On the Origin of Pottery from Tel Miqne–Ekron

JAN GUNNEWEG
The Hebrew University
Jerusalem, Israel

TRUDE DOTHAN
The Hebrew University
Jerusalem, Israel

ISADORE PERLMAN
The Hebrew University
Jerusalem, Israel

SEYMOUR GITIN
The W. F. Albright Institute of
Archaeological Research, Jerusalem, Israel

Provenience research on Mycenaean IIIC:1b and Philistine bichrome wares offers objective data regarding the origins of the Sea Peoples and their pattern of settlement in 12th-century B.C. *Canaan.*

Forty-four ceramic specimens from the 1981 and 1982 excavations at Tel Miqne–Ekron were subjected to instrumental neutron activation analysis to learn where they were made.

The main interest of this study was Mycenaean IIIC:1b wares found at Miqne. Iron Age I plain wares were analyzed because if they were made locally their composition could be a reference for other wares. It was deduced that all of the Mycenaean IIIC:1b pottery was made locally.

Three of five pieces of Philistine ware from Miqne were locally made; the other two came from the Coastal Plain. Pottery of a "foreign" style, Mycenaean IIIC:1b, appearing at Miqne at the beginning of the Iron Age, was locally made. The classification of the pottery was accurate, for the wares are indistinguishable in appearance from the same kind found in their "homeland," showing that the potters in different places shared a common cultural affinity.

INTRODUCTION

Long ago identified as biblical Ekron (Naveh 1958: 87–100, 165–70), Tel Miqne (hereafter Miqne) was the location of a major Philistine City.[1] Its importance is attested by its size—about 50 acres—and by its strategic location overlooking an ancient major network of roads. Miqne is set apart from other Philistine cities by its proximity to the western slope of the Shephelah, the border zone that separated Philistia from Judah. It is an ideal place to examine the processes of interaction between the Philistines and the Israelites. Critical to this research is the determination of the origin or sources of the material cultural evidence and specifically the ceramic data found at Miqne.

Both Philistines and Israelites produced unique material cultures, which have been attested in the results of the first two seasons of excavation at Miqne in 1981 and 1982. While the chronological profile that emerged from these initial explorations included 13 occupation phases from the Chalcolithic to the end of Iron Age II, the major assemblages of artifacts came from Iron Age I, Phases 9–6, and Iron Age II, Phases 5–3 (Dothan and Gitin 1982: 150–53; 1983: 127–29; 1985: 67–71).

This report focuses on the origin of the Iron Age ceramic data. The purpose is to provide a preliminary study of the provenience of several types of Iron Age wares as determined by neutron activation analysis (NAA). This method for judging provenience independent of typological analysis (Perlman and Asaro 1969: 21–52) adds a new dimension to what is normally learned from traditional ceramic studies.[2]

METHOD FOR PROVENIENCE DETERMINATION

Neutron activation analysis as applied to pottery is a method for determining with high precision the quantities of a large array of chemical elements. The basic premise for provenience work is that the chemical profile of pottery made from one clay source will be distinguishable from those of all other sources. We shall explain some of the complications that can arise.

The analytical results for a piece of pottery do not by themselves reveal where it was made; for this, one must find a match with the chemical profile of reference material from a site. Reference material generally consists of pottery for which a strong case can be made for local manufacture. Sometimes, local clay sources can be used as reference material.

At the start of the present study, no pottery from Miqne had been analyzed; therefore sherds or vessels had to be selected to serve as reference material. Reference data from other sites used in this report were taken from existing data banks at the University of California at Berkeley and the Hebrew University in Jerusalem.

In the present study, 44 ceramic specimens were taken for analysis (figs. 1–3). The largest single group of these consisted of stylistically homogeneous Mycenaean IIIC:1b (hereafter Myc. III C:1b) wares found at Miqne in large numbers.[3]

In such a case, it is important to learn whether the pottery vessels are also chemically homogeneous. If so, they were probably made at a single place. If some samples of the stylistic group differ markedly in composition from the others, they were probably made elsewhere and therefore present a separate provenience problem.

MYC.IIIC:1B WARES AND REFERENCE MATERIAL

Fifteen Myc.IIIC:1b sherds were analyzed; these will be identified by their laboratory serial numbers (Nos. 15, 16, 18–26, 28–30, and 32). Their descriptions and other pertinent information will be found in Table 1. (Table 1 also relates the laboratory serial numbers to the numbers on the sherds in figs. 1–3.) Table 2, Column 1 shows the data for 16 chemical elements in condensed form for a group of 13 Myc.IIIC:1b sherds, excluding Nos. 16 and 20. Numbers 25 and 26 in Table 1 are sherds from the same vessel, and we shall point out what was learned by comparing their data. No. 20 will be discussed later.

For each element in Column 1 there is a set of paired numbers symbolized by $M \pm \sigma$. M is the mean value for the member of the group and σ is an index for the spread of values encountered among the members. This expression has statistical connotations that pertain to the distribution of values within a group, hence, the probability that the value for a kindred subject (in this case a piece of pottery) makes this subject a member of the group. If σ is small compared with M, the membership in the group is limited to a small range of values around the mean value.

An examination of the data in Column 1 shows that this group is less homogeneous than is usually found in chemical groups. This could mean that the vessels were not made from the same clay source or, conversely, that they were made from a single source that was not very uniform in composition. We favor the latter explanation because the data could not be separated into distinct subgroups. There was supporting evidence for this premise when it was found that two samples (Nos. 25 and 26) from the same vessel disagreed to a higher extent than has been noted in other studies where two sherds from the same vessel were analyzed.

The largest number of Myc.IIIC:1b wares in Israel with which we dealt were found at Ashdod and were made there (Asaro, Perlman, and Dothan 1971: 169–75). It was important to know whether the Miqne wares might have come from Ashdod, an issue to be taken up first.

About 90 pieces of such wares from Ashdod were analyzed and the data were separated into a number of closely similar subgroups. Since each of these matched large numbers of Ashdod wares of different local styles there was no doubt that the Myc.IIIC:1b wares were made at Ashdod (Perlman, Asaro, and Frierman 1971: 216–19). The data for one of these subgroups is shown in Table 2, Column 2. Even a cursory comparison of the data in Columns 1 and 2 shows that they are very different.

