THE PROVENANCE OF AEGEAN- AND SYRIAN-TYPE POTTERY FOUND AT TELL KAZEL (SYRIA)

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with an appendix by Michael Kerschner[v]

Since the beginning of the 20th century Aegean pottery – mostly of Mycenaean type – has been the focus of studies referring to western contacts of the Levantine kingdoms and principalities of the Late Bronze and beginning Early Iron Age.[1] Several monographs and extensive articles have dealt with the topic in broad regional overviews.[2] Despite this considerable interest and a large number of site reports publishing Aegean pottery, there has been, so far, no equally intense scientific research for establishing the exact provenance of the imported Hellado-Mycenaean and the so-called Levanto-Mycenaean pottery[3] and for identifying the production centers of the different local Levantine variations and derivations of Aegean-style pottery in the Eastern Mediterranean coastal area.

For the Mycenaean pottery exports to the Levant in general one can refer to some studies centered on a few sites. Those studies employing the highly exact method of Neutron Activation Analysis (NAA) have provided us with a very clear cut picture based on comparisons with previously identified Mycenaean workshops in Greece:[4]

1) The Mycenaean type pottery adhering to the common Hellado-Mycenaean LH IIIA and IIIB styles, also including pictorial pottery, is generally of Argive origin – with a clear predominance of a specific chemical pattern, which can be ascribed to Mycenae/Berbati. A far smaller number comes from the workshops of Tiryns/Asine and still fewer pieces are Cretan products from Khaniá. Other regions in Greece producing Mycenaean pottery (chemical patterns of Boeotia, Attica, Achaia) are not represented yet. This holds true for all the major assemblages of imported Mycenaean-type pottery in the Eastern Mediterranean, whether they are found in Egypt (at Tell el-Amarna and Qantir[5]) or in the southern Levant (at Akko, Tell Abu-Hawam and Tell Dan[6]). These results seem to hint at a certain monopoly of that specific Argive workshop or group of workshops.[7]

2) A specific class of small container vessels decorated with simple bands classified as the so-called Simple Style[8] does not seem to represent products from Greece, but at present cannot be assigned to a single production region; Cyprus and Egypt are possible candidates.[9]

3) The so-called Philistine pottery (monochrome and bichrome) of 12th century Palestine (an Aegeanizing pottery class) was locally produced (e.g. at Ashdod and Ekron[10]).

However, our picture is limited. To date, chemical and petrographic analyses of Aegean-style pottery have been conducted mainly on finds from the Palestinian part of the East Mediterranean coast,[11] yet not from Lebanese and Syrian coastal sites (very few exceptions remain largely unpublished[12]). In the light of this unequal state

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[1] For a short overview see VAN WIJNGAARDEN 2002: 31–35.

[2] STUBBINGS 1951; HANKEY 1967; LEONARD 1994; VAN WIJNGAARDEN 2002.

[3] For its definition see FURUMARK 1941: 9f. and passim; cf. LEONARD 1994: 6f.

[4] The reference groups for the localisation of the workshops are mainly kiln wasters.

[5] MOMMSEN *et al.* 1992; LEONARD *et al.* 1993; MOMMSEN *et al.* 1996; MOUNTJOY and MOMMSEN 2001.

[6] ASARO and PERLMAN 1973; GUNNEWEG *et al.* 1986; YELLIN and MAEIR 1992; HOFFMANN and ROBINSON 1993; LEONARD *et al.* 1993; H. MOMMSEN and J. MARAN 2000/01; FRENCH 2004 (at Lachish one piece is assigned to Thebes, which would be an exception to the rule outlined above); FRENCH and TOMLINSON 2004 (with extensive bibliography).

[7] Cf. PODZUWEIT 1994: 468f.

[8] Cf. LEONARD 1994: 7f.

[9] MOUNTJOY and MOMMSEN 2001: 125, 138.

[10] ASARO and PERLMAN 1973: 223f.; GUNNEWEG *et al.* 1986.

[11] See n. 6.

[12] For the situation at Ugarit cf. MONCHAMBERT 2004: 133.

of research, large scale provenance analyses of imported and presumably locally produced Mycenaean pottery as well as of Grey Ware and Handmade Burnished Ware (HMB) from the Syrian coast would fill a serious gap in our knowledge. Tell Kazel in the Akkar Plain of southern coastal Syria is a promising site for such a broader analysis project. The huge quantities of Aegean and Aegeanising pottery (many hundreds of sherds and pots) from the time span of LB II to IA I can be divided into different categories: 1. imported Mycenaean pottery; 2. presumably locally produced Mycenaean pottery adhering closely to the Hellado-Mycenaean style; 3. typologically mixed products showing a combination of Mycenaean and Syrian characteristics; 4. Grey Wares; 5. Handmade Burnished Ware. Descriptions of the site's topography, stratigraphy and finds have been published in a number of reports[13] and need not be repeated here. In our project 45 petrographic samples and 109 NAA samples were analysed.[14] Hans Mommsen carried out the chemical analysis, Marie-Claude Boileau did the petrographic analysis, Leila Badre and Reinhard Jung were responsible for the sampling and the archaeological classification of the pottery. We briefly summarise our results and conclude with a joint discussion.

1. Tell Kazel, chemical analysis by NAA and results

Chemical analysis of pottery is an old and today well understood method to determine provenance, since the elemental composition of pottery is characteristic for the producing workshop.[15] The element concentrations depend mainly on the geochemical composition of the clays which have been locally exploited, since a trade of clay over long distances is not very probable in ancient times. In addition, the element concentrations also depend on the refinement procedures which the potters used to homogenize their clay pastes. The levigation of the clay in order to reduce the coarse fraction, the addition of tempering material or even the mixing of several raw clays[16] will influence this element composition. Since changes in composition due to firing or also due to burial conditions are rarely encountered,[17] the measured composition of pottery reflects the composition of the paste only.[18] Therefore not only the workshop, but also each 'production series' of a workshop defined here as consisting of all wares made of the same paste produced by the same 'recipe' can be recognized by chemical analysis.

In Bonn, Neutron Activation Analysis (NAA) has been routinely applied for many years.[19] Thirty concentrations of minor and trace elements, if above the detection limit, can be measured with high precision in samples of about 80 mg. The neutron irradiations are performed at the research reactor of the GKSS at Geesthacht. As a standard an in-house pottery powder is used which has been calibrated with the well known Berkeley pottery standard.[20] The data evaluation searching for samples of similar composition is done with a statistical packet developed in Bonn,[21] which has the advantage, compared to the usual multivariate cluster analysis methods, that experimental measuring errors of individual concentration values are considered. Furthermore, the hypothesis that a sample belongs to an already formed group of samples can be checked directly according to statistical criteria. In addi-

13 Badre *et al.* 1990; Badre *et al.* 1994; Badre and Gubel 1999–2000; Badre 2003; Capet 2003; Jung, in press a; Jung, in press b.

14 We would like to thank the Directorate General of Antiquities and Museums in Syria for permission to take the samples and their support for our project. We gratefully acknowledge the financing of our project by the Institute for Aegean Prehistory (INSTAP), which enabled us to carry out the work published in this report. The authors wish to thank the staff of the research reactor at the GKSS, Geesthacht, for the competent performance of the neutron irradiations. R. Jung furthermore wishes to thank the German Archaeological Institute and the Mykenische Kommission of the Austrian Academy of Sciences, which through their financial support made it possible for him to take part in the Tell Kazel excavation campaigns in 2003 and 2004 respectively. Our special thanks to Emily Schalk for reviewing the English text.

15 Perlman and Asaro 1969.

16 Schwedt and Mommsen 2004.

17 Schwedt *et al.* 2004.

18 Mommsen 2004.

19 Mommsen *et al.* 1991.

20 Perlman and Asaro 1969.

21 Beier and Mommsen 1994.

tion, a possible dilution of a sample, e. g. by a varying amount of sand or calcite, can be corrected during the group forming procedure calculating a best relative fit factor, called 'dilution factor'. Finally, to check whether or not the groups are formed correctly, the spreads σ (root mean square deviations) of the average concentration values have to be inspected. If these variances are much larger than the experimental uncertainties, a wrong chemical classification is probable, since generally it can be assumed, that potters homogenized their pastes very well and elemental concentrations should not vary greatly. Samples, which agree in composition except for one or two elemental values are considered as associated with the groups.

The 109 samples from the excavations of Tell Kazel selected for NAA represent the main fabrics of the different archaeological groups: probably locally produced, painted (19) and unpainted (9) fabrics of nearly exclusively Mycenaean-type vessels; probably imported fabrics (51, mainly from the Aegean); Syrian Bichrome painted fabrics (1); fabrics of Syrian-type pottery (13, mainly unpainted); Grey wares (5) and Handmade Burnished Wares (11). The data analysis, done with the concentration values only, without the knowledge of the archaeological classification, resulted in three large groups of 40 (+ 2 associated), 16, and 6 (+1) samples, in two small groups of 4 and 3 samples, respectively, and in 6 sample pairs, 25 samples are chemical loners in this set. The formation of pairs has to be considered with care, since only two concentration sets may not define the composition of a clay paste adequately.

Comparison with our large data bank of more than 5500 samples revealed, that the largest group corresponds in composition to our well known group called MYBE (Mycenae/Berbati) assigned to an Argive production. A second group of 3 samples (TKaH) is similar to a group assigned to local Trojan production (TRO-B) and made there.[22] All other elemental pattern are new and not represented in our data collection. These groups are named here TKaA, TKaB, etc. until TKaK (TKaE does not exist). However, some samples which are chemical loners in the Tell Kazel data set can be assigned to already known groups of definite provenance (TK 14: MILD, from Miletus,[23] and TK 69: EPHX, from Ephesos [unpublished, but see appendix by M. Kerschner]). Seven more single samples belong to or are associated with existing groups which are still not assigned by reference material to a production place and are of unknown origin (but see discussion).

The data of the average concentration values of the groups and pairs formed together with their spread values are given in Tab. 1. The composition patterns are all very well separable, as a comparison of the values reveals. This result can be demonstrated, too, by a discriminant analysis depicted in Fig. 1.[24]

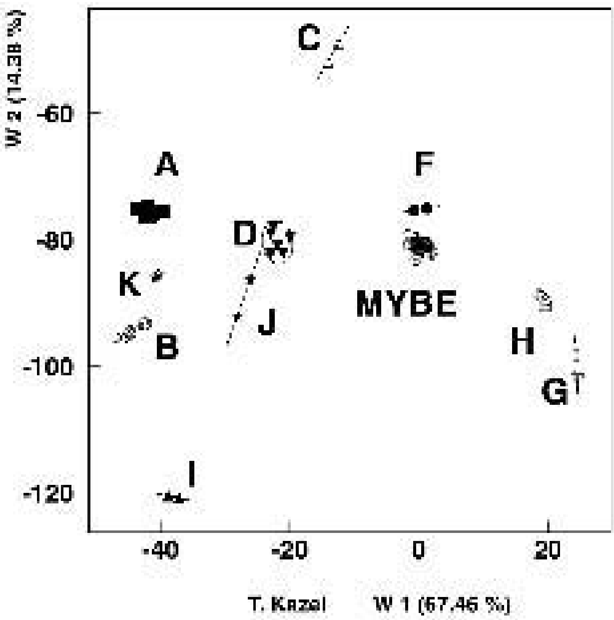

Fig. 1 Result of a discriminant analysis using 27 elements (all given in Tab. 1 except As, Ba and Na) of the 81 grouped samples assuming 11 groups. Plotted are the discriminant functions W1 and W2 describing 67.3 % and 13.7 %, respectively, of the between group variance. The ellipses are the 2σ boundaries of the groups. All concentration patterns are well separated

[22] Mommsen *et al.* 2001.

[23] Akurgal *et al.* 2002.

[24] The detailed analytical results of all samples can be found on the website of the Bonn archaeometry group: http://www.iskp.uni-bonn.de/gruppen/mommsen/top.html.

Concentrations of elements: Averages M in μg/g (ppm), if not indicated otherwise, and spreads σ in percent of M, corrected for dilution with respect to M

	MYBE		TKaF		TKaD		TKaG		TKaA		TKaB		TKaI		TKaJ		TKaK		TKaH (TRO-B)		TKaC	
	40 samples		2 samples		6 samples		2 samples		16 samples		4 samples		2 samples		2 samples		2 samples		3 samples		2 samples	
	M ±	(%)	M ±	(%)	M ±	(%)	M ±	(%)	M ±	(%)	M ±	(%)	M ±	(%)	M ±	(%)	M ±	(%)	M ±	(%)	M ±	(%)
As	7.61	57.	10.6	52.	14.7	13.	13.4	25.	8.98	40.	13.0	12.	16.9	19.	16.8	17.	14.1	15.	19.0	26.	17.6	25.
Ba	418.	18.	407.	8.9	461.	13.	451.	8.3	548.	23.	616.	8.4	453.	48.	396.	9.0	538.	7.6	568.	6.6	513.	25.
Ca %	9.84	15.	10.4	25.	11.2	9.6	9.53	9.0	10.7	13.	5.40	17.	1.57	11.	3.23	66.	4.07	31.	3.99	37.	21.1	11.
Ce	59.9	3.7	56.0	6.7	74.6	12.	52.3	0.8	63.9	7.3	90.1	2.7	133.	7.9	95.0	5.4	79.2	3.1	64.4	1.9	36.6	5.4
Co	27.2	6.2	20.7	8.4	24.9	6.9	39.7	4.0	45.4	2.1	47.2	5.8	50.5	0.4	34.7	6.6	39.1	13.	20.5	1.4	11.9	20.
Cr	210.	6.7	196.	2.4	236.	6.6	609.	1.3	259.	2.6	294.	6.7	303.	11.	218.	9.7	284.	9.3	159.	8.9	93.8	14.
Cs	7.96	6.4	5.59	6.3	3.64	12.	5.30	5.2	1.54	9.8	2.37	15.	2.61	14.	2.70	21.	1.83	9.1	7.99	14.	1.04	17.
Eu	1.11	3.8	1.11	4.1	1.58	6.8	1.02	2.3	1.87	2.2	2.05	3.3	1.88	6.7	1.19	2.0	1.96	1.5	1.12	9.0	0.96	11.
Fe %	4.90	4.0	3.57	1.1	5.63	8.6	5.02	0.9	7.76	2.1	8.76	4.1	7.74	0.5	5.38	2.5	8.09	5.3	4.22	1.9	2.96	13.
Ga	23.4	11.	18.7	27.	19.4	13.	15.7	7.0	20.6	15.	22.0	6.0	22.2	5.2	17.4	10.	20.1	16.	18.3	7.7	9.81	16.
Hf	3.63	7.3	3.87	6.7	5.97	2.5	3.99	1.6	5.73	2.9	7.47	1.7	12.6	1.5	11.0	16.	6.45	1.2	4.74	10.	2.77	2.2
K %	2.64	7.2	2.13	5.8	1.53	20.	1.75	11.	1.02	11.	1.24	26.	1.29	27.	1.33	5.3	1.68	1.2	3.10	10.	1.32	5.8
La	30.1	1.9	26.9	4.7	33.5	7.7	26.0	0.3	29.5	2.1	36.8	3.5	47.2	3.0	31.4	3.1	35.4	3.6	31.5	2.1	19.6	5.0
Lu	0.40	3.9	0.34	4.1	0.44	5.4	0.35	4.9	0.40	4.8	0.51	3.6	0.59	4.3	0.46	13.	0.47	5.0	0.36	8.8	0.23	4.6
Na %	0.55	23.	0.62	19.	0.60	26.	0.78	2.3	1.13	15.	0.52	9.1	0.32	64.	0.15	4.5	0.49	15.	0.81	13.	0.20	30.
Nd	26.0	11.	32.0	8.8	30.4	10.	20.3	14.	27.7	12.	32.5	7.9	37.8	6.8	27.7	12.	34.5	9.6	26.1	23.	25.4	9.5
Ni	213.	17.	193.	16.	166.	21.	448.	8.9	172.	27.	169.	27.	110.	49.	112.	57.	156.	32.	127.	31.	109.	63.
Rb	150.	6.3	113.	6.4	78.3	9.8	85.9	2.7	45.3	11.	57.9	7.6	70.9	3.8	70.4	8.8	77.5	3.6	139.	6.2	49.1	3.8
Sb	0.47	11.	0.76	60.	0.73	14.	1.21	15.	0.38	20.	0.63	2.9	0.80	3.1	0.63	9.0	0.54	5.2	1.30	21.	0.63	8.6
Sc	19.8	3.4	14.5	0.6	17.7	5.4	19.5	0.2	19.4	2.5	22.0	1.2	19.9	3.7	15.8	0.7	20.7	5.8	16.4	4.0	9.39	12.
Sm	4.70	5.6	4.96	2.3	6.03	7.5	3.98	2.5	5.84	3.0	6.97	3.2	7.54	4.4	4.92	0.8	6.79	4.6	4.61	4.7	3.67	2.3
Ta	0.68	11.	0.57	4.8	1.40	8.8	0.64	4.6	1.43	7.2	1.90	2.2	2.16	2.0	1.60	4.7	1.69	4.5	0.82	3.6	0.80	7.3
Tb	0.65	9.8	0.67	6.7	0.82	6.2	0.56	9.0	0.87	8.0	0.98	6.1	1.00	5.8	0.69	7.1	0.91	6.7	0.64	16.	0.56	6.8
Th	10.4	2.0	8.59	4.9	8.67	7.2	9.08	1.2	5.43	4.4	7.91	4.0	13.1	2.2	10.4	4.8	6.83	7.5	15.0	6.3	4.02	5.8
Ti %	0.52	15.	0.55	20.	0.93	7.8	0.58	13.	1.32	8.2	1.44	5.3	1.22	5.2	0.78	17.	1.37	7.7	0.41	16.	0.66	8.0
U	2.29	5.2	2.52	30.	1.85	10.	1.78	5.3	1.49	8.3	2.24	4.0	3.58	10.	2.36	7.8	1.87	8.5	3.60	8.5	3.34	15.
W	2.19	12.	2.04	7.3	1.53	15.	1.46	12.	1.29	14.	1.52	7.8	1.90	5.2	1.62	14.	1.23	10.	2.51	6.4	0.58	20.
Yb	2.67	2.7	2.57	2.0	2.92	6.3	2.21	2.7	2.59	2.5	3.18	3.5	4.09	3.6	2.95	3.0	2.84	8.4	2.45	6.8	1.77	2.3
Zn	101.	16.	88.8	5.6	97.0	4.9	107.	10.	114.	16.	118.	4.7	80.6	12.	84.4	3.6	125.	4.5	104.	13.	69.0	4.2
Zr	131.	23.	140.	17.	206.	13.	137.	19.	245.	12.	309.	9.5	473.	15.	407.	6.5	217.	14.	145.	18.	106.	21.

