MASTER

Tell el Yahudiyeh Ware: A Re-evaluation*

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INTRODUCTION

In a Festschrift honoring Fred Matson, it is fitting to include an article which mirrors his work in Near Eastern material and reflects his multidisciplinary approach to archaeological problems. This article concerns Tell el Yahudiyeh ware (hereafter TY), an incised pottery, usually in juglet form, which occurs in Cyprus, Egypt, Nubia and the Levant during the period c. 1750-1550 B.C. This is the time of the Second Intermediate Period in Egypt when the centralized government of the Middle Kingdom has broken down, at least part of the land is occupied by foreign rulers (Hyksos) and, it is generally assumed, trade outside of Egypt grinds to a halt. TY was first associated with the Hyksos (and therefore a Levantine manufacturing area) by Sir William Flinders Petrie in 1906, an association which has grown so strong over time that Engberg and Van Seters included TY in their discussion of the Hyksos without hesitation (Engberg 1939, Van Seters 1966).

This association has not gone unquestioned. Cyprus, Egypt and Nubia have also been suggested as manufacturing areas (Dussaud 1928, Macalister 1912, Reisner 1923, Junker 1921). More recent work, however, has not concentrated on the basic question of its origin but on defining its geographic range (Amiran 1957), dividing it into types (Åström 1957, Van Seters 1966, Merrilllees 1974), or using it to date the Middle Cypriote

III-Late Cypriote periods in Cyprus (Åström 1957, Oren 1969, Merrillees 1971). Several of these studies reach contradictory conclusions in part because the authors concentrate on TY ware from a particular region (Cyprus, Egypt or the Levant).

It was decided that a complete study of the ware was warranted and that it required an integrated, multi-disciplinary approach. First, a typology of the ware was constructed based on vessels from all areas, not just from one cultural region. These types were then plotted according to findspot and the geographic distribution of each type inspected for indication of possible manufacturing areas. In a parallel effort, samples of the ware were analyzed by neutron activation to determine the area(s) of manufacture. A chronological analysis of the findspots would indicate which manufacturing area is the earlier if more than one exists. A high correlation between the results of the chemical and typological/geographical analyses would give us increased confidence in the conclusions we draw, while a lack of correlation would indicate a need for more study to identify the causes of the disagreement. It should be noted that the typological and chemical analyses were performed, for the most part, on different vessels; complete (or nearly complete) vessels were required for the typological work while samples for chemical analysis were most available from fragments and partial vessels. Each of these areas of investigation will be discussed below.

TPOLOGY

The typology is based upon form and other attributes such as base type, number of strands forming the handle, decoration and so forth. The information on body form was coded as the three proportions shown on Figure 1 and subjected to a cluster analysis based on average linkage of the mean Euclidean distance between points (Sneath and Sokal 1973). Figure 2 is the resultant dendrogram for the 155 encoded vessels. Five distinct form categories are shown as well as a "mixed" and "squat" cluster.

Each form category was then inspected to see whether it could be further subdivided on the additional basis of discrete attributes. (A discrete attribute is one which takes a distinct series of values; i.e., a handle may be formed from one or more strands of clay. In contrast, there is a theoretically infinite number of values between the minimum and maximum possible proportions of a vessel. These two types of variables cannot be handled in the same cluster analysis.) Because of the high frequency of some attributes (e.g., single handle) a cluster analysis using a coefficient of association was not suitable (Kaplan, 1980). The form categories were therefore subdivided by eye. Tables 1 and 2 show the patterns evident for two attributes: handle type and orientation of the decoration. The remaining attributes show similar patterning. This subdivision resulted in ten major types of TY.

Three "mixed" vessels are illustrated in Figure 3. They are obviously different types, yet all three body proportions are identical for each vessel. This situation illustrates one of the difficulties with a cluster analysis based only on body form without information on other discrete attributes such as decoration, rim, handle, or base types. It also brings to mind G. Cowgill's caveat, "if the data are reasonably reliable and reasonably relevant one may expect reasonable but only reasonably correct results from statistical analysis" (Cowgill 1968). These vessels and the "squat" ones were not considered while the other clusters of body forms were being subdivided: they were later assigned to various types on the basis of the discrete information. The major types of TY are illustrated in Figure 4 and are described below.

