A Diachronic Study of the Early Bronze Age Pottery from Heraion on Samos, Greece: An Integrated Approach

Volume I

By:

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ABSTRACT

Heraion on Samos lies in a strategic position between the central Aegean and western Anatolia. Recent excavations have revealed an extensive settlement of the Early Bronze Age (EBA), a time characterised by increasing social differentiation, intensified interaction, and technological innovation. An integrated study of the rich ceramic assemblage from both new and old excavations, this thesis addresses fundamental questions about the position of Heraion in a changing EBA world, examining aspects of production, specialisation, connectivity, and technological transfer.

Following an agent-centred approach, diachronic change in local ceramic production is investigated, the provenance of imports suggested, with insights into the circulation of pottery within Aegean-Anatolian exchange networks. This is achieved through typological study, phasing, and contextual analysis of three ceramic major deposits, with the integrated study by macroscopic analysis, thin section petrography and microstructural analysis. This is supplemented by consideration of the local geology, ceramic resources, and ethnography.

A revised EBA sequence is produced for Heraion, with the secure characterisation of local pottery production on Samos. Following a *chaîne opératoire* approach, the stages of manufacture have been reconstructed from a ‘bottom-up’ perspective. In addition to production in the environs of Heraion, several other locations of production over the island are suggested whose products were consumed at Heraion. The changes in these patterns reveal aspects of continuity but also marked changes in ceramic production on Samos from the Late Chalcolithic to EB III.

Insights into ceramic provenance highlight connections with both the western Anatolian littoral, and the central Aegean from the Chalcolithic period, though with shifts in intensity and directionality of interaction. It is argued that the significance of Heraion goes beyond the geographical, that it is more than just a convenient stopover on routes to Anatolia, but rather comprises an active social and economic force in different networks of interaction.

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ABBREVIATIONS

a	angular
Al	Aluminium
BS	Brown slipped
BSB	Black slipped and burnished
BSE	Backscattered electrons
BT	Bakla Tepe
BT	Black topped
Ca	Calcium
Ch	Chalcolithic
CS	Ceramic sample (traditional/modern)
CV	Complete Vitrification
DFInc	Dark-faced and incised
DGSBInc	Dark grey slipped and burnished – incised
DR/RBS	Dark red/reddish brown slipped
DoL	Dark-on-Light
E	East
EBA	Early Bronze Age
EB (I, II, III)	Early Bronze (I, II, III)
EC	Early Cycladic
EDS	Energy-dispersive X-ray spectroscopy
EH	Early Helladic
el	elongate
EM	Early Minoan
EN	Early Neolithic
eq	equant
Fe	Iron
FN	Final Neolithic
GS	Geological sample
HR	Heraion
HR15	Heraion 2015[1]
HS	Heilige Straße[2]
HT12	Hera Temple 2012[3]
IrrB	Irregularly burnished
IV	Initial Vitrification
K	Potassium
LBA	Late Bronze Age
LC	Late Cycladic

[1] This code name refers to pottery samples taken from the 1981 and 2009-2013 assemblages excavated in the area north of the Sacred Road.
[2] This code name refers to the area of the Sacred Road and it was used as abbreviation for inventorying diagnostic pottery sherds and architectural features of the new excavations (2009-2013).
[3] This code name refers to pottery samples taken from the 1950s assemblage in 2012 excavated in the area of the Hera Temple.

LCh	Late Chalcolithic
LT	Liman Tepe
LN	Late Neolithic
LR/RS	Light red/red slipped
MBA	Middle Bronze Age
M/BP	Matte/black painted
MC	Middle Cycladic
MG	Macroscopic Group
MN	Middle Neolithic
Mn	Manganese
N	North
NAA	Neutron activation analysis
NL	Neolithic
NV	No Vitrification
NW/NE	North West/North East
O	Oxidising
O-R	Oxidation-Reduction firing
PBS	Pale brown slipped
PG	Petrographic Group
PPL	Plane polarised light
P/RYS	Pink/reddish yellow slipped
r	rounded
R	Reducing
RBS	Reddish brown slipped
R/BSB	Red/black slipped and burnished
RS	Red slipped
RSB	Red slipped and burnished
S	South
sa	sub-angular
SE	Secondary electrons
SEM	Scanning electron microscopy
Si	Silicon
sr	sub-rounded
SU	Stratigraphical Unit
SW/SE	South West/South East
TCFs	Textural concentration features
TV	Total Vitrification
V	Vitrification
W	West
W/YBS	Whitish/yellowish brown slipped
wr	well-rounded
XP	Crossed polars
XRD	X-ray diffraction
YSB	Yellow slipped and burnished

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CHAPTER 1: Introduction

1.1 Setting the stage

Since Renfrew's seminal work on the *Emergence of Civilisation* (1972), the study of the Early Bronze Age (henceforth EB/EBA) has produced an abundance of new archaeological information about the establishment of 'complex' *cultures* in all areas of the Aegean, expanding beyond the extensively investigated geographical limits of the western (Mainland Greece: Early Helladic/EH culture; cf. Maran 1998; Alram-Stern 2004), central (Cyclades: Early Cycladic/EC culture; cf. Wilson 1999; Broodbank 2000; Brodie *et al.* 2008), and southern regions (Crete: Early Minoan/EM culture; cf. Barrett and Halstead 2004; Schoep *et al*. 2012; Driessen and Langohr 2015). More particularly, the EM and EH cultures have received considerable attention in attempts to explain the emergence of palatial centres in the 2nd millennium BC, while research on the EC was largely triggered due to the distinct material character of the Cycladic islands that led to their early exploration (cf. Dickinson 1994; Shelmerdine 2008). A notable interest in less-studied microregions has been developed in recent years, namely northern Greece (cf. Stefani *et al*. 2014), the east Aegean islands and the western Anatolian littoral (cf. Doumas and La Rosa 1997; Kouka 2002; Şahoğlu 2005b; Erkanal *et al.* 2008; Şahoğlu and Sotirakopoulou 2011), and the Dodecanese islands (cf. Marketou 2010a; 2010b; Georgiadis 2012; Vitale 2013).

Despite the developments in archaeological research, these geographical microregions have been traditionally considered as representing distinct cultural groups largely caused by a variety of environmental factors and diverse ecosystems (cf. Terkenli 2001) that, however, together make up "an otherwise uniform civilisation" (Doumas 2008, 131). These evolutionary theories have favoured the notion of cultural homogeneity in the material expression of these regions at the expense of a coherent picture of small-scale developments at a local level. The characteristics most commonly considered to be reflected in the material culture of the 3rd millennium BC are developments in craft technology (e.g. ceramics, metals) and specialisation, distinctive patterns of production and consumption, the identification of intensive cultural connectivity and interaction via mobility and exchange, and the increasing complexity of socio-technological, political, and economic behaviours (cf. Whitelaw 2004; Gkiasta 2011; Knappett and Nikolakopoulou 2015, 28-30; Kiriatzi and Knappett 2016).

Pottery has held a key position in investigating these issues and especially craft specialisation, mainly through typological and stylistic analysis, in many cases failing to characterise technological practices or changes and continuities that go beyond vessel form and surface finish. The integration of new methodologies in ceramic analyses mainly in Crete and the Cyclades (see Chapter 4.2.1-4.2.3) has successfully demonstrated that questions of production, consumption, and distribution of pottery can be approached in a more meaningful way and old ideas or assumptions should be challenged through new studies of archaeological material. The almost complete absence of such work in the eastern Aegean has impeded a better understanding of the islands often thought of as intermediaries or stepping stones in the transmission of finished products (e.g. ceramic containers), knowledge and ideas, and people towards the west. This thesis employs an integrated ceramic analytical programme at such an island settlement and considers anew issues of complexity, specialisation, and social change.

1.2 Theoretical assumptions in the explanation of change

A number of theoretical approaches have long been proposed for the explanation of cultural change in prehistoric archaeology, depending on the respective interpretational orthodoxies and confined by the boundaries of specific theoretical trends (Trigger 2006). These have often interpreted societal change by a direct analogy with developments in technology and craft specialisation. Past prevailing concepts deriving from evolutionary theories were mainly based on systemic models of a gradual, linear explanation of change (from simple to complex societies). As archaeologists became more aware of the complexity of the archaeological record and ceased to view cultural evolution as a naturally, self-determined process, the development of a culture-historical approach in the late 19th century put more emphasis on the variation of the material culture between different areas/sites, as being attributable to several causes (e.g. temporal and geographical differentiation), in an attempt to relate artefact assemblages with historical phases. Diffusion and migration, rather than independent development, were considered as the factors of change, overlooking the matter of choices and decisions. Moreover, indigenous people were usually treated as passive rather than creative in the adoption of new cultural traits (Trigger 2006, 285-286).

The insufficient explanations for sociocultural and technological changes led to the development of the so-called New or Processual Archaeology, which sought to overcome the inadequacies of the preceding approach. Therefore, any causes for change were attributed to internal conditions rather than to external stimuli, and the focus was moved away from an eventful diffusionist approach to a more progressive one, which would take into consideration the general socioeconomic and political dynamics. Renfrew (1972), in his study of the Aegean EB, adopted an economically and ecologically/environmentally driven approach which favoured an internal explanation for the transformations occurring during the course of the 3rd millennium BC. According to this, the prehistoric Aegean archipelago exhibits a great geographical and cultural variability (different landscapes and seascapes, microregions, and diverse sites), reflecting the constant visual, cognitive, and experiential engagement between humans and their proximal environment and therefore the material constructions, socio-economic processes, and social interactions deriving from this relationship (Terkenli 2001). The reconstruction of an internal logic of the technological changes – technological determinism – was also one of the prime objectives of New Archaeology, for it was thought to be the source of social progress (Trigger 2006, 390).

An alternative to Processual Archaeology began to develop in the 1980s, referred to as Post-processual Archaeology (Shanks and Hodder 2007), which has in turn been influenced by advances of the anthropological-social sciences, such as the concepts of materiality (Knappett 2007), technological invention and innovation (Geselowitz 1993; Dobres 2000), and agency (Dobres and Robb 2000; Barrett 2001). It aimed at rejecting the neoevolutionary approaches of the previous traditions, while moving towards the explanation of social change by focusing on human agents; the latter being engaged actively with material culture within a wider spatiotemporal long-term system. Furthermore, the study of material culture – especially pottery – has not only questioned the principle of linear causality, but has also shifted away from solely diffusionist and evolutionary theories mainly concerned with the reconstruction of typo-chronological sequences that are based on the ground of stylistic and morphological observations and typological-functional similarities between sites (Arnold 1985, 19). There has instead been a turn towards the consideration of other factors in order to explain interrelation between technological processes, socio-economic developments, and material/ideological transmissions (Rice 1987, 113-166; Sinopoli 1991, 83-160). This suggests that the examination of any kind of technological change should go beyond the study of technical attributes and rather concentrate on the embodied practical knowledge of skill (Ingold 1990, 7).

Taking into consideration all the aforementioned theoretical developments, the explanation of socio-cultural and technological change is far from being directly linked. Nevertheless, ceramics have been valuable in understanding changes, at least at a technological level, within the framework of network theories and interaction between different sites/areas. Since previous studies of EB ceramics from Heraion are either limited or almost absent (Milojčić 1961; Podzuweit 1979, 82-85) and have focused on establishing a relative chronology and a basic typology for comparisons with the rest of the east Aegean, based mainly on stratigraphical observations and variation in morphological and stylistic terms, the present project provides a unique opportunity to examine how different aspects of a ceramic system articulate with each other.

1.3. Significance and timeliness of this project

This thesis examines both the internal conditions and external stimuli that shaped the EB insular communities of Samos, using a ceramic-based perspective. The research focuses on Heraion, the largest and extensively documented 'proto-urban' settlement in the eastern Aegean. The integrated examination of ceramics from this site, including various scales of analysis (typological classification, macroscopic and microscopic fabric analysis, examination of variation between form, fabric, and finish, microstructural analysis), will be placed against changing modes of intra-site organisation and understood against the network of economic exchanges, cultural influences, and technological transfers across the Aegean.

Although the prehistoric settlement has been known since the 1950s (Milojčić 1961; Walter 1963; Kouka 2002, 276-294), the significance of Heraion has been generally overlooked within archaeological scholarship, as well as of that of the eastern Aegean in general, in favour of the western, central, and southern prehistoric Aegean. The recent discovery (2009-2013) of unknown habitation levels at Heraion, dating from the Chalcolithic (Ch) through the EB II early periods (Kouka 2013; 2014a; 2014b), provide the opportunity for an holistic consideration of the settlement's life-history and for a re-investigation of some of the central theoretical issues governing the EB. The wealth of ceramic evidence at Heraion presents us with the potential to explore intra-site technological practice, as well as inter-site relations at a regional level through the comparative examination of thin sections (see below) from other sites and an extensive bibliographical research on form/finish/fabric comparanda and vessel parallels from across the Aegean and Anatolia in the Ch-EB. Given the absence of systematic research within the geographical setting of Samos, except for its SE part which constitutes the only known, inhabited area on the island, this study attempts to bring together the available data on the EB pottery.

The significance of this material and timeliness of this interdisciplinary project lies in several factors:

1. The ceramic material under study derives from an extensively excavated site, whose development can be traced both over space (horizontally) and across time (vertically). The recent excavations undertaken by the University of Cyprus (2009-2013) under the auspices of the German Archaeological Institute at Athens north of the Sacred Road of the Hera Sanctuary (Kouka 2013; 2015) provide the opportunity to analyse unpublished ceramic assemblages, covering the entire EB and coming from well-defined habitation contexts, a small part of which derives from an older excavation conducted in 1981 in the same area.

2. The site under investigation constitutes the largest insular society in the eastern Aegean, traditionally characterised as early urban, and as such is characterized by a well-planned settlement pattern, the construction of buildings with a special function (Heraion I: *Grossbau*/Communal or Storage building; Heraion III: *Zyklopischer Bau*/Cyclopean building) and its protection with a monumental fortification/anti-flooding wall. All these features have been interpreted as communal efforts that required the presence of a political/central authority and a hierarchically-structured community (Kouka 2002, 295-302, pls. 45-55).

3. Samos belongs to a hitherto neglected area, whose focal position within prehistoric Aegean developments is only now beginning to be appreciated, on the grounds that the eastern Aegean islands are assumed to constitute the geographical and cultural link between western Anatolia and the central Aegean. Recent and ongoing studies on sites of the eastern Aegean/western Anatolia (e.g. Poliochni on Lemnos, Thermi on Lesbos, Emporio on Chios, Miletus, Liman Tepe, Bakla Tepe, Çukuriçi Höyük) and the Cyclades will provide the proposed project with a wider comparative framework, as well as synchronization of cultural developments (Kouka 2002; 2013; Şahoğlu 2005b; Horejs 2017; Broodbank 2000; Hilditch 2008; Wilson 1999; 2013; Sotirakopoulou 2016).

4. The strength of this project lies in its integrated methodology which combines macroscopic examination of 1970 individual vessels or sherd concentrations with analytical techniques of 343 samples for petrography and 20 samples for scanning electron microscope/SEM analyses. Rather than concentrating on a single ceramic category, this study covers the range of wares, fabrics, and shapes present in all three ceramic assemblages from Heraion.

5. It employs a theoretical approach which concentrates explicitly on the social dimensions of technological practice, according to which technology is a socially constituted dynamic "process of combined social and material engagement, situated within and structured by the interactions of technical agents with each other...and their material world" (Dobres 2000, 125).

1.4 Main research components

This thesis sets out to explore the unknown intra-site organisation of the production technology, as well as the inter-site circulation of EB pottery, the latter by using comparison of the Heraion material to an extensive comparative body of analytical data from selected contemporary sites of the Cyclades (Ayia Irini on Kea, Akrotiri on Thera, Panormos on Naxos, Phylakopi on Melos), Crete (Ayia Photia, Phaistos, Knossos), the eastern Aegean islands (Emporio on Chios), and the western Anatolian littoral (Liman Tepe, Bakla Tepe, Çukuriçi Höyük, Miletus). It employs a systematic, integrated, and contextual analysis of ceramic production, exchange, and consumption.

- The first component of the project is the integrated analysis of domestic pottery assemblages from successive habitation phases. The first aim is to illuminate aspects of ceramic manufacture and technology and to reconstruct the operational sequence of the pottery production process through the *chaîne opératoire* approach (see Sections 4.2.2-4.2.3 in Chapter 4 for definition and advantages/disadvantages). This micro-scale analysis will allow the reconstruction of choices made by individual potters and workshops, the diachronic transmission of technical skills, and the emergence of local technological traditions and ceramic styles. This analysis will build on the author's MSc dissertation (Menelaou *et al*. 2016), which for the first time revealed a compositionally diverse local assemblage in the EB II late-III periods. The current project will extend chronologically to include the entire EBA, will combine in a consistent manner three ceramic assemblages excavated at different times and areas at Heraion, and will integrate different scales of analysis and methods (see below).

- Having established an understanding of the local ceramic tradition, the second component of the project will consider the imported pottery and the examination of stylistic influences on local manufacturing traditions, as evidenced by macroscopic and microscopic features. The results of this analysis will be contextualised in the changing intensities and shifting networks of exchange which characterize the Aegean EB. Previous comprehensive studies (Broodbank 2000; Kouka 2002) have discussed an increase in ceramic exchange already from EB I onwards and have suggested links with the circulation of metal and obsidian (Kouka 2002, 299-301; 2013, 576-578). The second half of the EB sees more extensive and intensive contacts, especially during the so-called Lefkandi I-Kastri phase, manifested in the spread of specific pottery technologies, types, and styles indicating multidirectional influences and technological transfers (Rutter 1979; Kouka 2002, 300-301; Day *et al.* 2009; Pullen 2013). Only a few studies have systematically contextualised these newly-emergent shapes in their assemblages (Wilson 1999), or have assessed the implications of their adoption for transformations in recipient local ceramic traditions. The aim of this analysis is to understand the position of Heraion in these exchanges and to understand their scale and intensity.
- The third component is the study of the use and consumption of ceramics in different social contexts. Special attention will be given to variation between the pottery of isolated domestic structures and the communal buildings in order to understand relations between individual units and the community as a whole (Kouka 2002, 285-294, pls. 45-55, tabs. 95, 97, 101, 106, 110). Drawing together the information on procurement and consumption of pottery may allow us to assess choices made at the level of individual households, but also cooperation/competition between family units and social groups.

1.5 Aims and objectives

This thesis follows a multi-scale programme of analysis, using typological, macroscopic, petrographic, and microstructural (SEM) methods to examine in a consistent fashion a wide range of ceramic forms from the Ch to the end of the EB. The primary analytical objectives of this study can be summarised as follows:

1. To classify the samples into fabric groups and, thus, to characterize macroscopically and microscopically the production technology of the pottery assemblage (raw materials, surface treatment, forming techniques, firing characteristics, etc.);
2. To reconstruct manufacturing traditions and to examine their diachronic development;
3. To assess the relationship between ceramic forms, fabrics, and functional categories;
4. To examine if the distribution and circulation of specific classes of pottery is restricted to specific contexts of the settlement under investigation. For instance, to test if there is a preference of storage vessels for buildings thought to have a special use, or even so if certain 'wares' and decorative modes (e.g. painted, incised) are found consistently in relation to pots and specific areas of the settlement;
5. To identify possible raw material sources through the clay prospection programme (geological provenance) undertaken by the author in 2015-2016 and specific areas of production (geographical provenance) of the samples examined, and to distinguish between local products and possible imports.

Furthermore, the interpretation of these analytical objectives will have implications for the reconstruction of the intra-site organisation and socio-political and economic aspects of the EB Heraion community. Therefore, a number of more interpretative aims have also been set:

1. To assess the assumption that technological changes and craft specialisation reflect processes of social change;
2. To explore the technological choices and decisions taken at household level in a period of emerging complexity;
3. To position the Heraion community within Aegean networks of material and ideological transfers in a period of increasing connectivity.

1.6 Structure of thesis

This thesis is organised into ten chapters, including Chapter 1: Introduction. Chapter 2 presents the chronological framework of the EB Aegean and Anatolia, including a brief overview of the literature on the archaeological evidence available with a specific emphasis on the eastern Aegean. It attempts to provide a solid background for Samos and discusses briefly the ceramic developments in a diachronic fashion, focusing on key conceptual approaches that have directed the study of the EB. Chapter 3 provides background information on Samos with a main focus on the settlement of Heraion, emphasising its geographical location, architecture, archaeological stratigraphy, and contexts. The methodology employed in the course of this project is discussed in Chapter 4, along with a brief overview of any available analytical data on pottery from Samos. It describes the principles of each method with examples from previous Aegean studies and most importantly it outlines the theoretical and conceptual framework used in this thesis in the technological reconstruction of pottery and the role of choice. Chapter 5 presents the geology of Samos with an overview of the main rock units, focusing mainly on the south-central part where the settlements are located. This chapter also discusses the aims and objectives of the clay prospection and sampling, as well as the criteria for the selection of specific geological samples, and provides a detailed account of the deposits sampled and the results of their analysis (Appendix I). The interpretation of these results is discussed alongside those of the following chapters. Chapter 6 discusses information resulting from the macroscopic analysis (wares, fabrics, types/shapes, forming techniques, surface treatments) of the stratified ceramic assemblages from EB Heraion presented chronologically. This constitutes a detailed presentation of the shape repertoire and wares, as defined by the original study undertaken by the author (Appendix II). Chapters 7 and 8 present the analytical results with a brief introduction on the use and utility of each method. More specifically, in Chapter 7 (Appendix IV) the petrographic results are presented by fabric and technological and provenance associations within each are given, alongside a discussion on the spatial distribution of fabrics, mineralogical links between the groups, provenance determination, and intergroup links between the macroscopic and microscopic levels of analysis. Chapter 8 presents the results of the SEM analysis of representative samples, followed by a discussion of these results in association with the macroscopic results and the fabric groups deriving from the petrographic analysis. Chapter 9 provides a synthesis of the analytical results and attempts an holistic characterisation of the production technology of the local ceramic tradition, along with an investigation of their provenance, where possible. All this information is discussed from an interpretative perspective trying to identify patterns of social change at Heraion and the eastern Aegean in general during the course of the 3rd millennium BC. Finally, Chapter 10 summarises the conclusions and suggests issues for further research.

1.7 Summary

During the last decades there have been many changes in the way we approach the EBA and new questions have been formulated, not only due to the study of larger datasets, but also due to refinements in traditional chronological systems and new theoretical trajectories guided by explanatory models concerning the often assumed correlation between chronological, technological, and sociocultural change. To sum up, this thesis uses an integrated analytical approach to characterise the technological variability observed in an island ceramic assemblage in terms of diachronic changes. These changes or continuities in the local technological tradition, identified through the examination of a range of vessel types, fabrics, and functional categories, reflect the levels of intra-site and interregional scales of production, consumption, and distribution of pottery during the 3rd millennium BC.

CHAPTER 2: The chronological and archaeological framework of the Early Bronze Age in the eastern Aegean and western Anatolian littoral

2.1 Introduction

The Aegean EB is synonymous with the 3rd millennium BC (*ca*. 3100/3000-2000 BC), although the synchronization of the various cultural sequences, as well as their absolute dating can be problematic due to regional diversity, issues of terminology, and the ever-growing dataset of excavated sites (cf. Kouka 2009; Manning 1995, figs. 1-2). In this chapter the chronological framework of the period in question is defined, followed by a brief overview of the available archaeological evidence from the eastern Aegean and western Anatolia. It is not the aim of this thesis to undertake a detailed review of research carried out in the EB Aegean, as this has been done successfully elsewhere (cf. Cullen 2001; Kouka 2002). Instead, emphasis is placed on providing a chronological and historical framework for this project and on positioning Samos within Aegean-Anatolian developments (Figs. 2.1-2.2). Although the ceramic material from Heraion, alongside a detailed presentation of comparanda and contextual information, is carried out in Chapter 6, references are made here to the diachronic development of pottery in the region under discussion.

2.2 Chronological framework of the Aegean Early Bronze Age

The relative chronology of the Aegean Bronze Age was established already in the early 20th century, based on the tripartite chronological system introduced at Phylakopi by Mackenzie and later on by Evans for Minoan Crete and by Wace and Blegen for Mainland Greece and the Cyclades (Wace and Blegen 1916-1918, 186-189). According to this system, the EBA was distinguished by cultural labels, namely EM for Crete, EC for the Cyclades, and EH for the Greek mainland. Subsequently, with the expansion of the archaeological research to northern Greece and the east Aegean islands from the 1950s onwards, new tripartite divisions were introduced (EB I-III or EB 1-3; Renfrew 1972, 116-134), while further sub-divisions were also applied for specific sites based on architectural and ceramic sequences (e.g. Troy I-V, Thermi I-V, Emporio V-I, Heraion I-V). For each of the aforementioned cultural periods three sub-phases (I, II, III) were also marked off, based exclusively on typological correlations between different ceramic sequences from reliable stratified deposits (Maran 1998, 37-53, tabs. 80-82; Alram-Stern 2004, 151-193; Manning 2010), although this tripartite system "became less convenient when subsequent discoveries showed that real ceramic distinctions do not always fall neatly at the boundaries between the periods" (Shelmerdine 2008, 3).

2.2.1 The relative chronology of EBA Cyclades and Mainland Greece

Although not immediately related to the present study, a brief overview of the relative chronological systems developed over time in EBA Cycladic archaeology is attempted below (Tab. 2.1), as certain correlations are made throughout this thesis with the Heraion pottery sequence.

Renfrew, in an attempt to refine the conventional tripartite scheme (1972, 53-55), introduced a new system that uses geographical labels for the distinction of cultural groups. Hence, he recognized the existence of Grotta-Pelos culture for EC I (Kampos Group for late EC I), Keros-Syros culture for EC II, and Phylakopi I culture for EC III (1972, 135-195, tab. 9.2; 196-221, tabs. 13.2-13.4; Manning 1995, 41-73). He also suggested (Renfrew 1972, 99-116) that EH I of Mainland Greece is named as the Eutresis culture and EH II as the Korakou culture, while he designated EH III as the Tiryns culture for the NW Peloponnese and Lefkandi I Group or assemblage for the coastal areas between Thessaly in the north and eastern Attica in the S (e.g. Aegina, Attica, Boeotia, Euboea).

Further refinements of the Cycladic relative chronology were attempted by Barber and MacGillivray (1980, 150-151, 155-157, tab. I, Ill. 2), who sub-divided EC III into EC IIIA (contemporary with the Kastri Group) and EC IIIB (contemporary with Phylakopi I culture). Rutter, who had already underlined the contemporaneity of the Lefkandi I assemblage in Mainland Greece with the Kastri assemblage of the EC II Keros-Syros culture (1979, 1-8, tab. 3), as defined by Renfrew (1972, 180-183, 533-534, tab. 13.3), moved a step forward, and suggested that a cultural hiatus existed in the EC III, proposing a different division (Rutter 1983, 70-71, 74): EC II was divided into EC IIA, corresponding to the Keros-Syros culture, and EC IIB, corresponding to the Kastri Group, while the EC IIIA of Barber and MacGillivray would represent an EC III gap and EC IIIB was renamed as Middle Cycladic (MC) I (cf. Kouka 2009, tab. 1).

Figure 2.1: Map showing western/central Aegean and Greek mainland sites mentioned in this thesis (after Kouka 2016, fig. 9.1).

Period	West Aegean	Date
EC III/EC IIIB	Phylakopi I-ii-iii (Melos); Dhaskalio C (Keros)	*ca*. 2250/2200-2150 BC
EB IIB/EC IIIA (Kastri Group-Lefkandi I)	Ayia Irini III (Kea); Akrotiri Pillar Pits 7N, 35N (Thera); Dhaskalio B (Keros); Zas Cave IV and Panormos (Naxos); Markiani IV (Amorgos); Palamari III (Skyros); Lerna III:late C-D (Argolid); Kolonna III/Phase C (Aegina); Lefkandi I (Euboea)	*ca*. 2500/2450-2300/2250 BC
EC II developed	Ayia Irini II (Kea); Phylakopi A2 (Melos); Skarkos (Ios); Panormos (Naxos); Palamari II (Skyros); Lerna III:C (Argolid); Kolonna II/Phase B (Aegina)	*ca*. 2550-2500/2450 BC
EC IIA/EC II early (Keros-Syros)	Akrotiri (Thera); Dhaskalio A (Keros); Markiani III (Amorgos); Lerna III:A-B (Argolid)	*ca*. 2700/2650-2550 BC
EC I (Grotta-Pelos and Kampos Group)	Phylakopi AI; Markiani I-II (Amorgos); Akrotiri (Thera)	*ca*. 3100/3000-2700/2650 BC
FN/Ch/Attica-Kephala	Ayia Irini I and Kephala (Kea)	End of 4th millennium BC

Table 2.1: Synchronisations between various Cycladic islands and selected sites of the Greek mainland (after Kouka 2009; Renfrew *et al*. 2012; Wilson 2013).

'Gaps' in the relative chronology of the late Early Bronze Age

Recent studies have revisited Rutter's view on the existence of a gap in the late EB (1983) and presented new evidence from the Cyclades, the Greek mainland, Crete, and the eastern Aegean (Broodbank 2013; Pullen 2013; Brogan 2013; Kouka 2013). These studies have rightly implied that there seems to be no common trend in the evolution of the EB sequence amongst the various Aegean cultural regions. Instead, it is most likely to explain this gap from the perspective of the Aegean regionalism and cultural distinctiveness of certain areas, according to which a number of local parameters, environmental causes (Wiener 2013; 2014), and wider socioeconomic phenomena may have shaped the available material evidence and in turn our ideas of the cultural continuity/discontinuity in the late EB. In fact, it has been suggested that no abrupt breaks or gaps in the material culture can be recognized, either in our knowledge, or from a chronological standpoint, in the case of Crete and the eastern Aegean (Brogan 2013; Kouka 2013). Nevertheless, an entirely different picture prevailed in past scholarship, which favoured theories of destructions and catastrophes for the explanation of archaeological gaps in the end of the EB, much discussed by Mellaart in his overview of Anatolia and the Aegean (1958).

In contrast to the smooth development of the material culture in the aforementioned regions, in the Cyclades and the southern Greek mainland a more pronounced or relatively undocumented cultural break or transition is observed from EB II to EB III, reflecting according to Broodbank (2013) both a lacuna in time and a hiatus in our ability and knowledge to interpret how the cultural behaviour shifted from one phase to the other, which is due to the lack of well-stratified sites in the Cycladic islands, the manifestation of dispersed island trajectories, climate changes, and major technological advances in maritime travel associated with sail-driven shipping (Rutter 2013, 594; Broodbank 2000, 341-349). Sotirakopoulou (2016, 354-357) has recently argued strongly against an EC III gap, based on the evidence form Dhaskalio on Keros (for further discussion, see Chapter 9).

2.2.2 The relative chronology of EBA western Anatolia and the eastern Aegean islands

A comparable picture is seen in the relative chronology of the EB in western Anatolia, hence following the conventional tripartite system of the EB I, EB II, and EB III as organized around the major stratigraphical sequences of the Anatolian peninsula, especially of the well-studied sites of Troy, Beycesultan, Demircihüyük, and Tarsus (Blegen *et al*. 1950; 1951; Lloyd and Mellaart 1962; Goldman 1956; Easton 1976; Korfmann and Kromer 1993). As Mellaart first noted (1957, 55), a reconsideration of

Anatolian chronology was requisite in its own right, instead of being "an adjunct to that of Syria and the Aegean". Based on ceramic and architectural links, Mellaart (1957, 69-85) attempted to establish chronological correlations between different regions in Anatolia, such as Kültepe and Alishar Hüyük with Mesopotamia, paying more attention to the comparative chronology of these sites with Tarsus in Cilicia (SE Anatolia) and Troy in the NW, and of the latter ones with the EH and EC cultures in search of foreign contacts, especially during the late EB.

Renfrew, taking into account the chronological correlations between the Troy sequence and those of the Cyclades and the Greek mainland, synchronized the NW Anatolian EB 1 with Troy I, the EB 2 with Troy II, and the EB 3 with Troy III-V (1972, 127-131, 206-210; Kouka 2009, 134). He has also correctly pointed out the difficulty in correlating the Trojan EB period with the sequence at Tarsus and establishing an absolute chronology (cf. Renfrew 1972, 216-221, tabs. 13.4-6; Mellink 1992, tabs. 2-3). This was partly due to the complex chronological scheme and nomenclature developed by various researchers over the course of the last 130 years to describe the stratigraphy at Troy, and the inadequacies of the first excavations at the site (Easton 1976, 145, tab. 1; Korfmann and Kromer 1993). Recent studies dealing with the relative and absolute chronology of Troy have produced much progress to date, based mainly on ceramic typology, seriation and correspondence analysis, absolute dating methods, etc. (cf. Manning 1995, 154-160; 1997; Çalış-Sazcı 2006; Pavúk 2010; Weninger and Easton 2014; 2017).

Similarly to the Cycladic chronology, there has been considerable debate among scholars over the periodization of Anatolian chronology and how major stratigraphical sequences of particular sites fit into the proposed tripartite scheme. Hence, the Anatolian chronological system was further developed by Efe (1988, Abb. 98; 207, fig. 18), based on the stratigraphical evidence from Demircihüyük (EB 1, EB 2a, EB 2b, EB 3a, EB 3b), and Mellink (1992, 213-219, tabs. 2-3) who proposed a different subdivision based on the much-discussed correlation between Troy and Tarsus (EB IA, EB IB, EB II, EB IIIA, EB IIIB) (Kouka 2009, 134).

The most immediate chronological synchronisms for the eastern Aegean islands were derived from the major western Anatolian settlements, mainly Troy, rather than from the central Aegean (Tab. 2.2). For instance, Heraion I-V has been correlated by Milojčić (1961, 59ff, fig. 3) with Troy I late/II early to Troy V (Podzuweit 1979, 82ff; Manning 1995, 84). While the overall phasing and relative dating in the east Aegean follows Anatolian schemes, the slight divergence of certain periods and varied nomenclature between Aegean and Anatolian chronology can often create confusion, especially when dating a phase by imported pottery from the central/west Aegean (e.g. Dhaskalio C on Keros: Sotirakopoulou 2016). For instance, imported frying pans and Urfirnis sauceboats found at Liman Tepe VI:1d and VI:1c-1b (Anatolian EB I) were taken as indications of the earliest Cycladic/Helladic imports to western Anatolia and would indicate that the Kampos Group of the Cyclades must have been extended back to the beginning of the EC I (Kouka 2009, 146, fig. 9; Kouka and Şahoğlu forthcoming; for the chronology of EH sauceboats, see Manning 1995, 49). This is due to a synchronisation of the end of the Anatolian EB I with the beginning of the EC II/EH II. Similarly, at Çukuriçi Höyük IV-III (EB I) a number of transport jar handles should be synchronised with the EC II late, which is however absent from the local sequence (M. Röcklinger, pers. comm., November 2017). Thus, synchronisms of the eastern Aegean islands, due to their position between these two regions, are based on a combination of both the central Aegean and the western Anatolian systems.

Period	East Aegean islands	Western Anatolia	Dodecanese	Date
EB IIIB/EB 3B/EB 3 late	Poliochni Yellow (Lemnos); Heraion V (Samos)	Troy IV; Liman Tepe IV:1; Aphrodisias EB 4	Asomatos 3B (Rhodes); Serraglio and Aspri Petra Cave (Kos); Vathy Cave, Daskalio (Kalymnos)	*ca*. 2200-2000 BC
EB IIIA/EB 3A/EB 3 early (Anatolian Trade Network)	Poliochni Yellow (Lemnos); Heraion IV (Samos)	Troy III-IV; Liman Tepe IV:2; Miletus IId; Aphrodisias EB 4; Tavşan Adası 2	Asomatos 3A (Rhodes); Serraglio and Aspri Petra Cave (Kos)	*ca*. 2300-2200 BC
EB II late-final/EB 2 late (Anatolian Trade Network)	Poliochni Red-Yellow (Lemnos); Emporio I-II (Chios); Heraion II-III (Samos)	Troy II; Liman Tepe V:2-1; Miletus IIc; Aphrodisias EB 3; Tavşan Adası 2	Asomatos 2 (Rhodes); Asklupis settlement and cemetery (Kos)	*ca*. 2500-2300 BC
EB II developed	Thermi V (Lesbos); Emporio II? (Chios); Heraion I/1 (Samos)			*ca*. 2650-2500 BC
EB II early/EB 2	Poliochni Green (Lemnos); Thermi IV (Lesbos); Emporio III (Chios); Heraion 3-2 (Samos)	Troy I late; Liman Tepe V; ÇuHö II? mixed	Asklupis settlement and Halasarna region (Kos)	*ca*. 2750-2650 BC
EB I late	Poliochni Blue (Lemnos); Thermi III (Lesbos); Emporio IV	Troy I early/middle; Liman Tepe VI; ÇuHö Va-III; Miletus IIa	Asklupis settlement and Halasarna region (Kos)	*ca*. 3100/2900-2750 BC

EB I /EB 1	(Chios); Heraion 4 (Samos) Poliochni Blue (Lemnos); Thermi I-II (Lesbos); Emporio V (Chios); Heraion 5 (Samos)			
Ch	Poliochni Black (Lemnos); Ayio Gala Upper Cave, Emporio X-VI (Chios); Tigani III-IV, Heraion 6 (Samos)	Liman Tepe VII; Bakla Tepe; ÇuHö VII-Vb; Miletus Ia-Ib; Tavşan Adası 1	Vathy Cave (Kalymnos); Halasarna region (Kos)	*ca.* 4000-3100/2900 BC

Table 2.2: Synchronisations between the east Aegean islands, western Anatolian littoral, and the Dodecanese islands (after Şahoğlu 2005b; Kouka 2009; Marketou 2010a; 2010b; Georgiadis 2012; Vitale 2013; Horejs 2017).

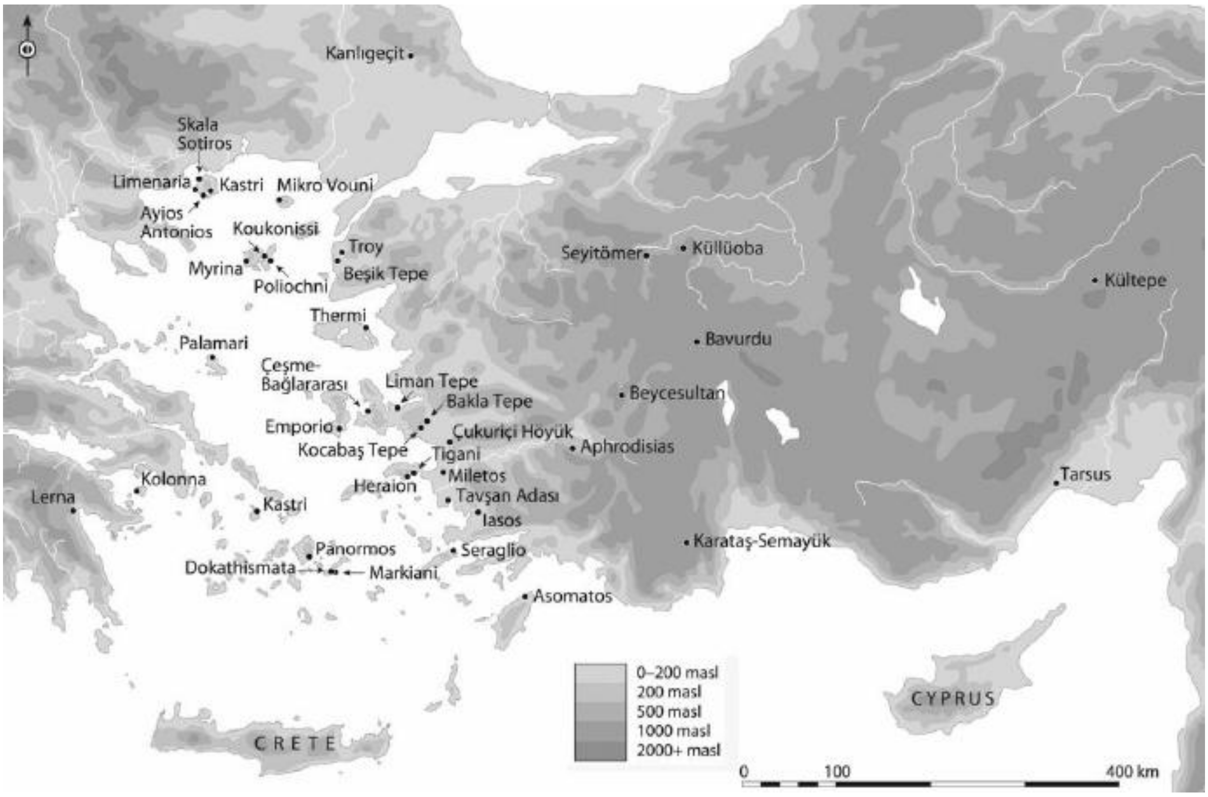


Figure 2.2: Map showing eastern Aegean and Anatolian sites mentioned in this thesis (after Kouka 2013, fig. 4).

2.2.3 Interpretative chronological terms and descriptive nomenclature

Apart from the alphanumerical chronological system, several cultural/interpretative labels encompassing a wider meaning have also been established in the Anatolian chronology, on the basis of strong interconnections and affinities identified between material assemblages and archaeological features – mostly pottery and architecture – within and between different regions. One such was introduced by Korfmann (1996, 2, 22, fig. 18) for the description of the strong links in the material culture across the eastern Aegean/western Anatolia, with Troy I-III being the focal point, named as 'Maritime Troia Kultur/Maritime Culture of Troy' (Sazcı 2005). In extension, for the period Troy IV-V Korfmann introduced the 'Anatolian Troia Culture' term, to stress the significant shift in the material culture between Troy III and the following phase in terms of its more mainland Anatolia-oriented connections. As Efe rightly remarked (2007, 47), there is a breaking point in the development of the Trojan indigenous culture in the EB III, which can be better understood in the framework of the "intensification of Troy's cultural and economic relations with the interior of Anatolia and beyond".

Shortly after Korfmann's definition, and having taken into account the overlooked eastern Aegean islands, Kouka (2002, 295-302, 305-306) proposed a different term deriving from her thorough review of the so-called 'Trojan culture', namely 'Kulturkreis der Nord- und Ostägäis/Northern and Eastern Aegean Culture'. Kouka's definition is based on the recognition of a cultural *koine* throughout the east Aegean islands (Lemnos, Lesbos, Chios, Samos) and the western Anatolian littoral already from EB I, in terms of settlement pattern and planning, material culture, and socioeconomic structures, expanding beyond the vicinity of the Troad (Kouka 2016, 210).

More terms have been proposed for the second half of the 3rd millennium BC, especially the period corresponding to the Helladic/Cycladic 'Lefkandi I-Kastri Group' or 'Wendezeit/Time of change' as defined by Maran (1998, 450-457), as cultural interaction and connectivity reached its peak right after the Keros-Syros phase encapsulated in Renfrew's 'International Spirit' (1972). In Anatolia, EB II late is termed by Şahoğlu (2005b) the 'Anatolian Trade Network' period, during which a distinctive set of cultural features are identified over a wide geographical area extending from south-eastern Anatolia via central and eastern Anatolia, the east Aegean islands, the Cyclades, and Mainland Greece. Apart from Şahoğlu's sea-route based cultural scheme, an opposite counterpart inland trade route, connecting Cilicia with the north Aegean, has been also proposed to exist in the same period, known as the 'Great Caravan Route' (Efe 2007, fig. 18).

Despite the usefulness of the aforementioned chronological systems, the increasing number of Aegean terminologies and nomenclatures (cf. Kouka 2009, 133-

137, tabs 1-2, 5), either in a purely alphanumerical system or one based on site names, geographical labels, and cultural groups, do not always carry intrinsic chronological information, nor do they take into account that in some instances certain ceramic groups extend beyond confined chronological boundaries. Instead, as Renfrew (1979, 56) has already stated "there is already the risk that the material is being arranged to fit the classificatory scheme, rather than the reverse".

2.2.4 The absolute chronology of the Aegean EBA

As opposed to the confusion created over the relative chronology, recent developments in absolute dating offer a more secure and straightforward basis for understanding Aegean-Anatolian correlations. This mainly relies upon the use of radiocarbon dating and dendrochronology methods on samples from a range of sites across the Aegean and Anatolia (cf. Manning 1995, 141-153, tab. 2; 1997; 2008; Kouka 2009, tabs. 2-7). Taking into account the available stratigraphic (relative chronology) evidence as well as the calibrated data (absolute chronology) from sites in the EB eastern Aegean and western Anatolia, which constitutes the core area of the present study, the following chronological scheme (Tab. 2.3) is generally adopted (after Kouka 2002, tab. 1; 2009, 137-140; 2013, fig. 1; Şahoğlu 2005b, fig.2; Efe 2007, fig. 18):

Cultural Phase	Years BC Calendrical
EB I	3100/3000-2750/2700
EB II early	2750/2700-2550/2500
EB II late	2550/2500-2200
EB IIIA	2200-2100
EB IIIB	2100-2000/1950

Table 2.3: EB periodization of the eastern Aegean/western Anatolian region.

2.3 The historical background: archaeological evidence from the eastern Aegean/western Anatolian region

This section deals with the brief presentation of the cultural framework of this study, with a special geographical focus on the eastern Aegean region. First, a background study is provided, followed by a discussion on the cultural features marking the EB.

As Rutter has recently pointed out (2013, 595), there is "need to become more familiar with the different culture zones that together make up the eastern margin of the Aegean – namely, the sites and material culture of the western Anatolian mainland". This view is reflective on the one hand of the significance of this region forming an interface between the Aegean basin and the Anatolian plateau, and on the other hand of the lacuna in archaeological scholarship regarding the study area in question, which has only received more attention in the past two decades. Although an enormous amount of work has been undertaken in the form of systematic archaeological excavations and surface surveys, since the early 20th century[4], the eastern Aegean/western Anatolian littoral has been generally neglected, in contrast to the western, northern, and southern Aegean where the material record has been intensively investigated. A possible explanation for this is the absence in this area of succeeding 'cultures' that are comparable to the palatial civilisations of Minoan Crete and Mycenaean Greek mainland. Much scholarly attention has been paid to the search for the origins of this cultural manifestation in the aforementioned areas (Renfrew 1972).

This is also due to the existence of only a few thoroughly published sites in the region of interest (Poliochni on Lemnos, Thermi on Lesbos, Emporio on Chios, Troy, Beycesultan, Demircihüyük, Tarsus-Gözlükule, Karataş-Semayük), while the majority still await meaningful publication (e.g. Heraion on Samos, Küllüoba, Liman Tepe, Bakla Tepe, Çukuriçi Höyük, Miletus). Yet another possible explanation lies in the political turmoil between Greece and Turkey in the early 20th century, during which the geographically distant east Aegean islands were still considered to be part of the Ottoman Empire. It is in this framework that these islands should be examined also during prehistory. Mellink (1986, 140) has remarked that the "natural connections of the coastal zone of western Anatolia are with the Aegean area...than the faraway urban trade centres of the Anatolian plateau", which can be also supported in reverse for the east Aegean islands. Moreover, past significant discrepancies in archaeological practice across the Greek-Turkish political border have impeded earlier attempts towards integrating these two sub-regions. Nonetheless, the relatively recently improved political relations between the two countries allow effective collaborative research to emerge across national divides (e.g. Erkanal *et al*. 2008).

Continuous archaeological research from the 1870s through the 1960s in the eastern Aegean islands and western Anatolia has revealed a rich stratigraphic sequence of the EBA. This is the case for the extensively excavated sites of Troy, Poliochni, Thermi, Emporio, and Heraion (Blegen *et al*. 1950; 1951; Bernabò Brea 1964; 1976; Lamb 1936; Hood 1981; 1982; Milojčić 1961). Since the 1980s new archaeological

[4] The case of Troy is an exception, being excavated ceaselessly and studied systematically since the late 19th century, when part of the fortified settlement first came to light by H. Schliemann (see numerous reports in Studia Troica; Blegen *et al*. 1950; 1951).

evidence has been made available from excavations in sites of the northern and eastern Aegean such as Skala Sotiros, Kastri, Ayios Antonios and Limenaria on Thasos, Mikro Vouni on Samothrace, Palamari on Skyros, Myrina and Koukonissi on Lemnos, Heraion on Samos, Seraglio on Kos, Asomatos on Rhodes, as well as in the western Anatolian littoral such as Liman Tepe, Bakla Tepe, Çeşme-Bağlararası, Çukuriçi Höyük, Miletus, and Tavşan Adası (cf. Kouka 2002, 2-7, maps 1-2; 2013; 2014a; 2014b; Şahoğlu 2005b; Horejs 2017).

The following discussion will review the relative phasing of the EBA with the aim to assess the various theoretical and interpretational notions developed in archaeological theory regarding the *emergence* and *evolution* of cultures and the relationship between technological developments and social change or complexity, incorporating Heraion where possible.

2.3.1 The Chalcolithic background

This brief review begins from the late 4th millennium BC because the LCh – known as FN or LN I-II in other areas and recently named as Proto-EBA or EB IA (Coleman and Facorellis 2018) – sees the appearance of the processes until recently thought to have been characteristic of the EBA. The time span covering the 4th millennium BC in western Anatolia (cf. Tomkins 2014, fig. 1 for comparative chronology between Cretan, Cycladic, and Anatolian NL and Ch) has received very sparse attention compared to the antecedent and preceding periods. This hiatus in our knowledge is a consequence of the hitherto limited archaeological research, which has changed fundamentally in the last decades, and the nature of archaeological remains that have been dated to this period. Although a poorly investigated and ill-defined period, it has a crucial position between the emergence of farming and sedentary life characterising the EN-MN and the development of urban communities in the EB in western Anatolia. This ‘threshold view of the past’ as characterised by Düring (2011a, 200), has resulted in an uneven investigation of the prehistory of western Anatolia, to a large degree originating from theoretical schemes that condense prehistoric developments into a few, rapidly occurring events in the explanation of cultural changes.

The view of the Ch in western Anatolia as an eventless and unimportant period with smaller-scale, less complex societies has recently changed due to increasing interest in this period (cf. Horejs and Schwall 2018; Mina 2018). New data and indeed the careful re-examination of older excavations (e.g. Beycesultan, Aphrodisias, Ulucak, Çamlibel Tarlası, Çukuriçi Höyük, Bakla Tepe, Poliochni Nero and Myrina-Richa Nera on Lemnos, Emporio on Chios, Tigani and Ch Heraion on Samos; see Horejs and Schwall 2015, fig. 1; Kouka 2014b), as well as new perspectives on the processes that encouraged the development of urban revolution already in the 4^{th} millennium BC, offer one route for a re-evaluation of this transition. But to effect such a re-assessment, we need to first bridge the gap in understanding the transition between the 4^{th} and 3^{rd} millennia and to clarify stratigraphic sequences (cf. Manning 1995, 41-43). Our perception of the Ch in the eastern Aegean/western Anatolia has been dramatically transformed also due to the introduction of theories that seek explanation for the 'urban revolution' of the EB in gradual processes originating in the 4^{th} millennium BC (cf. Düring 2011a, 200-256; 2011b; Horejs and Mehofer 2014). Currently, in a time when the Neolithic is thought of as an arena in which social differentiation, organisation beyond the household unit, and long distance exchange were a part of everyday life, the simplistic idea of a FN or Ch as a transition to complexity is less credible (Tab. 2.4; Mina 2018).

The 4^{th} millennium BC can no longer be regarded as merely a prelude towards the well-researched EB period, but as has been proposed in recent studies the LCh should be understood within the framework of the *longue durée* process of 'proto-urbanisation' (Horejs 2014). According to the model of 'proto-urbanisation', which Horejs suggested in her study of the Izmir region coast (Çukuriçi Höyük VII=3300-3100 BC), a process of consolidation of communities took place, that led to the formation of regional and supra-regional centres around the beginning of the 3^{rd} millennium BC (Tab. 2.5).

Chalcolithic		Early Bronze Age
Old views	**Recent views**	
Simple, egalitarian society	Beginning of social interaction and differentiation	Complex/social differentiation
Domestic production and no specialisation	Limited craft specialisation	Extensive craft specialisation
Rural	Proto-urbanisation	Urban
Household-based and self-sufficient	Household-based	Re-distributive
Limited use of space	Settlement organisation	Well-organised settlements; regional centres
Seasonal sites	Sedentism, livestock management	Population growth and densely inhabited landscape
Independent domestic units	Architectural diversification	New settlement patterns
Isolated	Small-scale connectivity, irregular exchange systems	Increasing connectivity and intensification of exchanges

Table 2.4: Socioeconomic differences between Ch and EBA periods (modified after Horejs 2014, fig. 12).

Chalcolithic cultural features	Archaeological indicators
Limited craft specialisation	• Textile production (cylindrical loom-weights and impressions on pot bases; Bakla Tepe: Şahoğlu and Tuncel 2014, fig. 8; Schoop 2014; Çukuriçi Höyük: Britsch and Horejs 2017); • Copper working areas (clay tuyèeres and metal remains; Bakla Tepe: Şahoğlu and Tuncel 2014, fig. 7); • Food preparation (querns and millstones); • Production of chipped-stone artefacts.
Small-scale exchange systems and connectivity	• Imported raw materials (e.g. Melian obsidian); • Copper at least at Çukuriçi Höyük; • White painted ware pottery; • Marble beakers from Tigani and Liman Tepe (see Horejs 2014; Kouka 2013, 570; 2014b).
Architectural diversification (beginning of social interaction and differentiation)	• Limited presence of ditches and possible enclosures for symbolic or defensive function (e.g. Çukuriçi Höyük), although not comparable to Mainland Greece and the Cyclades (early communal efforts: cf. Kouka 2014b, 57); • Circular buildings probably for storage – communal organisation in permanent settlements (Kouka 2009, 143) such as Myrina, Poliochni, Liman Tepe VII, Bakla Tepe, Miletus I; • Less common presence of the grill-plan houses, the principle function of which is not yet clear; • Different construction techniques, i.e. entirely stone-built walls, superstructure with mud-bricks, wattle-and-daub (Çukuriçi Höyük: Horejs and Schwall 2015). • Different types of domestic buildings, i.e. rectangular, apsidal/elliptic, circular, stone row structures (Çukuriçi Höyük: Horejs and Schwall 2015);
Denser settlement pattern and use of more diverse areas of exploitation	• Various settlement models between the sub-regions in Anatolia; • Differentiation between ephemeral/seasonal sites and more permanent or complex villages (Düring 2011b, 803-806).

Table 2.5: Suggested archaeological indicators for the identification of the ‘proto-urbanisation’ process in the Ch western Anatolia and eastern Aegean.

An informative picture of other Aegean regions during the LN/Ch is provided by recent studies (Nowicki 2014; Alram-Stern 2014), which focus on the distribution of pottery technologies and styles as well as on metallurgy to describe an already established Aegean network before the EB, as well as the emergence of long-distance trade networks and the establishment of gateway coastal communities (e.g. Kephala-Petras on Crete: Papadatos and Tomkins 2013; 2014).

Ceramic developments in the Ch period

The pottery of this period in western Anatolia/eastern Aegean usually appears with dark brown-black or less commonly red surfaces with areas of discolouration, due to the fast, low-firing procedures most likely taken place in open-air constructions. In terms of fabrics and shape repertoire the Ch pottery is usually interpreted as homogeneous, with common features being the clay pastes that are coarse and rich in organic temper. The vessel repertoire is represented by bowls, jars, jugs, cooking pots, and vessels thought to be indicative of this phase such as rolled-rim bowls and cheesepots (e.g. Bakla Tepe: Şahoğlu and Tuncel 2014, 73-75; Poliochni Black and Myrina-Richa Nera on Lemnos, Tigani IV and Heraion Ch on Samos, Miletus I: Kouka 2014b). As Manning (1995, 44) has rightly stated “mere presence of a ‘rolled rim’ is thus not a satisfactory criterion for an early date”. Similarly, the identification of cheesepots at various sites across the Cyclades, Crete, the Dodecanese islands, the northeast Aegean islands, and western Anatolia has been traditionally taken as both a chronological marker and a sign of foreign contacts, usually considered as spread westwards from the Dodecanese (Nowicki 2008, 224, figs. 13.29-13.30). Recent analytical work at Kephala-Petras on east Crete (Papadatos and Tomkins 2013, 358) has documented both a local ceramic tradition and the importation of foreign shapes (e.g. cheesepots) most probably from the Cyclades, thus shifting from monolithic views of pottery homogeneity and isolation to ideas of connectivity.

2.3.2 The Early Bronze Age period

The Aegean EB is traditionally characterised as a phase of growing complexity and increasing connectivity/interaction and development of long-distance exchange networks, interpreted as largely caused by the need to acquire coveted raw materials and finished products, especially metals. The period shows evidence of population growth, and seemingly of social differentiation and the establishment of elites, craft specialisation, the intensification of exchanges, and the appearance of a site hierarchy (cf. Barrett and Halstead 2004).

Compared to the preceding period, the EB is well-investigated throughout the Aegean and western Anatolia (163 excavated EB sites in western Anatolia as opposed to 68 LCh; Düring 2011a, 257; Fidan *et al*. 2015, fig. 1), although its beginning is not always distinguishable, because of the lack of clear stratigraphic sequences at many sites and the continuation of pottery shapes and wares from the Ch, along with the introduction of new ones. Considerable advances have been made since Renfrew's influential work (1972) which placed the process of social change in a sophisticated theoretical framework, although the emergence of social complexity and urbanism remains one of the most pressing questions in Aegean prehistory (cf. MacSweeney 2004; Gkiasta 2011).

Renfrew (1972) introduced the idea of the multiplier effect, i.e. the division of the Aegean cultures into constituent sub-systems that interact between each other and are enhanced through positive feedback. According to this model, the agricultural intensification and surplus led to the emergence of a redistributive elite, which promoted innovations such as craft specialisation, by extension stimulating the growth of new economic, social, and political conditions, and ultimately leading to the 'emergence of civilisation' (Renfrew 1972, 27-44). This was mainly based on the assumption of Processual Archaeology that cultural changes during the 3rd millennium BC, brought about through internally-operating factors and endogenous processes, laid the foundations for the gradual transformation and evolution of the subsequent palatial societies of Crete in the beginning of the 2nd millennium BC and the rise of Mycenaean civilisation on the Greek mainland. In search for the origins of these cultures the past was viewed as a linear progress toward civilization and the internal explanation for the rise of Aegean states, punctuated by the periodic impact of external influence. More theoretical approaches have been proposed for the explanation of social change within the framework of Post-processual Archaeology, emphasising the role of human agency (Dobres 2000).

More recently, the changes that occurred in the EB have been explained by three main factors: 1) human communities start to modify their landscape and exploit the surrounding resources in a larger scale, 2) climate changes from 2500 BC onwards, and especially in the period between 2200-1900 BC, triggered different social responses in the human-landscape relationship, and 3) increasing control of routes and natural resources by specific groups of people altered the socioeconomic balance (Massa and Şahoğlu 2015).

2.3.2.1 Early Bronze Age I (*ca*. 3100/3000-2700/2650 BC)

The beginning of the EB in the eastern Aegean/western Anatolia has often been characterised as an arbitrary one in that there is no abrupt distinction from its preceding Ch period. The material culture of EB I displays continuity in terms of ceramic developments, although various regional traditions exist, raising controversies in the relative chronology. This phase is often labelled 'Maritime Culture of Troy' *(*Sazcı 2005*) or* the beginning of the 'Northern and Eastern Aegean Culture' (Kouka 2002, 295-302) on the basis of an assumed cultural *koine* throughout the north and east Aegean.

During the period covering most of the first half of the 3rd millennium BC the evidence from the eastern Aegean suggests a busy social environment with a densely inhabited landscape, as indicated by an increase in the number of settlements. The sites were located in diverse landscapes, such as in close proximity with river banks and water sources in general and large arable lands (e.g. Heraion, Liman Tepe), in the foothills of mountains, or on low coastal hills (Poliochni, Thermi, Troy). The increase of settlements can be explained by the change in the socioeconomic structures during the EB, when the subsistence economy was not only expanded beyond the household-based agricultural level, but was also marked by the establishment of olive and vine cultivation, especially in EB II early (Margaritis 2013).

Significant technological developments are also noticed in the craft production and introduction of more specialised techniques and exploited materials. Moreover, the LCh structural layout of independent domestic units gives way to a radially-arranged settlement type with closely-spaced, freestanding, long-room houses that share common walls, being surrounded by stone-built enclosures. This settlement type was termed by Korfmann as the 'Anatolian Settlement Plan' (1983, 222-223). However, recent data show that this type of row house was not common only in western Anatolia in this particular period (Demircihüyük, Beycesultan, Bakla Tepe, Liman Tepe VI), but also in the nearby islands (Thermi I-III, Heraion 5-1) (Ivanova 2013). In addition, a number of different architectural systems and settlement plans are identified during EB I-III, namely the 1) linear (Poliochni Blue-Yellow, Thermi V, Küllüoba), consisting of clustered house blocks (insulae) that are separated by streets and open areas, 2) the radiocentric/radiating (Thermi I-IIIB, Heraion I-V, Troy I-II, Bakla Tepe, Aphrodisias, Karataş-Semayük, Demircihüyük), organised around a central open area with free-standing, long-room buildings forming an enclosure with the back facade, and 3) the rectangular plan (Thermi IVA/IVB) (cf. Kouka 2002, 296, 304; 2016, 206). Apart from the settlement organisation (Fidan *et al*. 2015, 67, fig. 2), changes occur also in the construction techniques used, involving stronger stone foundations with a mud-brick superstructure. Everyday practices, e.g. preparation of food, cooking, raw materials processing, were taking place both inside and outside the domestic unit, according to movable or stable installations identified.

Ceramic developments in the EB I period

In terms of pottery, there is no common agreement regarding the distinction between Ch and EB I traditions. To a certain degree this is an effect of the lack or bad preservation of related architecture for the Ch in many sites and in essence the continuation of the shape repertoire into EB I. Regional differences do occur, as for instance is the case of the Kampos Group in late EC I (cf. Day *et al*. 2012) or the various pottery styles in the Anatolian regions (Fidan *et al*. 2015, 68-69), but the traditional consensus of the existence of a craft specialisation during this period is not directly reflected. A good ceramic and chronological correlation is provided between the Kampos Group late EC I/early EC II with later Poliochni Blue on Lemnos on the presence of fruitstands/chalices (Manning 1995, 77-79). As Nowicki has stated (2008, 212) "the pottery...shows more advanced technology (better firing and more careful surface finishing), which points perhaps to an early EM I date", reflecting a technologically-deterministic approach that interprets changes in ceramic technology from a narrative of cultural improvements. Liman Tepe has the first secure Cycladic imports during the Anatolian EB I (LT VI:1) in the form of frying pans, dark-on-light pyxides, and urfirnis sauceboats that are correlated with the EC I/II early (Şahoğlu 2011b).

2.3.2.2 Early Bronze Age II (*ca*. 2700/2650-2300 BC)

This is the longest EB phase and can be roughly distinguished into an early and a late phase although some sites show evidence for a middle phase usually termed as developed or advanced. Different terminologies have been used for this tripartite sub-phasing (Maran 1998, pls. 80-81; Wilson 2013, pls. 10 and 12).

EB II early, corresponding to Keros-Syros culture or EC IIA in the Cyclades, has been aptly described by Renfrew (1972, 451) as encompassing an ‘International Spirit’, being characterised by important social, economic, and technical advances. The distinctive character of EB II can be well attested in the cultural transformations, already established in the preceding phase, and can be summarised as follows (Broodbank 2000, 279-283; Kouka 2002, 11-12, 295-302; 2009, 141; 2016; Şahoğlu 2005b; Fidan *et al*. 2015, 70-74):

- The rise of well-organised societies and more complex specialised industries (e.g. metallurgical industries of tin bronze, obsidian, textile manufacture);
- The development of central, supra-regional, and early urban sites and growth of many major settlements between 3.5 and 6.0ha (e.g. Heraion, Liman Tepe);
- The expansion of close interconnections and wide-ranging communication within the framework of long-distance, canoe-based exchange networks;
- The evolution of larger, fortified settlements with communal works and monumental architecture. Around the mid-3rd millennium BC a remarkable change in the row-housing tradition appears with the construction of long-room structures with an assumed special function, found in both western Anatolia and the western Aegean (megara and corridor houses);
- The development of ranked/stratified communities (status differentiation, differential access to natural resources, uneven distribution of prestige goods);
- The emergence of a set of novel burial customs;
- The emergence of administration and standardised systems of measuring and weighing;
- Developments in crafts such as metallurgy (silver production) and pottery manufacture.

In a general appraisal, identifying evidence of social complexity and the process towards its development can often be problematic, despite a number of theories and central factors having been put forward. Renfrew favoured an economically deterministic theoretical model, which neglected the role of external stimuli, and instead introduced the concept of agricultural advances and the population growth as more decisive factors (1972, 225); the latter is not always easily recognisable, while opinions on settlement sizes differ (for the Cyclades see, Broodbank 2000, 215, 218, 225; other examples in MacSweeney 2004, tab. 1). Halstead (1995), reassessing Renfrew's concept of the redistribution of commodities, developed the idea of social storage from the FN onwards (storage facilities and communal buildings with probably administrative and economic character), thus providing insights into aspects of social differentiation. Such communal storage or administrative buildings have been found at Poliochni Blue-Yellow (Bouleuterion/Communal Hall, Granary/Communal Storage, Megaron 317; Kouka 2002, 50, 75, 93, 116, 308), Thermi I-IIIB and Thermi V (Buildings A and Θ respectively; Kouka 1999; 2002, 167-168, 179, 194, 237), Heraion I-III (*Grossbau*, *Zyklopischer Bau*; Milojčić 1961, 27; Kouka 2002, 287, 290), Troy II (Megaron IIA), Liman Tepe II (Kouka 2009, 147; 2013, 571-572), and EB II Küllüoba (Complex I-II; Efe 2007, 49-50, figs. 4, 6).

More recently, considerable progress has been made with approaches focusing on less unidirectional processes in the explanation of social complexity, shifting away from purely internally-explained models. Instead, they stress the interplay between societal systems, advantageous places, external stimuli, and social agency, using a personalized interpretation of changes in the material culture. For instance, Broodbank has long proposed the importance of Aegean maritime activity in the Cyclades and the participation of trade networks, controlled by specialised island centres and individuals, such as navigators and traders/merchants (2000, 247), while Nakou (2007) has emphasized the role of metals and their socio-cultural impact in long-distance trade and their use as status items by the elite. Moreover, Kouka (2002, 305) has pointed out the involvement of metalworkers of Thermi, Poliochni, and Liman Tepe (Kouka 2013, 570) in trade, as Cycladic imports occur in these workshops in multiple phases of use. More recently, MacSweeney (2004, 61-62, tabs. 2-3) has questioned the consideration of population estimates and settlement sizes in the reconstruction of complex societies and has underlined the importance of other factors such as location (Düring 2011a, 281). Among such borderline sites are Thermi and Poliochni in the eastern Aegean (MacSweeney 2004, tab. 4), which, despite their size, constitute good examples of proto-urban settlements.

‘Kastri Group-Lefkandi I assemblage/ceramic phase’ or ‘Anatolianising’ phenomenon: chronological/cultural associations and ceramic developments in later EB II

The above-described cultural transformations occurring at the outset of EB II, reached a peak at around 2500-2200 BC, a period which has dominated scholarly discussions due to the lack of a consensus regarding its chronology and appearance, terminology, and character between different regions and even sites within the same region (cf. Rutter 1979; Sotirakopoulou 1993; Manning 1995, 51-63, 81-86; Day *et al*. 2009; Pullen 2013; Sotirakopoulou 2016, 351-377). It is not the aim of this section to provide a detailed, holistic overview of the inexhaustible scholarship on these issues, but rather to provide the main framework for the sake of ceramic analysis within the present thesis (for further discussion, see Chapter 9).

A number of interpretations have been developed over time for the period *ca*. 2500-2000 BC (see Section 2.2.1) largely based on the appearance of ceramic novelties at the end of the Keros-Syros culture. This new set or assemblage of vessel forms and morpho-stylistic features were named as 'Lefkandi I' for Mainland Greece (Rutter 1979, 1-8) and 'Kastri Group' for the Cyclades (Renfrew 1972, 180-183, 533-534). A still largely unresolved chronological issue lies on 1) the placement of this ceramic horizon/phase in EC II late (EC IIB) and thus supporting the existence of a gap in the Cycladic sequence of EB III, 2) its placement in EC IIIA, or 3) the continuation of this phenomenon from late EC II to early EC III (cf. Manning 1995, 52). There is a similar dispute regarding its occurrence in Anatolia, either in EB IIB or in EB IIIA (cf. Kouka 2009, 135).

Based on typological and stylistic similarities with the northeast Aegean and western Anatolia different theories have emerged regarding its appearance and dissemination in a westward direction, either representing immigrant communities, and invasions, being symptomatic of a period of cultural decline (Renfrew 1972, 477), or the spread of a prestige fashion through trade networks such as the 'Anatolian Trade Network' and 'Great Caravan Route' horizon in western coastal and inland Anatolia (Sotirakopoulou 1997, 530-538; Şahoğlu 2005b; Efe 2007). The former theory has further been supported by the appearance of short-lived fortified Cycladic settlements, although this is less credible in the current research as some of these have a long history that dates back to the FN, e.g. Skarkos on Ios (Angelopoulou 2017). Explanations favouring mobility and long-term interaction have been recently put forward, rather than sudden events of migration, where mobile groups of specialists, traders, and metal prospectors infiltrated the Aegean. This is materially evidenced not only through pottery but also with new textile tools and specific metal pin types (Rahmstorf 2015, 166). Another suggestion involves their use by the local elites in the framework of feasts organised in central buildings or communal, open spaces (Kouka 2013, 573-574). This is further supported by Pullen (2013, 535), building on Nakou's work (2007), who argued that these vessels represent attempts to imitate Anatolian metal feasting equipment or even new dining rituals.

Following Manning's statement (1995, 71), "that cultures and chronological frameworks should not be confused, nor do cultures follow each other in the orderly progression we would like", in the end of this thesis (Chapter 9) an attempt is made to provide a synthetic review of this phenomenon from an understanding gained from the Heraion ceramic material: Can this complex phenomenon be explained in purely chronological or sociocultural terms? How can we explain its uneven representation at specific sites in terms of the absence of some shapes, or the total lack of this shape repertoire from others? What are the interpretative implications of its inherent heterogeneity in terms of ceramic developments at the end of EB II?

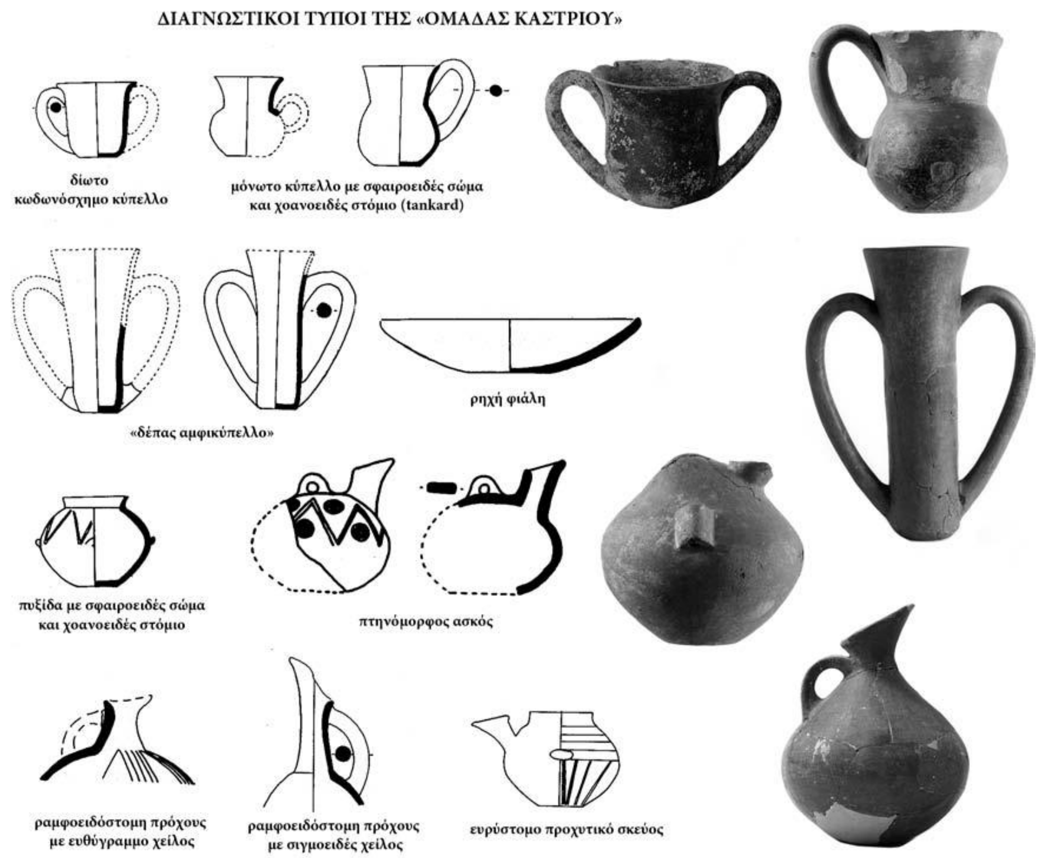


Figure 2.3: Diagnostic vessel types of the Kastri Group (after Angelopoulou 2014, fig. 8.1).

Ceramic developments in the EB II period

During EB II early pottery is generally characterised by a morpho-stylistic uniformity in its handmade tradition and continuation of shapes from the preceding phases. The EB II developed/mature pottery in Mainland Greece sees the appearance of new drinking/serving shapes (sauceboats and saucers) that are replaced by the Lefkandi I shapes, similarly to Ayia Irini II-III on Kea (Kouka 2016, 215-216). Heraion during EB II developed (phase Heraion I) also documents newly-emergent shapes within a largely EB II early repertoire. However, during EB II late there is a marked change, well-evidenced in the development of ceramic traditions with increasing convergence in pottery types and wares across the Aegean and western Anatolia, as well as the appearance of the first wheel-made pottery (cf. Renfrew 1972, 102-103; Barber and MacGillivray 1980, 150-151; MacGillivray 1983, 82; Choleva 2012, 345-347). It has been suggested that this pottery assemblage (Fig. 2.3), comprising of *Anatolianising* elements (one-handled tankard, bell-shaped cup, depas amphikypellon, lentoid jug, S-profile jug with cut-away spout, shallow bowl/plate), first appeared in inland and littoral Anatolia and spread from there to Lemnos, Chios, and Samos, towards the Cyclades and Mainland Greece (east coast of Attica, coastal Thessaly, the Saronic Gulf, Euboea) (Sotirakopoulou 2008c, 536, 546; Angelopoulou 2008, 149; Rutter 2012, 74). It has been also suggested that these shapes are often combined with *Cycladicising* ones (beaked jug with a straight rim, incised spherical pyxis, teapot, duck vase/askos) (Sotirakopoulou 1993, 8; 1997, 526; Angelopoulou 2003, 164-168; 2014, 485). The convergence of ceramic repertoires in EB II late might point to the emergence of shared cultural practices, such as the consumption of wine (Broodbank 2008, 61). It was also suggested that these, usually thin-walled and dark-surfaced, drinking and serving shapes reflect the imitation of metal vessels (Nakou 2007).

In the Cyclades, examples of these characteristic shapes have been identified predominantly in settlements (e.g. Kastri on Syros, Ayia Irini on Kea, Markiani on Amorgos, Akrotiri on Thera, Kynthos on Delos, Phylakopi on Melos, Panormos and Zas Cave on Naxos) and less frequently in cemeteries (e.g. Chalandriani on Syros, Rodinades on Naxos, Akrotiraki on Siphnos, Rivari on Melos).

This ceramic phenomenon shows an early and a late phase in the occurrence of specific types, where the bell-shaped cup and tankard appear first, e.g. in Poliochni, Heraion, Troy, and Liman Tepe, and the depas amphikypellon, shallow bowl, wheel-made plate follow (Kouka 2009, 135; Rutter 2012, 76; Angelopoulou 2014, 487-488). In sites beyond western Anatolia and the east Aegean these shapes coexist in the same phase or stratigraphic horizon, such as Ayia Irini III on Kea, Markiani IV on Amorgos, Palamari II on Skyros, Pefkakia, Aphrodisias, Tarsus. Furthermore, this ceramic set occurs only in small proportions and only a few sites provide evidence for the full range of these vessel shapes such as Ayia Irini III on Kea, and Akrotiri on Thera (Manning

1995, 51, footnote 110; Wilson 1999, 238; 2013, 431; Broodbank 2000, 313). The detailed macroscopic, typo-morphological, and petrographic analysis of the Heraion II-III pottery, corresponding to EB II late, alongside comparative thin sections from a number of Cycladic (Panormos on Naxos, Akrotiri on Thera, Ayia Irini on Kea) and western Anatolian sites (Liman Tepe, Bakla Tepe, Miletus) has enabled the reconsideration and re-evaluation of this phenomenon.

2.3.2.3 Early Bronze Age III (*ca*. 2300-2000 BC)

The cultural features outlined above become more intense in EB IIIA, with common developments appearing over a large area from inland western Anatolia towards the Aegean coastline and beyond. Efe (2007), in his explanation of these changes, introduced the idea of an intense communication-trade land route extending west of Cilicia (Great Caravan Route). All the developments brought about within this newly established relation between distant regions, are decreased with the advent of EB IIIB (2200-2000/1950 BC; also known as Transitional Period into the MBA), which sees the end of prosperity marking EB II late (2500-2300 BC) and EB IIIA (2300-2200 BC) in the eastern Aegean/western Anatolia, corresponding to the Kastri Group phase (EC IIB or EC IIIA) in the Cyclades, seemingly contemporary with a horizon of drought waves of the 4.2ka BP climatic event (cf. Massa and Şahoğlu 2015). These radical changes culminate with the appearance of more complex socio-political structures at the beginning of MBA.

This period is characterised by important transformations in the cultural and political system of western Anatolia, which was more oriented towards central Anatolia than the Aegean in the previous phase (Sari 2013, 309; Fidan *et al*. 2015, 74-76). During late EB III, a series of destructions and abandonments are noted, possibly showing evidence of a short occupation gap or significant reorganisations in some sites of the western Anatolia (e.g. Troy III-IV, Liman Tepe, Beycesultan, Aphrodisias, Tavşan Adası, Tarsus) (Korfmann and Kromer 1993, 168-169; Joukowsky 1986, 145). Similar abandonments and gaps are noted at Poliochni Yellow-Brown and Emporio (Kouka 2002, 99) and the Greek mainland (Maran 1998, 450-457; Alram-Stern 2004, 522-534). Explanations proposed an Indo-European migration or the so-called 'Luwian invasion' (Mellaart 1958, 11), displacement of trading networks, or more recently climate change which further led to changes in the social relations (Massa and Şahoğlu 2015, 72; Rahmstorf 2015, 149).

Shifting away from merely diffusionist theories in the explanation of the so-called 'collapse of civilisations' (*ca*. 2300-2000 BC) in the eastern Mediterranean, Wiener (2014) in a detailed study summarizes the main impacts resulting from the abrupt climate and other changes in the late EB, although noting that there is no common pattern in terms of chronology and severity of destructions between different areas. For instance, the archaeological and archaeobotanical evidence for Troy II-IV (2550-2100 BC) imply changing agricultural conditions due to climate fluctuations that in turn led to other changes such as destruction of the fortification wall, a drastic decrease of the inhabited area, and the abandonment of smaller surrounding sites (Blum and Riehl 2015). Major changes are also evidenced in the decline of the once strong urban centres and the abandonment of their monumental administrative buildings, such as Liman Tepe IV and Heraion III/IV (*Zyklopischer Bau*), in EB IIIB, most probably affected by the contraction of the 'Anatolian Trade Network' (Şahoğlu 2005b, 354; Kouka 2013, 573-577; Wiener 2014). Similarly, abandonments and changes are in evidence at various sites of the Greek mainland and the Cyclades, with the destruction of the corridor houses (House of the Tiles at Lerna, *Weisses Haus* at Kolonna on Aegina) being the most characteristic, while there is a decline in metallurgy and the exchange of exotic artefacts (e.g. marble objects) and the use of seals (Markiani on Amorgos, Zas Cave on Naxos). These changes have been explained under the prism of a decreasing social complexity and a return to a less organised, more isolated way of life and material expression by the end of EB III (cf. Blum and Riehl 2015, 181).

Ceramic developments in the EB III period

Regarding ceramic developments there seems to be an abrupt change in EB III at many Aegean and Anatolian sites. More particularly, the shape repertoire is greatly enriched with new types, technological changes are observed in various stages of the manufacturing process such as the use of finer clays or a more careful processing by the potters, occasionally a shift towards more calcareous clays that give the final product a light-coloured fabric, achievement of higher temperatures and better controlled firing procedures, etc. (cf. Day *et al*. forthcoming: Akrotiri Phase A). All these are usually interpreted as the result of a more specialised and standardised ceramic production. Good examples are found at Heraion phases IV-V and other areas of the Dodecanese or western Anatolia (e.g. Asomatos on Rhodes, Serraglio on Kos, Miletus II, Troy IV-V). For instance, the presence of a two-handled cup in Heraion IV-V and its correlation with similar cups from EH III Tiryns and Aegina, Beycesultan XI, Tarsus EB IIIB, Miletus II, and Troy IV provide good chronological correlations between these areas in relative terms (Manning 1995, 86-87).

The dark-faced askos or duck-vase with incised decoration is a characteristic shape of the EB III Heraion, but its chronological association with other Aegean areas is less straightforward than the two-handled cup. While it finds very close parallels at the Dodecanesian sites of Asomatos on Rhodes and Serraglio on Kos during the local EB 3 period, this shape is considered as of a later, early MB date in the Cyclades. Similarly, the collared jars with plain horizontal handles of EB III Heraion, which are considered as local, show significant typological similarities with the MB jars with crescent/lunate-shaped handles.

The only Cycladic EB III site known so far corresponds to Dhaskalio phase C on Keros, which promises to fill the chronological gap of EC III (see above). This phase dates in absolute terms between 2400 and 2300 BC (Renfrew *et al*. 2012, tab. 6) and includes characteristic pottery of the Kastri Group horizon, as well as shapes, wares, and fabrics (light-coloured volcanic) that are representative of what is considered as the beginning of the MBA (Phylakopi I-ii-iii) in the rest of the Cycladic islands (cf. Day *et al*. forthcoming). In the ceramic sequences of Ayia Irini on Kea and Akrotiri on Thera there seems to exist a very clear gap after the late EC II, which is also evidenced by the absence of any Cycladic imports to other areas in EB III (Wilson 2013, 430-431). This could be either an effect of dating a site whose pottery is almost entirely imported. Typological correlations of pottery (e.g. Red-coated Ware) from Dhaskalio C and Troy V (Sotirakopoulou 2016; Blum 2016b) imply rather a different chronology for the former site, most likely in the early MB or even the varied nature of certain contexts. Apart from Dhaskalio, the lack of stratigraphic evidence for the relationship between the Kastri Group horizon and the Phylakopi material, variously defined as EC IIB/EC IIIA and EC IIIB/MC I respectively, and reconsideration of phasing in absolute terms may shorten the gap (Manning 1995, 66-67).

Similar light-coloured orange fabrics are known from Küllüoba and Beycesultan, as well as the first appearance of wheel-made pottery at the beginning of the Anatolian EB III (Fidan *et al*. 2015, 77, fig. 12). The Anatolian EB III corresponds to EB II late in the Aegean, while middle EB III corresponds to the beginning of the Aegean EB III (Fidan *et al*. 2015, 78-79). Different theories have been proposed for the introduction and dissemination of the wheel in the Aegean, but recent data imply that it originated in inland western Anatolia (cf. Choleva 2012, 375) through direct, long-term contacts in the framework of exchange networks. The former Anatolian style pottery types (see Section 2.3.2.2) are merged with the local styles, preserving and assimilating the technological knowledge acquired in the preceding period (Rahmstorf 2015, 166).

2.4 Summary

The presentation of the chronological background of the Aegean and Anatolia reveals the problems of equivalence in terminology and relative chronology of developments taking place on either side of the Aegean basin. This is well explained in Manning's (1995, 73) words “as chronological-typological precisions increases, the chronology obtained can no longer be accurately portrayed in simple terms of complete wider geographic/cultural entities against time. Instead, regional variations...take over, making concepts of neat blocks of several centuries of culture, correlated with such blocks, at worse untenable and at best unsatisfactory approximations”. Since the construction of relative chronological sequences relies heavily on pottery, generalisations are often unavoidable in comparisons between different sites or regions. It is suggested here that a closer approximation can be achieved when dealing with total assemblages from a diachronic perspective, such as those examined in this thesis from Heraion on Samos. Heraion has produced pottery from all periods and phases discussed and its complete ceramic sequence may provide renewed information on 1) the transition from the Ch to EB I, 2) on EB II late and its chronological and cultural significance, and 3) on the transition from EB II late to EB III. Samos's key geographical position between the central Aegean and western Anatolia, as well as the appraisal of Heraion as being the largest EB urban site in the insular east Aegean, has led several scholars in the past to suggest that Samos may have constituted the cultural mediator in the transmission of ideas, technological innovations, and goods between these regions, especially in EB II late-III. The following chapter presents the natural resources of Samos and the archaeological contexts of Heraion, providing a secure background for the examination of the ceramic developments examined in Chapters 6-8.

CHAPTER 3: The study area: background research and new archaeological evidence on Samos

3.1 Introduction

This chapter presents the available evidence for prehistoric habitation on the island of Samos and the archaeological background of the site under study. It places special emphasis on the recently excavated levels of Heraion, which forms the main focus of this thesis, with information regarding the relative chronology of each phase. The first sections present the background research, including the geographical and geomorphological setting of the island, with references to natural resources that led to the emergence of an important coastal site in the EBA and the development of its pottery manufacturing tradition.

3.2 Geographical and geomorphological setting

3.2.1 Location and geographical description

The island of Samos is located in the eastern Aegean (Fig. 3.1), at the southernmost extension of what has been defined by Kouka (2002, 295-302) as a uniform cultural region (‘Northern and Eastern Aegean Culture’) covering the north and east Aegean islands (Poliochni on Lemnos, Thermi on Lesbos, Emporio on Chios till Rhodes) and Skyros to the west and the western Anatolian littoral (Troy, Liman Tepe, Bakla Tepe, Miletus), on the basis of an assumed cultural *koine*.

Samos, with a total area coverage of 477km² and a coastline of approximately 159km, is the eighth largest island in the Aegean and the twelfth largest in the Mediterranean (Shipley 1982, 5-7). Its axis lies W to E and has a length of 45km from Katabasis to Cape Gatos, and 19km width from N to S, from Avlakia to Cape Samiopoula. Samos lies S of the Gulf of Kuşadası, which is bounded by the Karaburun peninsula and the Izmir region coast, SE of Chios island, E of Ikaria island and the island group of Fourni. S of Samos are located the Dodecanese islands, the nearest of which are Agathonisi, Arki, Patmos, and Lipsi. Samos lies only 1.6km from the Asia Minor coastline and the promontory of Samsun Daği across the Mycale Strait (known as ‘επταστάδιος πορθμός’, i.e. the seven-stade strait). It was connected to the mainland in the last glacial period and earlier phases of the Holocene prior to the last sea-transgression when the sea level was about 120-130m lower than today (Eryılmaz *et al*. 1998, 68-69; Kayan 2004, 37).

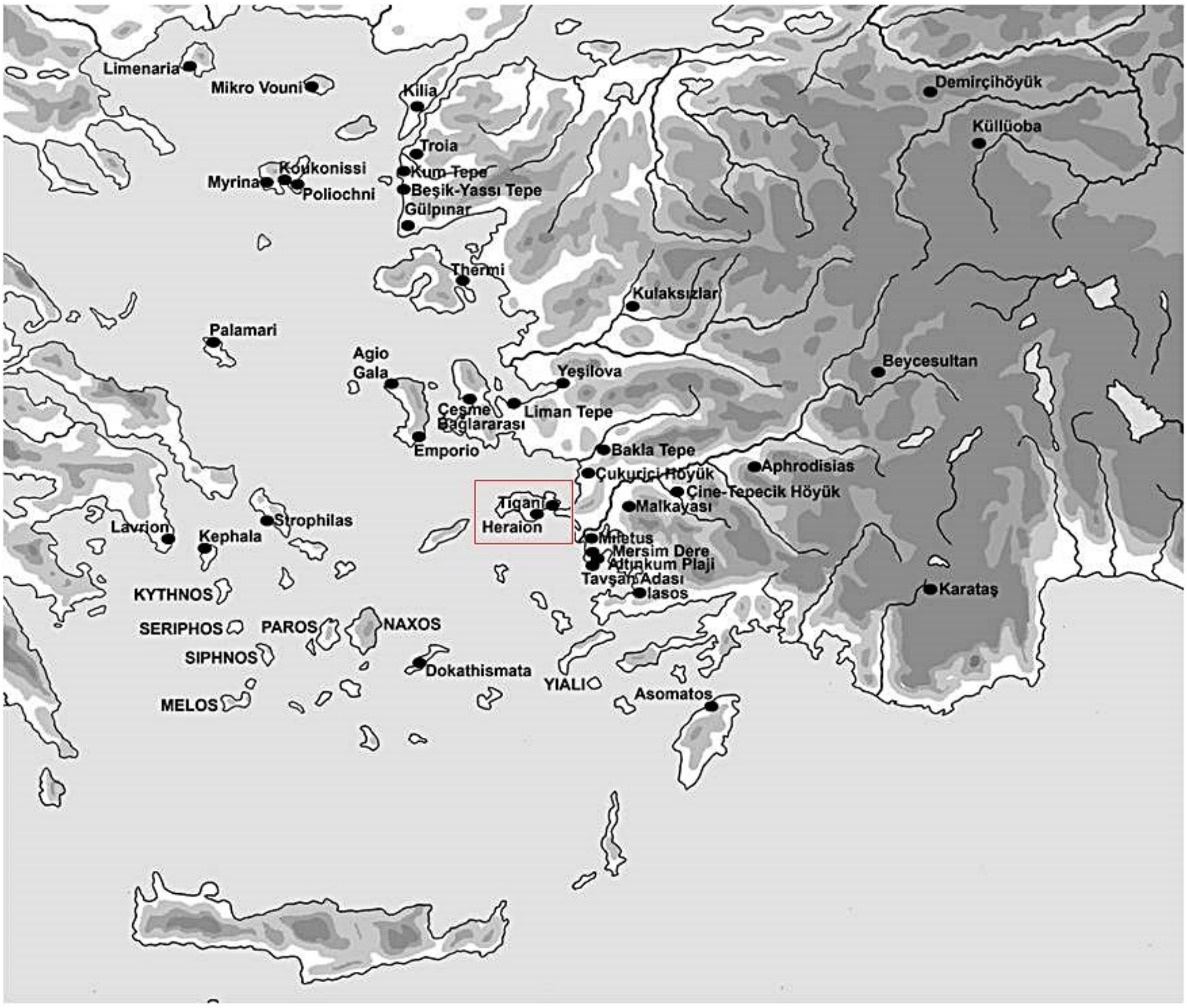


Figure 3.1: Map with the location of Samos and other contemporary sites (after Kouka 2014b, fig. 1).

3.2.2 Relief and geomorphological description

According to a study of Samos's relief 69.6% (332.267km²) of its surface is mountainous, 22% (105.027km²) is semi-mountainous, and 8.4% (40.101km²) is flat (Vassilopoulos *et al*. 2008, 12). Perhaps more useful for our purposes, Samos may be divided into 5 main geomorphological and physiographic units (Fig. 3.2), consisting of three (1-3) mountain massifs that are separated by the geologically distinct lowland areas of Neogene-Quaternary basins (4-5). These were distinguished by Shipley (1987, 269-270) as follows:

1. Mount Kerketeas/Kerkis lying at the western end (1433m) of the island. The highest, NW part is characterised by steep cliffs while the SW part is relatively low and less steep. Only small beaches and a few small anchorages exist around the coast;

2. Mount Ambelos (Karvounis) occupying 1/3 of the island's entire area and covering mostly the central part (1150m), is also characterised by intense relief and steep slopes with high cliffs on the coastline and a rapid deepening of the sea-floor offshore;

3. The Zoodochos Pigi massif (433m) in the E of the island, characterised by karstic forms and steep, dry limestone hills rarely over 300m, with promontories fringed by cliffs and medium slopes;

4. The western lowlands consisting of the Karlovassi basin that lies between Kerketeas and Ambelos. This is an area of low hills and valleys;

5. The eastern lowlands consisting of Palaiokastro and Mytilinii basins to the E of Mt. Ambelos (overall extent 18.3km^2). S of this area lies the Mytilinii basin, which is made up of two large coastal plains, the Kambos-Chora plain and Mesokambos plain. The gradient of the topography, decreasing to the E and the SE part of the island, is characterised by gentle, smooth relief and low slopes extending towards the coastline (Fig. 3.3). The coastal bathymetry on the S and E is shallower (50-200m) than to the N and NW coasts between Samos and Ikaria that are characterised by major marine faults of more than 1000m depth (Eryılmaz *et al*. 1998, 63). The western and eastern lowlands with their alluvial-rich soil and large arable plains were the most suitable areas for cultivation, justifying the proverbial expression by the poet Menander (14.1.15), as recorded by Strabo, *"it produces even birds' milk/φέρει καί ὀρνίθων γάλα"*, i.e. an exaggeration to emphasize the productivity of Samos (Dueck 2004, 47-48). Being an extremely mountainous island, the parts of Samos more easily accessible and suitable for habitation and exploitation are the eastern lowlands that are known to host most of the archaeological sites (Shipley 1987, 269-270, 274).

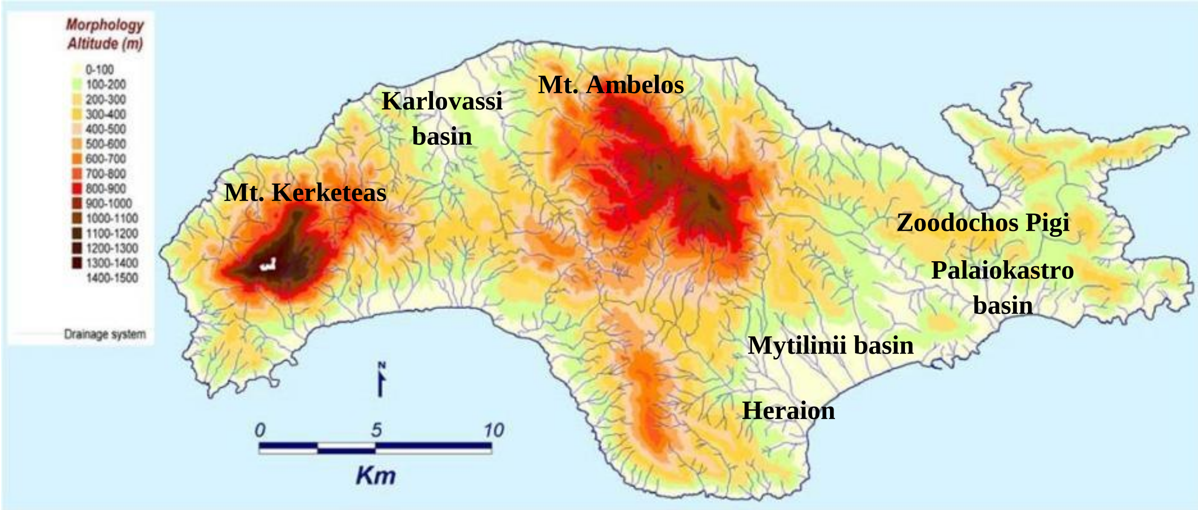


Figure 3.2: Morphological map and drainage system of Samos (after Gournelos *et al*. 2001, fig. 2).

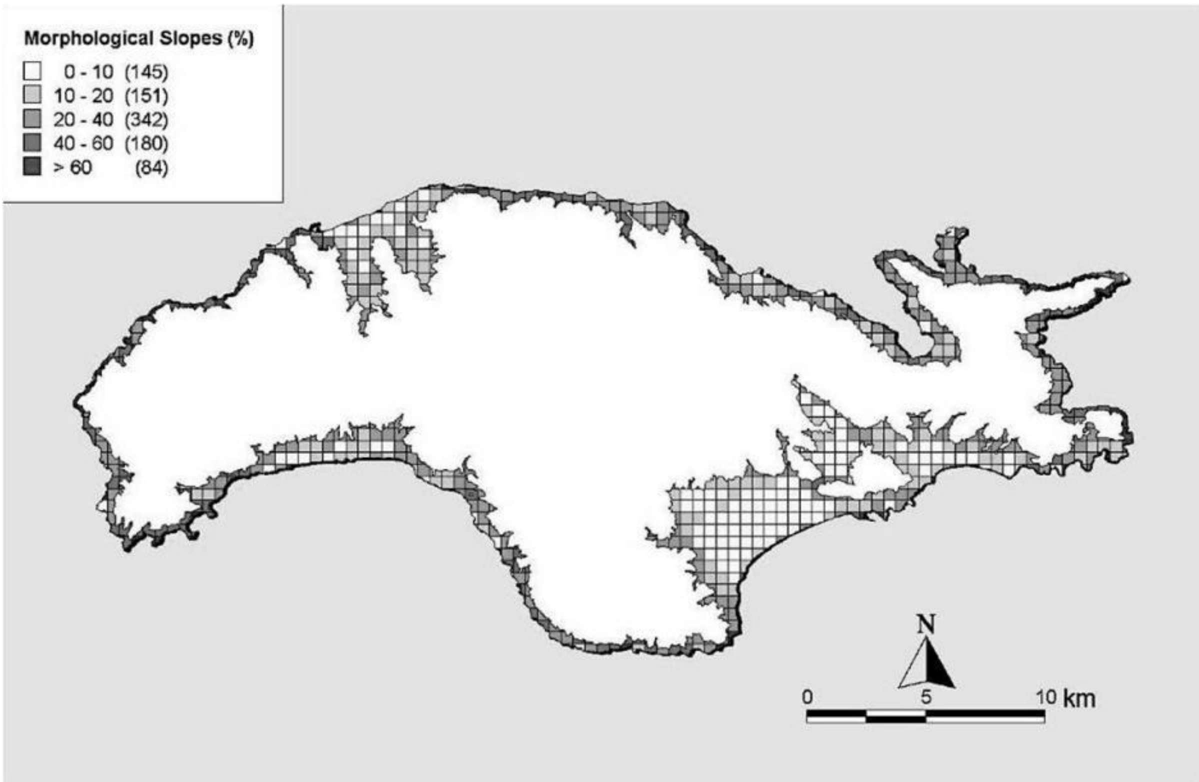


Figure 3.3: The topographical gradient and morphological slopes of the coastal zones (after Evelpidou *et al*. 2008, fig. 5).

3.2.3 Palaeogeography and coastal changes on Samos

Recent studies of the relative sea-level changes for sites of the NE Aegean and Asia Minor littoral have indicated a spatial variability in Holocene coastlines, although being consistent with a continuous rise in the last 6.0 ka BP (Vacchi *et al*. 2014). More specific studies on the palaeogeographical reconstruction of Samos were based on trends in vertical displacement (uplift and subsidence), as well as geomorphological and archaeological indicators (Stiros 1998; Stiros *et al*. 2000, fig. 1; Kayan 2004; Mpleta 1998; Pavlopoulos *et al*. 2012, fig. 5).

According to archaeological studies of quasi-submerged or submerged ancient ruins along the southern and eastern coasts of Samos there is clear evidence of sea-level rise and shoreline change in this geographical part (Stiros 1998, 17-18). For instance, an underwater excavation at Pythagoreion harbour revealed the submerged ancient mole at a depth of 1.80-3.20m dating to *ca*. 300 BC (see Pavlopoulos *et al*. 2012, tab. 1; Vacchi *et al*. 2014, tab. 1: -2.8 to -3.6m in *ca*. 2500 BP). Moreover, the excavation of the Sacred Road which used to connect the 6th century BC Heraion sanctuary with the ancient town of Samos (modern Pythagoreion), only revealed random parts along the coastline indicating that it should be sought in the nearby swamps developed after a marine transgression (Shipley 1987, 8). More convincing evidence derives from the excavation of prehistoric layers (0.40 to -0.1m above sea level) at Heraion, which imply the establishment of the settlement on a coastal, low hill bordered by the two branches of the Imvrassos River between the SW border of the Hera Temple area (Buschor 1953) and the NE in the area of the Sacred Road (Kouka 2015, 224), forming some kind of river delta. The palaeogeographical evolution of the last 6.500 years BP has been verified by an integrated study of the SE part of Samos (Evelpidou *et al*. 2010). The palaeogeographical changes have clearly altered the prehistoric landscape and possibly affected the use of ceramic resources, which are of crucial importance for this thesis.

3.3 Natural configuration and resources

The information provided in the following sections aims to outline the hydrological profile of Samos, with a focus on the SE part of the island, in order to facilitate a discussion in the following chapters of this thesis regarding accessibility to natural resources for pottery manufacture (Chapter 5) and the position of Samos within Aegean communication routes and networks.

3.3.1 Hydrological setting: water resources and supply

Samos has no large rivers, but is drained by many streams and creeks which flow throughout the year (Fig. 3.4). This combined with the island's numerous springs justify the use of many poetic epithets for its description as well-watered (Tsakos and Viglaki-Sofianou 2012, 17-18). Shipley (1982, 24-25; 1987, 272, 274), in his study of the

Samian landscape and water availability in the various physiographic units recorded a number of streams and rivers. More streams and springs are recorded in the western highlands and lowlands and central highlands of Samos (Shipley 1987, 279), but the focus is on the eastern lowlands.

The latter area is important in terms of alluviation and hydrology and the creation of raw material sources in antiquity. It is generally well-watered and accommodates the largest water sources on Samos, which have been responsible for the formation of the two large plains in the SE part of the island. These are: the Rema Mytilinion/Chisios River, which rises below the summit of Mt. Ambelos and flows SE past Mytilinii down to Chora village and is almost entirely silted up in the vicinity of the ancient town of Pythagoreion in the Mesokambos plain; the seasonal river of Imvrassos, also known as the Dhafnias/Parthenos River, with the main branch of its hydrologic network being 2.27km in length and with a NW-SE axis. Imvrassos comprises various smaller streams (*ca*. 83 branches) that spring from the S and E slopes of Mt. Ambelos at a height of *ca*. 980m, flows through Myli and crosses the Heraion site to discharge in the sea at the W end of the Chora plain (Zoulfou 2014). These are two of the largest rivers on Samos and are known since antiquity, especially the Imvrassos River which due to its location was historically connected with the birth and cult of Hera (see Buschor 1953; Walter 1976, 14-16, pls. 5-6). The river crosses the site only below ground nowadays and its direction was changed intentionally around 1900 and lies 500m W of its course during prehistory (see Buschor 1930).

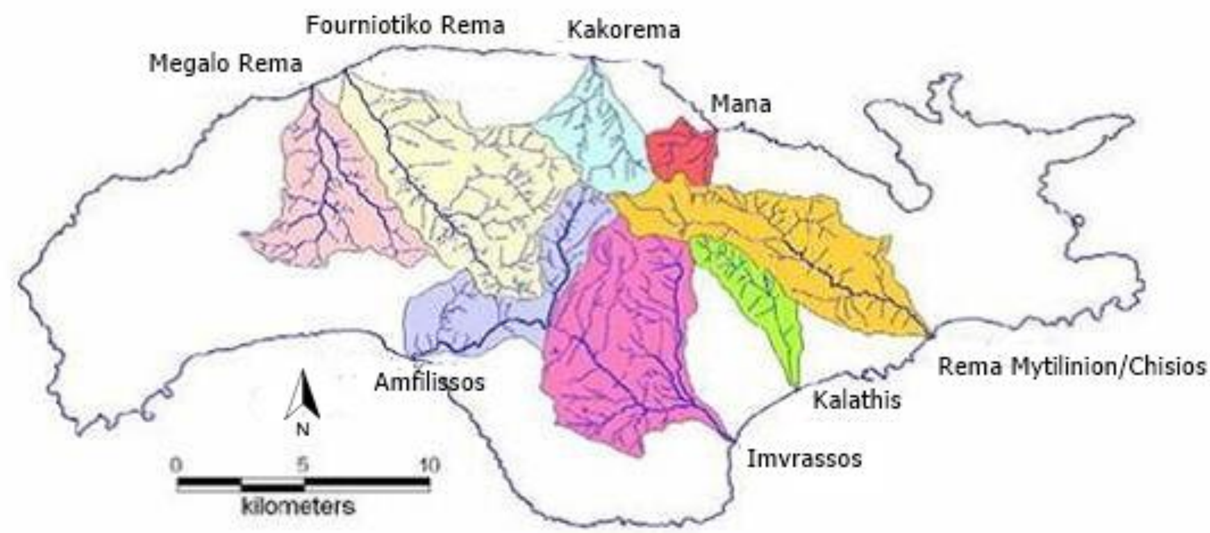


Figure 3.4: The main river catchments in Samos and their distribution (modified after Stavrianou 2009, 12, fig. 4).

3.3.2 Sea conditions, passages, and anchorages

Sea travel in the direction of the S and SE was historically always the first choice for the Samians and this can be perhaps explained not only by the diachronic choice to settle the southern part of the island, due to its geomorphological configuration already explained above, but also due to reasons related to currents, sea routes, and passages.

The deep (1000-2000m) channels between Samos and Chios to the N and between Samos and Ikaria to the W (Eryılmaz *et al*. 1998, 63) made passage between these islands difficult in antiquity. However, along the other coasts the depth does not exceed 50-200m (Stiros *et al*. 2000, 42, fig. 1). In her thorough study of the network of maritime communication routes in the Aegean during the NL and the EBA Papageorgiou (2002) proposed that two main routes/passages facilitated the communication between Samos and the rest of the Aegean. More particularly, Samos is the last landfall before the Gulf of Kuşadası, if one is following the so-called Route B and is sailing from the S, crossing the passage between the islands of Rhodes, Kasos and Karpathos, as well as the passage between the Dodecanese and the Cyclades (Papageorgiou 2002, 163-164, 303-321), and the first on the principal route (Route Z) from Asia Minor to the central Aegean and mainland Greece or in reverse (Agouridis 1997, 8). Samos, due to its nodal position in the eastern Aegean, is assumed to constitute the geographical and cultural link between western Anatolia and the central Aegean during the period in question. Particularly important in this communication are the two arteries extending from the interior of Asia Minor: the Gulf of Ephesus NE of Samos formed by the Kaustrios river, and the Meander valley to the SE formed by the Büyük Menderes river (Papageorgiou 1997, fig. 4; 2002, 541).

Taking into account the aforementioned factors it is assumed that Samos is rather a staging-post/stepping stone island on the sea-routes to and from Asia Minor and the eastern and south-eastern Mediterranean, the latter well-evidenced throughout the lifespan of the ancient city of Samos (Pythagoreion) and the Heraion sanctuary (Doğan and Michailidou 2008; Touratsoglou and Tsakos 2008), than connecting routes to the northern Aegean. It was much safer to follow the route connecting the Cyclades (Mykonos) and Ikaria to the W of Samos, since the largest gap on this route is *ca*. 45km of open sea, whereas the area between Chios or Lesbos to the N is deeper (Shipley 1982, 8). The strategic importance of Samos during the Classical and Hellenistic periods (439-188 BC) is well-outlined by Shipley (1982, 253-265, 269-270).

The coastal landscape of Samos is characterised by a few natural harbours and anchorages, as well as numerous bays, coves and inlets, of which the majority are found in the eastern part of the island. These were often the ‘apple of discord’ between Miletus, Ephesus, and Priene on the opposite coast in their rivalry over the control of the Ionian coast and the consequent benefits arising from this political success (Shipley 1982, 168-170, 258-263, 265, 269-270), or even to facilitate control of the Cyclades (Shipley 1982, 236). Among others (e.g. Malagari, Kalami, Poseidonio, Klima, Psili Ammos), these include a series of smaller bays and natural shelters/capes found from the SE part of the island along the area between Aspros Kavos W of the modern village of Ireon to Cape Katsouni in the E, e.g. Agios Dominikos, Kolona, Kotsika, etc. (Shipley 1982, 25-26).

The largest and best-protected harbour on Samos lies in the NE part in the Gulf of Vathy. In antiquity, the main harbour was at the S in the Gulf of Pythagoreion, which was strengthened by the tyrant Polycrates (6^{th} century BC) with the construction of a mole as part of his attempt to embellish the ancient city of Pythagoreion, by undertaking the so-called Samian *erga* (Irwin 2009, 395, 398; Pelling 2011).

As has been outlined above, despite Samos's advantageous position between these very important maritime routes, only two prehistoric settlements are known to exist. The establishment of the SE part as the main area for habitation since the NL period (Kastro-Tigani) is immediately connected with the exploitation of the safe anchorages provided and the island's link with the Asia Minor littoral opposite.

3.4 Archaeological framework and history of research

Well before the beginning of systematic investigations on Samos a number of explorers, natural scientists, and art historians from the beginning of the 18^{th} century expressed interest in studying and recording the religious landscape of Heraion. Despite the great importance of the Archaic-Classical (6^{th}-5^{th} centuries BC) Hera Sanctuary, only a very little information has come down to us in the literary sources. First among those travellers was J.P. de Tournefort (1702) who was prompted to conduct further research at the Heraion by the still-standing column (11.21m height) of the Great Temple, after which the surrounding region was named – and is still called by the locals – *Kolona*. This column was probably left in place intentionally in order to serve as a landmark for cargo ships approaching the anchorage, especially after the 3^{rd} century AD when the stone material was used for construction purposes and exportation (Kalpaxis 1990, 23-

25; Tsakos and Viglaki-Sofianou 2012, 73-74). By the late 18th and early 19th century most of the visible remains of the Hera Temple were drawn and described by M.G.F.A Choiseul-Gouffier, D.R. Rococke and J. Dallaway (1776-1797) and more systematically by the London Society of Dilletanti (1812).

These early explorations were followed by several excavation campaigns carried out first by the French archaeologist V. Guérin (1850/1855) under governor G. Konemenos at public expense, and continued under Ioannis Ghikas at his own expense (1853). In the following years more archaeological investigations were undertaken by V.K. Humann (1859/1862), P. Girard (1879), and M. de Clarc (1883), although often with constraints imposed by the nature of the site, which lies in a marshy river basin (deep water table, silt deposits from different flooding episodes, dense vegetation repeatedly covering the excavated areas), and ownership problems with the local people (Tsakos and Viglaki-Sofianou 2012, 19). After a series of political attempts to enshrine the right for a systematic investigation, in 1902-1903 P. Kavvadias and Th. Sophoulis undertook a short-term excavation and brought to light the Rhoecus Temple (6th century BC) on behalf of the Archaeological Society of Athens (Kalpaxis 1990, 63-65). Between 1910 and 1914 new excavations were undertaken by Th. Wiegand and M. Schede on behalf of the Royal Museums of Berlin (Wiegand 1911). After a short break due to the political conditions of this period (World War I), the systematic investigation of the Heraion Sanctuary was resumed from 1925-1939 under the direction of E. Buschor. Excavations by Welter north of the Hera Temple in 1925-1927 brought to light a Mycenaean chamber tomb. Due to the outbreak of World War II, the excavations at Heraion resumed in 1951/3 and have continued since then with short pauses by the German Archaeological Institute of Athens under the direction of E. Buschor, E. Homann-Wedeking, H. Kyrieleis, H. Kienast, W.-D. Niemeier (2009-2013 with O. Kouka, University of Cyprus), and J. Heiden. Between 2004 and 2007 the 21st Ephorate of Prehistoric and Classical Antiquities undertook an operational programme for the protection, conservation and presentation of the archaeological site of Heraion (Tsakos 2005; Tsakos and Viglaki-Sofianou 2012, 20-22; Viglaki-Sofianou 2013). Excavations have also been conducted at the ancient town of Samos (Tigani/modern Pythagoreion) (for a synopsis of the Archaic-Roman excavations see Tsakos 2000; Tsakos and Giannouli 2006).

Archaeological research so far has revealed only five prehistoric sites on the entire island (Fig. 3.5). According to excavated, stratified levels on the Kastro-Tigani peninsula at the modern town of Pythagoreion (Ancient Samos) prehistoric habitation on Samos extends back to the LN and FN/Ch periods (Felsch 1988), the latter being contemporary with the recently excavated Ch level north of the Sacred Road at Heraion (Kouka 2014b). Apart from the Ch and EBA settlements under examination, other sites are also known through stray architectural, ceramic, and obsidian surface finds that date between the MBA and LBA periods (Kavo Phanari/Cape Fonias and Mesokambos situated in the SE part of Samos to the E of Pythagoreion), as well as two partly-preserved Late Mycenaean chamber tombs (Heraion and Myli) (see Shipley 1987, 25-26, 261, 263-264 [Catalogue no. 1901a, 2001, 2103] for further bibliography; Milojčić 1961, 25-26, 58; Kouka 2002, 279-280, map 28). As has been already implied above, the geomoprhological character of Samos, being an extremely mountainous island, would only allow the development of these sites in the most extensive, fertile plain in the south-central/SE part of the island. This should also be assessed in accordance with other factors, such as the proximity to the opposite mainland, with which Samos was closely related in the historical periods, and the straits.

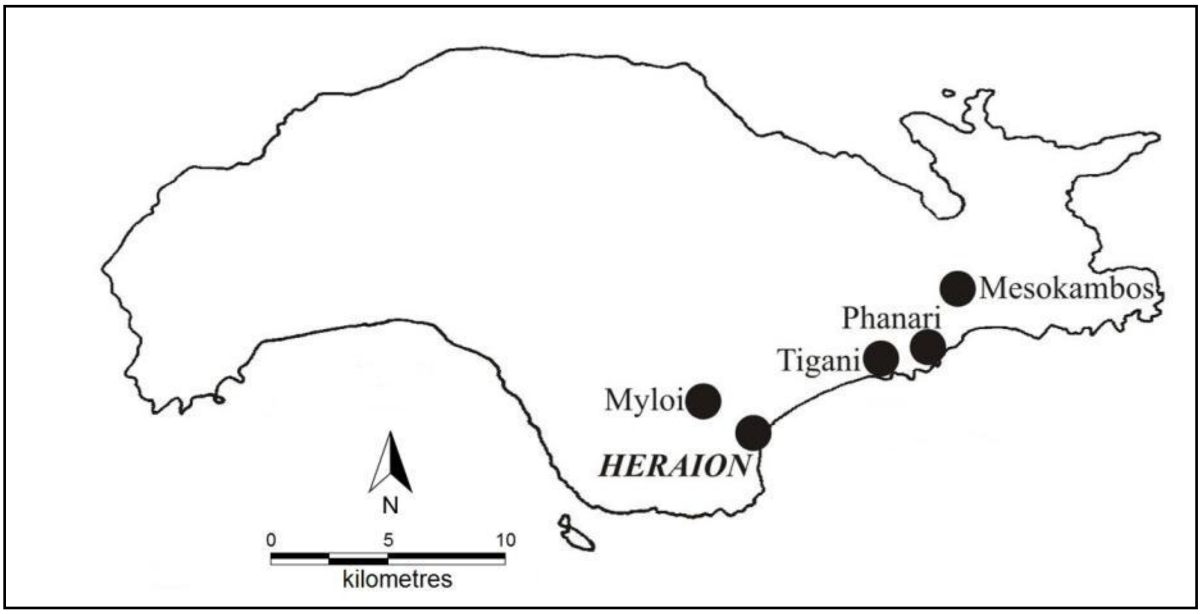


Figure 3.5: Map of Samos showing the location of the Bronze Age archaeological sites (modified after Kouka 2002, map 28).

According to Shipley's small-scale survey and fieldwork conducted in the archaeologically unknown western part of the island (around Karlovassi and Marathokambos), there seems to be a diachronic and geographical shift of the population density from the Roman period onwards (Shipley 1987, 249-266). While SE Samos was densely populated from the NL until the Late Hellenistic period (Shipley

1987, 231-239, maps. 9-14), according to ancient and modern literary sources and stray archaeological finds, the western part was first settled during the Late Hellenistic and Roman periods (Shipley 1987, maps. 13-14), and systematically settled since the Early Byzantine period (Shipley 1987, maps. 15-17). The NE part of the island shows evidence of occupation also during the Early and Middle Byzantine periods. The absence of habitation traces in the western part of the island before the Roman period, in combination with the geomorphology, was considered by Kouka (2002, 282-284) as an indication that it was not inhabited during prehistory.

3.5 The Chalcolithic and Early Bronze Age settlement of Heraion

3.5.1 Location and history of research

The site of Heraion lies in the south-central part of Samos, less than 1km E of the modern village with the same name, extending in the largest, most fertile and best watered plain of the island between the two main branches of the Imvrassos River (Buschor 1953) (Fig. 3.6). Although its location at a first glance does not seem advantageous, as it is developed in a marshy basin and often exposed to floods (Milojčić 1961, 3; Papageorgiou 2002, 439), the continuation of use over the millennia rather contradicts this view. The foundation of the prehistoric settlement of Heraion in the area N of the Sacred Road, since the mid-5th millennium BC (O. Kouka, pers. comm.), followed the example of other contemporary settlements that were developed on low hills; although not obvious anymore due to the sea-level rise and sedimentation processes, the settlement extended along a small bay in close proximity to the opposite Anatolian coast and was bordered to the E by Imvrassos (Kouka 2002, 281). The recent investigations in trenches N of the Sacred Road between 2009 and 2013 confirmed that the earliest horizon of the Ch period was located directly on coastal pebbles (-0.20m and -0.11m/-0.37m below sea level) and extended from the E up to the W branch of the Imvrassos River on the Heraion coast (Kouka 2014b, 50-51).

The Heraion's significance as one of the greatest sanctuaries in the ancient Greek Classical world has come down to us in the form of literary sources (e.g. Herodotus), although limited and scanty at times. Less reliable and more fragmented information is given by chronologically later sources, which cannot entirely be evaluated as they appear long after the floruit of the Hera cult. Largely based on visible archaeological remains, of which most important is a half-preserved column of the Archaic Hera

Temple (55.2 x 108.6m) that is still standing upright since its construction, the investigation of the Heraion (Early Iron Age-Late Roman periods, 1050 BC-400 AD) has been carried out mainly through excavation of the area by the German Archaeological Institute since 1911. The sanctuary with the temples and the altars was exploited for building materials (limestone and marble) from the Middle Ages onwards, resulting in dismantled buildings and ruins that were not visible before systematic excavation began in the early 20th century.

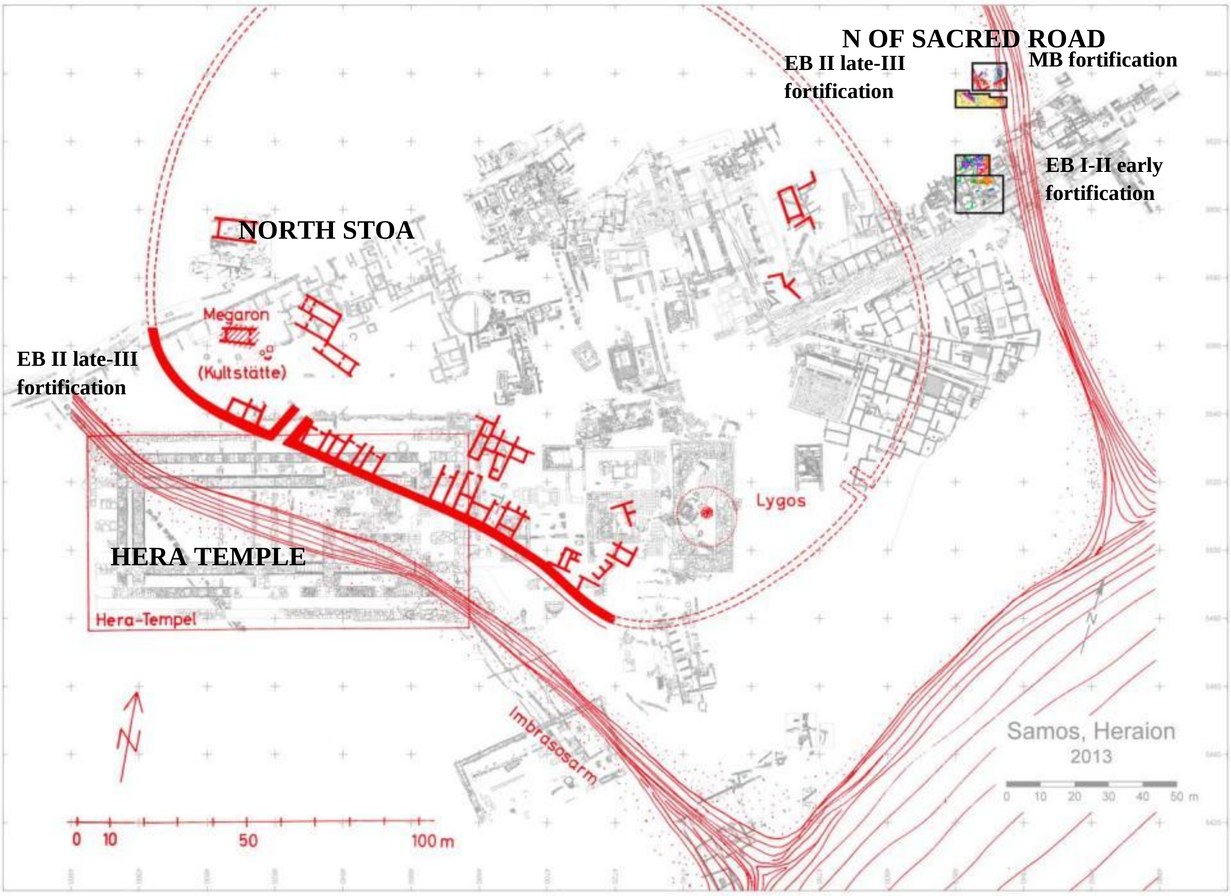


Figure 3.6: Reconstruction of EBA Heraion with the Imvrassos River (after Walter 1976, fig. 3) in combination with the architectural remains (2009-2013) north of the Sacred Road (after H. Birk and O. Kouka, unpublished). The black labels refer to the red layers, which represent the prehistoric levels.

EBA Heraion constitutes the largest prehistoric island settlement with proto-urban characteristics in the eastern Aegean, covering an estimated 35,000m² (Milojčić 1961, 3; Kouka 2002, 285-294, pls. 45-55). The first stray finds of the fortified settlement were uncovered to the E of the Temple (J10) by Buschor (1930, 8, fig. 3), while the first systematic investigation of the prehistoric levels was undertaken in 1953 and 1955 by Milojčić in the area between the Hera Temple and the North Stoa (E-H/6-9), as well as underneath the Pronaos (Fig. 3.7) and published in the first volume of the

Samos series (Milojčić 1961, 56-67, tab. 3). The stratified levels led to the definition of five successive architectural phases (Heraion I-V; Fig. 3.8), spanning the second half of the 3rd millennium BC (*ca*. 2550/2500-2000 BC). Milojčić also identified stray finds of the MBA and LBA and designated these as Heraion VI and VII respectively. Further investigations at Heraion between 1958-1960 by Walter (1963, 286-289, fig. 1; Walter and Vierneisel 1959, fig. 1) in the area beneath the N and E Prostasis and E of the Hera Temple (H-K/9-10), as well as in 1966 by Isler (1973) in the area N of the North Stoa brought to light architectural remains of the late EBA and enriched our knowledge of a thriving fortified settlement with complex political, economic, and social structures (Walter 1965, fig. 4; 1976, fig. 3). Unfortunately, apart from some sparse references and preliminary reports, the results of these excavations still remain unpublished. In the area N of the Hera Temple and E of the North Stoa stray EBA III architectural remains, pottery and other ceramic finds, obsidian tools, and marble figurines were also unearthed in 1963 by Homann-Wedeking (1964, figs. 7-9; 1967, 402-403, fig. 470a-c). Later investigations by Kyrieleis and Weisshaar in 1980-1981 in the area N of the Sacred Road (Fig. 3.7) revealed four successive architectural phases directly beneath the Late Roman settlement dating to Heraion I and earlier (Kyrieleis *et al*. 1985, 409-418, figs. 35-37; Kouka 2002, 286, tab. 1), which also remain unpublished. The existence of an earlier occupation has been testified by the recent excavations undertaken by the University of Cyprus (O. Kouka) within the framework of a joint project with the German Archaeological Institute at Athens between 2009 and 2013 in the area N of the Sacred Road (Niemeier and Kouka 2010; 2011; 2012; Kouka 2015). These new results challenge the previous view of the first habitation of Heraion being *ca*. 2500 BC (Walter 1976, 13-14), and extend the sequence back to the Ch period.

Figure 3.7: Plan of Heraion with the various excavations undertaken since 1925 with prehistoric finds (after H. Birk and O. Kouka, unpublished).

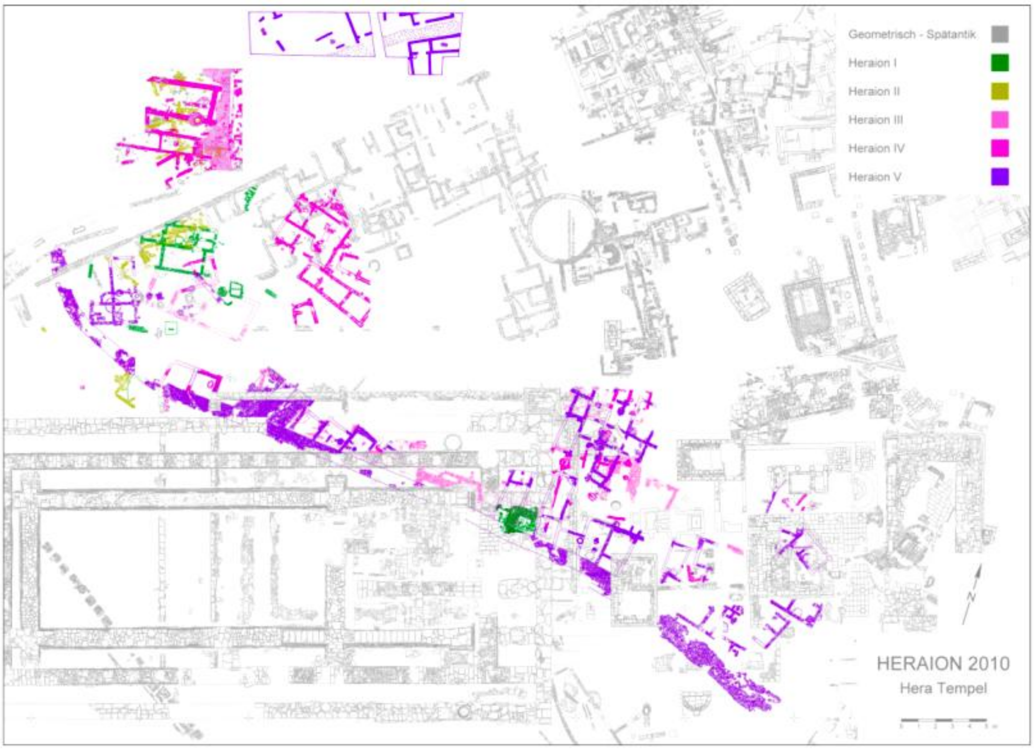


Figure 3.8: Plan of Heraion with excavated parts in the area of Hera Temple, belonging to phases Heraion I-V (after Kouka 2015, fig. 1).

3.5.2 Excavation methodology

A complete picture of the prehistoric settlement of Heraion is only possible by the integration of data gathered from different areas and excavation campaigns, the majority of which are unpublished. Three pottery assemblages have been studied in this thesis, deriving from the excavations by Milojčić (1950s), Kyrieleis and others (1981), and Kouka (2009-2013). Such an approach is confronted by a series of difficulties caused by the nature of the contexts and the necessity to cross-correlate results from various soundings. More particularly, the most important issues that arose were the use of different methods of excavation and documentation of data, the variation in depth of the bedrock-virgin soil, and the use of different standard points of reference for the measurement of the depths.

Milojčić's excavations in the area of the Hera Temple investigated a large area which was divided into 20x20m trenches with a N-S orientation (1961, 4). The excavated area of 2000m² (Kouka 2002, 285) followed the constraints imposed by the dense building activity of later periods. In terms of nomenclature, the grid coordinates used have followed the Latin letters E-H for the horizontal axis and numbers 6-9 for the vertical axis (Milojčić 1961, plans 1-3; Kouka 2002, plan 45b). The trenches were further subdivided into 100 squares of 2x2m size. Although the results of this excavation were published, the study of all pottery necessitated the correlation of contexts and recording system with the marking codes identified on the sherds. Moreover, while only diagnostic sherds are included in the publication, in this thesis a number of boxes with diagnostic and non-diagnostic sherds were identified and recorded.

Kyrieleis and Weisshaar's excavation of the prehistoric layers in the area N of the Sacred Road investigated a much smaller area of 8x10m with a NW-SE orientation (Kyrieleis *et al*. 1985, 410). The orientation of the trenches, generally parallel to the Sacred Road, followed the geomorphological constraints of the area which is slightly more elevated than the Hera Temple area. The prehistoric levels were investigated immediately beneath Roman house complexes (2nd to 4th centuries AD) where the area was largely free of a dense occupation (Kyrieleis *et al*. 1985, 401, fig. 27) (Fig. 3.10). The results of this excavation remain unpublished. Thus, careful examination of the original documentation was required through the hand-written excavation notebooks (Kyrieleis and Kienast 1981; Weisshaar 1981). More particularly, we were able to reconstruct the grid coordinates system and stratigraphical sequence of the excavated contexts. The grid coordinates used probably continue from those established in the older excavations and, therefore, the trenches with the prehistoric finds correspond to R-S (horizontal axis) and 4-5 (vertical axis) (Kyrieleis *et al*. 1985, 366, fig. 1). The area was demarcated by *Fläche* 2 and 3, which included *Raum* A, being subdivided into 100 squares of 1x1m size, and further extended towards the west in *Fläche* E, which was subdivided into 30 squares of 1x1m size (Fig. 3.9). A smaller area, namely Fläche F, was excavated to the E of Raum A. The excavation system followed was based on the identification of *passes*, namely minimum excavation units or the artificial subdivision of archaeological layers of *ca*. 0.10m between one another (*Oberfläche/Abhub* 6-20 from earlier/top to later/bottom). A number of codes were identified in the notebooks corresponding to architectural or other features (pits, hearth, floors, stone concentrations) and are referred to as Nr. (special unit), P (stone pillar), M (*Mauer*/wall), *Steinversturz* (stone concentration), *Störung* (disturbance), *Grube* (pit), etc. The pottery of each *passa* or special feature was collected separately and marked with the relevant inventory codes (see Chapter 4, Section 4.5). As in the excavations by Milojčić the vast majority of pottery identified belonged to diagnostic sherds, i.e. they comprise a selection of excavated material, with non-feature sherds largely disposed. Although not included in the only published plan of the prehistoric levels (Kyrieleis *et al*. 1985, fig. 35), more prehistoric finds were identified also in nearby areas (*Flächen* 15, 17-18, 27-28; *Räumen* L, K, J).

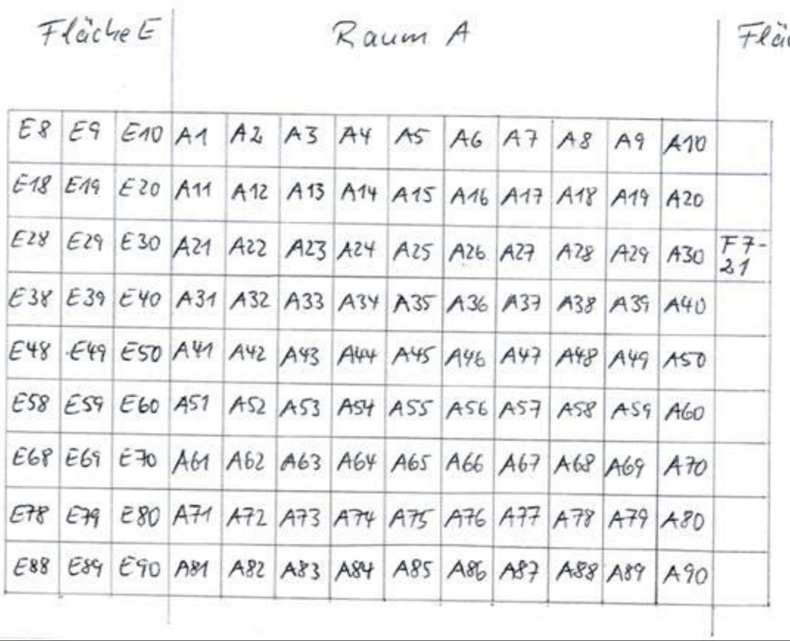


Figure 3.9: The grid plan with the areas and trenches excavated in 1981 (after Kyrieleis and Kienast 1981, unpublished).

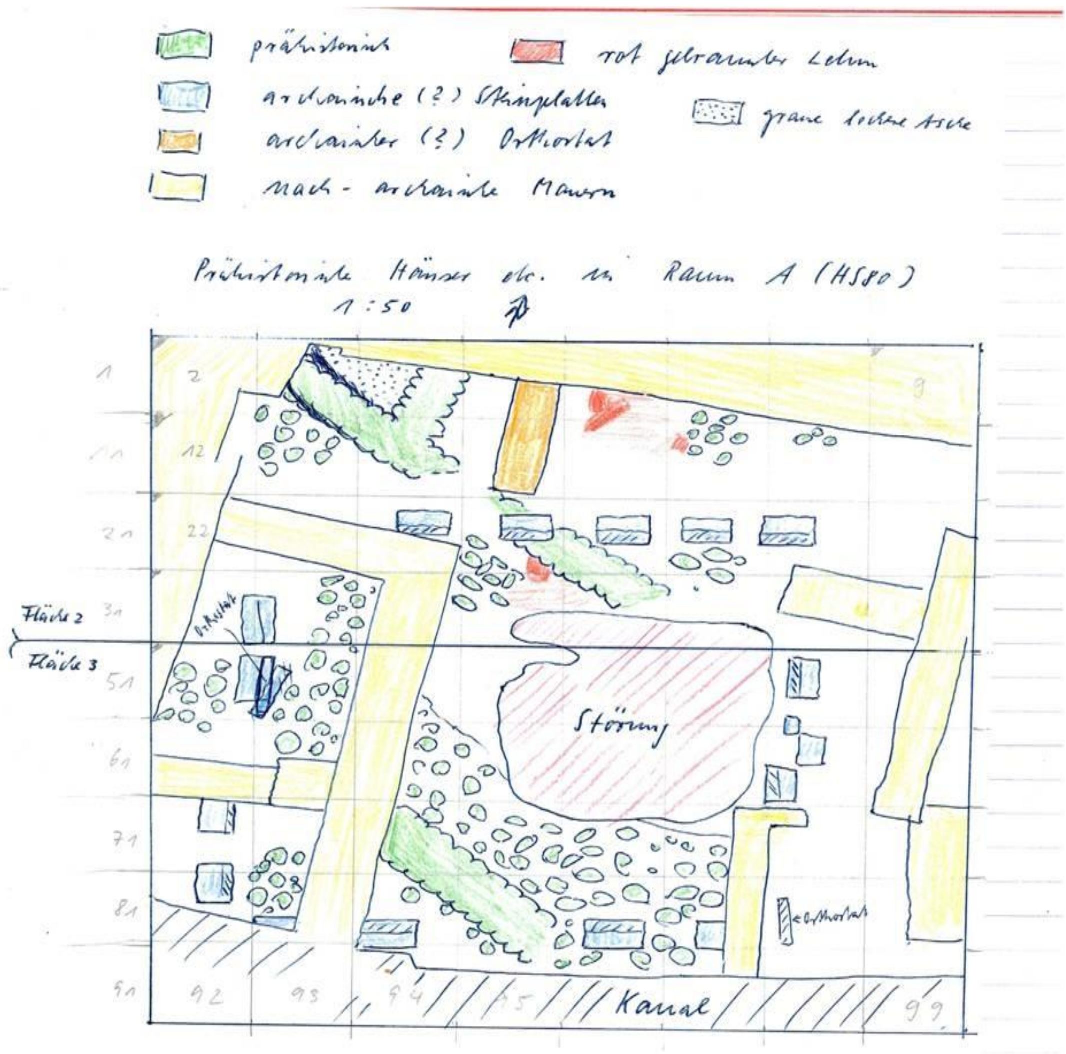


Figure 3.10: Sketch plan of excavated area with prehistoric walls highlighted in green (after Kyrieleis and Kienast 1981, unpublished).