Tab. 1 Grouping values of samples from Tell Kazel, measured by NAA, Bonn University

1.1 NAA results for 109 samples from Tell Kazel

List of group members, associated members[-] and individual fit factors [in ( )] of each sample to the average compositions of the groups:

1. Group MYBE of 40 samples (and 2 associated samples):

TK 1 (0.96), 2 (0.96), 3 (1.16), 4 (1.03), 5 (1.02), 6 (0.97), 7 (0.98), 8 (1.12), 13 (0.99), 17 (0.94), 18 (0.94), 19 (0.93), 21 (0.98), 22 (1.00), 23 (0.97), 24 (0.98), 25 (0.96), 27 (0.94), 30 (1.01), 31 (0.97), 33 (0.95), 34 (0.95), 35 (1.03), 36 (0.96), 37- (0.98), 38 (1.04), 42 (1.00), 43 (1.06), 44 (1.04), 45 (1.04), 46 (1.09), 47 (1.12), 48 (0.95), 50 (1.03), 51 (1.00), 52 (1.00),
67 (1.00), 70 (0.91), 72- (1.12), 100 (1.06), 106 (1.00), 108 (0.95)

2. Group TKaA of 16 samples:

TK 9 (1.02), 10 (1.05), 12 (1.00), 16 (1.04), 41 (0.95), 49 (1.01), 63 (1.12), 64 (0.97),
76 (0.95), 78 (0.95), 79 (1.04), 80 (0.99), 81 (0.93), 82 (0.97), 86 (0.97), 99 (1.03)

3. Group TKaB of 4 samples:

TK 58 (0.95), 61 (1.05), 102 (1.06), 105 (0.95)

4. Group (pair) TKaC of 2 samples (questionable):

TK 55 (1.04), 62 (0.96)

5. Group TKaD of 6 samples (and 1 associated sample):

TK 32 (1.00), 73- (0.86), 75 (0.96), 85 (1.02), 90 (1.06), 92 (0.89), 98 (1.05)

6. Group (pair) TKaF of 2 samples:

TK 26 (1.04), 28 (0.96)

7. Group (pair) TKaG of 2 samples:

TK 53 (0.97), 54 (1.03)

8. Group TKaH of 3 samples:

TK 65 (1.01), 66 (0.98), 97 (1.01)
(This group is similar to a large group of samples made in Troy [TRO-B])

9. Group (pair) TKaI of 2 samples:

TK 60 (1.02), 87 (0.98)

10. Group (pair) TKaJ of 2 samples:

TK 59 (1.01), 101 (0.99)

11. Group (pair) TKaK of 2 samples:

TK 103 (1.00), 104 (1.00)

12. Single samples (9) matching other groups in the Bonn data bank:

TK 14: group MILD, from Miletus (Akurgal *et al.* 2002: 44–47, 126)
TK 15: not very different from group CYPI, probably from Cyprus (Mountjoy and Mommsen 2001, Mommsen *et al.* 1996)
TK 20: associated with group CYPH, probably from Cyprus (ref. like TK 15)
TK 68: associated with group CYPH, probably from Cyprus (ref. like TK 15)
TK 69: group EPHX (unpubl.), group from Ephesus (see appendix)
TK 71: group CYPh, small group of now 3 samples found in Palestine/Syria, provenance
still unknown
TK 83: associated with group CYPH, probably from Cyprus (ref. like TK 15)
TK 107: associated with group CYPH, probably from Cyprus (ref. like TK 15)
TK 109: Crete or Boeotia? (Co high)

13. 16 chemical single samples:

TK 11 (not matching, but near TKaA), 29, 39 (not matching, but near TKaD),
40, 56, 57, 74, 77, 84, 88, 89, 91, 93, 94, 95, 96

2. Results of the petrographic analysis

The petrographic analysis[25] of 45 samples from Tell Kazel identified 8 petrofabric groups and 5 singletons. The main mineralogical and petrographical characteristics of these petrofabrics are briefly summarised, followed by a discussion on provenance.[26] Despite their preliminary character they are quite interesting as the petro-

[25] M.-C. Boileau would like to thank Dr. Z. Jing (UBC) for access to the Nikon Eclipse polarising microscope used in this study.

[26] The methodology used for petrographic description follows Whitbread's proposal for the systematic description of ceramic thin sections, see Whitbread 1995: 379–388.

Petrofabric	*Number of samples*	*INAA*	*Origin*	*Characteristics*
Fine	7	MYBE	Mycenae/ Berbati	Fine-grained inclusions of quartz, mica and calcareous material
Micaceous	1	EPHX	Ephesos	Clay rich in coarse mica laths with quartz, feldspars and few calcareous material
Fine Serpentinite	2	TKaG	Syria?	Fine-grained inclusions of quartz, micritic limestone, feldspar, mica and notable presence of serpentinite inclusions
Quartz Sand	3	2 Singles	Syria?	Coarse well-rounded quartz grains added to fine clay
Calcareous	13	TKaA 2 Singles	Akkar Plain	Calcareous clay with fine limestone inclusions and quartz, and fine-grained inclusions of plagioclase feldspar, chert, pyroxene and argillaceous rock fragments
IRF/Chert Sand	8	TKaD 1 Single	Akkar Plain	Similar to Calcareous petrofabric but with less calcareous material and fine to medium coarse sand inclusions of basalt, plagioclase, pyroxene, chert and mono quartz
Handmade Burnished	5	TKaJ TKaB TKaI 2 Singles	Akkar Plain	Similar to Calcareous group but with coarser-grained inclusions dominated by micritic limestone, quartz, chert, TCF and polycrystalline quartz
Basalt Tempered	1	Single	Akkar Plain	Coarse to medium sand-size basalt inclusions and probable mix of two clays, one richer in iron
TK 87	1	TKaI	Syria	Similar to IRF/Chert Sand fabric
TK 88	1	Single	Syria	Similar to IRF/Chert Sand fabric
TK 91	1	Single	Syria	Similar to IRF/Chert Sand fabric
TK 93	1	Single	Syria	Similar to IRF/Chert Sand but with clay richer in microfossils and phosphate inclusions
TK 94	1	Single	Syria	Similar to IRF/Chert Sand fabric

Tab. 2 Petrographic classification based on 45 samples (IRF = igneous rock fragments)

graphic analysis (for the most cases) fits well with the NAA results. The above Tab. 2 briefly summarises the correspondence between the petrofabrics and the NAA results.

Geological background[27]

The coastal zone of the Akkar Plain is characterised by Quaternary deposits of alluvial material. Further inland and closer to the site small outcrops of Pliocene Plaisancien of marine deposits are found. The inland zone of the Akkar Plain and further east (region of the Homs Gap) is mostly characterised by Pliocene alcaline basalts[28] while the coastal zone to the south of the Akkar Plain, around Tripoli (Lebanon), is composed of Neogene lacustrian deposits.

North of the Akkar Plain, the western region of Jebel Ansariyeh is of undifferentiated Cretaceous deposits (limestones and dolomites) with small isolated outcrops of Middle Eocene clayey limestones and nummulitic limestones and Paleocene-Lower Eocene undifferentiated marls, clayey limestones and nummulitic limestones. These deposits reach in a narrow band the site of Tell Kazel. The coastal area is characterised by both Pliocene marine and continental deposits and Lower-Middle Quaternary shelly limestones, sandstones, conglomerates and calcareous tuffs.

A greenstones/Ophiolite system characterises the area north of Lattakia (Baer-Bassit) where large deposits characterised by Pre-Upper Triassic basic and ultrabasic rocks mainly composed of olivinites, serpentinised peridotites, serpentines, gabbros, dolerites and pyroxenolites are found.

27 After Beydoun 1977; Ponikarov 1963; Dubertret 1949.

28 Dubertret 1949; Ponikarov 1963.

Petrofabrics and provenance discussion

Fine Petrofabric

7 samples: TK 4, TK 5, TK 7, TK 8, TK 31, TK 47 and TK 111

This homogeneous petrofabric is characterised by very fine-grained inclusions of quartz and rare to common[29] mica laths, probably muscovite (white mica), and few carbonates. The coarse fraction is essentially composed of quartz, micritic limestone, reddish textural concentration features (hereon TCF[30]) and very rare muscovite laths (Pl. 1a).

Regarding this petrofabric, six out of seven vessels sampled for petrography were also sampled for NAA. All of them belong to the MYBE chemical group, which comes from the Argolid region in the northeastern Peloponnese of Mainland Greece. Furthermore, published petrographical data of Bronze Age pottery coming from this region attest the presence of muscovite in the local clay sources[31], which is consistent with the results of the petrographic analysis of the Tell Kazel samples.

Micaceous Petrofabric

1 sample: TK 69

This petrofabric is represented by only one sample but its composition attests a non-Syrian origin. Both the fine and coarse fractions of the fabric are dominated by mica laths (mostly yellow) with common quartz, feldspar and very few carbonate and dark brown rounded TCF. Mica laths are strongly oriented parallel to the vessel walls (Pl. 1b).

Such a petrofabric is not consistent with the geology of the coastal area of Syria/Lebanon and the NAA results have assigned this sample to the EPHX group of western Asia Minor (Ephesus[32]).

Fine Serpentinite Petrofabric

2 samples: TK 53 and TK 54

The two samples are characterised by the presence of fine (silt to fine sand) serpentinite inclusions, TK 54 is rich in serpentinite, while TK 53 is poorer. Serpentinite is bright orange in plain polarised light and dark orange, rarely greenish in cross polarised light or with *machen-strukture*. Other inclusions are micritic limestone, quartz, feldspar and rare muscovite, chert and very rare biotite (Pl. 1c and 1d).

The serpentinite inclusions are not consistent with the geology of the area around Tell Kazel and could derive from the Ophiolite complex which exists north of Lattakia. However, such complexes also occur further north in the Antalya or Diyarbakir areas of Turkey and the Troodos complex of west and south-west Cyprus[33] and it is not known for now whence our two samples come. According to the NAA these two samples form a pair (TKaG), but this elemental pattern does not find a match in the Bonn data collection. Thus, so far it is not possible to make a statement regarding the provenance of these vessels.

Calcareous Petrofabric

13 samples: TK 9, TK 10, TK 16, TK 41, TK 49, TK 63, TK 76, TK 79, TK 84, TK 86, TK 89, TK 99 and TK112

This group is slightly heterogeneous as some samples are better fired (those with a matrix optically inactive) and others are richer in microfossils. Both fine and coarse fractions are dominated by micritic limestone with very few to rare chert, quartz, detrital igneous inclusions (plagioclase feldspar and pyroxene), opaques and few to very rare microfossils. Traces of weathered igneous rock fragments (probably basalt) were observed in few samples. Rare dolomite grains were noted in 2 samples and rare red and dark brown rounded textural concentration features are present in all samples. Overall the inclusions are well sorted with a unimodal distribution suggesting that potters did not add the coarser inclusions (Pl.1e and 1f).

The Calcareous petrofabric is most probably a local ware as detrital igneous inclusions together

29 Frequency percentages (predominant > 70 %, dominant 50–70 %, frequent 30–50 %, common 15–30 %, few 5-15 %, very few 2–5 %, rare 0.5–2 %, very rare < 0.5 %) were determined following Kemp's classes, see Kemp 1985: 17.

30 See Whitbread 1986.

31 Pottery from Lerna III and IV: Shriner and Dorais 1999. We wish to thank Eva Alram-Stern for this bibliographical reference.

32 A short fabric description of the Ephesian members of EPHX can be found in S. Ladstätter in: Akurgal *et al.* 2002: 118.

