to the Achaemenid period (538–332 B.C.E.) (see fig. 2, no. 5).[40] Hydriai have not been previously discussed among vessels exported to the eastern Mediterranean in the fifth and fourth centuries B.C.E., since

[38] The table amphoras discussed in this section are Type 1e in Shalev 2014, 185–87.

[39] Tal 1999, pl. 4.16, no. 3.

[40] London, British Museum, inv. no. 1995,1226.27 (L.1124; registration no. 3179).

they were not identified among Attic exports to the east nor, until now, among the "East Greek" decorated pottery with which we are concerned here. From this period, no complete or near-complete "East Greek" hydriai are known from the Levant. Thus, our identification of these two fragments as hydriai requires explanation. The two main criteria we used are the form of the rim and decorative comparanda for body sherds.[41] The rims that we believe to belong to hydriai are usually rounded and thickened and have a concave inner lip (fig. 8). Occasionally they are slightly outturned and have a narrow aperture approximately 8 cm in diameter. The diameter of the upright neck places this vessel in an intermediate size category between table amphoras and jugs. These necks are slightly narrower than those of table amphoras but significantly wider than those of jugs, implying a considerably larger vessel. The two body sherds that we attribute to hydriai are adorned with combinations of horizontal bands on the body, a dense undulating band (wavy line) on the shoulder, and/or small pendant languettes (or "tongues") on the upper shoulder. Such decorations never appear on jugs. Also, the motifs are smaller and less elongated than those adorning table amphoras. Hence the two fragments cannot belong to jugs or table amphoras but should be identified as hydriai.

Rims of these forms include several examples from Al Mina, strata 4–2 (e.g., British Museum inv. no. 1195,1226.8; see fig. 8, no. 1), seven from Dor (see examples in fig. 8, nos. 3–6), one from Tel Michal, one from Apollonia (see fig. 8, no. 7), and one from Jaffa.[42] All these examples come from contexts dating generally to the fifth or fourth century B.C.E.; somewhat better precision is available only for the rim from Apollonia, which is dated to the fifth century. The only other example known to us is a neck/rim at Mersin-Yümüktepe in Cilicia, dated to the late sixth or fifth century (see fig. 8, no. 2).[43] These vessels are usually coated with a matte yellowish-white slip and have red or reddish-brown dilute gloss, a treatment similar to the body and neck fragments tested by NAA.

These rim, neck, and shoulder fragments have close morphological and decorative parallels with a type of Cretan hydria from the Classical period. For example, an identical rim is seen on a hydria from Priniatikos Pyrgos, dated to ca. 475–450 B.C.E. (fig. 9, no. 1).[44] Two other Cretan hydriai from Knossos have rim forms comparable to our examples: one of the late fifth or early fourth century B.C.E. (see fig. 9, no. 2),[45] and the other, resembling "Hadra" hydriai of the late fourth or early third century (see fig. 9, no. 3).[46] These Cretan hydriai are 30–35 cm tall and have an upright neck. Their rim forms represent a continuation of a tradition of hydria manufacture going back at least into the late seventh century B.C.E.[47] According to Coldstream and Eiring, this tradition spans the sixth-century Knossian gap and comes back into focus in the fifth century with vessels showing little change from their Orientalizing-period predecessors.[48] In the Late Archaic and Early Classical periods, Cretan hydriai were still adorned with bands on their rims, at the base of the neck, on the belly, and above the base, like the seventh-century examples. One of the main changes is the form of the rim: those of Classical-period hydriai are more rounded or undercut. In addition, the neck and rim became more vertical in the fourth century, a trend reversed in the Hellenistic period with the Hadra hydriai and their projecting rims. There was also a change in decoration in the Classical period. In the second quarter of the fifth century, hydriai at Knossos began to be adorned with pendant languettes on the upper shoulder. This decoration is distinctive of Cretan hydriai. Identical examples in both shape and decoration have been found in other Classical-period contexts at Knossos[49] and elsewhere on the island, most notably Priniatikos Pyrgos (see fig. 9, no. 1).[50] Indeed, a single deposit from this site yielded one of the largest assemblages of decorated hydriai from Crete (48 bases, 17 rims, several shoulder fragments, and 1

[41] In several cases, especially with small body fragments, the attribution to a hydria rather than to a table amphora is uncertain.

[42] Dor: Shalev 2014, 186, fig. 3.3.29, nos. 3–6 (registration nos. 93806, 93804/2, 152330/4, 152449/2, respectively). Tel Michal: Kapitaikin 2006, fig. 12, no. 18. Apollonia: Tal 1999, fig. 4.16, no. 1. Jaffa: unpublished (see provisionally Shalev 2014, 491, appx. 2, pl. 2.8, no. 213).

[43] Arslan 2010, pl. 66, no. 496.

[44] Erickson 2010b, fig. 8, no. 1.

[45] Deposit H4: Callaghan 1992, 92, pl. 75, no. 7; Coldstream and Eiring 2001, 85, fig. 2.5b.

[46] From Well 14: Callaghan 1992, 100–2, pl. 81, no. 30; Eiring 2001, 120, fig. 3.14, no. 1. From the tower on the Kefala Ridge: Hood and Boardman 1957, 228, fig. 2.

[47] See, e.g., Johnston 1993, fig. 3b. For Early Iron Age Cretan hydriai, see Kotsonas 2008, 43–8.

[48] Coldstream and Eiring 2001, 85.

[49] E.g., from the kiln site (Homann-Wedeking 1950, 172, pl. 12E).

[50] In the ash deposit dated to ca. 475–450 B.C.E. (Erickson 2010b, 306–7, fig. 8, no. 1).

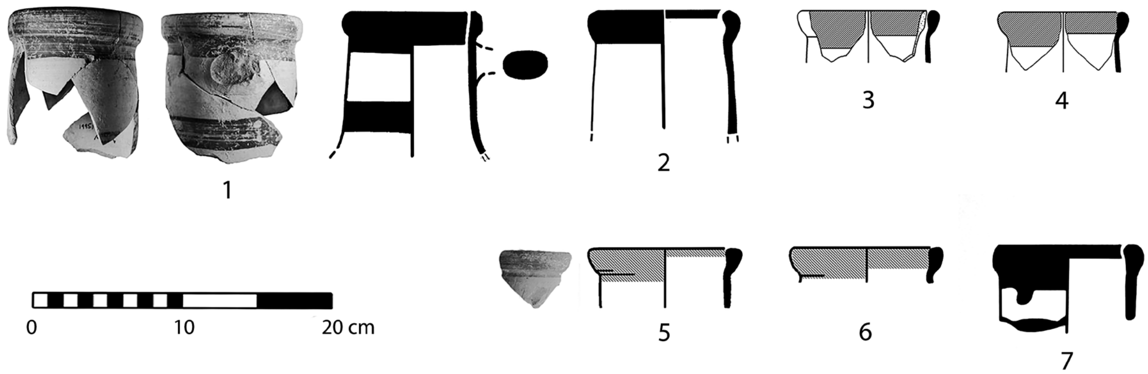

FIG. 8. Rims identified as Cretan hydriai based on their similarity in form, fabric, and surface treatment to the vessels identified as Cretan by NAA and by morphological and decorative criteria: *1*, Al Mina (London, British Museum, inv. no. 1995,1226.8; courtesy The Trustees of the British Museum); *2*, Mersin-Yümüktepe (after Arslan 2010, pl. 66, no. 496; courtesy Nurettin Arslan); *3–6*, Dor (courtesy Tel Dor Excavations); *7*, Apollonia (after Tal 1999, fig. 4.16, no. 1; courtesy the Sonia and Marco Nadler Institute of Archaeology of Tel Aviv University).

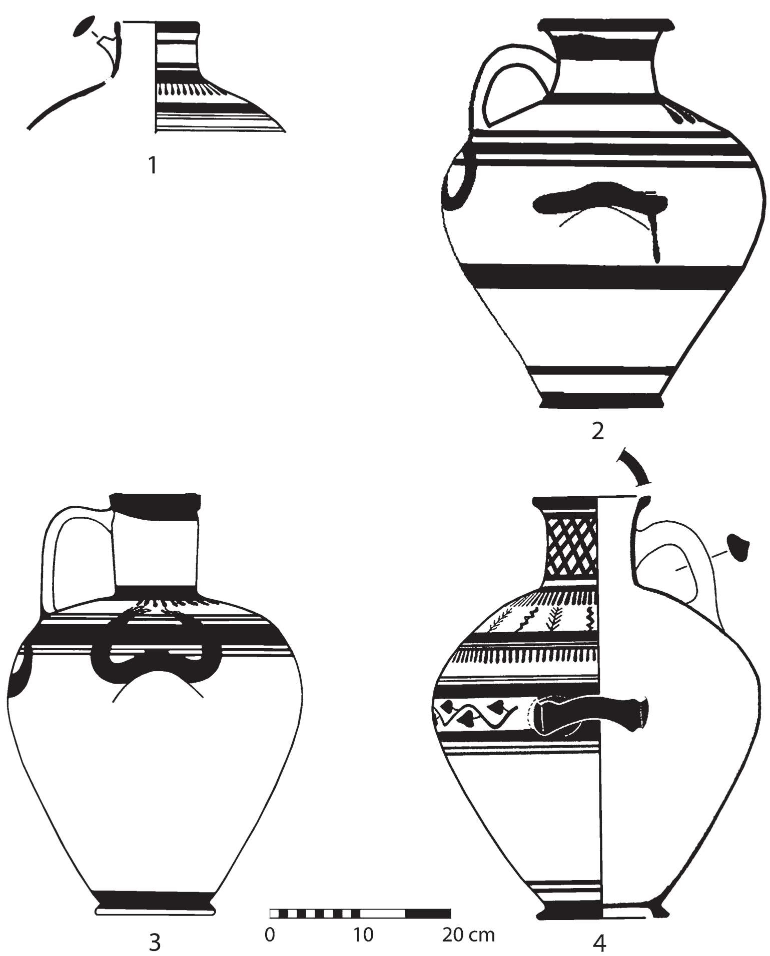

FIG. 9. Classical Cretan hydriai: *1*, Priniatikos Pyrgos (after Erickson 2010b, 306–7, fig. 8, no. 1); *2*, *3*, Knossos (after Callaghan 1992, 92, pl. 75, no. 7; 101, pl. 81, no. 30; reproduction with permission of the British School at Athens); *4*, Azoria (after Haggis et al. 2007, fig. 25, no. 4; courtesy the Trustees of the American School of Classical Studies at Athens).