Despite the manifest difference, it is not easy in this case to rule out Ashdod as the source of the Miqne group. The first element, calcium, in the Miqne group is much higher than in the Ashdod

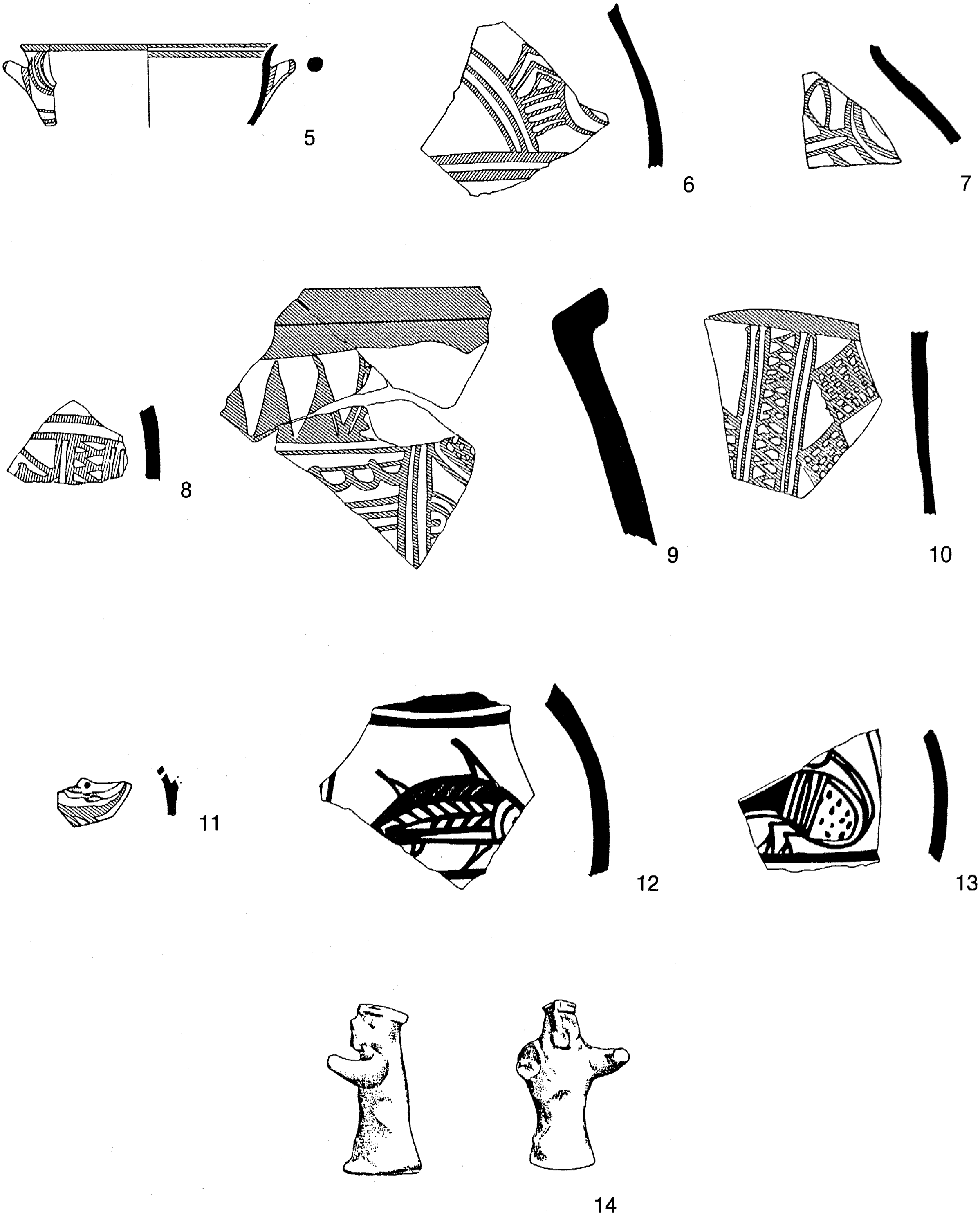

Fig. 1. Mycenaean IIIC:1b ware and a figurine from Miqne.