33 Bourriau *et al.* 2001.

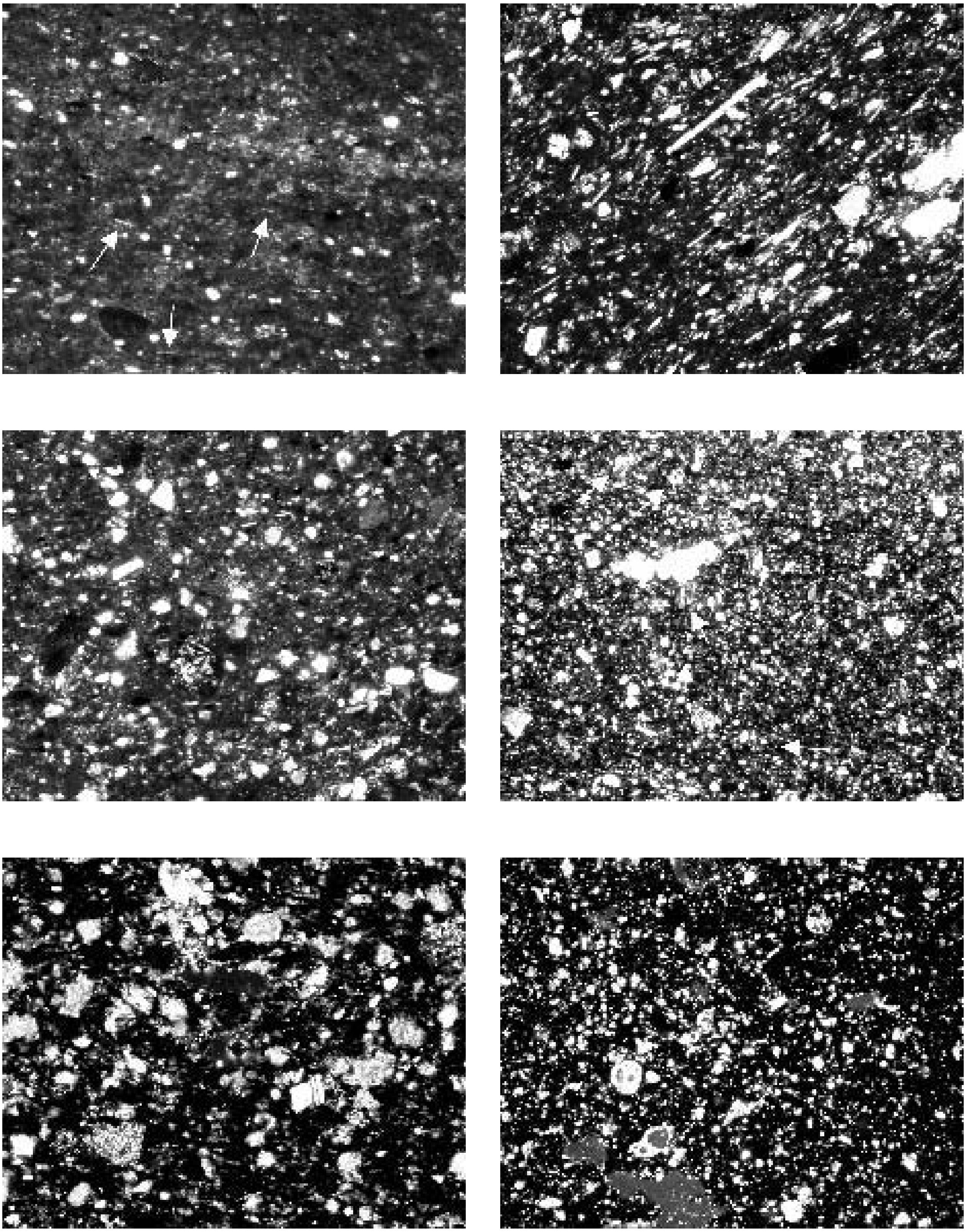

Plate 1 a) Silty muscovite laths (identified by the white arrows) with rounded silty and very fine sand-sized quartz inclusions. W=1.2 mm; b) Mica laths of various sizes in a preferred orientation; the round pale inclusions are quartz and micritic limestone. W=1.2 mm; c) Serpentinite grains (grey, large one in center) with quartz, feldspars and micrite. W=1.2 mm; d) Silty serpentinite grains marked by arrows. W=2.5 mm; e) Cloudy subangular grains are chert, plagioclase feldspar in bottom right and other whitish inclusions are quartz and micritic limestone grains. W=1.2 mm; f) Same petrofabric as 1e but showing microfossils. W=1.2 mm with chert, limestone and rare dolomite inclusions are consistent with the geology of the Akkar Plain where Tell Kazel is located.[34]

IRF/Chert Sand Petrofabric

8 samples: TK 32, TK 39, TK 75, TK 85, TK 90, TK 92, TK 98 and TK 110
This group is heterogeneous with two end members, one with igneous rock fragments (IRF hereon) and the other with chert inclusions. Both end members are kept in this group because there is a gradation between the two. Inclusions are poorly sorted with a bimodal distribution. The fine silty fraction is composed of micritic limestone, quartz, feldspar, mica laths and bright orange inclusions. The coarse fraction has common quartz and limestone inclusions (both micritic and sparry calcite) with few to rare dark brown argillaceous rock fragments (most probably mudstone), micro- and megaquartz chert (some grains are grading into mudstone), plagioclase feldspars and pyroxene grains. Traces of weathered igneous rock fragments IRF (possibly basalt), mica laths and very rare fine-grained igneous rock fragments (trachyte) were observed in one sample. Rare dolomite grains were noted in one sample. The coarse fraction also contains common to very few TCF, ranging from dark red with silt-size quartz inclusions to dark brown. The red TCF seem to be associated with the cherty end members while the darker TCF are found within the IRF members (Pl. 2a and 2b).

This petrofabric with its igneous and sedimentary inclusions is similar to the Calcareous group and most probably represents a local ware.[35] The higher igneous and lower calcareous components might attest to raw material sources more inland, closer to the basalt deposits.[36]

Handmade Burnished Petrofabric

5 samples: TK 56, TK 57, TK 58, TK 59 and TK 60
This is a very heterogeneous group with poorly sorted inclusions showing a bimodal relative distribution. One sample has a very porous structure. The silty fine fraction is mainly composed of quartz, feldspar, carbonates with few chert and rare opaques and red inclusions (serpentinite?). The coarser inclusions, ranging from fine to coarse sand consist mostly of micritic limestone (with some grains depleted in the matrix) and quartz inclusions with few micro and megaquartz chert (some gradating into mudstones), polycrystalline quartz with straight or sutured borders, plagioclase feldspars and TCF (Pl. 2c and 2d). Rare foraminifera microfossils, quartzite and rock fragments showing fibrous quartz grains (secondary chert?) were found in few samples. Plate-like voids surrounded by blackened micromass in one sample (TK 59) suggest that organic material was added to the clay preparation and burned out during the firing stage.

One sample (TK 58) has TCF, which could be interpreted as grog inclusions because they have clear boundaries and are discordant with the matrix. However their shape is subrounded to subangular, which does not fit well with crushed pottery.[37]

The inclusions of the Handmade Burnished ware are also consistent with the local geology.

Sand Tempered Petrofabric

3 samples: TK 74, TK 96 and TK 113
This group is characterised by fine to medium sand-sized and well-rounded quartz grains which were probably added as temper to fine calcareous clays. The fine fraction is predominantly composed of micritic limestone with very few quartz

[34] For a similar fabric used for the manufacture of Late Bronze Age transport amphorae and originating from the Akkar Plain see Serpico *et al.* 2003: 369.

[35] For similar petrographic results linking three Amarna tablets from Sumur with Tell Kazel in the Akkar Plain, see Goren *et al.* 2003: 4 Tab. 1; 7f.

[36] The traces of trachyte, quartzite, mica and mudstone could indicate a source north of the Akkar Plain, in the Ophiolite complex. Clearly more analysis needs to be done on clay sources and local pottery wares in order to better locate the origin of the raw materials used for this group.

[37] Previous petrographic studies of Handmade Burnished Ware found in the Aegean have suggested that grog was added to the clay materials, see Whitbread 1992: 306 (Menelaion, Laconia; thanks are due to Evangelia Kiriatzi who brought this study to our attention). Grog inclusions are also present in Handmade Burnished Ware at LH IIIC Aigeira (northern Peloponnese), see Sauer, in press. We are grateful to Sigrid Deger-Jalkotzy who made this study available to us prior to publication.

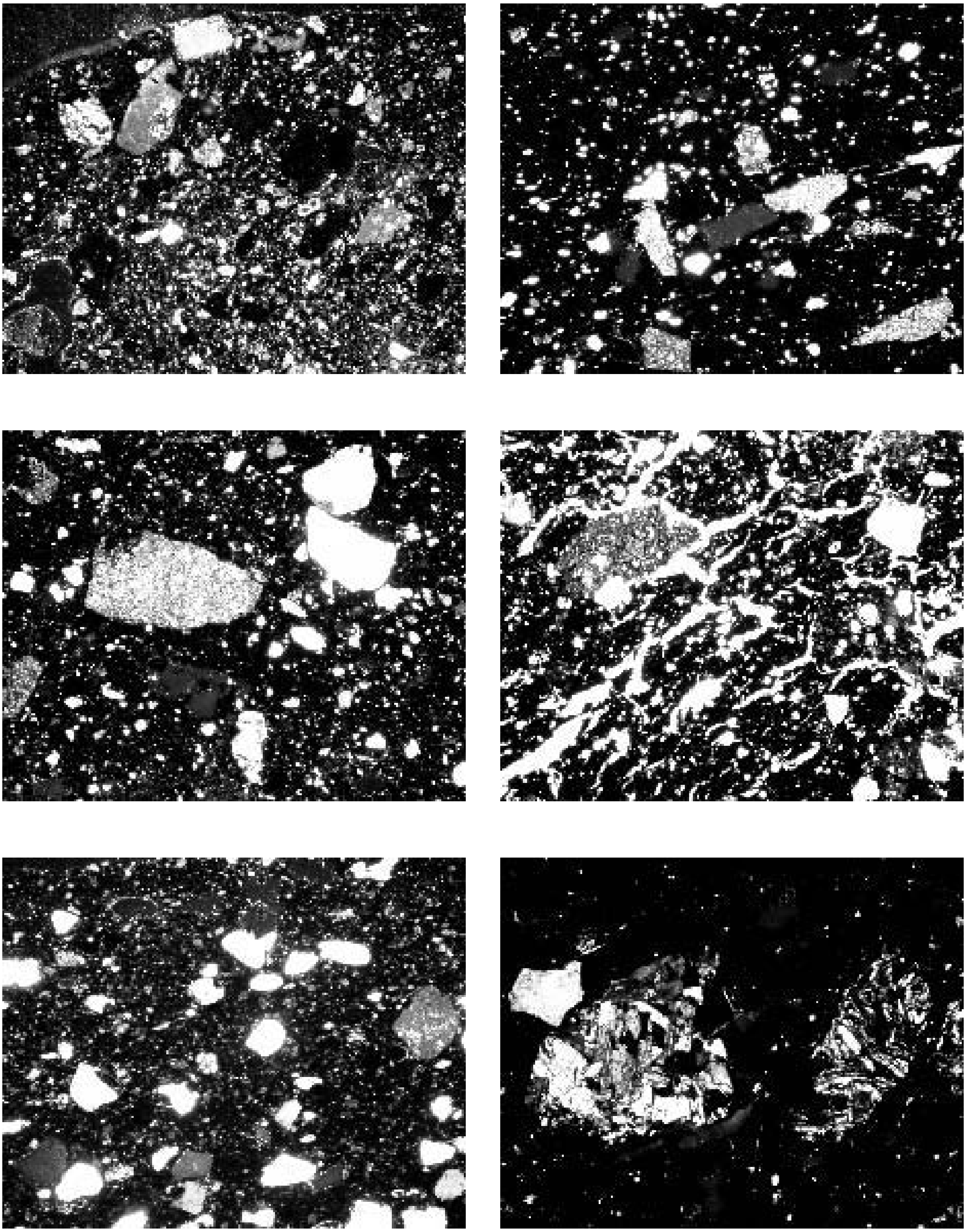

Plate 2 a) Volcanic rock fragment, micritic limestone and pyroxene grains in top left. W=1.2 mm; b) Subangular couldy inclusions are chert grains (center), other inclusions are quartz, feldspars and micritic limestone grains. W=1.2 mm; c) Fine to medium sand-sized inclusions of chert (cloudy grain in center) with quartz (white grain on the right). W=2.5 mm d) Possible inclusion of grog (left) separated from rest of matrix which has a very porous structure. W=2.5 mm; e) Fine to medium sand-sized inclusions of subrounded to rounded quartz (white grains). W=2.5 mm; f) Large rounded volcanic rock fragments (basalt) in a very dark matrix. W=2.5 mm and coloured minerals (pyroxene?). The well-rounded quartz grains predominate the coarse fraction and are accompanied by rare micritic limestone, foraminifera microfossils, polycrystalline quartz, pyroxene and chert fine-sand inclusions (Pl. 2e).

The origin of this group is not known. The three samples that make up this group have a fabric very different in terms of inclusions and distribution from the other local and imported fabrics analysed in this study.

Basalt Petrofabric

1 sample: TK 95

This sample is characterised by a red and black matrix (mix of two clays?) and medium to coarse sand-sized rounded basalt inclusions. The basalt fragments are composed of fine plagioclase laths with pyroxenes and opaques (olivines?). Other inclusions consist of frequent limestone, detrital igneous inclusions (plagioclase feldspar, olivine and pyroxene) and chert, opaques and quartz. The fine fraction is essentially composed of silt-size quartz inclusions (Pl. 2f).

This sample is from a cooking pot which, according to the archaeologists, is of local manufacture.[38] The analysis of the fabric further supports the local origin by the presence of coarse basalt inclusions, which were added to the clays. Basalt outcrops are attested east of the Akkar Plain. Since the basalt inclusions are rounded to well-rounded, potters did not crush basalt rocks but used a naturally occurring basaltic sand.

3. Comparative discussion

In general, one can observe, that both NAA and petrographic results agree well with the macroscopic fabric classification and provenance expectations based on that fabric classification.

Argive Imports

First of all, the large fabric groups with many samples that were archaeologically classified as being Argive products proved to belong to the chemical group Mycenae/Berbati (Tab. 3). The fact that this chemical group includes no less than eight fabrics, is due to the kind of archaeological fabric definition. A fabric was defined by all macroscopically observable technical characteristics of the pottery: inclusions, colours of break, surface and paint, paint quality, surface finish and hardness of the ceramic. Several of these factors are rather related to the potter's skills and methods and do not exclusively depend upon the chemical composition of the clay matrix. For instance, the differences between M 10, M 12 and M 13 consist of small variations in surface colour and the amount of inclusions. However, the latter are generally few or very few and mainly consist of white particles; mica seems to be virtually absent (when examining the sherds with the naked eye). The two largest groups of samples, which belong to the chemical group Mycenae/Berbati, i.e. M 10 (e.g. Fig. 2.5) and M 13 (e.g. Fig. 2.3), are at the same time among the most common imported fabrics of the site. They were already classified as Argive imports

NAA groups / Archaeological fabrics	M 8 (import)	M 10 (Argive)	M 11 (Argive)	M 12 (Argive)	M 13 (Argive)	M 16 (import)	M 19 (import? local?)	M 22 (import? local?)	No fabric (import)
Mycenae/ Berbati	TK 17, 19, 33	TK 3, 5, 7, 18, 22, 25, 27, 30, 31, 34, 35, 44, 52, 70, [72], 106	TK 51, 67, 100	TK 23, 45, 47	TK 4, 6, 13, 21, 24, 36, [37], 38, 42, 48	TK 1, 2, 108	TK 50	TK 8, (46)	TK 43
TKaF			TK 26, 28						

Tab. 3 Correspondence between archaeologically defined fabrics and NAA groups (1): presumably imported pottery (assignations of origin according to archaeological classification). The assignation of samples in round brackets to a specific archaeological fabric is not entirely certain. Samples in square brackets are associated members of a chemical group

[38] It fits with the local typology of Late Bronze Age Syrian cooking pots and can be considered a typical example of these, see Capet 2003: 72, 75, fig. 9a .