Finally, the recent excavations undertaken by Kouka directly N of the trenches of the aforementioned excavated area followed a different system, where a modern grid system with geodetic/geographic references created by H. Birk for the entire site of Heraion. Originally, the South Sector (60m²) was opened and excavated between 2009 and 2011, which was divided into four trenches of 5x5m size (4820/4510, 4820/5615, 4825/5610, 4825/5615) (Figs. 3.11-3.12). As in the 1981 trenches, the prehistoric levels were discovered 2.5m beneath modern ground and below architectural levels of the Late Roman period. The North sector (138m²) was comprised of four new trenches (4825/5635, 4825/5640, 4830/5635, 4830/5640) opened in 2010 and three others excavated between 2012 and 2013 (4820/5630, 4825/5630, 4830/5630). The system followed was based on the excavation of all trenches simultaneously, thus depending on the year that they were opened, by layers in a stratigraphical order. A running serial number was given for each excavated unit for every excavation season (Stratigraphical Unit) for the identification of walls and other features. All pottery groups were kept and studied but only the diagnostic sherds or concentration of sherds were given an inventory number and drawn.`

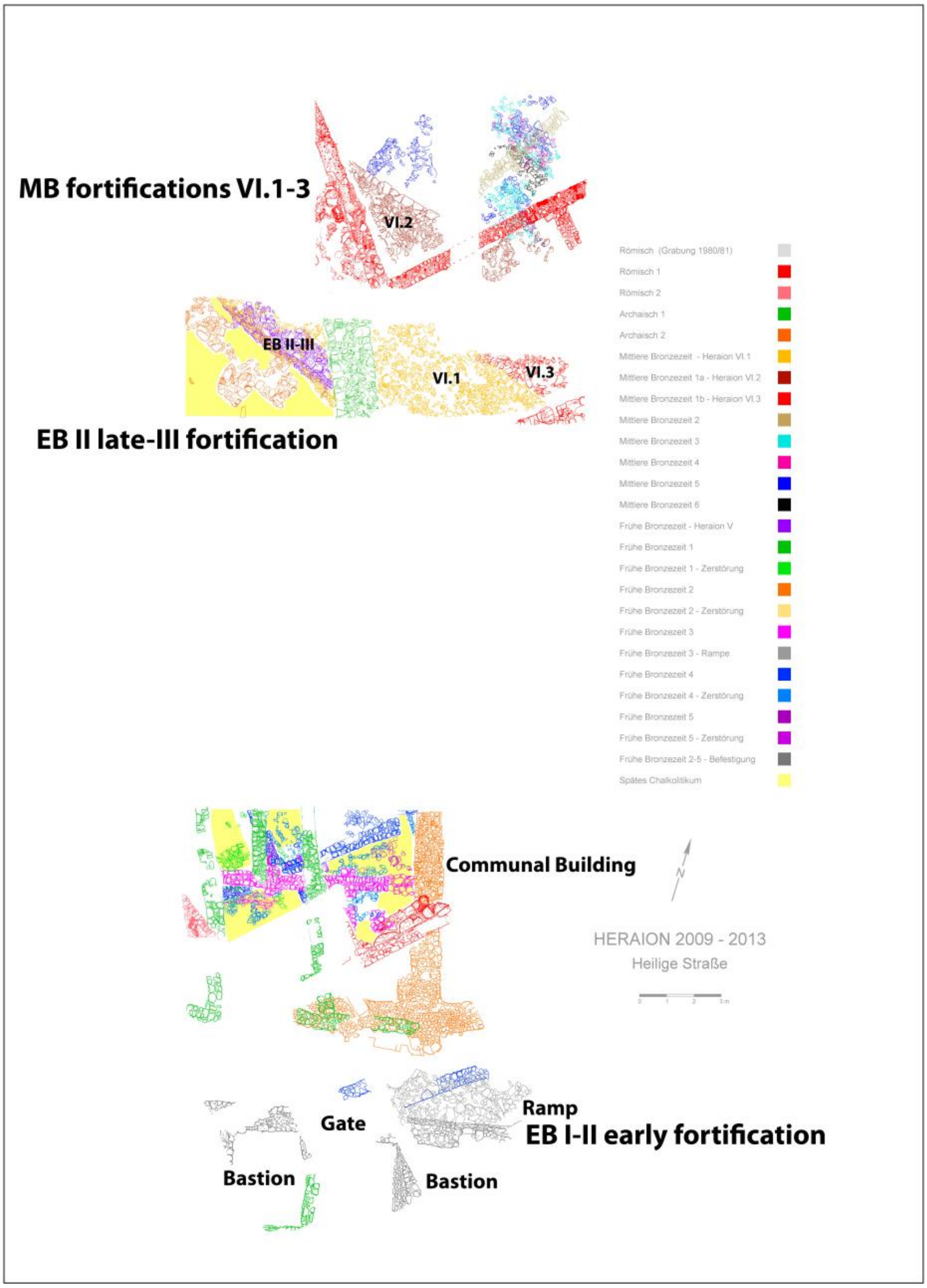


Figure 3.11: The 1981 and 2009-2013 excavations N of the Sacred Road (after Kouka 2015, fig. 2).

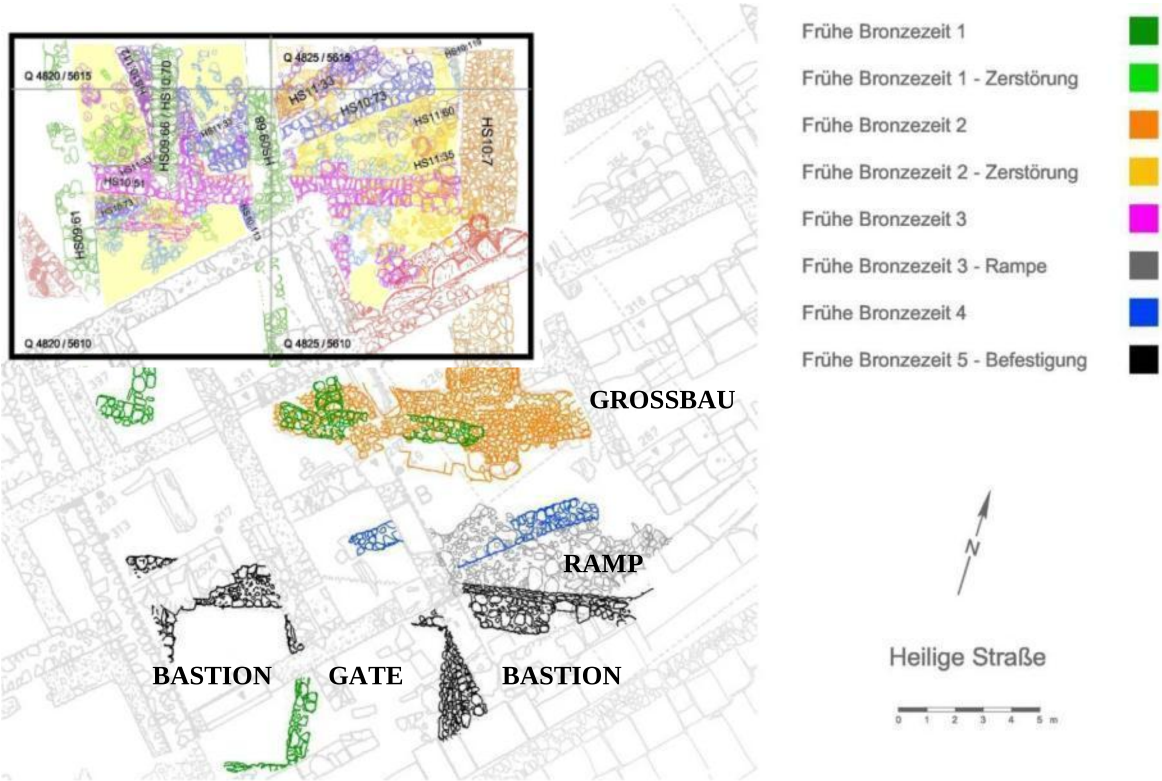


Figure 3.12: Close-up of Ch-EBA areas: the 1981 (South) and 2009-2013 (North) excavations N of the Sacred Road (after Kouka 2015, fig. 2).

As shown by the above information, there are certain differences in the methodologies applied in the excavations under discussion. In many cases erosion, along with building activities of later periods, caused disturbance of the EBA contexts especially in the area N of the Sacred Road. Occasionally, this impeded an understanding of the stratigraphic sequence of the pottery, particularly in the deepest contexts that lay beneath the groundwater. There is no consistent depth for the appearance of groundwater, e.g. N of the Hera Temple it occurred at 2.0m above sea level and N of the North Stoa at 2.50m (Milojčić 1961, 4), while N of the Sacred Road it was reached at 1.34m. Only the recent excavations have managed to reach virgin levels. This necessitated the use of pumps for the removal of water to make excavation possible. The 1981 excavation reached a depth of 2m above sea level and ceased once the groundwater appeared (Kyrieleis *et al*. 1985, 410), while Milojčić's excavation (1961) dug up to 0.4m deep, but never reached the ground level. The pottery assemblages have been associated by the excavators with successive architectural phases and/or other features. Only in a few cases, the pottery could not be associated with a certain architectural phase due to the foundation of later walls deep in the deposits of earlier phases. Therefore, special attention was given to ceramic concentrations deriving from individual buildings or related to features such as hearths and floors that are more reliable for a chronological and contextual assessment.

3.5.3 Stratigraphic observations and contexts: a summary of excavation data

This section provides a short presentation of Heraion's stratigraphy and main contexts included in this study, although detailed analysis of stratigraphy, architecture, and contexts is in progress by Kouka for the final publication (2009-2013). The sources of information on architecture and contexts used in this discussion derive from both published and especially unpublished preliminary reports by Kouka and previous excavators. The integration of the different excavation results led to the reconstruction of an uninterrupted sequence at Heraion from the late 5th to the late 3rd millennia BC (Tab. 3.1).

Heraion - Architectural phases		**Relative chronology**	**Absolute chronology**
Hera Temple	**Sacred Road**		
Heraion V	Heraion V	EB III	*ca*. 2200-2000 BC
Heraion IV	Heraion IV	EB III	
Heraion III	Heraion III	EB II late	*ca*. 2550-2200 BC
Heraion II	Heraion II	EB II late	
Heraion I	Heraion I/1	EB II developed	*ca*. 2650-2550 BC
n/a	Heraion 2	EB II early	*ca*. 2750-2650 BC
n/a	Heraion 3	EB II early	
n/a	Heraion 4	EB I	*ca*. 3000-2750 BC
n/a	Heraion 5	EB I	
n/a	Heraion 6	Ch	*ca*. 4500-3000 BC

Table 3.1: The stratigraphical sequence of the Ch and EBA settlement at Heraion (after Kouka and Menelaou forthcoming).

3.5.3.1 Chalcolithic: Phase Heraion 6

The Ch (Middle and Late Ch, *ca*. 4500-3000 BC) period corresponds to the sixth cultural level (Heraion 6: yellow area in Fig. 3.12) identified at Heraion in trenches (4820/5610, 4820/5615, 4825/5610, 4825/5615) excavated in 2011 in the area N of the Sacred Road (South Sector). Although no architectural remains of this period are preserved – apart from indirect evidence such as roof clay, roof beams, and parts of floors – due to the continuous occupation of the area and construction of houses in the EBA, Ch pottery was located directly on sterile soil among and below the destruction or foundation levels of the EB I-II walls of phases Heraion 5 (walls HS11:33, HS11:112, HS11:35, and HS11:60) and Heraion 4 (walls HS10:73 and HS10:84) respectively

(Niemeier and Kouka 2012, 100, fig. 21). Stray Ch pottery in small quantities was also found in mixed EB II early deposits of phase Heraion 3 (SU 30, 37, 44, and 70) and beneath those levels up to the virgin soil in destruction deposits in the form of roof clay and burnt mudbricks. Successive Ch layers have been unearthed beneath the foundation level of wall HS11:33 of phase Heraion 5 (EB I) (Niemeier and Kouka 2012; Kouka unpubl. excavation report 2011).

More Ch finds were unearthed in 2013 in the area S-SW of the EB III enclosure/fortification wall in trenches 4820/5630 and 4825/5630 (North Sector). The deep foundations of the EB III wall have destroyed the architecture of the Ch and EB II periods, as indicated by mixed pottery deposits in SU 57, 58, 60, 63, 64, 66, 67, and 69-75 (Kouka unpubl. excavation report 2013). According to this evidence, Kouka suggested that the Ch settlement extended west of the Imvrassos River up to the coast (2014b, 50-52).

More evidence of this period was identified in the 1981 ceramic assemblage excavated in trenches directly S of those excavated in 2011. In particular, the majority of Ch pottery derives from the deepest levels (e.g. A62-72/16-20) and was found to be mixed with EB I pottery. These levels were excavated S of the fortification wall that was in use for three successive architectural phases (Phases 1-3=EB I-II early) as defined by Kyrieleis *et al*. (1985, 410-412, figs. 35-38) and correspond to Phases 5-2 of the trenches excavated by Kouka (2014a, fig. 1). Stray Ch pottery has also been identified among EB II deposits across the 1981 trenches.

More stray Ch pottery has been recovered in the area of the Hera Temple between 1953 and 1955 (Milojčić 1961, pls. 35:74, 37:16, 38:5), although it was published together with phase Heraion I material (e.g. E8/73, *Kellergrube*, etc.).

3.5.3.2 EB I: Phases Heraion 5-4

EB I, hitherto unknown at Heraion, was discovered and well-documented in the 2011 excavation season in trenches of the South sector (Fig. 3.12). It includes the walls HS11:33 and HS11:112, which belong to a rectangular long-room house with a NE-SW orientation. The buildings of this architectural phase differ from Phases 1-4 in that they are constructed with limestone slabs and occasionally also dark volcanic slabs, instead of rounded pebble stones (e.g. SU 80). The sparse presence of pottery in this phase might be explained by the poor preservation of contexts due to the building activity of the later phases. Among the contexts also belong features like mudbricks from the walls' superstructure, roof clay or ashes from possible floors. Other architectural features include walls HS11:60 and HS11:35 founded directly on the coastal pebbles, 80cm apart. Their arrangement does not exclude their function as a grill-like foundation of a storage building that required a floor isolated from the humidity of the coastal ground.

Further contexts of this period include parts of a free-standing fortification wall that was unearthed in the 1981 excavation in trenches S of the 2009-2011 South Sector and corresponds to *Bauphase* 1, i.e. the latest architectural phase (Kyrieleis *et al*. 1985, 410-411, figs. 35-39). The fortification wall, with an E-W orientation, measures 10m x *ca*. 1.5-2m and is supported by two rectangular bastions. According to the excavators, an older wall was identified beneath the fortification wall but was not investigated due to the high water table (Kyrieleis *et al*. 1985, 410; Davis 1992, 743). The recent excavations in 2009-2010 have shown that the fortification was older than the phase of Heraion 4 and that it was in continuous use between Heraion 5 and 2. In Heraion 1 it ceased to be in use, as indicated by the construction of houses above and outside of it. This led Kouka to suggest the extension of the settlement towards the area of the Hera Temple in the end of the EB II early period and the construction of a new fortification wall by Heraion III (Kouka 2013, 576).

Phase Heraion 4

To this phase belong the walls HS10:73, HS10:84, and HS10:113 which comprise two rectangular long-rooms, two-spaced houses built side by side with a NE-SW orientation. Two of the walls were founded above Ch levels, therefore destroying earlier contexts, while HS10:113 was founded on top of the EB I wall HS11:33 of Heraion 5. Other interesting architectural features of contexts of this phase include SU 32 excavated between walls HS10:73 and 84 and representing a layer of red, burnt clay and traces of ashes possibly belonging to roof clay, below which a hearth was discovered. Below these layers and to the E of HS10:84, a possible pebble and limestone slab floor was unearthed in SU 44 (Kouka unpubl. excavation report 2010). Possible walls belonging to this phase were first discovered in 1981 in trenches S of the South Sector (4825/5605, 4830/5605), but were not included in the preliminary published plan (Kyrieleis *et al*. 1985, fig. 35). This correlation was recently made by Kouka in her examination of architecture and stratigraphy.

3.5.3.3 EB II early: Phases Heraion 3-2

The EB II early period was first identified at Heraion by Kyrieleis *et al*. (1985) in the 1981 excavation, although simply defined as earlier (before *ca*. 2500 BC) than what was already known from Milojčić's excavations in the area of the Hera Temple (Fig. 3.8, Phase Heraion I). Correlations are given within the following sections regarding the terminology of architectural phasing between old and new excavations. With the end of phase Heraion 2 important changes take place in the settlement, as the EB I-II early habitation core extends towards west in Heraion 1/Heraion I.

Phase Heraion 3

To this phase belong at least two rectangular long-room houses, which extend N and S of wall HS10:51. Due to the unstable ground and the danger of earthquakes, traces of which have been observed in its W part, the latter long wall has been strengthened with four rectangular stone buttresses (Niemeier and Kouka 2011, 104, fig. 17; Kouka 2015, fig. 3). Burnt mud-bricks and roof clay with traces of thick wooden beams have been found in both houses. To the interior arrangement of the houses belonged floors laid with fine pebbles or with flat pieces of limestone. In the SW corner of the main room of the N house an amphora *in situ* but upside down has been found directly beside the buttress, full of carbonized cereals (Fig. 3.13). In the same room besides storage, also food preparation and consumption (tripod bowl, jug with incised handle) and textile production (two rounded sherds) took place (Kouka *et al*. forthcoming). Moreover, the free-standing fortification wall of Phase 5 was supported by a stone ramp, excavated in 1981 and corresponds to *Bauphase* 3 (1.91-0.43/0.51m above sea level) (Kyrieleis *et al*. 1985, 412).

Figure 3.13: Burnt area with an upside down, *in situ* amphora (after Kouka, unpublished).

Phase Heraion 2

This phase includes the so-called *Grossbau* (Large Building; Fig. 3.12), a big part of which has been uncovered in 1981 (Kyrieleis *et al*. 1985, figs. 35-37) and corresponds to *Bauphase* 2. The new excavations between 2009 and 2011 within the South Sector revealed the continuation of this building to the N (Niemeier and Kouka 2010, 113, fig. 16; 2011, 104-105, figs. 17-18; 2012, 100-101, fig. 21). The *Grossbau* (HS10:7) was located 2.5m N of the fortification wall (Heraion 2-5) and has a N-S orientation. The excavated dimensions of this building are *ca*. 9x10m. Its destruction level is 0.30-1.10m thick and included burnt mud-bricks collapsed in a direction from E-NE to W-SW. Beneath the destruction level with mud-bricks burnt wooden beams have been observed in an E-W direction (Fig. 3.14). They belonged most probably to the floor of a wooden upper storey of this building. The strongly burnt layers of roof clay and mud-bricks covered a thick layer with grey ash, which extended over the pebble floor of the Large Building.

The location of the *Grossbau* directly N of the settlement gate, its strong construction, which is similar to that of the fortification wall, as well as its dimensions indicate a communal building, synchronous to the Communal storage 28 and the Communal Hall of Poliochni Blue-Green on Lemnos and Liman Tepe V (Kouka 2002, 49-50, 295-296, pls. 3-4; 2013, 570-572, fig. 3; 2014b, 52; 2015, 227). The finds belonging to this building are not indicative enough to specify its exact function. There should be, though, no doubt that this exceptional building displays the earliest communal building found so far in EB Heraion. Thus, we refer to it preliminarily *Communal Building I* (Kouka *et al*. forthcoming).

Figure 3.14: Destruction layer of *Grossbau* with mud-bricks and burnt wooden beams (after Kouka, unpublished).

3.5.3.4 Early Bronze Age II developed: Heraion I, Bauphase 4, and Heraion 1

This period is predominantly known from contexts excavated by Milojčić (1961) between 1953 and 1955 in the area between the Hera Temple and the North Stoa, as well as underneath the Pronaos (E-H/6-9) in the NW part of the settlement (Fig. 3.8, Phase Heraion I). It corresponds to phase Heraion I, as defined by Milojčić, and represents the latest phase he recognised (1961, 58, plan 1). Heraion I is contemporary with Bauphase 4 (*Rechteckbau*), as defined by Kyrieleis and Weisshaar in the area N of the Sacred Road (Kyrieleis *et al*. 1985, 413, figs. 35 and 40; Kouka 2002, 286-288, plans 46-47). These belong to double-spaced rectangular buildings with an E-W orientation of their long walls (Fig. 3.12). More architectural remains of this phase have been identified in 2009 in trenches (4820/5610, 4825/5610) immediately to the N of the 1981 excavation, comprising a continuation of the same house walls and corresponding to Phase Heraion 1 (Niemeier and Kouka 2010, 113, fig. 16; Kouka 2013, fig. 1). According to a re-evaluation of the stratigraphy in combination with the preliminary typological examination of the old and new ceramic material, it can be deduced that phase Heraion 1 N of the Sacred Road and Heraion I in the area of Hera Temple correspond to the final stage of the early EB II period or EB II developed (Kouka 2015, 227-228) and are not synchronous with Troy I (late) as Milojčić (1961) argued. More particularly, towards the end of the EB II early, unknown factors precipitated the extension of the settlement in Heraion I towards the W, the earliest EB fortification wall north of the Sacred Road (Heraion 5-2) went out of use and a new fortification wall was erected, which was used until the end of EB III and has been documented both in the 1950s in the Hera Temple area and in 2013 N of the Sacred Road (Kouka 2013, 576; 2015, 227-228). It has been argued that the expansion of the settled area during this period is also observed in other contemporary settlements of the NE Aegean such as Troy I late, Poliochni Green, Thermi IVA, Emporio III, Liman Tepe V, Bakla Tepe (Kouka 2002, 295; 2013, 570-571, figs. 2-3).

Phase Heraion I

The architecture of Heraion I testifies to a substantial re-organisation of the EB settlement, due to the aforementioned abandonment of the earliest EB fortified settlement N of the Sacred Road, the building of long-room rectangular houses (architectural phase Heraion 1=later stage of Heraion I) on top of the first EB I fortification, the expansion of the settlement westwards up to the W arm of the Imbrassos River, and the erection of a new protection/fortification wall along the river in the area of the later Hera Temple (Kouka *et al*. forthcoming). Apart from the recently discovered houses N of the Sacred Road, this phase is represented in the temple area in two *Kellergruben* and also testified on floors of long-room houses (9x4m). Apart from the houses, an extraordinary building, the *Grossbau/Communal Building II*, distinctive for its massive stone construction and dimensions (5x4m), was erected next to the southern part of the fortification wall (beneath the Pronaos) (Milojčić 1961, 27, plans 4-5, pl. 5:1; Kouka 2002, 286-287, fig. 24, plans 46-47; 2013, 576), most probably as a successor of the above mentioned *Communal Building I* of the EB II early settlement core N of the Sacred Road.

Phases Bauphase 4 and Heraion 1

This phase includes four N-S orientated, rectangular and/or slightly trapezoidal long-room, two- or tripartitite houses with a length of *ca*. 8-14m (Niemeier and Kouka 2010, 113, fig. 16). These houses were founded N and S of the fortification wall, within the destruction level of the *Grossbau* of Heraion 2, and were extensively destroyed in Roman times. One house extended W of wall HS09:61; its SE corner was excavated in 1981 (named then *Rechteckbau*) and was assigned to *Bauphase* 4. The houses between walls HS09:66 and HS09:68 and E of the latter one were furnished with pebble floors, clay hearths, and installations for grinding. Between walls HS09:61 and HS09:66 23 grinding stones were found, while W of the latter wall a permanent installation for grinding (1.0x0.5m) has been documented (Kouka *et al*. forthcoming). The archaeobotanical analysis by Margaritis (2013, 750) revealed not only the grinding of cereals but also the crushing of olives for limited olive oil production, one of the earliest indications for the production of olive oil in the Aegean.

House deposits E of HS09:68 comprised a storage area laid with a 8-15 cm thick layer of fine pebble stones on which the following pots were found *in situ*: parts of cooking pots, an amphora with incised decorated handles, part of a black burnished jug with carinated body, part of a wide-mouthed jug, and an almost intact miniature pyxis with vertically-pierced lugs (Kouka 2015, fig. 7b, g). The archaeobotanical material revealed vine seeds that suggest the use of the amphora and the jugs for storing and pouring wine. The houses of Phase Heraion 1 are synchronous with those of Heraion I found by Milojčić N of the Temple and beneath the Pronaos.

3.5.3.5 Early Bronze Age II late: Phases Heraion II and III

This period is predominantly known from contexts excavated by Milojčić between 1953 and 1955 in the area between the Hera Temple and the North Stoa, as well as underneath the Pronaos (E-H/6-9) at the northwest part of the settlement (Figs. 3.8 and 3.15). These constitute the only published data from prehistoric Heraion and the related stratified levels correspond to the settlement phases Heraion II and III as defined by Milojčić (1961, 56-67, tab. 3) each representing an early and a late part of the EB II late period. It corresponds to Şahoğlu's 'Anatolian Trade Network' (Şahoğlu 2005b) period of western and central Anatolia and the 'Lefkandi I-Kastri Group' of the Greek Mainland and the Cyclades respectively (Rutter 1979; 2012, 73-79).

Pottery of this period was also uncovered in contexts from the area N of the Sacred Road, predominantly in mixed contexts together with earlier or later material. More particularly, it is found in trenches 4820/5630 (SU 39, 42, 44, 51, 60), 4825/5630 (SU 57), and 4830/5630 (SU 40, 54, 64) in contexts related to the destruction level of house deposits, foundation level of MBA houses or fortification walls. In other contexts there occur only a few sherds that are typologically/morphologically related to EB II late pottery, but largely comprised of EB III and MB material (SU 6, 9, 11, 24, 28, 49, 50, 67, 69, 70, 71, 72, 74). These correspond to red slipped tankards, dark slipped shallow/slightly carinated bowls, red slipped shallow bowls, and EC collared transport jars. The documentation of EB II late material in the area of the Sacred Road implies for the first time that the settlement extended beyond that already known from the area of the Hera Temple.

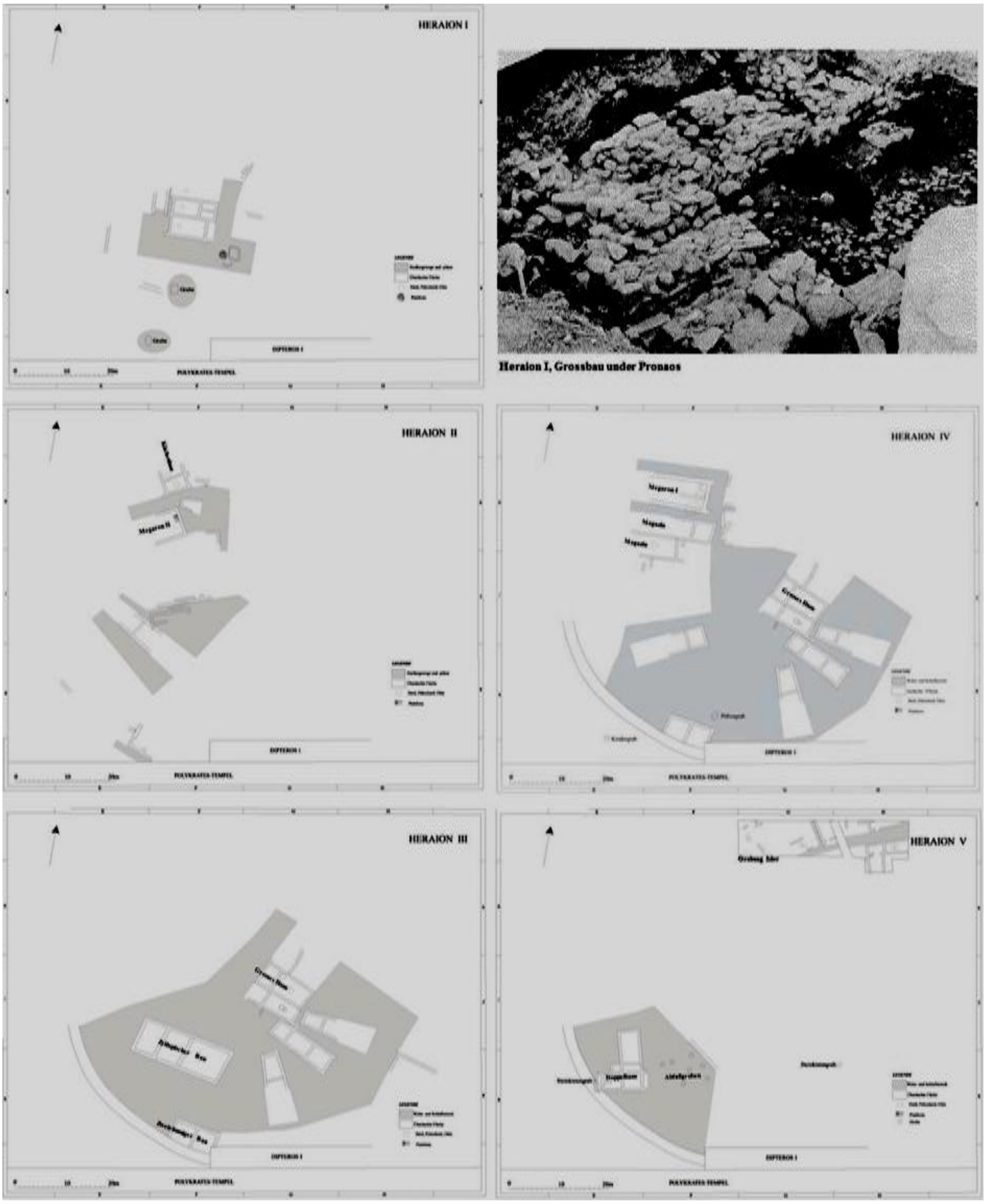


Figure 3.15: Phases Heraion I-V (after Kouka and Menelaou forthcoming, fig. 4).

Phase Heraion II

This phase comprises long-room houses and for the first time also trapezoidal houses with antae in their both short sides (F6 and E-F 7-8; Fig. 3.15). They show a different orientation, were built mostly independent from each other, and were protected by a fortification (Milojčić 1961, 25, pl. 3). The houses were furnished with clay hearths and a variety of storage facilities, such as rectangular stone platforms and pithoi in shallow cavities (Milojčić 1961, 36-37; Kouka 2002, 288-289, fig. 25, plans 48-49). Those facilities, as well as reliable household contexts with a considerable amount of pottery, allowed the identification of certain activities in *Megaron II* (F6) and in the *Küchenbau* (F6/77–78), such as food preparation, cooking, storage, etc. Heraion II seems to have been destroyed by an earthquake.

Phase Heraion III

After the destruction of Heraion II, a re-organisation of the settlement took place (Fig. 3.15). Heraion III is encompassed by a strong (2m) stone fortification with a gate (Milojčić 1961, 7, 58, 68), long–room rectangular (9x4m) and trapezoidal (14.5x5m), two- or tripartite houses in a radiating arrangement towards the curvilinear fortification, built either separately or in groups of at least three buildings sharing common walls (Milojčić 1961, 24-25, plan 1; Kouka 2002, 289-290, fig. 26, plans 50-51). Besides, the *Zweiraumiger Bau* in F8 was attached to the fortification wall. This phase is best represented in the layer between the *Megaron II* and the *Megaron I*, as well as in the area beneath the *Haus* in G7/70-80. The most striking building of this phase is the rectangular tripartite *Zyklopischer Bau* (E-F 7-8) (Milojčić 1961, 17–19, 69, plan 2) that is distinctive through its location, dimensions (18.5x8 m) and monumental construction that resembles those of the fortification. On account of these, the *Zyklopischer Bau* has been interpreted as a building with a special social or political function, e.g. for hosting communal meetings or even the settlement's chief (Kouka 2002, 290, plan 51), who may have coordinated the new settlement planning of Heraion III. Unfortunately, no finds were retrieved from this building that could infer something more specific about its function. Of particular interest is also the *Grosses Haus* (G7) (Milojčić 1961, 23-24, plan 1, pls. 6, 8:2; Kouka 2002, 290) and the house beside it *(Anbau von Grossem Haus)*, that preserves floors and hearths with storage vessels (Kouka 2002, plan 51, tab. 101; Milojčić 1961, 23f, pl. 41:29-30), and included the majority of the finds ascribed to Heraion III (Kouka 2002, tab. 98-101, diagramme 18-21).

3.5.3.6 Early Bronze Age III: Phases Heraion IV and V

This period is predominantly known from contexts excavated by Milojčić between 1953 and 1955 in the area between the Hera Temple and the North Stoa, as well as underneath the Pronaos (E-H/6-9) at the NW part of the settlement (Fig. 3.8). These constitute the only published data from prehistoric Heraion and the related stratified levels correspond to the settlement phases Heraion IV and V as defined by Milojčić (1961, 56-67, tab. 3) each representing an early and a late part of the EB III. More evidence was revealed by the excavations undertaken in 1958-1960 by Walter (1963, 286-289, fig. 1; 1965, fig. 4; 1976, fig. 3; Walter and Viemeisel 1959, fig. 1) in the area beneath the N and E Prostasis and E of the Hera Temple (H-K/9-10), as well as in 1966 by Isler (1973) in the area N of the North Stoa. In the area N of the Hera Temple and E of the North Stoa, stray EB III architectural remains, pottery and ceramic finds, obsidian tools, and marble figurines were also unearthed in 1963 by Homann-Wedeking (1964, figs. 7-9; 1967, 403, fig. 470a-c). Unfortunately, apart from some sparse references and preliminary reports, these excavations still remain unpublished and therefore the focus of our study is on Milojčić's material.

More data on the EB III period, although to a large extent found mixed with earlier or later material, was produced from the 2012 excavation season. EB III pottery sherds belonging to shallow bowls, bowls with S-shaped rim, cups, jugs, jars, and cooking pots were identified in the deeper layers and more particularly SU 91, 96, 99, and 101. The 2013 excavation season revealed a substantial amount of evidence that confirmed for the first time activity during the EB III in the area N of the Sacred Road. More particularly, in the North Sector (trenches 4820/5630, 4825/5630) beneath the foundation of house walls of the MBA (HS13:10) and W of the MBA fortification wall (HS13:22), an enclosure/fortification wall (HS13:30) of the EB III period was uncovered with a NW-SE direction along the Imvrassos River, six metres in length and 1.64m high (Kouka 2015, 228). This important construction provides solid evidence for the NE limit of the settlement during the EB II late-III period, which until 2013 was documented only in the area of the Hera Temple. Pottery belonging to the period was found together with earlier (SU 44 [EB II late], 47-50, 67-69) or later (SU 22, 25-38 [associated with the MB fortification wall], 48, 50, 55, 59, 61, 63-65, 67-69, 71-75) material.

Phase Heraion IV

The evidence of this phase shows (Kouka and Menelaou forthcoming) that the fortified settlement of the preceding phase (Heraion III) with its rectangular and trapezoidal long-room houses was re-used (Fig. 3.15). New rectangular houses were built only in the N part of the settlement, also following a radiating arrangement. The best preserved contexts with the majority of the pottery are those of the *Grosses Haus*, which was in use since Heraion III (Milojčić 1961, 23), the *Megaron I*, with its domed horseshoe-shaped oven built directly next to the long wall of the building (Kouka 2002, plans 52-53), the *Magazine* (Milojčić 1961, 32-34), and the area of the *Zisterne*. Features such as floors, hearths, and pithoi in shallow cavities, as well as the distribution of finds do not indicate any changes in household activities. However, more prestige items were found in the houses, such as schematic figurines made of clay (Milojčić 1961, 52, pl. 34:1, 3) and marble (Milojčić 1961, 55, pl. 34:6) respectively and a bronze blade. Moreover, a bronze pendant, a miniature axe and a pendant both made from lead (Milojčić 1961, pls. 40:4, 50:21, 54) derive from the two pithos burials, found for the first time in the settlement area (*Pithosgrab* and *Kindergrab*), that belonged rather to special members of the Heraion's society (Milojčić 1961, 10-11; Kouka 2002, 291). The preservation of such rich house inventories might be explained by a destructive fire that probably followed an earthquake, as suggested by Milojčić (1961, 69).

In the following presentation of the shape repertoire emphasis is given to pottery from the old excavations, as opposed to the 2013 pottery which is used only to highlight certain features or for quantification purposes.

Phase Heraion V

The last EB III architectural phase (Kouka and Menelaou forthcoming) was built immediately after the destructive fire of Heraion IV with a new orientation and planning of rectangular, two-partite houses organised in groups sharing common walls and separated by streets (Fig. 3.15). The organisation of houses in groups may indicate the necessity for housing an increased number of inhabitants and point to a flourishing period for Heraion at the end of the EB III. The settlement was still protected through the fortification wall. Houses have been investigated in the area of the Hera Temple close to the fortification wall (*Doppelhaus*) (Milojčić 1961, 12-13, 19-20) and N of the North Stoa (Isler 1973). Besides the houses, a number of pits (*Abfallgruben*) (Kouka 2002, 292-293, fig. 28, plans 54-55) and two cist graves belong to this phase (Milojčić

1961, 25, pls. 1, 14:4-5, 42:7-9). Although this phase has not revealed much pottery from the area close to the fortification excavated by Milojčić, the shapes represented continue the same ceramic tradition as that of Phase IV.

3.6 Summary

This chapter has introduced the site of Heraion and Samos in general, as it forms the geographical focus of this thesis. The description of its geographical position, geomorphological configuration, natural resources, and hydrological systems showed the significance of Heraion's development during prehistory at the south-central plain, in close proximity to the western Anatolian littoral. The correlations of the recent and old excavations have enabled the establishment of a secure chronology of the pottery finds. The archaeological periods and contexts at Heraion, presented briefly in this chapter, will be examined in further detail from a ceramic perspective in the following chapters. Information on geomorphology and natural resources should be combined with the geological background of Samos (Chapter 5), while the relative chronology is further examined in Chapter 6 of pottery analysis.

CHAPTER 4: Methodology and analytical approaches in ceramic studies

> "Archaeologists in general and students of ceramics in particular largely live in an ancient world of their own creation. They have built up the background of the period they study by means of the material objects available to them, and they have filled in the gaps largely by hypothesis, analogy and guesswork. This, after all, is part of the game...In the study of ceramics this is especially evident" (Casson 1938, 464).

> "If we are to see an increase in the scope of analyses in the future as seems desirable, it will soon be necessary to introduce objective methods to sort and classify the mass of scientific data obtained" (Peacock 1970, 385).

4.1 Introduction

The quotes above signify at least two methodological concerns regarding the study of ancient pottery in the 20^{th} century. In his pessimistic statement Casson, reflects on the one hand the prevalence of art-historical and typo-chronological methodologies followed at his time and the study of pottery mainly by analogy to other sources of evidence, and on the other hand he implies a desirable shift towards new paths of research and interpretation. This shift is reflected in Peacock's statement 30 years later, in his overall acknowledgement of the need for new methods or, better, new aims and questions that would enable a meaningful management of the ever-growing amount of analytical data.

The study of pottery has historically served as a testing ground for archaeological theories, both due to its abundance in the archaeological record and its multifaceted use in the development of various methodological tools for the investigation of issues of exchange and external influence, technological tradition, social organisation, economic trends and other cultural associations in past societies (e.g. Sinopoli 1991; Rice 1987). Although the study of pottery has largely extended the range of tools and techniques beyond traditional approaches that focus on stylistic (art-historical), morphological and typological (typological-chronological) attributes aiming at constructing chronological sequences (see Rice 1996 with references; Orton and Hughes 2013, 3-12), recent years in Aegean studies have witnessed an increasing concern towards the technological significance of pottery and its social context from a rather scientific-processual perspective (cf. Wilson and Day 1994; Day *et al*. 2006; Sherratt 2011; Mentesana *et al*. 2017). More recent synthetic works or edited volumes with case studies from around the world tend to integrate *traditional* and *modern* aspects of pottery studies (e.g. Orton and Hughes 2013; Hunt 2016; Sibbesson *et al*. 2016; Ownby *et al*. 2017). This shift towards a combination of robust analysis with traditional approaches has proved to be favourable, as it integrates aspects of typology, context, and technological reconstructions with the aim to reveal cultural changes.

For each study dealing with the multifaceted analysis of pottery the methods applied differ, depending on the aims and objectives, the questions set, context of application, and the material studied. However, the most commonly used and widely applied techniques for such large-scale analytical projects are macroscopic analysis, microscopic/petrographic analysis, microstructural analysis, and the analysis of chemical composition. In the last few decades the combination of these methods has grown to be extremely valuable in the reconstruction of past production processes and technological choices, since they complement each other (e.g. Day *et al.* 1999). Most analyses of archaeological ceramics involve three basic questions (Hilditch *et al*. 2016, 75), namely a) fabric characterisation through the identification of mineralogy and other compositional features of the clay paste, b) provenance determination, where possible, through the identification of geological and/or geographical source of raw materials, and c) technology and the reconstruction of crafting choices, occasionally applying the *chaîne opératoire* approach (see Section 4.2.2), which describes either the whole manufacturing process and is defined as the operational sequence including the technical steps and social acts in the process of making and transformation of raw materials to a finished product, or several *chaîne opératoires* are involved in every action, determined by cultural and functional factors (cf. Roux 2016).

It is not the aim of this section to provide a detailed overview on the development and use of these techniques in past ceramic studies, but rather to present the methods used in the course of this project which are focused on fulfilling the original aims already described in Chapter 1. The methods applied in this study are considered the most appropriate given the restrictions and constraints imposed by the nature of the contexts and related material. Therefore, in this chapter the methodological steps followed will be presented, providing first a brief insight into the main theoretical schemes in ceramic studies and background of analytical work undertaken on pottery from Samos from a diachronic perspective.

4.2 Theoretical approaches in ceramic studies

Theoretical and analytical developments in ceramic studies from the end of the 20^{th} century onwards have redirected the focus towards new kinds of research questions that perceive pottery not merely as a tool for demarcating geographical provenance, but also its emphasis on socially-embedded technologies. The following sections discuss the most prominent theoretical directions in ceramic studies of the last decades.

4.2.1 Provenance determination

Until relatively recently the determination of provenance, and in turn patterns of regional trade or interaction, was the primary focus of scientific studies of Aegean ceramics through chemical/elemental analysis and the employment of a range of mineralogical and geochemical methodologies (XRF, ICP-MS, INAA) and identification of reference groups (Day *et al*. 1999; Day and Kilikoglou 2001; Tite 2008, 225-226). According to the 'provenance postulate' the intra-group compositional variability of a ceramic group should be lower than at an inter-group level (cf. Buxeda i Garrigos *et al*. 2001), although inherent variation within geological sources can often make interpretation more difficult (Hein *et al*. 2004a; 2004b; Hein and Kilikoglou 2017, 565-566). Petrographic research also had a strong impact in this respect through the identification of rocks and minerals in a given fabric and its associations with a certain geological background and availability of raw material sources. More commonly it compares with groups of pottery from related sites. This was mainly focused on coarsewares in the past (Riley 1981), but recent advances in chemical analysis allow discrimination of fine ware vessels. Often there existed a preference for analysing fine wares based upon assumption that coarsewares do not circulate, but this has been proven wrong in recent studies (e.g. Quinn *et al*. 2010; Whitbread and Mari 2014).

The degree of resolution of geological or geographical provenance varies depending on the lithological complexity and repeated lithology over large areas. While geological provenance assumes that a ceramic object should reflect the geology of the location where it was made, geographical provenance is more difficult to assess as it is affected by various criteria (abundance of pottery at a given site, proximity to production centre and raw materials source, circulation of pottery, etc.) rather than just assuming that an individual potter was using a specific source, preferably in the vicinity of the production site (Quinn 2013, 117, 119).

The lithological diversity of the Aegean has offered a positive testing ground of provenance issues. For instance, the repeated presence of raw materials over large distances and the problems in distinguishing between different provenance areas on Crete led Day and colleagues to develop an analytical programme that involved the comparative mineralogical, chemical, and petrographic analysis of raw material sources with ancient pottery samples of assumed origin, with the aim to understand compositional variability (Hein *et al*. 2004a; 2004b). Other projects have shown that the production of pottery in Minoan Crete was concentrated in certain centres with wide distribution networks already from the NL and EBA (Tomkins and Day 2001; Day *et al*. 1997) or have argued for the consumption of ceramics from different centres at EM IIB Myrtos-Fournou Korifi (Whitelaw *et al*. 1997). Although largely assessing textural images, rather than discriminating between chemical and mineralogical data, the automated scanning electron microscopy-energy dispersive spectroscopy (SEM-EDS) analysis (QEMSCAN) has been applied to achieve a better understanding of provenance of petrographically indistinguishable fabrics or classes of wares (e.g. Naxian fabrics) in LBA pottery from Akrotiri on Thera (Knappett *et al*. 2011; Hilditch *et al*. 2016). Moreover, a recent study of the Phase A material from Akrotiri argued that there are petrographic distinctions between Thera and Melos (Day *et al*. forthcoming).

The identification of provenance has been particularly central in the reconstruction of trade networks and exchange patterns (Tite 1999, 202-203), following theoretical assumptions that favour the circulation of certain 'wares' or vessel types in the explanation of socio-cultural or economic changes (mainly focused on Minoan pottery). Such recent projects include, for instance, the analysis of Mycenaean transport stirrup jars (Kardamaki *et al*. 2016). The current research project does not employ bulk chemical analysis, but a relative estimation and assessment of local *versus* non-local fabrics is made through a combination of contextual, macroscopic, and petrographic information.

4.2.2 Technology and *chaîne opératoire*

There has been a shift of interest towards issues of production technology and the reconstruction of manufacturing traditions through the application of ceramic petrography or in combination with other techniques (Tite 2008). The most successful technological studies have concentrated on holistic reconstructions of distinctive classes of pottery or diachronic changes in certain aspects of the manufacturing process, mainly with the aim to provide insights into the skills and decisions taken by the potters.

The anthropological study of technology has taken various routes of interpretation including the reconstruction of technological choices (Lemonnier 1993) through the application of the *chaîne opératoire* approach, often in combination with ethnographic or ethnoarchaeological strategies (Van der Leeuw 1993; Gosselain 1998;

Livingstone Smith 2000). According to the concept of the *chaîne opératoire* it is assumed that a technical act, such as the manufacture of pottery, can be separated into a sequence of independent operations that form together an interrelated technical system. The latter is socially informed through the interaction of the agent (potter or other members of the community, producer) with the raw materials and their transformation into culturally-significant objects (e.g. Dobres 2010). This theoretical concept which was originally developed by A. Leroi-Gourhan over 50 years ago (cf. Jeffra 2015, 142; Roux 2016) has been a much favoured subject in ceramic studies and has often been applied by ethnoarchaeologists or anthropologists (cf. Arnold 1985; 2017; Gosselain 1992; Gosselain and Livingstone Smith 2005). It is concerned with the conscious and unconscious decisions taken by potters within a given socio-cultural environment from the selection, collection and processing of raw materials to the discard of the final products, which are in turn influenced by a range of socioeconomic, symbolic/ideological, and other factors. Previous Aegean pottery projects have attempted to undertake such a task (e.g. Hilditch 2008; Mentesana *et al*. 2016a), although this is not always applicable due to constraints related to the nature and context of material, techniques employed, and theoretical framework applied.

This thesis incorporates a *chaîne opératoire* approach from a diachronic perspective, mainly aiming to reconstruct the actions taken by the potters in the interplay between learning and process of knowledge transmission, functional and experiential or other socio-cultural criteria, and the landscape where this tradition was developed. By identifying the technological variation within a given ceramic assemblage through observing and recording the three aspects (techniques, methods, and tools) noted by Jeffra (2015, 143) the social groups producing them may be better defined. More meaningful results may be produced by contextualising this approach with experimental archaeology or ethnography (see Chapter 5.7).

4.2.3 Technological change and the social context of material culture

This thesis combines the *chaîne opératoire* concept with an agency-centred theoretical approach, which sees technology as situated practice and change as the interplay between internal processes and external stimuli (Dobres 2000; Dobres and Robb 2000). By attempting to reconstruct the various stages in the manufacturing process, the role of technological choice is also taken into account (Lemmonnier 1993; Gosselain 1998), along with its relation with the overall environmental, economic, social, and ideological context of production, e.g. the availability of raw materials depends on the local environment and is influenced by the technical ability of the potter and his/her cultural perception (Tite 2008, 223-224). As Arnold (2017, 25) has recently stated: "All this is to say that changes in raw materials, pastes, and paste recipes do not necessarily indicate changes in society, cultural complexity, organization of production, or migration, but rather may mean something as simple as a change in sources, or within-source variability. Pastes are not immutable. Rather they are adaptations to local materials to make a viable pot. Changes in raw materials and paste recipes across space and time do not necessarily have social meaning".

Furthermore this thesis is concerned with the reconstruction of technological choices diachronically through the examination of changes, emphasising the social embeddedness of technological practices. However, one important obstacle concerns our inability to reconstruct the operation of prehistoric technologies in their full social setting according to recent social constructionist approaches (Killick 2004, 573). The socio-cultural context of technologies has been also emphasised by Sillar and Tite (2000), as well as the insufficiency of the *chaîne opératoire* approach to evaluate completely the articulation of a ceramic object outside its overall context. As technology has been seen increasingly in its social setting, the processes which bring about or hinder change have been highlighted. Interest has also increased in the scale and mode of production, for example in the presence of specialist potters and the deliberate standardisation of pottery types or diffusion of common traits across social boundaries (cf. Roux 2015).

More anthropological or sociological themes to be addressed concern the ideas of appropriation or transformation of ceramic traits and styles across time and space through mobility or connectivity (cf. Heitz 2017) and the transmission of knowledge and learning skills within communities of practice (cf. Santacreu 2017). These modes of transmission or change are dependent upon social context, not necessarily determined by tradition, but are rather influenced by technical (performance characteristics), behavioural (indigenous knowledge), and environmental (landscape) factors through a bilateral human-nature-object relationship (Arnold 2017).

4.3 The analytical background of Samos: history of research

This research on the prehistoric ceramics from Samos constitutes a pioneering project. It uses an integrated approach that combines morphological examination, petrographic and microstructural analyses in the study of pottery from an area without any previous history in the use of such analytical techniques for this early period.

Previous analytical work in studies dealing with sites of the eastern Aegean, although limited, has been mainly based on the provenance characterisation and less systematically on the examination of the production technology of pottery from the Geometric to the Roman periods (9th century BC-3rd century AD). For instance, chemical analysis (neutron activation analysis - NAA) has been applied to determine the provenance of specific Archaic wares (7th -6th centuries BC), for the manufacture of which a number of production centres had already been suggested including Samos itself (Villing 2010). Since the 1980s developments in the use of elemental analysis has allowed the understanding of production and distribution of specific ceramic types and wares at sites such as Miletus, Ephesus, Klazomenai, and Rhodes, to name but a few (Dupont 1983; Jones 1986; Akurgal *et al.* 2002; Kerschner *et al.* 2002). This has produced extensive analytical databases that can be used comparatively in diachronic studies of the aforementioned sites and geographical regions, such as *ceraDAT* developed and hosted by NCSR 'Demokritos' at Athens (Hein and Kilikoglou 2012).

In the case of Samos, previous analysis of ceramics dating to historical periods has included some early chemical work on Geometric to Roman pottery by X-ray fluorescence (Dupont 1977) and an informative petrographic analysis of Samian amphorae from Heraion by Whitbread contextualised within an account of the island's geology (1995, 122-133). Whitbread's petrographic examination of a small number of amphorae samples believed to be of Samian origin has not proven to be the ideal technique for determining provenance, due to the very fine nature of fabrics. Since petrography alone would limit the prospects of characterising Samian amphorae, Dupont (1983) undertook the chemical analysis of these finewares and compared them with the composition of clay samples. He further proposed that the composition of certain types is similar to that of Mavratzei on the western edge of the Mytilinii Basin in south-central Samos, while another amphora type showed a chemical composition compatible with Milesian pottery. However, no direct analytical relationship should be sought between a clay source and a pot (see Chapter 5). This is in part due to the complex geological background of the island and, therefore, the natural variation in the clay samples used, as well as the relatively fine-grained mica-rich fabrics analysed.

The ceramic class of Samian amphorae, also known as East Greek amphorae or East Aegean amphorae (Gassner 2011) shows a wide geographical distribution in the

Mediterranean and is found in large quantities at several sites of the Ionian region covering a long time span. More specifically, following the detailed macroscopic, morphological, and typological analysis by Grace (1971, 72-73), who first described the fabrics of Samian amphorae in hand specimen, a series of analytical work has been undertaken on the grounds that a number of different origins had been ascribed to amphorae typologically believed to be of Samian production or otherwise associated with Samos. However, similar shapes have also been recognized to exist in nearby areas of production in western Anatolian littoral such as Miletus and the area of the Samian Peraia on the opposite coast (Denker and Oniz 2015), making the ascription of provenance on typological/morphological grounds alone not feasible at most times.

Recent archaeometric analysis of Classical Samian amphorae dating to the 5th and 4th centuries BC has been carried out with the aim to provide new evidence on the ascription of provenance of this ceramic class (Gassner 2011). According to the macroscopic and microscopic characterisation, Samian amphorae can be distinguished by a mica-rich, fine fabric with very few quartz, although a similar fabric can also be found in Ephesus and Miletus. Similar examples of Late Roman/Byzantine amphorae from the small island of Pseira in the NE coast of Crete are characterised by a highly micaceous fabric with frequent sub-angular quartz and few phyllite fragments and, thus, are also ascribed with a provenance on Samos in particular or the coast of Asia Minor more broadly (Poulou-Papadimitriou and Nodarou 2007, 758, fig. 4e; 2014, 876, fig. 11). This characteristic fabric is also compatible with Hellenistic amphorae found on Samos (Whitbread 1995, 129). However, the overall treatment of this fineware ceramic class as homogeneous in terms of shape and fabric is risky and the attribution of its provenance beyond Samos itself reflects how little analytical information is available for the eastern Aegean and western Anatolia. The examination of comparative EBA ceramic thin sections from Liman Tepe and Bakla Tepe in western Anatolia, as well as MBA Lemnos, available at the Department of Archaeology, University of Sheffield further clarified these issues (refer to Chapter 7).

4.4 The multilevel analysis of prehistoric pottery from Heraion: towards a 'bottom-up' approach

A first effort to shed light on the Samian ceramic technological tradition of the EB and the establishment of the settlement's ceramic profile was undertaken in the framework of the author's MSc dissertation. Although that comprised a small-scale project, based on the petrographic analysis of 44 ceramic samples of the EB II late-III periods from the excavations of 1953 and 1955 by Milojčić, it offered a reference basis for the analytical results of the current project (Menelaou *et al.* 2016). The present project has shifted the methodological focus from the analysis of individual ware groups, presumably from Samos (see Section 4.3), to analysing the full spectrum across an assemblage, an approach that has been extensively developed by Wilson's and Day's work in Crete (cf. Wilson and Day 1994; Wilson *et al*. 1999).

This thesis will build upon various levels of analysis in the context of whole assemblages including: a) the morphological examination of pottery at a macroscopic level and its stratigraphic classification into wares, fabrics, and shapes/types, b) the petrographic analysis of 343 samples selected on the basis of macroscopic features, c) the petrographic examination of comparative material from predominantly contemporary sites across the Aegean, d) the study of selected geological deposits from the Heraion vicinity and their petrographic comparison with the ceramic samples, and e) the microstructural analysis via SEM of 20 samples belonging to different ware groups.

The integration of these varied levels of analytical enquiry turns the focus to the interpretation of the processes behind the finished ceramic products following the so-called 'bottom-up' approach. This concentrates on the step-by-step reconstruction of the related past technical system and the social, cultural, and economic forces affecting the potters' actions in the manufacture of pottery (e.g. Lemonnier 1993). It therefore represents a shift away from solely morphological and stylistic patterns of object-driven approaches. Therefore, for every step of the manufacturing process different techniques are applied. Raw material characterisation is assessed by ceramic petrography (e.g. Whitbread 1995), forming techniques are identified through macroscopic observation and occasionally the examination of thin sections (e.g. Choleva 2012), surface treatment is examined macroscopically, petrographically, and with SEM analysis, while the firing regime is assessed mainly with SEM-EDS analysis (e.g. Kilikoglou 1994) and through macroscopic and petrographic observations. Although other techniques are also available, namely XRD or FTIR (cf. Mentesana *et al*. 2017), SEM was chosen due to availability in the course of this project.

Not all manufacturing steps are reconstructed equally, i.e. the fabric characterisation, processing of raw materials, surface treatment are better studied, whereas the interpretation of forming methods and firing conditions varies in confidence, depending on the available data.

4.5 The sorting, processing, and recording of the pottery

Since the ceramic assemblages under study are almost entirely unpublished, the first stage of the work involved the on-site examination and recording of the various pottery assemblages, which are kept in the Heraion storerooms. Before proceeding to the processing of the pottery, a thorough study of the documentation was essential, especially in the case of the 1981 ceramic assemblage that has not been systematically studied before. Relying upon the only published preliminary report of the 1981 excavation (Kyrieleis *et al.* 1985) and the original, hand-written notebooks kept at the Samos Archive of the German Archaeological Institute (Kyrieleis and Kienast 1981; Weisshaar 1981) the author was able to reconstruct the steps in the recording process of the archaeological contexts, the registration system followed by the excavators, and the stratigraphical sequence. The field notebook contained the excavation documentation, including the daily record and textual description of the excavation progress, as well as plans, drawings, and references to finds.

The pottery of the old excavations (1981) was identified in different locations, amounting to several thousands of sherds and taking up *ca*. 50 boxes. First, the pottery was washed with tap water in order to remove the dirt, given that a great part of the sherds were coated with layers of lime encrustation. Before the first recording the sherds were laid out in stratigraphic order according to their context number. At this stage the concentration of sherds belonging to the same vessels or sherd-links found amongst various contexts were reassembled, restored where possible and separated from the remaining potsherds, after being catalogued and described. The reconstructed or largely complete vessels and diagnostic sherds were stored in polyethylene bags.

After cleaning and reconstructing the pottery fragments the author proceeded with the recording and detailed examination of the pottery assemblage, following the German Archaeological Institute's original system. Therefore, every diagnostic sherd, i.e. rim, handle, base, or any potsherd that provides an indication of the vessel's original shape/form, was given an inventory unique number that was written on its inner surface with a technical pen after the original grid coordinates marked by the excavators (e.g. A17/7.**1**, E20/15.**2;** cf. Fig. 3.9 in Chapter 3). Although the recording and numbering of individual sherds can provide very detailed information, it often requires a considerable amount of time, especially when presented with a pre-existing recoding system, as was the case in this project. According to the excavation notebook, each inventoried find was initially given a section indication (*Raum* or *Fläche* A, E, F) designated by the trench number where it was found (1-100) and a running serial number (6-20), which indicates the layer/stratum or the so-called *passes* (minimum excavation unit or artificial subdivision of archaeological layers). The careful examination of the context/inventory numbers provided confident links between the finds and their contextual position through time. In order to get a more clear idea of the excavation area and therefore the distribution of finds within space, a topographical grid reconstruction was prepared with AutoCAD Software. This allowed the understanding of the spatial relationship between the architectural features revealed by the old and the new excavations. The architectural remains are not visible anymore as the trenches were backfilled after the completion of the excavation.

Subsequently, for each diagnostic sherd a form known as an 'Identity Card' was filled out, including information about the form/shape of the vessel, its dimensions/measurements (thickness, weight, width, length), its chronology, information on the macroscopic fabric (colour, quality/firing, inclusions) and the surface treatment (slip, decoration), i.e. features that could be distinguished by naked eye, and finally a general description of the vessel represented. This information formed the basis for the construction of a database for the material of both the 1981 and the 2009-2013 excavations. In parallel, all the sherds bearing the same context number were recorded in separate forms, the 'Field Comments', together with other finds such as loom weights, spindle whorls, bone fragments, roof clay fragments, and lithic tools. The contextual analysis of these finds is important for the characterisation of the households' activities and use of space in general, although the examination of the non-ceramic categories do not comprise part of the current study.

The same procedure was followed for the recording of the new excavations' (2009-2013) ceramic assemblage, starting from the upper levels excavated in 2009 and moving towards the deeper and chronologically earlier levels. Although the basic concept in the recording of this material has followed the same steps as for the 1981 ceramic assemblage, the different delineation of the excavated areas and use of a different grid system required the establishment of a distinct serial numbering for the inventoried sherds and small finds (e.g. HS09.67.1), i.e. designated by the excavation area (HS: *Heilige Straße*/Sacred Road), excavation date (2009-2013), context number/stratigraphical unit (e.g. 67), and a running inventory number (e.g. 1). Finally, the published material deriving from the systematic excavations carried out in the area between the Hera Temple and the North Stoa by Milojčić (1961) between 1953 and 1955 was also studied systematically. The recording system of pottery used by the excavator followed the grid coordinates and the depth that each sherd was found. It was under these restrictions that the synchronization and contextualisation of the different ceramic assemblages was tackled. The context variable is crucial in the intra-site analysis of entire assemblages, as the distribution of specific vessel shapes/fabrics/wares might provide information regarding production and consumption patterns.

4.6 The macroscopic examination of the pottery

4.6.1 Terminology and other methodological paradigms

Depending on the approach and research aims, state of preservation, and/or desired resolution of analysis, previous projects have traditionally focused on stylistic/morphological criteria (ware, shape/type) in the formation of classificatory schemes and typological sequences for chronological seriation without taking into consideration paste/fabric. On the other hand, the terms ware and fabric are often used inconsistently and interchangeably or hold a distinct meaning in various ceramic studies. According to Rice (1976) these two concepts comprise independent properties with the former being culturally-driven (surface treatment as a cultural choice) and the latter environmentally-determined (paste composition as representation of raw material sources). Given these constraints Rice suggested that the ware classificatory scheme should be redefined and the two basic attribute classes separated, as one crosscuts the other in some cases creating more confusion to their interpretation. This is well reflected in the way archaeologists working with pottery, not necessarily experts in fabric analysis, often divide the different groups in 'coarse ware', 'medium-coarse ware' and 'fine ware' categories, also encompassing information that relate to the visual properties of the paste. The present project employed a more flexible, and often combined, use of these terms and did not subscribe to Rice's definition.

Apart from the many definitions and inconsistencies of the ware concept (e.g. Rice 1987, 286-287), which has dominated Aegean ceramic studies, the importance of macroscopic fabric analysis focusing on the paste composition has been greatly highlighted within the framework of several survey projects. However, it is recognised that this method has only recently begun to be accepted by Aegean archaeologists and is still not always incorporated into ceramic projects. Among the most important surveys are the Kavousi Region Survey on East Crete (Haggis 1996, 387-388), which showed that typologically indistinguishable sherds could be dated by their fabric or even aid in the formation of a comparative, regional chronology, the Sphakia Survey on Crete by Moody (Moody *et al*. 2003), the Keros project (Broodbank 2007; Hilditch 2013; 2015), and that on Kythera (Kiriatzi 2003). The systems developed within these projects included a visual assessment of various properties, such as body colour, coarseness of paste, degree of hardness, porosity, etc.

Turning to the current project it was decided to base the formation of macroscopic groups on an integration of fabric and ware attributes in a more flexible way. This multi-level approach to analysing diachronically entire ceramic assemblages, rather than specific wares, in a combination of surface treatments, shapes, and fabrics was well-developed by Wilson and Day in their study of the EBA material from Knossos (Wilson and Day 1994; Wilson *et al*. 1999). This approach moved away from previous methods of analysis purely focused on morphological and decorative information and combined this with technological considerations to form ware-fabric groups in order to examine diachronic developments or technological continuities/changes, the geographical and chronological distribution of certain shapes, and how these crosscut different categories. The decision was not only driven by the character and size of the ceramic assemblages, but also because both attributes equally represent some aspects of choice by the ancient potters. In addition, a solely ware-based system would not provide sufficient information and, therefore, could not be considered separately from the fabrics due to the poor preservation of the surface treatment and persistence of monochrome wares throughout the EBA. Although monochrome wares are also found in other Aegean regions of this period (e.g. 'Red/brown ware' at Ayia Irini on Kea), it comprises a strong regional (northeast Aegean and western Anatolia) ceramic phenomenon that characterises other contemporary sites such as Emporio on Chios, Thermi on Lesbos, Poliochni on Lemnos, Çukuriçi Höyük, Troy, etc. This comes in contrast with other Aegean regions with several ware repertoire traditions and stylistic particularities, such as central and west Crete that have produced well-defined ware groups or descriptive terms solely based on the characterisation of surface, primarily indicating broad or site-based decorative styles, e.g. 'Pyrgos ware' denoting pattern-burnished pottery of Early Minoan (EM) I, 'Vasiliki ware' denoting mottled decoration of EM IIB-III, 'Dark-on-light painted ware' of Ayios Onouphrios (EMI) and Koumasa style (EM IIA) (Wilson and Day 1994; Nodarou 2011, 27-30).

4.6.2 Recording and processing of macroscopic data

Despite the large amount of pottery, all diagnostic sherds were recorded and examined macroscopically in detail over a period of eight months at the storerooms of Heraion between summer 2014 and summer 2015, while the non-diagnostic sherds of each potter group and stratigraphical unit were recorded and only selectively taken into account for their macroscopic features. Following the recording and cataloguing as described above (see Section 4.3.1), the pottery was sorted into meaningful categories of ware, fabric, and shape in order to observe possible associations between these variables. A FileMaker Pro database was created that enabled multi-level searches. The ceramic assemblages were broadly classified into three categories: 1) entirely-preserved pots or sherd families, 2) diagnostic and/or decorated sherds, and 3) undecorated non-diagnostic sherds. The categorisation of the pottery into macroscopic groups followed, where possible, previously existing schemes applied to contemporary assemblages from other Aegean sites, given the originality of this study and the absence of a previous agreed terminological system for the Heraion pottery.

The examination of fabric was carried out by naked eye, although a plugable USB Handheld Digital Microscope with magnification up to 200x was used on selected samples with fresh sections (cf. Druc 2015), providing preliminary views of the clay fabrics and enabling the selection of possible samples for petrographic analysis (see Figs. 6.1-6.6 in Chapter 6). More photographs were taken with a stereoscope at the facilities of NCSR 'Demokritos' Institute at Athens of the remaining sectioned samples used for petrographic analysis. Description forms were used for the recording of all attributes. The main features recorded are the colour (Munsell Soil Color Chart 1975), texture (smooth, fine, irregular, hackly), hardness (soft, hard, very hard), feel of surface (harsh, rough, smooth, soapy, powdery), fracture, voids, as well as the identification of non-plastic inclusions and description of size, shape, roundness, frequency, and sorting within the paste (cf. Orton and Hughes 2013, 73-74, 155-160, 277-283). The identification of the nature of inclusions relied on information provided by Orton and Hughes (2013, 75-76, 280-281, tab. A2) and more recently by Druc with more visual examples (2015, 23-58), although this was often only confirmed with accuracy by petrography. Where possible information on the construction, forming techniques, and firing environment of the pot was also recorded. The macroscopic fabric group classification is therefore based on a combination of these criteria where the higher the presence of these features between samples the more likely they are grouped together.

The second variable included the examination of surface treatment and decoration (see Figs. 6.7-6.12 in Chapter 6), although the majority of pottery does not preserve surface features, due to long exposure beneath in the groundwater of Heraion. Examples include monochrome wares with plain/granular, smoothed, slipped, and burnished surface. Decorative patterns are not frequent, but include incised, plastic/relief, grooved and very rarely impressed/stamped, scored, and painted decoration. Decoration is in most cases restricted to the exterior surfaces.

The third variable comprised the assessment of vessel shape and type. Where possible, the typological classification followed existing schemes from other contemporary sites across the Aegean and especially the eastern part along with western Anatolia (see Appendix II for comparanda). As no fixed typologies exist for Heraion, a combination of a traditional type-series system and classification based on measurements was employed. All diagnostic and representative sherds or whole vessels were drawn in order to reconstruct shapes from the full profile or to emphasise specific vessel attributes (see Figs. 6.13-6.26 in Chapter 6). In the cases when the non-diagnostic body sherds were not suggestive of a specific shape, an attempt was made to distinguish between open and closed vessels. The shapes are presented in chronological order, according to stratigraphical information, from earlier to later periods and parallels are provided for each category (see Appendix II). Their discussion follows the same structure as for the previous two variables.

Aside from the qualitative criteria, the recording of all variables takes also into account quantified information by sherd counting. This relative frequency of weight counts proved to be less meaningful in general, and therefore was excluded from this thesis, as data can be affected by the physical properties of vessels (thickness). However, it can be generally useful in estimations of intra-site distribution of shape or fabric/ware categories, especially in contexts with a substantial amount of pottery.

4.7 Thin section petrography

Ceramic petrography has been a major analytical technique for studies of pottery from the prehistoric Aegean and beyond, over the last 40 years, providing mineralogical information on both the raw materials and technology of manufacture of the finished products (see Whitbread 1989; 1995; Reedy 1994; 2008; Quinn 2013; Santacreu 2014). It is today a very effective analytical technique for the integration of compositional and technological data, although not without limitations. The last 50 years of ceramic analysis in studies of the Aegean Bronze Age have witnessed radical changes, moving towards an increasing interest in the reconstruction of technological practice in addition to questions of provenance (cf. Knappett *et al*. 2011, 220-221). The latter were mainly focused around interregional exchange issues and overlooked intra-site patterns of production and consumption (e.g. Vaughan and Wilson 1993). However, provenance studies often ignored issues related to technological choices that might alter the compositional identity of certain ceramic pastes, i.e. mixing of clays, sieving or levigation, tempering, firing, or even the natural variability of clay sources (cf. Day 1989). Recent interpretational advances concern issues of identity and ethnicity, social organisation, specialisation, etc. (e.g. Day *et al*. 1997; 1998; 2012).

Petrographic analysis has been applied to a variety of ceramic assemblages especially in Crete, the varied geology of which enabled a better discrimination between raw material sources, focusing on both site-based and regional production and distribution patterns (Wilson and Day 1994; Day and Kilikoglou 2001; Day *et al*. 2005; 2006; Tomkins and Day 2001; Tomkins *et al*. 2004; Nodarou 2011; Mentesana *et al*. 2016a). Important petrographic work has been carried out or is currently in progress in the Cyclades, namely Akrotiri on Thera, Panormos on Naxos, Skarkos on Ios, Phylakopi on Melos, Markiani and Mikre Vigla on Amorgos, Kavos and Dhaskalio on Keros, etc. (Vaughan 1990; 2006; Vaughan and Williams 2007; Hilditch 2007; 2008; 2013; 2015; Day *et al*. forthcoming). Research based on petrography has also been carried out on Bronze Age material on the Greek mainland (e.g. Menelaion, Sparti: Whitbread 1992; Thebes, Argolid, Nemea, etc.: Hilditch *et al*. 2008; Haskell *et al*. 2011; Burke 2016; Burke *et al*. 2017), the Saronic Gulf (Kiriatzi *et al*. 2011; Gilstrap *et al*. 2016), and the islands of Kythera and Antikythera (Kiriatzi 2003; Pentedeka *et al*. 2010). Recent years have witnessed the emergence of analytical ceramic projects across coastal Asia Minor or even further inland (Troy: Kibaroğlu and Thumm-Doğrayan 2013; Liman Tepe and Bakla Tepe: Day *et al*. 2009; Iasos: Hilditch *et al*. 2012; Miletus: Knappett and Hilditch 2015; Çukuriçi Höyük: Peloschek 2016a; 2016b; 2017; Aphrodisias: Joukowsky 1986, 297-298, 303ff; Tarsus: Ünlü 2009; 2011; Konya plain: Gait and Kiriatzi in progress; Emporio on Chios: B. Lambrechts in progress; Kos: Vitale and Morrison in progress), which will aid in forming a comparative picture for this hitherto under-represented area.

The need for the integration of ceramic petrography with other techniques such as chemical analysis has been fostered at the Fitch Laboratory of the British School at

Athens and continues to innovate at other institutes, e.g. with the application of novel techniques such as the comparative characterisation of fine and coarse ware vessels with automated SEM-EDS using QEMSCAN technology to maximise the integration of the less informative fine fabrics with the coarse ones with respect to composition and technology (Hilditch *et al*. 2016). A brief overview of research themes investigated by ceramic analysis has been recently undertaken by Hilditch (2016). These include a renewed interest in the identification of forming methods (macrotrace analysis), different levels of ceramic exchange from local communities to regional and supra-regional scales, diachronic characterisation of long-lived ceramic communities, technological transmission, and focus on specific wares or vessel functions (Hilditch 2016).

Thin section petrography allows the identification and characterisation of the main rock and mineral inclusions (composition, quantity, shape, grain size and distribution) and textural features (microstructure, colour, optical activity) of the fabrics, which in turn enables characterisation and grouping of the thin sections, reconstruction of technological practice (raw material processing and clay preparation, firing characteristics, forming techniques), and, where possible, suggestion of provenance (geological and/or geographical). The latter can be often meaningfully examined in combination with morphological and typological information in cases where the mineralogy is less informative and there is a repeated or indistinct geology in the area under investigation.

Ceramic petrography constitutes a visual continuum from the preceding macroscopic and stylistic analysis and it aims at producing more archaeologically meaningful results with respect to the production, consumption, and distribution of ceramics. It forms the main analytical technique applied in this thesis. Upon completion of the recording and macroscopic study of the pottery, a representative selection of ceramic samples was undertaken based on the three variables described above (ware, fabric, shape). As there was no intention of treating the petrographic data statistically in the future, it was not necessary to ensure that the number of samples representing each category was analogous to their actual proportions within the whole assemblage. However, more samples were taken from the main categories, in order to test variability. As petrography often provides more information when applied to coarser fabrics, due to the higher content of identifiable non-plastic inclusions, the chosen fineware samples are numerically fewer.

4.7.1 Sampling strategy and laboratory work

The aim of sample choice was to cover a representative range of the different categories distinguished within the ceramic assemblages in terms of shape, ware, and fabric, taking into account the different contexts and stratified layers. Emphasis was especially placed upon specific contexts/layers, which hosted higher concentration of well-contexted pottery. A total of 343 samples were selected for analysis, mainly from diagnostic sherds. The sample selection does not reflect the proportions of different fabric types in the Heraion pottery assemblage and therefore is not representative in terms of quantitative criteria, nor does it represent equally each category. Instead, the samples are subject to qualitative, contextual, and chronological criteria, covering proportionally where possible the various types and wares deriving from different areas of the settlement, from a diachronic standpoint. Extra care was taken to ensure that the samples selected derived from well-dated areas, either floors from house deposits with facilities and installations for food and material processing, or from deposits inside special buildings and nearby the fortification wall (see Appendix IV).

The thin sections were prepared at standard thickness of 30μm (cf. Quinn 2013, 23-33). Petrographic analysis was carried out on a Leica Polarizing Light Microscope, at typical magnifications from x25 to x400 in both plane polarised light (PPL) and under crossed polars (XP) with digital images taken for all the sections. The main features assessed were: a) the nature and characteristics of the mineral and rock types comprising the non-plastic inclusions (composition, quantity, shape, grain size and distribution within the clay body), b) the textural and optical characteristics of the clay matrix (microstructure, colour, and optical activity), and c) the textural concentration features.

4.7.2 Processing and interpretation of the petrographic data

The microscopic examination began with a 'blind' analysis of the thin sections, according to which they were grouped based on a variety of criteria. Each group consists of samples exhibiting a high degree of compositional and textural homogeneity. Once a preliminary separation of the groups – and sub-groups where necessary – took place, each group was described individually following the descriptive system and terminology proposed by Whitbread (1989; 1995, 379-388). Comparative charts were used to estimate voids and inclusions frequency, sorting, sphericity and roundness. The full petrographic descriptions can be found in Appendix V. The summaries of the main characteristics of each fabric (mineralogical characterisation, technological features, and suggested provenance) are given in Chapter 7. Comparative material from various sites – predominantly contemporary with Heraion – across the Aegean and western Anatolia has been used to detect possible provenance areas of non-local fabrics (see Chapter 7.1 for the comparative material).

4.8 The geological sampling

The overall aim of the raw material prospection was to assess the degree of compatibility between pottery and the nearby geology and to establish the profile of local ceramic production at Heraion. However, it should be kept in mind that a direct link between clays and ceramic products may be problematic (see Chapter 5.7). The prospection was carried out in June 2015, within a radius of 15 km from the archaeological site of Heraion to explore potential sources based on geological maps and literature. First, the sampling aimed at collecting red alluvial deposits and Neogene marls in the south-central and SW part of the island, in order to produce a basic characterisation of two of the most obvious potential ceramic raw materials. The sampling of the second season (June 2016) targeted similar deposits on Samos at a greater distance from Heraion, in an attempt to clarify certain questions prompted by the analysis of the first clay samples and the archaeological pottery. Detailed descriptions of the sampling location, samples, as well as the results of their petrographic analysis are presented in Chapter 5 (see Section 5.7.6, Appendix I: tabs. I.1-I.3). A number of unconsolidated and consolidated raw material and rock samples were collected focusing on the surroundings of the archaeological site, although there is no direct evidence of pottery production at site, as well as the two main traditional/modern ceramic production centres in Mavratzei and Karlovassi. References to the petrographic analysis of these raw materials are made where necessary in Chapter 7 in comparison to the ancient fabrics.

Brick and tile samples deriving from modern workshops on Samos were also analysed petrographically and combined with information gathered from the small scale ethnoarchaeological survey undertaken around the main ceramic workshops and related villages on Samos and the processing of analytical data regarding raw material sources and their properties (see Chapter 5.7.7, Appendix I: tab. I.4).

4.9 Scanning electron microscopy-energy dispersive X-ray spectroscopy (SEM-EDS)

Examination of archaeological ceramics with SEM is nowadays widely used for the investigation of technological issues related to firing conditions and temperatures and surface modification or decorative techniques. At magnifications of around x2000, the microstructural characterisation of the body and surface of the ceramic vessel is achieved, which allows the examination of the degree of vitrification and the texture of the clay body and, thus, an estimation of the equivalent firing temperature. The application of SEM in combination with other analytical techniques, e.g. ceramic petrography, is currently under-represented in other EB sites of the eastern Aegean or western Anatolian region, but has been utilised in the investigation of ceramic material from other sites across Mainland Greece, the central Aegean, and Crete (e.g. Maniatis and Tite 1981; Wilson and Day 1994; Day and Kilikoglou 2001; Day *et al*. 2006).

The interpretation patterns followed in this thesis are based on the extensive work undertaken by Maniatis and Tite (1981), Day and Kilikoglou (2001), as well as more recent ethnographic studies (Gosselain 1992; Livingstone Smith 2000) which proved that a range of variation could take place in terms of firing conditions and temperatures within a single firing event. The latter indicates the importance that the combination of macroscopic and microscopic or microstructural information holds for the achievement of a better assessment of the technological steps under discussion. This primarily involves the macroscopic examination of the original pottery sherds and their core colour (Rye 1981, fig. 104) and the optical activity of the groundmass in petrographic thin sections, prior to the application of more detailed analytical methods like SEM. Through the semi-quantitative analysis available through EDS coupled to the SEM, the surface treatment and chemical relation with the ceramic body is assessed, as well as the calcium content for the identification of calcareous or non-calcareous clay pastes.

4.9.1 Firing conditions

This section provides a brief summary of information about the study of firing conditions through SEM analysis and it clarifies, where necessary, terms associated with the visual description of vitrification development in ceramic material. By investigating the firing conditions of a vessel we try to understand issues of craft skill and technological choice of the ancient potter, since in order to achieve desired atmospheres and required temperatures a certain level of control and knowledge is necessary. The first estimate of firing atmosphere and temperature is achieved visually: 1) macroscopically through the visual description of changes in colour effects of the ceramic break and core, which might be indicative of the amount of carbon or iron in the clay mix or duration of firing, and 2) microscopically (petrographically) through the observation of the optical activity of the clay matrix which can indicate the degree of vitrification, i.e. high optical activity shows low temperature and *vice versa*.

Given that firing leads to permanent changes in the microstructure of a ceramic material, by looking at these changes we are able to estimate temperature ranges and firing conditions. More particularly, within specific temperature ranges there are distinct changes taking place in the extent of vitrification of the microstructure, which also relates to the firing atmosphere and the calcium concentration (Maniatis and Tite 1981). The stages of vitrification are observed as temperature increases in a specific ceramic type. A microstructure that does not exhibit any sign that the vitrification process has begun is described as having no vitrification (NV) with an equivalent firing temperature estimate of <750°C in reducing atmosphere and <800°C in oxidising conditions irrespective of calcium concentration. The initial stage of vitrification (IV) is very similar in both calcareous and non-calcareous ceramics with typical firing temperatures occurring in 800-850°C in an oxidising atmosphere. After the initial vitrification stage, the abundance of calcium in the matrix is significant in the final estimations of equivalent firing temperatures as non-calcareous ceramics tend to vitrify at lower temperatures in both oxidising and reducing atmospheres.

For non- or low-calcareous clays, those with <6% CaO content in the clay matrix, isolated areas of the fracture surface exhibiting initial vitrification will have expanded as temperature is increased. Though this is the case with all ceramics, the difference between initial vitrification and continuous or total vitrification in non-calcareous matrices is only 150°C (Maniatis and Tite 1981). Firing in a reducing atmosphere lowers the temperature ranges approximately 50°C and at the extensive vitrification stage (V) fine bloating pores will be introduced into the matrix. Total vitrification is reached at above 950°C in oxidising and between 900-1000°C in reducing atmospheric conditions. Bloating pores are likely to be present, with size dependent upon both mineralogical composition and firing atmospheric condition.

Atmospheric conditions are determined by the colour of body, core and decoration. Reddish and brown body colour is used to indicate an oxidising atmosphere (O) where a buff or grey coloured body indicates a mixed or reduction atmosphere (R).

Dark coloured decoration on light bodies indicates an oxidation-reduction-oxidation firing regime (ORO).

It has been shown that ceramics with higher calcium concentrations reach the vitrification stage at higher temperatures (Tite and Maniatis 1975; Maniatis and Tite 1978; 1981; Kilikoglou 1994). Equivalent firing temperatures are reported as estimates (Maniatis and Tite 1981) and are used as qualitative data in assessing patterns of firing technology present in ancient ceramic production sequences. Fabric groups dominated by NV but ranging into higher levels of vitrification can be suggestive of a low degree of control over the firing process. Conversely, fabrics that demonstrate a high degree of vitrification across a single fabric may represent extensive knowledge of pyrotechnology firing and control over the firing event of a production sequence.

4.9.2 Surface treatment

Surface modification techniques can be examined through identification of the presence or absence of surface treatments, such as burnishing, slip or paint. Analysis of its thickness and bulk chemical composition with relation to the ceramic body can provide information on the types of clays used for both the surface treatment layers and the base clay. Examination of the microstructure of the vessel surface requires observation of the degree of vitrification of the surface decoration. The semi-quantitative analysis with EDS attached to the SEM unit provides the elemental concentrations of specific spots, which in turn can be compared with the resulting spectrums of the clay body in order to reach conclusions regarding the types of raw materials. Special attention is paid to the levels of Iron (Fe), Calcium (Ca), Aluminium (Al), Potassium (K), and Manganese (Mn).

4.10 Summary

This chapter has outlined the programme of analysis and techniques used for the investigation of the original aims of this research project. A short description of all methods applied is presented, alongside contextual information of previous Aegean studies and the local background of Samos. This step-by-step presentation is intended to show that the integration of different techniques and levels of analysis provides a continuum for the better reconstruction of theoretical issues developed earlier in this chapter. These include the diachronic development of the local ceramic tradition, technological change and exchange systems and identification of provenance, and the investigation of issues related to intra- and interregional interaction. In the following chapters these methods are employed either separately or in combination with each other. More specifically, a first assessment of raw materials processing, fabric, forming method, surface treatment, and firing is attempted in the macroscopic analysis of the ceramic material (Chapter 6) and further complemented by the extensive petrographic analysis of raw material samples (Chapter 5) and pottery (Chapter 7). Finally, the SEM-EDS analysis of selected ceramic samples (Chapter 8) provides supplementary information in the macro- and microvisual continuum of this diachronic technological reconstruction.

CHAPTER 5: Exploring the geology and ceramic landscapes of Samos

5.1 Introduction

This chapter presents the geology of Samos with an overview of the main rock units focusing mainly on the south-central part, where the settlement of Heraion is located. The study of the island's geological background, compositional variability, and spatial relationship of the various formations is necessary, not only because it will reveal information regarding the geological provenance of the analysed pottery samples (Chapter 7), it will also provide insights into technological choices taken by the prehistoric potters. These include the exploitation and processing of certain sources of raw materials and the wider 'resource environment' that produced them, for the manufacture of pottery. Nevertheless, it should be stressed that these choices are often the result of cultural decisions and selective processes not always feasible to interpret, given processes of environmental change (Mentesana *et al*. 2016b). The desk-based account of the island's geological background is followed by a presentation of the raw materials prospection programme and modern ceramics sampling (pottery, bricks, and tiles mainly of the mid-20th century) carried out for comparative purposes.

5.2 Geological background of Samos

Samos forms part of the Median Aegean Crystalline Belt, large parts of which underwent a high pressure/low temperature metamorphism (Durr *et al*. 1978). It is situated between the Attic-Cycladic geotectonic zone to the W and Menderes massif to the E and, therefore, shares similar geological characteristics with the Cyclades (especially the northern complex: Syros, Tinos, Andros, Kea and Kythnos), a part of Attica, and southern Euboea (Mountrakis *et al*. 1983, fig. 5; Ring *et al*. 1999, fig. 1) and a part of the Asia Minor littoral (Dilek peninsula) (Candan *et al*. 1997, fig. 1; Çakmakoğlu 2007; Gessner *et al*. 2013, 246). These masses are compositionally heterogeneous and comprise of various Blueschist/Greenschist formations.

The island consists of a number of metamorphic nappes of the Cycladic Blueschist Unit, formed during the Lower-Middle Eocene subduction. These nappes are overlaid by Late Oligocene-Miocene non-metamorphic formations (Kallithea nappe) and the Neogene and Quaternary formations that fill the island's Upper Miocene-Pliocene basins (Ring *et al*. 1999, 1575; Chatzipetros *et al*. 2013, 116).

5.3 Pre-Neogene units

The Pre-Neogene geological basement of Samos can be distinguished into two main geotectonical units. The lower stratigraphic units are divided into four different nappes of autochthonous, metamorphic formations, above which an allochthonous, non-metamorphic tectonic nappe is overthrusted (Theodoropoulos 1979; Ring *et al*. 1999, tab. 1) (Fig. 5.1).

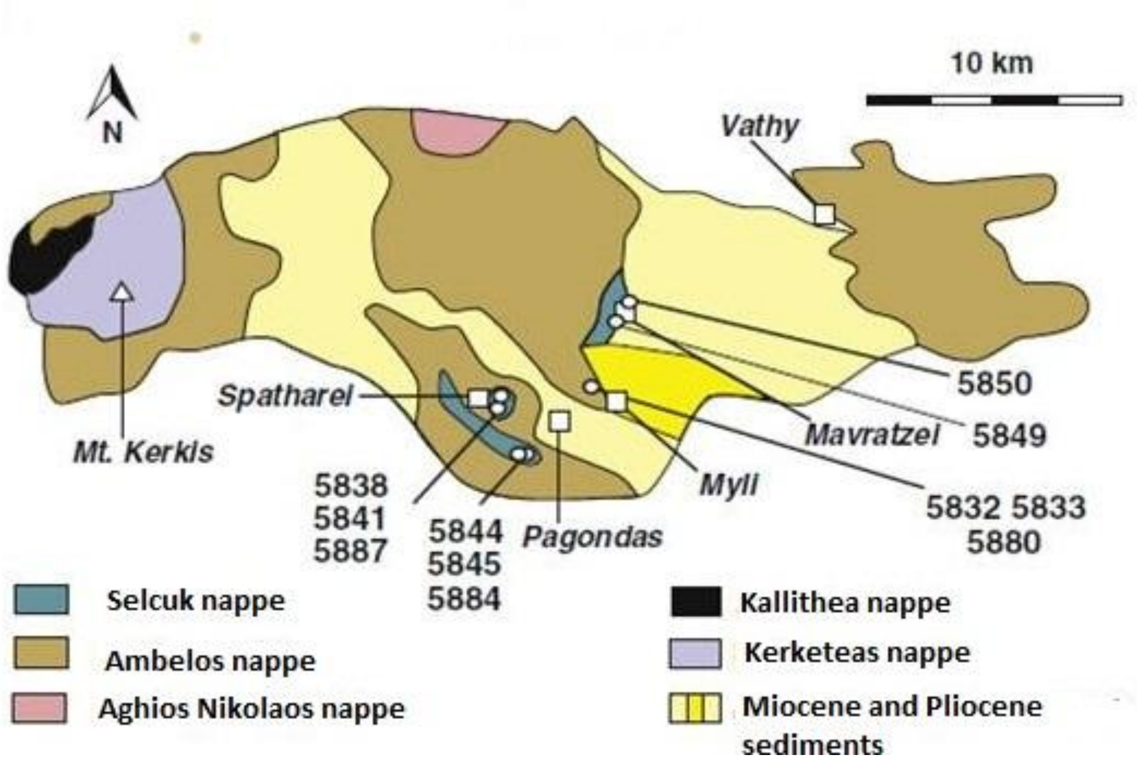


Figure 5.1: Simplified geological and tectonic map of Samos (after Bröcker *et al*. 2014, fig. 2a).

5.3.1 Autochthonous metamorphic system

It consists of four individual nappes. Kerketeas nappe is the lowest in stratigraphic terms, which is followed by the nappes of Aghios Nikolaos, Ambelos – including the Aghios Ioannis and Vourliotes-Zoodochos Pigi sub-units – and Selçuk nappe (Ring *et al*. 1999, fig. 2; Ring *et al*. 2007, fig. 2; Gessner *et al*. 2011).

5.3.1.1 Kerketeas nappe: it consists of a thick succession of dolomitic marbles and schists. The marbles cover most of Mt. Kerketeas and occur occasionally as intercalations within the Marathokambos-Kosmadei schist bodies (muscovite schists, quartz schists).

5.3.1.2 Aghios Nikolaos nappe: it is the lowermost nappe of the Cycladic Blueschist Unit and only exposed in a few outcrops at the northern coast close to Aghios Nikolaos and Aghios Konstantinos villages, consisting of metagranitic gneiss, garnet-mica schist, garnet glaucophanite, and dolomitic marble (Ring *et al*. 2007, 6).

5.3.1.3 Ambelos nappe: it consists of marbles, metapelite (including chloritoid-kyanite schist), quartzite, and various schists (muscovitic, glaucophanitic, epidotic, greenschist). Intercalations of mafic and ultramafic magmatic formations also occur. The Ambelos nappe correlates with the Dilek nappe in the opposite coast.

- **Ambelos schists**: they cover the largest body of Samos's central part and constitute the upper extension of the Marathokambos-Kosmadei schists. They consist of common mica schists (muscovite schists, quartz-muscovite schists). Epidote amphibolites, chloritic schists, quartzites, and phyllites also occur within the schist bodies, as well as rare intercalations of ultramafic igneous rocks, often schistose (Myli village).
- **Ambelos volcanic bodies**: mainly occur around Ambelos village as small bodies within schists (potassic trachyte and minor rhyolite). They also consist of Late Miocene volcanic and volcaniclastic rocks that crop out in the foothills of Mt. Ambelos and along the margins of the Miocene basins in the western (Karageorgiou 1946, 255-275; Pe-Piper and Tsolis-Katagas 1991, 239-241: mostly acid volcanic rocks, i.e. rhyolitic tuffs and flow-banded or spherulitic rhyolites in Karlovassi graben, near Koumeika and Platanos) and eastern part of the island (Ring *et al*. 1999, 1577, fig. 2; Gessner *et al*. 2011, 12, fig. 8: rhyolite and alkali basaltic rocks or bimodal basalt-rhyolite in Pyrgos graben/Mytilinii and Vathy basins around Kokkari, Mytilinii, Mavratzei, Pagondas, Spatharei). There is a geographical distinction between volcanic types: in the Karlovassi basin there are mostly occurrences of acid-intermediate rocks (rhyolites, dacites, trachytes), except for a small display of basic-intermediate lavas at the eastern margin of the basin near Platanos, whereas in the Mytilinii basin the occurrence of basic rocks (basalts and basaltic tuffs) and minor glass within them is mostly noted (Karageorgiou 1946, 252-253; Stamatakis *et al*. 1989). A recent study has characterised these rocks as metavolcanics (metabasalts and metandesites), being related to ophiolites (Stouraitis 2017, 13-14). The occurrence of basalts with weathered top, overlain by felsic pyroclastic deposits, was also documented on the western margins of Vathy basin (Aghios Pandeleimon) and near Pagondas and Pyrgos villages, which also

correlate with the Pythagoreion Formation (Mavratzei Beds) in the centre of the Mytilinii basin (Pe-Piper and Piper 2007, 78, figs. 2-3; Koufos *et al*. 2011, fig. 2). According to previous geochemical analysis the igneous formations of Samos, and more specifically the porphyritic alkali basalts, resemble those of the islands of Patmos and Kos, and the Bodrum peninsula of Turkey, while rather similar rocks are also present at Urla region E of the Karaburun peninsula (Pe-Piper and Piper 2007, 75; Agostini *et al*. 2007, 3, fig. 2).

5.3.1.3a Aghios Ioannis sub-unit: it occurs at the western part of Samos and consists of metamorphic mafic and ultramafic magmatic formations (metabasites with epidote, metabauxites, glaucophane) (Mezger *et al*. 1985, fig. 2). These include small-sized peridotite-serpentinite sills and ophiolite bodies that are frequently found within the Ambelos schists and are partly schistose.

5.3.1.3b Vourliotes-Zoodochos Pigi sub-unit: it occurs mostly at eastern Samos and consists of the Vourliotes-Syrrachos and Zoodochos Pigi marbles and Kotsika-Psili Ammos schists (muscovitic, quartzitic, chloritic, glaucophanitic).

5.3.1.4 Selçuk nappe: intercalations of ultramafic igneous rocks, as well as kyanites, peridotites, serpentinites, meta-gabbros (glaucophane with blue and green amphiboles, epidote, chlorite, albite; epidotite with actinolite, chlorite, albite; omphacite), and ophiolites are also found within the Ambelos schists (Stouraitis 2017, 13-14). This is the uppermost nappe of the Cycladic Blueschist Unit and only exposed in small outcrops near Myli, Spatharei, Pagondas and W of Mavratzei (Ring *et al*. 1999, 1591-1592, fig. 13; 2007, 25-26, fig. 29; Bröcker *et al*. 2014, 237, fig. 3). This ophiolitic mélange consists of meta-gabbro in primary contact with serpentinised peridotite, and mica schist (Ring *et al*. 2007, 6; Gessner *et al*. 2011; Bröcker *et al*. 2014, fig. 2b).

5.3.2 Allochthonous non-metamorphic series

Although a mainly metamorphic island, the westernmost part of Samos is characterised by the presence of the non-metamorphosed Kallithea-Katavasis intrusive complex, overlying the Kerketeas nappe. It forms part of the Miocene granitoid province of the Attic-Cycladic Crystalline Complex (Mezger *et al*. 1985, 353, figs. 1-2; Ring *et al*. 2007, fig. 5). It consists of Upper Triassic and Lower Jurassic limestones, igneous rocks that are filled with acid and basic plutonic rocks, peridotites, and serpentinites. The peridotites display similarities with those of the Selçuk nappe (Pomonis and Chatzipanagiotou 1998, 217-218, 221, fig. 2; Mezger and Okrusch 1985, 73-76).

5.4 Sedimentation and formations of Neogene basins

While Samos is made up by three Pre-Neogene metamorphic massifs (Kerketeas in the W, Ambelos in the centre, and Zoodochos Pigi in the E), the areas that separate them are largely composed of Neogene sediment deposits, coinciding with the Upper Miocene topographic lows of the Mytilinii basin in the central-east, the Pyrgos basin in the centre, and the Karlovassi in the NW, as well as the smaller Pliocene basin of Palaiokastro in the NE. These deposits consist of five successive lacustrine-fluviatile formations (Tab. 5.1; after Weidmann *et al*. 1984, fig. 2; Stamatakis *et al*. 1989, 67, figs. 2-3; Owen *et al*. 2011; Koufos *et al*. 2011, 239-240, fig. 2), corresponding to a limnic palaeoenvironment (Whitbread 1995, 124; Ring *et al*. 1999, 1581, tab. 2; Ring *et al*. 2007, 7, fig. 3).

According to the structural evolution of these formations, three stages can be recognised: a) repeated fluctuation from shallow to deeper waters in a saline lake related to tensional faulting and diagenesis/silicification, b) saline lake and playa environments with evidence for frequent earthquake events, and c) the development of small separate lakes that partially interfinger with each other (Owen *et al*. 2011, fig. 8). A saline lake with abundant diatoms was developed in the NW part of the Mytilinii basin, indicating that seasonal changes affected the deposition of different formations. During the Pleistocene-Holocene several phases of alluviation occurred related to folding and tensional faulting, being responsible for the tectonic features affecting the present day outline of Samos (Weidmann *et al*. 1984, 488).

A selective presentation of the lithostratigraphic succession of Neogene formations follows, with a focus on the Mytilinii basin that accommodates Heraion. Other basins include those in Karlovassi and Palaiokastro. The Mytilinii basin consists of lacustrine limestones and thin-bedded marls with common red soils and clays of the lower series that occupy the western part of the basin, including Pagondas-Pythagoreion area and Mavratzei. Between the Mavratzei Beds and the overlying Hora Formation there is a thick volcanic and volcaniclastic sequence with small dykes of basalts near Pagondas and Spatharei (Weidmann *et al*. 1984, 482). More red to yellowish soils and clays are found in the clastic series. Also important is the spatial differences between the SE and NW parts of the basin (Owen *et al*. 2011, 153-159, figs 2-3; Koufos *et al*. 2011, fig. 1).

The Karlovassi basin is lithologically distinct from the Mytilinii basin by the presence of zeolitized ash tuffs (Vassilopoulos *et al*. 2008, 30, tab. 1). Its lower series consist of whitish-grey or yellowish, thin-bedded hard marls, with intercalations of clays. Other formations of its lower series are related with the diagenetic alteration in a saline-alkaline environment, namely pyroclastic material, cherts with chalcedony, and small deposits of saponites deriving from post volcanic hydrothermal activity (Stamatakis *et al*. 2009; Hall and Stamatakis 1992, 424). Small volcanic bodies are also present (rhyolitic tuffs, trachytes, small basalt cones) along the eastern margin of the basin (Pe-Piper and Tsolis-Katagas 1991; Stamatakis *et al*. 1996, 476; Kantiranis *et al*. 2007).

Formation	Lithological characteristics	Area of exposure
1. Basal Conglomerate	Red-brown sands, alluvial deposits	Outcrops in western margin of Mytilinii basin (between Mavratzei and Mytilinii)
2. Pythagoreion	Limestones, green-yellow clays, marlstone, tuffaceous rocks. Andesites to basalts occur as intrusions near the western margin of the Mytilinii basin	Outcrops on the Spiliani Hill, E of Pythagoreion modern town
2a. Mavratzei Beds	Bituminous limestones with a rich fauna of freshwater molluscs, grey-green clays and sands	Outcrops to the W of the Mytilinii basin
2b. Basalt and Tuff Member	Volcanic and volcaniclastic tuffs and small dykes of basalts	Outcrops between Mavratzei Beds and Hora Formation in Pagondas and Spatharei
3. Hora	Silica-rich rocks, diatomaceous sediments, thick-bedded lacustrine limestone, marls with intercalations of greenish tuffaceous clays, and some volcanic glass	Outcrops extensively over the central and eastern regions of the Mytilinii basin and main road to Marathokambos (Karlovassi basin)
4. Mytilinii	Clastic sedimentary rocks and volcaniclastic deposits with reddish tuffaceous silts, mammal fauna fossils	Outcrops N-NW of Mytilinii basin
5. Kokkari	Limestones, green-brown clays, tuffaceous sands, gastropod fossils	Outcrops to the E and S of the Mytilinii basin

Table 5.1: The five successive lacustrine-fluviatile formations and their tectonostratigraphic relation from bottom to top.

5.5 Quaternary deposits

These coastal deposits consist of sand dunes, alluvial deposits with clayey-sandy material, loam, pebbles, gravels, *terra rossa* with grits and coarse torrential material, recent scree and talus cones, unconsolidated or weakly cemented with clayey-sandy matrix. The most extensive area of Quaternary deposition is the Chora plain. Finer depositions of clays and loams are found on the coastal areas (Theodoropoulos 1979; Vassilopoulos *et al*. 2008, 30).

5.6 The geology of the study area

The SE part of Samos, and more particularly the Mytilinii basin that accommodates the sites under investigation, is mainly characterised by the Neogene Pythagoreion Formation, including tuffs, bituminous limestones, marlstones and porcelanites (Fig. 5.2), and the overlying Hora Formation with its limestones and diatomites (Section 5.4.1). These two formations are partially covered by younger sedimentary rocks and the sporadically occurring trace fossils.

The immediate area around Heraion (<5km) is comprised mainly of Quaternary alluvial plains as well as of Neogene sediments, marls, and clays that are formed through the action of streams and groundwater that flow from the metamorphic highlands and transport the products of erosion in a NW-SE direction towards the sea. Heraion is situated within these deposits and in very close proximity to outcrops of the Pythagoreion and Hora Formations to the NW, while Kastro-Tigani is situated closer to outcrops of the Mytilinii Formation to the E (Koufos *et al*. 2011, fig. 1).

This area is of major geological interest since it is characterised by active faults and subsidence of its shorelines, related to periods of tectonic rotations that have contributed to its configuration (see Section 3.2.4). According to previous geological works on the tectonostratigraphic evolution of Samos, different phases of metamorphism have been distinguished that can be seen in the development of different metamorphic rocks throughout the island. Although difficult to detect petrographically, the distinction of specific rocks and minerals could provide a more accurate provenance, also in the case of pottery analysis (Chapter 7, Fabric 1).

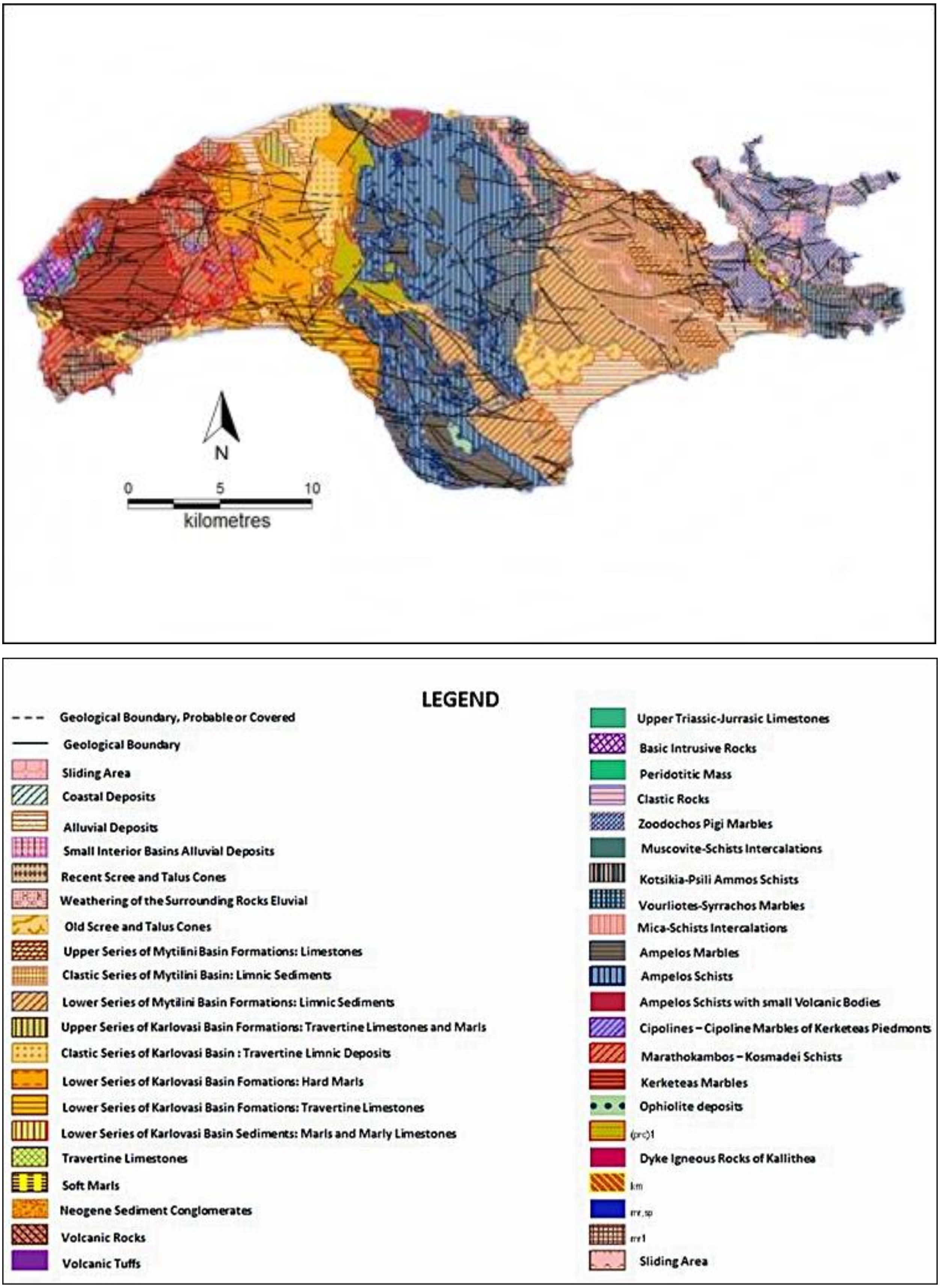


Figure 5.2: Geological map of Samos (modified after Stavrianou 2009, figs. 14-15).

5.7 Raw materials for pottery manufacture: ethnographic evidence and geological prospection

In order to examine further the question of local ceramic production, as well as to gain a better understanding of the technological decisions associated with the raw materials and their processing, this study takes into consideration the so far available data from previous surveys and ethnographic parallels of pottery manufacture by local, traditional/modern potters.

In addition to this, it also included a geological survey in which clay, sediment/soil, and rock samples were collected, with the permission of the Institute of Geology and Mineral Exploration (IGME) at Athens. This section discusses the aims and objectives of the prospection, as well as the criteria for the selection of specific geological samples and provides a detailed account of the deposits sampled and the results of their analysis. The successful fulfilment of the sampling required the study of Samos's geological background through literature and maps (Fig. 5.2; Sections 5.3-5.6). However, these usually present an idealised picture of the geology, as the description of large units does not reflect the small variations in rock and sediment types which are relevant to a potter seeking out suitable raw materials.

The term clay is used here in a more generic way and does not necessarily apply to the geological grain size (<4μm). Instead, it refers to the earth/raw materials that become plastic when mixed with water and can produce a workable paste that will withstand the forming and firing of ceramic vessels. In most cases, natural clay-rich minerals are not directly suitable for ceramic production and the choice of specific raw materials by the potters is often the result of cultural and technical decisions that are informed by experiential criteria. Taking into consideration the above, in combination with ethnographic parallels from other areas (e.g. for Crete, see Day 2004; for Corinth, see Whitbread 2003), it must be borne in mind that the determination of geographically-specific sources is usually very difficult, as a number of compositional changes may be introduced at several stages of the operational sequence (Day *et al*. 1999, 1027). Recent geochemical and mineralogical work on red alluvial and Neogene clays from Crete has demonstrated that the compositional diversity and natural variability within clay deposits often impedes a direct link between analysed ceramics and a distinct clay source; this can be overcome when ceramic samples of known or assumed origin are used as comparative material (Hein *et al*. 2004a; 2004b). Similar studies of ceramic raw materials have been progressively increased in archaeometric and ethnographic/ethnoarchaeological research, as they offer a way to test methods and assumptions that form the basis of the analytical approach – especially regarding provenance – to archaeological ceramics (e.g. Day *et al*. 1999; Neff *et al*. 1999; Arnold *et al*. 2000; Montana *et al*. 2011; Fowler *et al*. 2011; De Bonis *et al*. 2013; Cau Ontiveros *et al*. 2015; Masucci and Carvalho 2016; Mentesana *et al*. 2016b).

For the sake of this study the concept of 'ceramic landscapes/taskscapes' is examined, not as representing mere spatial configurations, but rather perceived as the socially-structured place of adopted technical practices and even more as an arena where human agent interacts with the material world (Dobres 2000, 127). More particularly, the concept of landscape transcends the visible features constituting its physical appearance (land morphology, flora and fauna, architectural remains, etc.) and includes also abstract features (climate, location, toponyms, population, etc.). Recent theoretical schemes have moved away from solely ecological approaches (see Arnold 1985 for references) for the interpretation of raw material collection strategies and long-term use of resources and focused on a combination of functional, economic, symbolic, and socio-cultural explanations, where concepts from Landscape Archaeology are combined with the social theory of technology (Santacreu 2017). While the ceramic ecology approach is environmentally-deterministic, as it considers distance and accessibility to raw material sources as the key variables in the explanation of potters' behaviour (Arnold 2006), the functionalist approach sees the physical properties and efficiency of raw materials as the favourable variables in the exploitation of certain raw materials. Unlike these theories, the landscape views in combination with the social theory of technology consider space, as experienced by ancient and modern potters, as the wider context that consists of places differentiated between each other by invested meaning, memory, experiences, and social relationships or interactions formulated within it (Tilley 2006, 18; Robin *et al*. 2007, 834-835). It is a living and constantly transformed process, which in relation with 'taskscapes' creates the spatial and temporal location of practice, histories of interactions between potters, materials, and the environment, and persistent places that are socially-built through visibility (Ingold 2000; Michelaki *et al*. 2015). This 'space of experience' should be viewed as the territory within which potters undertake other daily tasks and activities in the framework of clay and temper exploitation and acquisition (e.g. exploitation of other resources, collection of fuel, cultivation of fields), which can subsequently transform certain areas from convenient locations into culturally and socially-meaningful places

(Ingold 2000, 195; Gosselain and Livingstone Smith 2005; Gosselain 2008, 70, 77; Michelaki *et al*. 2015, 784).

5.7.1 Traditional and modern pottery production: a summary of the ethnographic data

This section focuses on the local, traditional and modern pottery production and aspects of the manufacturing process, that may provide ethnographic insights into the selection and processing of raw materials, labour organisation and mode of production, continuity and change of traditions, etc. This is by no means an exhaustive account of ethnographic data, nor does it represent a structured analysis of the aforementioned issues, instead it provides some preliminary observations that can be developed in the future into a more systematic study. A number of modern kilns, almost exclusively related with brick or tile manufacturing, were identified and offered the opportunity to expand this research into the exploitation of raw material sources. The relevant information derives mainly from ethnographic sources and to a lesser extent from a number of brief visits and interviews conducted by the author between 2015 and 2016. References are used to highlight certain information where available, mainly from potters' families, namely Giakoumis in Mavratzei, Koulouris in Heraion, and the Kontoroudas and Vathiotis workshops in Karlovassi.

Samos was one of the major pottery production centres in the eastern Aegean (Fig. 5.3), at least from the mid 19th to the mid 20th century, with the workshops concentrating mainly at the potting centres of Mavratzei and Karlovassi (Orfanos 2005; Kogias 2001). The first synthetic attempt on the Samian traditional pottery production was made by Casson (1938, 469-470) and more recently Jones (1986, 857, tab. 12.1, fig. 12.1). Past research indicates that the pottery manufacturing tradition was developed as the main occupation of Mavratzei up until the 1930s, giving it the name of ‘Little Çanakkale’ from the famous pottery production centre of Çanakkale in the Dardenelles, Asia Minor (Psaropoulou 1986, 113). According to Demetriou (1990) around 47 different potters (*tsoukalades* or *gavathades*, lit. cooking pot makers or deep bowl makers respectively) exercised this profession between the late 19th and the mid 20th centuries. More specifically, a number of 14 full time potters and 36 individuals specialising in the manufacture of tiles and bricks have been recorded up until 1874 (Kogias 2004, 154). Only 5 active potters were recorded by Hampe and Winter in 1960 (1965, 151). In addition to this, a number of 15 active workshops (Kogias 2004, 154) were recorded until 1920 in Mavratzei (Demetriou 1986), which were reduced to 2 by 1976 (Kyriazopoulos 1984, 43). Although not all are identified or preserved intact, the pottery workshops were dispersed in the village as testified by the presence of kilns (*kaminia*); 45 kilns operated around 1945 which decreased to only 1 in the early 1980s (Kyriazopoulos 1984, 43).

More evidence is available for the manufacture of tiles and bricks, as this tradition continued until very recently with manufacturers using local raw material sources. The majority of tile and brick workshops have been gradually developed in the vicinity of Karlovassi after 1955 (Mr Chousas, pers. comm., June 2016). More kilns for tile manufacturing are reported from Chora and Pagondas (S. Niotis, pers. comm., June 2016).

From Mavratzei the potting tradition was transferred first to Pagondas, although it lasted on a short time (Demetriou 1986, 274; Varvounis and Macha-Mpizoumi 2012, 13), and then in the late 19th century gradually to Karlovassi, giving rise to the second largest production centre on Samos. In the early 20th century 13 potters are estimated, as well as 14 specialising in the manufacture of tiles and bricks and 12 kilns in the 1930s (Kogias 2004, 158). Kyriazopoulos refers to *ca*. 10 active workshops in the late 1930s and 18 kilns between 1970s-1980s, with only 1 operating around 1983 (Kyriazopoulos 1984, 43-44; Voyiatzoglou-Sakellaropoulou 2009, 239). Among the workshops recorded from Karlovassi only 2 remained active after the 1980s. These belong to Kontoroudas[5] and Vathiotis families (Voyiatzoglou-Sakellaropoulou 2009, 240-241; Varvounis and Macha-Mpizoumi 2012, 30-31).

Traditional workshops are known to have existed also in Vathy, which were established by itinerant Siphniot potters during the late 19th century (Kogias 2004, 155), in Fourni/Ydroussa until 1928 owing its name to the many kilns (*fourni*) (Kyriazopoulos 1984, 44), in Mytilinii around 1918/1930 (Kogias 2004, 157), and in Keramidias N of Mavratzei (specialised in tiles; Shipley 1987, 261). After 1975 the traditional production of utilitarian vessels declined drastically, and was eventually replaced by the manufacture of more items more suitable as souvenir in modern workshops. New techniques were introduced (electric wheels and furnaces), and the local raw materials were only rarely used (Varvounis and Macha-Mpizoumi 2012, 14). Instead, commercial stoneware and earthenware clays are imported from Athens. The

[5] This workshop is not taken much into account because the potter V. Kontoroudas has largely ceased working during the course of this study.

latter is in fact attributable to the time-consuming and expensive process of clay extraction and processing.

The lack of communication and exchange of technical knowledge between the two potting centres led to the development of two distinct traditions that have co-existed for over a century, *ca.* 1870-1970 (Kogias 2004, 160). In fact, the geographically-restricted knowledge developed by the potters regarding the landscape and resources, as well as techniques and tradition, is primarily based upon what they were taught by their fathers or other master potters and the personal expertise developed over time. In Mavratzei the potters specialised in the production of transport and storage vessels of various sizes (*stamnes* and *stamnakia*), as well as pots for serving and consumption of food, like large open vessels/bowls (*gavatha*) (Varvounis and Macha-Mpizoumi 2012, 29-30). In Karlovassi the production was aligned towards the manufacture of a broader range of types, although focused mainly on water jugs/jars (*kanatia*) and a variety of decorative motifs. According to P. Vathiotis among the storage vessels only small ones (*kioupia*) were manufactured at their workshop, while no cooking pots or pithoi were made due to the low refraction index of the available clays.[6] This is in agreement with the Mavratzei workshops.[7] N. Koulouris also mentioned that pithoi were locally manufactured in the mid-20th century at workshops along the Heraion coast and at Pagondas from clayey sediments available in the area.[8] The rare manufacture of low-quality pithoi at Mavratzei ceased by the mid-20th century, while Samos was involved in the, already since the late 19th century, established exchange networks of pithoi from the important ceramic centres of Koroni, Messenia in the SW Peloponnese and Ainos (modern day Enez) in Thrace (Kyriakopoulos 2015, 261; Liaros 2016, 60).

An important factor for the development of the strong potting tradition in Mavratzei, at least during the summer-autumn months (*ca*. May to October), is the limited presence of arable lands that would allow an exclusive agricultural occupation. On the contrary, pottery production was the main source of livelihood in Karlovassi (Korre-Zografou 1995, 155; Kogias 2004, 154). Until the late 1960s the Samian ceramics, especially from Karlovassi, were exported in Thrace, Macedonia, Thasos,

[6] Pers. comm., June 2016. Storage jars and cooking pots were imported from Siphnos and Patmos (also confirmed by K. Kogias, pers. comm., March 2017). Similarly, cooking pots from Siphnos are known also in Crete (see Day 2004, 133-134). According to P. Vathiotis the pithoi were imported from Crete and Cyprus between *ca*. 1950-1970.
[7] According to K. Kogias *kioupia* were manufactured rarely and in small amounts in Mavratzei (pers. comm., March 2017).
[8] Pers. comm., June 2016. At Pagondas the workshop was mainly specialised in the manufacture of tiles.

Lemnos, Chios, Mytilini, Ikaria, the Dodecanese, and the Cyclades (Hood 1981, 299-300; Kogias 2004, 160-161).

5.7.2 The location of suitable clay sources for pottery manufacture and previous geological samplings

The establishment of the largest potting centres on the island in Mavratzei and Karlovassi was largely due to the close proximity to good quality clay sources. The latter are usually identified or are exploited for longer than one generation through either hearsay or testing and prospecting (cf. Livingstone Smith 2000, 24). A number of criteria were used to assess the quality and suitability of clays and sediments with the main being the colour, texture, smell, or even taste. However, this is not to suggest that potters follow a mere functionalist approach, according to which the physical properties of clays define their decisions and actions (e.g. Santacreu 2017), but rather take into account certain beliefs and traditions that are intertwined with their social landscape.

In Keramidias, N of Mavratzei, there exist abundant red clay deposits (*kokkinochoma*) that were until recently partly exploited by some local potters of the wider area (Demetriou 1986, 274; Korre-Zografou 1995, 160). Although since the 1980s the majority of raw materials are imported from Athens, there are still modern potters using the local resources on a small scale mostly for artistic experimentations (e.g. T. Chatzilagos in Koumaradei, pers. comm., June 2015). These *terra rossa* deposits often provide the required non-plastic inclusions that decrease the natural plasticity of the clay paste and are favoured by potters because of their ability to withstand higher temperatures compared to the pale Neogene clays (cf. Day 2004, 132).

At Karlovassi[9] the potters used to extract the white/grey clays (*asprochoma*) from Profitis Ilias hill some 15-20 minutes away (*ca*. 5km) from the workshops by car (S. Vathiotis, pers. comm., June 2016) and from the Xirokambos plain (hard marls of the lower series of the Karlovassi basin) which accommodates a brick factory (Shipley 1987, 258), the pale white clays from Fourni/Ydroussa[10], and more specifically from the area of Aghia Paraskevi, while the red clays (*bandanas*), used mainly for the manufacture of cooking pots and the creation of slip, were brought from the area of Platanos (Hampe and Winter 1965, 152; Psaropoulou 1986, 114). Potter's clay is also

[9] According to Whitbread (1995, 125) "potters from the Karlovassi Basin exploit fluvio-lacustrine deposits" or according to Dupont they used marine deposits (1983).

[10] The area extending between Ydroussa and Platanos has the best quality clays on the island, according to T. Chatzilagos (pers. comm., June 2016). Another indication is provided by the old name of the village Fourni-Keramida (lit. kilns), due to the large presence of kilns for pottery and tiles.

reported from the area of Myli village (Shipley 1987, 20). The seasonal Siphniot potters in Vathy were probably using red sediments collected and strained through ground pits from rainwater, as no suitable primary raw material sources are known to have been exploited in the area (Psaropoulou 1986, 113).

Karageorgiou also mentions the presence of grey clay outcrops close to Heraion (1946, 248). The chemical analysis of selected ceramic finewares made from that clay, in combination with information gathered from the analysis of clay samples by Dupont (1983, 33-34), revealed close affinities with that of Mavratzei, “where the potters collect their clays from small deposits in the fluviatile Neogene sediments” (Whitbread 1995, 125, fig. 4.9). Comparative analysis of clays from the Karlovassi and Mytilinii basins revealed a considerable natural variability between the NW and the SE part of the island (Vassilopoulos *et al*. 2008, tab. 1). In the Heraion beach are reported clayey sediments for the *in situ* manufacture of pithoi at Koulouris' workshop (N. Koulouris, pers. comm., June 2016).

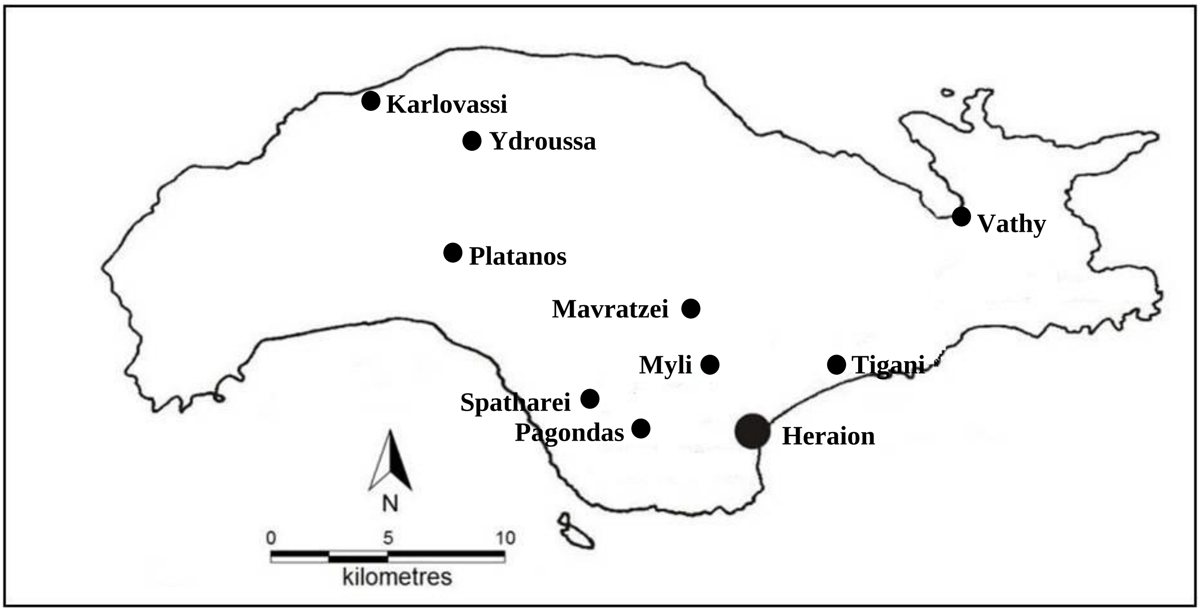


Figure 5.3: Main sites and villages of Samos with ceramic manufacture tradition mentioned in the text (by S. Menelaou).

The best known clay source on Samos since antiquity is the so-called Samian Earth (*Σαμία γη*). Until recently, in the absence of any archaeological samples, the way these clays were extracted and processed, as well as their location and areas of exploitation, have been controversial and heavily relied on textual evidence (Photos-Jones *et al*. 2015, 259). It is referred to a variety of clays previously equated by several ancient authors with kaolin because of its white-pale grey colour, soapy texture, and lightweight substance (Pabst and Kořánová 2009) and known primarily for its medicinal properties, and artistic or industrial use (e.g. pigment, cleansing agent, fuller's earth, or raw material for pottery making) (Shipley 1987, 20-21). It is also known to have been exported to Egypt and elsewhere already since the 6th or 4th century BC (Shipley 1987, 207, 277).

According to the geological background of Samos certain mineral deposits like the volcanic rocks and fuller's earth (*σαπουνόχωμα*, saponites) in the vicinity of Platanos in western Mt. Ambelos (*ca.* 520m) were the best candidate source for exploitation (Karageorgiou 1947, 216-217; Shipley 1987, 277-278). A recent analytical programme supported the identification and correlation of Samian Earth with this area, and more particularly the borate deposits to be found in proximity with bentonitic clays between Sourides and Konteika (Photos-Jones *et al*. 2015, figs. 2-3, tab. 7; Kantiranis *et al*. 2007).

Lastly, a small-scale raw material sampling was undertaken by the Austrian Academy of Sciences in the 1990s, in the framework of which three samples were collected (L. Peloschek, pers. comm., December 2016, unpublished results). Samples SAM T1 and SAM T2a were collected from the vicinity of Pagondas and SAM T2 from Mavratzei.

5.7.3 Aims of raw material sampling

The sampling programme was carried out in the course of two field seasons (June 2015 and 2016) and was restricted to specific areas on the island. Each season fulfilled different objectives. Following a brief study of the island's geological background through maps and bibliographical sources, and before undertaking the petrographic analysis of the archaeological ceramic samples, a small-scale sampling was carried out in the first season. A radius of *ca*. 15km around the study area in the south-central part of Samos (Chora plain) was covered, that accommodates the so far known archaeological sites and various drainages/streams (Fig. 5.4). The site of Heraion is situated in the largest alluvial, coastal plain, which is formed by material carried out by streams flowing from NW and, therefore, would be expected to reflect residual clays of the parent geological formations. However, this is often obstructed by potential landscape changes caused by natural or anthropogenic processes, as is the case of the Imvrassos river's rerouting, the original streambed of which was revealed in the excavation seasons of 2011-2013 at about -0.10m depth. This explorative sampling aimed primarily at collecting randomly clay-rich sediments from various geological formations on the basis of macroscopic criteria (colour, texture), in order to obtain a general idea of the compositional variability within and diversity among different deposits.

A second, more targeted raw material prospection was carried out after the preliminary petrographic examination of the ceramic samples in an attempt to clarify specific technological (composition, paste processing, texture, etc.) and provenance (local resources) questions. These included the distinction between different sources for the manufacture of similar fabrics that contain varied amounts of metamorphic inclusions and are related with local geological formations. The focus was also placed around the two modern potting centres of Samos (Mavratzei and Karlovassi), and the identification of specific deposits beyond the immediate vicinity of Heraion, that could have served as possible raw material sources for the manufacture of pottery. The latter was driven by both an understanding of the local geology and information provided by modern potters or other family members that have a solid knowledge of the landscape (see Sections 5.7.1 and 5.7.2)

5.7.4 Sampling and characterisation of raw materials

A number of unconsolidated and consolidated raw material samples were collected focusing on the surroundings of the archaeological site, although there is no direct evidence for pottery production on site,[11] as well as the two main traditional/modern ceramic production centres. Kilns are generally very rarely preserved in the archaeological record, which might be due to the destruction of layers and continuous habitation at the same area in the case of Heraion. The lack of ancient kilns and pottery wasters prevent the establishment of secure compositional reference groups that can be associated directly to a particular workshop. Other samples, especially red colluvial/alluvial sediments, were collected from natural slopes or road cuts throughout the central part of the island and the margins of the two main plains, namely Chora and Karlovassi. The sampling was performed by removing the surface part of the clayey deposit in order to minimize the presence of recent soil.

The first phase involved the collection of 17 samples, mostly from surface but also from marine deposits, as well as 1 prehistoric mudbrick and the manufacture of 4

[11] The only ceramic kiln known from Samos possibly dates to the Geometric period and was found at Pythagoreion (Hasaki 2002, 221-223, 330-331 with references).

experimental samples with different raw material mixes. In addition to these, the second phase involved the collection of 20 samples, 6 rock samples, and the manufacture of 5 experimental samples with different raw material mixes. A number of 17 tile and brick samples were also collected from known and suspected production areas and were used as reference points towards the correlation between clay sources used by modern potters and the geological deposits sampled by the author. In Table I.1 (see Appendix I) the deposits/sampling locations, which were recorded using GPS equipment, the macroscopic features and physical properties of the collected samples prior and post-firing are presented. Photographs of the locations and samples collected are available in Figs. 5.5-5.7.

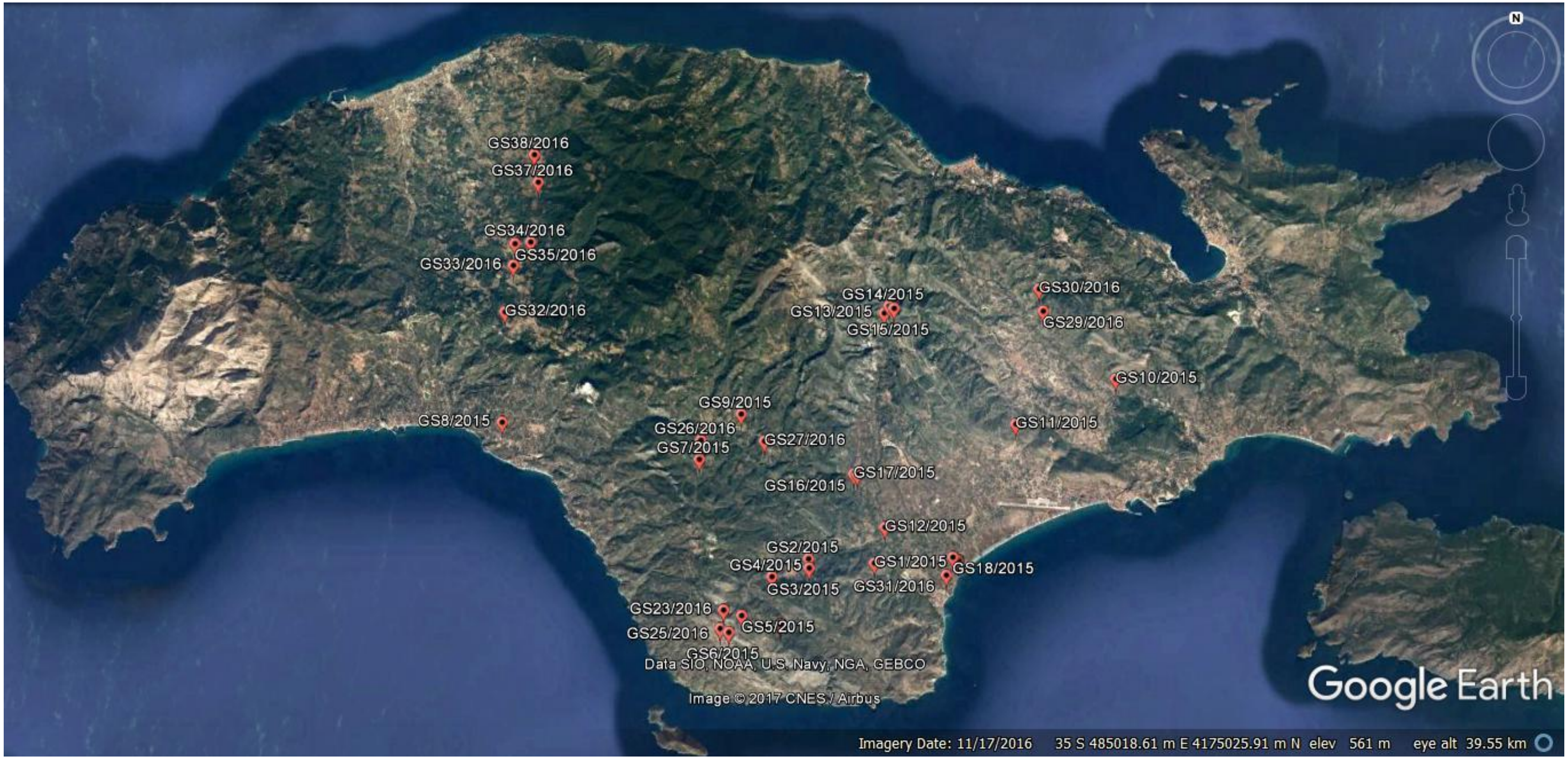


Figure 5.4: Map of sampling locations on Samos (through Google Earth) (by S. Menelaou).


A B


C D


E F

Figure 5.5: Location of representative geological samples (left column) and samples collected (right column). A-B. GS1/2015; C-D. GS2/2015; E-F. GS5/2015.

Figure 5.6: Location of representative geological samples (left column) and samples collected (right column). A-B. GS7/2015; C-D. GS10/2015; E-F. GS13/2015.

A B

C D

E F

Figure 5.7: Location of representative geological samples (left column) and samples collected (right column). A-B. GS15/2015; C-D. GS27/2016; E-F. GS29/2016.

5.7.5 Laboratory work and experimental briquettes

The samples were processed at the Department of Archaeology, University of Sheffield. Most were ground in a mortar and only the coarse ones were dry-sieved to 1mm or less in order to remove the coarse inclusions and vegetal matter. Other samples were prepared without sieving and only processed by removing the coarse inclusions by hand (see Appendix I, Tab. I.1) in order to examine their performance when containing natural inclusions. In both cases all samples were mixed with water in order to reach the desired plasticity. Three experimental briquettes (*ca*. 5x1x1 cm) were manufactured from each batch of raw materials and left to dry in room-temperature for two-three days in order to observe any possible impact on their consistency (Fig. 5.8). Each briquette was subjected to different firing temperature: one specimen was left unfired, while the rest were fired at 700°C and 900°C respectively in fully oxidizing conditions in a laboratory furnace (Figs. 5.9-5.10). The different temperatures were accomplished gradually, following a slow heating rate of 200°C/h, and remained at peak temperature for one hour, after which the briquettes were allowed to cool down slowly overnight in a decreasing temperature. The chosen temperatures were expected to lead to different microstructures, which would enable a cross-check of similarity with the firing of the ceramic samples.

Table I.1 (Appendix I) summarises the observations regarding the physical properties of the samples during manufacture, drying, and firing of the briquettes. The majority of samples displayed good to very good workability and plasticity, with few being poorly manipulated or with low plasticity (most likely inappropriate for pottery manufacture; especially the light-coloured sediments: GS1/2015, GS8/2015, GS11/2015, GS31/2016) and only four were characterised by very good to excellent performance (GS40-42/2016). In addition, there is colour variation among the samples with the majority ranging from dark brown/brown to reddish brown prior to firing and reddish brown to red after firing (700°C) and slightly darker at 900°C. In most cases the light-coloured samples retained similar pale colours after firing and displayed extensive cracking or gradually collapsed after drying or first firing. The best examples in terms of workability, fabric consistency, and firing behaviour were GS6/2015, GS14/2015, GS15/2015, GS25/2016, GS41/2016 collected from the margins of the Chora plain and the area surrounding the modern workshops of Mavratzei, as well as GS34/2016, GS38/2016 and GS40/2016, GS42/2016 that were respectively accumulated from

Fourni/Ydroussa (used to accommodate ceramic kilns for the manufacture of bricks/tiles) and Platanos (collection of clays from modern potters in Karlovassi).

Figure 5.8: The experimental briquettes of the clay samples before drying.

Figure 5.9: The experimental briquettes after the first firing at 700°C.

Day 1 Day 2 Day 3

Figure 5.10: The experimental briquettes after the second firing at 900°C.

5.7.6 Petrographic analysis of the geological thin sections

The thin sections were first grouped according to composition, following the same criteria as in the pottery thin sections. These two groups of material were then comparatively examined in order to determine the provenance of specific fabric groups and, if possible, to specify certain areas of clay exploitation by the prehistoric potters, as well as to understand various technological steps of the manufacture (see Chapter 7). The fabrics distinguished are presented below in two categories, i.e. pale marly sediments (Tab. 5.2) and red deposits (Tab. 5.3), and more detailed information of each sample is given in Table I.2 (Appendix I). Experimental samples GS45/2016, GS46/2016, and GS47/2016 are excluded from the fabric groups as they represent the mixing of two different clay samples in each case and, therefore, are only utilised to assess certain technological features.

Fabric group	Sample No.	Petrographic features	Figure No.
Fabric 1: Buff brown, fine-very fine carbonate-rich	GS1/2015, GS8/2015, GS16/2015	Fine-very fine texture and calcareous composition. Composed of carbonates (micrite clots of varying sizes) and very few-rare inclusions of quartz, mica, and crystalline calcite	Fig. 5.11:A
Fabric 2: Buff brown, semi-fine with carbonates and bioclasts	GS11/2015, GS31/2016	Similar to Fabric 1, but with a coarser groundmass. Mainly composed of carbonates, few mono- and polycrystalline quartz, plagioclase, as well as very few mica, volcanic rock fragments, and fine-grade metamorphic rock fragments	Fig. 5.11:B
Fabric 3: Reddish brown semi-fine with carbonates	GS33/2016	Similar to Fabric 2, but more sparite than micrite, some muscovite, quartz, feldspar, and amphibole	Fig. 5.11:C

Table 5.2: Summary of fabrics defined from the pale-coloured marly sediments and their petrographic attributes.