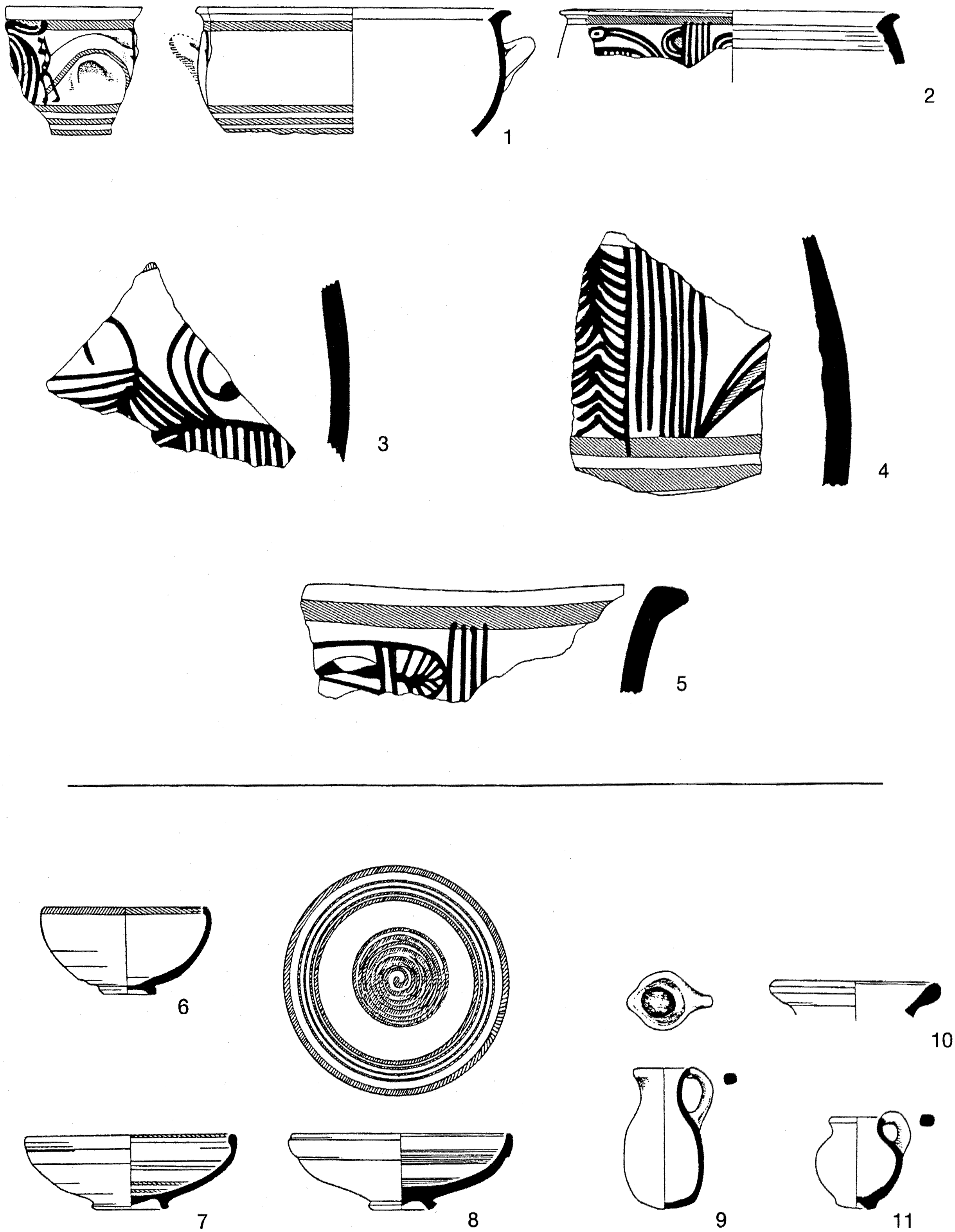

Fig. 2. Philistine bichrome ware and Iron Age I plain ware from Miqne.

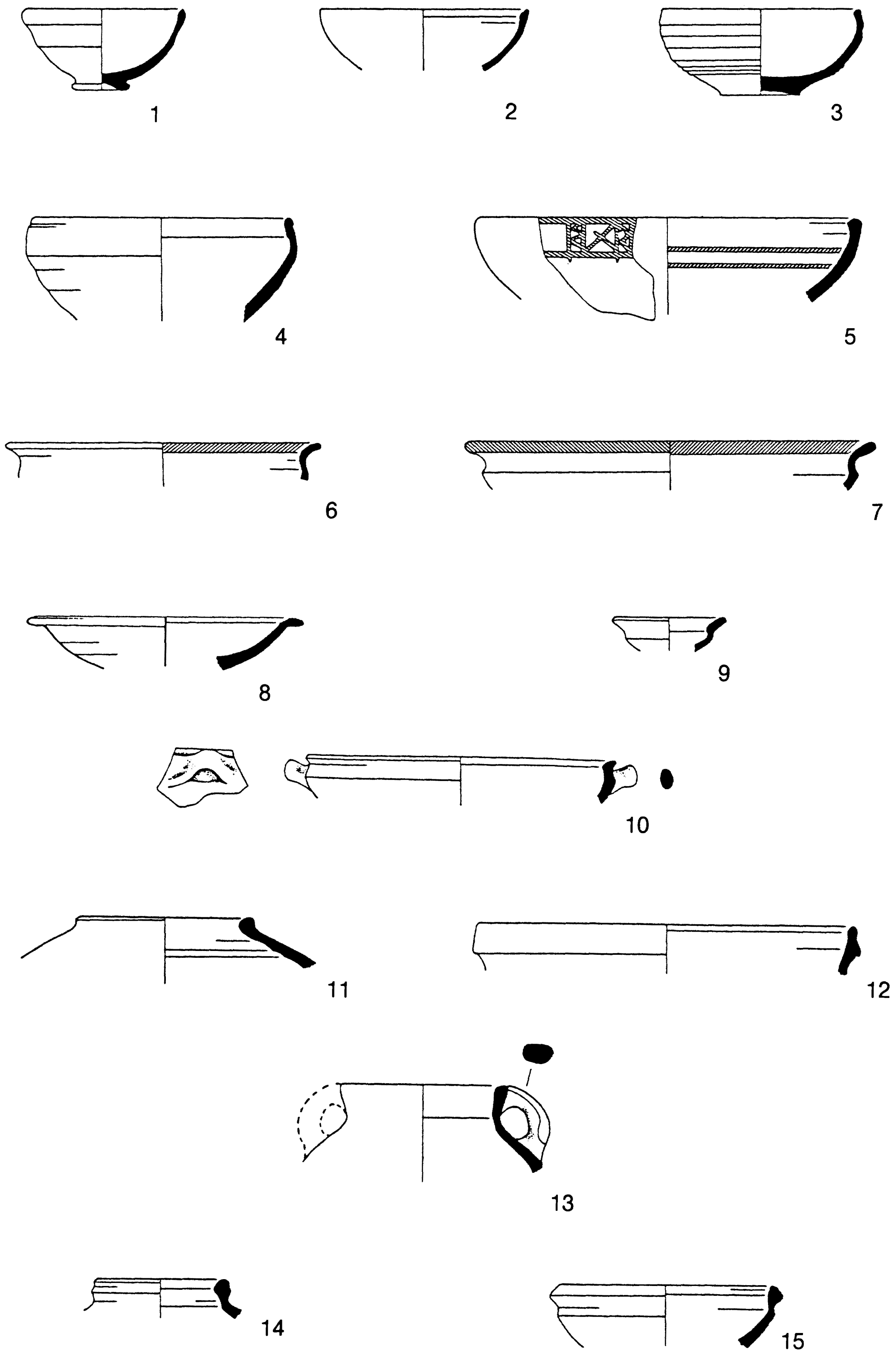

Fig. 3. Iron Age I plain and decorated wares and Iron Age II (Nos. 11, 14, and 15) plain wares.

