

The origin of Aegean-like pottery from western Negev and northern Sinai by Neutron Activation Analysis

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ABSTRACT Aegean and Aegean-like sherds excavated in Palestine have been analysed by neutron activation analysis. The analysis indicated, that the classes defined as 1) import from the Argolid and 2) the Levanto/Cypro-Mycenaean styles are made from a clay paste known to have been used at a Mycenaean

workshop in Berbati/Mycenae. However, for the vessels typologically classified as Simple Style many different patterns are measured. It must be assumed, that the vessels of this category were manufactured at various workshops. Only two patterns of Simple Style are known to point to a Cypriot production.

1. Introduction

Excavations at a number of well dated sites in the western Negev and the northern Sinai (Tel Haror, Tel Ridan, Tel Sera', Tel el Ajjul, Tel Fara) brought to light a large number of Aegean or Aegean-like pottery, dated to the 13th-12th century BC. Such ceramics are widespread in the eastern Mediterranean. For example, some 2300 imported Aegean and Aegean-like vessels from 87 sites in Syria/Palestine were classified by Leonard (1994). Nevertheless, the mechanism of the Aegean trade in the Mediterranean basin is under debate and systematic scientific research to determine the provenance of these ceramics is wanted.

It is generally agreed, that intensive trade relations between Greece and the markets of Cyprus, the eastern Mediterranean and Egypt began in the LHIIIA period (early 14th century BC), continuing uninterruptedly until the destruction of the Mycenaean palaces at the end of LHIIIB, ca. 1200 BC. During this period, Mycenaean ceramics of Argive manufacture, including open shapes such as pictorial kraters, kylixes and rhyta, as well as closed vessels like stirrup jars and lentoid flasks were exported on a large scale to Syria and Palestine either as service dishes or as transport containers for commercial products. Neutron Activation Analyses (NAA) indicated that the main Argive pottery workshop was situated at Berbati near Mycenae (MommSEN et al., 1992; Gunneweg et al., 1992; MommSEN and Maran, 2001). The organisation, quality and quantity of this trade declined at about 1200 BC. In the following LHIIIC period a variety of mediocre products from different workshops occur in Cyprus and Palestine.

Alongside these high quality Mycenaean imports from the Peloponnese, a number of related, though different styles have been identified (Furumark, 1941; Leonard, 1994, p. 6). One such group is the so-called Levanto-Mycenaean or Levanto-Helladic style, which is also referred to as Cypro-Mycenaean or Cypro-Helladic style. It has been observed that certain forms of the Levanto-Helladic category are often less common in mainland Greece. Since

their place of production is still enigmatic, labels such as Levanto- or Cypro-Mycenaean style should by no means imply (or exclude) a place of manufacture in the Levant or Cyprus (Leonard, 1994, p. 7). A second typological group was labelled by Furumark as Simple Style to designate ‘a peculiar kind of quasi-Mycenaean ware found in Egypt, Palestine and Syria that was distinctly different from the local copies of Aegean forms’ (Leonard, 1994, p. 7). Vessels of this category are manufactured in a coarser clay and generally have only linear decoration. Most common shapes of this group were piriform jars, stirrup jars, and lentoid flasks.

Koehl and Yellin (1982) cited a chemical analysis of a Simple Style stirrup jar from Tell es-Sa’idiyah and concluded that the composition matches pottery made in Cyprus and therefore, the Simple Style is possibly a product of the island. Another archaeometric study in Manchester did not produce scientifically viable conclusions (Leonard, 1994, p. 7). Recently, some Simple Style sherds from Qantir in the eastern Delta of Egypt have been analysed in Bonn resulting with several different elemental patterns (Mountjoy and Mommsen, 2001). Two of the patterns (CYP-H, CYP-I) have a general composition which points to a Cypriot origin. At the same time certain unknown chemical patterns were recorded (QAN-K, QAN-L) which are not yet assignable with certainty. At present state of research, other production centres, besides Cyprus, of Simple Style pottery, are presumably located in Palestine and/or Egypt.

