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Eretrian ceramic production through time: Geometric to Hellenistic periods

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ABSTRACT

Eretria, in the centre of the Aegean (Greece), has been the focus of an interdisciplinary programme that combines macroscopic, petrographic and elemental analysis in a diachronic investigation of pottery production and supply on the site from the early third millennium (Early Bronze Age) to the end of the first millennium BCE (Hellenistic period). This paper reviews the preliminary results of the analyses of the pottery of historical times, mainly from the Geometric to the Hellenistic periods (phase II of the Eretria pottery project). It presents the compositional and technological characteristics of the local fabrics and offers examples of how continuity and innovation characterise different aspects of Eretria's pottery production. In addition, different categories of imported vessels that arrived in Eretria are investigated in order to recognize the origin of these specific products.

1. Archaeological context[1]

Eretria, a coastal site on Euboea in the centre of the Aegean (Greece) (Fig. 1), has been the focus of an interdisciplinary programme that combines macroscopic with petrographic and elemental (chemical) analysis towards a diachronic investigation of pottery production and supply at the site from the early third millennium (Early Bronze Age) to the end of the first millennium BCE (Hellenistic period).

The main objective is to characterise, both compositionally and technologically, local production, tracing variations and changes in local craftsmanship over time. Moreover, in order to define better the characteristics of local tradition(s) in relation to those of neighbouring areas (in Euboea, Boeotia and Attica), pottery samples of possible regional style were included.

The current research has begun to shed light on many phases of Eretria's past. During the third millennium BCE, and mainly in Early Bronze II, Eretria represents a key area for understanding cultural transmission between the Aegean and Anatolia but also between the islands and the mainland (see Charalambidou et al., 2016; Müller Celka et al., in press). During the Mycenaean period archaeological evidence is scarce. The first centuries of the Early Iron Age are hardly known at Eretria with some exceptions, such as the 9th-century BCE (Subprotogeometric II) warrior burial in the vicinity of the later sanctuary of Apollo Daphnephoros (Blandin, 2007, vol. II, 91–92, pls. 163–166; Verdan, 2013, vol. II, 8, pl. 58). On the other hand, there is rich evidence for occupation in the 8th century BCE from domestic buildings (Mazarakis Ainian, 1987), burial grounds (Blandin, 2007) and cult sites, most importantly the Apollo Daphnephoros sanctuary (Verdan, 2013) and the Northern Sacrificial area (Huber, 2003) (more recently a synopsis of Early Iron Age-Early Archaic evidence: Charalambidou, 2017; in press). In the 8th century BCE, Eretria becomes one of the major actors in Greek colonisation in northern Greece and southern Italy (Descoeudres, 2006–2007; Charalambidou, in press; Malkin, in press).

During the 7th century BCE, at some Euboean sites, there is noticeable shrinkage (such as in Eretria: evidence from the settlement and burials is less than in the 8th century BCE) or even abandonment (in Lefkandi, which is reported to have been abandoned ca. 700 BCE, see e.g. Lemos, 2012, 159). The phenomenon is often attributed to repercussions from the so-called Lelantine war (Hall, 2006, 1–8). In the 6th century BCE Eretria expands all over the *intra muros* area and the city flourishes until its partial destruction by the Persian army in 490 BCE. The 5th century BCE was marked by a fluctuating relationship

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[1] Abbreviations used in this article. *Chronological abbreviations*: G: Geometric; MG: Middle Geometric; LG: Late Geometric; A: Archaic; EA: Early Archaic; LA: Late Archaic; Cl: Classical; H: Hellenistic; R: Roman. *Other*: HaM: handmade; WhM: wheel-made; FG: Fabric Group; ESAG: École suisse d'archéologie en Grèce/Swiss School of Archaeology in Greece; CNRS: Centre national de la recherche scientifique/French National Centre for Scientific Research.

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Fig. 1. Map of Euboea with Eretria among other important sites on the island. Courtesy of the Swiss School of Archaeology in Greece.

with the nearby metropolis of Athens, with conflicts and treaties succeeding each other. It is difficult to estimate the effect these events may have had on commerce and artisanship; importation of Athenian pottery does not seem to have abated at any point. The prosperity Eretria enjoyed in the Classical and Early Hellenistic periods is reflected in its art and architecture, as evidenced, for example, by the Late Classical House of the Mosaics (Ducrey et al., 1993). During the Late Hellenistic period (2nd and 1st centuries BCE), Eretria declined slowly (Ducrey et al., 2004; Martin-Pruvot et al., 2010).

2. Aims and objectives

The current research is part of an ongoing collaboration between the Swiss School of Archaeology in Greece, the Fitch Laboratory of the British School at Athens and the French National Centre for Scientific Research, that has been set up and coordinated by S. Müller Celka and that started with the characterisation of the Bronze Age pottery from Eretria (Charalambidou et al., 2016; Müller Celka et al., in press). It aims to investigate diachronically pottery production and supply in Eretria, in the Bronze Age and in historical times – from the Geometric to the Hellenistic period – and to explore Eretria's connectivity in the context of local and regional networks. Our interdisciplinary approach integrates the traditional archaeological study of ceramics with petrographic and elemental analysis, refiring tests, investigation of local resources and processing of sediments from the vicinity of the site, so as to understand the development of the urban landscape of Eretria through its pottery production in different periods of the site's history. The diachronic study of ceramic landscapes is an approach that has been followed in many of the Fitch Laboratory's recent projects (Kiriatzi, 2003; Gauss and Kiriatzi, 2011; Kiriatzi et al., 2012).

Research has focused on:

- the identification, sampling and characterisation of potential raw materials in the vicinity of the site, and
- the examination of the ceramic fabrics macroscopically defined as local in order to confirm and further characterise, compositionally and technologically, assumed local Eretrian ceramic production and trace continuity and changes in local craftsmanship over time. The development of local pottery tradition is examined in relation to the attested continuities and breaks in the history of the site during these centuries, which in turn mark changes in the role Eretria played in socio-economic processes in the Aegean and the Mediterranean.

On top of the 164 pottery samples already analysed from the Bronze Age phases (Charalambidou et al., 2016; Müller Celka et al., in press), a total of 170 ceramic samples were selected from stratified domestic, ritual and funerary deposits dated mainly from the Geometric to the Hellenistic periods. Ceramic samples are compared to samples of geological materials, including both hard rocks and loose sediments, as well as to samples associated with direct evidence for pottery production (i.e. lining of potter's kiln, kiln supports). The current article summarises the preliminary results of the analyses of the pottery from

Table 1
Summary of the basic archaeological information for the macroscopic groups (see abbreviations in note 1).