TABLE 1. Summary of Miqne Samples

Lab. No.	*Registration No.*	*Period or Style*	*Type*	*Fig. No.*	*Provenience*
1	INE 3.132/1	Iron I	Bowl	2:7	Ashdod
2	INE 3.133/1	Iron I	Bowl	2:10	Miqne
3	INE 3.134/1	Iron I	Bowl	2:6	unknown
4	INE 3.135/1	Iron I	Juglet	2:9	Miqne
5	INE 3.136/1	Iron I	Bowl	2:8	Miqne
6	INE 3.137/1	Iron I	Juglet	2:11	Miqne
7	INE 5.100/1	Iron I	Bowl	3:1	Miqne
8	INE 5.100/4	Iron I	Bowl	3:8	unknown
9	INE 5.124/1	Iron I	Bowl	3:4	unknown
10	INE 5.154/9	Iron I	Bowl	3:3	Miqne
11	INE 5.168/18	Iron I	Chalice	3:9	Ashdod
12	INE 5.181/38	Iron I	Bowl	3:5	Miqne
13	INE 5.184/10	Iron I	Bowl	3:6	Ashdod
14	Object no. 140		Figurine	1:14	Ashdod
15	INE 4.73/2	Mycenaean IIIC:1b	Sherd		Miqne
16	INE 4.80/2	Mycenaean IIIC:1b	Sherd	1:10	Miqne
17	INE 5.28/6	Iron Age I	Bowl	3:2	South Coast
18	INE 5.33/6	Mycenaean IIIC:1b	Sherd	1:7	Miqne
19	INE 5.71/4	Mycenaean IIIC:1b	Strainer	1:11	Miqne
20	INE 4.88/2	Mycenaean IIIC:1b	Krater	1:6	Miqne
21	INE 4.88/10	Mycenaean IIIC:1b	Krater	1:1	Miqne
22	INE 4.128/44	Mycenaean IIIC:1b	Krater	1:2	Miqne
23	INE 4.133/7	Mycenaean IIIC:1b	Krater	1:3	Miqne
24	INE 4.144/81	Mycenaean IIIC:1b	Jug	1:12	Miqne
25	INE 4.154/19	Mycenaean IIIC:1b	Krater	1:9	Miqne
26	INE 4.154/52	Mycenaean IIIC:1b	Krater (same as #25)	1:9	Miqne
27	INE 4.197/11	Iron Age I	Bowl	1:4	South Coast
28	INE 5.97/11	Mycenaean IIIC:1b	Krater	1:8	Miqne
29	INE 5.104/19	Mycenaean IIIC:1b	Krater	1:5	Miqne
30	INE 5.134/6	Mycenaean IIIC:1b	Krater		Miqne
31	INE 5.154/5	Mycenaean IIIB	Body Sherd		probably Cyprus
32	INE 5.192/23	Mycenaean IIIC:1b	Jug	1:13	Miqne
33	Surface	Philistine Bichrome	Krater	2:2	Miqne
34	INE 4.6/2a-d	Philistine Bichrome	Krater	2:1	Miqne
35	INE 4.60a/2	Philistine Bichrome	Krater	2:5	Ashdod
36	INE 5.8/3	Philistine Bichrome	Sherd	2:4	Miqne
37	INE 5.8/4	Philistine Bichrome	Sherd	2:3	South Coast
38	INE 3.58/12	Iron Age I	Bowl	3:7	Miqne
39	INE 5.33/28	Iron Age I	Cooking Pot	3:12	Miqne
40	INE 4.59/12	Iron Age I	Bowl	3:10	Miqne
41	INE 5.68/1	Iron Age I	Jug	3:13	Ashdod
42	INE 2.26/33	Iron Age II	Jar	3:15	North Coast
43	INE 2.32/5	Iron Age II	Jar	3:14	North Coast
44	INE 2.35A/22	Iron Age II	Bowl	3:11	Miqne

TABLE 2. Tel Miqne and Tel Ashdod Myc III C:1b

Chemical			*Miqne Myc.IIIC:1b (13 samples)* M ± σ			*Ashdod[a] Myc.IIIC:1b (30 samples)* M ± σ			*Ashdod No.653 (1 sample)*	*Miqne Myc.IIIC:1b (6 samples)* M ± σ		
calcium	Ca	%	18.7	±	2.7	6.5	±	0.9	20.5	20.5	±	1.8
cerium	Ce		43.7	±	5.1	67.9	±	1.6	40.6	40.1	±	4.2
cobalt	Co		9.2	±	1.8	18.4	±	0.4	8.4	8.2	±	1.7
chromium	Cr		90	±	9	126	±	9	81	84	±	6
cesium	Cs		1.1	±	0.2	2.0	±	0.2	1.4	1.0	±	0.2
iron	Fe	%	2.51	±	0.38	4.07	±	0.11	2.31	2.21	±	0.40
hafnium	Hf		6.30	±	0.39	14.03	±	0.73	6.80	6.74	±	0.65
lanthanum	La		23.5	±	2.4	31.8	±	1.2	20.8	20.9	±	1.5
lutecium	Lu		0.34	±	0.10	0.51	±	0.03	0.29	0.31	±	0.03
sodium	Na	%	0.43	±	0.10	0.68	±	0.06	0.37	0.46	±	0.11
nickel	Ni		56	±	11	51	±	17	40	54	±	10
scandium	Sc		8.80	±	1.18	13.32	±	0.31	7.65	7.64	±	0.47
tantalum	Ta		0.80	±	0.16	1.44	±	0.05	0.75	0.72	±	0.11
thorium	Th		5.42	±	0.67	8.72	±	0.40	4.90	4.79	±	0.39
titanium	Ti	%	0.48	±	0.17	0.73	±	0.03	0.34	0.42	±	0.12
uranium	U		2.66	±	0.26	1.97	±	0.10	2.48	2.64	±	0.35
ytterbium	Yb		2.36	±	0.36	3.34	±	0.17	2.18	2.21	±	0.35

All elements are in units of parts-per-million unless indicated by the % sign
[a]Data from I. Perlman and F. Asaro, 1982, Table 9.

group and the other elements except uranium are much lower. The extra calcium depresses the values for the other elements, and were it not for the very high calcium in the Miqne group, the values for the other elements would be closer to those of the Ashdod group. To see what this has to do with Ashdod as a possible source of high-calcium pottery, we must examine the nature of potters' clays as applied to Ashdod.