Fabric group	Sample No.	Petrographic features	Figure No.
Fabric 4: Coarse/medium-coarse with quartz-rich and biotite schist rocks	GS2/2015, GS14/2015, GS15/2015, GS21/2015, GS22/2015, GS40/2016, SAM T2	Fine-grained, red-firing matrix, frequent biotite mica, quartz and feldspar, very few amphiboles and orange-brown/greenish pyroxenes. Coarse fraction also contains common biotite-quartz schists, polycrystalline quartz, red TCFs, limestone, rare chert, opaques, and possible serpentinite	Fig. 5.11:D-E
Fabric 5: Coarse quartz-rich with metamorphic rocks	GS5/2015, GS27/2016	Frequent quartz-rich metamorphic rocks with examples displaying layers of muscovite and/or less biotite and ferromagnesian mineral. Groundmass dominated by mica (mainly white) and quartz, very few-rare plagioclase, opaque minerals, amphibole, and large biotite laths	Fig. 5.11:F
Fabric 6: Medium-coarse with quartz-rich metamorphic rocks and	GS6/2015, GS25/2016	Broadly compatible with the previous fabric. Less schists and finer biotite-rich groundmass, pyroxenes, as well as very few	Fig. 5.12:A

epidote group minerals		chlorite aggregates, possible serpentinite, epidote group minerals like epidote, clinozoisite or zoisite	
Fabric 7: Coarse micaceous with medium-grade metamorphic rocks	GS7/2015, GS23/2016, GS42/2016	Common muscovite and metamorphic rock fragments, mainly muscovite schists, biotite schists, and quartz-rich polycrystalline rock fragments. Also some sillimanite schist, possible greenschist, phyllites, very few-rare serpentinite, chlorite aggregates, amphibole	Fig. 5.12:B-C
Fabric 8: Coarse sandy metamorphic	GS18/2015, GS19/2015, GS20/2015	Similar to Fabrics 4 and 7, but differs by the dominance of biotite mica in the groundmass and more varied range of inclusions. Mainly biotite schist, some muscovite schist, polycrystalline quartz, dark phyllite, rare amphibole, pyroxene, epidote, volcanic rocks (spherulites)	Fig. 5.12:D
Fabric 9: Coarse with chlorite-rich rock fragments and very few volcanic rock fragments	GS4/2015	Consists of serpentinised, chlorite-rich rock fragments and very few fresh and slightly altered volcanic rock fragments of intermediate-basic composition, and their constituents minerals	Fig. 5.12:E
Fabric 10: Coarse with metaggabro and epidote-rich rocks	GS13/2015	Consists of meta-basic igneous rocks (probably meta-gabbros), as well as peridotites with a schistose or serpentinised texture and epidote-rich rock fragments	Fig. 5.12:F
Fabric 11: Coarse with common chlorite schist and serpentinite fragments	GS24/2016	Consists of common elongate chlorite aggregates/schist rocks, serpentinites and altered basic rocks that retain parts of their initial forming minerals such as pyroxenes and olivines, few epidote group minerals including clinozoisite	Fig. 5.13:A
Fabric 12: Fine/semi-fine with volcanic rocks	GS10/2015, GS29/2016, GS30/2016	Consists of fine to medium-grained volcanic rocks with acid to intermediate/minor basic composition, mainly displaying fresh, porphyritic to trachytic texture, common alkali feldspar crystals and quartz, few-very few plagioclase, and rare metamorphic rock fragments	Fig. 5.13:B
Fabric 13: Coarse with volcanic and metamorphic rocks	GS32/2016, GS37/2016	Consists of frequent-common alkali feldspar and quartz, mica (mainly muscovite), volcanic rock fragments with acid to intermediate composition and fresh and/or altered porphyritic texture, and metamorphic rock fragments (fine to medium-grained schists or phyllites)	Fig. 5.13:C
Fabric 14: Medium-coarse with TCFs/mudstone? and igneous rock minerals	GS3/2015	Consists of common a-sa and tabular feldspar crystals ranging from plagioclase to orthoclase and more rarely microcline, as well as fewer quartz grains, rare volcanic rocks, TCFs or mudstone fragments, and medium-grade metamorphic rock fragments	Fig. 5.13:D
Fabric 15: Coarse with metamorphic, siliceous (chert) and volcanic rocks	GS17/2015, GS34/2016, GS35/2016, GS36/2016, GS38/2016, GS39/2016	Consists of common mono- and polycrystalline quartz and coarse muscovite mica/mica schist and phyllite, few siliceous rocks/chert (chalcedony) and possible acid volcanic rocks with spherulitic/fibrous texture. GS17/2015 stands out by the common presence of siliceous rock fragments with a radiating fibrous texture, probably related to chert or acid volcanic rocks	Fig. 5.13:E

Fabric 16: Medium-coarse with metamorphic, clastic and volcanic rocks	GS9/2015, GS26/2016, SAM T1, SAM T2a	Consists of mica-rich metamorphic rocks, clastic or pyroclastic rocks with possible serpentinised fragments and volcanic rock fragments (mainly altered) of intermediate to basic composition (probably andesite to basalt)	Fig. 5.13:F
Fabric 17: Fine with sedimentary rocks	GS41/2016	Calcareous (mixing of two different clay sources), with common mica in the groundmass and very few inclusions comprising the coarse fraction, mainly sedimentary/argillaceous rocks (siltstones to sandstones)	Fig. 5.14:A
Fabric 18: Coarse sandy with metamorphic rocks, mafic and epidote minerals and minor volcanics	GS28/2016, GS43/2016	Consists of a fine groundmass with quartz and mica and a coarse fraction with common metamorphic rock fragments (mainly medium to coarse-grained mica schist or quartz-rich rocks), few orange phyllite or slate fragments, pyroxene (mainly clinopyroxene), limestone, and very few-rare muscovite mica, opaque minerals, serpentinite or altered mica-rich metamorphic rocks, plagioclase feldspar, volcanic rock fragments (intermediate to basic in composition, fresh texture, probably basalt), epidote group minerals, and olivine. GS43/2016 is made of sand mixed with studio clay, resulting in a finer groundmass with common clay pellets	Fig. 5.14:B-C
Fabric 19: Coarse with intermediate volcanic rocks	GS44/2016	Consists of common volcanic rocks of intermediate composition and their constituent minerals (plagioclase, amphibole, biotite, opaque minerals). This sample derives from a crushed millstone fragment mixed with studio clay. It differs greatly from the rest of the fabrics and it most probably reflects a non-local fabric	Fig. 5.14:D

Table 5.3: Summary of fabrics defined from the red/brown sediments and their petrographic attributes.

Summary of the results

According to the large number of fabric groups distinguished from the petrographic analysis of the raw material samples, it is evident that there is some strong variability within and among the different geological formations and deposits sampled. However, this is not only a symptom of the aims, sampling strategy, and sources chosen to be exploited in the framework of the prospection, but also a confirmation of the complex geological background of Samos. The latter was confirmed analytically in the work undertaken by Dupont for fineware ceramic samples, which was interpreted as a result of the natural variation in the clay sources (see Whitbread 1995, 125).

Occasionally there were samples collected from the same formation, separated from each other only by a few metres, while other areas were represented to a lesser extent due to reasons related to the extension of the formation outcrops and macroscopic features of the material. The light-coloured fabrics (Fabrics 1-3) were found to be very fine and associated with carbonates, possibly related with marine environments, although some variability does exist in terms of the coarseness of inclusions. In contrast to these, the red sediment samples tend to fire red/reddish brown/dark brown and are coarser in texture, related with different types of deposits that possibly reflect terrestrial to colluvial/alluvial sediments deriving from weathered or primary rocks of the Pre-Neogene basement. The majority of samples deriving from red sediment deposits of alluvial origin relate to the metamorphic Ambelos nappe. Apart from the fabric groups restricted to specific deposits (e.g. Fabric 4 quartz-biotite schist restricted to the Mavratzei area; Fabric 5 quartz-rich metamorphics; Fabric 6 quartz-rich metamorphics and epidote group minerals), there are also a few that share a very similar composition and derive from both the SE (Chora) and the NW (Karlovassi) plains, such as Fabric 7. A different picture of compositional similarity is given by the presence of volcanic rock fragments in Fabrics 12 and 15, both of which contain samples from the south-central and north-central parts of the island.

This has demonstrated how difficult the distinction between deposits of the same geological formation is, and that they can be repetitive on a broader geographical scale extending beyond SE Samos, this thesis's area of study. This might caution against assuming a common geological provenance for ancient ceramic fabrics that share similar mineralogical/compositional features only from a petrographic point of view. Having said that, it is encouraging that the distinction between metamorphic fabrics is demonstrated in both the experimental and ancient samples in a similar fashion (see Section 8.3.1 and subsections 8.3.1.1-8.3.1.5). In some cases there is evidence for textural and, perhaps, also compositional alteration among briquettes prepared from the same material, but fired at different temperatures. Nevertheless, it should be kept in mind that the latter observations are related to a combination of cultural/technological and habitual/experiential criteria that demonstrate the importance of human agent and, therefore, potters' choices and surpass the superficial environmental factors and ecological constraints.

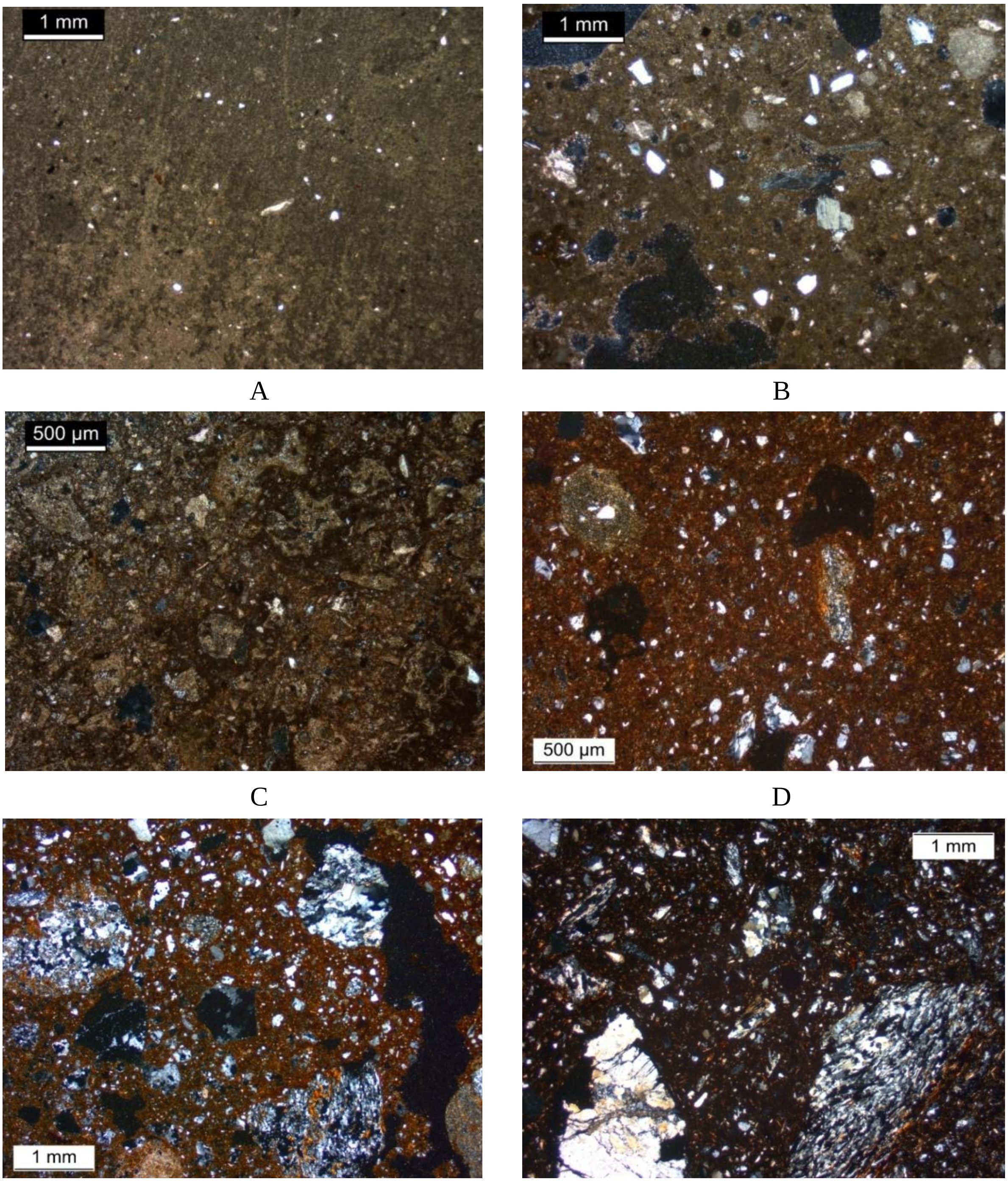


Figure 5.11: Micrographs of geological sample fabrics. A. Fabric 1: GS1/2015; B. Fabric 2: GS11/2015; C. Fabric 3: GS33/2016; D. Fabric 4: GS2/2015; E. Fabric 4: GS14/2015; F. Fabric 5: GS5/2015. Images taken in XP.

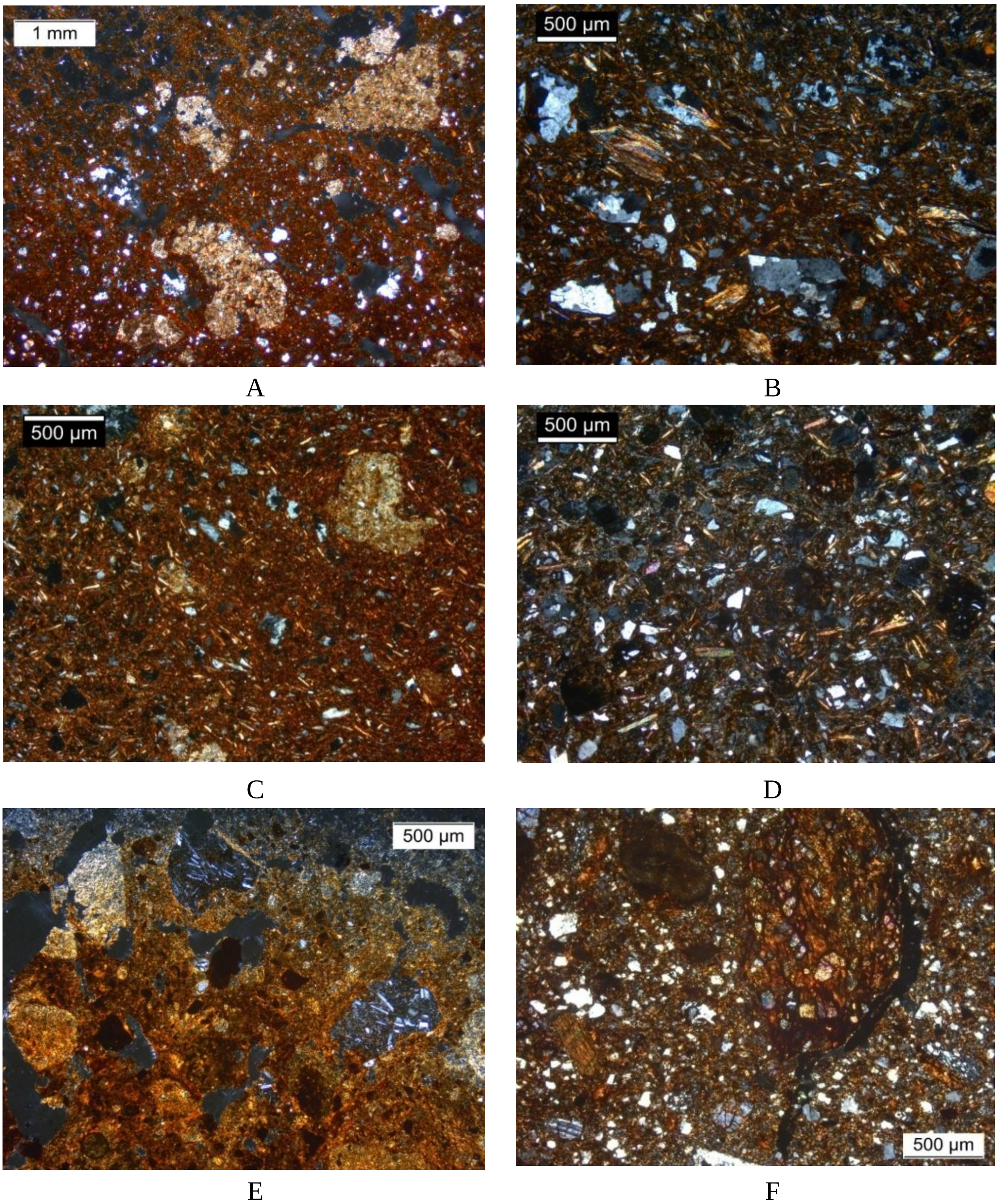


Figure 5.12: Micrographs of geological sample fabrics. A. Fabric 6: GS6/2015; B. Fabric 7: GS23/2016; C. Fabric 7: GS42/2016; D. Fabric 8: GS20/2016; E. Fabric 9: GS4/2015; F. Fabric 10: GS13/2015. Images taken in XP.

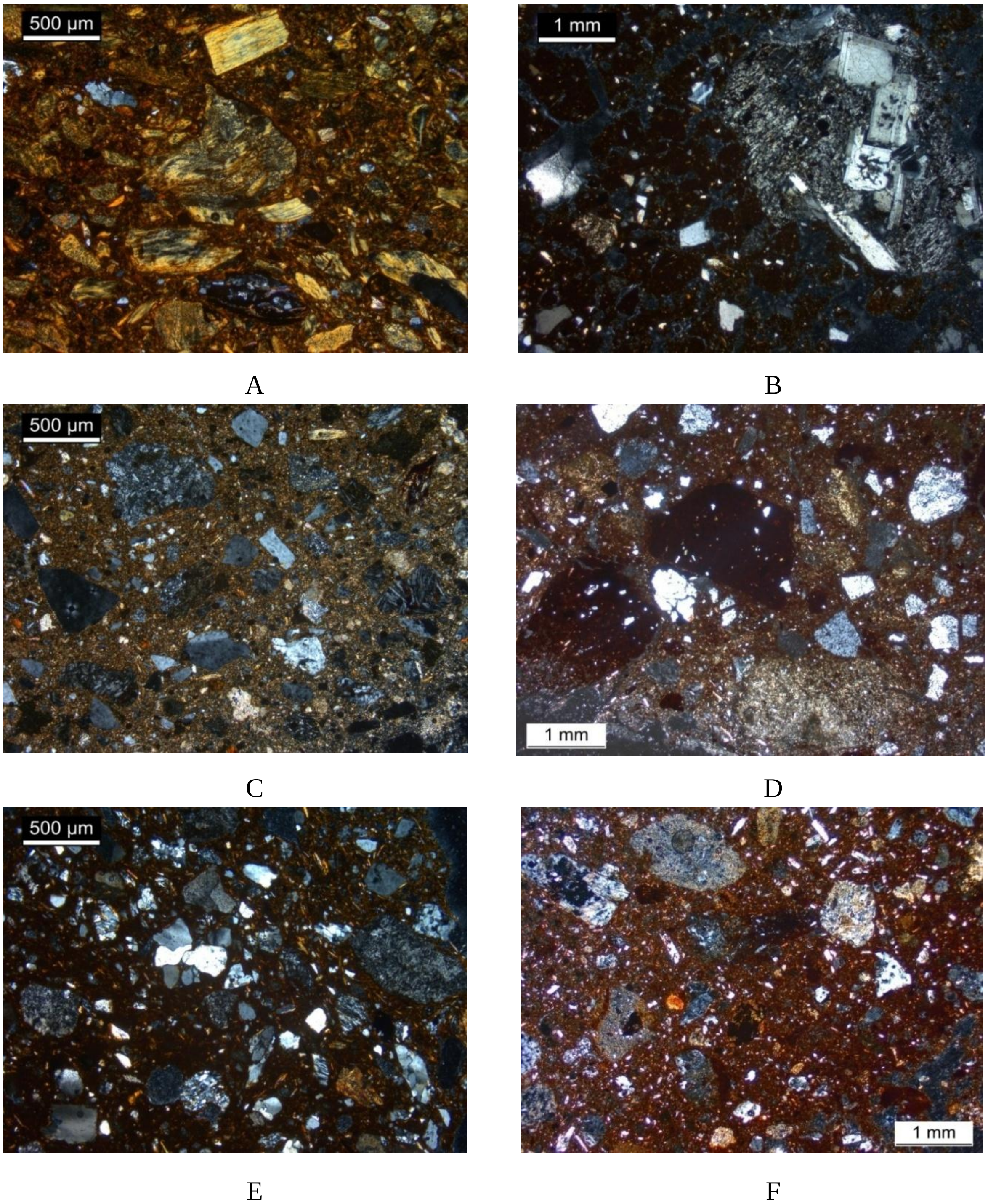


Figure 5.13: Micrographs of geological sample fabrics. A. Fabric 11: GS24/2016; B. Fabric 12: GS29/2016; C. Fabric 13: GS32/2016; D. Fabric 14: GS2/2015; E. Fabric 15: GS34/2016; F. Fabric 16: GS9/2015. Images taken in XP.

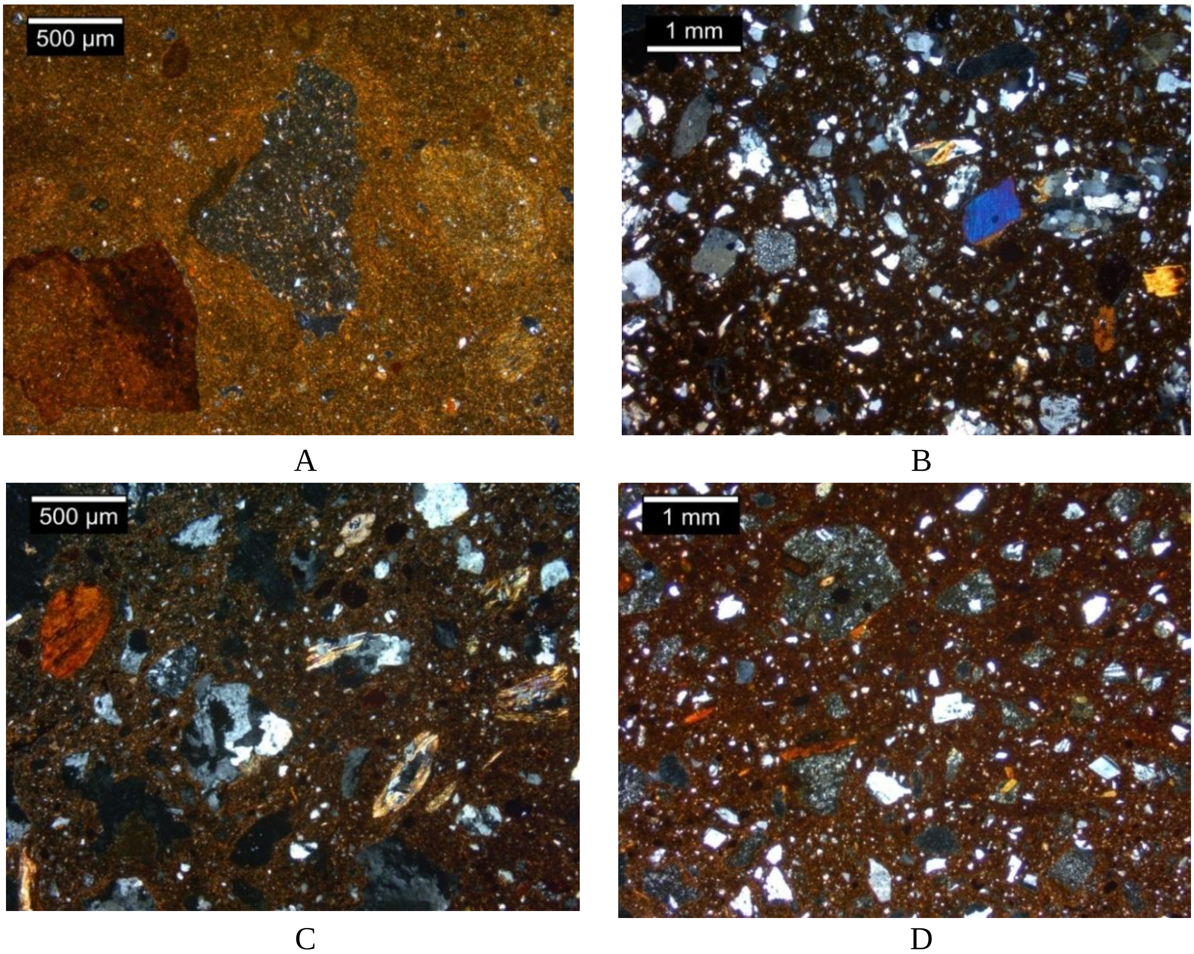


Figure 5.14: Micrographs of geological sample fabrics. A. Fabric 17: GS41/2016; B. Fabric 18: GS28/2016; C. Fabric 18: GS43/2016; D. Fabric 19: GS44/2016. Images taken in XP.

5.7.7 Petrographic analysis of the modern ceramic samples

The preparation and examination of these ceramic samples followed the typical procedure as in the ancient pottery samples. A number of 9 fabric groups have been distinguished (Tab. 5.4). More detailed information of each sample is given in Table I.4 (Appendix I).

Fabric group	Sample No.	Petrographic features
Fabric 1: Fine with sand metamorphic inclusions	CS 1, CS 4	Fine micaceous groundmass and sparse coarse fraction comprised of quartz-muscovite schist fragments, polycrystalline quartz, rounded limestone, rare pyroxene and altered/serpentinised phyllite, and very rare volcanic rock fragments. It can be linked with Fabric 18 (see Section 5.7.6)
Fabric 2: Coarse metamorphic (quartz-mica schist and dark phyllite)	CS 2, CS 3	Consists of metamorphic rock fragments (mainly polycrystalline quartz and quartz-muscovite/biotite schist fragments and their constituent minerals, dark orange-red phyllite, as well as limestone, red TCFs, and rare greywacke fragments. It can be linked with Fabric 8
Fabric 3: Coarse with common chlorite aggregates	CS 5	Consists of chlorite laths and aggregates/schist fragments, rare epidote/clinozoisite aggregates and pyroxene, and very rare volcanic rock fragments. It can be linked with Fabric 11 (GS24/2016)
Fabric 4: Coarse, well-packed with quartz-rich metamorphic rocks	CS 6	Consists of common sand- and silt-sized quartz and weakly-banded quartz-rich metamorphic rock fragments (with thin bands of biotite or iron oxides). It can be probably linked with Fabric 5
Fabric 5: Medium-coarse with bioclastic limestone and metamorphic rocks	CS 7, CS 11	Consists of a highly calcareous content in the form of micritic fragments that occasionally merge with the groundmass and elongate bioclasts, especially in CS 11. It also includes medium-grade metamorphic rock fragments (mainly quartz-muscovite schist with iron oxides and fewer phyllites and chlorite-rich rocks) and mudstone/clay-rich fragments
Fabric 6: Fine/Very fine micaceous with evidence of clay mixing	CS 8, CS 9, CS 10	Consists of a very fine micaceous groundmass, i.e. CS 8 contains mainly fine biotite and the rest a combination of white mica and biotite. The clay base is most probably calcareous and the presence of common red TCFs in rounded form or striations is indicative of the admixture of two incompatible clay sources. CS 10 reflects the coarser version of this fabric
Fabric 7: Coarse well-banded metamorphic rock fragments (quartz-muscovite schist)	CS 12, CS 13	Consists of dominant coarse/very coarse, medium-grade metamorphic rock fragments, mainly well-banded quartz-muscovite schist and muscovite aggregates/phyllites (occasionally oxidised), and their constituent minerals set in a fairly fine groundmass. It finds close similarities with Fabric 7 (see Section 5.7.6) in terms of the common metamorphic rocks and micaceous content, although differences do exist
Fabric 8: Fine/Very fine with evidence of clay mixing	CS 14, CS 16, CS 17	Consists of a very fine groundmass, rich in red TCFs and grey-greyish brown clay striations (calcareous), indicating the admixture of two incompatible clay sources. CS 14 is slightly different and coarser than the rest
Fabric 9: Coarse with naturally-mixed metamorphic and volcanic rocks	CS 15	Consists of common metamorphic rocks (weakly-banded quartz-muscovite schist, polycrystalline quartz, and rare phyllite), very few volcanic rock fragments (fresh porphyritic and with altered/devitrified matrix) and their constituent minerals, as well as few limestone. It can be linked with Fabrics 13 and 15 (see Section 5.7.6)

Table 5.4: Summary of fabrics defined from thin sections of the modern ceramic samples from Samos.

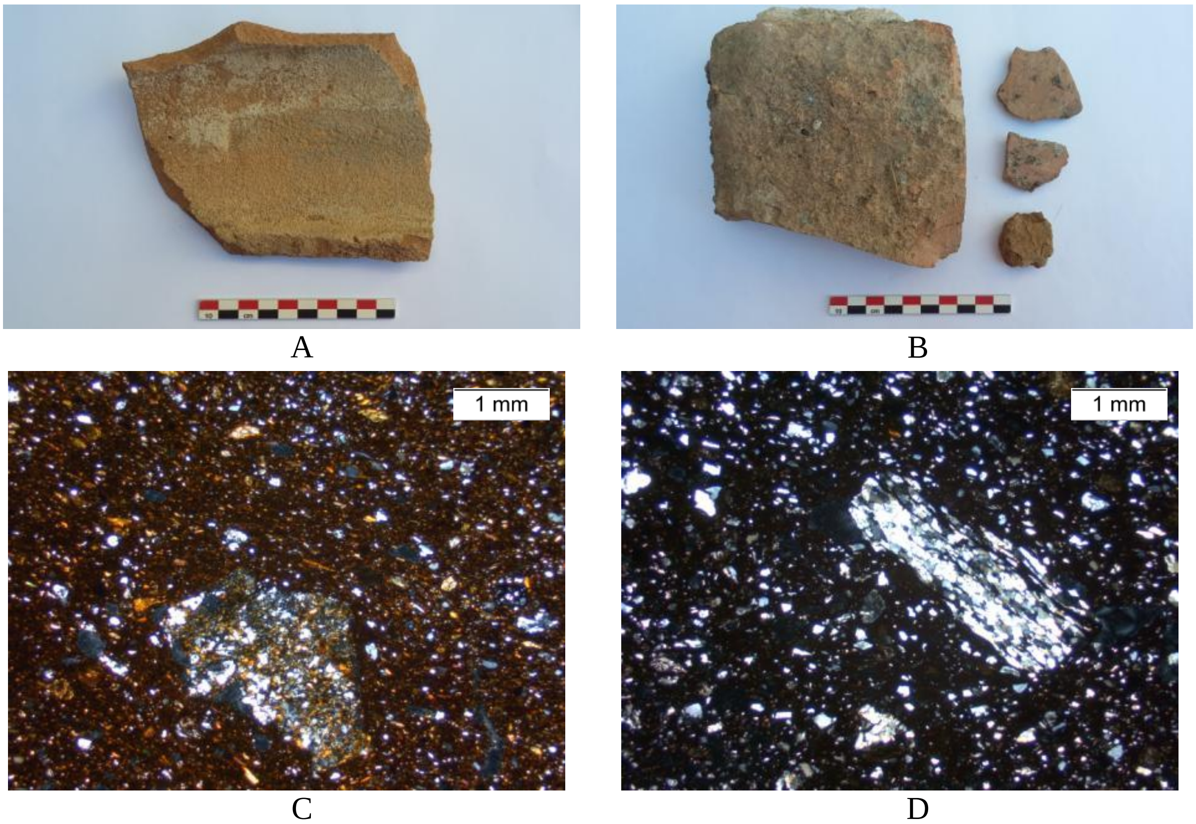


Fig. 5.15: Modern ceramic samples. A. Tile sample from Mavratzei workshop (1960s); B. Brick and pottery wasters from Vathiotis' workshop (Karlovassi, 1950s-1960s); C. Fabric 3: CS 5; D. Fabric 4: CS 6. Images C-D taken in XP.

Summary of the results

The analysis of modern ceramics and kiln wasters[12] (Fig. 5.15:A-B) was expected to reveal a compositional link between the raw material samples and ancient pottery samples, on the basis of their presumed relation to their place of deposition and immediate association with the nearby workshops/kilns. A number of different compositional groups could be distinguished. More particularly, Fabrics 1 and 2, being related to workshops operated in the immediate vicinity of Heraion, revealed very good matches with both raw material and ancient pottery samples, similarly to Fabric 3 that can be linked with Mavratzei-Spatharei geographical area and the ophiolite-serpentinite deposits. Other samples sharing the same area of deposition were found to belong to distinct fabrics, e.g. from Mavratzei (Fabrics 3-6; Fig. 5.15:C-D), or the reverse (Fabrics 5 and 6), indicating a comparable varied picture as in the raw material samples, due to inherent heterogeneity within alluvial or metamorphic-related formations in the Chora plain. Fabric 7 is fairly distinct from the rest and is assumed as being originally

[12] No accurate dates of manufacture could be retrieved, but the majority are estimated to date between 1950 and 1970 (see Sections 5.7.1-5.7.2).

imported to the island or representing sources that are unknown among the raw materials and ancient pottery fabrics. Interestingly, Fabric 5 (especially CS 11) was found to contain elongate bioclasts such as those known in certain pottery fabrics (e.g. Fabrics 6C and 13; see Sections 8.3.5.3 and 8.3.8 respectively). Finally, Fabrics 6 and 8, although being distinctive and related to different workshops in Mavratzei and Karlovassi respectively, are very fine and share important textural and compositional similarities with the fine micaceous ancient pottery pastes of the EB III period (Fabrics 14-17; see Sections 8.3.9-8.3.12) in terms of raw materials processing and firing. Although some good associations were identified, these cannot be taken as direct evidence for reaching secure conclusions regarding provenance determination. Instead, they are used comparatively as a general guide to the similarities or differences from ancient material.

5.8 Discussion

This chapter has focused on an overview of the geology of Samos, and more specifically the formations and deposits dominating the SE part of the island, where Heraion is located. This bibliographical information, alongside the geological maps, provided the core data for establishing the profile of locally-manufactured pottery through petrographic analysis of selected samples (refer to Chapter 7). Nevertheless, it should be kept in mind that the present landscape of the Heraion plain resulted from millennia of geological transformation and that human presence in the area had a strong impact since the NL period.

Although by no means exhaustive, the bibliographical research has served as the basis for planning the geological prospection programme and for the identification of possible raw material sources. The clay sampling was preceded by an ethnoarchaeological survey that focused on the known and newly-identified ceramic workshops or kiln sites on the island. The main categories of materials identified in the geological prospection and/or having been used in the modern context of ceramic production include:

- red/brown colluvial/alluvial clays or sediments from the immediate environs of Heraion, related to the metamorphic Ambelos nappe;
- pale-colour marly sediments, mainly derived from marine deposits; these are not ideal for pottery manufacture;

- grey clays have been reported at the vicinity of Heraion but could not be identified by the author;
- red clays of good quality were identified at *Keramidias,* N of Mavratzei; these can be correlated with the clay sources exploited by traditional/modern potters at Mavratzei;
- brown loose sediments in the vicinity of Mavratzei were found to closely match the fabric of bricks and tiles.

This work has provided insights into the potential exploitation of several raw material sources. Good correlation between evidence from modern ceramics and clays collected by the author provide strong support towards the geological provenance of certain sources. There are a number of multi-causal criteria that remain unchanged over time for millennia in the exploitation of clay sources, a topic that has been extensively researched in the past ethnographically and archaeologically in various contexts and chronological periods (e.g. Arnold 1985; Masucci and Macfarlane 1997). Although much emphasis has been placed on the distance [13] of clay sources to the kiln site/production centre and the technical/functional features of given resources, deriving from ceramic ecology theories (cf. Arnold 1993, 3-5; 2006), other criteria also exist that surpass environmental/ecological factors and relate to cultural, social, and technological aspects (e.g. tradition, habit, religion, land tenure, sense of place, indigenous knowledge) (Arnold 2006; 2011, 85-86; Costin 2010). The practices associated with raw material management and procurement are important in that they are informed by social interaction and boundaries imposed by the way these potting communities conceived their landscape, involving the interaction of multiple factors (Livingstone Smith 2000, 38; Gosselain 2008).

To sum up, some of these criteria are: a) the proximity of raw material sources to the workshop or household, depending on the context and mode of production, b) the proximity to water and fuel, c) familiarity with the local raw materials and potential risk in the exploitation of new resources, d) cost of transportation and distance to the kiln site, e) tradition and established practice, and f) local demand. The most frequently cited factors in the investigation of such issues is the availability/suitability and proximity/distance to the raw material sources, as nearby ones are most likely preferable because their exploitation is more efficient. According to Arnold's 'exploitable

[13] This criterion differs between ancient and modern potters, as the latter had at their disposal a broader range of transportation options enabling the exploitation of sources in longer distances from the workshops.

threshold model' (1985, 35-60, tab. 2.1) the procurement of these resources usually takes place within a radius of 1km or less from the workshop for the collection of clay and temper, following his threshold A, while as the distance extends beyond threshold B (7km for clay and 6-9km for temper) the exploitation system would require modification for being uneconomic.

Threshold A model is generally applicable in the case of traditional and modern potters of Samos. More specifically, the preferred resources for Koulouris' workshop at Heraion were readily accessible in a distance of less than 1km, which could also be the case for the ancient potters, taking in mind that in the immediate area there was available water by the Imvrassos River. In a similar fashion in Pagondas, Pyrgos, and Ydroussa (*Keramida*) the craftsmen used to exploit the available resources in close proximity to the workshops. A more complex picture is revealed in Mavratzei and Karlovassi workshops, possibly related to the larger number of potters operating, compared to the previous sites. According to ethnographic data, the potters in Mavratzei exploited the rich resources to the N of the village (*Keramidias*), occasionally exceeding threshold A. In Karlovassi the various workshops must have taken advantage of a number of different raw material sources. Depending on the position of the workshop, the majority fall into threshold B (Platanos, approximately 7-9km), while others between threshold A and B (Profitis Ilias, approximately 2-3km).

The geological samples were assessed with reference to the variability of formations and the availability of different kinds of raw material sources for the manufacture of pottery. The variability within and among different geological formations, also due to the complex geological background of Samos, became evident by the large number of fabrics identified through the petrographic analysis of the experimental thin sections, the majority of which were found to represent metamorphic environments. Given that the latter reflects the dominant geological formation on the island, the petrographic results not only confirmed the varied nature of the geographically-restricted area under examination, they also demonstrated that material deriving from different types of sources can be similar in composition. This is also reflected in the composition of the archaeological ceramics (see Section 7.3.1).

Furthermore, the results indicate the difficulty in distinguishing between deposits of the same geological formation. There is no doubt that chemical analysis can reveal meaningful compositional differences between geological formations (cf. Hein *et al*. 2004a; 2004b) to a certain degree. Nevertheless, several ethnographic studies have shown that it is often not feasible to discriminate between human-made decisions and natural alterations in the discrimination between a single or multiple sources or workshops (Buxeda i Garrigós *et al*. 2003). For instance, sometimes the raw materials may have been used directly with no modification, providing more secure suggestions regarding its provenance through its comparison with ancient pottery samples. However, in most cases the analysis may require an examination of all relevant variables (composition, texture, spatial relationship *vs* source location, type, processing), a deeper knowledge of the local sediments, and experimental work to replicate the final products that may have been produced using technological processes such as tempering or mixing. Since the latter processes complicate any behavioural inferences drawn from the composition of ancient pastes, what can be rather examined are community-based patterns of resource use than distinct workshops using clay sources in a heterogeneous and repetitive geological environment (Arnold *et al*. 2000, 301, 313).

This study will be extended in the future into a large-scale geological prospection and ethnoarchaeological programme, in order to identify how distinctive clays are distributed within given landscapes and what their relation is to other local resources. Furthermore, more detailed analytical work, including also a more careful examination of plasticity by linear shrinkage test, mineralogical analysis by X-ray diffraction (XRD), and chemical composition (NAA), will be carried out.

Having established a thorough understanding of the geology and ceramic landscapes of Samos, the following chapters (Chapters 6 and 7) will explore at different levels of resolution the degree of variability of the local ceramic technological tradition at Heraion.

CHAPTER 6: Macroscopic characterisation and diachronic analysis of the pottery: classification and variability of fabrics, surface treatments, and forms

"The creation of a comparative unit for pottery such as 'ware' based on both paste composition and surface treatment is a variation of the classic 'apples and oranges' problem. These two classes of attributes are technologically independent and should not be combined into a single organizational level" (Rice 1976, 539).

"Macroscopic ceramic fabric analysis (MACFA) is to ceramic analysis what surface survey is to archaeology: it provides the big picture" (Moody *et al*. 2003, 105).

6.1 Introduction

The principal aim of this chapter, alongside Appendix II, is to contribute to the establishment of a complete ceramic sequence and the formation of an intra-site classification and characterisation of the stratified pottery assemblages from prehistoric Heraion. This is undertaken through an in-depth analysis of three different pottery assemblages excavated in 1953/1955 in the area of the Hera Temple and 1981 and 2009-2013 from the area north of the Sacred Road. The combination of these assemblages provides a complete chronological picture of the Heraion's habitation during the EBA. However, due to constraints imposed by the nature of the old material excavated in the 1950s and 1980s respectively, which only consists of diagnostic sherds as the non-diagnostic were discarded by the excavators, the 2009-2013 material is more suitable for quantitative analysis. Before turning to the detailed presentation, some overall features of the material may be introduced.

The pottery assemblages can be securely linked to architectural phases and their related household contexts of the EB and a particular focus is placed on layers corresponding to floors, destruction deposits, and various constructions (hearths, platforms). Certain layers with mixed pottery or unclear contexts were excluded. The diachronic classification of the pottery by contexts can contribute to the establishment of both a local and a regional sequence that will enable discussions on the chronological correlation between Samos and the eastern Aegean/western Anatolia with the central Aegean. References are made regarding stratified context and chronological position within Heraion's phasing. Amongst other important topics addressed through the macroscopic characterisation and contextual analysis of the pottery, these data could clarify the often unclear transition from the Ch to the EB I period. An attempt to identify pottery joins between different units belonging to the same architectural phase was also made in order to understand the distribution of pottery and relation of various units within the excavated trenches. Nevertheless, the spatial distribution and assessment of contexts is only examined in a preliminary fashion.

This chapter is organised by the three variables identified during macroscopic processing and visual examination of the pottery, including fabric and raw material variability, surface treatment and decoration modes, and shapes, and discusses them with respect to fabric composition, forming and finishing techniques, and firing. Before moving on to the analysis and presentation of the macroscopic fabric/ware groups, it is necessary to clarify that any kind of material categories and classes are artificially created by the researcher and that they comprise analytical/technical tools rather than representing 'real' technological decisions by the ancient potters. One should also bear in mind that every macroscopic, morphological or typological scheme, with its advantages and limitations, is used most effectively to answer possible questions addressed by the researcher who designed it, even if it partly incorporates existing classes from other published works. Nevertheless, this stage of analysis is important in that it establishes the level of resolution that can be gained without further microscopic examination given also that the majority of fabric studies undertaken in EB pottery from Aegean sites relies on macroscopic criteria.

6.2 Recoding and classification of macroscopic fabric groups: clay paste variability

The sorting of the material into fabric groups was based on personal macroscopic observations for each deposit and further sub-division by shape. The recording system followed is primarily based on the guidelines given by Orton and Hughes (2013, 67-75, 231-242) and 'The Study of Prehistoric Pottery' (PCRG 2010, 16-28), while taking into account more recent studies that dealt with various Aegean sites and chronological boundaries (Moody *et al*. 2003: 'Sphakia Survey'; Kiriatzi 2003, 124-126: 'Kythera Island Project Survey'; Pentedeka *et al*. 2010: 'Antikythera Survey Project'; Broodbank 2007; Hilditch 2008; 2013: Keros excavations; Gauss and Kiriatzi 2011: Kolonna on Aegina).

The macroscopic features recorded were identified in hand specimen (colour, hardness, feel, texture, lustre, porosity, etc.), in most cases through the examination of fresh breaks across the core or from the surface in the plain ware vessels, using a combination of criteria in order to determine preliminary compositional and technological aspects (groundmass, coarse fraction, fine fraction, nature/size/sorting of inclusions, forming technique, firing, surface treatment and decoration) of the pottery manufacturing sequence. This information was recorded in printed forms and then transferred to Excel files. Each group is prefaced with a table summarising this information (see Appendix II). The colour was described using Munsell Soil Color Chart references, but in addition a standardised set of more descriptive colour names was developed (cf. Cuomo Di Caprio 2017, 112-114). In some cases only a rough colour description was made, due to the often decolourised surfaces and variation observed.

The identification of the various inclusions with a low magnification lens or USB handheld microscope is not an easy task, since it requires thorough geological knowledge and familiarity. However, the systematic study and description of the inclusions colour, size, shape, range, density and distribution and the use of a standardised terminology for each type enabled the possible identification of a number of the most common rock forming minerals or rock fragments and the division of fabric families or individual fabrics. Occasionally, the presence of visually very diagnostic inclusions or other features (paste colour, surface treatment) might help define a fabric. The various groups are given distinctive, descriptive names that reflect the development of analysis during processing of the sherd material. Infrequently, there are sub-groups representing minor compositional or technological variations. The macroscopic fabric group classification is based on a combination of several criteria: abundant occurrence of the same type of inclusions, similar density and distribution of inclusions, as well as similarities in fabric colour and texture. This information is correlated, where possible, with the microscopic results (Chapter 7) and an attempt is also made to broadly distinguish local fabrics from possible imports. The definition of 37 fabrics accounted for almost all the ceramic material from Heraion. A list of all identified fabrics is presented in Table 6.1 with information about vessel count in the total sherd material. The group-by-group treatment of the material found in Appendix II includes a description of each fabric, a list of associated shapes and surface treatments, and a discussion of technology and provenance. The EB I-II early pottery derives from a much more limited area than the EB II developed/late-III material.

Chronology / Macroscopic groups	Ch	Ch/EB I	EB I	EB II early	EB II developed	EB II developed/late	EB II late	EB II-III	EB III	EB III/MB	Unclear	**Total**
1	50	18	9	14	10	2	-	-	2	2	4	111
1A	-	-	-	-	-	-	1	-	-	1	-	2
2A	-	-	15	14	17	11	-	-	-	-	2	59
2B	-	-	1	3	4	-	4	-	-	-	4	16
3	-	-	-	3	4	11	4	7	11	-	9	49
4	-	9	3	25	50	-	1	15	2	-	-	105
5A	65	11	139	80	35	-	-	-	-	-	22	352
5B	-	3	23	35	180	-	5	-	8	-	25	279
5C	-	-	5	5	30	3	3	19	8	-	11	84
5D	-	-	-	-	2	1	3	10	23	-	10	49
5E	-	2	-	-	2	1	-	8	7	-	-	20
6	-	-	-	-	69	22	43	4	-	-	12	150
7A	-	-	-	-	7	5	8	-	-	-	5	25
7B	-	-	-	-	15	-	1	-	5	-	4	25
8	-	-	-	-	3	6	9	-	-	-	1	19
9	-	-	-	-	-	6	10	-	-	-	2	18
10	-	-	-	1	4	16	6	-	314	40	49	430
11	-	-	-	-	-	-	-	-	22	-	2	24
12	-	-	-	-	-	-	12	-	53	-	-	65
13	-	-	6	5	4	-	-	-	-	-	4	19
14	-	-	-	-	-	-	15	-	-	-	-	15
15	-	-	-	-	-	-	1	-	-	-	-	1
16	-	-	-	2	3	-	1	-	13	-	7	26
17	-	-	-	-	-	-	-	-	1	-	-	1
18	-	-	-	-	-	-	-	-	1	-	-	1
19	-	-	-	-	-	-	1	-	3	-	-	4
20	-	-	-	1	-	-	-	-	-	-	-	1
21	-	-	-	-	-	-	-	-	1	-	-	1
22	-	-	-	-	-	-	2	-	-	-	-	2
23	-	-	-	1	-	-	-	-	-	-	-	1
24	-	-	-	-	1	-	-	-	-	-	-	1
25	-	-	-	-	1	-	-	-	-	-	-	1
26	-	-	-	-	1	-	-	-	-	-	-	1
27	-	-	-	-	-	-	-	-	-	1	-	1
28	-	-	1	-	1	-	-	-	-	-	-	2
29	-	-	-	-	1	-	-	-	-	-	-	1
30	-	-	-	-	-	-	-	1	-	-	-	1
31	-	-	-	-	-	-	1	-	-	-	-	1
32	-	-	-	-	-	-	1	-	-	-	-	1
33	-	-	-	-	-	-	1	-	-	-	-	1
34	-	-	-	-	-	-	-	-	-	1	-	1
35	-	-	-	-	-	-	-	1	-	-	-	1
36	-	-	-	-	1	-	-	-	-	-	-	1
37	-	-	-	-	-	-	2	-	-	-	-	2
Total	115	43	202	189	445	84	135	65	474	45	173	**1970**

Table 6.1: Quantification of macroscopic fabric groups by period.

I. Coarse green-blue schist or serpentinite (ophiolite-related) fabric groups

This category includes the groups that contain greenish grey or bluish elongate inclusions and occasionally those with a brown chalky texture. They are coarse and rich in organic matter.

- Macroscopic Group 1 (MG1): characterised by a range of reddish brown/reddish yellow/greyish brown (5YR 5/6-6/6, 10YR 5/3) paste colours with varied coarse inclusions in a non-calcareous clay paste (Fig. 6.1:A-B). The fabric ranges from very coarse to medium-coarse with most common moderately-sorted yellowish brown/light grey to greenish-grey inclusions and frequent organic temper. Common shapes are cheesepots, cooking pots, basins, amphorae with or without incised handles, and less common various types of jugs such as cut-away spouted jug, wide-mouthed jug, barbotine ware jug, or jars and a one-handled cup. It corresponds mainly to the Ch and EB I period and the surface treatment is predominantly plain/granular and rough or occasionally red slipped on the interior of cheesepots. The EB I-II early amphorae have incised decoration on the handles. A medium-coarse version (MG1A) is also distinguished.

- Macroscopic Group 2 (MG2): this group appears to be consistent with a finer version of MG1, containing similar types of inclusions. Two varieties may be distinguished in terms of the quantity of organic temper, presence/absence of certain inclusion types, size and frequency of inclusions, hardness, and surface treatment. The main inclusion types are yellowish brown chalky rock fragments that predominate in the previous group, as well as those with a metamorphic/sedimentary origin (Fig. 6.1:C). It also contains frequent felsic, light-coloured mineral inclusions such as quartz and feldspar crystals and occasionally mica. The paste is usually soft and occasionally slightly hard and the colour ranges from reddish yellow/yellowish red/red-orange (5YR 5/6-6/6, 2.5YR 5/6-5/8-6/8) surfaces and wall margins with a dark grey/reddish grey/black and rarely a light grey core (2.5YR 5/1, 5YR 4/1-3/1, 7.5YR 5/1-3/1). Very few examples preserve a thick reddish brown-red/weak red slip on the exterior (2.5YR 5/6, 10R 5/4-5/8), possibly originally burnished. It is most probably higher fired than the previous group. The shapes represented are coarse storage vessels like pithoi, jars, jugs, and basins.

- Macroscopic Groups 29 and 30 (MG29, MG30): these loners differ from the fabric groups described above, but are included in this category due to the presence of angular bluish/grey or grey/greenish inclusions found in the MG1 and MG2 (Fig. 6.6:A).

II. Volcanic fabric groups

This category includes those groups with light brown/grey soft and sr inclusions identified as volcanic rock fragments, as well as common shiny black and sa inclusions or golden mica (biotite). This is not to suggest that both groups are of the same composition, but that they share some basic features. In fact, MG4 is very distinctive and most probably of a non-local provenance (see discussion below).

- Macroscopic Group 3 (MG3): the clay paste is coarse to very coarse, light/reddish brown to greyish brown (5YR 6/3-6/4, 7.5YR 6/3-6/4) and usually has a dark core (5YR 4/1-4/2). It is characterised by a range of non-plastic inclusions, the most characteristic being light brown chalky ones with a soft and porous texture (Fig. 6.1:D). These belong most likely to volcanic rock fragments and their association with black mafic inclusions provides additional evidence towards this interpretation. These inclusions are similar to those identified in MG4. Other non-plastics include white/grey or transparent crystalline minerals belonging to quartz and feldspar grains, as well as elongate silver rock fragments that most probably correspond to metamorphic rocks. The majority of vessels are also rich in organic temper. A first identification of this group was made by Milojčić (1961, 40, pls. 32:1-5, 40:28, 48:31), in which he assigned a group of large, open storage vessels with relief decoration and a dark red/reddish brown, smoothed exterior surface. It is predominantly used during the EB II developed and late period for the manufacture of pithoi with relief decoration and less commonly jars with horizontal handles, jugs, and shallow bowls. Its distinction from MG5 is not always feasible.

- Macroscopic Group 4 (MG4): this is one of the most distinctive fabrics in hand specimen. It is distinguished by a medium-coarse/coarse clay paste with reddish yellow/reddish brown/brown (5YR 6/6, 2.5YR 6/6, 7.5YR 6/4-5/2) matrix that usually exhibits a core-margin differentiation of dark grey/black (7.5YR 5/1-4/1) and reddish yellow/red (5YR 6/6, 2.5YR 5/6-6/6) colour respectively, suggestive of an incompletely oxidising firing atmosphere. The fabric is usually hard and the texture of the fresh break is predominantly rough. It is characterised by frequent to common, moderately to poorly-sorted inclusions comprised of fine sparkling and shiny golden, a-sa inclusions that most probably represent biotite mica laths, fine to medium angular dark grey/black translucent/glassy inclusions, chalky-white sa-r rock fragments, as well as frequent amount of organic temper (Fig. 6.1:E-F). Burning out of the organics has created common to few elongate voids across the majority of the samples.

This fabric is macroscopically linked with MG1 recorded at Kolonna on Aegina (Gauss and Kiriatzi 2011, 47-49, tab. 12, figs. 17, 29-31) and the 'Volcanic macroscopic group' (V10) from Dhaskalio on Keros (Hilditch 2013, 474). However, a stronger link is suggested here with the 'Obsidian Ware' from Emporio on Chios, which is characterised as imported at the site and known to span Phases VII-II (Hood 1981, 168-169). This group at Emporio is distinguished by the presence of hard, shiny, black angular particles that resemble obsidian and it corresponds to large storage jars/pithoi during Phases V-IV (Hood 1981-1982, 308, 358, 434, pl. 80 no. 1362). Aside from the fabric, similarities exist also in shape and surface treatment. The latter appears with the characteristic scoring traces, as those known from Heraion, and have been linked by Hood (1982, e.g. pl. 104:2397, Period II) with the 'Scored Ware' large storage jars known to have been imported in middle-late Troy I and II from further east in Anatolia (Blegen *et al*. 1950, 39, 53-54, 222). A number of 79 sherds assigned to the so-called 'Obsidian Ware' were also recovered from the Halasarna area on Kos, belonging mainly to closed storage vessels that date from LN II-FN I to EB III, although predominantly to EB. A provenance in close proximity to Kos is suggested by Georgiadis (2012, 24-25). Lastly, very few possible vessels of this ware/fabric were recently identified at Tavşan Adası 2 (Didyma) (K. Eckert, pers. comm., June 2017).

This group covers the period from EB I to EB II early, although there are a few examples that probably fall within the EB II late-EB III period. It is represented by pottery covered with a thick, micaceous red slip and burnish and is comprised mainly of thick-walled storage vessels (wide-mouthed open jars/deep bowls and pithoid jars/pithoi), as originally defined by Milojčić (1961, 40, pls. 31:2 and 48:35). The majority of sherds belong to body fragments (0.9cm-1.2cm thick), rim sherds with a characteristic everted angle, and vertical handles with a circular or oval cross-section.

- <u>Macroscopic Group 26 (MG26)</u>: this loner is medium-coarse and contains common dark grey crystalline inclusions and light grey chalky ones, most probably of volcanic origin (Fig. 6.5:D).

III. Metamorphic fabric groups

This category includes more than 1/3 of all ceramic material under study (MG5A-MG5E). Despite the differences between the sub-groups, all appear with various combinations of quartz-rich metamorphic rocks, silver schistose rocks, organic matter, and range from coarse to medium-coarse (Fig. 6.2). Owing to its amount and relative variability, this category is taken as broadly local.

- Macroscopic Group 5 (MG5): this is the largest group and it can be divided into various sub-groups (MG5A-MG5E) on the basis of inclusions, coarseness, and surface treatment modes. It is interesting to note that this group of fabrics was utilised for the manufacture of all functional categories and a range of open and closed vessels of all periods. Despite the effort to separate the sub-groups in terms of diagnostic macroscopic features, it was often found impossible. It has been identified as the local group of fabrics at Heraion, strengthened by the quantity of samples and the large range of vessel shapes and surface treatment modes represented. The variations range from semi-fine to medium-coarse and coarse, but overall a more loose classification is attempted here. All sub-groups are interlinked by the presence of a number of non-plastic inclusions. These include frequent crystalline inclusions such as quartz and quartzite or polycrystalline quartz, and a range of metamorphic rocks among which the quartz-mica schist predominates. This is identified as elongate a-sr rocks with silver grey and crystalline white composition and a hard feel. Other metamorphic inclusions comprise of schist composed of red shiny minerals, most probably biotite, and purple/red ones that are less common. Secondary inclusions are composed of limestone, etc. Almost all the samples within this group are characterised by the presence of organic temper, which is considerably more frequent in the early-dated samples.

The most frequently represented shape is the carinated bowl in different varieties according to size and rim profile, and various jar sub-types. Less common shapes are the cooking pots, cheesepots, jugs, pyxides, miniature vessels, vertical and horizontal handles, etc. Furthermore, MG5A is predominantly used in the Ch and EB I periods for the manufacture of bowls, jars, and cooking pots and the surface is usually poorly smoothed; MG5B contains more felsic inclusions and the surface is usually dark grey to reddish grey poorly slipped or burnished and is used for the manufacture of carinated bowls (including footed bowls), jugs, pyxides, and miniature vessels; MG5C contains less organic temper and the clay matrix is red/reddish brown and is used mainly in the EB II period; MG5D has a characteristic dark reddish brown granular feel and is restricted to the EB III period, predominantly for the manufacture of cooking pots; MG5E has a characteristic red/orange-firing fabric and common mica.

IV. Sandy/alluvial fabric groups

This category includes those fabrics with common and well-distributed felsic crystalline inclusions that range from whitish grey to transparent and can be identified as quartz or quartz-rich inclusions.

- Macroscopic Group 6 (MG6): it constitutes a medium-coarse sandy fabric with common white transparent crystalline inclusions (most probably quartz), grey and silver angular ones that relate to metamorphic rock fragments, possible limestone, and few organics that are particularly visible on the surface (Fig. 6.3:A). It is therefore taken as the coarser version of MG5A. This fabric might represent an alluvial metamorphic environment. The paste colour varies from light reddish brown to reddish yellow (5YR 6/4-6/6) to red (2.5YR 5/6-5/8) or brown (7.5YR 5/3), while the core is usually dark reddish grey (2.5YR 4/1) to dark grey (5YR 4/1). Evidence of the surface treatment is usually preserved in the form of a red-reddish brown (10R 4/8-5/6, 2.5YR 5/6) thin to thick slip on both surfaces. Occasionally, the surface treatment gives the impression of a self-slipped effect when it is indistinguishable from the body. This group seems to be associated with the manufacture of shallow bowls/plates, deep bowls, two-handled cups, and jugs in the EB II developed and late periods. The vast majority of the vessels represented derive from the 1953 and 1955 excavations.

V. Quartz and igneous related fabric groups

This category includes fabrics with common felsic inclusions of a whitish or light grey colour and hard feel. These inclusions can be identified as quartz or quartz-rich rocks and they are found in combination with mica-rich elongate rocks, most likely schist fragments.

- Macroscopic Group 16 and 17 (MG16 and MG17): they are characterised by a medium-coarse clay paste light brownish grey (10YR 5/1-6/1-6/2) or light brown/light grey colour (7.5YR 6/4/10YR 7/2). Some examples appear with a dark grey surface

(10YR 4/1-3/1). In general this fabric appears with a soft and smooth feel/texture and a medium hardness. All examples contain common felsic and dark mafic inclusions that probably relate to an igneous granitic environment (Fig. 6.4:E). The vessels represented are predominantly decorated with incised motifs and belong to pyxides and jars of various types dating to EB II and III. On the basis of morphological features these are taken as non-local products.

VI. Micaceous quartz fabric groups

This category is reminiscent of the Quartz fabric groups but differ by the finer composition and abundance of silver mica. The mica gives these fabrics a shiny appearance. These groups correspond to cups of various types and small bowls or jugs of the EB II developed and late, implying a probable off-island provenance.

- Macroscopic Group 7 (MG7): ranges from fine to medium-coarse and is represented by two different surface treatment modes. It may be distinguished into MG7A and MG7B. MG7A is characterised by very few dark grey or transparent inclusions, most probably quartz or feldspar grains, dark grey/silver angular and elongate ones that belong to metamorphic rock fragments, very few to rare light brown (possibly calcareous), and dominant sparkling, silver mica (Fig. 6.3:B). All vessels share the same red slipped and burnished exterior surface (10R 5/8-6/8), which is always thick and highly micaceous, creating a visual contrast with the light-coloured clay paste and giving the vessels a metallic texture. Nevertheless, regarding the interior surface the majority appear with a dark grey/black colour (2.5YR 2.5/1, 5YR 3/1), or in one example with a black topped rim on the exterior, as is the case in MG9. Occasionally, the surface preserves imprints of fine organic matter, probably deriving from the treatment or application of the slip. MG7B is the coarser version of MG7A and contains more quartz. All vessels share the same red slipped and burnished surfaces. A first identification of this 'ware' was made by Milojčić (1961, 40), who described this group of vessels with a highly polished/burnished red slip on the exterior surface and a dark grey/black on the interior as 'excellent crafted ware'. This fabric is used for the manufacture of EB II late drinking vessels, such as two-handled bowls, tankards, bell-shaped cups, short-necked cups, depas amphikypella, etc.

- Macroscopic Group 8 (MG8): this rare group is characterised by the presence of dominant silver mica, most probably muscovite laths, set in a generally fine groundmass. Other inclusions comprise of fine a-sa transparent minerals with a white/grey colour, most probably quartz, and coarser elongate ones in dark grey/silver colour that might represent mica-rich metamorphic rock fragments (Fig. 6.3:C). The paste colour ranges from light to dark grey (10YR 5/1-4/1) and the surface is black slipped and burnished. The vessels represented are cups of the same types as in MG7 with the addition of a tripod bowl, pedestalled bowls/fruitstands, and one flask-shaped jug of the EB II late period. Its rarity and shape repertoire represented may imply an off-island provenance.

VII. Limestone and calcite-tempered fabric groups

This category includes all fabrics with intentionally-added opaque and angular inclusions that can be identified as limestone or calcite. The groups vary between one another on the basis of the size of inclusions, their density, and other characteristics of the clay paste in general. The low frequency of samples and repertoire of vessel shapes represented imply an off-island provenance for these groups.

- Macroscopic Group 9 (MG9): this rare group is macroscopically very distinctive and characterised by angular limestone or calcite fragments, which have been intentionally added in the clay paste (Fig. 6.3:D). The colour ranges from brown (7.5YR 6/3-6/4) to light reddish brown/reddish yellow (5YR6/4-6/6) or red (2.5YR 5/6-6/6). All samples preserve a red/light reddish brown thick slip layer on the exterior (10R 5/6-5/8, 2.5YR 6/4), although the rim and upper part exhibit a characteristic black colour (black-topped) which is most probably intentionally achieved. The interior surface is dark-fired (2.5YR 2.5/1). Both surfaces are burnished and occasionally lustrous with a metallic appearance. Similarly to MG7 and MG8, the vessels represented are EB II late two-handled bowls and cups of various types.

- Macroscopic Groups 22-25 (MG22, MG23, MG24, MG25): these loner fabrics are linked through the limestone inclusions, but are otherwise distinguishable (Fig. 6.5:A-C). They all correspond to closed jars or transport jars with incised handles of the EB II period.

VIII. Fine and semi-fine micaceous fabric groups

This category includes those fabrics with a fine micaceous paste and in most cases rare to absent inclusions of other types. It is almost entirely restricted to the EB III period for the manufacture of a range of different vessel types.

- Macroscopic Group 10 (MG10): this constitutes one of the largest groups and is restricted to the EB III period. It is taken as local. It is generally very fine to fine and rich in mica and contains rare, coarse non-plastic inclusions, such as metamorphic rock fragments and polycrystalline quartz (<0.65mm). The most prominent characteristic of this fabric is the dominant presence of small to medium mica laths, mainly biotite, and fine monocrystalline quartz (<0.2mm). The paste colour ranges from bright orange to yellowish red or light red (2.5YR 6/8, 5YR 6/8, 7.5YR 6/6), with a similarly coloured or dark grey (5YR 4/1), grey-bluish, or pinkish red core (Fig. 6.3:E-F). In general this fabric appears with a characteristic smooth texture and soapy-powdery or dusty feel and all features imply a moderate to high-temperature and a predominantly oxidising firing. Although the majority of examples appear with a plain, smoothed surface, some rare vessels preserve red/reddish brown slip layers (2.5YR 6/4, 10R 5/6-6/6). Where the slip is preserved it appears thick and well-burnished and, therefore, it is assumed that the majority of vessels, if not all, were similarly covered with a slip and burnish. The vessel repertoire includes shallow or hemispherical bowls, bowls with S-shaped rim, two-handled or handleless cups (*Samos Becher*), neck-handled ovoid jugs with trumpet mouth, collared jars of various profiles and horizontal handles, 'crown' lids, grooved handles, and other less well-represented shapes. Due to its fine composition, this fabric appears with a number of varieties, but further analysis would be required for a better resolution and provenance determination.

- Macroscopic Group 11 (MG11): it relates to MG10 on the basis of its fine micaceous clay paste, although differing by the greyish brown/brownish grey colour (10YR 5/2-6/2) and soapy feel (Fig. 6.4:A). It is found to be consistently used for the manufacture of askoi and pyxides with incised decoration dating to the EB III period.

- Macroscopic Group 12 (MG12): it may be distinguished into fine and medium-coarse varieties. The former provides a link with MG10 and the latter appears with a granular texture with sand inclusions (Fig. 6.4:B). The paste colour is reddish yellow to light red (5YR 6/6-6/8, 2.5YR 6/6). The surface treatment is usually not preserved, but some examples appear with a red/light red (2.5YR 5/6-6/6, 10R 6/6) or light reddish brown (5YR 6/4) slip on both sides. It was consistently found to represent wheel-made or wheel-finished plates of the EB II late and mainly EB III periods.

IX. Blue/red schist or phyllite fabric groups

This category includes those fabrics with blue/red elongate inclusions that can be identified as schist or phyllite. The vessels represented are transport jars and jugs, strongly implying an off-island provenance for these fabrics (see discussion below and in Appendix II:24-25).

- Macroscopic Group 14 (MG14): it is very distinctive and is characterised by angular and elongate purple/red metamorphic inclusions, most probably phyllite and a dark red/reddish brown to reddish yellow (2.5YR 5/6-5/8, 5YR 5/4-5/6) coarse clay paste with a soapy-smooth feel (Fig. 6.4:D). It is readily identified macroscopically and it has various parallels from other Aegean sites of the EB II period. It corresponds to the 'Blue Schist' macroscopic fabric group described by Broodbank (2007, 124-125, 179) for the EC II Kavos Special Deposit North on Keros material and is directly comparable with the 'Blue Schist Ware' known from Markiani III-IV on Amorgos (Vaughan 2006, 99-101). It is also called 'Glaucophane-Schist' fabric, 'Phyllite–Quartzite' fabric, and more recently 'Coarse or Dark Phyllite' fabric and has been identified in various EB II Cycladic sites (Hilditch 2007, 239; Angelopoulou 2008, 151; Marangou *et al*. 2008, 102). More recent finds include the material from Dhaskalio on Keros, where this fabric shows a considerable increase in Phase B (Sotirakopoulou 2016, 71). Upon macroscopic examination of fabric and form it became immediately obvious that this group represents non-local products, i.e. transport jars with slashed/incised handles and beaked jugs with a two-stage neck profile of the EB II late period.

- Macroscopic Group (MG15): almost absent and probably relates to the previous fabric by the red/purple phyllite inclusions. It is also taken as an import.

X. Fine/semi-fine calcareous volcanic fabric groups

A number of loners are included in this category. Different surface treatment modes, i.e. black-painted and dark-on-light pattern-painted, and shapes (one askos, small bowls, one sauceboat) are represented that imply a non-local provenance.

- Macroscopic Groups 18-20 (MG18, MG19, MG20): these loner fabrics are characterised by a semi-fine clay paste, most likely calcareous, with a yellowish brown to light brown colour (7.5YR 5/6-6/6) and a range of white-light grey crystalline or other volcanic-related inclusions (Fig. 6.4:F). They are separated on the basis of texture and presence/absence of individual inclusion types.

- Macroscopic Group 21 (MG21): fine buff and contains some chalky and grey transparent felsic inclusions, as well as few silver crystalline of possible volcanic nature. It is represented by one transport jar of the EB III period and is therefore taken as an import.

XI. Loners or small groups: the remaining fabrics represent loner samples or small groups of 2-3 vessels and include transport jars with incised handles, closed vessels like jars or pithoi, jugs, one shallow bowl, and sauceboats dating to the EB II developed/late and EB III periods. Owning to the rarity and incompatibility of these fabrics with the rest of the assemblage, as well as the shapes represented, these are largely taken as off-island products.

- Macroscopic Group 13 (MG13): this is a very distinctive group in hand specimen (Fig. 6.4:C) and is distinguished by a dark-fired, fine clay paste and a surface treatment that ranges from light to dark grey/black (10YR 4/1-7/1) or light brownish grey/greyish brown with reddish brown hues in places (10YR 6/2-5/2). The majority of sherds belong to thin-walled closed vessels with a dark grey (7.5YR 3/1) slipped and burnished exterior, most probably EB I-II early pyxides or jugs. The exterior surface is usually decorated with incised linear and geometric patterns (zig-zags, single or multiple chevrons, horizontal and vertical lines).

- Macroscopic Groups 27 and 28 (MG27, MG28): these loners share similar mudstone or orange/dark red inclusions such as phyllite (Fig. 6.5:E-F). They correspond to closed (transport) jars and therefore are taken as off-island products.

- Macroscopic Group 31 (MG31): it has a metallic texture and contains dark grey/greenish inclusions (Fig. 6.6:B) and a characteristic scored decoration. It corresponds to a transport jar and is most probably an import.

- Macroscopic Group 32 (MG32): it appears with a characteristic pinkish grey semi-fine fabric and calcareous inclusions related to lime-spalling (Fig. 6.6:C). Its colour, clay paste, and texture are non-distinctive and the vessel corresponds to an imported transport jar.

- Macroscopic Group 34 (MG34): this loner is characterised by dominant black transparent and glassy, angular inclusions, most probably related to mafic volcanic rocks.

- Macroscopic Groups 33 and 35 (MG33 and MG35): these two loners are characterised by soapy fabrics with silver metamorphic inclusions and in combination with other minor inclusions such as talc (Fig. 6.6:D-E). They correspond to EB II late transport jars and are taken as imports.

- Macroscopic Group 36 (MG36): this fine loner appears with a calcareous texture and an unusual dark greyish fabric.

- Macroscopic Group 37 (MG37): this small group is characterised by a fine reddish buff to orange clay paste (Fig. 6.6:F) and a thick yellow slip (10YR 8/4) and lustrous burnish covering both surfaces. It corresponds to imported sauceboats.

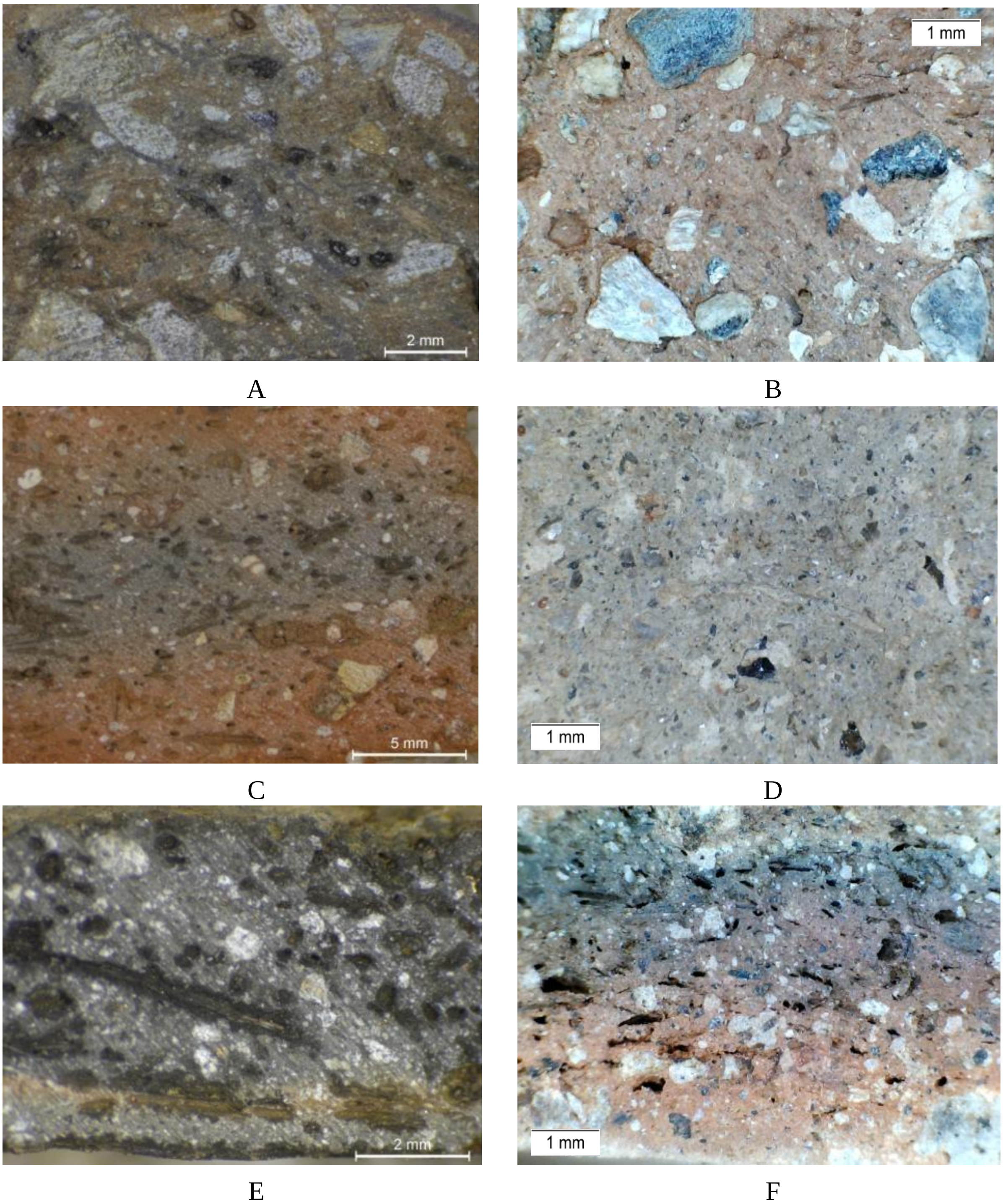


Figure 6.1: USB microscope and stereoscope macrographs. A. HR15/68 (MG1); B. HR15/244 (MG1); C. HR15/237 (MG2A); D. HR15/268 (MG3); E. HR15/109 (MG4); F. E49/16.4 (MG4).

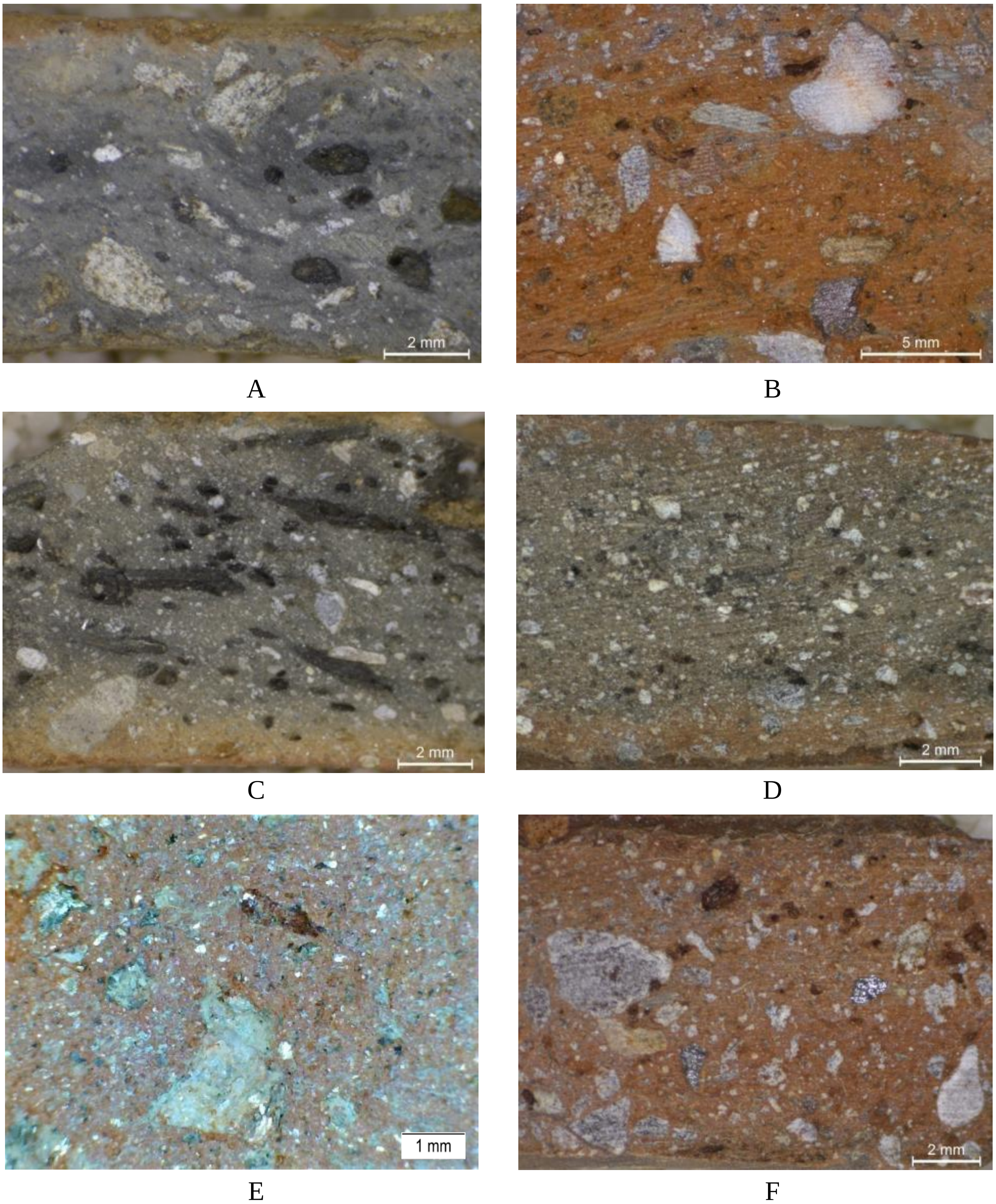
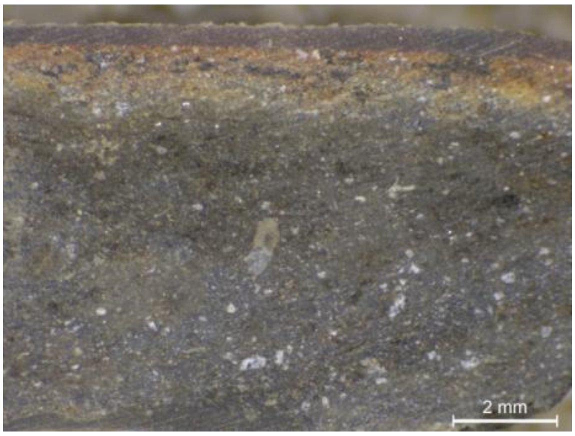
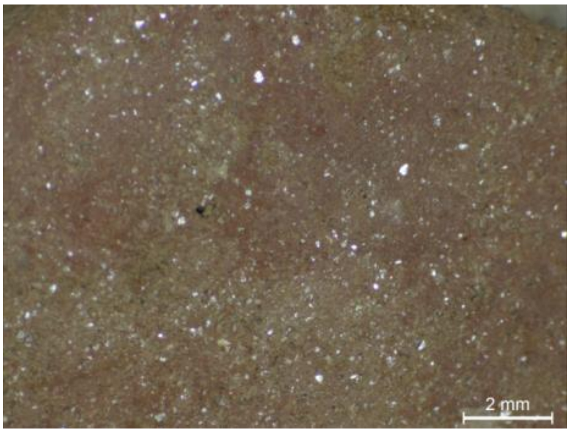


Figure 6.2: USB microscope and stereoscope macrographs. A. HR15/184 (MG5A); B. HR15/223 (MG5A); C. HR15/40 (MG5B); D. HR15/24 (MG5C); E. HR15/287 (MG5D); F. HR15/92 (MG5E).





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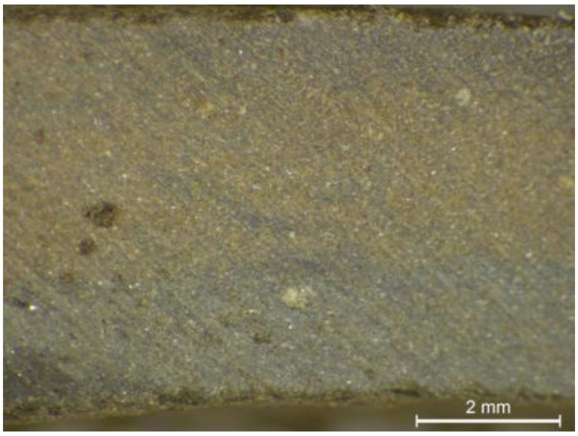

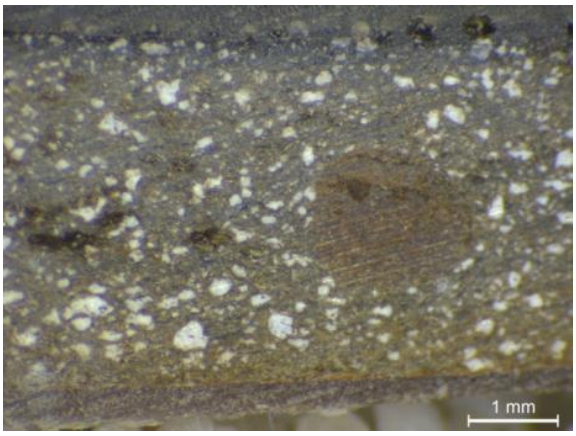

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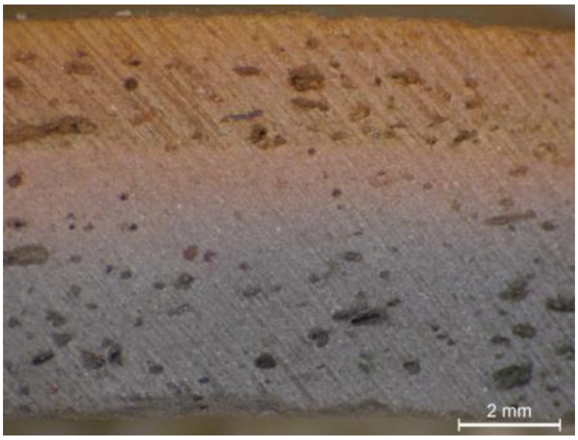
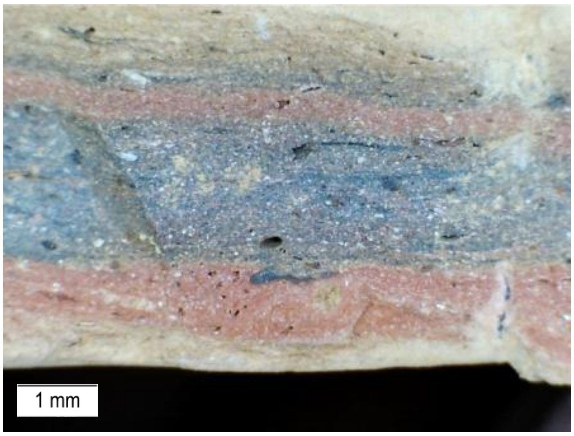




E F

Figure 6.3: USB microscope and stereoscope macrographs. A. HR15/199 (MG6); B. HR15/193 (MG7A); C. HR15/252 (MG8); D. HR15/157 (MG9); E. HR15/187 (MG10); F. HT12/34 (MG10).

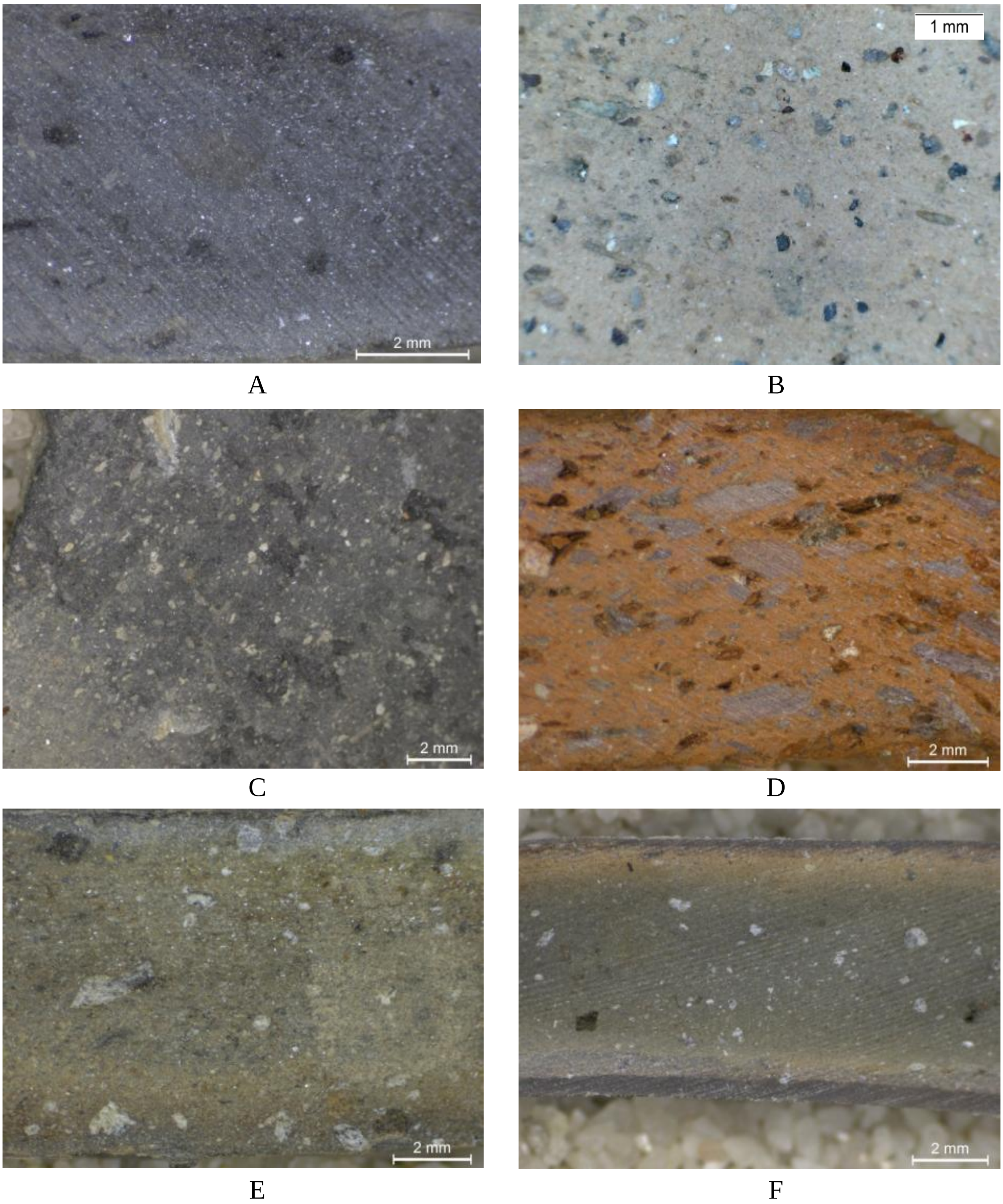


Figure 6.4: USB microscope and stereoscope macrographs. A. HR15/149 (MG11); B. 929 (MG12); C. HR15/52 (MG13); D. HR15/151 (MG14); E. HR15/151 (MG16); F. HR15/114 (MG20).

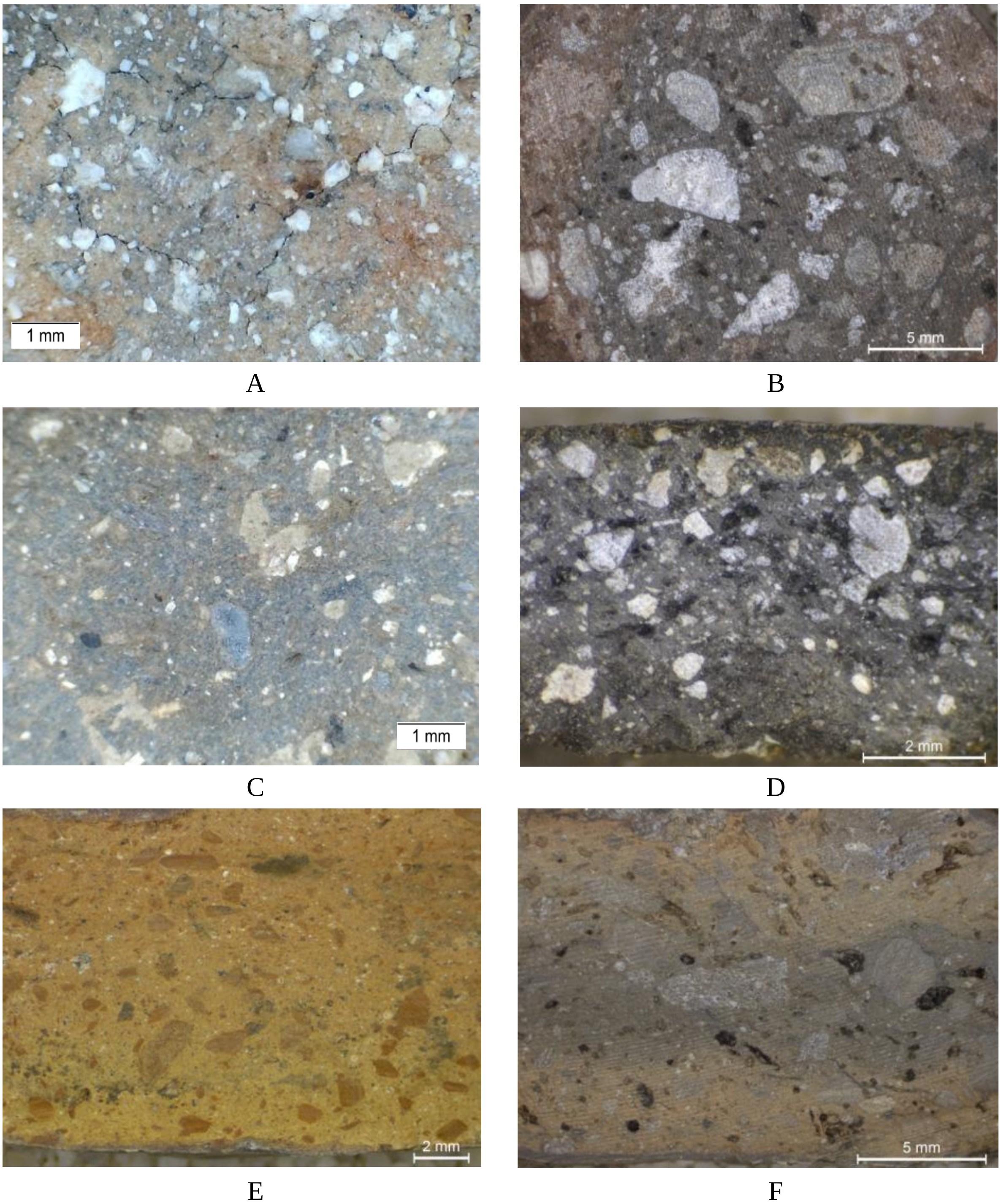


Figure 6.5: USB microscope and stereoscope macrographs. A. 513 (MG22); B. HR15/33 (MG23); C. 364 (MG25); D. HR15/242 (MG26); E. HR15/141 (MG27); F. HR15/35 (MG28).

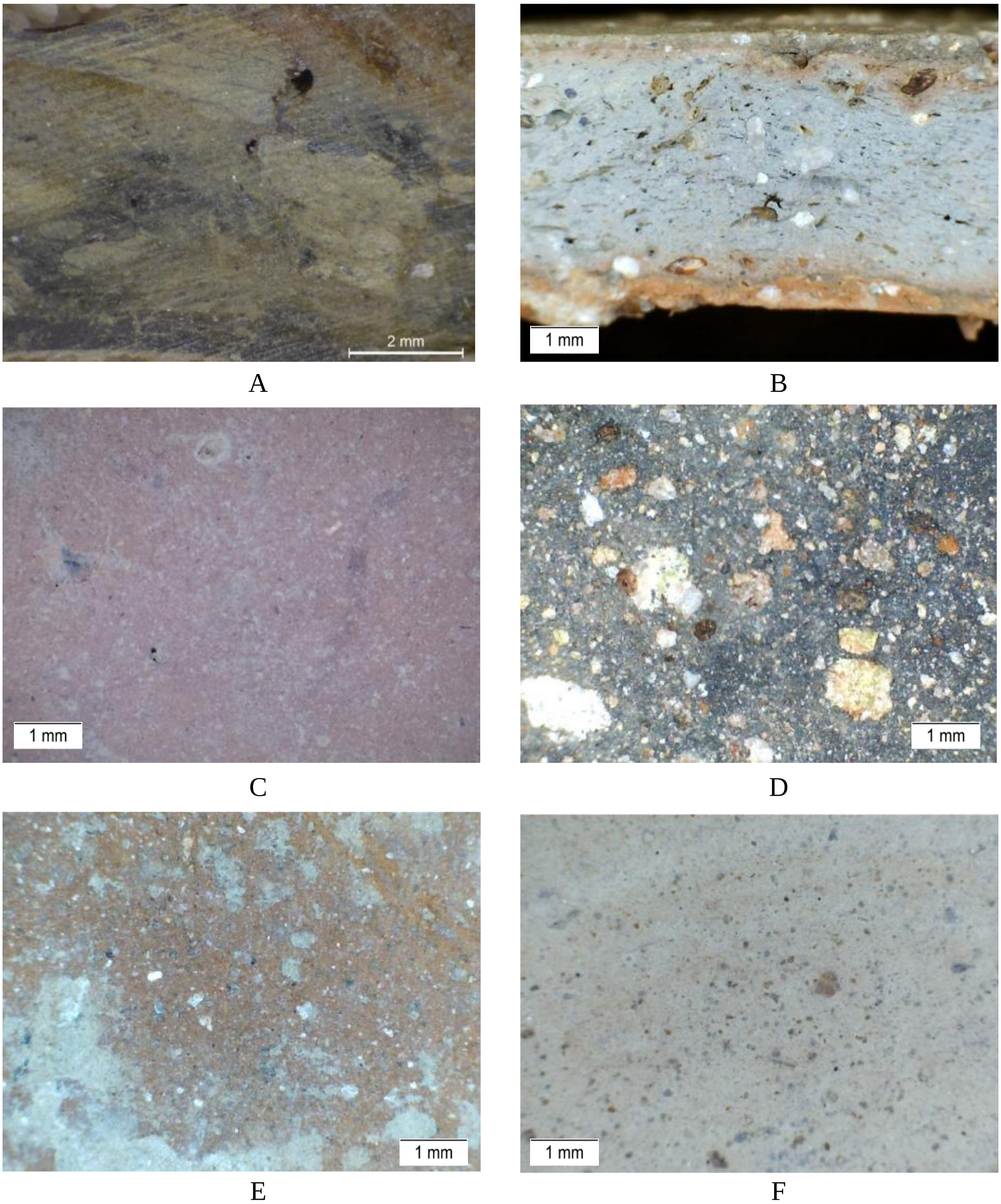


Figure 6.6: USB microscope and stereoscope macrographs. A. HR15/241 (MG29); B. HT12/4 (MG31); C. HR15/299 (MG32); D. HR15/213 (MG33); E. HR15/284 (MG35); F. HS12.100.20 (MG37).

Macroscopic groups / Shapes		MG1	MG1A	MG2A	MG2B	MG3	MG4	MG5A	MG5B	MG5C	MG5D	MG5E	MG6	MG7A	MG7B	MG8	MG9	MG10	MG11	MG12	MG13	MG14	MG15	**Total**
Bowls and related shapes	Deep bowl, carinated rim	-	-	-	-	-	-	69	68	9	-	-	58	-	-	-	-	-	-	-	-	-	-	204
	Bowl, bevelled rim	-	-	-	-	-	-	3	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
	Bowl, carinated shoulder	-	-	-	-	-	-	9	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
	Deep bowl, curving sides	-	-	-	-	-	-	15	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29
	Deep bowl, straight walls	-	-	-	-	-	-	4	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
	Bowl, inward-curving rim	-	-	-	-	-	-	7	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
	Bowl, internally-differentiated rim	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	Bowl, outward-curving and thickened rim	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
	Footed bowl	-	-	-	-	-	-	-	27	-	-	-	2	-	-	-	-	-	-	-	-	-	-	29
	Shallow bowl, pierced lug	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Bowl with rolled rim	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	Spouted bowl	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Conical saucer	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	DOL small bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tripod bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
	Two-handled bowl	-	-	-	-	-	-	-	-	-	-	-	-	1	-	3	8	-	-	-	-	-	-	12
	Pedestalled bowl/fruitstand	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	4
	Shallow bowl with everted rim	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Shallow bowl with curving sides	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	Shallow bowl/plate	-	-	-	-	-	-	-	-	-	-	-	67	-	-	-	-	-	-	-	-	-	-	67
	Conical bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	3
	Shallow/hemispherical bowl	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	119	-	-	-	-	-	121
	S-rim bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	113	-	-	-	-	-	113
	Wheel-made plate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63	-	-	-	63
	Unusual wheel-made shallow bowl	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Basin	11	-	6	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18

Table 6.2: Correlation between shapes and macroscopic fabrics.

Cups and related shapes	Tankard	-	-	-	-	-	-	-	-	4	-	-	-	10	17	-	5	2	-	-	-	-	-	38
	Two-handled cup/bell-shaped	-	-	-	-	-	-	-	-	-	-	-	6	5	6	-	2	-	-	-	-	-	-	19
	Bell-shaped cup	-	-	-	-	-	-	-	-	-	3	-	-	1	-	1	-	-	-	-	-	-	-	5
	Short-necked cup	-	1	-	-	-	-	-	-	-	-	-	-	2	-	3	2	-	-	-	-	-	-	8
	Depas amphikypellon	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	3
	Handleless cup, ribbed	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2
	Strap-handled/handleless cup	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64	-	-	-	-	-	64
	One-handled cup	1	-	-	-	-	-	-	-	-	4	-	1	-	-	-	-	-	-	-	-	-	-	6
	Two-handled vessel/large tankard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	3
	Dipper cup	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Jars and related shapes	Jar Variety A	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
	Jar Variety B	-	-	-	-	-	-	59	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68
	Jar Variety C	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
	Jar Variety D	-	-	-	-	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
	Jar Variety E	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-		-	-	-	1
	Wide-mouthed jar/deep bowl	1	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	19
	Wide-mouthed jar, horizontal handles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	7
	Concave-necked jar	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36	-	2	-	-	-	39
	Collar-necked jar	-	-	2	1	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	9
	Conical-necked jar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Collared jar with vertical loop handles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	4
	Jar with horizontal handles	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
	Winged jar	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Transport jar with plain horizontal/vertical handles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Transport jar with incised/slashed handles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	1	14
	Closed jar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jar/jug	-	-	6	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	7
	Unassignable jar sherds	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
	Narrow-necked/straight-sided jug	-	-	-	-	-	-	1	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
	Wide-mouthed jug	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1

Table 6.2: Correlation between shapes and macroscopic fabrics (continued).

Jugs and related shapes	Cut-away spouted jug	3	-	-	-	-	-	4	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
	Beak-spouted jug	-	-	-	-	1	-	1	2	11	-	-	2	-	-	-	-	3	-	-	-	-	-	20
	Steep-necked jug	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Jug with vertical incisions	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
	Two-stage profile beaked jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
	Flask-shaped jug	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	2
	Barbotine jug	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	Concave-necked jug	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Strap-handled jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Neck-handled jug with trumpet mouth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	18
	Jug with trefoil mouth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
	Amphora	19	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	21
	Jug/jar	-	-	-	-	2	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	9
	Juglet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	2
	Miniature jug	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	Unassignable jug sherds	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
Pyxides and related shapes	Pyxis/jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	18
	Spherical pyxis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	2
	Small concave-necked jar/pyxis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
	Truncated conical pyxis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Collar-necked pyxis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
	Double tripod pyxis	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Miniature pyxis	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Globular pyxis with pierced lug	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Pithoi and related shapes	Pithoid jar/pithos	-	-	-	-	-	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	85
	Pithos	-	-	-	-	-	-	9	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	11
	Collar-necked or conical-necked pithos	-	-	37	12	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51
	Pithos with relief decoration	-	-	-	-	22	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	23

Table 6.2: Correlation between shapes and macroscopic fabrics (continued).

Cooking vessels	Cooking pot	22	-	-	-	8	-	39	5	1	35	9	-	-	-	-	-	-	-	-	-	-	-	119
	Cooking pot/deep bowl	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Tripod cooking pot	-	-	1	-	-	-	-	10	5	-	-	-	-	-	-	-	-	-	-	-	-	-	16
	Baking pan/hearth	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	3
	Cheesepot	50	-	-	-	-	-	35	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	87
Miscellaneous shapes	Askos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	-	-	-	-	19
	Perforated vessel	-	-	-	-	-	-	2	-	-	3	-	-	-	-	-	-	3	-	-	-	-	-	8
	Teapot	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
	Miniature vessel	-	-	-	-	-	-	-	15	-	2	-	-	-	-	-	-	-	-	-	-	-	-	17
	Sauceboat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lid	-	-	-	-	-	1	-	6	4	-	1	-	-	-	-	-	-	-	-	1	-	-	13
	'Crown' lid	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	13	-	-	-	-	-	14
	Spoon	-	-	-	-	1	-	-	6	-	-	1	-	-	-	-	-	4	-	-	-	-	-	12
	Vertical handles	-	-	3	-	1	-	30	5	31	-	-	5	-	-	-	1	1	-	-	-	-	-	77
	Twisted/grooved handles	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	16	-	-	-	-	-	18
	Horizontal handles	-	-	-	-	-	-	7	12	1	-	-	-	-	-	-	-	-	-	-	-	-	-	20
	Bases	-	-	-	-	-	-	-	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	8
	Body sherds (closed vessels)	-	-	-	-	2	-	-	-	-	-	-	-	-	2	5	-	12	-	-	-	-	-	21
	Body sherds with rounded knobs	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
	Worked sherds	-	-	4	1	-	2	-	3	3	-	-	-	-	-	-	-	5	-	-	-	-	-	18
Sub-total		111	2	59	16	49	105	353	279	84	49	20	150	25	25	19	18	430	24	65	19	15	1	**1917**
Macroscopic groups / **Shapes**		MG16	MG17	MG18	MG19	MG20	MG21	MG22	MG23	MG24	MG25	MG26	MG27	MG28	MG29	MG30	MG31	MG32	MG33	MG34	MG35	MG36	MG37	**Total**
Bowls and related shapes	Deep bowl, carinated rim	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bowl, bevelled rim	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bowl, carinated shoulder	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Deep bowl, curving sides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Deep bowl, straight walls	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bowl, inward-curving rim	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bowl, internally-differentiated rim	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bowl, outward-curving and thickened rim	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6.2: Correlation between shapes and macroscopic fabrics (continued).

	Footed bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Shallow bowl, pierced lug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bowl with rolled rim	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Spouted bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Conical saucer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DOL small bowl	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
	Tripod bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Two-handled bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Pedestalled bowl/fruitstand	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Shallow bowl with everted rim	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
	Shallow bowl with curving sides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Shallow bowl/plate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Conical bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Shallow/hemispherical bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	S-rim bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Wheel-made plate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Unusual wheel-made shallow bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Basin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cups and related shapes	Tankard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Two-handled cup/bell-shaped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bell-shaped cup	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Short-necked cup	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Depas amphikypellon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Handleless cup, ribbed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Strap-handled/handleless cup	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	One-handled cup	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Two-handled vessel/large tankard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dipper cup	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jar Variety A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jar Variety B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jar Variety C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jar Variety D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6.2: Correlation between shapes and macroscopic fabrics (continued).

Jars and related shapes	Jar Variety E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Wide-mouthed jar/deep bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Wide-mouthed jar, horizontal handles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Concave-necked jar	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Collar-necked jar	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
	Conical-necked jar	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
	Collared jar with vertical loop handles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jar with horizontal handles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Winged jar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Transport jar with plain horizontal/vertical handles	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	1	-	-	-	1	-	-	4
	Transport jar with incised/slashed handles	1	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	1	1	-	-	-	-	5
	Closed jar	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	Jar/jug	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
	Unassignable jar sherds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jugs and related shapes	Narrow-necked/straight-sided jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Wide-mouthed jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cut-away spouted jug	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
	Beak-spouted jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Steep-necked jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jug with vertical incisions	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Two-stage profile beaked jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Flask-shaped jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barbotine jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Concave-necked jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Strap-handled jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
	Neck-handled jug with trumpet mouth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jug with trefoil mouth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Amphora	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jug/jar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Juglet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6.2: Correlation between shapes and macroscopic fabrics (continued).

	Miniature jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Unassignable jug sherds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyxides and related shapes	Pyxis/jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Spherical pyxis	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
	Small concave-necked jar/pyxis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Truncated conical pyxis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Collar-necked pyxis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Double tripod pyxis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Miniature pyxis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Globular pyxis with pierced lug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pithoi and related shapes	Pithoid jar/pithos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Pithos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Collar-necked or conical-necked pithos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Pithos with relief decoration	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cooking vessels	Cooking pot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cooking pot/deep bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tripod cooking pot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Baking pan/hearth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cheesepot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous shapes	Askos	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Perforated vessel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Teapot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Miniature vessel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sauceboat	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	3
	Lid	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	‘Crown’ lid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Spoon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Vertical handles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Twisted/grooved handles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Horizontal handles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bases	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6.2: Correlation between shapes and macroscopic fabrics (continued).

	Body sherds (closed vessels)	11	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	13
	Body sherds with rounded knobs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Worked sherds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total		26	1	1	4	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2	53
Total																								**1970**

Table 6.2: Correlation between shapes and macroscopic fabrics (continued).

Summary

From the above presentation some first conclusions may be drawn. The outlined fabric categories represent broad lithological characteristics that are shared between the various groups. The vast majority of the sherds correspond to coarse fabrics, more particularly to the metamorphic fabric group (764 sherds). The next bigger category includes the fine micaceous fabrics (529 sherds).

Regarding correlation between fabrics and shapes (Tab. 6.2), an observation made at first sight is that there is a number of shape-specific clay pastes used throughout Heraion's history. More particularly, the carinated bowls and their varieties of the EB I-II periods are exclusively of coarse metamorphic or alluvial metamorphic fabrics (MG5A, MG5B, MG6); the shallow bowls and S-rim bowls of the EB III period are made in MG10; the askoi are made in MG11; the wheel-made plates are made in MG12. With respect to the jars and related shapes these are found to follow the same pattern as the bowls. The volcanic fabrics are almost exclusively used for the manufacture of storage vessels, such as pithoid jars (MG4) and jars with horizontal handles (MG3). Cups are predominantly made in micaceous quartz fabrics (MG7-9) or fine micaceous (MG10). Jugs and pyxides show a wider distribution amongst fabrics (MG5, MG10, MG13, MG16), as well as cooking pots. However, the latter is probably more consistent in MG1 for the earlier periods and MG5D for the later periods. Similarly, the cheesepots are made in MG1 and MG5A.

Regarding provenance, it is assumed that the large fabric groups are local, which is also supported by the wide range of vessel shapes produced with them (MG1, MG4, MG5, MG10). Nevertheless, the fine nature of MG10 prevents a secure determination. A number of loners and small groups have also been identified (28 fabrics), representing distinct fabrics and, therefore, implying an off-island provenance for the majority, that is also supported by the shapes represented (transport jars, closed jars, jugs; MG15, 17-37).

Regarding the chronological distribution of fabrics some preliminary observations can be made. Certain fabrics seem to appear in specific periods of the site, e.g. MG1 and MG5 first appear in the Ch and continue through EB II developed, MG2-4 are in use from EB I until EB II developed, MG6 is in use during EB II developed and late, MG10-12 are in use in EB III, while the majority of loners or small groups, considered to be imported, occur in the EB II late period, that is considered as the zenith of interactions and ceramic exchanges.

6.3 Surface treatment and 'ware' groups

All recorded vessels were also examined with regard to their surface treatments. It has to be noted that some of the vessels were loosely classified under the smoothed or burnished category, as it was not always easy to distinguish between the two, especially in the early periods. The various groups are discussed below and comments are also made regarding chronology, appearance, and change. Nevertheless, the identification is not always feasible, as the original surfaces are commonly affected by the high water table of Heraion.

1. Plain: this category includes vessels with undecorated surfaces or those that do not preserve the slip or burnish. For instance, the majority of vessels in MG1, dating to the Ch and EB I periods, are characterised by a rough/granular surface that is occasionally smoothed or wiped. No special attention was paid to the exterior surface, which is usually characterised by a hasty, very irregular and careless finishing and dominated by cavities and random linear marks due to the rough use of organic matter (Fig. 6.7:A). Similarly, the early-dated vessels (cheesepots, cooking pots, basins) of MG5 appear with a plain surface. Nevertheless, this broad category includes different types of plain surfaces.

2. Smoothed: this includes examples with a usually poorly slipped or only well smoothed exterior surface and it corresponds to reddish brown or reddish grey colours (Fig. 6.7:B). It is difficult to detect if this is the effect of a self-slipped process upon firing or the use of a compositionally compatible thin slip as the clay body (2.5YR 5/4-5/6). It is particularly common in MG5A and MG5D. Many vessels were smoothed while still wet with a soft tool, leaving a non-glossy appearance with soft surface striations.

3. Irregularly burnished (IrrB): the exterior surface preserves evidence of burnishing in the form of horizontal marks giving the effect of differently coloured areas that vary from dark grey to reddish grey (2.5YR 4/1-3/1, 5YR 4/2, 10YR 4/1-4/2) and occasionally reddish brown (2.5YR 5/4). More often there are discolourations of yellowish brown to dark greyish brown (10YR 5/2-6/3) due to irregular burnishing or smoothing (Fig. 6.7:C-D). Occasionally this appears with a more lustrous appearance. The lustrous or shiny effect was produced by rubbing the surface with a

smooth, hard object. The preservation is poor in many examples, where the burnish is worn over or is only partially preserved. It is particularly common in MG5B carinated bowls and various types of jugs dating to the EB I-II early period.

4. Red slipped and burnished (RSB): this is best represented in MG4. It appears in the form of a thick red slip (10R 5/6) on the exterior or both surfaces (Fig. 6.7:E-F). When only the exterior is slipped, the interior surface exhibits a characteristic scored or comb-incised treatment in the form of parallel horizontal or perpendicular striations. The surface is always well burnished and some vessels display a lustrous effect. A similar thick red slip and burnish (10R 5/8) is represented by a loner closed jar (MG23), as well as pithoi in MG5A and some vessels of MG5E. In addition, it occurs very rarely on the interior surface of cheesepots in MG1 and MG5A. Despite the similarity of this red slip with that of MG4, it differs slightly in colour varying from reddish brown to dark red (5YR 6/3, 10R 5/6), texture, and quality and it is usually unburnished.

5. Dark red/reddish brown slipped or self slipped (DR/RBS): this ware group is characterised by a dark red-reddish brown thin or rarely thick slip (10R 4/8-5/6, 2.5YR 5/6) on both surfaces (Fig. 6.8:A). Occasionally, the surface treatment gives the impression of a self slipped effect when it is indistinguishable from the body. It is mainly represented by shallow bowls/plates (MG6) of the EB II developed/late period.

6. Red/black slipped and burnished (R/BSB): the exterior surface is always covered with a thick, highly micaceous red (10R 5/8-6/8) slip and burnish and the interior is majorly dark grey/black (2.5YR 2.5/1, 5YR 3/1) (Fig. 6.8:D-E). This differentiation is intentionally created through controlled firing process. The surfaces are almost always burnished. This surface treatment mode is represented in MG7A to cover thin-walled drinking vessels, creating a visual contrast with the light-coloured base clay and giving these vessels a metallic texture. Occasionally, the surface preserves imprints of fine organic matter, probably deriving from the treatment or application of the slip.

7. Black slipped and burnished (BSB): this rare treatment mode is represented by drinking cups and small bowls of MG8. Both surfaces are covered with a black/dark grey (7.5YR 2.5/1, 10YR 3/1) slip and burnish or are just burnished. The slip is highly micaceous and the burnish creates a lustrous metallic appearance (Fig. 6.8:F).

8. Red slipped (RS): this is equivalent to the ware described above with the difference that the vessels represented are red slipped (10R 5/6-4/6) throughout (Fig. 6.8:B-C). Occasionally the interior is rough or just smoothed. The slip layer is always thick and highly micaceous and preserves imprints of fine organic matter (MG7A and MG7B).

9. Black topped (BT): this ware is equivalent to BSB with the difference that the rim is black topped, i.e. the exterior is covered with a thick micaceous red slip (10R 5/6-5/8) and the interior and exterior rim exhibit a characteristic black colour (2.5YR 2.5/1). Both surfaces are burnished and occasionally lustrous with a metallic appearance. The shapes represented are mainly drinking vessels (cups, small bowls) of the MG9, but also one example from MG7A.

10. Reddish brown slipped (RBS): this is not very common and appears on vessels of MG5A and MG5C. It is characterised by a thin slip layer in reddish brown (5YR 5/4) that usually covers only the exterior surface and is occasionally burnished (Fig. 6.9:A). It is also found in imported loners (MG22, MG28).

11. Light red/red slipped (LR/RS): this is almost always poorly preserved and abraded, but when present it appears with a light red/red thin to thick layer (2.5YR 6/4, 10R 6/6) (Fig. 6.9:B). It is found on vessels of the EB III period (MG10, MG12) and it is therefore assumed that the majority were similarly covered with a slip and occasionally a burnish. In the case of open vessels, such as bowls and cups, on both surfaces and in the case of closed vessels, such as jugs, only on the exterior surface.

12. Brown slipped (BS): this is very rare and is characterised by a brown/brownish grey slip (Fig. 6.9:C). It is represented by a loner (MG36).

13. Pale brown slipped (PBS): this is very rare and only represented by a loner transport jar with horizontal handles, most probably dating to the late EB III or MB period (MG27). The exterior surface is covered with a thin very pale brown slip (10YR 7/4) (Fig. 6.9:D). Owing to its rarity and distinctiveness of treatment, this is taken as an off-island product.

14. Pink/reddish yellow slipped (P/RYS): this is very rare and only represented by one EB II late transport jar with incised horizontal handles (MG32). The exterior surface is covered with a thin pink to reddish yellow slip (7.5YR 7/4-7/6) (Fig. 6.9:E).

15. Yellow slipped and burnished (YSB): this is very rare and only represented in MG37 on imported sauceboats (cf. Georgiadis 2012, 27: one yellow mottled ware sauceboat on Kos). It is characterised by a thick yellow slip (10YR 84) and lustrous burnish covering both surfaces (Fig. 6.9:F). A possible correlation can be made with the Attic white slipped ware, which appears with a monochrome white to yellow, sometimes mottled, slipped surface and covers mainly transport collared jars (Day and Wilson 2016, 27, fig. 4).

16. Whitish/yellowish brown slipped (W/YBS): this is very rare and only represented by a single closed jar with a lunate-shaped lug-handle dating to the EB III period (MG17). The exterior surface is covered with a whitish/yellowish brown slip (Fig. 6.10:A). Owing to its rarity and distinctiveness of shape, this is taken as an off-island product.

17. Matte/black painted (M/BP): it occurs only on one askos loner (MG18) of the EB III late or early MB. The exterior surface is covered with a black (10YR 3/1) paint that is very poorly-preserved (Fig. 6.10:B). Owing to its rarity and the identification of other Aegean parallels, this is considered an off-island product. A possible similar black slip or paint is identified on a sauceboat (MG20).

18. Dark-On-Light pattern-painted (DOL): the yellowish brown/pale brown (10YR 7/3) surface background is covered with red (10R 4/6) horizontal stripes along the exterior and interior side of the rim and a number of vertical stripes or a combination

of vertical and horizontal ones (cross-hatched pattern) on the exterior surface (Fig. 6.10:C). It is represented by small bowls of the EB II late-III period (MG19). Owing to its rarity and the identification of other Aegean parallels, this is considered an off-island product.

19. Dark-faced and incised (DFInc): this ware group appears with a characteristic light grey to dark grey smoothed or poorly slipped exterior surface (Fig. 6.10:D) and is restricted to the manufacture of EB III askoi and pyxides (MG11). Various patterns of incised decoration with white encrustation are also very diagnostic for this group.

20. Dark grey slipped and burnished – incised (DGSBInc): this ware shows similarities with DFInc but differs due to its darker grey slip (7.5YR 3/1) and burnish (Fig. 6.10:E-F). The exterior surface is usually decorated with incised linear and geometric patterns (zig-zags, single or multiple chevrons, horizontal and vertical lines) or in combination with pointillé decoration and impressed circular indentations created with most probably an organic tool/straw. These patterns are often infilled with white encrustation paste. It corresponds to pyxides or jugs of the EB I-II early period (MG13). Owing to the distinctiveness of surface treatment and shapes, this is taken as an off-island product. Similar incised and pointillé decorative patterns are found on pyxides and jars of the EB II-III periods (MG16).

Summary

Four main surface treatment modes may be distinguished (plain, smoothed, burnished, slipped), each including different varieties in terms of colour or quality (Tab. 6.3). Plain includes about half of the total sherd amount, although this may be an effect of abraded surfaces in many cases. In this category the early-dated vessels, such as cooking vessels and jars, are best represented. The smoothed mode is represented by the majority of fabrics, while the burnished mode with its particular characteristics as described above is best represented in bowls dating between EB I and EB II early of MG5A and MG5B. This often appears with darkened patches on the surface suggesting firing in contact with fuel, leading to uneven oxidisation. The slipped surface treatment is very common and can occur in combination with burnishing (e.g. MG4). This mode may be divided into RS, RBS, LR/RS, BS, PBS, YSB, W/YBS, all corresponding to different macroscopic fabric groups in most cases. Nevertheless, the overwhelming majority of slipped pottery is red in colour.

Regarding the correlation between surface treatment and shapes, Table 6.4 shows that the majority of bowls fall into the IrrB category, with some occurring in RBS. Furthermore, the shallow bowls and S-rim bowls of the EB III period appear with smoothed surfaces, which might be a symptom of the lack or bad preservation of a light red slip that is preserved in few examples of these shapes. Interestingly, most of the cups (tankards, bell-shaped cups, etc.) of the EB II late period appear with a RSB surface of high quality or are divided between various modes (BT, BSB, etc.) implying a number of provenance locations of these vessels. Apart from these large categories there are a number of under-represented modes (e.g. BP, DOL, YS, etc.) that correspond to loners and support once again the off-island provenance of these vessels (e.g. sauceboats, askos, pyxides, etc.).

Surface treatment Macroscopic groups	Plain	Smoothed	IrrB	RSB	DR/RBS	R/BSB	BSB	RS	BT	RBS	LR/RS	BS	PBS	P/RYS	YSB	W/YBS	M/BP	DOL	DFInc	DGSBInc
1	X			X																
1A		X																		
2A	X	X		X																
2B	X	X																		
3	X	X								X										
4				X			X													
5A	X	X	X	?						X										
5B		X	X							X										
5C	X	X																		
5D	X																			
5E		X		X	X															
6					X			X												
7A						X		X	X											
7B								X												
8							X													
9						X			X											
10		X						X			X									
11																			X	
12		X									X									
13																				X
14		X																		
15		X																		
16	X																			X
17																X				
18																	X			
19																		X		
20																	X			
21	X																			
22										X										
23				X																
24	X																			
25		X																		
26		X																		
27													X							
28										X										
29		X																		
30		X																		
31		X																		
32														X						
33		X																		
34	X																			
35										X										
36												X								
37															X					

Table 6.3: Correlation between surface treatment modes and macroscopic fabrics.

Surface treatment / Shapes		Plain	Smoothed	IrrB	RSB	DR/RBS	R/BSB	BSB	RS	BT	RBS	LR/RS	BS	PBS	P/RYS	YSB	W/YBS	M/BP	DOL	DFInc	DGSBInc	**Total**
Bowls and related shapes	Deep bowl, carinated rim	-	30	116	-	46	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	204
	Bowl, bevelled rim	-	-	7	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-	-	20
	Bowl, carinated shoulder	-	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
	Deep bowl, curving sides	4	-	10	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-	29
	Deep bowl, straight walls	3	1	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
	Bowl, inward-curving rim	-	-	10	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	13
	Bowl, internally-differentiated rim	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	Bowl, outward-curving and thickened rim	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
	Footed bowl	-	-	27	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	29
	Shallow bowl, pierced lug	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Bowl with rolled rim	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	Spouted bowl	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Conical saucer	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	DOL small bowl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	4
	Tripod bowl	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Two-handled bowl	-	-	-	-	-	-	3	-	9	-	-	-	-	-	-	-	-	-	-	-	12
	Pedestalled bowl/fruitstand	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	4
	Shallow bowl with everted rim	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
	Shallow bowl with curving sides	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2
	Shallow bowl/plate	-	-	-	-	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67
	Conical bowl	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	3
	Shallow/hemispherical bowl	-	83	-	-	1	-	-	1	-	-	36	-	-	-	-	-	-	-	-	-	121
	S-rim bowl	-	105	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	113
	Wheel-made plate	-	53	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	63
	Unusual wheel-made shallow bowl	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Basin	14	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18

Table 6.4: Correlation between surface treatment modes and shapes.

Cups and related shapes	Tankard	-	-	4	-	-	5	-	29	-	-	-	-	-	-	-	-	-	-	-	-	38
	Two-handled cup/bell-shaped	-	-	-	-	3	-	-	14	2	-	-	-	-	-	-	-	-	-	-	-	19
	Bell-shaped cup	3	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	5
	Short-necked cup	1	-	-	-	-	4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	8
	Depas amphikypellon	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	Handleless cup, ribbed	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	Strap-handled/handleless cup	-	41	-	-	-	-	-	-	-	-	23	-	-	-	-	-	-	-	-	-	64
	One-handled cup	5	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
	Two-handled vessel/large tankard	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	3
	Dipper cup	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Jars and related shapes	Jar Variety A	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
	Jar Variety B	10	-	30	1	-	-	-	-	-	27	-	-	-	-	-	-	-	-	-	-	68
	Jar Variety C	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
	Jar Variety D	-	-	8	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-	-	20
	Jar Variety E	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
	Wide-mouthed jar/deep bowl	4	-	-	14	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	19
	Wide-mouthed jar, horizontal handles	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
	Concave-necked jar	1	36	-	-	-	-	-	-	-	-	2	-	-	-	-	1	-	-	-	-	40
	Collar-necked jar	3	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	4
	Conical-necked jar	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	12
	Collared jar with vertical loop handles	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
	Jar with horizontal handles	-	6	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	10
	Winged jar	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Transport jar with plain horizontal/vertical handles	2	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	4
	Transport jar with incised/slashed handles	-	16	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	1	19
	Closed jar	-	-	-	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	3
	Jar/jug	4	1	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
	Unassignable jar sherds	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	9
	Narrow-necked/straight-sided jug	1	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
	Wide-mouthed jug	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1

Table 6.4: Correlation between surface treatment modes and shapes (continued).

Jugs and related shapes	Cut-away spouted jug	2	2	8	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
	Beak-spouted jug	1	10	1	-	-	-	-	6	-	-	2	-	-	-	-	-	-	-	-	-	20
	Steep-necked jug	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Jug with vertical incisions	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	2
	Two-stage profile beaked jug	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	Flask-shaped jug	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	Barbotine jug	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	Concave-necked jug	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Strap-handled jug	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Neck-handled jug with trumpet mouth	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
	Jug with trefoil mouth	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Amphora	20	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	21
	Jug/jar	-	-	-	-	7	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	9
	Juglet	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	2
	Miniature jug	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	Unassignable jug sherds	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
Pyxides and related shapes	Pyxis/jug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	18
	Spherical pyxis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5	7
	Small concave-necked jar/pyxis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
	Truncated conical pyxis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
	Collar-necked pyxis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
	Double tripod pyxis	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Miniature pyxis	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Globular pyxis with pierced lug	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Pithoi and related shapes	Pithoid jar/pithos	-	-	-	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	85
	Pithos	9	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
	Collar-necked or conical-necked pithos	27	5	-	19	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	58
	Pithos with relief decoration	-	5	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-	23

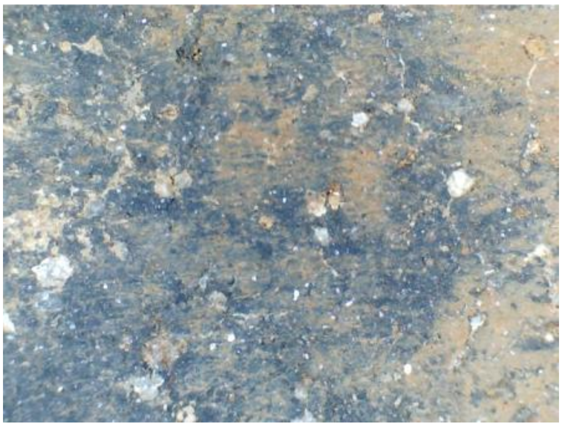
Table 6.4: Correlation between surface treatment modes and shapes (continued).

Cooking vessels	Cooking pot	77	16	7	2	3	-	-	-	-	14	-	-	-	-	-	-	-	-	-	-	119
	Cooking pot/deep bowl	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Tripod cooking pot	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
	Baking pan/hearth	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	Cheesepot	72	2	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	87
Miscellaneous shapes	Askos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	19	-	20
	Perforated vessel	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
	Teapot	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Miniature vessel	5	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
	Sauceboat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	-	-	3
	Closed vessels/body sherds	2	14	-	-	-	-	5	2	-	3	-	-	-	-	-	-	-	-	-	8	34
	Lid	-	4	7	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	2	15
	‘Crown’ lid	-	10	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	13
	Spoon	7	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
	Vertical handles	24	7	19	4	5	-	-	-	-	1	13	-	-	-	-	-	-	-	-	-	73
	Twisted/grooved handles	-	13	1	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	18
	Horizontal handles	-	-	19	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
	Bases	1	-	5	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	8
	Body sherds with rounded knobs	-	7	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
	Worked sherds	6	3	3	2	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	18
	Total	344	542	355	156	135	14	20	74	13	134	108	1	1	1	2	1	2	4	24	42	**1970**

Table 6.4: Correlation between surface treatment modes and shapes (continued).

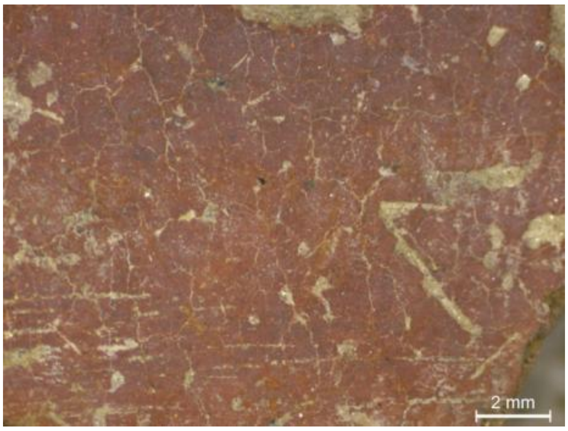
A

B

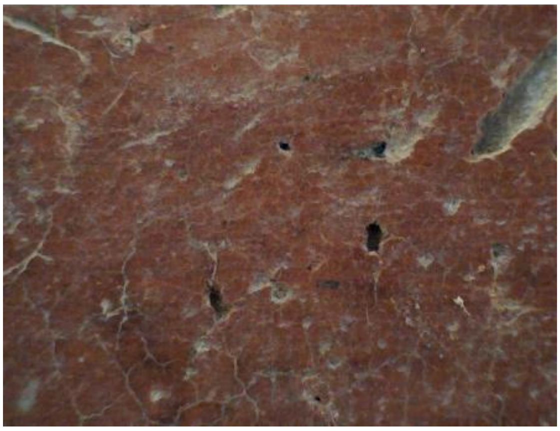


C

D



E



F

Figure 6.7: Surface treatment mode macrographs (no scale). A. Plain (MG1: HR15/136); B. Smoothed (MG5A: HR15/185); C. IrrB (MG5A: HR15/164); D. IrrB (MG5B: HR15/133); E. RSB (MG4: HR15/239); F. RSB (MG4: HR15/188).

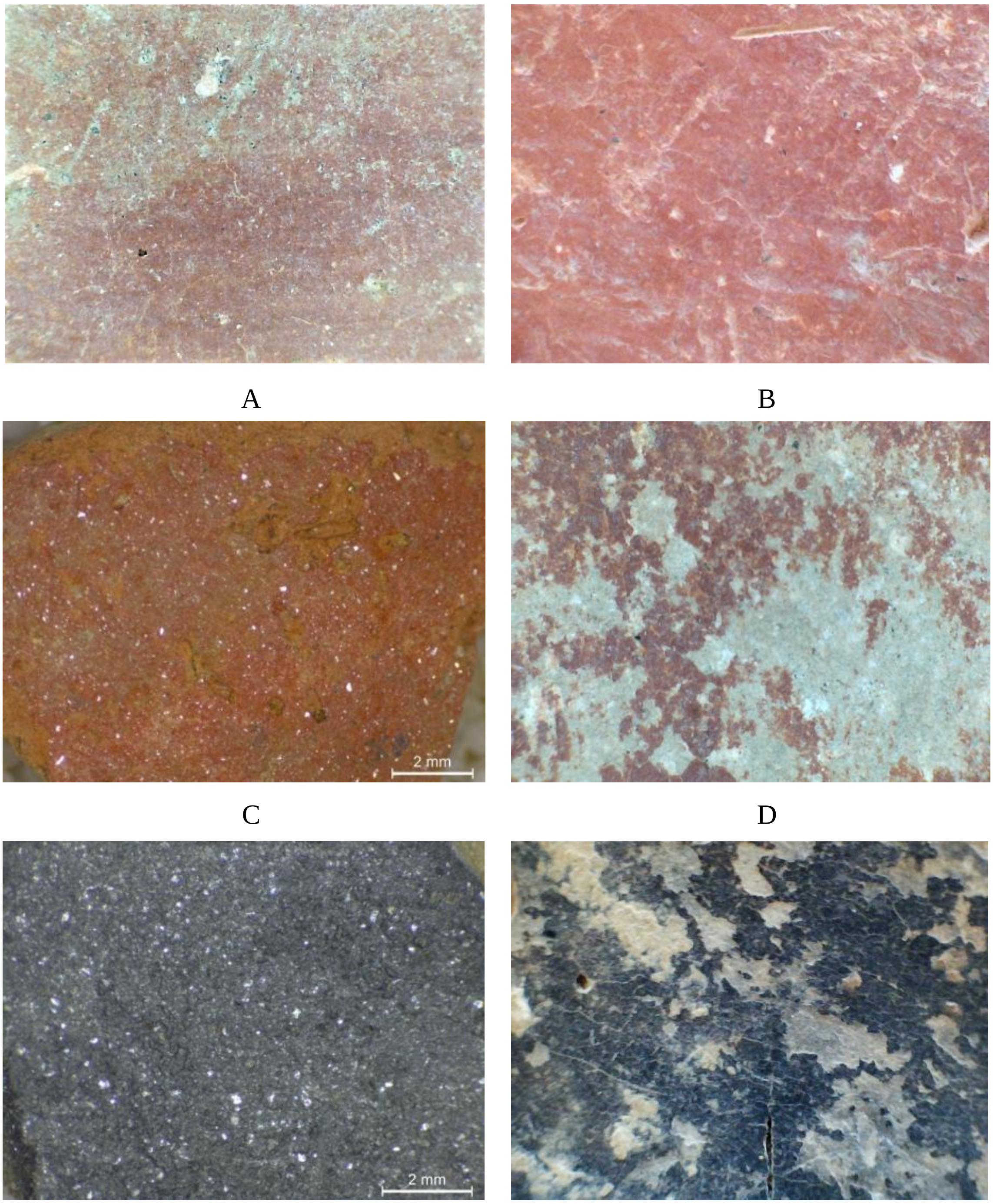


Figure 6.8: Surface treatment mode macrographs (no scale). A. DR/RBS (MG6: 293); B. RS (MG9: 296); C. RS (MG7B: HR15/206); D. R/BSB or BT (MG9: 843); E. R/BSB (MG7A: HR15/193); F. BSB (MG8: 474).

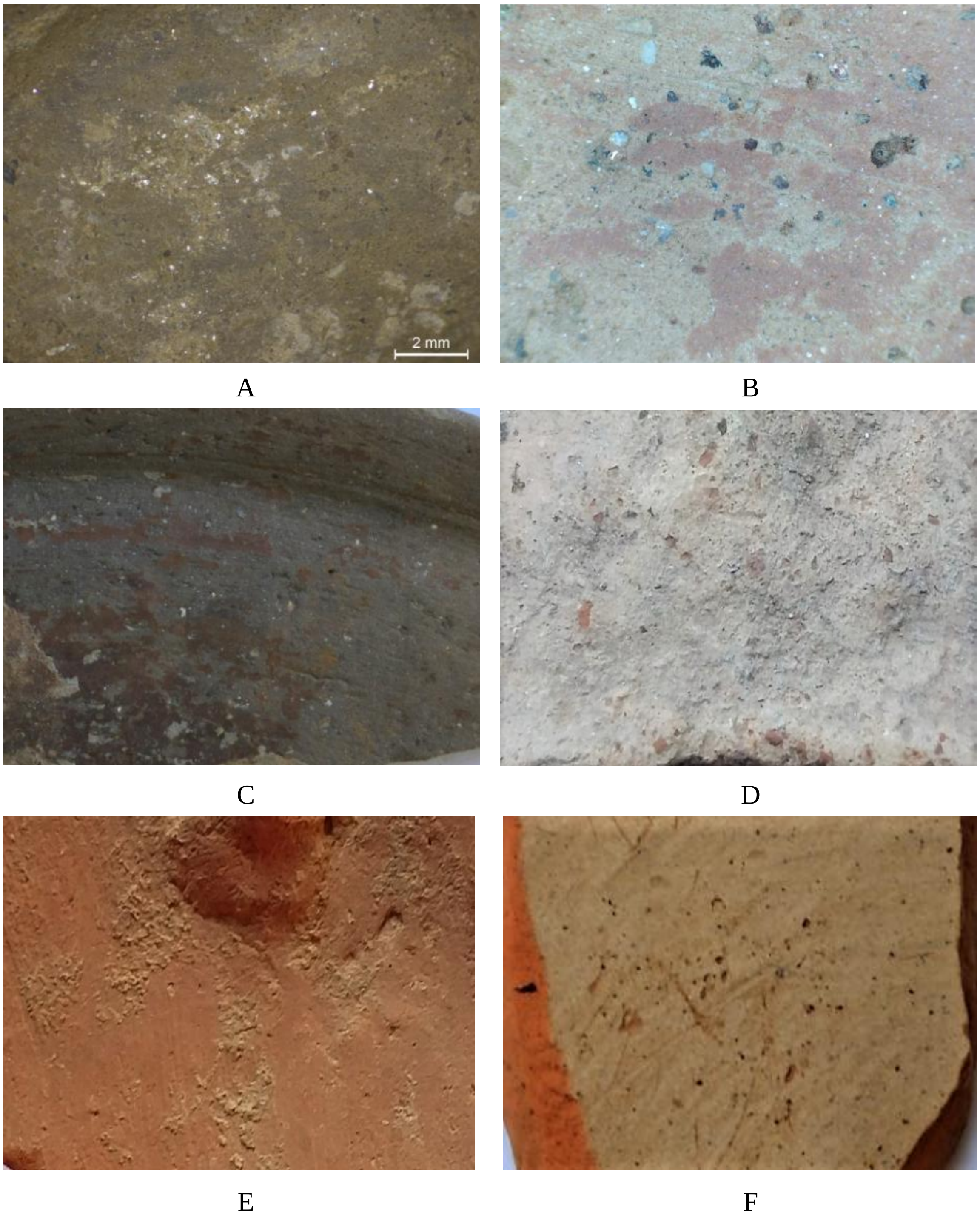


Figure 6.9: Surface treatment mode macrographs (no scale). A. RBS (MG5A: HR15/42); B. LR/RS (MG12: 889); C. BS (MG36: HT12/32); D. PBS (MG27: HR15/141); E. P/RYS (MG32: HR15/199); F. YSB (MG37: HS12.100.20).