Date	Macroscopic group	Ware/vessel type	Frequency	Number of samples
MG II–LG I	G-G1	Coarse HaM pithos, pithoid jar and basins/lekanae	Low	5
MG II–LG I	G-SG1	Cooking ware	High	5
MG II–LG II	G-SG2	Coarse HaM cooking ware and one storage vessel	Medium	5
LG I–LG II	G-SG3	Coarse HaM plain ware (some vessel types are unidentified)	Low	5
MG II–LG I	G-F1a	Fine WhM table ware (drinking vessels and plates) (pendent semicircle group)[a]	High	6
LG I–LG II	G-F1b	Fine WhM table ware (drinking vessels) (chevron group)[a]	Medium	6
LG I–LG II	G-F1c	Fine WhM table ware (drinking vessels) (concentric circle group)[a]	Medium	6
LG I–LG II	G-F1d	Fine WhM table ware (drinking vessels) (bichrome group)[a]	Medium	6
G	G-F1e	Fine WhM decorated ware (cut-away neck jug, two kraters, one open vessel and one closed vessel)	–	5
EA	A-G1	Coarse HaM pithos ware as well as one basin and one brazier (?)	High	5
EA	A-SG1	Coarse HaM pots, probably hydriae	Low	5
EA–LA	A-F1a	Fine HaM unpainted small hydriae	High	5
EA–LA	A-F1b	Fine HaM painted small hydriae and jugs	High	5
EA–LA	A-F2a	Fine WhM painted small hydriae	High	5
EA–LA	A-F2b	Fine WhM painted small hydriae	Medium–low	5
Cl (4th cent. BCE)	C-SG1	Semi-coarse WhM mortars	Medium–high	5
Cl (4th cent. BCE)	C-SF1	Semi-fine WhM mortars	Medium–high	5
Cl (end of 5th cent. BCE)	C-SF2	Semi-fine WhM 'giant' lekythoi	Low	10
Cl (ca. 420–400 BCE)	C-F1	Fine WhM lekythoi	Medium	10
Cl (ca. 420–400 BCE)	C-F2	Fine WhM lekythoi	Medium	7
Cl (first half of 5th cent. BCE)	C-F3	Fine WhM table ware (drinking vessels)	High	10
H (ca. 325–250 BCE)	H-SG1	Semi-coarse to coarse WhM cooking ware	High	5
H (ca. 325–250 BCE)	H-SG2	Semi-coarse to coarse WhM cooking ware	High	5
H (end of the 4th–mid 1st cent. BCE)	H-SF1	Semi-fine WhM plain ware	High	10
H (late 4th–3rd cent. BCE)	H-SF2	Semi-fine WhM pointed-base amphorae	Medium	5
A–H	FIG-F1	Fine mold-made figurines of different periods	High	8
H	H-REF: ERE14/157–162	Fine to coarse ware artifacts (stamped tiles, kiln support, misfired fish-plate)	Rare	6
R	R-REF: ERE14/163–167	Kiln supports	High	5
Total number of ceramic samples				170

[a] Pendent semicircle group, chevron group, concentric circle group and bichrome group comprise stylistic groups associated with distinct types of painted decoration.

Geometric to Hellenistic times, in keeping with the presentation of the results of the Bronze Age pottery from the site (Charalambidou et al., 2016; Müller Celka et al., in press). Archaeometric, mainly elemental, analysis has been conducted before in central Euboea (Stern and Descœudres, 1977; Pollard et al., 1983; Jones, 1986, 141–150; Kerschner and Lemos, 2014 on elemental analysis and Gautier, 1976, 56–57 on petrography) but this is the first occasion that combined petrographic and elemental analysis of ceramic and geological samples has been employed to investigate the composition and technology of Eretrian ceramics through time.

3. Sampling and methodology

The selection of archaeological ceramic samples was based on the general research questions (see above), as well as on more specific questions associated with each period and the respective nature of ceramic material of the studied phases. The sample selection and analysis followed broad chronological divisions (Geometric, Archaic, Classical, Hellenistic) that form the basis of the archaeological study of the ceramic material from the ESAG excavations at Eretria. Macroscopic groups were established for each of the above periods. A minimum of five samples were selected for each group, to enable characterisation of each group and assessment of its internal variation, while more samples were chosen for most fine fabric groups where elemental analysis would be more crucial.

In addition to the geological samples and samples of ancient building materials that had been collected from Eretria and its vicinity and analysed during the first phase of the project (Charalambidou et al., 2016, 532 with a discussion on the geology of Eretria and the locally available raw materials), a fieldtrip was conducted to investigate geological variation across central and southern Euboea and collect supplementary geological samples.

A total of 208 samples were analysed during the second phase of the project:

- 170 samples of ancient ceramics from Eretria
- 32 geological samples from central and southern Euboea
- 6 samples of ancient building materials from Eretria.

The selection of pottery samples aimed to cover the majority of the main macroscopic groups observed among the ceramic material of each period and identified as local/Eretrian. For this reason, a detailed macroscopic examination of ceramics was conducted, putting emphasis on the combined study of fabric colour, texture and inclusions in combination with the standard ceramic material typology (in the case of pottery: ware and vessel type).

Table 1 summarises the basic archaeological information for the macroscopic groups defined by the ESAG researchers (S. Verdan [Geometric pottery], S. Huber [Archaic miniature hydriae and jugs], K. Gex [Classical pottery], G. Ackermann [Hellenistic pottery], M. Palaczyk [Hellenistic pointed-base amphorae], P. Maillard [figurines]).

All the ancient ceramic samples were subjected to petrographic analysis with thin sections and elemental analysis, while the geological samples were examined through petrographic analysis and, selectively, through elemental analysis, following exactly the same methodology employed in the analysis of the Bronze Age pottery from Eretria (Charalambidou et al., 2016, 531; Müller Celka et al., in press). Clay-rich sediments were made into briquettes, fired at three different temperatures (700, 900 and 1050 °C) and then thin sectioned. The briquettes fired to 900 °C are the only geological samples that were also analysed chemically.

The elemental composition of archaeological and geological samples was determined with a Bruker S8-TIGER wavelength dispersive X-ray fluorescence spectrometer (WD-XRF), on ignited samples prepared as fused glass beads. The following 26 elements were analysed: Na, Mg, Al, Si, P, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Rb, Sr, Y, Zr, Ba, La, Ce, Nd, Pb, Th.

4. The pottery fabrics: preliminary results

Based on the combination of petrographic and elemental analysis, 13 main ceramic fabric groups covering the Geometric to the Hellenistic periods have been defined, most of which have a number of variants, while there are some samples that are considered as loners (Fabric Groups A–O; Tables 2–5 and Figs. 2–14).

It should be noted that temporary working titles are used for the fabric groups defined thus far in phase II of the project. Once the integration of the data of the two phases of the Eretria pottery project (phase I: Bronze Age and phase II: historical times) is complete, a unified system of numbering and labelling will be introduced.

Fabric groups have been distinguished in three categories:

a) Fabrics compatible with local geology (local),
b) Fabrics not compatible with local geology (imports),
c) Fabrics whose compatibility with local geology is uncertain.

Table 2
The main FGs of pottery used in Eretria in historical times and their provenance assignments.

Fabric Group (code)	Fabric Group (full name)	Provenance assignment
FG A	Coarse metamorphic – quartz + mica phyllite/schist	Local
FG B	Coarse metamorphic – mica schist	Imported
FG C	Coarse metamorphic – quartz + mica phyllite/schist, with carbonates	Local
FG D	Coarse metamorphic – greenschist	Imported
FG E	Semi-coarse metamorphic – quartz + mica phyllite/schist	Local
FG F	Semi-coarse metamorphic – quartz + mica phyllite/schist, with carbonates	Local?
FG G	Semi-coarse metamorphic – with epidote group minerals	Imported
FG I	Semi-fine silicate, with carbonates	Local?
FG K	Fine to semi-fine silicate – white mica	Local
FG L	Fine to semi-fine silicate – white mica - high Cr and Ni content	Probably imported
FG M	Fine silicate, with textural concentration features	Local?
FG N	Fine carbonate and silicate	Local?
FG O	Fine silicate, with few to rare carbonates	Local?