The qualities that characterize clays are given by minuscule crystals of a family called "clay minerals," which, as found in nature, are always admixed with foreign materials that may differ in kind and amount from place to place. Clay minerals themselves contain calcium but almost never more than a few percent; therefore, higher values for calcium must come as admixed calcite (calcium carbonate). Almost all of the elements we measure are virtually not found in calcite, so these elements are diluted by the presence of calcite. Since calcite weighs 2.5 times as much as the calcium it contains, the dilution can be severe.

One might ask what would be the composition of the Ashdod group if it had the calcium value of the Miqne group. High-calcium pottery could have been made at Ashdod; and it was, albeit rarely. The evidence for this is based on two facts:

1. A cut made through the red clays that lie under the sand dunes revealed conspicuous lenses of chalky calcite; Ashdod potters could thus have made vessels with almost any amount of calcium upward from about 5 percent.
2. In a kiln area, high-calcium fragments of unbaked pottery were found.

From the calcium contents in Columns 1 and 2 of Table 2, one can calculate that the data in Column 1 can be put on the same clay-content basis as Column 2 by increasing each value of the Miqne group by 45 percent. When this "normalization" was carried out, the clays of the Miqne and Ashdod groups were not grossly different. More important, the normalized groups still did not give an acceptable statistical match; hence we concluded that the Miqne Myc.IIIC:1b wares were not made at Ashdod.

Before proceeding with reference material from Miqne, we shall reexamine some early results on

Myc.IIIC:1b ware from Ashdod in light of information now available from the Miqne wares.

Among the many sherds from Ashdod that we analyzed, were a few that had much higher calcium values than that shown in Column 2 of Table 2. The data for one of these (Ashdod No. 653) was published with the interpretation that it was probably a product of Ashdod made of a highly diluted clay (Perlman and Asaro 1982: 78, Table 9).

Column 3 of Table 2 shows the data for Ashdod 653 whose calcium value was 20.5 percent. In Column 4, a group was made of the six Miqne Myc.IIIC:1b sherds with the highest calcium value, which accidentally averaged 20.5 percent. A statistical comparison of Ashdod 653 with this group showed an almost perfect match. On this basis, we concluded that Ashdod 653 has the same provenience as the Miqne wares.

Only one Miqne Myc.IIIC:1b sherd (No. 20) was not included in the group of Column 1. The elements in this sample showed the same pattern as the others from Miqne, but it was even more highly diluted. There is little doubt that No. 20 was made at the same place as the others.

MIQNE MYC.IIIC:1B AND MIQNE REFERENCE MATERIAL

Establishing reference material sufficient to provide a comprehensive view of the compositions of pottery made at different sites was the most taxing problem in the provenience studies. Several hundred vessels from Ashdod were analyzed from 20 strata before an adequate definition emerged of the variations in composition of locally made pottery. (Perlman, Asaro, and Frierman 1971: 216–19). Although hundreds were also analyzed from sites in eastern Cyprus, it is still not possible to tell which of the many "reference" groups were made at specific sites (Gunneweg, Perlman, and Yellin 1983: 11–12).

At the time of the present study, laboratory limitations precluded comprehensive testing of the Miqne samples. Consequently, we concentrated on Iron Age I wares which stylistically we assumed to be local. This evidence offered the best possibility for establishing a pottery reference group that might relate chemically to the Myc.IIIC:1b pottery.

Nineteen pieces of these Iron Age I wares were analyzed, but in contrast to the 13 Myc.IIIC:1b vessels that were quite clearly made in one place, the Iron Age I samples were not homogeneous. Nevertheless, ten of the samples could be placed in one chemical group. This group served as the reference material for Miqne despite the fact that it was not as calcareous as the Myc.IIIC:1b wares.

Column 4 of Table 2 shows a subgroup of six Miqne Myc.IIIC:1b samples with the highest calcium values (20.5% ± 1.8%). Column 1 of Table 3 represents a group made up of the other seven Myc.IIIC:1b samples whose calcium content is 17.0% ± 1.2%, whereas Column 2 shows the data for the Miqne reference group consisting of ten Iron Age I specimens.

The calcium in the reference group is considerably lower than that in the Myc.IIIC:1b subgroup in Column 1, Table 3, while the other elements are higher. Both of these factors suggest that the Myc.IIIC:1b pottery may be related to the Iron Age I reference pottery in the sense that the clays are essentially the same, but one group is more highly diluted by calcite than the other.

Column 3, Table 3, presents the results of normalizing the data of Column 1 to the same calcite level as Column 2. The data for the Myc.IIIC:1b ware of Column 3 are much closer to those of the reference group of Column 2 and the agreement is statistically satisfactory, because 15 of 17 elements have a deviation smaller than 1 σ on the distribution curve. In our opinion, a sufficient case has been made that the Miqne Myc.IIIC:1b wares were homogenous and were made locally. This assumption is strengthened by the evidence that this pottery could not have been made in the Coastal Plain. This is based on the lack of a compositional match with the only group available from that area and the data from Ashdod. We have no way of knowing why potters chose clays that were less calcareous for some Iron Age wares than for others, like the Myc.IIIC:1b pottery, nor do we know why the Ashdod potters avoided using calcite in most of their wares.

One element, uranium, is not corrected for dilution. The reason is that calcite contains uranium at about the same level (~ 2.65 ppm) as is found in the clay fraction; therefore, calcite is not a simple diluent for this element.