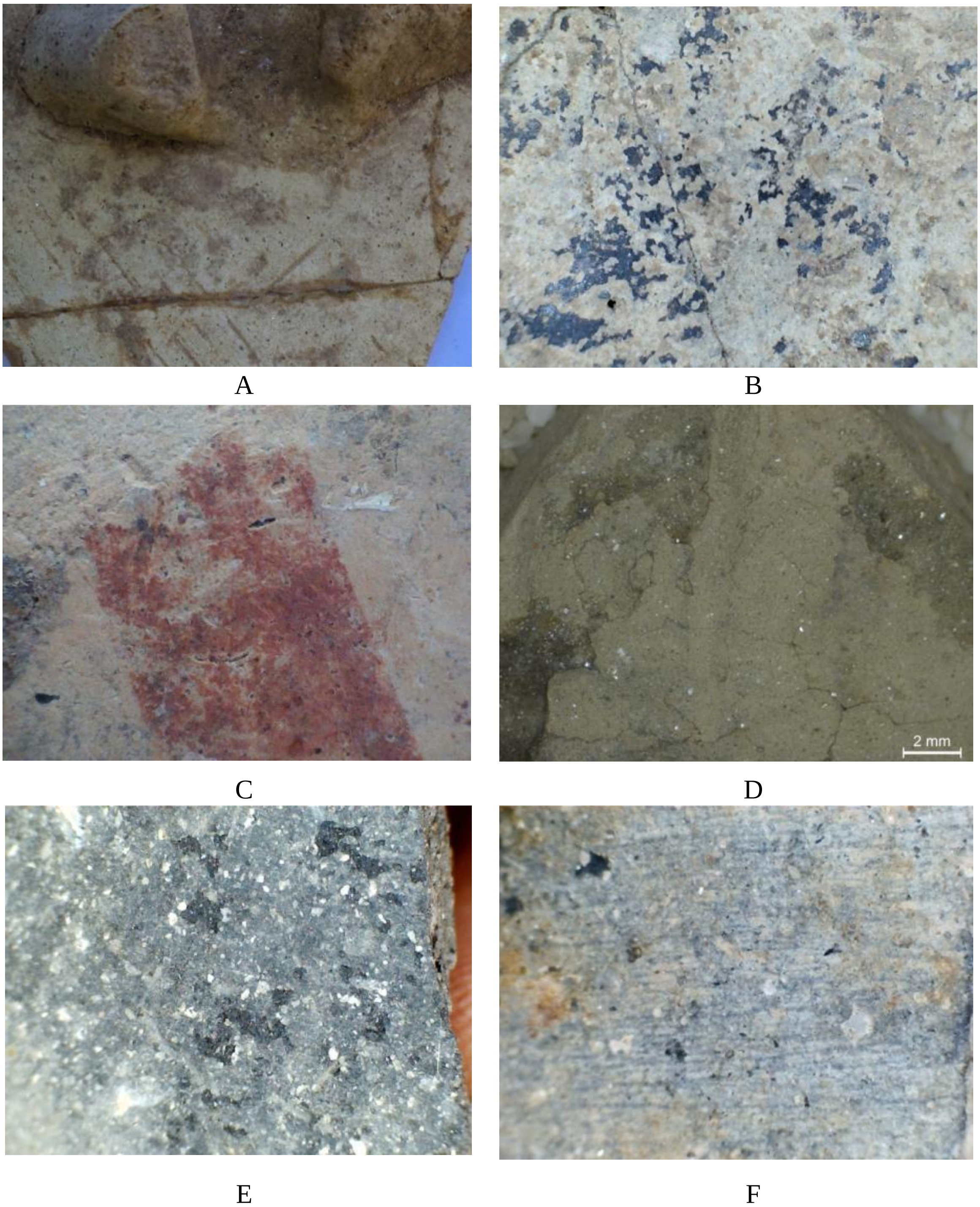


Figure 6.10: Surface treatment mode macrographs (no scale). A. W/YBS (MG17: HT12/31); B. M/BP (MG18: HR15/293); C. DOL (MG19: HR15/266); D. DFInc (MG11: HR15/149); E. DGSBInc (MG13: HR15/52); F. DGSBInc (MG13: HR15/122).

6.4 Decoration

The decorated sherds comprise only a small percentage of the overall Heraion pottery assemblage (275 sherds). Nevertheless, these provide an insight to the site's links with other Aegean sites as some of the decorative modes are extremely rare at Heraion and are taken as off-island. It should be remembered that the numbers of sherds are influenced by the amount of the vessel's surface that was decorated, and the size of the vessels, rather than being direct reflections of the numbers of vessels that were decorated in each mode at Heraion. As will be seen below, further distinctions can be discerned with regard to the kinds of vessels and fabrics associated with each mode.

I. Incised: this is the most common decorative mode occurring at Heraion. In most cases this is restricted to the upper part of the exterior surface. Different varieties are identified: 1. *Simple incised*: this is characterised by various patterns, mainly triangles, zig-zags, and horizontal lines or group of horizontal lines intersecting a group of diagonals, chevrons, multiple triangles, X motifs, and possible drop-like strokes. It is represented mainly by EB III askoi and pyxides of MG11 and MG16 respectively (Fig. 6.11:C-D). 2. *Incised-and-pointillé*: as the previous, but in combination with pointillé. The most common decorative patterns are vertical and diagonal incisions or chevrons flanked by horizontal banded lines or bordering horizontal or vertical zones of dots and multiple diagonals bordered by a pair of horizontal incisions. 3. *Incised-and-encrusted*: this variety appears with incised linear and geometric patterns (zig-zags, single or multiple chevrons, horizontal and vertical lines) that are often infilled with white encrustation paste (Fig. 6.11:E). 4. *Incised-and-impressed*: this differs from the previous by the impressed circular indentations, most probably created with an organic tool. It is mainly represented by EB I-II early pyxides and jugs of MG13 (Fig. 6.11:F).

Other motifs include parallel diagonals or herringbone patterns on amphorae handles and jugs of MG1 (Fig. 6.11:A), radiating slashes on horizontal handles of transport jars of MG14 (Fig. 6.11:B), and more rarely fish motifs on one jug and one transport jar (Milojčić 1961, pls. 16:3, 19:7, 44:3). The fish motif or other curvilinear ones with concentric arcs are known from Dhaskalio A on Keros (Sotirakopoulou 2016, 53, fig. 2.28) and Markiani IV on Amorgos (Eskitzioglou 2006, 155, fig. 7.17:1, 7.26:14, 17, 18, pls. 36:e, 38:a).

Incised decoration was particularly common in nearby sites of the eastern Aegean, such as Kos, where it was applied to potentially imported spherical pyxides

(Georgiadis 2012, 61), Thermi on Lesbos, and Emporio on Chios. At the latter site incised decoration was well in use throughout the NL and the EB, although more common in Period VIII and usually confined to jars (Hood 1981, 227-232). It consisted of linear motifs, such as groups of diagonal lines, bands of chevrons, etc. and occasionally filled with white encrustation (Hood 1981, figs. 111-112). In Periods V-IV it becomes again the dominant decorative technique and continues until Period II (Hood 1981, 233-238, figs. 214-217).

II. Relief or plastic: relief decoration appears in the form of bands on conical pithoi (MG2) or combined into various motifs below the rim or neck on wide-mouthed pithoi of MG3 (Fig. 6.12:A). Plastic decoration rather appears in the form of rounded knobs usually on jugs (Fig. 6.12:B). Comparanda are found from LN and EBA contexts in the NE Aegean islands of Poliochni Blue-Yellow on Lemnos (Bernabò Brea 1964, pls. LXII:a, e-g, LXIII:d, e, h, i), Thermi on Lesbos (Lamb 1936, pl. XVII:a-g), and Emporio V-IV, II on Chios (Hood 1981, 61-62, fig. 92), as well as Mainland Greece, the Cyclades, and Crete (see discussion in Georgiadis 2012, 62).

III. Impressed: this is rare and appears in combination with incised or relief decoration.

IV. Twisted/grooved/ribbed: this class includes predominantly vertical handles of jugs and jars with a characteristic twisted effect that varies from deep to shallow and it most probably imitates metallic prototypes, especially in the case of cups in MG7-9 (Fig. 6.12:D). Occasionally it is more regular and is better described as grooved. Ribbed decoration is very rare. Similar handles are known from Emporio II on Chios in off-island micaceous wares (Hood 1982, 468, fig. 206:1711) and one example from Poliochni Yellow on Lemnos (Bernabò-Brea 1976, pl. CCIX:m), as well as Thermi on Lesbos (Lamb 1936, fig. 30), Yortan cemetery (Kâmil 1982, fig. 80:282), and Aphrodisias EB 3 (Joukowsky 1986, fig. 408:4). Earlier examples are found at Troy Ib-c (Blegen *et al*. 1950, pls. 236:24-25, 240:9-10). Twisted handles are believed to indicate metallic prototypes and occur commonly in beak-spouted jugs of coastal and inland western Anatolian sites (Şahoğlu 2011a, 140, cat. no. 145; Şahoğlu and Sotirakopoulou 2011, cat. nos. 247 [Demircihüyük Phase H], 262 [Küllüoba Phase IVF], 313-314 [Beycesultan Level XIV], 330-332, 492 [Harmanören EB II-III], 415

[Seyitömer Level Va]). Less frequent examples of twisted handles are found on Crete, such as EM IIA beaked jugs from Knossos (Wilson 2007, fig. 2.11:11).

V. Painted: this is very rare and attested on two fabrics in the form of BT and DOL pattern painted decoration (Fig. 6.12:E) on small bowls and one askos of the EB II late and EB III periods (see Section 6.3:17-18, fig. 6.10:B-C). One sauceboat shows possible traces of BT decoration.

VI. Scored: this is not traditionally considered as decoration, but more like a result of scraping the clay and smoothing the vessel surface (Fig. 6.12:F). It usually occurs on the interior of closed vessels as is the case for MG4. One additional body sherd of a transport jar has scoring (MG31). Scored ware is known from a number of sites across LN-EBA Aegean and Anatolia (Georgiadis 2012, 165-166), e.g. the Cyclades (Sotirakopoulou 1999, 80-81; 2016, 25) and Crete (Wilson 2007, 55, fig. 2.3:4-5). The shapes, fabrics, and surface treatments represented (see Section 6.2), as well as the absence of scoring from the main local fabrics of Heraion imply a potential foreign provenance for these vessels.

Correlation between modes of decoration and fabrics (Tab. 6.5) shows that the incised decoration is shared between various different fabrics, but it is particularly represented in MG1 (12 vessels), MG14 (15 vessels), and MG16 (21 vessels). Each of these fabrics relates to specific decorative motifs and shapes (see below) and it was observed that while the former is most probably local the other two fabrics are imported. The incised-and-encrusted decoration is found in MG11 and MG13, the relief decoration corresponds mainly to MG3 (22 vessels), and the plastic decoration corresponds mainly to MG5B (12 vessels). Lastly, the twisted or grooved effect is equally represented by a number of fabrics, but mainly represented by MG10, the painted decoration is found in a group of calcareous fabrics that are most likely imported (MG18-20), and scoring is only occurred in MG4.

Correlation between modes of decoration and shapes (Tab. 6.6) shows that the incised decoration is found primarily on horizontal slashed handles of transport jars and beaked jugs with a two-stage neck profile, which have already been identified as imports in terms of fabric, as well as askoi and pyxides that are traditionally thought to derive from the Cyclades. More incised patterns are known from amphora handles and pithoi that are most probably local according also to surface treatment and shape information. The relief decoration is found on pithoi, the plastic on jugs and body sherds of unidentifiable shape. The impressed is also found on a pithos, the twisted/grooved on jugs, jars, and cups, the painted on small bowls, and lastly the scored on pithoid jars.

The overall impression is that decoration is preferably applied on closed storage or transportation vessels and less often on serving vessels. When combined with information of fabric, surface treatment, and shape it becomes more apparent that the groups considered more local at Heraion are predominantly undecorated, whereas those presumed to be imported are decorated.

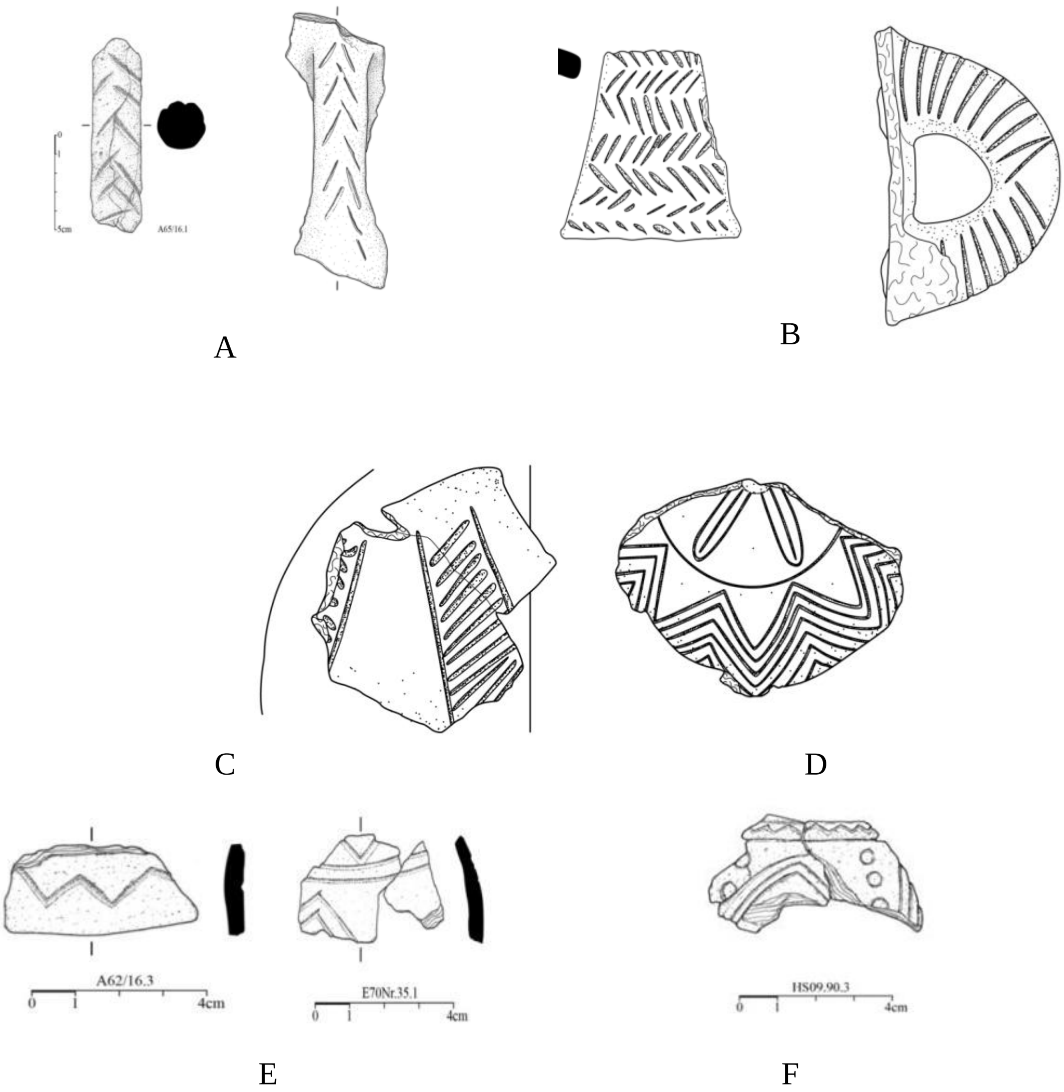


Figure 6.11: Decorative modes. A. Incised/herringbone texture (A65/16.1-HR15/66; HS09.75.2-HR15/244); B. Incised/parallel diagonals and radiating slashes (HR15/155; HR15/278); C. Incised pyxis (HT12/41); D. Incised askos (HT12/42); E. Incised jugs/pyxides (A62/16.3; E70Nr.35.1); F. Incised-and-impressed (H9.90.3-HR15/250). Drawings made by A. Kontonis and C. Kolb.

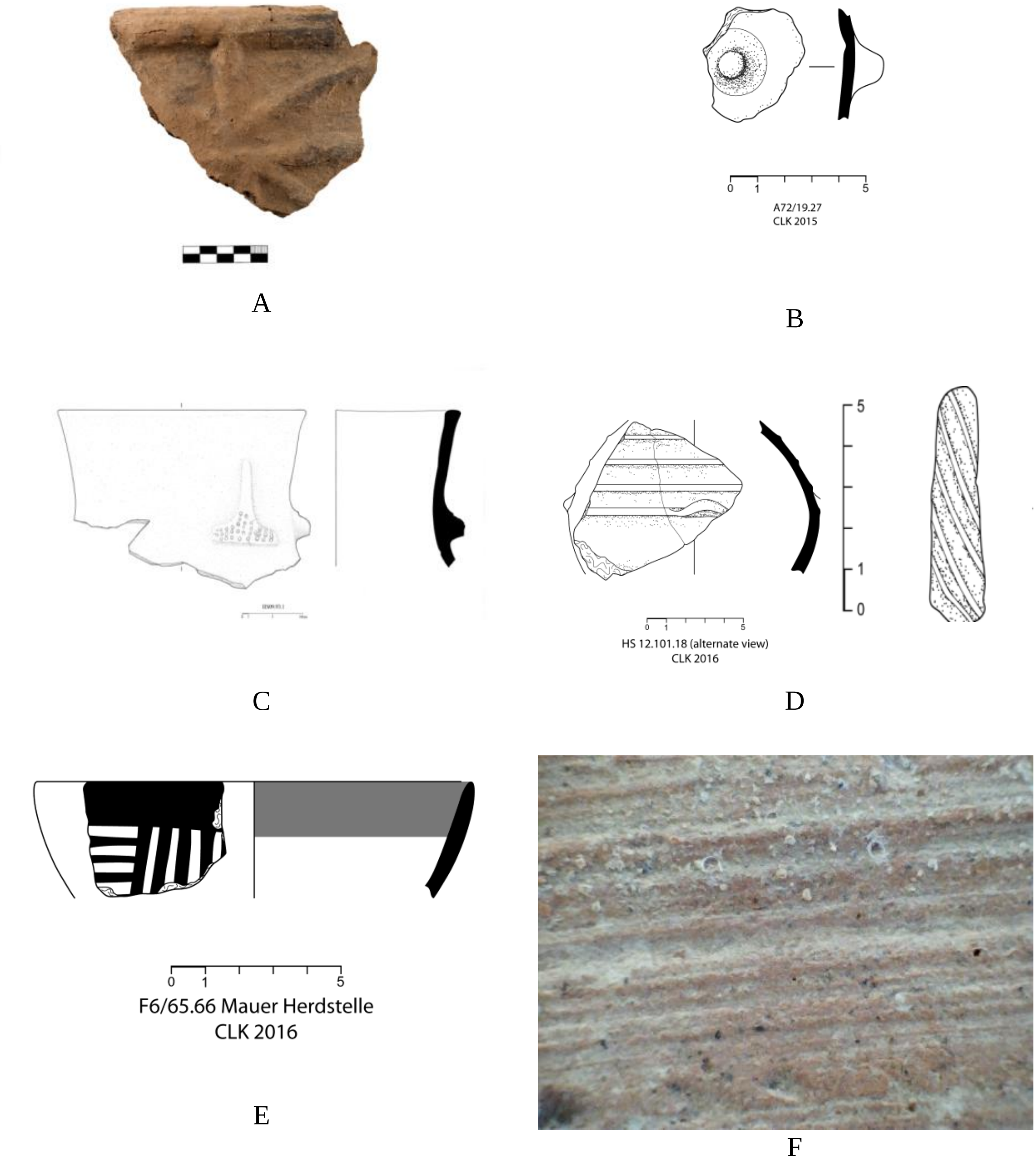


Figure 6.12: Decorative modes. A. Relief (HT12/2); B. Plastic (A72/19.27); C. Plastic-and-impressed (HS09.90.1); D. Twisted/grooved (HS12.101.18); E. Painted/DOL (460); F. Scoring (MG4: HR15/188). Drawings made by A. Kontonis and C. Kolb and photograph A taken by C. Papanikolopoulos.

Decoration / Macroscopic groups	Incised	Incised-and-Pointillé	Incised-and-encrusted	Incised-and-impressed	Relief	Plastic	Plastic-and-impressed	Twisted/grooved/ribbed	Painted	Scored	**Total**
1	12	-	-	-	-	2	-	-	-	-	14
1A	-	-	-	-	-	-	-	-	-	-	-
2A	-	-	-	-	2	-	-	1	-	-	3
2B	1	-	-	-	1	1	-	-	-	-	3
3	-	-	-	-	22	-	-	1	-	-	23
4	-	-	-	-	-	-	-	-	-	85?	85
5A	1	-	-	-	-	-	1	-	-	-	2
5B	-	-	-	-	-	12	-	-	-	-	12
5C	3	-	-	-	1	-	-	3	-	-	7
5D	-	-	-	-	-	-	-	-	-	-	-
5E	-	-	-	-	-	-	-	1	-	-	1
6	-	-	-	-	-	-	-	-	-	-	-
7A	1	-	-	-	-	-	-	5	-	-	6
7B	-	-	-	-	-	-	-	5	-	-	5
8	-	-	-	-	-	-	-	5	-	-	5
9	-	-	-	-	-	-	-	-	-	-	-
10	1	-	-	-	-	-	-	16	-	-	17
11	3	-	19	-	-	-	-	-	-	-	22
12	-	-	-	-	-	-	-	-	-	-	-
13	-	-	15	1	-	3	-	-	-	-	19
14	15	-	-	-	-	-	-	-	-	-	15
15	-	-	-	-	-	-	-	-	-	-	-
16	21	2	-	-	-	-	-	-	-	-	23
17	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	1	-	1
19	-	-	-	-	-	-	-	-	4	-	4
20	-	-	-	-	-	-	-	-	1	-	1
21	-	-	-	-	-	-	-	-	-	-	-
22	1	-	-	-	-	-	-	1	-	-	2
23	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-
25	1	-	-	-	-	-	-	-	-	-	1
26	-	-	-	-	-	-	-	-	-	-	-
27	1	-	-	-	-	-	-	-	-	-	1
28	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-
31	-	-	-	-	-	-	-	-	-	1	1
32	1	-	-	-	-	-	-	-	-	-	1
33	1	-	-	-	-	-	-	-	-	-	1
34	-	-	-	-	-	-	-	-	-	-	-
35	-	-	-	-	-	-	-	-	-	-	-
36	-	-	-	-	-	-	-	-	-	-	-
37	-	-	-	-	-	-	-	-	-	-	-
Total	63	2	34	1	26	18	1	38	6	86	**275**

Table 6.5: Correlation between decorative modes and macroscopic fabrics.

Decoration / Shapes		Incised	Incised-and-Pointillé	Incised-and-encrusted	Incised-and-impressed	Relief	Plastic	Plastic-and-impressed	Twisted/grooved/ribbed	Painted	Scored	**Total**
Bowls	Small bowl	-	-	-	-	-	-	-	-	4	-	4
	Tripod bowl	-	-	-	-	-	-	-	1	-	-	1
	Pedestalled bowl/fruitstand	-	-	-	-	-	-	-	3	-	-	3
Cups	Tankard	-	-	-	-	-	-	-	3	-	-	3
	Two-handled cup/bell-shaped	-	-	-	-	-	-	-	4	-	-	4
	Bell-shaped cup with high-swung loop handle	-	-	-	-	-	-	-	1	-	-	1
	Handleless cup	-	-	-	-	-	-	-	2	-	-	2
	Two-handled cup	1	-	-	-	-	-	-	-	-	-	1
Jars	Transport jar	19	-	-	-	-	-	-	-	-	1	20
	Conical-necked jar	6	-	-	-	-	-	-	-	-	-	6
	Closed jar	-	-	-	-	-	-	-	1	-	-	1
	Jar/jug (vertical handles)	2	-	-	-	-	-	-	22	-	-	24
Pithoi	Pithoid jar/pithos	-	-	-	-	-	-	-	-	-	85	85
	Wide-mouthed pithos	-	-	-	-	24	-	-	-	-	-	24
	Collar-necked pithos	-	-	-	-	-	-	1	-	-	-	1
	Conical-necked pithos	-	-	-	-	2	1	-	-	-	-	3
	Pithos	1	-	-	-	-	-	-	-	-	-	1
Jugs	Jug with a straight profile	1	-	-	-	-	-	-	-	-	-	1
	Cut-away spouted jug	1	-	-	-	-	-	-	-	-	-	1
	Jug with vertical incisions	2	-	-	-	-	-	-	-	-	-	2
	Two-stage profile beaked jug	2	-	-	-	-	-	-	-	-	-	2
	Flask-shaped jug	-	-	-	-	-	-	-	1	-	-	1
	Barbotine jug	-	-	-	-	-	2	-	-	-	-	2
	Jug/amphora	-	-	-	-	-	-	-	1	-	-	1
	Amphora	12	-	-	-	-	-	-	-	-	-	12
Pyxides	Pyxis/jug	-	-	14	1	-	3	-	-	-	-	18
	Spherical pyxis	3	2	-	-	-	-	-	-	-	-	5
	Spherical/biconical pyxis	2	-	-	-	-	-	-	-	-	-	2
	Truncated conical pyxis	1	-	-	-	-	-	-	-	-	-	1
	Collar-necked pyxis	1	-	-	-	-	-	-	-	-	-	1
Misc.	Askos	-	-	19	-	-	-	-	-	1	-	20
	Lid	1	-	1	-	-	-	-	-	-	-	2
	Body sherds (closed vessels)	8	-	-	-	-	-	-	-	-	-	8
	Body sherds with rounded knobs	-	-	-	-	-	12	-	-	-	-	12
Total		63	2	34	1	26	18	1	39	5	86	**275**

Table 6.6: Correlation between decorative modes and shapes.

6.5 Shapes and typological classification

The shape categories are generally well-defined and show a wide variety of forms, ranging from open to closed and from small to large vessels and represent various functions. The main pottery classes include bowls and related shapes, cups and related shapes, jars and related shapes, jugs and related shapes, pyxides and related shapes, pithoi and related shapes, cooking pots and related shapes, and miscellaneous shapes. The division of types within these eight categories (Tab. 6.2) is based on both morphological and functional criteria. Although interpretations of possible functions are a difficult subject in archaeological studies, some overall observations are taken as valid.

All the pottery was quantified by individual vessel counts. However, the records of the old excavations show that body or undiagnostic sherds were mostly discarded, whereas in the new excavations all sherds were kept and recorded. It must be, therefore, cautioned that the quantification of pottery is based only on the extant ceramic material and represents the minimum estimate of the overall assemblages. In most cases, this is based upon the count of rim sherds and every effort was made to match rims, bases, handles, and body sherds. A number of 1970 individual vessels were recorded and examined macroscopically. At least half of these were chosen for drawing (by A. Kontonis and C. Kolb) and all were photographed (by C. Papanikolopoulos and S. Menelaou).

The diachronic study of all functional categories shows an interesting change from Ch to EB I-II early, in the predominance of cooking pots in the former and the increase in bowls and jars in the latter periods. Interestingly, a further increase in bowls and a decrease in cooking pots are observed in EB II developed onwards, while cups become more common in EB II late and EB III (Fig. 6.13).

A full account of representative vessel shapes and types, possible variants, and parallels from selected sites across the Aegean and Anatolia is presented in Appendix II by fabric, accompanied by tables with contextual information in a chronological order. Only the most representative shapes are presented below. Within each shape category a discussion by chronological period is attempted. The focus in this chapter is on the summarised presentation of the 8 morphological/functional categories, the correlations between the variables of form, surface treatment, and fabric, and the assessment of diachronic changes observed rather than a repetition of information found in Appendix II.

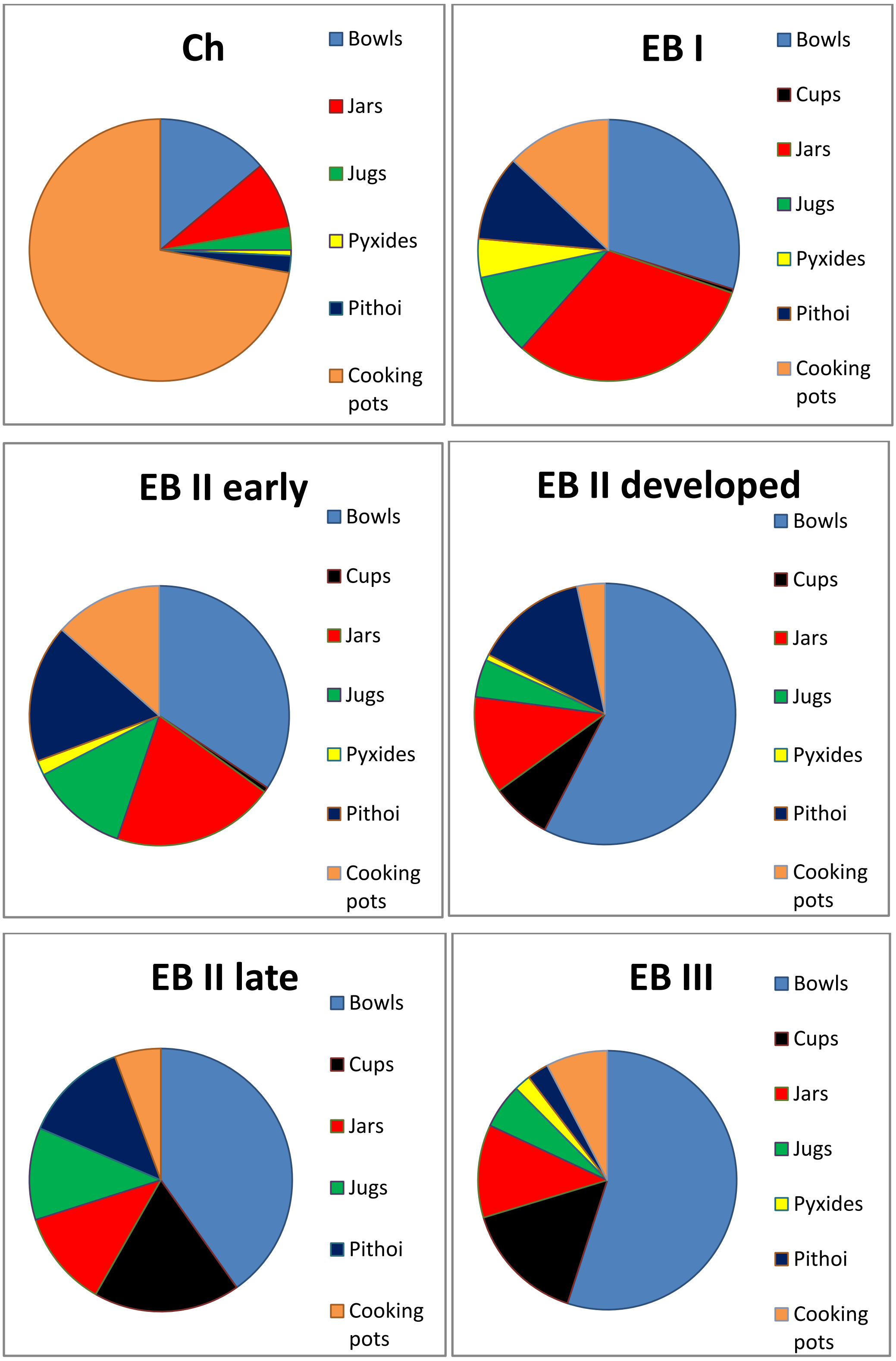


Figure 6.13: Charts showing the diachronic frequency of the seven functional vessel categories.

6.5.1 Bowls and related shapes

A total of 757 bowls were recorded overall, which are divided into 26 varieties according to rim and wall angle, overall profile, and size (Tab. 6.7). The bowl is the most popular shape in the Heraion assemblage and accounts for almost 1/4 of the total amount. The full profile is very rarely preserved and therefore the lower part of the vessels cannot be reconstructed in most cases.

Bowls were in use throughout the settlement's history, although a number of correlations between appearance and chronological distribution of specific types are observed. During the Ch only 20 vessels are recorded, while the vast majority appear in the EB III period (265 vessels). This could be an outcome of the limited excavated area of the Ch-EB I compared to the later EBA. More particularly, the first half of the 3rd millennium BC includes mainly bowls with carinated rim, which can be further distinguished into sub-varieties of low or high carination and shallow to deep forms (Fig. 6.14:1, 3). Some rare examples appear with horizontal trumpet lugs on or below the rim (Fig. 6.14:2). Variety A accounts for more than 1/4 of the total bowl amount and is particularly common in the EB II period, when the presence of plastic knobs on and below the rim, and horizontal handles, become more common (Fig. 6.14:4-5). Other types spanning the Ch-EB II period include deep bowls with bevelled rim (Fig. 6.14:6), with straight sides, with incurving sides or rim, with internally-differentiated rim (Fig. 6.14:6), etc. (Varieties B-H). Nevertheless, some types are consistently found to be in use in the Ch and EB I periods, namely the bowls with carinated shoulder (Variety C; Fig. 6.14:7), the deep bowls with curving sides (Variety D; Fig. 6.15:1-2), the bowls with inward-curving rim (Variety F; Fig. 6.15:4-5), bowls with outward-curving and thickened rim (Variety H; Fig. 6.15:7), and those with a rolled rim (Fig. 6.15:8). The vast majority of the remaining types first appear in EB II developed, although often continuing in the EB II late and EB III periods, namely footed bowls (Fig. 6.16:1), pedestalled bowls/fruitstands, shallow bowls/plates (Fig. 6.16:8) or are restricted to EB II developed (spouted bowl, conical saucer; Fig. 6.16:5). Apart from those types continuing from previous periods, EB II late sees also the appearance of new types such as DOL small bowls (Fig. 6.16:2), tripod bowls, two-handled bowls (Fig. 6.16:6), and wheel-made plates. Lastly, in EB III some of the afore-mentioned types continue with an apparent decrease, but new types predominate and outnumber the rest such as shallow/hemispherical bowls (105 vessels, Fig. 6.16:3), S-rim bowls (99 vessels, Fig.

6.16:4), and wheel-made plates (51 vessels, Fig. 6.16:9). A number of 42 vessels are characterised as unclear and do not fit chronologically to a particular period.

In terms of macroscopic fabrics there seems to be consistency with specific types (Tab. 6.2). More specifically, Varieties A to H are consistently made in MG5A-B and occasionally MG5C or MG6. This is also in line with the chronological correlation of specific fabrics. The footed bowls are similarly made in MG5B and MG6, while the shallow bowls/plates are only made in MG6. Strong chronological and fabric correlations are also identified in the DOL small bowls (MG19), tripod bowls (MG8), two-handled bowls (MG7A, MG8, MG9), pedestalled bowls/fruitstands (MG8), which are mostly dated to the EB II late period. The EB III shapes are only made in MG10 (shallow/hemispherical bowls, S-rim bowls) and MG12 (wheel-made plates) respectively. The only type that shows a wider variability of fabrics is the basin (Fig. 6.16:7), which appears in MG1 and MG2. This might indicate the use of this shape for cooking purposes, as it fits better with the picture of fabric variability of the cooking vessel types (Section 6.5.7).

The relation between surface treatment and shape is occasionally loose and some types appear in more than one mode (Tab. 6.4). More particularly, the plain mode is better represented in bowls and basins of the Ch and EB I (29 vessels), while the smoothed mode is more loosely distributed among shapes and fabrics. This could be also the effect of non-preservation or the result of abrasion of the original surface. It includes carinated bowls (Variety A), shallow/hemispherical and S-rim bowls of the EB III, and wheel-made plates, all amounting to 278 vessels. The IrrB mode is correlated with the different bowl varieties, but is best represented by Variety A and the footed bowls. Other minor treatment modes include DR/RBS that represents Variety A bowls and shallow bowls/plates, RBS that represents Variety B bowls and Variety D bowls, as well as RS that represents Variety A bowls and footed bowls. Modes BSB and LR/RS are period-specific and cover respectively EB II late bowls (tripod bowl, two-handled bowl, pedestalled bowl) and EB III types (conical bowl, shallow/hemispherical bowl, S-rim bowl, wheel-made plate).

Only a few bowl examples are decorated (Tab. 6.6), including the small bowls in DOL painted decoration and the tripod bowl and pedestalled bowls/fruitstands with grooved decoration. The small numbers of these vessel types combined with information about their fabrics and surface treatment indicate that they are most likely off-island products.

Chronology / Shapes		Ch	EB I	EB II early	EB II developed	EB II late	EB III	Unclear	**Total**
Bowls and related shapes	Deep bowl, carinated rim (Variety A)	-	32	23	129	11	-	9	204
	Bowl, bevelled rim (Variety B)	3	2	6	7	-	-	2	20
	Bowl, carinated shoulder (Variety C)	-	7	7	3	-	-	-	17
	Deep bowl, curving sides (Variety D)	12	5	3	9	-	-	-	29
	Deep bowl, straight walls (Variety E)	-	3	1	12	2	2	1	21
	Bowl, inward-curving rim (Variety F)	-	9	-	4	-	-	-	13
	Bowl, internally-differentiated rim (Variety G)	-	1	-	2	-	-	-	3
	Bowl, outward-curving and thickened rim (Variety H)	2	3	-	-	-	-	-	5
	Footed bowl	-	-	-	13	5	5	6	29
	Shallow bowl, pierced lug	-	-	-	1	-	-	-	1
	Bowl with rolled rim	3	-	-	-	-	-	-	3
	Spouted bowl	-	-	-	1	-	-	-	1
	Conical saucer	-	-	-	1	-	-	-	1
	DOL small bowl	-	-	-	-	4	-	-	4
	Tripod bowl	-	-	-	-	1	-	-	1
	Two-handled bowl	-	-	-	-	12	-	-	12
	Pedestalled bowl/fruitstand	-	-	-	3	1	-	-	4
	Shallow bowl with everted rim	-	-	-	1	-	-	-	1
	Shallow bowl with curving sides	-	-	2	-	-	-	-	2
	Shallow bowl/plate	-	-	-	39	18	-	10	67
	Conical bowl	-	-	-	-	-	3	-	3
	Shallow/hemispherical bowl	-	-	-	4	8	105	4	121
	S-rim bowl	-	-	-	2	3	99	9	113
	Wheel-made plate	-	-	-	-	12	51	-	63
	Unusual wheel-made shallow bowl	-	-	-	-	1	-	-	1
	Basin	-	-	14	3	-	-	1	18
	Total	20	62	56	234	78	265	42	**757**

Table 6.7: Correlation between bowls and chronological periods.

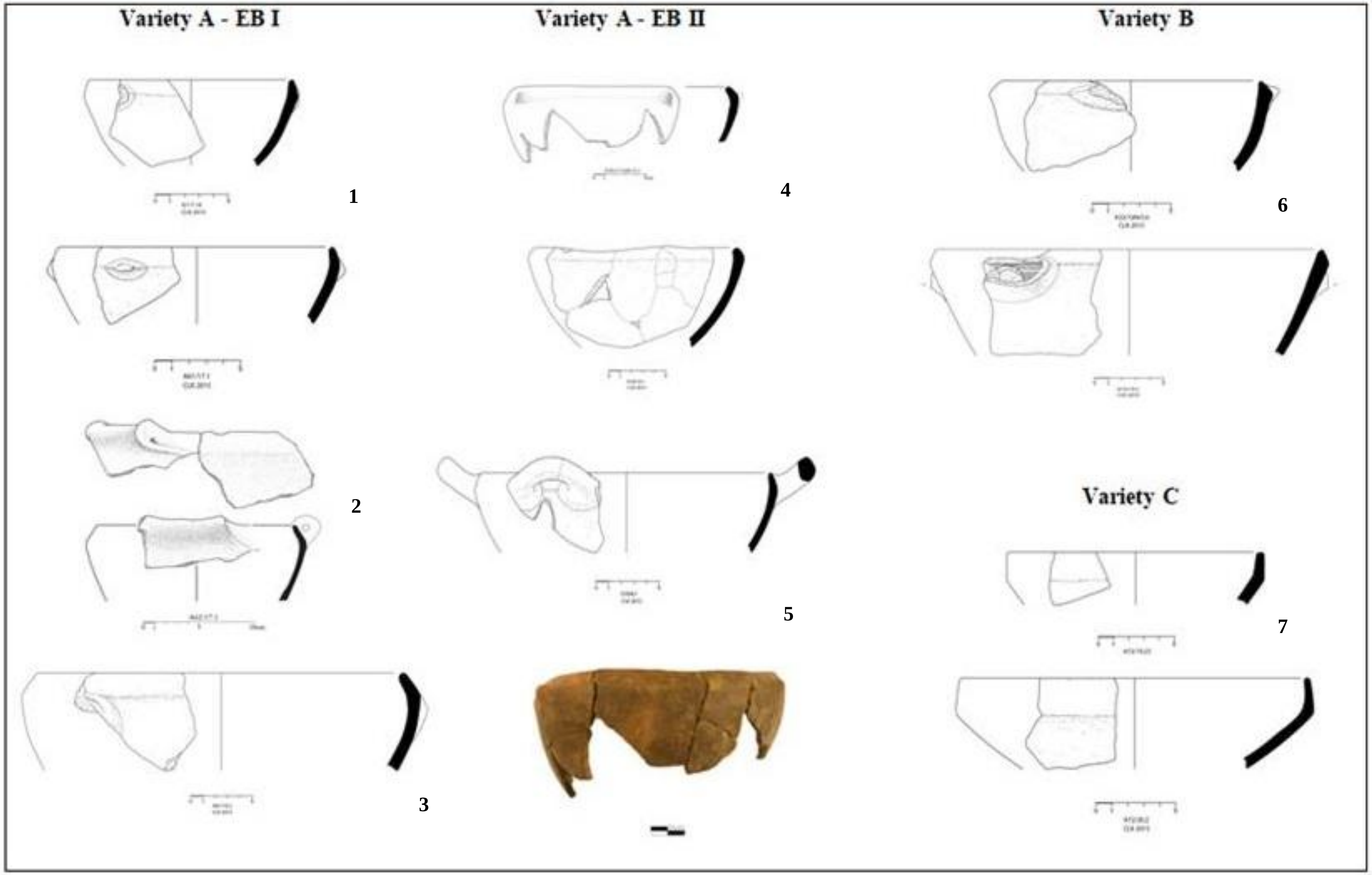


Figure 6.14: Bowls and related shapes. Variety A (1-5); Variety B (6); Variety C (7).

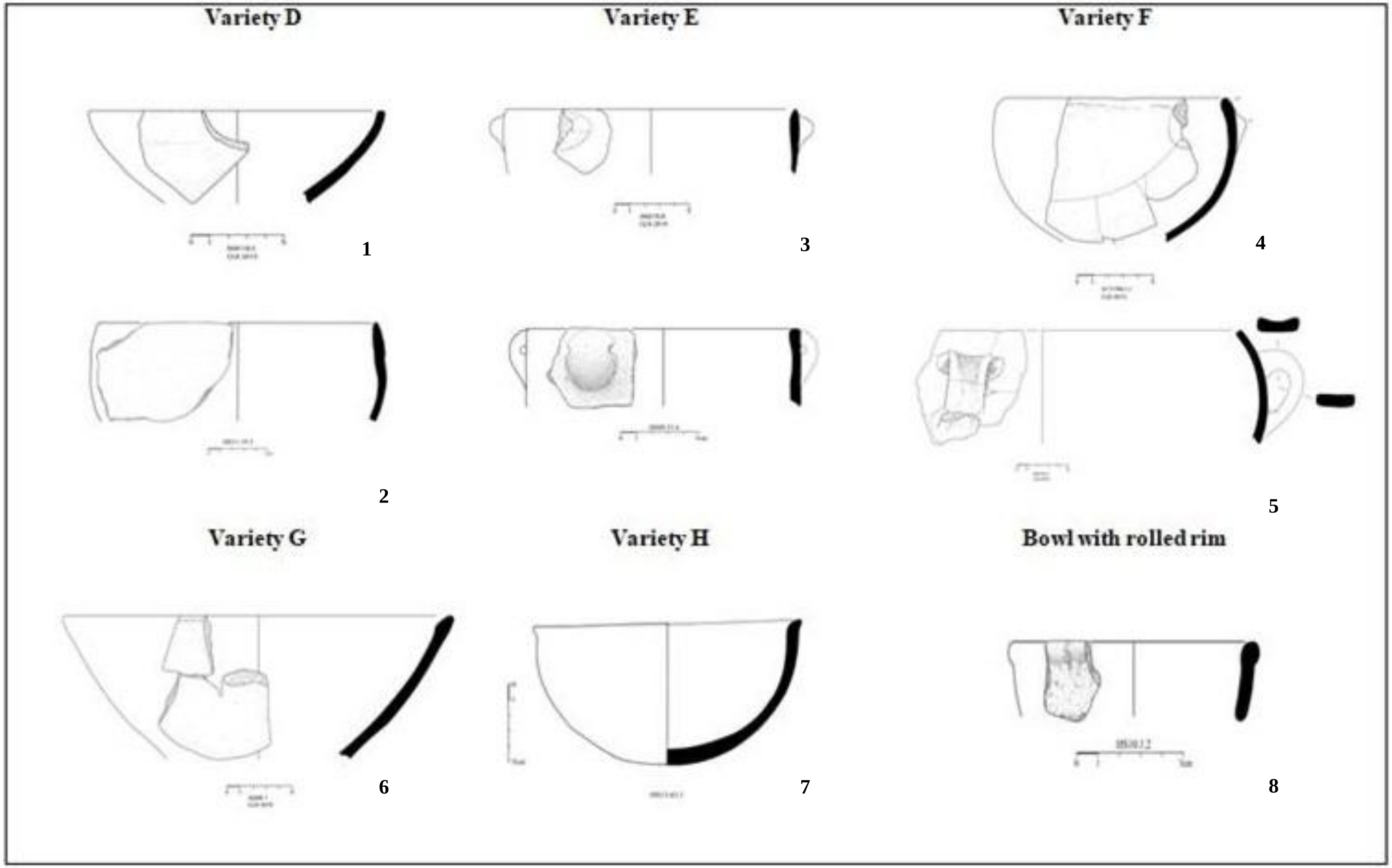


Figure 6.15: Bowls and related shapes. Variety D (1-2); Variety E (3); Variety F (4-5); Variety G (6); Variety H (7); Bowl with rolled rim (8).

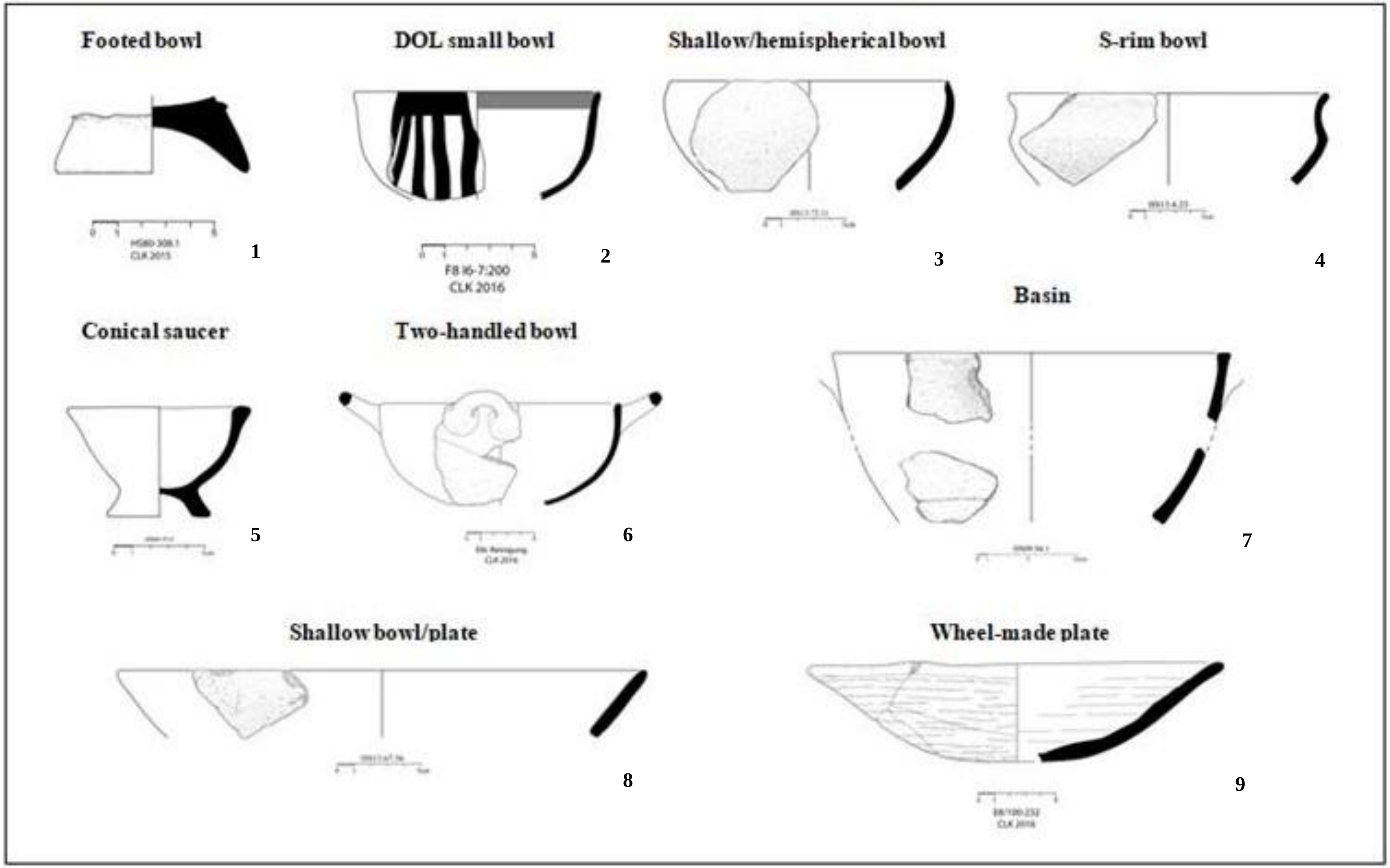


Figure 6.16: Bowls and related shapes. Footed bowl (1); DOL small bowl (2); Shallow/hemispherical bowl (3); S-rim bowl (4); Conical saucer (5); Two-handled bowl (6); Basin (7); Shallow bowl/plate (8); Wheel-made plate (9).

6.5.2 Cups and related shapes

The cups represent only a small part of the overall assemblage, amounting to 150 individual vessels (Tab. 6.8). With respect to their appearance and chronological distribution it was observed that the first cups appear in EB I (1 vessel) in the form of a one-handled dipper cup made in the local coarse metamorphic fabric. A single example of a one-handled cup is known from the EB II early period made in MG1. In EB II developed there occur the first tankards (Fig. 6.17:1), two-handled cups or bell-shaped cups (Fig. 6.17:2), and short-necked cups (Fig. 6.17:5), although the last two types are out-numbered by the tankard. The same shapes continue in EB II late with a small increase in the bell-shaped cups (Fig. 6.17:4), as well as the dipper cup (Fig. 6.17:9) and one-handled cup (Fig. 6.17:8) that are known from EB I and II early respectively. New types also appear for the first time such as the depas amphikypellon (Fig. 6.17:3; 3 vessels) and the strap-handled cup. The depas appears slightly later than short-necked cups, tankards, and bell-shaped cups, more particularly in Heraion III as in other Aegean and Anatolian sites (see Appendix II.16:5). The strap-handled cup could be interpreted as stray finds of EB III. EB III includes half of the total amount (74 vessels), with the majority being strap-handled or handleless cups (Fig. 6.17:6; 59 vessels) made in MG10. This type is essentially new and its morphological features imply that it imitates metallic prototypes. The thin walls, size, general form, and fabric point to new technological developments in the ceramic manufacture during this period. These cups include wheel-made and handmade examples. In all cases, their very thin walls, their vertical strap handles that replaced the rounded-sectioned loop handles of the traditional tankards and depas cups, the use of fine and high-fired fabrics and their geographical distribution (see Appendix II.20:4) imply the imitation of metallic prototypes, especially in the case of wheel-made examples with ridging or ribbing. At the same time, their standardisation and large-scale production probably was associated with their use in social events, as they were mostly unearthed in the *Grosses Haus*. Finally, the geographical distribution of these cups suggests the establishment of a micro-regional network of interactions throughout south-central western Anatolia and the islands of the SE Aegean. Almost all other types are present, but in very small numbers, except for dipper and depas cups.

There seems to be a correlation of macroscopic fabrics with specific types (Tab. 6.2). More particularly, the tankards are made in MG5C, MG7, MG9, and MG10 with the majority being found in MG7, the bell-shaped cups and two-handled cups/bell-shaped cups in MG5D, MG6, MG7, MG8, and MG9, the short-necked cups in MG7A, MG8, and MG9, the depas in MG7A, the strap-handled or handleless cups in MG10, the one-handled cups in MG1, MG5D, and MG6, and the dipper cups in MG5A and MG5C. Thus, it is observed that the majority of types are made in fabrics taken as local, while others represent fabrics that are most probably off-island or are found in combination with both categories (tankards, bell-shaped cups, short-necked cups, depas cups). The latter observation is very important in that it supports and strengthens the argument regarding the exchange and circulation of these cup types during the EB II late period.

There seems to be a good correlation in most cases between the various cup types and surface treatment modes (Tab. 6.4). More particularly, the majority are RS, especially tankards (29 vessels) and two-handled cups/bell-shaped cups (14 vessels). Nevertheless, a number of treatment modes are shared between the types, such as R/BSB, BSB, and BT. Other modes are less well-represented and are confined to specific types such as LR/RS used for the strap-handled cups of the EB III.

Chronology / Shapes		Ch	EB I	EB II early	EB II developed	EB II late	EB III	Unclear	**Total**
Cups and related shapes	Tankard	-	-	-	20	12	3	3	38
	Two-handled cup/bell-shaped	-	-	-	6	9	-	4	19
	Bell-shaped cup	-	-	-	-	1	4	-	5
	Short-necked cup	-	-	-	4	3	1	-	8
	Depas amphikypellon	-	-	-	-	3	-	-	3
	Handleless cup, ribbed	-	-	-	-	2	-	-	2
	Strap-handled/ handleless cup	-	-	-	-	3	59	2	64
	One-handled cup	-	-	1	-	1	4	-	6
	Two-handled vessel/large tankard	-	-	-	-	-	3	-	3
	Dipper cup	-	1	-	-	1	-	-	2
	Total	-	1	1	30	35	74	9	**150**

Table 6.8: Correlation between cups and chronological periods.

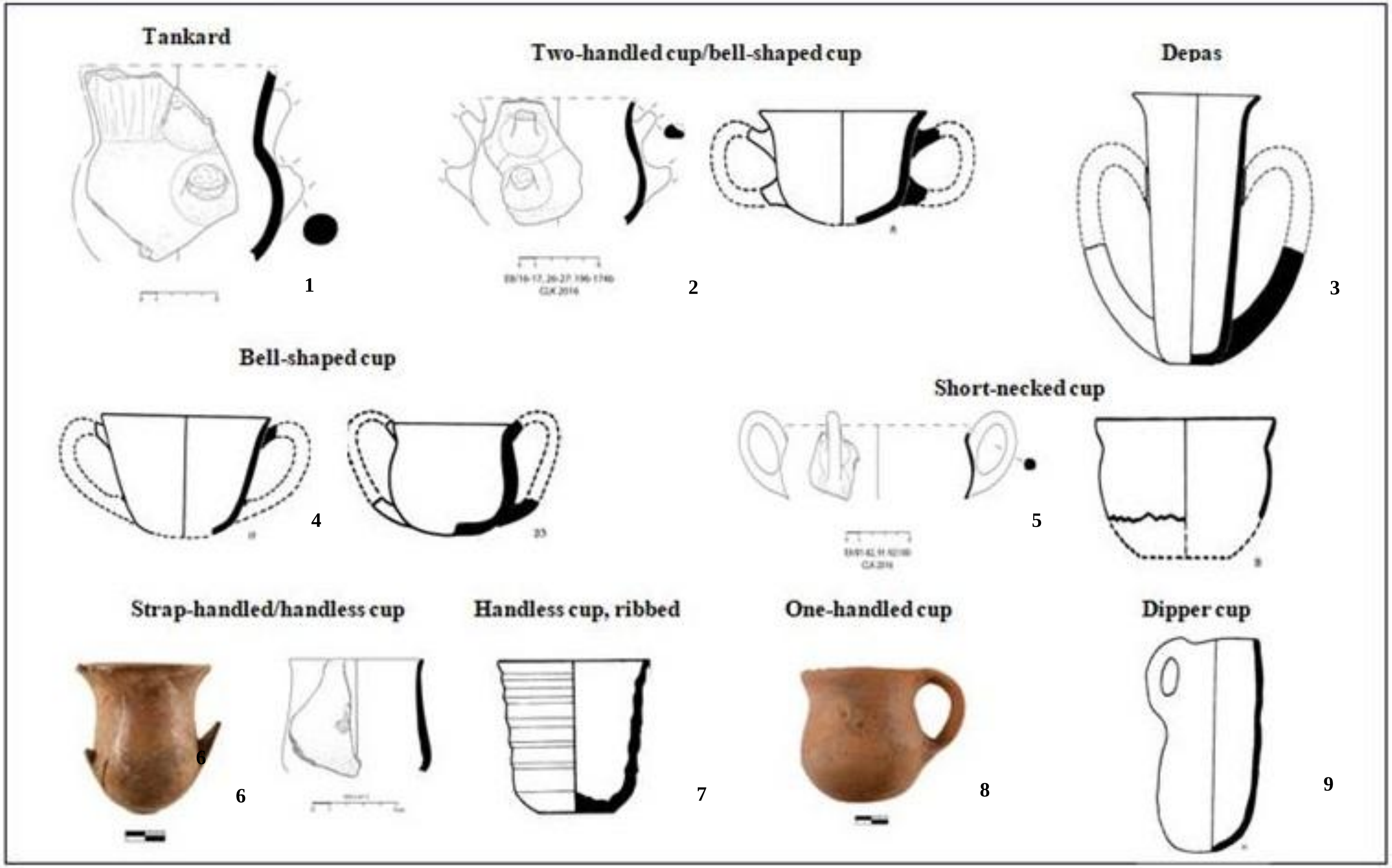


Figure 6.17: Cups and related shapes. Tankard (1); Two-handled cup/bell-shaped cup (2); Depas cup (3); Bell-shaped cup (4); Short-necked cup (5); Strap-handled/handleless cup (6); Handleless cup, ribbed (7); One-handled cup (8); Dipper cup (9).

6.5.3 Jars and related shapes

Following the bowls and miscellaneous shapes categories, the jars and related shapes are represented by a total of 242 vessels (Tab. 6.9). Similarly to bowls, jars exhibit a wide range of varieties and can be distinguished into 18 sub-types according to differences in the rim and neck, size, and decoration. However, the main forms are less but for the sake of the holistic recording undertaken in this thesis, a detailed number of sub-types are distinguished on the basis of chronological changes in surface and fabric.

Jars were in use throughout the settlement's history and are somewhat equally distributed among the periods, showing a good correlation between chronological distribution and types in most cases. The basic form remains unchanged in general, but what changes is usually the profile/angle and position of rim and neck. Thus, two main forms may be distinguished, i.e. the open and closed jars with a number of varieties and sub-types. More particularly, the early phases (Ch-EB I) include four varieties, i.e. jars with collared neck (Variety A; Fig. 6.18:1), jars with straight or everted rim and slightly outcurving shoulders (Variety B; Fig. 6.18:2-3), open jars with straight walls (Variety C; Fig. 6.18:4), and jars with differentiated necks and outcurving rim (Variety D; Fig. 6.18:5), of which only Varieties B and D also continue with a decrease in EB II early and developed. Variety B outnumbers all jar types recorded at Heraion. Some of the aforementioned types continue in EB II early and disappear by the end of this period or EB II developed (Variety B, Variety D, wide-mouthed jar, Fig. 6.18:6; collar-necked jar), while new types appear in EB II developed (concave-necked jar, conical-necked jar, jar with horizontal handles). In the second half of the 3rd millennium BC the majority of jar shapes disappear, apart from a few that continue from EB II developed in very small numbers (concave-necked jar, jar with horizontal handles). Nevertheless, EB II late is characterised by the first appearance of transport jars with horizontal slashed/incised handles (Fig. 6.19:3), which are imported from a number of central Aegean sites. During EB III the majority of jar shapes are new and include types such as the wide-mouthed jar with horizontal handles (Fig. 6.19:6), concave-necked jar in much larger numbers (Fig. 6.19:2), conical-necked jar, collared-jar with vertical loop handles (Fig. 6.19:4-5), and winged jar (Fig. 6.19:8).

With respect to the relation between macroscopic fabrics and shapes, these seem to be consistent in most cases. More particularly, Varieties A to E are correlated with MG5A and MG5B and the wide-mouthed jars/deep bowls with MG4. Other types are found in various fabrics, e.g. the concave-necked jars in MG10 and MG16, the closed jars in MG22, MG23, and MG24, and the transport jars with incised/slashed handles in MG14, MG15, MG16, MG22, MG25, MG32, and MG33.

Regarding the relation between surface treatment and shape (Tab. 6.4) it becomes apparent that most types are represented by a number of different modes. The majority fall into the plain and smoothed modes, especially the early-dated examples, while the jar Varieties A to D include also examples with IrrB or RBS surface. Other modes include the RSB, that covers off-island wide-mouthed jars/deep bowls and a winged jar, as well as the DGSBInc that is represented by conical-necked jars.

Only a few jar examples are decorated (Tab. 6.6). These include the transport jars with incised/slashed handles, the conical-necked jars with various incised motifs (Fig. 6.19:7), and some jar/jug vertical handles with twisted/grooved decoration.

Chronology / Shapes		Ch	Ch/EB I	EBI	EB II early	EB II developed	EB II late	EB III	Unclear	**Total**
Jars and related shapes	Jar Variety A	5	2	-	-	-	-	-	-	7
	Jar Variety B	3	28	6	17	14	-	-	-	68
	Jar Variety C	-	-	8	-	-	-	-	-	8
	Jar Variety D	-	-	11	3	6	-	-	-	20
	Jar Variety E	-	-	-	-	1	-	-	-	1
	Wide-mouthed jar/deep bowl	-	-	3	7	6	-	3	-	19
	Wide-mouthed jar, horizontal handles	-	-	-	-	-	-	7	-	7
	Concave-necked jar	-	-	-	-	2	1	33	3	39
	Collar-necked jar	-	-	-	2	7	-	-	-	9
	Conical-necked jar	-	-	-	-	1	-	5	-	6
	Collared jar with vertical loop handles	-	-	-	-	-	-	4	-	4
	Jar with horizontal handles	-	-	-	-	8	2	-	-	10
	Winged jar	-	-	-	-	-	-	1	-	1
	Transport jar with plain horizontal/vertical handles	-	-	-	-	-	2	2	-	4
	Transport jar with incised/slashed handles	-	-	-	-	1	17	-	1	19
	Closed jar	-	-	-	1	1	1	-	-	3
	Jar/jug	-	-	7	-	-	-	1	-	8
	Unassignable jar sherds	4	-	-	3	2	-	-	-	9
	Total	12	30	35	33	49	23	56	4	**242**

Table 6.9: Correlation between jars and chronological periods.

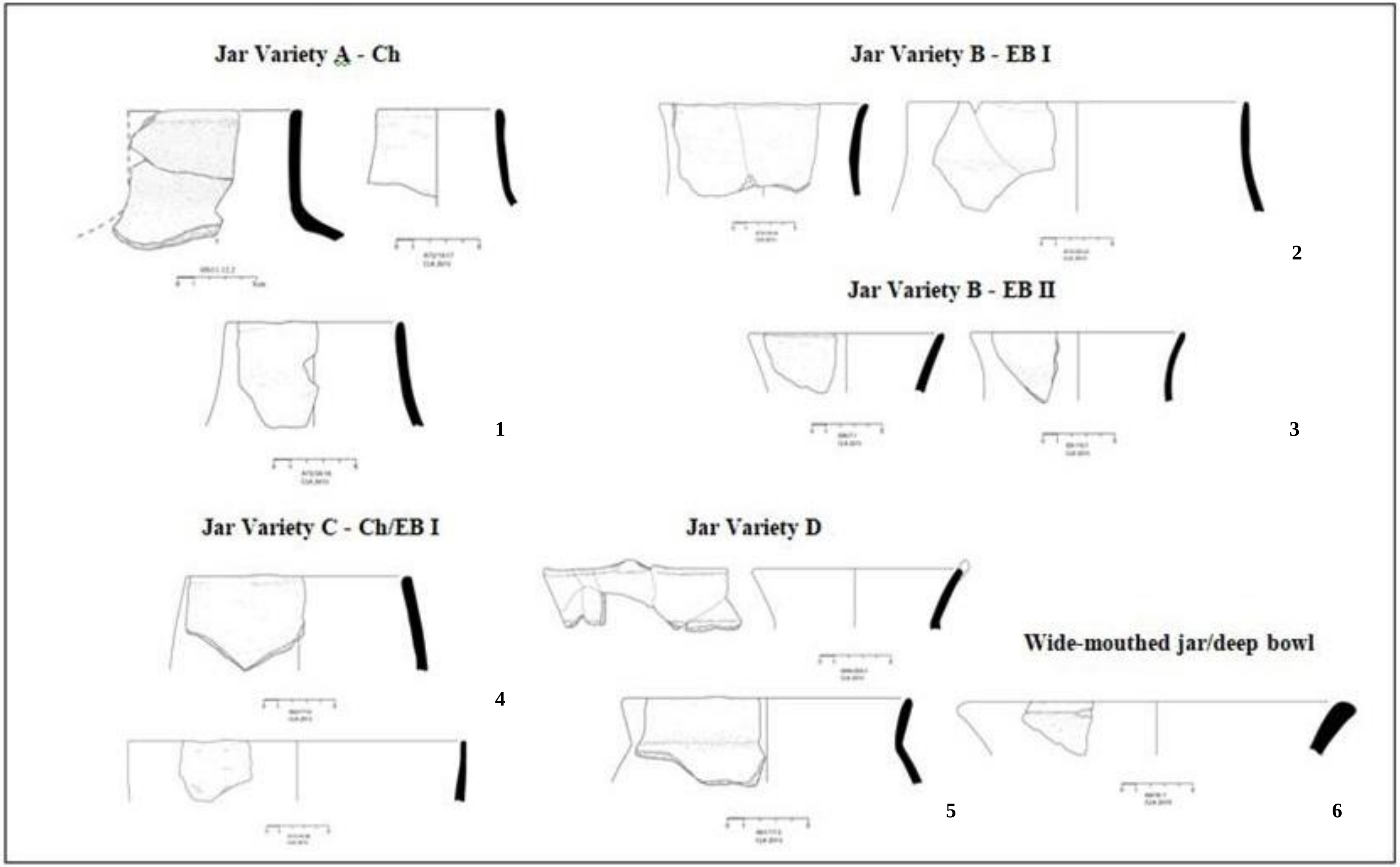


Figure 6.18: Jars and related shapes. Variety A (1); Variety B (2-3); Variety C (4); Variety D (5); Wide-mouthed jar/deep bowl (6).

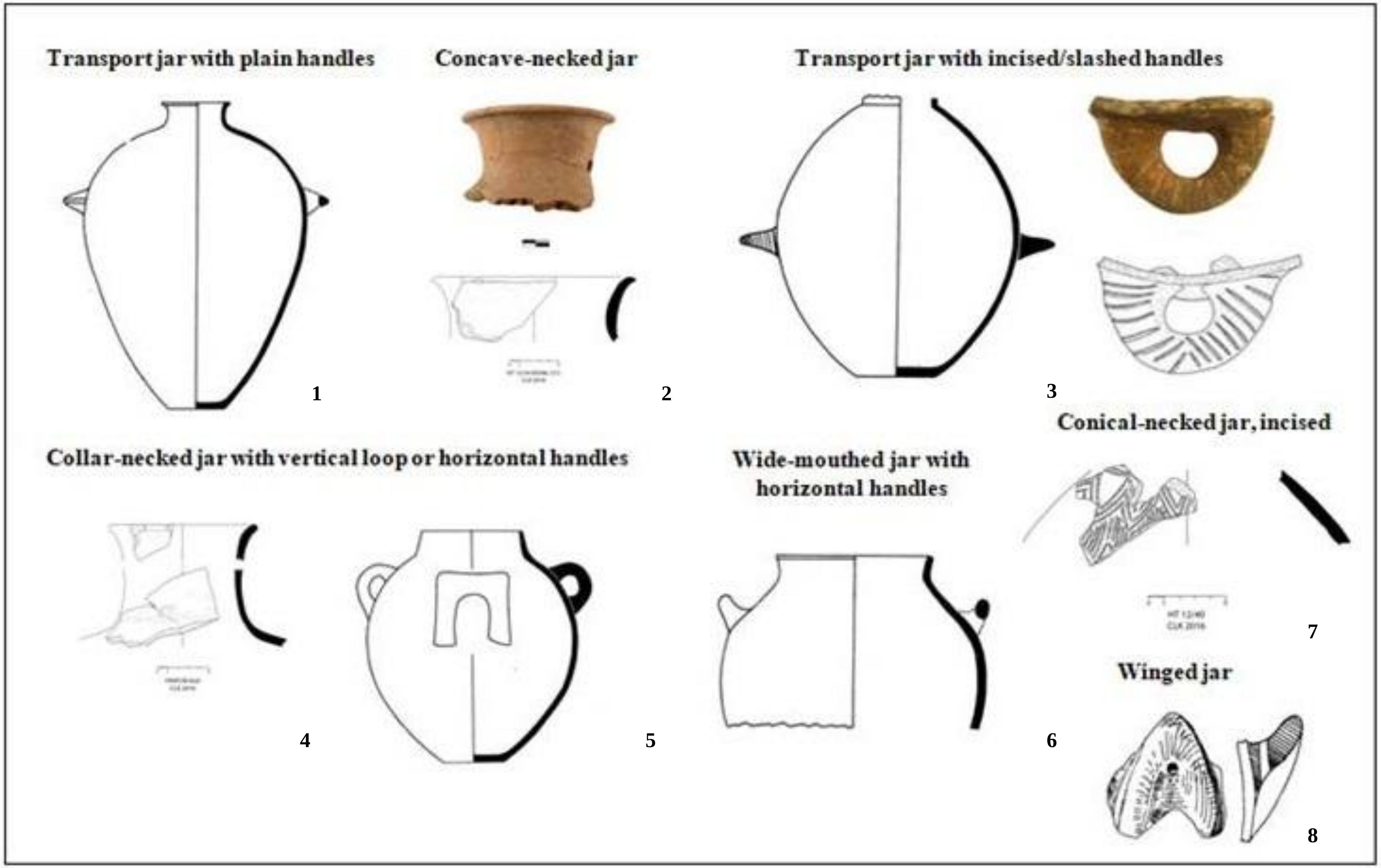


Figure 6.19: Jars and related shapes. Transport jar with plain handles (1); Concave-necked jar (2); Transport jar with incised/slashed handles (3); Collar-necked jar with vertical loop or horizontal handles (4-5); Wide-mouthed jar with horizontal handles (6); Conical-necked jar, incised (7); Winged jar (8).

6.5.4 Jugs and related shapes

This shape is represented by 117 individual vessels of various types, equally distributed from EB I to EB III period (Tab. 6.10). Only 4 jugs date to the Ch period, and are exclusively cut-away spouted (Fig. 6.20:2, 4). The best-represented types are the cut-away spouted jugs (16 vessels), beak-spouted jugs (20 vessels), neck-handled ovoid jugs with a trumpet mouth (18 vessels), and amphorae (21 vessels).

Regarding the relation between periods and types, it seems that there is some degree of correlation. More particularly, the cut-away spouted jugs were in use from the Ch until the EB II developed, the beak-spouted jugs (Fig. 6.21:1) mainly in EB I-II early period, while the straight-sided jugs (Fig. 6.20:1) occur only in EB I. However, in EB II late the jug repertoire is enriched, but its frequency does not exceed the previous periods. These new types represent imports in most cases and include the steep-necked jug (Fig. 6.21:6), jug with vertical incisions (Fig. 6.21:2), beaked jug with a two-stage neck profile (Fig. 6.21:3), flask-shaped jug (Fig. 6.21:4), and concave-necked jug. They do not seem to continue into EB III, but rather new shapes appear such as the neck-handled ovoid jug with a trumpet mouth (Fig. 6.21:7), the trefoil-mouthed jug, and the barbotine ware jug (Fig. 6.21:5).

Regarding the relation between fabric and form (Tab. 6.2), there seems to be a distinction between the long-lasting types (e.g. cut-away spouted, beak-spouted, straight-sided) that fall into fabrics considered to be local (MG1, MG5A, MG5B, MG5C, MG6), and those types that appear in the end of the EB II period and are seemingly imported (MG4, MG7, MG8, MG14). The types appearing in EB III are interpreted as local (MG10), although the fine nature of their fabric prevents a secure determination to date.

No particular correlation between surface treatment and shape is observed (Tab. 6.4). The early-dated examples are usually plain/smoothed or IrrB and more rarely RSB. The later examples are mainly RS or RBS, but this does not follow a specific pattern.

Some vessels appear with decoration on the exterior surface, amongst which most common is the incised mode. More particularly, the amphorae and less often the cut-away spouted jugs are characterised by herringbone or zig-zag motifs on the upper part of the vertical handles (Figs. 6.20:3, 6.21:8). Other examples with linear or zig-zag motifs include jugs with vertical incisions and beaked jugs with a two-stage neck profile. Examples with grooved decoration also occur, although less well-represented, as well as a single example of a barbotine ware jug with plastic decoration.

Chronology									
Shapes		Ch	EB I	EB II early	EB II developed	EB II late	EB III	Unclear	**Total**
Jugs and related shapes	Narrow-necked/straight-sided jug	-	4	1	3	-	-	-	8
	Wide-mouthed jug	-	-	-	1	-	-	-	1
	Cut-away spouted jug	4	3	3	4	-		2	16
	Beak-spouted jug	-	5	6	1	2	4	2	20
	Steep-necked jug	-	-	-	-	1	-	-	1
	Jug with vertical incisions	-	-	-	-	2	-	-	2
	Two-stage profile beaked jug	-	-	-	-	2	-	-	2
	Flask-shaped jug	-	-	-	-	2	-	-	2
	Barbotine jug	-	-	-	-	-	2	-	2
	Concave-necked jug	-	-	-	-	1	-	-	1
	Strap-handled jug	-	-	-	-	1?	-	-	1
	Neck-handled jug with trumpet mouth	-	-	-	-	1	17	-	18
	Jug with trefoil mouth	-	-	-	-	-	1	-	1
	Amphora	-	6	8	5	-	2	-	21
	Jug/jar	-	-	-	-	9	-	-	9
	Juglet	-	-	-	-	1	1	-	2
	Miniature jug	-	-	-	3	-	-	-	3
	Unassignable jug sherds	-	3	2	2	-	-	-	7
	Total	4	21	20	19	22	27	4	**117**

Table 6.10: Correlation between jugs and chronological periods.

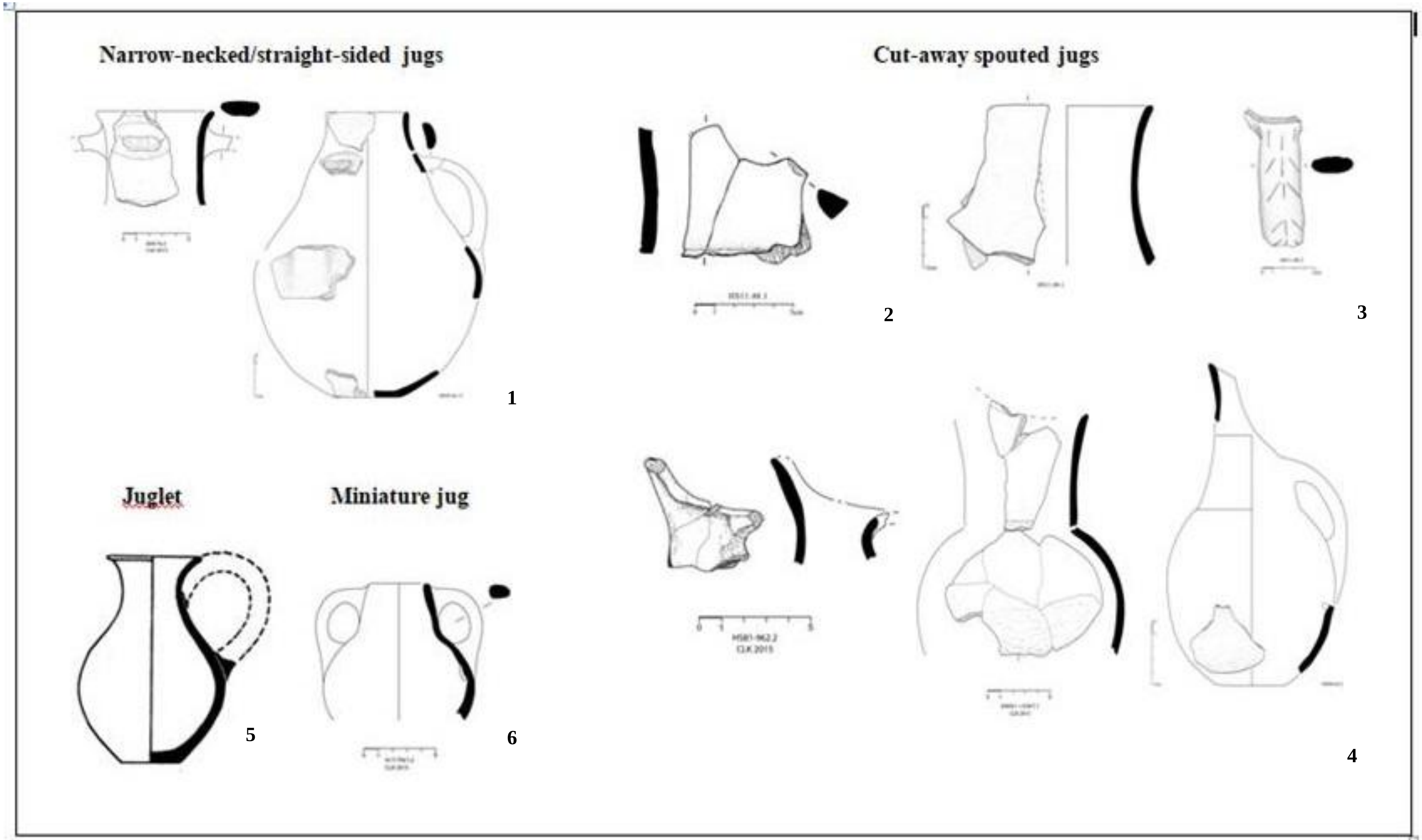


Figure 6.20: Jugs and related shapes. Narrow-necked/straight-sided jug (1); Cut-away spouted jug (2-4); Juglet (5); Miniature jug (6).

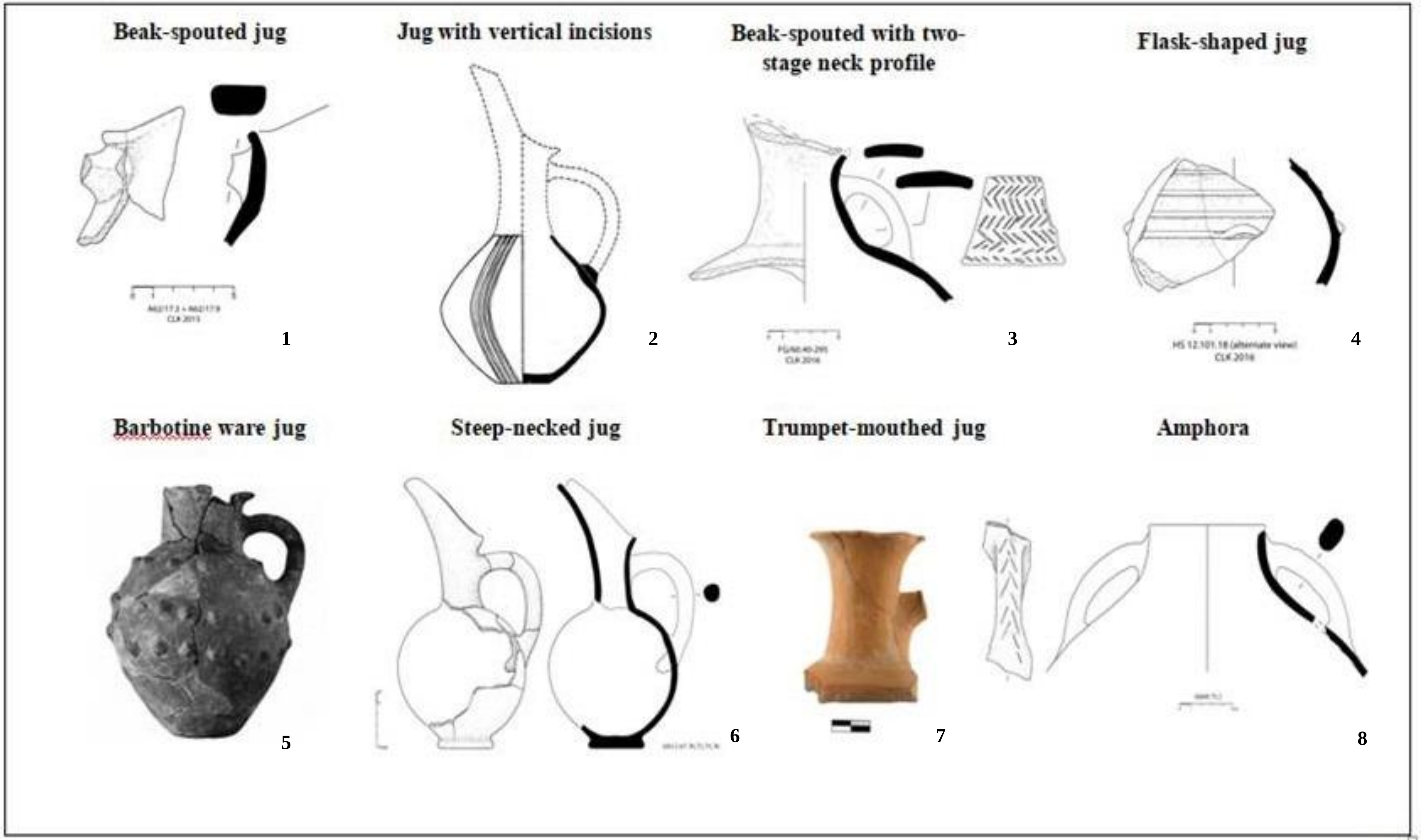


Figure 6.21: Jugs and related shapes. Beak-spouted jug (1); Jug with vertical incisions (2); Beak-spouted jug with two-stage neck profile (3); Flask-shaped jug (4); Barbotine ware jug (5); Steep-necked jug (6); Trumpet-mouthed jug (7); Amphora (8).

6.5.5 Pyxides and related shapes

These represent only a very small fraction of the overall assemblage (31 vessels; Tab. 6.11). The majority correspond to types first appearing in the EB III period (spherical, truncated conical, collar-necked; Fig. 6.22:2-3), while a group of pyxides/jug body sherds are dated to the EB I and EB II early periods (Fig. 6.22:1). One double tripod pyxis and a single miniature pyxis date to EB II early/developed (Fig. 6.22:6-7) and a single globular pyxis with pierced lugs dates to the Ch or EB I (Fig. 6.22:5).

There seems to be a good correlation between fabrics and forms (Tab. 6.2) as the EB I pyxides/jugs are made in MG13, the EB III pyxides are made in MG11 and MG16, and the EB II early/developed in MG5B. Similarly, the surface treatment and decoration modes are very consistent with specific types (Tabs. 6.4 and 6.6). More specifically, almost all types are dark grey slipped and burnished or just dark burnished/smoothed and bear various patterns or decorative incised motifs on their exterior surface (DFInc, DGSBInc).

The often small size of these vessels in combination with usually decorated exterior has been taken as evidence for a somewhat aesthetic value of pyxides primarily due to their content (potentially perfumed oils). This shape, although in different varieties in terms of fabric and decoration, occurs in roughly contemporary EB II contexts in the Mesara plain, Crete in fine grey incised wares (Wilson and Day 1994, 79).

Chronology / Shapes		Ch	EB I	EB II early	EB II developed	EB II late	EB III	Unclear	**Total**
Pyxides and related shapes	Pyxis/jug	-	10	3	1	-	-	4	18
	Spherical pyxis	-	-	-	-	-	7	-	7
	Small concave-necked jar/pyxis	-	-	-	-	-	1	-	1
	Truncated conical pyxis	-	-	-	-	-	1	-	1
	Collar-necked pyxis	-	-	-	-	-	1	-	1
	Double tripod pyxis	-	-	-	1	-	-	-	1
	Miniature pyxis	-	-	-	1	-	-	-	1
	Globular pyxis with pierced lug	1?	?	-	-	-	-	-	1
	Total	1	10	3	3	-	10	4	**31**

Table 6.11: Correlation between pyxides and chronological periods.

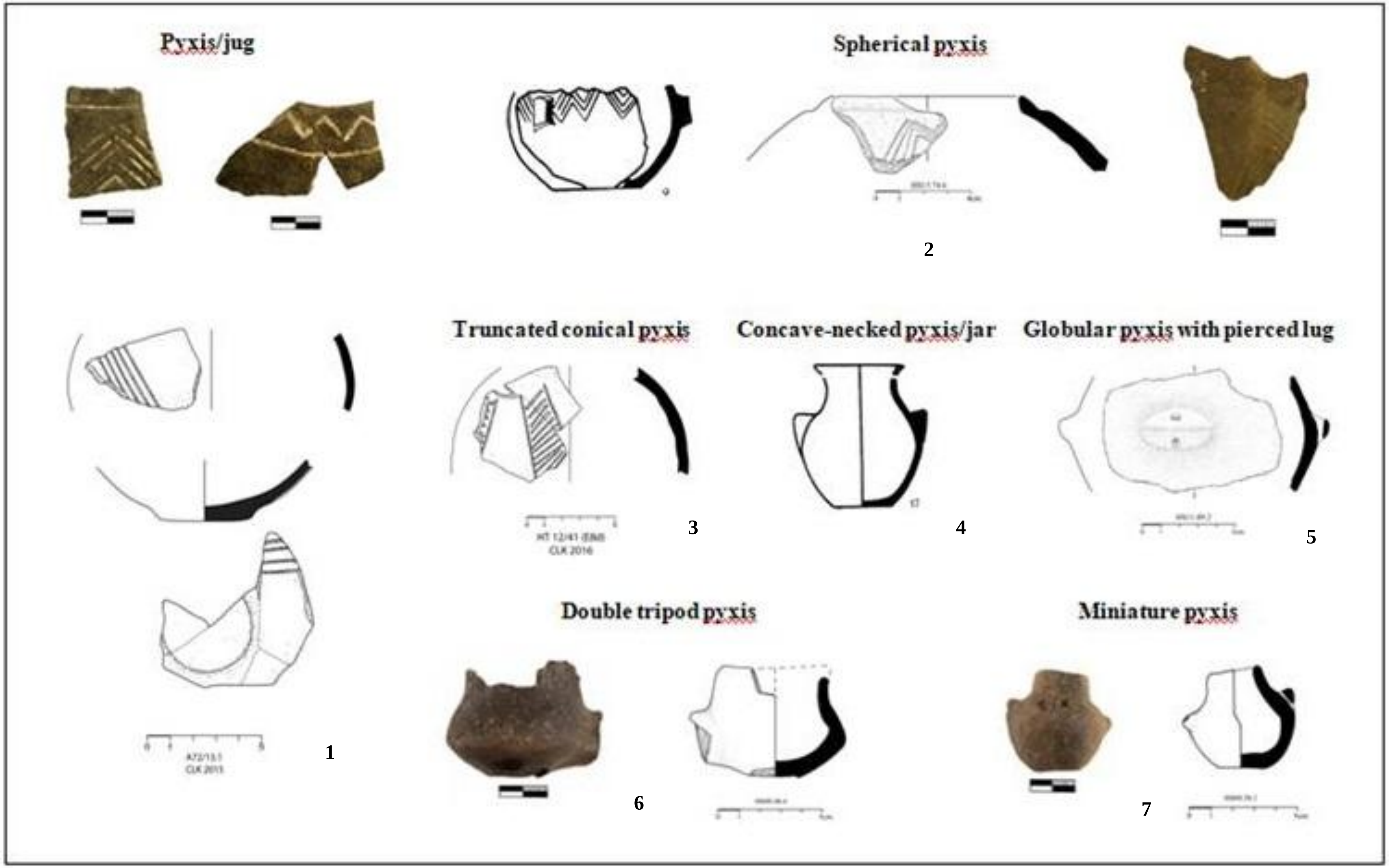


Figure 6.22: Pyxides and related shapes. Pyxis/jug (1); Spherical pyxis (2); Truncated conical pyxis (3); Concave-necked pyxis/jar (4); Globular pyxis with pierced lug (5); Double tripod pyxis (6); Miniature pyxis (7).

6.5.6 Pithoi and related shapes

This category consists of large, thick-walled storage vessels such as pithoid jars and pithoi. These are equally represented by diagnostic and non-diagnostic sherds and amount to 170 individual vessels (Tab. 6.12). Pithoi are generally more frequent in EB II, although appearing very sporadically already in the Ch/EB I in the case of the pithoid jars (Fig. 6.23:1) and collar/conical-necked pithoi with different rim and neck varieties (Fig. 6.23:3-5). The third main type, i.e. the wide-mouthed pithos with relief decoration (Fig. 6.23:2), first appears in EB II developed/late and continues over EB III. A similar pattern of rise in the number of pithoi in EB II is found in Crete and Mainland Greece.

Fabric and form (Tab. 6.2), almost always correlate. More particularly, the pithoid jars/pithoi are confined to MG4, the collar/conical-necked pithoi are found in MG2 and very few examples in MG5A, the pithoi with relief decoration are mostly found in MG3 and occasionally in MG5C, while those pithoi that cannot be assigned to a specific type are made in MG5A and MG5E.

Regarding the surface treatment modes (Tab. 6.4), almost all vessels and pithoi types seem to be RSB, although the quality and hues of the slip slightly differ between the types. More specifically, the pithoid jars appear with a very distinctive treatment of a thick red slip and burnish (RSB), while the collar/conical-necked pithoi have a thinner and darker red slip. Other modes are less represented and include plain or abraded surfaces, smoothed, and RBS.

Specific decorative modes also occur (Tab. 6.6), such as relief decoration confined to the wide-mouthed pithoi of the EB II-III period, and occasionally plastic and incised decoration on the neck of the collar/conical-necked pithoi.

Chronology / Shapes		Ch	EB I	EB II early	EB II developed	EB II late	EB III	Unclear	**Total**
Pithoi and related shapes	Pithoid jar/pithos	-	9	18	43	3	5	7	85
	Pithos	-	6	-	1	4	-	-	11
	Collar-necked or conical-necked pithos	3	7	10	11	14	-	6	51
	Pithos with relief decoration	-	-	-	2	4	8	9	23
	Total	3	22	28	57	25	13	22	**170**

Table 6.12: Correlation between pithoi and chronological periods.

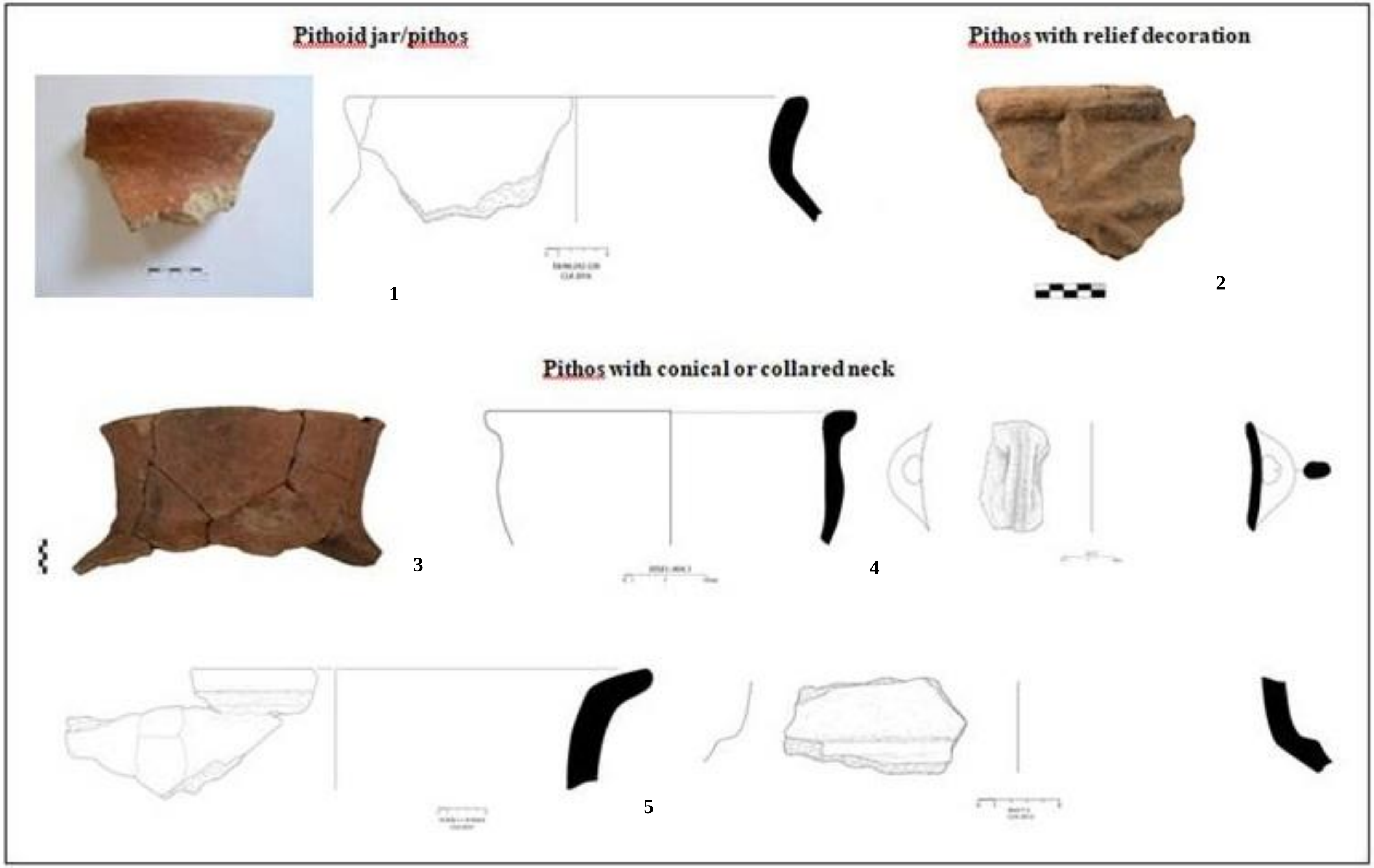


Figure 6.23: Pithoi and related shapes. Pithoid jar/pithos (1); Pithos with relief decoration (2); Pithos with conical or collared neck (3-5).

6.5.7 Cooking vessels and related shapes

This category is represented by 226 vessels that are related to cooking (Tab. 6.13). The general form of the cooking jars is reminiscent of the various jar types described above, but the surface treatment or evidence of burning on the exterior surface support their use in cooking activities. Four main types may be distinguished, namely cooking jars, tripod cooking pots, baking pans or hearths, and cheesepots. The cooking jars predominate and occur in different varieties with a usually spherical or rounded body and a slightly everted rim. These pots are almost always preserved in the upper part from rim to neck and parts of the handles, but a few examples can be entirely-reconstructed. One such is dated to the Ch period and has a rounded base. Other examples have a flat base.

In terms of the chronological distribution of the various types it may be observed that the cooking jars are larger in size and more frequently present in the Ch and EB I than in the EB II period. Also, these early cooking jars can have horned lugs below the rim (Fig. 6.24:1) and the vertical handles are at rim level or occasionally raised above it (Fig. 6.24:2-3). The handle cross-sections are usually circular but less often sub-rectangular. The EB II examples are more varied and usually have their handles at rim level or slightly below it (Fig. 6.24:4-7). In EB III appears a new cooking jar type that is characterised by a larger size and deeper form compared to the preceding periods and inward-curving sides with a flattened rim (Fig. 6.24:8). Two vertical loop handles are attached below the rim. A footed, one-handled version of this type also occurs in EB III, but is much rarer (Fig. 6.24:9). In EB II late and EB III the cooking jars occasionally have lugs of various motifs such as lunate or crescent. The tripod cooking pots first appear in EB I and continue with a decrease in EB II (Fig. 6.25:1). The baking pans are very rare (Fig. 6.25:2; 3 vessels). The cheesepots on the other hand are quite common (87 vessels) and show a number of varieties according to rim angle, i.e. everted, T-shaped, outward-curving, and size varying from 50-70cm or even larger (Fig. 6.25.3). A single example differs in profile, fabric, and thickness and it most probably dates to EB I, rather than the Ch period (Fig. 6.25:4).

In terms of fabrics (Tab. 6.2), the cooking jars show a wide variability and seem to be made in at least 7 different fabrics, although the majority are found in the various metamorphic sub-groups (89 vessels). The Ch cooking jars are consistently made in MG1, the EB I-II early in MG5A, and MG5B, while those of the EB II late and EB III in MG3 and MG5D-MG5E. The tripod cooking pots are made in MG2A, MG5B, and MG5C. The baking pans are made in MG5B and MG5D, while the cheesepots are found in fabrics MG1 and MG5A with only two examples in MG5E. It becomes rather obvious that all cooking vessels are made in two major fabrics, namely MG1 and MG5.

Regarding the surface treatment and decoration (Tab. 6.4), the majority of all vessel types have plain surfaces (167 vessels), especially cooking jars (77 vessels) and cheesepots (72 vessels). The rest are RS or smoothed, but the cooking jars have some very few examples with IrrB and RBS surfaces.

Chronology / Shapes		Ch	EB I	EB II early	EB II developed	EB II late	EB III	Unclear	**Total**
Cooking vessels and related shapes	Cooking pot	19	20	13	11	10	37	9	119
	Cooking pot/deep bowl	-	-	1	-	-	-	-	1
	Tripod cooking pot	-	5	5	3	1	-	2	16
	Baking pan/hearth	-	-	3	-	-	-	-	3
	Cheesepot	85	2?	-	-	-	-	-	87
	Total	104	27	22	14	11	37	11	**226**

Table 6.13: Correlation between cooking vessels and chronological periods.

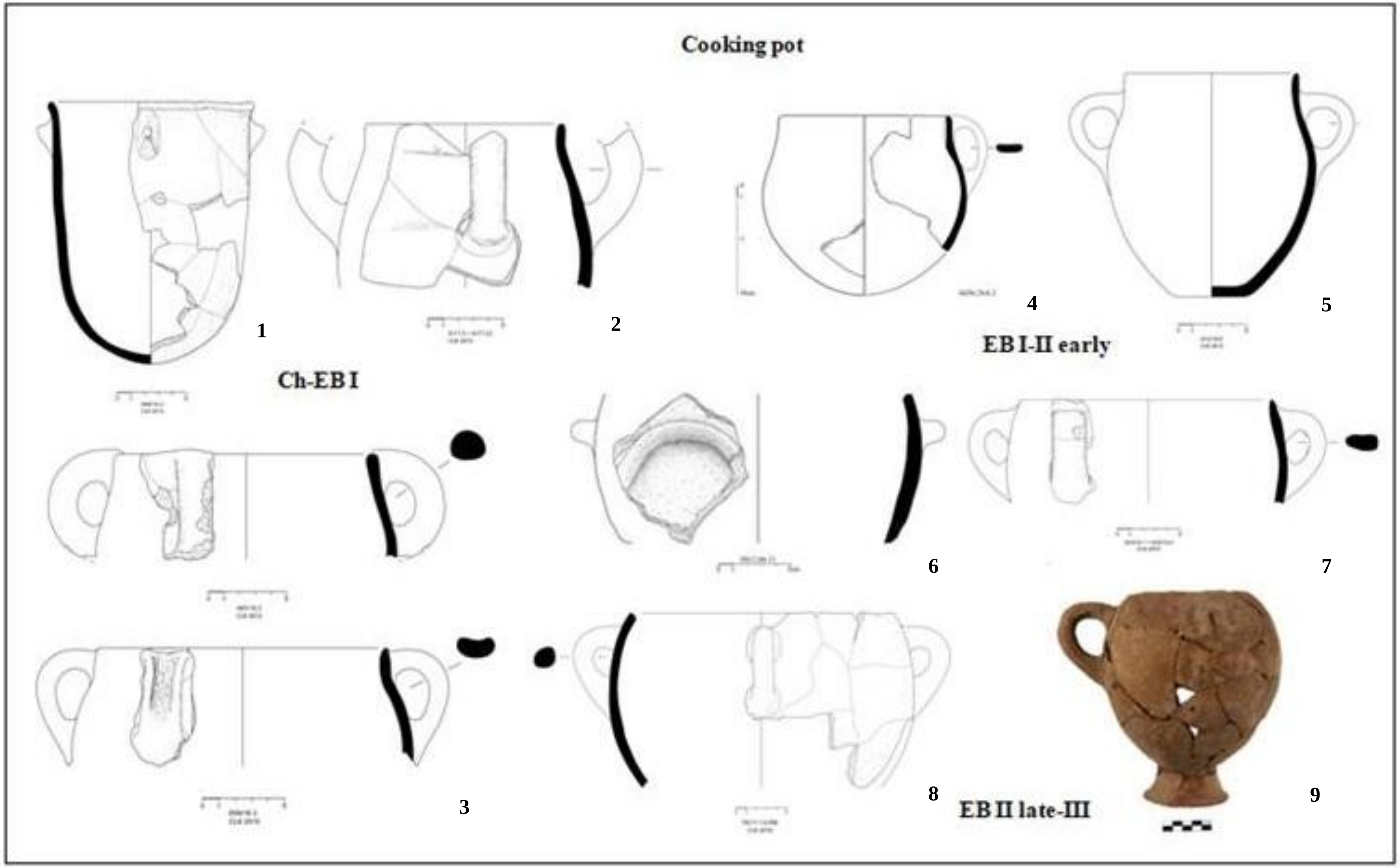


Figure 6.24: Cooking pots and related shapes. Cooking jars in the Ch/EB I (1-2); Cooking jars in the EB I (3); Cooking jars in the EB I-II early (4-5); Cooking jars in the EB II developed/late (6-7); Cooking jars in the EB III (8-9).

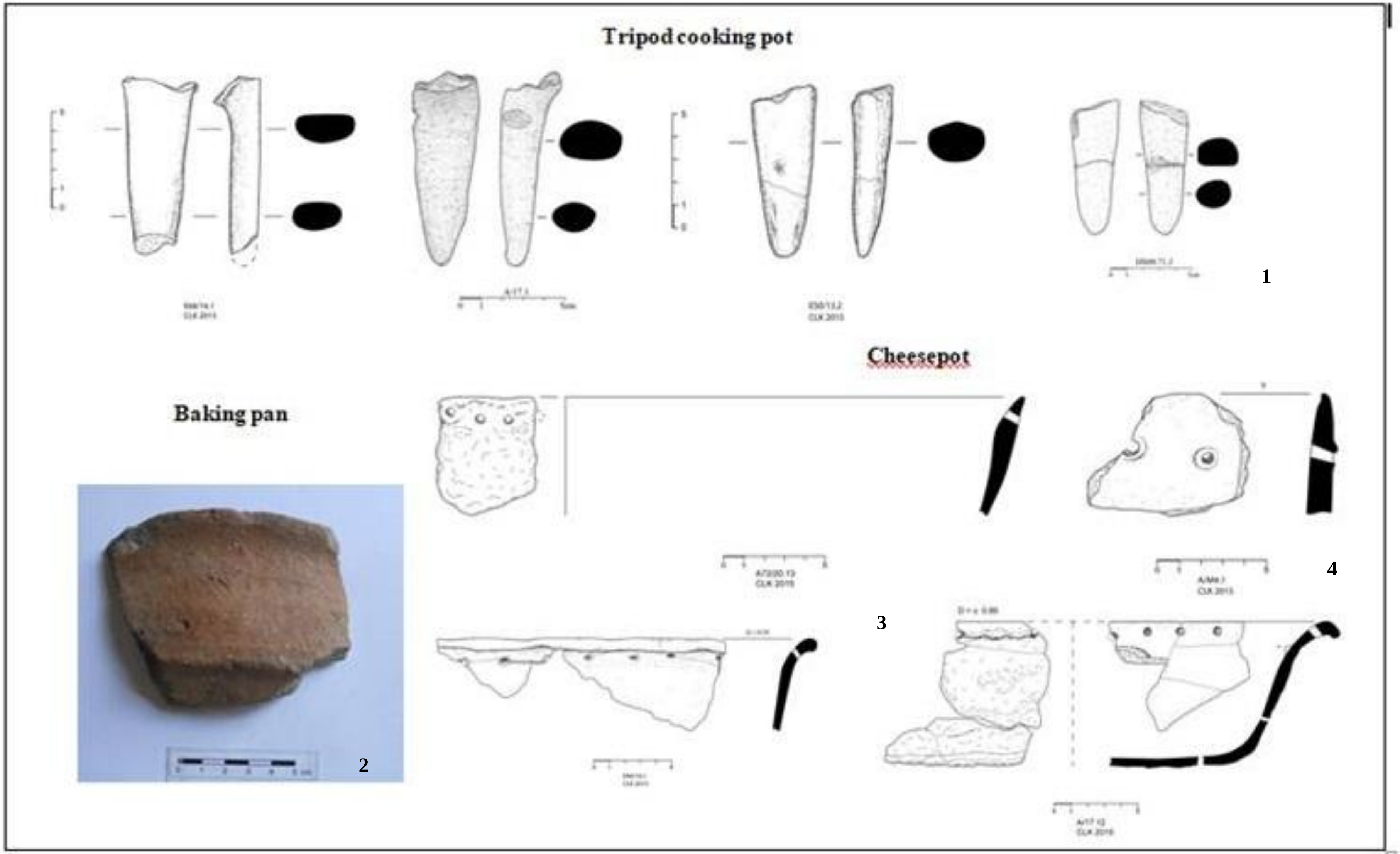


Figure 6.25: Cooking pots and related shapes. Tripod cooking pot (1); Baking pan (2); Cheesepot in the Ch (3); Cheesepot in the Ch/EB I (4).

6.5.8 Miscellaneous shapes

This category includes all vessels that do not fit easily into the previous categories (Tab. 6.14). However, this does not exclude a possible functional overlap of these vessels with the above categories. The most representative shapes are the askos (Fig. 6.26:1), dated to EB III and being distinguished between those with dark faced and incised decoration (MG11), and a single example in black painted decoration and a pale volcanic fabric (MG18), the teapot (Fig. 6.26:2; MG5E), and the sauceboat (Fig. 6.26:3; MG20). The perforated vessels (Fig. 6.26:4) include various shapes such as one-handled pedestal cups, large open vessels, and others that are suggested to have had a number of possible functions. Other shapes include miniature vessels and are more common in the EB II developed in various forms and fabrics (Fig. 6.26:5-6). More shapes include a number of spoons (Fig. 6.26:7) dating to EB I onwards in various fabrics, but being particularly more frequent in EB III and a number of lid types. These include flat-topped (Fig. 6.27:2) or disc-shaped lids (Fig. 6.27:3) that date to the EB II early/developed period, made in MG5B and have a smoothed or IrrB surface, as well as the crown lid type (Fig. 6.27:1) known from the EB III period and made in MG10.

Aside from all shapes described above that do not fit into the other 7 functional or morphological categories, a number of selected diagnostic sherds were examined macroscopically and recorded in the total amount of pottery from Heraion. These include mainly handles, namely vertical, horizontal, or with some sort of decoration (Fig. 6.27:4-6), as well as a few bases, decorated body sherds or undecorated ones of a most probably identified shape (Fig. 6.27:7), and worked sherds in second use (Fig. 6.27:8).

Chronology / Shapes		Ch	EB I	EB II early	EB II developed	EB II late	EB III	Unclear	**Total**
Miscellaneous shapes	Askos	-	-	-	-	-	20	-	20
	Perforated vessel	-	2	-	-	-	6	-	8
	Teapot	-	-	-	-	-	1	-	1
	Miniature vessel	-	5	-	9	-	2	1	17
	Sauceboat	-	-	1	-	2	-	-	3
	Lid	-	-	3	6	2	2	2	15
	‘Crown’ lid	-	-	-	1	2	9	2	14
	Spoon	-	1	1	3	-	5	2	12
	Vertical handles	18	2	9	21	6	17	4	77
	Twisted/grooved handles	-	-	1	1	-	13	3	18
	Horizontal handles	-	7	-	13	-	-	-	20
	Bases	-	-	1	6	1	-	-	8
	Body sherds (closed vessels)	-	-	2	10	2	20	-	34
	Body sherds with rounded knobs	-	2	2	7	-	-	1	12
	Worked sherds	2	3	4	4	-	5	-	18
	Total	20	22	24	81	15	100	15	**277**

Table 6.14: Correlation between miscellaneous shapes and chronological periods.

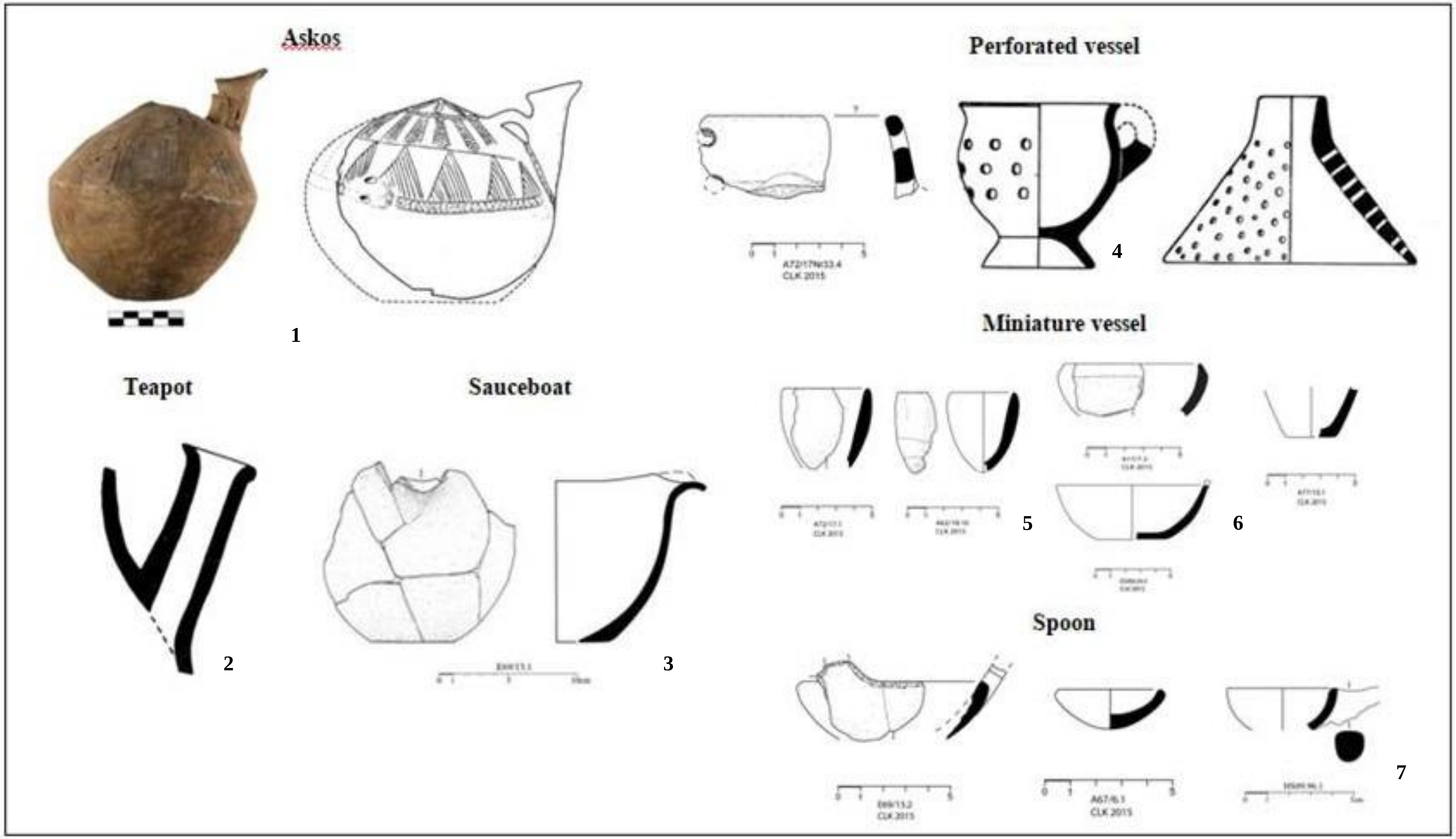


Figure 6.26: Miscellaneous shapes. Askos (1); Teapot (2); Sauceboat (3); Perforated vessel (4); Miniature vessel (5-6); Spoon (7).

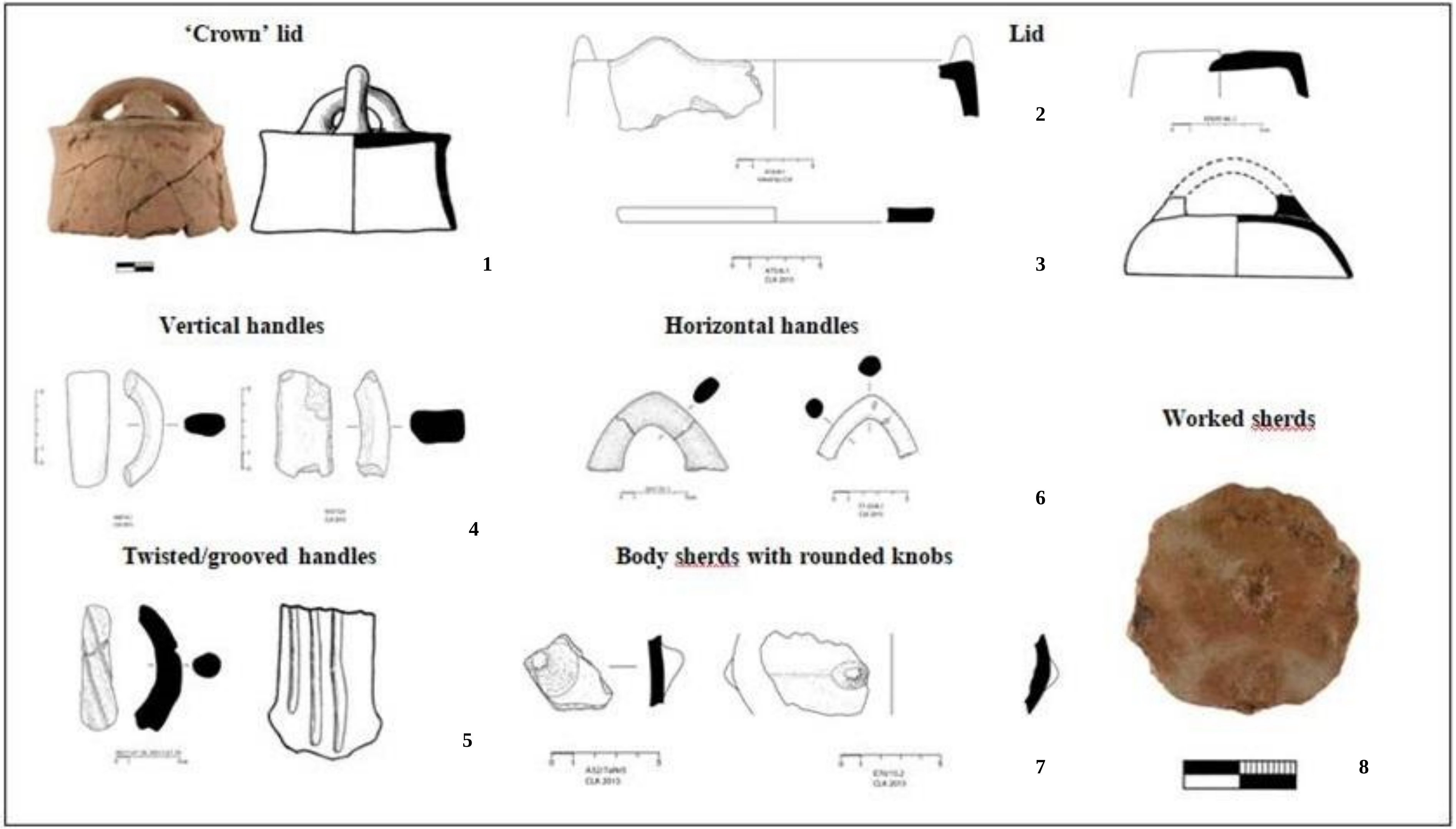


Figure 6.27: Miscellaneous shapes. 'Crown' lid (1); Lid (2-3); Vertical handles (4); Twisted/grooved handles (5); Horizontal handles (6); Body sherds with rounded knobs (7); Worked sherds (8).

Summary

The above presentation of the various shape categories in combination with the detailed typological classification and identification of parallels from around the Ch and EB east Aegean and western Anatolia showed that Heraion developed all vessel types known from existing typologies and is, therefore, a crucial assemblage for understanding the relationship between these two geographical and cultural areas. However, it must be noted that some types are poorly represented, namely certain cups, pyxides, or jug types that appear as loners. This study also reached important conclusions regarding the diachronic development of the vessel repertoire at Heraion and confirmed preliminary observations made through the analysis of fabric and surface treatment. More particularly, the overall assemblage is dominated numerically by bowls of various types, followed by jars. This is followed, in descending order of frequency, by the cooking vessels, especially cooking jars, the pithoi, the cups of various types and especially the EB III varieties, the jugs, and lastly the pyxides. Within these categories certain types outnumber the others, namely the carinated bowls and their varieties, which are very popular in EB I and especially in EB II early/developed, as well as jar varieties A-D. This study has identified date-specific and fabric-specific vessel types, e.g. the bowl with carinated shoulders is mainly restricted in EB I and made in MG5, while the different varieties of a shorter carination on the rim is better represented in EB II early and disappears by EB II late. Similarly, specific types are confined to the EB III such as hemispherical bowls, handleless or two-handled cups, etc., that are made in MG10.

A number of observations were also made regarding the association between functional categories and chronological periods. What becomes obvious is that during the early periods at Heraion there is no clear morphological distinction between deep bowls and open jars and that these predominate in the repertoire. In the following periods, especially EB II early, the typology is richer, but bowls still outnumber the rest. A significant change is observed from Heraion I to Heraion II-III, with the introduction of new, smaller shapes, such as bell-shaped cups, tankards, depas cups, beak-spouted jugs, shallow bowls and wheel-made plates. In EB III, there is a noteworthy increase in the number of small vessels. The drinking shapes of Heraion II-III cease to exist and new shapes appear, the most common being the hybrid, metallic-looking, strap-handled or handleless cup. Therefore, a preference for large utilitarian or tableware vessels is observed in Ch-EB I, while a more varied typology is attested by the EB II late and EB III. A more ‘standardised’ manufacturing process can be suggested for EB III, as almost all shapes and functional categories are made in the same fabric and share similar technical features.

6.6 Discussion

The study of the Ch-EB pottery from Heraion can contribute to the investigation of pottery stylistic variability in Samos and the eastern Aegean in general including the surrounding islands, as well as the opposite Anatolian littoral. The assemblage under study has proven to be typologically rich and diverse, both in forms/shapes and fabrics. The following sections summarise the main outcomes of the macroscopic analysis and provide a brief synthesis of the three variables discussed above.

6.6.1 Contextualisation and spatiotemporal distribution of pottery

This section is concerned with the distribution of pottery within selected contexts across the excavated deposits of the settlement, in order to reveal possible patterns about the use of space (Appendix III). As became clear from the stratigraphic treatment of the pottery and the relevant phases of occupation observed in the excavated trenches, most layers produced pottery dated to more than one period, although others are chronologically more exclusive. Therefore, the contexts are not equally clear due to disturbed layers, especially those found deeper that correspond to the Ch or EB I periods. On the basis of stratigraphic observations, specific pottery shapes and joins between layers, six phases of occupation were recognised.

More particularly, the Ch is identified predominantly in the area N of the Sacred Road and especially in the 1981 excavation, where it is usually mixed with EB I pottery. Since no architectural remains of this period were recovered, most likely destroyed by the deep foundations of houses of the later periods built immediately above it, the concentration of pottery in certain areas might imply the presence of households. For instance, phase Heraion 6 (*Bauphase* 1) is best represented in the deepest contexts (*passes* 16-20) in the area outside the fortification wall (e.g. A62, A63, A65, A72), corresponding to more than 100 vessels. Similarly, it is represented in mixed contexts above bedrock or in pits opened for draining the high water table through pumps. Therefore, the 2009-2013 excavations revealed Ch pottery in almost all trenches, but the majority was found in the South Sector (4820/5610, 4825/5610, and 4820/5615) in secure contexts, as well as trenches in the North Sector (4820/5630 and 4830/5630) in disturbed layers beneath Archaic or MB contexts.

Very few Ch vessels were also identified in Milojčić's excavations, which are considered stray finds and were mixed with material from phases Heraion I-V. However, their distribution in the various contexts of the Hera Temple area could be either interpreted as evidence for the existence of earlier habitation at this part of the settlement or represent secondary products drawn away by Imvrassos.

The EB I pottery is characterised by strong continuity from the Ch period. It is well represented N of the Sacred Road, which formed the earliest core settlement at Heraion. It was mainly identified nearby the fortification wall (*Bauphase* 1), as is the case for the Ch pottery, and less often as stray finds within otherwise pure EB II contexts. More secure contexts were excavated in 2010 and 2011 in trenches 4820/5610 and 4825/5610, in which the earliest buildings of the settlement were recovered, namely in Stratigraphical Units 37, 55, 80, 89, etc.

EB II early is recovered in more contexts compared to the earlier periods. It corresponds to an early (*Bauphase* 2) and a late phase (*Bauphase* 3) in the 1981 excavation and corresponds to the area of the *Grossbau* and *Rampe* respectively. It was also identified in the recent excavations corresponding to house walls or the destruction layers of the *Grossbau* in trenches 4820/5610 and 4825/5610 or mixed contexts beneath MB or EB II-III deposits in trenches 4820/5630 and 4830/5630.

EB II developed shows both continuity and change. Some features continue from the previous period, including the spatial distribution of pottery, while others are new and continue in the succeeding periods. It is not well defined, but it can be roughly placed between EB II early and EB II late. According to the distribution of pottery it becomes apparent that in EB II developed the settlement grows larger and extends towards W. This corresponds to what has been defined as phase Heraion I/Heraion 1 and is best represented in *Kellergrube* and *Rechteckbau* (*Bauphase* 4). More varied contexts were recovered in the new excavations in floor deposits of the *Rechteckbau* (HS09:61, HS09:66, HS09:68), as well as mixed contexts beneath the MB house walls and the EB II-III fortification wall in trench 4820/5630.

EB II late was identified in the 1953/1955 excavations and a number of secure contexts were recovered in trenches F6, F7, E8, and G7. Nevertheless, it was best recovered in the area of the *SO-NW gerichtetes Mauer* and the *SO gerichtetes Megaron* for phase Heraion II and the *Zweiräumiges Bau* for Heraion III. More EB II pottery was identified in the 2013 excavation season in mixed contexts beneath the EB II-III fortification wall in trenches 4820/5630 and 4825/5630.

Lastly, the EB III period is well represented in the 1953/1955 excavations and was defined as phases Heraion IV and V. This period pottery is restricted to specific contexts, namely *Megaron I* and *Magazine* in trench F7, the *Grosses Haus* in trench G7, while the latest phase Heraion V is predominantly represented by pits. Less reliable EB III contexts were uncovered in the 2012 and 2013 excavation season in predominantly mixed deposits beneath the EB II-III fortification wall in trench 4820/5630 or beneath the foundation levels of MB architecture in trenches 4830/5630 and 4825/5640. These most likely belong to an EB III household beneath an MB architectural phase.

Regarding the correlation between contexts and vessel shapes, this seems to be inconsistent in most cases as almost all shapes were produced in households of all periods. However, in some cases specific shapes are related to specific contexts, which might help towards the interpretation of their function. For instance, the *Grossbau* was found to contain storage vessels and pithoi of various fabrics (e.g. MG2, MG4) in the EB II early period in higher frequencies than other contexts. Shapes such as the shallow bowls/plates of EB II developed are consistently found in the *Kellergrube* or the *Haus unter der Befestigungsmauer*, as well as the area of the EB II-III fortification wall in trench 4820/5630. The EB II late period has produced small shapes and a more varied typology compared to the preceding periods. Shapes related to serving and consumption, such as drinking cups, bowls, and jugs were consistently found in *Megaron II* or *SO gerichtetes Megaron*. In a similar fashion shapes of EB III are restricted to certain contexts, i.e. the hemispherical bowls are more common in *Magazinbereich* and *Zisterne*, the S-rim bowls in *Megaron I*, *Zisterne*, and *Grosses Haus*, the strap-handled or handleless cups (*Samos Becher*) and collared jars in *Grosses Haus*, and the plates in *Zyklopischer Bau* and *Grosses Haus*. Moreover, some contexts have produced more cooking vessels that are occasionally found in proximity with hearths and in association with animal bones, especially in the EB I and EB II early periods (E70, A62, A71, A72, A78, etc.). The high levels of fragmentation and abrasion is some contexts, especially those close to the EB I fortification wall, might imply that to some degree they represent areas of discard.

6.6.2 Technology

In this section the fabrics, forms, and surface treatments of the Ch-EB III pottery are discussed together and their diachronic development, from the collection and processing of the raw materials to the firing of the final product. This discussion highlights the single- or multi-period associations of the three variables and the main changes that occurred in each period.

Raw materials and clay recipes: the presentation of fabrics in Section 6.2 and Table 6.1 revealed that there is some good correlation between chronology and the preference for specific raw material clay recipes. There is a distinction between those fabrics associated with a long span and those being restricted to a shorter time or even a single period. The former category usually appears from the Ch or EB I and continues up to EB II developed (MG1, MG2, MG4, MG5B) or is better represented in the Ch/EB I-II early periods (MG5A). Other fabrics continue up to EB III (MG5C) or appear in EB II early and continue until the EB III period (MG3). The second category accommodates those fabrics that can be described as date- or period-specific and are more common from EB II developed onwards. These are in use in EB II developed and late, i.e. MG6 and MG7, which attest more frequently in EB II developed, and MG8 and MG9, which are more frequent in EB II late. Similarly, MG10, MG11, and MG12 are almost entirely restricted to EB III. A number of small fabrics or loners are dated to EB II late (MG14, MG15, MG19) or EB III (MG17, MG18, MG21).

A picture of continuity and change in the choice of raw materials is observed (Figs. 6.28-6.29). In particular, a number of coarse metamorphic-related clay pastes (MG1, MG2, MG5) were used in the first half of the 3rd millennium BC, that occasionally continue in the later periods, but in much less quantities. The volcanic fabrics are more common in the EB II developed/late and EB III periods. The most apparent change occurs in the EB II developed (Fig. 6.29), when the clays start to become finer and possibly better processed and new recipes appear such as the alluvial/sandy and micaceous quartz fabric groups (MG6, MG7, MG8). This technological choice and change of practice continues and is better reflected in the following period, the EB II late, with the appearance of new recipes, both local and imported, such as the micaceous fabrics (MG8), the calcite-tempered (MG9), and the fine calcareous volcanic ones. This change is combined with the introduction of new shapes that, however, make their first appearance in the preceding period (tankard, bell-shaped cup, Anatolian-type beaked jug, coiled or wheel-fashioned plate). EB III represents the second horizon of change (Fig. 6.29). A preference towards fine to very fine, highly micaceous pale fabrics (MG10, MG11, MG12) is documented which did not occur in the previous periods, that might also reflect new developments in the processing of clays and firing of the final products. This dramatic increase of pale fine fabrics is accompanied by a noticeable increase in typology. Among all periods, the EB II has the greatest fabric variability and the higher frequency of vessels.

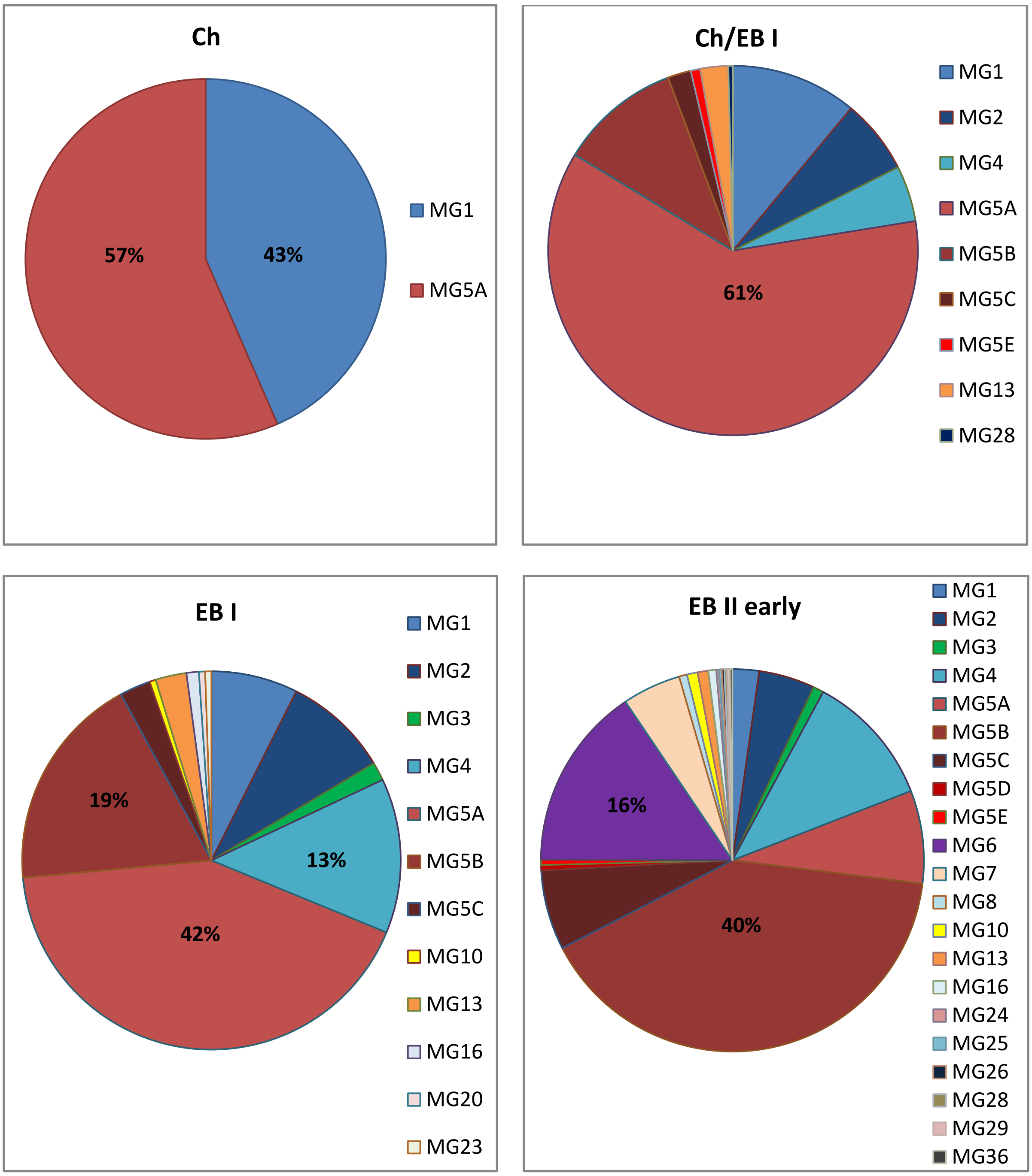


Figure 6.28: Charts showing the diachronic frequency of the macroscopic fabrics.

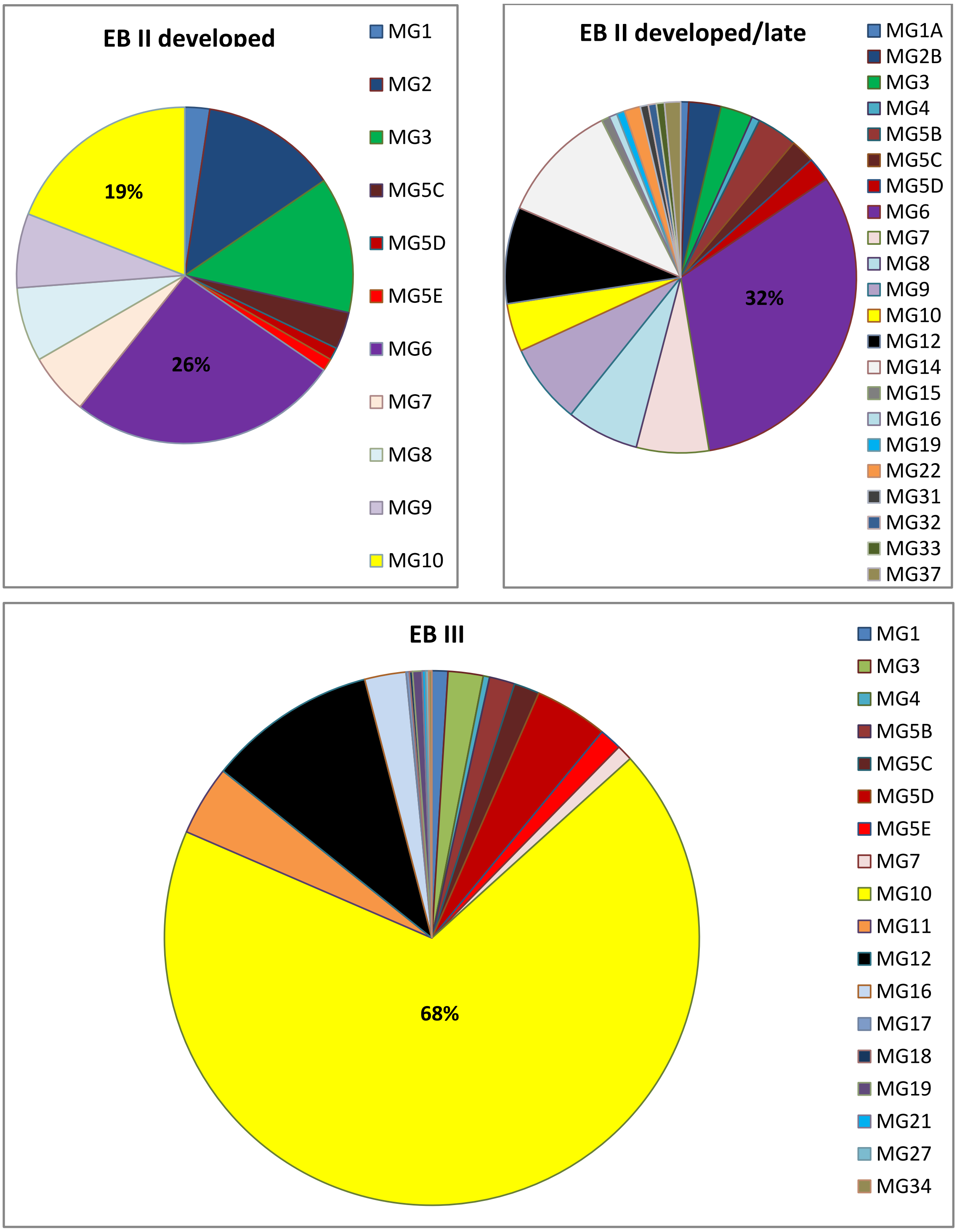


Figure 6.29: Charts showing the diachronic frequency of the macroscopic fabrics.

Forming methods: the main body of information regarding forming methods was based on the extensive macroscopic analysis of vessel surface and sherd break (see Appendix II). Nevertheless, the distinction between the various handmade techniques is not always feasible. The best-represented and most easily identifiable hand-built forming method is coiling. Coils are identified as diagonal discontinuities or linear anomalies in the arrangement of voids or inclusions on the sherd break or can be observed as heterogeneous, horizontal parallel striations on the vessel's surface and varying thickness of walls. The majority of examples exhibit irregularities on the vessel walls, especially on their interior, and shallow cavities from kneading or putting pressure on the clay (Fig. 6.30:B). Starting from the Ch, the cheesepots (Fig. 6.30:A) preserve the first evidence for coiling (MG1, MG5A). Better coiling examples are shown by the carinated bowls, especially those dated to EB I (Fig. 6.30:C-D), in which the carinated rim seems to have been added separately from the rest of the body (MG5A).

Possible traces of the slab-building method are identified in the closed storage vessels of MG4 (Fig. 6.23:1), according to the identification of distinct, superimposed clay layers or compressed coils (Fig. 6.30:E-F). This is obvious in body sherd sections, but can also be observed close to rims or handle attachments, where the wall is thicker, and probably implies the addition of these features at a later stage. The slabs/flattened coils are identified by elongate voids or the examination of the differential orientation of inclusions created upon formation of the vessels. The pithoi of MG2B also seem to have been made in two separate slabs joined between rim and neck.

The wheel-made vessels take up only 1/5 of the overall vessel count at Heraion and are not easily assignable to a specific category (wheel-coiled/wheel-finished or wheel-fashioned, wheel-thrown). According to the available macroscopic evidence the first indications of wheel use comes from Heraion II (cf. Milojčić 1961, 43-46, 49; Kouka 2013, 576, footnote 64), which represents the first phase of EB II late, but becomes more frequent only in EB III (Heraion IV-V). Depending on what stage of the forming process the rotary device was introduced and the levels of rotative kinetic energy (RKE) used in the different fashioning/finishing operations (Choleva 2012 for description of the various modes), the main wheel-made methods identified can be summarised in the following categories:

A) It covers those vessels that are principally shaped with coiling, but exhibit possible traces of their finishing on a slow rotary device in the form of irregular horizontal undulations or striations, especially on the rim or immediately below it, as well as discontinuous configuration of the surfaces due to pressure while building the rough-out. It corresponds to shallow bowls/plates and tankards of EB II developed/late (Fig. 6.31:B). Other evidence includes traces of smoothing on the exterior surface and coil joins in the form of heterogeneous voids on the interior (Appendix II.14:6). The wheel is used only to facilitate the shaping of the upper part and possibly also smoothing of the surface.