The Cylindrical group is noticeably separated from the other form groups in the dendogram (Figure 2), yet can be further subdivided on the basis of other attributes. Cylindrical 1 juglets are small, with rounded bases and gentle angles of transition from the shoulder to the body and from the body to the base. The rim is rolled-over and the handle is always single. The decoration is a wide band covering all of the available body area. Cylindrical 2 juglets are larger with flat or slightly rounded bases. The transition from the shoulder to the body and from the body to the base is sharply defined. The handle is always double and the decoration consists of one or two narrow bands of incision which cover only a fraction of the available body area.

The Globular type is very homogeneous. The rim is primarily rolled-over and the handle is always single. The most common form of decoration is three or four vertical gores of herringbone incision.

Biconical 1 juglets have two wide bands of horizontal decorations (usually chevrons), leaving only a narrow unincised band around the middle of the vessel. The rim is always rolled-over, the handle always single and the base is always in the form of a button. Biconical 2 juglets are distinguished by the number of bands, their thickness and narrower bases and rims.

The Piriform family is marked by slender-bodied juglets with high shoulders. Piriform 1 has two to four horizontal bands of geometric decoration covering most of the available body area. The bodies are often burnished all over, unlike the majority of other types. The rim is usually inverted, the handle is almost always multiply-stranded and the base varies from a ring to an indented button. Piriform 2a bears a decoration which invariably consists of three or four vertical gores of herringbone punctures. The handle is always single and the base may be a ring or button. Piriform 2b is extremely similar to Piriform 2a; its distinguishing features are double handles, thinner rims, and a slight plumpness in the body. The base is a pronounced button, often ending in a point. Piriform 3 juglets are marked by one or two narrow bands of horizontal decoration which cover only a fraction of the available body area. The

handle is usually multiply-stranded, though single handles do occur. The base is usually in the form of a button.

Ovoid juglets form a heterogeneous group. The predominantly light color of the vessels sets them apart from the majority of the dark-bodied vessels. The body is marked by the absence of a distinct shoulder, in contrast to the Piriform group. The handle is usually two or three strands of clay, and the base ranges from pointed to flat to button. The rim is never rolled-over, but varies from straight to slightly everted. A more detailed discussion, including minor groups not included in this paper, may be found in Kaplan 1980.

GEOGRAPHICAL DISTRIBUTION

If the ware is to be associated with the Hyksos, it should be most common in the Levant, with some occurrences in the Nile Valley after their invasion of the latter area. It is also possible that a single type of TY may show a manufacturing area in the Levant and a later one in the Egyptian Delta (i.e., the potters moved after the conquest), but this would be more apparent in the chemical analysis. If two types from the same form category occur in separate geographical areas with minimal overlap, then separate manufacturing areas may be postulated. The validity of these hypotheses can then be tested by neutron activation analysis of the ware to determine the area of manufacture.

The difference in geographic distributions for Cylindrical 1 and Cylindrical 2 is striking (Figure 5). It is not illogical to propose a separate manufacturing area for each type. Piriform 1 (Figure 6) has the widest distribution of any type, ranging from Kerma (Sudan) to Ras Shamra (Syria) and Cyprus. Not evident from Figure 6 is the relative frequency with which it is found in Egypt though it tends to occur as isolated examples in the Levant (except at the site of Byblos which is noted for its close ties with Egypt). This frequency suggests it was manufactured in the Nile Valley. Ovoid juglets appear restricted to the Levant with two interesting vessels which occur in Level F at Tell el Dab'a in the Delta (personal communication, Dr. M. Bietak). Tell el Dab'a is a fascinating site which shows a change in settlement plan and ceramic repertoire after a burning level (Bietak 1968a, 1968b, 1970 and 1975). It may well be a site which shows the arrival of the Hyksos into Egypt by conquest. If it is, then it is all the more important to note that these ovoid juglets are not the earliest pieces of TY found at that site. We will return to this point on the section correlating the typological and chemical analyses.