We now summarize what is known about the other nine samples of Iron Age 1 wares which are not in the Miqne reference group:

1. Nos. 11, 13, and 41 were closely similar to each other and matched a large group of 46

TABLE 3. Miqne Myc.IIIC:1b and Miqne Iron Age I Reference Group

		Miqne[a] *Myc.IIIC:1b* *(7 samples)* *M* ± *σ*	*Miqne*[b] *Iron Age I* *(10 samples)* *M* ± *σ*	*Col. 1 norm Col. 2*[c]
Ca	%	17.0 ± 2.2	11.9 ± 2.5	—
Ce		47.4 ± 3.4	52.1 ± 4.5	53.1 ± 3.8
Co		10.1 ± 1.4	13.6 ± 1.3	11.3 ± 1.6
Cr		94 ± 10	96 ± 12	105 ± 11
Cs		1.08 ± 0.23	1.23 ± 0.28	1.21 ± 0.26
Fe	%	2.77 ± 0.13	2.98 ± 0.29	3.10 ± 0.15
Hf		6.97 ± 1.75	9.13 ± 1.83	7.81 ± 1.96
La		23.4 ± 2.4	25.2 ± 2.6	26.2 ± 2.7
Lu		0.34 ± 0.04	0.38 ± 0.04	0.38 ± 0.05
Na	%	0.42 ± 0.08	0.43 ± 0.08	0.47 ± 0.09
Ni		57 ± 12	63 ± 18	64 ± 13
Sc		9.65 ± 0.54	10.32 ± 1.18	10.81 ± 0.61
Ta		0.88 ± 0.14	0.96 ± 0.11	0.99 ± 0.16
Th		5.91 ± 0.39	6.10 ± 0.52	6.62 ± 0.44
Ti	%	0.49 ± 0.13	0.54 ± 0.12	0.55 ± 0.15
U		2.65 ± 0.18	2.50 ± 0.53	—
Yb		2.45 ± 0.33	2.52 ± 0.14	2.74 ± 0.37

[a]15, 18, 21, 23, 24, 26, 29.
[b]2, 4, 5-7, 10, 12, 38-40
[c]Column 1 normalized to Column 2, increasing Column 1 by 12%.

vessels from Ashdod which is different from the Ashdod group in Table 2.

2. Nos. 17 and 27 were closely similar to each other but good matches could not be found. However, the data suggest a coastal, rather than an inland, site.
3. No. 1 was probably also from the Coastal Plain. Its composition is similar to much of the Ashdod ware but a statistical match could not be found.
4. Nos. 3, 5, and 8 were dissimilar to each other and did not match closely any pottery that has been analyzed.

MIQNE PHILISTINE BICHROME AND OTHER MIQNE IRON AGE I WARE; ASHDOD IRON AGE WARE

Five Philistine bichrome sherds from Miqne were analyzed. Three of these, Nos. 33, 34, and 36, were closely similar in composition, and the data for this small group are shown in Column 1, Table 4. In Column 2, we repeat the Miqne reference group of Column 2, Table 3.

A cursory comparison of these two columns indicates that the compositions are very similar, and statistical analyses show that the match is as good as could be expected. Since a strong case can be made that the reference group was produced at Miqne, it is assumed that the three Philistine samples were also made there. This finding is of more general interest because until now little has been known about where Philistine pottery was manufactured. Only at Ashdod has the production of such pottery been definitely established.

Column 3 of Table 4 shows the data for a single Miqne Philistine krater (No. 35) that is quite different from the three other Miqne Philistine samples. However, No. 35 does match a group of 54 mixed Iron Age vessels from Ashdod (Column 4, Table 4). There is abundant evidence that this chemical group is one of a number of similar groups made at Ashdod.

TABLE 4. Miqne Philistine, Miqne Iron Age I Plain Ware, Ashdod Mixed Iron Age I

		Miqne Philistine Nos. 33, 34, 36 (3 samples)	*Miqne Iron Age I[a] (10 samples)*	*Miqne Philistine No. 35 (1 sample)*	*Ashdod Mixed Iron Age[b] (54 samples)*
Ca	%	13.2 ± 2.4	11.9 ± 2.5	4.8	5.4 ± 1.0
Ce		54.1 ± 3.0	52.1 ± 4.5	68.1	65.8 ± 3.0
Co		13.6 ± 1.0	13.6 ± 1.3	19.1	19.0 ± 1.1
Cr		108 ± 7	96 ± 12	121	118 ± 7
Cs		1.39 ± 0.10	1.23 ± 0.28	1.70	1.73 ± 0.40
Fe	%	3.00 ± 0.25	2.98 ± 0.29	3.98	4.28 ± 0.20
Hf		11.17 ± 1.87	9.13 ± 1.83	12.93	10.80 ± 1.06
La		24.9 ± 1.9	25.2 ± 2.6	30.2	30.7 ± 1.8
Lu		0.39 ± 0.04	0.38 ± 0.04	0.48	0.45 ± 0.03
Na	%	0.47 ± 0.03	0.43 ± 0.08	0.66	0.69 ± 0.06
Ni		55 ± 10	63 ± 18	97	67 ± 33
Sc		10.16 ± 0.72	10.32 ± 1.18	13.14	14.00 ± 0.56
Ta		1.02 ± 0.10	0.96 ± 0.11	1.35	1.33 ± 0.05
Th		7.00 ± 0.54	6.10 ± 0.52	7.99	7.63 ± 0.46
Ti	%	0.55 ± 0.12	0.54 ± 0.12	0.70	0.65 ± 0.05
U		2.30 ± 0.11	2.50 ± 0.53	2.40	2.07 ± 0.18
Yb		2.72 ± 0.59	2.52 ± 0.14	3.26	3.14 ± 0.27

[a]Same group as in Columnm 2, Table 3.
[b]Unpublished results from the Berkeley data bank.

The fifth Philistine sample (No. 37) is difficult to place. Its composition is much more like that of coastal material than that of Miqne, but so far there is no match for it.

IRON AGE II WARE

Iron Age II strata are prominent at Miqne but only three vessels have been analyzed so far: a bowl (No. 44) and two storage jars (Nos. 42, 43). The composition of the bowl matched the Miqne reference group (Column 2, Table 3) and is therefore, considered local.

The compositions of the two jars (Nos. 42, 43) could not be related to any of the other samples in this study, nor to any other reference group from the southern part of Israel. On the other hand, their chemical profile is found in the northern coastal region and at some inland sites.