Table 3
Chemical composition of archaeological pottery samples: average values (M) and relative standard deviations (rsd) of the coarse (A, B, C, D) and semi-coarse (E, F, G) fabric groups.

	A (N = 23)		B (N = 4)		C (N = 3)		D (N = 5)		E (N = 6)		F (N = 4)		G (N = 3)	
	M	rsd %	M	rsd %	M	rsd %	M	rsd %	M	rsd %	M	rsd %	M	rsd %
Na_2O (%)	0.99	16	2.05	10	1.10	23	1.22	9	1.21	18	0.86	14	1.03	2
MgO (%)	1.87	12	1.92	13	1.93	3	4.37	7	2.33	7	2.58	17	2.48	10
Al_2O_3 (%)	18.72	5	19.13	4	16.42	3	13.38	4	18.59	4	20.58	1	14.79	2
SiO_2 (%)	62.69	3	62.05	3	63.65	1	62.12	3	60.10	3	58.13	2	61.89	1
P (ppm)	830	58	516	55	1153	16	1072	33	794	19	694	1	846	25
K_2O (%)	3.07	9	3.29	8	2.80	11	1.89	7	3.28	5	3.62	7	2.36	3
CaO (%)	1.04	34	0.49	57	4.08	13	1.81	36	3.27	20	4.31	40	6.59	11
TiO_2 (%)	0.77	13	0.90	5	0.80	1	0.78	2	0.93	9	0.95	2	0.77	3
V (ppm)	126	10	141	7	119	7	121	3	137	10	138	12	111	11
Cr (ppm)	124	10	110	3	130	9	781	5	171	6	203	11	306	22
Mn (ppm)	1403	38	581	14	1195	5	1913	51	1185	8	682	14	985	8
Fe_2O_3 (%)	7.21	8	7.40	4	6.78	4	8.12	6	7.97	9	6.10	8	6.79	3
Co (ppm)	20	20	18	15	19	11	43	13	24	9	21	6	24	4
Ni (ppm)	76	17	44	8	71	6	464	6	99	7	121	19	230	19
Cu (ppm)	50	21	47	19	45	8	63	24	55[b]	44	44	16	46	15
Zn (ppm)	93	14	140[a]	76	86	8	113	13	105	8	87	13	84	2
Rb (ppm)	122	10	126	6	113	7	75	3	131	4	160	4	95	2
Sr (ppm)	89	32	45	29	147	16	98	21	96	11	211	15	95	1
Y (ppm)	32	8	35	9	32	11	28	5	33	5	35	10	28	7
Zr (ppm)	194	8	230	6	210	5	165	4	202	7	220	18	190	2
Ba (ppm)	697	20	742	27	606	7	577	35	590	8	568	6	444	6
La (ppm)	37	13	42	21	40	10	29	14	38	15	45	9	28	17
Ce (ppm)	74	8	85	14	78	8	58	10	78	4	93	11	59	1
Nd (ppm)	35	9	40	11	38	11	30	10	38	8	44	9	29	27
Pb (ppm)	35	18	57[a]	87	41	15	32	15	43	6	24	21	36	10
Th (ppm)	17	12	16	20	16	25	15	25	14	16	17	13	13	24

[a] High Zn and Pb mean values and large spreads in group B are introduced by elevated levels of these elements in sample 136 (likely due to contamination).
[b] Elevated Cu mean values and large spread in group E are introduced by elevated levels of this element in sample 91.

Table 4
Chemical composition of archaeological pottery samples: average values (M) and relative standard deviations (rsd) of fine and semi-fine (I–O) fabric groups.

	I (N = 9)		K (N = 46)		L (N = 4)		M (N = 6)		N (N = 5)		O (N = 5)	
	M	rsd %	M	rsd %	M	rsd %	M	rsd %	M	rsd %	M	rsd %
Na_2O (%)	1.27	15	1.38	17	0.92	7	1.40	7	1.04	3	1.34	12
MgO (%)	2.20	8	2.69	8	4.62	7	2.81	8	3.79	8	3.26	9
Al_2O_3 (%)	17.49	6	20.99	5	16.32	4	22.40	4	17.61	5	20.73	4
SiO_2 (%)	56.64	3	54.73	4	55.08	3	53.17	2	48.49	2	52.24	2
P (ppm)	1001	43	703	24	871	18	759	32	903	9	833	25
K_2O (%)	3.27	4	3.80	6	3.15	12	4.68	5	3.86	4	4.20	3
CaO (%)	4.63	27	4.78	18	6.47	10	3.35	25	9.67	6	6.15	14
TiO_2 (%)	0.79	6	0.92	5	0.87	7	0.90	2	0.73	3	0.85	3
V (ppm)	110	9	135	9	124	10	173	4	135	6	152	3
Cr (ppm)	134	6	172	9	498	9	202	10	290	20	241	9
Mn (ppm)	1009	7	1039	8	815	6	1131	5	1032	3	1135	8
Fe_2O_3 (%)	6.47	5	8.32	9	7.96	5	7.72	3	7.10	5	7.59	2
Co (ppm)	19	7	24	10	34	9	25	9	26	5	26	4
Ni (ppm)	84	8	117	14	347	8	111	14	184	5	144	3
Cu (ppm)	45	12	46	13	76	14	60	19	72	12	63[b]	41
Zn (ppm)	107	12	122	13	117	6	126	4	105	4	111	8
Rb (ppm)	120	5	148	9	126	15	181	6	140	6	160	4
Sr (ppm)	102	11	105	14	220	8	160	18	225	7	192	12
Y (ppm)	31	3	31	6	29	3	27	7	24	6	27	5
Zr (ppm)	184	9	158	11	161	9	179	4	155	5	171	4
Ba (ppm)	584	22	726	8	649	9	712	2	598	5	665	1
La (ppm)	35	13	39	11	37	9	36	6	31	13	34	7
Ce (ppm)	74	9	81	8	71	7	70	11	61	9	70	9
Nd (ppm)	35	15	36	13	34	2	33	14	29	14	31	5
Pb (ppm)	38	22	54[a]	125	29	27	36	11	27	12	31	3
Th (ppm)	13	10	15	14	10	5	16	7	11	4	12	9

[a] The elevated mean and large spread of Pb in group K is introduced by sample 128, which appears contaminated with lead.
[b] Elevated Cu mean values and large spread in group O are introduced by elevated levels of this element in sample 77 (likely due to contamination?).