2. Sample choice and methodology

Neutron Activation Analysis (NAA) has been applied in the present research project to determine the concentrations of mainly the minor and trace elements in 33 Aegean-like sherds from Palestine. Table 1 presents the list of samples, their respective sites and archaeological classifications, whereas site location is indicated in Fig. 1. About 30 concentration values can be measured by NAA in Bonn, of which many with such a high precision, that different clay pastes prepared by the ancient potters could be readily discerned. The Bonn pottery standard was calibrated against the well-known Berkeley standard (Perlman and Asaro, 1969). The data were statistically evaluated with a ‘filter’ procedure developed in Bonn (Beier and Mommsen, 1994). This procedure enables us to sort out chemically similar samples from a large data bank by calculating modified (dilution corrected) Mahalanobis distances in the multidimensional concentration space.

Our Greek databank contains now more than 5300 samples from many regions of Mycenaean Greece, Cyprus and Palestine. As a result, assignments of single samples to already known groups should be feasible.

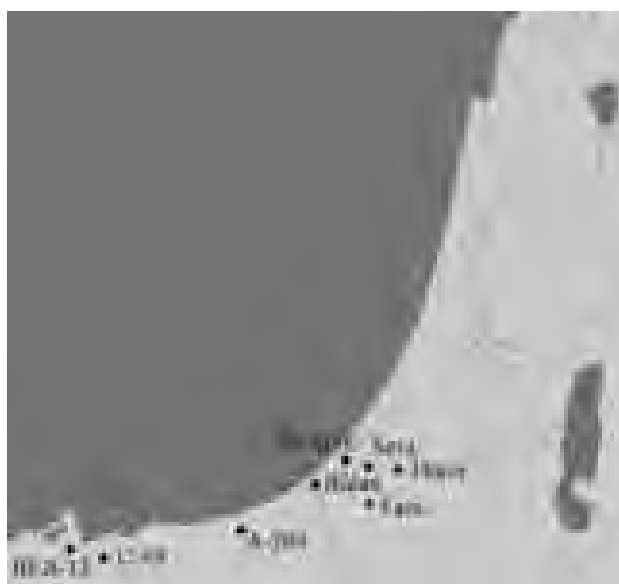


FIG. 1 – Map of western Negev and northern Sinai with finding sites of the samples.

TABLE 1

List of samples analysed by NAA and NAA group (see text, group- = only associated to group, MB?= only general Greek composition, sin = chemical single).

label	Inv.No	site	description [FS:Furumark shape]	NAA group
ARGIVE IMPORTS (LHIIIA/B)				
5	19673	Tel Haror	stirrup jar[FS183]	MB
6	3452	Tel Ridan	stirrup jar[FS179]	MB
7	9351/1	North Sinai	alabastron[FS94]	MB
8	13275	Tel Sera	pictorial krater[FS53-55]	MB?
11	1060/2	Tel Sera	kylix[FS258]	MB
12	16454	Tel Ridan	amphora[FS36]	MB
14	9790/2	Tel Sera	kylix[FS258]	MB
20	7175	North Sinai	flask[FS186]	MB
21	3451	Tel Sera	zoomorphic rhyton	MB
CYPRO/LEVANTO-MYCENAEAN STYLE				
3	19685	Tel Haror	bowl[FS310]	MB
4	20730	Tel Haror	stirrup jar[FS171]	MB
9	20723	Tel Haror	bowl[FS310]	MB
10	18122	Tel Haror	bowl[FS310]	MB
22	E.X360/1	Tel el-Ajjul	stirrup jar[FS166]	MB
27	E.VI 24/11	Tel Fara T.902	jug[FS139]	MB
SIMPLE STYLE				
1	20851	Tel Haror	flask[FS186]	sin
2	92425	North Sinai	stirrup jar[FS171-3]	CYP-H
13	9466	North Sinai	stirrup jar[FS171-3]	QAN-L
15	1	North Sinai(A-289)	stirrup jar[FS171-3]	CYP-H
16	249(L/B)	North Sinai	flask[FS186]	CYP-H
17	163/395(L/B)	North Sinai	stirrup jar[FS171-3]	CYP-H
18	130/243(L/B)	North Sinai	stirrup jar[FS171-3]	CYP-H
19	289(L/B)	North Sinai	stirrup jar[FS171-3]	CYP-I
23	NN	Tel Ridan,T.6	stirrup jar[FS179]	MB?
24	E.VI 24/8	Tel Fara T.902	piriform jar[FS36]	CYP-H
25	E.VI 24/10	Tel Fara T.902	stirrup jar[FS171-3]	sin
26	E.VI 24/41	Tel Fara T.902	stirrup jar[FS171-3]	CYP-H
28	E.VI 18/1	Tel Fara T.933	flask[FS186]	QAN-L-
30	NN	Tel Fara T.914	juglet[FS?]	sin
31	E.VI 19/1	Tel Fara T.925B	flask[FS186]	sin
32	E.VI 30/20	Tel Fara T.552A	flask[FS186]	sin
33	E.VI 35/1	Tel Fara T.518	flask[FS186]	sin
LOCAL PALESTINIAN				
29	E.VI 20/13	Tel Fara T.934	stirrup jar[FS171-3]	sin