The two jars are stylistically different, yet they are close enough in composition to suggest that they were made in the same place. The connection of these jars with the north is important enough to present data that illustrate diagnostic distinctions of northern and southern pottery. It should be emphasized, however, that not all pottery from northern sites has the same chemical profile as the two Miqne jar samples.

Before discussing the similarity of these jar samples (Nos. 42, 43) to reference material from northern sites, we shall discuss the contrast with southern pottery. The first column in Table 5 contains the data on the two Miqne jars. Since they were so similar, only the average values for the respective elements are shown. Column 2 repeats the reference group from Miqne for comparison. The calcium values are not appreciably different; therefore, any deviations for the other elements cannot be laid to calcite dilution.

Although the contrast between Columns 1 and 2 is apparent, this only shows that the two jars of Column 1 from Miqne were not made there. What we are concerned with here are the diagnostic elements which set the north and south apart even though there are considerable variations in each region. We now call attention to the following elements:

1. The elements chromium, cerium, iron, lanthanum, and scandium are about 50 percent higher in Column 1 than in Column 2.

TABLE 5. Miqne Storage Jars, Miqne and Ashdod Reference Groups

		Miqne Jars (2 samples)[a]	*Miqne Iron Age (10 samples)*[b] M	±	σ	*Ashdod Iron Age*[c] *(54 samples)* M	±	σ	*Col. 3 norm Col. 2*[d]	±	
Ca	%	13.2	11.9	±	2.5	5.4	±	1.0	—		
Ce		78.6	52.1	±	4.5	65.8	±	3.0	53.0	±	2.4
Co		10.9	13.6	±	1.3	19.0	±	1.1	15.3	±	0.9
Cr		145	96	±	12	118	±	7	95	±	10
Cs		4.20	1.23	±	0.28	1.73	±	0.40	1.41	±	0.32
Fe	%	4.24	2.98	±	0.29	4.28	±	0.20	3.45	±	0.16
Hf		4.03	9.13	±	1.83	10.80	±	1.06	8.69	±	0.80
La		41.1	25.2	±	2.6	30.7	±	1.8	24.7	±	1.4
Lu		0.44	0.38	±	0.04	0.45	±	0.03	0.36	±	0.03
Na	%	0.20	0.43	±	0.08	0.69	±	0.06	0.56	±	0.05
Ni		102	63	±	18	67	±	33	54	±	26
Sc		14.31	10.32	±	1.18	14.00	±	0.56	11.27	±	0.77
Ta		1.06	0.96	±	0.11	1.33	±	0.05	1.07	±	0.04
Th		11.26	6.10	±	0.52	7.63	±	0.40	6.14	±	0.03
Ti	%	0.40	0.54	±	0.12	0.65	±	0.05	0.52	±	0.04
U		4.50	2.50	±	0.53	2.07	±	0.18	1.67	±	0.15
Yb		3.24	2.52	±	0.14	3.14	±	0.27	2.53	±	0.22

[a]Average values for Nos. 42, 43.
[b]Same group as in Column 2, Table 3.
[c]Same group as in Column 4, Table 4.
[d]Column 3 data normalized to Column 1, decreasing Column 3 by 20%.

2. Cesium, thorium and uranium are higher in Column 1 by even larger amounts.
3. Cobalt and titanium are lower in Column 1, and hafnium is much lower.
4. Scandium is higher than cobalt in Column 1 and thorium is higher than hafnium.

These relationships are reversed in Column 2.

To show that the same diagnostic features separate the two Miqne jars from pottery of the southern coastal strip, we shall compare these jars with a representative group of pottery from Ashdod. Column 3 of Table 5 shows the Ashdod reference group. The Ashdod group is not calcareous and this complicates the comparison of this group with the calcareous Miqne jars.

The elements that we measured—other than calcium—are in the clay minerals, and it is the clay fraction whose composition varies from place to place. Therefore, the measured values in the pottery are depressed more and more as the admixed calcite increases. Bearing in mind that the Ashdod potters could have made calcareous pottery—and sometimes did—it is useful to calculate what the Ashdod group would look like if it had been diluted with calcite sufficient to bring the calcium value to that of the Miqne jars of Column 1.

The data in Column 4 are those of Column 3 corrected for the dilution by calcite necessary to bring the total calcium from 5.4 percent to 13.2 percent.

The same diagnostics that separate northern from southern pottery apply to coastal Ashdod (Column 4), as was found for inland Miqne (Column 2). The elements chromium, cerium, iron, lanthanum, scandium, cesium, thorium, and uranium are those found in the southern region. We shall now show that these jars came from the north and, more specifically, from the northern plain.

The compositional pattern dominant in the Miqne pottery is also dominant in the pottery of sites from Akko north along the coast to Sarafand in Lebanon. It is seen as well in some examples from sites south of Akko. However, these examples represent only a small fraction of the pottery from the south, the dominant forms of which are chemically different.

TABLE 6. Miqne Storage Jars, Reference Pottery from Sarafand and Akko

		Miqne Jars Nos. 42 and 42 (2 samples)	*Sarafand (4 samples)*	*Sarafand (7 samples)*	*Akko (22 samples)*
		M	*M* ± *σ*	*M* ± *σ*	*M* ± *σ*
Ca	%	13.2	12.6 ± 0.8	13.2 ± 2.6	15.5 ± 2.2
Ce		78.6	80.7 ± 6.7	62.5 ± 3.4	64.9 ± 6.4
Co		10.9	11.0 ± 0.8	8.3 ± 0.9	9.3 ± 1.1
Cr		145	133 ± 8	108 ± 11	111 ± 13
Cs		4.20	4.20 ± 0.55	3.48 ± 0.19	2.9 ± 0.6
Fe	%	4.24	3.75 ± 0.18	2.97 ± 0.20	3.63 ± 0.23
Hf		4.03	3.87 ± 0.36	3.76 ± 0.49	3.29 ± 0.41
La		41.1	40.1 ± 3.5	31.9 ± 1.6	33.6 ± 3.2
Lu		0.44	0.44 ± 0.04	0.34 ± 0.02	0.36 ± 0.04
Ni		102	84 ± 14	77 ± 11	82 ± 21
Sc		14.31	14.36 ± 0.41	11.14 ± 0.82	11.7 ± 1.0
Ta		1.06	1.03 ± 0.10	0.83 ± 0.06	0.82 ± 0.11
Th		11.26	11.45 ± 0.58	8.80 ± 0.66	9.4 ± 0.9
Ti	%	0.40	0.37 ± 0.03	0.32 ± 0.08	0.33 ± 0.13
U		4.50	4.23 ± 0.79	3.64 ± 0.15	3.2 ± 0.9
Yb		3.24	2.88 ± 0.32	2.35 ± 0.17	2.45 ± 0.29

Table 6 provides sufficient information to assign a northern coastal provenience to the two Miqne jars. Columns 2 and 3 pertain to vessels from Sarafand of which 13 were analyzed and 11 had similar compositions, including six storage jars, three bowls, and two plates. This chemical group was separated into two subgroups of four and seven vessels, shown in Columns 2 and 3.