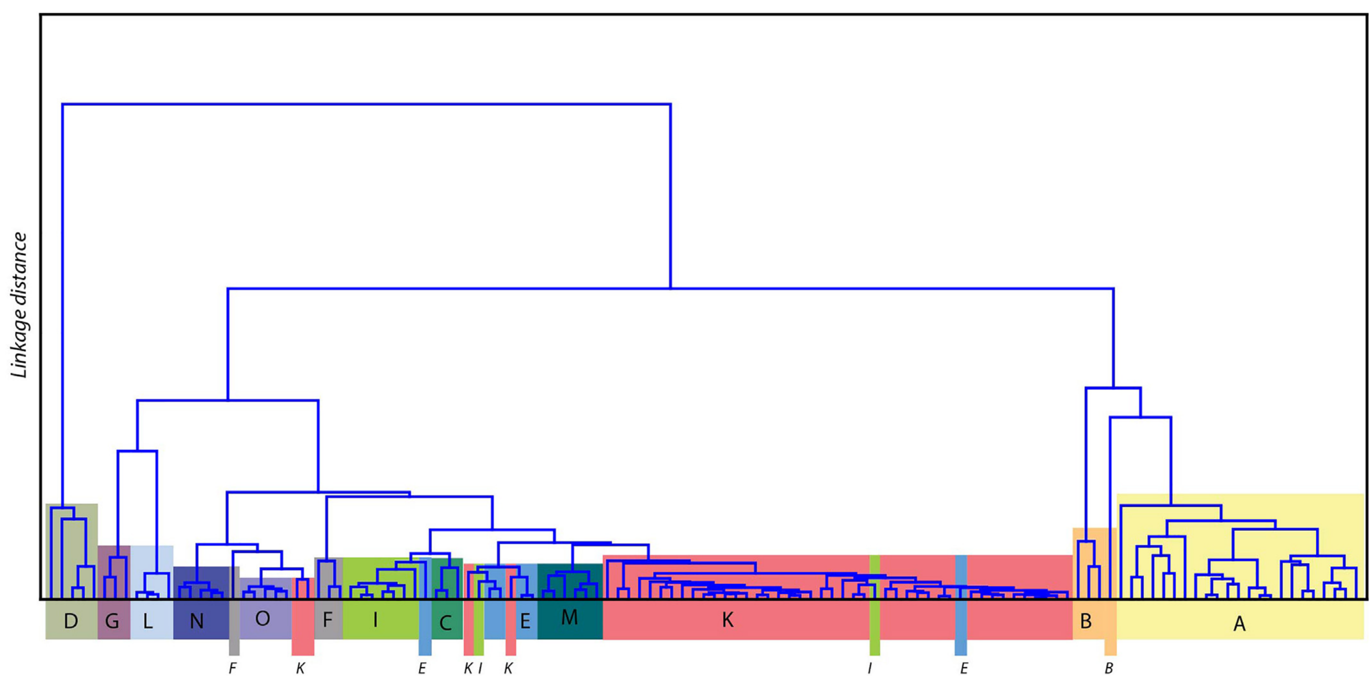

Fig. 2. Dendrogram including samples from all fabric groups (petrographic loners and variants are excluded) after cluster analysis performed on log transformed concentrations of Mg, Al, Si, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Zn, Rb, Sr, Y, Zr, Ba, La, Ce, Nd, Th, using un-weighted pair-group averages and squared Euclidian distances.

Fabric groups A to D comprise coarse grained fabrics, FGs E to G semi-coarse grained ones, while FGs I to O are fine and semi-fine grained fabrics.

Two coarse fabrics (FG A and C) and one semi-coarse fabric (FG E) can be directly associated with the local geology of Eretria and characterised as the main coarse and semi-coarse local fabrics, respectively. Fine FG K can also be associated with local production mainly through its elemental association with the earlier local Bronze Age fine fabric, FG 8 (see below).

Four FGs, of coarse metamorphic (FG B and FG D), semi-coarse metamorphic (FG G) and fine (FG L) fabrics are not compatible with the geology of Eretria in terms of their mineralogical and elemental composition. They are considered to reflect pottery manufactured with raw materials not locally available.

There are five more FGs, of semi-coarse (FG F) and fine or semi-fine (FG I, M, N, O) fabrics that show important similarities to the series of local fabrics but there are certain differences in their chemical composition that prevent us, for the time being, from assigning them an indisputable local origin.

4.1. Fabric Groups compatible with local geology (local) (FG A, C, E, K)

Three fabric groups (coarse FG A and C and semi-coarse FG E) can be directly associated with the local geology of Eretria. Furthermore, the fine fabric FG K can also be associated with local production mainly through its chemical association with the earlier local Bronze Age fine fabric, FG 8 (Charalambidou et al., 2016, 532, 534: Table 2; Müller Celka et al., in press: Tables 2 and 3). The inclusions identified in all these fabric groups also characterise the sediments sampled from the vicinity of Eretria and have also been attested in the ancient building materials analysed during the two phases of the project. More specifically, both geological samples and those of ancient building materials from Eretria indicate that the locally available sediments are characterised by a fine-grained metamorphic rock, ranging from phyllite to schist and consisting of quartz, white mica and/or biotite; there are also varied amounts of carbonates, very rare to absent epidote group minerals and grains of highly altered volcanic rocks of basic composition.

The coarse FG A (Figs. 2, 3; Table 3), characterised by metamorphic rocks (ranging from phyllite to quartz + white mica ± biotite ± feldspar schist and polycrystalline quartz) and rare volcanic rock fragments, was used both in the 8th and 7th centuries BCE. It is noteworthy that this fabric was used for the production of a variety of analysed coarse ware shapes ranging from storage vessels to cooking pots and hydriae. In terms of manufacturing technology, all the above mentioned

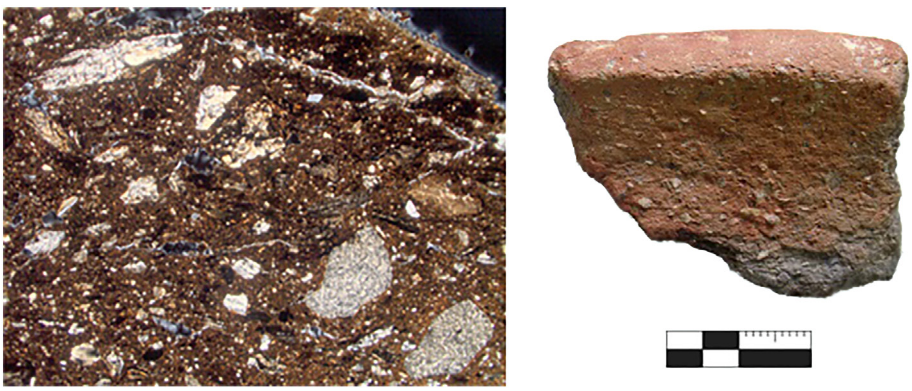

Fig. 3. FG A. Sample ERE14/1 (MG II–LG I pithos): photomicrograph of fabric (XPL, field of view = 7.35 mm) and hand specimen.

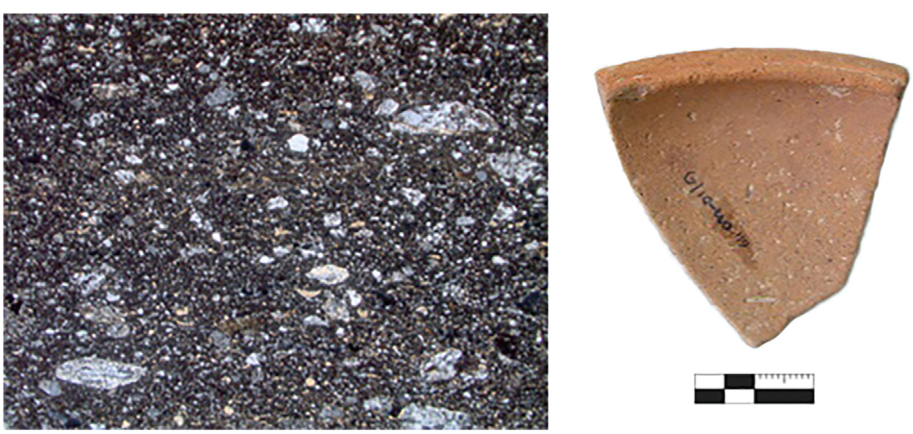

Fig. 4. FG C. Sample ERE14/86 (Cl mortar): photomicrograph of fabric (XPL, field of view = 7.35 mm) and hand specimen.