near-complete vessel).[51] Finally, a Cretan hydria with slightly more elaborate decoration but employing the same pendant languettes on the upper shoulder was found in an early fifth-century context at Azoria (see fig. 9, no. 4).[52]

Based on these parallels, all the vessels under consideration here should be identified as hydriai of Cretan manufacture. The motif of pendant languettes on the shoulder is a distinguishing feature of Classical-period Cretan hydria production. One could hardly ask for a closer morphological and decorative parallel to the Cretan series than that provided by the vessel found at Al Mina and shown in figure 2 (no. 5). This and other examples of its class have a chemical signature identifying them as members of the KnoL group that we believe were made on Crete. Our NAA analysis points to no other production center, and we regard these hydriai as exclusively Cretan, unlike the table amphoras and jugs (discussed below) that were also produced at other centers. These hydriai provide an anchor for other members of the KnoL group with the same chemical signature. We are thus able to identify the table amphoras and jugs in the KnoL group as Cretan, even in the absence of direct Cretan parallels for the shapes and decoration.

Table Amphoras

Six table amphoras sampled by NAA have a Cretan chemical signature (KnoL) as described above (see tables 1–3; fig. 2, nos. 1–3, 6–8; fig. 10).[53] Three more samples also have this signature; these, however, are small fragments of closed vessels, and their identification as table amphoras is uncertain (see fig. 2, nos. 12–14). These nine pieces constitute about a third of the 24 table amphoras sampled by NAA as part of this project and are represented by necks/rims, body sherds, and one base. These belly-handled amphoras are oval, somewhat squat vessels, about 30–35 cm tall. The necks are about 10 cm in diameter with outturned rims, either rounded or nearly triangular in section, having a concave inner face (see figs. 2, no. 1; 11, nos. 1–2; 12, nos. 3–5). The amphoras we examined are rather fine, with walls about 3–4 mm thick. Under the stereomicroscope, the fabric is seen to consist of light-reddish to pink fine sand; it is well levigated and slightly porous and has a few small rounded white inclusions (see fig. 10, left). A very few other examples are of the same fabric but medium porous, including many large oval yellowish-white inclusions (ca. 10%–15%) (see fig. 10, right). Analysis under a stereomicroscope is enough to distinguish these fragmentary vessels from those identified as produced in Cilicia, where the fabric is more silty and slightly porous and has inclusions that are usually larger and more varied in color. The surface treatment and fabric of these vessels (as seen under the stereomicroscope) are similar to those of the hydriai discussed above, providing another link.

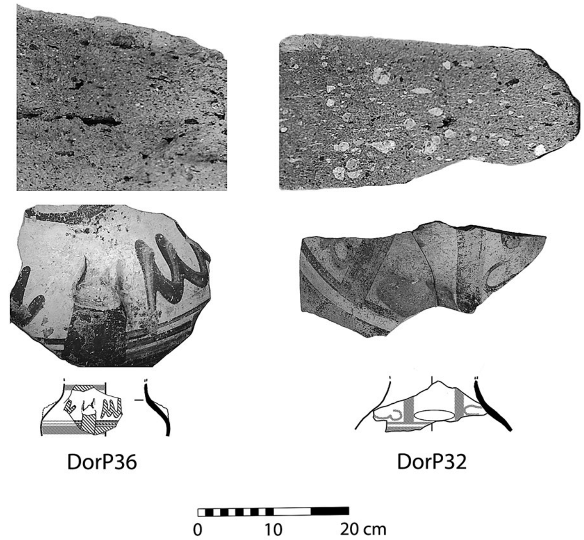

FIG. 10. Two Cretan (KnoL) table amphora fragments from Dor, showing the fabric under the stereomicroscope and the surface treatment: *left*, table 1, no. 7 (DorP 36); *right*, table 1, no. 3 (DorP 32).

The table amphoras identified chemically as Cretan, both the secure and possible identifications, come from the following sites and contexts: Kinet Höyük period 4, Al Mina strata 6–5 and 4–3, Shiqmona, and Dor. All date to the Achaemenid period. We were unable to find illustrated examples of such vessels on Crete, although the existence of table amphoras more generally in the local repertoire of the fifth century has been noted by Erickson,[54] and a table amphora has

[51] Erickson 2010b, 315, fig. 8, nos. 1–4.

[52] Haggis et al. 2007, 278, fig. 25, no. 4.

[53] The table amphoras discussed in this section are Type 1b in Shalev 2014, 179–81. Type 1a are Cilician table amphoras, to be discussed in the future.

[54] Erickson 2010b, 333 n. 72.

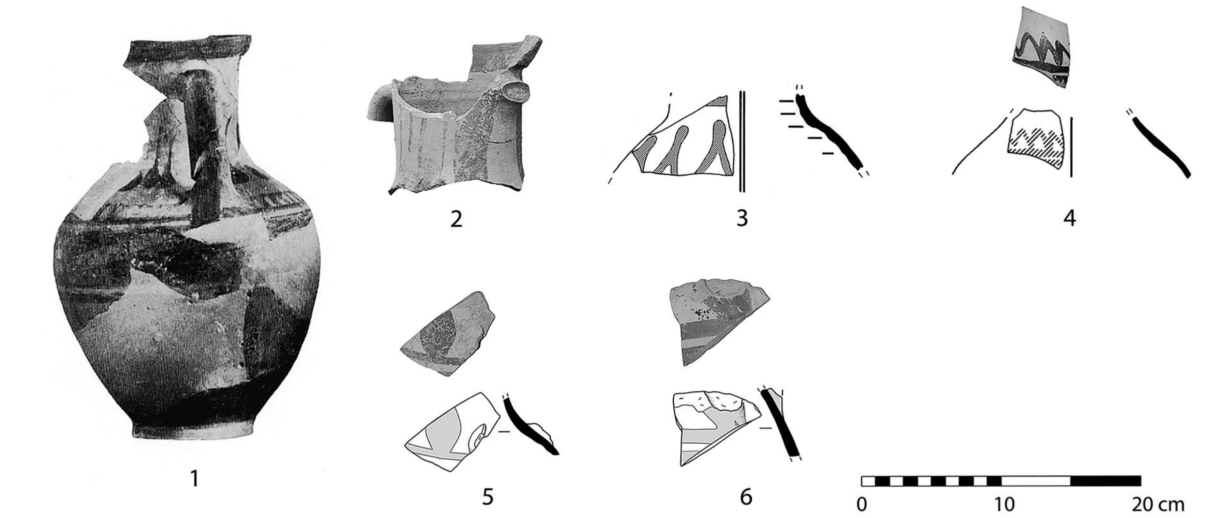

FIG. 11. Probable Cretan table amphoras from the Levant, fifth to fourth centuries B.C.E. The Cretan origin is deduced from a macroscopic and stereomicroscopic examination of the fabrics: *1*, Shiqmona (Elgavish 1968, 48, no. 86); *2*, Al Mina (Oxford, Ashmolean Museum, inv. no. AN 1954.477; © Ashmolean Museum, University of Oxford); *3, 4*, Dor (nos. 96160/11, 10D5-3186; courtesy Tel Dor Excavations); *5, 6*, ʿAkko (nos. F128/2, F520/16). Except for the vessel in the Ashmolean Museum (no. 2), the ceramics are in the respective excavation storerooms.