Fig. 2 Examples for the chemical group MYBE (imported Mycenaean pottery from the Argive workshops of the Mycenae area). 1 sample TK 2; 2 sample TK 108; 3 sample TK 37; 4 sample TK 45; 5 sample TK 44. Scale 1:3

because of their fabric. The sample TK 72, which was taken from a pictorial chalice of fabric M 10, differs in the elements K and Rb from the composition of the Mycenae/Berbati group. However, the possibility of variations in these two elements is a known phenomenon.[39] Thus, an attribution to the group Mycenae/Berbati has a high probability. The style of the pictorial scene on this vessel could not only be connected to the Argolid, but even to finds from the potters' quarter at Berbati itself.[40]

Like M 10 and M 13, M 12 (e.g. Fig. 2.4) was also regarded as Argive import, whereas M 8 and M 16 (e.g. Fig. 2.1, 2) could be identified as imports, but without provenance attribution. That was due to the fact, that they differ in surface finish (slip) and hardness from those fabrics, which could confidently be assigned an Argive provenance. For the small fabric groups M 19 and M 22[41] doubts were expressed as to whether they are imports or rather good quality local products. Theses doubts resulted from the inferior paint quality and the higher amount of inclusions when compared to the other imported fabrics. Nevertheless, these two fabrics M 19 and M 22 are good quality products. Experience from Macedonia and southern Italy suggested, that even in a cultural environment with totally different potters' traditions and a predominance of coarser wares, people could be able to produce fine wheel-thrown pottery, which regularly does not reach Argive quality but in some cases may not be far from it.[41a] Therefore, it seemed best to express caution and not to exclude a local production of M 19 and M 22 too hastily.

Another case is M 11, which was classified as imported from the Argolid, but differs from the other fabrics of presumed Argive origin (apart from colours) in the higher amount of white inclusions and the presence of a small amount of mica. However, only three samples of this fabric show the chemical composition of Mycenae/Berbati. The other two samples fall into another chemical group, the pair TKaF. It is possible, that an incorrect estimate of mica quantity is responsible for the classification of these two samples as M 11.[42] This should be checked again with the material at Tell Kazel; it is possible that M 11 subsequently can be divided into two different fabrics. The chemical pair TKaF is not very similar to the chemical group Mycenae/Berbati, but it shows a general similarity to other groups from Greece. Thus, TKaF can be classified as "general Greek composition".

When looking at the petrographic results of those sherds belonging to the chemical group Mycenae/Berbati (Fine Petrofabric), one notes that all of them contain muscovite (white mica). This is remarkable, because usually Argive pottery is said to contain no mica at all. However, during a study of finds from the Argolid in the storerooms

39 Buxeda i Garrigós *et al.* 2002.

40 Jung in press b, fig. 7.19.

41 There are hardly more specimen than those sampled for NAA.

41a See e.g. Jung 2002, 48–56; 237.

42 A macroscopically visible property of the M 11 samples in TKaF seems to be a higher mica content in comparison with the M 11 samples in the Mycenae/Berbati group.

Petrographic fabrics / Archaeological fabrics (presumed origin)	M 10 (Argive)	M 12 (Argive)	M 13 (Argive)	M 17 (import)	M 22 (import? local?)
Fine	TK 5, TK 7, TK 31	TK 47	TK 4, TK 111		TK 8
Micaceous				TK 69	

Tab. 4 Correspondence between archaeologically and petrographically defined fabrics (1): presumably imported pottery (assignations of origin according to archaeological classification)

of Náfplio and Tiryns, it was possible to observe that a few fabrics containing mica are indeed found in this region.[43] While defining the archaeological fabrics at Tell Kazel, mica could only be observed in Argive fabrics M 8, M 10, M 11 and M 19 and not in M 12, M 13 and M 16; but they all belong to the MYBE group (and those sampled for petrography belong to the Fine Petrofabric, Tab. 4). The explanation for these discrepancies lies in the fact that mica is present only in the fine fraction of this petrofabric and thus may not be noted when examining sherds with the naked eye. As additional evidence one may cite other petrographic studies, which noted the presence of muscovite in the local Argive clay sources and in local (Early) Bronze Age pottery.[44]

Mycenaean Pottery of Syrian Production

The second largest chemical group is TKaA which comprises the majority of the presumed local Mycenaean samples (Tab. 5). Fabrics M 1, M 1a and MU 1 are present in this group. M 1 and M 1a differ from each other only in respect to the quantity and coarseness of inclusions, M 1a actually being a coarse version of M 1. MU 1 is the unpainted version of M 1. Thus, the chemical group TKaA is fully consistent with the archaeological classification. One sample in this group was taken from an unpainted vessel which may be of Syrian type (TK 86 classified as a Closed Bowl, Fig. 4.1), whose fabric is close to the local Mycenaean fabric MU 1 but coarser. In the petrographic analysis the samples of the chemical group TKaA constitute the Calcareous Fabric. The presumably local Mycenaean fabrics M 1, M 1a and MU 1 are represented (Tab. 6) in this petrofabric – just as in the chemical group TKaA –, but it additionally includes three samples of Syrian-type vessels (TK 86 of group TKaA and TK 84 and 89, which are chemical singles). One of them (TK 86) was described as being close to the (local Mycenaean) archaeological fabric MU 1,

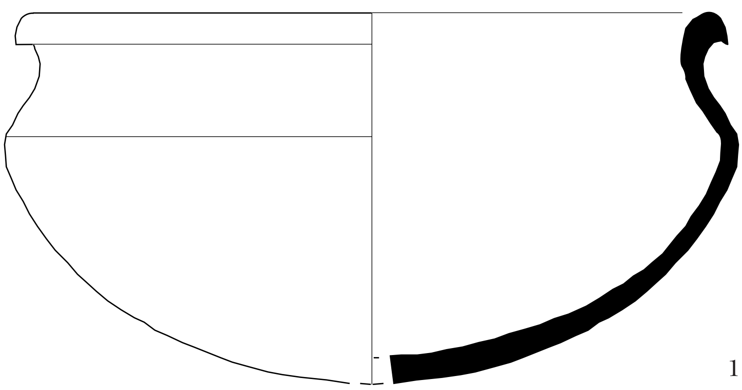

Fig. 3 Syrian-type cooking pot sample TK 95 (Basalt Petrofabric). Scale 1:3

[43] Those fabrics contain a very small amount of mica. The vessels in question do not differ in style from the usual Argive products, cf. Jung 2002: 567–569 nos. 1. 5. 10. 13; p. 571 nos. 4. 6–8; p. 573 no. 15.

[44] See above n. 31.

NAA groups / Arch. fabrics	M 1 (local)	M 1a (local)	MU 1 (local)	M 2 (local)	M 6 (local)	M 21 (local)	(HMB) (local)	B 2 (local)	S 1 (local)	S 2 (local)	(Syrian: type and fabric) (local)
TKaA	TK 16, 41, 76, 78, 79, 80, 81, 82	TK 9	TK 10, 12, 49, 63, 64, 99								(TK 86)
TKaB							TK 58, 61, 102, 105				
TKaD		[TK 73]	TK 75						TK 32	TK 98	TK 85, 90, 92
TKaG				TK 53, 54							
TKaI							TK 60				TK 87
TKaJ							TK 59, 101				
TKaK							TK 103, 104				
Singles		TK 39, (77)	TK 11		TK 40	(TK 74)	TK 56, 57	TK 96			TK 84, 88, 89, 91, 93, 94, 95

Tab. 5 Correspondence between archaeologically defined fabrics and NAA groups (2): presumably local pottery (assignations of origin according to archaeological classification). The assignation of samples in round brackets to a specific archaeological fabric is not entirely certain. Samples in square brackets are associated members of a chemical group

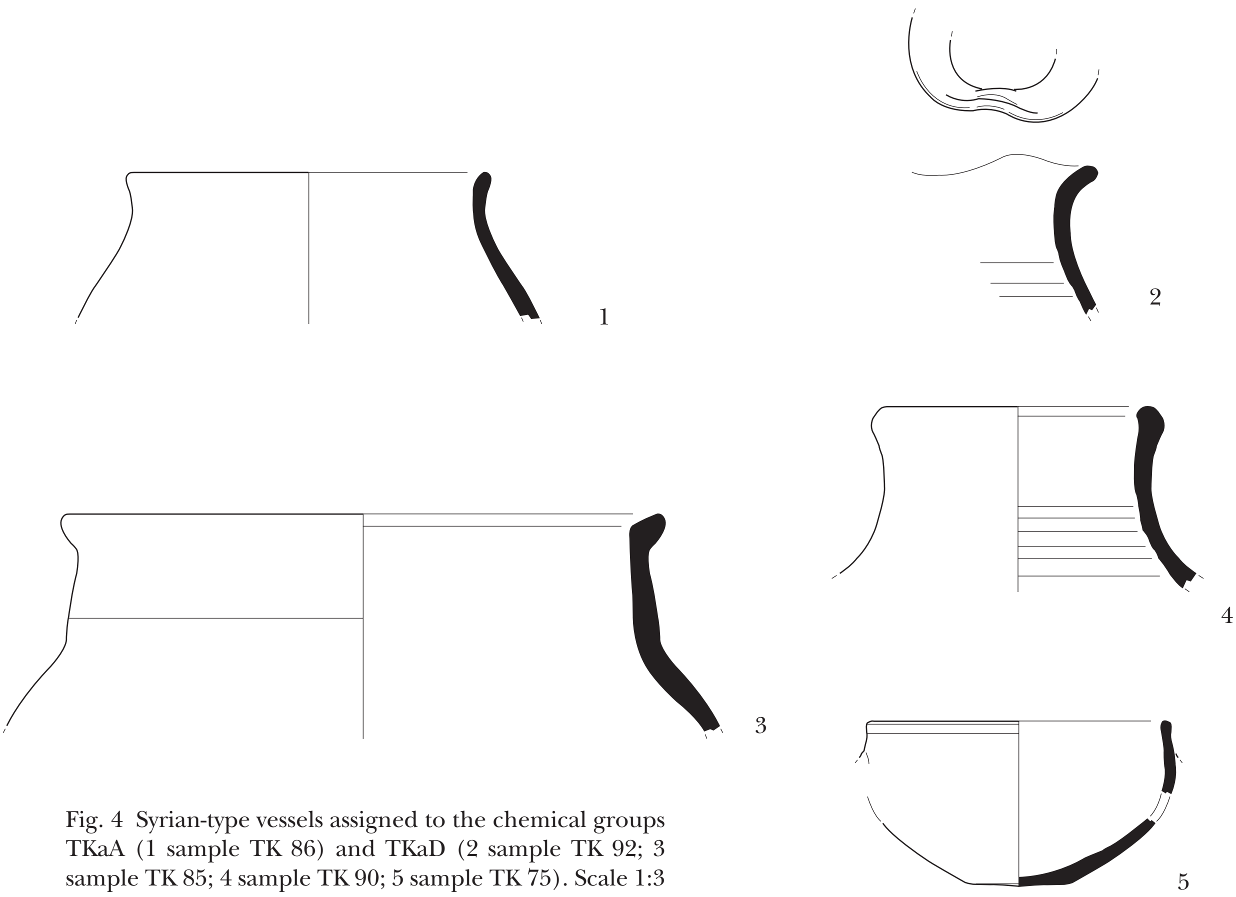

Fig. 4 Syrian-type vessels assigned to the chemical groups TKaA (1 sample TK 86) and TKaD (2 sample TK 92; 3 sample TK 85; 4 sample TK 90; 5 sample TK 75). Scale 1:3

Petrographic fabrics / Archaeological fabrics (presumed origin)	M 1 (local)	M 1a (local)	MU 1 (local)	M 2 (local)	M 21 (local)	B 2 (local)	S 1 (local)	S 2 (local)	(HMB) (local)	(Syrian: type and fabric)
Calcareous	TK 16, TK 41, TK 76, TK 79,	TK 9, TK 112,	TK 10, TK 49, TK 63, TK 99							TK 84, (TK 86), TK 89
IRF/Chert Sand	TK 110	TK 39	TK 75				TK 32	TK 98		TK 85, TK 90, TK 92,
Fine Serpentinite				TK 53, TK 54						
Handmade Burnished									TK 56, TK 57, TK 58, TK 59, TK 60	
Quartz Sand					(TK 74), TK 113	TK 96				
Basalt										TK 95
Singles										TK 87, TK 88, TK 91, TK 93, TK 94

Tab. 6 Correspondence between archaeologically and petrographically defined fabrics (2): presumably local pottery (assignations of origin according to archaeological classification). The assignation of samples in round brackets to a specific archaeological fabric is not entirely certain

but the shape of this vessel may be Syrian. However, one cannot exclude the possibility that this rim sherd might belong to a Mycenaean-type cooking pot. Hence, this question must remain open until further examples of this type are found.[45] From the NAA and petrographic results it follows then, that the Mycenaean-type vessels showing fabrics M 1, M 1a and MU 1 are indeed Syrian products. The petrography of the Calcareous Petrofabric is consistent with the region of the Akkar Plain. Thus, we can be fairly certain, that we grasp here the local Mycenaean pottery production of Tell Kazel. This conforms with the fact, that the Mycenaean vessels of fabric M 1 exhibit certain stylistic traits that seem to be exclusive to Tell Kazel and are not found in other Levantine regions nor in Cyprus.[46]

There is another chemical group containing samples of vessels in presumably local Mycenaean fabrics, that is TKaD. The sample TK 75 was taken from a vessel ascribed to fabric MU 1, but this vessel is an unpainted bowl of Syrian type (Fig. 4.5). Another three Syrian-type vessels of different unpainted fabrics are present in TKaD (TK 85, TK 90, TK 92, Fig. 4.2–4).[47] Furthermore, two pieces belonging to TKaD show a mixture of Syrian and Mycenaean stylistic elements: a painted krater of fabric S 1 (Fig. 5.1) and an unpainted and burnished three-handled piriform jar of fabric S 2 (Fig. 5.2). Most of the Syrian-type vessels as well as

[45] There is no complete profile, that would prove beyond doubt that Mycenaean cooking pots were used at the site.

[46] See Jung, in press b. This is at least the impression one gets from the published material. Future research may verify, that these stylistic features can be used to define an Amurru style of Mycenaean pottery.

[47] For the sampling no attempt was made to establish a fabric typology for the Syrian-type pottery, as this would be beyond the scope of the present analysis project concentrated on the Aegean-type wares. Instead, each sampled Syrian piece was described in the same detailed way, that was used for the Mycenaean fabrics in order to make the descriptions comparable.