B) Other vessels of EB II late occur with the same features as the above, but with additional traces that include more regular wall thickness on the upper part and some cavities on the lower part (Fig. 6.31:A). The exterior is well smoothed or slipped, according to parallel striations, which might imply the introduction of RKE at a different stage compared to Category A, perhaps shaping the rough-out and thinning the walls. Examples include drinking cups of MG7 (Appendix II.16:2, 5, 6), MG8, and MG9, such as tankards, bell-shaped cups, short-necked cups, and depas cups. If this is combined with the fact that the majority of these vessels are most likely imported at Heraion, the technical differences might as well reflect manifestations of cultural behaviour and possibly also the transmission of forming knowledge in EB II late Samos from a neighbouring region.

C) In EB II late the first wheel-made plates are introduced at Heraion (Milojčić 1961, pl. 44:1), which increase in number in EB III (Milojčić 1961, pls. 29, 38:19-21, 46:4-7). This characteristic shape appears in different sub-types according to wall profile and form of rim, which is also reflected in fabric and finish differences (MG12; Appendix II.22:1). Although not homogeneous in all vessels, the macroscopic evidence includes parallel undulations or grooved zones of low relief set in an irregular distance between one another and are usually restricted to the area below the rim and up to mid-body (Fig. 6.31:C). These vessels can be securely described as wheel-fashioned, in which the rim and final shape of the vessels was formed on the wheel. In some occasions the absence of horizontal bands or ribs on the interior is due to smoothing in order to facilitate usage. A different plate sub-type is characterised by a more convex shape and a plain surface, while the forming evidence differs slightly from the previous. More particularly, the horizontal striations and undulations are more regular and evenly-distributed from rim to lower body, but some irregularities in wall thickness are still observed (Fig. 6.31:D-E). It seems that the RKE was involved in the process earlier than in the other type.

D) This category includes vessels made predominantly in MG10 (Appendix II.20:1, 4), such as EB III shallow bowls, S-rim bowls, and cups (mainly handleless). The macroscopic evidence is consistent with the introduction of RKE from the first stages of the manufacturing process. The continuous pressure creates a more homogeneous rough-out, which is expressed in the form of denser horizontal striations throughout the vessel body visible on both surfaces (Fig. 6.32:A and C) and concentric spiral undulations on the base (Fig. 6.32:B and D).

E) The wheel-fashioning technique was further developed into wheel-throwing with the full incorporation of RKE in the manufacturing process. Vessels in this category occur at Heraion very rarely in the late EB III and are largely present in the transition to the MBA. The evidence is consistent with regular wall thickness, horizontal striations that are evenly distributed from rim to base, and concentric striations (string marks) on the underside of the base (Fig. 6.32:F).

This study demonstrates that the introduction of the potter's wheel went through intermediate stages, i.e. vessels were made up of coils and then fashioned on a wheel, rather than leading directly to the wheel-thrown technique. Therefore, this innovation did not result in a wholly new production process, but was adapted to the existing *chaîne opératoire* of the coil-building technique, as is the case in other Aegean sites or beyond (Courty and Roux 1995; Roux and Courty 1998; Choleva 2012; 2015)

Other secondary indications of forming methods concern the examination of handles and less popular shapes, such as askoi. The EB III askoi seem to have been manufactured in two separate parts at about mid-body, according to break marks on the interior (Fig. 6.32:E; Appendix II.21). The handles are predominantly added separately on the surface (Fig. 6.32:G), but from EB II onwards those of the plug-in type become more common (Fig. 6.32:H). This handle type usually belongs to closed vessels like storage jars and were pushed through holes made in the vessel while the clay was still soft, usually causing convex swellings or cylindrical/conical protrusions on the interior.

Overall, the diachronic analysis of forming methods showed that the Ch and EB I pottery is characterised by irregular walls of uneven thickness and evidence of coiling and that coil-made pottery also predominates in EB II early for all shapes, irrelevant of fabric or surface finish. The first change occurs in EB II developed with the manufacture of shallow bowls/plates that show the first evidence of coiling in combination with wheel finishing. This is further evidenced in EB II late for the manufacture of small, thin-walled vessels and the first plates made in MG12. However, what seems to be a drastic technological change occurs in EB III with the introduction of a faster wheel and the manufacture of the first wheel-thrown or perhaps just still wheel-fashioned vessels with the RKE being introduced at different stages of the manufacturing process.

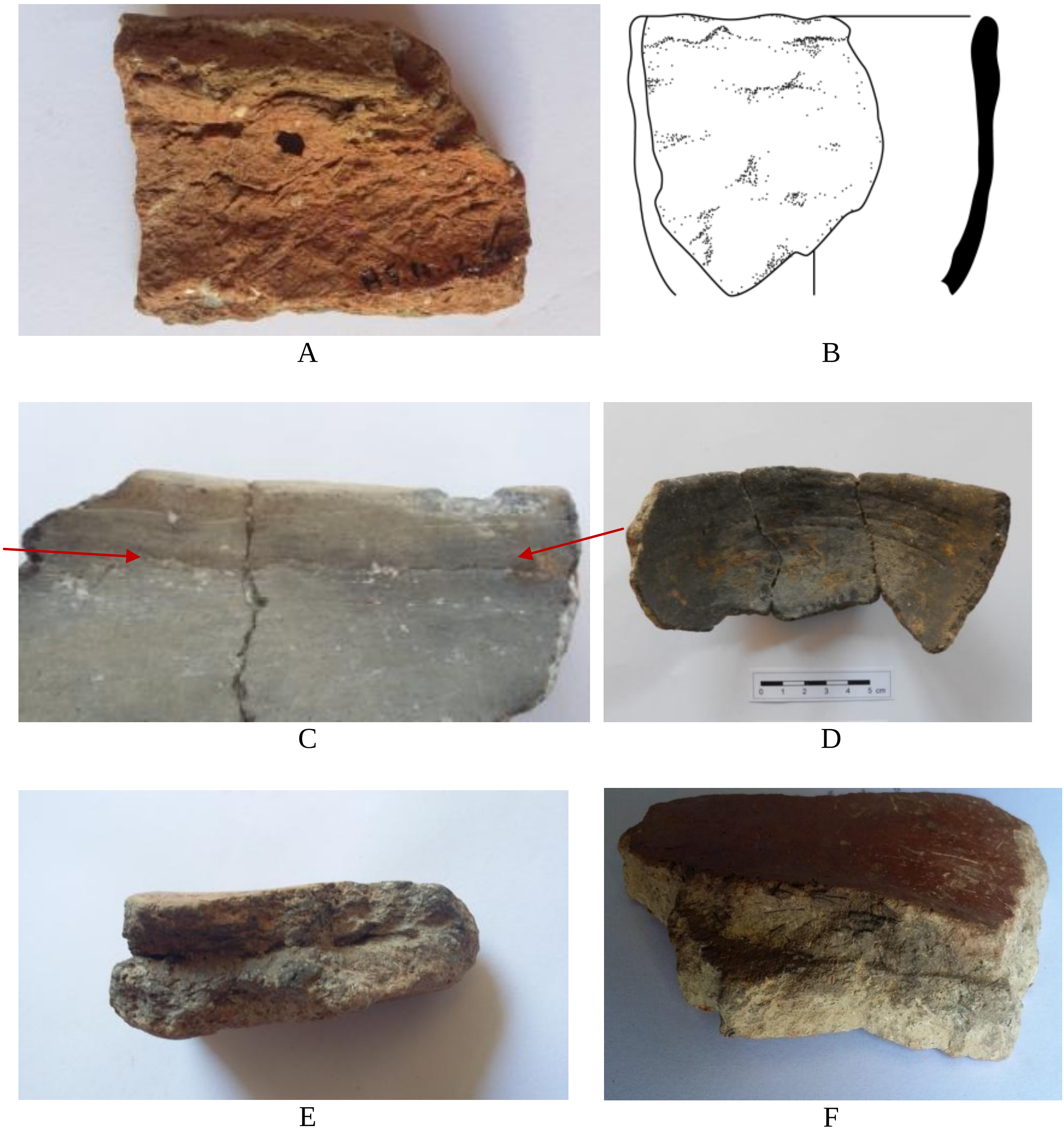
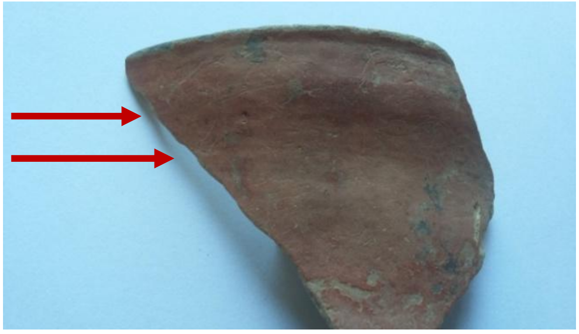
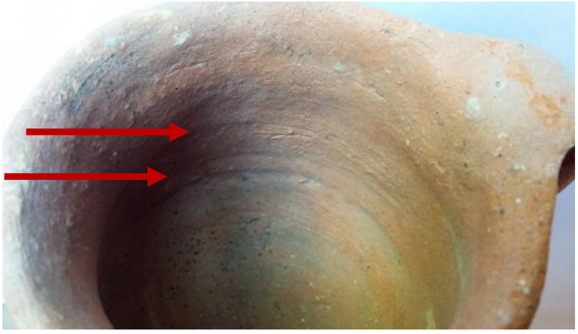


Figure 6.30: Evidence of forming methods (no scale). A. Cheesepot of Ch with irregular, unscraped clay areas; B. Deep bowl of EB I with cavities (coiling or pinching); C. Carinated bowl of EB I with horizontal striations (coil joins); D. Deep bowl of EB I with horizontal

striations (coil joins); E and F. Pithoid jars/pithoi of EB I-II early (MG4) with possible clay slabs. Photographs taken by S. Menelaou and drawing made by C. Kolb.



A



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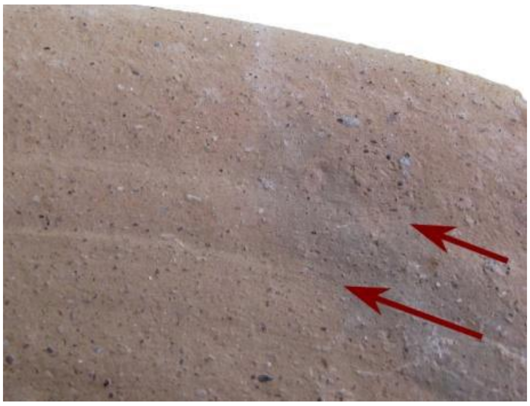
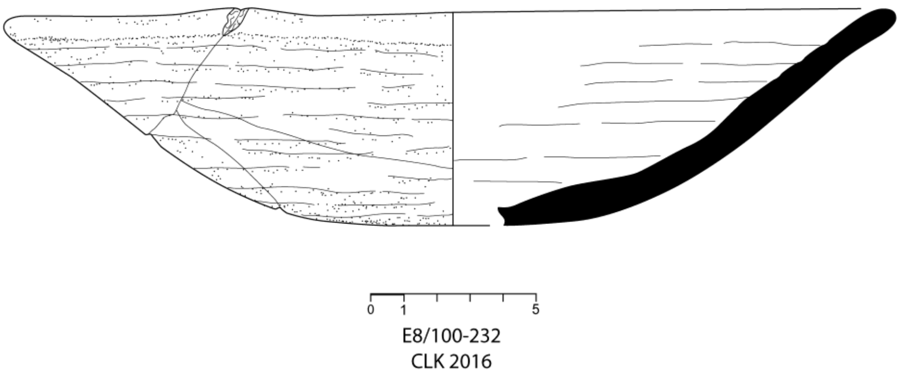


C

D



E

Figure 6.31: Evidence of forming methods (no scale). A. Tankard of EB II late (wheel-fashioned?); B. One-handled cup of EB II late with parallel striations and coil joins at mid-body (wheel-fashioned); C. EB II late/III plate with horizontal striations and undulations below rim (wheel-fashioned); D and E. EB III plate with dense horizontal striations (wheel-fashioned). Photographs taken by S. Menelaou and drawing made by C. Kolb.

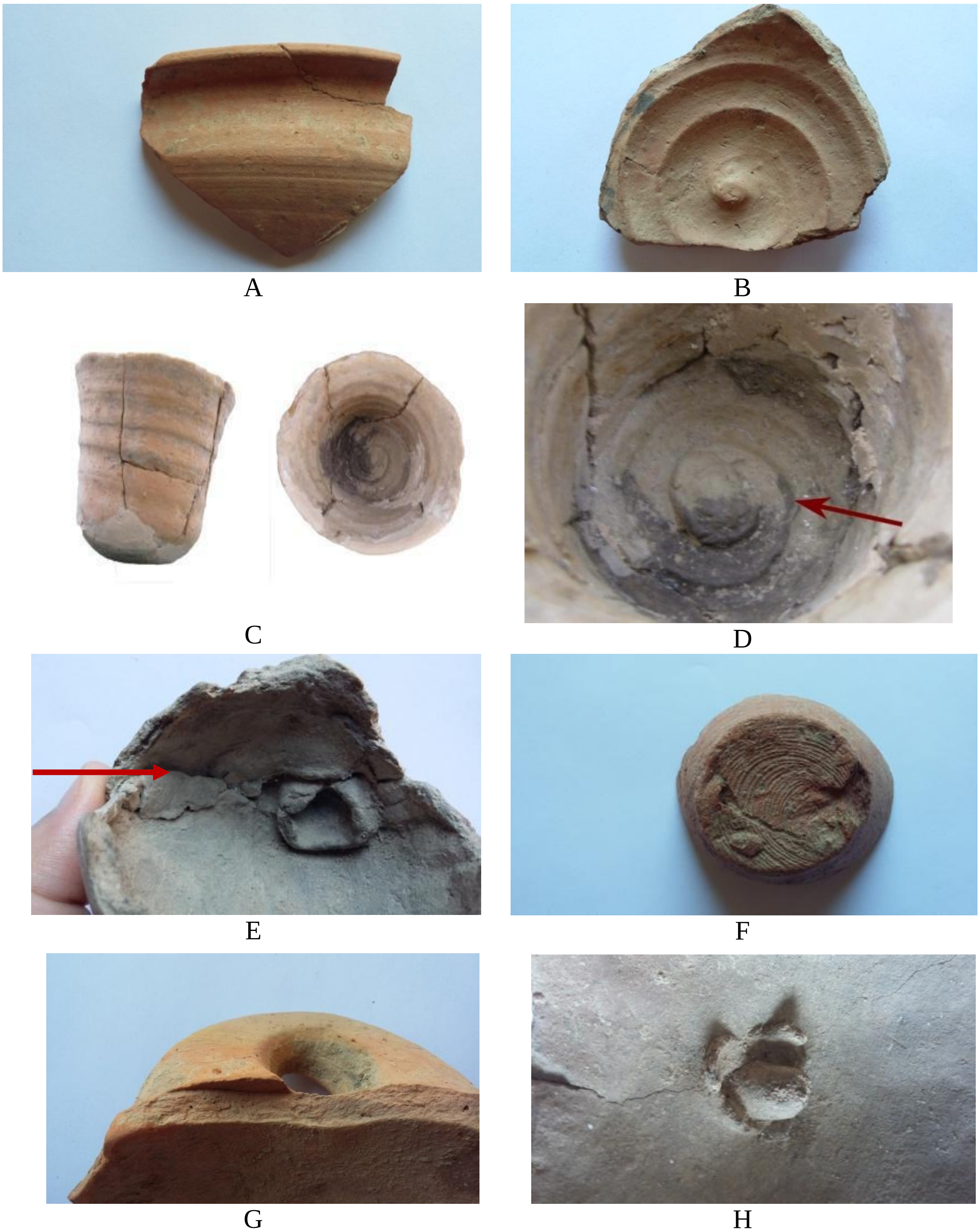


Figure 6.32: Evidence of forming methods (no scale). A. S-rim bowl of EB III with dense parallel striations (wheel-thrown?); B. Base of EB III jug with concentric spiral (wheel-thrown?); C and D. EB III handleless cup (MG10) with undulations in and out and concentric spiral (wheel-fashioned); E. EB III askos with unsmoothed join on the interior; F. Exterior of jug base (wheel-thrown); G. Handle attachment of EB III jar; H. Pushed-through handle of EB II late jug. Photographs taken by S. Menelaou.

<u>Finishing methods</u>: these include what has been traditionally classified as ‘wares’ or surface treatments. The various modes have been classified and discussed in detail in Section 6.3 in 4 main categories that include 20 sub-categories with particular

differences between one another. Most importantly, a number of chronological or fabric correlations of the finishing methods have been distinguished, although in a more loose and less consistent fashion compared to raw materials and clay recipes. In short, the early-dated vessels are usually plain or only smoothed, and generally with a hasty, less careful treatment of the surface. This is especially conspicuous in the storage and cooking vessels. Less rarely, some vessels like pithoi or cheesepots preserve traces of a thick red slip, but again it is not of a good quality. The application of a slip and burnishing are multi-period techniques, but there are differences in colour and quality in each period. As far as slips are concerned, some popular colours occur during the Ch-EB II early periods: mainly darker colours compared to the later periods, i.e. reddish brown, dark grey, greyish brown, reddish grey, red. Red and reddish brown predominate in EB II early onwards, while lighter colours appear in EB III. These changes are linked with developments in the firing technology over time. Burnishing appears more common in specific surface treatment modes and fabrics, such as MG7-9, which created a metallic texture and shiny appearance on the drinking vessels and other tableware made in these groups. Other examples include MG4, which on the contrary represents storage vessels and, therefore, burnishing was used for its mechanical properties. Apart from the change in hues and quality of finishes no other correlations are identified. Perhaps it is interesting to note that EB II late accommodates a broader range of finishing techniques, both surface treatments and decorative modes (especially incised), which relates to the presence of more imports. Milojčić (1961, 40-41) originally noted that certain wares correspond to older or younger layers (Phases Heraion I-V) and others pass evenly through all deposits. A comparable picture is observed in Emporio II-I on Chios, when light-coloured fabrics become more common, the organic temper decreases significantly, and the paste becomes harder due to changes occurring in the firing processes (Hood 1981, 168, 433).

<u>Firing procedure</u>: only preliminary observations are made through the macroscopic study of pottery breaks and clay paste and surface colours (for a more detailed discussion see Chapter 8), as the reconstruction of ancient pyro-technology requires a more complex methodology and consideration of many variables (raw materials, firing structure, temperature, atmosphere, duration of firing). Macroscopic analysis of colour variation has highlighted a range of firing practices that relate to the atmosphere developed during the last stage of firing (cf. Mentesana *et al*. 2017), namely oxidising

(O) for light-coloured vessels showing evidence of exposure to abundant oxygen and reducing (R) to those being exposed to abundant carbon monoxide and having a dark colour evenly developed from core to margins. More common are the intermediate firing stages, when the vessels show a core-margin differentiation with the core being dark and the margins light-coloured, or more rarely those with half dark-coloured and half light-coloured wall break. These are defined as Partly O-R, where firing was not maintained for long enough to allow complete oxidation, and relate to the alternation of reducing to oxidising atmospheres and/or the high presence of organic matter in the clay paste.

This is in good terms with technological changes taking place in other stages of the manufacturing process (raw materials processing, finishing methods). More particularly, the early-dated pottery can be characterised as generally low-fired in poorly-controlled and usually varied atmospheric conditions (Partly O-R), according to a number of indications. These include the often darkened patches and mottled areas on the exterior surface, especially related to the IrrB or smoothed treatment of vessels in MG5A and MG5B (Fig. 6.7:B-D). The majority of vessels in these groups have a reddish brown/greyish brown surface and the core is nearly dark grey/black throughout or shows a strong differentiation with light-coloured margins. This is also explained by the dominance of vegetal temper in the Ch-EB I coarse fabrics. Similarly, MG2 and MG4 show evidence of incomplete oxidation and a strong core-margin differentiation (Fig. 6.1:C, E-F). This is less conspicuous in MG1, where the sherd break colour is less sharply differentiated, although it still represents a short, low-firing process where the carbon was not entirely removed from the vessel's walls. Other groups are more varied and include both evenly-fired clay pastes with a homogeneous colour and unevenly-fired with a more heterogeneous colour (MG3, MG6). This usually corresponds to fabrics that have a longer chronological span and are not restricted to one period.

It seems that from EB II developed onwards potters gained more control over firing strategies than in the previous periods. This is more conspicuous in EB II late. For instance, vessels made in MG7 appear with a characteristic red exterior and black interior slip and burnish (R/BSB), which is intentionally achieved with controlled atmospheric conditions, in order to create a visual contrast with the light-coloured base clay and give the thin-walled, drinking vessels a metallic texture. A similar effect is achieved in the BT drinking and serving vessels of MG9, while MG8 is black both on the surface and the sherd break and, therefore, fired under a homogeneous reducing atmosphere (Figs. 6.3:C-D, 6.8:D-F). These surface treatment modes are usually linked with specific vessels of particular macroscopic fabric groups, suggesting that these trends may relate to specific production centres and knowledge of potters.

An even more drastic change is noted in the EB III pottery, which seems to have been fired to generally higher temperatures and better controlled firing conditions than those of the preceding periods. The majority of vessels show a homogeneous red-orange colour throughout the section break (MG5C, MG5E, MG10), which is indicative of maintaining an oxidising atmosphere over the firing process (Fig. 6.2:E-F). This is also linked with the absence of organic matter in the clay pastes of EB III and might also be associated with the intentional use of certain clay recipes not occurring in the EB II early phase, such as calcareous fabrics and finer, micaceous clay pastes for fineware vessel production. Nevertheless, variation is also observed within these fabrics, i.e. sub-groups of MG10 appear with a core-margin differentiation and colour variation of grey/bluish grey and red-orange or pinkish (Fig. 6.3:E-F). In addition, other EB III fabrics (MG11, MG12, MG16, MG17, etc.), which are classified as imports at Heraion, show different variations between one another implying the technical skills of certain potters in certain areas for the manufacture of specific vessel types.

6.6.3 Provenance

Macroscopic fabric analysis in combination with information on surface treatment and shape was able in some cases to determine the provenance of the pottery. More particularly, the vast majority are most likely locally produced (MG5 and sub-groups), based on the predominance of metamorphic fabrics that relate to the metamorphic geology of the immediate environs of Heraion, the frequency of vessel numbers represented by this group of fabrics, and the range of shapes. Other possible local fabric groups are MG1, which represents the main cooking fabric, MG2, representing the main fabric of large storage vessels, MG10, representing the main fabric in EB III, although too fine to allow a precise provenance determination.

A number of fabrics were found to deviate from what is believed to be local and are, therefore, taken as broadly Samian or even off-island products. For instance, MG4, despite being a large group, differs considerably from those considered to be local on the basis of its clay paste and surface treatment. In addition, the vessels represented are predominantly jars. Other possible imported groups, mainly based on shape and surface treatment, are MG7 to MG9 with which EB II late pottery is made including shapes such as tankards, bell-shaped cups, etc. Another indication is provided by the considerably low numbers represented in these fabrics. Similarly, MG11, MG12, MG13, and MG16 are suspected to be imported. Lastly, some fabrics can be more confidently taken as imports, namely MG14, MG15, MG18-MG20, MG26-MG27, MG31-MG33, and MG37 and are interestingly almost entirely represented by transport jars and more rare shapes such as sauceboats and askoi. An increase in imports is observed in EB II, compared to the preceding and succeeding periods, which become conspicuously more frequent during EB II late (Fig. 6.33).

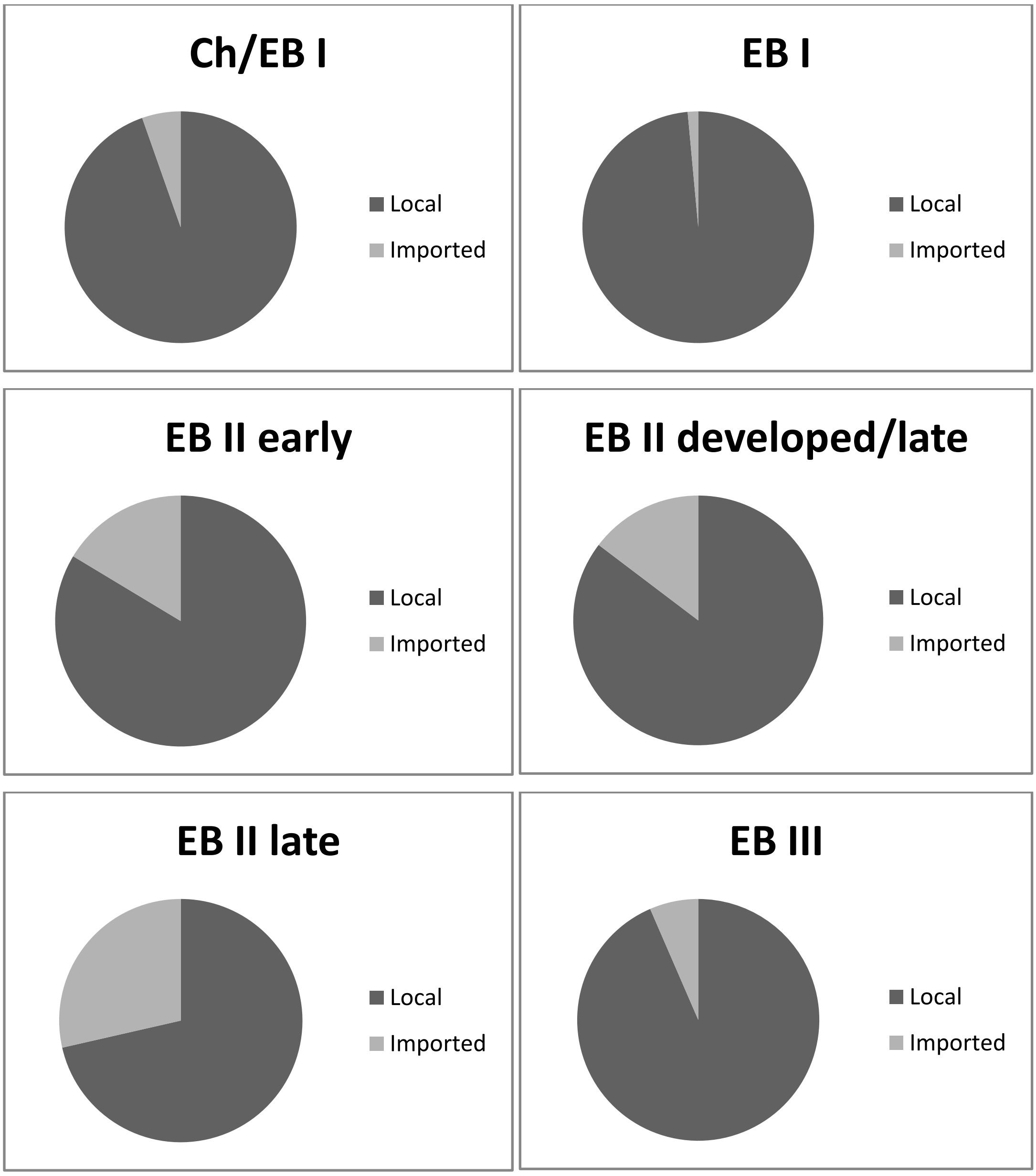


Figure 6.33: Charts showing the diachronic frequency of local *versus* imported pottery.

6.7 Summary

This chapter has demonstrated the importance in analysing entire assemblages at a detailed resolution. Most importantly, the macroscopic work has been able to characterise all stages of the ceramic manufacturing tradition at Heraion and to establish a first basis for the identification of suspected imported pottery through a combination of form, fabric, and finish information. In Chapter 7 the analysed pottery will be extended to the microscopic visual continuum and an important integration of both levels of results is attempted. The interrelated links between the macroscopic and microscopic groups are further highlighted in Chapter 7, demonstrating how the integration of these scales of analysis provide a more solid picture of ceramic production and distribution at a given site or region.

CHAPTER 7: Petrographic analysis of the pottery

7.1 Introduction

This chapter presents the results of the petrographic analysis, which followed the systematic macroscopic and contextual study of the Heraion pottery assemblages. The samples were selected based on a number of properties taking into account morphological/typological (form, shape) and stylistic (ware/surface treatment, decoration) criteria, as well as the compositional/macroscopic (type and range of inclusions, paste colour) variation observed. Thin-section petrography was combined with geological prospection and the analysis of clay/sediment and rock samples, as well as traditional/modern ceramics to illuminate aspects of technology and provenance (see Section 5.7). The main objectives of this analytical work were: a) to characterise the local pottery production through the identification of the mineralogical composition, b) to assess the coherence of each macroscopic group (Chapter 6) and correlation with the microscopic groups, characterising the compositional and technological variation observed, c) to reconstruct, where possible, various technological stages in the manufacturing procedure, d) to assign the fabric groups in certain geological and or/geographical areas and, therefore, to explore issues of provenance and pottery exchange through the identification of imports.

A number of 343 pottery sherds were sampled, thin-sectioned, and analysed under a Leitz Polarising Light Microscope at the Department of Archaeology, University of Sheffield after the necessary permits were issued by the Ministry of Culture and Sports in Greece. This research constitutes the first major, multi-sample petrographic study of prehistoric pottery from Samos and as a result there were no prior indications as to what the best criteria for group formation might be. Thus, a 'blind' grouping of the thin sections was undertaken based on the similarities and differences observed in the non-plastics suite and clay groundmass. The pottery thin sections were analysed alongside thin sections made from 37 clay/sediment samples, 9 experimental fired briquettes, 1 prehistoric mudbrick, 6 rock samples, and 17 modern ceramic samples that resulted from the geological prospection programme and small-scale ethnographic work carried out in two seasons between 2015 and 2016 (see Sections 5.7.6-5.7.7, Appendix I).

The provenance and possible production areas of the samples were suggested by comparing the mineralogical composition with the geological environment of the area in question (see Chapter 5), as well as through the examination of partly published and mainly unpublished comparative material. Comparative thin sections, predominantly contemporary with those from Heraion, were examined from the sites of Ayia Irini on Kea (EC II), Akrotiri on Thera (EC-LC), Panormos on Naxos (EC II), Phylakopi on Melos (EC II), Koropi in Attica (EH I-II), Koukonisi on Lemnos (MB), Poros-Katsambas (late EM I-IIA early), Myrtos-Fournou Korifi (EM I-IIA), Ayia Photia (EM I), Phaistos (FN-EM II) and Knossos (EN-FN) on Crete, Liman Tepe (EB I-II) and Bakla Tepe (EB II-IIIA) in western Anatolia that are available at the Department of Archaeology, University of Sheffield. In addition, the thin sections from Emporio and Ayio Gala on Chios (EN-FN) which are being analysed by B. Lambrechts (University of Leuven, Belgium), as well as the thin sections from Miletus (Ch-EBA III; analysed by J. Hilditch) and Çukuriçi Höyük (LN-EBA I; analysed by L. Peloschek) in western Anatolia were examined at the Amsterdam Centre for Ancient Studies and Archaeology (ACASA), University of Amsterdam and the Austrian Academy of Sciences (OeAW) in Vienna respectively. Finally the thin sections from Kastro-Tigani on Samos (NL) which are being analysed by I. Whitbread and F. Mavrides were examined at the School of Archaeology and Ancient History, University of Leicester.

7.2 Petrographic results

In total, 18 large fabric groups with occassional sub-groups, 5 small groups, and 19 loners were identified. The structure of this chapter sets the focus on the presentation of each fabric that follows the descriptive system and terminology proposed by Whitbread (1989; 1995). The petrographic fabrics do not necessarily follow a serial number order but are instead arranged in three broad categories, i.e. a) assumed local fabrics, b) non-local fabrics with known or suspected provenance, and c) fabrics for which provenance could not be determined or has been hypothesized. Where a tentative hypothesis about the potential place of production can be drawn, this is mentioned in the text. Within each category the fabrics are usually presented from the coarser to the finer and from the larger to the smaller groups and loners. Comparative charts were used to estimate voids and inclusions frequency, sorting, and roundness. Each fabric is named after the main mineralogical and technological features and comprises of thin sections that share similarities and, where necessary, sub-groups are formed that display the degree of intra-group variation. Furthermore, the separate fabrics are prefaced with a table including information about the vessel types, macroscopic group, surface treatment, as well as intra-site phase and relative chronology represented, followed by comments on the mineralogical and petrological composition, technological features (forming method, surface treatment, firing estimate, etc.), typological and stylistic observations, and provenance determination. The full standardised descriptions of the petrographic fabrics can be found in Appendix V in a serial number order.

7.3 Assumed local fabrics

7.3.1 Fabric 1: Coarse mixed metamorphic

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/3	Cooking pot	MG5A	Reddish brown slipped	Heraion I/II	EB II developed/late
HT12/9	Cooking pot	MG5D	Plain	Heraion I/II	EB II developed/late
HT12/11	Deep bowl	MG6	Red slipped and burnished	Heraion I	EB II developed
HR15/4	Cooking pot?	MG5A	Burnished	Bauphase 2	EB II early
HR15/5	Cooking pot	MG5A	Burnished	Bauphase 2	EB II early
HR15/9	Lid	MG5C	Smoothed	Bauphase 4	EB II developed
HR15/15	Deep bowl	MG5B	Irregularly burnished	Bauphase 4	EB II developed
HR15/22	Tripod cooking pot	MG5C	Red slipped/smoothed	Bauphase 4	EB II developed
HR15/24	Amphora	MG5C	Red slipped/smoothed	Bauphase 4	EB II developed
HR15/30	Hole-mouthed jar	MG5A	Red slipped/smoothed	Bauphase 4	EB II developed
HR15/34	Carinated bowl	MG5A	Irregularly burnished	Bauphase 4	EB II developed
HR15/36	Cooking pot	MG5A	Red slipped/smoothed	Bauphase 1	EB I
HR15/38	Carinated bowl	MG5A	Red slipped	Bauphase 4	EB II developed
HR15/39	Cooking pot	MG5A	Plain	Bauphase 4	EB II developed
HR15/46	Bowl with horizontal handle	MG5A	Dark grey smoothed	Bauphase 1	EB I
HR15/60	Pithos	MG5A	Red slipped/smoothed	Bauphase 4	EB II developed
HR15/62	Jar	MG5A	Red slipped/smoothed	Bauphase 2	EB II early
HR15/80	Jar	MG5A	Irregularly burnished	Bauphase 1	EB I
HR15/85	Deep bowl	MG5B	Dark grey slipped and burnished	Bauphase 1	EB I
HR15/86	Jug	MG5B	Dark grey smoothed	Bauphase 1	EB I
HR15/87	Carinated bowl	MG5A	Irregularly burnished	Bauphase 1	EB I
HR15/93	Deep bowl	MG5B	Red slipped/smoothed	Bauphase 2/3	EB II early
HR15/100	Cut-away spouted jug	MG5B	Irregularly burnished	Bauphase 2?	EB II early
HR15/110	Carinated bowl	MG5A	Irregularly burnished	Bauphase 2/3	EB II early
HR15/113	Carinated bowl	MG5A	Reddish grey smoothed	Bauphase 2/3	EB II early
HR15/115	Amphora	MG5C	Red slipped/smoothed	Bauphase 4	EB II developed
HR15/129	Narrow-necked jug	MG5B	Brown/grey smoothed	Bauphase 1	EB I
HR15/132	Cut-away spouted jug	MG5B	Irregularly burnished	Bauphase 4	EB II developed
HR15/183	Cooking pot	MG5A	Red slipped/smoothed	Heraion 6	Ch
HR15/185	Cooking pot	MG5A	Plain	Heraion 6	Ch
HR15/202	Two-handled cup	MG6	Red slipped	Heraion II-III	EB II late
HR15/236	Narrow-necked jug	MG5B	Irregularly burnished	Heraion 3	EB II early
HR15/243	Narrow-necked jug	MG5B	Yellowish brown burnished	Heraion 1	EB II developed

Table 7.1: Samples of Fabric 1.

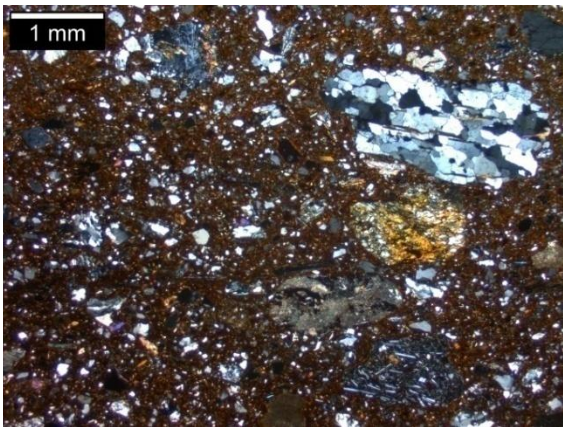
Variants

HR15/53	Cooking pot	MG5A	Plain	Bauphase 1	EB I
HR15/57	Carinated bowl	MG5A	Reddish grey smoothed	Bauphase 1	EB I
HR15/81	Cooking pot	MG5A	Light brown smoothed	Bauphase 1	EB I
HR15/161	Deep bowl	MG5A	Plain	Heraion 6	Ch
HR15/168	Cheesepot	MG5A	Plain	Heraion 6	Ch
HR15/171	Cheesepot	MG5A	Plain	Heraion 6	Ch

HR15/25	Bowl horizontal handle	MG5B	Dark grey smoothed	Bauphase 4	EB II developed
HR15/111	Pithos	MG5A	Red slipped	Bauphase 1	EB I
HR15/245	Jar base	MG5B	Reddish brown smoothed	Heraion 1	EB II developed

HR15/96	Jar	MG5A	Red slipped	Bauphase 2	EB II early
HR15/133	Jug with carinated body	MG5B	Irregularly burnished/smoothed	Bauphase 1	EB I
HR15/231	Jar?	MG5A	Red slipped	Heraion 3	EB II early

Table 7.1 (continued): Samples of Fabric 1.



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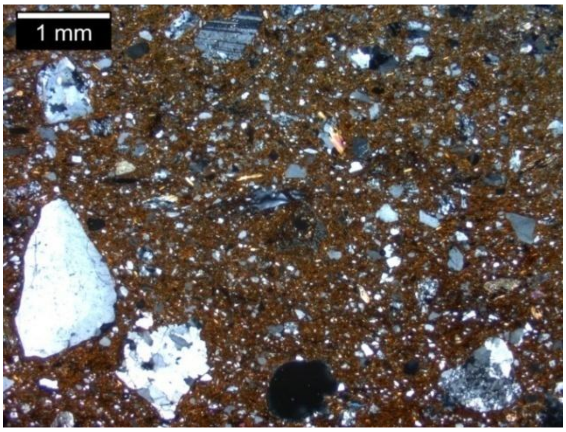

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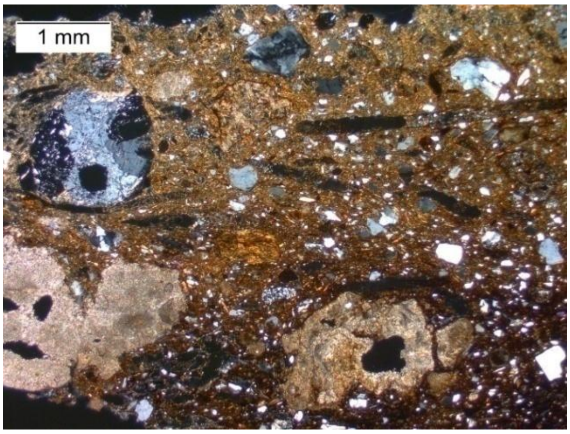

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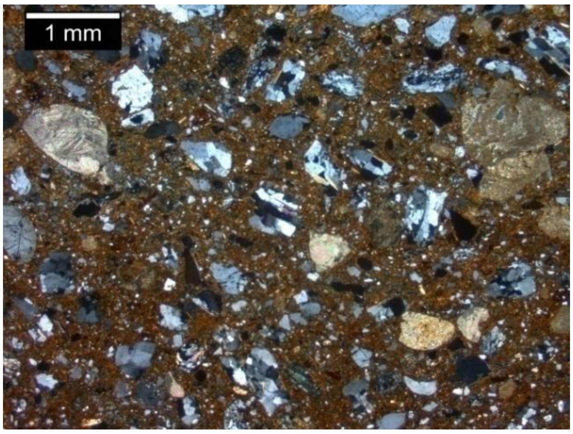

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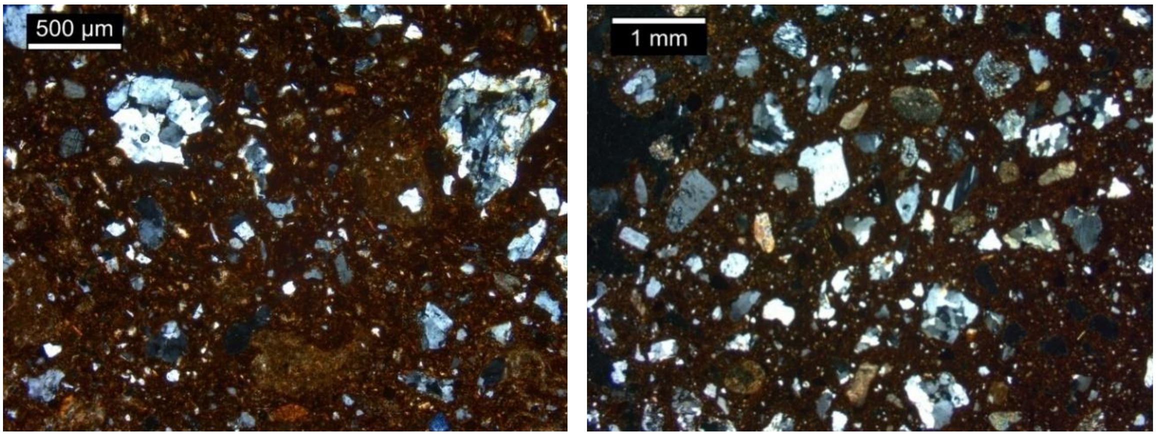

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Figure 7.1: Micrographs of samples within Fabric 1. A. HR15/161; B. HR15/93 with a possible coil; C. HR15/185 with remains of vegetal temper; D. HR15/111; E. GS25/2016; F. GS43/2016. All images taken in XP.

Composition

The most diagnostic feature of this fabric in terms of composition is the varied, naturally-mixed metamorphic lithology. The main inclusions consist of coarse high-grade metamorphic rock fragments and their dissociated minerals, namely polycrystalline quartz/quartzite, banded quartz-mica schist (mainly with muscovite), phyllite, as well as very few-absent sillimanite schist, amphibole aggregates, epidote/clinozoisite aggregates, actinolite schist, serpentinised rocks, and metagabbro fragments (Fig. 7.1:A-C). The coarse nature of this fabric and the presence of the same suite of rocks and minerals in both size fractions, seem to reflect the use of a relatively fresh, immature non-calcareous primary clay.

Technological features

Despite the intra-fabric variation in terms of presence/absence, sorting, coarseness and frequency of inclusions, all samples are discussed in one group as they most probably represent the natural variability of the local raw material deposits. Therefore, a degree of heterogeneity is observed between samples also regarding the textural features (different types of TCFs), colour of groundmass, and firing conditions. The majority appear with a pronounced colour differentiation with a darker core, related to the common presence of vegetal temper especially marked in the earlier-dated and coarser examples (e.g. HR15/5, 9, 39, 60, 62, 168, 171). These appear in the form of planar and channel voids that are occasionally surrounded by a dark rim or preserve partially-combusted matter (Fig. 7.1:C). The latter implies a fast, low-firing process characterised by uneven temperature and atmosphere, which is also indicated by the optically active micromass. Some samples exhibit a concentric arrangement of inclusions in places, possibly corresponding to coils or compressed slabs (e.g. HR15/60, 93, 100, 110, 113). With respect to the surface treatment only some samples exhibit a darker outer margin that is related to the compaction of the surface (e.g. HR15/115).

A number of variants were identified on a compositional and technological basis. Those lacking the diagnostic red TCFs that characterise the main group (HR15/53, 57, 81, 161, 168, 171), those with a well-sorted coarse fraction that might indicate intentional sand tempering (HR15/25, 111, 245; Fig. 7.1:D), and those with a relatively finer version and a higher amount of micrite (HR15/96, 133, 231).

Typological/stylistic observations and macroscopic correlations

It is typologically a varied group, as it covers vessels of different functions, namely bowls, jugs, jars, pithoi, cooking pots that date from the Ch to the end of the EB II early period (EB II developed), although the main body of samples belong to the EB II. A number of different surface treatments have been identified and the samples correspond macroscopically with several groups and sub-groups that are all linked through their metamorphic content (MG5A-C, MG6).

Petrographic parallels and suggested provenance

The integration of contextual and morphological/stylistic information, in conjunction with the petrographic analysis, provides confident evidence regarding its local provenance and allows the formation and interpretation of the different sub-groups. Its compositional variability implies the exploitation of different raw material sources that belong broadly to the same metamorphic geological formation of the Ambelos nappe. More specifically, it relates to the Ambelos schist bodies (see Section 5.3.1). As previously mentioned this fabric or series of fabrics are most likely naturally mixed and have been produced from red alluvial deposits that cover the immediate area around Heraion and the Chora plain in general (see Section 5.6). The deposits are formed through the action of streams and rivers – more particularly Imvrassos River which surrounded the settlement in the EB – that flow from the metamorphic highlands and transport these products of erosion towards the sea.

The mineralogical consistency of this fabric with the geology of Samos is also supported by the comparable clay sources sampled in the vicinity of Heraion (see

Section 5.7.6: Fabrics 6 and 18; Fig. 7.1:E-F). Nevertheless, even the most detailed geological prospection may not be able to provide direct petrological links as metamorphic geologies usually vary even within the same outcrop and the continuous erosion and transportation of alluvial sediments transformed the clays exploited in antiquity.

This fabric group, together with its sub-groups (see below), covers 1/3 of the analysed samples and it crosscuts all vessel shapes and chronological phases. A closely comparable picture is noted in the Çukuriçi Höyük ceramic material (Peloschek in progress; pers. exam. of thin sections, December 2016), in which the 'Metamorphic fabric groups' cover *ca*. 60% of the analysed assemblage from the NL till the historical periods for the manufacture of all ceramic shapes, although they are more common during the EB for the manufacture of cooking vessels (Peloschek 2013, 45, top fig.; 2016a, 255; 2016b, 200, fig. 2b; 2017, 129, fig. 6.3:1-2). Nevertheless, this relates to the inherent lithological/petrological variation within metamorphic outcrops and therefore the range of these variations, which are highlighted in the sub-groups defined below, are to be expected within a local sequence where this type of fabric is dominant. All these are not to suggest a shared provenance between the two sites, but rather to stress their geological compatibility due to close proximity and repetition of similar formations.

7.3.1.1 Sub-fabric 1A: Red coarse metamorphic – common polycrystalline quartz, quartz-mica schist, and TCFs

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/10	Cooking pot	MG3	Plain	Heraion I/II	EB II developed/late
HT12/13	Deep bowl	MG6	Reddish brown slipped	Heraion I	EB II developed
HR15/14	Cheesepot	MG5A	Plain/smoothed	Bauphase 1	Ch
HR15/20	Jug pedestal	MG5C	Plain	Bauphase 4?	EB II developed
HR15/56	Cheesepot	MG5A	Plain/smoothed	Bauphase 1	Ch
HR15/63	Jug with carinated body	MG5B	Yellowish brown burnished	Bauphase 2/3	EB II early
HR15/77	Deep bowl	MG5A	Plain/smoothed	Bauphase 1	EB I
HR15/89	Jar	MG5A	Reddish brown slipped	Bauphase 1	EB I
HR15/92	Cooking pot	MG5E	Plain/smoothed	Bauphase 4	EB II developed
HR15/116	Carinated bowl	MG5A	Yellowish brown/irregularly burnished	Bauphase 2	EB II early
HR15/124	Miniature jug	MG5B	Irregularly burnished	Bauphase 4	EB II developed
HR15/138	Cut-away spouted jug	MG5B	Reddish brown/reddish grey burnished	Bauphase 3?	EB II early
HR15/181	Cheesepot	MG5A	Plain	Heraion 6	Ch
HR15/212	Hemispherical bowl	MG5E	Red slipped	Heraion III/IV	EB II late/III
HR15/217	Shallow	MG6	Red slipped	Heraion I/II	EB II

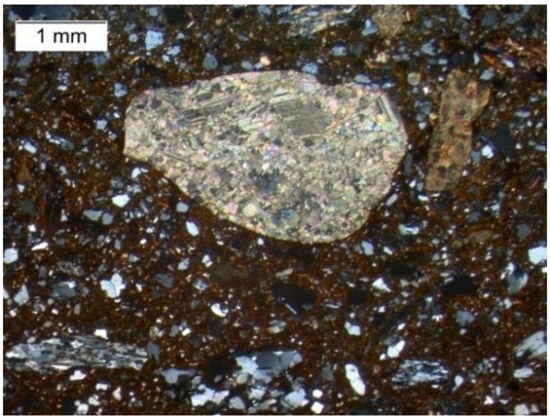
	bowl/plate				developed/late
HR15/223	Pithos	MG5A	Red slipped/smoothed	Heraion V/VI	EB III/MB
HR15/247	Carinated bowl	MG5B	Red slipped/smoothed	Heraion 1	EB II developed
HR15/271	Perforated vessel	MG5D	Reddish brown smoothed	Heraion IV	EB III
HR15/279	Cooking pot	MG5E	Red smoothed	Heraion IV	EB III
HR15/283	'Crown' lid	MG10	Red slipped	Heraion I/II	EB II developed/late

Variants

HR15/286	Wheel-made cup	MG1A	Plain	Heraion V/VI	EB III/MB

HR15/1	Tripod cooking pot	MG2A	Plain	Bauphase 1	EB I
HR15/125	Tripod cooking pot	MG5C	Plain	Bauphase 2	EB II early

Table 7.2: Samples of Sub-fabric 1A.



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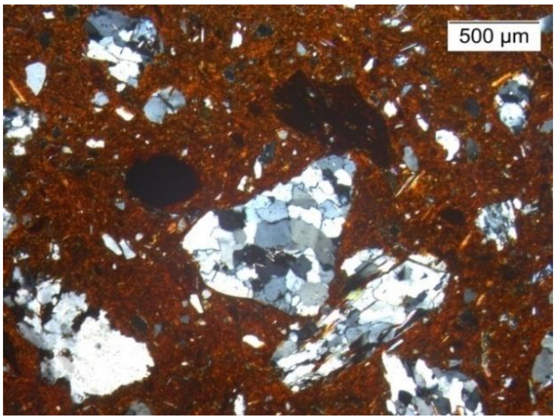

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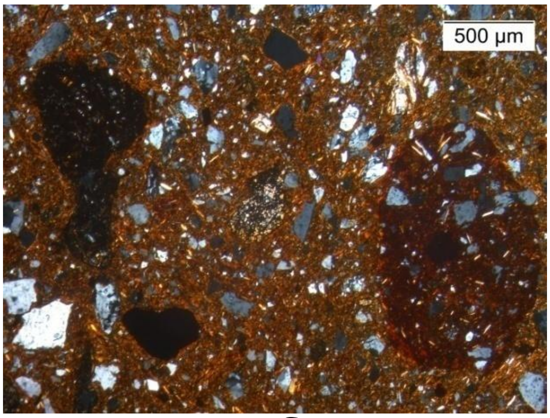

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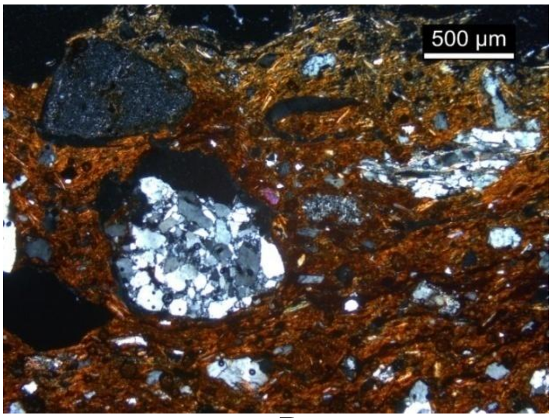

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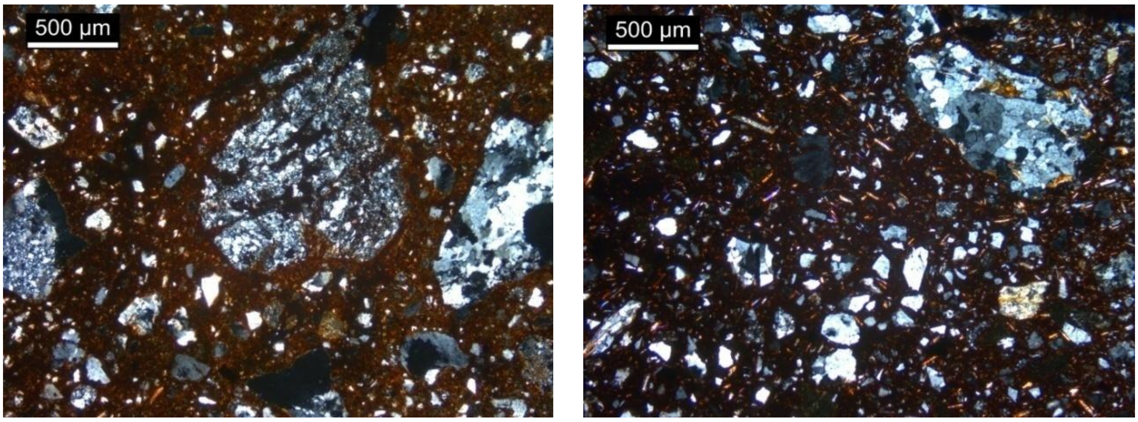

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Figure 7.2: Micrographs of samples within Sub-fabric 1A. A. HR15/56 with a limestone fragment; B. HR15/92; C. HR15/89 with red TCFs; D. HR15/279 with a chert fragment (top left); E. GS21/2015; F. GS27/2016. All images taken in XP.

Comment

This sub-group varies in a number of respects, including the rarity of the mixed metamorphic rocks (e.g. chlorite schist, sillimanite schist, etc.) and epidote group minerals described above (samples dated to the Ch/EB I: HR15/14, 56, 89), the relative size and abundance of polycrystalline quartz and weakly to well-banded quartz-muscovite schist fragments that are occasionally oxidised and phyllite, and more prominently the evenly-fired red-orange paste and range of TCFs, mainly those with a compact red-orange texture. The latter could either be indicative of incomplete mixing or being naturally-present in the raw materials (Fig. 7.2:C). Other TCFs include dark streaks related to the high presence of iron oxides that occur between voids or cracks and occasionally surrounding the larger inclusions (e.g. HR15/279). The same types of TCFs, especially the red-orange ones, are found in the clay samples (see Section 5.7.6: Fabric 4). The same was also observed for the generally rounded limestone fragments and their presence in the coarse fraction is usually very conspicuous (Fig. 7.2:A). The rare presence of chert (e.g. HR15/89, 92, 223, 271), among other secondary non-plastic inclusions, indicates a possible common origin for the raw materials (Fig. 7.2:D) and provides an additional link with main Fabric 1, as does Fabric 4 of the geological samples.

This sub-group consists mostly of EB II early period samples, but also a considerable number of later EB samples are noted. The latter (e.g. HR15/271, 283) are characterised by a finer and more micaceous groundmass and find a good match with Fabric 5 of the geological samples (see Section 5.7.6; Fig. 7.2:E-F). The relative homogeneity of the colour and level of optical activity would seem to suggest a generally even firing temperature and atmosphere, although more rarely high-fired samples exist that date to the EB III period (e.g. HR15/283). Other technological features include the use of vegetal temper for the early-dated samples (e.g. HR15/14, 56, 77, 89) and concentric areas that perhaps correspond to coils.

In terms of shapes and wares, the majority of samples cover mainly reddish brown smoothed/self-slipped or poorly-burnished tableware (bowls and jugs) vessels. A small number of variants were identified such as HR15/1 and HR15/125 that, although compatible with the rest of the samples, contain a small amount of glassy, altered volcanic rock fragments. They are, however, very consistent and represent tripod cooking pots.

7.3.1.2 Sub-fabric 1B: Coarse metamorphic – quartz-rich

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/7	Pithos/jar	MG3	Red slipped and burnished	Bauphase 4	EB II developed
HR15/12	Cooking pot	MG5A	Red slipped	Bauphase 1	Ch/EB I
HR15/16	Deep bowl	MG5B	Red slipped and burnished	Bauphase 4	EB II developed
HR15/19	Jar	MG5A	Red slipped/smoothed	Bauphase 2	EB II early
HR15/29	Carinated bowl	MG5B	Reddish brown slipped	Bauphase 4	EB II developed
HR15/44	Jug	MG5B	Red slipped	Bauphase 4	EB II developed
HR15/55	Carinated bowl	MG5A	Reddish grey smoothed	Bauphase 1	EB I
HR15/75	Jug/jar handle	MG5B	Plain	Bauphase 4	EB II developed
HR15/105	Jug	MG5A	Red slipped	Bauphase 1?	Ch/EB I
HR15/108	Cooking pot	MG5A	Plain	Bauphase 2	EB II early
HR15/123	Jug	MG5B	Reddish grey smoothed	Bauphase 1	EB I
HR15/131	Jug	MG5B	Reddish brown burnished	Bauphase 2/3	EB II early
HR15/135	Jar	MG5A	Reddish brown slipped/smoothed	Bauphase 1	EB I
HR15/137	Carinated bowl	MG5A	Reddish brown slipped	Bauphase 3	EB II early
HR15/238	Jar	MG5A	Red slipped	Heraion 1	EB II developed
HR15/248	Jug	MG5B	Reddish grey smoothed	Heraion 1	EB II developed

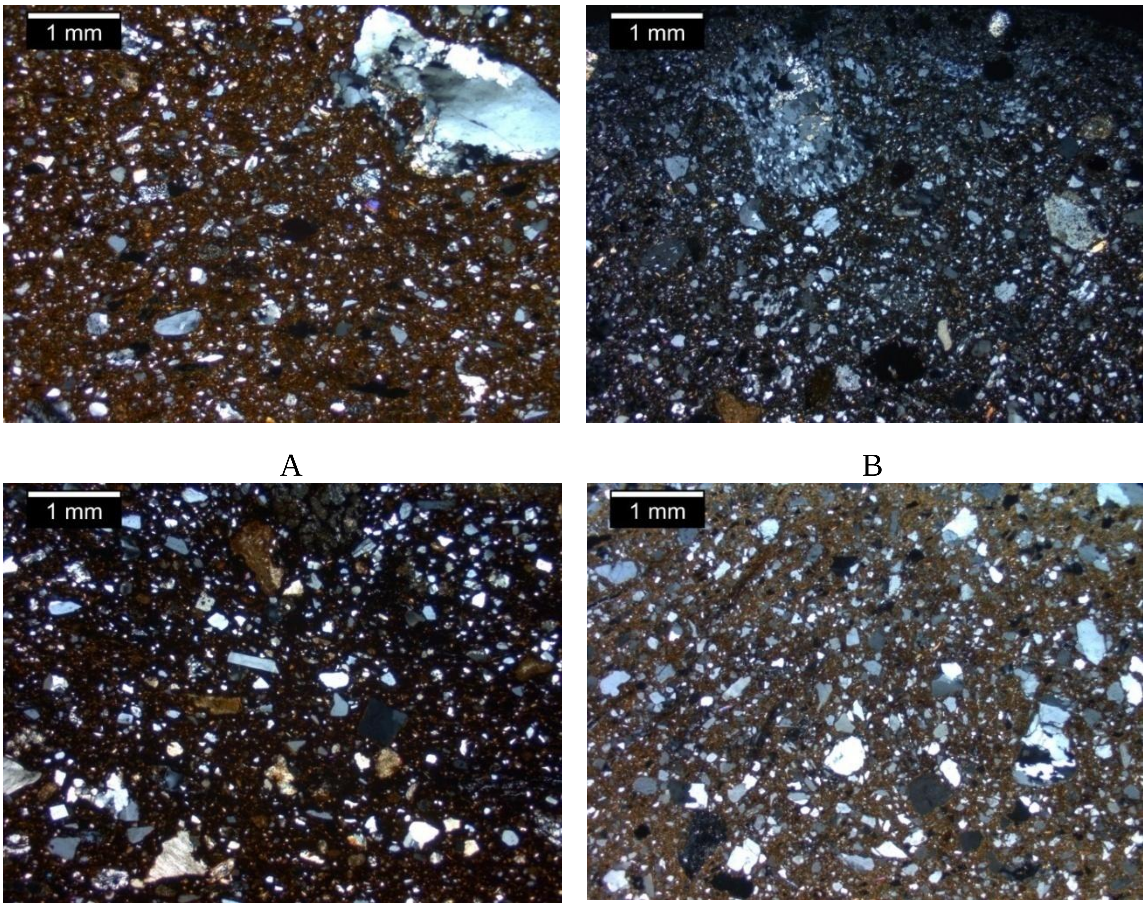
Variants

HR15/42	Carinated bowl	MG5A	Reddish brown slipped	Bauphase 4	EB II developed
HR15/43	Carinated bowl	MG5A	Red slipped	Bauphase 4	EB II developed
HR15/127	Carinated bowl with horned lugs	MG5A	Yellowish brown/grey smoothed	Bauphase 1	EB I

HR15/173	Deep bowl	MG5A	Plain	Heraion 4/5	EB I
HR15/176	Jar	MG5B	Reddish grey	Heraion 6	Ch

			smoothed		
HR15/240	Cut-away spouted jug	MG5B	Yellowish brown/grey burnished	Heraion 1	EB II developed

Table 7.3: Samples of Sub-fabric 1B.



C D

Figure 7.3: Micrographs of samples within Sub-fabric 1B. A. HR15/12; B. HR15/42; C. HR15/176; D. HR15/248. All images taken in XP.

Comment

Although generally compatible with Fabric 1 and Sub-fabric 1A, this sub-group differs by its finer texture, reduced levels of mica schist fragments, and higher quantity of quartz-rich rock fragments (polycrystalline quartz, quartzite) with constituent minerals (silt- and sand-sized monocrystalline quartz, equant and tabular/prismatic feldspar) set in a well-sorted texture. The earlier-dated samples (e.g. HR15/12, 173, 176) contain vegetal matter present in the form of elongate voids, some samples contain more mica (e.g. HR15/55, 75, 108), the majority appear with some colour differentiation but some are evenly-fired or very dark. A number of variants were also identified, on the basis of a distinctive calcareous, dark greyish brown groundmass with high presence of micrite (HR15/42, 43, 127) and due to the pronounced presence of tabular/prismatic feldspar crystals and vegetal temper that is probably responsible for their dark colour (HR15/173, 176, 240; Fig. 7.3:C). This sub-group may represent a number of discrete raw material sources within the broad metamorphic deposits of the Chora plain or even the products of different workshops. A local ascription can be likely suggested according to mineralogical links with Fabric 1. The fabric occurs mainly in bowls and jugs, in a number of wares dating from the EB I to II developed.

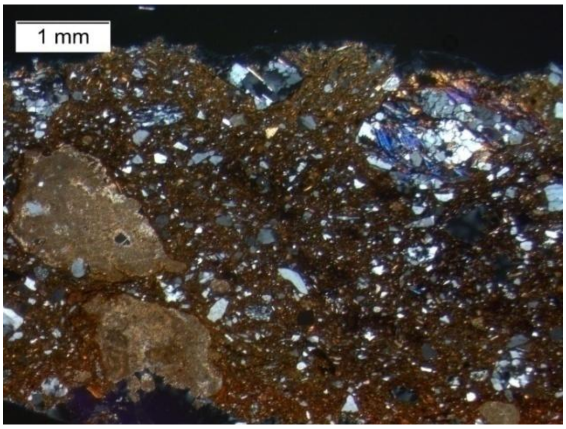
7.3.1.3 Sub-fabric 1C: Coarse metamorphic – common quartz-mica schist and vegetal temper

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/158	Globular pyxis with pierced lug	MG5A	Red slipped/smoothed	Heraion 5	EB I
HR15/160	Cheesepot	MG5A	Plain/smoothed	Heraion 6	Ch
HR15/162	Cut-away spouted jug	MG5A	Red slipped	Heraion 5	EB I
HR15/178	Jar with horned lug	MG5A	Reddish grey slipped	Heraion 4	EB I

Variants

HR15/28	Jar	MG5A	Plain/smoothed	Bauphase 1	Ch/EB I
HR15/51	Cooking pot	MG1	Reddish grey slipped	Bauphase 1	Ch/EB I
HR15/94	Jar with horned lugs	MG5A	Reddish brown slipped/smoothed	Bauphase 1	Ch/EB I
HR15/246	Jar	MG5A	Plain/smoothed	Heraion 1	EB II developed

Table 7.4: Samples of Sub-fabric 1C.



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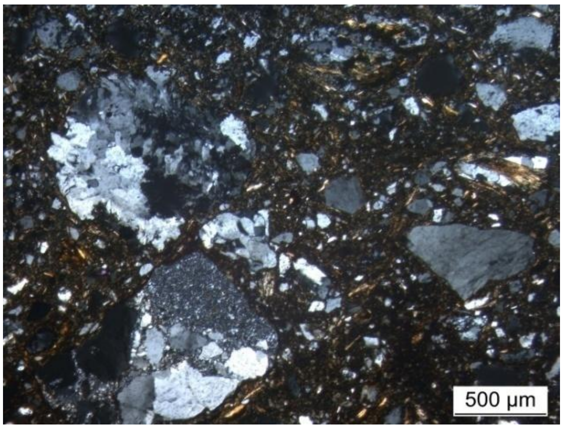
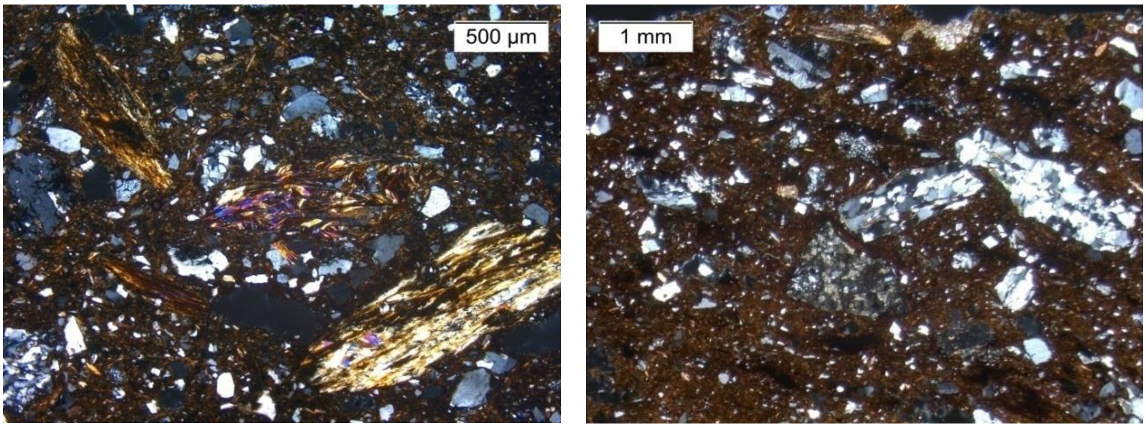


B



C D

Figure 7.4: Micrographs of samples within Sub-fabric 1C. A. HR15/158; B. HR15/162; C. HR15/178; D. HR15/28. All images taken in XP.

Comment

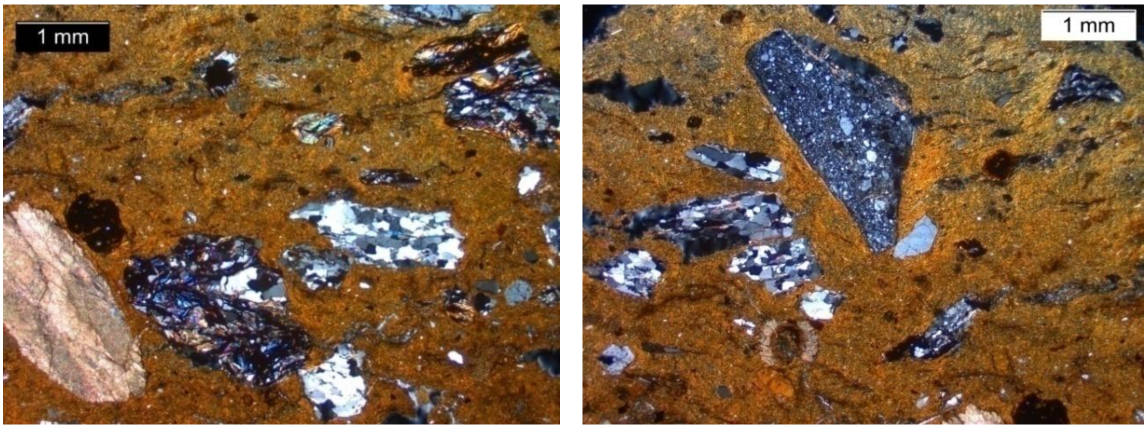
This sub-group is characterised by coarse, elongate quartz-muscovite schist fragments that can be foliated and in places strongly schistosed, and exhibit a somewhat high degree of alignment with the vessel margins. Some fragments exhibit a distinctive texture with iron oxides masking the mica laths and giving the rocks a dark red-purplish colour (Fig. 7.4:A and C). The presence of such coarse inclusions might indicate tempering or crushing of the parent rocks. All samples contain a substantial amount of vegetal temper and exhibit dark streaks related to its partial combustion, as well as rare greywacke fragments (Fig. 7.4:B) also seen in the afore-described fabrics. A variant could be distinguished by the presence of coarse volcanic rock fragments (Fig. 7.4:D).

All samples with the exception of one EB II developed variant date tightly to the Ch and EB I periods with a variety of shapes and surface treatments. The similarity of the quartz-muscovite schists and greywacke fragments with Fabric 1 and Sub-fabric 1A may indicate a local provenance. Perhaps these diagnostic technological features and compositional variations can be attributed to distinct raw material sources or a separate production centre in the early phases of the settlement.

7.3.1.4 Sub-fabric 1D: Sand-tempered metamorphic with common oxidised quartz-mica schist

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/164	Closed jar	MG5A	Reddish brown slipped	Heraion 6	Ch
HR15/179	Closed jar	MG5A	Red slipped	Heraion 6	Ch
HR15/184	Collar-necked jar	MG5A	Red slipped	Heraion 6	Ch

Table 7.5: Samples of Sub-fabric 1D.



A B

Figure 7.5: Micrographs of samples within Sub-fabric 1D. A. HR15/179; B. HR15/179 with a greywacke fragment, mica-schists, and a microfossil. All images taken in XP.

Comment

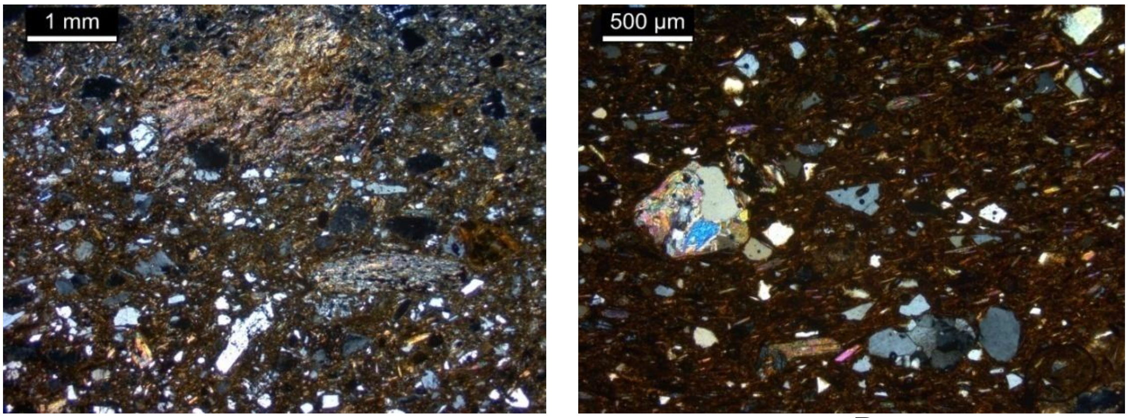
Its principal inclusions are as in Sub-fabric 1C, although the coarse metamorphic rocks are most prominent and commonly consist of quartz-muscovite schist fragments with distinct layers of quartz, muscovite mica, and iron oxides occasionally partly or entirely masking the rock and appearing nearly opaque (Fig. 7.5:A). Rare greywacke fragments (Fig. 7.5:B) are also present, as well as limestone fragments that can be occasionally slightly weathered and with a fossilized structure. The presence of such coarse inclusions in a generally very fine groundmass strongly indicates the intentional addition of sand temper in the clay paste. This is more conspicuous in sample HR15/179 which has a finer texture and a fairly calcareous groundmass. All samples contain a substantial amount of vegetal temper and exhibit dark streaks related to its partial combustion.

It is chronologically and typologically a very consistent group (Ch) and corresponds to red/dark-slipped jars (Variety A: Chapter 6, fig. 6.18:1). Although technologically and texturally distinctive from Fabric 1 and sub-groups 1A-C, the mineralogical links could imply a broadly local origin (especially similar with HR15/39, 92, 158). Nevertheless, sample HR15/179 finds a very close match in ‘Sand-tempered fabric group’ from Çukuriçi Höyük (Peloschek 2016b, 192-193, fig. 2), which is considered locally-produced and covers EB I (phases ÇuHö IV-III) samples belonging to closed vessels and tripod cooking pots. This fabric contains the same oxidised muscovite schists, greywacke fragments, vegetal temper, and fine groundmass. This could suggest a shared provenance for this sample. However, because of repeated geology and variable lithology within that, it is likely that provenance of some of these distinctive groups will not become clear until more analysed comparative material from a variety of sites is available.

7.3.1.5 Sub-fabric 1E: Coarse micaceous metamorphic

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/19	Deep bowl	MG5B	Dark burnished	Heraion I	EB II developed
HR15/261	Shallow bowl	MG1A	Plain/smoothed	Heraion II	EB II late
HR15/285	Jug	MG30	Plain/smoothed	Heraion II-V	EB II late-III
HR15/298	Jar handle	MG5C	Red slipped	n/a	EB II early

Table 7.6: Samples of Sub-fabric 1E.



A B

Figure 7.6: Micrographs of samples within Sub-fabric 1E. A. HT12/19; B. HR15/298. All images taken in XP.

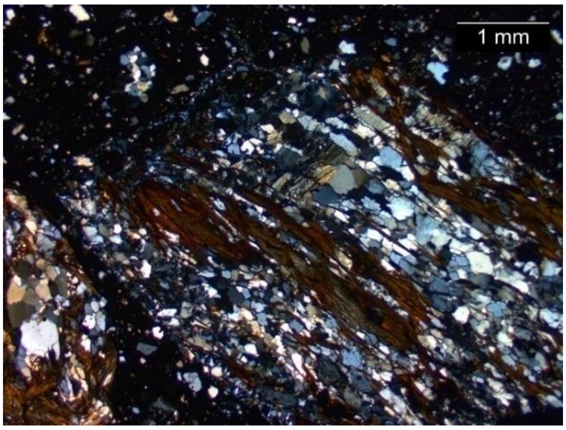
Comment

This sub-group is generally finer and contains more white mica (muscovite) laths. It is consistent with tableware vessels (jugs and bowls) with different surface treatments. The samples are generally low/moderately-fired, as indicated by the highly optically to moderately active micromass. Sample HR15/261 exhibits areas with perpendicular and concentric arrangements of mica that might relate to the forming method employed and it is macroscopically defined as wheel-coiled. With respect to its provenance, this fabric relates also to a metamorphic environment, but diverges from the afore-described main group and sub-groups. The petrological differences observed might be explained by the inherent variability of the metamorphic deposits in the vicinity of Heraion, but may indicate a non-local provenance.

7.3.2 Fabric 2: Dark-fired, coarse metamorphic, and volcanic rocks

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/47	Jar/jug	MG2A	Plain	Bauphase 1/2	EB I/II early
HR15/50	Jar/jug	MG2A	Plain	Bauphase 1	EB I
HR15/54	Jar/jug	MG2A	Red slipped	Bauphase 1	EB I
HR15/65	Jug	MG2A	Plain	Bauphase 1	EB I
HR15/76	Jug	MG2A	Plain	Bauphase 1	EB I
HR15/102	Pithos	MG2A	Red slipped	n/a	EB II early?
HR15/121	Pithoid jar	MG4	Red slipped	Bauphase 2	EB II early
HR15/169	Pithos	MG2A	Plain	Heraion 4	EB I
HR15/224	Jar	MG2A	Plain	n/a	EB II early?
HR15/274	Pithos	MG2A	Plain	Heraion I	EB II early

Table 7.7: Samples of Fabric 2.



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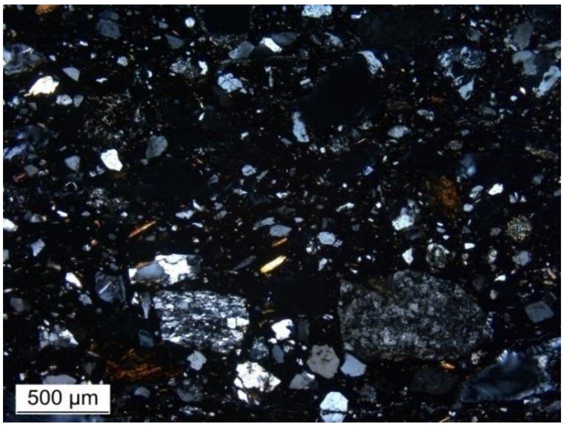

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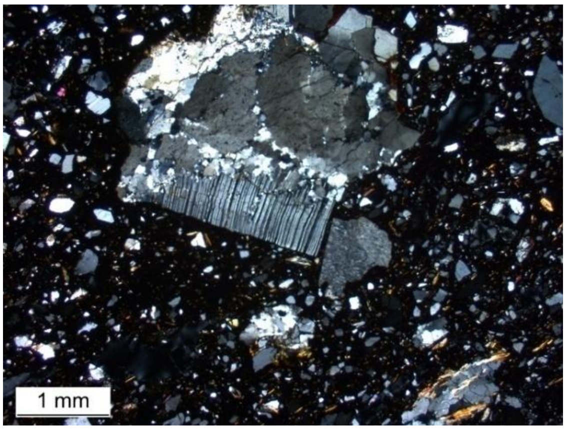

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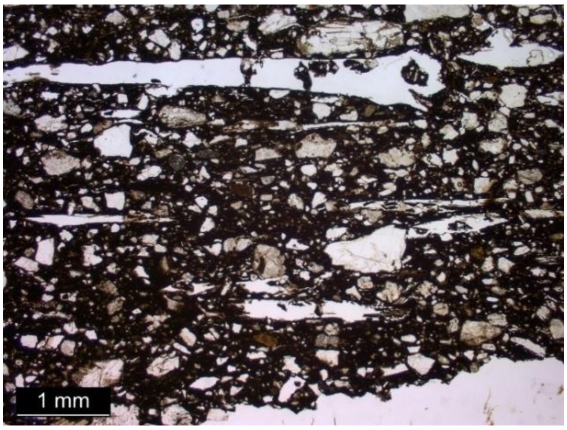

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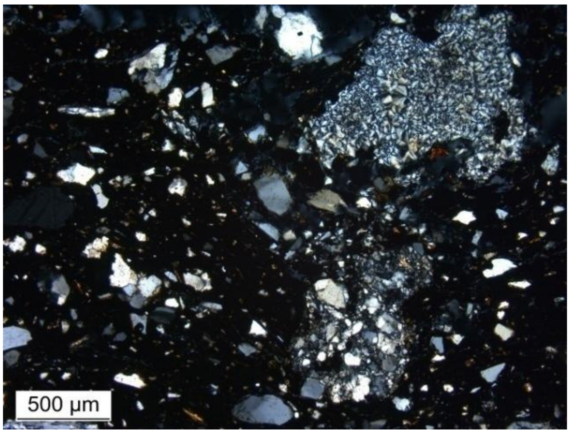
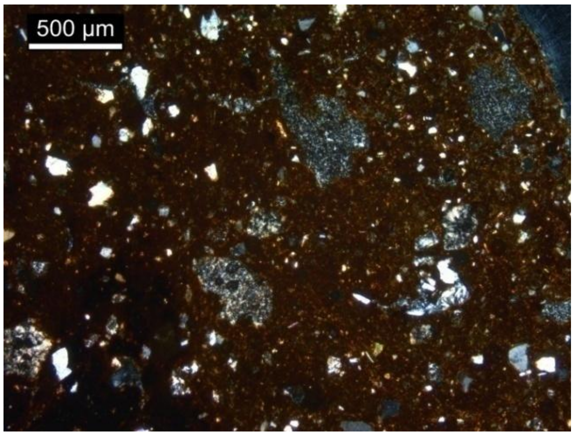




E F

Figure 7.7: Micrographs of samples within Fabric 2. A. HR15/102; B. HR15/54; C. HR15/121; D. HR15/121 with remains of vegetal temper; E. HR15/224 with chalcedony/spherulite fragments; F. GS17/2015 with chalcedony/spherulite fragments. All images taken in XP except of D.

Composition

It contains dominant-very few medium to high-grade metamorphic rock fragments, mainly quartz-mica schist, and sillimanite schist/gneiss. Although varying in quantity between the thin sections, all metamorphic fragments show a well-foliated texture and a sub-angular elongate shape/form, and are generally aligned with the vessel margins (Fig. 7.7:A). Other non-plastic inclusions of the coarse fraction consist of polycrystalline quartz, alkali feldspar tabular crystals with simple or no twinning and occasionally a cloudy appearance (Fig. 7.7:B-C). Another characteristic feature of the coarse fraction is the presence of volcanic rock fragments ranging in composition and texture from altered/devitrified trachyte/trachybasalt to rhyolitic spherulites.

Technological features

The variability of inclusions from very coarse to very fine and their angularity and freshness could indicate tempering. Moreover, the presence of large planar and channel voids throughout the samples suggests vegetal tempering (Fig. 7.7:D). No evidence for the forming technique could be identified, aside perhaps a single example of a coil join (HR15/47). The samples seem to be consistent with a moderate-high temperature and reducing atmosphere, as indicated by the moderately active/optically inactive micromass. A possible slip layer is partly preserved in sample HR15/121.

Typological/stylistic observations and macroscopic correlations

The samples belong to body or more rarely rim and handle sherds, mainly of large storage vessels, namely EB I-II early jars/jugs and pithoi. Originally all samples must have been covered with a thick red slip, but this is only rarely preserved. Macroscopically they are distinguished by a hard-baked, soft-textured clay paste and correspond to MG2A.

Petrographic parallels and suggested provenance

This fabric is most probably linked with a primary clay source in association with a metamorphic environment, although the small occurrence of volcanic rock fragments could relate with the volcanic bodies present along the margins of the Mytilinii basin that intersect as sills within the Ambelos schist formations. This fabric is taken as local primarily due to its mineralogical compatibility with the coarser versions of Fabrics 1 and 6. It contains a similar range of metamorphic rocks with Fabric 1 and a range of volcanics with intermediate to minor basic composition, either with fresh porphyritic or devitrified/altered matrices, as observed in Fabric 6. It exhibits some mineralogical and textural similarities with Fabric 15 of the geological samples (Fig. 7.7:F).

7.3.3 Fabric 3: Ophiolite-derived with serpentinite

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/10	Basin	MG1	Slipped/smoothed?	Bauphase 4	EB II developed?
HR15/17	Cheesepot	MG1	Reddish brown smoothed	Bauphase 4	Ch
HR15/23	Cheesepot	MG1	Plain	Bauphase 4	Ch
HR15/27	Amphora	MG1	Plain	Bauphase 1	EB I
HR15/32	Cheesepot	MG1	Plain	Bauphase 4	Ch
HR15/37	Amphora	MG1	Plain/smoothed	Bauphase 2	EB II early
HR15/58	Cheesepot	MG1	Plain	Bauphase 1	Ch
HR15/61	Cooking pot	MG1	Plain	Bauphase 4	EB I-II early?
HR15/66	Amphora	MG1	Plain, incised	Bauphase 1	EB I
HR15/67	Cooking pot	MG1	Plain	Bauphase 1	EB I
HR15/68	Cheesepot	MG1	Plain	Bauphase 4	Ch
HR15/69	Amphora	MG1	Plain/smoothed	Bauphase 3	EB I-II early
HR15/70	Cooking pot	MG1	Plain	Bauphase 1	Ch/EB I
HR15/72	Pithos	MG2B	Reddish brown slipped/smoothed	Bauphase 4	EB II early
HR15/91	Cheesepot	MG1	Plain/smoothed	Bauphase 1	Ch
HR15/98	Cut-away spouted jug	MG1	Plain/smoothed	Bauphase 4	EB I/II early
HR15/104	Pithos	MG1	Reddish brown slipped	Bauphase 2	EB II early
HR15/117	Amphora	MG1	Plain, incised	Bauphase 1	EB I
HR15/119	Cheesepot	MG1	Plain/smoothed	Bauphase 2	Ch
HR15/128	Cheesepot	MG1	Reddish brown slipped	Bauphase 2	Ch

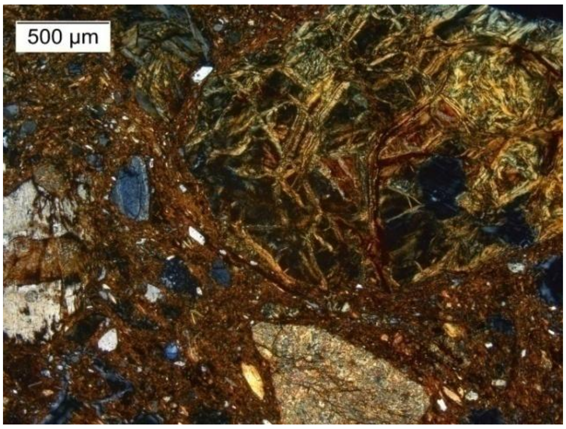
Table 7.8: Samples of Fabric 3.

HR15/136	Cheesepot	MG1	Plain	Bauphase 3	Ch
HR15/166	Cheesepot	MG1	Red slipped/smoothed	Heraion 4	Ch
HR15/177	Cooking pot	MG1	Reddish brown slipped	Heraion 4	Ch/EB I
HR15/225	Basin	MG1	Plain	Heraion 2/3	EB II early
HR15/229	Amphora	MG1	Plain	Heraion 2/3	EB II early
HR15/230	Basin	MG1	Plain	Heraion 3	EB II early
HR15/234	Amphora	MG1	Plain/smoothed	Heraion 2/3	EB II early
HR15/235	Cheesepot	MG1	Plain	Heraion 2	Ch
HR15/244	Amphora	MG1	Reddish brown slipped, incised	Heraion 1	EB II developed
HR15/249	Basin	MG1	Plain	Heraion 1	EB II developed

Variant

HR15/18	Pithos	MG2A	Plain	Bauphase 4	EB II developed

Table 7.8 (continued): Samples of Fabric 3.



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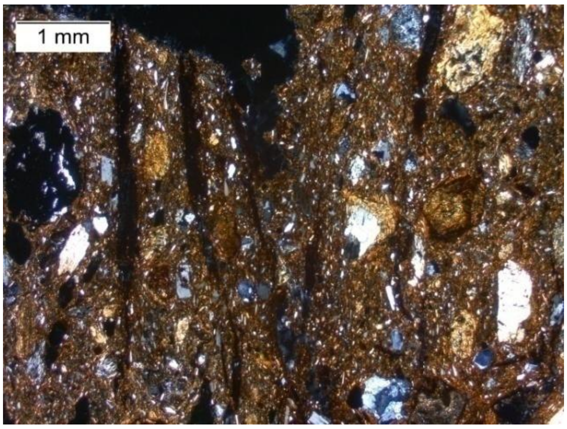

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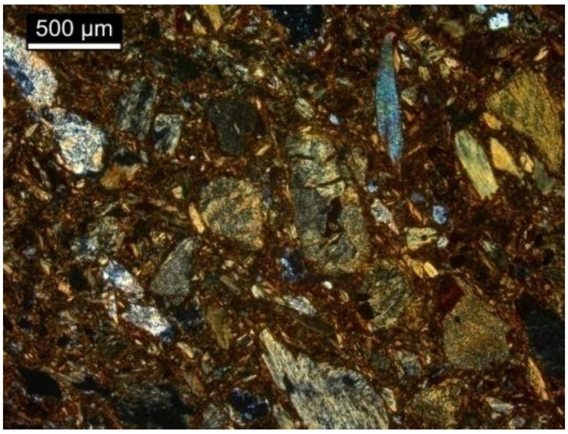

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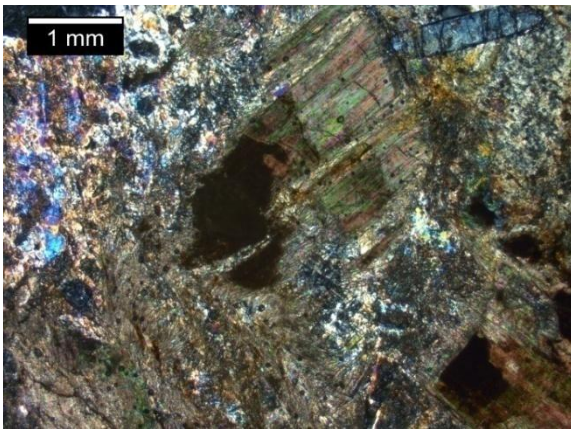

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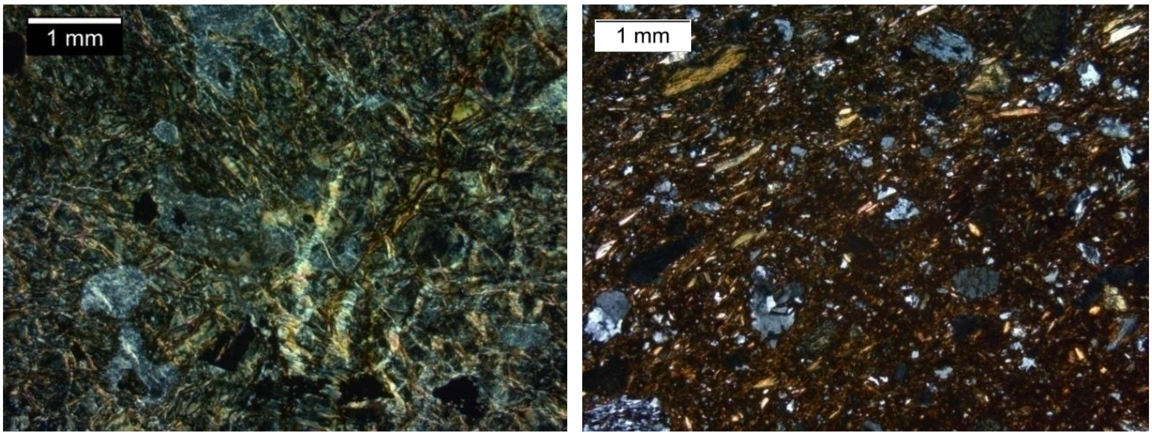


E F

Figure 7.8: Micrographs of samples within Fabric 3. A. HR15/68; B. HR15/66 with remains of vegetal temper; C. GS24/2016; D. GS48/2016; E. GS50/2016; F. CS 5. All images taken in XP.

Composition

This is a very coarse, well-packed fabric characterised by a mixed lithology, due to its relation to ophiolite-derived sediments. The coarse fraction includes a range of altered, mainly serpentinised, rocks of volcanic and metamorphic origin, namely chlorite aggregates, chloritoid schist and other medium-grade metamorphic rocks, and metagabbro (Fig. 7.8:A-B).

Technological features

A primary, naturally-varied sediment source was possibly utilised. This is implied by experimental sample GS24/2016 that is compositionally and texturally compatible with the pottery fabric (see Section 5.7.6, tabs. 5.1-5.2) (Fig. 7.8:C). There is a substantial number of planar voids reflecting vegetal tempering, usually identified from partially-combusted chaff with a dark oxidised infill (Fig. 7.8:B). The latter also implies that all samples were most probably subject to a fast, low-firing temperature process. No immediate evidence for the forming method used was identified.

Typological/stylistic observations and macroscopic correlations

It is chronologically and typologically very consistent and presents a clear picture of compatibility between fabric, form, and presumed function of the analysed vessels. More particularly, 1/3 of the samples correspond to cheesepots of the Ch, while the rest are represented by two-handled cooking pots, deep bowls/open jars, collar-necked amphorae with or without incised decoration, all dating between the Ch and the EB II early periods with the majority corresponding to the earlier periods. There is a good correlation with MG1. Almost all of the samples appear with a plain surface, with only few examples preserving traces of a reddish brown thin slip. The remaining cheesepot samples are made in Fabric 1 (see Section 8.3.1), indicating that more than one group of potters produced this shape.

Petrographic parallels and suggested provenance

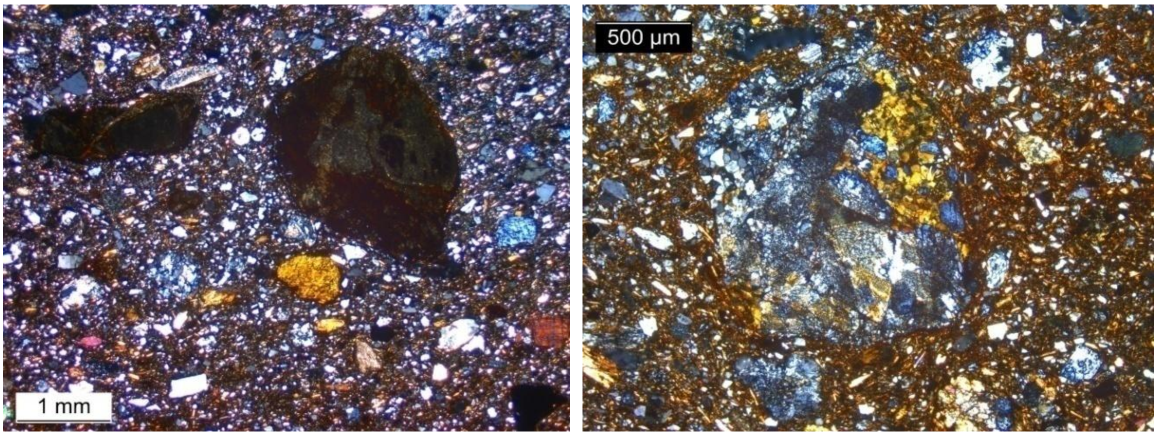
This fabric is linked with the small-sized, partly schistose ophiolite outcrops and peridotite-serpentinite sills of the Pre-Neogene basement (Selçuk nappe) occurring NW of Heraion in the area of Pagondas-Spatharei (Theodoropoulos 1979). The very homogeneous nature of the fabric – absence of fresh metamorphic rock fragments or other accessory minerals seen in other local fabrics, that could relate to weathering processes within the metamorphic basement or transportation of the sediments – and its possible relation to primary sources imply the direct exploitation of these deposits, which are only found in an area situated in a distance of *ca*. 10km from the settlement and an altitude of *ca*. 400m. This area also hosts metagabbro bodies similar to what has been observed in the fabric in question, as indicated by previous geological studies (Ring *et al*. 2007, 25-26, fig. 29). This is also supported by the raw material and rock samples (GS24/2016, GS48/2016, and GS50/2016 respectively; see Section 5.7.6 and tabs. 5.1-5.3) collected from the vicinity of Pagondas (Fig. 7.8:D-E). A similar, although finer, fabric is also identified within the modern tiles analysed, namely CS 5 (see Fabric 3 in Section 5.7.7, tab. 5.4) which was collected from Mavratzei village (Fig. 7.8:F). Despite the absence of any physical evidence, this fabric points confidently to the existence of a production centre beyond Heraion itself.

It finds compositional and textural similarities with the locally-produced fabrics (‘Serpentinite fabric group’ and ‘Actinolite fabric group’) from Çukuriçi Höyük (Peloschek 2014, 49-50; 2017, 130, fig. 6.3:3-4 and 7), although not at such degree as to be indistinguishable, e.g. common presence of serpentinite fragments (different types and less oxidised than the ones from Heraion), meta-gabbroic rocks, metamorphosed mafic rocks, vegetal temper, but with less epidote group minerals and more metamorphic rocks. Although not compatible, it is interesting to note the consistency in chronological and technological choices between the two sites, suggesting a similar practice in raw materials exploitation and pottery production.

7.3.3.1 Sub-fabric 3A: Ophiolite-derived with serpentinite, quartz/feldspar aggregates, and epidote group mineral aggregates

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/226	Basin	MG2A	Plain/smoothed	Heraion 4	EB I/II early
HR15/228	Basin	MG2A	Plain/smoothed	Heraion 2/3	EB II early

Table 7.9: Samples of Sub-fabric 3A.



A B

Figure 7.9: Micrographs of samples within Sub-fabric 3A. A. HR15/226; B. HR15/228. All images taken in XP.

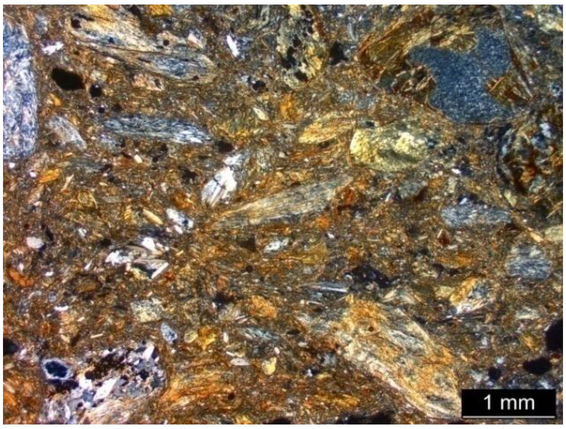
Comment

Although generally compatible with the main fabric group, these samples are discussed separately due to some compositional and textural differences; the vegetal temper ranges from rare to absent, the colour is more orange-red, the non-plastic inclusions are less packed, the serpentinite fragments exhibit a different texture/colour than those of the main group and are outnumbered by quartz/feldspar crystals, epidote group minerals and zoisite crystals are more common. The samples are functionally and macroscopically compatible with the main group. The differences indicate the exploitation of a discrete raw material deposit that might relate with the same geological formation.

7.3.3.2 Sub-fabric 3B: Chlorite-rich aggregates and metamorphic rocks with rare/absent serpentinite

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/97	Pithos	MG2B	Plain/smoothed	Bauphase 2?	EB II early
HR15/134	Pithos	MG2B	Red slipped/smoothed	Bauphase 2?	EB II early

Table 7.10: Samples of Sub-fabric 3B.



A B

Figure 7.10: Micrographs of samples within Sub-fabric 3B. A. HR15/97; B. HR15/134. All images taken in XP.

Comment

These samples differ substantially from Fabric 3 and Sub-fabric 3A due to the dominant presence of elongate, chloritised metamorphic rock fragments with a characteristic texture and yellowish-light green colour. These inclusions appear also in the fine fraction and tend to merge with the groundmass, thus indicating the use of a weathered, possibly primary sediment. The very rare serpentinite fragments and other mineral inclusions link this fabric with Fabric 3, but the differences suggest the exploitation of a distinct clay and a conscious technological choice that might relate with the functional use of the vessels, namely pithoi.

7.3.4 Fabric 4: Metabasite and epidote-rich rocks

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/2	Pithos	MG2A	Red slipped	Bauphase 1	EB I
HR15/13	Pithos	MG2A	Plain	Bauphase 1	EB I
HR15/26	Jar	MG2A	Plain	Bauphase 3	EB II early
HR15/41	Pithos	MG2A	Red slipped	Bauphase 2	EB II early
HR15/90	Pithos	MG2A	Red slipped	Bauphase 1	EB I
HR15/170	Pithos	MG2A	Red slipped	Heraion 6/5	Ch/EB I
HR15/232	Pithos	MG2A	Plain	Heraion 3	EB II early
HR15/237	Pithos	MG2A	Red slipped	Heraion 1	EB II developed

Table 7.11: Samples of Fabric 4.

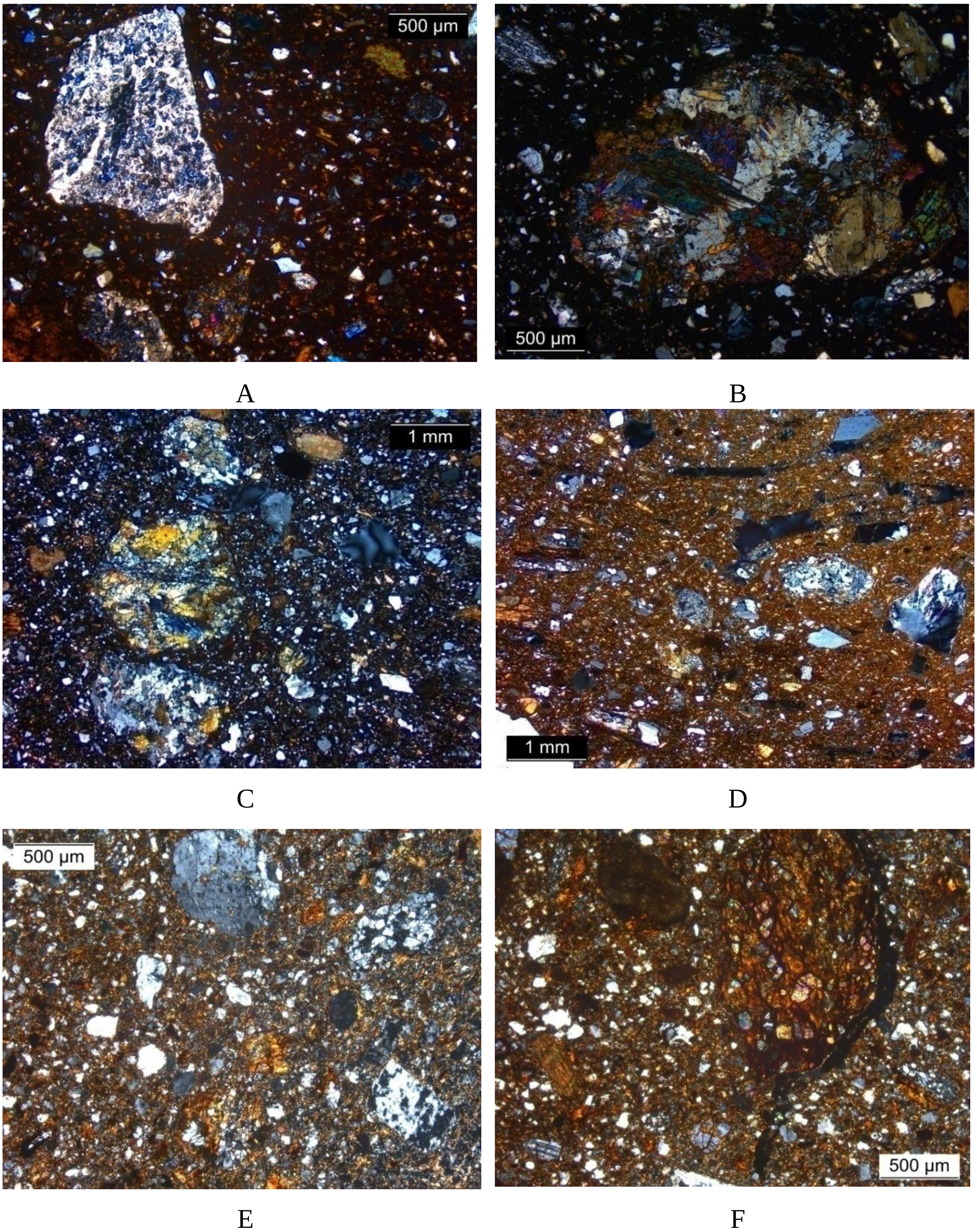


Figure 7.11: Micrographs of samples within Fabric 4. A. HR15/26; B. HR15/41; C. HR15/90; D. HR15/170 with remains of vegetal temper; E-F. GS13/2015. All images taken in XP.

Composition

This fabric is characterised by a range of metabasite rocks, i.e. mainly coarse-grained metagabbroic rocks with a combination of interlocking minerals such as actinolite, hornblende, epidote group minerals, mica, feldspar/albite, and occasionally glaucophane crystals and/or kyanite (Fig. 7.11:A-C). In comparison with Fabric 3, this group is distinguished by the presence of more epidote-rich rocks and peridotites, metamorphic rock fragments (banded quartz-mica schists, chlorite mica schists, phyllites), very rare fresh volcanic rocks (rhyolite to dacite/basalt), and lacks the serpentinite fragments.

Technological features

There is a range of colours, although all samples are characterised by a colour differentiation between the dark brown/black core and red-orange margins. This is indicative of the fast firing process and incomplete oxidising atmosphere, as well as the high presence of vegetal temper, which is also observed by the elongate voids (Fig. 11:D). The darker areas of the micromass are optically inactive, indicating a moderate-high temperature.

Typological/stylistic observations and macroscopic correlations

The majority of samples belong to body sherds of large, open thick-walled storage vessels (pithoi and large jars) of the EB I-II early, forming a very consistent typological and functional group. It is macroscopically very consistent and corresponds to MG2A. This group, together with its sub-group, constitutes the most tight pithos fabric, although pithoi made in other fabrics (e.g. Fabric 2 and Sub-fabric 3A) indicate more than one groups of potters producing these vessels or even the existence of different workshop locations within the environs of Heraion.

Petrographic parallels and suggested provenance

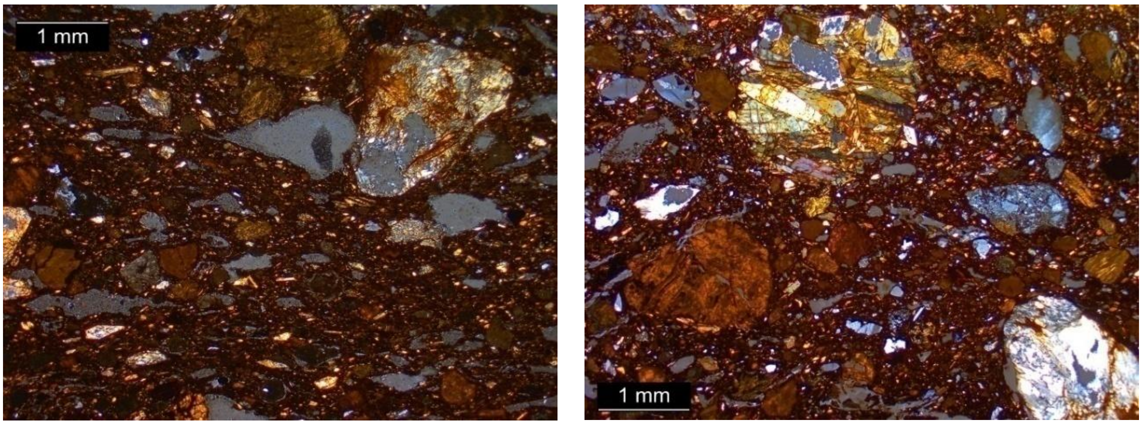
This is a broadly local fabric that is lithologically related with Fabric 3. This implies the exploitation and use of a distinct raw material source, most immediately related with the metamorphic mafic and ultramafic formations (peridotite-serpentinite bodies) of Aghios Ioannis sub-unit or Selçuk nappe, which appear as small-sized sills within the Ambelos schists and only exposed in areas near the localities of Myli, Spatharei, Pagondas, and west of Mavratzei (Thedoropoulos 1979; see Section 5.3.1). This is also supported by the geological sample GS13/2015 (Fabric 10; see Section 5.7.6), that was collected from sediments NW of Mavratzei (Fig. 11:E-F).

7.3.4.1 Sub-fabric 4A: Serpentinite, metamorphic rocks, and metagabbro fragments

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/1	Pithos	MG2A	Plain	Heraion I/II	EB II developed/late

HR15/118	Pithos	MG2A	Plain	Bauphase 3	EB II early

Table 7.12: Samples of Sub-fabric 4A.



A B

Figure 7.12: Micrographs of samples within Sub-fabric 4A. A. HT12/1; B. HR15/118. All images taken in XP.

Comment

This sub-group provides a compositional link between Fabrics 3 and 4, as it combines the main mineralogical features observed in both groups, i.e. dominant to common serpentinite fragments (more similar to the serpentinite observed in Sub-group 3A than Fabric 4), different types of metamorphic rocks (actinolite schist, chlorite-muscovite-actinolite schist, chlorite mica schist), as well as metagabbro fragments, quartz/feldspar aggregates, and their dissociate minerals. The samples are functionally and macroscopically compatible with the main fabric group (red-slipped pithoi; Menelaou *et al*. 2016, fig. 6b). It is noteworthy that this series of petrologically linked coarse fabrics (Fabrics 3 and 4), correspond to coarse-ware, usually thick-walled, vessels of prolonged function such as long-term storage and cooking. This technological choice clearly reflects the potters' decision to enhance the performance and mechanical properties of these vessels.

7.3.5 Fabric 6: Fresh and altered volcanic rocks

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/2	Pithos	MG3	Plain, relief	Heraion I/II	EB II developed/late
HT12/28	Cooking pot	MG3	Plain	Heraion I	EB II developed
HR15/11	Miniature jug	MG5B	Yellowish brown smoothed	Bauphase 4	EB II developed
HR15/71	Closed vessel	MG3	Reddish brown slipped/smoothed	Bauphase 4	EB II developed
HR15/73	Pithoid jar	MG4	Red slipped	Bauphase 2	EB II early

Table 7.13: Samples of Fabric 6.

HR15/84	Cooking pot	MG5A	Red slipped	Bauphase 1	Ch
HR15/95	Jar	MG5A	Plain/smoothed	Bauphase 1	EB I
HR15/99	Jar with horned lugs	MG5A	Red slipped/smoothed	Bauphase 2/3	EB II early
HR15/101	Spoon	MG5B	Plain	n/a	EB II early?
HR15/107	Jar	MG5A	Reddish grey smoothed	Bauphase 4	EB II developed
HR15/130	Closed vessel	MG3	Reddish brown slipped	Bauphase 4	EB II developed
HR15/159	Jar	MG5A	Red slipped	Heraion 6	Ch
HR15/165	Jar	MG5A	Red slipped	Heraion 6	Ch
HR15/180	Deep bowl	MG5A	Plain	Heraion 6	Ch
HR15/182	Jar	MG5A	Reddish grey slipped	Heraion 6	Ch
HR15/188	Jug/jar	MG6	Red slipped	Heraion I-IV?	EB II-III?
HR15/222	Pithos	MG5A	Plain/smoothed	Heraion I-IV?	EB II-III?
HR15/227	Baking pan	MG5B	Plain/smoothed	Heraion 2/3	EB II early

Variants

HR15/103	Cooking pot	MG5A	Red slipped/smoothed	n/a	EB II early?

HR15/251	Tripod cooking pot	MG5B	Plain	Heraion 2	EB II early

HR15/273	Pithos	MG3	Reddish brown slipped, relief	Heraion IV	EB III

HT12/5	Jar horizontal handle	MG3	Plain	Heraion I	EB II developed
HR15/203	Jar horizontal handle	MG3	Plain	Heraion I/II	EB II developed/late

HR15/268	Jar horizontal handle	MG3	Plain/smoothed	Heraion I	EB II developed
HR15/280	Cooking pot	MG3	Reddish brown slipped/smoothed	Heraion IV	EB III

HR15/269	Cooking pot	MG3	Plain	Heraion IV	EB III
HR15/282	Cooking pot	MG5D	Plain	Heraion II	EB II late

Table 7.13 (continued): Samples of Fabric 6.

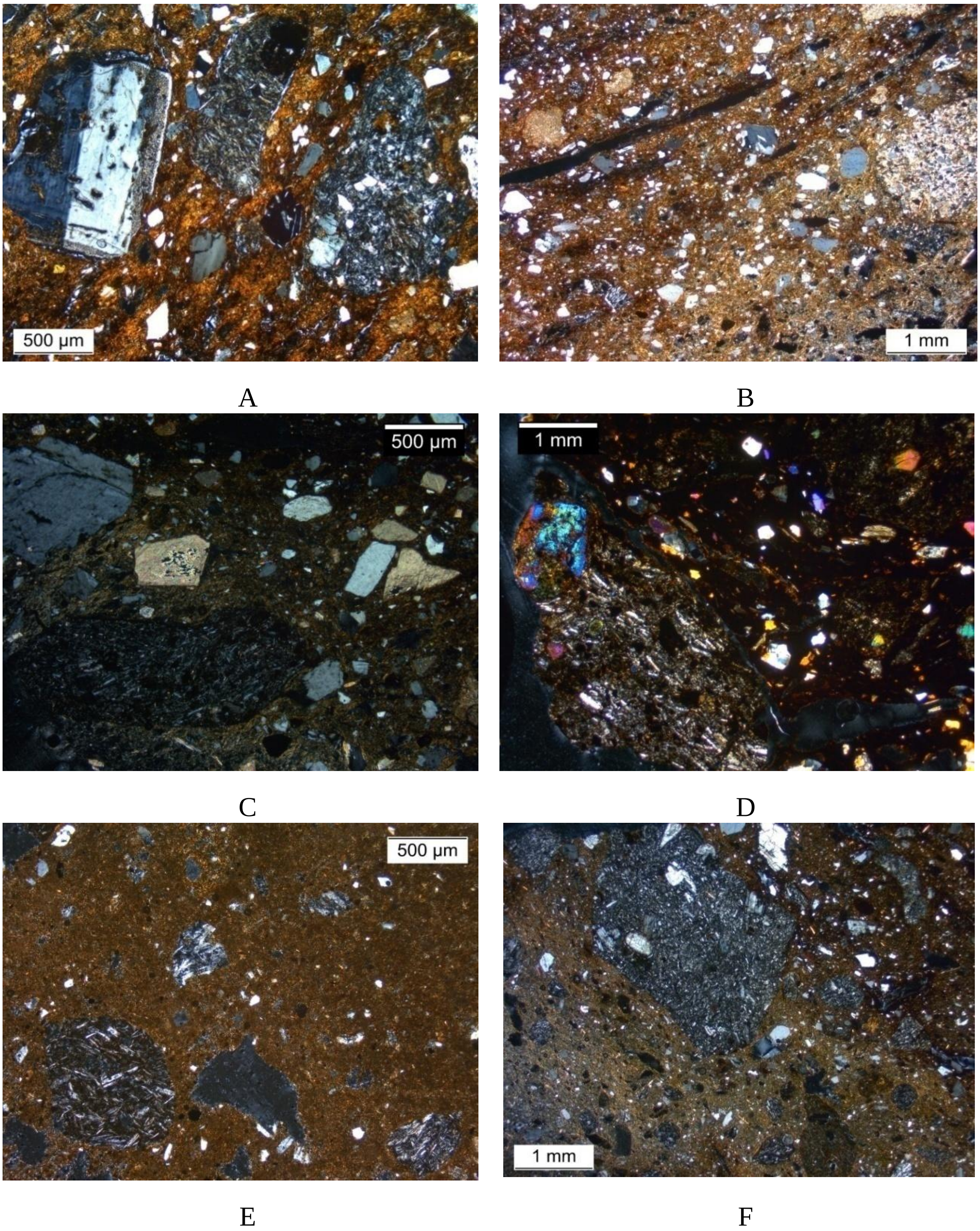


Figure 7.13: Micrographs of samples within Fabric 6. A. HR15/222; B. HR15/182 with remains of vegetal temper; C. HR15/273; D. HR15/269; E. GS10/2015; F. LT03/41. All images taken in XP.

Composition

This group contains a range of volcanic rock fragments with most frequent those with a fine/medium-grained, intermediate to minor basic composition, either with fresh porphyritic or devitrified/altered matrices, and their constituent minerals. The volcanic rocks can be more frequent in some samples (e.g. HT12/5) or less packed in others (e.g.

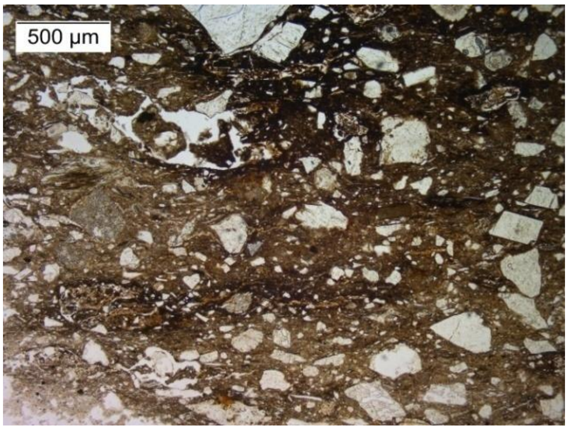
HR15/159, 182). This range of volcanic rocks, not always equally represented across the samples, consists of mafic plagioclase-rich dolerites to basalts (e.g. HR15/282), felsic pyroclastics with parallel-orientated microlites and a usually altered/devitrified groundmass (e.g. HT12/5, HR15/268), rare trachydacites and andesites with a porphyritic or trachytic texture (e.g. HT12/28, HR15/180), and very rare-absent rhyolites with spherulitic texture or chalcedony (e.g. HR15/84, 130, 180, 280) and possible volcanic glass (e.g. HR15/73, 107) (Fig. 7.13:A-D).

A number of variants were identified on a compositional and technological basis. For instance, HT12/5 and HR15/203 are fired to a higher temperature and have a calcareous-rich matrix, and contain more fine-grained felsic pyroclastic rocks, whereas the majority of samples are probably made of a non- or low-calcareous paste. Other samples (e.g. HR25/11, 73, 95, 159, 165, 182, 222) with generally more metamorphic rock fragments (mica schist or quartzite fragments) exhibit a high textural and compositional resemblance with some of the metamorphic sub-groups (see Sub-fabrics 1A and 1B). A good link can be established between HR15/182 and HR15/92, the latter belonging to Sub-fabric 1A. More variants include HR15/273, which differs due to the presence of calcite temper (Fig. 7.13:C). Samples HR15/268 and HR15/280 are distinguished due to the higher presence of metamorphic rocks and their dissociates, especially mica, while samples HR15/269 and HR15/282 are highlighted as variants due to the common presence of coarse basic volcanic rocks (e.g. olivine basalts; Fig. 7.13:D).

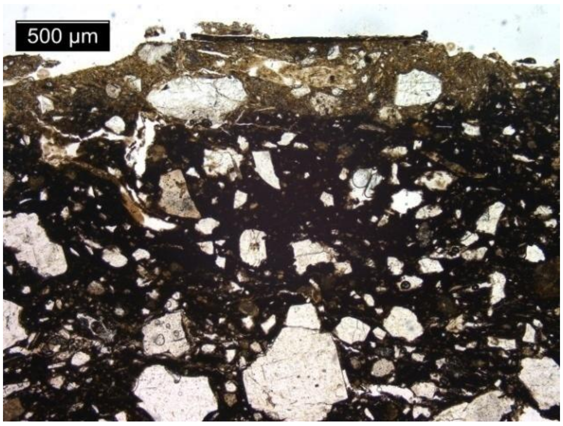
Technological features

A degree of heterogeneity can be observed among the samples in terms of the size, frequency, and sorting of the main non-plastic inclusions making up the coarse fraction. The Heraion experimental clayey samples that contain naturally-present volcanic rocks (see Section 5.7.6: Fabric 12 Fig. 7.13:E) exhibit a similar range of sizes and shapes of the non-plastics set in a generally fine, possibly calcareous groundmass. These well-rounded rocks and their sparseness from the fine fraction could imply their derivation from a secondary source which has been transported via water. Overall, the presence of volcanic rocks in the ceramic fabric might result from their intentional addition to the clay paste rather than from natural variation, as they are present predominantly as coarse fragments and underrepresented in the fine fraction.

With respect to firing conditions, the majority exhibit a low-firing paste according to the optically active groundmass. Generally, the more low-fired the samples are the more calcareous they look. Variability exists in terms of colours, which reflects variable firing conditions. Certain samples exhibit a strong alignment of the elongate voids parallel to the vessel margins, originally belonging to vegetal temper that has burnt out upon firing and corresponding to large vessels such as pithoi and cooking pots (e.g. HT12/2, 28, HR15/73, 222, 273, 282). The earlier-dated samples contain more planar voids that relate to the higher presence of vegetal matter in the paste (e.g. HR15/84, 165, 180, 182; Fig. 7.13:B). The combination of some diagonal voids with concentrically-arranged inclusions might as well indicate the use of coiling as the preferred forming method (e.g. HR15/73, 95, 107, 159, 165, 180; Fig. 7.14:A). Some samples exhibit traces of a dark red/reddish brown slip layer (HR15/84, 165, 273; Fig. 7.14:B) or thin layers that might relate to the compaction of the surface due to smoothing or polishing (HR15/99, 130, 188, 222, 273).



A



B

Figure 7.14: Micrographs of samples within Fabric 6. A. HR15/180 with a possible coil join; B. HR15/165 with a slip layer. All images taken in PPL.

Typological/stylistic observations and macroscopic correlations

The vessels represented cover the entire functional range and belong to domestic shapes such as storage jars, pithoi, cooking pots, as well as few coarse bowls and jugs, spanning from the Ch to the EB III period. It is, nevertheless, noteworthy that the variants are typologically consistent and cover mainly cooking pots and storage jars/pithoi. The range of observed surface treatments corresponds mainly to slipped and slightly burnished surfaces in the samples of the earlier periods and less carefully-finished or badly-preserved surfaces of the later periods (especially late EB II-III). The majority of samples were successfully classified in the same macroscopic group (MG3), with some exceptions assigned in MG5.

Petrographic parallels and suggested provenance

According to the freshness and angularity of inclusions the clay derives from a primary source close to volcanic parent rocks, or instead reworked through water action and related to volcaniclastic rocks. The presence of such small quantities of metamorphic rock fragments in most of the samples is probably related to the original presence of small volcanic bodies within the schist formations in the margins of the Mytilinii basin.

This fabric was originally taken as a possible off-island product due to its suspected compatibility with Group 1 ('Rounded volcanic rocks fabric group'; Day *et al*. n.d.) from Liman Tepe in the Izmir region (Menelaou *et al*. 2016, 485, tab. 1, fig. 4b) (Fig. 7.13:F). At Liman Tepe this volcanic fabric was suggested to be locally-produced for the manufacture of domestic vessels of the EB I-II periods (Day *et al*. 2009, 341, 343). However, the Liman Tepe fabric contains more common rounded volcanic rocks and plagioclase crystals, whereas the Heraion fabric contains more metamorphic rock fragments as accessory inclusions.

The study of geological maps and literature indicated important differences between the volcanic outcrops of Samos and the Izmir region (Pe-Piper and Piper 2007, 75; Helvaci *et al*. 2009). Samos has a limited presence of Upper Miocene-Quaternary volcanic rocks (trachydacites, minor basalts, rhyolites) restricted at the lower series of both basins as well as small bodies intersecting as sills within the schist formations in the eastern side of Ambelos Massif (Theodoropoulos 1979). The petrographic results from the analysis of the geological samples (see Section 5.7.6) further imply a local origin of this fabric.

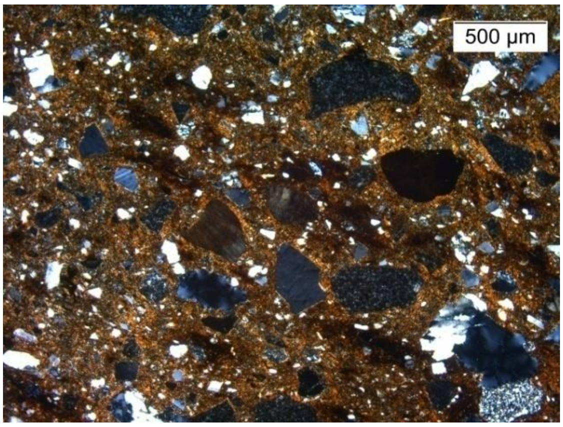
An interesting picture was revealed by the comparative examination of the thin sections from the site of NL Tigani, which lies only 7km to the east of Heraion settlement and predates it by approximately two millennia. The largest fabric distinguished there is directly matching the fabric under discussion from Heraion, although exhibiting a degree of variability in terms of the size and frequency of dominant inclusions and colour of the groundmass (Whitbread and Mavrides in progress; pers. exam. of thin sections, November 2016). The Tigani fabric was at first described by Whitbread as 'Granitic gneiss fabric group' (Mavrides 2007, 255-257, tab. 36), but renamed as 'Volcanic fabric group' after a recent re-examination (I. Whitbread, pers.

comm., November 2016). The correlation with the Heraion fabric further confirms its ascription to a local provenance and shows a long continuity in the use of this paste recipe for at least two millennia.

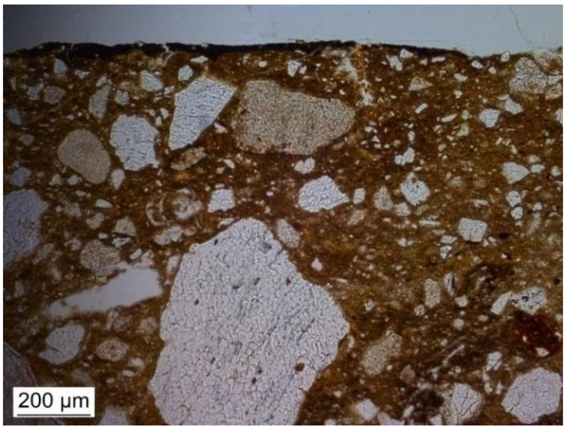
7.3.5.1 Sub-fabric 6A: Silica-rich glassy volcanic with metamorphic and sedimentary rocks

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/242	Closed vessel	MG26	Black smoothed	Heraion 1	EB II developed

Table 7.14: Sample of Sub-fabric 6A.



A



B

Figure 7.15: Micrographs of sample HR15/242. Images A and B taken in XP and PPL respectively.

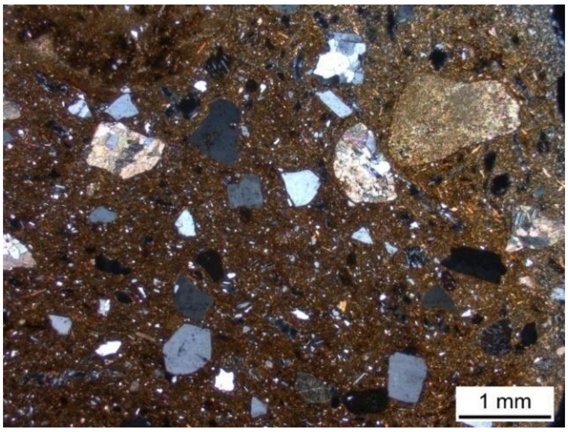
Comment

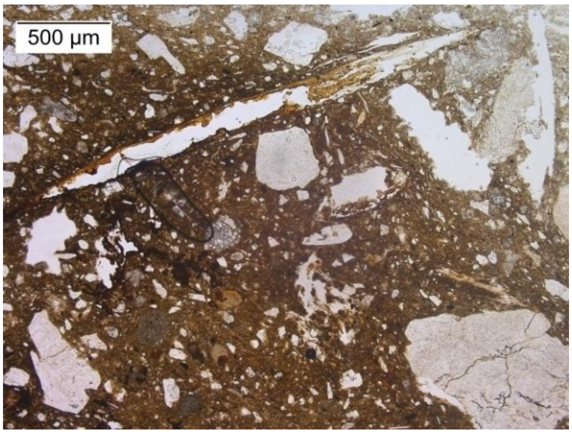
It differs from Fabric 6 by the dominance of fine-grained, glassy silica-rich rock fragments that probably relate to devitrified volcanic rocks (common fibrous and spherulitic texture similar to chalcedony). In addition, the feldspar crystals (mainly plagioclase) are outnumbered by the glassy rocks, unlike the main group that is dominated by alkali feldspars and less volcanic rock fragments. Similarly with the main group, there is a substantial amount of vegetal matter. It is most probably an import and finds close parallels at Bakla Tepe, the main local fabric of which is distinguished by the presence of silica-rich, volcanic rocks (Day *et al*. n.d., e.g. Fabric 2 and sample 03/5 of Fabric 6). It belongs to a body sherd corresponding to a small-sized closed vessel of the EB II early period, most probably a dark-slipped jug (Fig. 7.15:B).

7.3.5.2 Sub-fabric 6B: Rounded limestone with volcanic and metamorphic rocks

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/40	Bowl	MG5B	Red slipped	Bauphase 2	EB II early
HR15/59	Miniature vessel	MG5B	Plain	Bauphase 1	EB I
HR15/74	Jug handle	MG3	Plain	Bauphase 2	EB II early
HR15/233	Shallow bowl	MG3	Plain	Heraion 2/3	EB II early
HR15/276	Bell-shaped cup	MG7B	Red slipped	Heraion I	EB II developed

Table 7.15: Samples of Sub-fabric 6B.





A B

Figure 7.16: Micrographs of samples within Sub-fabric 6B. A. HR15/74, taken in XP; B. HR15/40 with remains of vegetal temper, taken in PPL.

Comment

This fabric is distinguished from the main group due to its relatively high calcareous content, which is attested in the form of distinct micrite grading into the groundmass as clots (rare presence of elongate bioclasts). In addition, there is a considerable amount of large limestone fragments in different shapes and forms. Similarly to the main group there is a range of smaller and fewer volcanic rock fragments, as well as mainly fine-grained rocks with dark devitrified matrices with acid to intermediate composition and rare volcanic glass fragments. A considerable amount of vegetal matter occurs in all samples, as identified by the elongate voids (Fig. 7.16:B). The base clay appears highly calcareous and the generally moderate to high optical activity of the micromass indicates a low-firing temperature. A raw material source different from the main group is most likely represented that is linked to a calcareous environment. This fabric is chronologically and typologically varied.

7.3.5.3 Sub-fabric 6C: Rounded and bioclastic limestone with volcanic and metamorphic rocks – medium-coarse with more vegetal temper

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/199	Jug/jar	MG6	Red slipped	Heraion I/II	EB II developed/late
HR15/206	Tankard	MG7B	Red slipped	Heraion II?	EB II late
HR15/275	Two-handled cup/bell-shaped	MG7B	Red slipped	n/a	EB II late
HR15/291	Jug	MG7A	D-o-L painted	Heraion II	EB II late

Table 7.16: Samples of Sub-fabric 6C.

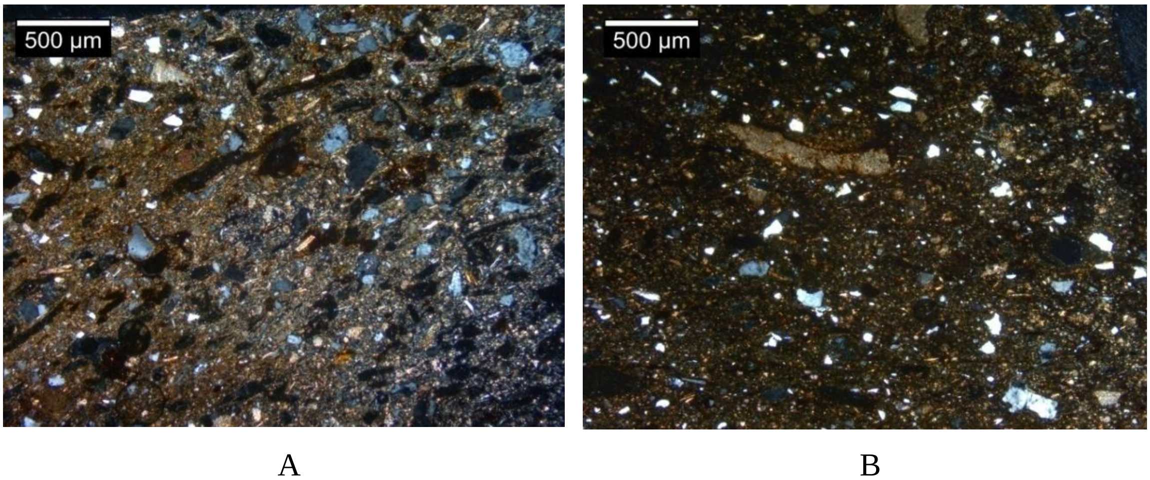


Figure 7.17: Micrographs of samples within Sub-fabric 6C. A. HR15/275 with remains of vegetal temper. B. HR15/291 with micrite clots and bioclasts. All images taken in XP.

Comment

This represents a finer version of Sub-fabric 6B and is similarly characterised by a high calcareous content (predominantly micrite and rare bioclasts, e.g. HR15/214, 291; similar bioclasts are seen in the modern ceramics; see Section 5.7.7: Fabrics 5-6) (Fig. 7.17:B) and same range of non-plastic inclusions, although with less volcanic rock fragments (ranging from trachydacite to basalt with altered matrices in all samples and rare tuff/volcanic glass fragments in HR15/199). It also differs by the presence of more vegetal matter occurring either in the form of elongate voids or partially-combusted and with oxidised rims (especially in HR15/275; Fig. 7.17:A). Possible surface treatment traces are observed as thin slip layers (HR15/275) or weakly compacted due to smoothing or burnishing. It is typologically very consistent and is represented by jugs and tankards of the EB II late period.

7.3.6 Fabric 7: Medium-coarse quartz and feldspar sand in a calcareous matrix

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/15	Tankard?	MG7A	Red slipped and burnished	Heraion I/II	EB II developed/late
HT12/17	Tankard?	MG7A	Red slipped and burnished	Heraion III?	EB II late
HR15/139	Two-handled cup/bell-shaped	MG7A	Red slipped and burnished	Heraion I	EB II developed
HR15/190	Jug/jar	MG6	Red slipped	Heraion I/II	EB II developed/late
HR15/204	Shallow bowl	MG10	Red slipped	Heraion II-IV	EB II late-III
HR15/214	Two handled cup/bell-shaped	MG6	Red slipped	Heraion II/III	EB II late
HR15/259	Tankard	MG7B	Red slipped and burnished	Heraion I	EB II developed

Table 7.17: Samples of Fabric 7.

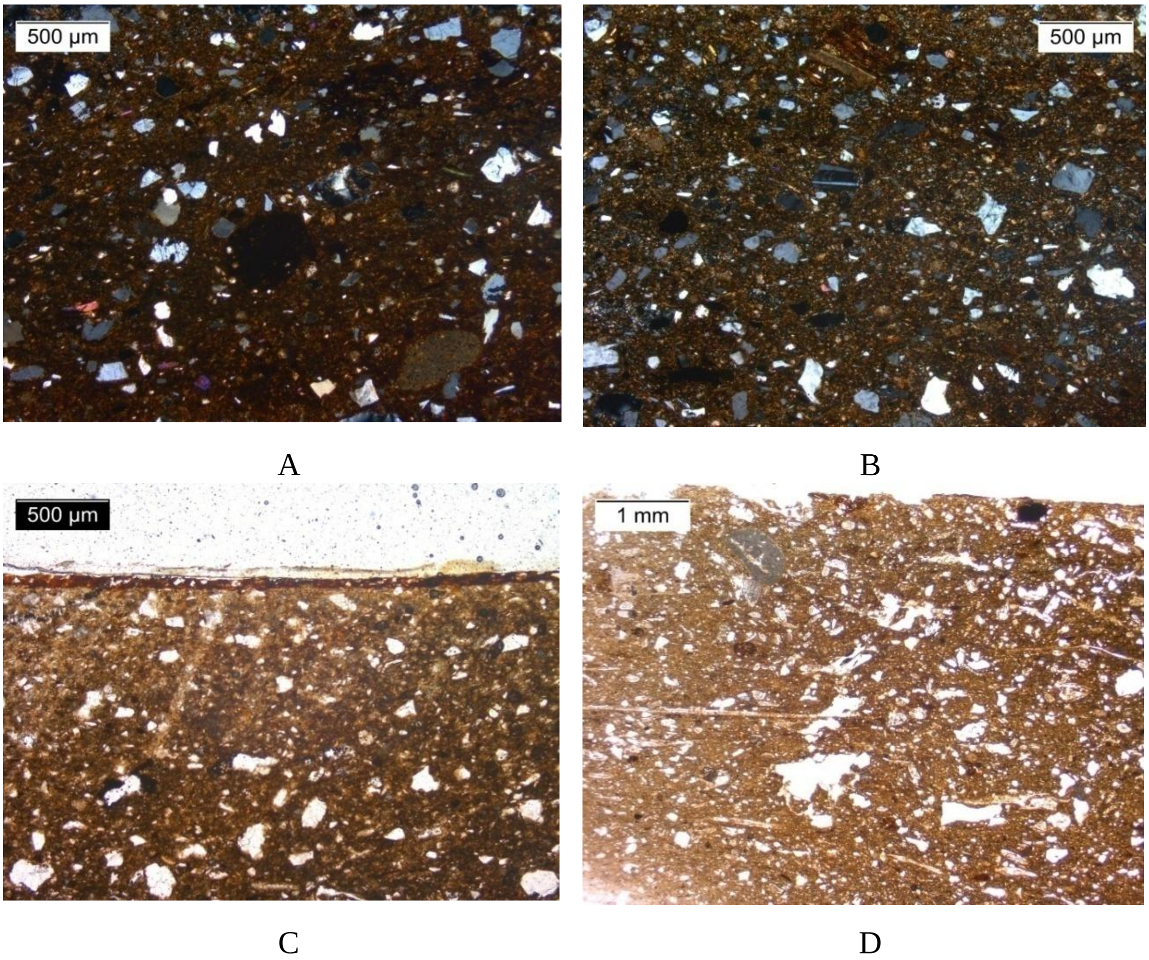


Figure 7.18: Micrographs of samples within Fabric 7. A. HR15/139 with a possible coil join, taken in XP; B. HR15/214, taken in XP; C. HT12/17 with a slip layer, taken in PPL; D. HR15/190 with remains of vegetal temper, taken in PPL.