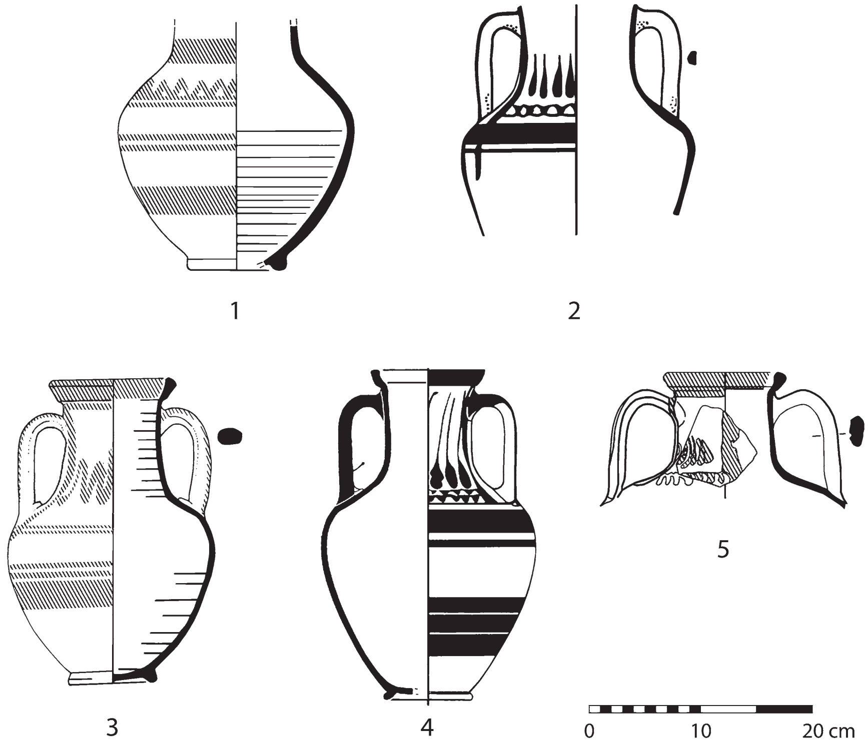

FIG. 12. Possible Cretan table amphoras, fifth to fourth centuries B.C.E.: *1*, Tell Kazel (after Badre and Gubel 2000, fig. 4b); *2*, Al Mina (after Lehmann 2000, fig. 11, no. 2); *3*, Tel Michal (after Marchese 1989, fig. 10.1, no. 1; courtesy Sonia and Marco Nadler Institute of Archaeology of Tel Aviv University); *4*, Kition (after Salles 1983, 102, fig. 38, no. 360; courtesy Mission Archéologique de Kition et Salamine [Chypre]); *5*, Tell el-Herr (after Defernez 2007, 571, fig. 11, no. 30).

been found in a Late Archaic Cretan context at Azoria.[55] These Cretan amphoras, however, differ from the vessels under consideration here in terms of their larger size and different decorative schemes. Our amphoras are rather small, almost qualifying as amphoriskoi. Moreover, their decoration finds no exact parallel in the Cretan fine ware repertoire. Although our banded amphoras with pendant languettes do resemble, in general terms, decorated hydriai from Cretan sites, there is no exact Cretan parallel for an amphora or any other shape with a yellowish-white slip and a shoulder decorated with an undulating band. One would expect decoration as simple as an undulating band to have more parallels on the island. The closest Cretan example may be a krater from a fifth-century context at Priniatikos Pyrgos with a distinctive fine buff slip (slightly yellowish) and an undulating band beneath a thick band on the rim (fig. 13).[56] This krater belongs to a special class of vessel, perhaps made in a single workshop, that barely registers in the archaeological record of the site and is yet unattested elsewhere on the island.

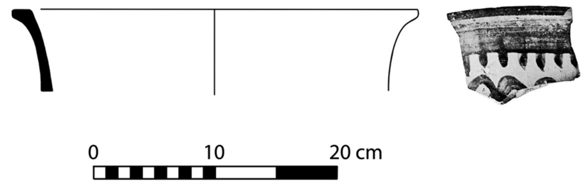

FIG. 13. Fifth-century B.C.E. krater from Priniatikos Pyrgos (after Erickson 2010b, fig. 14, no. 6).

Undulating bands also occasionally appear on other shapes in the Early Iron Age and Hellenistic ceramic repertoire of Crete, but these sporadic examples provide no valid parallel for our amphoras either.[57] Moreover, similar undulating bands are a hallmark of the wavy-line ceramic koine of the northern Aegean in the Late Archaic and Early Classical periods.[58] This ceramic repertoire includes hydriai and table amphoras decorated with undulating bands, but the shapes do not match our vessels, and the configuration of the bands on the vessels does not match our examples either. Nor does this repertoire make much use of languettes, drops, or other motifs often found in conjunction with the undulating bands in our examples.

In the absence of specific typological and decorative parallels, the identification of table amphoras under consideration here as Cretan products must depend on NAA: they exhibit a chemical signature identical to the hydriai that have convincing shape and decorative parallels with examples produced on Crete. The table amphoras, however, are currently poorly matched on Crete, even if they seem to partake of Cretan decorative traditions.

It is also clear that table amphoras of closely similar shape and decoration to the ones illustrated here were produced in places other than Crete; these hint at an eastern Mediterranean stylistic koine that included the Levant, Cilicia, and Cyprus. Our NAA results (to be published) show that an additional 15 sampled table amphoras from Levantine sites were produced in Cilicia and Cyprus. Based on shape and decoration alone, it is difficult to distinguish amphoras from these different sources. A clearer delineation of Cretan and Cilician production may result from the publication of the evidence from Cilicia, which is part of our larger project. As a preliminary step, we observe that the different groups identified by their chemical signatures also seem to correlate with different fabrics viewed under the stereomicroscope. Based on fabric distinctions, additional table amphoras that we examined may

[55] Haggis et al. 2007, fig. 8, no. 9. Table amphoras are also known from Early Iron Age Crete, but they are different from the ones in question here in terms of form and decoration. For such examples from Knossos, see Coldstream and Catling 1996, 126, Tomb 80, no. 2, fig. 100; 206, Tomb 218, no. 73, pl. 196. For Early Iron Age table amphoras from east Crete, see Tsipopoulou 2005, 360–61.

[56] Erickson 2010b, 322, fig. 14, no. 6.

[57] E.g., undulating bands are the prominent decorative scheme of a Late Geometric table amphora from Praisos in east Crete (Tsipopoulou 2005, 291, no. AN8780, pl. 14) and a class of east Cretan jugs dating to the Protogeometric period (Tsipopoulou 2005, 398–99). For a Hellenistic example, Englezou (2005, 111, no. 526, pl. 77) illustrates a third-century hydria with a neck decorated with an undulating band.

[58] Perron (2013, 834, pls. 9, 66), in his study of the material from Argilos and other northern Aegean sites, does illustrate an amphoriskos decorated with drops and undulating bands as well as a hydria that combines these motifs. But the shapes in each case differ from our examples. It should be acknowledged, however, that fragmentary vessels such as the table amphora upper body illustrated in fig. 2 (no. 7) herein, decorated with bands and a single undulating band, would be hard to distinguish from fragmentary examples of the northern Aegean wavy-line koine. This production, however, seems to have ceased by ca. 425 B.C.E., so the northern Aegean koine cannot be a source of the fourth-century examples in our study.

provisionally be identified as Cretan as well (see fig. 11). They were all found in contexts dating to the Achaemenid period: four (unpublished) examples from Kinet Höyük period 4, one from Al Mina strata 4–3 (see fig. 11, no. 2), two from ʿAkko Area F (see fig. 11, nos. 5, 6), one from Shiqmona stratum P (see fig. 11, no. 1), and two more from Dor (see fig. 11, nos. 3, 4).[59]

Moreover, table amphoras with the morphological and decorative characteristics described above are known from publications across a wide geographic region and may also be Cretan, although we have not been able to inspect these visually (see fig. 12).[60] In the northern Levant, these amphoras occur in contexts dating generally from the sixth to the fourth century B.C.E., such as at Neirab, Ras Shamra, and Tell Sukas.[61] The largest concentration is at Al Mina.[62] Only two examples can be identified in the publication record for sixth- to fourth-century B.C.E. sites in central Phoenicia (Lebanon; see fig. 1); they are from Tell ʿArqa and Tell Kazel (see fig. 12, no. 1)—that is, from the northernmost part of this region.[63]

In the southern Levant, these amphoras are more common and are well documented in early fifth- to fourth-century contexts at sites such as ʿAkko (see fig. 11, nos. 5, 6), Khirbet Malta, Shiqmona (see fig. 11, no. 1), Dor (see fig. 11, nos. 3, 4), Tel Mevorakh, Apollonia, Tel Michal (see fig. 12, no. 3), and Gezer.[64] In Cilicia, already mentioned as another region that produced such table amphoras (as demonstrated by our other NAA results), examples are known from Mersin (fifth to fourth century B.C.E.)[65] and Kinet Höyük (periods 6 and 4, sixth to fourth century B.C.E.).[66] Only a few such vessels have currently been published from Cyprus: two from unknown contexts, two from the Ayios Georgios cemetery at Kition, dated to the Cypro-Classical I period (ca. 475–400 B.C.E.), and one from Kition-Bamboula, dated to ca. 425–325 B.C.E. (see fig. 12, no. 4).[67]

Such amphoras even reached sites farther afield, in Egypt. The largest assemblage there is from Thônis-Héracléion, west of the Delta, where 14 examples were found, including a near-complete amphora (the rest are decorated shoulder fragments). They date from the middle or late fifth to the mid fourth century B.C.E.[68] At Tell el-Herr, east of the Delta, such amphoras are known from palatial contexts of the third quarter of the fourth century B.C.E. and somewhat later (see fig. 12, no. 5).[69] It should be cautioned that we know these amphoras from Egyptian sites only from publications. Since we have not visually examined their fabrics and surfaces, it would be difficult if not impossible to distinguish among them vessels that originated in Crete, Cilicia, or other possible production centers.