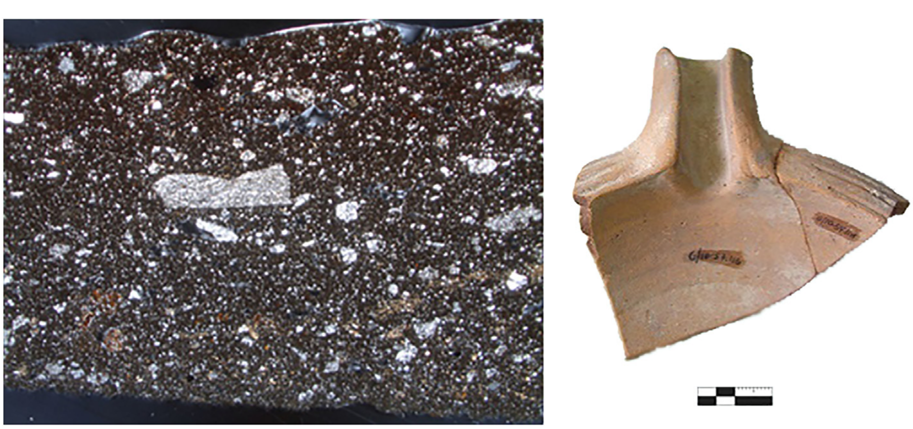

Fig. 5. FG E. Sample ERE14/90 (Cl mortar): photomicrograph of fabric (XPL, field of view = 7.35 mm) and hand specimen.

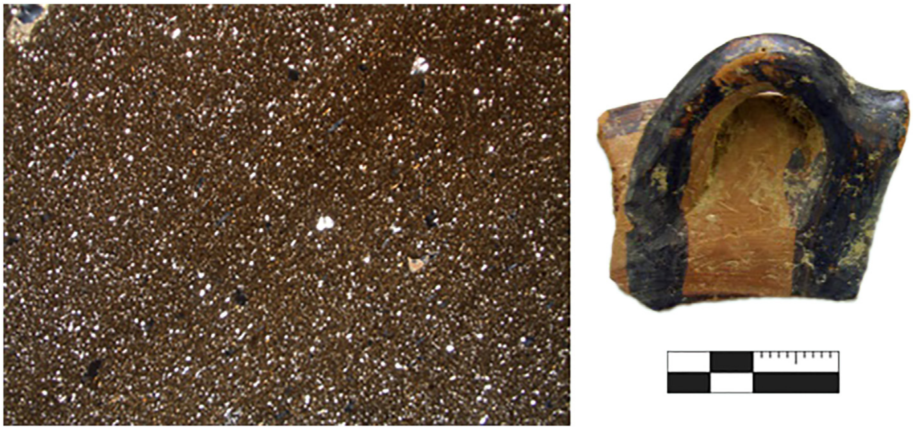

Fig. 6. FG K. Sample ERE14/21 (MG II–LG I plate): photomicrograph of fabric (XPL, field of view = 7.35 mm) and hand specimen.

vessels are handmade. In FG A, as in Bronze Age FG 1 (Charalambidou et al., 2016, 532, 534: Table 3; Müller Celka et al., in press: Table 2), it seems that a primary, very low calcareous clay was used. Overall, there are close similarities between Bronze Age FG 1 and Geometric-Archaic FG A both in terms of their mineralogical and chemical composition. Two Classical mortar samples (ERE14/87 and 88) have some affinities with FG A but they are also connected to FG E (see below) in terms of their grain size distribution.

Coarse FG C (Figs. 2, 4; Table 3) includes the same type of metamorphic inclusions as FG A but it has more carbonates in the matrix than the above-mentioned local coarse fabric. The samples of this fabric – three wheel-made mortars – belong to the Classical period and start revealing changes in clay paste preparation from this period onwards.

The semi-coarse FG E (Figs. 2, 5; Table 3) is again characterised by schist/phyllite and polycrystalline quartz rock fragments. This fabric is associated here with samples of Classical wheel-made mortars and one Hellenistic lekane. Overall, this fabric has smaller grains and is fired at a higher temperature than FG A, therefore a different clay base and processing than those of FG A wares is presumed.

The fine to semi-fine FG K (Figs. 2, 6; Table 4) exhibits very close similarities with the earlier local Bronze Age fine fabric FG 8 (Charalambidou et al., 2016, 532, 534: Table 2; Müller Celka et al., in press: Tables 2 and 3). In terms of petrography its aplastic inclusions fall within the same types as the inclusions of the coarse and semi-coarse local fabrics. FG K seems to be the most common local fabric among the analysed fine wares of historical times; thus far it covers the 8th century BCE and the Classical period. It is the fabric of the great majority of the Geometric fine-ware samples analysed from Eretria – Geometric pendent semicircle group, Geometric chevron group, Geometric concentric circle group, Geometric bichrome group – and of Classical lekythoi, cups/skyphoi and some Classical figurines. Samples of 7th- and 6th-century finewares of presumed local origin are currently being sampled for analysis to explore their connections with this fabric.[2]

In terms of its elemental composition, FG K, as well as FG 8, shows a close correlation to Mommsen's EuA group (Mommsen, 2014) which comprises a large number of samples from central Euboean sites, including Eretria and Lefkandi, as well as clay samples from the clay deposits close to Phylla. It has been assigned to workshops in the area of central Euboea.

4.2. Fabric Groups not compatible with local geology (imports) (FG B, D, G, L)

These fabrics are characterised by inclusions of metamorphic rocks not attested in the vicinity of Eretria and are distinct from each other chemically (Tables 3 and 4).

Coarse metamorphic FG B (Figs. 2, 7, Table 3) concerns wheel-made cooking pots and is restricted to the Hellenistic period. It is characterised by fragments of metamorphic rocks (dominantly quartz + white mica + biotite ± feldspar ± epidote group minerals schist), coarser textured in relation to those included in the local coarse fabrics. This is a low calcareous fabric (0.5% CaO average) with relatively low Cr and Ni content, and with elevated Na_2O as compared to the rest of the coarse and semi-coarse fabrics.

FG D (Figs. 2, 8) contains inclusions associated with metamorphic rocks but of different type to the inclusions of FG A. The inclusions in FG D reflect metamorphic rocks again of coarser texture and of different composition (dominantly quartz + white mica ± biotite ± feldspar ± epidote group minerals ± sphene schist), containing also more epidote group minerals in the fabric matrix than the FG A. Chemically it is characterised by higher Cr, Ni content and elevated MgO concentrations compared to the local FG A (Table 3). This is a small group including Geometric handmade wares (large bowl/basin, cooking pot, closed vessels and possibly one storage vessel), which come from the sanctuary of Apollo Daphnephoros. This fabric bears some resemblances, mainly mineralogical, to the imported Bronze Age FG 2 and FG 3 (Charalambidou et al., 2016, 532–533, 534: Table 2; Müller Celka et al., in press, Table 3). The inclusions of FG D (and of the earlier Bronze Age FGs 2 and 3) can be linked to metamorphic rocks of greenschist facies of the central Aegean Blueschist Unit that appear in southern Euboea, eastern Attica and the northwest Cyclades (Katzir et al., 2000).