Piriform 2a has a distribution pattern similar to that of Piriform 1, but it lacks the sites in the Northern Levant. Piriform 2b and 3 have distribution patterns restricted to the Levant (Figure 7). Again, the patterns imply different manufacturing areas, the Nile Valley for Piriform 2a and the Levant for

Piriform 2b and 3. Biconical 1 and Globular have similar geographic distributions, predominantly occurring in the Nile Valley. Biconical 2 occurs only in the Levant (Figure 8).

The geographical analyses, then, suggest that there are two "families" of TY with two manufacturing areas. The widespread nature of the types which are most frequent in the Nile Valley suggest that they were manufactured there. The relative infrequency of the types which are restricted to the Levant and their resemblance to the more common Egyptian types suggest that these are imitations of the Egyptian material. This is in direct contrast to what is generally believed and it is for this reason that the neutron activation analysis plays a necessary and integral part of this study.

NEUTRON ACTIVATION ANALYSIS

Neutron activation analysis has been applied to archaeological problems for nearly a quarter century (Sayre and Dodson 1957). It may therefore be considered a maturing discipline where the procedures for sample preparation and irradiation have become standardized, at least within each laboratory. (This work followed methods described in Abascal-M. et al. 1974). A more important aspect, however, is that these years of research have built up a substantial data base with which to work. Before the TY project began, Brookhaven already had reference chemical groups and statistical methods for distinguishing between the following areas:

- o Egypt (Tobia and Sayre 1974)
- o Cyprus (Bieber 1977; Bieber et al. 1976a and 1976b)
- o Southern Levant (Brooks et al. 1974; Brooks 1975; Bieber et al. 1976b).

i.e., nearly all the areas where TY could have been made. The TY project included supplementing known groups with additional samples in order to form a better statistical description of each group. Fred Matson supplied samples of Nile alluvium for this purpose, while one of the authors gathered samples of local ancient ceramics from Egypt, Sudan and the northern Levant. (Fred Matson has been of great assistance in generating the Brookhaven data bank by supplying numerous clay and ceramic samples from many areas in the Near East.)

It is not the purpose of this paper to explain in detail the methods which were used to establish the chemical groups since they have been published elsewhere (Brooks et al. 1974; Bieber et al. 1976a and 1976b; Harbottle 1976). Statistical analysis of the new local material resulted in the identification of four additional chemical groups: (1) material from the site of Ras Shamra in Syria, (2) material from Aswan in Egypt, (3) material from the area of Nubia between the Second and Third Cataracts of the Nile, and (4) sherds made from a mixture of Nile alluvium and the underlying Pleistocene clay. A further description of the distinguishing chemical characteristics of each of these groups may be found in Kaplan, et al. 1981.

Once the reference chemical groups had been established, the 155 TY samples were compared to them. Methods of identifying the group to which they belonged included: (1) cluster analysis, (2) comparing each sample to each group individually (via the computer program ADCORR) and (3) comparing each sample to a number of groups at the same time. The latter technique, discriminant analysis, is one which can only be used with well-established reference groups; this again illustrates the importance of a data base which makes this type of analysis possible. These techniques are described in the references given above as well as Doran and Hodson 1975.

The neutron activation analysis indicated TY was manufactured both in the Levant and the Nile Valley. (For the purpose of this study, this gross geographical attribution is more important than a finer distinction such as whether a sherd was made from Nile alluvium or Nile alluvium plus Pleistocene clay.) There are more samples of Egyptian material (92) than Levantine (52), but in the absence of any archaeological data, we would not be able to say whether this was due to Egyptian material actually being more abundant in the archaeological record or if samples from it were more readily obtained. More information, however, can be obtained by combining the typological and chemical analyses.