Jugs

Of the three jugs sampled by NAA, two were determined to be Cretan (the KnoL group; see tables 1–3; fig. 2, nos. 9, 10).[70] One Cretan example is from Al Mina, strata 4–3, dating to the Achaemenid period,

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[59] Al Mina: Shalev 2014, 492, pl. 2, no. 206 (stored at the Ashmolean Museum in Oxford, registration no. AN1954.477). ʿAkko: Shalev 2014, 334, fig. 3.5.26, nos. 17, 18. Shiqmona: Elgavish 1968, fig. 48, no. 86. Dor: Shalev 2014, 287; 291; figs. 3.5.8, no. 4; 3.5.11, no. 28.

[60] Vessels in fig. 12 were studied from publications only and not examined firsthand.

[61] Neirab: Abel and Barrois 1928, fig. 8a–c. Ras Shamra: Stucky 1983, pls. 41, 69, nos. 139–50. Tell Sukas: Ploug 1973, pl. 17, nos. 372–74.

[62] Lehmann 1996, Form 539/b1–2, pl. 60; 2000, Form 11, fig. 11, no. 2. Many more are recorded in Shalev's (2014, 206–8, 222–27, pl. 2.2, no. 58) dissertation.

[63] Tell ʿArqa: Thalmann 1990, fig. 1, no. 5. Tell Kazel: Badre and Gubel 2000, fig. 4b.

[64] ʿAkko: Shalev 2014, 334, fig. 3.5.26, nos. 13, 16–18. Khirbet Malta: Covello-Paran 2008, fig. 46, no. 4. Dor: Examples include Mook and Coulson 1995, fig. 3.10, nos. 7–9; Stern 2000, pl. 2.2; Shalev 2014, 282, 292, figs. 3.5.4, nos. 6–8; 3.5.11, nos. 22–9; see also fig. 11, nos. 3, 4 herein. Tel Mevorakh: Stern 1978, fig. 10, nos. 13–15; pl. 30, nos. 7, 8. Apollonia: Tal 1999, pls. 4.16, no. 3; 4.29, no. 10. Tel Michal: Marchese 1989, fig. 10.1, no. 1. The Tel Michal example is from stratum XI, dated by the excavators to ca. 525–490 B.C.E., but a much more likely date would be the first quarter of the fifth century (Martin 2007, 82–4; Shalev 2009). Gezer: Gitin 1990, pl. 31, nos. 16, 18.

[65] Lehmann 1996, Form 359/b3, fig. 60.

[66] A few examples are illustrated in Shalev 2014, 485, pl. 2.2, nos. 55–7.

[67] Unknown contexts: Gjerstad 1977, pl. 21, nos. 2, 4. Ayios Georgios cemetery: Hadjisavvas 2012, 8, fig. 3, no. 2 (Tomb 1); 17, fig. 7, no. 7 (Tomb 3). Kition-Bamboula: Salles 1983, 102, fig. 38, no. 360. The Cypriot examples may in fact be products of Cyprus since one such vessel has been identified as Cypriot by NAA (to be published).

[68] Grataloup 2012, 168, fig. 10, nos. 1–4; 180 n. 90 (for references to her earlier discussion of this subject).

[69] Defernez 2007, 571, fig. 11, no. 30; 579, fig. 16, no. 48. We thank Claudine Defernez for her advice regarding the Tell el-Herr material and other relevant finds in Egypt.

[70] The jugs discussed in this section are Shalev's (2014, 193–94) Type 2a. In Cretan terminology, these vessels would be classified as lekythoi.

and the other is from Tel Michal, stratum XI, dating to the first quarter of the fifth century B.C.E.[71] The provenance of the third jug, also from Tel Michal (fig. 14, no. 3), has not been identified. These are globular to oval vessels, about 20–30 cm tall, with a tall narrow neck ending with a simple rim, either vertical or slightly outturned. The handle slants upward from the middle of the neck, then drops vertically to the shoulder. Under the stereomicroscope, the fabric of the examples identified as Cretan by NAA seems almost identical to the fabrics of the Cretan hydriai and table amphoras discussed above. The slip on the jugs, however, is not quite as light or thick as the slip common to the hydriai and amphoras. The painted decoration of the two Cretan jugs and others of this class identified by stylistic criteria is executed in a gloss of a reddish brown to black color and consists of a wide band on the external face of the rim, a narrower one at the base of the neck, an undulating band on the shoulder, and several more horizontal bands on the belly. The handle is usually decorated with a vertical band that extends down and intersects with the horizontal bands on the body of the vessel. Bands also decorate the interior of the vessel at the upper part of the neck.

As with the other categories of containers discussed above, the Levantine distribution of the jugs of this class includes the two extremes of northern Syria and the southern Levant, but hardly anything has currently been published from Lebanon (central Phoenicia), and the situation there is presently unclear. In northern Syria, such jugs are well known from several sites and are dated to the second half of the fifth and the early fourth century.[72] They are especially common at Al Mina,[73] strata 4–3 (see fig. 14, no. 1), but also appear, for example, at Achaemenid-period sites in northern Syria, such as Tell Abu Danna and Deve Höyük (see fig. 14, no. 2).[74] Farther north, at contemporary Kinet Höyük, many unpublished body fragments of containers decorated with a "rapid" undulating band may well have belonged to such jugs. The ubiquity of such jugs in northern Syria led Lehmann to suggest that they were produced there locally.[75] In the southern Levant, jugs of this class were found at ʿAkko (unpublished), Dor, Tel Megadim (unpublished), Tel Mevorakh, Tel Michal (see fig. 14, no. 3), and Gezer (see fig. 14, no. 5).[76] These all seem to date to the fifth or fourth century B.C.E. The earliest known example that has a more precise date is from Tel Michal stratum XI (early fifth century).[77] A few more such jugs reached contemporary sites farther inland, including Khirbet er-Rujm in the Sharon Plain (see fig. 14, no. 4), Samaria in the central hill country, and ʿEin-Gedi in the Judean Desert.[78]

Beyond the Levant, a few identical jugs are known from Cyprus, classified by Gjerstad as White Painted VII and dated to the fourth century B.C.E. These were found at Marion Tomb 60 and Aphendrika Tomb 48.[79] In contrast to the wider distribution patterns of the hydriai and table amphoras discussed above, no jugs of this class have been published from Cilicia farther north-northwest of Kinet Höyük, and no such jug is known from Egypt.

On Crete itself, nothing like these banded jugs has come to light from a Classical-period context, nor is there much in the way of a decorative parallel for vessels with undulating bands on the shoulder. Some large lekythoi from Early Iron Age Eleutherna, with globular to ovoid bodies, bear a vague resemblance to the containers found in the Levant, but the Eleutherna lekythoi are smaller and have a different neck and rim form that is much more outturned and flaring, resulting in a more concave profile.[80] The largest

[71] Following Martin 2007, 82–4; Shalev 2009, 268.

[72] See discussion in Lehmann 1996, Form 269; 2000, fig. 8b, Form 8.

[73] Woolley 1938, 139–42; Lehmann 2000, 94 n. 46, fig. 8b, no. 1.

[74] Tell Abu Danna: Lebeau 1983, pl. 136.3. Deve Höyük: Moorey 1980, fig. 4, no. 41. Lehmann (2000, 94 n. 46) suggested that a few fragments from Tell Sukas and Ras Shamra belonged to such jugs. Our reexamination of these fragments, however, suggests that the curve of the shoulder would be more compatible with table amphoras.

[75] Lehmann 2000, Form 8.

[76] Dor: Mook and Coulson 1995, fig. 3.11, no. 14; Shalev 2014, 388, fig. 3.5.9, no. 9. Tel Mevorakh: Stern 1978, fig. 10, nos. 13, 14; pl. 30, nos. 7, 8. Tel Michal: Marchese 1989, fig. 10.1, no. 2. Gezer: Gitin 1990, pl. 46, no. 15.

[77] Martin 2007, 82–4; Shalev 2009.

[78] Khirbet er-Rujm: Lerer 2008, fig. 3, no. 3. Samaria: Reisner et al. 1924, fig. 158, no. 21a; pl. 69g. ʿEin-Gedi: Stern 2007, 137.

[79] Tomb 60: Gjerstad et al. 1935, 362, no. 22, pl. 67 (upper row); Gjerstad 1948, fig. 64, no. 3a. Tomb 48: Dray and du Plat Taylor 1951, 77, fig. 47, no. 7; pl. 23, no. 5.

[80] Kotsonas 2008, 168, 171, fig. 41. Our form also vaguely resembles Early Iron Age lekythoi from Knossos, for which see Coldstream and Catling 1996, 236, Tomb 283, no. 83, fig. 138, pl. 218; 245, Tomb 285, nos. 45, 49, fig. 140, pl. 223; 263, Tomb 292, nos. 48, 51, fig. 145, pl. 239.