FG G (Figs. 2, 9) is a semi-coarse, low calcareous, fabric characterised also by coarse-textured metamorphic rock fragments (quartz + feldspar ± white mica ± biotite schist), carbonates and epidote group minerals. Chemically, the Hellenistic samples included in this group (coming from a lekane, a jug and a mortar) are characterised by elevated CaO, Cr and Ni contents compared to the local FG A, while Cr and Ni concentrations are lower than in the previously discussed FG D (Table 3).

FG L (Figs. 2, 10) which comprises Classical wheel-made lekythoi is a fine to semi-fine fabric that includes monocrystalline quartz, white ± biotite mica, schist (dominantly quartz + feldspar ± white mica ± biotite schist), and polycrystalline quartz rock fragments. This group is chemically characterised by a high Cr and Ni content that distinguishes it from FG K, the typical local fine fabric (Table 4). This fabric, presumably imported mainly according to chemical criteria, shows similarities to the composition of Attic pottery of the Classical period (for petrographic and chemical comparanda see e.g., Pentedeka et al., 2012, 125–128 [black-glazed vessels of presumed Attic origin], group KrPP in Mommsen et al., 2016 or the composition of the majority of vessels identified as of Attic origin in Tzachou-Alexandri, 1990).

[2] In addition, samples of 6th-century coarse wares (of presumed local origin as well) will be analysed to investigate their connections with the local FG A.

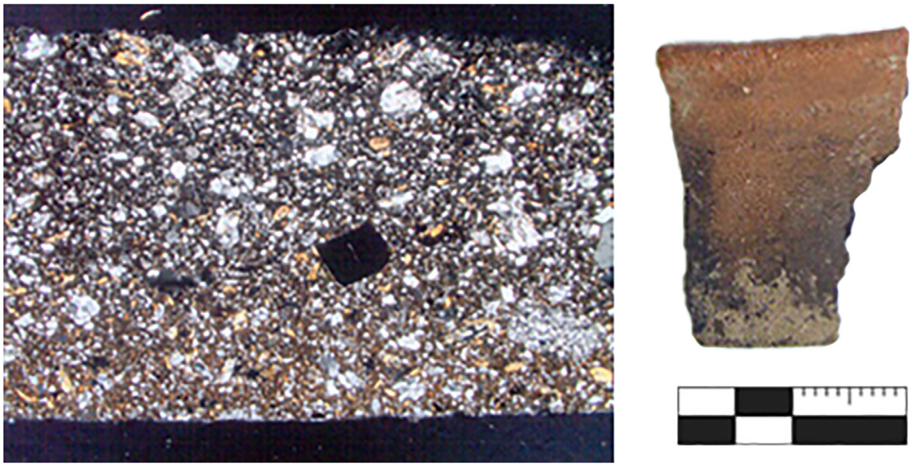

Fig. 7. FG B. Sample ERE14/135 (H brazier): photomicrograph of fabric (XPL, field of view = 7.35 mm) and hand specimen.

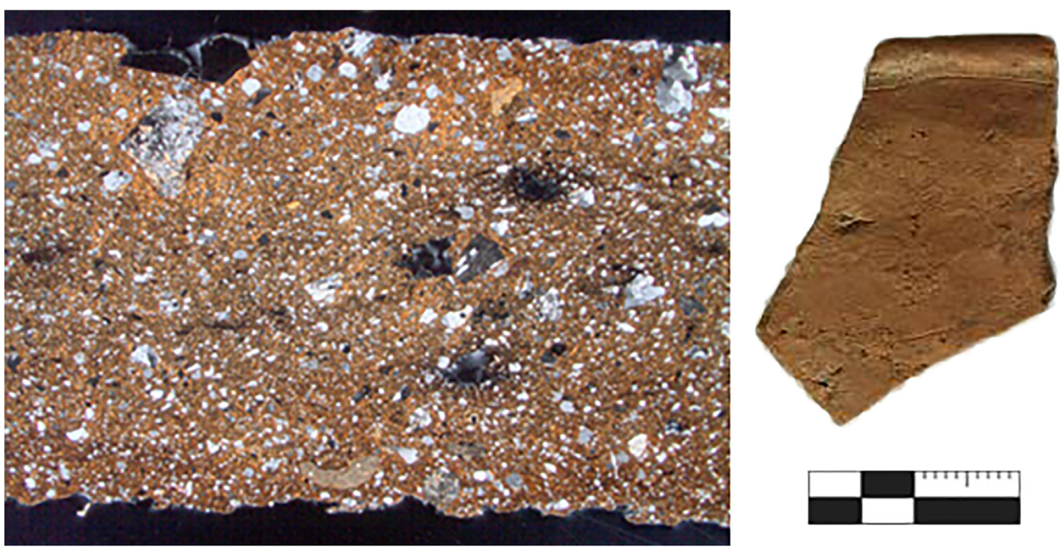

Fig. 8. FG D. Sample ERE14/16 (LG I–II large bowl or basin): photomicrograph of fabric (XPL, field of view = 7.35 mm) and hand specimen.

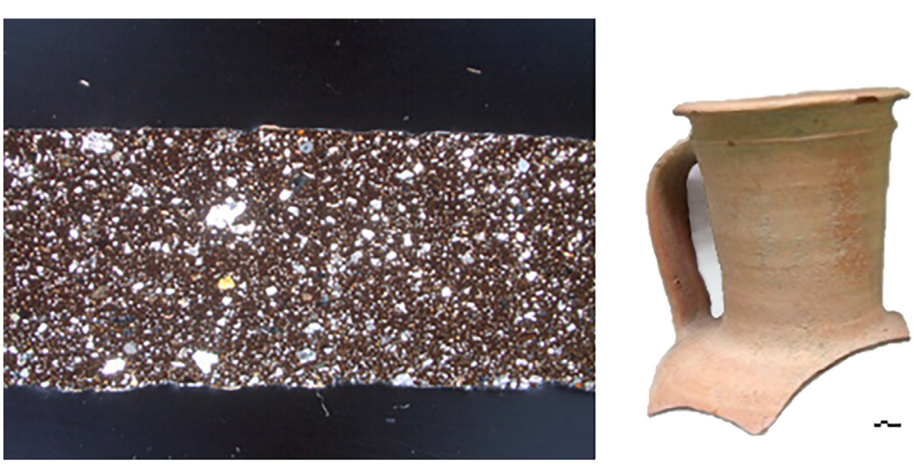

Fig. 9. FG G. Sample ERE14/147 (H jug): photomicrograph of fabric (XPL, field of view = 7.35 mm) and hand specimen.