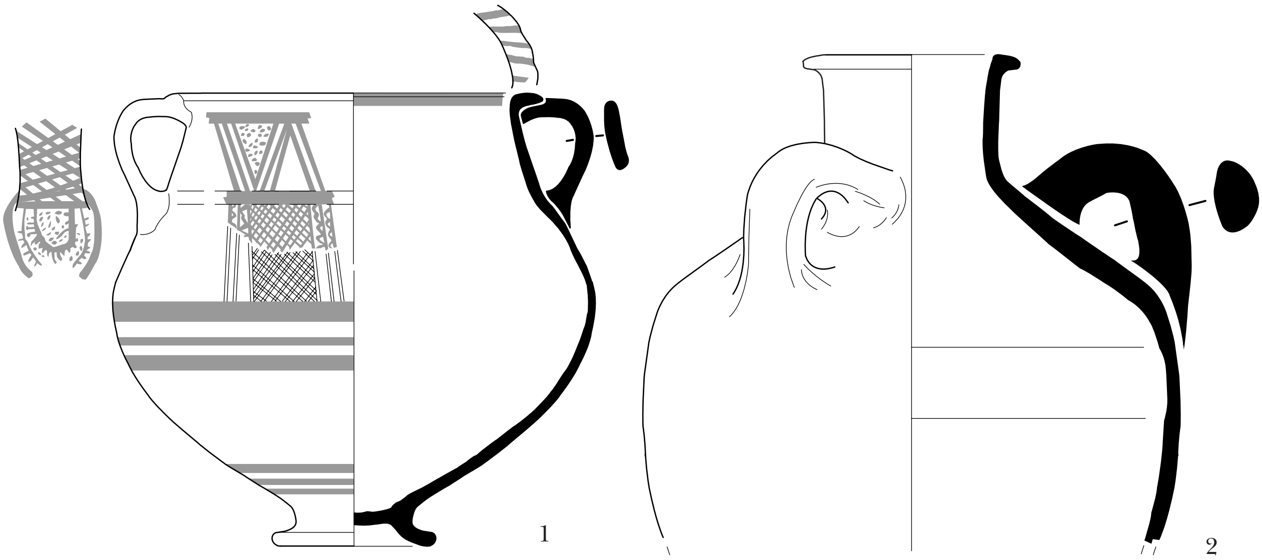

Fig. 5 Vessels with mixed Syrian and Mycenaean typological traits assigned to the chemical group TKaD.
1) sample TK 32 (scale 1:6); 2) sample TK 98 (scale 1:3)

the example of S 1 and the one of S 2 are coarse or even very coarse pieces with a large amount of inclusions. However, the macroscopic examination seemed to show that quantity and also quality of inclusions vary considerably among the samples that make up TKaD. One Syrian-type vessel (TK 75, Fig. 4.5) even shows the finer local Mycenaean fabric MU 1 (see above). Finally one can remark upon the fact, that there is a sample taken from a large closed vessel of Mycenaean type, which belongs to fabric M 1a and is associated to TkaD (TK 73).

In the petrographic analysis the samples of group TKaD are united in the IRF/Chert Sand Petrofabric. Additionally there is a local Mycenaean fragment classified as fabric M 1 which could be grouped with this petrofabric (sample TK 110, not sampled for NAA). The similarity of the IRF/Chert Sand Petrofabric to the Calcareous Petrofabric has already been discussed (see chapter 2). In summarising the evidence, one may conclude that TKaD represents a Syrian pottery production which however cannot be ascribed with certainty to the region of Tell Kazel. This production seems to be related to the local Mycenaean pottery production of Tell Kazel, though it is not identical with it.

The chemical pair TKaG comprises those two samples which have been taken from the supposed local Mycenaean fabric M 2 (Fig. 6.1, 2). There is no chemical overlap of this fabric with any other

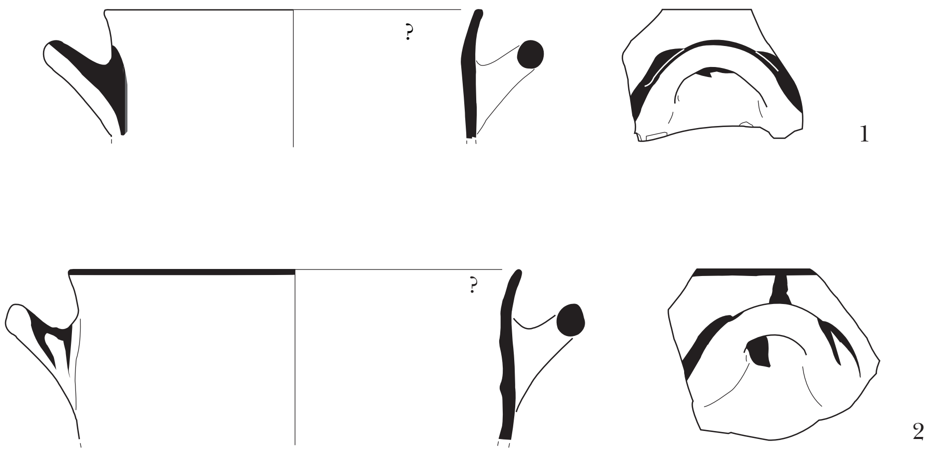

Fig. 6 Mycenaean-type deep bowls assigned to the chemical pair TKaG. 1 sample TK 53; 2 sample TK 54. Scale 1:3

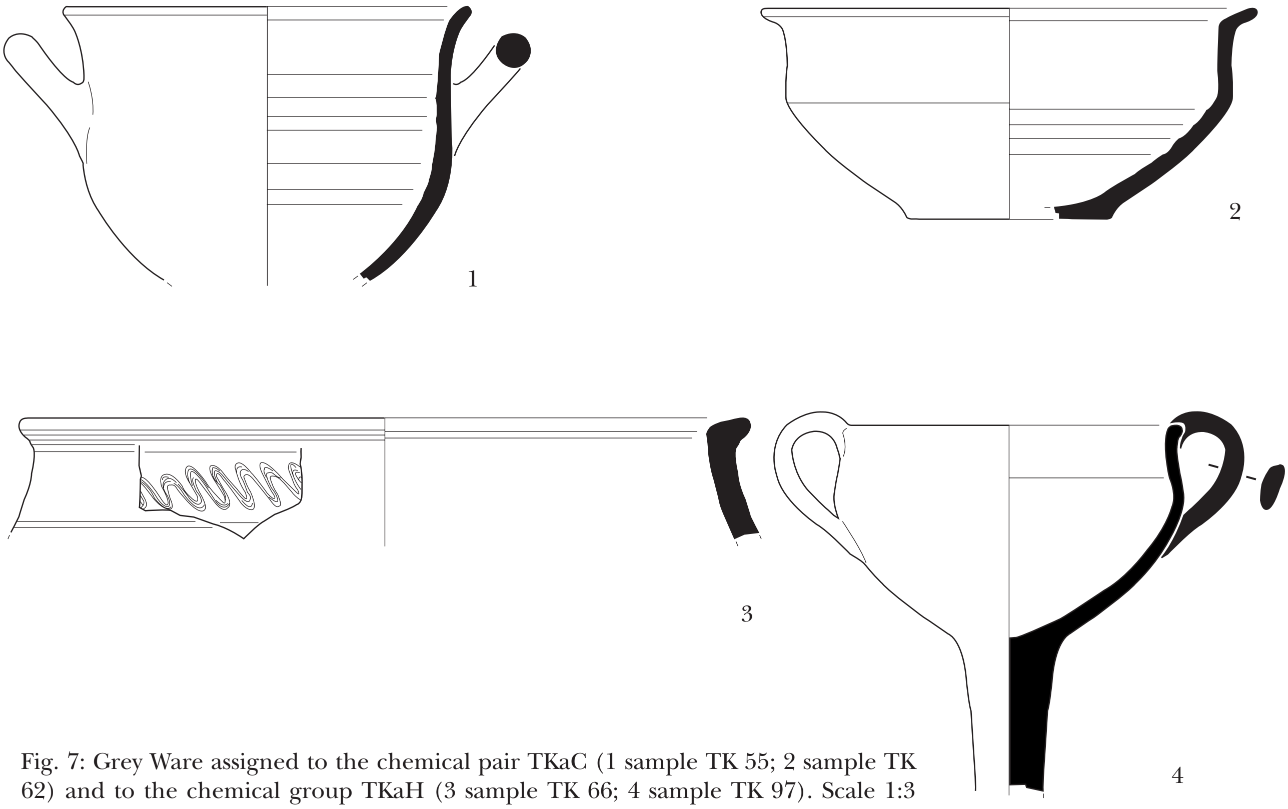

Fig. 7: Grey Ware assigned to the chemical pair TKaC (1 sample TK 55; 2 sample TK 62) and to the chemical group TKaH (3 sample TK 66; 4 sample TK 97). Scale 1:3

Syrian- or Mycenaean-type pottery. The same applies to the petrography of M 2. Initially the vessels of fabric M 2 seemed to be technologically, typologically and stylistically close to those of fabric M 1. Therefore in the process of archaeological classification they were regarded as local products. However, one must admit that M 2 is far less common at Tell Kazel than the local Mycenaean fabric M 1. Furthermore, the vessels of fabric M 2 do not show those specific stylistic traits that are typical for the local Mycenaean products of Tell Kazel. They rather show simple banded decoration; on none of these vessels has a motif been observed thus far. Future research should open up a possibility for the location of this production series. According to the petrographic results one may look in Cyprus and the northern Syrian coastal zone, and from the archaeological point of view this seems indeed to be a good possibility.

Grey Ware

Two Grey Ware fabrics were identified at Tell Kazel. The first one shows a burnished surface and white inclusions in the matrix (fabric G 1). The samples of this fabric form the chemical pair TkaC (Tab. 7), the provenance of which could not be determined so far, because it does not match any chemical group in the Bonn data base. One of the shapes that was restored is a Mycenaean-type deep bowl (Fig. 7.1), the other one is a carinated bowl without typological parallel in the regular Mycenaean vessel repertory (Fig. 7.2).[48] The second grey ware fabric

[48] For the Mycenaean deep bowl as a Grey Ware type (A 71) at Troy VI Late, VIIa and VIIb see most recently Pavúk 2002: 37, fig. 1; p. 61. – At Troy VIIa and VIIb there is a local Grey Ware shape, the carinated one-handled cup A 93, which resembles the carinated bowl from Tell Kazel, but does not show the everted rim of the Syrian example, cf. Pavúk 2002: 59, fig. 16.57; p. 61. A find from the 1960s excavations at Tell Kazel is morphologically closer to the Trojan A 93, see Allen 1990: 348f. no. 452; p. 4123 fig. 63.9. This and another find from the 1960s at Tell Kazel were analysed by the Manchester NAA group (N. Bryan, S. Hoffmann and V. Robinson) with the result that they probably originate from the Levant (priv. comm. P. Pavúk).
A South Italian type matches best the carinated bowl Fig. 7.2 (cf M. Bettelli and D. De Angelis, in: Bettelli 2002: 80f. fig. 29.23D).

NAA groups / Archaeological fabrics	M 7 (import)	M 9 (Cyprus)	M 14 (Cyprus?)	M 15 (import)	M 17 (import)	M 20 (Cyprus)	M 24 (import)	G 1 (import)	G 2 (NW Asia Minor)
TKaC								TK 55, 62	
TKaH									TK 65, 66, 97
EPHX					TK 69				
MILD				TK 14					
near CYPI				TK 15					
CYPH	[TK 20], [68], [107]	[TK 83]							
CYPh			TK 71						
Singles						TK 29	TK 109		

Tab. 7 Correspondence between archaeologically defined fabrics and NAA groups (3): presumably imported pottery (assignations of origin according to archaeological classification). The assignation of samples in round brackets to a specific archaeological fabric is not entirely certain. Samples in square brackets are associated members of a chemical group

resembles the Bronze Age grey ware of northwestern Asia Minor with its thick polished slip and silver and gold mica in the matrix (G 2). Some pieces of this fabric also show the typical Trojan decoration of incised wavy lines (samples TK 65 and 66, Fig. 7.3). A nearly complete pot of fabric G 2 belongs to a Mycenaean kylix type, which is also attested in Grey Ware at Troy (Fig. 7.4).[49] Indeed, the chemical analysis confirmed the ascription of G 2 to northwestern Asia Minor, as the three samples of this fabric form the chemical group TKaH which matches the Trojan chemical group TRO-B[50] (Tab. 7).

Imports from Cyprus and Asia Minor

The “Simple Style” is represented at Tell Kazel by different fabrics which also show different chemical qualities: fabric M 21, represented only by sample TK 74 (Fig. 8.1) and fabric M 7 (samples TK 20, TK 68 and TK 107, Fig. 8.2, 4). Sample TK 74 is a chemical single,[51] but in the results of the petrographic study it is grouped together with sample TK 113 (not measured by NAA), which was equally classified as fabric M 21. This last sample was taken from a deep bowl A. All the samples of fabric M 7 do not exactly match, but are associated to an already known group in the Bonn data base, CYP-H which is of Cypriot origin.[52]

Interestingly, sample TK 83 is also associated with the chemical group CYP-H (the Rb concentration deviates). This sample was taken from a Proto-White Painted vessel of fabric M 9. It was expected to be from Cyprus on typological

[49] Type A 85 of Troy VI Late and VIIa: Pavúk 2002: 37 fig. 1; p. 60.

[50] Mommsen *et al.* 2001: 173–176. Meanwhile, the assignment of this pattern to the region of Troy is supported by a clay sample. – The chemical group TRO-B is found not only in Grey Ware but also in Mycenaean pottery at Troy and was especially common during the period contemporary with LH IIIB (P.A. Mountjoy in: Mommsen *et al.* 2001: 188). This is the time span to which the Tell Kazel pieces of fabric G 2 also belong.

[51] Fabric M 21 is thought to belong to the local pottery production because of its inclusions that resemble those of the Syrian-type vessels. However, it must be noted that the assignation of sample TK 74 to this fabric is not entirely certain. Thus, the conclusions based on the chemical analysis of this one sample may not apply to all members of the fabric group M 21. The petrographic analysis indicates, that the inclusions of TK 74 and TK 113 belonging to M 21 are similar to those of sample TK 96. TK 96 is a bichrome vessel showing Mycenaean inspiration (Fig. 8,5). In the NAA analysis this piece turned out to be a single.

[52] Mountjoy and Mommsen 2001: 125. 130f. 138. – Extensive discussion in Mommsen *et al.* 1996: 171f. 176f. figs. 2 and 3 (group H). A group of sherds from Milia measured in Berkeley is very similar to this group, cf. Artzy *et al.* 1976.

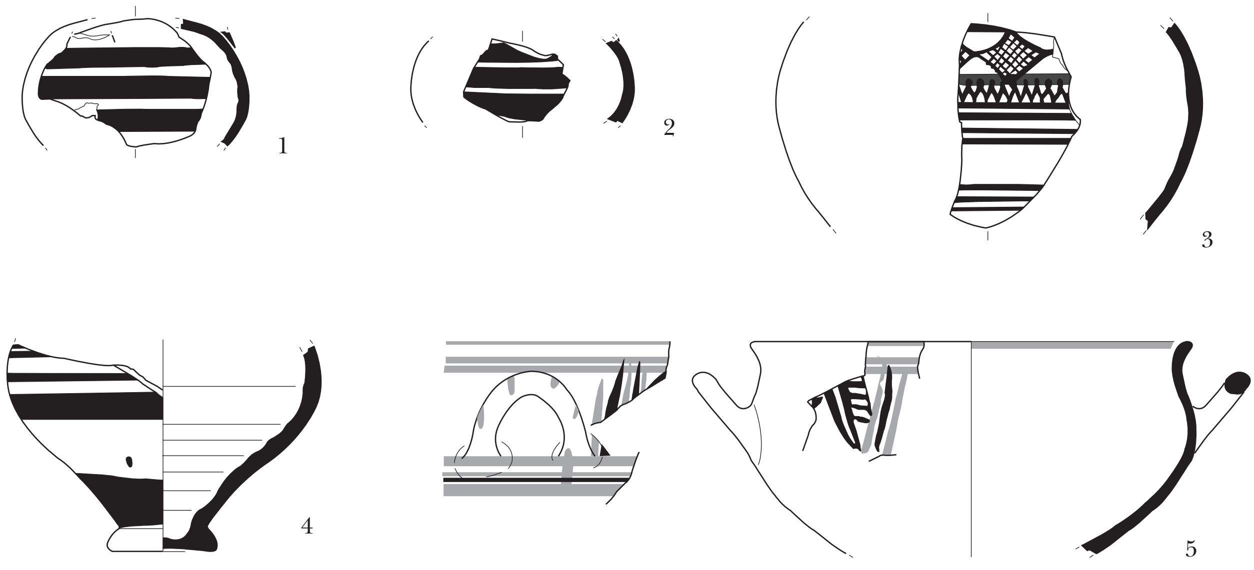

Fig. 8 Mycenaean-type vessels showing the Simple Style (1 sample TK 74; 2 sample TK 68); Mycenaean closed vessels (3 sample TK 71; 4 sample 107); skyphoid krater with mixed Syrian and Mycenaean typological traits (5 sample TK 96). 1–4 scale 1:3; 5 scale 1:6

grounds and because of its typical PWP fabric.[53] Another vessel fragment was also expected to originate from Cyprus, but only on stylistical grounds: a "Pastoral Style" krater of fabric M 20. However, sample TK 29 taken from this sherd turned out to be a chemical single and thus could not be ascribed to any known production series or region.