The same pattern is found in Column 2 as in Column 1; but more important, the two sets of data provide an excellent statistical match. Although the same pattern appears in Column 3, the match there is not as close. The significance of two closely similar groups from Sarafand is not clear from the existing information. When many vessels from a single site are analyzed, several closely similar compositions often appear and a good case can be made that all are local. For the present case, in which only 13 vessels (13 analyzed and 11 similar) have been analyzed, such a deduction is not warranted.

Column 4 of Table 6 adds further complications. This group of 22 mixed Iron Age pottery samples from Akko is closely similar to the Sarafand group in Column 3.

From the currently available information, it seems clear that the two Miqne jars were made in the northern coastal region but a specific site cannot be assigned.

Other Wares

Two pieces of pottery have not yet been mentioned: a rather crude "Mycenaean" figurine (No. 14), and a Myc.IIIB sherd of good workmanship (No. 31).

The composition of the figurine was like much of the pottery from Ashdod; in fact it matched figurines excavated at Ashdod (Hachlili 1971: 125–35).

More than a decade ago, 45 of these cult objects were analyzed at the University of California at Berkeley by Perlman and Asaro, but the results have not been published. The large majority of these matched typical Ashdod wares in composition, and the remainder were like the highly diluted Ashdod composition. In this case, however, calcite was not the diluent, but rather quartz sand, which is always found in Ashdod pottery, sometimes in large quantities. The figurine from Miqne (No. 14) matched the typical compositions of the Ashdod figurines and therefore was probably brought from there.

The composition of the Myc.IIIB sherd (No. 31) is much different from anything that has yet been discussed; in fact it is unlike that of any reference material from sites in Israel. There is also nothing like it in the abundant reference groups from mainland Greece or among the scantier samplings from the Aegean islands, Crete, and the northern Levant.

This Myc.IIIB sherd surely came from Cyprus, even though its composition does not match the vast majority of Cypriot wares. It did match a small group of mixed Myc.IIIB and Myc.IIIC.1 wares found at Kition. We cannot assert that this sherd (No. 31) was made there because pottery of this kind from Kition fell into a number of chemical groups and we cannot tell which of them were local.

The same composition turned up in a Myc.IIIB vessel that was described in an article on the provenience of material from Deir-el-Balah. (Perlman, Asaro, and Dothan 1973: 151). In that article, virtually the same wording appeared regarding the uncertainty of assigning provenience to a specific site.

SUMMARY

Myc.IIIC:1b pottery at Miqne was locally manufactured and the calcareous Myc.IIIC:1b wares from Ashdod may have come from Miqne. The majority of the Philistine bichrome sherds from Miqne were also locally made, although at least one Philistine bichrome sherd may have come from Ashdod and another from the Coastal Plain. The largest group of Iron I wares other than Myc.IIIC:1b and Philistine bichrome wares was locally produced; other groups of Iron I wares could have come from the Coastal Plain, some specifically from Ashdod. Because the testing of Iron II plain wares was limited, the results are inconclusive. However, one of the ceramic forms tested proved to be local, and two were imports from the northern Coastal Plain. Of the other wares tested, the "Mycenaean" figurine is presumed to have come from Ashdod and the single Myc.IIIB sherd from Cyprus, typical of the Mycenaean imports of the Late Bronze period.

NOTES

[1]The Tel Miqne-Ekron excavation project is a joint program of the W. F. Albright Institute of Archaeological Research in Jerusalem, one of the American Schools of Oriental Research, and the Institute of Archaeology of the Hebrew University of Jerusalem. The project is directed by T. Dothan of the Hebrew University and S. Gitin of the Albright Institute. The project is also sponsored by Boston College and Southeastern Baptist Theological Seminary. Supporting institutions are Aurora University, Baltimore Hebrew College, Brown University, and Harvard Semitic Museum, with grants from The Dorot Foundation and The National Geographic Society.

[2]We also call attention to a large study of Eastern Terra Sigillata in which the determination of provenience was instrumental in clearing up much of the confusion that has surrounded the classification and chronology of this large repertory. First of all, it was found that the sources attributed to the various subcategories of Eastern Terra Sigillata were incorrect. Then, by grouping vessels according to provenience, it became possible to define better the stylistic variations belonging to each group; and by choosing sites that have the most reliable stratigraphy for each form, it was possible to revise the chronologies attributed to them. (Gunneweg, Perlman, and Yellin 1983).

[3]Myc.IIIC:1b pottery can be associated with the use of the site's first Iron Age city mudbrick wall in the 12th century B.C. This wall, which probably encompassed the entire 50-acre tel, was built by a new group of settlers on the remains of the violently destroyed Late Bronze Age Canaanite city. Myc.IIIC:1b pottery continued to appear in the architecturally poor Phase 8, 12-to-11th century B.C. occupation levels, where it was found together with Philistine bichrome and other Iron Age I wares. Philistine bichrome ware, the successor to Myc.IIIC:1b pottery in shape and decoration, is distinctive from its predecessor in its coarse ware, white slip, and red and black bichrome decoration—the hallmark of Philistine pottery. The Philistine bichrome ware at Miqne continued into Phase 7 of the 11th century B.C. and, like the Myc.IIIC:1b, was locally made at Miqne.

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