TABLE 2

Comparison of reference group MYBE with group MYBE (new).

	MYBE (refer.) 208 samples M +/- σ (%)		MYBE (new) 14 samples M +/- σ (%)	
Ca %	9,47	23,	10,9	25,
Ce	62,3	2,5	65,1	2,7
Co	28,1	5,9	27,7	4,4
Cr	219,	9,7	225,	4,9
Cs	8,57	9,1	8,26	9,7
Eu	1,13	4,3	1,15	3,4
Fe %	5,14	3,6	5,22	5,0
Hf	3,62	9,4	4,05	9,9
K %	2,60	9,0	2,71	11,
La	31,1	2,7	31,8	2,9
Lu	0,42	5,1	0,45	4,5
Na %	0,53	29,	0,78	32,
Nd	26,2	6,0	23,1	7,6
Ni	216,	13,	210,	17,
Rb	149,	6,3	148,	7,3
Sb	0,56	15,	0,48	16,
Sc	21,2	3,4	21,2	5,2
Sm	4,79	4,6	4,39	4,2
Ta	0,80	6,6	0,81	4,3
Tb	0,66	7,2	0,71	9,9
Th	10,9	2,8	11,3	1,9
Ti %	0,44	20,	0,47	18,
U	2,26	6,1	2,35	6,0
W	2,15	14,	2,41	8,1
Yb	2,73	3,0	2,85	2,3
Zn	110,	8,7	113,	5,9
Zr	154,	23,	122,	25,

Given are 27 element concentrations: averages M in $\mu\text{g/g}$ (ppm), if not indicated otherwise, and spreads σ (root mean square deviations) in percent of M, MYBE (new) corrected by a best relative fit factor to group MYBE of 1.06.

3. NAA results

Comparing the concentration patterns of the 33 Palestinian samples with the patterns of our data bank of Greek (and related) pottery groups we found 25 samples with patterns already encountered before. 14 samples have the well known pattern named MYBE that belongs to a workshop at Berbati. This assignment is ascertained by wasters from the site (Mommsen and Maran, 2001). As can be seen in Table 1, all sherds archaeologically classified as imports as well as the sherds belonging to the Levanto/Cypro-Mycenaean styles are members of this group. Only one sample (No. 8) does not match this pattern in all elements, but has a composition which points to Greece as production region. In Table 2 the average

concentration values of the Argive reference group MYBE (208 samples from the Argolid) are compared to the values of the 14 new samples belonging to this group. Both data sets agree very well. In both groups many spread values are below 5%, the largest difference (in units of the average spread values) is found for the element Sm. There is no doubt, that the new samples are made with a very similar clay paste as the argive wares. Unless the clay itself had been transported from Greece to some eastern Mediterranean workshops, all these vessels were most likely manufactured in mainland Greece, more specifically in the Argolid, and were eventually exported to Palestine. The dominance of the Berbati workshop as major production centre is clearly manifested in the new samples because the second Argive workshop with pattern TIR (assigned to the region of Tiryns) is not represented at all in this sample set, although some pieces from Tiryns were exported to the coastal port of Tel Abu Hawam (Mommsen and Maran, 2001).