Samples have been taken from two vessels, which, based on macroscopic criteria, belonged to the same fabric M 15. This fabric had been tentatively ascribed to Rhodes by the light coloured matrix and the mica content, but this was a mere guess. It seemed however clear, that it is no Argive production. By NAA one piece (TK 14) could be ascribed to the group MILD[54] from Miletus in southwestern Asia Minor (known for its micaceous clay[55]), the other (TK 15) is associated with group CYP-I from Cyprus.[56]

There are two further samples that could be grouped with known chemical groups. TK 71 is a wall fragment of a closed vessel, which shows the typological and fabric characteristics of a much discussed group of imported LH IIIC stirrup jars[57] from the Levantine region (Fig. 8.3). This sample forms a triple with two others from Megiddo and Beth Shean (CYP-h), but their origin cannot be determined yet. TK 69 was taken from a belly-handled amphora or hydria, which is a secure import to Tell Kazel, but which could not be assigned to any well-known fabric from the Aegean. It could be grouped with a still unpublished group (EPHX) which must originate from Ephesus in western Asia Minor (see appendix by M. Kerschner).

Handmade Burnished Ware

An interesting case is provided by the handmade burnished ware (HMB), which made its first appearance at Tell Kazel together with the local

53 This fabric ascription was confirmed by V. Karageorghis at Tell Kazel during the 2003 campaign.

54 Akurgal *et al.* 2002 : 14–17. 18 tab. 1; 44–47 with fig. 3.

55 Wolf-Dietrich and Barbara Niemeier kindly confirmed the macroscopic similarity of this piece (Jung in press b, fig. 13.51) to their finds at Miletus, when they were shown colour photos and a fabric description of it.

56 Mountjoy and Mommsen 2001: 125. 130f.; Mommsen *et al.* 1996: 171f., 176f., figs. 2 and 4 (group I). Cf. group CYP-H with a similar group measured at Berkeley (see above n. 52).

57 Most recently Mountjoy 2005; Mazar in press. Unfortunately the sherd from Tell Kazel is not stratified.

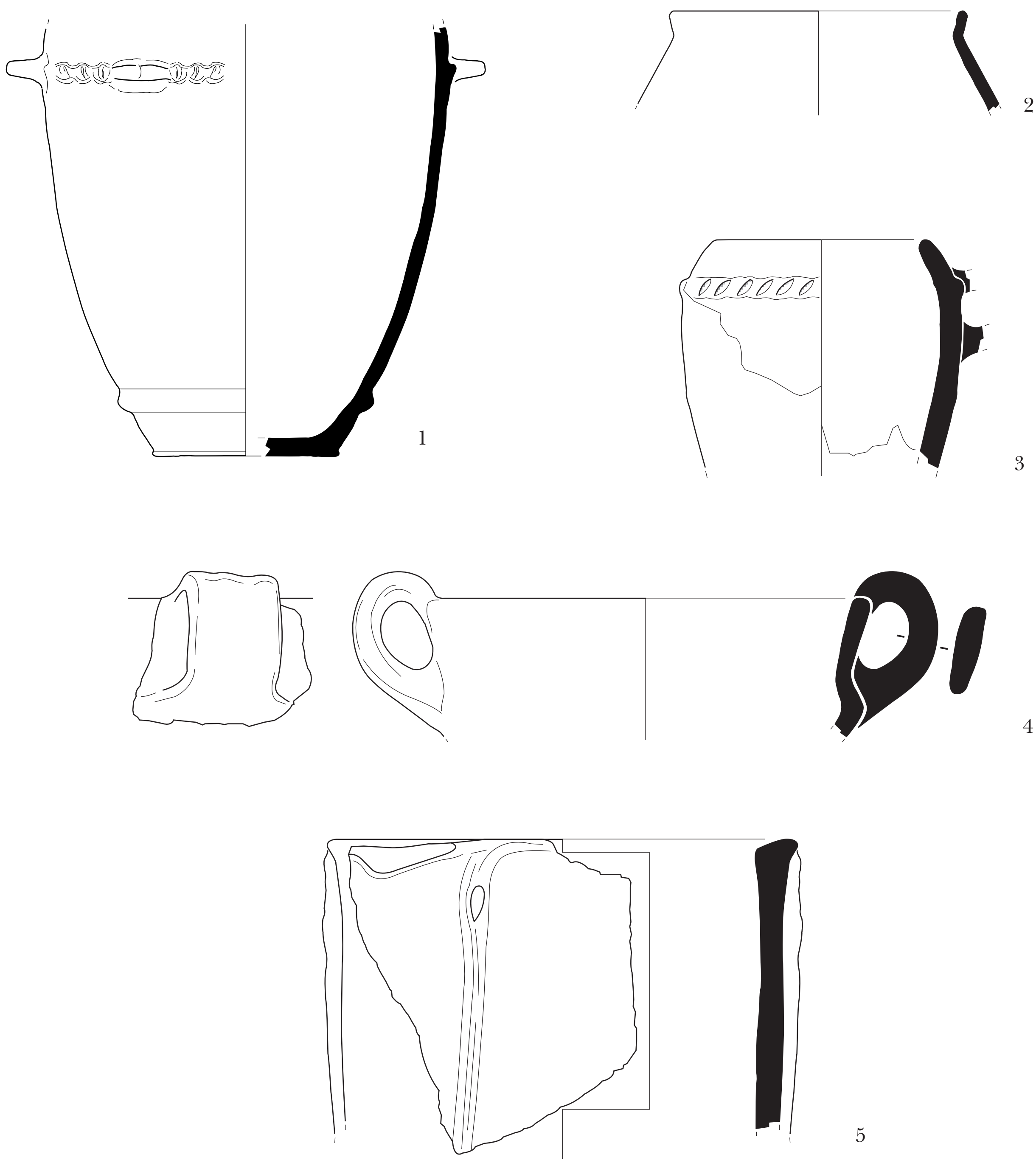

Fig. 9 Handmade Burnished Ware (1 sample TK 60; 3 sample TK 61; 4 sample TK 101; 5 sample TK 56) and Syrian-type vessel (2 sample TK 87) assigned to the chemical group TKaB, to the chemical pairs TKa I and TkaJ and single. 1 scale 1:6; 2–5 scale 1:3

Mycenaean pottery production.[58] Eleven samples were taken from different sherds. The vessels of HMB show a considerable technological variation with respect to the surface treatment and the firing quality and also the colours (often irregular even on one and the same vessel). However, it was not expected, that these eleven samples would belong to four chemical groups and pairs (and furthermore comprise two chemical singles, Tab. 5), especially as the amount and kind of

[58] Badre 2003: 89–94 with figs. 6; 7; 9.

inclusions seemed to be fairly similar between the different vessels. The petrographic analysis partly confirmed that macroscopic impression: the HMB of Tell Kazel can be grouped as one petrofabric. However this petrofabric is very heterogeneous with poorly sorted inclusions. An explanation for these phenomena might be that different clays were used, but the same type of temper was added. It could also be a case where potters mixed different clays in the preparation.

One chemical group (TKaB, Fig. 9.3) and two pairs (TKaJ, Fig. 9.4, and TKaK) comprise exclusively HMB samples. Two HMB samples are chemical singles (TK 56, Fig. 9.5, and TK 57). Finally, there is one chemical pair (TKaI) which includes one HMB (TK 60, Fig. 9.1) and one Syrian-type wheel-thrown vessel, a Closed Bowl IX.4e (TK 87, Fig. 9.2). This pair seems to suggest a local production at least for this one HMB vessel.[59] Additional evidence for this hypothesis is provided by the close relationship between the chemical group TKaB and the chemical pair TKaK with HMB only and the chemical group TKaA with mainly local Mycenaean pottery and one Syrian-type vessel (cf. Fig. 1). The chemical groups TKaA, TKaB and TKaK differ from each other, but they are all situated close in the multidimensional concentration space. Also the two chemical pairs TKaI and TKaJ are close in composition. Finally, the petrographic analysis shows, that the inclusions of the HMB in general are consistent with the local geology. To conclude, both NAA and petrographic examination hint at a local production of HMB in the region of Tell Kazel. In the Aegean HMB found in LH/LM IIIB–IIIC contexts is likewise of local production, as various analyses of material from the Peloponnese (Aigeira, Mycenae), Boeotia (Thebes) and Crete (Khaniá) have shown.[60] The Palestinian coastal site of Tell Qasile yielded seven HMB vessels, which however differ considerably in type from the Tell Kazel vessels.[61] Two of the Tell Qasile pieces were analysed by NAA and assigned to the local pottery production of the site.[62] Several pieces of HMB found in Cyprus have been analysed by NAA and were separated into five different chemical groups.[63] Unfortunately those vessels which are typologically closest to some of the Tell Kazel finds are not amongst the sampled pieces.[64]

When examined macroscopically, the HMB found at Tiryns, Mycenae and Tell Kazel and the so-called *impasto* ware from southern Italy show a great deal of similarity regarding surface finish, temper and mode of firing.[65] Unfortunately, few studies are published on the petrography and technology of HMB in the eastern Mediterranean. The HMB from the Menelaion site of Sparta was found to be grog-tempered, the same may apply to the HMB from Aigeira.[66] This technological peculiarity is shared with some impasto pottery from settlement sites in southern Italy (e.g. Broglio di Trebisacce and Coppa Nevigata[67]), the region where the technique of potting HMB possibly originated (at least regarding the Aegean HMB production[68]). However, the HMB at Tell Kazel does not contain grog

59 In the petrographic analysis TK 60 was grouped with the rest of the HMB samples, whereas TK 87 turned out to be a single (Tab. 6). Furthermore, the mineral composition of TK 87 is closer to the IRF/Chert Petrofabric than to the HMB, but potters might have used similar clays for both fabrics, which are believed to be of local origin.

60 *Thebes* (NAA, H. Mommsen, Bonn laboratory): Mommsen *et al.* 2002: 608. *Mycenae* (petrography by J. Riley, Southampton; NAA, V.J. Robinson, Manchester laboratory): French 1989: 47f. *Aigeira* (petrography, R. Sauer, Vienna): Deger-Jalkotzy 2003: 465–467. *Khaniá* (AAS, R.E. Jones): B.P. Hallager in: E. Hallager and B.P. Hallager 2003: 253.

61 Mazar 1985: 43f., 177, fig. 18.16, 17; 199 fig. 29.20–22; 209 fig. 34.12, 13. Based on the (local) Mycenaean-type pottery from the same layers the HMB is clearly more recent in date than the earliest HMB from Tell Kazel. The Tell Qasile HMB may be contemporary with the latest HMB from Tell Kazel or still later in date.

62 Jerusalem laboratory: J. Yellin and J. Gunneweg in: Mazar 1985: 113, 115, tab. 15 nos. 7 and 8.

63 Manchester laboratory: V. Robinson in: Pilides 1994: 113–121.

64 Pilides 1994: 88f., cat. nos. 27 and 28, fig. 19.5; 20,1 pl. V.1, 2.

65 R. Jung wishes to thank Elisabeth French, Joseph Maran and Renato Peroni for the possibility to examine HMB from Mycenae, Tiryns and Broglio di Trebisacce.

66 See above n. 37.

67 Levi *et al.* 1999: 133. 241f. 329. 339. At Broglio di Trebisacce approximately 20 % of the analysed impasto vessels from contexts of the Recent Bronze Age (which is contemporary with those contexts from Tell Kazel containing HMB) show grog inclusions (*ibidem* 133).

68 Cf. Bettelli 2002: 117–127; Jung 2005: 480f. pl. 106.b–h.

inclusions (with one possible exception, cf. chapter 2). Many more petrographic and technological studies of HMB in its various regions of appearance are necessary until sound comparisons between different regional technological traditions can be made.

Singles

The majority of chemical singles (seven out of 16) and all of the petrographic singles in our sample series consist of Syrian-type pottery. This concentration of Syrian-type pottery amongst the singles is due to the fact, that no representative sample choice of Syrian-type pottery was intended for this analysis project. The sample choice of Syrian pieces depended first of all upon macroscopic comparability with the presumed local Mycenaean pottery and the HMB ware (mainly regarding the inclusions), in order to find potential chemical matches for constructing reference groups and thus defining the local production of Tell Kazel. Second, some samples were taken from fabrics, the vessels of which show mixed Mycenaean and Syrian typological traits. These samples were equally thought to be potential reference pieces for local production, if matches with the local Mycenaean pieces could be found.

Conclusions

The results of chemical and petrographic analyses allow some interesting conclusions regarding pottery import and consumption at Tell Kazel in the Syrian kingdom of Amurru. During LB II Mycenaean pottery was mainly imported from the Argolid, namely from the workshops in the region of Mycenae. This confirms the observations based on the macroscopic analysis of fabrics and typology. More specifically, we note that the Argive imports include both, Hellado-Mycenaean and Levanto-Mycenaean, classes of pottery and all pictorial fragments which have been sampled (except for the Pastoral Style piece). Thus, the image of an export-oriented pottery industry controlled by Mycenae and working for the Levant and Cyprus is confirmed more and more – now also with regard to Tell Kazel.[69] Moreover, the strong Argive connection of Tell Kazel is also interesting in the light of written evidence for trade relations between Amurru and the (Mycenaean) kingdom of Ahhiyawa during the 13th century BC.[70] Towards the end of LB II, these Argive imports ceased. They could not be substituted in quantity by Mycenaean pottery imports from other regions in the Aegean. However, it is noteworthy that in the destruction layer dated to the transition from LB II to IA I there are some imports of Mycenaean-type pottery from the west coast of Asia Minor[71] and Cyprus. At about the same time local Mycenaean pottery production and production of handmade burnished ware (HMB) commenced in the Akkar Plain. For the two different fabrics of Grey Ware found at Tell Kazel more stratigraphic research is necessary before it is possible to say, if and when the Grey Ware imported from Troy was substituted by the second Grey Ware fabric of so far undetermined provenance.