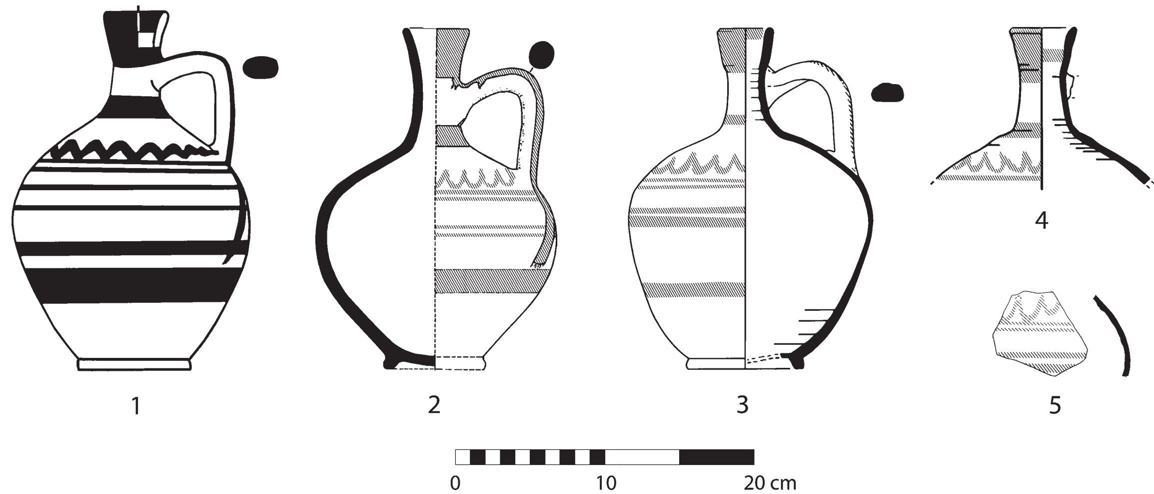

FIG. 14. Possible Cretan jugs from the northern and southern Levant: *1*, Al Mina (after Lehmann 2000, fig. 8b); *2*, Deve Höyük (after Moorey 1980, fig. 4, no. 41; reproduced with permission of BAR Publishing, www.barpublishing.com); *3*, Tel Michal (after Marchese 1989, fig. 10.1, no. 2; courtesy Sonia and Marco Nadler Institute of Archaeology of Tel Aviv University); *4*, Khirbet er-Rujm (after Lerer 2008, fig. 3, no. 3; courtesy Israel Antiquities Authority); *5*, Gezer (after Gitin 1990, pl. 46, no. 15; courtesy Hebrew Union College, Jerusalem).

of these large lekythoi—a rare type in the Cretan repertoire—is defined as taller than 18 cm, still smaller than our jugs. The absence of Cretan parallels for this particular jug form should probably be explained by our generally poor understanding of the Classical-period Cretan ceramic repertoire. We strongly suspect, however, as hinted by the Tel Michal jug in figure 14 (no. 3), which has a different chemical composition, that this jug type was not exclusively manufactured on Crete. The distribution pattern of such jugs also suggests that they were made at several places across a wide region in the Levant, including northern Syria. A larger sample of NAA testing would be needed to identify more such Cretan products and those of other possible production centers.

Juglet

The one juglet sampled by NAA, from Al Mina (AlmP 46, from the late Achaemenid-period stratum 3), belongs to the KnoL group and so is identified as Cretan (the KnoL group, tables 1–3; fig. 2, no. 11).[81] A Cretan origin is particularly surprising in this case, for, as with the jugs, nothing like this class of vessel is known from the island.

This vessel is morphologically a smaller version of the jug described above, with a rounded body and tall, narrow neck decorated with black bands. Juglets of the exact same shape and decoration in black or red gloss are among the most typical forms in Achaemenid Syria and northern Lebanon, especially at Al Mina, so much so that Woolley dubbed them "Al Mina juglets."[82] At Al Mina, they appear in contexts dating from the second half of the fifth to the early fourth century B.C.E. Such juglets are also known from Achaemenid contexts at Tell Sukas and Ras Shamra along the Syrian coast, farther inland at Deve Höyük and Neirab, and in Lebanon at Byblos.[83] Based on their ubiquity in northern Syria, and on their attribution by Ashton and Hughes' NAA study to a local Al Mina production, Lehmann, too, accepted that these juglets were north Syrian products.[84]

Several such juglets are also known from Cyprus, dated mostly to the Cypro-Classical I and II periods (475–400 and 400–300 B.C.E.). A few, for example, were found at Kition, both in the cemeteries and at the Kathari sanctuary.[85] A few others (undecorated) are

[81] The juglet is Shalev's (2014, 198) Type 4a.

[82] Woolley 1938, fig. 4.

[83] See discussion and references in Lehmann 2000, Form 9, fig. 8b, nos. 3, 4.

[84] Lehmann 2000.

[85] Cemeteries: Hadjisavvas 2012, 67, fig. 35, no. 2 (Tomb 20);

known from other sites—for example, Amathus.[86] In the southern Levant, in contrast to Syria and Cyprus, only one such (undecorated) juglet has been currently identified, at Tel Mevorakh, stratum IV, dating to the second half of the fourth century.[87]

Our NAA results suggest that Crete was another producer of such juglets, but it is difficult to draw conclusions from the one juglet we identified as a Cretan product. A much larger sample would be needed to assess the proportionate quantities that were produced in the different production centers and to trace the movement of these juglets across the Mediterranean.

Summary of Types and Their Production Spheres

Based on the robust link between the KnoL compositional group and central Crete, as well as on other NAA results obtained both in the framework of our own project and in that conducted by Ashton and Hughes, and according to the typological and distributional arguments presented above, the following may be concluded at present regarding Crete's participation in the fifth- to fourth-century eastern Mediterranean ceramic koine. Of the four types of containers identified in our study as Cretan, the hydriai are the only vessels that seem to have been exclusively produced on the island. Table amphoras (to be comprehensively published in the future) were produced on Crete, and at the least on Cyprus and in Cilicia as well. Jugs were also produced on Cyprus, probably in northern Syria as well (based on distribution), and in at least one other, unidentified location (based on NAA). Juglets were also produced in Syria. All this, however, might just be the tip of an as yet barely charted iceberg.

CRETAN AND LEVANTINE CONNECTIONS IN THE FIFTH AND FOURTH CENTURIES B.C.E.

Our identification of several types of containers in the Levant as Cretan products provides unexpected evidence of Cretan connections with the eastern Mediterranean in the fifth and fourth centuries B.C.E. Here an attempt is made to put these contacts into a historical perspective. It is a difficult task mainly since we do not have even the full range of Cretan fine wares imported into the Levant, let alone the fuller record of transport amphoras and other containers presumably involved in this trade, that would be necessary to construct a more nuanced picture of the character and extent of these contacts. But even with these limitations, the evidence for Cretan exchange with the Levant presented in this study is of paramount importance for understanding Classical-period Crete and its economy and society. A growing number of publications have challenged the traditional model of Cretan isolation and a subsistence economy—a view premised on a traditional Dorian aristocracy relying on serf labor and engaging in a redistributive system that inhibited economic development, a picture ultimately derived from a suspect literary tradition.[88] And yet even with these recent challenges to the traditional model of conservatism and isolation, the absence of identifiable Cretan exports anywhere in the Mediterranean in the Archaic and Classical periods has impeded acceptance of a more dynamic and trade-oriented picture of Cretan economic and social development. As long as we could not identify a single Cretan export to Egypt, the Levant, the coast of Asia Minor, or anywhere else for these periods (ca. 600–300 B.C.E.), the perception of Crete as a backward society with no interest in a market economy and trade persisted.[89]

To provide a historical perspective for the Cretan-Levantine connections in the Classical period, we offer a brief survey of Cretan external relations after the end of the Orientalizing period in the seventh century, the last phase when the island could be characterized as demonstrating multifaceted and conspicuous links to the Near East.[90] The following centuries, the Archaic and Early Classical periods (sixth and fifth centuries B.C.E.), have long been regarded as one of the most poorly understood phases in the island's history, and despite recent work to understand these periods better, they largely remain so.[91] Until recently, the ceramic

45, fig. 22, no. 3 (Tomb 14). Kathari sanctuary: Karageorghis 2005, pls. 86, 179, no. 1200; pl. 152, no. 3750; pl. 82, no. 4830.

[86] Flourentzos 2004, pls. 4, no. 38; 7, no. 73 (Tomb 646).

[87] Stern 1978, fig. 9, no. 15.

[88] Chaniotis (1999, 182) presented the case for a largely subsistence economy on Crete with little role for markets and trade in the Archaic and Classical periods. Much of the work since then has challenged this static picture. For a review of recent scholarship, see Gagarin and Perlman 2016, 95–120.

[89] Gagarin and Perlman (2016, 116) pointed to the poor record of Cretan exports as an obstacle to accepting the model of a market economy and exchange.

[90] Burkert 1992, 16, 21–2, 27, 63; Morris 1992, 150–94; Hoffman 2000; Jones 2000; Whitley 2001, 120–21; Wallace 2010, 218–28.

[91] Erickson 2010a, vii; 2010b, 306–7.

assemblages of these periods, which should have served as the main basis for chronological sequencing and archaeologically based historical narratives, attracted little attention.[92] One reason for this neglect was what Callaghan termed "the detrimental scholarly effects of the lack of imports"[93] and the nearly complete disappearance of the attractive orientalizing styles of the previous period.[94] Simply put, the plain local pottery of the sixth and fifth centuries attracted little attention. Our understanding of the Cretan ceramic sequences has improved considerably in the last 10 years, but we still face a rather fragmentary record. It is therefore perhaps not surprising that the island itself lacks parallels for some of the vessel forms we identify here as Cretan exports to the Levant.