CORRELATION OF TYPOLOGICAL, CHEMICAL, AND CHRONOLOGICAL ANALYSES

In the first two sections of this paper, we established a typology for TY and suggested areas of manufacture for these types according to their geographical distribution. This is what

is meant by the heading "Archaeologically Predicted Areas of Manufacture" on Table 3. This table lists the number of samples analyzed by neutron activation for each type, where the archaeological data suggests the material was manufactured and where the chemical analysis says they were manufactured. Eleven TY samples could not be assigned to a chemical reference group, that is, they did not lie within the 95% confidence bounds of any of the reference groups*. The prediction rate is based upon the number of samples which could be classified. For example, twenty-three Piriform 2a sample could be assigned to manufacturing areas; twenty-two of them (96%) were made in Egypt.

There is a very high correlation between the archaeological and chemical analyses. The typological and geographical analyses suggest that Cylindrical 1 and Globular type vessels were manufactured in the Nile Valley. Every sample taken from a vessel of this type has a chemical composition which matches one of the Nile Valley sources. The archaeological analyses suggest that Cylindrical 2, Piriform 2b and 3, Biconical 2, and Ovoid were manufactured in the Levant. Again, every sample from a vessel of these types matched a Levantine clay source. Of the remaining types, Piriform 1 and 2a and Biconical 1, there

*This is not an unexpectedly large number of samples to remain unclassified; the use of the 95% confidence level implies that five samples of every hundred would not be assigned to a group to which it actually belonged.

are, at most, two samples which do not match the predicted area of manufacture. There are two possible explanations for this. Samples for neutron activation analysis were often taken from sherds; had more of the vessel survived, it might have been classified as a different type. Second, we may have copies which even a trained archaeologist's eye cannot detect. Except for these rare occurrences, the near perfect correlation allows us to postulate, with some confidence, the existence of two "families" of TY, one Egyptian and one Levantine.

It should be noted that there are only Levantine copies of Egyptian types. The reverse is what would be expected if the ware were associated with the Hyksos. The Egyptian material shows a wide geographic spread during a period in which her trade was thought to be in decline. The Levantine types, on the other hand, are restricted to the Levant.

The exception to this is the two ovoid juglets found at Tell ed Dab'a. These were sampled, and they are manufactured from a Levantine clay. Tell el Yahudiyeh ware occurs in an earlier level at that site and a sample of that material shows that it was Egyptian in manufacture. The data from Tell ed Dab'a are extremely important because it is the only site with such stratigraphic evidence. Material from Egypt is often dated to the Second Intermediate Period because of the presence of TY ware. When the remaining material is examined, however, a data for the late 12th or 13th Dynasty is often possible,

i.e., before the arrival of the Hyksos. In addition, several Egyptian types may continue as late as the early 18th Dynasty, i.e., after the expulsion of the Hyksos. The pattern seen in the Levant is that those types appear after the Egyptian material. (For a site-by-site analysis, see Kaplan 1980.)

So it appears that Tell el Yahudiyeh ware cannot be considered a homogeneous type of pottery affiliated with the Hyksos. It can be divided into a "family" of Levantine types and a "family" of Egyptian types. The former are more restricted in geographic distribution and include copies of Egyptian types.

Now that these "families" have been established, can we go back and discern other, more general differences between them? Each vessel and sherd was examined by a hand lens for temper. Both "families" can contain sand, chaff or other materials but only the Egyptian ceramics contain mica, which is more visible on the surface rather than in cross-section. None of the Levantine samples contain mica. There are also differences in the manufacture of these vessels. Piriform juglets manufactured in the Levant often have a heavy base but very thin walls near the point of maximum diameter. This thinness leads to an unexpected lightness when contrasted with an Egyptian vessel of the same size, and many vessels break at this point. The manufacturing areas also show differences in the ability of the potters to control the atmosphere in the kiln. The ware is usually dark but the cores are often reddish, which suggests that the dark exterior

was formed by changing the kiln atmosphere to a reducing one after a period of oxidation. This kiln technique is not common to the Levant in this period, during which most of the pottery is red (Amiran 1970). Only half of the Levantine vessels can be described as grey or black whereas 77% of the Egyptian vessels are those colors. It may be suggested that the Egyptians had better control of their kilns.