APPENDIX: A NEW PROVENANCE GROUP OF POTTERY PRODUCED AT EPHESUS

By Michael Kerschner

The NAA of the fragment TK 69, belonging to a Mycenaean belly-handled amphora or hydria, resulted in the as yet unpublished element pattern EPHX that has already turned up among analysed vessels found in the East Aegean.[72] At the present stage of our research, the provenance

[69] Transshipment was organized via the harbour site of Tiryns, see Jung, in press b.

[70] For a discussion of that written evidence see Jung, in press b.

[71] This may coincide with the well-known import of pictorial pottery of south-east Aegean style to Ugarit, cf. J.-C. Courtois 1973: 149–165, pl. 21.3, 4; J.-C. Courtois and L. Courtois 1978: 318f. fig. 41.1–2; p. 334 fig. 47.9; p. 346–350 fig. 54.1; 54.A–C; J.-C. Courtois 1990: 134–139.

[72] The analyses discussed here have been conducted in the course of a joint archaeometric project at the pottery centres of the East Aegean by the Helmholtz-Institut für Strahlen- und Kernphysik der Universität Bonn and the Austrian Archaeological Institute in Vienna launched in 1997. The archaeologists taking part are: M. Akurgal (İzmir), R. Attula (Greifswald), T. Bakır (İzmir), M Berg Briese (Odense), G. Gürtekin-Demir (İzmir), M. Frasca (Catania), C.H. Greenewalt, Jr. (Berkeley), W.-D. Niemeier (Athens), R. Posamentir (İstanbul) and U. Schlotzhauer (Berlin). The results so far have been published in: Akurgal *et al.* 2002; Kerschner *et al.* 2002.

group EPHX[73] comprises eight specimens, including TK 69. Apart from the latter, all the other pieces were found at Ephesus. They cover a time-span of more than one thousand years, from the Late Bronze Age (TK 69) to the Late Hellenistic period (Ephe 29[74]), including examples of the Protogeometric (Ephe 178, an amphora with concentric circles, unpublished), Geometric (Ephe 7; Ephe 15[75]; Ephe 205, a pendant semi-circle skyphos, unpublished) and Archaic epochs (Ephe 181, a dish with meander hooks on the rim; Ephe 207, a cup with everted rim, both unpublished). This means that potters used the same clay bed(s) from the 13th to the end of the 2nd/2nd half of the 1st century B.C. without a fundamental change in their way of processing the raw clay. One sherd of the provenance group EPHX, Ephe 29, was part of the original fill of a Late Hellenistic potters' kiln excavated by S. Ladstätter below Terrace House II.[76] Since the 131 miniature vessels of this *in situ* deposit, including Ephe 29, were still being fired by the time the kiln was abandoned, there can be no doubt that they are of local origin, assigning the provenance group EPHX to Ephesus. It is an interesting result of the NAA that the three analysed miniature vessels Ephe 28–30, although of the same shape and fired in the same kiln, were made of different fabrics. Ephe 29 belongs to provenance group EPHX, whereas Ephe 30 shows another Ephesian element pattern, named EPHH, with Ephe 28 still a chemical loner.[77] There is, however, a comparable case of a kiln filled with vessels made of different clay pastes and paste mixtures.[78] From the Aegean viewpoint, the attribution of TK 69 to the Ephesian provenance group EPHX is of key importance. It is original proof that painted pottery of Mycenaean style had been produced in Ephesus. At first sight, this result might seem astonishing since recent research has shown that in the 2nd millennium B.C. Ephesus was not a Mycenaean site like e.g. Miletus,[79] but is highly probably identifiable with Apasa, the capital of the Luwian kingdom of Arzawa.[80] It will be an important point of debating and for future research in Ephesus to define the ethnic and cultural identity of Apasa and to investigate the degree to which its material culture exhibits Mycenaean features.

4. List of samples and fabric descriptions

Sample no.	Sherd no.	Type and Description	Fabric	NAA group (indiv.fit factor)	Petrofabric	Fig.
TK 1	4281.12, 4283.9 + 5447.2,4,5, 4634.58, 5447.3	Mycenaean animal head rhyton	M 16	MYBE (0.96)	–	Jung, in press b, fig. 11.45
TK 2	5062.46 + 5113.127	Mycenaean mug	M 16	MYBE (0.96)	–	Fig. 2.1
TK 3	4290.20, 4477.14	Mycenaean kylix with fish and hybrid flower motif	M 10	MYBE (1.16)	–	Jung, in press b, fig. 2.4
TK 4	6035.9 + 6302.5, 6302.2, 6302.3, 6302.4, 6302.6, 6302.7, 6302.8	Mycenaean amphoroid krater with chariot representation	M 13	MYBE (1.03)	Fine	Jung, in press b, fig. 6.18

73 The different provenance groups have been named with a capital letter in their order of first appearance in our anaylses. As a result, the position of the letters in the alphabet have no other significance.

74 M. Kerschner in: Akurgal *et al.* 2002: 115 cat. no. 102 pl. 8. At that time, this piece was still a chemical loner.

75 M. Kerschner in: Akurgal *et al.* 2002: 98 cat. no. 18 pl. 1 (Ephe 7); 106 cat. no. 57 pl. 4 (Ephe 15). At that stage of our investigation, Ephe 7 had been assigned to, and Ephe 15 tentatively connected with what was then still a small Aeolian provenance group EPHG. This provenance group has, however, been re-defined on the basis of some 70 new pieces in the course of our recent research, cf. H. Mommsen in: Kerschner *et al.* 2002: 189–193; the contributions of M. Kerschner and H. Mommsen in press.

76 Schretter 1997; Ladstätter 1998; eadem in: Akurgal *et al.* 2002: 117–119; cf. Wiplinger 1997: 76 fig. 2.

77 M. Kerschner in: Akurgal *et al.* 2002: 47–50. 115 cat. no. 101. 103 pl. 8.

78 Schwedt and Mommsen 2004 (Roman potters' kilns excavated in Bonn).

79 B. Niemeier and W.-D. Niemeier 1997: 244–246; W.-D. Niemeier 1998: 30–34.

80 Hawkins 1998: 1. 22; W.-D. Niemeier 1998: 40–41; Büyükkolanci 2000: 39–43; W.-D. Niemeier in: Akurgal *et al.* 2002: 60–62; Kerschner, in press. The identification of Apasa with Ephesus was first proposed by Garstang and Gurney 1959: 84. 88–89.

Sample no.	Sherd no.	Type and Description	Fabric	NAA group (indiv.fit factor)	Petrofabric	Fig.
TK 5	5374.79 + 5419.21	Mycenaean conical stirrup jar with flower motives on shoulder and chevron between lines	M 10	MYBE (1.02)	Fine	Jung, in press b, fig. 9.32
TK 6	4127.2,3	Mycenaean shallow bowl with fish motif	M 13	MYBE (0.97)	–	–
TK 7	1224.11 + 1394.68,71 + 1755.5 + 2026.45, 1394.48 + 1754.1, 1394.47 + 1757.25	Mycenaean globular stirrup jar with v-pattern on shoulder	M 10	MYBE (0.98)	Fine	Jung, in press b, fig. 8.27
TK 8	6452.9A, 6452.9B, 6452.9C	Mycenaean squat stirrup jar	M 22	MYBE (1.12)	Fine	Jung, in press b, fig. 7.26
TK 9	4021.30 + 4782.34 + 4978.119 + 5212.117,123, 4978.105,107	Mycenaean spouted basin	M 1a	TKaA (1.02)	Calcareous	Jung, in press b, fig. 16.73
TK 10	4978.37, 4978.61,81	Mycenaean unpainted carinated kylix	MU 1	TKaA (1.05)	Calcareous	Jung, in press b, fig. 14.55
TK 11	4978.36, 4978.82	Mycenaean unpainted carinated kylix	MU 1	Single, near TKaA	–	Jung, in press b, fig. 14.56
TK 12	4978.63, 4978.64, 4978.83	Mycenaean unpainted carinated kylix	MU 1	TKaA (1.00)	–	Jung, in press b, fig. 14.57
TK 13	5055.161	Mycenaean conical rhyton	M 13	MYBE (0.99)	–	Jung, in press b, fig. 10.41
TK 14	5287.1A, 5287.1B	Mycenaean kylix with whorl-shell group	M 15	MILD	–	Jung, in press b, fig. 13.51
TK 15	5016.17, 5387.5, 5751.25, 6076.13	Mycenaean small open vessel	M 15	similar CYPI	–	Jung, in press b, fig. 13.52
TK 16	6472.8A, 6472.8B	Mycenaean deep bowl A with stroke motif on interior rim	M 1	TKaA (1.04)	Calcareous	Jung, in press b, fig. 15.63
TK 17	1930.90	Mycenaean deep bowl A	M 8	MYBE (0.94)	–	Jung, in press b, fig. 19.89
TK 18	2026.6,11,16	Mycenaean stirrup jar with flower motif	M 10	MYBE (0.94)	–	–
TK 19	5719.6, 5719.70.72 + 5720.77 + 5721.39	Mycenaean small piriform jar (wall fragment)	M 8	MYBE (0.93)	–	Jung, in press b, fig. 9.31
TK 20	4215.1	Mycenaean Simple Style stirrup jar (wall fragment)	M 7	assoc. CYPH	–	–
TK 21	4189.6,11	Mycenaean amphoroid krater with chariot representation	M 13	MYBE (0.98)	–	Jung, in press b, fig. 5.16
TK 22	–	Mycenaean large stirrup jar	M 10	MYBE (1.00)	–	–
TK 23	5622.3	Mycenaean stirrup jar with flower motif	M 12	MYBE (0.97)	–	–
TK 24	5422.11	Mycenaean conical rhyton with triglyph motif	M 13	MYBE (0.98)	–	Jung, in press b, fig. 10.38
TK 25	4427.1	Mycenaean conical rhyton	M 10	MYBE (0.96)	–	Jung, in press b, fig. 10.40
TK 26	6304.9	Mycenaean conical rhyton	M 11	TKaF (1.04)	–	–
TK 27	4122.6, 4122.8 + 4303.16	Mycenaean conical rhyton with palm II motif	M 10	MYBE (0.94)	–	Jung, in press b, fig. 11.43
TK 28	4616.28, 5082.50 + 5094.225, 5422.11	Mycenaean conical rhyton with bivalve shells and octopuses	M 11	TKaF (0.96)	–	Jung, in press b, fig. 10.39
TK 29	4270.17 + 5257.23	Cypro-Mycenaean Pastoral Style krater	M 20	Single	–	Jung, in press b, fig. 19.86
TK 30	4103.3	Mycenaean straight-sided alabastron	M 10	MYBE (1.01)	–	–
TK 31	4303.38,46, 4303.39,47, 4314.12	Mycenaean straight-sided alabastron	M 10	MYBE (0.97)	Fine	–
TK 32	5212.54	Syrian painted krater (shape shows Mycenaean inspiration)	S 1	TKaD (1.00)	IRF/Chert Sand	Fig. 5.1

Sample no.	Sherd no.	Type and Description	Fabric	NAA group (indiv.fit factor)	Petrofabric	Fig.
TK 33	5055.42	Mycenaean shallow cup with spiral motif	M 8	MYBE (0.95)	–	–
TK 34	TK 91.103	Mycenaean shallow cup with linear decoration	M 10	MYBE (0.95)	–	Jung, in press b, fig. 7.21
TK 35	6388.1	Large ring base of Mycenaean open vessel	M 10	MYBE (1.03)	–	Jung, in press b, fig. 4.15
TK 36	2067.25 + 2073.5 + 2091.4	Mycenaean pilgrim flask, horizontal type	M 13	MYBE (0.96)	–	–
TK 37	TK 97, unstratified	Mycenaean pilgrim flask, vertical type	M 13	assoc. MYBE (0.98)	–	Fig. 2.3
TK 38	4229.8	Mycenaean amphoroid krater, rim fragment	M 13	MYBE (1.04)	–	–
TK 39	4792.3	Mycenaean vessel with base of handle	M 1a	Single, near TKaD	IRF/Chert Sand	–
TK 40	4784.2	Ring base of Mycenaean vessel	M 6	Single	–	–
TK 41	6158.1	Mycenaean ring base with in ring on interior	M 1	TKaA (0.95)	Calcareous	Jung, in press b, fig. 17.81
TK 42	5269.9	Mycenaean amphoroid krater with flower motif	M 13	MYBE (1.00)	–	–
TK 43	4229.5	Mycenaean amphoroid krater with representation of humans	–	MYBE (1.06)	–	–
TK 44	5015.4	Mycenaean amphoroid krater with representation of horse	M 10	MYBE (1.04)	–	Fig. 2.5
TK 45	4866.2	Mycenaean amphoroid krater with representation of horse	M 12	MYBE (1.04)	–	Fig. 2.4
TK 46	2071.5	Mycenaean amphoroid krater with representation of sphinx (?)	M 22 (not entirely certain)	MYBE (1.09)	–	–
TK 47	5748.4	Mycenaean torus base, probably of an amphoroid krater	M 12	MYBE (1.12)	Fine	–
TK 48	1394.67, 1882.42	Mycenaean amphoroid krater with octopus	M 13	MYBE (0.95)	–	Jung, in press b, fig. 6.17
TK 49	4769.1	Mycenaean unpainted carinated kylix	MU 1	TKaA (1.01)	Calcareous	–
TK 50	1047.39	Neck fragment of Mycenaean closed vessel	M 19	MYBE (1.03)	–	–
TK 51	4616.31 + 5079.112E + 6381.7, 4616.32 + 5079.112A, 5079.71, 5079.112C, 5079.112D, 5082.51	Mycenaean kylix with vertical whorl-shells	M 11	MYBE (1.00)	–	Jung, in press b, fig. 3.8
TK 52	1382.15	Foot of Mycenaean chalice (?)	M 10	MYBE (1.00)	–	–
TK 53	5607.2	Mycenaean deep bowl A	M 2	TKaG (0.97)	Fine Serpentinite	Fig. 6.1
TK 54	1014.5	Mycenaean deep bowl A	M 2	TKaG (1.03)	Fine Serpentinite	Fig. 6.2
TK 55	6343.44	Grey Ware deep bowl	G 1	TKaC (1.04)	–	Fig. 7.1
TK 56	6343.40, 6343.3	Handmade burnished pot with vertical plastic rib	HMB	Single	HMB	Fig. 9.5
TK 57	6343.42 (probably from the same vessel: 6343.4)	Handmade burnished pot (according to the second fragment with horizontal plastic rib)	HMB	Single	HMB	–
TK 58	6343.10, 6343.41	Base of handmade burnished vessel	HMB	TKaB (0.95)	HMB	–
TK 59	6343.43	Handmade burnished vessel	HMB	TKaJ (1.01)	HMB	–
TK 60	5042.50	Handmade burnished storage vessel	HMB	TKaI (1.02)	HMB	Fig. 9.1