Composition and technological features

This group is characterised by a relatively calcareous fabric and it appears slightly heterogeneous across the thin sections in terms of texture, colour, and presence/absence of certain inclusions. More particularly, some samples (HR15/190) differ by the occurrence of elongate planar voids, that relate to vegetal tempering (Fig. 7.18:D). The non-plastic inclusions consist of monocrystalline quartz, common-few limestone varying from fine sparite to micrite (appearing as clots within both fractions) and very rarely possible bioclasts (HR15/190, 214) (Fig. 7.18:B), and other secondary inclusions such as rare volcanic rock fragments (glassy, porphyritic texture with acid to intermediate composition) and alkali feldspar crystals. The presence of different types of TCFs might indicate the mixing of two different clays, namely a fine micaceous that relates to an alluvial metamorphic environment and a calcareous one.

Indications of the forming method used could also be recognised, according to two possible coil joins attested by concentrically-arranged inclusions in HR15/139 (Fig. 7.18:A). The moderate-low optical activity suggests a low/moderate-firing temperature. The microscopic analysis confirmed the presence of a thin red-reddish brown slip layer (ca. 0.02-0.03mm thickness) in some samples (HT12/17, HR15/139, 190), (Fig. 7.18:C), while others exhibit a thicker and darker layer with a parallel alignment to the surface, possibly being the result of compaction due to burnishing (HR15/259).

Typological/stylistic observations and macroscopic correlations

This is a chronologically and typologically consistent fabric group, comprised of EB II developed and late drinking and serving vessels (tankards, bell-shaped cups, shallow bowls, jugs) (Menelaou *et al*. 2016, tab. 1, Fabric 5). It appears considerably varied macroscopically and it corresponds to MG6, MG7, and MG10.

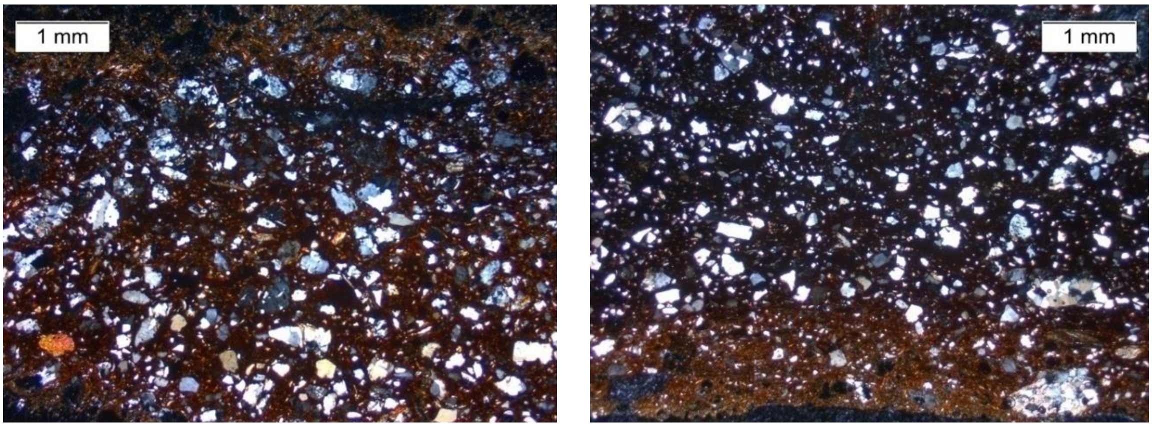
Petrographic parallels and suggested provenance

A similar range of fabrics is also noted at Liman Tepe (especially samples 03/20, 21, 22, 24 of Group 3; Day *et al*. n.d.) and Bakla Tepe (especially samples 03/31 and 34 of Group 1; Day *et al*. n.d.), equally represented by red slipped and burnished one-handled cups, jugs, and shallow bowls, although displaying differences in terms of the mica versus micrite content and some variability in the amount of monocrystalline quartz and metamorphic rock fragments. The Liman Tepe thin sections are more similar due to the higher presence of fresh plagioclase feldspars and micrite/sparite fragments, as well as the rare occurrence of volcanic rock fragments. The provenance of this fabric at Liman Tepe could not yet be defined with confidence. A group of calcareous fabrics are also known from Miletus, which are especially reminiscent of HT12/17 and HR15/214 (samples 256, 261, and 283; Knappett and Hilditch in progress) with respect to the mineral/rock suite and textural features. To date, this fabric is not diagnostic of provenance, but the limited presence of vegetal matter, lacking from other contemporary fabrics used for the same vessel types (i.e. Fabrics 8, 11, 12), implies a different origin, or could provide a technological link with a local, long-lasting tradition of chaff tempering (e.g. Fabrics 1-4, 6).

7.3.7 Fabric 10: Medium-coarse sandy/alluvial metamorphic

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/7	Deep bowl	MG6	Plain	Heraion I	EB II developed
HT12/12	Shallow bowl/plate	MG6	Reddish brown slipped	Heraion I	EB II developed
HT12/14	Shallow bowl/plate	MG6	Red slipped	Heraion I	EB II developed
HT12/18	Deep bowl	MG5B	Dark grey burnished	Heraion I	EB II developed
HT12/20	Deep bowl	MG5B	Dark grey burnished	Heraion I	EB II developed
HT12/21	Shallow bowl/plate	MG6	Reddish brown slipped/smoothed	Heraion I	EB II developed
HT12/23	Deep bowl	MG6	Red slipped and burnished	Heraion I	EB II developed
HR15/263	Beak-spouted jug	MG6	Red slipped	Heraion II	EB II late

Table 7.18: Samples of Fabric 10.



A B

Figure 7.19: Micrographs of samples within Fabric 10. A. HT12/14; B. HT12/21. All images taken in XP.

Composition and technological features

This fabric is characterised by a generally well-packed texture and dominated by silt- and sand-sized monocrystalline quartz grains, common to few metamorphic rock fragments ranging from polycrystalline quartz to quartz-mica schist and phyllite fragments. The weakly bimodal to unimodal grain size distribution of the fabric and the uniformity of its constituents suggest that the clay was tempered with a residual, unrefined sandy sediment rich in silicate minerals. With respect to firing, it seems that the vessels were subject to a moderate temperature, as indicated by the weakly active to optically inactive micromass.

Typological/stylistic observations and macroscopic correlations

The samples are typologically and chronologically very consistent, namely shallow and deep bowls of the EB II developed/late period. Stylistically the majority of samples have a red-reddish brown self-slipped or poorly-slipped surface and belong predominantly to MG6.

Petrographic parallels and suggested provenance

Its mineralogy reflects an alluvial metamorphic environment and, although not representing a diagnostic fabric, it can be taken as broadly local. In terms of petrography, it seems compatible with Fabric 1, perhaps a refined version. However, the metamorphic geology of Samos is by no means limited to certain areas and it is therefore difficult to pinpoint a more secure provenance. Possible fabric matches were identified in Whitbread's 'Felsic Group' in the thin section from NL Kastro-Tigani (pers. comm., November 2016).

7.3.8 Fabric 13: Fine micaceous with few sand-sized inclusions

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/24	S-rim bowl	MG10	Red slipped and burnished	Heraion V	EB III
HT12/26	Ovoid jug with trumpet mouth	MG10	Red slipped and burnished	Heraion IV	EB III
HT12/29	Plate	MG12	Plain	Heraion II	EB II late
HT12/42	Askos	MG11	Light grey slipped and incised	n/a	EB III
HR15/140	Askos	MG11	Dark grey smoothed and incised	Heraion IV	EB III
HR15/149	Askos	MG11	Light grey smoothed and incised	Heraion IV	EB III
HR15/150	Conical-necked jar	MG16	Incised	Heraion IV-V	EB III
HR15/187	Bowl/jar	MG10	Red slipped	Heraion IV-V	EB III
HR15/198	Shallow bowl	MG10	Red slipped	Heraion IV-V	EB III
HR15/265	Plate	MG12	Plain	Heraion II	EB II late
HR15/272	Plate	MG12	Light brown smoothed	Heraion II	EB II late
HR15/277	Perforated vessel	MG5D	Plain	n/a	EB III?
HR15/281	Plate	MG12	Red slipped	Heraion II	EB II late

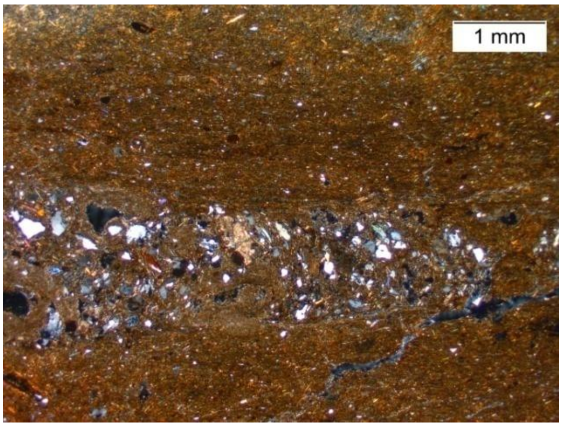
Table 7.19: Samples of Fabric 13.

HR15/288	Plate	MG12	Reddish brown slipped	Heraion V?	EB III
HR15/289	Plate	MG12	Reddish brown slipped	Heraion V?	EB III
HR15/292	Collar-necked pyxis	MG11	Incised	n/a	EB III?
HR15/294	Conical-necked jar	MG16	Incised	n/a	EB III?
HR15/296	Plate	MG12	Reddish brown slipped	Heraion V?	EB III

Variant

HT12/6	Two-handled cup	MG10	Plain	Heraion IV	EB III

Table 7.19 (continued): Samples of Fabric 13.



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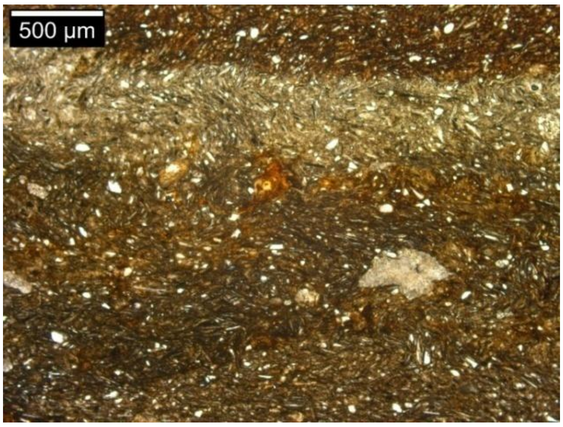

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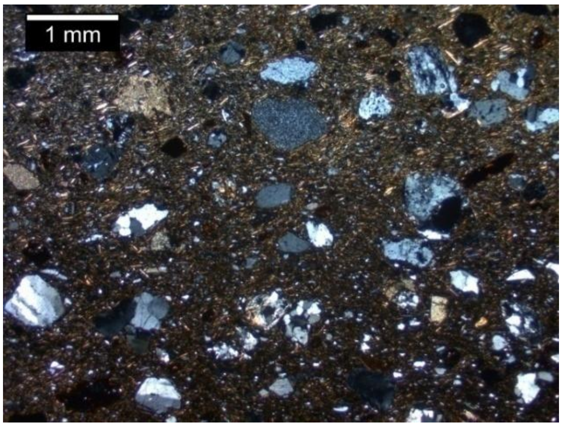

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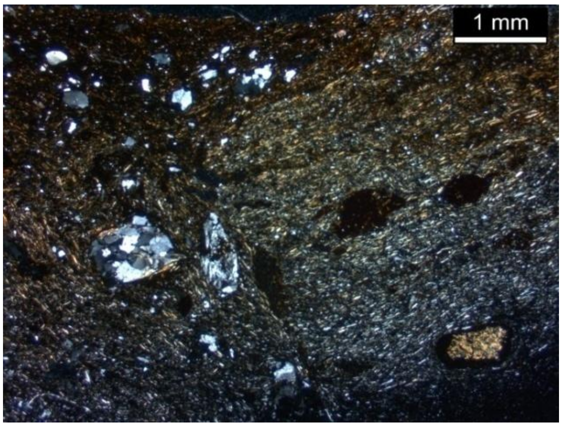

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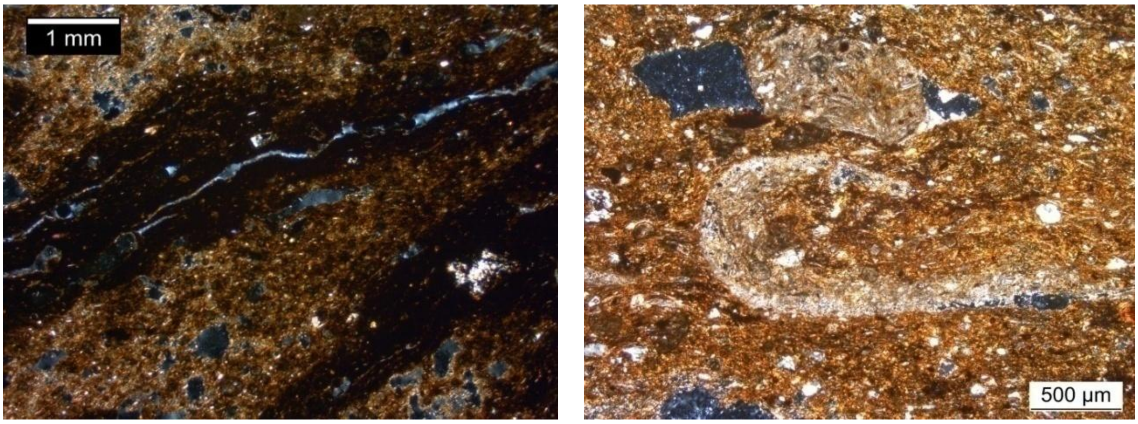


E F

Figure 7.20: Micrographs of samples within Fabric 13. A. HR15/140; B. HR15/150; C. HR15/272; D. HR15/277; E. HR15/292; F. HT12/6. All samples exhibit evidence of clay mixing except for D. All images taken in XP except for B.

Composition and technological features

This is a fine, highly micaceous fabric with a compatible groundmass with Fabrics 14 and 15, although occasionally differing by the presence of larger high-birefringent muscovite mica laths. A relative heterogeneity is observable according to the very fine (askoi) and relatively medium coarse (plates) versions of the fabric, which seems to correspond broadly to the vessel type. While these differences are pointed out below, it was decided as more meaningful to describe all samples together in one group, since no clear boundaries exist between them; sample HR15/140 was key in the decision to combine the full spectrum of this fabric in one description, as it represents the incomplete mixing of two different clay sources and the contrasting end members of the fabric (Fig. 7.20:A).

More particularly, what links all samples is the fine micaceous base clay with the difference that some have a substantial amount of fine calcareous content in the groundmass (occasionally with elongate bioclasts) or displaying a very characteristic texture with alternated clay domains of a darker colour (e.g. HR15/149, 150, 289, 292, 294, 296) (Fig. 7.20:B). The variability is taken to be due to processes of clay preparation and the application of a wheel-forming technique for most of the samples, rather than indicating different sources. Moreover, another prominent textural feature of this fabric is the perpendicular or horizontal alternation of clay domains, that are probably indicative of the incomplete mixing of different clays (e.g. HR15/277) (Fig. 7.20:D).

While in some samples it is not feasible to draw a line between the fine and coarse fractions, some others show a sparse coarse fraction that probably reflects sand tempering, mainly made up of inclusions of quartz-rich metamorphic rocks and their breakdown minerals, including few calcite fragments, pyroxenes, plagioclase, and fine-grained volcanic rock fragments (e.g. HR15/265, 272, 277, 278) or represent the mixing of a coarse-grained and a fine-grained clay (Fig. 7.20:A and C). Variant HT12/6 is distinguished by the presence of coarse volcanic rock fragments (porphyritic basalt) and more prominent evidence of incomplete clay mixing (Fig. 7.20:F). The micromass is generally highly to moderately optically active, with only small areas close to margins being occasionally slightly inactive. Distinct slip layers in dark red are observed in samples HT12/29, HR15/296 and also possibly HR15/292 and HR15/294.

Typological/stylistic observations and macroscopic correlations

This is a very consistent group in typological and chronological terms, comprised of askoi and wheel-made/wheel-coiled plates or shallow bowls of the EB III period. With respect to macroscopic correlations the samples were found to be dispersed in different groups (MG10, MG11, MG12, MG16), with the finer examples being grouped with the fine micaceous fabric. The askoi are usually characterised by a dark to light grey paste and buff grey surface with various patterns of incised decoration (Menelaou *et al*. 2016, fig. 3c left), while the plates exhibit a characteristic yellowish paste with sand inclusions.

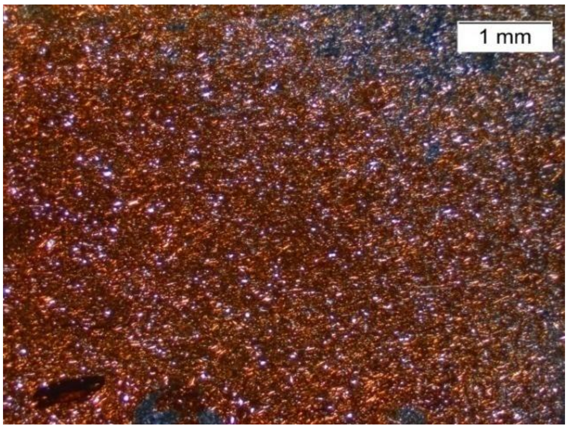
Petrographic parallels and suggested provenance

Although too fine to allow a precise provenance determination on petrographic grounds alone, its compatibility with Fabrics 14 and 15 and its coarse non-plastics suite are possibly indicative of a local production. Based on the number of askoi recovered at Heraion, Isler suggested that askoi are mostly of local manufacture (1973, 175). It is also worth noting that this group is matched by modern ceramics Fabric 1 (see Section 5.7.7) that relates with the *in situ* manufacture of tiles and bricks (mid 20th century) in close vicinity to the archaeological site of Heraion. Another indication derives from the occasional presence of elongate bioclasts, which are also noted within other modern ceramics fabrics. A less conspicuous match is established with Fabric 18 of the geological samples (see Section 5.7.6), which again consists of sediment samples deriving from the close vicinity of Heraion (Fig. 7.54:E). However, future chemical analysis might shed more light in the distinction between finer and coarser fabrics. Some strong compositional and textural similarities were identified between Fabric 10 (‘Fine micaceous rounded micrite fabric group’) from Bakla Tepe (dark-slipped and burnished two-handled bowls) and samples HR15/149 and HR15/198 in the presence of rare bioclasts/shell fragments.

7.3.9 Fabric 14: Very fine red micaceous with rare metamorphic rocks

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/27	Perforated shallow bowl	MG10	Red slipped and burnished	Heraion V	EB III
HT12/37	S-rim bowl	MG10	Reddish brown slipped	Heraion II	EB II late
HT12/39	Shallow bowl	MG10	Red slipped	Heraion II	EB II late
HR15/8	Jug/jar handle	MG10	Incised	Bauphase 2	EB II early?
HR15/142	Two-handled cup	MG10	Plain	Heraion II	EB II late?
HR15/152	Two-handled cup	MG10	Red slipped and burnished	Heraion IV	EB III
HR15/153	Collared jar	MG10	Plain	Heraion IV	EB III
HR15/207	Shallow bowl	MG10	Red slipped	Heraion IV	EB III
HR15/256	Shallow bowl	MG10	Plain	Heraion IV-V	EB III

Table 7.20: Samples of Fabric 14.



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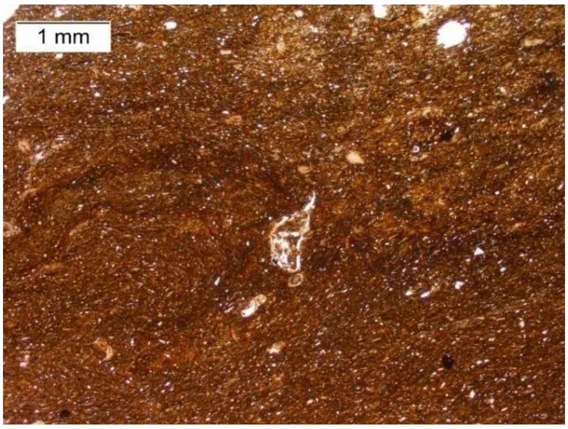

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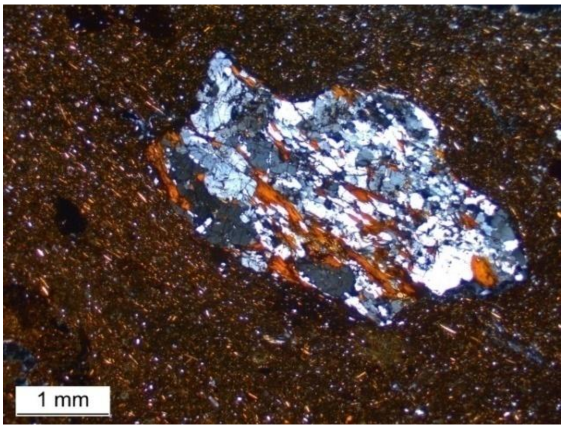

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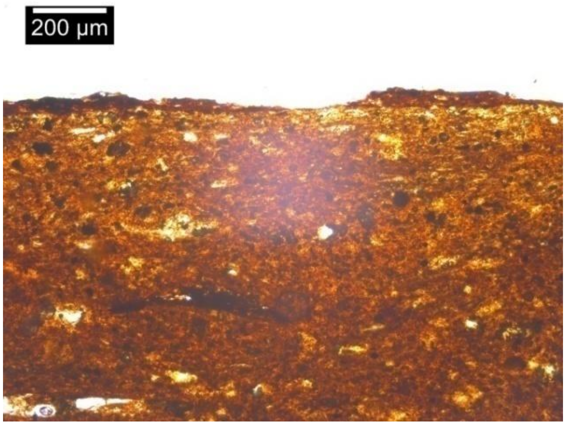
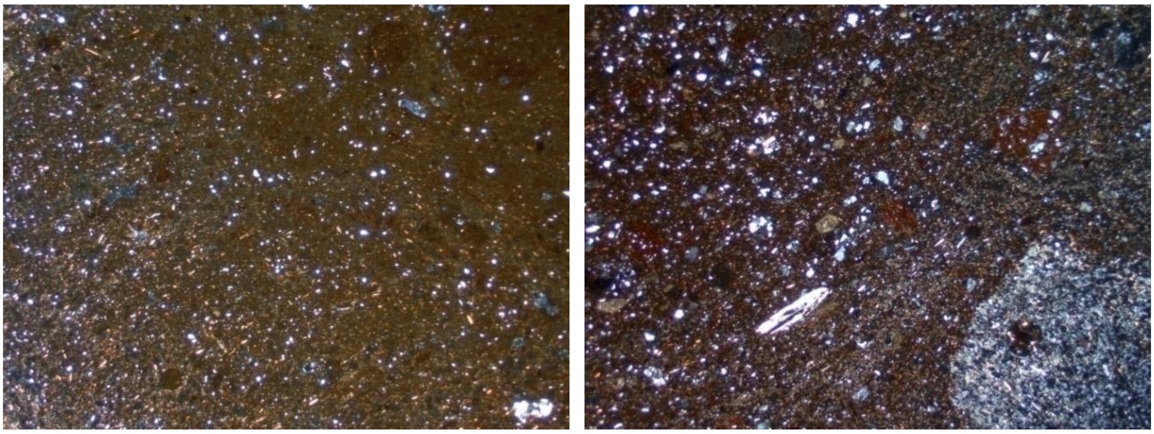


D



E F

Figure 7.21: Micrographs of samples within Fabric 14. A. HT12/27; B. HR15/142 with evidence of clay mixing; C. HR15/153; D. HT12/39 with a slip layer; E. CS 9; F. CS 10. All images taken in XP except for B and D.

Composition and technological features

This very fine highly micaceous, red/orange-firing fabric is predominantly composed of silver/white mica and frequent-common biotite that contains a small amount of coarse non-plastic inclusions (Menelaou *et al*. 2016, 485, fig. 3a right). The most prominent feature of this fabric is the herringbone texture, resulting from the perpendicular and horizontal alignment of mica laths. This strong alignment could also imply the forming technique employed, possibly related to the application of pressure on the clay body or smoothing of the surface (Reedy 2008, 180-181). All samples exhibit striations or amorphous clay aureoles of darker colour and more compact/finer texture, which appear either concentrically-arranged or parallel with the section margins, and are possibly indicative of clay mixing or formed from extensive compaction and incomplete wedging of the clay base (especially in HR15/8 and HR15/142) (Fig. 7.21:B). Distinct red-orange slip layers are observed in samples HT12/39 and HR15/207 (Fig. 7.21:D).

Typological/stylistic observations and macroscopic correlations

This is a very consistent group with respect to morphological, macroscopic (MG10), and chronological features. The representative samples belong to fine ware open and closed vessels used for drinking and/or eating and short term storage, i.e. shallow/hemispherical bowls (Menelaou *et al*. 2016, fig. 3a left), handleless or two-handled cups (*Samos Becher*), and collar-necked jars, all considered macroscopically homogeneous and corresponding to characteristic shapes of the EB III period. In macroscopic terms the samples of the late 3rd millennium BC are distinguished by a fine orange, soft texture with a characteristic slipped and burnished surface, usually badly-preserved due to post-depositional processes.

Petrographic parallels and suggested provenance

A secure provenance cannot be established on petrographic grounds alone and further chemical characterisation is likely to clarify this issue. However, it is taken as potentially locally-made, most probably related to Neogene red clays of a metamorphic environment. Although not immediately related, a similar fine micaceous fabric with evidence of clay mixing has been identified among the modern ceramics thin sections (see Section 5.7.7: Fabric 6) (Fig. 7.21:E-F). The range of vessels represented, that are considered diagnostic of Samian or of broadly SE Aegean inspiration, their quantity among the assemblages, and their highly-micaceous content that is known to characterise also the later Samian ceramic products (Whitbread 1995, 124, pl. 4.32) further support a local provenance.

7.3.10 Fabric 15: Red micaceous with fine quartz

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/25	S-rim bowl	MG10	Red slipped	Heraion II	EB II late
HT12/34	Collared jar	MG10	Red slipped	Heraion II	EB II late?
HT12/35	Ovoid jug with trumpet mouth	MG10	Plain	Heraion II	EB II late?
HT12/36	Two-handled cup	MG10	Red slipped	Heraion II	EB II late
HT12/38	S-rim bowl	MG10	Red slipped	Heraion IV	EB III
HR15/143	Collared jar	MG10	Plain	Heraion IV	EB III
HR15/186	Jar?	MG10	Red slipped	Heraion IV-V	EB III
HR15/191	Jar?	MG10	Red slipped	Heraion IV-V	EB III
HR15/253	Bowl/jar	MG10	Plain	Heraion V	EB III
HR15/254	Bowl/jar	MG10	Plain	Heraion V	EB III
HR15/257	Bowl?	MG10	Red slipped	Heraion V/VI	EB III/MB
HR15/260	Ovoid jug with trumpet mouth	MG10	Plain	Heraion IV	EB III
HR15/262	'Crown' lid	MG10	Light red slipped	Heraion IV	EB III

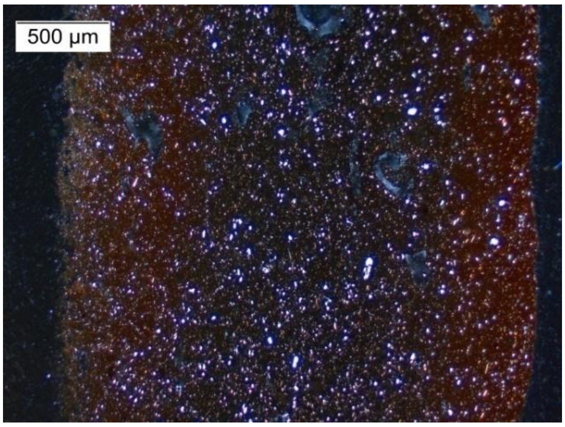
Variants

HR15/208	Collared jar	MG10	Plain	Heraion IV	EB III

HR15/218	Bowl?	MG10	Red slipped	Heraion IV	EB III

HR15/297	Collared jar	MG10	Plain	Heraion IV	EB III

Table 7.21 Samples of Fabric 15.



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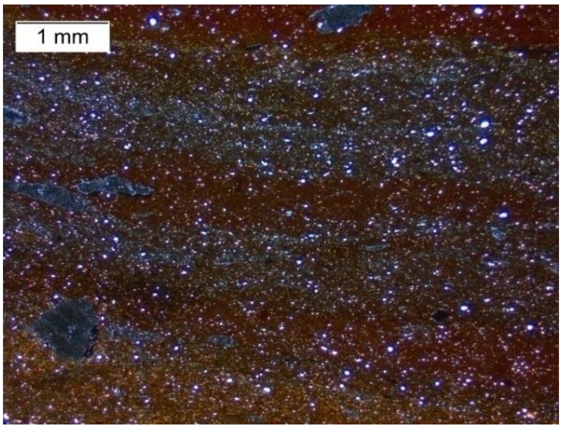

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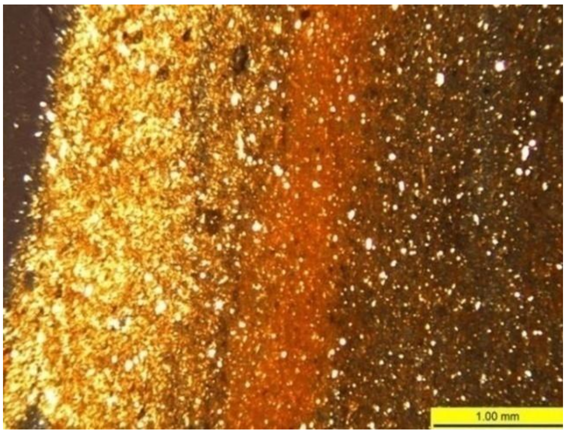

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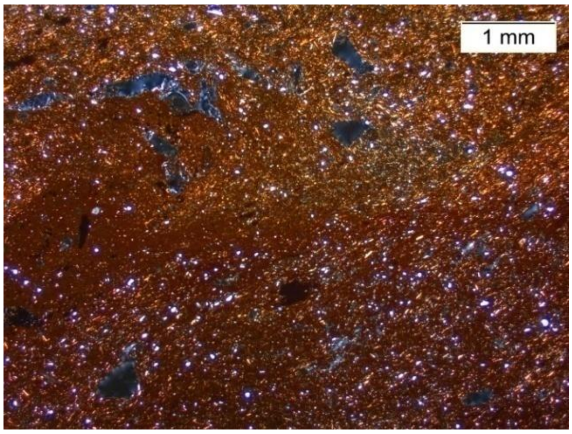
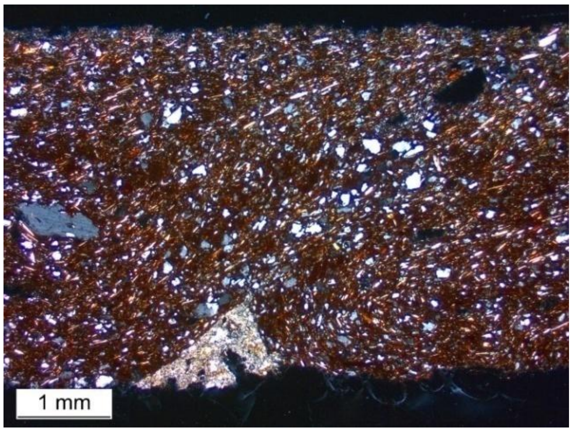
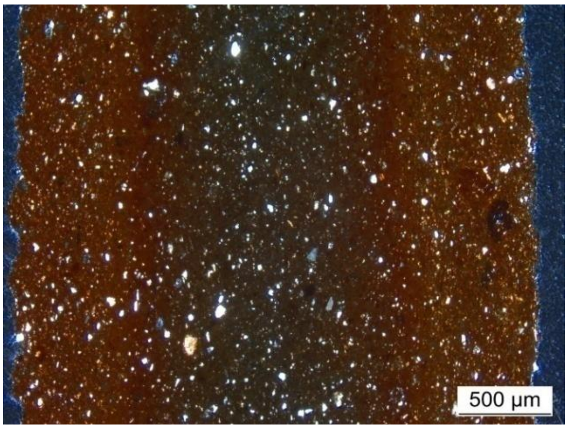


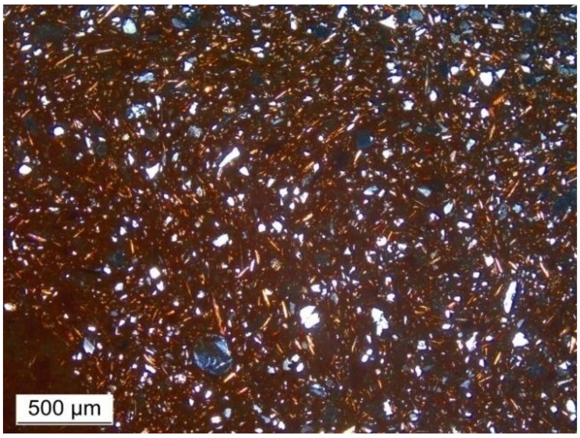
D

E



F





G H

Figure 7.22: Micrographs of samples within Fabric 15. A. HT12/25; B. HT12/34 with evidence of clay mixing; C. HT12/35 with evidence of clay mixing. D. HR15/191 with evidence of clay mixing; E. HR15/254; F. HR15/218 with a possible coil join; G. LT03/29; H. LT03/23; All images taken in XP.

Composition and technological features

This group presents great similarities with Fabric 14 and it could be alternatively described as its sub-group (Menelaou *et al*. 2016, tab. 1, Fabric 1b). Although very compatible in terms of their highly micaceous base clay, these samples vary in the frequency and sorting of the relatively higher amount of coarser non-plastic inclusions, general textural and technological features (TCFs and clay processing), and amount of biotite over muscovite mica. The non-plastic inclusions show a weak bimodal or unimodal grain size distribution and contain well-sorted fine monocrystalline quartz grains, but largely dominated by very fine mica laths. The groundmass appears homogeneous (comparable with Fabric 14 with respect to its uniformly red-fired paste) to slightly heterogeneous among the samples, with the majority showing a strong colour differentiation between the dark grey/greyish brown core and the orange-red margins (e.g. HT12/25, HR15/254, HR15/297) (Fig. 7.22:A and E). Other samples exhibit a strong colour differentiation in the form of clay striations/domains that may reflect incomplete clay mixing (e.g. HT12/35, HR15/186; Menelaou *et al*. 2016, fig. 3b left) (Fig. 7.22:B-D). The micromass ranges from low optically active/moderately inactive to optically active especially in the margins, indicating a generally moderate-high temperature and differential atmospheric conditions, i.e. alternating episodes of oxidation and reduction at least in the case of the non-uniformly fired samples. This layering effect and the achievement of the related kiln conditions require certain skills and, therefore, imply the existence of a well-controlled ceramic craft specialization.

The presence of different TCFs, with most common the dark iron-rich clay pellets with high optical density (e.g. HT12/38, HR15/186) and the amorphous aureoles/clay striations (e.g. HT12/34, 35, HR15/143), indicate the mixing of two different clay sources, i.e. comprised of the typical fine micaceous clay and one finer in texture that is dominated by fine monocrystalline quartz and possibly deriving from a sandy environment. These fine micaceous fabrics dating in the EB III period reflect the use of raw materials that may have been subjected to more intensive processing, perhaps implying the probable existence of some form of standardised mode of production (Menelaou *et al*. 2016, 484). The preferred direction of the lath-like inclusions could attest that the surface was subject to a degree of pressured scraping or smoothing or the use of a rotary device in the manufacturing process. This is best exhibited in HR15/218, although most likely in combination with coiling according to the well-formed perpendicular/concentric clay arrangements (Fig. 7.22:F).

Typological/stylistic observations and macroscopic correlations

This is a very consistent fabric and corresponds to MG10. As Fabric 14, it comprises of orange fine ware open and closed vessels (deep and shallow/hemispherical bowls, Samian two-handled cups, collar-necked jars, and ovoid jug with trumpet mouth) that date mainly to the EB III period (phases Heraion IV-V) (Menelaou *et al*. 2016, fig. 3b right). Some of the samples are most probably wheel-finished.

Petrographic parallels and suggested provenance

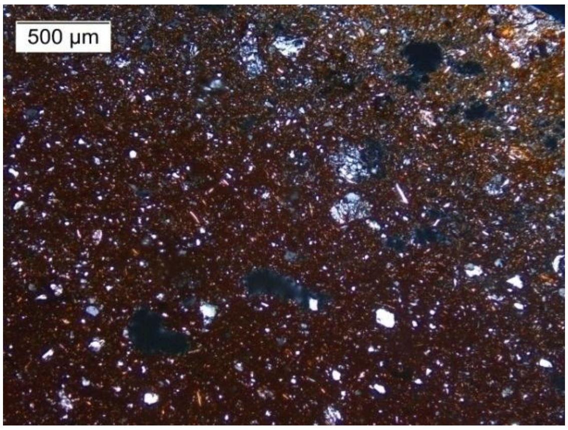
It most probably represents a local product judging by the general lithology, highly micaceous texture, and relation to other local fabrics (rare metamorphic rock fragments). Another indication is provided by the vessel types represented, such as the two-handled cup and ovoid jug with trumpet mouth that are considered as characteristic Samian shapes during the Heraion IV phase (Milojčić 1961, pls. 13:1-2, 19:1-3, 27:4, 39:6, 42:15-6, 43:14, 47:13). Originally, sample HT12/25 was considered as a candidate fabric match with Group 7 (‘Fine Urfirnis fabric group’) from Liman Tepe (Menelaou *et al*. 2016, 485), which is made up of the imported ‘Urfirnis’ sauceboats (Day *et al*. 2009, 342) (Fig. 7.22:G).This provides a most probably superficial link, as the proliferation of very fine fabrics throughout the Greek mainland, the Cyclades and the Anatolian littoral at this time often does not allow their discrimination, let alone the ascription of provenance, solely on petrographic grounds.

Other possible parallels include HR15/218 with sample 03/23 (loner Fabric 5) from Liman Tepe (Fig. 7.22:H) and sample 03/21 (loner Fabric 4) from Bakla Tepe represented by a red slipped and burnished jug and a one-handled cup respectively. This compositional and textural resemblance could rather suggest a non-local provenance for the Heraion sample. Other individual samples (HR15/143 and HR15/257) can be paralleled with certain samples of Fabric 3 from Liman Tepe (03/13 and 03/27), that correspond to a black/grey slipped and burnished tankard and a depas cup respectively, and samples 03/01 and 03/32 of Fabric 1 from Bakla Tepe corresponding to a black slipped and burnished depas cup and a red-buff shallow bowl/plate respectively. Despite belonging to broader groups these specific samples exhibit the very characteristic well-packed mica-rich groundmass that is observed in the present Heraion fabric.

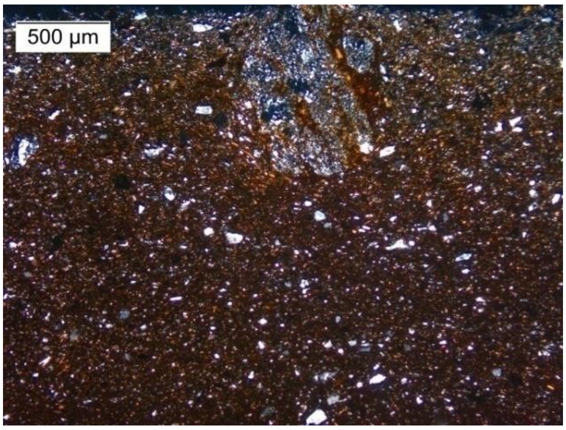
7.3.11 Fabric 16: Medium red micaceous with metamorphic rocks

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/195	Bowl/jar	MG10	Red slipped	Heraion IV-V	EB III
HR15/205	Bowl?	MG10	Plain/smoothed	Heraion IV-V	EB III
HR15/210	Two-handled cup	MG10	Plain/smoothed	Heraion IV	EB III
HR15/211	Two-handled cup	MG10	Red slipped	Heraion IV	EB III
HR15/255	Bowl?	MG10	Plain/smoothed	Heraion V/VI	EB III/MB

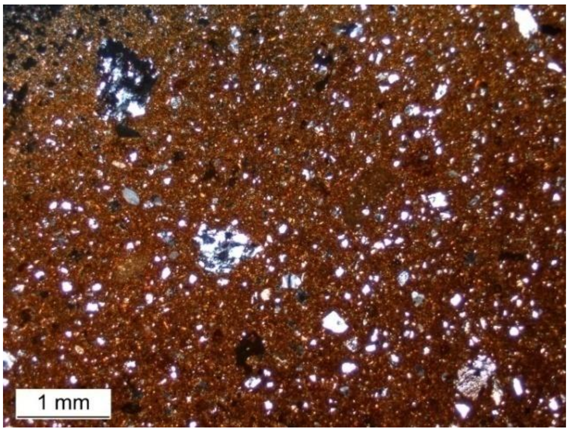
Table 7.22: Samples of Fabric 16.

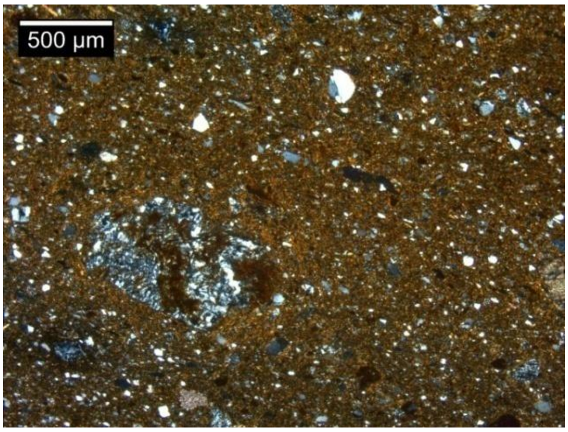


A



B





C D

Figure 7.23: Micrographs of samples within Fabric 16. A. HR15/210; B. HR15/255; C. GS2/2015; D. BT03/31. All images taken in XP.

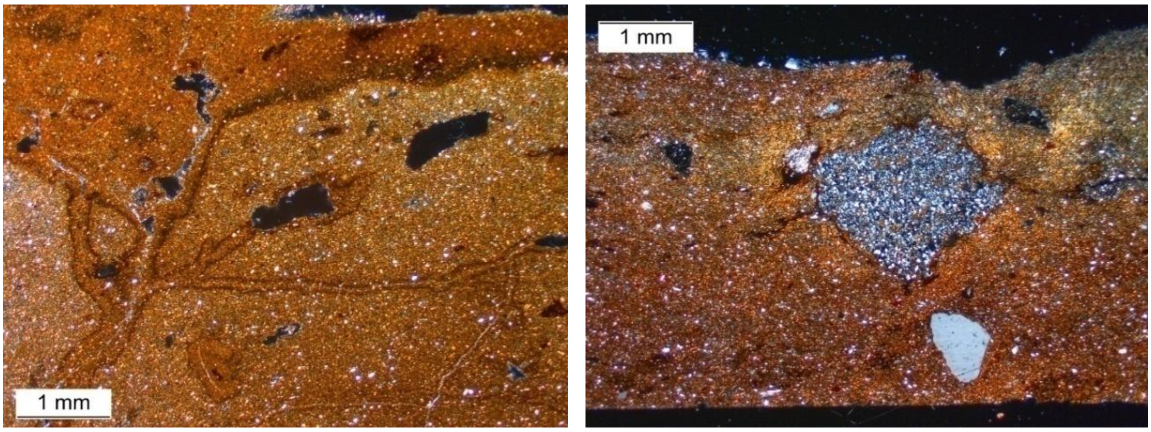
Comment

It relates to Fabric 15 and is separated by the lower mica content and rather coarser non-plastic inclusions. Nevertheless, it shares the same red-firing paste and firing regime (moderate-high temperature and oxidising atmosphere), but it differs by the silty texture and high iron content in the form of opaque minerals in both fractions. This group is richer in fine biotite than Fabrics 14 and 15 and contains more metamorphic rocks (polycrystalline quartz, biotite-quartz schist, biotite/chlorite-rich phyllite) (Fig. 7.23:A-B). Similarly to the previous fabrics, a number of different TCFs are distinguished, all indicating the mixing of different clays. With respect to the forming method, HR15/211 exhibits possible coil joins as indicated by concentrically-arranged inclusions. Distinct slip layers in dark red/brown are observed in samples HR15/195, 205, and 211. It is chronologically and typologically consistent, corresponding to bowls and Samian cups of the EB III period. This fabric is potentially local given its very close match with Fabric 4 of the geological samples (especially sample GS2/2015; see Section 5.7.6) deriving from the vicinity of the Heraion and the Mytilinii basin (Fig. 7.23:C). Fabric matches have been identified in Miletus (sample 270) and Bakla Tepe (sample 03/31) thin sections (Fig. 7.23:D).

7.3.12 Fabric 17: Fine micaceous with silt-sized quartz and micrite

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/194	Collared jar?	MG10	Plain	Heraion V/VI	EB III/MB
HR15/209	Two-handled cup	MG10	Red slipped	Heraion IV	EB III
HR15/221	Shallow bowl?	MG10	Red slipped	Heraion IV	EB III

Table 7.23: Samples of Fabric 17.



A B

Figure 7.24: Micrographs of samples within Fabric 16. A. HR15/194; B. HR15/209. All images taken in XP.

Comment

This buff-firing fine fabric appears very similar to the previous micaceous fabrics, although varying by its less conspicuous mica content and common calcite, predominantly observed in HR15/194. It is characterised by a birefringent, well-sorted and packed texture, with the sparse coarse fraction containing rare metamorphic rock fragments (probably quartz-mica schists), amphibole, plagioclase, siltstone fragments (Fig. 7.24:B), and very well-distributed silt-sized quartz grains. As in Fabrics 14-16 there is a number of TCFs, perhaps related with the processing of the clay paste. The samples represented are jars and Samian cups of the EB III period.

7.4 Non-local fabrics with known or suspected provenance

7.4.1 Fabric 5: Porphyritic intermediate volcanic rocks (andesite)

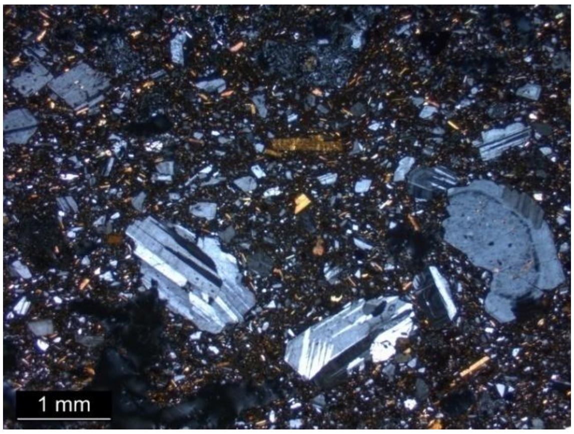
Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/6	Pithos	MG4	Red slipped and burnished	Bauphase 2	EB II early
HR15/21	Open jar	MG4	Red slipped and burnished	Bauphase 2	EB II early
HR15/31	Pithoid jar	MG4	Red slipped and burnished	Bauphase 4	EB II developed
HR15/49	Pithoid jar	MG4	Red slipped and burnished	Bauphase 1	EB I
HR15/64	Open jar/bowl	MG4	Red slipped and burnished	Bauphase 1	EB I
HR15/82	Pithoid jar	MG4	Red slipped and burnished	Bauphase 1	EB I
HR15/88	Pithos	MG4	Red slipped	Bauphase 1	EB I
HR15/106	Pithos	MG4	Red slipped and burnished	n/a	EB II early?
HR15/109	Open jar/bowl	MG4	Black slipped and burnished	Bauphase 4	EB II developed
HR15/112	Pithos	MG4	Red slipped	Bauphase 2	EB II early
HR15/126	Pithoid jar	MG4	Red slipped	Bauphase 1	EB I
HR15/163	Pithos	MG4	Red slipped and burnished	Heraion 6/5	Ch/EB I

Table 7.24: Samples of Fabric 5.

HR15/167	Pithos	MG4	Red slipped and burnished	Heraion 5/4	EB I
HR15/172	Pithoid jar	MG4	Red slipped	Heraion 4	EB I
HR15/174	Pithoid jar	MG4	Red slipped	Heraion 3	EB II early
HR15/189	Pithoid jar	MG4	Red slipped and burnished	Heraion 2/1	EB II early/developed
HR15/196	Pithoid jar	MG4	Red slipped and burnished	Heraion II-IV?	EB II late-III
HR15/216	Cut-away spouted jug	MG4	Red slipped	Heraion IV-V	EB III
HR15/239	Pithos	MG4	Red slipped	Heraion 1	EB II developed

Table 7.24: (continued) Samples of Fabric 5.

A



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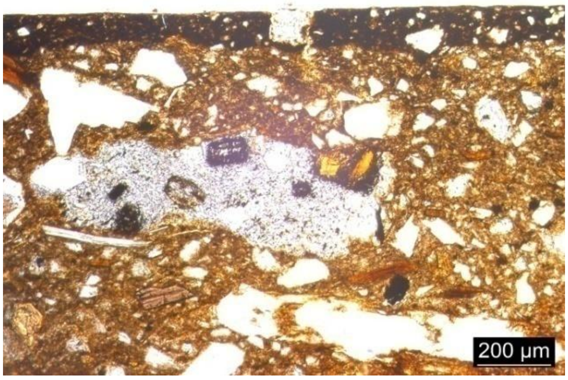
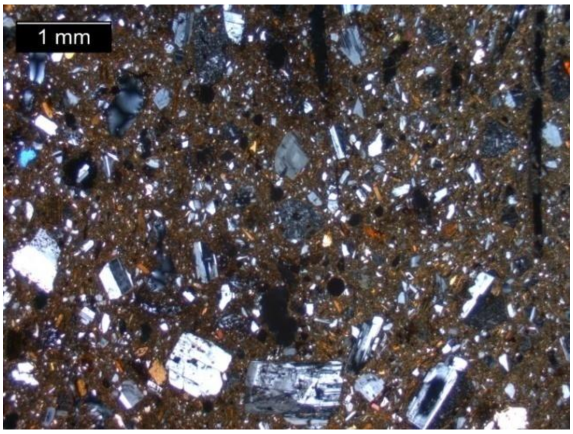
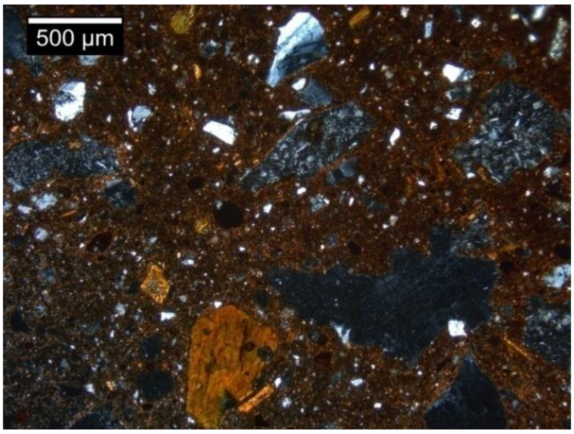


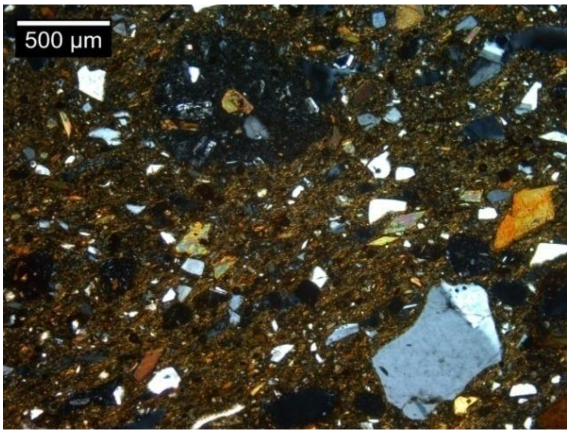
C



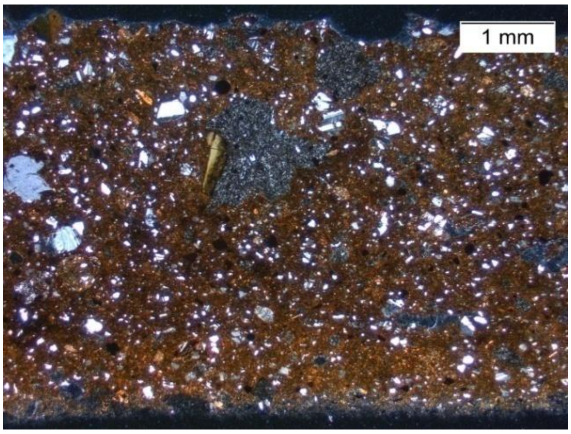
D



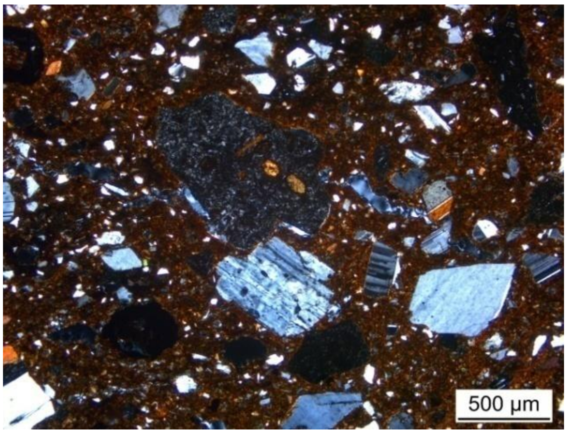
E



F



G



H

Figure 7.25: Micrographs of samples within Fabric 5. A. HR15/88; B. HR15/163; C. HR15/109 with a slip layer; D. HR15/172 with a possible coil join and remains of vegetal temper; E. GS44/2016; F. Agios Pandeleimonas 12/33; G. LT03/2; H. Emporio 2. All images taken in XP except for C.

Composition

This coarse fabric is characterised predominantly by volcanic rock fragments of intermediate composition (andesite grading into dacite) and their constituent minerals (varying amounts of plagioclase feldspar, amphibole, biotite, pyroxene, etc.). In almost all samples there is a considerable amount of burnt-out vegetal temper appearing as elongate voids (Fig. 7.25:D). The only exceptions are the samples comprising smaller vessels (HR15/64, 109) and sample HR15/216 which is of a later date (EB III). It is a homogeneous, very consistent fabric group in terms of composition, although there are minor differences between samples according to the presence/absence of amphiboles in favour of pyroxenes (Fig. 7.25:A-B).

Technological features

Although a very homogeneous fabric, there is some variability with respect to coarseness and roundness/angularity of the non-plastic inclusions. On the one hand, the range of inclusions in both size fractions indicates that a relatively unprocessed clay consistent with *in situ* weathering was most probably in use, with the finer examples representing a better processed paste. A similar argument has been made regarding the Aeginetan volcanic fabric (Fig. 7.25:F), according to which the raw materials were the product of natural weathering (primary sediments), rather than resulting from tempering (Kiriatzi *et al*. 2011, 131-134).

However, the petrographic analysis of experimental sample GS44/2016 (see Section 5.7.6), which was made by tempering studio clay with crushed volcanic rock, originally belonging to an EB II millstone (Fig. 7.25:E), resulted in a similar picture to the pottery examples with both rounded volcanic rock fragments and angular minerals. This cautions against assessing processing practices only by roundness/angularity or shape of inclusions.

The micromass is optically active suggesting a low-moderate firing temperature. Only sample HR15/216 has a moderately active to slightly inactive micromass that could indicate firing to a higher temperature than the rest of the group. Although a generally homogeneous group there is colour differentiation in most samples between the darker core and lighter-coloured margins (HR15/6, 21, 31, 64, 82, 112, 163, 172, 174, 239) suggesting an incomplete firing atmosphere. Other samples possibly indicate differences in the firing strategies as suggested by the relatively homogeneous colour (HR15/88, 96, 106, 126, 167, 189). Certain samples exhibit strong alignment of elongate voids, which can be also diagonal to the vessel's margins. Taken together with the concentrically-arranged inclusions they probably represent compressed coils or slabs (e.g. HR15/64, 109, 163, 216) (Fig. 7.25:D). Some preserve traces of a dark red-reddish brown (HR15/6, 21, 31, 167, 174, 189) or dark brown-black slip (HR15/109), the thickness of which ranges from 0.02mm to 0.04mm (Fig. 7.25:C).

Typological/stylistic observations and macroscopic correlations

Like composition and technological characteristics, it is very homogeneous with respect to shape and surface treatment. The majority of samples correspond to storage, probably transport vessels like pithoid jars as well as open jars, and two bowls that date between the EB I and EB II early periods. There is one sample dating to the EB III (beak-spouted jug) that is distinctive in fabric and firing. A very distinctive surface treatment characterised by a thick red-reddish brown slip and burnish (occasionally highly burnished and lustrous) can be recognised across the samples. Vertical or horizontal burnishing marks can be seen in some examples, mainly on the outer surface when both sides are treated. The majority of samples have a carefully wiped, slightly rough inner surface, apart from the upper part of the neck, leaving distinct horizontal and/or vertical parallel traces (scoring/wiping) resulting from the use of a tool probably for scraping away the remaining clay. This morphological feature, alongside others, such as the carination below the rim on the inner surface and thickening on the exterior that may relate to the building technique (Lis *et al*. 2015, 70), recalls the Aeginetan LBA cooking pots (Lis *et al*. 2015, 66, fig. 1a-b) as well as other EB II shapes (Kiriatzi *et al*. 2011, 247). This fabric can be directly correlated with MG4, reinforcing its distinctiveness in hand specimen.

Petrographic parallels and suggested provenance

Overall, the composition of this fabric is not diagnostic for Samos. The limited Neogene volcanic bodies that penetrate the metamorphic substrate in the margins of the Mytilinii basin are characterised by basaltic tuffs and minor trachydacites, while more acidic lavas and rhyolitic tuffs occur in the Karlovassi basin (see Section 5.3.1).

Its provenance determination remains open. This is also particularly impeded by the up-to-date lack of extensive analytical results from the eastern Aegean and western Anatolian region where similar geological formations are encountered. A better picture of the neighbouring regions, that could represent the provenance areas of the fabric in question, is given by the geological literature. According to geochemical and petrographic analyses the Neogene (early Miocene to Pliocene) volcanic units of the Karaburun peninsula east of Chios in the Izmir region are associated with a system of complex formations, which are represented by olivine-bearing basaltic-andesites to shoshonites and related pyroclastic rocks (Karaburun volcanics), high-K calc-alkaline andesites, dacites and latites (Yaylaköy, Armağandağ and Kocadağ volcanics), mildly-alkaline basalts (Ovacik basalts), and rhyolites with trachyte-like porphyritic outcrops (Urla volcanics) (Helvaci *et al*. 2009, 185-186, fig. 3; Ersoy *et al*. 2012, fig. 1). Common volcanics are also widely distributed in the areas to the north and south of the Karaburun peninsula, with the former being characterised by high-K and calc-alkaline products (Lemnos island) and alkali basaltic lavas to the east in western Anatolia (Biga peninsula, Troas), high-K andesites, dacites, and rhyolites (Lesbos island and the opposite coast and mainland), as well as alkaline olivine basalts, calc-alkaline rhyolites, dacites, and andesites outcrops in Chios. The latter exhibits a comparable geochemical signature with NW Anatolia andesitic-dacitic rocks (Innocenti and Mazzuoli 1972, 87), although differences occur in the composition of rhyolite outcrops (Helvaci *et al*. 2009, 188). SW Anatolia, the Bodrum peninsula area, and the Dodecanese islands of Kos, Yali and Nisyros include younger volcanic rocks (Upper Miocene to Quaternary) and are characterised by trachytes, rhyolites and, basalts (Helvaci *et al*. 2009, fig. 2). Similar andesite-rich fabrics have been recently identified in the EBA pottery from the Konya plain.[18]

[18] http://www.bsa.ac.uk/index.php/research/projects-cat/302-the-konya-plain-project (Fig. 7).

The following comments note the consistency within each comparative fabric and point out similarities or differences. The most readily comparable fabric, mainly because it is well-known and thoroughly published, derives from the island of Aegina in the Saronic Gulf. There are strong similarities with Fabric Group 1, which is characterised by intermediate, mostly andesitic rocks, recovered at Kolonna from the EB III to the Classical period (Kiriatzi *et al*. 2011, 93; Pentedeka *et al*. 2012, 106-108). The recent integrated work of Kiriatzi and others has documented a small number of imports of suspected Aeginetan origin dating between the MN and LN/FN through the EB II periods, mainly dark/black burnished, at a number of sites in central Mainland and NE Peloponnese (Kiriatzi *et al*. 2011, 24-25 with references; Whitbread and Mari 2014, 86-87, fig. 6g, 'Fresh volcanic class'; Burke 2016, Macroscopic Group 4 and Petrographic Group 24).

The presence of imported pottery on these sites (e.g. EB II Vayia in Corinthia; Tartaron *et al*. 2006, 152) is combined with the circulation of volcanic millstones/grinding stones, already known from the later NL, within the context of interregional exchange networks, and assumed to have originated in the Saronic Gulf and reach Attica and the Peloponnese (Kiriatzi *et al*. 2011, 241; Tartaron 2013, 216). Such millstones are known from NL Franchthi Cave in the Argolid and Kitsos Cave in Attica, which have been attributed to andesite sources in the Saronic Gulf and were interpreted as reusable temper sources for pottery production (Vitelli 1993, 208-209; cf. Whitbread and Mari 2014, 81).

The experimental raw material sample, GS44/2016, from Heraion (volcanic millstone) provides supporting evidence regarding the off-island provenance of the millstone, although it probably displays more similarities with the Aeginetan fabric than the pottery samples. This could probably support two different sources for the pottery and the volcanic millstone respectively. More particularly, a closer examination of the Heraion fabric revealed some important differences with the Aeginetan fabric: first, in some samples of the former there exist more pyroxenes than amphiboles and biotite that characterise the Aeginetan fabric, and the latter is characterised by significant internal variation in terms of composition (green or brown amphiboles), texture, and firing colour. Furthermore, the presence of vegetal temper in the Heraion fabric contrasts with the Aeginetan one, although a recent petrographic study documented a non-calcareous volcanic fabric with chaff temper that appears as a common practice in the LH IIIB period (Gilstrap *et al*. 2016, 502, fig. 4).

A similar andesitic fabric has also been recorded in LBA pithoi analysed from Troy. These have been assigned with a local provenance related to the Ezine volcanic outcrops and the fluvial deposits about 10-20km away from the site (Kibaroğlu and Thumm-Doğrayan 2013, 48-49, fig. 2d). A different petrographic analysis of pottery from Troy VI-VIIA demonstrated the common presence of altered and fresh volcanic rocks in all assumed local fabrics and vessels typologically considered as island wares and connected to the nearby islands of Samothrace, Lemnos, and Lesbos were proven to be indistinguishable from the local Trojan fabrics (Krijnen 2014, 25).

Recent analysis of LBA pottery from Koukonisi on Lemnos, together with clay and tile samples from the vicinity of Koukonisi and Poliochni in the SE part of the island, revealed a range of fine volcanic fabrics as well as few coarse ones of intermediate composition (Day and Tsai in progress). Despite some minor, superficial similarities no direct link can be drawn with the Heraion fabric.

EB Liman Tepe has produced a number of volcanic fabrics, of which Group 1: 'Rounded volcanic rocks fabric group' represents the main local fabric and relates to volcanic bodies in the Karaburun peninsula (Day *et al*. 2009, 341) (Fig. 7.25:G). Its composition and texture is however different from the Heraion fabric, but is better linked with Fabric 6 (see Section 7.3.5).

Another fabric of similar composition has been recently identified petrographically by B. Lambrechts in the Neolithic pottery from Emporio and Agio Gala on Chios ('Porphyritic rhyolite fabric group'; Fig. 7.25:H). It is taken as a local product and relates either to the Agiasmata area close to the north coast or the rhyolite domes that outcrop north of Emporio in the south part of the island (Higgins and Higgins 1996, 137-138, figs. 13.5 and 13.7). Chios has also several calc-alkaline andesite and basalt volcanic bodies (Pe-Piper *et al*. 1994). Nevertheless, the Chian fabric differs from the Samian one by the presence of less pyroxenes and general predominance of altered biotite and amphibole crystals (Lambrechts in progress; pers. exam. of thin sections, January 2017).

The best fabric match identified so far derives from Miletus and corresponds to two thin sections belonging to pithoi sherds (Knappett and Hilditch in progress; pers. exam. of thin sections; samples 255 and 282) that date to Periods I and II (Ch and EB II late periods respectively). Their sparse presence within the analysed samples in Miletus, although this might reflect the sampling strategy, might indicate a non-local provenance.

7.4.2 Fabric 18: Coarse/dark phyllite

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/148	Beaked jug with a two-stage neck profile	MG14	Plain, incised	Heraion II	EB II late
HR15/155	Beaked jug with a two-stage neck profile	MG14	Plain, incised	Heraion II	EB II late
HR15/192	Transport jar	MG14	Plain	Heraion III	EB II late
HR15/220	Transport jar	MG14	Plain	Heraion II-III	EB II late
HR15/295	Transport jar	MG14	Plain	Heraion II-III	EB II late

Table 7.25: Samples of Fabric 18.

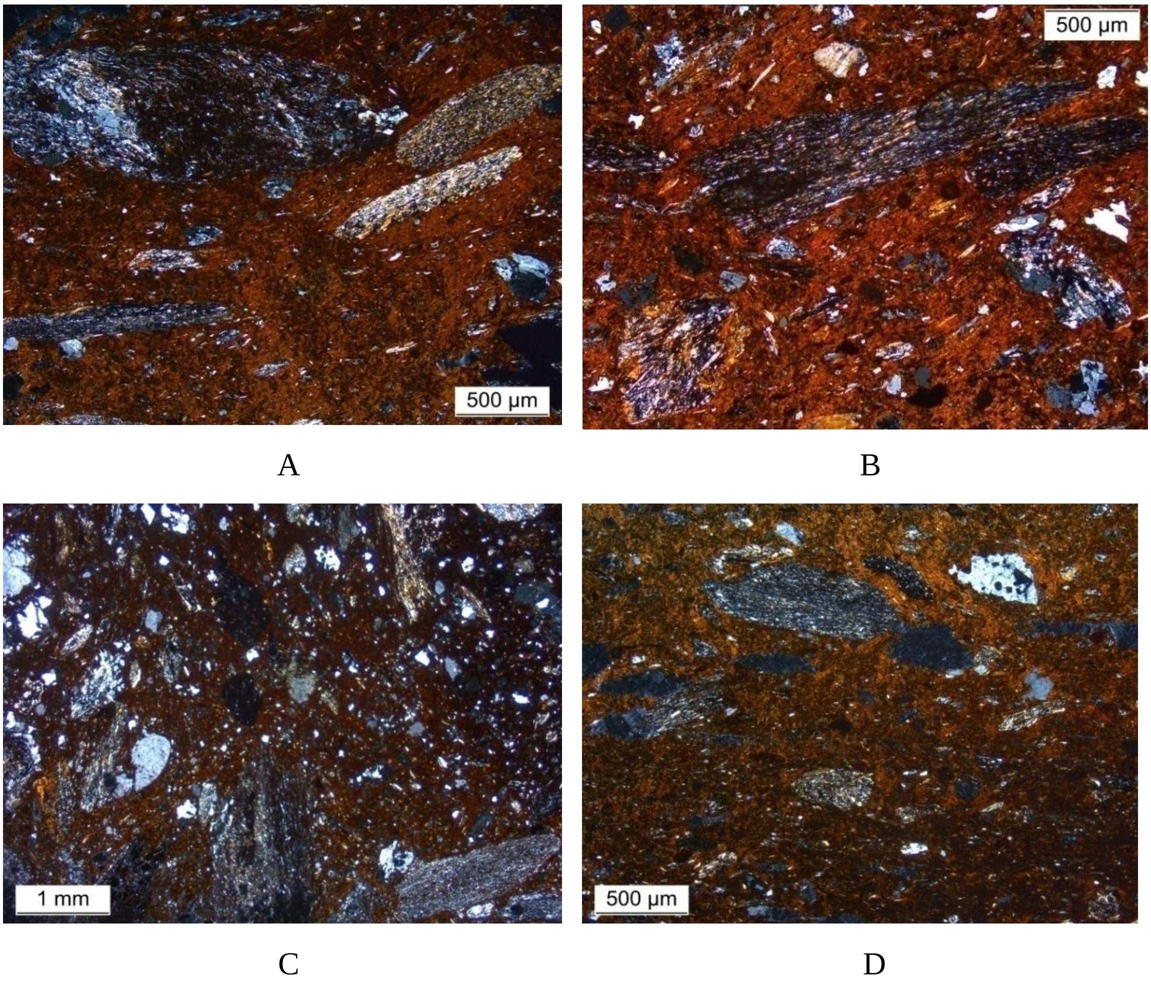


Figure 7.26: Micrographs of samples within Fabric 18. A. HR15/155; B. HR15/192; C. Akrotiri 03/128; D. Panormos 03/30. All images taken in XP.

Composition and technological features

The non-plastic inclusions consist predominantly of low-grade, fine-grained metamorphic rock fragments and more specifically of red-brown, oxidised phyllite fragments that occasionally grade into slate (Fig. 7.26:A-B). There are also a few quartz-mica schist fragments, possible sedimentary rock fragments (quartz arenites/quartzites or sandstones), and quartz-feldspar aggregates. Judging from its weak optical activity the fabric was probably fired to a relatively high temperature and probably an oxidising atmosphere.

Typological/stylistic observations and macroscopic correlations

This fabric covers two vessel types, the beaked jug with two-stage neck profile and the transport collared jars with incised or slashed handles, both of which are used for transportation and serving of liquid commodities and known to have been exchanged across the Aegean during the EB II period (Day and Wilson 2016, fig. 2). The beaked jug examples from Heraion comprise a ceramic type that is found commonly throughout the Cyclades (Sotirakopoulou 1993, 11-13, with further bibliography; 1997, 526) (see Section II.24 in Appendix II). More examples of this fabric were identified in transport collared jars with horizontal handles that bear decoration of incised radiating lines on the upper surface. This type is widely known since EC II in the Cyclades (cf. Sotirakopoulou 1993, 15). Similar storage vessels have been identified at many EC/EB sites (see Section II.24 in Appendix II).

There is a direct correlation between the macroscopic and petrographic groups as this fabric is very easily identifiable. The surface treatment is usually not preserved, aside from the greasy/often soapy feel of the exterior and slightly smoothed texture or matt slip.

Petrographic parallels and suggested provenance

Various names have been given to this fabric both in macroscopic and petrographic terms (see Section II.24 in Appendix II). This fabric can be positively characterised as local to the island of Amorgos (Vaughan 2006, 99-101), as it has been recorded petrographically in numerous sites throughout the island and in higher amounts than in any other site in the Cyclades (Day and Wilson 2016, 29), e.g. Akrotiri on Thera (Day *et al.*, n.d. Fabric group 26, 03/120, 128, 132: three collared jars with slashed handles) (Fig. 7.26:C), Panormos on Naxos (Day *et al*. n.d., Fabric group 17: two beaked jugs and two collared jars) (Fig. 7.26:D), Kavos Special Deposit North (Hilditch 2007, 239, 247, fig. 6.48), Kavos Special Deposit South (Hilditch 2015, 220, 228, V3A Macroscopic Group and P4 Petrographic Group), and Dhaskalio on Keros (Hilditch 2013, 471-472, 479, V3A Macroscopic Group and P4 Petrographic Group). All assemblages from Keros revealed a broad range of shapes (several jar types, baking pans, one-handled tankards, depas cups) (Hilditch 2015, 231). Other possible Amorgian imports are briefly mentioned from Skarkos on Ios (Marthari 2008, 79) and also possibly identified by the author in the EB 1 material from Çukuriçi Höyük (three samples; pers. exam. of thin sections, December 2016).

7.4.3 Fabric 19: Red phyllite

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/278	Transport jar	MG14	Plain, incised	Heraion II-III	EB II late

Table 7.26: Samples of Fabric 19.

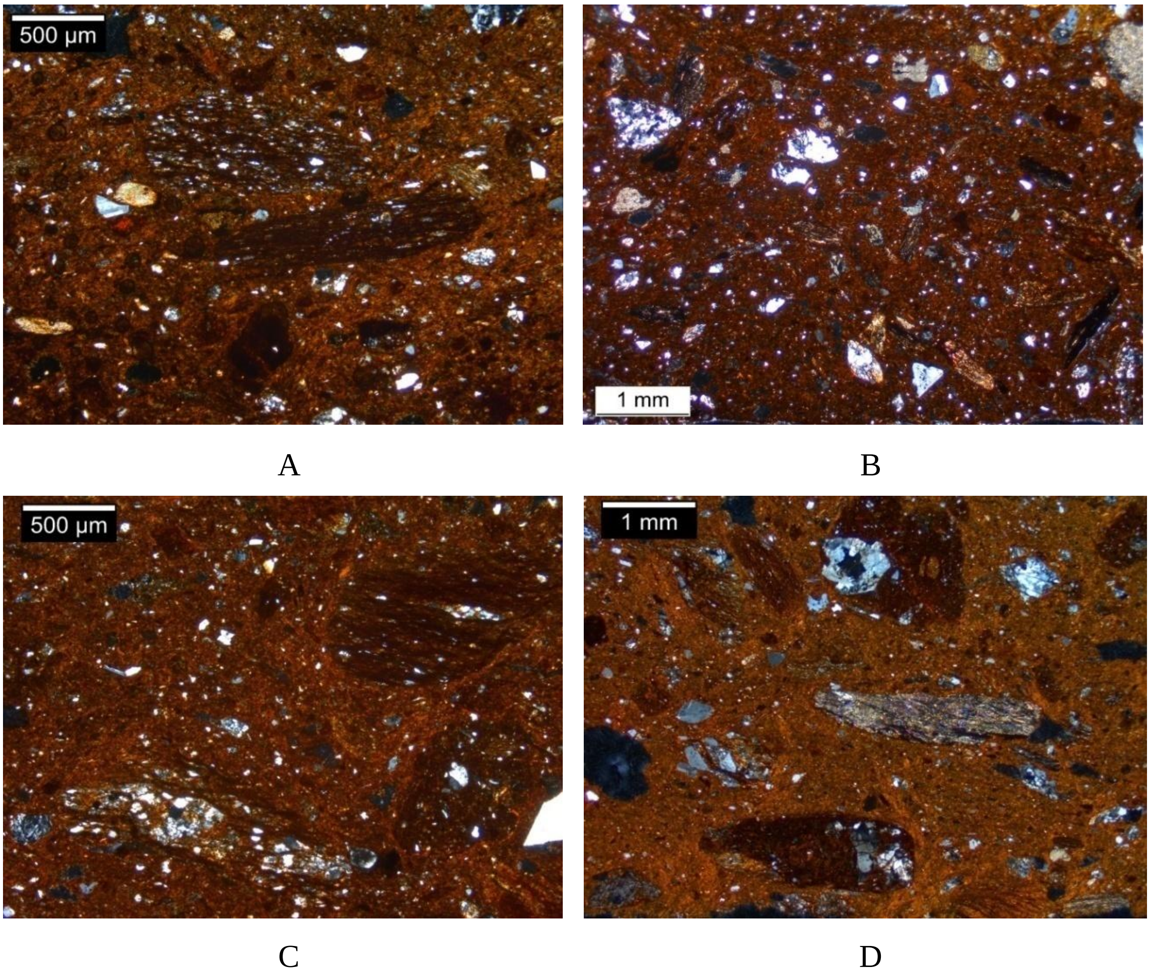


Figure 7.27: Micrographs of samples within Fabric 19. A. HR15/278; B. Akrotiri 03/133; C. Akrotiri 03/134; D. Panormos 03/16. All images taken in XP.

Composition and technological features

This fabric is very similar to Fabric 18 in compositional and textural terms and is characterised by a red/orange-firing clay paste. It is characterised by the presence of elongate, low-grade metamorphic rock fragments, principally phyllite/shale, but also a substantial amount of medium to coarse-grained quartz-mica schists (Fig. 7.27:A).

Typological/stylistic observations and macroscopic correlations

This loner belongs to a transport collared jar with horizontal, slashed handles (see Fabric 18). Macroscopically it could not be distinguished from the previous fabric and, therefore, corresponds to MG14 (see Section II.25 in Appendix II).

Petrographic parallels and suggested provenance

This fabric was first identified by Vaughan (2006) at Markiani on Amorgos and was named as 'Red shale fabric'. It was suggested to be local on the basis of its correlation with the 'Phyllite-quartzite fabric' (see Fabric 18). Other possible petrographic parallels derive from the Kavos Special Deposit North on Keros, where it is named as 'Shale and quartzite fabric' (Hilditch 2007, 247, 253) and corresponds to the 'Red schist macroscopic fabric group' (Broodbank 2007, 125). Broodbank suggested an Amorgian provenance, although reflecting a different production location/unit or different raw material sources to that of his 'Blue schist macroscopic fabric group'. However, a more detailed understanding of the variation within these fabrics is needed for such interpretations to be valid. At Dhaskalio on Keros it corresponds to petrographic fabric 'P4: Phyllite and marble' ('Dark/red phyllite sub-group') and covers a range of shapes (Hilditch 2013, 479). The same picture emerges for the Kavos Special Deposit South, both macroscopically and petrographically, and corresponds to a wide range of domestic shapes (jars, bowls, baking pans, drinking and pouring vessels, pyxides) (Hilditch 2015, tab. 6.1, 220-221, 228, 231). Another parallel is found at Panormos on Naxos (Day *et al*. n.d., Fabric group 10), represented by a single transport jar sample (Fig. 7.27:D). The latter has been suggested to resemble the 'Red phyllite fabric' (Fabric group 27, 03/133, 134: one two-stage jar neck and one transport jar with slashed handles) from Akrotiri on Thera (Day *et al*. n.d.), which is also considered to be of a Naxian origin due to the rare presence of volcanic rocks (Fig. 7.27:B-C).

7.4.4 Fabric 20: Felsic plutonic (granite) rocks in a fine groundmass

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/40	Conical-necked jar	MG16	Light grey incised	Heraion I	EB II?
HR15/151	Conical-necked jar	MG16	Greyish brown incised	n/a	EB II-III

Table 7.27: Samples of Fabric 20.

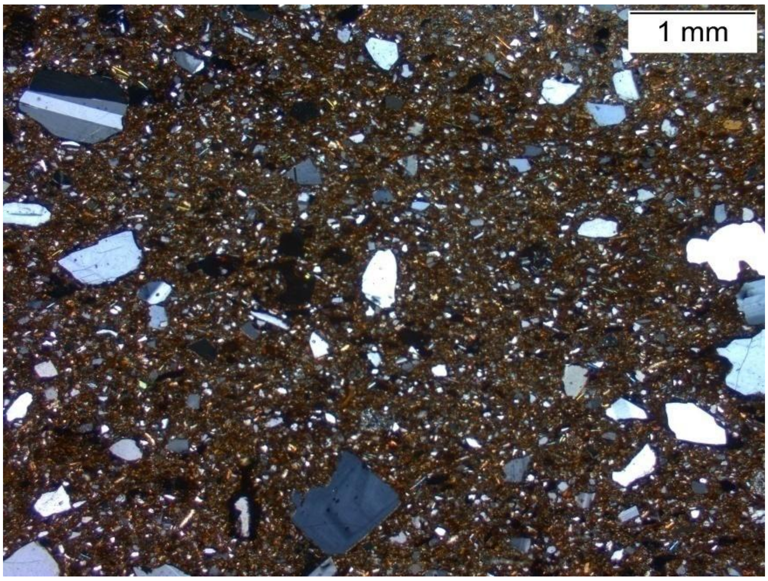


Figure 7.28: Micrograph of sample HR15/151, taken in XP.

Composition and technological features

This fabric is characterized by sparse coarse inclusions set in a rather fine groundmass. Apart from monocrystalline quartz, its most prominent compositional characteristic is the considerable amount of fresh-looking, a-sa feldspar crystals (especially plagioclase), several of which stand out by their size and relief (Menelaou *et al*. 2016, tab. 1, 'Fabric 6: Zoned feldspars and quartz', fig. 5b right) (Fig. 7.28). Other inclusions comprise of quartz-feldspar aggregates with myrmekite and granophyric textures, as well as fine-grained volcanic rock fragments, both of which are related to an acid geological environment.

Typological/stylistic observations and macroscopic correlations

This is a very consistent group in typological and chronological terms, comprising of conical-necked jars with a light grey/greyish brown surface and decorated with incised zig-zag or herringbone motifs. They are dated to the EB II-III period. It corresponds with MG16.

Petrographic parallels and suggested provenance

Taken together, its acid igneous mineralogy and general texture are probably indicative of an off-island provenance, possibly related to Naxos itself or a source in the southeastern Cyclades in general (Hilditch 2007, 240).

7.4.5 Fabric 21: Acid igneous and quartz-rich metamorphic rocks in a biotite-rich matrix

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/31	Jar	MG17	Yellowish brown slipped	Heraion IV	EB III
HR15/120	Jar?	MG16	Plain	Bauphase 3	EB II early

Table 7.28: Samples of Fabric 21.

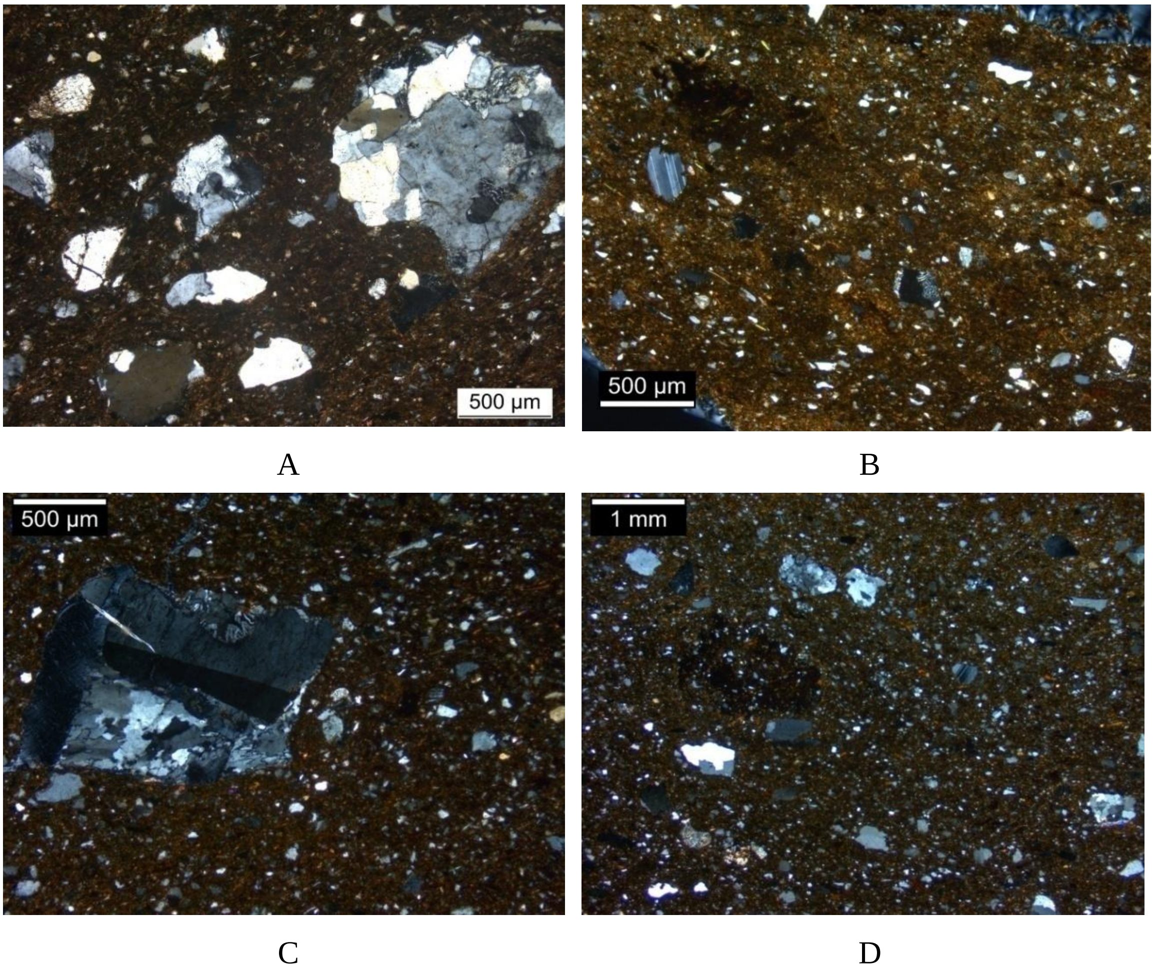


Figure 7.29: Micrographs of samples within Fabric 21. A. HT12/31 with metagranitic rocks exhibiting myrmekitic tetxure; B. HR15/120; C. Panormos 03/3; D. Panormos 03/15 with metagranitic rocks exhibiting myrmekitic texture. All images taken in XP.

Composition and technological features

Similarly to Fabric 20, this fabric is also characterized by a sparse coarse fraction and a rather fine, biotite-rich groundmass. The most prominent inclusions comprise of quartz-rich metamorphic rock fragments and acid igneous rocks or metagranite and their mineral dissociates (examples with myrmekitic and granophyric textures) (Fig. 7.29:A-B). The groundmass is buff/light yellowish brown and it probably reflects the use of a Neogene calcareous clay.

Typological/stylistic observations and macroscopic correlations

It is represented by one jar with a horizontal loop/lunate-shaped handle and a body sherd corresponding most probably to a similar vessel. Macroscopically, sample HT12/31 preserves a white/yellowish brown slip on the exterior surface, which is non-diagnostic for the local technological tradition.

Petrographic parallels and suggested provenance

Taken together, its mineralogy and texture are probably indicative of an off-island provenance. It is most likely geologically linked with Fabric 20 and a possible provenance area can be suggested on the island of Naxos, as can be assumed by parallels from Panormos (Day *et al*. n.d.). More specifically, it is linked with Panormos Group 1 ('Metamorphic and igneous rocks in biotite rich matrix fabric group') according to a number of distinctive mineralogical properties, such as the presence of granule-sized, moderately to poorly-sorted acid igneous and metamorphic rock inclusions, rare green amphiboles in the fine fraction, very rare micrite and microfossils, in a biotite-rich groundmass (Fig. 7.29:C-D).

7.4.6 Fabric 22: Metamorphic with muscovite and few feldspars

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/41	Truncated conical pyxis	MG16	Dark grey incised	n/a	EB III?

Table 7.29: Samples of Fabric 22.

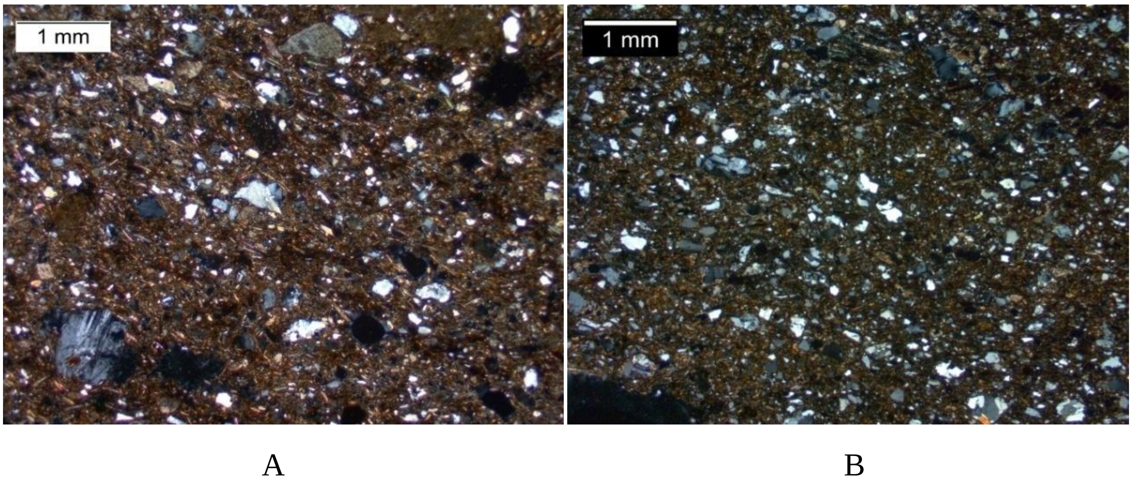


Figure 7.30: Micrographs of samples within Fabric 22. A. HT12/41; B. BT03/41. All images taken in XP.

Composition and technological features

This is a medium-coarse fabric with common muscovite mica, frequent-few mono- and polycrystalline quartz, quartz-mica schist, as well as very few plagioclase feldspar crystals and other accessory inclusions (Fig. 7.30:A). A low-firing temperature is assumed, according to the optically active micromass.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a body sherd of a conical-necked jar, with a characteristic decoration of incised vertical bands with parallel lines set in a dark grey surface (Milojčić 1961, pl. 49:8; Menelaou *et al*. 2016, fig. 5b left). It dates to the EB III (phases Heraion IV-V) and this surface treatment is non-diagnostic for the local Samian tradition.

Petrographic parallels and suggested provenance

The combination of type/shape attributes, which are generally believed to be Cycladic in origin, and surface treatment/decoration suggest an off-island provenance. Originally it was classified as a heterogeneous sample of imported Fabric 20 (Menelaou *et al*. 2016, tab. 1, 'Fabric 6: Zoned feldspars and quartz'), but a careful re-examination confirmed that it shares close mineralogical, typological/morphological, and chronological parallels with Fabric 17 (loner sample 03/41: 'Muscovite schist fabric') from Bakla Tepe (Fig. 7.30:B), that is thought of as a local product (Day *et al*. n.d.).

7.4.7 Fabric 23: Fine carboniferous limestone (shell-rich)

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/114	Sauceboat	MG20	Buff-brown smoothed	Bauphase 2	EB II early

Variant

HR15/215	Spherical pyxis	MG16	Incised-and-pointillé	Heraion IV	EB III

Table 7.30: Samples of Fabric 23.

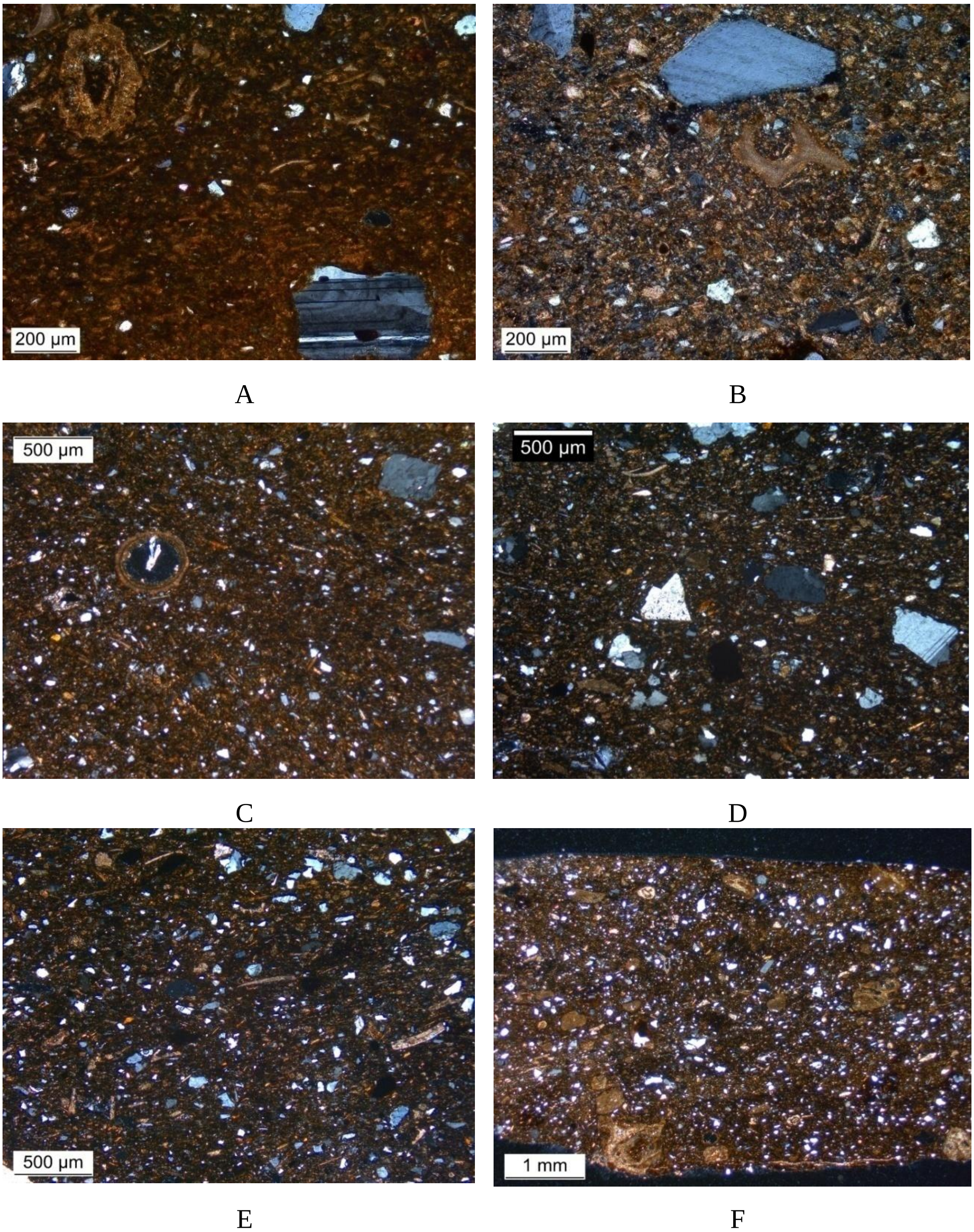


Figure 7.31: Micrographs of samples within Fabric 23. A. HR15/114 with a microfossil; B. HR15/215; C. Panormos 03/5; D. Akrotiri 03/127; E. LT03/31; F. BT03/6. All images taken in XP.

Composition and technological features

This fine calcareous fabric is characterised by a sparse coarse fraction comprised of quartz-rich rock fragments/quartz-feldspar aggregates related to metagranitic rocks. Occasionally, these exhibit granophyric or micrographic textures. Rare metamorphic rock fragments and their constituent minerals are also present. The most prominent feature of this fabric is the presence of a substantial amount of fossiliferous limestone with rare microfossils (ostracods) and possibly also calcium-rich organic inclusions or shell fragments (Fig. 7.31:A-B). The high calcareous content may relate to a marine clay source or the intentional tempering with calcitic material or shell.

Typological/stylistic observations and macroscopic correlations

It is represented by a sauceboat with a yellowish to greyish green clay paste and a spherical pyxis.

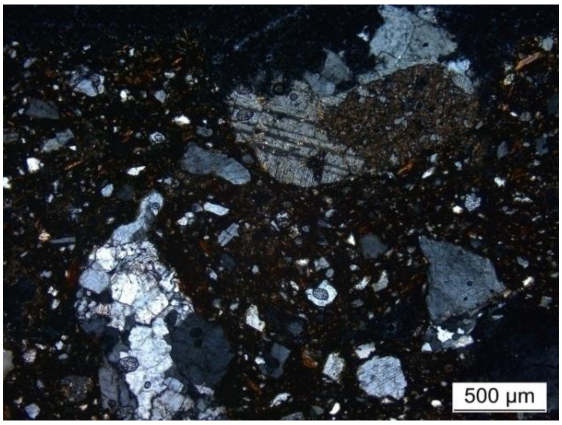
Petrographic parallels and suggested provenance

This is a non-diagnostic fabric for Samos and it therefore reflects an off-island provenance. It finds very close parallels with sample 03/5 (Fabric 3: ‘Fine micaceous with rare igneous rocks’) from Panormos on Naxos (Fig. 7.31:C). They share a significant number of mineralogical (composition and texture) and typological similarities, such as the presence of very few coarse inclusions related to acid igneous rocks, as well as minor quartzite and metamorphic rocks set in a fine biotite-rich, calcareous groundmass with fossiliferous limestone (micrite and some ostracods). At Panormos this fabric corresponds also to a sauceboat with a characteristic greyish green fabric and is taken as local, according to its link with other Naxian fabrics (Day *et al*. n.d.). Similarly, sample 03/7 (Day *et al*. n.d.: Fabric 6: ‘Very fine calcareous’) from the same site (single red-slipped jug/jar) shares a similar range of diagnostic inclusions. Another probable fabric match was identified among the Liman Tepe thin sections (sample 03/31), represented by a single ‘Urfirnis’ sauceboat, and being compatible on the basis of the acid igneous content, substantial amount of limestone (micrite and bioclasts/shell fragments), and micaceous base clay (Fig. 7.31:E). Less compatible but still broadly similar appears to be sample 03/6 from Bakla Tepe (Day *et al*. n.d.: Fabric 8: ‘Bioclastic limestone’), represented by a single black slipped and burnished tankard. Its provenance is yet to be determined (Fig. 7.31:F). Perhaps this fabric can be correlated with petrographic Groups C and E from Kavos Special Deposit North on Keros (Hilditch 2007, 243) and Broodbank's macroscopic groups ‘Fine Orange’ and ‘Fine Buff Micaceous’ that are primarily related to sauceboats and have a possible provenance on Naxos (2007, 128-129).

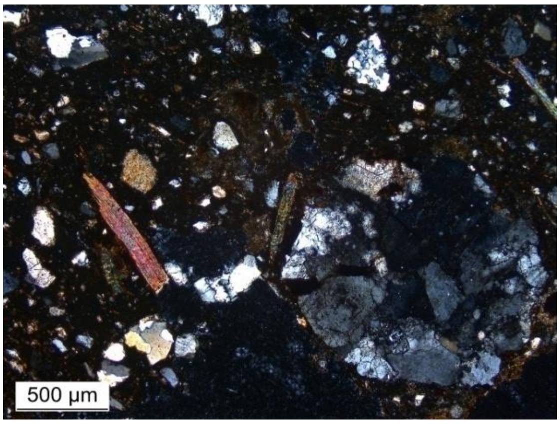
7.4.8 Fabric 25: Biogenic calcareous with metamorphosed acid igneous and metamorphic rocks

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/30	Transport jar	MG21	White slipped/smoothed	Heraion IV	EB III

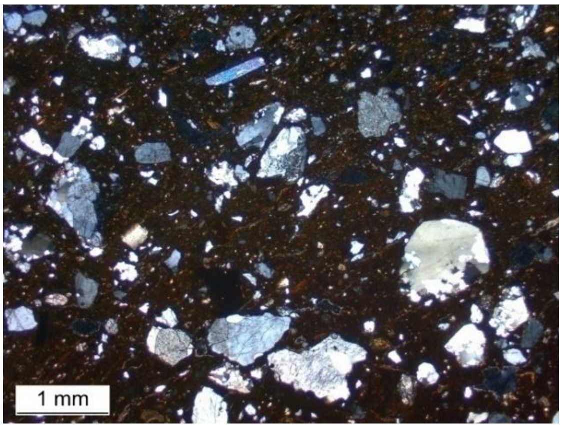
Table 7.31: Samples of Fabric 25.



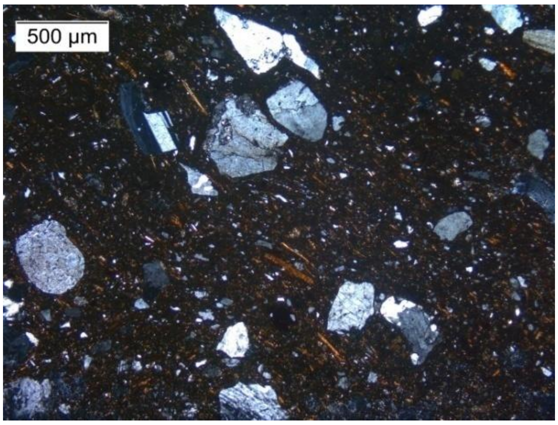
A



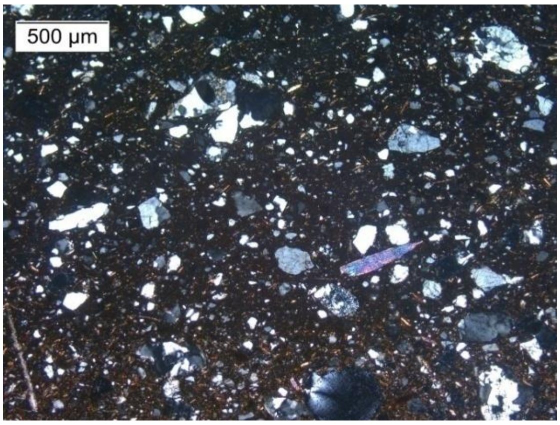
B



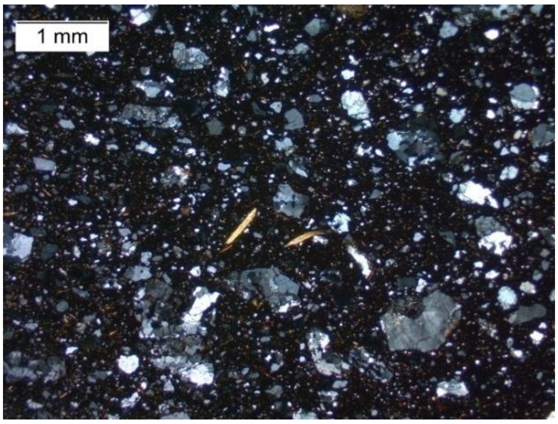
C



D



E



F

Figure 7.32: Micrographs of samples within Fabric 25. A. HT12/30; B. HT12/30; C. Panormos 03/32; D. Panormos 03/47; E. Akrotiri 03/109; F. Ayia Irini 97/68. All images taken in XP.

Composition and technological features

It is characterised by common granitic or metagranitic rocks. Some of them display characteristic acid igneous textures like myrmekitic/granophyric, perthitic and microgranitic intergrowths (Fig. 7.32:A-B). The same range of inclusions is present in both fractions suggesting that a rather primary, probably calcareous (Neogene marl) source of raw materials was used. The micromass appears weakly optically active to optically inactive, indicating that it is fired to a relatively high temperature.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a body sherd of a closed vessel, most probably corresponding to a transport jar. No evidence for surface treatment is preserved other than a poorly white slipped or smoothed exterior. It is macroscopically very distinctive due to its pale/buff-coloured fabric, soft feel, and soapy texture.

Petrographic parallels and suggested provenance

This is a non-diagnostic fabric for Samos and it therefore reflects an off-island provenance. The closest parallels are found at Panormos on Naxos, Fabric Groups 7 and 20 (Day *et al*. n.d.). The Heraion sample falls between these two groups, which are both characterised by granitic and quartz-rich metamorphic rocks, as well as green amphiboles in a calcareous matrix (Fig. 7.32:C-D). They indicate a Naxian origin, possibly produced locally at Panormos. The vessels represented are transport jars and jugs.

A number of fabrics with similar characteristics, containing granite-related rocks and constituent minerals in combination with metamorphic rock fragments and calcareous/biogenic inclusions (e.g. 'Granite and schist fabric', 'Metamorphic calcareous-rich fabric'), were also identified at Kavos (Special Deposit North) on Keros and are suggested to derive from Naxos (Hilditch 2007, 240-241, 245). However, more recent analytical work suggests that similar lithologies could also link these varied fabrics with other islands such as Paros or Amorgos (Hilditch 2013, 477; 2015, 227, P4: 'Quartz' [Meta-quartz and granite]). Furthermore, the 'Biogenic and Granite fabric' identified at Kavos was suggested to link with Erimonisia (characteristic calcareous clay) or even Keros itself (Hilditch 2007, 246). There are also some similarities with samples 03/24 (dark-on-light transport jar handle) and 03/109 (dark brown-slipped jar body) from Akrotiri on Thera (Fig. 7.32:E) and 97/68 and 97/69 (Group 8: 'Biogenic calcareous and metamorphic coarse fabric'; white-slipped jar body and brown-painted/broad streak transport jar respectively) from Ayia Irini Period III on Kea (Fig. 7.32:F) that are considered to be Melian (Day *et al*. n.d.). This white-slipped fabric is also known from Ayia Irini Period II (Group 7), although with mineralogical differences, as well as Koropi in Attica and Poros-Katsambas on Crete. The absence of green amphiboles and sphene fragments from the Heraion loner and the afore-mentioned parallels could possibly suggest a more secure connection with Melos rather than Naxos.

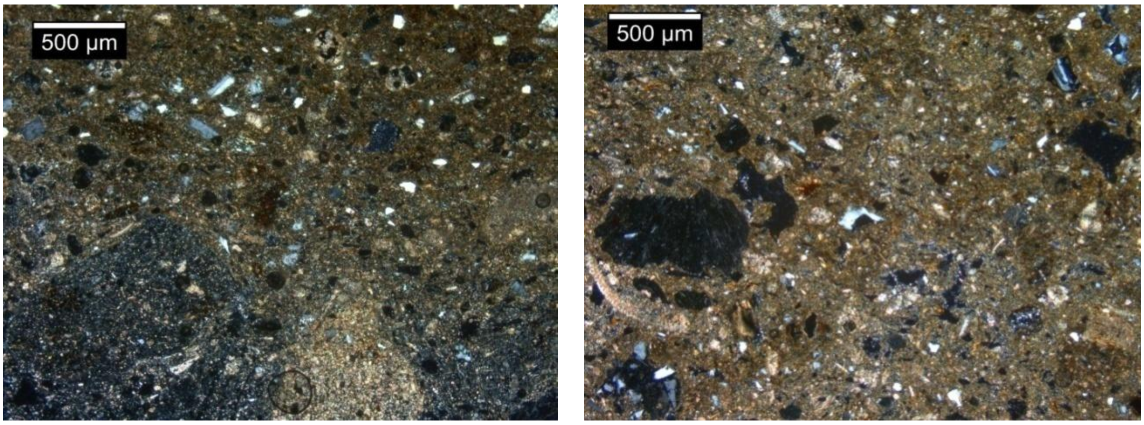
7.4.9 Fabric 26: Buff calcareous volcanic

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/293	Askos	MG18	Black painted	Heraion V	EB III

Variant

HR15/266	Small bowl	MG19	D-o-L painted	Heraion IV	EB III

Table 7.32: Samples of Fabric 26.



A B

Figure 7.33: Micrographs of samples within Fabric 26. A. HR15/293; B. Akrotiri 03/42. All images taken in XP.

Composition and technological features

This fabric has a buff/pale calcareous clay matrix, containing visible micritic and sparitic clots, with inclusions of volcanic rock fragments (fine-grained and acid/intermediate in composition, probably rhyodacite) and their constituent minerals. These include mainly plagioclase feldspar, vesicular glass or tuff, common micrite aggregates or TCFs, biogenic particles/microfossils (foraminifera) that are usually detectable only in PPL, and very rare accessory minerals such as pyroxene and muscovite mica (Fig. 7.33:A). It has been suggested that a mix of clays have been used for the manufacture of this fabric at Akrotiri on Thera (Day *et al*. forthcoming).

Typological/stylistic observations and macroscopic correlations

It is consistent with MG18-19, reinforcing the distinctiveness in hand specimen of this pale buff fabric. Typologically it is represented by one black painted askos and one variant of a DOL cup, both dating to the EB III period.

Petrographic parallels and suggested provenance

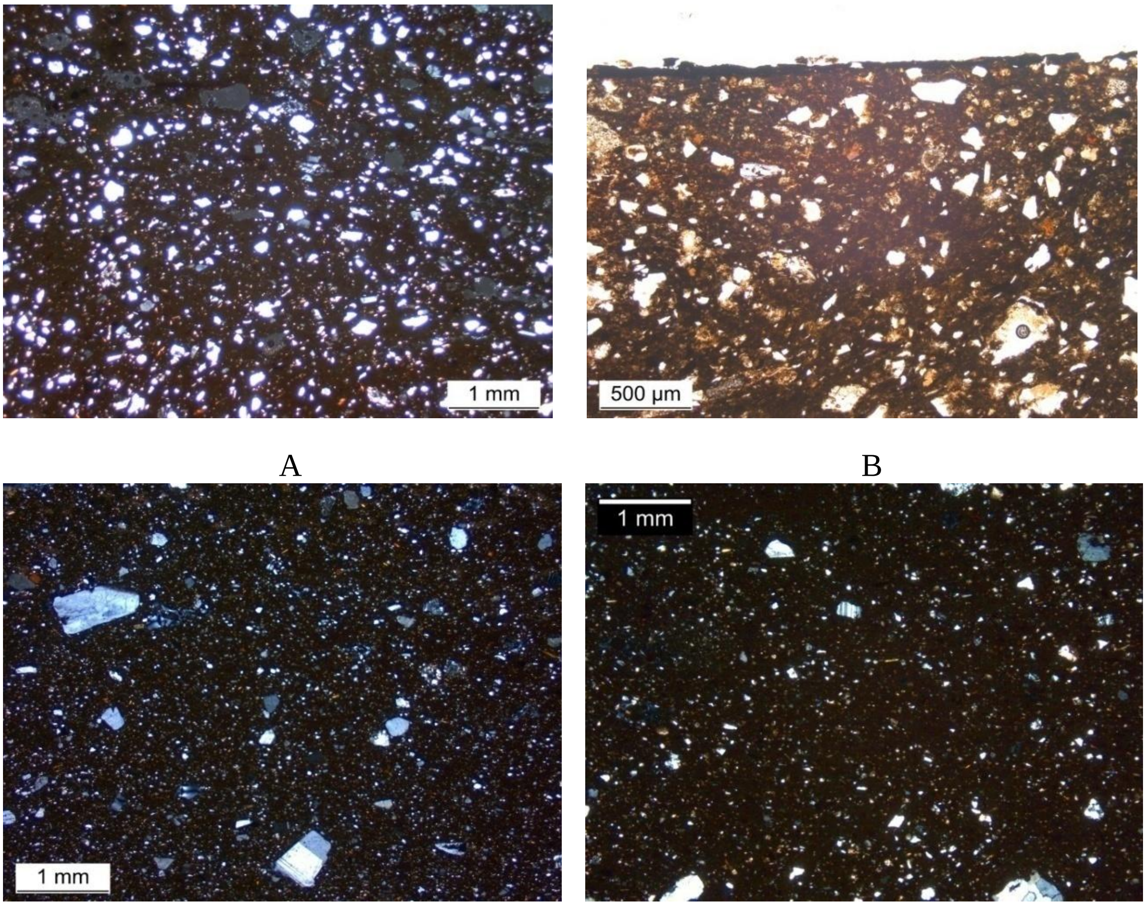
The samples can be securely characterised as imports, and the combination of a fossiliferous calcareous clay with volcanic rock fragments is compositionally compatible with a Theran or Melian provenance, although Thera is the best candidate according to comparative thin sections from Akrotiri and Phylakopi respectively (Day *et al*. n.d.). This fabric is already known from the petrographic work undertaken by Vaughan, Williams, and more recently Hilditch (2008, 195-209, Fabric A: 'Buff calcareous with volcanic and metamorphics', Akrotiri, Phases B and C) from a number of published studies (Vaughan 1989, MBA-LBA from Mikre Vigla; Vaughan 1990, Fabric A from EBA Akrotiri; Vaughan and Williams 2007, EBA-MBA from Phylakopi; Davis and Williams 1981, Group B from Ayia Irini Period V; Hilditch 2013, 478-480, Fabric P3: 'Volcanic' from Dhaskalio on Keros, the majority of which relate to a Theran provenance and represent EB II late shapes). It represents the local fabric used for the whole range of ceramic products.

A number of matches have been identified among the Akrotiri thin sections (Fig. 7.33:B), dating to the EC II 'Kastri Group' phase (e.g. samples 03/20 [broad streak painted transport jar], 03/39 [red-slipped and burnished shallow bowl], 03/42 [red-slipped and burnished lid], and 03/94 [dark brown shallow bowl]; Day *et al*. n.d.), but the vast majority is represented by the early MBA (Phase A) material (Day *et al*. forthcoming; Fabric 1: 'Pale calcareous volcanic, main local fabric'; especially samples 09/8, 11, 22, 25, 26, 27, 28, 32, 61, 99) and is represented by various wares (e.g. matt painted, dark-on-light, black-burnished, light-on-dark) and shapes (carinated bowl, cup, globular jug, jar, askos, pithos).

7.4.10 Fabric 28: Fine calcareous volcanic

Sample	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/201	Hemispherical bowl	MG6	Red slipped	Heraion II-III	EB II late

Table 7.33: Samples of Fabric 28.



A B

C D

Figure 7.34: Micrographs of samples within Fabric 28. A. HR15/201; B. HR15/201 with a slip layer; C. Koukonisi 15/24; D. Koukonisi 15/42. All images taken in XP except for B.

Composition and technological features

This yellowish brown/buff-firing fabric is characterised by fresh, a-sa monocrystalline quartz, few polycrystalline quartz fragments, fresh feldspar crystals (mainly plagioclase but also very few orthoclase), mica, and other secondary inclusions such as very rare volcanic rock fragments with a glassy matrix and a spherulitic texture (Fig. 7.34:A). In addition to these inclusions the fine fraction contains biotite mica, opaque minerals, and orange/green (XP) amphibole crystals. Apart from the very few TCFs present in this fabric the dark streaks probably indicate mixing of two different clays, a mica-rich and a calcareous volcanic one. The moderately inactive micromass is probably suggestive of a high-firing temperature. A distinct red slip layer is also observed in PPL (Fig. 7.34:B).

Typological/stylistic observations and macroscopic correlations

Typologically this loner belongs to a shallow/hemispherical bowl of the EB II late and is characterised by a red-slipped surface. It corresponds to MG6.

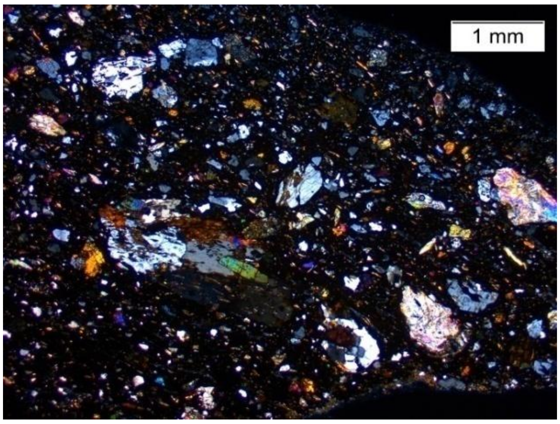
Petrographic parallels and suggested provenance

The composition and general texture are reminiscent of the main Theran fabric that is also characterised by a buff-firing, calcareous volcanic paste (see Akrotiri 03/23 and especially 03/78). However, the marked differences (plagioclase over quartz in the Akrotiri samples, higher presence of amphiboles in the Heraion samples) between the two fabrics do not allow a secure provenance determination as yet. It was perhaps found to be more closely associated with Fabric 4 (especially samples 15/24 and 42; 'Fine micaceous with discrete plagioclase and rare volcanic rocks') from Koukonisi on Lemnos dating to the Mycenaean period (E. Tsai, pers. comm., 2016) (Fig. 7.34:C-D).

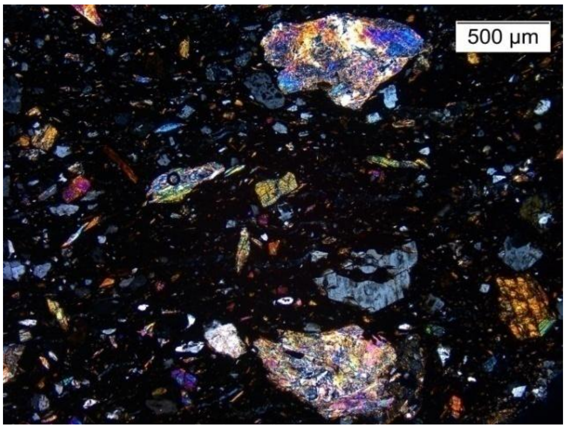
7.4.11 Fabric 29: Epidote-rich metamorphic with very few talc

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/213	Transport jar	MG33	Plain, incised	Heraion II-III	EB II late

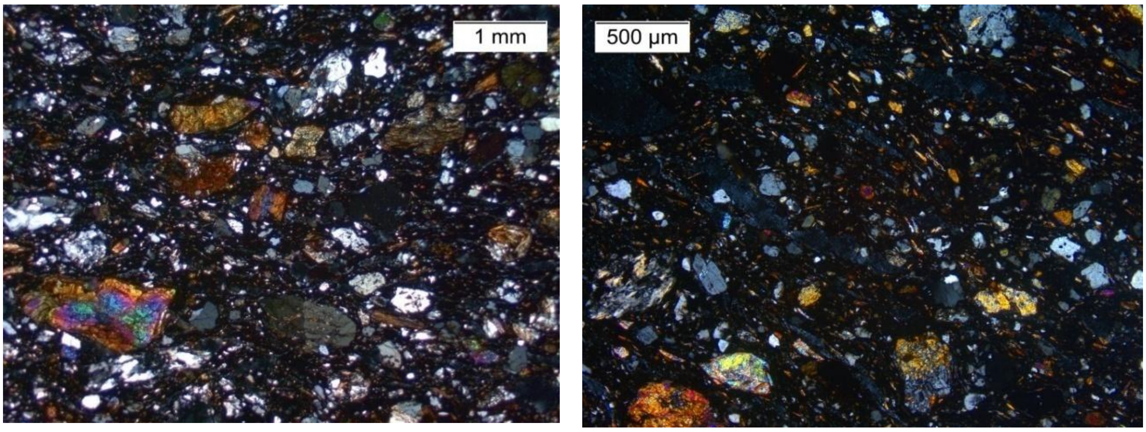
Table 7.34: Samples of Fabric 29.



A



B



C D

Figure 7.35: Micrographs of samples within Fabric 29. A. HR15/213; B. HR15/213 with talc fragments; C. Ayia Irini 97/5; D. Akrotiri 03/131. All images taken in XP.

Composition and technological features

It is characterised by a varied amount of metamorphic rock fragments, including medium-grade metabasites and blueschists to low-grade pelites (quartz-mica schists, chlorite/biotite mica schists with clinozoisite/epidote) and their constituent minerals, with more prominent the epidote-rich content (Fig. 7.35:A-B). The homogeneous dark colour and texture combined with the low optical activity of the micromass indicates that it was fired to a relatively high temperature.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a horizontal, incised handle of a transport collared jar. It is macroscopically very distinctive due to its soapy texture and greasy smoothed surface, as well as its range of inclusions (MG33).

Petrographic parallels and suggested provenance

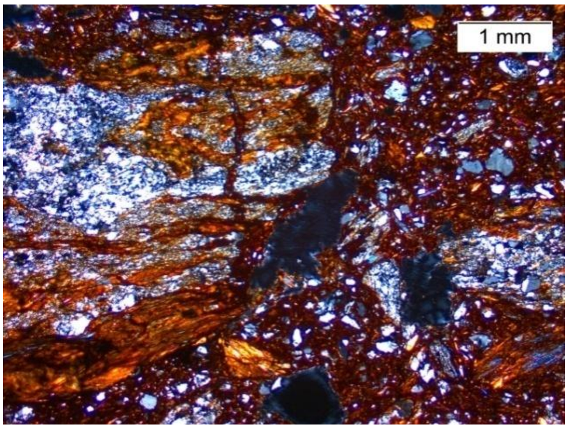
It can be securely classified as a non-local fabric and, therefore, best correlated with Fabric Group 1 from Ayia Irini on Kea, although displaying similarities with more than one of the sub-groups distinguished (Day and Hilditch n.d.). At Ayia Irini this varied fabric covers the majority of the analysed samples and corresponds to the ‘Red brown coarse metamorphic macroscopic group’ as defined by Wilson (1999, 24-42; Day and Wilson 2016, 22-23), that is made up of vessels dating between Phases I-III (LN, EB II developed and late). The probable local provenance of this fabric on Kea has been suggested by the analytical work of Vaughan, Day, and Hilditch (Vaughan and Wilson 1993; Day and Hilditch n.d.). However, the varied nature of the fabric and inherent variability of metamorphic deposits, as well as the fact that other western and central Cycladic islands (Kythnos, Seriphos, Siphnos, Paros, Naxos, and Amorgos) share similar geological features prevents a secure discrimination on petrographic grounds alone. More comparative analytical results are in need before one of these areas can be ruled out as the best potential candidate for provenance.

The high presence of epidote group minerals links the Heraion fabric with Ayia Irini Sub-group 1.1 (‘Red brown coarse metamorphic: epidote-rich’), although the latter indicates a perhaps non Keian source, as suggested by the small number of samples and their relation with ‘Kastri Group’ shapes (Fig. 7.35:C). The small presence of talc in the Heraion fabric provides a probable link with Sub-group 1.4 (‘Red brown coarse metamorphic: talc-rich’). However, the near absence of talc deposits (could relate to the dolomitic limestone outcrops on Kea: see Vaughan and Wilson 1993, 179) from Kea and its dominance on the island of Siphnos (Vaughan and Wilson 1993, 179-180) could indicate a different provenance. ‘Talc ware’ vessels have so far been identified at Ayia Irini Periods II and III on Kea (Wilson 1999, 69, 130-131), Kavos and Dhaskalio on Keros (Broodbank 2007; Sotirakopoulou 2016), Akrotiri on Thera (Sotirakopoulou 1999, 76-79), and Panormos on Naxos (Angelopoulou 2014, 92-93). Other comparative material derives from Akrotiri on Thera (samples 03/15 and 03/131, transport jars with slashed handles; Day and Wilson 2016, 26) (Fig. 7.35:D).

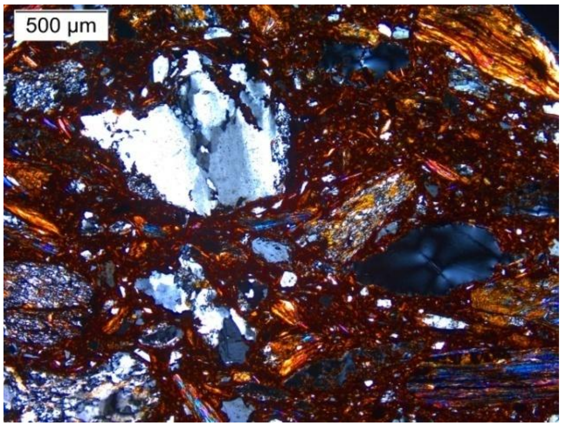
7.4.12 Fabric 30: Muscovite-rich medium-grade metamorphic

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/3	Cheesepot	MG5E	Plain	Bauphase 1	Ch/EB I

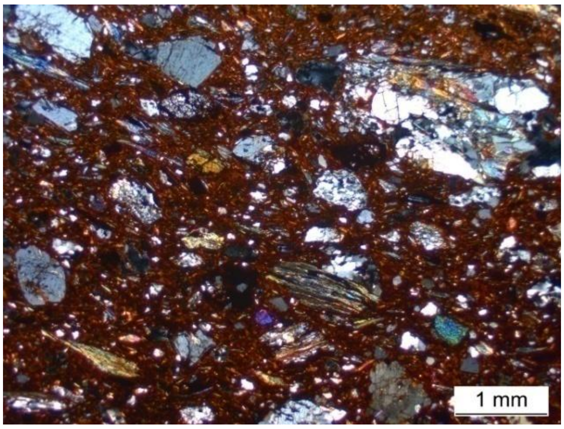
Table 7.35: Samples of Fabric 30.

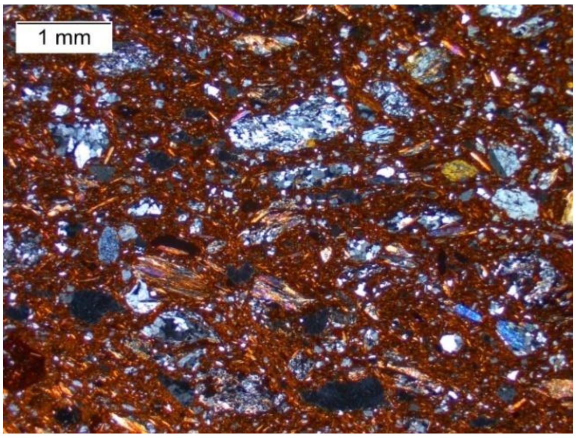


A



B





C D

Figure 7.36: Micrographs of samples within Fabric 30. A-B. HR15/3; C. Ayia Irini 97/26; D. Akrotiri 03/125. All images taken in XP.

Composition and technological features

It is characterised by dominant coarse elongate, mica-dominated, banded schist and phyllite fragments and their dissociated components, and very rare clinozoisite/epidote minerals (Fig. 7.36:A-B). The schist fragments predominantly contain muscovite in association with quartz grains, as well as few biotite/chlorite mica and feldspar minerals, and they are very similar to the quartz-mica banded schists observed in Fabric 29. The micromass appears highly optically active and indicates a low-firing temperature.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a cheesepot dating to the Ch/EB I period. It differs from the rest of the locally-produced cheesepot examples by its bright, orange-red fabric colour and shiny appearance due to the high silver mica-rich content (Chapter 6.5.7, Fig. 6.25:4)

Petrographic parallels and suggested provenance

It can be correlated roughly with the main Keian metamorphic Fabric Group 1 (‘Red brown coarse metamorphic’, especially samples 97/17, 21, 26) from Ayia Irini (Day and Hilditch n.d.) (Fig. 7.36:C). Despite sharing similarities with Heraion Fabric 29, its link with Sub-group 1.6 (‘Red brown coarse metamorphic: micaceous’, especially sample 97/18) and Fabric Group 2 (‘Micaceous red brown metamorphic’, especially sample 97/78) from Ayia Irini, confirms both the internal variation of the metamorphic geology of Kea, if assumed that they are both Keian in origin, and the western Cyclades in general. This could also imply the existence of two different production centres related to Kea itself or another island with a similar geology. The main difference between them is the very rare presence of epidote group minerals and the higher presence of mica schists in the present fabric.

A possible compositional and typological connection can also be established between this fabric and the ‘White mica schist fabric’, or series of fabrics, identified in Kephala-Petras on Crete covering only a *ca*. 10% of the assemblage and almost exclusively encountered in the FN IV period, with only rare examples in EM IA period (Nodarou 2012a, 83, fig. 4; Papadatos and Tomkins 2013, 358). A broadly Cycladic origin has been suggested for this fabric, also strengthened by the vessel types represented (cheesepots, biconical jars), which are considered to have their prototypes in the Cyclades (Papadatos and Tomkins 2013, 360, fig. 6), although its comparison with the Keian fabrics did not reveal identical examples. Similar fabrics have been also reported from the late FN assemblages of Kephala on Kea, and the EB I-II Phylakopi on Melos (Vaughan and Williams 2007, 118, ‘Quartzite and quartz-mica schist fabrics’; Day n.d., sample 97/70, EC II period), Markiani on Amorgos (Vaughan 2006, 99-100, ‘Quartz-muscovite schist fabric’), Akrotiri on Thera (Fig. 7.36:D; Day n.d., sample 03/125, transport jar with slashed handles, EC II late period; Day and Wilson 2016, 26), Panormos on Naxos (Day *et al*. n.d., sample 03/22), and Kavos on Keros (Hilditch 2007, 239, ‘Quartz-mica schist fabric’). Other Keian fabrics are also known from as far as Poros-Katsambas on Crete, appearing in early EM IIA contexts and, therefore, predating those known from elsewhere that date to EB II developed and/or late deposits (mainly collared jars; Day and Wilson 2016, 20, 26).

7.4.13 Fabric 31: Mica-schist metamorphic rocks and amphibole aggregates

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/284	Transport jar	MG35	Light red slipped	Heraion III/IV	EB II late/III

Table 7.36: Samples of Fabric 31.

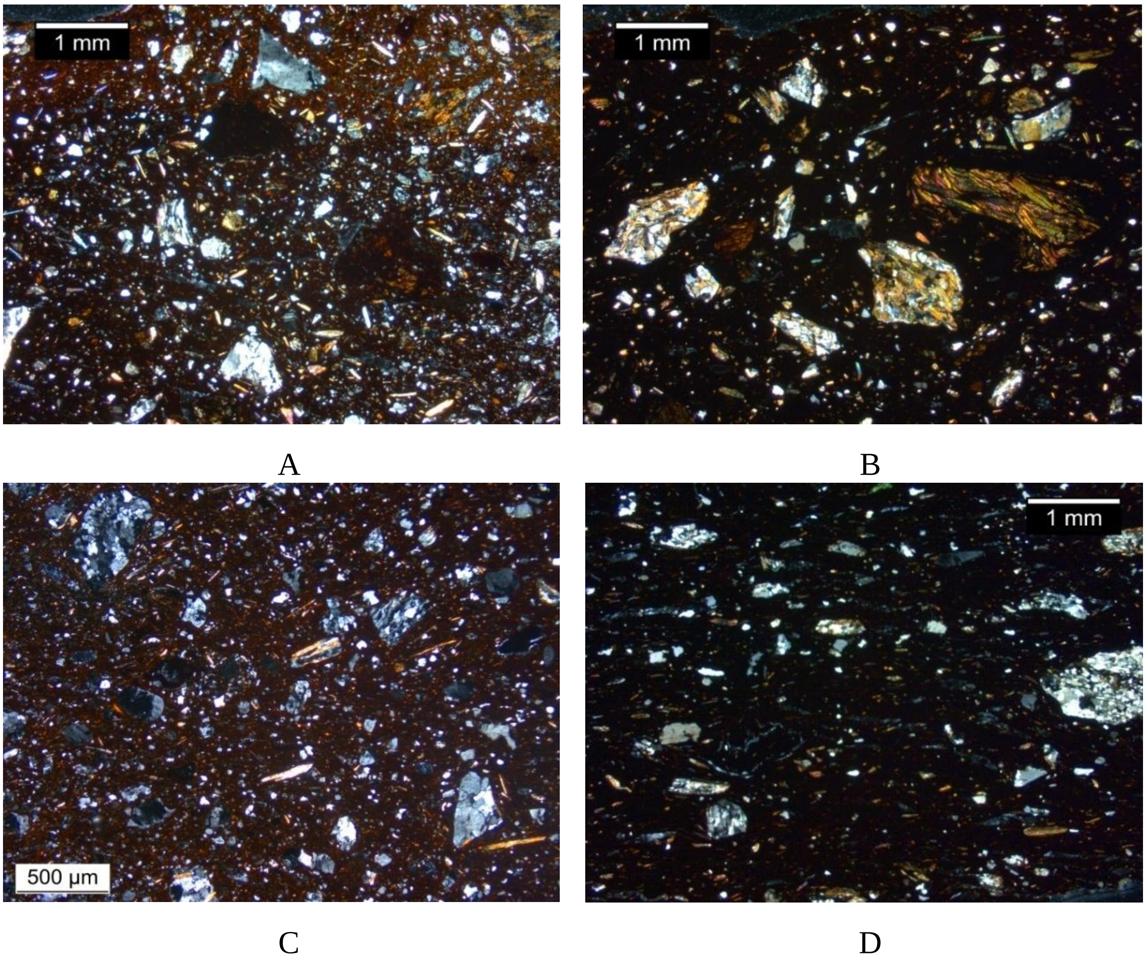


Figure 7.37: Micrographs of samples within Fabric 31. A-B. HR15/284; C. Ayia Irini 97/65; D. Ayia Irini 97/77. All images taken in XP.

Composition and technological features

It is characterised by a range of metamorphic rock fragments similar to Fabric 30, including quartz-muscovite schist, polycrystalline quartz, phyllite and white-mica aggregates (rarely distinct fragments exhibit a characteristic comb structure), but distinguished by the amphibole aggregates and high-grade rocks with tremolite-actinolite alteration (Fig. 7.37:A-B). The micromass appears optically active to optically inactive closer to the core, indicating a relatively high-firing temperature.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a horizontal arched handle of a transport collared jar dating to the EB II late/III period.

Petrographic parallels and suggested provenance

Similarly with Fabric 30, it constitutes an off-island fabric and can be correlated with the coarse metamorphic fabrics known from Kea. It is generally linked with Keian

Group 1 – especially sample 97/77 on the basis of its dark red fabric, mineralogy, opaques and oxidised amphiboles (Fig. 7.37:D), and shape –, although its varied nature does not allow a closer provenance resolution. Despite sharing similarities with the main fabric, this loner presents stronger links with Keian Sub-group 1.3 (‘Red brown coarse metamorphic: quartz-rich fabric’; especially 97/65, 66, 67), on the basis of the reduced amount of mica-dominated schists (Fig. 7.37:C). It has been proposed that this sub-group may represent a discrete raw material source on Kea or even an off-island provenance (e.g. Ios), based also on shape and surface treatment properties (shallow and deep bowls, Day and Hilditch n.d.). It might also relate to the ‘Amphibole-bearing Schist’ fabric defined by Hilditch (2007, 239).

7.4.14 Fabric 32: Red coarse micaceous metamorphic

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/287	Cooking pot	MG5D	Plain	n/a	EB II late/III

Table 7.37: Samples of Fabric 32.

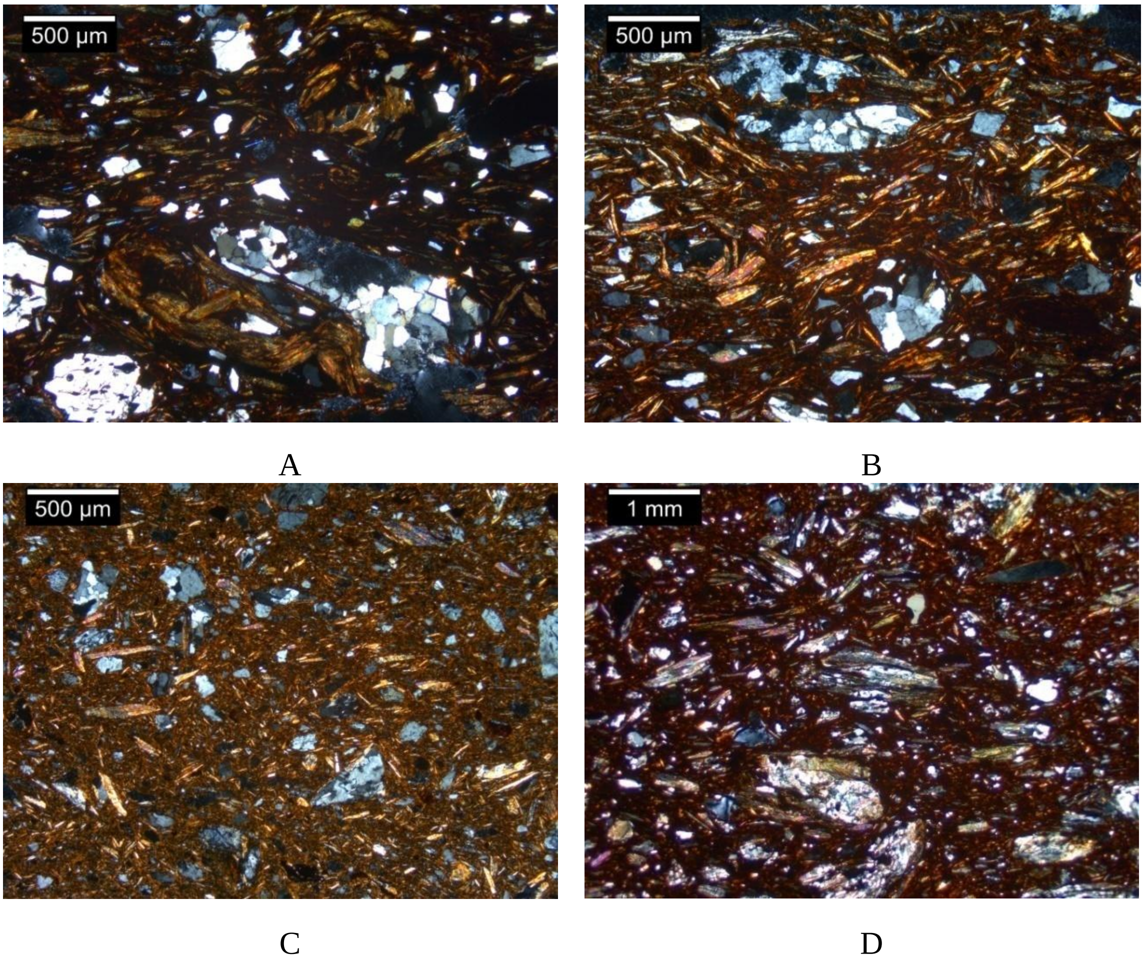


Figure 7.38: Micrographs of samples within Fabric 32. A-B. HR15/287; C. Ayia Irini 97/64; D. Ayia Irini 97/78. All images taken in XP.

Composition and technological features

It is characterised by a well-packed texture, comprised predominantly of white mica laths and aggregates, frequent monocrystalline quartz and possible feldspar crystals, as well as common metamorphic rock fragments as those observed in Fabric 31, however, lacking the dark oxidised fragments and amphibole aggregates (Fig. 7.38:A-B).

Typological/stylistic observations and macroscopic correlations

This loner belongs to a body sherd of a cooking pot with a plain surface. It dates to the EB II late-III period.