CONCLUSIONS

Archaeology, however, is ultimately more interested in the potters than the pots. The TY project has some interesting implications for understanding the cultural interactions of this period. The Second Intermediate Period is one during which centralized government in Egypt collapses and, it is generally assumed, so does her trade network. Foreigners -- the Hyksos -- are able to enter the country and rule at least part of it. The results of this study, however, indicate the TY is primarily an Egyptian pottery which appeared before the Hyksos entered and may have continued in use after they left. It cannot, therefore, be tightly associated with the Hyksos nor can it be used to judge the extent of their influence. Its wide distribution shows that Egypt continued to trade goods outside her boundaries throughout this period. Finally, not only goods travelled between what were generally considered to have been hostile neighbors, but the trade appears to have included ideas and technology as well.

TABLE 1 Type by Handle Crosstabulation

Type	Number of Strands in Handle		
	One	Two	Three
Cylindrical 1	11	-	-
Cylindrical 2	-	4	-
Piriform 1	-	13	1
Piriform 2a	20	-	-
Piriform 2b	-	5	-
Piriform 3	5	10	-
Ovoid	2	11	6
Biconical 1	43	1	1
Biconical 2	2	1	1
Globular	22	-	-

TABLE 2 Type by Decoration Crosstabulation

Type	Decoration	
	Horizontal	Vertical
Cylindrical 1	9	2
Cylindrical 2	3	1
Piriform 1	12	2
Piriform 2a	2	18
Piriform 2b	-	5
Piriform 3	14	1
Ovoid	17	2
Biconical 1	45	-
Biconical 2	4	-
Globular	-	22

TABLE 3 Correlation of Archaeological and Chemical Analyses
of Tell el Yahudiyeh Ware

Type	Number of Samples	Archaeologically Predicted Areas of Manufacture*		Actual Areas of Manufacture**			Prediction Rate***
		Egypt	Levant	Egypt	Levant	Un.	
Cylindrical 1	10	x		10			100%
Cylindrical 2	2		x		2		100%
Globular	11	x		11			100%
Piriform 1	24	x		17	2	5	89%
Piriform 2a	24	x		22	1	1	96%
Piriform 2b	6		x		6		100%
Piriform 3	30		x		28	2	100%
Biconical 1	35	x		32	2	1	94%
Biconical 2	2		x		2		100%
Ovoid	11		x		9	2	100%

* Areas of manufacture suggested by the typological and geographical analyses.

** Areas of manufacture determined by neutron activation analysis.
"Un" = unknown.

*** Prediction rate based on the number of samples which could be classified as to place of manufacture in the chemical analysis.

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FIGURE CAPTIONS

- Figure 1. Measurements used to characterize the body proportions of Tell el Yahudiyeh ware.
- Figure 2. Dendogram of cluster analysis of Tell el Yahudiyeh ware by body proportions.
- Figure 3. Three different types of Tell el Yahudiyeh ware with equal proportions.
- Figure 4. The major types of Tell el Yahudiyeh ware.
- Figure 5. Geographic distributions of find sites of the Cylindrical 1 and 2 specimens.
- Figure 6. Geographic distribution of find sites of the Piriform 1 and Ovoid specimens.
- Figure 7. Geographic distribution of find sites of the Piriform 2a, 2b and 3 specimens.
- Figure 8. Geographic distributions of the find sites of the Biconical 1 and 2 and the Globular specimens.

PROPORTIONS UTILIZED

B/A: NECK HEIGHT TO
OVERALL HEIGHT

E/A: MAXIMUM DIAMETER
TO OVERALL HEIGHT

D/C: POINT ON BODY WHERE
MAXIMUM DIAMETER IS
REACHED TO BODY
HEIGHT

Q-125-17

MIXED

OVOID

BICONICAL

PIRIFORM

GLOBULAR

SQUAT

CYLINDRICAL

2-231-77

3-232-77

CYLINDRICAL
1

CYLINDRICAL
2

GLOBULAR

BICONICAL
1

BICONICAL
2

PIRIFORM
1

PIRIFORM
2a

PIRIFORM
2b

PIRIFORM
3

OVOID

57-1466-73

10. 528-78

16-530-78

10-571-78

10-527-78