Sample no.	Sherd no.	Type and Description	Fabric	NAA group (indiv.fit factor)	Petrofabric	Fig.
TK 61	5289.5	Handmade burnished vessel	HMB	TKaB (1.05)	–	Fig. 9.3
TK 62	6343.45	Grey Ware open carinated vessel	G 1	TKaC (0.96)	–	Fig. 7.2
TK 63	5263.13	Base of Mycenaean unpainted carinated kylix	MU 1	TKaA (1.12)	Calcareous	–
TK 64	4978.65, 4978.68	Mycenaean unpainted conical kylix	MU 1	TKaA (0.97)	–	Jung, in press b, fig. 14.54
TK 65	4623.126	Grey Ware krater with multiple wavy-line motif	G 2	TKaH (1.01), similar TRO-B	–	–
TK 66	6025.37	Grey Ware krater rim with wavy-line motif	G 2	TKaH (0.98), similar TRO-B	–	Fig. 7.3
TK 67	5125.6 + 5408.17, 6982.2	Mycenaean squat stirrup jar with flowers and wavy line	M 11	MYBE (1.00)	–	–
TK 68	4978.139	Mycenaean Simple Style stirrup jar (wall fragment)	M 7	assoc. CYPH	–	Fig. 8.2
TK 69	1972.1 + 4978.38D, 4197.33 + 4978.38C,106,113, 4707.127, 4978.35, 4978.38B	Mycenaean belly-handled amphora or hydria	M 17	EPHX	Micaceous	Jung, in press b, fig. 13.53
TK 70	6339.1A–D	Mycenaean krater with octopus motif	M 10	MYBE (0.91)	–	Jung, in press b, fig. 4.12
TK 71	5087.49.50	Mycenaean closed vessel with lozenge chain	M 14	CYPh	–	Fig. 8.3
TK 72	6421.1 + 6652.14	Mycenaean chalice with procession scene	M 10	assoc. MYBE (1.12)	–	Jung, in press b, fig. 7.19
TK 73	6407.8	Large Mycenaean closed vessel	M 1a	assoc. TKaD (0.86)	–	–
TK 74	1390.76	Mycenaean Simple Style stirrup jar (wall fragment)	M 21 (not entirely certain)	Single	Quartz Sand	Fig. 8.1
TK 75	4661.5a, 4661.13	Syrian unpainted bowl	MU 1	TKaD (0.96)	IRF/Chert Sand	Fig. 4.5
TK 76	1963.76	Mycenaean deep bowl A with stroke motif on interior rim and with wavy-line motif	M 1	TKaA (0.95)	Calcareous	Jung, in press b, fig. 15.64
TK 77	1963.96	Mycenaean deep bowl A	M 1a (not entirely certain)	Single	–	–
TK 78	5263.11	Mycenaean deep bowl A	M 1	TKaA (0.95)	–	Jung, in press b, fig. 17.78
TK 79	4237.7	Mycenaean concave base with ring on interior	M 1	TKaA (1.04)	Calcareous	–
TK 80	4751.7	Mycenaean deep bowl A with stroke motif on interior rim	M 1	TKaA (0.99)	–	–
TK 81	4299.51	Mycenaean ring base with decoration underneath	M 1	TKaA (0.93)	–	–
TK 82	4135.2	Mycenaean concave base	M 1	TKaA (0.97)	–	–
TK 83	5205.62, 5205.63,65,66, 5205.64, 5205.67, 5205.68, 5205.69	Closed Proto White-Painted vessel	M 9	assoc. CYPH	–	Jung, in press b, fig. 19.88
TK 84	5251.12.18–21	Syrian Closed Bowl XIX.4	Syrian, unpainted	Single	Calcareous	–
TK 85	4388.5	Syrian Closed Bowl X.1	Syrian, with a white slip	TKaD (1.02)	IRF/Chert Sand	Fig. 4.3
TK 86	4021.6	Syrian Closed Bowl IX.4a	close to MU 1, but more coarse	TKaA (0.97)	Calcareous	Fig. 4.1

Sample no.	Sherd no.	Type and Description	Fabric	NAA group (indiv.fit factor)	Petrofabric	Fig.
TK 87	5748.6	Syrian Closed Bowl IX.4e	Syrian, unpainted	TKaI (0.98)	Single	Fig. 9.2
TK 88	6210.12	Syrian Straight Bowl XIX.11	Syrian, unpainted	Single	Single	–
TK 89	1054.12	Syrian Straight Bowl XIX.2	Syrian, unpainted	Single	Calcareous	–
TK 90	5097.104	Syrian Jar V.6f	Syrian, unpainted	TKaD (1.06)	IRF/Chert Sand	Fig. 4.4
TK 91	5095.12	Syrian tall base	Syrian, unpainted	Single	Single	–
TK 92	5277.15	Syrian Jug II.1 (trefoil-mouthed jug)	Syrian, unpainted	TKaD (0.89)	IRF/Chert Sand	Fig. 4.2
TK 93	5512.114	Syrian Plate 31,1i	Syrian, unpainted	Single	Single	–
TK 94	4487.344	Syrian Plate 18.14	Syrian, unpainted	Single	Single	–
TK 95	4971.7	Syrian Cooking Pot V.7a	Syrian, unpainted	Single	Basalt	Fig. 3
TK 96	4975.1a–b,3a–b	Syrian Bichrome skyphoid krater (shape shows Mycenaean inspiration)	B 2	Single	Quartz Sand	Fig. 8.5
TK 97	6652.1 + 6689.52 (TK 03.143)	Grey Ware kylix	G 2	TKaH (1.01), similar TRO-B	–	Fig. 7.4
TK 98	5273.7	Syrian unpainted three-handled piriform jar (shape shows Mycenaean inspiration)	S 2	TKaD (1.05)	IRF/Chert Sand	Fig. 5.2
TK 99	4978.80,84	Mycenaean unpainted carinated kylix	MU 1	TKaA (1.03)	Calcareous	Jung, in press b, fig. 14.60
TK 100	6704.93A.B.C + 6711.15B, 6704.93, 6704.93E, 6711.15A.C, 6707.1, 6713.1	Mycenaean amphoroid octopus krater	M 11	MYBE (1.06)	–	–
TK 101	6343.9	Handmade burnished pot with vertical handle and carination	HMB	TKaJ (0.99)	–	Fig. 9.4
TK 102	6343.47	Base of handmade burnished pot	HMB	TKaB (1.06)	–	–
TK 103	6343.50	Base of handmade burnished pot	HMB	TKaK (1.00)	–	–
TK 104	6343.49	Base of handmade burnished pot	HMB	TKaK (1.00)	–	–
TK 105	6343.48	Base of handmade burnished pot	HMB	TKaB (0.95)	–	–
TK 106	6689.1A, 6689.1B	Mycenaean kylix of Zygouries type	M 10	MYBE (1.00)	–	–
TK 107	6367.31A	Mycenaean torus base of a small closed vessel	M 7	assoc. CYPH	–	Fig. 8.4
TK 108	6676.1	Mycenaean conical rhyton	M 16	MYBE (0.95)	–	Fig. 2.2
TK 109	6304.96,98	Mycenaean large closed vessel, probably early or middle Mycenaean (LH II–IIIA1) or Minoan	M 24	Crete or Boeotia?	–	–
TK 110	4977.6	Mycenaean wall fragment (probably from a deep bowl A)	M 1	–	IRF/Chert Sand	–
TK 111	6460.1A–F	Mycenaean amphoroid krater (wall sherd of lower part)	M 13	–	Fine	–
TK 112	4197.16	Mycenaean bowl with thickened rim	M 1a	–	Calcareous	–
TK 113	4799.34	Mycenaean deep bowl A	M 21	–	Quartz Sand	Jung, in press b, fig. 17.77

Fabric descriptions have been given in the main publication of Mycenaean pottery found at Tell Kazel.[81] Fabrics that do not appear in that article are included in the following list:

M 2. Fired hard – clinky hard. – Surface not smoothed, fine wheel-marks clearly visible. – Solid cover of dull paint. – Colour of paint 10YR 4/2 (dark grayish brown) to 3/1 (very dark gray), 2.5YR 4/4 (reddish brown); colour of surface 2.5Y 6/3 (light yellowish brown), 10YR 6/4 (light yellowish brown); colour of break 10YR 7/3 (very pale brown). – Moderate amount of inclusions; size from fine to middle and coarse (white particles).

M 6. Fired hard. – Surface irregularly burnished with some hard tool. – Paint dull; solid cover to diluted. – Colour of paint 2.5YR 4/4 (reddish brown), 4/6 (red); colour of surface 10YR 5/4 (yellowish brown); colour of break 10YR 5/3 (brown). – Moderate amount of inclusions; size middle (to coarse) (white particles).

M 14. Fired hard. – Surface well smoothed, probably covered with self slip. – Paint dull to slightly shiny; mainly solid cover, but also diluted with brush marks. – Colour of paint 10YR 4/3 (brown), 3/2 (very dark grayish brown); colour of surface 10YR 8/2 (very pale brown); colour of break like colour of surface. – Very small amount of inclusions; coarse to very coarse white particles.

M 19. Fired clinky hard. – Surface wet-smoothed, smoothing traces partly visible. – Paint dull to slightly shiny; solid cover to diluted with brush marks. – Colour of paint 5YR 4/4 (reddish brown), 5YR 3/3 (dark reddish brown); colour of surface 10YR 7/3 (very pale brown); colour of break like colour of surface. – Moderate amount of inclusions; size fine (very small amount of mica), middle – coarse (white particles).

M 24. Fired soft, but slip and paint hard. – Surface slipped; no wheel-marks visible. – Paint dull to slightly shiny; solid cover or solid cover with brush-marks. – Colour of paint 10YR 3/1 (very dark gray), 3/2 (very dark grayish brown), black; colour of slip approx. 10YR 8/3 (very pale brown); colour of break 2.5Y 7/3 (pale yellow). – Large amount of inclusions; size from fine to middle and coarse (white and dark particles).

B 2. Fired hard. – Surface smoothed; wheel-marks and smoothing marks visible – Dull paint; solid cover to diluted. – Paint colours: a) black, b) greyish red – 2.5YR 5/3–5/4 (reddish brown); colour of surface 10YR 6/4 (light yellowish brown); colour of break 10YR 7/3 (very pale brown). – Large amount of inclusions; size mainly fine to middle, few coarse (mainly black particles, but also white ones).

S 1. Fired hard. – Surface covered with thick whitish-buff slip. – Dull paint; solid cover, in places diluted. – Colour of paint 10R 3/4 (dusky red), 4/6 (red); colour of slip whitish buff; colour of break 7.5YR 6/4 (light brown), 5YR 4/3 (reddish brown). – Large amount of inclusions; size middle to coarse (white particles), some very coarse (quartz).

S 2. Red burnished fabric, unpainted. – Fired rather soft. – Surface irregularly burnished with some hard tool; burnishing marks clearly visible. – Colour of surface 5YR 4/6 (yellowish red); colour of break on the edges reddish brown, very wide grey core. – Large amount of inclusions; size middle to very coarse (black particles [basalt?], few white particles, red particles); handles with straw.

G 1. Fired hard. – Surface slipped? Burnished with some hard tool – mainly parallel to the rim, but in places also irregularly: shiny appearance. – Colour of burnished surface dark grey–2.5N (black); colour of break 10YR 8/2 (very pale brown) to 8N (white). – Small amount of inclusions; size from middle to coarse (white particles), in places very coarse (white particles).

G 2. Fired hard. – Surface covered with a thick slip, which is polished: shiny appearance. – colour of polished surface 5N (gray)–4N (dark gray)–3N (very dark gray); colour of break light grey, slightly darker core – 7N (light gray). – Moderate amount of inclusions; size from fine to middle (mica: mainly silver, in places gold), middle to coarse (white particles).

[81] Jung, in press b. Fabric descriptions largely follow the guidelines established by Schneider *et al.* 1989. Colours were determined using a Munsell Soil Color Chart (2000 edition). – Abbreviations used for fabric categories include M = fabrics of painted Mycenaean type vessels; MU = fabrics of unpainted Mycenaean-type vessels; S = fabrics of vessels with mixed Syrian and Mycenaean typological characteristics; B = bichrome painted fabrics; G = Grey Wares.

HMB. Fired not very hard – hard. – Surface often burnished with some hard tool – parallel to the rim; if vertical rib is present, then also vertically burnished; quality of burnishing is of great variety – sometimes densely burnished, sometimes with wide gaps between the burnishing marks. – Colour of surface 10YR 3/1 (very dark grey), 3/2 (very dark grayish brown), 5YR 4/3, 4/4 (reddish brown), black (irregular colour), 10YR 5/4 (yellowish brown), 4/3 (brown). – Large amount of inclusions; size middle – very coarse (white particles), few very coarse quartz particles.

Description of sampled vessels of Syrian type

TK 84. Fired very hard, clinky hard. – Surface irregularly burnished with some hard tool, parallel to the rim – in between of the burnishing marks wheel-marks visible. – Colour of surface 7.5YR 5/3 (brown), 10YR 6/4 (light yellowish brown), 3N (very dark gray); colour of break 3N (very dark gray). – Large amount of inclusions; size from middle to coarse (white particles).

TK 85. Fired very hard. – Surface covered with thick white slip. – Colour of interior (unslipped) surface approx. 10YR 6/4 (light yellowish brown), 6/3 (pale yellow); colour of break as colour of surface. – Very large amount of inclusions; size from fine to coarse (mainly red-brown particles, few white ones).

TK 86. Fabric very similar to MU 1, but with more inclusions.

TK 87. Fired hard. – Surface smoothed on the exterior, but not on the interior. – Colour of surface 5YR 5/3 (reddish brown), 4/1 (dark gray), 4/2 (dark reddish gray); colour of break 2.5YR 5/8 (red), core grey. – Large amount of inclusions; size from fine to coarse (mainly white particles, few coarse black ones).

TK 88. Fired hard. – Surface not smoothed. – Colour of surface and break 7.5YR 5/4 (brown), 10YR 5/4 (yellowish brown). – Large amount of inclusions; size from fine to very coarse (white particles); fine to middle, in places coarse (black particles), few coarse quartz.

TK 89. Fired hard. – Surface carelessly wet-smoothed, in places not smoothed at all. – Colour of surface 10YR 5/3 (brown); colour of break 10YR 5/4 (yellowish brown), wide grey core. – Large amount of inclusions; size from fine to very coarse (white particles, few coarse quartz).

TK 90. Fired hard. – Surface wet-smoothed, but wheel-marks still visible. – Colour of surface and break 7.5YR 5/4 (brown). – Large amount of inclusions; size from fine to coarse (white particles and red-brown ones).

TK 91. Fired hard. – Surface not smoothed at all, wheel-marks visible. – Colour of surface and break approx. 7.5YR 4/4 (brown). Large amount of inclusions; size from fine to coarse (white particles, red-brown particles).

TK 92. Fired clinky hard. – Surface seemingly not treated at all. – Colour of surface 10YR 6/4 (light yellowish brown); colour of break approx. 10YR 4/1 (dark gray), 5/1 (gray). – Large amount of inclusions, size from middle to coarse (white particles, fewer middle dark particles).

TK 93. Fired hard. – Surface on the exterior wet-smoothed, on the interior burnished with some hard tool (Shiny effect, burnishing marks visible). – Colour of surface approx. between 7.5YR 5/4 (brown) and 10YR 5/4 (yellowish brown); colour of break like colour of surface, but with thin grey core. – Moderate to large amount of inclusions; size from fine to coarse (white and dark particles, coarse quartz).

TK 94. Fired hard. – Surface burnished in an irregular way, but mainly parallel to the rim (shiny appearance), burnishing marks visible. – Colour of surface 10YR 4/3 (brown); colour of break like colour of surface, but with grey core. – Moderate (to large) amount of inclusions; size from fine to middle, in places coarse (black particles, fewer white ones).

TK 95. Fired hard. – Surface carelessly smoothed, wheel-marks visible in many places. – Colour of surface 10YR 4/1 (dark gray), 4/2 (dark grayish brown), 5YR 4/3 (reddish brown); break has a very wide grey core. – Large amount of inclusions; size from fine to coarse, in places very coarse (white particles).

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