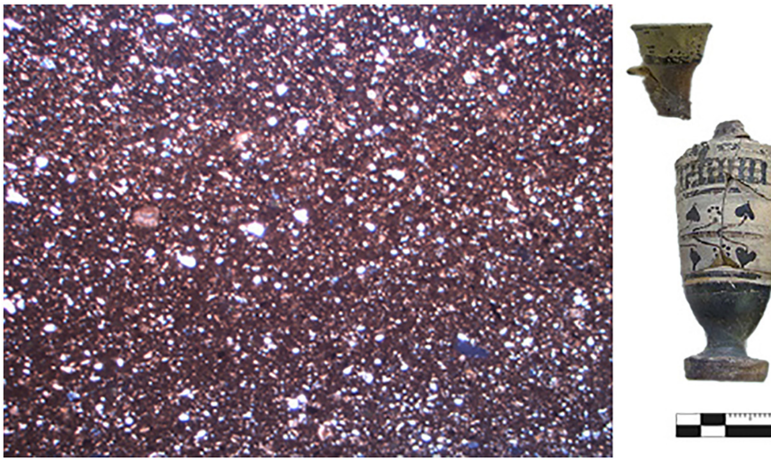

Fig. 10. FG L. Sample ERE14/113 (Cl lekythos): photomicrograph of fabric (XPL, field of view = 7.70 mm) and hand specimen.

4.3. Fabric Groups of uncertain compatibility with local geology (FG F, I, M, N, O)

FG F (Figs. 2, 11) is a semi-coarse fabric that comprises Hellenistic pointed-base amphorae and is characterised by metamorphic inclusions similar to the local metamorphic fabrics with the addition of carbonates. Chemically, it has similarities to the fine local FG K but also important differences concerning mainly its higher Sr and Zr content (Table 3).

Semi-fine FG I (Figs. 2, 12) is a silicate-rich fabric with types of metamorphic rock fragments that occur in the local fabrics. It is similar to the main local FG K but again has important differences in the values of many elements: it contains less Cr and Ni, less Fe, K and Rb, as well as a smaller Al:Si ratio and more Zr than FG K (Table 4). It comprises the vast majority of the Classical wheel-made 'giant' lekythoi sampled (of average height 60–70 cm). This fabric group shows evidence of clay

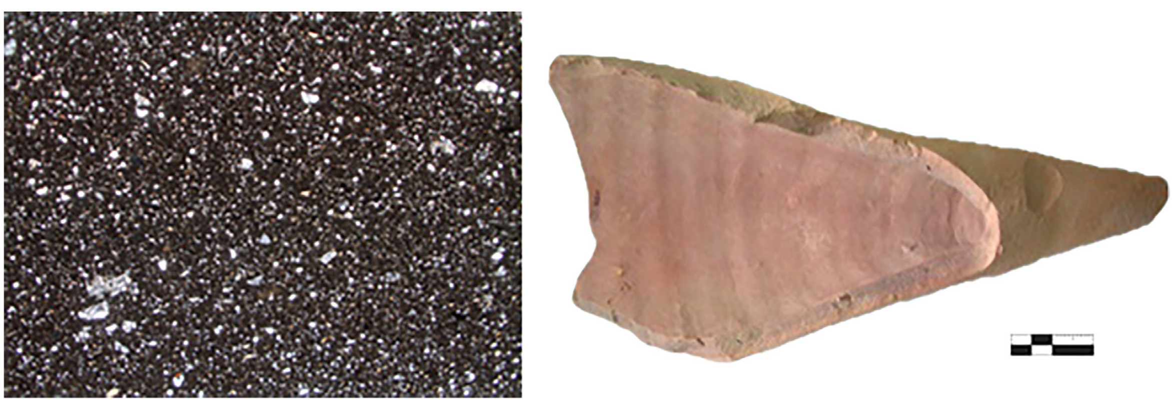

Fig. 11. FG F. Sample ERE14/152 (H pointed-base amphora): photomicrograph of fabric (XPL, field of view = 7.35 mm) and hand specimen.

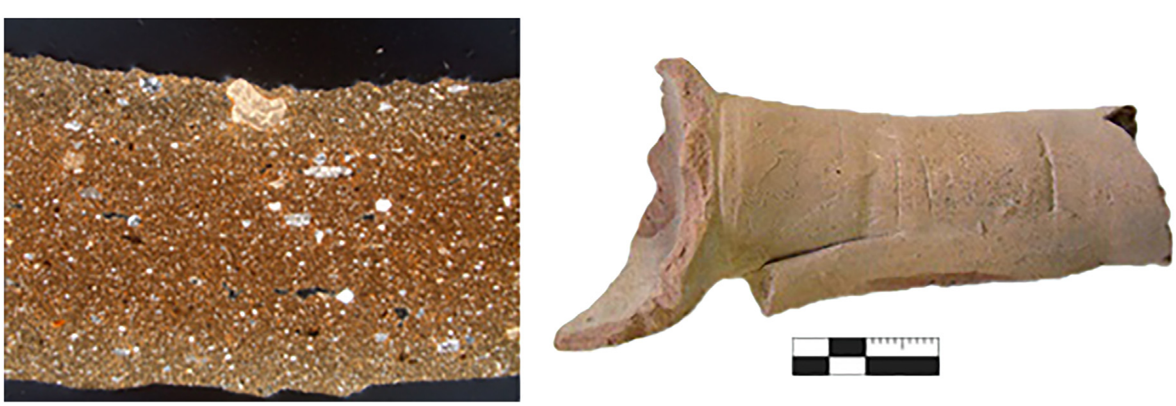

Fig. 12. FG I. Sample ERE14/96 (Cl 'giant' lekythos): photomicrograph of fabric (XPL, field of view = 7.35 mm) and hand specimen.

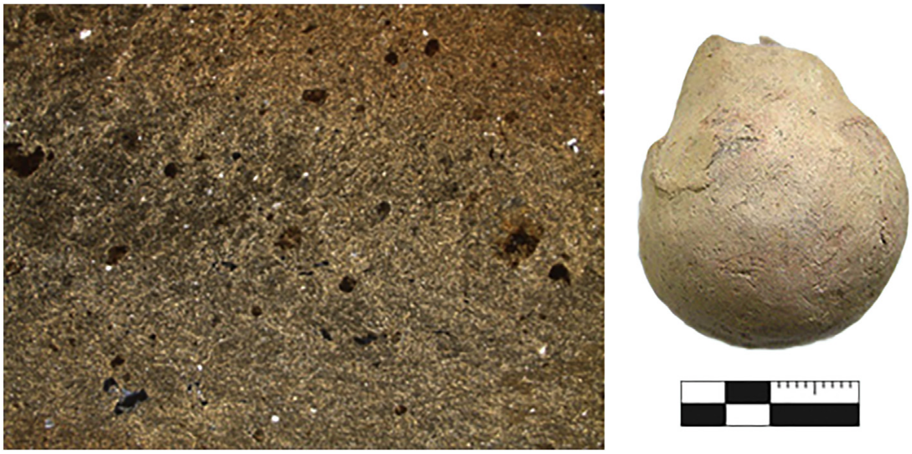

Fig. 13. FG M. Sample ERE14/69 (A miniature hydria): photomicrograph of fabric (XPL, field of view = 7.35 mm) and hand specimen.