This poorly understood archaeological record has generated bleak historical scenarios. For many past observers, the sixth and fifth centuries on Crete were a period of extreme demographic and economic decline, with the production and consumption of prestige objects nearly ceasing and intra-island and overseas contacts receding, giving birth to terms such as "the sixth-century gap," "the archaic gap," and "the period of silence."[95] Evocatively, Sarah Morris wrote that "history turned its back on Crete after 600 B.C.E."[96] The perceived absence of literary and archaeological evidence for contacts with the rest of the Greek world led scholars to postulate a period of cultural and economic withdrawal stemming from conservative Dorian elites promoting "traditionalism" and inhibiting market production for export both within Crete and beyond it.[97] Thus, the Cretan economy in these centuries has usually been characterized as strictly subsistence.[98]

Recent studies, however, have modified this austere assessment, either claiming that the recession was not so significant or rejecting the "dark age" scenario altogether. For example, Perlman drew on epigraphic and archaeological evidence to argue that specialized production, monetization, and a market economy had developed at Eleutherna by the sixth century B.C.E.[99] This undermines the perception of Archaic-period Cretan society as impoverished and lacking complexity. At Gortyn, there is evidence for building operations, cult activity, and inscriptions throughout the sixth and fifth centuries B.C.E.[100] With improved ceramic chronologies, more sixth-century activity and settlements on the island have now been documented.[101] Indeed, the excavators of Azoria in eastern Crete have replaced the old model of economic decline with a "phase transition" ca. 600 B.C.E., as new settlement patterns and a restructuring of relationships between households and communities heralded a leap in political complexity and territorial structures.[102] We have even better archaeological documentation for the fifth century at major centers such as Kydonia, Gortyn, Eleutherna, and Knossos and other lesser sites such as Priniatikos Pyrgos.[103] Still more Classical-period settlements, of course, are known from literary sources.[104]

The picture is also gradually changing with respect to intra-island contacts and overseas exchanges. Improvements in ceramic sourcing have documented the movement of Cretan fine wares from site to site and from one part of the island to the next. Eleutherna is an example of a site with numerous ceramic imports from other Cretan locales (including Gortyn and Knossos), enough to suggest that it was a transshipment point between land routes and overseas trade networks.[105] Here and elsewhere, we now have better documentation of overseas imports. In the sixth century B.C.E., these im-

[92] Erickson 2004, 200; 2010a, 1 n. 2, 22–3 (with references); see also Gagarin and Perlman 2016, 30–1.

[93] Callaghan 1992; see also Erickson 2010a, 2.

[94] Erickson 2010a, viii.

[95] Respectively, Whitley 2001, 244; Wallace 2010, 327–30 (with references); Erickson 2010a, ch. 1, 1–3 (citing a term coined by Stampolidis). Erickson (2010a, 1) surveys the range of opinions and various descriptions of the problematic sixth and fifth centuries B.C.E.

[96] Morris 1992, 172.

[97] E.g., Ian Morris (1998, 66–8) proposed that the Archaic- and Classical-period islanders were "turning away from the outside world." Whitley (2001, 251–52) saw the Cretans going their own way by refusing to embrace the symposium and other aristocratic institutions and practices.

[98] Demargne 1947, 348–53; Dunbabin 1952, 195–97. For more recent discussions, see Morris 1992, 169–72; Whitley 1988; 1998; 2001, 251–52; Chaniotis 1999, 182; Perlman 2004b, 95–6; Erickson 2005, 619–22; 2010a, 1–22, 186–87; Wallace 2010, 327.

[99] Perlman 2004b, 107–8, 113, 121, 128.

[100] Perlman 2000, 60–1, 72, 78.

[101] Haggis et al. 2004; Sjögren 2004 (e.g., 3, 34, 38); Erickson 2010a, ix; Wallace 2010, 328.

[102] Haggis 2014. Kotsonas (2002), Erickson (2010a, 235–71), and Gagarin and Perlman (2016, 6–36) also preferred to see the changes in the archaeological record as a restructuring or internal social transformation rather than a decline.

[103] Erickson 2002; 2004; 2010a, ix; Sjögren 2004; Wallace 2010, 328.

[104] For which see, e.g., Perlman 1992, 2004a.

[105] Erickson 2004; 2010a, 221–28, 289; see also Gagarin and Perlman 2016, 114.

ports included Attic, Lakonian, Argive, and Cycladic fine wares as well as "copies" of Attic types beginning in the late sixth century, with regional and site-specific variations in the quantity and origins of these overseas imports.[106] This is still a picture largely based on fine wares; it has taken longer to integrate transport amphoras, cooking vessels, and other possible articles of trade into the account.[107] Erickson detected a change in the record of overseas imports on the island in the fifth century B.C.E.[108] The larger quantity of Attic pottery at Eleutherna and Kydonia at this time led him to propose that these sites became west Cretan foci of maritime commerce with mainland Greece "as eastern Mediterranean markets faded away."[109]

Despite these advances in our understanding of Cretan overseas contacts, the impression of isolation or at best a passive role for Crete in overseas networks has not entirely gone away. One reason is the almost complete absence of identifiable Cretan exports during the sixth and fifth centuries B.C.E. Two exceptional sites where small quantities of Cretan pottery were imported in the sixth century, Tocra and Cyrene on the Libyan coast,[110] have been interpreted as evidence of a North African terminus of a Peloponnesian trade network, a particular directional route along which Greek merchants heading for Egyptian grain markets stopped on Crete.[111] Crete seems to have participated in this southern Peloponnesian/North African network, or at the very least some sites on the western end of the island served as intermediaries or transit ports of call. Before the archaeological evidence for a North African route, Viviers was one of the few scholars to explore the possibility that maritime trade had an impact on the economy of some communities on Crete, but his emphasis was on the Hellenistic period.[112]

Kotsonas, too, considered a more active role for Cretans in overseas exchange networks, but his argument for Cretans exporting pottery to the Levant (in the seventh century) involved only a few pieces, a possible Cretan skyphos or necked pyxis (identification uncertain) exported to Tyre and two more securely identified Cretan exports to Syria.[113] The broader picture of Cretan exports in that period is not much richer. Exported Cretan pottery reached nearby Thera in the seventh century, but other examples from Gela in Sicily have traditionally been explained as a result of Cretan participation in the colonizing venture there, not trade.[114] In contrast, the Cretans imported modest amounts of Cypriot pottery and other Near Eastern products in the Early Iron Age. Kotsonas described this pattern as "basically unilateral" exchange, in contrast to the Bronze Age pattern in which Cretan material was exported to places like Cyprus and conversely Cypriot material was imported to Crete.[115]

The proposed Peloponnesian realignment of Cretan trade in the sixth century presented a sharp contrast to the orientalizing culture on the island in the seventh century and earlier with its various links to the eastern Mediterranean. Before this study, Crete had produced virtually no archaeological evidence for commercial or other contact with the eastern Mediterranean, not even with Cyprus, in the sixth through fourth century B.C.E., and no Cretan artifacts or commodities had been identified overseas. The identification here of Cretan exports to the Levant, however, has now blurred this distinction between a Cretan focus on

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106 Erickson 2004, 204; 2010a, 186–87, 229–33.

107 More recent excavations of Archaic- and Classical-period Cretan sites have documented transport amphoras, most notably at Priniatikos Pyrgos (Erickson 2010b, 311, fig. 5, no. 9; 341–42, fig. 21) and Azoria (Haggis et al. 2007, 277, fig. 25, nos. 1–3).

108 Erickson 2010b, 310–11.

109 Erickson 2004, 209; 2010a, 292, 294. But even at the seemingly most connected sites, such as Kydonia, few overseas imports are attested between 460 and 400 B.C.E. (again, with regional differences; see Erickson [2005, 637–39, 651; 2010a, 295–98], including a discussion of the possible reason for this phenomenon; cf. Perlman 2004b). We should, however, be cautious about matters of scale. When considering this Cretan record of overseas imports from the perspective of the Levant, where every coastal occupation of the fifth through fourth century has yielded many dozens if not hundreds of Greek (mostly Attic) imports (see, e.g., Berlin and Lynch 2002; Waldbaum 2003; Stewart and Martin 2005, 87), their general relative paucity in the Cretan context is conspicuous.

110 Boardman and Hayes 1966, 1973; Boardman and Schweizer 1973, nos. 42–44.

111 Erickson 2010a, 32. Tocra also yielded Lakonian imports. Coldstream (1973a, 47 n. 23) suggested that the Cretan pottery at Tocra was produced at some site with access to the southern shore of the island (possibly Gortyn, Phaistos, or Arkades [Aphrati]). The results of OES led Boardman and Schweizer (1973) to propose production sites in central and east-central Crete (Knossos, Tylissos, Gournia, Ayia Triada). Erickson (2010a, 32 n. 43) suggested Aphrati as the source for the pottery both at Tocra and Cyrene; see also Gagarin and Perlman 2016, 116–17.

112 Viviers 1999.

113 Kotsonas 2008, 287–88.

114 Payne 1931, 5; Blakeway 1932–1933, 204; Dunbabin 1948, 20; Papasavvas 2012, 135.

115 Kotsonas 2012, 156–57.

trade with the Levant in the seventh and earlier centuries and a later commercial focus with mainland Greece in the sixth, fifth, and fourth centuries.