The 17 samples of Simple Style are not represented by one, but by several different composition patterns. These wares are made of a number of different clay pastes as also indicated by the high number of chemical singles (6 samples) which might represent a variety of pastes used in some workshops. Two of the pastes (CYP-H: 7 samples; CYP-I: 1 sample) are again already known from the Qantir pottery (Mountjoy and Mommsen, 2001, concentration values given) and can be assigned to a Cypriot origin. This assignment is supported by the published NAA data of Cypriot vessels studied in Berkeley (Mommsen et al., 1996). The archaeological assumption, that Cyprus was engaged in producing Mycenaean imitations of Simple Style is therefore ascertained.

Another pattern, QAN-L of unknown origin (Mountjoy and Mommsen, 2001, concentration values given), increased its number of members by 2 samples (although these 2 samples are only associated to this group, they do not match in 2 or 3 elemental values). Pattern QAN-L, like the above-mentioned loners, is very different from all of our Greek and other compositions. This might point to a Palestinian or Egyptian origin. More reference material from these regions may therefore help in assigning its patterns in future studies.

The chemical groups MYBE from the Argolid, CYP-H and CYP-I from Cyprus and the unknown group QAN-L are depicted in Fig. 2 as resulting from a discriminant analysis and demonstrating the good chemical separability of these groups. Sample No 23 is the only Simple Style vessel that shows a general Greek composition. As mainland Greece production of Simple style pottery is most unlikely, it is possible, that this sample might have been wrongly classified in the process of selection and a repeated measurement is scheduled. Sample No 29 which is classified as a local Palestinian product is a chemical single and does not match any of the other groups or singles.

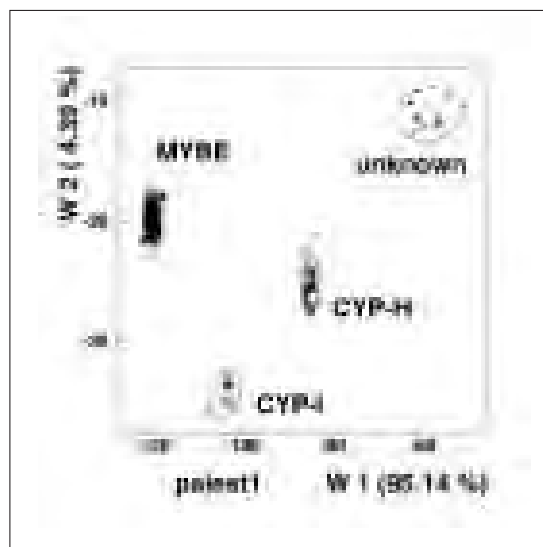


FIG. 2 – Discriminant analysis of 24 samples (without No 8, 23 and chemical singles) of Aegean-like sherds from sites in Palestine (shown in bold) assuming 4 groups. Associated samples are included. The unknown group is QAN-L. Plotted are the discriminant functions W1 and W2 which cover 95 and 4 of the between group variance. The ellipses drawn are the 2 σ boundaries of the groups.

4. Conclusions

High precision concentration measurements using NAA enable us to differentiate between different clay pastes used by pottery workshops in different regions. The archaeological assumptions concerning the production places of Aegean and Levanto/Cypro-Mycenaean wares could be ascertained. Some of the Simple Style wares could be assigned to a Cypriot origin, but were probably made also elsewhere in Palestine or Egypt. With this study the open questions of provenance of Aegean and Aegean-like pottery found at sites in northern Sinai and western Negev are resolved to a large extent.

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NOTES

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