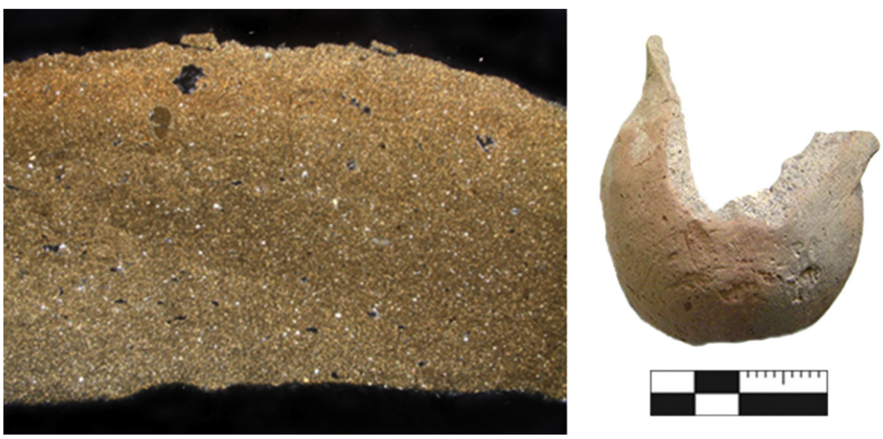

Fig. 14. FG N. Sample ERE14/66 (A miniature hydria): photomicrograph of fabric (XPL, field of view = 7.35 mm) and hand specimen.

mixing associated with the presence of textural concentration features. This probably contributes to the chemical variation observed in FG I samples.

In Eretria, vessels of small dimensions, mainly miniature hydriae and some miniature jugs, are found in cult contexts of the Archaic period – in our case all our samples come from the Northern Sacrificial area (Huber, 2003). Among the selected samples of these miniature vases three fabric groups have been recognized: FG M (Figs. 2, 13; Table 4) is a fine silicate-rich fabric with distinct textural concentration features. This fabric relates to handmade and wheel-made, painted and unpainted, miniature hydriae. FG N (Figs. 2, 14; Table 4) is a fine carbonate and silicate-rich fabric used in the manufacture of handmade painted and unpainted miniature hydriae and jugs. FG O (Fig. 2; Table 4) does not have the distinctive textural concentration features of FG M or the amount of carbonate material of FG N, although it is more closely associated with FG N. It relates to wheel-made painted miniature hydriae. FG M is not very dissimilar chemically to the main local fine FG K so we currently assume that its local origin is very possible. Less similar to FG K are FG N and FG O due to high CaO, Cr, Ni, Sr (Table 4).

The semi-coarse FG F, semi-fine FG I and fine FGs M, N, O fabrics show similarities to the series of local fabrics, in terms of mineralogical and, to a certain extent, chemical composition (see Tables 3 and 4). In comparison to the main local fine fabric FG K, the chemical associations appear in most cases strong enough not to allow us to securely reject the local origin of these fabrics. Their mineralogy is also compatible with the local geology and the analysed reference materials. Nevertheless, there are certain differences in the chemical composition of these fabrics mainly in relation to the main local FG K (Table 4) that prevent us, at present, from assigning them an unquestionably local origin. As the analysis of a number of geological samples from the area is still in progress, the provenance(s) of these fabrics will be further reviewed in the light of the expected new data.

5. Concluding remarks

During the Geometric and Early Archaic periods in Eretria there are two distinct technological traditions; handmade coarse wares and predominantly wheel-made fine and semi-fine wares. Coarse wares, such as storage vessels and cooking pots from the sanctuary of Apollo Daphnephoros and the Heroon cult area, dating to the Geometric and Early Archaic periods respectively, indicate that the coarse, very low calcareous, metamorphic fabric known from the Bronze Age (FG 1) remains in use, with some variations, in the 8th and 7th centuries BCE (FG A). Furthermore, the fine FG K, which has thus far been identified in the 8th century BCE and in the Classical period, has compositional values that fall within the range of the main Bronze Age fine fabric FG 8, and therefore seems very closely related. FG K is used for a wide range of fine Geometric drinking vessels (mainly skyphoi), including categories such as the pendent semicircle group, the chevron group, the concentric circle group and the bichrome drinking vessels. During the 8th century BCE, vessels of most of the above-mentioned groups were exported to or imitated in Euboean colonial contexts and other Mediterranean regions that had contacts with Euboea (e.g. Euboean imports and local imitations of the pendent semicircle group have been identified through elemental analysis at Ephesos in the Eastern Aegean,

Table 5
The main fabric groups: chronology, vessel categories and technological characteristics.

		Geometric	Archaic	Classical	Hellenistic
COARSE & SEMI-COARSE FABRICS	FG A	LOCAL HaM pithoi, cooking pots, basins	LOCAL HaM pithoi, hydriae, basin		
	FG B				IMPORTED WhM cooking pots
	FG C			LOCAL WhM mortars	
	FG D	IMPORTED HaM large bowl/basin, cooking pot, closed vessels, pithos			
	FG E			LOCAL WhM mortars	LOCAL WhM lekane
	FG F				LOCAL? WhM pointed-base amphorae
	FG G				IMPORTED WhM lekane, jug, mortar
FINE & SEMI-FINE FABRICS	FG I			LOCAL? WhM 'giant' lekythoi	
	FG K	LOCAL WhM pendent semicircle skyphoi and plates, chevron skyphoi, concentric circle skyphoi, bichrome skyphoi and kantharoi		LOCAL WhM lekythoi, cups/skyphoi, figurines	
	FG L			PROBABLY IMPORTED WhM lekythoi	
	FG M		LOCAL? HaM and WhM miniature hydriae		
	FG N		LOCAL? HaM miniature hydriae and jugs		
	FG O		LOCAL? WhM miniature hydriae		

Fabric groups compatible with local geology (local)

Fabric groups not compatible with local geology (imported)

Fabric groups whose compatibility with local geology is uncertain

Al Mina in the Levant, Cerveteri, Pontecagnano and Veii in Italy, see Kerschner and Lemos, 2014).

Therefore, in the course of the 8th century BCE, when Eretria evolved as one of the key players in the Greek colonisation phenomenon and Mediterranean trade networks, Eretrian potters seem to have been using the same or similar raw material sources and 'old' recipes in the production of certain coarse and fine wares, thereby continuing Bronze Age traditions – despite the archaeological hiatus at Eretria at the end of the Bronze Age and the beginning of the Early Iron Age corresponding to the Submycenaean and Protogeometric periods. Moreover, not only do we see FG A in the 8th century BCE when Eretria flourished and was involved in colonial enterprises but also during the 7th century BCE, from which there is limited settlement evidence at the site, a phenomenon often associated with the Lelantine war.

Thus far, changes in the types of raw materials and recipes used in the local pottery production are discerned mainly from the Classical period onward. The same types of metamorphic inclusions characterise the majority of the coarse fabrics analysed from the 8th century to the Hellenistic period, but in the case of Classical and Hellenistic fabrics textural differences – concerning the grain size distribution as well as the amount of inclusions – can possibly reflect different preparations of the clay pastes in comparison to the Geometric and Early Archaic ceramic fabrics.

Furthermore, specialised products such as miniature hydriae and jugs found in Eretrian cult contexts – in our case at the Northern Sacrificial area – show a variety of fabric groups. This evidence may be indicative of the use of different clay paste preparation technologies or different clay sources for the production of these vases; it may also suggest the existence of different workshops that produced these pots.

This paper has examined how continuity and innovation characterise different aspects of Eretria's pottery production through time. It is of great interest that in certain periods that have been associated with significant social and cultural transformations there are often no abrupt changes in either the selection and use of raw materials or in the preparation of the clay pastes used in local ceramic production. Instead, ceramic production appears to display a gradual incorporation over time of new elements into the pre-existing local tradition(s).

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