What had previously been seen as a sharp rupture in Cretan external relations ca. 600 B.C.E. was attributed to external factors, mainly the defeat of the Neo-Assyrian empire and the detrimental effects of the Babylonian conquest in the Levant, especially Phoenicia.[116] Morris suggested that Phoenician commercial interests subsequently shifted to the western Mediterranean, causing a change in trade routes and transforming Crete into a commercial backwater.[117] This would have had a detrimental effect on Cretan ports, especially those serving east–west Mediterranean trade routes, with the prototypical example being Kommos, where very little activity is attested between ca. 500 and 375 B.C.E.[118] Crete has been depicted as a rather passive agent in this process, although Erickson proposed a modest Cretan reaction to this possible collapse of Near Eastern trade routes with the new Peloponnesian focus described above, which benefitted ports on the northwestern coast.[119]

This brief survey of Cretan external contacts helps us place our findings in a broader context of interaction. The Cretan ceramic exports we identify in the Levant, and possibly also in Cyprus and Egypt, constitute the first concrete evidence for contact between the island and the eastern Mediterranean during the fifth and fourth centuries B.C.E. Indeed, they are the first attested Cretan exports anywhere during this period. The next known Cretan ceramic exports overseas date to the third century B.C.E. and consist of transport amphoras and, significantly, hydriai—the earliest in the series of Hadra hydriai found in Egypt.[120] Explaining the evidence for contact in the Classical period will depend almost entirely on archaeological evidence, since the literary sources reveal next to nothing about possible Cretan contacts with the Near East during this time. Herodotus (7.99.2), however, mentions that the mother of Artemisia of Halicarnassus (early fifth century B.C.E.) was a native of Crete, suggesting marital links between Cretan and Anatolian elites. In addition, Athenaeus (*Deipnosophistae* 2.48) records a visit paid by Entimus of Gortyn to the Persian emperor Artaxerxes II (405–358 B.C.E.) and the lavish welcome bestowed on him, revealing that at least one of the Cretan ruling elite was known on the international stage in the early fourth century B.C.E.[121] He also reports that the Cretan dancer Zenon drew the attention of the Persian king Artaxerxes in the early fourth century (*Deipnosophistae* 2.40). But these diplomatic, personal, and marital relationships need not indicate commercial ties, for which the pottery provides better evidence.

One tool for assessing pottery as evidence for trade is quantification, the frequency of imported shapes in local assemblages and the geographic contours of ceramic patterns.[122] At this stage, sophisticated methods of quantification cannot be undertaken at the Levantine sites where Cretan imports have been identified. The original publications do not provide numbers that would allow one to estimate the proportion of the pottery we now identify as Cretan vs. other imports and local wares. Quantification is also hampered by basic problems of defining the Cretan pottery vs. Cilician and other producers, perhaps including Cyprus, that participated in a common stylistic koine. One suspects that the scale of Cretan exports to the Levant was rather modest; the table amphoras, hydriai, jugs, and juglets of the types discussed here do not by themselves seem to have been an extensive and economically viable export.

Since current evidence consists entirely of containers, one obvious possibility would be to understand them as receptacles for some more valuable commodities.[123] The jugs/lekythoi with their narrow apertures would be suitable for the transportation of liquids, perhaps olive-oil based perfumes. Indeed, Cretan production of small lekythoi in Cypriot Black-on-Red style in

[116] Morris 1992, 148–49, 169–71; Erickson 2005, 627; 2010a, 298.

[117] Morris 1992, 169–71. Similar views were expressed by Erickson (2005, 625) and, to a certain extent, in Perlman 2004b, 131.

[118] The excavators, however, argue that an internal explanation should be sought for this hiatus (Shaw and Shaw 2000, 2, table 1.1; 724 n. 28).

[119] E.g., Erickson 2010a, 274.

[120] Vogeikoff-Brogan and Apostolakou (2004) and Vogeikoff-Brogan (2014, 38–42) provide recent starting points examining local production of transport amphoras and the record of imported transport amphoras to Crete in the Early Hellenistic period. Hadra hydriai were produced in Crete during the Hellenistic period and were exported mainly to Egypt (*New Pauly* 1077–79, s.v. "Hadra Ware" [Docter]; Enklaar 1986).

[121] According to Athenaeus, not only did the king give Entimus many gifts, but he also invited him to breakfast—an honor not shared by any other Greek visitor.

[122] Peacock and Williams 1986, 36; Orton and Hughes 2013, 202–18.

[123] As mentioned, in contrast to the Cretan ceramics, among the Cilician imports we identified in the Levant, most are open vessels.

the Iron Age has been interpreted as local or Phoenician agents packaging Cretan oil for sale within and outside the island.[124] The smaller of the Classical-period table amphoras could have served a purpose similar to that of the oil containers. But this explanation does not suit the larger table amphoras or the hydriai; in these cases, the pots themselves seem to be the articles of trade rather than containers for some other, more valuable commodity.

Table amphoras and hydriai are usually regarded as components of symposium sets. Indeed, Martin proposed that, in the southern Levant, the "East Greek" amphoras served to complete symposia sets formed from local pots and Attic imports.[125] These sets, she argued, could only partly be assembled from Attic imports since hardly any Attic decanting vessels were ever documented in this region. Attic hydriai, for example, as mentioned above, are presently unknown in the southern Levant. Martin explained the rarity of Attic and other imported hydriai in the southern Levant as a function of wine not being diluted in local practice and there being consequently no need for hydriai. But the discovery of Cretan hydriai and table amphoras at the same sites—at least at Al-Mina and Apollonia, possibly also at ʿAkko, Dor, and Tel Michal—might have implications for our understanding of cultural practices in the Levant in the Classical period, or at least at some of its major port towns. It implies consumption by individuals who had an idea that the appropriate equipment for the symposium included table amphoras and water jars.[126] But this still leaves us with the question of why local demand for hydriai and table amphoras in these social circles in the Levant was not met by the extensive importation of Attic wares. In addition, it would be odd if Cretan table amphoras and hydriai traveled to the southern Levant as part of the cultural baggage of the symposium, since it is not clear whether the institution of the symposium or anything like it developed on Crete, where the literary tradition stresses public dining in mess halls (*syssitia*).[127]

The possibility is also worth considering that Cretan banded hydriai in the fifth century were manufactured specifically to be traded overseas.[128] These might be precursors to the well-known production in the Hellenistic period of Hadra hydriai in specialized workshops on Crete for export, especially to Egypt, where they were used as funerary urns.[129] Indeed, these fifth-century hydriai, what we might call proto-Hadra hydriai, and a Cretan interest in the export market in the Classical period may have had an even earlier history, for about half of the 10 complete or near-complete Archaic-period Cretan vessels discovered at Tocra (mentioned above) were hydriai.[130] This prompted Erickson to suggest that decorated hydriai were valued as objects of display. Indeed, the new evidence for such hydria production from Priniatikos Pyrgos in the fifth century seems to confirm this: they appear prominently in debris from feasting contexts and are among the most elaborately decorated vessels at the site.[131] Perhaps the export of fifth-century Cretan hydriai to the Levant prefigured the more specialized production and presumably higher output in the Hellenistic period

[124] Kotsonas 2008, 65–8; 2012, 159–70.

[125] Martin 2007, 320–21. The fact that several of the "East Greek" containers are hydriai was unknown at the time.

[126] Cf. McLaughlin 2001; Berlin and Lynch 2002; McGeough 2003; McGeough and Lev-Tov 2006; Martin 2007, 145–55; Lynch 2011.

[127] Whitley's (2001, 251–52) view that Cretans rejected the symposium and the narrative imagery that accompanied it in favor of communal dining contexts such as the *syssitia*, where birth and wealth, not performance and display, determined status, has been called into question in Erickson 2011, 388–91; Gagarin and Perlman 2016, 33. But the whole issue involves enormous complications, including an evaluation of the literary tradition and assessments of the archaeological record to determine the presence or absence of certain pottery shapes and their potential use at the symposium. The Cretans may have used different shapes at symposia and *syssitia*, or the same shapes but with different standards of decoration.

[128] Appadurai's (1986) "commodities by destination."

[129] *New Pauly* 1077–79, s.v. "Hadra Ware" (Docter); Guerrini 1964; Cook 1966. For OES of hydriai, see Callaghan and Jones 1985, 10. Only nine elemental values have been measured by them with OES, including calcium (Ca) and sodium (Na). Both these elements often vary in a group of vessels of the same origin. The remaining (seven only) elemental concentrations make a comparison between their results and our chemical ones difficult. But the similarity between the Knossian composition and the Cretan one is already mentioned there.

[130] Boardman and Hayes 1966, 78–80, pls. 55, 56; supra n. 110.

[131] Erickson 2010b, 333 n. 73. In the framework of this article, we cannot consider in much detail the localized variations of the symposium set, but even the supposed centrality of the hydria to the Athenian symposium is not entirely certain (see references in Erickson 2010b, 333 n. 74). For Crete, Erickson (2010b) suggested that hydriai characterized communal feasting at Priniatikos Pyrgos but not necessarily something resembling the symposium. Moreover, he doubted whether these Cretan hydriai were used to convey water. Their painted decoration would have stood against the "monotone black tablewares" (Erickson 2010b, 333) and made them appropriate as wine vessels.

with the Hadra hydriai and their export to Egypt ca. 270–260 B.C.E.[132]

The integration of Crete in eastern Mediterranean markets in the fifth century B.C.E. is suggested not only by the production of shapes on Crete with a possible aim for the export market but also by Cretan participation in a stylistic koine. As mentioned above, fabric analysis shows that table amphoras and rounded jugs nearly indistinguishable from the Cretan ones in shape and decoration were produced in Cilicia, on Cyprus, and in at least two other unidentified centers. If these assignments are correct, Crete would seem to have participated in a ceramic koine encompassing at least these regions (or specific production centers in them).[133] This, even more than the actual number of Cretan exports to Levantine sites, implies economic and perhaps broader cultural connections. Fundamentally, it indicates information exchange and knowledge of foreign markets. In a similar way, Buora and Laflı saw the circulation of Hadra hydriai at coastal sites in Cilicia in the Early Hellenistic period as evidence of close relationships between Crete, Egypt, and Cilicia—a material koine resulting from commercial ties—before the political integration of Cilicia into broader networks.[134]

Ships traveling between Crete and various destinations in the eastern Mediterranean in the fifth and fourth centuries B.C.E. undoubtedly carried more than the pots currently documented. Possibilities for the main Cretan cargoes include oil, wine, timber (cypress and cedar), and specialty products such as honey and resin.[135] Connections to foreign markets would have encouraged agricultural intensification on Crete, something considered by the excavators of Azoria in their model of a "phase transition" ca. 600 B.C.E. The lingering impression of Cretan isolation and a poorly developed economy now needs to take into account the possibility of a substantial Cretan trade with the eastern Mediterranean, including Syria, the southern Levant, and at least parts of Phoenicia, Cyprus, and Egypt.