Petrographic parallels and suggested provenance

It can be securely ascribed with a non-local provenance and it presents similarities with Fabric 31. The only available comparative fabric that can be roughly correlated with is Group 2 (Day and Hilditch n.d.: 'Micaceous red brown metamorphic fabric') from Kea, although the loner under discussion contains more dissociated mica laths and less quartz-mica schist fragments (Fig. 7.38:C-D). A similar loner fabric is known from Phylakopi on Melos (sample 97/68, jar base, EC II developed) and is taken as a Keian import at this site (Day and Wilson 2016, 26). This could also suggest a Keian provenance for the Heraion sample, although representing a distinct raw material source from Fabrics 30 and 31, or a provenance in a different island of the western Cyclades. Interestingly, the samples of the equivalent Keian sub-group cover the so-called *Anatolianising* shapes that characterise Ayia Irini Period III.

7.4.15 Fabric 33: Red with fine biotite, TCFs, and gneiss/metagranite fragments

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/299	Transport jar	MG32	Light red slipped, incised	Heraion III	EB II late

Table 7.38: Samples of Fabric 33.

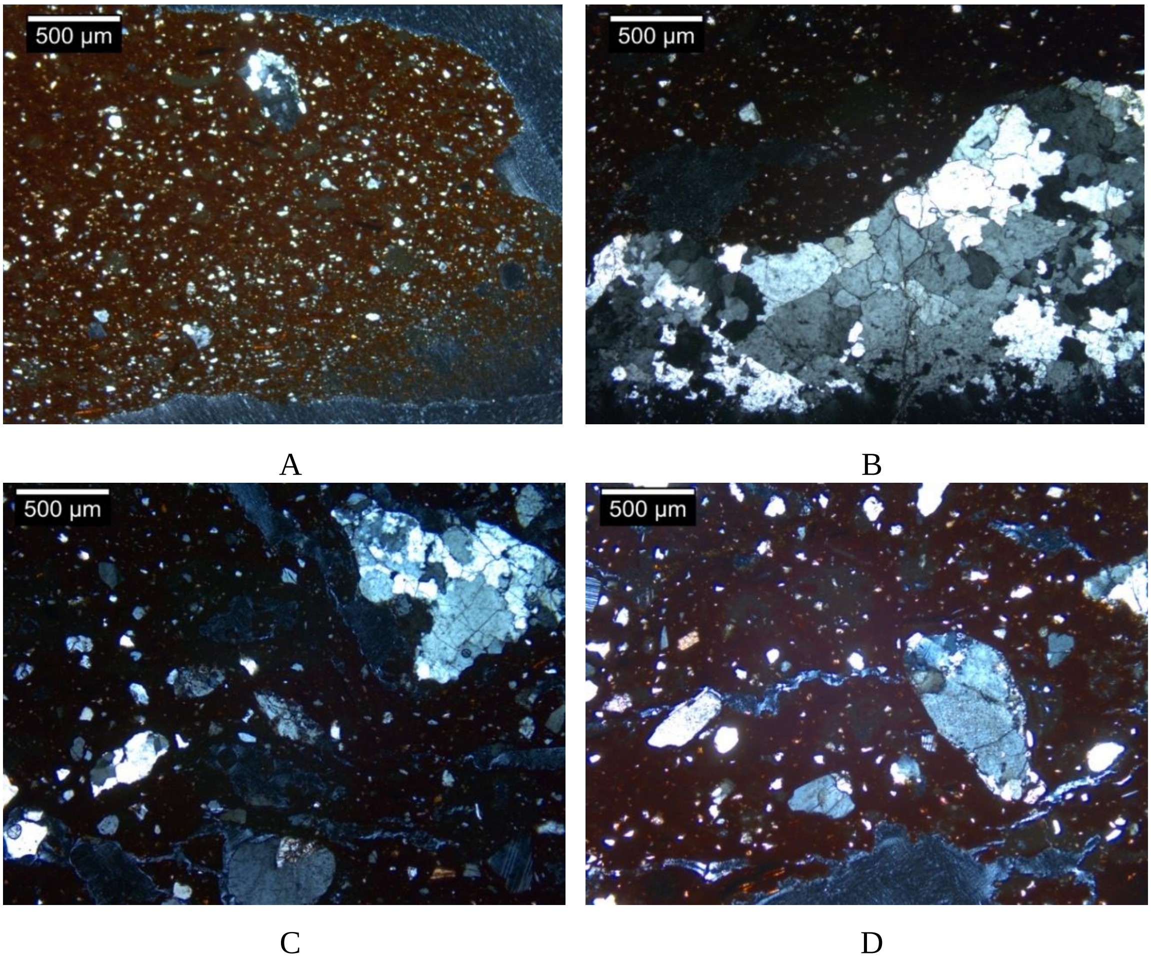


Figure 7.39: Micrographs of samples within Fabric 33. A. HR15/299 with rounded dark greyish brown clay pellets; B. HR15/299; C. Panormos 03/34; D. Panormos 03/34 with a dark red matrix and rounded dark greyish brown clay pellets. All images taken in XP.

Composition and technological features

This reddish brown-firing fabric has a very sparse coarse fraction, comprising mainly of polycrystalline quartz-rich fragments (possibly gneiss), as well as their constituent minerals (quartz, alkali feldspar, plagioclase, biotite mica) and very rare fine-grained volcanic rock fragments of basic composition (Fig. 7.39:B). The fine fraction contains all the above with the addition of some dark mafic minerals, possibly amphiboles or pyroxenes. The groundmass contains optically inactive, greyish red calcareous particles or microvesicles, creating a mottled texture (Fig. 7.39:A). This might indicate mixing of two incompatible clay sources, i.e. a dark red, iron-rich and a pale calcareous clay. The micromass appears moderately inactive, indicating a relatively high-firing temperature.

Typological/stylistic observations and macroscopic correlations

This loner corresponds to an EB II late transport jar with horizontal incised handles. It is macroscopically very distinctive due to its reddish grey-purplish paste colour and light-coloured slipped surface, as well as its hard fabric with calcareous spalls. The surface is covered with a whitish wash and the paste is generally hard.

Petrographic parallels and suggested provenance

This fabric is classified as non-local, due to its characteristic reddish brown-purplish paste, prominent calcareous spalls/haloes and microvesicle voids infilled with micrite, as well as its macroscopic attributes and shape. Similar fabrics corresponding to white slipped storage vessels were recently recorded at Dhaskalio on Keros (Phases B and C) and are possibly related to a local manufacture on Ano Kouphonisi (J. Hilditch, pers. comm., September 2017). A more secure connection can be probably established with Fabric 18 from Panormos on Naxos (especially sample 03/34), which has a similar fine biotite-rich, high-fired groundmass, granitic/metagranitic rock fragments, and some micritic limestone (Fig. 7.39:C-D). Another possible connection is found in petrographic Group H from Kavos Special Deposit North on Keros (Hilditch 2007, 243), which represents white slipped transport jars with incised/slashed handles, similarly to the Heraion loner.

7.4.16 Fabric 34: Metagranitic and quartz-rich metamorphic rocks with coarse muscovite

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/267	Conical-necked jar	MG16	Incised	n/a	EB II late/III

Table 7.39: Samples of Fabric 34.

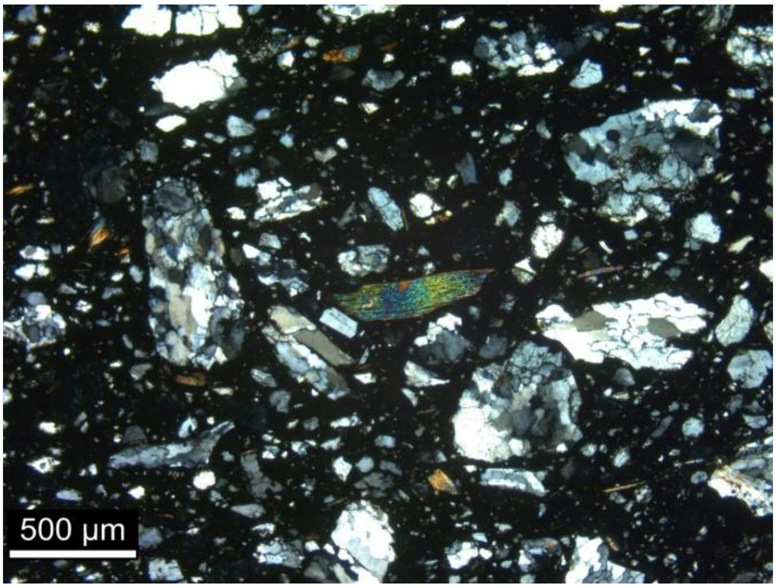


Figure 7.40: Micrograph of sample HR15/267. Image taken in XP.

Composition and technological features

This fabric is characterised by frequent mono- and polycrystalline quartz/quartzite, as well as common quartz-muscovite schist fragments, few metamorphosed acid igneous rocks rarely exhibiting microperthite or granophyric textures, very few coarse/medium-sized muscovite mica laths, etc. It has been fired to a relatively high temperature, according to the generally inactive micromass.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a body sherd of a potential conical-necked jar with incised decoration.

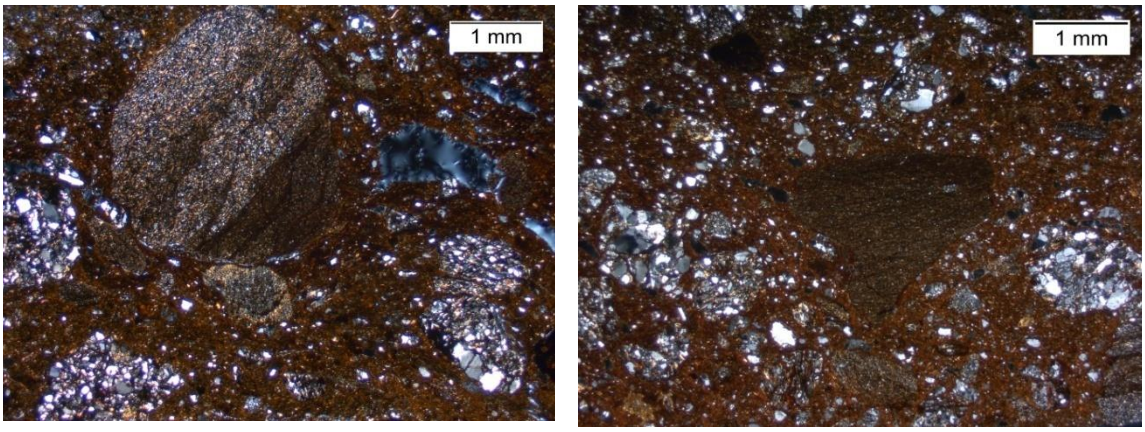
Petrographic parallels and suggested provenance

It constitutes a non-diagnostic fabric at Heraion. The general petrology and combination of low-grade metamorphic and metagranitic rocks with fine green amphiboles and pyroxenes might indicate an origin on Naxos.

7.4.17 Fabric 39: Non-calcareous sedimentary

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/35	Jar/pithos	MG28	Plain	Bauphase 4	EB II developed

Table 7.40: Samples of Fabric 39.



A B

Figure 7.41: Micrographs of samples within Fabric 39. A. HR15/35; B. Ayio Gala 120. All images taken in XP.

Composition and technological features

This fabric is characterised by dominant sedimentary rock fragments. These are mainly fine/medium-grained siltstones that occasionally grade into shale. Other non-plastic inclusions are common sandstone fragments, as well as very few slate/shale fragments, rare chert, and their dissociated minerals set in a relatively fine groundmass (Fig. 7.41:A). Some vegetal temper was also present according to rare planar voids. The optically active micromass implies a low-firing temperature.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a rim fragment of a collar-necked jar. It is macroscopically very diagnostic due to the prominent presence of sand-sized inclusions that differ from other assumed local fabrics. It corresponds with MG28.

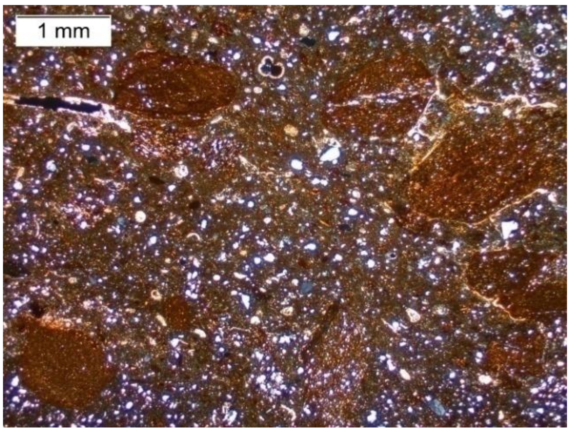
Petrographic parallels and suggested provenance

This is a non-local fabric and finds very close parallels in Main Group 1A: 'NW autochthon fabric'; Fig. 7.41:B) and Sub-group 'Slatey sedimentary fabric' from NL Chios (Lambrechts in progress; pers. exam. of thin sections, February 2017). This Chian fabric covers 1/4 of the thin sections analysed and it exhibits some variability in terms of the frequency of sedimentary rocks, firing, and textural features.

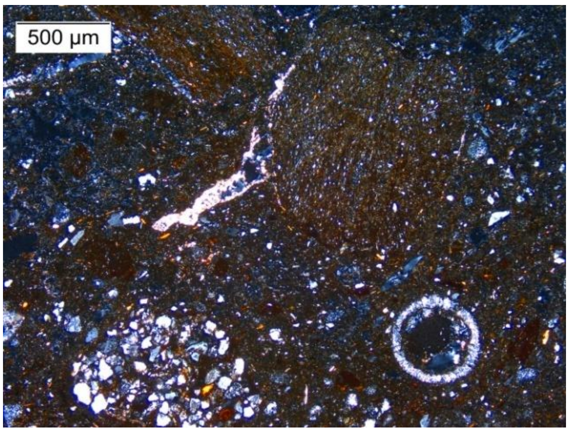
7.4.18 Fabric 41: Calcareous low-grade metamorphic rocks (mainly phyllite) with sedimentary rocks and microfossils

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/141	Transport jar	MG27	Plain	Heraion I	EB III/MB?

Table 7.41: Samples of Fabric 41.



A



B

Figure 7.42: Micrographs of sample HR15/141. All images taken in XP.

Composition and technological features

This buff calcareous fabric is compositionally characterised by frequent low-grade metamorphic rock fragments (mainly reddish brown phyllite), common micrite clots and microfossils (foraminifera and possibly also bioclasts), as well as other secondary inclusions. Judging by the slightly optically active to moderately inactive micromass, it is probably relatively high-fired.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a horizontal handle with possible grooved decoration of a transport jar. It is macroscopically very diagnostic and it most probably dates to the early MBA.

Petrographic parallels and suggested provenance

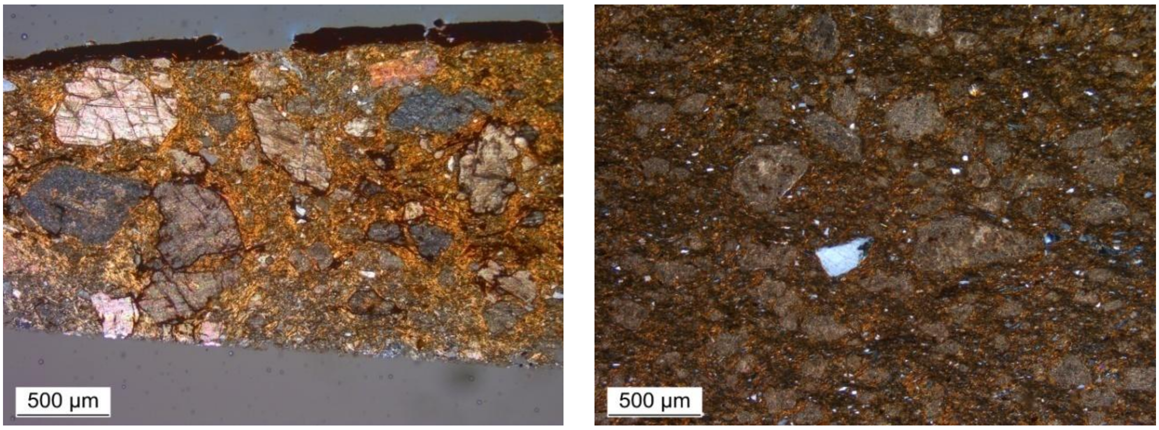
It can be securely ascribed with an off-island provenance and its general lithology is compatible with an origin on Crete. More particularly, a very similar fabric has been identified in sample 95/407 (MM IB, dish) from Knossos, and less likely in samples 09/109, 110, and 116 (MC, Phase A) from Akrotiri on Thera (Fabric 3: 'Frequent low grade metamorphic rocks, dominantly phyllite, with chert'), although appearing with a low calcareous groundmass (Day *et al*. forthcoming). A possible provenance might be suggested in north-central Crete and the Phyllite-Quartzite Series NW of Herakleion.

7.5 Fabrics with unclear or unknown provenance

7.5.1 Fabric 8: Limestone-tempered

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/16	Tankard	MG9	Red slipped and burnished	Heraion I/II	EB II developed/late
HT12/33	Tankard	MG9	Red slipped and burnished	Heraion I/II	EB II developed/late
HR15/147	Two-handled bowl	MG9	Red slipped/black-topped and burnished	Heraion II	EB II late
HR15/154	Two-handled bowl	MG9	Red slipped/black-topped and burnished	n/a	EB II late?
HR15/157	Two-handled cup/bell-shaped	MG9	Red slipped and burnished	Heraion II	EB II late
HR15/200	Tankard	MG9	Red slipped and burnished	Heraion II-III	EB II late

Table 7.42: Samples of Fabric 8.



A B

Figure 7.43: Micrographs of samples within Fabric 8. A. HR15/147 with a slip layer; B. HR15/157. All images taken in XP.

Composition

This fabric is predominantly characterised by limestone fragments, mainly a-sr calcite crystals. These are either fresh and display perfect cleavages and lamellar twinning, or altered and exhibit the relict primary form of sparite. These distinct rhombohedral crystals are probably related to metamorphosed limestone (Fig. 7.43:A). The calcite occasionally grades into micrite of various sizes occurring as sr grains or clots with no clear margins (HR15/157), which would seem to indicate the alteration of calcite during firing (Fig. 7.43:B). Sample HR15/154 contains larger quartz grains and less calcite than the rest of the samples, but shares the same groundmass.

Technological features

It is homogeneous in terms of texture and composition, seemingly related to the addition of calcite fragments in a red-firing groundmass. The addition of soft limestone fragments perhaps implies a rather gentle tempering method that involves crumbling the raw material simply by hand rather than crushing it with the aid of a tool.

Tempering aims at enhancing the properties of the clay body during manufacture by improving workability through decreased plasticity, smoother drying, elimination of cracking, reduced shrinkage, as well as the mechanical features of the finished product (Kilikoglou *et al*. 1998). This could point to a number of explicit technological choices by the potters, related to raw materials selection and firing control. Although previous theories have favoured the presence of calcite in the clay paste for minimising the effect of thermal stress on the vessel due to the similar thermal expansion coefficient of clay base and temper (Rice 1987, 229; Shoval *et al*. 1993), recent work has demonstrated a contradicting picture. According to this, calcite can affect performance in other stages of the manufacturing sequence such as increasing the workability of the raw clay (Müller *et al*. 2014, 265) and allowing the manufacture of thinner vessels that are resistant to mechanical stress (Hoard *et al*. 1995). Such thin-walled vessels are represented in the fabric under discussion.

Distinct, non-calcareous slip layers have been identified in samples HT12/33 and HR15/147 deliberately used to create a distinction between the dark finish and an otherwise light-fired fabric (Fig. 7.43:A). The majority lack the slip layer, but exhibit areas near their surface with slightly different optical activity due to compaction resulted from burnishing.

Typological/stylistic observations and macroscopic correlations

It forms a very consistent group in shapes and surface treatment, corresponding to MG9. The macroscopic fabric can be easily recognized due to the dominant presence of white/beige-coloured, soft-textured mineral fragments that stand out from the rest. All samples belong to EB II late drinking vessels, namely tankards and two-handled cups/small bowls.

Petrographic parallels and suggested provenance

The addition of carbonates in the clay paste finds a number of technological links within the EB Aegean and neighbouring regions in general. More particularly, it constitutes a well-known, long-lasting practice that is named, occasionally interchangeably, as limestone-tempered, calcite-tempered, or marble-tempered fabrics/wares, although these terms reflect the use of different carbonate materials with a distinct petrographic signature under the microscope. It has been identified, either macroscopically or petrographically, by previous work undertaken mainly in Crete and the Cyclades. In Crete, this phenomenon is widespread during the Prepalatial period. Tomkins' integrated study of EN pottery from Knossos has led to the identification of a range of limestone-tempered fabrics. These reflect different technological choices undertaken by local potters in terms of clay mixing and tempering (Tomkins and Day 2001, pls. 2-5; Tomkins *et al*. 2004, 52, fig. 2.Ia-h). This tradition seems to be particularly common also in FN and EM I-IIA periods elsewhere in Crete, such as Kavousi region and Myrtos-Fournou Korifi EM I-IIA for the manufacture of cooking pots (baking pans/plates) (Day *et al*. 2005, 180). Similar fabrics are found widely in western Crete (Moody *et al*. 2003, 64-65) and have been analytically studied in a number of EM I-IIB sites (Chania, Debla, Nopigeia) in the form of crushed calcite temper (Nodarou 2011, 41, 43-44, 50). Calcite-tempered EBA cooking pots are also known from the survey pottery from Antikythera Island to the NW of Crete (Pentedeka *et al*. 2010, 41-47).

The site of Petras provides a more varied picture of the calcite-tempering practice with the FN IV material from Kephala being most probably imported from other Cretan sites. It continues with changes in EM IA and increases in the EM IB Rock Shelter (Nodarou 2012a, 84-85, fig. 6a-b). The EM IB calcite-tempered fabrics correspond to a ‘foreign’ style pottery assemblage (Dark burnished and/or incised ware bottles, chalices, globular and cylindrical pyxides, and bowls) of the so-called ‘Kampos Group’ of the Cyclades and find close parallels at Ayia Photia (Day *et al*. 1998; 2012), Gournes, Pyrgos burial cave, Poros-Katsambas (Wilson *et al*. 2004, 69), Livari Skiadi cemetery (Nodarou 2012b, fig. 1; Papadatos and Sofianou 2015, 39), and Agios Charalambos burial cave (Langford-Verstegen 2015, 10). The most favoured argument for Petras, as well as the rest of the sites mentioned above (e.g. Ayia Photia: Day *et al*. 2012, 122-123, Fabric 3), is directed towards the coexistence of off-island (Cyclades) and locally-produced fabrics (Papadatos and Tomkins 2013, 363).

Due to the non-diagnostic composition of this fabric it is not possible by petrographic grounds alone to establish a secure provenance for Heraion, either linked directly with a Cycladic production centre(s) based mainly on evidence of stylistic affinities (Cycladic/*Cycladicising* shapes), or being produced in western Anatolia. What can be confidently stated is that the calcite-tempering practice holds a strong Cycladic tradition and the best known EB I Cycladic parallels derive from Agrillia on Ano Kouphonisi, Agioi Anargyroi and Tsikniades on Naxos, and Kampos on Paros (Day *et al*. 2012, 130, pl. 67:E-F), while comparative examination of material from sites including Phylakopi on Melos (samples 30 and 31, EC I-II transport jars), Akrotiri on Thera, Agia Irini on Kea, Panormos on Naxos (Day *et al*. n.d., Groups 13 ‘Marble fabric’ and 15 ‘Calcite-tempered fabric’), and Markiani on Amorgos (Vaughan 2006, 99-100, ‘Marble fabric’) did not reveal any matching fabrics.

More recent analytical work undertaken at Çukuriçi Höyük revealed a series of locally-produced marble-tempered fabrics used for the manufacture of coarse vessels (mainly pithoi) and dating to the LCh and EB 1 periods (Peloschek 2013, 45, bottom fig.; 2016b, 194-195, fig. 2c; 2017, 132, fig. 6.3:8). The closest match with the Heraion fabric was identified in the Miletus ceramic thin sections, belonging to one possible tankard sample (Knappett and Hilditch in progress, sample 290; pers. exam. of thin sections).

From this presentation of fabric parallels it can be concluded that no direct link can be established with the Cycladic tradition as is the case for Crete, since the Heraion fabric differs in terms of chronology, shape, surface finishing, as well as compositional and textural features. On the contrary, the Milesian example provides the best compositional, chronological, typological, and morphological link and it probably implies a common production centre. Beyond provenance determination and mere technical explanations (functional and mechanical properties of clay recipe), the afore-described situation indicates the practice of a technologically similar pottery manufacturing tradition in different locations across the Aegean that can be explained in the context of long-lived intergenerational tradition and shared technological knowledge between the various areas/sites, the engagement in interregional exchange networks, movement of craftspeople and subsequent expression of identity (e.g. Day *et al*. 2012, 137; Vaughan 1994).

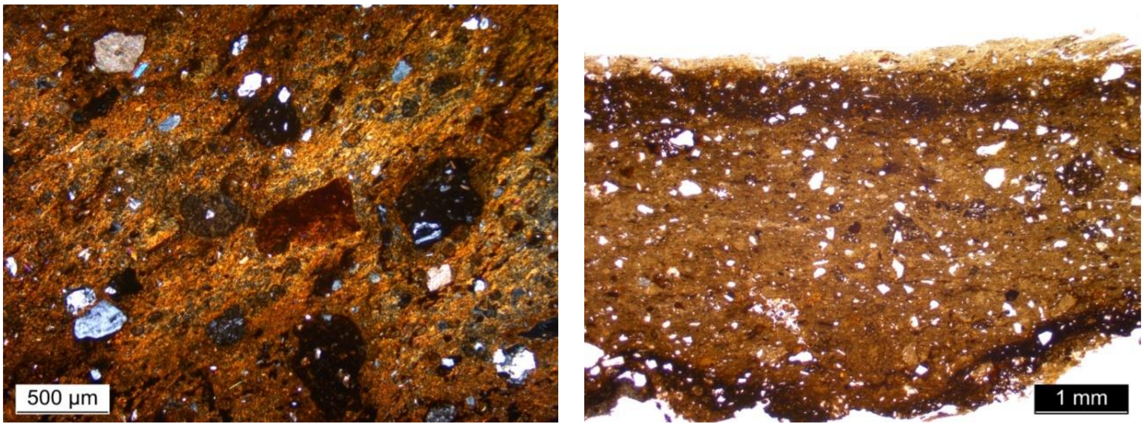
7.5.2 Fabric 9: Grog-tempered with calcite and metamorphic rocks

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/48	Pyxis	MG13	Black burnished and incised	Bauphase 1	EB I/II early
HR15/52	Pyxis	MG13	Black burnished and incised	Bauphase 2	EB I/II early
HR15/78	Pyxis	MG13	Black burnished and incised	Bauphase 1	EB I/II early
HR15/79	Pyxis/jug	MG13	Black burnished and incised	Bauphase 2	EB II early
HR15/83	Pyxis	MG13	Black burnished and incised	Bauphase 1	EB I/II early

Variants

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/122	Jug?	MG13	Plain, incised	Bauphase 3	EB II early
HR15/250	Pyxis	MG13	Incised and impressed	Heraion 1	EB II developed

Table 7.43: Samples of Fabric 9.



A B

Figure 7.44: Micrographs of samples within Fabric 9. A. HR15/48, taken in XP; B. HR15/78, taken in PPL.

Composition and technological features

This fabric is characterised by grog and calcite temper, although the latter in much less quantities, set in a fine groundmass (Fig. 7.44:A). The majority of samples display some colour differentiation in the form of dark clay striations that might relate to oxidation processes or the incomplete combustion of the rare vegetal matter (e.g. HR15/48, 78; Fig. 7.44:B). In a few examples there appear also cracks surrounding the coarse inclusions, always infilled with a black anisotropic substance that could possibly relate to the differential thermal expansion between grog and the host matrix.

The most diagnostic feature in this fabric is the occurrence of grog fragments and clay concentration features, of which three different types could be recognised. The limited quantity of grog indicates that its significance goes beyond an often assumed technological/technical role (mechanical and physical properties), but rather implies a more cultural/symbolic use that relates to its processing and preparation than its form as a reusable by-product. Rather than being significant for consumers, the practice of grog tempering seems to embody certain socially-constructed concepts (Kiriatzi *et al*. 2016). This is also suggested in Petras-Kephala material, where the change in the amount of grog from the FN to the EM IA does not correspond to changes related to firing technology or visual appearance of vessels and surface treatment (Nodarou 2012a, 86).

Typological/stylistic observations and macroscopic correlations

The samples belong to body sherds of closed vessels (pyxides and/or small jugs) that are macroscopically very distinctive (MG13), due to the fine soft and light grey fabric, thin walls, and black slipped/polished exterior. The surface is decorated with incised linear patterns (zig-zags, single or multiple chevrons), infilled with white encrustation, as well as occasionally with impressed circular indentations. Other sherds with dark burnished surface and incised-and-encrusted decoration have been also identified in drawings of the original excavation notebooks (Kyrieleis and Kienast 1981) and, therefore, no observations can be made regarding their fabric. These belong most probably to closed vessels and a lid of the EB I-II early periods (Contexts A32/7 Nr.5; A32/8, E49/8, E49/11,E50/13, E68/13).

Petrographic parallels and suggested provenance

This constitutes a non-diagnostic fabric for Samos, although no direct petrographic parallels have yet been identified, also because grog-tempered fabrics are not always easy to distinguish from other clay-rich concentration features (Whitbread 1986; Cuomo Di Caprio and Vaughan 1993). A brief discussion on the occurrence of similar fabrics and their dissemination in the broader NL and EBA Aegean is attempted below, with the aim to provide a comparative typo-chronological and socio-technological framework.

The grog-tempering technological practice holds a long tradition since the LN/FN and continues, although with substantial changes, into the EB I-II periods across the southern and central Aegean, western Greece, and adjacent islands (Broodbank and Kiriatzi 2007, 250). Its origins, transmission, and widespread use signify a shared technological knowledge across regions, although a thorough spatiotemporal investigation of this phenomenon has yet to be undertaken. Examples of grog-tempered fabrics, with varying quantities of grog or in combination with other inclusions, have been identified in the MN and LN pottery from the Cave of the Cyclops on Youra (Quinn *et al*. 2010, 1046, fig. 4f), the LN and FN pottery from Euripides Cave on Salamis (Whitbread and Mari 2014, 86, fig. 6h; with references about other FN sites), and more recently the NL Emporio on Chios where they are considered local products (B. Lambrechts, pers. comm., January 2017).

More is known about the long-lasting tradition of grog-tempered fabrics from Crete, which is commonly practiced during the FN IV and EB I-II periods and is thought of as a ‘local’ rather than an island (Cyclades) phenomenon (Day *et al*. 2012, 135-138). More evidence exists about east and central Crete. Recent analytical work on pottery from FN and EM I from Kephala-Petras demonstrated that this fabric or series of fabrics are compatible with a local provenance and are encountered in high percentages (80% in FN, 98% in EM IA, main fabric in EM IB), covering all kinds of shapes and sizes, and almost all wares. It is noteworthy that the presence of grog temper becomes denser in the EM IA creating some textural differences from the earlier period (Nodarou 2012a, 82-83, figs. 1-2). Interestingly, a new fabric appears in the EM IA that contains grog and minor calcite temper, which is relatively rare at Petras (Papadatos *et al*. forthcoming). In the EM IB a more complicated picture emerges with the appearance of the so-called 'Cycladic style' ceramic shapes at Aghia Photia in east Crete and Poros-Katsambas (e.g. 97/75, 98/36, 46, 48) in central Crete, corresponding mainly to dark-burnished ware vessels known from the EC I late 'Kampos Group' material in the Cyclades (cf. Karantzali 2008; Wilson *et al*. 2008). The analysis of such vessels together with the 'Minoan style' ones demonstrated that there is a hybrid tradition combining calcite and grog temper, alongside the 'normal' calcite-tempered and grog-tempered fabrics (Day *et al*. 2012, 123-124, pl. 68D, Fabric 4).

Possible grog-tempered fabrics have been also identified in western and central Anatolia, implying technological transfer across distant regions. For instance, examples are noted from Çukuriçi Höyük dating in the EB I period (Peloschek 2016b, 194, fig. 2b), which appear with very few calcite fragments and few metamorphic rock fragments. A single sample (03/11) with grog temper has been detected at Liman Tepe EB I-II period corresponding to a dark grey burnished ware pyxis, although its provenance is yet to be determined. The hybrid tradition of grog and calcite-tempered fabrics has been recently detected in at least three EBA sites in the Konya plain in central Anatolia.[19] Indirect evidence of imported grog-tempered fabrics on Crete is recorded through the identification of stylistic affinities (pierced or unpierced tubular lugs) between EN-MN Knossos amd SW Anatolia and the eastern Aegean (Tomkins 2007, 23, 25, fig. 1.3:25).

With respect to provenance, it can be argued that the fabric in question is more likely imported at Heraion, based on a combination of typological, morphological, and decorative information. More particularly, the dark burnished surface with incised-and-encrusted decoration recalls the so-called frying pans of EC I late ('Kampos Group') and EB II Keros-Syros. These multi-meaning, symbolic vessels were made in various fabrics (e.g. calcite-tempered) and circulated across the Aegean (cf. Coleman 1985; Marthari 2017). Similar wares, although generally lacking the white encrustation, are

[19] http://www.bsa.ac.uk/index.php/research/projects-cat/302-the-konya-plain-project (Fig. 5).

also known in other shapes of the 'Kampos Group' material from the Cyclades and Crete (see discussion in Fabric 8), the presence and distribution of which in Crete suggests differential patterns of exchange and production (Day *et al*. 2010, 214-215). The 'Kampos Group' phase is considered by some researchers as evidence for an Anatolian cultural manifestation in the Aegean between the EC I and II or even cultural relations with Transylvania (Daróczi 2012). Interestingly, frying pans with this decoration have been identified as far as at Liman Tepe (phase VI 1d) (Kouka 2009, 146, fig. 7; Kouka and Şahoğlu forthcoming). The dark incised and encrusted ware has a long tradition in sites of the eastern Aegean and western/central Anatolia especially during the EB I, e.g. Liman Tepe EB I middle/late (Kouka and Şahoğlu forthcoming; lids, pyxides, jugs, bowls), Troy Ic-d (Blegen *et al*. 1950, fig. 238, 253; Fidan *et al*. 2015, 68-69, fig. 3), Emporio V-IV on Chios (Hood 1981, 419-421, inv. no. 1337-1355, pl. 55 [1338]), EB I Küllüoba phase 2 (Efe and Sari 2000, pl. 21:9-11) and mainly in EB II late Küllüoba phase IV D (Sari 2009, 93, fig. 11:2, pl. 7:25).

7.5.3 Fabric 11: Common silt/sand-sized quartz and muscovite mica

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/43	Bowl/cup	MG8	Black slipped and burnished	Heraion I/II	EB II developed/late
HT12/44	Tripod bowl	MG8	Black slipped and burnished	Heraion II	EB II late
HR15/145	Handleless cup	MG7A	Red/black slipped and burnished, ribbed	Heraion I	EB II developed
HR15/146	Tankard	MG7A	Red/black slipped and burnished	Heraion I/II	EB II developed/late
HR15/156	Tankard?	MG7A	Red slipped and burnished	Heraion II	EB II late
HR15/193	Tankard?	MG7A	Red/black slipped and burnished	Heraion II-III	EB II late
HR15/197	Cup	MG10	Red slipped	Heraion IV?	EB III?
HR15/264	Bowl/cup	MG8	Black slipped and burnished	Heraion I/II	EB II developed/late
HR15/290	Depas amphikypellon	MG7A	Reddish brown/reddish grey slipped	n/a	EB II late

Table 7.44: Samples of Fabric 11.

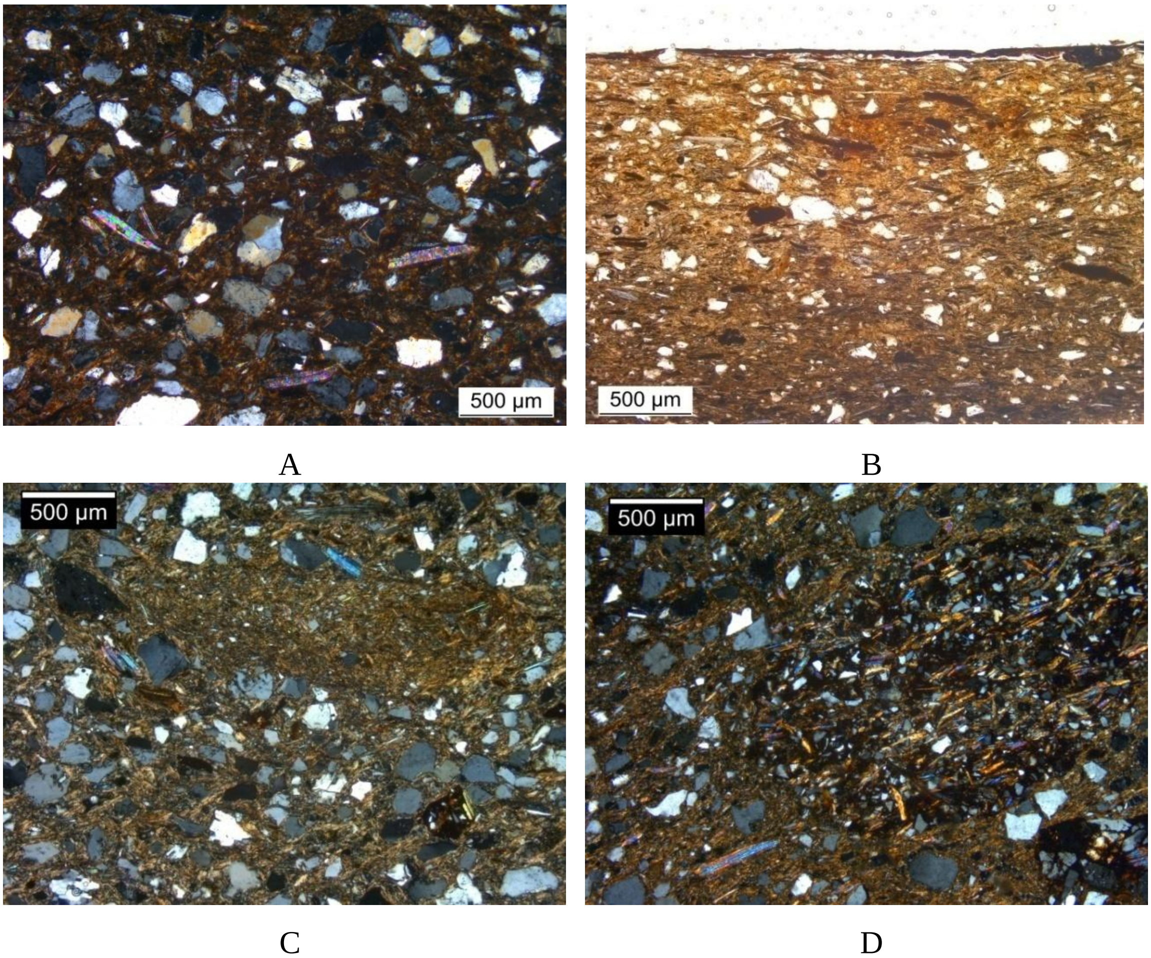


Figure 7.45: Micrographs of samples within Fabric 11. A. HT12/43; B. HR15/145 with a slip layer; C. HR15/146 with a clay pellet; D. BT03/4 with a clay pellet. All images taken in XP except for B.

Composition and technological features

This fabric is characterised by the dominant presence of sa-sr quartz and medium- to coarse-sized muscovite laths with a pronounced long axes orientation parallel to the vessel margins (Fig. 7.45:A). The weakly bimodal to unimodal grain size distribution and the uniformity of its constituents suggest that the clay was either tempered with a residual sandy sediment rich in silicate minerals (Menelaou *et al*. 2016, 486), or weakly processed by sieving or levigation. The presence of TCFs, probably clay pellets, of denser and finer, highly micaceous texture that are usually distinctive from the rest of the micromass could rather indicate the mixing of two clay sources (e.g. HR15/146, 197; Fig. 7.45:C). Some samples exhibit traces of a thick dark red/orange (HR15/145, 146, 156, 193) to dark brown/black (HT12/43) slip layer that can be better distinguished in XP (Fig. 7.45:B). Other examples exhibit darker areas close to the margins that might relate to compaction of the surface due to smoothing or burnishing (HR15/197).

Typological/stylistic observations and macroscopic correlations

The samples display a typological and chronological uniformity, corresponding to tableware vessels such as tankards, bowls/cups, one depas amphikypellon, and one tripod bowl, all dating to the EB II late period. They are characterised by a red or black slipped and burnished surface (Milojcic 1961, pls. 35:26, 46:4, 48:29).

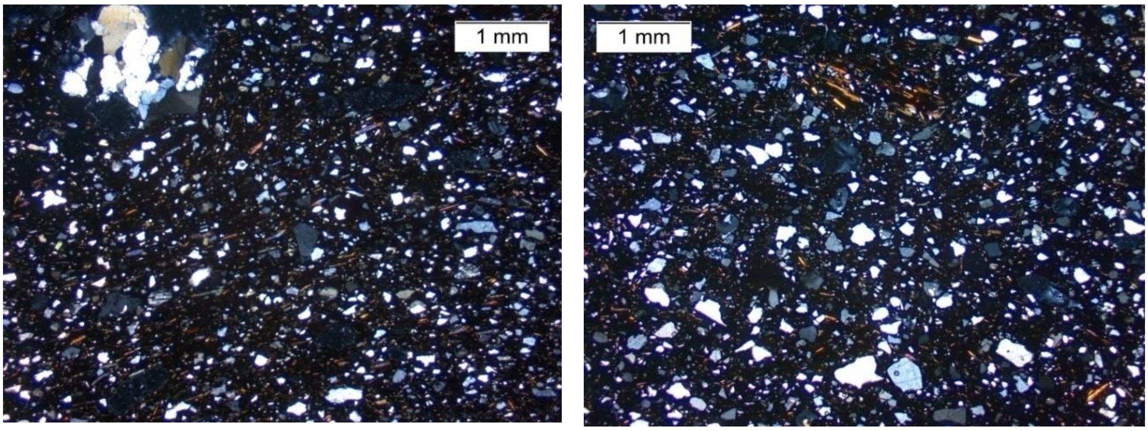
Petrographic parallels and suggested provenance

Its mineralogy reflects an alluvial metamorphic environment. Comparative examination of the Bakla Tepe thin sections suggested a non-local provenance for Heraion, according to chronological (EB II late), typological (mainly 'Anatolian-derived' drinking shapes like tankards, two-handled cups, shallow bowls), and technological (indications of clay mixing, see BT03/04 and BT03/36 in Day *et al*. n.d.) correlations. Fabric Group 2 'Coarse quartz and silica-rich rock fragments' (Day *et al*. n.d.) from Bakla Tepe provides very close parallels (Fig. 7.45:D). At Bakla Tepe, the equivalent fabric is determined as local and is used for the manufacture of burial jars among other shapes (Day *et al*. 2009, 342). Some differentiation exists in terms of the chalcedonic quartz ratio in the clay paste.

7.5.3.1 Sub-fabric 11A: High-fired with coarse quartz and muscovite mica

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/22	Jug	MG7B	Red slipped and burnished	Heraion I	EB II developed

Table 7.45: Samples of Sub-fabric 11A.



A B

Figure 7.46: Micrographs of samples within Sub-fabric 11A. A. HT12/22; B. BT03/33. All images taken in XP.

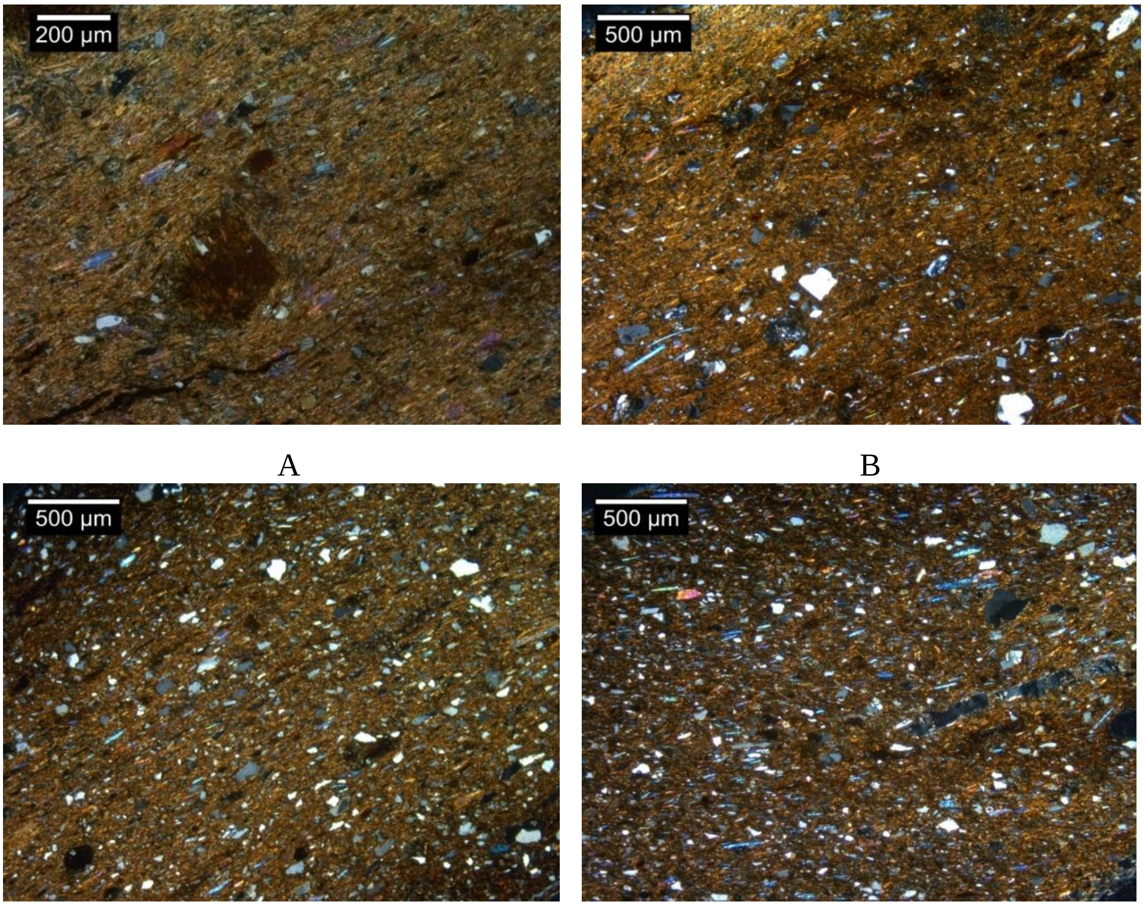
Comment

This sample is compositionally compatible with Fabric 11, although standing out due to its well-packed texture. The groundmass appears darker and with better sorted quartz grains (Fig. 7.46:A). It also probably reflects a higher temperature according to the optical inactivity of the micromass. The suite of inclusions matches the main fabric group, although there appears rare chalcedonic quartz with a radiating texture. The latter might provide a more secure link with Sub-group 2a from Bakla Tepe (Fig. 7.46:B). The sample represented corresponds to a jug of the EB II late period.

7.5.4 Fabric 12: Fine micaceous metamorphic with common muscovite mica

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/144	Short-necked cup	MG7A	Red/black slipped and burnished	Heraion I	EB II developed
HR15/219	Short-necked cup	MG8	Dark grey/black burnished	Heraion II-III	EB II late
HR15/252	Flask-shaped jug	MG8	Black slipped and burnished, grooved	Heraion II-III	EB II late

Table 7.46: Samples of Fabric 12.



C D

Figure 7.47: Micrographs of samples within Fabric 12. A. HR15/144; B. HR15/219; C. LT03/17; D. LT03/18. All images taken in XP.

Composition and technological features

This fabric constitutes a finer version of Fabric 11 and is characterised primarily by common-few muscovite mica and monocrystalline quartz. It displays some very diagnostic textural features, such as the very crude long axes orientation of the large muscovite laths parallel to the vessel margins and the strongly optically active micromass which creates elongated zones and high birefringent streaks (striated b-fabric) (Fig. 7.47:A-B). The strong alignment of mica is perhaps related to the clay paste manipulation (kneading) or may indicate the forming method used. All samples exhibit striations of a darker colour that are possibly indicative of clay mixing or incomplete wedging of the clay base. A distinct, dark red slip layer is observed in sample HR15/144.

Typological/stylistic observations and macroscopic correlations

This chronologically and typologically consistent group is comprised of EB II late drinking and serving vessels, namely short-necked cups and a flask/jug with characteristic grooved decoration. All samples are diagnostic of the 'Kastri Group' or 'Anatolianizing' shapes.

Petrographic parallels and suggested provenance

The general texture (strong alignment of voids and mica, common muscovite, high-birefringent fabric, dark oxidised clay pellets of finer consistency, clay striations) and strong similarity with Anatolian fabrics imply an off-island provenance. The strongest link was found in Fabric 3 (especially samples LT03/17 and 03/18) from Liman Tepe (Fig. 7.47:C-D), which includes the same range of red/black slipped and burnished shapes (tankards, one-handled cups, depas amphikypellon, askos; Day *et al*. n.d.). Nevertheless, its provenance at Liman Tepe could not yet be defined and is taken as non-local (Day *et al*. 2009, 341). Although less similar, a possible link can also be established with Fabric 1 from Bakla Tepe, which contains similar inclusions and occasionally the characteristic muscovite laths (Day *et al*. n.d.). It is potentially local, although too fine to allow a precise geological provenance determination, and is also comprised of drinking and serving vessels (tankard, depas, two-handled cups, shallow bowls, plate, jug/jar). Perhaps the strongest parallels were identified in Miletus Period II thin sections (especially samples 262, 268, 291) (pers. exam. of thin sections, November

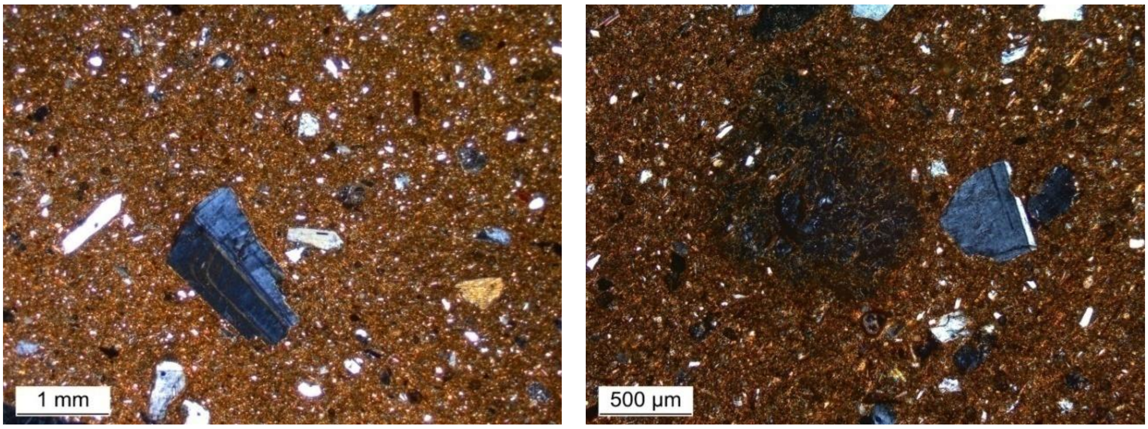
2016). These Milesian micaceous fabrics comprise potential central Anatolian imports (Knappett and Hilditch 2015, 201) and are also typologically consistent with what is considered as ‘Anatolian-type’ products (one-handled tankards, depas cups, etc.) in the Cyclades.

Similar fine micaceous fabrics have been identified macroscopically and petrographically at Dhaskalio and Kavos on Keros (Phases B-C, 2550-2300 BC), corresponding to Anatolian/*Anatolianising* shapes of the ‘Kastri Group’ horizon, i.e. especially the ‘Fine dark buff-grey micaceous group’ (red-brown to black slipped and burnished plates, sauceboats, teapot, one-handled tankards, pyxis, Anatolian style jugs, depas cups) (Hilditch 2013, 476; 2015, 223). Other fine micaceous groups (‘Fine red-brown’; ‘Fine orange’; ‘Fine green-brown micaceous’) are also consistently comprised of multiple *Anatolianising* drinking and pouring shapes that represent possible imports, but also a number of medium fabrics that are probably local imitations of these shapes (Hilditch 2015, 224, 231, tabs. 6.4 and 6.7). Possible Anatolian imports were also identified at Akrotiri on Thera (samples 03/34 and 03/40) corresponding to depas cups (pers. exam. of thin sections).

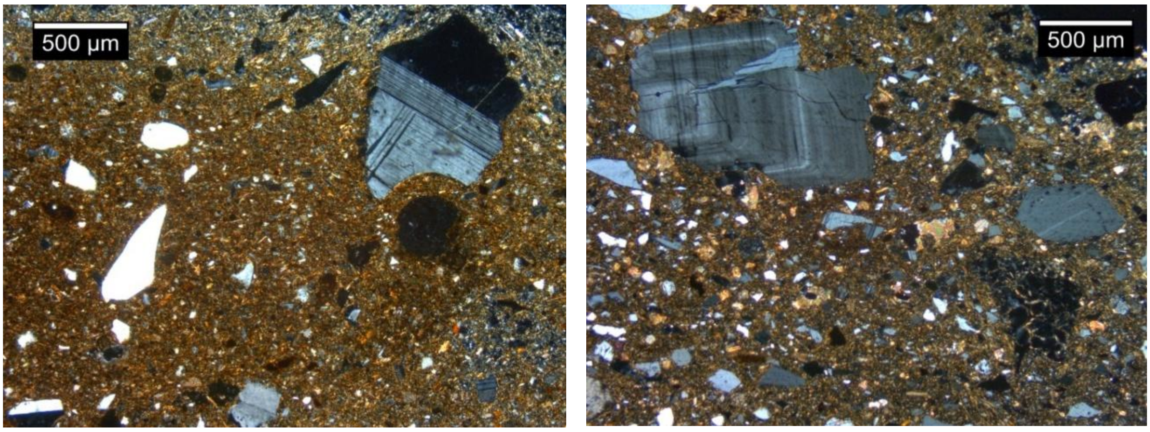
7.5.5 Fabric 24: Volcanic glass, zoned plagioclase, and microfossils

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/8	Concave-necked jar	MG12	Plain	Heraion IV	EB III
HR15/258	Concave-necked jar	MG12	Plain	Heraion IV	EB III

Table 7.47: Samples of Fabric 24.



A B



C D

Figure 7.48: Micrographs of samples within Fabric 24. A. HT12/8; B. HT12/8; C. HR15/258; D. Akrotiri 09/18. All images taken in XP.

Composition and technological features

This buff/light yellow-firing fabric is characterised by a fine mica-rich, probably calcareous clay groundmass and few non-plastic inclusions, comprising of a-sa, fresh-looking plagioclase phenocrysts with multiple twinning and zoning, as well as less alkali feldspar crystals (Fig. 7.48:A-C). Although very few, the presence of microfossils (foraminifera), usually better detectable in PPL, and volcanic glass with spherical fractures (perlitic cracks) distinguishes this fabric (Menelaou *et al*. 2016, tab. 2, fig. 6a right).

The absence of the main inclusions and volcanic glass from the fine fraction and the presence of calcareous materials such as microfossils, as well as the relative coarseness of the fabric possibly implies tempering or clay mixing of a red alluvial with a Neogene marly clay from a marine deposit (Quinn and Day 2007, 776). This can be also supported by the angularity and freshness of the inclusions. The fabric appears to have been fired to a low temperature, according to the high optical activity of the micromass. An overall impression of a low-firing temperature is also given by the visibility of the microfossils.

Typological/stylistic observations and macroscopic correlations

The samples belong to body sherds of EB III collared jars with a concave-necked profile and two horizontal handles (Menelaou *et al*. 2016. tab. 1, fig. 6a left). It corresponds to MG12 and it is worth noting that the samples could not be discriminated from the rest of the buff fabrics dominating the late 3rd millennium BC at Heraion.

Petrographic parallels and suggested provenance

The volcanic-related inclusions alongside rare microfossils, could possibly suggest its relation with a Neogene, fossiliferous sediment that is in close association with small deposits of basaltic and rhyolitic tuff like those occurring in the lower series of the Mytilinii and Karlovassi basins (Theodoropoulos 1979; Pe-Piper and Tsolis-Katagas 1991, 239-242; Stamatakis *et al*. 1996). Rare volcanic glass, alongside dominant polycrystalline quartz, monocrystalline quartz, white mica, feldspar, and very few biotite, is also mentioned in the Classical period Samian amphorae fabrics analysed by Whitbread (1995, 127).

The fabric's rarity at Heraion, although this might reflect a sampling symptom, along with the fabric's macroscopic similarity with the buff micaceous fabrics of the EB III, and general absence of volcanic glass from the rest of the analysed local fabrics might as well imply an off-island provenance (Menelaou *et al*. 2016, 485). Theoretically and on geological grounds only, the pyroclastic inclusions could have derived from a number of possible sources within the Aegean volcanic arc that is particularly extensive in the SE Anatolian coast (Bodrum region) and the Dodecanese (Nisyros, Giali, western Kos). Calcareous volcanic fabrics with glass and microfossils are also well-known from the islands of Thera and Melos (Day *et al*. forthcoming) and a close parallel has been identified in Akrotiri Phase A material (sample 09/18; Fig. 7.48:D), which corresponds to a MC red-slipped amphora and comprises a possible Melian import (Day *et al*. forthcoming: Fabric 14: 'Frequent zoned plagioclase and micrite').

7.5.6 Fabric 27: Fine micaceous with plagioclase phenocrysts

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/45	Transport jar?	MG16	Plain	Bauphase 2	EB II early

Table 7.48: Samples of Fabric 27.

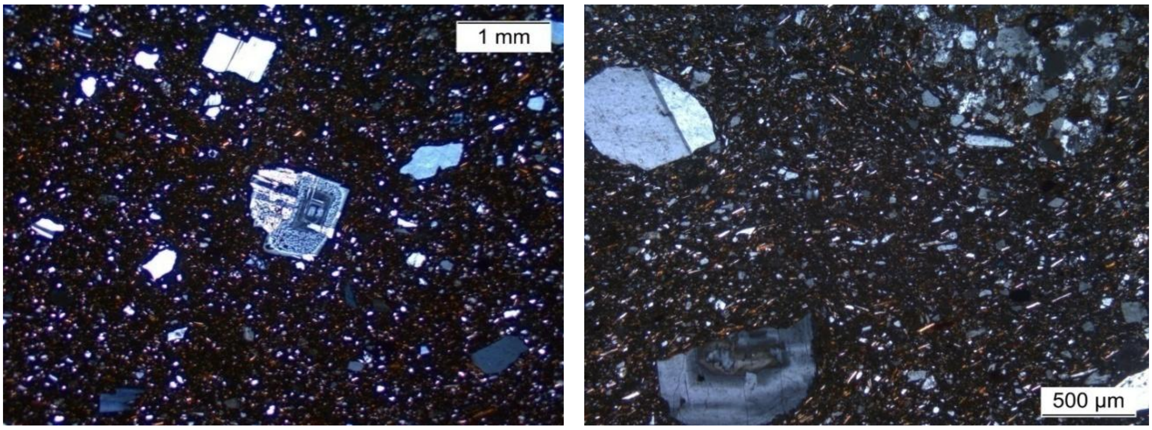


Figure 7.49: Micrographs of sample HR15/45. All images taken in XP.

Composition and technological features

This buff-firing fabric is characterised by large a-sa and eq-tabular plagioclase phenocrysts set in a fine micaceous (biotite laths) groundmass. The phenocrysts usually exhibit a fresh appearance with multiple twinning and zoning. One such example displays micrographic/granophyric intergrowth texture, which indicates a granitic environment. Some alkali feldspar crystals also occur, as well as very few monocrystalline quartz grains, rare volcanic rock fragments of fine-grained, intermediate to basic composition (fine plagioclase laths, rare amphiboles, biotite mica, iron oxides), pyroxenes, and very rare sandstone.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a jar body sherd. It stands out macroscopically according to its soft texture and light-coloured fabric, which is different from the other buff or yellowish brown clay pastes characterising the EB III local fabrics at Heraion.

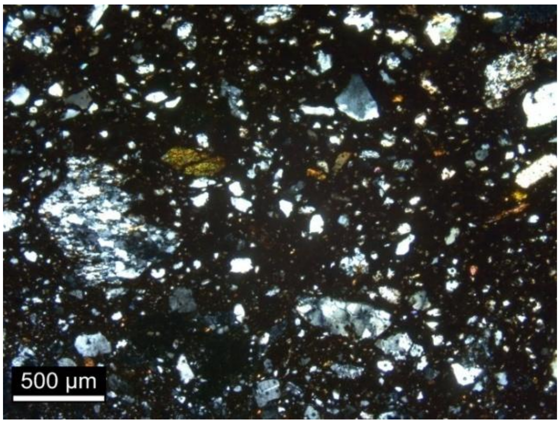
Petrographic parallels and suggested provenance

It is linked with an igneous granitic environment, possibly a primary source, given the freshness of the plagioclase crystals. Its shape and non-diagnostic fabric are suggestive of an off-island provenance. A possible parallel is found at Panormos on Naxos (Group 20, sample 03/36), exhibiting the same range of inclusions (plagioclase with granophyric texture, quartz, mica) and similar groundmass (fine, biotite mica, calcareous). This constitutes a local fabric on SE Naxos (Day *et al*. n.d.). Other fresh volcanic fabrics are known from Phylakopi on Melos and Akrotiri on Thera, although no possible parallels have been identified. Its biotite-rich fine groundmass and rare presence of volcanic rocks is also reminiscent of the ‘Urfirnis’ sauceboat fabric known from Phylakopi and other Aegean EB sites.

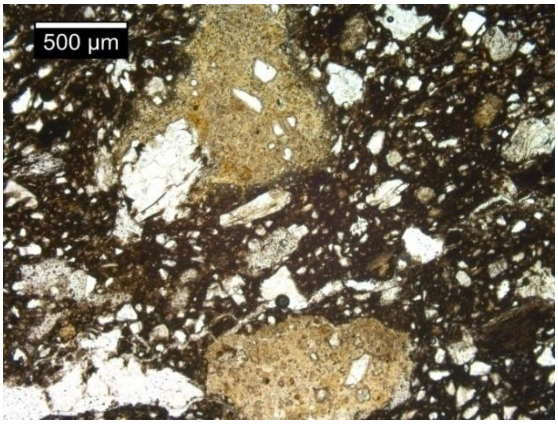
7.5.7 Fabric 35: Quartz-rich metamorphic rocks (quartzite) and volcanic glass

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/270	Jar?	MG24	Plain	Heraion I	EB II developed

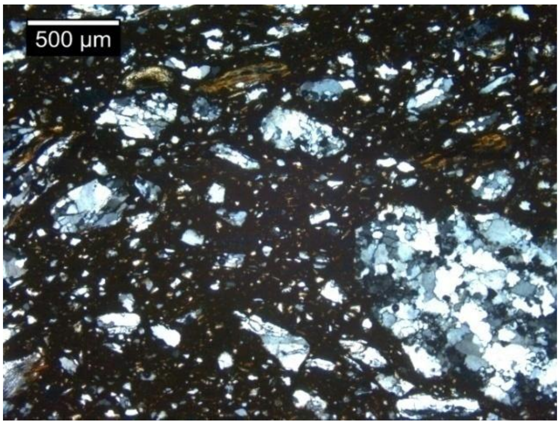
Table 7.49: Samples of Fabric 35.



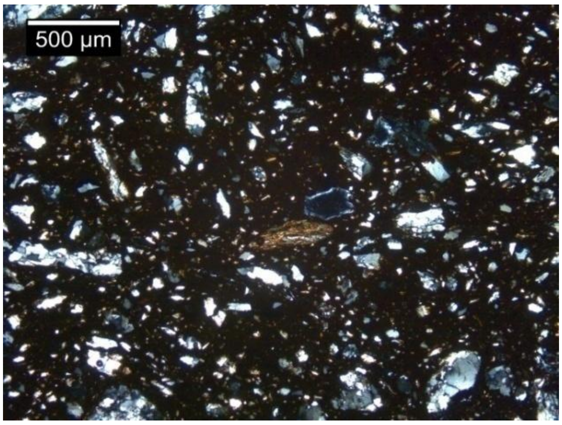
A



B



C



D

Figure 7.50: Micrographs of samples within Fabric 35. A. HR15/270; B. HR15/270 with volcanic glass fragments; C-D. BT03/35. All images taken in XP except for B.

Composition and technological features

This fabric is characterised by frequent low/medium-grade metamorphic rocks, namely quartzite and polycrystalline quartz fragments, as well as rare quartz-mica schist and phyllite, and is also prominently distinguished by sr-r altered volcanic glass fragments (Fig. 7.50:A-B). Other minerals include green-brown amphiboles, pyroxenes, and very rare epidote-rich aggregates. It has been fired to a relatively moderate/high temperature, according to the slightly optically active to optically inactive micromass.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a rim sherd of an EB II late potential jar. It is macroscopically very diagnostic due to its dark reddish brown colour and textural features that correspond petrographically with the volcanic glass fragments.

Petrographic parallels and suggested provenance

The general petrology and combination of low-grade metamorphic and metagranitic rocks with fine green amphibole and pyroxene grains might indicate an origin on the island of Naxos. The only possible parallel was identified in Bakla Tepe material (Day *et al*. n.d.: Loner fabric 15 [BT03/35]: 'Quartzite'), which is represented by a red slipped and burnished jar and can be characterised as non-local at this site (Fig. 7.50:C-D).

7.5.8 Fabric 36: Serpentinite and polycrystalline quartz

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/4	Transport jar	MG31	Grey plain, scored	Heraion II	EB II late

Table 7.50: Samples of Fabric 36.

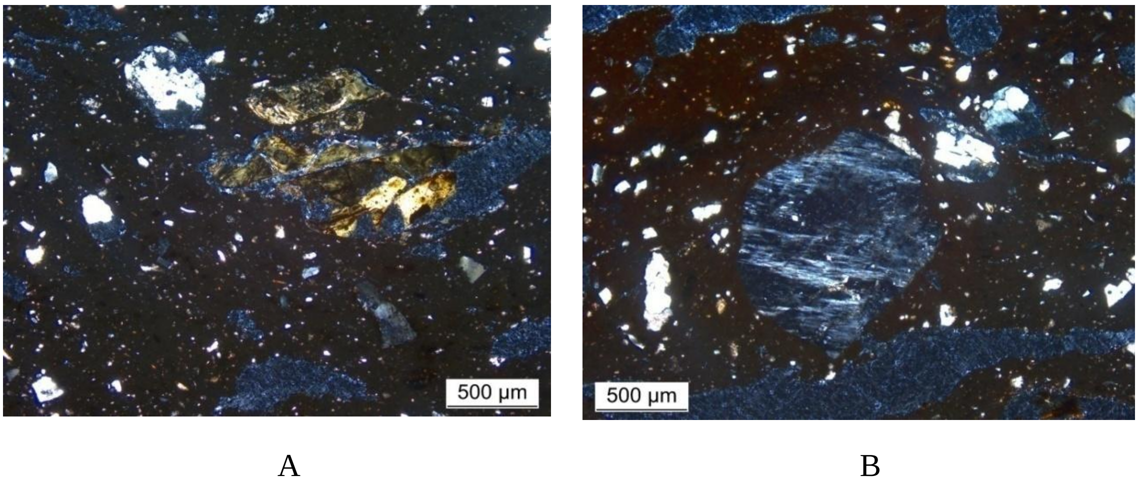


Figure 7.51: Micrographs of samples within Fabric 36. A. HT12/4 with serpentinite fragments; B. HT12/4 with rock exhibiting perthitic texture. All images taken in XP.

Composition and technological features

This fabric is prominently characterised by frequent polycrystalline quartz fragments/quartz-feldspar aggregates, possibly related to metamorphosed igneous rocks, in combination with serpentinite fragments. The serpentinite exhibits a characteristic dark greenish to yellowish colour in XP and often preserves relic minerals of the parent igneous rocks. Other non-plastic inclusions consist of silica-rich aggregates of quartz and alkali feldspars displaying micrographic or granophyric textures and possibly related to meta-igneous rocks. The base clay is very fine and the fine fraction consists of the breakdown minerals mentioned for the coarse fraction. It appears to have been fired to a high temperature, judging from the optical inactivity of the micromass.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a body sherd of a EB II late transport jar. Macroscopically it belongs to MG31 and it was distinguished by its non-diagnostic ware/fabric and firing colour, as well as its characteristic scored exterior surface.

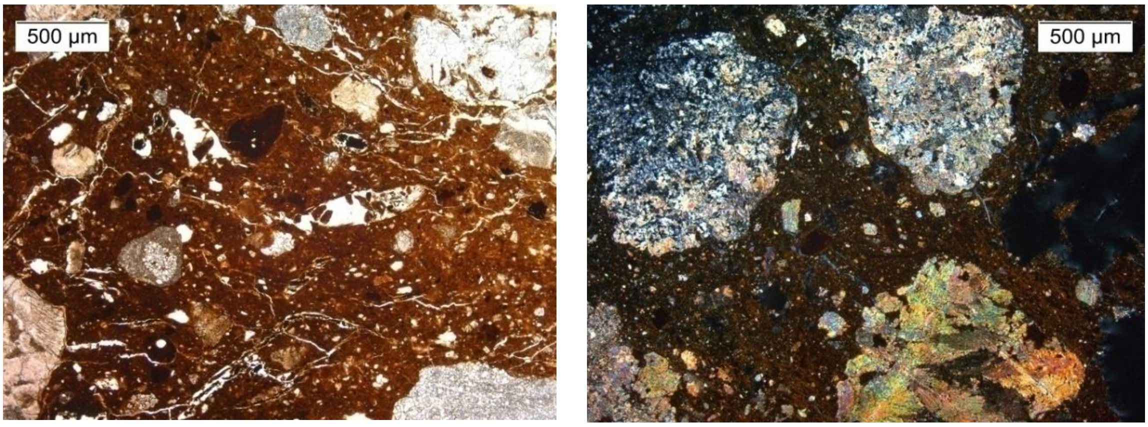
Petrographic parallels and suggested provenance

This fabric was originally thought of as being related to the small-sized peridotite-serpentinite bodies that occur as sills within the Ambelos schists, situated *ca*. 5km NW of Heraion (Theodoropoulos 1979). A probable link with the locally-manufactured Sub-fabric 4A (Menelaou *et al*. 2016, fig. 6b, HT12/1) was also suggested on the basis of the serpentinite-rich content, although a more detailed examination confirmed that Fabric 36 constitutes an off-island product (Menelaou *et al*. 2016, 485, tabs. 1-2, fig. 6c). A possible fabric link is reported from Kavos on Keros EB II material in terms of serpentinite temper (dark red to yellow-orange in XP *versus* greenish grey/dark brown in the Heraion fabric), quartz-feldspar aggregates with rare acid intergrowths that indicate a fresh igneous environment, and a high-fired calcareous groundmass (Hilditch 2007, 241, 259). In Kavos this fabric represents a loner too and its provenance is not clearly determined, but only cautiously ascribed with a Naxian provenance (Hilditch 2007, 248-249).

7.5.9 Fabric 37: Rounded coarse/fine-grained sparite and mudstone

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT15/33	Transport jar?	MG23	Red-orange slipped	Bauphase 3	EB II early

Table 7.51: Samples of Fabric 37.



A B

Figure 7.52: Micrographs of samples within Fabric 37. A. HR15/33, taken in PPL; B. HR15/33, taken in XP.

Composition and technological features

This fabric is characterised by a relatively sparse coarse fraction comprising of dominant calcite fragments. Other non-plastic inclusions comprise dark red/orange to black opaque fragments (possibly mudstone), all set in a fine red-brown matrix. The coarseness of the main inclusions in relation with the very fine groundmass and presence of very few TCFs, that are not compatible with the calcareous content of the fabric, could indicate clay mixing or tempering. Planar voids with darkened rims are also present, indicating the incomplete combustion of the vegetal matter, as well as common cracks, most probably caused by the differential thermal expansion between the host ceramic and the calcite fragments. It was subject to a low-moderate firing, according to the fairly optically active micromass.

Typological/stylistic observations and macroscopic correlations

This loner is represented by a horizontal handle of a storage vessel, possibly a transport jar. It is macroscopically very diagnostic, both in terms of fabric and surface treatment.

Petrographic parallels and suggested provenance

No petrographic parallels could be identified, either within the local fabrics or among any of the comparative material examined. Its provenance determination remains open.

7.5.10 Fabric 38: Micrite and bioclastic limestone

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HT12/32	Shallow bowl	MG36	Brown slipped	Heraion I	EB II developed

Table 7.52: Samples of Fabric 38.

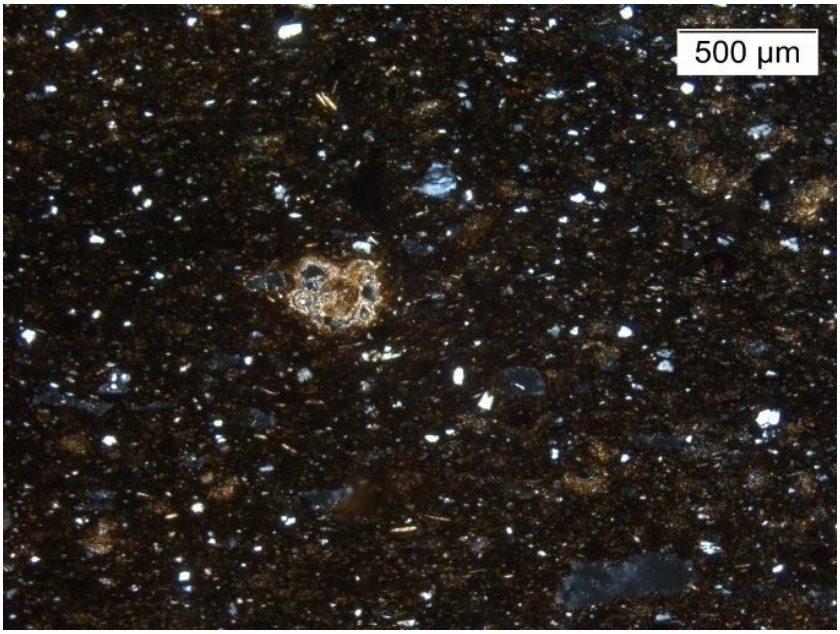


Figure 7.53: Micrograph of sample HT12/32, taken in XP.

Composition and technological features

This fine calcareous fabric is characterised by very few inclusions in the coarse fraction. It is prominently distinguished by micritic lumps and probable bioclastic limestone. The combination of fine mica with the high calcareous content might suggest the intentional mixing of two different raw material sources, a red micaceous clay of alluvial origin and a Neogene calcareous-rich clay. It has been fired to a low-moderate temperature according to the moderately optically active micromass. The vessel is wheel-finished according to the preferred orientation of some non-plastic inclusions and voids parallel to the vessel margins.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a shallow bowl with a flat, outcurved rim of the EB II developed period. It is distinguished by a dark greyish brown paste and a dark brown slipped surface.

Petrographic parallels and suggested provenance

It shares the same metamorphic-related geological background with Fabrics 14 and 15, as can be suggested by the rare presence of metamorphic rock fragments and the micaceous content. It is potentially a locally-produced fabric.

7.5.11 Fabric 40: Sand-tempered fabric with quartz-rich schist fragments, serpentinite/degraded basic igneous, and sedimentary rocks

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/175	Pithos	MG5A	Red slipped	Heraion 4/5	EB I

Table 7.53: Samples of Fabric 40.

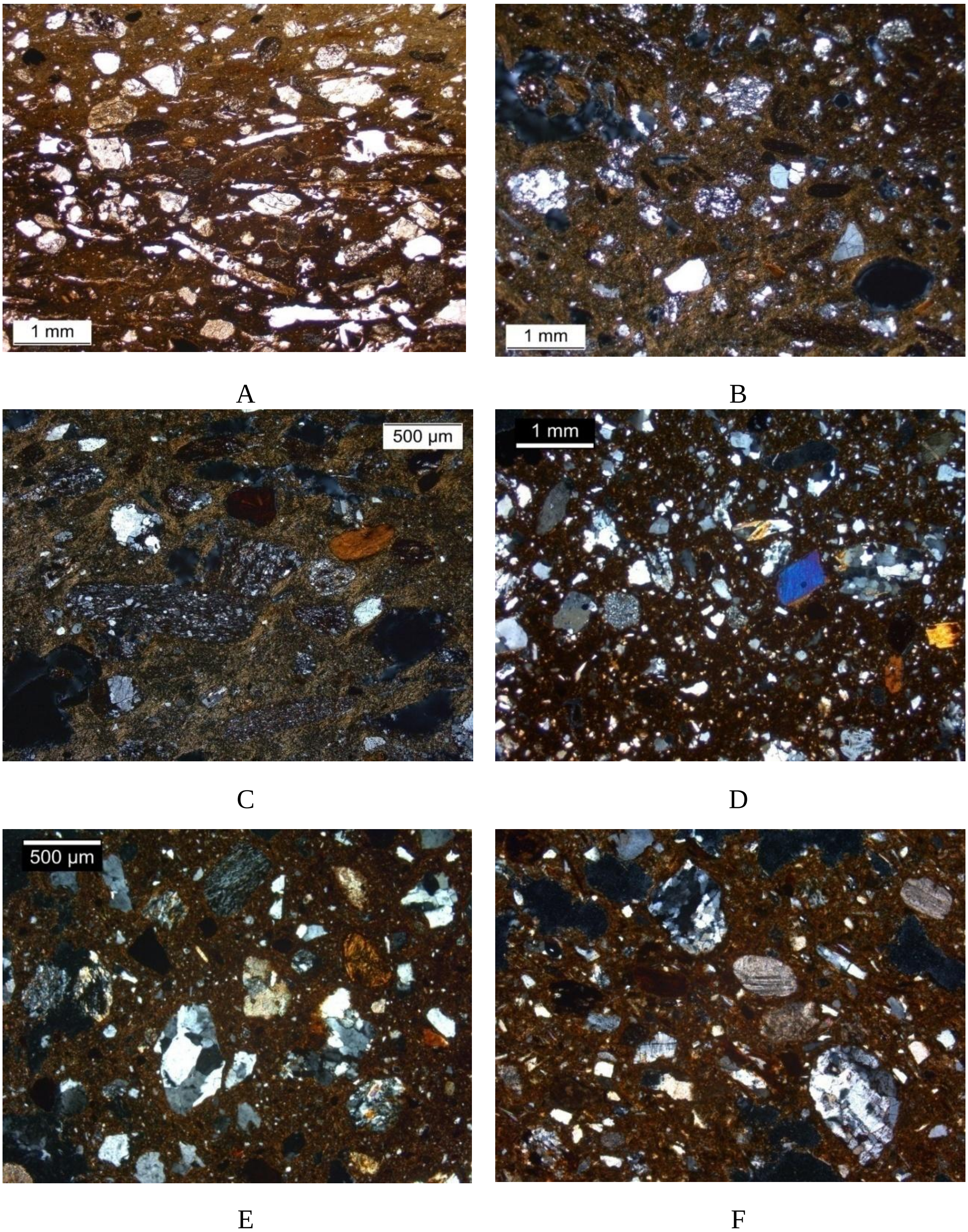


Figure 7.54: Micrographs of samples within Fabric 40. A. HR15/175 with remains of vegetal temper; B. HR15/175 with quartz-rich metamorphic rocks; C. HR15/175 with rounded serpentinite fragments; D. GS28/2016; E. GS43/2016 with metamorphic rocks and rounded serpentinite; F. CS 3. All images taken in XP except for A.

Composition and technological features

This fabric is characterised by sand-sized, well-sorted non-plastic inclusions, set in a homogeneous fine groundmass. The inclusions comprise mainly of medium-grade quartz-rich metamorphic rock fragments, phyllite fragments with a characteristic golden-reddish brown colour and slatey texture, few serpentinised rock fragments (red-orange to bright orange), and other secondary inclusions (Fig. 7.54:B-C). The frequency and sorting of inclusions suggest sand tempering. Vegetal temper is also documented by elongate voids and streaks (Fig. 7.54:A). This is also indicative, together with the optical activity of the micromass, of a low-temperature fast firing process.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a EB I pithos horizontal handle with a thick red slip and a characteristic granular texture with vegetal imprints. It corresponds macroscopically with MG5A.

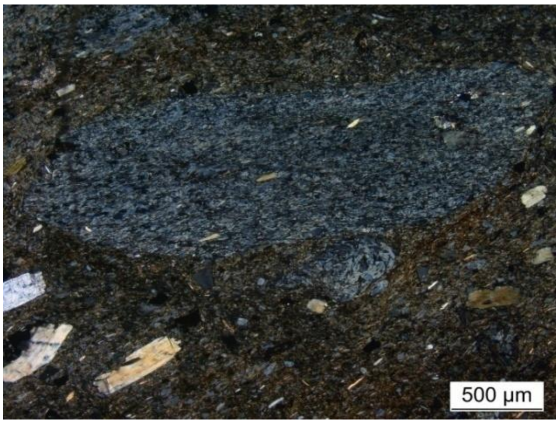
Petrographic parallels and suggested provenance

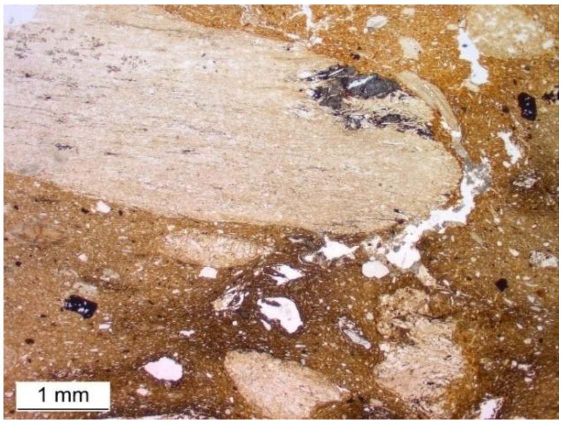
It is reminiscent of the local metamorphic fabrics and shows close similarities with raw material samples GS28/2016 and GS43/2016 (see Section 5.7.6: Fabric 18), which can be paralleled by the relatively fine groundmass and the same range of inclusions (quartz-rich metamorphic rocks, mica schist fragments, orange phyllite/slate, opaque minerals, serpentinite, volcanic rock fragments). Some differences do exist, namely the occurrence of limestone, pyroxene, and epidote group minerals that are almost absent from the ceramic fabric (Fig. 7.54:D-E). Interestingly, a link can be also made in technological terms. Sample GS43/2016 (studio clay tempered with sand) exhibits an almost identical texture. The sand temper was collected from the beach directly bordering the Heraion to the south, next to which a ceramics workshop operated during the mid 20th century for the manufacture of tiles and pithoi (see Fabrics 1 and 2 in Section 5.7.7) (Fig. 7.54:F). This is in good terms with suggesting a local production for this pithos loner.

7.5.12 Fabric 42: Low-grade metamorphic rocks with common chlorite

Sample no.	Vessel shape	Macro	Surface treatment	Phase	Date
HR15/241	Cut-away spouted jug	MG29	Plain	Heraion 1	EB II developed

Table 7.54: Samples of Fabric 42.





A B

Figure 7.55: Micrographs of sample HR15/241, taken in PPL and XP respectively.

Composition and technological features

This fabric is characterised by a homogeneous fine groundmass that is rich in low-grade metamorphic rocks like slate and phyllite. These rock fragments are distinguished by a high amount of chlorite and other platy minerals, possibly also glaucophane, with a bluish and green/grey colour that exhibit a slatey cleavage and a birefringent texture (Fig. 7.55). The presence of the same range of inclusions in the fine fraction implies that a rather weathered primary clay source has been utilised.

Typological/stylistic observations and macroscopic correlations

This loner belongs to a cut-away spouted jug that stands out macroscopically (MG29).

Petrographic parallels and suggested provenance

Its overall lithology links with Fabric 3 on the basis of the chlorite-rich metamorphic rocks. However, the absence of serpentinite and other metabasite inclusions imply a distinct raw materials source. Its provenance is most likely off-island.

7.6 Intergroup petrographic fabric links

The details provided for individual fabric groups and loners allow investigation of mineralogical and textural criteria that form their basis. Despite the general consistencies within specific fabrics, links exist between different groups either related to particular non-plastic inclusions that signify a common geological and/or geographical provenance – although not necessarily a single source – or similar groundmass and textural configurations that may indicate shared technological practice. In the following discussion these inter-relationships are assessed and meaningful associations are briefly considered. Attention is given mostly to the larger fabric groups of assumed local provenance.

7.6.1 Mineralogy and non-plastic inclusions

I. Low and medium-grade metamorphic rocks: the vast majority of the analysed thin sections are characterised by low to medium-grade metamorphic rock fragments, varying in coarseness, frequency, and quantity. Fabric 1 with its sub-groups cover around a third of the samples and are dominated by quartz-mica schists, polycrystalline quartz, quartzites, and mica-rich phyllites and their dissociated minerals. Fabric 1 is also occasionally characterised by very few to absent actinolite±sillimanite±kyanite schist and blueschist fragments, as well as chlorite-rich rocks, epidotites, serpentinised fragments, and metagabbroic rocks which link it with the fabric groups discussed below (see point II). Fabric 2 also contains a substantial amount of quartz-mica schist, quartzite, and phyllite, although the inclusions are generally coarser. Several other medium-coarse (Fabrics 10 and 40) and fine (Fabrics 14-17) groups contain small quantities of metamorphic rocks, providing good indications for their local provenance. All of these fabrics are linked in terms of their lithology, although they represent different raw material sources and possibly also deposits, and would seem to originate in outcrops in close proximity to Heraion. Fabrics 18 and 19, although dominated by low-grade metamorphic rocks, differ substantially and are confidently classified as off-island. Fabric 9 contains a single glaucophane schist/blueschist fragment, but its general configuration is of a non-diagnostic origin.

II. Altered igneous and metamorphic rocks, metabasites, and serpentinites: a small group of fabrics, although represented by a relatively large amount of thin sections, are characterised by serpentinised rocks of volcanic and metamorphic origin including serpentinite fragments of various degrees of oxidation, chlorite aggregates or chloritised mafic-rich rocks, fine/medium-grade metamorphic rocks (sillimanite schist, quartz-feldspar aggregates with epidote group minerals, possible chloritoid schist, and/or kyanite schist, sillimanite and actinolite schist), as well as very few metagabbro fragments, and epidotites/clinozoisite-epidote aggregates (Fabric 3 with sub-groups). Fabric 4 and its sub-group contain a similar range of rocks, but also a substantial amount of epidote-rich rocks and peridotites. The presence of some fresh volcanic rocks links it with Fabric 6 (see point III) and the fine/medium-grade metamorphic rocks (polycrystalline quartz, banded quartz-mica schist, phyllite) with Fabric 1 (see point I). Fabric 40 contains rare serpentinised rocks, which differ from those dominant in Fabric 3. Despite its epidote-group mineral inclusions, Fabric 29 is ascribed to an off-island provenance. These fabrics represent discrete raw material sources, probably a number of different ones even among the main groups, that may have an origin within the ophiolite formations and peridotite-serpentinite sills of Aghios Ioannis sub-unit or Selçuk nappe, the nearest outcrops of which are exposed in areas near the localities of Myli, Spatharei, Pagondas, and west of Mavratzei 5-10km NW of Heraion.

III. Fresh volcanic rocks: the presence of a range of volcanic rocks (predominantly fine/medium-grained) with acid/intermediate to minor basic composition (ranging from dolerite/basalt, trachydacite, rhyolite), either with fresh porphyritic or devitrified matrices, is particularly observed in Fabric 6 and its sub-groups. Some of its variants provide a secure mineralogical link with the metamorphic-rich fabrics, especially Sub-fabrics 1A and 1B through the same range of fine and medium-grade metamorphic rocks. Similar volcanic rocks are found in Fabric 2 and occasionally appear in much less quantities and smaller size as accessory inclusions in Fabrics 1 (1A-C), 3 (HR15/58), 4, 7, 9, 10, 13, and 40. This can be taken as an indicator for the local provenance of these fabrics, although the rare presence in others does not allow a more secure determination. More volcanic rocks occur in Fabric 5, although forming a distinctive andesite-rich group that differs significantly and is classified as non-local. Similarly, Fabrics 26 and 28 contain a small quantity of volcanic rocks, although their overall configuration indicates an off-island provenance.

IV. Mica-rich content: mica, both muscovite and biotite, is found in many fabrics, varying in quantity, coarseness, and frequency. Fabric groups richest in mica laths are Fabrics 14-17, predominantly 14 and 15, although differences exist in the higher presence of one type of mica over the other. These fabrics are generally too fine to allow discrimination of their provenance on petrographic grounds alone, but their close mineralogical (metamorphic rocks) and textural similarities with the main local fabrics suggest a local provenance. Likewise, Fabric 13 shares a very similar groundmass with Fabrics 14 and 15, although differing in the form, size, and distribution of the coarser non-plastic inclusions. White mica and, to a lesser extent, biotite are usually present as laths in the fine fraction of the majority of coarse (e.g. Fabrics 1, 2, 6) and medium-coarse (Fabric 10) fabrics with a local origin. Other fabrics containing mica exhibit more marked differences and their provenance is not clear yet (Fabrics 11, 12, 27, 38). Though clearly related to each other in terms of a geological origin, this might not reflect geographical proximity and they may derive from similar geology found on the opposite Anatolian coast. Although representing discrete technological choices and raw material sources, this mica content would seem to originate in the mineral dissociates of the low/medium-grade metamorphic parent rock deposits, such as those characterising the Ambelos schist outcrops surrounding the Mytilinii basin. A number of other micaceous metamorphic fabrics (Fabrics 25, 29, 30, 31, 32, and 34) share some similarities with the previous groups, but they have an off-island provenance in different Cycladic islands, mainly the western Cyclades.

Although a common mineral amongst ceramic fabrics, mica has been occasionally used for the macroscopic identification of specific production areas or geographical provenance. For instance, Aeginetan pottery was often identified, among other features, by the presence of gold mica (biotite), although recent analytical work showed a rather different picture (Kiriatzi *et al*. 2011, 22). However, extensive macroscopic and microscopic work undertaken in the Cyclades has shown that mica, mainly silver/white, is commonly found in fabrics of the FN-EB II, e.g. Ayia Irini on Kea (Wilson 1999, 24, 84), Amorgos, Ios, etc. (Hilditch 2015). More often the identification of mica has been linked with the SE Aegean and western Anatolian littoral in EBA pottery. Recent examples derive from the Halasarna region on Kos, where silver mica predominates in the local fabrics from the LN II to the EB III (Georgiadis 2012, 23-24). Silver mica, or less commonly combined with biotite, is also very common in the Ch-EB pottery from Miletus (pers. exam. of thin sections, December 2016), Thermi on Lesbos (Lamb 1936, 76), Yortan (Kâmil 1982, 15-19), Kos (Vitale 2013, 52), Çukuriçi Höyük (Peloschek 2016a, 255), etc. At Emporio on Chios the micaceous fabrics (Periods X-II) have been classified as off-island products, deriving more likely from Samos or the Cyclades, as mica is nearly absent from the local fabrics but in evidence at Ayio Gala (Hood 1981, 167-169, 239-240, 299-300, 308, 358; 1982, 434, 471).

V. Carbonates (limestone): the most frequent type is limestone, varying in form, size, and frequency. It ranges from fine to coarse-grained and individual samples or fabrics can contain a combination of different limestone forms, with micrite aggregates the most common. Fabric 1 and its sub-groups contain conspicuous fragments of micrite, sparite/microsparite aggregates, and less often crystalline calcite aggregates (composed of monocrystalline calcite crystals). Some fragments appear with a metamorphosed texture that relate to marble, while others appear with evaporites like gypsum and microsparite indicating geomorphological alterations and the precipitation of salty-marine water environments. In general, the limestone fragments form part of the clay component and are not the result of secondary formation. Often they occur as micritic clots in the fine fraction or filling voids and, indeed, being related to secondary formation (Fabrics 2 and 4). The form and distribution of limestone in Fabric 6 links it with the aforementioned groups, although with dominant micrite and occasional biogenic texture. Some samples have a highly calcareous groundmass and dark elongate streaks that might denote mixing of different clay sources or purely the use of naturally-varied raw materials. Sample HR15/273 is comparable to the main fabric (Fabric 6), but has crushed euhedral calcite. Sub-fabric 6B contains well-rounded fragments, while Sub-fabric 6C and Fabric 7 differ in their calcareous groundmass and more frequent presence of fine micrite, as well as the presence of rare elongate bioclasts. The latter is similar to Fabric 13, implying a local provenance for this otherwise fine, non-diagnostic fabric. A local provenance is also supported by the occurrence of similar bioclasts in the modern ceramic samples (see Section 5.7.7: Fabrics 1, 2, 5, and 6). A calcareous paste with bioclasts is also identified in Fabric 38. The non-diagnostic Fabric 37 remains distinctive with coarse fragments of mainly sparite, a texture that suggests tempering. A number of other calcareous or carbonate-rich fabrics exhibit sufficient differences from one another and from the above to allow their confident separation and suggests a non-local provenance (Fabrics 23-26, 28, and 41). Finally, Fabric 8 is tempered with sparite, which is less conspicuous than in Fabric 9. Neither is diagnostic of origin and, therefore, their provenance question must remain open. Overall, the majority of local fabrics are non-calcareous in nature, in contrast to the non-local ones that seem to originate in fossiliferous and highly-calcareous deposits.

VI. Organic material: the majority of fabrics contain completely or partially-combusted vegetal matter, although varying in amount and frequency. It usually appears as distinctive elongate voids (predominantly planar voids and channels) of various sizes that preserve the original shape of the organic material. Fabrics 1-6 are dominated by such voids, especially pronounced in or restricted to the early-dated (Ch-EB II early) and coarser (pithoi, large jars, cooking vessels) samples, implying deliberate tempering by the ancient potters. These voids are occasionally surrounded by a dark rim or preserve the original texture (oxidised infill), indicating a fast, low-firing process that is characterised by uneven temperature and atmosphere. Vegetal tempering provides a good link between these fabrics and implies a long-lasting continuity of technological practice which becomes less common after EB II early. More particularly, there is some minor presence of organics in medium-coarse fabrics of assumed local provenance that date to the EB II developed-late (Fabrics 7 and 10). Sub-fabrics 6B and 6C of the EB II late also contain a substantial amount of organic matter and provide another indication for the local manufacture of vessel shapes traditionally considered as foreign (e.g. tankards, bell-shaped cups). Other fabrics used for the manufacture of these drinking vessels do not contain any organic matter and this adds weight to the ascription of non-local provenance (Fabrics 11-12). The tradition of vegetal-tempering ceases by the end of EB II and is absent in EB III (Fabrics 13-17). Rare organic material is also observed in fabrics of non-local or unclear provenance that correspond to early-dated or coarse vessels (Fabrics 9, 30, 35, 37, and 40).

Chaff/straw-tempering is identified at many sites across the Aegean/Anatolian region. For instance, it constitutes a common element in pottery production throughout the Dodecanese (Georgiadis 2012, 30-31; EB II Kos: S. Vitale, pers. comm.), Emporio X-VI, but still present in much lesser quantities in Phase II, and Ayio Gala on Chios (Hood 1981, 167), Miletus, Çukuriçi Höyük only in EB I metallurgical ceramics (L. Peloschek, pers. comm., December 2016), the SE Anatolia from the LCh (Lloyd and Mellaart 1962, 106), etc. In all cases the chaff-tempering tradition shows a noticeable decrease from EB II onwards.

7.6.2 Technology

Paste preparation (clay mixing and tempering): the analyses suggest a basic distinction between a preference for coarse alluvial clays in the first half of the 3rd millennium BC and for finer, Neogene-related calcareous clays in the late 3rd millennium BC. These observations are based on the variation of groundmass and textural/clay concentration features among samples of the same fabric and between different fabrics. More particularly, different types of TCFs occur, often in the same sample and their origin is not always clear. They are formed either due to the natural heterogeneity of the clay source or during processing/manipulation (refinement, levigation, mixing) of the raw materials. The majority of fabrics fall into the first category, with most obvious Fabric 1 and especially Sub-fabric 1A. This contains common to very few TCFs of different types ranging in size, colour, optical density, relation with micromass, and texture. The frequency of dark orange-red pellets in the raw material samples confirms their natural presence in the ceramic clay paste (see Section 5.7.6: Fabric 4). Less frequent, although varying between samples, are 1) the dark brown/reddish brown oxidised clay pellets with high-moderate optical density, clear boundaries, discordant with the micromass, that contain the same range of inclusions as the groundmass, 2) the mid-brown/yellowish brown ones that are generally concordant with the micromass, have diffuse to merging boundaries and low optical density, as well as 3) dark elongate streaks that could relate to the combustion of organics or the high presence of iron oxides. Some samples in Fabric 6, Sub-fabrics 6A and 6B, and Fabric 7 contain also calcareous-rich TCFs and micritic concentrations that might suggest mixing of two heterogeneous clays.

Beyond these natural concentration features, evidence of clay mixing may be identified in a variety of ways, most commonly inferred by comparison of clay pellet composition and groundmass and the presence of less conspicuous striations (e.g. Fabric 7). Fabrics 11 and 12 with their common micaceous clay pellets might indicate either tempering with a residual sandy sediment rich in silicate minerals and mica or clay mixing. Less frequent are discrete clay domains or striations, which provide stronger evidence for the incomplete mixing of different clays. For instance, the fine micaceous fabrics (Fabrics 13-17) appear with common red-orange clay, but most importantly they exhibit dark red/reddish brown amorphous aureoles/clay striations that indicate the mixing of a fine red micaceous clay with a coarser red clay rich in quartz (Fabrics 14-16). This might also relate to the deliberate refinement and subtractive preparation (sieving or levigation) of the clay source or compaction of the clay body. Samples HR15/140 and HT12/6 combine the full spectrum of variability observed in Fabric 13 and exhibit the most conspicuous evidence for incomplete mixing with a coarser clay rich in metamorphic rocks. The variation observed in Fabric 13 is also important in the consideration of tempering practices, as its coarse fraction reflects the intentional addition of sand in the clay paste. Similarly, Fabric 1 (variants HR15/25, 111, 245), Sub-fabrics 1C and 1D, as well as Fabric 40 are tempered with metamorphic rocks sand. Tempering is also identified in Fabrics 8 and 9 in the form of crushed limestone and the addition of grog.

Forming methods: although macroscopic study of original sherd samples and whole vessels is by far the richest and most reliable source of information regarding forming methods (Section 6.6.2, figs. 6.27-6.29), it may be possible in some cases to identify complementary evidence by petrography. This is affected by the orientation relative to the sherd of the thin section. The majority of evidence concerns coil- or slab-building methods, as these may display traces in the form of concentrically-arranged inclusions, especially in the case of coarse fabrics. These structural discontinuities of inclusions or voids represent coil joins and vary from perpendicular to diagonal (Whitbread 1996). Possible examples are observed mainly in Fabrics 1, 1C, 5, and 6. These correspond chronologically to early-dated jars/pithoi, jugs, and bowls. They are less conspicuous in other groups (Fabric 2: HR15/47, Fabric 3: HR15/18). Coil or probably slab joins are more clearly seen in Fabric 5 in the form of diagonal and concentric orientation of voids and inclusions and can be positively also identified macroscopically (Chapter 6, fig. 6.30:E-F). Less conspicuous coil joins, or combined with other forming methods such as wheel-finishing, are observed in HR15/139 (Fabric 7) and HR15/261 (Fabric 1E) and correspond to a tankard and a bowl of the EB II late and EB III respectively.

Although forming techniques can be inferred largely from the preferred orientation of voids and inclusions in the coarse fabrics, the optical activity and orientation of clay mineral domains can be more useful in fine fabrics. More particularly, Fabric 13 exhibits distinct areas of perpendicular or horizontal alteration and birefringent texture due to the predominance of mica laths with a preferred orientation parallel to the vessel margins, indicating strongly the use of a rotary device (predominantly wheel-fashioned plates of the EB III period; Chapter 6, fig. 6.31:C-E). Fabrics 14, 15, and 38 exhibit a strong alignment of the mica-rich content that could either reflect the use of fast wheel and/or the application of pressure on the clay body during processing or smoothing of the surface. These correspond to a range of locally-produced vessels of the EB III period.

Finishing methods: the examination of surface treatment in analytical studies is usually combined with macroscopic observation (see Chapter 7) and SEM study of microstructure and composition (see Chapter 9) of features such as slip layers, burnishing layers/marks, and compaction/smoothing. More particularly, slip layers vary in colour and thickness: these appear as distinct non-calcareous, thick layers that lack non-plastic inclusions and have a generally sharp boundary with the clay body, implying their addition to the vessel surface prior to burnishing. This is particularly conspicuous in Fabric 5 in the form of a dark red-reddish brown (HR15/6, 21, 31, 167, 174, 189) or rarely dark brown-black (HR15/109) layer, the thickness of which ranges from 0.02mm to 0.04mm. Other examples of similar thick red-reddish brown slip layers (0.02-0.03mm) are observed in Fabric 7 (HT12/17, HR15/139, 190), dark red-orange (HR15/145, 146, 156, 193) or dark brown/black (HT12/43) in Fabric 11, dark red-reddish brown in Fabric 12 (HR15/144), in all cases corresponding to tankards. This is in good agreement with their macroscopic identification and the intentional creation of visual distinctiveness of this vessel type, which is considered as imitating or being inspired by metal prototypes. Perhaps this is best reflected in Fabric 8 (HT12/33, HR15/147), where such thick red slips are deliberately used to create a distinction between the dark finish and an otherwise light-coloured calcareous fabric.

In all cases, there also exist samples that lack the obvious slip layers but exhibit areas near the surface edges with a strong, parallel orientation and slightly different optical activity or birefringence that is probably related to compaction due to burnishing (Fabric 7: HR15/259, Fabric 8, Fabric 11: HR15/197). Other fabrics exhibit more consistent evidence of surface compaction with finishing layers of the same texture and composition as the clay body and are traced along the full length of the surface, that could also relate to smoothing and the creation of self-slipped surfaces (Fabric 1: HR15/115; Fabric 6: HR15/99, 130, 188, 222, 273; Fabric 9: HR15/48, 78, 79). In some cases the slip layers are too thin (>0.02mm) and such examples occur in Fabric 2 (HR15/121), Fabric 6 (dark red-reddish brown, HR15/84, 165, 273), Sub-fabrics 6A (reddish brown/dark brown) and 6C (HR15/275), Fabric 13 (HR12/29, HR15/292, 294, 296), Fabric 14 (red-orange, HT12/39, HR15/207), and Fabric 16 (dark red-brown, HR15/195, 205, 211). Other examples appear with thin birefringent layers and exhibit a strong preferred direction of the lath-like inclusions (Fabrics 14 and 15). This could imply that the surface was subject to a high degree of pressured scraping or smoothing or might relate to the processing and refinement of these fine fabrics. Finally, HR15/270 (Fabric 35) exhibits either a calcareous slip layer in buff/yellowish brown colour or more likely a clay layer that contains non-plastic inclusions and is mineralogically and texturally different from the clay body.

Firing regime: visual estimations of firing regime are based on the comparison of colour and optical activity of the micromass between samples, in combination with macroscopic evidence (colour in sherd break), while more secure information can be extracted from the SEM analysis (see Chapter 8). In the majority of fabrics the vessels were exposed to a variety of temperatures and firing atmosphere could vary from mixed oxidising/reducing to very rarely reducing. More particularly, the larger fabrics exhibit a much wider range of variation: the majority of samples in Fabric 1 show discolouration areas and pronounced colour differentiation with a darker core that relates to the common presence of partially-combusted vegetal temper (mainly in the early-dated samples); the carbon deposits were allowed to build up through a complete lack of oxygen, implying a fast firing process[20] (Kilikoglou and Maniatis 1993, 438). These blackened areas are more frequently seen in cooking vessels, due to post-production heating events. Judging by the optically active micromass, a low-temperature firing can be likewise assumed. Sub-fabric 1A differs by the relative homogeneity of the fired clay colour (red/reddish hue) and the level of optical activity would seem to suggest a generally even firing and a fairly consistent oxidising atmosphere, although more rarely there are high-fired samples dating to the EB III period (HR15/283). Other samples appear evenly dark (Sub-fabric 1B: HR15/173, 176, 240) and seem to be more consistently fired to a reducing atmosphere. Similarly to Fabric 1, almost all coarse fabric groups are consistent with fast firing according to the burnt or partially burnt organic material (Fabrics 3 and 6).

A more varied picture is observed in Fabric 6, as the optical activity ranges between samples from high to low, the firing colour exhibits different hues, and the presence/absence of differentiation between core and margins is indicative of the duration of firing. It is noteworthy that the early-dated, organic-rich fabrics are usually low-fired, although Fabrics 2 and 4 differ by their moderately active/optically inactive

[20] The colour differentiation effect could either imply a fast firing, where the ceramic turned black in an open firing and at a later stage it began to oxidise from the edges towards the core, however the firing was too short for the process to complete a full oxidation. Alternatively, if a slow firing is represented, the insufficient oxidation during cooling created a similar effect with darker core and lighter-coloured margins.

micromass, reflecting a higher temperature but still containing a high amount of vegetal temper. These features might as well fit with the predominance of coarse, thick-walled vessels in these groups.

Different firing strategies can be deduced from the end of EB II early through the EB III period. This is not to suggest that there is a homogeneous pattern of high-fired pottery during the later EB phases, but rather to point out that a technological change might be reflected in higher temperatures and more consistent firing atmosphere (red-fired oxidising) are prevalent. This might also be linked to changes observed in the exploitation and manipulation of raw materials and the absence of organic temper in the clay pastes. For instance, Fabrics 7 and 10 imply a moderate temperature according to their low optically active to slightly inactive micromass, while Fabrics 14 and 15 are generally moderately/high-fired. Further discussion on estimations of firing behaviour and firing environment can be found in Chapter 8.

7.6.3 Provenance

The petrographic analysis demonstrated that probably half of the fabrics are compatible with the environs of Heraion, i.e. the south-central part of Samos (Chora plain; Tab. 7.55). Despite important insights provided by petrographic analysis of raw material samples from this area, it is still difficult to assign provenance more precisely as various groups exhibit compositional similarities.

More particularly, Fabric 1 and its sub-groups represent the main local fabric series, although the compositional variability implies the exploitation of discrete clay sources or even the products of other Samian settlements yet to be found, and can be broadly related to the metamorphic substrate of Samos and the geological formation of Ambelos nappe (schist bodies) that underlie the immediate area of Chora plain. However, the inherent variability of metamorphic geologies and the repetition of different geological formations over a wide area can prevent discrimination between possible imports from the Anatolian coast that is to a large extent lithologically compatible with Samos (see Sub-fabric 1D: HR15/179). Some assumed local fabrics can be linked with distinct sources (e.g. Fabrics 2, 6, 10), while others can be also ascribed with a more detailed geological provenance: Fabrics 3 and 4 are related to the ophiolite outcrops and peridotite-serpentinite sills of the Pre-Neogene basement (Selçuk nappe) respectively, which are only found in the area NW of Heraion and situated in a distance of *ca*. 10km away from the settlement and at a much higher altitude (*ca*. 400m).

This could mean that the manufacture of pottery was being carried out not only in the vicinity of the site, where the finished products were consumed, but also in broader areas that could represent the existence of settlements or workshops in the area of the ophiolite outcrops. Such a suggestion is made in the light of Arnold's (1985) threshold model B and should be also understood in the framework of socially or experientally-meaningful places, where the collection of raw materials is linked with other activities (see Chapter 5.7). As implied in previous sections, a number of finer fabrics (Fabrics 7, 13-17), despite mineralogical and textural differences between one another, could also be ascribed with a local provenance according to mineralogical links with the coarser fabrics and possibly relate to the red clays of metamorphic origin found in the vicinity of Heraion. Indirect support for such interpretations is provided by consideration of form and finish.

Although representing only small quantities within the total assemblage (loner samples or small groups), it is noteworthy that these correspond to a large number of non-local fabrics (see Section 7.4) or fabrics with unknown provenance (see Section 7.5). However, it should be kept in mind that the determination of provenance cannot be used for the reconstruction of direct routes or contacts, but provides rather an estimation of vessel circulation patterns and preferred exchange networks. Fabrics 18 and 19 can be securely assigned to the island of Amorgos, Fabric 25 is more likely from Melos and Fabric 26 from Thera, while Fabrics 29-32 have several features in common and could share a provenance on the island of Kea or even represent different production areas in western Cyclades. Similarly, Fabrics 20-23 and 33-34 exhibit a geological diversity in their mineralogical composition and share a number of similarities, such as the presence of acid igneous and metamorphic-related rock fragments, green amphiboles and pyroxenes, indicating a possible common origin on the island of Naxos or neighbouring islands with a similar geology. Other imports with a secure provenance include Fabric 39 that can be possibly linked with Chios Island and Fabric 41 with north-central Crete, while Fabric 28 could be linked with Lemnos. Interestingly, this study has revealed that specific ceramic vessels were circulated, i.e. transport jars, beaked jugs, pyxides, sauceboats, askoi, drinking cups, all related to short-term storage, serving, and consumption of liquids (possibly mainly wine and perfumed oils).

There are also several fabrics in which the origins of production have yet to be determined or are suggestive of broad geographical locations. This is usually because of a lack of comparative material, infrequent or non-discriminant inclusions, or due to non-diagnostic mineralogy or similarity of lithology with surrounding regions. The latter is well-reflected in Fabrics 11 and 12, which are thought of as Anatolian products. Fabric 5 is more ambiguous, although potentially related to Anatolia, and its provenance remains open. Those examples with a more clear provenance open up the possibility that other fabrics, which are equally rare but of unclear provenance (Fabrics 8, 9, 24, 27, 35-38, 40), could also have been produced in areas beyond Heraion itself or Samos in general. This is in turn suggested by differences in form and finish.

No Samian exports are known from these early periods. This might relate to the lack of analysed comparative material of neighbouring areas to Samos in the E that could have acted as the immediate recipients of circulated products. Potential imports from Samos have been reported from Emporio on Chios, especially in the case of the micaceous wares (Hood 1981, 169, 299-300) and recent comparative examination of macroscopic fabrics has identified a number of EB Samian imports at Tavşan Adası in coastal western Anatolia (see Appendix II.20).

Fabric Group	Suggested provenance
1, 1A, 1B, 1C, 1E, 2, 6, 6A, 6B, 6C, 7, 10, 13?, 14, 15, 16, 17, 40?	Samos (Kambos-Chora plain, Heraion or beyond)
1D	Samos or Çukuriçi Höyük?
3, 3A, 3B, 4	Samos (NW Kambos-Chora plain)
5, 11, 11A, 12	Western Anatolia?
8, 9, 24, 27, 35, 36, 37, 38, 42	Unknown
18, 19	Amorgos
20, 21, 22, 23?, 33?, 34?	Naxos
25	Melos?
26	Thera
28	Lemnos?
29, 32	Kea or western Cyclades
30, 31	Kea
39	Chios
41	Crete

Table 7.55: Suggested provenance areas of the petrographic fabrics.

7.7 Intergroup links between macroscopic and petrographic fabric groups

Since one of the aims of this thesis is to explore the inter-relationship between macroscopic and microscopic resolution for the identification of different fabric groups, the two categories were compared (Tab. 7.56). The majority of petrographic fabrics can be isolated macroscopically. Nevertheless, those that resist macroscopic identification tend to comprise loner samples or small groups and are characterised by non-local or unclear provenance.

In short, the metamorphic fabrics (PG1 and sub-groups) were found to be broadly consistent with the macroscopic groups (MG5), although unevenly distributed between the various sub-groups, mostly represented by MG5A and MG5B. Good correlations are identified between the ophiolite-related and serpentinite groups (PG2, PG3, PG4) and MG1 and MG2. A more varied picture is seen in the local volcanic fabric PG6, which, however, is generally consistent with MG3 and MG5A. This confirms that the early-dated, coarse samples of PG5 and PG6 are not always distinguishable macroscopically. Good fabric correlations are found in the EB II developed/late groups: PG7 corresponds majorly with MG7A, PG8 with MG9, PG10 with MG6. The EB III fabrics, predominantly characterised by fine micaceous clay pastes, are well correlated on both levels of visual analysis. However, this study cautions against assuming a definite provenance or even a secure characterisation of such fine fabrics, as it was found that MG10 is dispersed in five different petrographic groups (PG13-17). A number of fabrics classified as imports were found to be the best links between macroscopic and microscopic analysis, namely PG5=MG4 and PG18+19=MG14. The remaining loners are generally well identified macroscopically in distinct fabrics. MG16 forms an exception and is found to be dispersed in six different petrographic loners, all corresponding to a broadly common geological/geographical origin in the Cyclades.

Petrographic Group No.	Macroscopic Group No.	Petrographic Group No.	Macroscopic Group No.
1	5A, 5B, 5C, 5D, 6	18	14
1A	1A, 2A, 3, 5A, 5B, 5C, 5D, 5E, 6, 10	19	14
		20	16
1B	3, 5A, 5B	21	16, 17
1C	1, 5A	22	16
1D	5A	23	16, 20
1E	1A, 5B, 5C, 30	24	12
2	2A, 4	25	21
3, 3A, 3B	1, 2A, 2B	26	18, 19
4, 4A	2A	27	16
5	4	28	6
6	3, 4, 5A, 5B, 5D, 6	29	33
6A	26	30	5E
6B	3,5B, 7B	31	35
6C	6, 7A, 7B	32	5D
7	6, 7A, 7B, 10	33	32
8	9	34	16
9	13	35	24
10	5B, 6	36	31
11, 11A	7A, 7B, 8, 10	37	23
12	7A, 8	38	38
13	5D, 10, 11, 12, 16	39	28

14	10		40	5A
15	10		41	27
16	10		42	29
17	10			

Table 7.56: Correlation between petrographic and macroscopic fabrics.

7.8 Summary

This systematic petrographic study has produced significant patterns of production and exchange. To begin, there is a good correlation between form and fabric, groups tend to be consistent in terms of their chronology, while there exist fabrics that cross-cut a broad range of vessel types and show a diachronic use (e.g. Fabrics 1 and 6). Regarding pottery production, the variation of fabrics and distinct technological features within each implies that there must be several production centres operating in parallel within the vicinity of the site or some perhaps beyond the environs of Heraion itself. Nevertheless, an additional and/or different explanation might be given for the group of metamorphic fabrics that comprise more than half of the total analysed samples. These might reflect both a number of workshops and varied raw material sources in the vicinity of Heraion. Combined with the macroscopic information, the microscopic analysis revealed some important associations between shape, assumed function, fabric and/or ware. From the diachronic examination of fabrics *versus* shapes, it appears that no differentiation can be detected between clay recipes used for large or medium/small-sized vessels or ware-specific groups in the Ch-EB I periods. In the subsequent period there emerges a more varied picture with fabrics used for the manufacture of particular vessel types or even a range of similar fabrics that could reflect the existence of several production centres that produce the same types in similar or different recipes. Moreover, the relative frequency of fine and coarse fabrics shows marked changes over time. This could point out distinct manufacturing traditions and markedly different clays that can be explained from a chronological and technological perspective.

The petrographic results presented in this chapter have succesfully revealed a complex picture of ceramic production and distribution at EBA Heraion. Furthermore, the integration with the macroscopic results of Chapter 6 has enabled the establishment of a detailed basis for the characterisation of the local ceramic technological tradition and the reconstruction of potential links of interaction with other Aegean and Anatolian sites through a detailed contextualisation of Samos within a regional framework from the Ch to the end of the EBA. These aspects and their interpretation are further discussed in Chapter 9.

CHAPTER 8: Scanning electron microscope-energy dispersive X-ray spectroscopy (SEM-EDS) analysis of the pottery

8.1 Introduction

SEM examination was performed in order to investigate microstructural changes occurring in the ceramic matrix to investigate surface treatment and firing conditions. The equivalent firing temperature of pottery is estimated by the degree of vitrification of the matrix compared to known morphologies of similar ceramics (cf. Maniatis and Tite 1981). The examination includes visual assessment of the microstructure of the clay body and surface. Where possible semi-quantitative analysis through EDS is applied and the bulk elemental composition of the ceramic body and slip are compared with one another in order to characterise the nature of the clays used. Due to the small number of samples and the uneven representation of the various chronological phases and fabrics identified in the macroscopic (Chapter 6) and petrographic (Chapter 7) analyses, the data produced by SEM do not serve quantitative criteria. Rather they are complementary and provide a preliminary picture of firing strategies and, where possible, the raw material choices of the ceramic technological traditions represented at Heraion. Therefore, the following discussion is not structured by fabric. Rather, the results are integrated in a more meaningful way.

Chapters 6 and 7 presented the results of the macroscopic and petrographic analyses respectively, with information on firing regime separately for each group. The SEM results have been combined with these observations relating to surface colour, core-margin homogeneity/heterogeneity, and the level of optical activity (see Tab. 8.1). These demonstrate the existence of different technological choices and production behaviours in terms of raw materials, surface modification, and firing practices. Also included is an estimation of firing temperature and atmosphere of each sample. Twenty samples from 13 fabric groups were analysed, representative of the larger groups of assumed origin. Where possible, the same fabric was represented by more than one sample, in order to investigate any possible diachronic changes, as well as the degree of correlation between firing behaviour and groupings based on fabric, form, and finish. More importantly, by integrating these different levels of analysis, technological choice and by analogy also provenance, are highlighted.

8.2 Technical details on the preparation and examination of samples

Sample preparation consisted of a freshly fractured cross-section of body and slip glued with electrically conducting glue on an aluminium stage. A fresh cross-section was cut in order to acquire the best possible surface and body for each sample. All samples were coated with a thin layer of carbon coater Emitech K-950 in high vacuum conditions in order to improve their electric conductivity.[21] SE mode was used to take images of the clay microstructural change while BSE mode was used to observe the topographical distribution of elements. EDS analysis was used to obtain a semi-quantitative estimation of the chemical composition of different areas of the sample. The preparation and analyses of samples was performed with an Oxford SEM (JEOL JSM 6510) and microanalysis was carried out with the Energy Dispersive X-Ray Spectometer (EDS) equipment available at the Department of Biology, University of Barcelona.[22] Microstructural changes are identified, named, and estimated according to the approaches mentioned in Chapter 4 (Section 4.9). The terminology used here follows the one developed by Maniatis and Tite (1981), Tite (1991), and Kilikoglou and colleagues (Kilikoglou 1994; Day and Kilikoglou 2001).

[21] The samples were prepared by Dr M. del Pino Curbelo.

[22] Special thanks are owed to Dr M. del Pino Curbelo for inviting me to undertake the analysis at Barcelona, as well as Dr Marisol Madrid Fernández and Cristina Fernández de Marcos of the Department of Prehistory, Ancient History and Archaeology for the valuable time they spent tutoring and explaining the use of the SEM equipment and interpretation of related data.

Sample	Shape	Date	Surface colour/finish	Biscuit colour	Petrographic fabric group	Optical activity	CaO %	Atmosphere	Vitrif. body	Estimated firing temperature (°C)
15/24	Amphora	EB II developed	Red slipped/smoothed	Reddish brown with greyish brown core	PG1	High	None	O-R	NV/IV	750-800
15/89	Jar	EB I	Reddish brown slipped/smoothed	Red/reddish brown	PG1A	High	Very low	O	NV	<750
15/160	Cheesepot	Ch	Plain	Yellowish brown with dark areas	PG1C	High	Low	O-R	NV	<750
15/102	Pithos	EB II early?	Red slipped	Red-orange with dark grey/black core	PG2	Moderate/low	Low	O-R	IV	750-800
15/234	Amphora	EB II early	Plain/smoothed	Yellowish brown/reddish yellow	PG3	High/mixed	None	O	IV	750-800
15/2	Pithos	EB I	Red slipped	Red-orange with black core	PG4	Moderate/low	None	O-R	NV	<750
15/31	Pithoid jar	EB II developed	Red slipped and burnished	Red with black core	PG5	High	None	O-R	NV/IV	750-800
15/109	Open jaw/bowl	EB II developed	Black slipped and burnished	Dark grey/black	PG5	Moderate	Low	R	NV	<750
15/188	Jug/jar	EB II-III	Red slipped	Reddish brown with dark grey core	PG6	Moderate/high	Low	O-R	IV	750-800
15/203	Jar	EB II developed/late	Plain	Yellowish brown buff	PG6	Moderate	Medium	O	IV	750-800
15/190	Jug/jar	EB II developed/late	Red slipped	Reddish brown/reddish yellow	PG7	Moderate/high	High	O-R	IV	750-800
15/147	Two-handled bowl	EB II late	Black topped	Reddish brown/light brown	PG8	Moderate/high	Medium (slip)	O-R	NV	<750

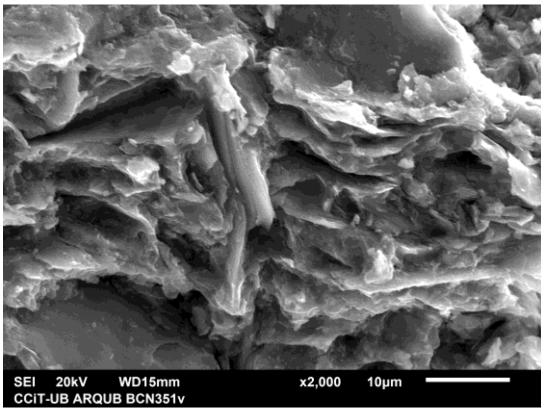
15/154	Two-handled bowl	EB II late	Black topped	Brown/reddish/ light brown	PG8	Moderate/high	Low/ medium	O-R	NV	<750
15/79	Pyxis/jug	EB II early	Dark grey slipped and burnished - incised	Dark grey-brown	PG9	High	Medium	R	NV	<750
15/193	Tankard	EB II late	Red/black slipped and burnished	Brown/reddish brown	PG11	Mixed/high	Low	O-R	NV/IV	750-800
15/149	Askos	EB III	Dark-faced and incised	Grey	PG13	Moderate	Medium	R	IV	750-800
15/191	Jar	EB III	Red slipped	Layering effect of pink-orange-light grey	PG13	Moderate	None	O-R	V	850-1050
15/142	Two-handled cup	EB II late	Red slipped	Red-orange	PG14	Moderate/low	Low/ medium	O	IV	750-800
15/152	Two-handled cup	EB III	Red slipped	Greyish brown	PG14	Moderate/low	None	O-R	IV/V	750-900
15/254	Bowl/jar	EB III	Smoothed	Pinkish orange with bluish grey core	PG15	Low	Low	O-R	CV	850-1050

Table 8.1: Summary of samples examined by SEM-EDS with information on firing and estimated temperatures. O – Oxidising atmosphere; R – Reducing atmosphere; O-R – Varied oxidising and reducing atmospheres; NV – No Vitrification; IV – Initial Vitrification; V – Extensive Vitrification.

8.3 Reconstruction of firing strategies

The following discussion is brief and takes into consideration the limitations of the small number of samples and the sampling strategy. These results are presented diachronically only in a preliminary fashion but still provide a general picture of technological changes related to the nature of the clays used and the firing process.

Following the definition provided by Maniatis and Tite (1981, tab. 1), four stages in the development of vitrification could be defined, occasionally with intermediate stages. More specifically, the majority of the analysed samples are characterised by the absence of vitrification of their microstructure (NV), where no definite smooth-surfaced areas of glass are developed (Fig. 8.1:A-B). Some samples appear to be non-vitrified, but some rounding of the edges of the clay plates occurs and thus it is defined as an intermediate stage between NV and IV (NV/IV; Fig. 8.1:C-D). The first stage of vitrification (IV) is associated with isolated smoothed areas of glass filaments (Fig. 8.1:E-F). In the next stage the isolated areas of glass steadily increases in size until an extensive vitrified layer is formed throughout the sample structure (V; Fig. 8.1:G). This layer can be extremely or completely vitrified (C; Fig. 8.1:H). No samples with evidence of total vitrification (TV) were identified, which would appear with larger bloating pores.



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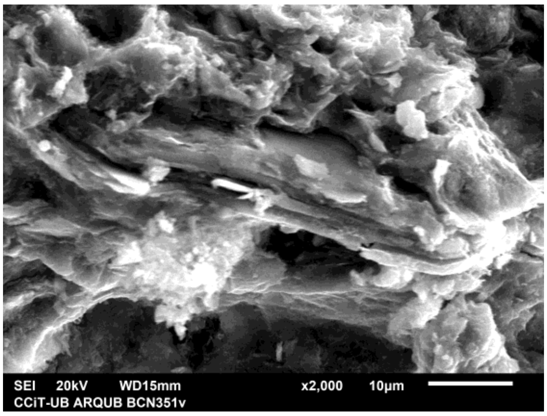

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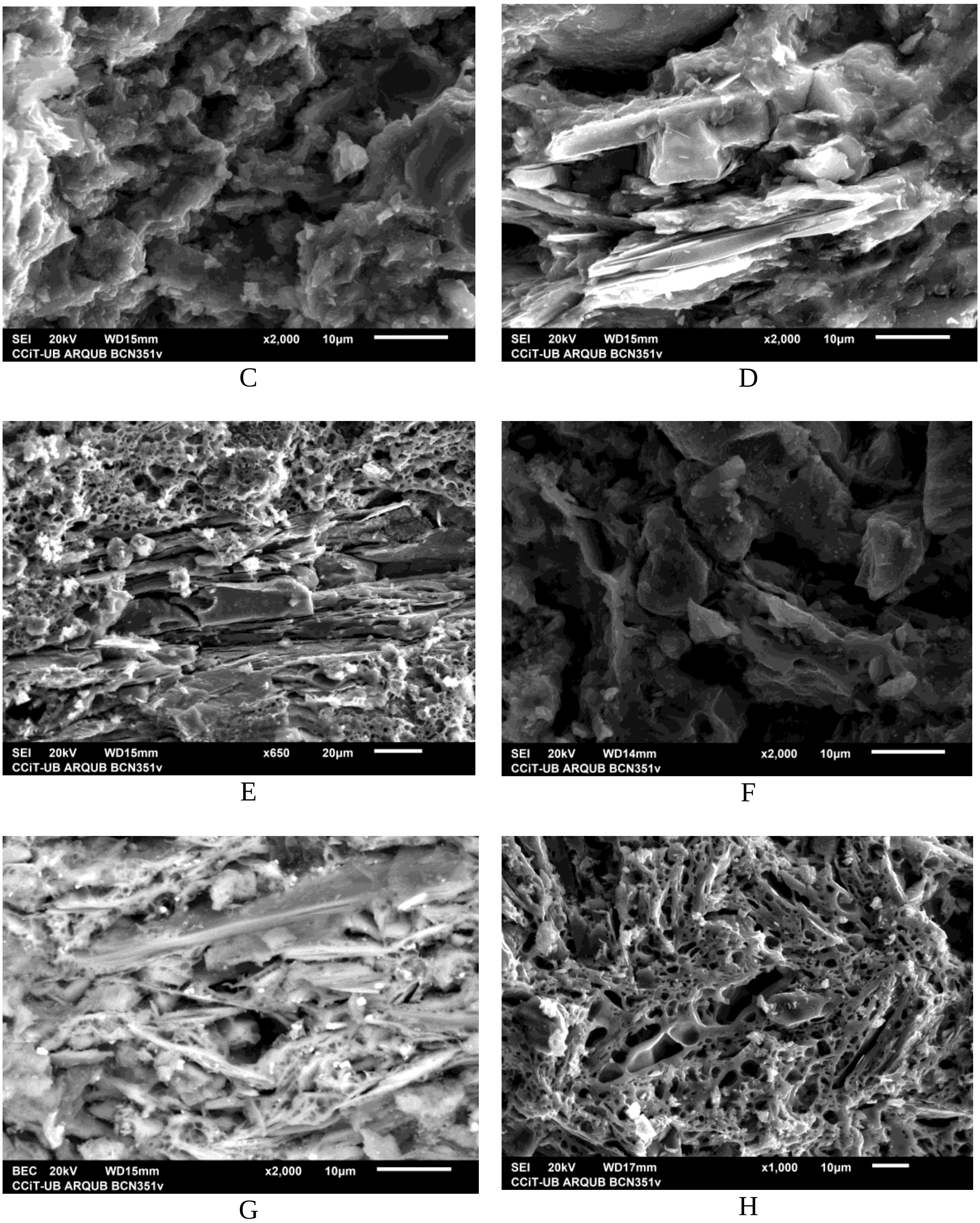
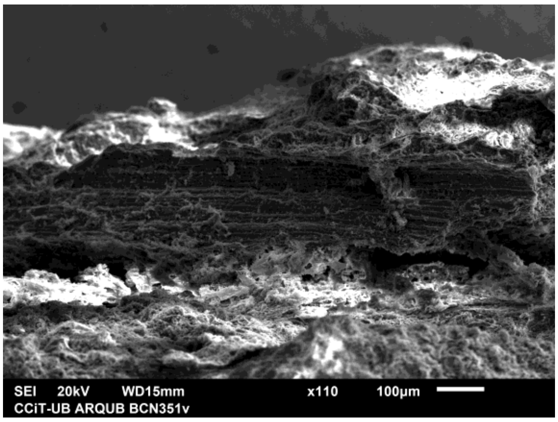


Figure 8.1: Images demonstrating the range of vitrification stages identified in the analysed samples. A. HR15/79: body microstructure showing NV with clear crystal boundaries and remains of the original structure; B. HR15/89: body microstructure showing NV; C. HR15/31: body microstructure showing NV/IV in the form of sparse glassy filaments; D. HR15/193: body microstructure showing NV/IV; E. HR15/102: body microstructure showing IV in the form of unevenly distributed, fine pores; F. HR15/203: body microstructure showing IV in the form of sparse fine pores; G. HR15/191: body microstructure showing V in the form of glassy filaments and fine pores; H. HR15/254: body microstructure showing CV in the form of glassy filaments and evenly distributed, fine pores.

8.3.1 Chalcolithic and Early Bronze Age I firing strategies

The early-dated samples (HR15/2, 79, 89, 160) are non- or low-calcareous in some cases, which may also relate to the presence of secondary limestone, consistently low-fired, and show no vitrification (NV). The estimated equivalent firing temperature is <750°C and no correlation between fabric, form or finish is observed. The colour of the fabric ranges from dark reddish brown to dark grey/black due to variation in firing atmosphere. According to macroscopic observations the majority of these samples exhibit a strong colour differentiation between the thin red/brown margins and the dark grey/black core. This along with the usually unslipped surfaces, which appear smoothed or lightly burnished, as well as the predominance of discolouration areas of dark grey or yellowish grey colour are taken as evidence of limited control over the firing procedures. This early-dated pottery is also predominantly tempered with organic material (chaff/straw), as evidenced both macroscopically and petrographically in the form of elongate voids created upon combustion, which resulted in the dark grey/black cores (Fig. 8.2). The firing conditions are not sufficient to allow the full combustion of the organic material and the total release of the carbon from the pores leaving the core dark. All this information would suggest that firing took place in an open environment (e.g. bonfire), which would also explain the discolouration on the exterior surface due to direct contact with the fuel. In addition, the partial combustion of the organic temper in some cases suggests a rather short firing and a fast heating gradient (Rice 1987, 336).



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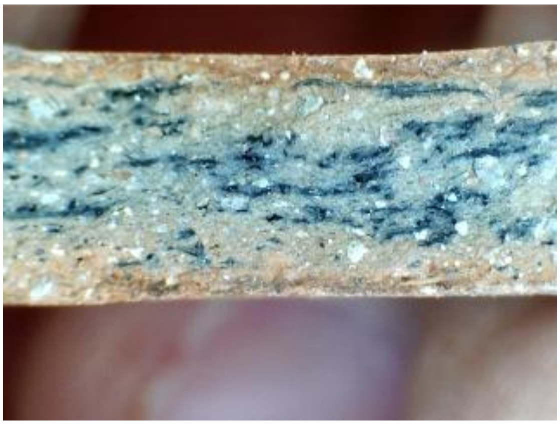


D

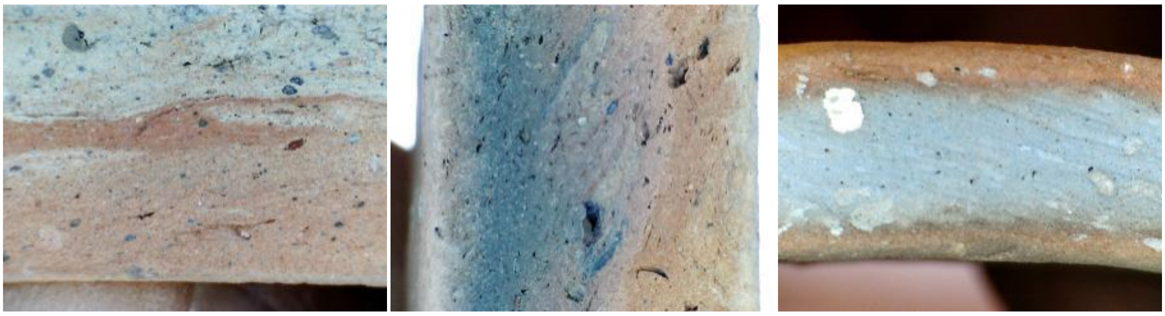
Figure 8.2: SEM and macroscopic observations of Ch-EB I pottery. A. SEM image of organic remains; B. Macrograph of discoloured exterior surface with organic imprints; C-D. Macrographs of sherd breaks with margin-core differentiation and combusted organics.

8.3.2 Early Bronze Age II firing strategies

Compared to the Ch-EB I (see above) and EB III samples (see Section 8.3.3), those dated to EB II are less homogeneous and exhibit a more varied picture in terms of firing strategies. More specifically, some samples (e.g. HR15/109) show no vitrification (NV), while others (e.g. HR15/31, HR15/193) exhibit a less homogeneous microstructure and combine areas with fine pores or glass filaments alongside non-vitrified areas (NV/IV). This is indicative of a low control over firing or even that firing took place in an open environment. The majority of the samples are consistent with a low vitrification (IV) and exhibit smooth-surfaced areas throughout the microstructure (e.g. HR15/102, HR15/234, HS15/203, HR15/190) and the estimated equivalent firing temperature is 750-800°C. There is no distinction between the vitrification stage and the various phases represented, namely EB II early, developed, and late. Nine different fabrics are represented in EB II and no particular consistency occurs in relation to shape or surface treatment. It is however important to note that the EB II early samples are macroscopically and petrographically reminiscent of the EB I samples in terms of body colour and the presence of a considerable chaff amount. The changes occurring in EB II developed concern the presence of low-medium calcareous clay pastes. A good example is HR15/203 which is also consistent with macroscopic observations of a yellowish brown/buff colour of the paste and appears with fine bloating pores that are unevenly distributed. A different calcareous fabric is represented by HR15/190, which appears with an iron rich red slip of a similar composition as the clay body, although the latter is medium calcareous (see Figs. 8.11-8.12). It is characterised by fine calcareous non-plastics that show evidence of secondary alteration (micritic clots), but no evidence of decomposition or failure of the ceramic is observed. In EB II late new clay recipes are in use (calcite-tempered; highly micaceous; fine calcareous) and newly-emergent surface treatments (black topped, red/black slipped and burnished; see Fig. 8.8:B). A third possibly medium calcareous fabric, represented by HR15/147 and HR15/154, is characterised by a high content of limestone or calcite temper, confirmed analytically with EDS analysis (Figs. 8.9-8.10). The presence of an iron-rich slip layer, which appears quite vitrified, of a different composition than the body (non-calcareous, high Fe and Ti) has been also identified macroscopically. The contrasting colour between the light coloured body and the bichrome slip (red exterior and black interior) would suggest the use of alternating firing atmospheres.

8.3.3 Early Bronze Age III firing strategies

Macroscopic and petrographic observations indicate that a considerable improvement in control over firing took place in EB III. This is in line with further technological changes in the ceramic manufacturing tradition of this period, which includes also the introduction of finer and better processed clays and a standardisation in the shape repertoire and surface treatments. The samples analysed with SEM are consistent with high firing, as indicated by the vitrified microstructure with an estimated equivalent temperature between 900 and 1050°C. This is identified at different stages from extensive to continuous vitrification in the form of evenly distributed glass filaments and a porous texture with fine bloating pores, indicative of a fast heating rate (Maniatis and Tite 1981, 74). The high firing temperatures were also confirmed petrographically (especially in PG 14 and PG15) by the optical inactivity of the micromass. Regarding atmospheres these seem to be quite varied, although the majority are red/orange throughout the sherd break and suggest that a prolonged soaking time was retained in the last stage of the firing process to allow a uniform oxidation state. Other samples appear with a weak core or bicoloured with half red/pinkish and half light grey (Fig. 8.3:A-B), possibly as a result of incomplete re-oxidation, or exhibit a ‘sandwich’ effect (Fig. 8.3:c), where a strong colour differentiation between a bluish grey core and red/orange margins imply a rapid change of the temperatures or differential oxidation-reduction episodes and insufficient oxidisation during cooling. This could also explain the microbloating of the matrix. The resulting colour is also affected by the mixing of different raw materials, most likely an iron-rich non-calcareous with a low-calcareous clay. The vessels represented are a jar, a bowl, and a two-handled cup, which comprise the main shapes of this period made in these fine micaceous fabrics. The use of low-calcareous clays in EB III (e.g. HR15/254), possibly from Neogene marl deposits in the vicinity of Heraion, would enable the achievement of increased temperatures since the ceramic structure remains relatively unchanged from the IV to the V stage (Maniatis and Tite 1981, 65, 75) and the control of firing needed to achieve a consistent quality is much less critical than when non-calcareous clays are used. The use of such low calcareous clay is evident in HR15/149 (askos), which would require better control over forming and firing to retain its original shape.