Possibly much of this trade was conducted by Ionian Greeks operating in the eastern part of the island. In a recent survey of the import record of eastern Crete, Brisart expanded on Erickson's observation of a Cycladic or eastern Greek focus of trade in this part of the island and drew on the results of recent excavations to show a more definite connection with Greek Ionia than previously realized.[136] He concluded that Aegean merchants (Ionian Greeks) stopped at Crete on the way to North Africa. Even though the main thrust of our project has been to discredit the traditional attribution of "East Greek" pottery at Levantine sites, Greeks (possibly Ionian Greeks) can still be seen as the main carriers of this trade. The fact that Greek merchants were active in the eastern Mediterranean during the fifth and fourth centuries B.C.E. is attested, for example, in the Ahikar Papyrus (475 B.C.E.) and by ample archaeological evidence.[137] One example is the Tektaş Burnu shipwreck, found off the Aegean coast of Turkey and dating to the third quarter of the fifth century. It revealed evidence of coastal trading with a cargo of Ionian Greek transport amphoras that included pseudo-Samian (Erythraian), Chian, Mendean, and Samian examples.[138] A more comprehensive discussion of trade routes and agents linking Crete and the eastern Mediterranean must, however, be relegated to another publication after all the production centers of the various painted ceramics identified in this project have been discussed.

CONCLUSIONS AND FUTURE PROSPECTS

Although events in the Levant around the turn of the seventh century B.C.E. must have had a detrimental impact on trade between Greece and the Levant, as suggested by many scholars,[139] their effects did not last into the fifth and fourth centuries, when traffic between various parts of the Aegean, the eastern

[132] Enklaar 1986. For the link between Archaic- and Classical-period Cretan hydriai and one subtype of the Hadra hydria (the O-type hydria), see Coldstream and Eiring 2001, 85.

[133] For a discussion of the concept of regional styles, cf. Lawall 2011, esp. 50–6.

[134] Buora and Laflı 2016, 320.

[135] Viviers 1999, 229 (with n. 26); Erickson 2004, 206. Perlman (2004b, 123) suggests that Eleuthernians may have produced snowbell resin (*Styrax officinalis*), which was apparently traded overseas.

[136] Erickson 2010a, 306; Brisart 2014, 272–76. E.g., excavations at Priniatikos Pyrgos and Azoria have yielded Cycladic Sub-Geometric pots and sixth- to fifth-century B.C.E. Ionian Greek fine wares. In addition, imported transport amphoras of the early fifth century B.C.E. from both sites point to a similar pattern of trade in northern Greek and Ionian wines. From Olous in eastern Crete came Classical-period terracottas of types either imported or closely following the styles of Rhodes, Chios, Samos, Clazomenae, Aeolis, and Paros (Brisart 2014, 273).

[137] Yardeni 1994, 70; Bresson 2016, 293.

[138] Carlson 2003, 596–98.

[139] E.g., Morris 1992; Aubet 2001, 59–60; Elayi 2013, 228.

Mediterranean, and Egypt seems to have reached unprecedented levels.[140] The most important implication of this study is that Crete formed part of this Classical-period recovery and established a link with eastern Mediterranean markets—certainly with parts of the Levant, Cyprus, and Cilicia and quite possibly also with Egypt. This should help change the common perception of an island disconnected from the eastern Mediterranean after ca. 600 B.C.E. and generate reassessments of the role of maritime contacts in the Cretan economy. Since ceramics are among the best archaeological indices of maritime exchanges, the correct identification of Cretan pottery overseas—of the types presented here and possibly others—will constitute an important first step in assessing Cretan trade. On Crete, pottery with banded decoration and rudimentary motifs like undulating lines and languettes—material that has been the subject of this study—has attracted even less attention than local black-gloss pottery, which itself is poorly represented in the publication record in favor of more elaborately decorated imports.[141] A bias in favor of Attic (and Atticizing) ceramics has probably influenced the picture of trade overall in the Classical period and given the impression of an overly Attic or mainland Greek focus at sites not just on Crete but in the Levant as well.[142] It is hoped that the proper identification of ceramics, Cretan and those of other regional producers, will reveal more nuanced patterns of trade between the Aegean and the Levant and within the Aegean region itself.

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Appendix 1: NAA Sampling and Measurement Procedures at the Helmholtz-Institut für Strahlen- und Kernphysik at Bonn

A sample of approximately 80 mg of powdered clay is obtained by drilling the vessel or sherd with a pointed corundum or diamond drill. The research reactor of the Reactor Institute Delft, the Netherlands, has been used

[140] Demesticha 2011, 48–9; see also Stern 2001, 518–22; Van Alfen 2002, esp. 270–85.

[141] Erickson 2010a, 25.

[142] We wonder whether the extensive "Attic" and "Atticizing" assemblages in the Levant do not include Cretan black-gloss ceramics as well. Since Cretan shapes are well known to only a handful of experts and hardly any fabric analysis has been conducted on "Attic" wares in the Levant, Cretan tablewares could conceivably remain unidentified in the storerooms. In addition, the proper identification of other "oriental" objects in Crete in the period under discussion, such as metal objects, glyptics, and jewelry, will certainly deepen our understanding of the cross-Mediterranean liaisons we should envision. For Knossos, see Coldstream 1973b, 157–58, 173, 185.

since 2010 for the 10-hour irradiations of the samples at a neutron flux of 5 x 10^{12} neutron/(cm^2 s). To correct for neutron flux inhomogeneities, six Bonn pottery standard samples are irradiated together with the pottery sample set. The composition of the Bonn standard has been presented by Mommsen and Sjöberg,[143] calibrated with the Berkeley standard.[144] After the transport of the irradiated samples to the laboratory in Bonn, they are measured for the next four weeks to determine the weight concentrations of about 30 minor and trace elements, those that are present above the detection limits. The set of these concentration values and their measurement uncertainties is the characteristic pattern of the clay paste used in the producing workshop. In addition to these values, the different measurement uncertainties (errors) are also important if the concentration patterns are to be compared with those of vessels and sherds of similar composition. A composition, for example, of 4% ±1% is statistically similar to a composition of 5% ±1%, whereas values of 4% ±0.1% and 5% ±0.1% are obviously very different. In Bonn, a statistical procedure to form groups of samples of similar composition is used, which works like a filter. It is able to sort out of the large data bank all similarly composed samples while taking the above-mentioned uncertainties into account and, in addition, to correct for constant shifts in all the values to consider the effects of possible dilutions or enhancements of the elemental concentrations of the clay paste by the ancient potters. If, for example, pure sand or calcium carbonate has been added, all elemental concentrations except those of the diluent are lowered by a constant factor that can be determined by comparison with undiluted samples performing a best relative fit.[145]

Appendix 2: Sampling and Measurement Procedures at the ARCHEA Laboratory, Warsaw

Samples weighing approximately 2 g each were prepared as follows. The surfaces of the samples were removed, and the samples were cleaned with distilled water in an ultrasonic device. Then the samples were pulverized. The resulting powders were dried for 12 hours at 105°C, then ignited at 900° (heating rate 200°C/h, soaking time 1 h). After cooling in a desiccator to room temperature, powders were balanced, mixed with a lithium-borate mixture (Merck Spectromelt A12), and melted. The mixtures were cast into small disks for measurement. The results, therefore, are valid for ignited samples but with the ignition losses given may be recalculated to a dry state. Samples were subsequently analyzed by wavelength dispersive X-ray fluorescence (WD-XRF; PANalytical AXIOS, GEO-Forschungszentrum Potsdam) to determine the content of the major elements, including phosphorus. It was also used to measure a series of 15 trace elements, six of which, however, could be measured only with poor precision. Total iron was calculated as iron oxide (Fe_2O_3). For easier comparison, the major elements were normalized to 100%. The precision for major elements is below 1%; for trace elements, this rises to 20% depending on the concentrations. Accuracy is tested by analyzing international reference samples and by exchange of samples with other laboratories. For major elements and the most important trace elements this is 5–10%.

[143] Mommsen and Sjöberg 2007, 360, table 1.

[144] For which see Perlman and Asaro 1969.

[145] This statistical grouping procedure was first published in Mommsen et al. 1988; the discussion was updated in Beier and Mommsen 1994 and subsequently in several other publications—e.g., Akurgal et al. 2002; Mommsen 2007, 2011; Mommsen et al. 2002a; Mommsen and Sjöberg 2007; Mommsen and Japp 2014.

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