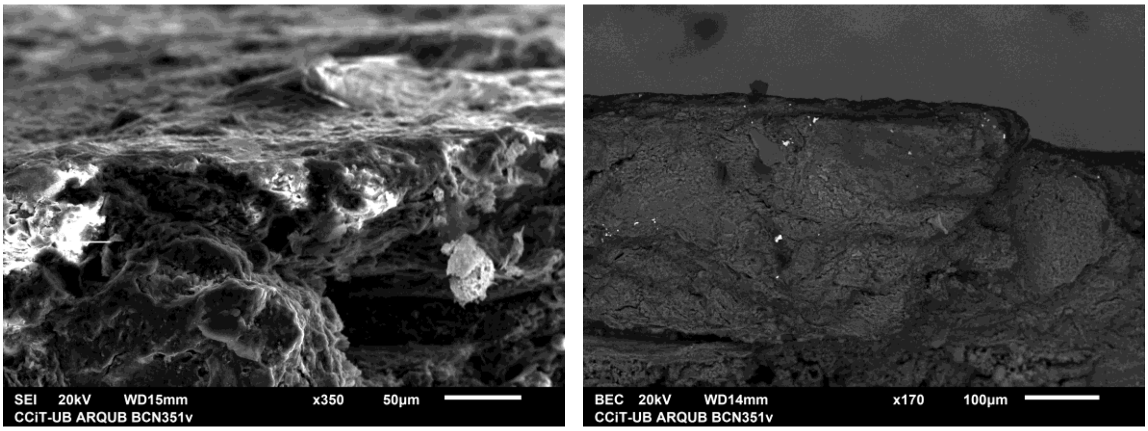


A B C

Figure 8.3: Macrographs of ceramic sherd breaks of EB III indicating different atmospheres.

8.4 Reconstruction of surface finishing

Study of the structure and composition of the surfaces revealed the existence of at least three finishing techniques among the analysed samples. More particularly, a number of samples exhibited a compacted surface and lacked any evidence of slip layers (Fig. 8.4), corresponding to what has been defined macroscopically as smoothed or plain surface treatments (see Chapter 6). No distinct boundaries between body and surface could be observed with SEM. This particular surface modification does not apply to specific fabrics or forms, but it usually corresponds to the early-dated samples (Ch-EB I) of PG1 that contains the majority of the analysed vessels. This compacted layer is of the same composition as the body, but the presence of high levels of Ca (HR15/160) might indicate the existence of a slightly finer, calcareous fraction on the surface produced as a direct consequence of burnishing or even the use of an unpreserved thin slip, but most likely due to depositional processes and natural lime-coating (Fig. 8.5). Other samples not examined with SEM appear with a smoothed surface that was originally covered with a thin non-calcareous slip, according to its identification in thin sections (PG13). Different samples would seem to indicate the presence of a finer fraction of the body with high values of Al and K, which would be consistent with an added non-calcareous slip layer.



A B

Figure 8.4: Compacted surface of samples A. HR15/89 and B. HR15/160.

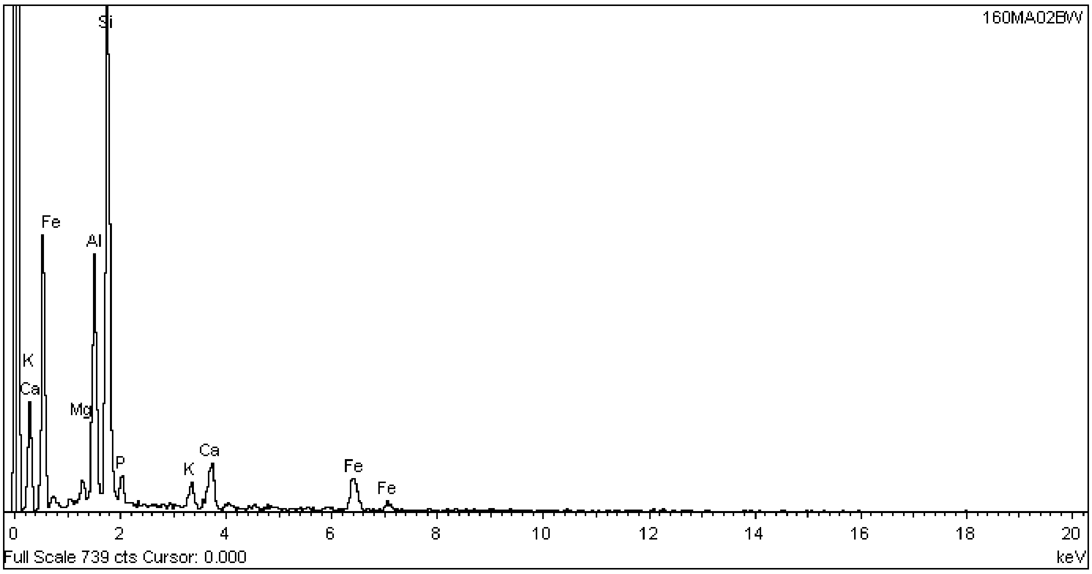


Figure 8.5: SEM-EDS element spectrums of HR15/160 showing a high Ca content of the surface.

A different finishing technique is characterised by the presence of a thick iron-rich slip layer that is clearly separated from the clay body (Fig. 8.6). This is also confirmed by the high Fe spectrum values of the EDS analysis (Fig. 8.7). This layer appears with a relatively vitrified glassy texture and corresponds to the vessels of PG5. It is macroscopically very distinctive and is predominantly fired to a red colour, although two samples appear black implying a controlled reducing atmosphere at the end of the firing procedure. The macroscopic visual homogeneity of these vessels is observed also in the firing strategies employed, i.e. low-firing with no vitrification but sparse areas that potentially exhibit initial vitrification.

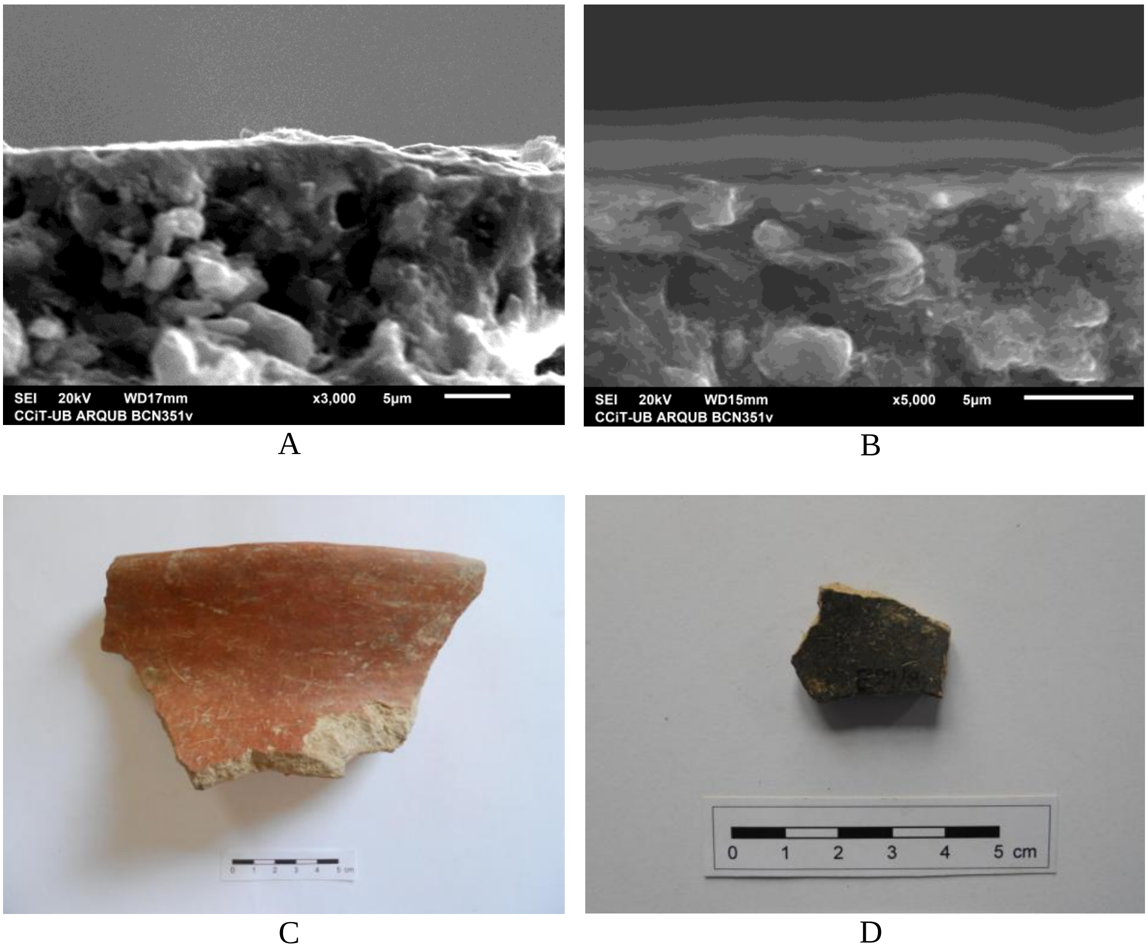


Figure 8.6: Slip layers examined macroscopically and with SEM. A. HR15/31; B. HR15/109; C. Thick red slip and burnish; D. Thick black slip and burnish.

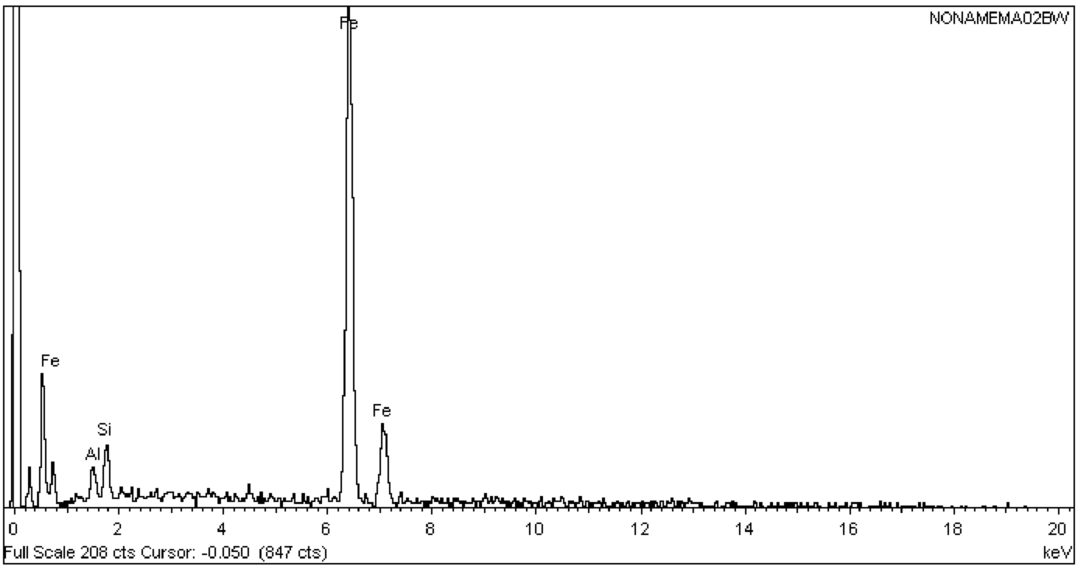
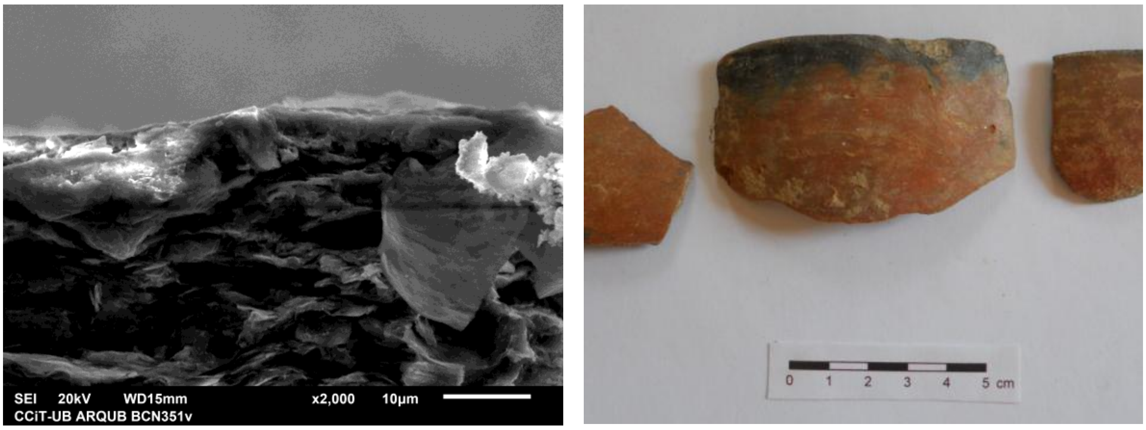


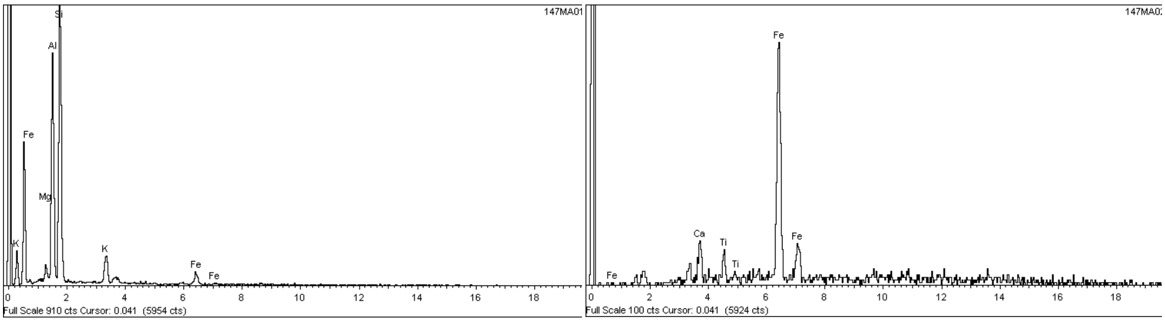
Figure 8.7: SEM-EDS element spectrums of HR15/31 showing a high amount of Fe on the slip surface.

The third surface finishing mode, namely black topped, has been described macroscopically as being characterised by a dark red slip on the exterior surface, which is fired black on the interior and the exterior along the rim (Fig. 8.8). Macroscopically these vessels belong consistently to two-handled bowls, tankards, and other drinking vessels of EB II developed/late (see Appendix II:19, MG9). The ceramic body exhibits a reddish brown/light brown colour which indicates a relatively uniform oxidation state. SEM analysis showed a contrast between the vitrified slip layer with small pores and the non-vitrified ceramic body, while EDS analysis confirmed the compositional incompatibility between the two. More specifically, the body appears with relatively high potassium values and low-medium iron, while the extremely high Fe values of the surface clearly indicate the use of an iron-rich slip. The latter is accompanied by high Ca and Ti values (Fig. 8.9). The presence of Ti in the slip spectrums might relate to the natural presence of iron oxides of maghemite in the clay. However, the low presence of Ca from HR15/154 suggests that the measurement for HR15/147 may be an effect of the high calcareous content (calcite-tempered fabric) of the clay body at the boundaries with the slip layer (Fig. 8.10). The highly calcareous content of the body required dominantly oxidising conditions to achieve the contrasting light colour, whereas the dark red of the exterior and black interior, as well as the achievement of a black topped rim would require the use of alternating firing atmospheres of reduction and oxidation. More particularly, the black coloured slip indicates that fully reducing conditions were achieved, but the creation of a different colour might be explained by intentionally covering the exterior up to below rim level during the phase of reduction, thus leaving the exterior red. Alternatively, this effect could be achieved by burying the rim upside down in carbon-rich material in an open firing. This technological choice implies good control over the firing atmospheres, intentionally giving the vessels in question an aesthetic value.



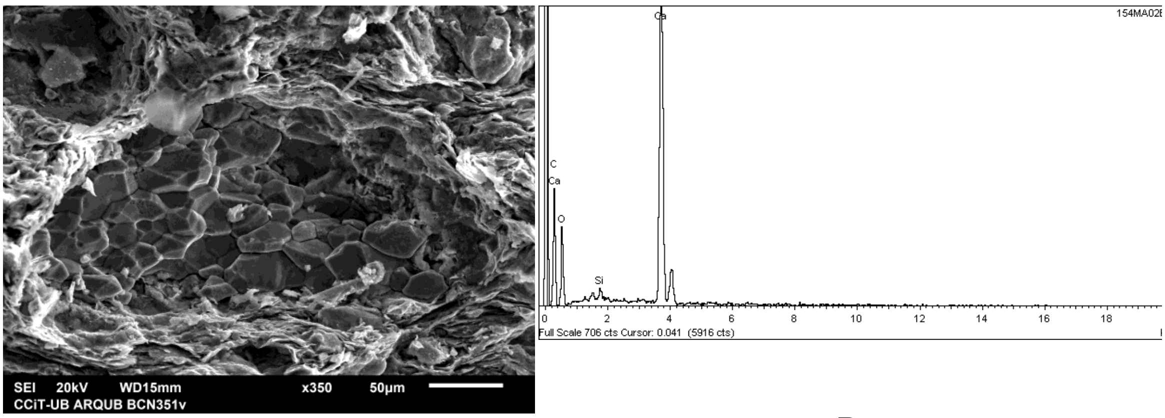
A B

Figure 8.8: Slip layers examined macroscopically and with SEM. A. HR15/147; B. C. Black topped slipped bowl.



A B

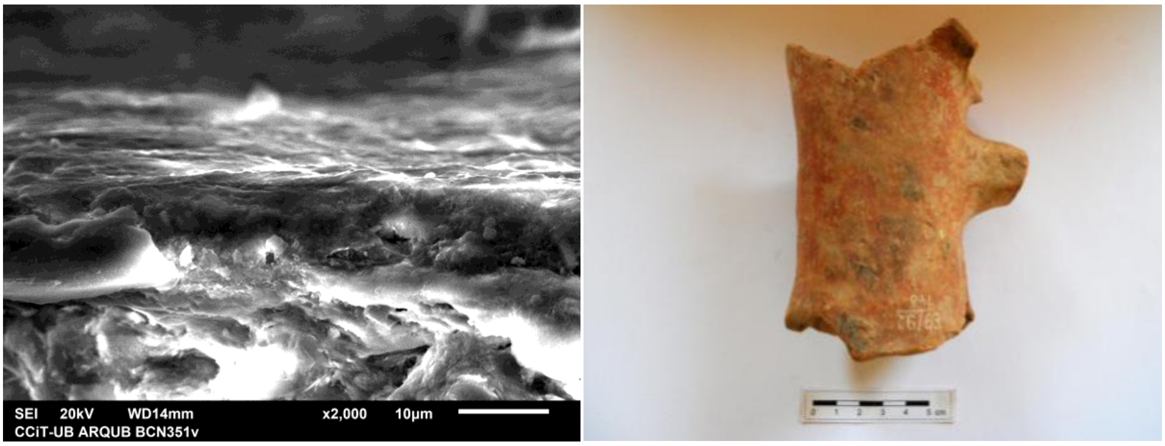
Figure 8.9: SEM-EDS element spectrums of HR15/147. A. Analysis of the body showing a high amount of K; B. Analysis of the slip showing a high amount of Fe, Ca, and Ti.



A B

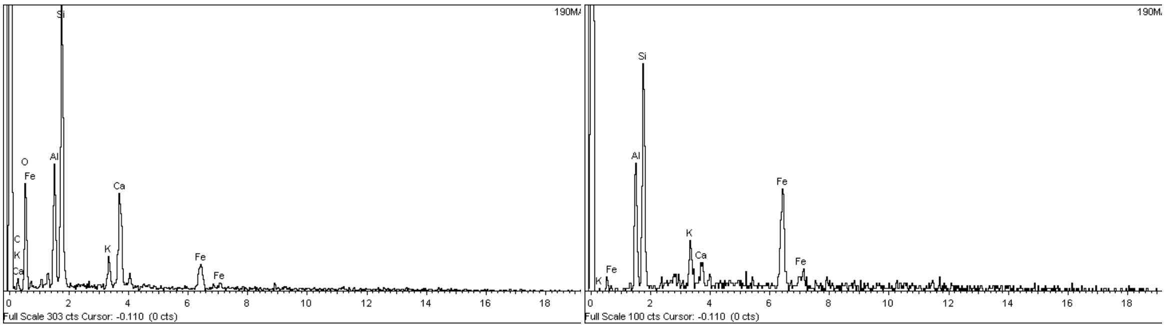
Figure 8.10: HR15/154. A. Ca-rich limestone inclusions; B. EDS spectrum compositional analysis of calcite inclusions.

The last surface modification mode identified with SEM corresponds to red slipped serving and drinking vessels of EB II developed/late (PG7). It is macroscopically distinguished from the previous red slipped and burnished modes as it is thinner and generally unburnished (Fig. 8.11). SEM analysis showed that there is no distinction between the surface and clay body in terms of firing temperature and state of vitrification and that both are relatively low fired. However, semi-quantitative analysis with EDS documented a compositional difference between the calcareous body and iron-rich surface (Fig. 8.12).



A B

Figure 8.11: Slip layers examined macroscopically and with SEM. A. HR15/190; D. Red slipped jug.



A B

Figure 8.12: SEM-EDS element spectrums of HR15/190. A. Analysis of the body showing a high amount of Ca; B. Analysis of the slip showing a high amount of Fe.

8.5 Summary

The results of the SEM-EDS analysis indicate that the ceramic technologies, as defined in terms of the type of clay and firing parameters employed (temperature, atmosphere, duration), varied diachronically, but that no clear distinction or correlation could be established with the form, fabric, or finish of the final products. Nevertheless, the diachronic examination of these developments implies a period-specific consistency in the changes observed and a distinct technological development in firing practices over time.

The majority of samples were found to be low fired, non-vitrified, and made in non- or low-calcareous fabrics. This corresponds specifically to the early-dated samples of locally produced vessels. SEM results in combination with macroscopic and petrographic observations suggest little control over the firing procedure or maintaining a homogeneous atmosphere, which further relates to the use of what has been suggested as open-air firings (e.g. pit fire or bonfire). These early-dated samples are also characterised by dominant organic temper. Its partial combustion has been interpreted as the result of fast heating rate in a short time in variable atmospheres, where reduction predominated in the last stage of the procedure, causing a strong core-margin colour differentiation or often uniformly black cores. In EB II there is considerable variation in the range of firing temperatures and the use of medium fired, non- or low-calcareous fabrics. This variation occurs irrespective of fabric or form. For the first time we have the introduction of low/medium calcareous clays in EB II developed and late and the organic temper is considerably decreased and ceases at the end of EB II. Drastic technological changes occur in EB III, with the introduction of finer clay pastes that are consistent with a vitrified microstructure, typically associated with high firing procedures. The colour of the clay body is more homogeneous compared to the previous periods, suggesting more homogeneous firing procedures.

Inferences regarding the firing environment were also possible: those samples exhibiting an intermediate stage of a NV/IV microstructure (often with micro-bloating) could imply a heterogeneous firing process where the heat gradient is uneven and fast and the duration of firing is short. This is also suggested by occasional fine bloating pores and a porous microstructure caused by localised reduction, which is also confirmed macroscopically by the grey/black colour or the strong core-margin colour differentiation of the sherd break. This could be caused by the positioning of the pottery during firing or from the addition of fuel during the firing process in order to produce a reducing atmosphere, usually associated with an open firing technique (Maniatis and Tite 1981, 74; Kilikoglou and Maniatis 1993). The heating gradient is more homogeneous in EB II late and EB III, which would suggest a better control over the firing procedure (steady temperature and exposure to a constant atmosphere, longer soaking time) and a better correlation with wares and fabrics, potentially associated with a two-space firing (i.e. kiln structure). The vessels develop a more uniform microstructure and colour of the clay body, which appears more light-coloured and occasionally buff.

Study of the surfaces resulted in the identification of a range of different finishing techniques and to a large extent these results confirm the petrographic and macroscopic observations. The early-dated samples are consistent with a compacted surface due to burnishing or intense smoothing. From EB II a greater number of surface finishing modes appear which would seem to also be an effect of the presence of imported pottery. For instance, the black topped and red/black slipped and burnished wares are potentially imports and differ considerably from the local tradition. In terms of firing temperatures there is no clear distinction between what has been defined as local and import in the previous levels and methods of analysis. Nevertheless, when this information is combined with associations of fabric, finishing, elemental composition of the ceramic body and slip with SEM-EDS, and the frequency of CaO in the ceramic sample this distinction can be confirmed in some cases.

This chapter has confirmed observations made in the macroscopic and petrographic analyses of the pottery regarding diachronic changes in terms of firing temperatures and potters' control over the firing conditions towards the end of the EBA. More importantly, the SEM analysis suggests that these changes could be ultimately explained by the introduction of new technical equipment that enabled the practice of new craft skills. Firing is an important part of the ceramic technological process and is better comprehensible within the context of other analytical levels and steps of the manufacturing procedure.

CHAPTER 9: Discussion

> "It should come as no real surprise that archaeology itself changes, not simply because we find more things but because the debate concerning the generalities upon which our interpretations are based remains one of active engagement" (Barrett and Halstead 2004, ix).

9.1 Introduction

In archaeological studies of pottery, we often divide social activities into three main categories, i.e. production, exchange, and consumption. However, in more recent studies these activities are considered as closely interrelated in the social understanding of material culture. This final discussion aims to provide a synthesis of the results from the multi-technique analytical study of pottery from Heraion and builds a range of interpretations. The methodology used throughout this thesis has already been applied successfully in previous projects working on Aegean prehistoric ceramics, mainly in Crete and the Cyclades. This has drastically transformed previous concepts of the EBA, revealing views of an avowedly more complex society with a higher degree of pottery specialisation and a busy seascape with long-distance networks of interaction. The present work has aimed to be truly integrated and has completed the full study of substantial assemblages in order to situate Heraion and Samos in this emerging picture of life in the Aegean EBA.

This thesis has also shown that the holistic examination of total ceramic assemblages at an intra-site level can contribute to a more meaningful interpretation of pottery development. The bottom-up approach employed deliberately moves away from solely typological and stylistic approaches to the study of EB ceramics that dominated past studies in the eastern Aegean, western Anatolia, and often the wider Aegean. Such approaches are particularly problematic, especially when interpreted simplistically correlating a posited emergence of social complexity directly with ceramic changes. These generalised interpretations and typologies form the basis of an understanding of common trends in EB *material culture* between different sites and regions, interpreted as evidence for a cultural or even socio-political *koine*. A lack of more 'localised' studies has prevented the reconstruction of detailed ceramic changes and/or continuities at a community level. As such, archaeologists have not addressed the significance of ceramic distribution patterns beyond chronological or cultural groupings. Similarly, the lack of detailed technological ceramic studies has impeded the reconstruction of production practices and an understanding of their embeddedness in a social milieu.

The present multi-level work has revealed a complex picture of continuity and change in the development of ceramic technological tradition at Heraion, as well as a solid basis for better understanding some of the theoretical issues raised in Chapters 1 and 2. The main themes discussed in the present chapter include: a) technological change in ceramic tradition and pottery production, b) identification of networks of interaction and ceramic exchange at an intra-regional and inter-regional level, and c) issues of complexity and specialisation in the EBA. It is suggested that only by addressing more focused micro-scale questions concerning the production and distribution of pottery that we can address more generalised questions about continuities and discontinuities or contextualise the associated social trajectories.

9.2 Diachronic reconstruction of the Heraion ceramic technological tradition: a *chaîne opératoire* approach

This section focuses on the micro-scale processes of pottery production that took place over time at Heraion, defined here as the interactions involving potters, their raw materials, and the social context in which the practice and related choices took place. In other words, it characterises intra-site developments and everyday actions of the local potters at Heraion using the *chaîne opératoire* approach. By highlighting where in the production sequence variability and change occurs and potters' choices, we can draw inferences concerning the location and organisation of ceramic production and the make-up of a group of craftspeople, as well as the shared repertoire of technical know-how or learning environment that characterises a particular community of practice. The following discussion is broken down into six separate stages from the procurement and collection of the raw materials for pottery manufacture to finished products. These different operational sequences are then compared to one another. In essence, the comments made in this chapter aim to detail, discuss, and develop the most important outcomes of this research.

9.2.1 Exploitation of raw material sources

These observations are based on geological literature and mapping, supplemented by raw material prospection and experimental analysis of clays and sediments from Samos. As this constitutes the first study on such a scale on Samos, aside from Whitbread's (1995, 122-133) informative study of Greek amphorae from the island, there still remains much work to be done on this topic. Nevertheless, despite the limitations imposed by the lack of comparative information on raw material sources or pottery analysis from Heraion, as well as diachronic change in such resources since the 3rd millennium BC, the present study has been able to suggest some specific clay deposits related to EBA ceramic production.

Macroscopic and microscopic fabric observations have revealed a good correlation between chronology and specific clay recipes (see Chapter 6.6.2, tab. 6.1, figs. 6.28-6.29). There is a distinction between those fabrics in use over a long span of time and those restricted to a shorter time-span or even a single period. There emerges a picture of continuity and change in the choice of raw materials, which may be the result of natural variability within sources, different production units using different sources or even the same production unit using different sources, but which, in turn, is affected by the physical properties and performance characteristics of the raw materials (Arnold 2017, 20). There is a clear distinction between a preference for coarse alluvial clays in the first half of the 3rd millennium BC and for finer, Neogene-related calcareous clays in the late 3rd millennium BC.

- During the first half of the 3rd millennium BC, a series of metamorphic-related clay pastes are in use, which occasionally continue into later periods, though in much lesser quantities. These relate to naturally varied sources in the vicinity of Heraion that are characterised by red alluvial clays with a usually mixed metamorphic lithology. This was also confirmed by the analysis of clay samples.
- A different series of fabrics with a volcanic lithology also cross-cuts periods, shapes, and functional categories. Macroscopically these are occasionally hard to distinguish from the metamorphic fabrics. This suggests that neighbouring potters operating concurrently may have exploited different sources for the manufacture of the same range of vessels. The volcanic fabrics are more common in the EB II developed/late and EB III periods.
- A completely distinct fabric or series of ophiolite-related fabrics were popular in the Ch-EB II early, for the manufacture of cooking vessels. Geological prospection and detailed examination of geological maps point to a possible area of exploitation, the ophiolite outcrops and peridotite-serpentinite sills of the Pre-Neogene basement (Selçuk nappe) occurring NW of Heraion in the area of Pagondas-Spatharei. The notable homogeneity of the fabric implies the direct exploitation of these deposits, which are only found *ca*. 10km from the settlement. This suggests that the manufacture of pottery was being carried out not only in the vicinity of the Heraion site, where the finished

products were consumed, but also further afield, with workshops established in the area of the ophiolite deposits.

- The most striking change in fabrics occurs in EB II developed, when the clays begin to become finer and possibly better processed and new recipes appear such as the alluvial/sandy and micaceous quartz fabric groups. This technological choice and change of practice continues and is better reflected in the following period, the EB II late, with the appearance of new recipes, both local and imported.
- EB III represents the second horizon of change. A preference towards fine to very fine, highly micaceous pale fabrics is documented which did not occur in the previous periods, that might also reflect new developments in the processing of clays and firing of the final products. This follows a general trend appearing across the Aegean (cf. Day *et al*. forthcoming: Akrotiri Phase A on Thera).

As shown above, the good correlation between shape and/or function and fabric within and between chronological phases imply that potters had a good knowledge of the landscape and the occurrence of different raw material resources. Furthermore, potters' decisions and actions may have been also shaped by certain beliefs and traditions that are intertwined with their social landscape.

9.2.2 Preparation and processing of the raw materials

EBA potters on Samos chose to either use clays in their natural state or to process and manipulate the raw materials by refinement, levigation or mixing. The former case is well evidenced in earlier pottery through the utilisation of naturally-mixed, heterogeneous clays of metamorphic origin (PG1). For instance, the identification of a number of different TCFs in the groundmass of PG1 was also observed in clay samples collected in the geological prospection. From EB II developed onwards there is more evidence for more intensive processing of the clay. Evidence for clay mixing may be identified in a variety of ways, most commonly inferred by comparison of clay pellet composition and groundmass. Less frequent are clay domains or striations, which provide stronger evidence for the incomplete mixing of different clays. This is the case for the EB III fabrics which, among other technological advances, include clear evidence for the refinement and mixing of clays. For instance, the fine micaceous fabrics (PG13-17) exhibit dark red/reddish brown amorphous aureoles/clay striations that indicate the mixing of a fine red micaceous clay with a coarser red clay rich in quartz (PG14-16). This might also relate to the deliberate refinement and subtractive preparation (sieving or levigation) of the clay or compaction of the clay body. PG17 contains also some calcareous-rich striations, indicating mixing of different clays.

Tempering is not consistent in the local tradition, nor does it show any correlation with shape or functional categories. PG13 provides a good example, as its coarse fraction reflects the intentional addition of sand to the clay paste. Similarly, PG1 (variants HR15/25, 111, 245), PG1C and PG1D, as well as PG40 are tempered with sand from metamorphic rocks. Tempering has also been identified in PG8 and PG9 in the form of crushed limestone and the addition of grog respectively, but these comprise off-island products (see below).

Vegetal tempering provides a good link between local fabrics and implies a long-lasting continuity of practice which decreases after EB II early. More particularly, there is some minor presence of organics in medium-coarse fabrics of assumed local provenance that date to EB II developed-late (PG7 and PG10). PG6B and PG6C of EB II late also contain a substantial amount of organic matter and provide another indication of the local manufacture of vessel shapes traditionally considered as foreign (e.g. tankards, bell-shaped cups). Other fabrics used for the manufacture of these drinking vessels do not contain organic matter and this comprises further evidence for their non-local provenance (PG11-12). The tradition of vegetal-tempering ceases by the end of EB II and is absent in EB III (PG13-17). This deliberate addition by the potter does not follow strictly functional criteria, as it was found in all vessel forms and shapes of the Ch-EB II early. Therefore, organic tempering might have a symbolic or other meaning (e.g. potential link of pottery manufacture with other production activities such as agriculture or field exploitation) rather than just simply a causal relation with techno-functional constraints (improvement of clay workability, vessel portability, thermal stress resistance), and represents a common trend of the Heraion community.

9.2.3 Forming techniques and the appearance of wheel technology

The majority of the locally produced vessels dating to the early EBA are formed using handmade techniques, such as coiling and slab-building. This observation is based on the extensive macroscopic analysis of vessel surface and sherd break, combined with observations of the groundmass in petrographic thin sections (preferred orientation of voids and inclusions for coarse fabrics, optical activity and orientation of clay mineral domains for fine fabrics).

As shown in Section 6.6.2 (Figs. 6.30-6.32), the first indications of the use of a rotary device are found in Heraion II (EB II late), but it seems to become more integrated in the manufacturing process during EB III (Heraion IV-V). The distinction of the various methods, be it wheel-coiled, wheel-finished/wheel-fashioned, and wheel-thrown, is not always feasible, but close macroscopic examination identified a number of patterns. Following the identification process as defined by Roux's work (cf. Roux and Courty 1998) and recently applied by Choleva (2012; 2015), the present study demonstrated that the introduction of the potter's wheel at Heraion went through a number of stages, i.e. vessels were made up of coils and then fashioned on a wheel, rather than an immediate introduction of the wheel-thrown technique. Therefore, this innovation did not result in a wholly new production process, but was adapted to the existing *chaîne opératoire* of the coil-building technique. Overall, the diachronic analysis of forming methods showed that the Ch and EB I pottery is characterised by walls of uneven thickness and evidence of coiling and that coil-made pottery also predominates in EB II early for all shapes, regardless of fabric or surface finish. The first change occurs in EB II developed with the manufacture of shallow bowls/plates that show the first evidence of coiling in combination with wheel-finishing. This is further evidenced in EB II late for the manufacture of small, thin-walled vessels and the first plates made in MG12. However, what seems to be a drastic technological change occurs in EB III with the introduction of a faster rotary device and the manufacture of the first wheel-thrown, or perhaps just still wheel-fashioned vessels, with the RKE being introduced at different stages of the manufacturing process.

The introduction of the wheel in the Aegean has been often linked with the spread of the *Anatolianising* vessel types in EB II late from western Anatolia to the Aegean islands (Sotirakopoulou 2008b, 86-87). However, this is not a homogeneous phenomenon across different areas and we must not assume a linear trajectory towards the replacement of traditional techniques. The adoption of wheel technology would require long-lasting and sustained interaction that would enable the transfer of skills and knowledge to the potters' community. For instance, wheel technology was not adopted in the EB Cyclades despite imported wheel-made plates being present in some assemblages (Wilson 1999, 94, 141-143). This technological transfer and insertion of new ceramic traits into previously established production environments entailed the transmission of technical knowledge and motor skills in the context of a long apprenticeship and prolonged interaction between different communities of potters, transcending "short-term encounters that occur through activities of trade and exchange" (cf. Gorogianni *et al*. 2016, 202-203). This interaction required physical participation between master and apprentice and could not be learnt through familiarity with or observation of finished products (Gosselain 2000, 192).

What can be observed at Heraion is rather a long process of adaptation to this new technology, which probably goes hand in hand with changes in the shape repertoire, with the newly-emergent drinking shapes (PG11, PG12). Macroscopic study of these imported tankards, bell-shaped cups and other drinking types shows that they were largely wheel-fashioned. This may imply that the Samian potters first interacted with wheel use in the form of finished products until they experimented in the manufacture of the first wheel-made plates. It does not support the arrival of a distinct group of potters or even the existence of a separate community of practice at Heraion in EB II late, but rather a period of slow adoption, adaptation, experimentation, and technological innovation that led to the full use of wheel technology by EB III. The local manufacture of tankards and bell-shaped cups using handmade techniques, alongside the importation of off-island products from western Anatolia, shows a more complicated picture of conscious choice and integration of new elements in the local ceramic tradition. This is even more conspicuous in EB III, when certain shapes, e.g. handleless cups (*Samos Becher*) are formed on the wheel (wheel-thrown), while their two-handled counterparts are coiled or wheel-fashioned. Changes that occurred in the forming techniques accompany wider technological developments observed in the use of different raw materials than in previous periods, better processing of the clays, and firing at higher temperatures. These changes should be seen as part of a long-term response to new skills and social engagement of the local potters with other communities of practice. These technical alterations reflect the demands of society and the dynamic relationship between craft and individual/collective identity, as well as the negotiation of learning mechanisms within (vertical) and between (horizontal) communities of practice (Gorogianni *et al*. 2016, 203).

9.2.4 Finishing methods and surface treatment

Compared to the other stages of the operational sequence, surface modification at Heraion is more conservative and shows only weak chronological or fabric correlations. The surface treatment modes remained relatively unchanged from the Ch until EB II early, commonly with plain or smoothed modes and with a generally hasty, less careful treatment of the surface, which appear compacted in SEM (see Section 8.4, fig. 8.4). The irregularly burnished vessels, especially bowls and jars, are particularly common in EB I and EB II early and dark surfaces with discolourations prevail. This is suggestive of uneven firing atmospheres or contact of the pots with fuel during firing. The predominance of monochrome wares is well known from eastern Aegean and western Anatolian ceramic traditions. The application of slip and burnishing are multi-period techniques, but there are differences in colour and quality over time. These are linked not only to raw material choice, but also to developments in firing technology.

Burnishing appears more common in specific surface treatment modes and fabrics, such as MG7-MG9, which created a metallic texture and shiny appearance on drinking vessels and other tablewares. Other examples include MG4, which in contrast represents storage vessels. In the last case, burnishing was used to reduce permeability. Apart from the change in hues and quality of finishes, no other correlations have been identified. Perhaps it is interesting to note that EB II late accommodates a broader range of finishing techniques, both surface treatments and decorative modes (especially incised), which relates to the presence of more imports. This is in good agreement with their macroscopic identification and the intentional creation of visual distinctiveness of these vessel types, which may imitate or be inspired by metal prototypes. Perhaps this is best reflected in Fabric 8, where such thick red slips are used to create a distinction between the dark finish and an otherwise light-coloured calcareous fabric. Samples of different imported fabrics with distinctive surface treatment were examined by SEM-EDS, which provided indirect supporting evidence for their incompatibility with the local ceramic tradition.

9.2.5 Firing strategies

The study of firing was based on a combination of macroscopic (colour of sherd break and surface), petrographic (optical activity of the groundmass, colour), and microstructural (degree of vitrification of the matrix) information. Firing is a complex step in the operational sequence and its understanding requires a number of parameters to be taken into account (estimated temperature, atmosphere, duration).

The diachronic examination of firing strategies implies a period-specific consistency in the changes observed and a technological development in firing practices over time. This seems to coincide with technological changes taking place in other stages of the manufacturing process (raw materials processing, finishing methods).

More particularly, the early-dated pottery can be characterised as generally low-fired and non-vitrified (*ca*. <750°C) in poorly-controlled and usually varied atmospheric conditions, as suggested by mottled areas on the exterior surface (see MG5A and MG5B) and the strong core-margin colour differentiation. This is also explained by the dominance of partially-combusted vegetal temper in the Ch-EB I coarse fabrics. The latter has been interpreted as the result of fast heating rate in variable atmospheres, where reduction predominated in the last stage of the procedure, causing a strong core-margin colour differentiation or often uniformly black cores.

In EB II there is considerable variation in the range of firing temperatures and the use of medium fired, non- or low-calcareous fabrics. This variation occurs irrespective of fabric or form. It seems that from EB II developed onwards potters gain more control over firing strategies. This pattern is more conspicuous in EB II late. An even more drastic change is noted in the EB III pottery, which seems to have been fired to generally higher temperatures and better controlled firing conditions than those of the preceding periods. This is not to suggest that there is a homogeneous pattern of high-fired pottery during the later EB periods, but rather to point out that a technological change might be reflected in higher temperatures and more consistent firing atmospheres (red-fired oxidising) are prevalent. The majority of vessels show a homogeneous red-orange colour throughout the section break (MG5C, MG5E, MG10), which indicates the maintenance of an oxidising atmosphere throughout the firing process. This is also linked with the absence of organic matter in the clay pastes of the EB III and might also be associated with the intentional use of certain clay recipes, such as calcareous fabrics and finer, micaceous clay pastes for fineware vessel production. As discussed above, the combination of information concerning surface treatment and fabric has enabled the secure identification of imports, especially in the EB II late-III period.

9.2.6 Finished products and typology

A detailed typological and contextual analysis of the Heraion ceramic assemblages is provided in Appendix II and further information has been discussed in Section 6.5. The main pottery classes include bowls, cups, jars, jugs, pyxides, pithoi, cooking pots, each category with related shapes, and finally miscellaneous shapes. The division of types within these eight categories (Tab. 6.2) is based on both morphological and functional criteria. Although interpretations of possible functions are a difficult subject in archaeological studies, some overall observations are taken as valid.

In the Ch, the assemblage is dominated by deep bowls and jars and the cheesepots are by far the most recognisable type. In EB I handmade smaller vessels are common, with frequent bowls with carinated rims of various types. Other shapes include jugs, jars of various types, and cooking pots. The increase in tableware becomes more obvious in EB II, with the appearance of new shapes such as miniature vessels, as well as the increase of individual vessels that imply a shift in commensal practice.

The correlation between form and fabric is striking by EB II developed, when new locally made and imported types occur at Heraion. Date-specific forms include shallow bowls/plates that are closely paralleled in western Anatolia (MG6). Other period-specific forms include the amphora with herringbone incised decoration on the handles (see Appendix II.1:6) which, although locally produced, may represent an eastern Aegean/western Anatolian type. The appearance of new drinking and pouring/serving vessel forms in EB II late is further discussed in Section 9.5.3, but the significance of this vessel repertoire and the prevalence of individualised vessels from EB II developed (e.g. small deep bowls, footed bowls, first tankards and bell-shaped cups) point towards changing consumption practices. This has been also suggested for Knossos in Crete in EM IIA late and especially for EM IIB (cf. Day and Wilson 2004). This change in small shapes is also accompanied by the emergence of new jar types in the second half of the 3rd millennium BC and the predominance of imported vessels. Jugs also become more diverse and typologically richer in EB II late, while pithoi are more common in EB II. Apart from the assumed new consumption practices by EB II developed onwards, developments in the typology and fabrics of cooking pots might imply shifts also in the cooking practices. This is evidenced by the manufacture of smaller and higher-fired vessels in EB II late and EB III (MG5D-E) that find very close parallels in other SE Aegean/SW Anatolian sites.

The EB III assemblage appears more standardised in clay recipes (fabrics) and shapes. Some shapes that may have been of special use in the previous phase (e.g. tankards and bell-shaped cups) now appear to be manufactured in the same coarse fabric as cooking pots (MG5D), although in very small numbers. This may imply a change in social value or even use of these intrusive forms.

The correlation between shapes and settlement contexts seems to be rather loose. Differentiation between contemporary contexts is difficult, though some shapes are more consistently found at specific areas or buildings, which may provide evidence for the spatial distribution of consumption practices. For instance, the majority of bowls, jars, and cooking pots of the Ch-EB I were recovered from the area next to the fortification wall (*Bauphase* 1), but still these periods show no differentiation between the various contexts in terms of shape repertoire. Other examples include the EB II early imported pithoid jars of PG5, which are mainly recovered from the *Grossbau*, and the EB III two-handled or handleless cups (MG10) that are found in the *Grosses Haus* which might imply some sort of communal social events. No particular contextual associations were identified with the imported vessels of EB II late, but it is noteworthy that the majority (MG7-9) were recovered from *SO gerichtetes Megaron* and *Zyklopischer Bau*. The latter has been designated by Kouka (2002, 290) as a building with a potential special function.

Finally, a general typological trend was observed diachronically in the assemblages from Heraion. The LCh-EB I and EB II early have purely eastern Aegean and western Anatolian associations, with closest parallels identified at Lemnos, Lesbos, Chios, Troy, the Izmir region (Liman Tepe, Çukuriçi Höyük), the Meander valley (Aphrodisias, Beycesultan), and imports from both areas, while EB II developed and late continue to be more 'regional' in character but with the addition of central Aegean imports and continuing Anatolian imports. This mixture of Aegean and Anatolian elements and imports becomes even more conspicuous in EB III (e.g. *Anatolianising*: twisted handles, crown lids, wheel-made plates; *Cycladicising*: convex-sectioned jar handles, askoi), which now show more direct connections with the southern Aegean and SE islands/SW Anatolian coast (Kos, Kalymnos, Rhodes, Miletus, Tavşan Adası, etc.).

9.3 Ceramic technological change and continuity at prehistoric Heraion

Past studies have mainly focused on the identification of regional and interregional similarities for the documentation of exchange networks. These generalised models of change, often based upon analogies and inexplicit assumptions about the relationship between pottery and people, have overlooked the complexity that micro-scale diachronic analyses of single sites hold, but recent work has proven valuable at the characterisation of horizons of change and continuity within separate stages of the ceramic operational sequence (cf. Mentesana *et al*. 2016a; 2017). This approach, mainly developed through ethnoarchaeological and experimental work, has emphasised variability as a means to illuminate patterning regarding intra-site differences and documented a range of parameters affecting the relationship between raw materials and finished products (cf. Stark *et al*. 2000; Livingstone Smith 2000). The complex relationship between the various manufacturing stages and the factors affecting them is rather explained beyond environmental and techno-functional constraints that include social and cultural choices.

The detailed technological analysis of pottery from Heraion revealed both change and continuity between the various settlement phases and periods in question. More particularly, there are strong correlations between the supposed function, ware, and fabric of the vessels, which varies from period to period. At the same time, there are changes and discontinuities that are related more to the shape and visual appearance (wares) of the pottery than the fabric.

The Ch and EB I pottery comprises mainly bowls and jars of various types, made in clay recipes (fabrics) that seem to continue over a long time at Heraion. Despite the substantial continuity, changes do occur in EB I with the disappearance of some shapes (e.g. cheesepot), the increase in the number of separate fabric categories, not used previously, and the predominance of irregularly burnished surfaces rather than smoothed or plain. Firing strategies remain unchanged between these periods.

A number of continuities occur in EB II early, particularly in the use of metamorphic fabrics, although not without variation in clay recipes and the exploitation of a more varied range of raw materials. The shape repertoire appears more diverse and a number of new vessel types are introduced within an otherwise conservative assemblage in the Ch-EB I period. This consists of an increased frequency of smaller carinated bowls of various types and the appearance of more imports.

In later EB II the shape repertoire is further enriched by rather small drinking and pouring vessels, locally-produced and imported from the central Aegean and western Anatolia (see Section 9.5.3). New shapes appearing in EB II developed include footed or pedestalled bowls, the first tankards, bell-shaped cups, and short-necked cups, accompanied by changes in the firing strategies (higher firing), exploitation and processing of raw materials (more calcareous fabrics, finer in texture, alluvial/sandy, less organic temper) and a combination of continuing and new surface finishing treatments. These changes are better exemplified in EB II late. The shape repertoire is even more diversified, owing also to the increase of imports, namely a range of transport jars, jugs, drinking cups and bowls, pyxides, and sauceboats. The foreign shapes do not replace those of the local repertoire, but rather constitute a conscious addition explained by consumption choices. Unlike the previous periods, EB II late accommodates more changes than continuities, even in the more ‘conservative’ stages of the manufacturing process, namely forming and finishing. More specifically, the handmade tradition, dominant up to that point, shows the first evidence for the introduction of wheel technology and the finishing techniques are more diverse. In short, analysis demonstrates that the pottery assemblage becomes more diverse, with more shape-specific technologies, and an increase in off-island imports that show a greater connectivity of the island.

EB III shows a drastic change at almost all stages of the operational sequence, reflected in the exploitation of new raw material sources, the introduction of new clay processing and manipulation practices (fine micaceous clays, clay mixing, disappearance of vegetal tempering), the integration of wheel technology for the manufacture of certain shapes, the preference towards lighter-coloured surfaces, and the achievement of higher temperatures due to homogeneous and well-controlled firing procedures, perhaps related to a standardisation of production. Whether the adoption of new firing strategies relates to the use of different equipment/structures is difficult to discern, but it most likely demonstrates changes in the skills, knowledge, and practice of the potters.

A striking technological continuity of practice, that is very distinctive at Heraion, is the longevity of organic tempering (improving performance in clay workability, thermal stress resistance). Chaff is added as temper throughout the Ch, a very specific technological practice which continues until EB II early, with an apparent decrease thereafter.

In fact it is not until EB II that the assemblage seems more compartmentalised and, for the first time, we see transport jars from various Cycladic islands and western Anatolia which show the growing reach of Heraion’s connections, being part of an Aegean-wide phenomenon (cf. Day and Wilson 2016). In summary, the ceramic evidence from Heraion certainly does not indicate a clear break between the Ch and EBA, but rather demonstrates a complex picture of continuity, accompanied by changes in the structure and diversity of the ceramic assemblage. Continuity is more apparent in the long-term exploitation and use of the same raw material sources, often in the long-lived recipes that crossed chronological boundaries. The link of such fabrics to specific forms and functions, such as cooking vessels (PG3: Ch-EB I; MG5D-E: EB II late-III) and storage vessels such as jars and pithoi (PG3B, PG4-4A: EB I-II early; PG6: EB II-

III), would seem to suggest the transmission over many hundreds of years of established choices and treatment of raw materials.

Continuity in specific, shared practice in separate potting communities on Samos, such as the use of organic temper, gives us an idea of the shared transmission over generations of technical knowledge and technological practice. Pottery manufacture over the 'transition' cannot be explained by loosely referring to an increase in 'specialisation'. Change happens and is reflected in the pottery, but it occurs through a number of different processes, not concentrated in one phase. The contrasts over the Ch-EB I transitional period are not of household *versus* specialist production. Instead they encompass the way people socialise with pottery, the way it is used to store and exchange, the scale of production, the reach of ceramics and their contents around the Aegean. There are many horizons of change and it would seem that in many ways the Ch-EB I transition is overshadowed by the later changes taking place in EB II and especially EB III period.

This section highlighted the need to move beyond evolutionary theories that seek explanation of change or technological developments in the transition between periods. Changes and continuities are more complex and do not necessarily occur gradually. They should rather be better explained within the concept of 'punctuated equilibria', where isolated episodes of change or discontinuities occur and are reflective of a variety of social, behavioural, technical, and environmental factors such as the potters' choices and skills, consumers' demands, social-cultural-economic shifts in investment and organisation of production and so on. These multi-causal choices are linked to the potters' material engagement of their indigenous knowledge with a variety of different external factors (cf. Arnold 2017).

9.4 Specialisation and the mode of pottery production on Samos

> "...rather than studying specialization as simply reflecting the change in social complexity, we may profit more from the perspective of skill, knowledge and technical competence in our examination of specialized production" (Day *et al*. 2010, 221).

This section tests the hypothesis of craft specialisation in the manufacture of pottery in EBA and attempts to identify changes within the specialised mode of production at Heraion. The organisation of pottery production is usually discussed with reference to specialisation, standardisation, and the identification of production units (cf. Arnold 2000). Is the 'standardised' typology of EB I-II early and the more varied one in the later periods also reflected technologically? What does the varied form of specialisation(s) imply with regards to the organisation of production at Heraion?

Detailed analytical studies of pottery in the past few decades in Crete and the Cyclades have solidified our ideas for the existence of specialisation in the Aegean EBA, identified already since the NL (cf. Tomkins *et al*. 2004), although its scale and expression differ from site to site (cf. Wilson and Day 1994, 84-85; Whitelaw *et al*. 1997; Day *et al*. 1997; Nodarou 2011, 81-83). This can be identified as specialisation in raw material sources and clay recipes, in the production of specific wares or shapes, in functional terms, and in site/location (Rice 1991). Past explanations of craft specialisation encompassed a range of views based on a causal relationship with labour division and social organisation, where the elite is responsible for the control of pottery production and maintains a status through the consumption and distribution of the finished products, largely affected by modern capitalist views (Day *et al*. 2010, 208-209). Renewed interest in the notion of craft specialisation has instead emphasised the skill, technical expertise, technological attributes of a craft product, and socio-historical context of exchange and consumption that affect the production (Day *et al*. 2010, 210).

The results of this thesis have shown that the majority of pottery consumed at Heraion was locally produced. Although lacking direct evidence for pottery production (kilns, ceramic wasters), the frequency of vessels represented in each phase, achieved through the quantification of fabrics, wares, and shapes (refer to Appendix II and tables of Chapter 6), provide secure evidence for the identification of production and consumption practices at Heraion and Samos in general. Therefore, the question is no longer whether specialisation can be assessed in the EBA, but how it alters spatially and temporally beyond a production perspective.

The diversity in the range of raw materials and clay recipes used, concurrently or consecutively, attests to naturally varied raw material sources or multiple sources of similar types. These changes do not necessarily carry intrinsic social and cultural meaning related to developments in the organisation of production. The majority of the pottery is made of fabrics rich in metamorphic rocks (PG1 and sub-groups), which are remarkably consistent over the entire EB period, although a number of mineralogical and technological variations are observed within this series of metamorphic fabrics. PG1 is varied in terms of shape repertoire, as it covers vessels of different forms and functions, of chronology, though the main body of samples belong to EB II, of surface treatment modes, but mainly smoothed and irregularly burnished in the Ch-EB I periods, and of firing, although mainly found to be low-fired. The heterogeneity observed and compositional variability between the various sub-groups implies the exploitation of different raw material sources that belong broadly to the same metamorphic geological formation of the Ambelos nappe.

PG2 provides some convincing evidence for resource and functional specialisation. Although it has mineralogical links with PG1 and PG6, its differences point to a discrete raw material source related to volcanic bodies present along the margins of the Mytilinii basin. It shows a good correlation between form (jars/pithoi), fabric, finish, and date (EB I-II early) and it also stands out in terms of firing and textural features.

PG3 is chronologically and typologically very consistent and shows a clear picture of compatibility between fabric, form, and presumed function of the analysed vessels. This may be translated as specialisation in raw materials and vessel function. More particularly, a third of the samples correspond to Ch cheesepots and other cooking pots of EB I. The remaining cheesepot samples are made in Fabric 1 (see Section 8.3.1), indicating that more than one group of potters produced this shape. This fabric is linked with the small-sized, partly schistose ophiolite outcrops and peridotite-serpentinite sills of the Pre-Neogene basement (Selçuk nappe) occurring NW of Heraion in the area of Pagondas-Spatharei. This suggests that the manufacture of pottery was being carried out not only in the vicinity of the site, where the finished products were consumed, but also in workshops elsewhere in the island.

PG4 implies the exploitation and use of a distinct raw material source, most immediately related with the metamorphic mafic and ultramafic formations (peridotite-serpentinite bodies) of Aghios Ioannis sub-unit or Selçuk nappe, which are only exposed in areas near Myli, Spatharei, Pagondas, and west of Mavratzei. This is the case for PG3B, PG4, and PG4A which all have been used for the manufacture of large storage vessels (pithoi of various types). This reflects a conscious technological choice by the potters that might relate with the functional uses of the vessels. PG4 and PG4A constitute the most tight fabric group, although pithoi made in other fabrics (e.g. PG2 and PG3A) indicate the existence of more than one group of potters producing these vessels or even the existence of different workshop locations within the environs of Heraion.

PG6 exhibits a more complex picture. While it shows specialisation in raw materials, reflected in the exploitation of distinct source(s) close to volcanic parent rocks related to the small volcanic bodies within the schist formations in the margins of the Mytilinii basin, it is functionally and chronologically inconsistent. A similar pattern of heterogeneity is also reflected in a compositional and technological basis, in terms of presence/absence of certain volcanic rock types, coarseness, and firing.

The periods preceding EB II developed display an inconsistency at different stages of the manufacturing process. From EB II developed onwards there seem to have been better-evidenced specialisation and standardisation accompanied by a number of technological and morphological-typological changes (better processing of raw materials, higher firing, new vessel types). For instance, PG10 covers a chronologically, typologically, and stylistically consistent group. Although it relates mineralogically with the metamorphic fabrics of the earlier periods, it shows distinct differences that may allow the discrimination of raw material sources in EB II developed and late. These changes are best typified in EB III, when a series of fine, mica-rich fabrics are used for the manufacture of a range of vessels with different functions (PG14-17). Although the discrimination of the various fine groups on fabric grounds alone is not easy, the combination of technological, stylistic, and typological information suggests a degree of functional specialisation that shows variation due to technological heterogeneity (e.g. clay mixing and firing). This is clearly the case for PG13 (askoi and plates).

To sum up, combined with the macroscopic information, the microscopic analysis revealed some important associations between shape, assumed function, fabric and/or ware. For instance, this relation is notable in PG2 (red/reddish brown slipped, jugs and jars), PG3 (plain, predominantly cooking pots), PG4 (red slipped, pithoi), PG7 (tankards, bell-shaped cups, and shallow bowls), PG13 (buff smoothed/slipped, askoi and plates), and PG14-17 (fine orange, shallow bowls, jars, jugs with trumpet mouth). The variation of fabrics and distinct technological features within each implies that there must be several production centres operating in parallel within the vicinity of the site, with some beyond the environs of Heraion itself.

The organisation of production shows by no means a linear evolution and appears rather complex, with choices and decisions affecting discrete stages. The technological links between different fabrics, discussed above, rather suggest that multiple potters made different decisions in the context of a similar *chaîne opératoire*, potentially trained in the same craft tradition, while discrete changes at different stages of the operational sequence should be seen as a result of experimentation, negotiation, and modification practices over time. The link between ceramic and settlement changes are not easily assessed, as this would require a more detailed contextual analysis of other find categories. However, the first horizon of technological change, in EB II developed, runs parallel to the growth and expansion of the settlement towards the area of the Hera Temple. Undoubtedly, this study has recognised strong evidence of specialised craft pottery production over time at Heraion. This is based largely on a combination of stylistic and technological evidence, but it still remains to understand the scale and labour division of this craft.

9.5 Patterns of connectivity and the distribution of pottery

Having characterised the *chaîne(s) opératoire* of the local ceramic technological tradition at a micro-scale level, the following sections address the meso- and macro-scale interactions within regional and supra-regional networks of pottery circulation. Only by examining and characterising the local traditions and the related context of receptivity of connectivity can we move beyond large scale narratives of interaction which are based on similarities between artefact types and styles. In other words, the identification of geographical areas of pottery production and deposition enables a better understanding of the exchange mechanisms responsible for the movement of ceramics from one place to the other.

Connectivity has been a much-discussed area of enquiry in Aegean archaeology and especially prehistory, as it has been traditionally considered a central cause for the development of interactions and thereby distinct ‘cultures’, shared trends, ideas, and objects, and the exchange and distribution of pottery in particular. Thus, we can talk about intra-site (micro-scale) connectivity and interaction, intra-regional (meso-scale), and inter-site or interregional (macro-scale). According to Gosselain (2016, 194-195), connectivity should be conceived as a structural framework that combines nodes, vectors (roads, rivers, maritime routes) and means of travelling, which is greatly affected by the given historical circumstances (economic and social relations, or organisation of craft practice).

The explanation of patterns of interactions has taken various trajectories over the years, but has been commonly explored under the prism of trade or exchange in the past or even migration-centred approaches (cf. Day *et al*. 2006, 26; Abell 2014). However, this monolithic, economic-driven, diffusionist explanation does not take into account the varied nature of these interactions, which could be also associated with travels for all sorts of reasons. The notion of interaction entails identity issues, as the transfer of ideologies or knowledge requires a sense of acknowledging similarities with a social group and differences between different groups. Interactions involve not only connectivity between human groups but also the dual engagement between human and the environment/landscape. Recent theoretical advances have favoured the concept of mobility in the explanation of long-distance networks (Kiriatzi and Knappett 2016; Heitz 2017).

In ceramic terms, interaction is interpreted through the identification of imports, either stylistically or in terms of fabric, which can reveal patterns of spatial and temporal associations between different sites or regions. The characterisation of the local ceramic technological tradition through examination of the raw materials and of fabric distribution patterns, combined with comparative material from a number of Aegean and Anatolian sites, has enabled identification of multiple areas of production. The present work demonstrates that a technology- and practice-centred approach, combined with a detailed micro-scale analysis of pottery, provides new perspectives on transfer and human mobility beyond explanations related directly to trade or the movement of the elites and merchants.

9.5.1 The Ch and early EBA: early evidence for ceramic exchange?

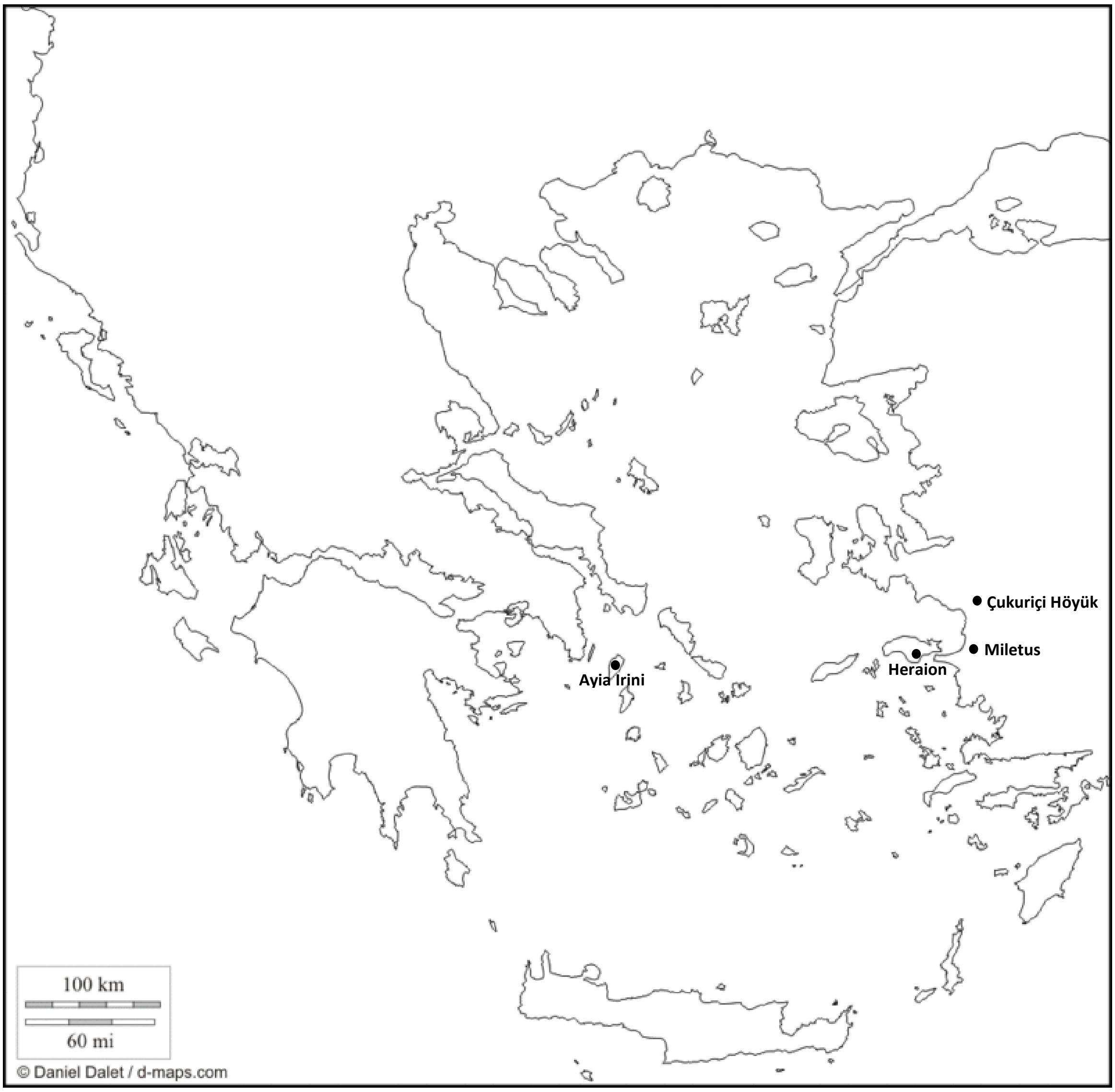


Figure 9.1: Map showing Heraion and possible provenance areas of specific petrographic fabrics in the Ch and EB I.

The evidence from Heraion, as presented and discussed in the previous chapters, confirms what has been suggested for other Aegean areas concerning a rather arbitrary and poorly-documented transition between the end of the 4th and the beginning of the 3rd millennium BC. Unfortunately no architectural remains of the Ch have been retrieved at Heraion, but this period is well represented below the successive phases Heraion 5 and 4 dated to EB I. Due to these limitations, combined with the general compatibility in ceramic technological and stylistic terms, these periods are discussed together.

Although missing direct evidence for pottery production at Heraion, it has been shown earlier that there is undoubtedly a strong ceramic manufacturing tradition since the foundation of the site. This concerns a rather homogeneous manufacture in terms of fabric, finish, forming, and firing techniques employed for the production of the full range of domestic vessels, large bowls, jars of various types, jugs, and cooking pots.

As more sites and datasets are studied and published consistently in more detail it becomes apparent that communities across the Aegean were already interacting in a dynamic way with one another since at least the Ch period. This is clear from similarities in material culture, predominantly discussed from a stylistic or typological perspective, and in the exchange of obsidian and textile tools. Horejs (2016) has recently suggested that a Central Anatolian Aegean Coastal Group existed, taking into account evidence from NL Çukuriçi Höyük and other nearby sites, which formed a strong regional network of interaction and was expressed in a regional 'style'. Horejs's model of connectivity is largely influenced by generalised concepts that favour interpretations at a regional level. The frequency and size of obsidian at Çukuriçi Höyük has been taken as evidence for a gateway community in EB I (Horejs 2016, 156), similarly to Kephala-Petras in east Crete (cf. Papadatos and Tomkins 2013). The earliest evidence for Cycladic imports in Anatolia in the NL come in the form of lithics (mainly Melian obsidian, conical marble beakers at Tigani III-IV on Samos and Iasos) and pottery, although this may only represent stylistic influences, such as collared jars with truncated conical necks at Tigani IVb (Sotirakopoulou 2008b, 71-72).

With respect to the ceramic evidence from Heraion, the holistic analysis of total assemblages for the first time provides secure evidence for the distribution of pottery between Samos and the central Aegean and Anatolia during this early period (Fig. 9.1). More particularly, PG1D represents potential jar imports from Çukuriçi Höyük in the Ch period. Although mineralogically very similar to the main fabric (PG1), which is local to Heraion, it finds very close parallels in the 'Sand-tempered fabric group' from Çukuriçi Höyük (see Chapter 7, Section 7.3.1.4) that covers largely EB I samples. More analytical work is needed to establish a secure connection between the two nearby sites, as both exhibit a similar fabric repertoire. Macroscopic observations could not distinguish these samples from the rest of local manufacture. This is due to the practice of using similar raw materials, readily available within the vicinity of both sites (metamorphic-rich alluvium) and monochrome red-slipped finishes that are common during this period.

A securely off-island fabric (PG5) is very distinctive both macroscopically and petrographically and stands out from the rest of local and non-local fabrics identified at Heraion (see Chapter 7, Section 7.4.1). Its intermediate volcanic rock (andesite) content and characteristic red slipped and burnished exterior and/or interior, as well as its scored interior when unslipped, find close matches in comparative thin sections from Ch-EB Miletus. Due to the small number of samples at Miletus and the relatively large number of vessels and shape repertoire (wide mouthed jars, pithoid jars, winged jar, lid, cut-away jug) recorded at Heraion (MG4, Appendix II.7) its provenance remains open. It is undoubtedly non-local and the potential published parallels point to western Anatolia. Unfortunately, the general lack of comparative material from western Anatolia and the size of the area in question do not allow a closer resolution at present. It is, however, interesting that this fabric at Heraion includes samples from all EB phases, with EB II comprising the majority, and that the vessel shapes are related to transportation/storage and serving. Potential macroscopic fabric and finish links are suggested here with the 'Obsidian Ware' from Emporio on Chios, which is characterised as imported at the site and known to span phases VII-II (Hood 1981, 168-169), the 'Scored Ware' large storage jars known to have been imported in middle-late Troy I and II from further east in Anatolia (Blegen *et al*. 1950, 39, 53-54, 222), Bozköy-Hanaytepe in the Troad (Yilmaz 2013, 868-869, fig. 11), Halasarna on Kos from the LN II-FN I to the EB III periods, although predominantly in the EB I-III periods (Georgiadis 2012, 24-25), and Tavşan Adası (Didyma) in western Anatolia.

The last fabric (PG30) dating to LCh or EB I is represented by a single cheesepot sample (see Chapter 7, Section 7.4.12) and according to its white mica schist and phyllite content it may be correlated with the main fabric from Ayia Irini on Kea or even related with Attica. Imported cheesepots of a white mica schist fabric or series of fabrics have been reported from Kephala-Petras on east Crete from FN IV and EM IA periods (Nodarou 2012a, 83, fig. 4; Papadatos and Tomkins 2013, 358), although not identical with the Keian examples. It is noteworthy that cheesepots are moving and the function/use of this vessel form is still under dispute. Similar metamorphic fabrics are found also in other Cycladic islands and have been reported from the late FN assemblages of Kephala on Kea, and the EB I-II Phylakopi on Melos, Markiani on Amorgos (Vaughan 2006, 99-100), Akrotiri on Thera (Day and Wilson 2016, 26), Panormos on Naxos, and Kavos on Keros (Hilditch 2007, 239), as well as far as Poros-

Katsambas on Crete, appearing in early EM IIA contexts (Day and Wilson 2016, 20, 26).

Although relatively limited, the analytical evidence from Heraion revealed an informative picture of movement and ceramic exchange already from the Ch and during EB I, specifically with western Anatolia, although the geographical provenance is still uncertain, and the central Aegean. Apart from the recent analysis from Crete already mentioned above, recent analytical work from EH I contexts at Nemea on the Greek mainland (Burke *et al*. 2017) revealed a complex picture of varied choices in the distribution and consumption practices from a number of sites/regions. The analyses of NL-EBA pottery from Çukuriçi Höyük (Peloschek 2017) and Emporio and Ayio Gala on Chios (Lambrechts in progress) have also shown a limited circulation of pottery within the Izmir region.

More ceramic links are reflected in terms of style and vessel form, which points towards an eastern Aegean tradition. Unfortunately, LCh/FN and EB I pottery styles/traditions are only broadly defined, hindering the identification of micro-scale developments. For instance, cheesepots are very popular during this period, especially in SE Aegean, and the presence of large amounts at various sites has been often interpreted as evidence for mobility, technological transfer or exchange (see Appendix II.1:1). The rarity or lack of analytical work or even a synthetic interpretative study of this vessel type prevents a meaningful identification of connectivity patterns during these early periods.

The evidence so far from Heraion shows a pattern of dispersed connections, closer to Anatolia than the central Aegean, which probably shaped the long-term interactions that continued at least until the end of the EBA. The location of Samos immediately opposite the Meander valley has facilitated this interaction and Heraion may have functioned as a link for the movement of other artefact/material categories such as obsidian.

9.5.2 Early Bronze Age II and the 'International Spirit': intensification of interactions?

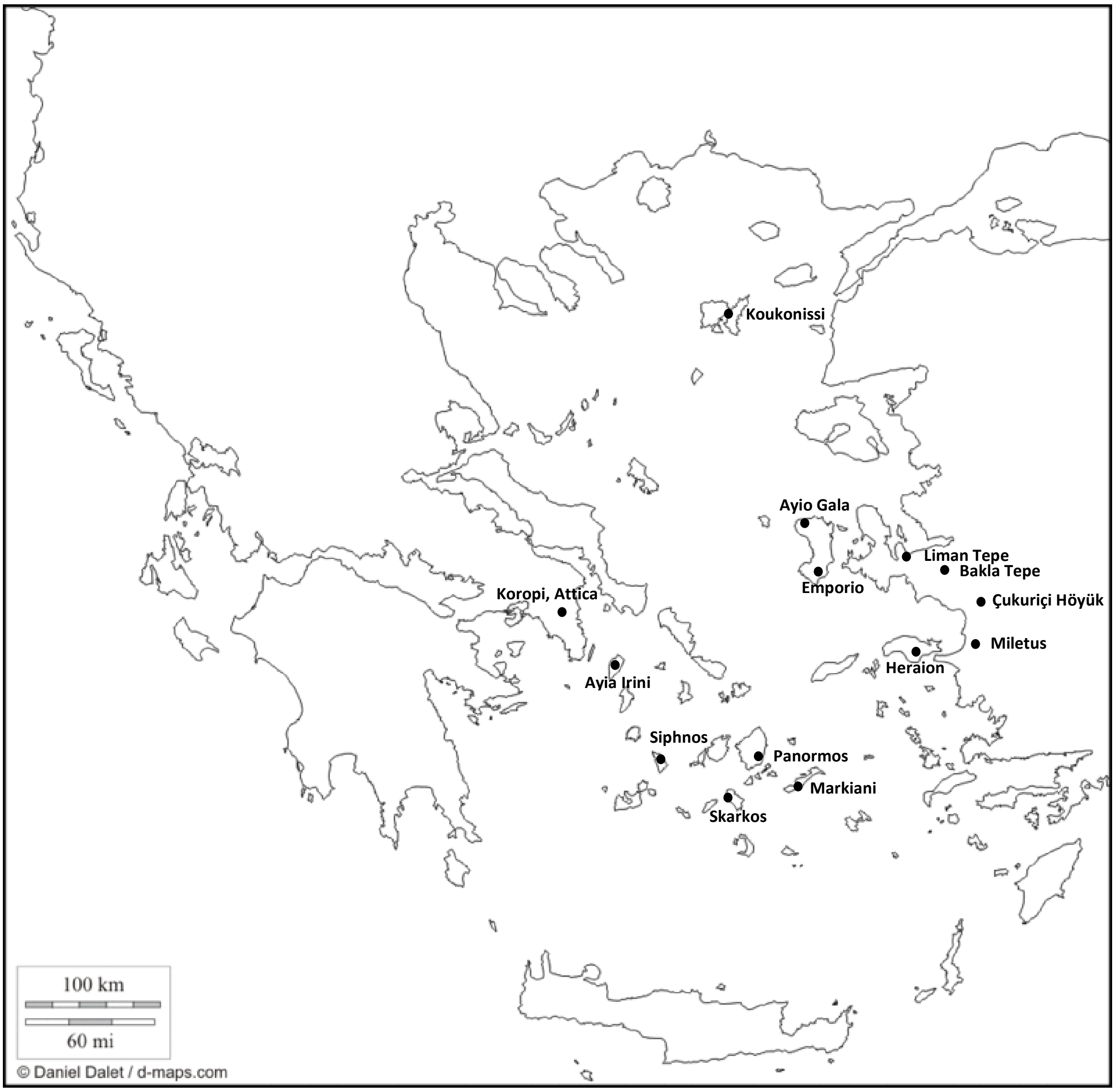


Figure 9.2: Map showing Heraion and possible provenance areas of specific petrographic fabrics in EB II.

Based hitherto on mainly stylistic and typological studies, EB II has been considered a period during when social interaction, long distance exchange networks, and circulation of finished products (including pottery) reached a peak. Renfrew's term 'International Spirit' is used to indicate the intensification of connections, mainly presumed to reflect trading links (1972, 451-455). Undoubtedly, the production and consumption of metallurgy played a key role in the development of long distance contacts. The connections started in the previous phases now become more sustained and this is reflected in the circulation of Cycladic, Mainland, Cretan, and Anatolian finished products and stylistic affinities across the Aegean. Although relatively rare, the more common among the Cycladic pottery finds of the NE Aegean/western Anatolia are frying pans, pyxides, Urfirnis sauceboats, transport collared jars, and beaked jugs (Sotirakopoulou 2008b, 73-75; Şahoğlu 2011b, 173).

EB II saw further developments in pottery technology (style, finishing, firing), as suggested by changes occurring in the finished products (cf. Broodbank 2008, 60), which may have been accompanied by changes in the organisation of production, consumption practices and so on. The sub-phases making up the long span of EB II exhibit considerable differences between one another in ceramic terms, the most conspicuous of which is the introduction of new drinking and pouring vessel forms that have been associated with an increased social consumption of liquids (see below).

Although numerically representing only minimal quantities within the total Heraion assemblage (loner samples or small groups), it is noteworthy that these correspond to a large number of non-local fabrics with a known or suspected geological provenance or fabrics where the origins of production have yet to be determined. This could be explained by the lack of comparative material and infrequent or non-discriminant inclusions and lithological similarity with surrounding regions. However, it should be kept in mind that the determination of provenance areas cannot be used for the reconstruction of direct routes or contacts, but provides rather an estimation of vessel circulation patterns and preferred exchange networks.

PG9 represents a very diagnostic group of vessels (pyxides and jugs) dating to late EB I or EB II early and characterised by a dark grey/black slipped and burnished exterior surface with incised encrusted or incised-and-pointillé decoration. This visually distinctive appearance in combination with the equally unusual grog-and-calcite tempered fabric point towards an off-island provenance. As discussed earlier in this thesis, grog tempered fabrics are often non-diagnostic in geological and geographical provenance and are relatively common throughout LN/FN and early EB Aegean, with the best-recorded evidence deriving from Crete. Potential grog tempered fabrics have been also identified in western and central Anatolia, implying technological transfer across distant regions, such as EB I Çukuriçi Höyük, EB I-II Liman Tepe, and EB Konya plain (see discussion in Section 7.5.2). Unfortunately, its provenance remains open, but it is worth noting that the date, shape, fabric, and visual appearance represented are reminiscent of the circulation of frying pans of the EC I late (Kampos

Group) and other vessels with a special use and a long tradition in the eastern Aegean and western Anatolia.

In EB II early-developed, PG5, which was first imported at Heraion in EB I (see above), continues in higher frequencies in the same shapes and thus a continuous connection is suggested with Miletus or some nearby location in western Anatolia. Further Anatolian fabric parallels are identified in EB II developed and especially in EB II late. One such corresponds to PG8, calcite-tempered, which despite representing a long-lasting technological tradition with parallels ranging from FN/EB Cyclades to the West, Crete to the South, and Ch-EB western Anatolia to the East finds its closest fabric match at Miletus. At both Heraion and Miletus these fabrics correspond to drinking vessels (tankards and bell-shaped cups), though its provenance remains unclear. Different links with western Anatolia are established through PG11 and PG12, which find good parallels at Liman Tepe and Bakla Tepe for the importation of various EB II late drinking cups (tankards, two-handled bowls, depas cups, short-necked cups). Nevertheless, this fabric at Liman Tepe differs markedly from the fabrics which are clearly local to the harbour site and whose specific provenance, presumably in the coastal plains around Izmir, remains unclear (Day *et al*. 2009, 341). These data clearly demonstrate consumption choices involving a similar range of vessels across different Anatolian sites.

The central Aegean ceramics reaching Samos in EB II, mainly its late phase, derive from Amorgos (PG18, PG19), Kea (PG32), Siphnos (PG29), possibly Ios (PG31), and Naxos (PG20, PG21, PG22, PG23, PG33). Although we now have a better resolution of the local geologies and comparative ceramic fabrics of many Cycladic islands (cf. Hilditch 2007; 2013; 2015), the repetition of similar lithologies in neighbouring islands and the complex geological backgrounds even within the same islands often prohibits a secure distinction. This is well reflected in the Naxian and Keian groups of fabrics, which although found to have mineralogical links between one another within the groups, this might as well reflect different sources within Naxos and Kea themselves or a different provenance in nearby islands, such as Paros, Ios, and Kythnos. Other EB II developed/late imports have a possible provenance on the islands of Melos (PG27), Chios (PG39), and probably also Lemnos (PG28). The farthest suggested origin of production, although lacking evidence of directionality in this connection, derives from the macroscopic identification of two yellow slipped and burnished sauceboats from Attica (see Appendix II.46: MG37). These vessels possibly date to EB II late and similar vessels have been identified at Koropi and Ayia Irini II on Kea (Wilson 1999, 76-77, 134, pl. 68:II-662, II-673; Day and Wilson 2016, 27; Douni 2015).

Interestingly, this study has revealed that pottery circulation was confined to specific vessel forms, i.e. sauceboats, transport jars with slashed/incised handles, beaked jugs with a two-stage neck profile, incised pyxides, drinking cups of various types such as tankards, bell-shaped cups, two-handled bowls/cups, depas amphikypella, short-necked cups, all related to short-term storage and transportation, serving, and consumption of liquids (possibly mainly wine and perfumed oils). This is in agreement with the argument put forward by Day and Wilson for the introduction of Cycladic transport jars since EM IIA and new drinking shapes at EM IIB Poros-Katsambas on Crete (Wilson *et al*. 2008). Cycladic sauceboats and jars with a two-stage neck profile are known from as far as Troy, Liman Tepe, and Poliochni Green on Lemnos (Bernabò Brea 1964, 409, pls. CXXIX:c, d, f, and CXXX:a, c, d). Similarly, Cycladic and Cretan imports (sauceboats, transport jars with slashed handles, two-handled bowl) have been identified petrographically at Liman Tepe (Day *et al*. 2009, 341-342).

Compared to EB I, there is indeed an increased connectivity visible through the appearance of ceramic drinking sets and transport vessels (cf. Wilson *et al*. 2008; Day and Wilson 2016), translated in the circulation of a larger range of shapes and the identification of a number of central Aegean and western Anatolian production centres (Fig. 9.2). These connections may have been established in the previous period, but they only became more regular in EB II, partly due to the exploitation of other raw materials (obsidian, metals, etc.). Furthermore, new and continuing interactions might also have been maintained as part of the spread of wheel technology in the end of EB II. In other words, there is a bilateral relationship between technical transmission and the circulation of materials and objects (see Section 9.5.3 for further discussion).

9.5.3 An *Anatolianising* or *Cycladicising* phenomenon at the end of EBA II? Zenith of interactions and ceramic distribution

As briefly discussed in Section 2.3.2.2 the identification of a number of ceramic shapes at various sites throughout the central Aegean and east coastal sites of the Greek mainland has been interpreted as the extension of influence or even the presence of Anatolian people, while more recent theories support the movement of craftspeople and finished products and the indirect transmission of technical knowledge. This ceramic ‘phenomenon’ has been called the Lefkandi I-Kastri Group in the western Aegean Greek world and the related shapes have been characterised as *Anatolianising*, as they have been taken to represent imitations of Anatolian prototypes. The following discussion attempts to re-evaluate these past notions on its origins, distribution, and social dimensions in the light of the present data from Heraion through an approach to human mobility and technology-based transfer and/or appropriation of practices.

Only a few studies have contextualised these newly-emergent shapes in their assemblages (Wilson 1999), or have assessed the implications of their adoption for transformations in recipient local ceramic traditions. The aim of this analysis is to understand the position of Heraion in these exchanges, as well as their scale and intensity. This ceramic phase and the term *Anatolianising* have been used to represent the broad impact of the ‘other/foreigner’, at least largely in the central and west Aegean, but how does the emergence of these new elements translate into the local micro-histories? What does the contextualisation of these shapes within their local assemblages suggest? What role did the exchange and consumption mechanisms play in the ascription of social value to these vessels? How would the consumers or producers have benefited from an association with these vessels? Should we imagine a social relationship with craftspeople?

<u>Chronology: EB II late, EB III early or both?</u>

Two lines of thought have prevailed in archaeological scholarship regarding the chronological position and origins of this ceramic ‘set’. One favours a date of EB II late and another that sees a continuation into EB III early. The evidence so far suggests heterogeneity in the chronology, appearance, and general expression, distribution, and integration within the local ceramic assemblages of these shapes. In fact, most of the Cycladic sites where such material was found date to EC II late, on the assumption of a chronological or cultural gap in the Cycladic sequence and the absence of an EC III period, but recent data from a number of sites implies that the elements comprising the Kastri Group continue into the early EB III period. More particularly, Markiani IV on Amorgos, Phylakopi I on Melos, Korphari ton Amygdalion-Panormos on Naxos date this material largely to EC III (Angelopoulou 2014, 157, 488), although without explaining its relation to other contemporary settlements with the same material. In fact, these sites have not produced reliable, dateable deposits that do not simply rely on pottery seriation assumptions. Palamari II on Skyros is also dated to early EB III (Bonatsos and Romanou 2015).

The recently published data from Dhaskalio on Keros promised to fill in the EC III gap on the basis of "indisputable stratigraphic evidence" (Sotirakopoulou 2016, 352). Dhaskalio Phase B, dated to EC II late, and Phase C, dated to EC III, both include Kastri Group shapes, although differing in their relative frequency. However, Phase C covers not only a number of Kastri Group shapes but also a range of ceramic features (light-faced pottery, crescent-shaped handles, pale clays and surfaces, volcanic fabrics) that find direct affinities with the Phylakopi I-ii-iii on Melos that is associated with the MBA in the Cyclades (Sotirakopoulou 2016, 352-354). Despite this, no part of the excavated area has found contexts of Phase C to directly succeed that of Phase B (Sotirakopoulou 2016, 352, 370), thus making its chronological position within EC III more problematic. This is not to say that EC III, or at least part of it, does not exist, but rather to caution against dating a ceramic phase merely by the presence/absence of specific features in analogy with others found in preceding or succeeding phases. Indeed the continuation, increase, and enrichment of the Kastri Group shapes in Phase C might indicate a different chronological sub-phase, but it could also be the case that represents differential consumption practices at a spatial level or even the mixture of excavated deposits. Furthermore, the fact that almost the entire ceramic assemblage recovered at Dhaskalio has been imported from elsewhere provides an additional caution against constructing a local relative chronological sequence in different terms than those given in the comparative systems followed.

The evidence from Heraion supports a chronology between EB II late and EB III early. More particularly, these new vessel forms are found already from EB II developed, but mainly in EB II late contexts. Although less frequent, some shapes seem to continue also into early EB III. A similar picture is observed in other sites of western Anatolia, where the equivalent phase of the 'Anatolian Trade Network' dates to EB II late-EB IIIA (Şahoğlu 2005b). It is hereby suggested that the presence of these shapes at a given site does not provide sufficient evidence for its relative dating, as its significance transcends the chronological boundaries and is rather guided by other social or economic parameters. The chronological heterogeneity and inconsistency of these shapes is also implied by their appearance at different times between different sites. This ceramic phenomenon shows an early and a late phase in the occurrence of specific types, where the bell-shaped cup and tankard appear first and the depas amphikypellon, shallow bowl, and wheel-made plate follow, e.g. in Troy, Poliochni, Heraion, Dhaskalio (Kouka 2009, 135; Rutter 2012, 76; Angelopoulou 2014, 487-488; Sotirakopoulou 2016, 369). In other sites these shapes coexist in the same phase or stratigraphic horizon, such as Markiani IV on Amorgos, Palamari II on Skyros, Pefkakia, Aphrodisias EB 4, EB III Tarsus, etc. Re-evaluation of the data from Ayia Irini III on Kea suggests that indeed the depas appears at a slightly later phase than the tankard and bell-shaped cup (Wilson 2013, 407, footnote 59).

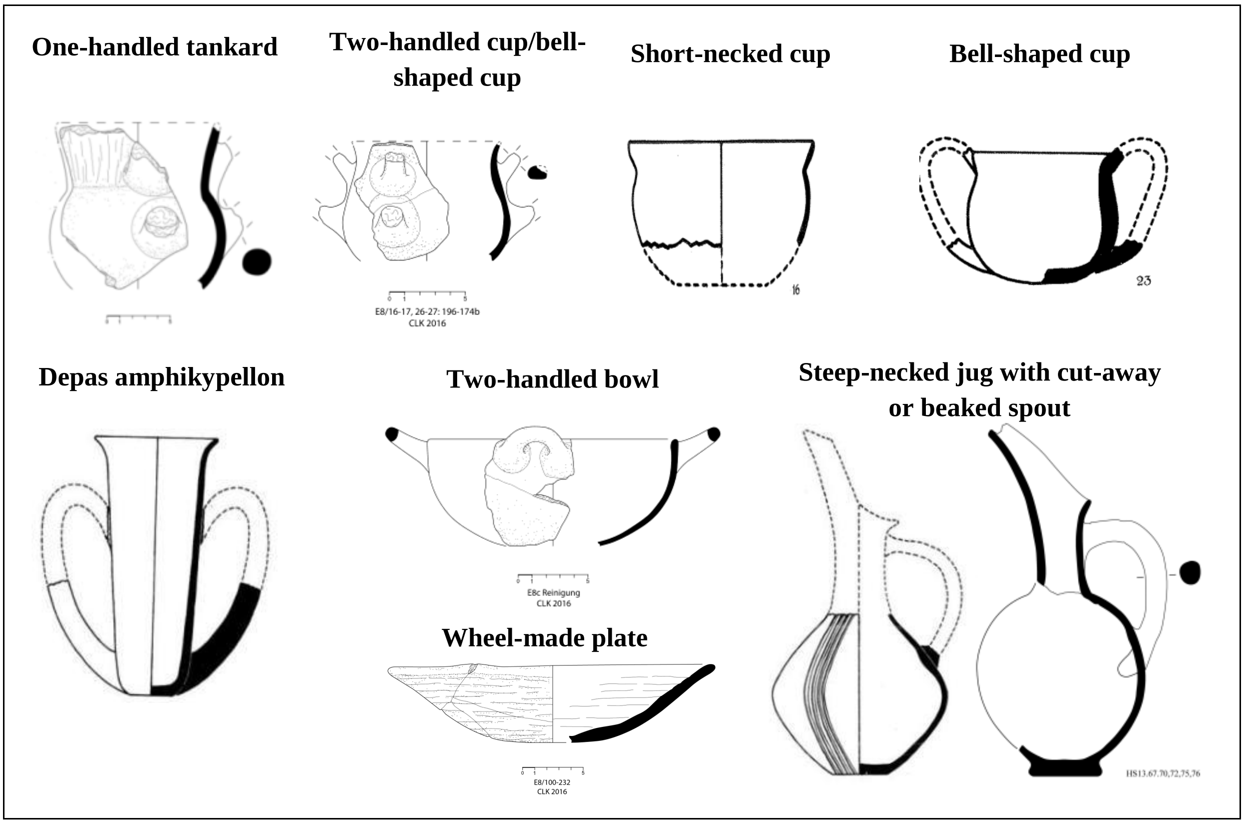


Figure 9.3: Anatolian or *Anatolianising* ceramic forms identified at Heraion (drawings made by A. Kontonis and C. Kolb).

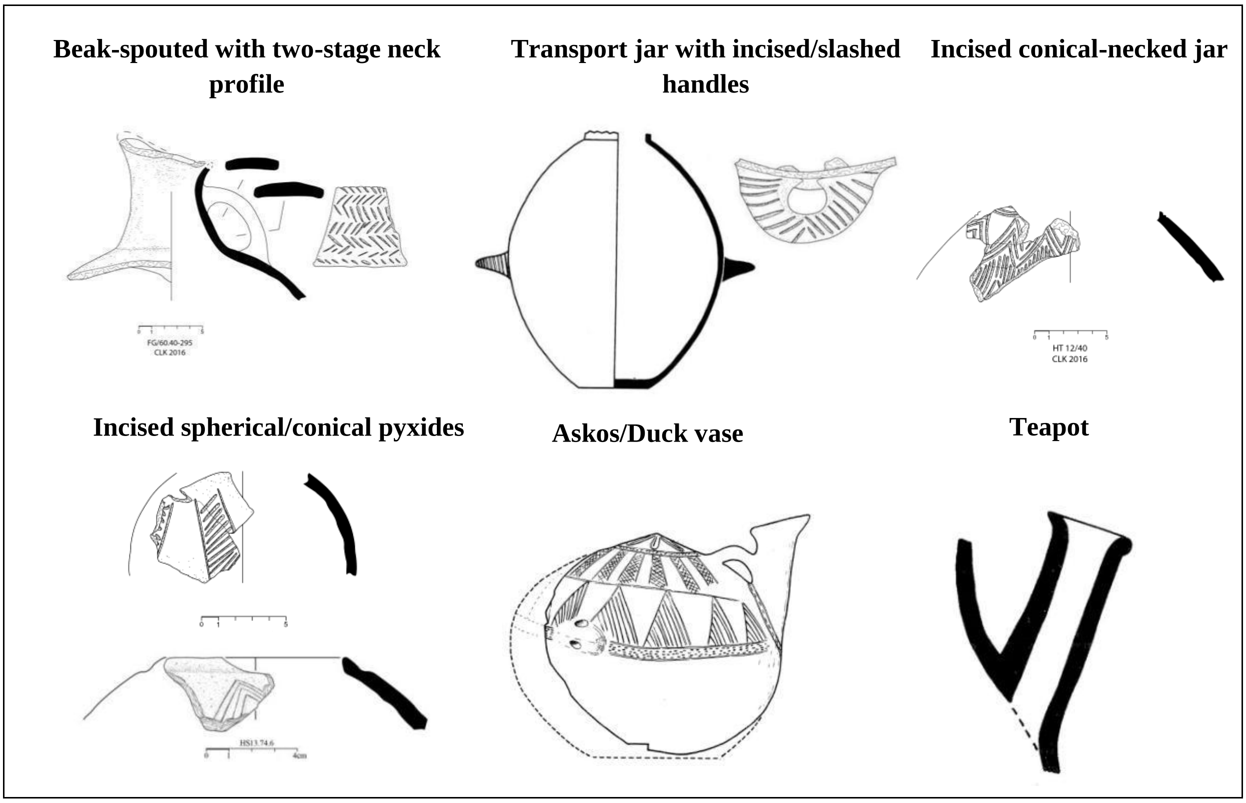


Figure 9.4: Cycladic and *Cycladicising* ceramic forms identified at Heraion (drawings made by A. Kontonis and C. Kolb).

Frequency and spatial distribution of the shape repertoire

It has been suggested, on the basis of stylistic comparisons, that two main directions of transmission/influence have been followed; namely from the NE Aegean (Poliochni) and the Troad via Thessaly and Euboea towards the northern Cyclades and/or the one connecting the SW coastal Anatolia and Cilicia, via Liman Tepe, Emporio, and Heraion and the southern Cyclades and Attica (Kouka 2002, 301; Day *et al*. 2009, 338). These distinctive shapes attain a high distribution on the coastal and inland western Anatolia, but they are not as strongly represented in the settlements of central Anatolia, which led some scholars to suggest that the mode of their diffusion was through maritime routes (Şahoğlu 2005b). Wilson (1999) has suggested that SW Anatolia was the source for foreign shapes at Ayia Irini III, while Sotirakopoulou (2008b, 87) has argued for a typological correlation between the various shapes comprising the Kastri Group with specific areas, i.e. the depas cup with Troy, the one-handled tankard and steep-necked jug with SW Anatolia, and the bell-shaped cup with Cilicia. The question remains, can we pinpoint the typological origin of individual forms and how useful would that be in stylistic terms? The following information does not attempt to solve this issue, but rather focus on more meaningful evidence provided by the fabric analysis in the determination of provenance.

Regarding its distribution, no patterns are observed in the coexistence of the various shapes, and only a limited number of sites recover the full range, including Heraion itself. Despite the general consensus regarding its appearance, there is no agreement regarding the duration of these shapes. The various shapes, including both *Anatolianising* (Fig. 9.3) and *Cycladicising* (Fig. 9.4), appear neither simultaneously nor in the same frequency and relative proportions at all sites (Sotirakopoulou 2016, 373). Therefore, this phenomenon is more complex and varied than traditionally thought. Similarly, their distribution in Anatolia is not indicative for the selective process followed in the central and west Aegean.

The relative frequency of this set of vessels within overall pottery assemblages seems to be relatively low (cf. Wilson 1999, 97-100, tabs. 3.4 and 3.7; Sotirakopoulou 2016, 371-373, tab 7.4). For instance, the highest frequency recorded so far is at Ayia Irini III on Kea amounting to 13% (Wilson 1999, 95). Although not comparable in terms of actual vessel numbers, at Heraion the percentage of the main forms (tankard, bell-shaped cup, short-necked cup, depas cup, flask-shaped jug, steep-necked jug, etc.) is *ca*. 12% (143 individual vessels) of the total assemblage spanning EB II developed/late-EB III early, during when the forms in question occur. The majority is represented by wheel-made plates (63 individual vessels) and tankards (38 individual vessels). At Panormos on Naxos the Kastri Group is represented by 0.16% and only by three of the diagnostic types (Angelopoulou 2014, tabs. 2.3-2.4: one-handled tankard, shallow bowl, beaked jug with straight rim). At Dhaskalio on Keros (Sotirakopoulou 2016) it comprises only 0.97% of the pottery of Phase B and only a few forms are represented (shallow bowl/plate, one-handled tankard, short-necked cup, teapot, Anatolian-type beaked jug with a long cut-away spout), while an increase is observed in Phase C (2.12%) with the enrichment of the repertoire (depas cup, steep-necked jug, incised pyxis, etc.). Similarly, these shapes appear limited at Markiani IV on Amorgos, being represented by one-handled tankards, shallow bowls, and a single depas (Eskitzioglou 2006), at Phylakopi on Melos only by three tankard sherds (Renfrew and Evans 2007), at Kastri on Syros, from which this ceramic phenomenon was named but lacks the tankard type, and Akrotiri on Thera, possibly covering the majority of shapes (Kariotis *et al*. n.d.).

These vessels are very scarce in the Peloponnese and almost absent from the Dodecanese islands (Vitale 2013). Their lack from the latter area is noteworthy given the proximity to coastal western Anatolia and the subsequent strong typological links with SW Anatolia and Heraion in EB III (see Section 9.5.4). Perhaps this is only a symptom of insufficient excavated data of EB II late in these islands. A different picture is found on Crete, where this range of vessels is completely absent in EM IIB, but the preference towards smaller tableware vessels (shallow bowl) suggests new dining practices in a similar fashion to the rest of the Aegean (Day and Wilson 2004; Wilson 2013, 429).

<u>Morphological and technological characteristics</u>

This group of vessels is characterised by drinking and serving/pouring shapes that have been described as intrusive in the traditional local assemblages. It comprises of *Anatolianising* elements (Fig. 9.3: one-handled tankard, bell-shaped cup, depas amphikypellon, lentoid jug, S-profile jug with cut-away spout, shallow bowl/plate), and often combined with *Cycladicising* ones (Fig. 9.4: beaked jug with a straight rim, incised spherical pyxis, teapot, duck vase/askos) (Sotirakopoulou 1993, 8; 1997, 526; Angelopoulou 2003, 164-168; 2014, 485). These vessels are almost always covered with a dark slip and burnished, which gives the exterior a metallic appearance. This is even more conspicuous when the clay paste is light-coloured, creating a visual contrast with the outer dark finish. However, this generalised coherence needs a more careful analysis of its individual technological steps in order to approach the questions set.

Unlike many of the Aegean and Anatolian sites where this range of vessels was identified, Heraion (phases I-IV=EB II developed/late-III early) has produced all vessel types and high frequencies in some contexts. Macroscopic fabric and petrographic analysis has successfully identified good correlations between the shapes in question and specific raw material recipes that represent a number of production sites. A central aim was to examine whether the morphological homogeneity is also reflected compositionally, and if any of these vessels were manufactured locally. In particular, MG7 (see Appendix II.16-17) covers tankards, two-handled cups/bell-shaped cups, short-necked cups, depas cups, and other cup variants, two-handled bowls, and jugs with incised decoration, all macroscopically very distinctive (red/black slipped and burnished). A similar, but finer, fabric (MG8; Appendix II.18) differs in its black slipped and burnished finish on both surfaces and is used for the manufacture of the same range of vessels with the addition of tripod bowls, pedestalled bowls/fruitstands, and flask-shaped jugs. Petrographic analysis indicates that these two groups correspond to PG11 and PG12, which are unquestionably from off-island sources and are associated to a western Anatolian production centre(s) that is to date unidentified, as is the case for the same range of shapes recovered at Liman Tepe and Bakla Tepe. Personal examination of drinking cups identified at Dhaskalio on Keros and their macroscopic fabric and morphological similarity with those from Heraion implies possibly a common western Anatolian provenance (see Sections 7.5.3-7.5.4). The same types were also produced in a calcite-tempered fabric (MG9 and PG8; see Appendix II.19 and Section 7.5.1) that is macroscopically different from the aforementioned groups due to its black topped surface treatment and it is suggested that it originates in western Anatolia, potentially Miletus. An Anatolian-type jug with a long cut-away spout (MG4/PG5; Appendix II.7:5) dating to EB III derives also from Miletus or a nearby western Anatolian site.

In contrast with these well-defined and very consistent groups of drinking and pouring vessels, more dispersed tankards, bell-shaped cups, and jugs with a beaked or cut-away spout were made in fabrics that have been macroscopically defined as broadly local to Heraion. This is the case for MG5C (Appendix II.11:2, 3, 7) dated to EB II developed and late, MG5D (Appendix II.12:1, 2) dated to EB III, one EB III teapot in MG5E (Appendix II.13:5), shallow bowls/plates, cups, and jugs in MG6 (Appendix II.14:1, 5-8) dated to EB II developed/late, as well as EB III shallow bowls and one-handled or two-handled tankards in MG10 (Appendix II.20:1, 12, 13). What differs between these groups and those confidently taken as imports, is their less careful surface treatment and finishing (usually smoothed or with a thin red slip), coarser fabrics, and presence of organics that find a good technological link in the local manufacturing tradition of the previous periods. Finally, the wheel-made plate is relatively popular in Anatolia, but its wide distribution in the Aegean from EB II late onwards has been interpreted as the outcome of Anatolian inspiration or the spread of wheel technology in the Aegean. This is a quite frequent vessel shape at Heraion, especially in EB III, and forms a neat macroscopic fabric or series of fabrics with a relatively fine clay paste (MG12: Appendix II.22). The petrographic analysis (PG13) is most likely indicative of its local production on Samos.

Those shapes considered as *Cycladicising* show a good correlation with specific fabric groups in a similar fashion to the *Anatolianising* shapes. More particularly, the relatively popular shapes of the transport jar with horizontal slashed/incised handles and occasionally with plain handles, as well as the beaked jug with a two-stage neck profile were found to crosscut a number of off-island fabrics at Heraion with a provenance in

Amorgos, Kea, Naxos, and possibly also Siphnos, Ios, and other Cycladic islands. These date mainly to EB II late, but some vessels were found to date to EB III. A number of pyxides, mainly incised, in various sub-types (spherical, truncated conical, collar-necked), were found to be relatively distinctive macroscopically in terms of fabric and surface treatment (MG16: Appendix II.26:1-2), although they cross-cut various petrographic fabrics (PG20-23, 27) all with a provenance on Naxos or islands in the western Cyclades. These are mainly of an EB III date, but earlier examples also exist. Other, less well-represented vessel shapes include sauceboats (MG37: Appendix II:47), which stand out macroscopically and are most likely from Attica or elsewhere in the western Cyclades (cf. Douni 2015). Finally, askoi or duck vases (MG11: Appendix II.21) are quite frequent at Heraion and, although macroscopically very similar to the pyxides in terms of the grey surface and incised decoration, petrographic analysis of several examples (PG13: Section 7.3.8) suggests their local provenance. However, variation and fineness of the fabric, as well as popularity of this shape in the Dodecanese islands may imply a different interpretation. This will be further clarified by future analytical work.

Function and use

The limited production but widespread consumption, of these vessels implies a special function. The identification of specific production centres that may relate to the use of distinct clay recipes for these vessels may have added to their value for consumers. As has been already suggested by Wilson (1999), the replacement of sauceboats and saucers (Ayia Irini II) by the range of new drinking and pouring vessels in Ayia Irini III, reflects new social practices related to drinking and eating. These changes would have aimed at meeting the satisfaction of consumers' demands. A morphological and typological shift from larger vessels, mainly bowls, to smaller ones has been observed at Heraion from EB II developed onwards, similarly to what has been suggested by Day and Wilson for Crete (Wilson *et al*. 2008, 269). Perhaps, these represent an emphasis on individual vessels, the wide distribution of which signals an affiliation to a common tradition, at least visually, which could be explained by their use in specific contexts and by particular consumers. Although limited, the presence of these shapes in Cycladic (e.g. Chalandriani on Syros, Akrotiraki on Siphnos) and Anatolian (Bakla Tepe) cemeteries might also suggest the differential status and access to resources, achieved through long-distance mobility.

These shapes have been associated with traders/merchants involved in the sea and land trade which was seemingly controlled by a rising elite in Anatolia (Şahoğlu 2005b, 344; 2011a, 140; 2011b, 175), and a special use in occasions like feasting and social display. Their small size and often narrow shape with a sub-rounded base, that made it difficult to stand upright without support (depas cup) – preferably held in the hand rather than laid on a surface – perhaps imply the communal consumption and commensality of alcoholic liquids transported in other ceramic containers such as collar-necked jars. Their use by the elites has been suggested for the east Aegean and western Anatolia, as examples of these vessels have been identified in communal buildings and open spaces related to a special function, such as Troy, Liman Tepe, and Küllüoba (Day *et al*. 2009, 339; Kouka 2013, 573-574). The value of such craft goods would have been appreciated and acted out on a collective level through specific consumption events (Wilson 1999, 235), but originally ascribed by a symbolic value due to their link with the long-distance trade and the control of raw material or objects obtained through this mechanism, including their metal prototypes.

The evidence at Heraion suggests that this range of vessels were used in various household contexts across the settlement, some of which contained larger numbers (*SO gerichtetes Megaron*; *Zyklopischer Bau*), thus implying a potentially special use related to drinking practices. More careful study of the contexts in association with one another and other categories of material finds should be undertaken in the future in order to elucidate further this issue.

<u>Anatolian influence, Cycladic adoption/emulation or a heterogeneous process?</u>

So this intrusive ceramic 'phenomenon' is varied and inconsistent in terms of its introduction and emergence at different sites, the distribution of its various elements, and associations of context, chronology, and possibly also use. It can be hardly described as a phenomenon in temporal and spatial terms, but what has become clear in recent years, also through the analysis of the Heraion material, is that the introduction of these new shapes in the later EBA reflects deliberate decisions and actions determined by social and other conditions. The question remains, what is the social significance of this ceramic 'phenomenon'?

This group of vessels does not represent a horizon in a narrow chronological, cultural or historical sense, but it rather comprises an analytical tool, largely established for the sake of constructing chronological sequences for comparative purposes between different sites. In other words, its study has focused on generalisations and the identification of mechanisms and processes instead of the individual people involved in the dissemination of its style and technology.

Based on the evidence from Heraion and selected comparative analytical data, it is suggested here that we see two broadly opposite traditions in the adoption and emulation of these shapes with relation to the Cyclades. At Heraion we see a more complex picture, as there is strong evidence for the importation of the vast majority of this range of vessels alongside locally-made examples in different clay recipes and technological traditions than in the previous periods. The Heraion material shows that the majority of the *Anatolianising* forms are imported from western Anatolia, while the *Cycladicising* forms are imported from various Cycladic islands. The complex character of the appearance of these vessels was also analytically tested at sites of western Anatolia, where even the nearby sites of Liman Tepe and Bakla Tepe show different patterns of origin and technology of these shapes. More particularly, the Bakla Tepe vessels come from a wider variety of local and non-local sources than those from Liman Tepe that appear in a fabric very different from the majority of pottery found at the site, which is demonstrably local in provenance (Day *et al*. 2009, 342-343).

Unlike this, at many Cycladic sites these 'foreign' shapes are introduced into otherwise unchanged ways of doing, as the same technological tradition continues, i.e. raw materials and clay recipes, firing practices, etc., whilst incorporating the new forms (e.g. Panormos on Naxos; Day *et al*. n.d.). Therefore, the emulation of these foreign shapes in local clays that occur in other shapes represents a long-lived ceramic tradition in the Cyclades that does not replace the previous assemblages. The Kastri Group types appear in the Cyclades as local imitations of generic prototypes and its frequency among different sites is not homogeneous and not comparable to the NE Aegean/western Anatolia. At Ayia Irini on Kea and Akrotiri on Thera there is a coexistence of both locally-made and imported vessels from other Cycladic islands (Wilson 1999, 61, 67, 91, 125-127, 230-232, tabs. 3.3-3.4; Kariotis *et al*. n.d.). However, these have been recognised as Cycladic and thus the absence of Anatolian imports or the limited amount of Cycladic pottery in the east suggest different mechanisms of exchange and transmission. The coexistence of local and imports in the same shapes implies that these carried a symbolic meaning or even representing a specific geographic location or group. Similarly to the movement of these shapes we see also an even more extensive circulation of transport collared jars with slashed handles, which reflect a large number of production centres in the Cyclades and Attica (Day and

Wilson 2016). A similar adaptation of new stylistic and morphological elements within local technological developments – locally-produced fine fabrics for *Anatolianising* shapes and other ‘local’ forms – is observed in Eretria in Euboea (Charalambidou *et al*. 2016) and Thebes in Boeotia (Hilditch *et al*. 2008, 266).

However, these geographically separate areas seem to share specific practices such as the achievement of dark slipped and burnished surfaces. This visual reminiscence and stylistic uniformity with the Anatolian forms demonstrates that the consumers did not seek a simple reflection of exotic objects but rather an active negotiation of a regional identity. It most likely represents the appropriation and adaptation of these foreign forms and the practice of drinking into local customs.

The term *Anatolianising* also implies the supremacy of the continent/mainland as opposed to the inferiority of islands in the west. But can we imagine a direct Anatolian influence moving outwards to islandscapes from a continental core or even the establishment of such long-lived settlements in the east if it was not for the connections facilitated through the islands? Perhaps the dissemination of the ceramic set can find some explanation in the idea of the *peraia*. The Samian *peraia*, at least in the Classical and Hellenistic periods (Shipley 1982, 59-80), was bounded on the north by the Küçük Menderes or Kaystros River south of İzmir, and on the south by the Büyük Menderes River in close proximity to Miletus. This must have constituted a vital area that linked various communication arteries also in prehistory. That connections between Samos and the opposite mainland were initiated by the former is hard to prove, although we should imagine a dynamic relationship between these areas that was diachronically redefined. Samos must have acted as a conduit for goods from Anatolia to the wider Aegean.

Furthermore, there are various paths in the explanation of this heterogeneous phenomenon. It reflects regionally specific contacts of different intensities with western Anatolia or the east Aegean islands. While we document the direct contact and transfer of Anatolian goods, as well as novel technological practices (potter's wheel), at Heraion, a different pattern of reception and adoption is observed in the Cyclades. A most favoured explanation put forward in the past decade associates these changes with models of trade/exchange, particularly in the search for metal ores or finished products and the transmission of the related technology (Knappett and Nikolakopoulou 2015, 29; Sotirakopoulou 2016, 373). The Cycladic islands were actively involved in long-distance movements and the spread of metal technology in the SE and NE Aegean islands, expanding an already established maritime network that started in the NL period. The presence of Cycladic/*Cycladicising* pottery and actual imports at the SE/NE Aegean/western Anatolia, including Samos itself, supports the view of the active and conscious involvement of the Cyclades in interaction with the East, rather than a passive process of acculturation.

Perhaps what we see at Heraion in the later EBA is a more tangible picture of interactions with western Anatolia, initiated with the spread of wheel technology. Similarly to the heterogeneous distribution of the *Anatolianising* forms among different sites, the introduction of the wheel should not be seen as an unavoidable outcome of technological evolution, but rather the selective response to differential interactions. The link between the wheel-fashioned imported vessels and the introduction of wheel at Heraion must have triggered new technological and social 'adjustments' by the potters' community and subsequent appropriations of technical expression in the manufacture of local pottery. If this hypothesis holds some truth, then we should be dealing in part with the mobility of potters – perhaps Samian potters within the context of an Anatolian tradition – and the subsequent adaptation of the local technology to an Anatolian way of doing and adoption of consumption practices. As stated above, mere observation of finished products does not allow the complete imitation of all manufacturing stages, but it is argued that the imported Anatolian pottery at Heraion must have played a key role in the establishment of familiarity with these 'foreign' trends. The socially and technologically-embedded meaning of these traits and their partial appropriation by the local communities, at least in the east Aegean islands, must have required a period of long interaction rather than occasional contacts. The intensification of these contacts, perhaps largely related with an increased emphasis in the metal trade, enabled an active engagement between the Cycladic 'seafarers' with the east Aegean.

To sum-up, what has been described as a homogeneous phenomenon in both temporal and spatial terms has proven to be varied in terms of chronology, geographical distribution, technological reception and perception, and social meaning. Undoubtedly, it reflects increased connectivity, but we should not assume a simple model of traders' mobility specifically for the circulation of metals. A complex picture of mobility including more kinds of people (e.g. craftspeople) and more kinds of reasons should be rather envisaged that allowed the circulation of more material categories. Thus, connectivity is not just economically-driven, but can have a multi-causal relation to the development of technological practice.

9.5.4 Early Bronze Age III: a period of abandonments and limited interactions?

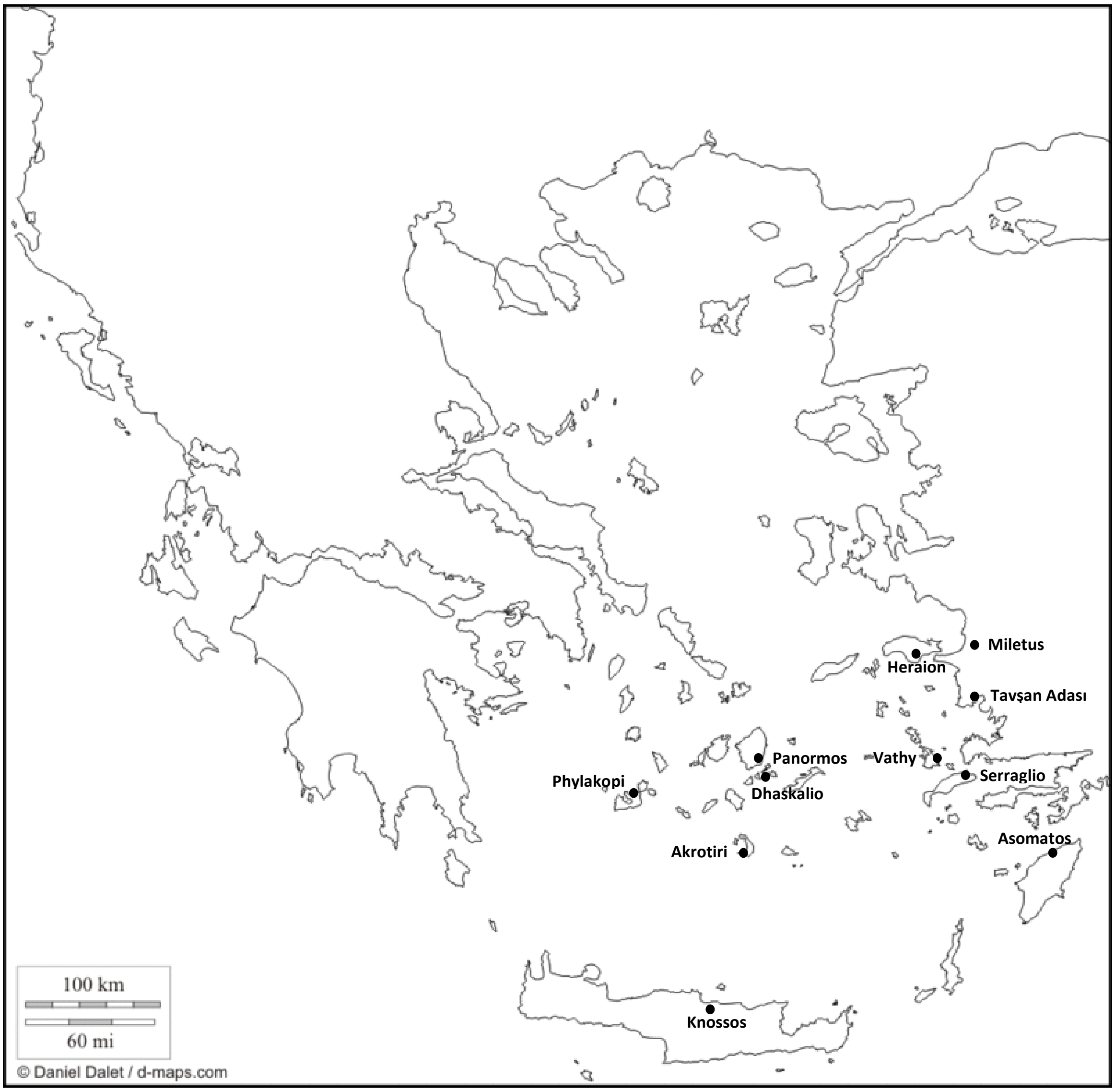


Figure 9.5: Map showing Heraion and possible provenance areas of specific petrographic fabrics in EB III.

Off-island pottery identified mainly through petrographic fabric analysis from this period is not as diverse as in EB II and less frequent. More specifically, some fabrics identified in EB II seem to continue into EB III, providing evidence for a strong continuity in the connections with specific sites already established in the previous period. This is the case for Naxos (PG21, PG22, and PG23) and Melos (PG25), although fabric variations may suggest different production centres or the use of different raw materials on these islands. The vessel types circulated are incised pyxides of various types, incised collar-necked jars, transport jars, and askoi. These are macroscopically and stylistically very distinctive. Other continuing connections are observed in PG5 and Miletus or a nearby site in western Anatolia. However, this is only represented by a beak-spouted jug and a winged jar in the EB III, which shows technological developments compared to the vessels of the previous periods by its decreased organic temper and higher-fired clay paste.

New connections seem to have been established in EB III, mostly at the end of this period and the transition to the MBA. This is the case for PG41 which is more likely from north-central Crete and PG26 that derives from Thera. These fabrics derive from stratigraphically unclear contexts and are likely to have a MBA date. Although no actual imports were found from the Dodecanesian sites of Asomatos on Rhodes, Vathy Cave on Kalymnos, and Serraglio on Kos, these are discussed in this section due to the homogeneity in fine orange fabrics and shape repertoire in EB III (strap-handled cups, ovoid jugs with trumpet mouth, shallow bowls, askoi). The vast majority of EB III fabrics at Heraion are fine to very fine micaceous and, although defined here as largely locally produced, their fineness might prevent a better resolution of intra-regional provenance areas and connections with nearby sites of the SE Aegean/SW Anatolian region (Fig. 9.5). Potential Samian imports were identified in the EB III material of Tavşan Adası in Didyma (K. Eckert, pers. comm., November 2017).

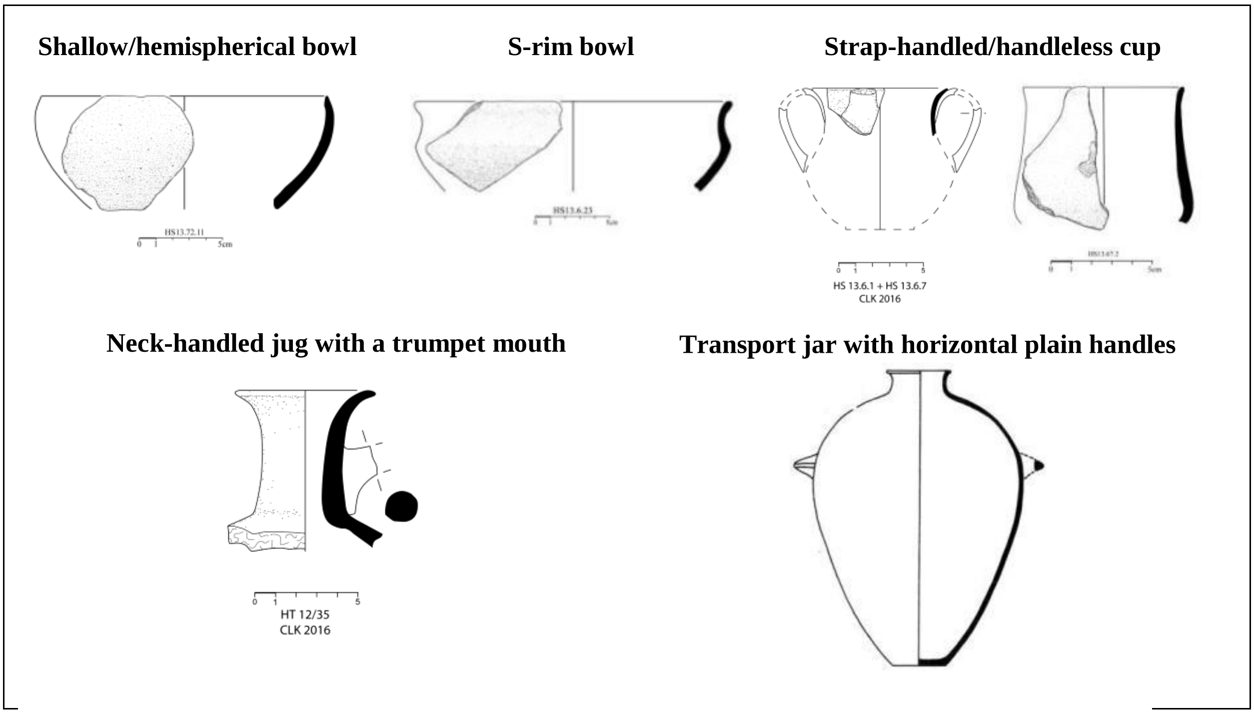


Figure 9.6: Characteristic EB III ceramic forms of the SE Aegean/SW Anatolian region identified at Heraion.

New shapes have been introduced during EB III. The shallow, hemispherical bowl and the strap-handled or handleless cups are frequent and seem to have replaced the range of Kastri Group shapes that were so popular in EB II late. The new shapes are smaller and more standardised, accompanied by certain technological advances. Their context of use, mainly identified in the *Grosses Haus,* and continued use of the *SO gerichtetes Megaron* and *Zyklopischer Bau* since EB II late might indicate that the social practices of communal drinking are now more pronounced in the context of identity negotiation and social display. The common presence of this range of shapes (Fig. 9.6) in the Dodecanese islands and sites of SW western Anatolia might point out to the existence of a strong regional network of interactions in EB III and even the exchange of some of these vessels (e.g. askoi). Unfortunately, the lack of comparative analytical data from this area allows only a tentative hypothesis. Perhaps these morphological and technological changes and regional similarities document the transfer of technological knowledge through a face-to-face interaction that could only be disseminated by the mobility of potters. Finally, the 'replacement' of drinking forms that predominated in the previous phase might indicate that the awareness of the social/symbolic use of those vessels slowly faded away.

This evidence shows a busy network of interactions in EB III. Even if abandonments took place at some sites, this would have largely impacted on the intensity of the network.

9.6. A seascape of change: maritime connectivity and social developments at Heraion

Samos was by no means isolated during the EBA, or even in the NL (Kastro-Tigani). This thesis demonstrated that the east Aegean islands have always been in contact with the Anatolian littoral due to close proximity, their location on major maritime routes, and the availability of natural resources. They were much more than convenient stopovers. Islands held a strong symbolic meaning for the opposite mainland since their colonisation in the NL period and we should imagine that the common experiences created through such a bilateral relationship must have formed a communal identity. Concepts of otherness and separateness do not provide sufficient theoretical frameworks for understanding the micro-scale histories of islands. The opposite mainland has historically acted as the *peraia* for the north and east Aegean and the Dodecanese islands, i.e. the area belonging to the territory of the island state (cf. Knappett and

Nikolakopoulou 2015, 27). This is not to suggest that a direct analogy can be achieved between prehistory and historical times, but it provides a framework for understanding the perception of space.

In later EBA, the movement of people and circulation of materials seem to have become more intense, not just resulting from small-scale episodes of interaction but more likely due to an organised structure of steady connections. This is well-reflected in technological developments and stylistic affiliations between distant sites across western Anatolia and the western Aegean (e.g. Kastri Group/*Anatolianising* pottery). Perhaps this was facilitated by the establishment of a better control over the sea routes by economic/political structures and innovations brought about by transport technology (cf. Broodbank 2000, 320-339). It has been suggested earlier that these connections were not simply related to trading activities, but instead were affected and reformed by regular contacts that included the transmission of knowledge and ideas, leading to the wider movement of other kinds of people in the context of craftsmanship.

Samos should not be seen merely as a stepping stone between the central Aegean and western Anatolia but rather as a strong intermediary in different maritime routes of the EBA. Although archaeology traditionally promotes geographical setting as the defining factor for explaining a site's importance and connectivity, recent developments have underlined that insularity is culturally and socially defined and an assumed superiority of mainland over island is not a sufficient concept for explaining interaction and receptivity of technological developments. Technological changes do not have inherent social meaning. They are rather related to choices taken by the producers and consumers, affected by availability of products, affordances and needs. Current archaeological research focuses on the meanings of technological choices and their permeability when attempting to understand the processes by which comparable phenomena are formulated between different places.

Whether or not connections with Anatolia and the central Aegean were frequent or sporadic, the spread of materials that were recognisably foreign would have altered the consumers', and perhaps also producers', perception of space and in turn of people. On a practical level, continuity in the connections between Samos and western Anatolia must have been greatly favoured due to stability on the major routes, possibly as well as being affected by environmental parameters such as shifts of the coastline, of the Küçük Menderes River and the Büyük Menderes River immediately opposite Samos to the north and south since mid-Holocene (cf. Brückner *et al*. 2017). The Meander valley, formed between these two rivers, facilitated communication from the coast to the interior of western Anatolia. This created an interface with long-lived settlements that could have acted as gateways, which is culturally expressed in an intermixture of elements ‘adopted’ through participation in different networks. Until recently, such gateway communities have been identified at Troy, Poliochni on Lemnos, Thermi on Lesbos, Liman Tepe, Çukuriçi Höyük, Miletus and Iasos. Despite focusing on just one material category, namely pottery, this thesis has demonstrated that Heraion on Samos should be seen as an *active agent* in developments taking place in the EBA Aegean.

CHAPTER 10: Conclusions

10.1 Summary of conclusions

The aims set out in Chapter 1 have been successfully addressed to a large degree. Here the methodological and archaeological implications of this study are summarised.

In terms of the innovative methodology, this was primarily developed around the original study and recording of pottery from Heraion. This included the reconstruction of the whole ceramic sequence with the combination of three different assemblages derived from new and older excavations at Heraion. This has allowed the establishment of a new phasing at Heraion and the cross-correlation with Aegean-Anatolian chronologies. An integrated, diachronic analysis of total ceramic assemblages has proven to be a very effective approach, particularly when combined with the examination of comparative data from other contemporary sites. The latter has also highlighted the need for the development of similar work in the east Aegean islands and Anatolia.

Aside from its significance in terms of an integrated, multi-technique methodology (macroscopic fabric, petrographic, microstructural analysis), this thesis has argued for the conceptual importance of a multi-scalar approach in the study and interpretation of change in the interrelated ceramic system of production, exchange, and consumption. It has also suggested that such an approach to technology can reach more meaningful conclusions regarding crafting practices in the Aegean EBA by emphasising the socially-informed aspects of a single site through a diachronic analysis of its individual elements. More importantly, this approach has shifted away from previous studies that were focused on generalised models in the identification of networks and has critiqued the notions of complexity, specialisation, and connectivity in ceramic studies. This theoretical framework has placed emphasis on the concept of choice and practice and has followed a bottom-up approach.

The archaeological dimensions of the abovementioned conceptual approach were highlighted first through the construction of a relative chronological sequence for Heraion. Apart from the detailed macroscopic fabric and typological analysis of all EBA pottery recovered at Heraion, including also a preliminary analysis of Ch pottery, this thesis has established the technological profile of the local ceramic production, following a *chaîne opératoire* approach, and has suggested the identification of raw material sources and their manipulation by the ancient potters, as well as methods employed in forming, finishing, and firing of the ceramic vessels. This has been largely achieved through macroscopic analysis and was refined and supplemented by petrographic and microstructural analysis of selected samples. Petrographic analysis of a representative number of samples covering a wide range of vessel shapes, finish modes, functional categories and chronological phases has enabled secure identification of distinct production practices and choices by the local community of potters at Heraion and elsewhere on Samos. The variation at different stages of the manufacturing procedure has been recorded in detail and correlations have been established at a spatial level, between the different assemblages at Heraion, as well as at a temporal level, covering all settlement phases from the 4^{th} millennium to the end of the 3^{rd} millennium BC. A complex picture of continuity and change has been revealed in the individual stages of the ceramic manufacturing sequence at Heraion, which transcends concepts of unilinear evolution and instead reflects a dialectic relationship between technological practice and specialised elements related to a combination of factors, namely interactions between potters and the environment/resources, skills, knowledge, affordances, demands, etc.

- Limited sources of raw materials existed in Ch, mainly related to metamorphic deposits of the Heraion environs that continue in EB I. “Conservative” forming and finish modes, predominance of large bowls and jars;
- In EB II early we observe the exploitation of a more varied range of raw materials, the shape repertoire is more diverse and new vessel types appear (more frequent small and medium-sized bowls);
- In EB II developed continuing and new raw material sources are in use and there is change in the firing strategies, exploitation and processing of sources, the appearance of new surface treatment modes, decrease of organic tempering, introduction of new drinking and serving shapes;
- In EB II late there are more conspicuous changes in forming and firing strategies, with the introduction of wheel technology, the pottery assemblages become more diverse, and there is a good correlation between fabrics and specific shapes;
- In EB III drastic changes were observed in all stages of the operational sequence (fine micaceous clays, clay mixing practices, disappearance of vegetal tempering, higher temperatures, etc.).

The results of this thesis have proven successful in tracing diachronic developments and patterns of interaction and exchange mechanisms both at an intra-island and an interregional level. The former was supplemented through the geological prospection programme on Samos and the identification of potential raw material sources for pottery production. Nevertheless, it has been demonstrated that the assignment of pottery to certain production centres or specific raw material sources through a direct analogy with clay recipes and fabrics is not feasible in many cases and our interpretations should take into consideration environmental and human impact, as well as actions and decisions taken by the potters that go beyond techno-functional constraints.

Apart from the micro-scale study of pottery at an intra-site level and the identification of intra-island connections between Heraion and potentially other settlements/workshops on Samos, the comparative examination of pottery sherds and/or thin sections from a number of central and east Aegean and western Anatolian sites has enabled the identification of imports already from the first settlement phases at Heraion and the establishment of a first understanding of the connections between Samos and other contemporary sites. This attempt to contextualise Heraion within synchronic Aegean-Anatolian phenomena of connectivity in the 3rd millennium BC has enabled a reassessment of the mainland-island division, so dominant in past research, and re-aligned a focus on a lively, conscious participation of a range of people (including craftspeople) in networks of mobility and exchange of goods and for reasons beyond the trade of metals. The meso-scale interactions, translated as the connections obvious in ceramic terms between Samos and the east Aegean, especially the SE Aegean/SW Anatolian region, are visible through common elements and manufacturing practices from the beginning of the EBA.

The detailed characterisation of local pottery production at Heraion and development of exchange patterns throughout the 3rd millennium BC has, in turn, revealed some important social aspects at Heraion. These concern the association between pots and cultural labels, expressed for specific ceramic forms of later EBA, namely *Anatolianising* and *Cycladicising*. The present work has contextualised these intrusive shapes and has shed new light on this much-disputed Aegean-Anatolian ceramic phenomenon. This topic is prominent in the final discussion and new interpretations have been suggested within a connectivity and mobility framework. From an interpretative perspective, the preference in the movement and exchange of specific vessel forms relating to transportation, storage, and serving of liquids (possibly alcohol) suggests not only shifts in the intensity of connectivity with certain areas but also changing consumption practices and fashions of commensality. These represent macro-scale interactions, clearly observable from EB II late onwards. The appearance of a range of vessels across the Aegean and western Anatolia and the selective adoption, adaptation, emulation, and experimentation of specific elements indicates among others changes in directionality, intensity, and purpose of interaction.

To sum up, the present project has not only enabled a more nuanced understanding of technological choice and practice in an Aegean island context, it has also allowed a re-evaluation of our current knowledge about the potential locations of regional production centres throughout the EBA, as well as consumption practices and exchange mechanisms, and in turn a more comprehensive view in the interpretation of socio-cultural complexity. Heraion and Samos in general is more than a convenient stopover and its significance goes beyond its geographical approximation with Anatolia and its location between two “distinct” worlds, namely the west Aegean and Anatolia. The intermixed character of Heraion, particularly examined in pottery developments, is rather a result of the site's changing connections and conscious participation in networks of interaction.

10.2 Limitations and future research

One of the greatest challenges encountered in carrying out the present research was the limited amount of information, and publications about prehistoric pottery from Samos and Heraion. This is highlighted in Renfrew's important work (1972), which rather overlooked the eastern Aegean and western Anatolia in his discussion of the emergence of complex cultures in the EBA. Similarly, more recent collective studies (e.g. Shelmerdine 2008; Cline 2010) still do not include this geographical area in the discussion of Aegean Bronze Age developments. This is in fact a symptom of the hitherto lack of joint archaeological projects between Greece and Turkey. Thus, the systematic comparison and publication of more ceramic assemblages from the east Aegean and western Anatolia seems imperative.

Renewed interest in this area, exemplified in the present study through the recovery of new excavation data from Heraion, as well as ongoing projects in Miletus, Çukuriçi Höyük, Liman Tepe, Bakla Tepe, Chios, provide a promising picture for future research on this analytically overlooked region. This would not only be implemented through access to published and unpublished ceramic material from this region, but also through the application of a more thorough documentation of a larger number of sites in the study region in terms of a conceptual framework and the characterisation of entire assemblages. This would be also effectively achieved by shifting away from past generalised attempts to interpret this region as culturally cohesive and rather focus on the identification of micro-scale variability within each site. Another limitation is seen in the lack of substantial analytical pottery data from this region, hampering a detailed comparative analysis and a more secure provenance determination or identification of imports from western Anatolia. The repetition of similar geological formations related to a metamorphic lithology across the central Aegean, Samos, and the opposite Anatolian coast further complicates the issues of provenance.

Future work on Samos will focus on a more detailed contextual analysis of the pottery in terms of use of space and spatial distribution of certain forms at different settlement areas. Moreover, the system of typological analysis and macroscopic fabric classification developed by the author will be used as the basis for future study of other unpublished ceramic assemblages from Samos and beyond.

A more detailed study of the Chalcolithic pottery from Heraion will also be undertaken, which will be correlated with pottery samples taken from the nearby site of Kastro-Tigani. The analysis of samples from this site will include Neolithic and Chalcolithic pottery and will be carried out in 2018/2019. This will allow a more holistic understanding of the connections between Heraion and Tigani in the earlier prehistory of the island. Despite this emerging picture of a busy landscape in the south-central part of Samos, the northern part is yet to be explored. Nevertheless, the analytical work of this thesis implies that there might be more prehistoric settlements beyond Heraion itself and that ceramic products could have been circulated at an intra-island level. The so far spatial gap in terms of prehistoric habitation could be filled out with future identification of archaeological traces through a surface survey. Moreover, the geological prospection on Samos, carried out in two seasons between 2015 and 2016, will be further extended to include larger geographical areas on the island and more detailed sampling of raw material sources. The results of this project will be further combined with an ethnoarchaeologial survey of modern pottery production on Samos.

Despite the limitations mentioned above this thesis highlights the need for a multi-scalar and multi-technique methodology, coupled with a sophisticated conceptual framework, in the analysis of large, single-type assemblages that transcend spatial and temporal boundaries, such as the pottery material from prehistoric Heraion on Samos. These first steps in an integrated understanding of the EBA pottery from Heraion will be extended in the future to include a detailed study of the preceding and succeeding periods from this site, namely the Chalcolithic-Neolithic and MBA respectively.

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